



**THE DATASHEET OF  
2N7002P,235**





# Discrete Semiconductors Selection Guide 2010

Diodes, transistors, ESD and signal conditioning devices  
Excellence in portfolio and performance



## Introducing new package technology

Portable and increasingly smaller end products fuel the race towards more sophisticated functionality in smaller form factors. To support system designers manage this challenge we as NXP develop products that fulfill requirements regarding space constraints, boosted performance and environmental aspects. Have a look at these five new SMD packages that take discretes to the next level:

### Leadless powerhouse – SOT1061 and SOT1118

#### Features

- ▶ Exposed heat sink for excellent thermal and electrical conductivity
- ▶ Power dissipation capability ( $P_{tot}$ ) of > 1 W
- ▶ Small footprint of 2 x 2 mm and height of 0.65 mm



#### Products in SOT1061

- 1 and 2 A low  $V_F$  Schottky rectifiers, pages 11 and 12
- Low  $V_{CEsat}$  (BISS) transistors, pages 57, 59, 64 and 65



#### Products in SOT1118

- Small-signal MOSFET P-channel and FET-KYs, page 77

### FlatPower – SOD123W and SOD128

#### Features

- ▶ High power ratings due to clip-bonding technology and optimized die design
- ▶ 1 mm low profile, footprint of 2.6 x 1.7 (SOD123W) and 3.8 x 2.5 mm (SOD128)
- ▶ Pad layout compatible with SMA for easy drop-in replacement
- ▶ AEC-Q101 qualified



#### Products in SOD123W and SOD128

- 400 W and 600 W TVS diodes, pages 44 and 45
- 1 to 5 A low  $V_F$  Schottky rectifiers, page 10

### Small, strong, perfectly visible – SOD882D

#### Features

- ▶ Exposed leads facilitate visual inspection of solder joints
- ▶ More rugged and reliable bond between device and PCB board
- ▶ Reduced height down to 0.37 mm and small footprint of 1 x 0.6 mm



#### Products in SOD882D

- Standard ESD protection devices, page 24

### Transfer to halogen-free products

Since 2009 all NXP small-signal discrete SMD packages on the market are “Dark Green”, meaning they are fully RoHS compliant (directive 2002/95/EC) and do not contain halogens or antimony exceeding allowed limits:

Substances	Limit
Antimony Oxides	< 900 ppm
Chlorinated + Brominated Compounds	$\Sigma$ < 900 ppm

# Discrete Semiconductors Selection Guide 2010

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Diodes

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Benefit from interactive features in the online edition of this selection guide: A click on a product type takes you to the corresponding product information page on the NXP website. There you'll find data sheets and other design-support documents. To access the online selection guide, go to [www.nxp.com/discrete\\_selection\\_guide](http://www.nxp.com/discrete_selection_guide)

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## Support tools

To help you achieve the best, most efficient design-ins with our products, we offer a wide variety of support tools, available on the NXP Semiconductors website.

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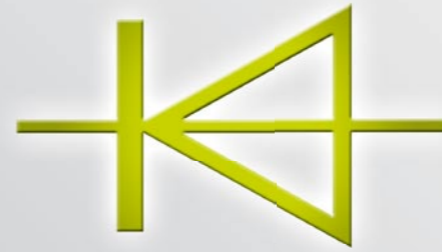
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## Diodes

### Schottky barrier diodes and rectifiers

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### Switching diodes

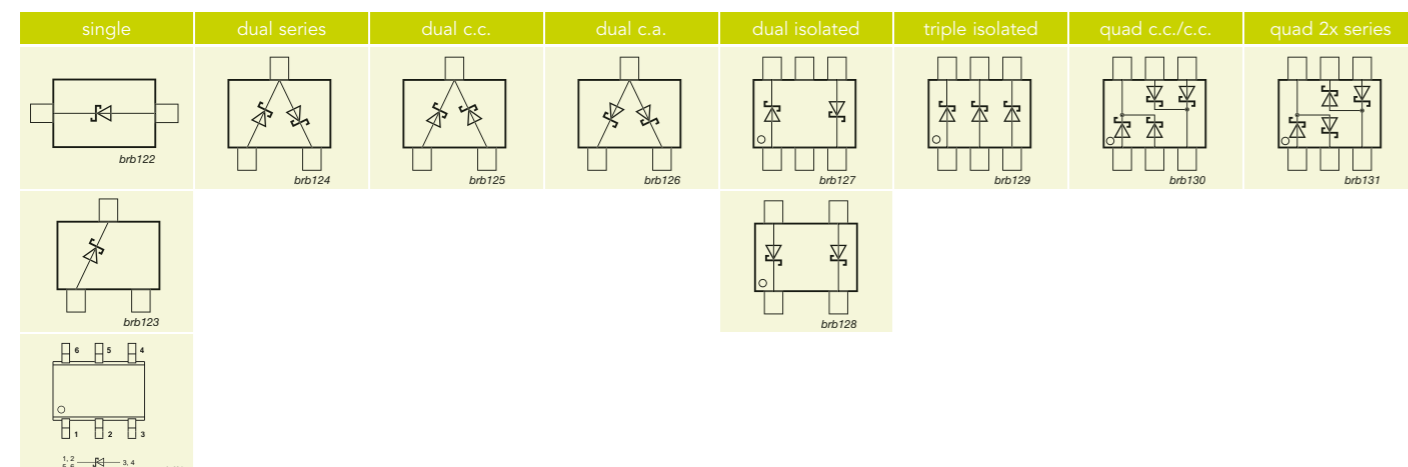
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General purpose Schottky diodes ≤ 250 mA














types in **bold** represent new products

I <sub>F</sub> max (mA)	V <sub>F</sub> max (V)	V <sub>F</sub> max (mV)	@ I <sub>F</sub> (mA)	I <sub>R</sub> max (μA)	@ V <sub>R</sub> (V)	Package	SOD80C (MiniMelf)	SOD68 (DO-34)	SOT23	SOT143B		SOD123F	SOT323 (SC-70)	SOT363 (SC-88)	SOD323F (SC-90)	SOD323 (SC-76)	SOT666	SOT416 (SC-75)	SOD523 (SC-79)	SOD882/SOT883 (SC-101)					
																									
							Size (mm)	3.5 x 1.5 x 1.5	3.04 x 1.6 x 0.55	2.9 x 1.3 x 1.0	2.9 x 1.3 x 1.0		2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.7 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.6 x 0.8 x 0.77	1.2 x 0.8 x 0.6	1.0 x 0.6 x 0.5				
P <sub>tot</sub> (mW)	300	500	250	250		830	250	300	550	400	300	150	500	250											
70	70	750	10	0.1	50	single			BAS70			BAS70H	BAS70W			1PS76SB70			1PS79SB70	BAS70L					
						dual series			BAS70-04			BAS70-04W													
						dual c.c.			BAS70-05			BAS70-05W													
						dual c.a.			BAS70-06			BAS70-06W													
						dual isolated				BAS70-07						BAS70-07S					BAS70-07V				
						triple isolated															BAS70VV				
120	40	370	1	0.5	30	quad 2x series																			
						single														RB751V40			RB751S40	RB751CS40	
						single			BAS40		BAS40H	BAS40W								1PS76SB40			1PS79SB40	BAS40L	
						dual series			BAS40-04			BAS40-04W													
						dual c.c.			BAS40-05			BAS40-05W											1PS75SB45		
						dual c.a.			BAS40-06			BAS40-06W													
200	30	300	10	30	10	dual isolated				BAS40-07								BAS40-07V							
						quad c.c./c.c.															BAS40-05V				
		quad 2x series																							
		single																			1PS79SB31				
		single							BAT754																
		dual series							BAT754S																
		dual c.c.							BAT754C																
		dual c.a.							BAT754A																
		triple isolated																							
		single	BAS85	BAT85	BAT54		BAT54H	BAT54W		BAT54J	1PS76SB10		<b>BAT54T</b>	1PS79SB10	BAT54L										
		dual series			BAT54S			BAT54SW																	
		dual c.c.			BAT54C			BAT54CW																	
		dual c.a.			BAT54A			BAT54AW																	
		dual isolated				BAT74				BAT74S				BAT74V											
triple isolated												BAT54VV													
quad c.c./c.c.												BAT54CV													
quad 2x series																									
single																				<b>RB521S30</b>					
single																				<b>RB520S30</b>					
250	100	950	250	18	75	single																			
						single																			
						single	BAS86	BAT86																	
						single																			
						single																			
						single																			



Medium power low  $V_F$  Schottky rectifiers single  $\geq 200$  mA

types in **bold** represent new products

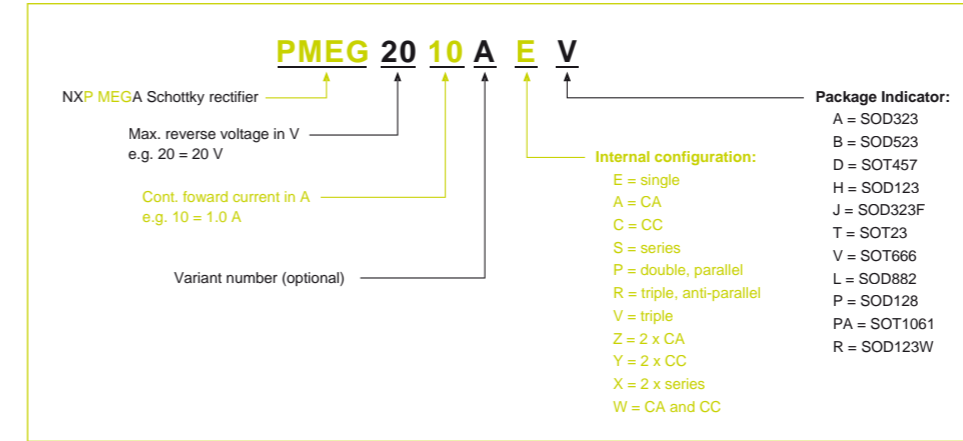
$I_F$ max (A)	$V_R$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_R$ max (mA) @ $V_R$ max	Package	SOD128	SOD87 (Melf)	SOT457 (SC-74)	SOT23	SOD123W		SOD123F	SOT1061	SOT323 (SC-70)	SOD323 (SC-76)	SOD323F (SC-90)	SOT666	SOD523 (SC-79)	SOD882		
																				
				Size (mm)	3.8 x 2.5 x 1.0	3.5 x 2.05 x 2.05	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.6 x 1.7 x 1.0		2.6 x 1.6 x 1.1	2.0 x 2.0 x 0.65	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6	1.0 x 0.6 x 0.5		
				$P_{tot}$ (mW) @ 1 cm <sup>2</sup>	1050	1000	540	420	950		830	1000	250	570	830	570	450	250		
				Optimization																
0.2	30	480	0.04	low $V_F$																
	40	600	0.01	low $I_R$																
	60	600	0.1	low $V_F$																
0.5	20	390	0.2	low $V_F$																
		440	1.5	low $V_F$																
		480	0.01	low $I_R$																
	30	500	0.03	low $I_R$																
		430	0.15	low $V_F$																
		500	0.5	low $V_F$																
40	470	0.1	low $V_F$																	
	550	0.1	low $V_F$																	
1.0	20	340	1	low $V_F$																
		375	1.9	low $V_F$																
		430	0.2	low $V_F$																
		450	0.05	low $I_R$																
		500	1.0	low $V_F$																
		550	0.2	low $V_F$																
	30	620	1.5	low $V_F$																
		450	1.0	low $V_F$																
		360	1.5	low $V_F$																
		450	0.05	low $I_R$																
		520	0.05	low $I_R$																
		550	1	low $V_F$																
	40	560	0.15	low $V_F$																
		680	0.5	low $V_F$																
		490	0.05	low $V_F$																
		600	1.0	low $V_F$																
		640	0.1	low $V_F$																
		570	0.05	low $I_R$																
60	530	0.06	low $V_F$																	
	650	0.35	low $V_F$																	
	660	0.05	low $I_R$																	
1.5	20	660	0.07	low $I_R$																
	30	550	1.0	low $V_F$																
2.0	10	460	3.0	low $V_F$																
		420	1.9	low $V_F$																
	20	525	0.2	low $V_F$																
		360	3.0	low $V_F$																
		420	1.5	low $V_F$																
		450	0.1	low $I_R$																
		470	2.5	low $V_F$																
		520	0.05	low $I_R$																
	30	620	1.0	low $V_F$																
		490	0.1	low $V_F$																
		535	0.1	low $V_F$																
	40	530	0.15	low $V_F$																
575		0.25	low $V_F$																	
3.0	10	530	3.0	low $V_F$																
	30	360	5.0	low $V_F$																
		450	0.15	low $I_R$																
	40	490	0.2	low $V_F$																
		540	0.1	low $I_R$																
5.0	30	360	8.0	low $V_F$																
	40	490	0.3	low $V_F$																

### Medium power low $V_F$ Schottky rectifiers dual $\geq 200$ mA

types in **bold** represent new products

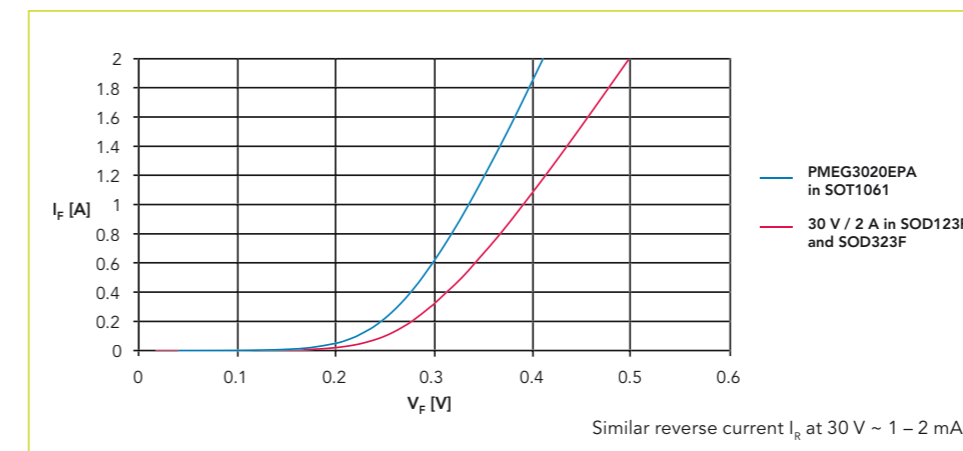
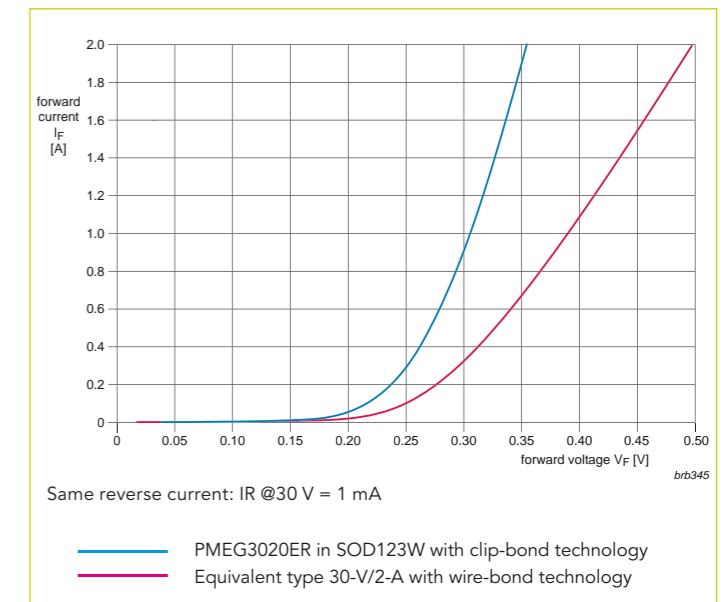
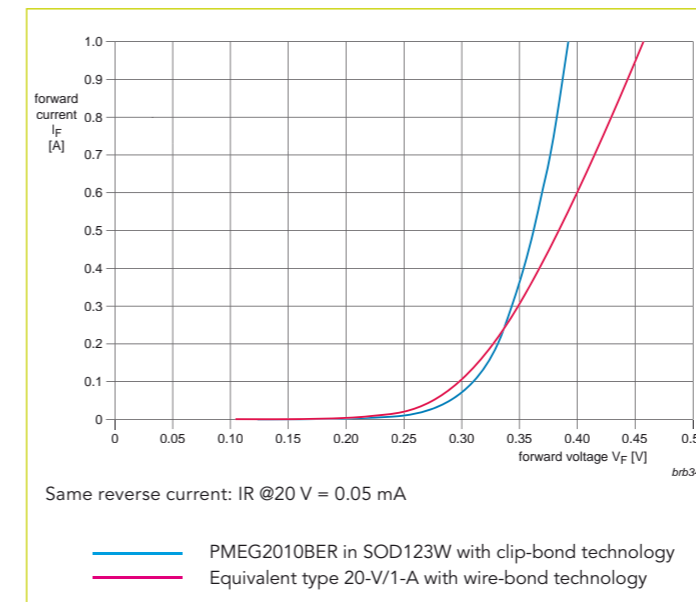
$I_F$ max (A)	$V_R$ max (V)	$V_F$ max (mV) @ $I_F$ max	$I_F$ max (mA) @ $V_R$ max	Optimization	Package	SOT223 (SC-73)	SOT23	SOT1061	SOT666	
						Size (mm)	6.5 x 3.5 x 1.65	2.9 x 1.3 x 1.0	2.0 x 2.0 x 0.65	1.6 x 1.2 x 0.55
						$P_{tot}$ (mW)	1500	250	1000	300
0.2	30	480	0.03	low $V_F$	dual isolated				PMEG3002TV	
	60	600	0.1	low $V_F$					PMEG6002TV	
0.5	20	390	0.2	low $V_F$	dual c.c.		PMEG2005CT			
	30	430	0.15	low $V_F$			PMEG3005CT			
	40	470	0.1	low $V_F$			PMEG4005CT			
1.0	25	450	1.0	low $V_F$	dual series	BAT120S				
				low $V_F$	dual c.c.	BAT120C				
				low $V_F$	dual c.a.	BAT120A				
	40	500	0.05	low $V_F$	dual c.c.			PMEG4010CPA		
				low $V_F$	dual c.c.			PMEG6010CPA		
	60	650	0.35	low $V_F$	dual series	BAT160S				
				low $V_F$	dual c.c.	BAT160C				
				low $V_F$	dual c.a.	BAT160A				
	2.0	20	420	1.0	low $V_F$	dual c.c.			PMEG2020CPA	
30		440	2.0	low $V_F$	dual c.c.			PMEG3020CPA		

### Nomenclature of low $V_F$ (MEGA) Schottky rectifiers










### Improved forward characteristics of (MEGA) Schottky rectifiers in new packages

NXP low  $V_F$  maximum efficiency general applications (MEGA) Schottky rectifiers in new FlatPower SOD123W and medium power leadless SOT1061 package





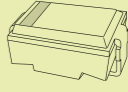
### Low capacitance Schottky diodes

$I_F$ max (mA)	$V_R$ max (V)	$V_F$ max (mV) @ $I_F$ (mA)	$C_d$ max (pF) @ $V_R = 0$ V	Package	SOT23	SOT323 (SC-70)	SOT363 (SC-88)	SOD323 (SC-76)	SOT666	SOD523 (SC-79)	SOD882
											
					Size (mm)	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.2 x 0.8 x 0.6
$P_{tot}$ (mW)					250	250	300	400	300	500	250
30	4	450	1	single	BAT17						
				single			1PS76SB17		1PS79SB17		
				triple isolated				1PS66SB17			
				dual series	PMBD353 PMBD354 <sup>1)</sup>						
	15	340	1	1	single		1PS70SB82				1PS10SB82
					triple isolated			1PS88SB82		1PS66SB82	
					dual series		1PS70SB84				
					dual c.c.		1PS70SB85				
					dual c.a.		1PS70SB86				

<sup>1)</sup> diodes have matched capacitance

### PN rectifiers in SMA, SMB, SMC

types in **bold** represent new products

Package	SOD131 (SMA)				SOD132 (SMB)			SOD133 (SMC)			
											
Size (mm)	4.25 x 2.67 x 2.14				4.32 x 3.62 x 2.29			6.86 x 5.91 x 2.34			
$t_r$ (ns)	30	60	300	2000	30	300	2000	30	60	300	2000
$V_R$ max (V)	$I_F$ max (A)										
50	1	<b>ES1A</b>	<b>US1A</b>	<b>RS1A</b>	<b>S1A</b>						
	1.5			<b>RS2AA</b>		<b>RS2A</b>	<b>S2A</b>				
	2					<b>ES2A</b>					
	3							<b>ES3A</b>	<b>US3A</b>	<b>RS3A</b>	<b>S3A</b>
100	1	<b>ES1B</b>	<b>US1B</b>	<b>RS1B</b>	<b>S1B</b>						
	1.5			<b>RS2BA</b>		<b>RS2B</b>	<b>S2B</b>				
	2					<b>ES2B</b>					
	3							<b>ES3B</b>	<b>US3B</b>	<b>RS3B</b>	<b>S3B</b>
200	1	<b>ES1D</b>	<b>US1D</b>	<b>RS1D</b>	<b>S1D</b>						
	1.5		<b>US2DA</b>	<b>RS2DA</b>	<b>S2DA</b>		<b>RS2D</b>	<b>S2D</b>			
	2					<b>ES2D</b>					
	3							<b>ES3D</b>	<b>US3D</b>	<b>RS3D</b>	<b>S3D</b>
400	1	<b>ES1G</b>	<b>US1G</b>	<b>RS1G</b>	<b>S1G</b>						
	1.5		<b>US2GA</b>	<b>RS2GA</b>	<b>S2GA</b>		<b>RS2G</b>	<b>S2G</b>			
	2					<b>ES2G</b>					
	3							<b>ES3G</b>	<b>US3G</b>	<b>RS3G</b>	<b>S3G</b>
600	1		<b>US1J</b>	<b>RS1J</b>	<b>S1J</b>		<b>RS2J</b>	<b>S2J</b>			
	1.5		<b>US2JA</b>	<b>RS2JA</b>	<b>S2JA</b>						
	3								<b>US3J</b>	<b>RS3J</b>	<b>S3J</b>
800	1		<b>US1K</b>	<b>RS1K</b>	<b>S1K</b>		<b>RS2K</b>	<b>S2K</b>			
	1.5			<b>RS2KA</b>	<b>S2KA</b>						
	3								<b>US3K</b>	<b>RS3K</b>	<b>S3K</b>
1000	1		<b>US1M</b>	<b>RS1M</b>	<b>S1M</b>		<b>RS2M</b>	<b>S2M</b>			
	1.5			<b>RS2MA</b>	<b>S2MA</b>						
	3								<b>US3M</b>	<b>RS3M</b>	<b>S3M</b>

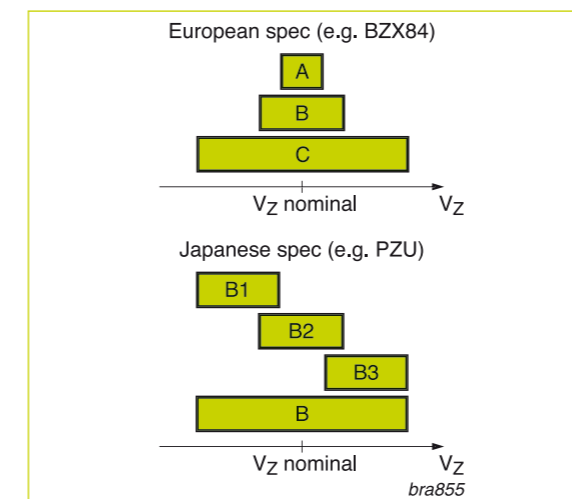
## General purpose Zener diodes

types in **bold** represent new products

$I_f$ max (mA)	$P_{ZSM}$ (W)	$V_z$ nom (V)	$V_z$ tolerance	Note	Configuration	Series	Package	Size (mm)	$P_{tot}$ (mW)
500	-	3.3~24	C	Eur	single	1N47xxA series	SOD66 (DO-41)	4.8 x 2.6 x 0.81	1000
	60	3.6~75				BZV85 series			
250	-	2.4~36	about 2 %	special	single	NZX series	SOD27 (DO-35)	4.25 x 1.85 x 0.56	400
	40	2.4~75	B, C	Eur		BZX79 series			
400	40	2.4~75	C	Eur	single	BZV90 series	SOT223 (SC-73)	6.5 x 3.5 x 1.65	1500
250	40	2.4~75	C	Eur	single	BZV49 series	SOT89 (SC-62)	4.5 x 2.5 x 1.5	1000
250	40	2.4~75	B, C	Eur	single	BZV55 series	SOD80C (MiniMelf)	3.5 x 1.5 x 1.5	300
200	40	2.4~75	B, C	Eur	dual c.a.	BZB84 series	SOT23	2.9 x 1.3 x 1.0	250
			A, B, C		single	BZX84 series			
250	30	5~6.8	0.2 V	Ave	single	PLVA600A series	SOT23	2.9 x 1.3 x 1.0	250
			0.2 V	Ave	dual c.a.	PLVA2600A series			
250	-	3.0~30	about 2.5 %	special	single	NZH series	SOD123F	2.6 x 1.6 x 1.1	830
	40	2.4~75	C	Eur		BZT52H series			
200	40	2.7~24	B2	Jap	dual isolated	PZUxDB2 series	SOT353 (SC-88A)	2.0 x 1.25 x 0.95	300
200	40	2.4~15	C	Eur	dual c.a.	BZB784 series	SOT323 (SC-70)	2.0 x 1.25 x 0.95	350
200	30	100	C	Eur	back-to-back	BZB100A	SOD323 (SC-76)	1.7 x 1.25 x 0.95	300
	40	2.4~36	B2	Jap	PDZ-B series				
250	40	2.4~75	B, C	Eur	single	BZX384 series	SOD323 (SC-76)	1.7 x 1.25 x 0.95	300
200	40	2.4~36	B, B1, B2, B3	Jap	PZUxBA series				
200	60	100	C	Eur	single	BZX100A	SOD323F (SC-90)	1.7 x 1.25 x 0.7	550
200	40	2.4~36	B, B1, B2, B3	Jap	PZUxB series				
250	40	2.4~75	B, C	Eur	single	BZX84J series	SOD323F (SC-90)	1.7 x 1.25 x 0.7	550
200	40	2.4~15	C	Eur	dual c.a.	BZB984 series	SOT663	1.6 x 1.2 x 0.55	350
200	40	2.4~75	B, C	Eur	single	BZX585 series	SOD523 (SC-79)	1.2 x 0.8 x 0.6	300
200	40	2.4~75	B, C	Eur	single	BZX884 series	SOD882	1.0 x 0.6 x 0.5	250
		2.4~36	B, B2	Jap		PZUxBL series			

Notes:  
 Jap: B selection: app. 5 %  $V_z$  tolerance, B1, B2, B3 selections: app. 2 %  $V_z$  tolerance in sequential intervals  
 Eur: A selection: app. 1 %  $V_z$  tolerance, B selection: app. 2 %  $V_z$  tolerance, C selection: app. 5 %  $V_z$  tolerance; the selections are in overlapping intervals  
 Ave: low voltage avalanche regulator diodes  
 dual c.a.: dual common anode

## Differences in Zener specification



## PZU-series in SOD323F, Japanese spec

y =	B-series ± 5 % $V_z$ (V)	B1-series ± 2 % $V_z$ (V)	B2-series ± 2 % $V_z$ (V)	B3-series ± 2 % $V_z$ (V)
PZU2.4y	2.3 - 2.6	-	-	-
PZU2.7y	2.5 - 2.9	2.5 - 2.75	2.65 - 2.9	-
PZU3.0y	2.8 - 3.2	2.8 - 3.05	2.95 - 3.2	-
PZU3.3y	3.1 - 3.5	3.1 - 3.35	3.25 - 3.5	-
PZU3.6y	3.4 - 3.8	3.4 - 3.65	3.55 - 3.8	-
PZU3.9y	3.7 - 4.1	3.7 - 3.97	3.87 - 4.1	-
PZU4.3y	4.01 - 4.48	4.01 - 4.21	4.15 - 4.34	4.28 - 4.48
PZU4.7y	4.42 - 4.9	4.42 - 4.61	4.55 - 4.75	4.69 - 4.9
PZU5.1y	4.84 - 5.37	4.84 - 5.04	4.98 - 5.2	5.14 - 5.37
PZU5.6y	5.31 - 5.92	5.31 - 5.55	5.49 - 5.73	5.67 - 5.92
PZU6.2y	5.86 - 6.53	5.86 - 6.12	6.06 - 6.33	6.26 - 6.53
PZU6.8y	6.47 - 7.14	6.47 - 6.73	6.65 - 6.93	6.86 - 7.14
PZU7.5y	7.06 - 7.84	7.06 - 7.36	7.28 - 7.6	7.52 - 7.84
PZU8.2y	7.76 - 8.64	7.76 - 8.1	8.02 - 8.36	8.28 - 8.64
PZU9.1y	8.56 - 9.55	8.56 - 8.93	8.85 - 9.23	9.15 - 9.55
PZU10y	9.45 - 10.55	9.45 - 9.87	9.77 - 10.21	10.11 - 10.55
PZU11y	10.44 - 11.56	10.44 - 10.88	10.76 - 11.22	11.1 - 11.56
PZU12y	11.42 - 12.6	11.42 - 11.9	11.74 - 12.24	12.08 - 12.6
PZU13y	12.47 - 13.96	12.47 - 13.03	12.91 - 13.49	13.37 - 13.96
PZU14y	-	-	13.7 - 14.3	-
PZU15y	13.84 - 15.52	13.84 - 14.46	14.34 - 14.98	14.85 - 15.52
PZU16y	15.37 - 17.09	15.37 - 16.01	15.85 - 16.51	16.35 - 17.09
PZU18y	16.94 - 19.03	16.94 - 17.7	17.56 - 18.35	18.21 - 19.03
PZU20y	18.86 - 21.08	18.86 - 19.7	19.52 - 20.39	20.21 - 21.08
PZU22y	20.88 - 23.17	20.88 - 21.77	21.54 - 22.47	22.23 - 23.17
PZU24y	22.93 - 25.57	22.93 - 23.96	23.72 - 24.78	24.54 - 25.57
PZU27y	25.1 - 28.9	-	-	-
PZU30y	28 - 32	-	-	-
PZU33y	31 - 35	-	-	-
PZU36y	34 - 38	-	-	-

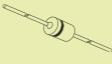
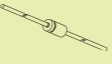



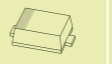






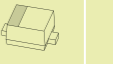



















## BZX-series, European spec

y =	C-series ± 5 % $V_z$ (V)	B-series ± 2 % $V_z$ (V)	A-series ± 1 % $V_z$ (V)
BZX84-y2V4	2.2 - 2.6	2.35 - 2.45	2.37 - 2.43
BZX84-y2V7	2.5 - 2.9	2.65 - 2.75	2.67 - 2.73
BZX84-y3V0	2.8 - 3.2	2.94 - 3.06	2.97 - 3.03
BZX84-y3V3	3.1 - 3.5	3.23 - 3.37	3.26 - 3.34
BZX84-y3V6	3.4 - 3.8	3.53 - 3.67	3.56 - 3.64
BZX84-y3V9	3.7 - 4.1	3.82 - 3.98	3.86 - 3.94
BZX84-y4V3	4 - 4.6	4.21 - 4.39	4.25 - 4.35
BZX84-y4V7	4.4 - 5	4.61 - 4.79	4.65 - 4.75
BZX84-y5V1	4.8 - 5.4	5 - 5.2	5.04 - 5.16
BZX84-y5V6	5.2 - 6	5.49 - 5.71	5.54 - 5.66
BZX84-y6V2	5.8 - 6.6	6.08 - 6.32	6.13 - 6.27
BZX84-y6V8	6.4 - 7.2	6.66 - 6.94	6.73 - 6.87
BZX84-y7V5	7 - 7.9	7.35 - 7.65	7.42 - 7.58
BZX84-y8V2	7.7 - 8.7	8.04 - 8.36	8.11 - 8.29
BZX84-y9V1	8.5 - 9.6	8.92 - 9.28	9 - 9.2
BZX84-y10	9.4 - 10.6	9.8 - 10.2	9.9 - 10.1
BZX84-y11	10.4 - 11.6	10.8 - 11.2	10.8 - 11.11
BZX84-y12	11.4 - 12.7	11.8 - 12.2	11.88 - 12.12
BZX84-y13	12.4 - 14.1	12.7 - 13.3	12.87 - 13.13
BZX84-y15	13.8 - 15.6	14.7 - 15.3	14.85 - 15.15
BZX84-y16	15.3 - 17.1	15.7 - 16.3	-
BZX84-y18	16.8 - 19.1	17.6 - 18.4	-
BZX84-y20	18.8 - 21.2	19.6 - 20.4	19.8 - 20.2
BZX84-y22	20.8 - 23.3	21.6 - 22.4	-
BZX84-y24	22.8 - 25.6	23.5 - 24.5	-
BZX84-y27	25.1 - 28.9	26.5 - 27.5	26.73 - 27.27
BZX84-y30	28 - 32	29.4 - 30.6	-
BZX84-y33	31 - 35	32.3 - 33.7	-
BZX84-y36	34 - 38	35.3 - 36.7	35.64 - 36.36
BZX84-y39	37 - 41	38.2 - 39.8	38.61 - 39.39
BZX84-y43	40 - 46	42.1 - 43.9	42.57 - 43.43
BZX84-y47	44 - 50	46.1 - 47.9	-
BZX84-y51	48 - 54	50 - 52	50.49 - 51.51
BZX84-y56	52 - 60	54.9 - 57.1	-
BZX84-y62	58 - 66	60.8 - 63.2	-
BZX84-y68	64 - 72	66.6 - 69.4	-
BZX84-y75	70 - 79	73.5 - 76.5	74.25 - 75.75

## NZX-series in SOD27

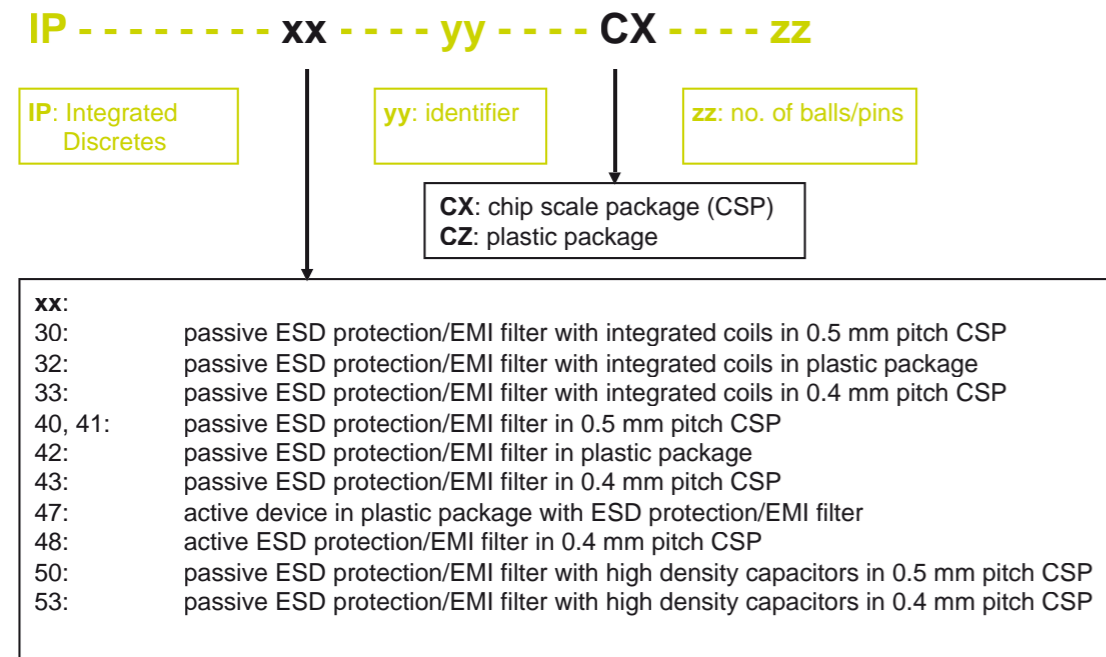
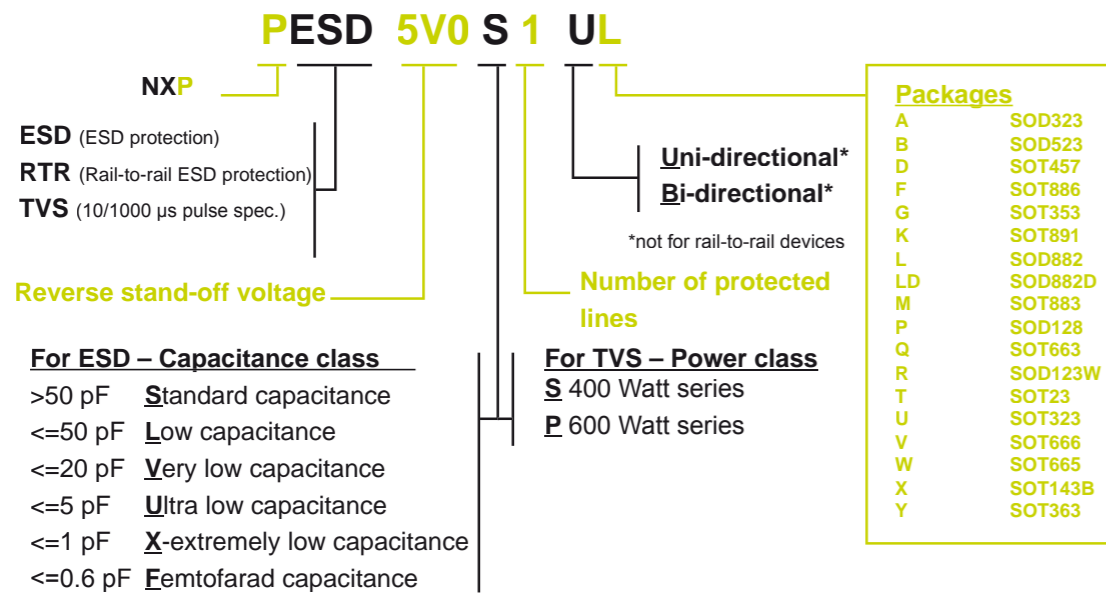
	$V_z$ (V)		$V_z$ (V)		$V_z$ (V)
NZX2V4A	2.3 - 2.5	NZX6V2D	6.1 - 6.4	NZX14B	13.5 - 14
NZX2V4B	2.4 - 2.6	NZX6V2E	6.3 - 6.6	NZX14C	13.8 - 14.3
NZX2V7A	2.5 - 2.7	NZX6V8A	6.4 - 6.7	NZX15A	14.1 - 14.7
NZX2V7B	2.6 - 2.8	NZX6V8B	6.6 - 6.9	NZX15B	14.5 - 15.1
NZX2V7C	2.7 - 2.9	NZX6V8C	6.7 - 7	NZX15C	14.9 - 15.5
NZX3V0A	2.8 - 3	NZX6V8D	6.9 - 7.2	NZX15X	14.35 - 15.09
NZX3V0B	2.9 - 3.1	NZX7V5A	7 - 7.3	NZX16A	15.3 - 15.9
NZX3V0C	3 - 3.2	NZX7V5B	7.2 - 7.6	NZX16B	15.7 - 16.5
NZX3V3A	3.1 - 3.3	NZX7V5C	7.3 - 7.7	NZX16C	16.3 - 17.1
NZX3V3B	3.2 - 3.4	NZX7V5D	7.5 - 7.9	NZX18A	16.9 - 17.7
NZX3V3C	3.3 - 3.5	NZX7V5X	7.07 - 7.45	NZX18B	17.5 - 18.3
NZX3V6A	3.4 - 3.6	NZX8V2A	7.7 - 8.1	NZX18C	18.1 - 19
NZX3V6B	3.5 - 3.7	NZX8V2B	7.9 - 8.3	NZX20A	18.8 - 19.7
NZX3V6C	3.6 - 3.8	NZX8V2C	8.1 - 8.5	NZX20B	19.5 - 20.4
NZX3V9A	3.7 - 3.9	NZX8V2D	8.3 - 8.7	NZX20C	20.2 - 21.2
NZX3V9B	3.8 - 4	NZX9V1A	8.5 - 8.9	NZX22A	20.9 - 21.9
NZX3V9C	3.9 - 4.1	NZX9V1B	8.7 - 9.1	NZX22B	21.6 - 22.6
NZX4V3A	4 - 4.2	NZX9V1C	8.9 - 9.3	NZX22C	22.3 - 23.3
NZX4V3B	4.1 - 4.3	NZX9V1D	9.1 - 9.5	NZX24A	22.9 - 24
NZX4V3C	4.2 - 4.4	NZX9V1E	9.3 - 9.7	NZX24B	23.6 - 24.7
NZX4V3D	4.3 - 4.5	NZX10A	9.5 - 9.9	NZX24C	24.3 - 25.5
NZX4V7A	4.4 - 4.6	NZX10B	9.7 - 10.1	NZX24X	22.61 - 23.77
NZX4V7B	4.5 - 4.7	NZX10C	9.9 - 10.3	NZX27A	25.2 - 26.6
NZX4V7C	4.6 - 4.8	NZX10D	10.2 - 10.6	NZX27B	26.2 - 27.6
NZX4V7D	4.7 - 4.9	NZX11A	10.4 - 10.8	NZX27C	27.2 - 28.6
NZX5V1A	4.8 - 5	NZX11B	10.7 - 11.1	NZX27X	26.99 - 28.39
NZX5V1B	4.9 - 5.1	NZX11C	10.9 - 11.3	NZX30A	28.2 - 29.6
NZX5V1C	5 - 5.2	NZX11D	11.1 - 11.6	NZX30B	29.2 - 30.6
NZX5V1D	5.1 - 5.3	NZX12A	11.4 - 11.9	NZX30C	30.2 - 31.6
NZX5V6A	5.2 - 5.5	NZX12B	11.6 - 12.1	NZX30X	29.02 - 30.51
NZX5V6B	5.3 - 5.6	NZX12C	11.9 - 12.4	NZX33A	31.2 - 32.6
NZX5V6C	5.4 - 5.7	NZX12D	12.2 - 12.7	NZX33B	32.2 - 33.6
NZX5V6D	5.5 - 5.8	NZX12X	11.44 - 12.03	NZX33C	33.2 - 34.5
NZX5V6E	5.6 - 5.9	NZX13A	12.4 - 12.9	NZX36A	34.2 - 35.7
NZX6V2A	5.7 - 6	NZX13B	12.6 - 13.1	NZX36B	35.3 - 36.8
NZX6V2B	5.8 - 6.1	NZX13C	12.9 - 13.4	NZX36C	36.4 - 38
NZX6V2C	6 - 6.3	NZX14A	13.2 - 13.7	NZX36X	35.36 - 37.19

General purpose switching diodes ≤ 100V

V <sub>r</sub> max (V)	V <sub>f</sub> max (V)	I <sub>f</sub> (mA)	I <sub>r</sub> max (mA)	@ V <sub>r</sub> (V)	t <sub>r</sub> max (ns)	Package	SOD27 (DO-35)	SOD68 (DO-34)	SOD80C (MiniMelf)	SOT23	SOT143B	SOD123F	SOT323 (SC-70)	SOT363 (SC-88)	SOD323 (SC-76)	SOD323F (SC-90)	SOT666	SOT416 (SC-75)	SOD523 (SC-79)	SOD882	SOT883 (SC-101)			
																								
							4.25 x 1.85 x 0.56	3.04 x 1.6 x 0.55	3.5 x 1.5 x 1.5	2.9 x 1.3 x 1.0	2.9 x 1.3 x 1.0	2.6 x 1.6 x 1.1	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.7 x 1.25 x 0.95	1.7 x 1.25 x 0.7	1.6 x 1.2 x 0.55	1.6 x 0.8 x 0.77	1.2 x 0.8 x 0.6	1.0 x 0.6 x 0.5	1.0 x 0.6 x 0.5			
						500	500	500	250	250	830	200	300	400	550	180	170	500	250	250				
50	1	50	100	50	4					BAL74														
70	1	50	1000	70	4					BAL99														
75	1	10	25	20	4			1N4531																
		50	1000	75	4					BAS28														
		100	5000	75	4				BAS32L															
90	1	50	500	80	4					BAW56			BAW56W						BAW56T			BAW56M		
																	BAW56S							
																		BAW756S						
100	1	10	25	20	4		1N4148																	
														BAS16H			BAS316	BAS16J						
										BAS16			BAS16W						BAS16T					
																				BAS516	BAS16L			
														BAS16VY				BAS16VW						
										BAV70				BAV70W						BAV70T			BAV70M	
															BAV70S									
										BAV99					BAV99W									
														BAV99S										



# Protection and signal conditioning nomenclature



# Protection and signal conditioning

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### Standard ESD protection devices

types in **bold** represent new products

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line</sub> typ (pF)	C <sub>line</sub> max (pF)	P <sub>PP</sub> <sup>[1]</sup> max (W)	ESD rating <sup>[2]</sup> max (kV)	I <sub>R</sub> max (μA) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)		
Unidirectional	Bidirectional												
1	0	3.3	207	300	150	30	2		PESD3V3S1UL	SOD882	1.0 x 0.6 x 0.5		
		5	152	200	150	30	1		PESD5V0S1UL				
		12	38	75	150	30	0.05		PESD12VS1UL				
		15	32	70	150	30	0.05		PESD15VS1UL				
		24	23	50	150	23	0.05		PESD24VS1UL				
		5	152	200	150	30	1		<b>PESD5V0S1ULD</b>			SOD882D	1.0 x 0.6 x 0.37
		3.3	207	300	330	30	2				PESD3V3S1UB	SOD523 (SC-79)	1.2 x 0.8 x 0.6
		5	152	200	260	30	1			PESD5V0S1UB			
		12	38	75	180	30	0.05			PESD12VS1UB			
		15	32	70	160	30	0.05			PESD15VS1UB			
		24	23	50	160	23	0.05			PESD24VS1UB			
		5	480	530	890	30	4			PESD5V0S1UA		SOD323 (SC-76)	
		12	160	180	600	30	0.1	PESD12VS1UA					
		5	480	530	890	30	4	PESD5V0S1UJ			SOD323F (SC-90)	1.7 x 1.25 x 0.7	
		12	160	180	600	30	0.1	PESD12VS1UJ					
		2.5	229	300	260	30	6	PESD5Z2.5				SOD523 (SC-79)	1.2 x 0.8 x 0.6
		3.3	172	200	260	30	0.05	PESD5Z3.3					
		5	89	150	180	30	0.05	PESD5Z5.0					
		6	78	150	180	30	0.01	PESD5Z6.0					
		7	69	150	180	30	0.01	PESD5Z7.0					
		12	35	75	200	30	0.01	PESD5Z12					
		0	1	5	35	45	130	30	0.1		PESD5V0S1BL		SOD882
				5	35	45	130	30	0.1		<b>PESD5V0S1BLD</b>	SOD882D	1.0 x 0.6 x 0.37
				5	35	45	130	30	0.1		PESD5V0S1BB	SOD523 (SC-79)	1.2 x 0.8 x 0.6
				5	35	45	130	30	0.1		PESD5V0S1BA	SOD323 (SC-76)	1.7 x 1.25 x 0.95
				5	35	45	130	30	0.1				

<sup>[1]</sup> 8/20 μs surge pulse acc. to IEC 61000-4-5

<sup>[2]</sup> acc. to IEC 61000-4-2 (contact discharge)

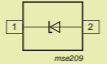






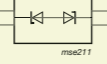







### Standard ESD protection protection devices

Number of protected lines		V <sub>RWM</sub> (V)	C <sub>line</sub> typ (pF)	C <sub>line</sub> max (pF)	P <sub>PP</sub> <sup>[1]</sup> max (W)	ESD rating <sup>[2]</sup> max (kV)	I <sub>R</sub> max (μA) @ V <sub>RWM</sub>	Configuration	Type	Package	Size (mm)		
Unidirectional	Bidirectional												
2	1	3.3	200	275	150	23	3		PESD3V3S2UQ	SOT663	1.6 x 1.2 x 0.55		
		5	150	215	150	30	0.3		PESD5V0S2UQ				
		12	38	100	150	30	0.03		PESD12VS2UQ				
		15	32	70	150	30	0.05		PESD15VS2UQ				
		24	23	50	150	23	0.05		PESD24VS2UQ				
		3.3	207	300	330	30	2		PESD3V3S2UT			SOT23	2.9 x 1.3 x 1.0
		5.2	152	200	260	30	1		PESD5V2S2UT				
		12	38	75	180	30	1		PESD12VS2UT				
		15	32	70	160	30	1		PESD15VS2UT				
		24	23	50	160	23	1		PESD24VS2UT				
		36	17	35	160	30	1 (@ 30 V)		PESD36VS2UT				
		3.3	207	300	330	30	2			PESD3V3S2UAT			
		5	152	200	260	30	1	PESD5V0S2UAT					
		12	38	75	180	30	0.05	PESD12VS2UAT					
		15	32	70	160	30	0.05	PESD15VS2UAT					
		24	23	50	160	23	0.05	PESD24VS2UAT					
		3.3	110	300	110	30	1 (@ 3 V)	PESD3V3S4UF		SOT886 (XSON6)	1.45 x 1.0 x 0.5		
		5	85	220	110	30	0.1 (@ 4.3 V)						PESD5V0S4UF
		4	3	3	107	125	-	8		1			BZA956A
				4	90	105	-	8	0.5	BZA962A			
4.3	78			90	-	8	0.1	BZA968A					
3	200			240	-	8	2	BZA856A	SOT353 (SC-88A)	2.0 x 1.25 x 0.95			
3	107			125	-	8	1	BZA856AL					
4	165			200	-	8	0.7	BZA862A					
4	90			105	-	8	0.5	BZA862AL					
4.3	145			180	-	8	0.2	BZA868A					
4.3	78			90	-	8	0.1	BZA868AL					
15	37			50	-	8	0.1	BZA820A					
3	200			240	-	8	2	BZA456A		SOT457 (SC-74)		2.9 x 1.5 x 1.0	
4	165			200	-	15	0.7	BZA462A					
14	37			48	-	8	0.075	BZA418A					
15	37			48	-	8	0.1	BZA420A					
3.3	215			300	200	30	0.8	PESD3V3S4UD					
5	165			220	200	30	0.2	PESD5V0S4UD					
12	73			100	200	30	0.015	PESD12VS4UD					
15	60			90	200	30	0.015	PESD15VS4UD					
24	40			70	200	23	0.015	PESD24VS4UD					
3.3	215			300	200	30	0.8	PESD3V3S5UD					
5	165	220	200	30	0.2	PESD5V0S5UD							
12	73	100	200	30	0.015	PESD12VS5UD							
15	60	90	200	30	0.015	PESD15VS5UD							
24	45	70	200	23	0.015	PESD24VS5UD							
0	4	5	45	75	-	15	0.1		BZA408B				
18	17	5.2	100	120	-	8	2		BZA100	SOT163 (SO20)	12.8 x 7.5 x 2.65		

<sup>[1]</sup> 8/20 μs surge pulse acc. to IEC 61000-4-5

<sup>[2]</sup> acc. to IEC 61000-4-2 (contact discharge)

Low capacitance ESD protection devices













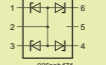



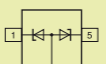


Number of protected lines		V <sub>RMV</sub> (V)	C <sub>line</sub> typ (pF)	C <sub>line</sub> max (pF)	P <sub>IP</sub> <sup>(1)</sup> max (W)	ESD rating <sup>(2)</sup> max (kV)	I <sub>R</sub> max (µA) @ V <sub>RMV</sub>	Configuration	Type	Package	Size (mm)			
Unidirectional	Bidirectional													
1	0	3.3	34	40	45	30	0.3		PESD3V3L1UL	SOD882 	1.0 x 0.6 x 0.5			
		5	25	30	42	26	0.1		PESD5V0L1UL					
		3.3	34	40	45	30	0.3		PESD3V3L1UB	SOD523 (SC-79) 	1.2 x 0.8 x 0.6			
		5	25	30	42	26	0.1		PESD5V0L1UB					
		3.3	34	40	45	30	0.3		PESD3V3L1UA	SOD323 (SC-76) 	1.7 x 1.25 x 0.95			
		5	25	30	42	26	0.1		PESD5V0L1UA					
		3.3	2.6	3.1	-	9	0.1 (@ 3 V)		PESD3V3U1UL	SOD882 	1.0 x 0.6 x 0.5			
		5	2	2.6	-	9	0.1		PESD5V0U1UL					
		3.3	2.6	3.1	-	9	0.1 (@ 3 V)		PESD3V3U1UB	SOD523 (SC-79) 	1.2 x 0.8 x 0.6			
		5	2	2.6	-	9	0.1		PESD5V0U1UB					
		3.3	2.6	3.1	-	9	0.1 (@ 3 V)		PESD3V3U1UA	SOD323 (SC-76) 	1.7 x 1.25 x 0.95			
		5	2	2.6	-	9	0.1		PESD5V0U1UA					
		0	1	3.3	101	-	500		30	2		PESD3V3L1BA	SOD882 	1.7 x 1.25 x 0.95
				5	75	-	500		30	1		PESD5V0L1BA		
12	19			-	200	30	0.05	PESD12VL1BA						
15	16			-	200	30	0.05	PESD15VL1BA						
24	11			-	200	23	0.05	PESD24VL1BA						
5	11			13	45	30	0.01	PESD5V0V1BL	SOD882 	1.0 x 0.6 x 0.5				
5	11			13	45	30	0.01	PESD5V0V1BB	SOD523 (SC-79) 	1.2 x 0.8 x 0.6				
5	11			13	45	30	0.01	PESD5V0V1BA	SOD323 (SC-76) 	1.7 x 1.25 x 0.95				
5	2.9			3.5	-	10	0.1	PESD5V0U1BL	SOD882 	1.0 x 0.6 x 0.5				
5	2.9			3.5	-	10	0.1	PESD5V0U1BB	SOD523 (SC-79) 	1.2 x 0.8 x 0.6				
5	2.9			3.5	-	10	0.1	PESD5V0U1BA	SOD323 (SC-76) 	1.7 x 1.25 x 0.95				

<sup>(1)</sup> 8/20 µs surge pulse acc. to IEC 61000-4-5

<sup>(2)</sup> acc. to IEC 61000-4-2 (contact discharge)

Low capacitance ESD protection devices

types in **bold** represent new products

Number of protected lines		V <sub>RMV</sub> (V)	C <sub>line</sub> typ (pF)	C <sub>line</sub> max (pF)	P <sub>IP</sub> <sup>(1)</sup> max (W)	ESD rating <sup>(2)</sup> max (kV)	I <sub>R</sub> max (µA) @ V <sub>RMV</sub>	Configuration	Type	Package	Size (mm)			
Unidirectional	Bidirectional													
2	1	3.3	22	28	30	15	0.3		PESD3V3L2UM	SOT883 (SC-101) 	1.0 x 0.6 x 0.5			
		5	16	19	30	15	0.025		PESD5V0L2UM					
		5	38	46	70	30	0.09 (@ 4 V)		PESD5V0L2UU	SOT323 (SC-70) 	2.0 x 1.25 x 0.95			
		6	34	40	60	30	0.018 (@ 4.3 V)		PESD6V0L2UU					
0	2	3.3	101	-	350	30	2		PESD3V3L2BT	SOT23 	2.9 x 1.3 x 1.0			
		5	75	-	350	30	1		PESD5V0L2BT					
		12	19	-	200	30	0.05		PESD12VL2BT					
		15	16	-	200	30	0.05		PESD15VL2BT					
		24	11	-	200	23	0.05		PESD24VL2BT					
		5	35	45	130	30	0.1		PESD5V0S2BT					
		5	2.9	3.5	-	10	0.1		PESD5V0U2BT					
		5	2.9	3.5	-	10	0.1		PESD5V0U2BM	SOT883 (SC-101) 	1.0 x 0.6 x 0.5			
		4	3	3.3	22	28	30		20	0.3		PESD3V3L4UF	SOT886 (XSON6) 	1.45 x 1.0 x 0.5
				5	16	19	30		20	0.025		PESD5V0L4UF		
3.3	22			28	30	20	0.3		PESD3V3L4UW	SOT665 	1.6 x 1.2 x 0.55			
5	16			19	30	20	0.025		PESD5V0L4UW					
3.3	22			28	30	20	0.3		PESD3V3L4UG	SOT353 (SC-88A) 	2.0 x 1.25 x 0.95			
5	16			19	30	20	0.025		PESD5V0L4UG					
3.3	13			17	14	10	1		<b>PESD3V3V4UK</b>	SOT891 (XSON6) 	1.0 x 1.0 x 0.5			
5	12			15	20	15	0.5		<b>PESD5V0V4UK</b>					
9	6.5			10	25	8	0.5		<b>PESD9V0V4UK</b>					
3.3	15			18	16	12	0.3		PESD3V3V4UF	SOT886 (XSON6) 	1.45 x 1.0 x 0.5			
5	12			15	16	12	0.025		PESD5V0V4UF					
3.3	15			18	16	12	0.3		PESD3V3V4UW	SOT665 	1.6 x 1.2 x 0.55			
5	12			15	16	12	0.025		PESD5V0V4UW					
3.3	15			18	16	12	0.3		PESD3V3V4UG	SOT353 (SC-88A) 	2.0 x 1.25 x 0.95			
5	12	15	16	12	0.025	PESD5V0V4UG								

<sup>(1)</sup> 8/20 µs surge pulse acc. to IEC 61000-4-5

<sup>(2)</sup> acc. to IEC 61000-4-2 (contact discharge)

### Low capacitance ESD protection devices

types in **bold** represent new products

Number of protected lines		$V_{RWM}$ (V)	$C_{in}$ typ (pF)	$C_{in}$ max (pF)	$P_{PP}^{[1]}$ max (W)	ESD rating <sup>[2]</sup> max (kV)	$I_R$ max (μA) @ $V_{RWM}$	Configuration	Type	Package	Size (mm)	
Unidirectional	Bidirectional											
0	4	5	2.9	3.5	-	10	0.1		PESD5V0U4BF	SOT886 (XSON6)	1.45 x 1.0 x 0.5	
		5	2.9	3.5	-	10	0.1		PESD5V0U4BW	SOT665	1.6 x 1.2 x 0.55	
5	4	3.3	22		25	20	1		<b>PESD3V3L5UK</b>	SOT891 (XSON6)	1.0 x 1.0 x 0.5	
		5	16		25	20	0.025		<b>PESD5V0L5UK</b>			
		3.3	22	28	25	20	0.3		PESD3V3L5UF	SOT886 (XSON6)		
		5	16	19	25	20	0.025		PESD5V0L5UF			
		3.3	22	28	25	20	0.3		PESD3V3L5UV	SOT666	1.6 x 1.2 x 0.55	
		5	16	19	25	20	0.025		PESD5V0L5UV			
		3.3	22	28	25	20	0.3		PESD3V3L5UY	SOT363 (SC-88)		2.0 x 1.25 x 0.95
		5	16	19	25	20	0.025		PESD5V0L5UY			
0	5	5	2.9	3.5	-	10	0.1		PESD5V0U5BF	SOT886 (XSON6)	1.45 x 1.0 x 0.5	
		5	2.9	3.5	-	10	0.1		PESD5V0U5BV	SOT666	1.6 x 1.2 x 0.55	
6	5	5	16	19	35	20	0.025		PESD5V0L6UAS	SOT505 (TSSOP8)	3.0 x 3.0 x 1.1	
		5	16	19	35	20	0.025		PESD5V0L6US	SOT96 (SO8)	4.9 x 3.9 x 1.75	
0	7	5	8	10	35	10	0.025		PESD5V0L7BAS	SOT505 (TSSOP8)	3.0 x 3.0 x 1.1	
		5	8	10	35	10	0.025		PESD5V0L7BS	SOT96 (SO8)	4.9 x 3.9 x 1.75	

<sup>[1]</sup> 8/20 μs surge pulse acc. to IEC 61000-4-5

<sup>[2]</sup> acc. to IEC 61000-4-2 (contact discharge)

### ESD protection for very high speed interfaces (< 2 pF)

types in **bold** represent new products

Number of protected lines		$V_{RWM}$ (V)	$C_{in}$ typ (pF)	$C_{in}$ max (pF)	ESD rating <sup>[2]</sup> max (kV)	$I_R$ max (μA) @ $V_{RWM}$	Configuration	Type	Package	Size (mm)	
Unidirectional	Bidirectional										
1	0	5	0.9	1	8	0.2		<b>PESD5V0X1UB</b>	SOD523 (SC-79)	1.2 x 0.8 x 0.6	
		5	1.8	2	15	0.2		<b>PESD5V0X1UAB</b>			
		16	0.83	0.95	8	0.1		<b>PESD16VX1UL</b>	SOD882		1.0 x 0.6 x 0.5
0	1	5.5	1	1.5	8	0.1 (@ 3 V)		PRTR5V0U1T	SOT23	2.9 x 1.3 x 1.0	
		5.5	1	1.5	8	0.1 (@ 3 V)		<b>PESD5V0F1BL</b>	SOD882	1.0 x 0.6 x 0.5	
0	1	16	0.5	0.65	8	0.1		<b>PESD16VX1UL</b>			
		3.3	1.3	1.6	9	0.1		PESD3V3X1BL			
		5	0.9	1.3	9	0.1		PESD5V0X1BL			
		5	0.9	1.3	9	0.1					
2	1	5	0.9	1.3	9	0.1		PESD5V0X1BQ	SOT663	1.6 x 1.2 x 0.55	
		5	0.9	1.3	9	0.1		PESD5V0X1BT	SOT23	2.9 x 1.3 x 1.0	
		80	0.6	0.75	30	0.1		<b>NUP1301</b>			
		5.5	1	1.5	8	0.1 (@ 3 V)		PRTR5V0U2X	SOT143B		
		5.5	1.8		12	0.1 (@ 3 V)		PRTR5V0U2AX			
		0	0	5.5	1	1.5	8	0.1 (@ 3 V)		PRTR5V0U2K	SOT891 (XSON6)
5.5	1			1.5	8	0.1 (@ 3 V)	PRTR5V0U2D	SOT457 (SC-74)		2.9 x 1.5 x 1.0	
5.5	1			1.5	8	0.1 (@ 3 V)	PRTR5V0U2F	SOT886 (XSON6)		1.45 x 1.0 x 0.5	
5.5	2			-	15	-		<b>IP4234CZ6</b>		SOT457 (SC-74)	2.9 x 1.5 x 1.0
5.5	1.5			-	8	-		<b>IP3219CZ6</b>		SOT1082-1 (VSON6U)	2.3 x 3.5 x 0.85

<sup>[1]</sup> 8/20 μs surge pulse acc. to IEC 61000-4-5

ESD protection for very high speed interfaces (< 2 pF)

## ESD protection for very high speed interfaces (< 2 pF)

types in **bold** represent new products

Number of protected lines		$V_{RWM}$ (V)	$C_{line}$ typ (pF)	$C_{line}$ max (pF)	ESD rating <sup>[1]</sup> max (kV)	$I_R$ max (μA) @ $V_{RWM}$	Configuration	Type	Package	Size (mm)
Unidirectional	Bidirectional									
2	0	5.5	0.7	-	8	-		<b>IP4282CZ6</b>	SOT886 (XSON6)	1.45 x 1.0 x 0.5
		5.5	1.3	-	15	-		<b>IP4359CX4</b>	CSP	0.76 x 0.76 x 0.61
4	0	5.5	1	-	8	-		<b>IP4220CZ6</b>	SOT457 (SC-74)	2.9 x 1.5 x 1.0
		5.5	1	-	8	-		<b>IP4221CZ6-S</b>	SOT886 (XSON6)	1.45 x 1.0 x 0.5
		5.5	1	-	8	-		<b>IP4221CZ6-XS</b>	SOT891 (XSON6)	1.0 x 1.0 x 0.5
		5.5	1	-	8	-		<b>IP4233CZ6</b>	SOT363 (SC-88)	2.0 x 1.25 x 0.95
		5.5	1	-	8	-		<b>PRTR5V0U4AD</b>	SOT457 (SC-74)	2.9 x 1.5 x 1.0
		5.5	1	-	8	-		<b>PRTR5V0U4D</b>	SOT363 (SC-88)	2.0 x 1.25 x 0.95
		5.5	1	-	8	-		<b>PRTR5V0U4Y</b>	SOT363 (SC-88)	2.0 x 1.25 x 0.95
		5.5	0.7	-	8	-		<b>IP4280CZ10</b>	SOT552 (TSSOP10)	3.0 x 3.0 x 1.1
		5.5	0.7	-	8	-		<b>IP4281CZ10</b>	SOT1059 (XSON10U)	1.0 x 2.5 x 0.5
		5.5	0.6	-	8	-		<b>IP4283CZ10-TB</b>	SOT1059 (XSON10U)	1.0 x 2.5 x 0.5
		5.5	0.6	-	8	-		<b>IP4283CZ10-TT</b>	SOT552 (TSSOP10)	3.0 x 3.0 x 1.1

<sup>[1]</sup> 8/20 μs surge pulse acc. to IEC 61000-4-5

ESD protection for very high speed interfaces (< 2 pF)

## ESD protection for very high speed interfaces (< 2 pF)

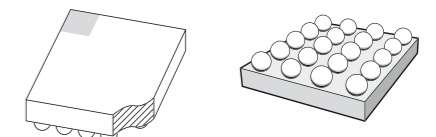
types in **bold** represent new products

Number of protected lines		$V_{RWM}$ (V)	$C_{line}$ typ (pF)	$C_{line}$ max (pF)	ESD rating <sup>[1]</sup> max (kV)	$I_R$ max (μA) @ $V_{RWM}$	Configuration	Type	Package	Size (mm)
Unidirectional	Bidirectional									
4	0	5.5	0.6	-	8	-		<b>IP4286CZ6-TBF</b>	SOT886 (XSON6)	1.45 x 1.0 x 0.5
		5.5	0.6	-	8	-		<b>IP4286CZ6-TTY</b>	SOT363 (SC-88)	2.0 x 1.25 x 0.95
		5.5	0.5	-	8	-		<b>IP4284CZ10-TB</b>	SOT1059 (XSON10U)	1 x 2.5 x 0.5
		5.5	0.5	-	8	-		<b>IP4284CZ10-TT</b>	SOT552 (TSSOP10)	3.0 x 3.0 x 1.1
5	0	5.5	1.3	-	15	-		<b>IP4358CX6</b>	CSP	0.76 x 1.16 x 0.61
		5.5	10	-	15	-		<b>IP4310CX8</b>	CSP	1.16 x 1.16 x 0.61
0	5	5	0.5	0.65	8	0.2		<b>PESD5V0F5BK</b>	SOT891 (XSON6)	1.0 x 1.0 x 0.5
8	0	5.5	1.3	-	15	-		<b>IP4309CX9</b>	CSP	1.16 x 1.16 x 0.61
		5.5	1	-	8	-		<b>PRTR5V0U8S</b>	SOT552 (TSSOP10)	3.0 x 3.0 x 1.1
		5.5	0.7	-	8	-		<b>IP4790CZ38</b>	SOT510 (TSSOP38)	9.7 x 4.4 x 1.1

<sup>[1]</sup> 8/20 μs surge pulse acc. to IEC 61000-4-5

### NXP Wafer-Level Chip Scale Package (WL-CSP)

- ▶ Smallest possible solution for ESD and EMI circuits, saving maximum of space
- ▶ Lowest parasitic inductance to GND contact, ensures best performance
- ▶ High mechanical robustness



### Audio interfaces

types in **bold** represent new products

Baseband interface	Number of protected lines	Line small-signal equivalents		Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)
		R <sub>line</sub>	C <sub>line</sub> (pF)					
Audio	2	0.9 Ω	290	-	Low-ohmic speaker (< ~8 Ω)	IP4047CX6/LF	6 ball CSP	1.56 x 1.01 x 0.65
		10 Ω	200	-	Low-ohmic speaker (> ~8 Ω)	IP4048CX5/LF	6 ball CSP	0.91 x 1.28 x 0.65
		15 Ω	5000	-	Low-ohmic speaker (> ~8 Ω)	IP5311CX5/LF		5 ball CSP
		68 Ω	110	-	Single-ended or differential microphone	IP4049CX5/LF	6 ball CSP	0.91 x 1.28 x 0.65
		470 Ω	35	-	Single-ended or differential microphone	IP4055CX6/LF		1.56 x 1.03 x 0.65
		470 Ω	20	-	Single-ended or differential microphone	IP4355CX6/LF		1.16 x 0.76 x 0.65
		50 Ω / 2.2 kΩ	2000	-	Single-ended to quasi-differential microphone channel with integrated biasing network	IP5002CX8/LF	8 ball CSP	1.67 x 1.67 x 0.65
		2.25 kΩ	4000	-	Differential microphone filter with integrated biasing network for ΣΔ ADC converters	IP5006CX11/LF	11 ball CSP	1.41 x 1.91 x 0.65
		5 Ω / 20 Ω / 1.5 kΩ	550	-	Differential microphone filter with integrated biasing network for ΣΔ including coupling capacitors	IP5020CX16/LF	16 ball CSP	2.01 x 1.91 x 0.65
		0.25 Ω, 3 nH	-	-	Inductive, low-ohmic differential channel LC filter	<b>IP3047CX6</b>	6 ball CSP	1.60 x 1.15 x 0.65
	0.25 Ω, 3 nH	-	-	Inductive, low-ohmic differential channel LC filter	<b>IP3048CX5</b>	5 ball CSP	1.51 x 1.15 x 0.65	
	2.2 kΩ / 1 kΩ / 0.8 kΩ	0.8 nF / 1.6 nF	-	Differential microphone biasing ESD protection / EMI filtering	IP5306CX8	8 ball CSP	1.19 x 1.19 x 0.61	
	4	10 Ω	5000	-	Dual differential speaker	IP5040CX11/LF	11 ball CSP	1.41 x 2.01 x 0.65
	6	15 Ω / 95 Ω	65 / 33	-	Single-ended microphone and high-ohmic speaker (> ~8 Ω) with integrated 2 kohm pull-up resistor	IP4363CX10/LF	10 ball CSP	0.76 x 1.96 x 0.61
40 Ω / 1450 Ω / 10 Ω		50 / 20 / 200	-	Fully integrated audio interface protection for differential microphone and differential speaker, including EMI filtering and pull up resistors	IP4025CX20/LF	20 ball CSP	1.98 x 2.53 x 0.65	
40 Ω / 1450 Ω / 10 Ω		50 / 20 / 200	-	Fully integrated audio interface protection for differential microphone and differential speaker, including EMI filtering and pull up resistors	IP4027CX20/LF		1.91 x 2.52 x 0.65	
50 Ω / 10 Ω		50 / 100 / 1000	-	Fully integrated audio interface protection for differential microphone and differential speaker, including EMI filtering and pull up resistors	IP4125CX20/LF		2.00 x 2.66 x 0.65	
8	0.8 Ω / 30 Ω / 200 Ω	20 / 50 / 150	~20	Fully integrated audio interface protection including EMI filtering for microphone and speaker, and additional 4-channel EMI filter	IP4110CX20/LF		1.91 x 2.47 x 0.65	

### Video interfaces


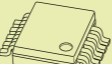



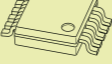

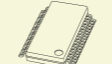
types in **bold** represent new products

Baseband interface	Number of protected lines	Buffer	Level shifter	C <sub>line</sub> (pF)	Resistor (Ω)	Remark	Type	Package	Size (mm)	
Display port	4	-	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TB</b>	SOT1059 (XSON10U)	1.0 x 2.5 x 0.5	
		-	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TT</b>	SOT552 (TSSOP10)	3.0 x 3.0 x 1.1	
		-	-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TB</b>	SOT1059 (XSON10U)	1.0 x 2.5 x 0.5	
		-	-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TT</b>	SOT552 (TSSOP10)	3.0 x 3.0 x 1.1	
	11	-	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4286CZ6-TBF</b>	SOT886 (XSON6)	1.45 x 1.0 x 0.5	
		-	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4286CZ6-TTY</b>	SOT363 (SC-88)	2.0 x 1.25 x 0.95	
	LVDS	10	-	-	5	100	100 Ω termination	IP4263CZ14	SOT108 (SO14)	8.65 x 3.9 x 1.75
		2	-	-	0.7	-	ESD protection for ultra high speed interfaces	<b>IP4282CZ6</b>	SOT886 (XSON6)	1.45 x 1.0 x 0.5
	HDMI	4	-	-	0.7	-	ESD protection for ultra high speed interfaces	IP4280CZ10	SOT552 (TSSOP10)	3.0 x 3.0 x 1.1
			-	-	0.7	-	ESD protection for ultra high speed interfaces	IP4281CZ10	SOT1059 (XSON10U)	1.0 x 2.5 x 0.5

Protection and signal conditioning







### Video interfaces

types in **bold** represent new products

Baseband interface	Number of protected lines	Buffer	Level shifter	C <sub>line</sub> (pF)	Resistor (Ω)	Remark	Type	Package	Size (mm)	
HDMI	4	-	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TB</b>	SOT1059 (XSON10U) 	1.0 x 2.5 x 0.5	
		-	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TT</b>	SOT552 (TSSOP10) 	3.0 x 3.0 x 1.1	
		-	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4286CZ6-TBF</b>	SOT886 (XSON6) 	1.45 x 1.0 x 0.5	
		-	-				<b>IP4286CZ6-TTY</b>	SOT363 (SC-88) 	2.0 x 1.25 x 0.95	
		-	-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TB</b>	SOT1059 (XSON10U) 	1.0 x 2.5 x 0.5	
		-	-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TT</b>	SOT552 (TSSOP10) 	3.0 x 3.0 x 1.1	
	5	-	-	0.5	-	ESD protection for up to 5 ultra high speed datalines	<b>PESD5V0F5BK</b>	SOT891 (XSON6) 	1.0 x 1.0 x 0.5	
		-	-	10	1.75 k, 100 k	HDMI, DDC, CEC, hotplug ESD protection and biasing	<b>IP4310CX8</b>	8 ball CSP	1.16 x 1.16 x 0.61	
	8	-	-	1.3	-	HDMI, TMDS line ESD protection	<b>IP4309CX9</b>	9 ball CSP	1.16 x 1.16 x 0.61	
	12	-	-	yes	0.7	-	ESD protection and level shifting for a complete HDMI port	<b>IP4776CZ38</b>		
		yes	yes	-	0.7	-	ESD protection, DDC buffering, noise reduction and Hot Plug application for a complete HDMI source port	<b>IP4777CZ38</b>	SOT510 (TSSOP38) 	9.7 x 4.4 x 1.1
		yes	yes	-	0.7	-	ESD protection, DDC buffering, noise reduction and Hot Plug application for a complete HDMI sink port	<b>IP4778CZ38</b>		

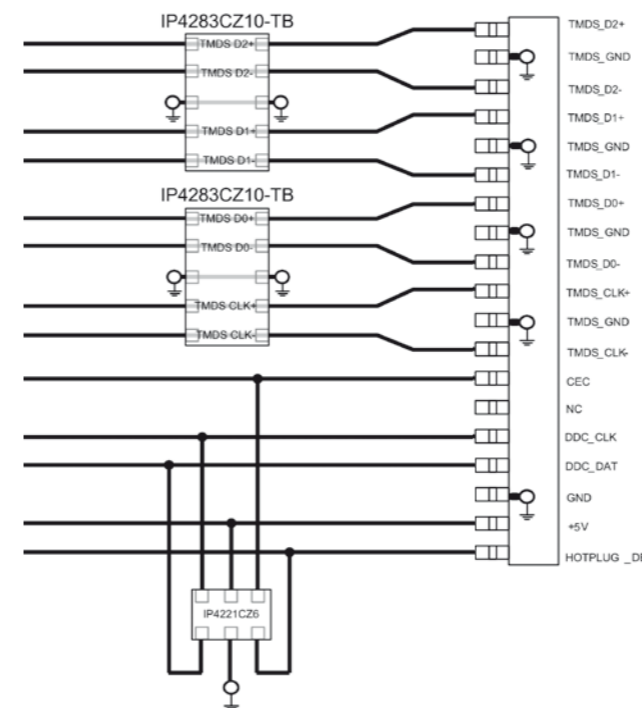
### Video interfaces

types in **bold** represent new products

Baseband interface	Number of protected lines	Buffer	Level shifter	C <sub>line</sub> (pF)	Resistor (Ω)	Remark	Type	Package	Size (mm)
VGA	7	yes	yes	5	55	H&V sync buffer, DDC level shifter	<b>IP4770CZ16</b>	SOT519 (SSOP16) 	4.9 x 3.9 x 1.73
		yes	yes	5	65	H&V sync buffer, DDC level shifter	<b>IP4771CZ16</b>	SOT519 (SSOP16) 	4.9 x 3.9 x 1.73
		yes	yes	5	10	H&V sync buffer, DDC level shifter	<b>IP4772CZ16</b>	SOT519 (SSOP16) 	4.9 x 3.9 x 1.73
		yes	no	4	10	VGA receivers and transmitters, H&V sync buffer	<b>IP4773CZ14</b>	SOT337 (SSOP14) 	6.2 x 5.3 x 2.0
		yes	no	4	10	VGA receivers and transmitters, H sync buffer	<b>IP4774CZ14</b>	SOT337 (SSOP14) 	6.2 x 5.3 x 2.0
		no	yes	4	1.3 - 2.4	VGA receivers and transmitters, DDC level shifter	<b>IP4769CZ14</b>	SOT402-1 (TSSOP14) 	5.0 x 4.4 x 1.1




For ultra high speed single line ESD protection please refer to pages 29 - 31

### HDMI ESD protection using IP4283CZ10-TB and IP4221CZ6-S



### Multichannel EMI filter, ESD protection for LCD and camera

types in **bold** represent new products

Baseband interface	Number of protected lines	Line small-signal equivalents		Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)	
		R <sub>line</sub>	C <sub>line</sub> (pF)						
LCD display, camera, keypad	1	75 Ω	36	~40	EMI filter, ESD protection with common ground	IP4307CX4/LF	4 ball CSP	0.76 x 0.76 x 0.61	
		100 Ω	30	~40	EMI filter, ESD protection	IP4256CZ3-M	SOT883 (SC-101)	1.0 x 0.6 x 0.5	
	2	100 Ω	30	~40	EMI filter, ESD protection	IP4256CZ5-W	SOT665	1.6 x 1.2 x 0.5	
		100 Ω	30	~40	EMI filter, ESD protection	IP4256CZ6-F	SOT886 (XSON6)	1.45 x 1.0 x 0.5	
	4	100 Ω	15	~50	EMI filter, ESD protection	IP4251CZ8-4	SOT983 (8 pin QFN)	1.7 x 1.35 x 0.5	
		40 Ω	18	~70	EMI filter, ESD protection	IP4252CZ8-4		1.7 x 1.35 x 0.5	
		100 Ω	45	~30	EMI filter, ESD protection	IP4254CZ8-4		1.7 x 1.35 x 0.5	
		200 Ω	45	~30	EMI filter, ESD protection	IP4253CZ8-4		1.7 x 1.35 x 0.5	
	100 Ω	60	~20	EMI filter, ESD protection plus 4x ESD	IP4054CX15/LF	15 ball CSP		2.96 x 1.32 x 0.65	
	6	100 Ω	15	~50	EMI filter, ESD protection	IP4251CZ12-6	SOT984 (12 pin QFN)	2.5 x 1.35 x 0.5	
		40 Ω	18	~70	EMI filter, ESD protection	IP4252CZ12-6		2.5 x 1.35 x 0.5	
		100 Ω	45	~30	EMI filter, ESD protection	IP4254CZ12-6		2.5 x 1.35 x 0.5	
		200 Ω	45	~30	EMI filter, ESD protection	IP4253CZ12-6		2.5 x 1.35 x 0.5	
		100 Ω	60	~20	EMI filter, ESD protection	IP4053CX15/LF		15 ball CSP	2.96 x 1.32 x 0.65
		100 Ω	30	~40	EMI filter, ESD protection	IP4153CX15/LF		15 ball CSP	2.91 x 1.28 x 0.65
	100 Ω	60	~20	EMI filter, ESD protection	IP4353CX15/LF	15 ball CSP		2.38 x 1.05 x 0.61	
	7	70 Ω	25	~40	EMI filter, ESD protection, extremely small size	IP4337CX18/LF/E	18 ball CSP	1.96 x 1.61 x 0.61	
		125 Ω	25	~60	60 nH coils RLC filter	<b>IP3337CX18/LF</b>		2.11 x 1.81 x 0.61	
	8	100 Ω	15	~50	EMI filter, ESD protection	IP4251CZ16-8	SOT985 (16 pin QFN)	3.3 x 1.35 x 0.5	
		40 Ω	18	~70	EMI filter, ESD protection	IP4252CZ16-8		3.3 x 1.35 x 0.5	
		100 Ω	45	~30	EMI filter, ESD protection	IP4254CZ16-8		3.3 x 1.35 x 0.5	
		200 Ω	45	~20	EMI filter, ESD protection	IP4253CZ16-8		3.3 x 1.35 x 0.5	
		100 Ω	50	~25	EMI filter, ESD protection	IP4088CX20/LF		20 ball CSP	3.91 x 1.28 x 0.65
	125 Ω	25	~60	60 nH coils RLC filter	<b>IP3338CX24/LF</b>			2.11 x 2.11 x 0.61	
	10	70 Ω	25	~40	EMI filter, ESD protection, extremely small size	<b>IP4338CX24/LF</b>	24 ball CSP	1.96 x 2.01 x 0.61	
		200 Ω	50	~20	EMI filter, ESD protection	IP4041CX25/LF	25 ball CSP	2.41 x 2.41 x 0.65	
	4	-	25	~175	LC low-pass filter	IP3253CZ8	SOT983 (8 pin QFN)	1.7 x 1.35 x 0.5	
	6	-	25	~175	LC low-pass filter	IP3253CZ12	SOT984 (12 pin QFN)	2.5 x 1.35 x 0.5	
	8	-	25	~175	LC low-pass filter	IP3253CZ16	SOT985 (16 pin QFN)	3.3 x 1.35 x 0.5	
	4	-	25	~175	LC low-pass filter	IP3254CZ8	SOT983 (8 pin QFN)	1.7 x 1.35 x 0.5	
	6	-	25	~175	LC low-pass filter	IP3254CZ12	SOT984 (12 pin QFN)	2.5 x 1.35 x 0.5	
	8	-	25	~175	LC low-pass filter	IP3254CZ16	SOT985 (16 pin QFN)	3.3 x 1.35 x 0.5	

### Multichannel EMI filter, ESD protection for LCD and camera



types in **bold** represent new products

Baseband interface	Number of protected lines	Line small-signal equivalents		Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)
		R <sub>line</sub>	C <sub>line</sub> (pF)					
Generic ESD protection	1	-	10	~40	1x back-to-back diode with one common ground, extremely small size	IP4302CX2/LF	2 ball CSP	0.49 x 0.67 x 0.38
	2	-	10	~40	2x back-to-back diode with one common ground, extremely small size	IP4303CX4/LF	4 ball CSP	0.76 x 0.76 x 0.61
		-	0.6	-	16 V ultra low capacitance ESD protection in 4 mm pitch	<b>IP4361CX4/LF</b>		0.76 x 0.76 x 0.61
	4	-	30	~30	4x single diode with one common ground	IP4042CX5/LF	5 ball CSP	0.91 x 1.28 x 0.65
		-	14	~40	4x single diode with one common ground	IP4142CX5/LF		0.91 x 1.28 x 0.65
		-	15	Breakdown: min. 5.5 V	Quad diode array with ESD protection	IP4332CX5/LF		0.76 x 1.06 x 0.61
		-	30	Breakdown: min. 5.5 V	Quad diode array with ESD protection	IP4342CX5/LF		0.76 x 1.06 x 0.61
		-	16	~40	4x back-to-back diode with one common ground	IP4043CX5/LF		1.12 x 1.12 x 0.65
		-	16	~40	4x back-to-back diode with one common ground, extremely small size	IP4343CX5/LF		0.93 x 0.93 x 0.61
	Special diode	1	-	65	Breakdown: min. 20 V Forward: 0.25 - 0.5 V	Schottky power diode in WLCSP	IP4306CX2/LF	2 ball CSP
2		-	19	Breakdown: min. 15 V Forward: 0.25 - 0.45 V	1x back-to-back diode with integrated dual Schottky diode array incl. ESD protection	IP4305CX4/LF	4 ball CSP	0.96 x 0.96 x 0.61

Protection and signal conditioning

## SD-, SIM-card and MMC





types in **bold** represent new products

Baseband interface	Number of protected lines	Line small-signal equivalents		Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)
		$R_{line}$	$C_{line}$ (pF)					
SIM card	3 + 2	47 $\Omega$ / 100 $\Omega$	10	~20	Integrated low capacitance SIM-card passive filter array & USB ESD protection	<b>IP4365CX11</b>	11 ball CSP	1.16 x 1.56 x 0.61
	3	47 $\Omega$ / 100 $\Omega$	40	~12	Integrated SIM-card EMI filter and ESD protection	IP4044CX8/LF	8 ball CSP	1.46 x 1.49 x 0.65
		47 $\Omega$ / 100 $\Omega$	20	~20	Integrated SIM-card EMI filter and ESD protection	IP4064CX8/LF/S		1.41 x 1.41 x 0.65
		47 $\Omega$ / 100 $\Omega$	20	~20	Smaller size, integrated SIM-card EMI filter and ESD protection	IP4364CX8/LF		1.16 x 1.16 x 0.61
		47 $\Omega$ / 100 $\Omega$	10	~20	Smaller size, low capacitance integrated SIM-card EMI filter and ESD protection	<b>IP4366CX8/LF</b>		1.16 x 1.16 x 0.61
		47 $\Omega$ / 100 $\Omega$	40	~12	Integrated SIM-card EMI filter and ESD protection	IP4264CZ8-40	SOT983 (8 pin QFN)	1.7 x 1.35 x 0.5
		47 $\Omega$ / 100 $\Omega$	20	~20	Integrated SIM-card EMI filter and ESD protection	IP4264CZ8-20		1.7 x 1.35 x 0.5
		-	1	~240	Quad channel low capacitance ESD protection	IP4221CZ6-S	SOT886 (XSON6)	
SD-card / MMC	4	47 $\Omega$ / 13 k $\Omega$ / 56 k $\Omega$	25	~30	MMC ESD protection, pull-up resistors	IP4051CX11/LF	11 ball CSP	1.44 x 1.96 x 0.65
		50 $\Omega$ / 75 k $\Omega$ / 7 k $\Omega$	18	~50	High-speed MMC ESD protection, pull-up resistors	IP4060CX16/LF	16 ball CSP	1.96 x 1.97 x 0.65
	7	40 $\Omega$ / 50 k $\Omega$ / 25 k $\Omega$	18	~20	(Mini) SD/trans flash card ESD protection, EMI filter, pull-up resistors	IP4052CX20/LF	20 ball CSP	2.54 x 1.96 x 0.65
		-	5	~24	Memory stick PRO ESD protection	IP4067CX9/LF	9 ball CSP	1.46 x 1.52 x 0.65
	6 (+3)	15 $\Omega$ / 50 k $\Omega$ / 15 k $\Omega$	8	> 52	Very low capacitance, low channel resistance (mini) SD card/trans flash ESD protection EMI filter, pull-up resistor	IP4350CX24/LF	24 ball CSP	1.95 x 2.11 x 0.61
		40 $\Omega$ / 50 k $\Omega$ / 15 k $\Omega$	20	> 52	(Mini) SD card/trans flash ESD protection, EMI filter, pull-up resistor	IP4352CX24/LF		2.02 x 2.01 x 0.61
		-	-	> 52	(Mini) SD/SDIO memory card level shifter, can be combined with IP4352CX24/LF	IP4852CX25/LF	25 ball CSP	2.01 x 2.01 x 0.61
		40 $\Omega$ / 50 k $\Omega$ / 15 k $\Omega$	-	> 52	(Mini) SD/SDIO memory card level shifter, and voltage regular, incl. ESD and EMI filter	<b>IP4853CX24/LF</b>	24 ball CSP	2.01 x 2.01 x 0.61

For ultra high speed single line ESD protection please refer to pages 29 - 31





## Battery and charger protection

types in **bold** represent new products

Baseband interface	Number of protected lines	$C_{line}$ (pF)	Diode voltage	Remark	Type	Package	Size (mm)	
Battery & charger protection	1	180	Breakdown 16 V	Power diode	IP4085CX4	4 ball CSP	0.91 x 0.91 x 0.65	
		450	Breakdown 7 V	Power diode	IP4385CX4		0.76 x 0.76 x 0.61	
		160	Breakdown 16 V	Power diode	<b>IP4386CX4</b>		0.76 x 0.76 x 0.61	
		290	Breakdown 10 V	Power diode	<b>IP4387CX4</b>		0.76 x 0.76 x 0.61	
		160	$V_{RWM} = 12 V$	Power diode	PESD12VS1UJ	SOD323F (SC-90)		1.7 x 1.25 x 0.7
		160	$V_{RWM} = 12 V$	Power diode	PESD12VS1UA	SOD323 (SC-76)		1.7 x 1.25 x 0.95
		480	$V_{RWM} = 5 V$	Power diode	PESD5V0S1UJ	SOD323F (SC-90)		1.7 x 1.25 x 0.7
		480	$V_{RWM} = 5 V$	Power diode	PESD5V0S1UA	SOD323 (SC-76)		1.7 x 1.25 x 0.95









## USB, LVDS, SATA, LAN

types in **bold** represent new products

Baseband interface	Number of protected lines	$R_{line}$	$C_{line}$ (pF)	Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)		
USB (CSP package)	2	33 $\Omega$ / 1.3 k $\Omega$	30	>6	Fully integrated USB low / fullspeed interface with EMI filter, ESD protection, pull-up resistors and impedance matching	IP4056CX8	8 ball CSP	1.27 x 1.83 x 0.65		
		33 $\Omega$ / 1.3 k $\Omega$ / 10 k $\Omega$	30	>6	Fully integrated USB low / fullspeed interface with EMI filter, ESD protection, pull-up resistors and impedance matching	IP4057CX10	10 ball CSP	1.56 x 1.91 x 0.65		
		33 $\Omega$ / 1.3 k $\Omega$ / 17 k $\Omega$ / 15 k $\Omega$	27	>6	Fully integrated USB low / fullspeed interface with EMI filter, ESD protection, pull-up resistors and impedance matching	IP4065CX11	11 ball CSP	1.47 x 1.97 x 0.65		
		33 $\Omega$ / 1.5 k $\Omega$	35	>6	Fully integrated USB low / fullspeed interface with EMI filter, ESD protection, pull-up resistors and impedance matching	IP4058CX8	8 ball CSP	0.91 x 1.91 x 0.65		
		17 $\Omega$ / 1.5 k $\Omega$	35	>6	Fully integrated USB low / fullspeed interface with EMI filter, ESD protection, pull-up resistors and impedance matching	IP4158CX8				
		33 $\Omega$	35	>6	Fully integrated USB low / fullspeed interface with EMI filter, ESD protection and impedance matching	<b>IP4078CX6</b>	6 ball CSP	0.91 x 1.41 x 0.65		
	-	1.3	~1 GHz	USB2.0 high-speed ESD protection	<b>IP4359CX4</b>	4 ball CSP	0.76 x 0.76 x 0.61			
	3+2	47 $\Omega$ / 100 $\Omega$	10	~20/6	Integrated low capacitance SIM-Card & USB passive filter array with ESD protection	IP4365CX11	11 ball CSP	1.16 x 1.56 x 0.61		
	4	-	3	>240	USB2.0 high-speed ESD protection	IP4059CX5	5 ball CSP	0.96 x 1.34 x 0.65		
		-	1.3	~1 GHz	USB2.0 high-speed ESD protection	<b>IP4358CX6</b>	6 ball CSP	0.76 x 1.16 x 0.41		
	USB2.0 (Plastic package)	2	-	1.5	-	2-channel common mode filter with integrated ESD protection	<b>IP3219CZ6</b>	SOT1082-1 (VSON6U)		2.3 x 3.5 x 0.85
			0.5	2	-	>15 kV IEC contact ESD protection with pi-filter	<b>IP4234CZ6</b>	SOT457 (SC-74)		2.9 x 1.5 x 1.0
-		1.0	-	ESD protection for up to 2 ultra high speed datalines	PRTR5V0U2X	SOT143B		2.9 x 1.3 x 1.0		
-		1.8	-	ESD protection for up to 2 ultra high speed datalines with 12 kV ESD robustness	PRTR5V0U2AX					
-	0.7	-	ESD protection for ultra high speed interfaces	<b>IP4282CZ6</b>	SOT886 (XSON6)		1.45 x 1.0 x 0.5			











### USB, LVDS, SATA, LAN

types in **bold** represent new products

Baseband interface	Number of protected lines	$R_{line}$	$C_{line}$ (pF)	Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)
USB2.0 (Plastic package)	2	-	1	-	ESD protection for up to 2 ultra high speed datalines	PRTR5V0U2K		1.0 x 1.0 x 0.5
		-	1	-	ESD protection for up to 2 ultra high speed datalines	PRTR5V0U2D		2.9 x 1.5 x 1.0
		-	1	-	ESD protection for up to 2 ultra high speed datalines	PRTR5V0U2F		1.45 x 1.0 x 0.5
	4	-	1	-	ESD protection for USB2.0 high- speed, SD-Card, SIM card	IP4221CZ6-S		2.9 x 1.5 x 1.0
		-	1	-	ESD protection for USB2.0 high- speed, SD-Card, SIM card	IP4220CZ6		
		-	1	-	Dual USB2.0, ESD protection	IP4220CZ6		
		-	1	-	ESD protection, as IP4220CZ6 but different bonding	PRTR5V0U4AD		
		-	1	-	ESD protection, as IP4220CZ6 but different package	PRTR5V0U4Y		2.0 x 1.25 x 0.95
		-	1	-	ESD protection for USB2.0 high-speed, SD-Card, SIM card	IP4221CZ6-S		1.45 x 1.0 x 0.5
		-	1	-	ESD protection for USB2.0 high-speed, SD-Card, SIM card	IP4221CZ6-XS		1.0 x 1.0 x 0.5
	1	3	-	>15 kV IEC contact ESD protection with pi-filter	<b>IP4225CZ10</b>		2.9 x 1.5 x 1.0	

### USB, LVDS, SATA, LAN











types in **bold** represent new products

Baseband interface	Number of protected lines	$R_{line}$	$C_{line}$ (pF)	Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)
USB3.0 SuperSpeed USB / USB2.0	4	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TB</b>		1.0 x 2.5 x 0.5
		-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TT</b>		3.0 x 3.0 x 1.1
		-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TB</b>		1.0 x 2.5 x 0.5
		-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TT</b>		3.0 x 3.0 x 1.1
	5	-	0.5	-	ESD protection for up to 5 ultra high speed datalines	<b>PESD5V0F5BK</b>		1.0 x 1.0 x 0.5
Display port	4	0.6	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TB</b>		1.0 x 2.5 x 0.5
		-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TT</b>		3.0 x 3.0 x 1.1
		-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TB</b>		1.0 x 2.5 x 0.5
		-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TT</b>		3.0 x 3.0 x 1.1
		-	0.6	-	ESD protection for high speed interfaces	<b>IP4286CZ6-TBF</b>		1.45 x 1.0 x 0.5

Protection and signal conditioning




### USB, LVDS, SATA, LAN

types in **bold** represent new products

Baseband interface	Number of protected lines	$R_{line}$	$C_{line}$ (pF)	Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)
Display port	4	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4286CZ6-TTY</b>	SOT363 (SC-88) 	2.0 x 1.25 x 0.95
	11	-	0.7	-	ESD protection	IP4790CZ38	SOT510 (TSSOP38) 	9.7 x 4.4 x 1.1
LVDS	10	-	5	-	100 $\Omega$ termination	IP4263CZ14	SOT108 (SO14) 	8.65 x 3.9 x 1.75
SATA	2	-	0.7	-	ESD protection for ultra high speed interfaces	<b>IP4282CZ6</b>	SOT886 (XSON6) 	1.45 x 1.0 x 0.5
		-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4286CZ6-TBF</b>		
	4	-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4286CZ6-TTY</b>	SOT363 (SC-88) 	2.0 x 1.25 x 0.95
		-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TB</b>	SOT1059 (XSON10U) 	1.0 x 2.5 x 0.5
		-	0.6	-	ESD protection for ultra high speed interfaces	<b>IP4283CZ10-TT</b>	SOT552 (TSSOP10) 	3.0 x 3.0 x 1.1
4	-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TB</b>	SOT1059 (XSON10U) 	1.0 x 2.5 x 0.5	
	-	0.5	-	ESD protection for ultra high speed interfaces	<b>IP4284CZ10-TT</b>	SOT552 (TSSOP10) 	3.0 x 3.0 x 1.1	
IEEE1394	4	55	5	-	ESD protection and termination for IEEE1394	IP4224CZ6	SOT457 (SC-74) 	2.9 x 1.5 x 1.0

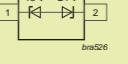

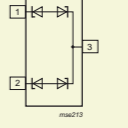

### USB, LVDS, SATA, LAN

types in **bold** represent new products

Baseband interface	Number of protected lines	$R_{line}$	$C_{line}$ (pF)	Digital interface clock speed (MHz)	Remark	Type	Package	Size (mm)
LAN	1	-	0.6	-	Ethernet ESD protection $V_{RWM}=3.3$ V	PESD3V3U1UT		2.9 x 1.3 x 1.0
		-	0.6	-	Ethernet ESD protection $V_{RWM}=5.0$ V	PESD5V0U1UT		
		-	0.6	-	Ethernet ESD protection $V_{RWM}=12$ V	PESD12VU1UT		
		-	0.6	-	Ethernet ESD protection $V_{RWM}=15$ V	PESD15VU1UT		
	-	0.6	-	Ethernet ESD protection $V_{RWM}=24$ V	PESD24VU1UT			
4	-	1	-	Ethernet ESD protection	IP4220CZ6	SOT457 (SC-74) 	2.9 x 1.5 x 1.0	
	-	1	-	Ethernet line surge ESD protection	<b>IP4233CZ6</b>	SOT363 (SC-88) 	2.0 x 1.25 x 0.95	

For ultra high speed single line ESD protection please refer to pages 29 - 31

### Automotive LIN/CAN/FlexRay

Number of protected lines bidirectional	$V_{RWM}$ (V)	$C_{line}$ typ (pF)	$C_{line}$ max (pF)	$P_{PP}^{(1)}$ max (W)	ESD rating <sup>(2)</sup> max (kV)	$I_T$ max [ $\mu$ A] @ $V_{RWM}$	Configuration	Type	Package	Size (mm)
1	15 (diode 1) 24 (diode 2)	13	17	160	23	0.05		PESD1LIN	SOD323 (SC-76) 	1.7 x 1.25 x 0.95
2	24	11	17	200	23	0.05		PESD1CAN		2.9 x 1.3 x 1.0
		25	30	230	30	0.01		PESD2CAN		2.9 x 1.3 x 1.0
		11	17	200	23	0.05		PESD1FLEX		2.9 x 1.3 x 1.0

<sup>(1)</sup> 8/20  $\mu$ s surge pulse acc. to IEC 61000-4-5

<sup>(2)</sup> acc. to IEC 61000-4-2 (contact discharge)

TVS diodes, 24 W / 40 W

types in **bold** represent new products

Power (W) (10/1000 $\mu$ s waveform) <sup>[1]</sup>	$V_{Rmax}$ (V)	$V_{Rmin}$ (V) @ $I_R$	$V_{Rtyp}$ (V) @ $I_R$	$V_{Rmax}$ (V) @ $I_R$	$I_R$ (mA)	ESD rating <sup>[2]</sup> max (kV)	$C_{int}$ typ (pF)	$V_{Cl}$ max (V) @ $I_{pp}$	$I_{pp}$ (A)	$I_{Rmax}$ ( $\mu$ A) @ $V_{Rmax}$	Configuration	Type	Package	Size (mm)			
24	3	5.32	5.6	5.88	20	30	210	8	3	5		<b>MMBZ5V6AL</b>	SOT23	2.9 x 1.3 x 1.0			
	3	5.89	6.2	6.51	1	30	175	8.7	2.76	0.2		<b>MMBZ6V2AL</b>					
	4.5	6.48	6.8	7.14	1	30	150	9.6	2.5	0.3		<b>MMBZ6V8AL</b>					
	6	8.65	9.1	9.56	1	30	155	14	1.7	0.1		<b>MMBZ9V1AL</b>					
	6.5	9.5	10	10.5	1	30	130	14.2	1.7	0.02		<b>MMBZ10VAL</b>					
40	8.5	11.4	12	12.6	1	30	110	17	2.35	0.005		<b>MMBZ12VAL</b>	SOT23	2.9 x 1.3 x 1.0			
	12	14.25	15	15.75	1	30	85	21	1.9	0.005		<b>MMBZ15VAL</b>					
	14.5	17.1	18	18.9	1	30	70	25	1.6	0.005		<b>MMBZ18VAL</b>					
	17	19	20	21	1	30	65	28	1.4	0.005		<b>MMBZ20VAL</b>					
	22	25.65	27	28.35	1	30	48	40	1	0.005		<b>MMBZ27VAL</b>					
	26	31.35	33	34.65	1	30	45	46	0.87	0.005		<b>MMBZ33VAL</b>					
	8.5	11.4	12	12.6	1	30	110	17	2.35	0.005					<b>MMBZ12VDL</b>	SOT23	2.9 x 1.3 x 1.0
	12.8	14.3	15	15.8	1	30	85	21.2	1.9	0.005					<b>MMBZ15VDL</b>		
	14.5	17.1	18	18.9	1	30	70	25	1.6	0.005					<b>MMBZ18VCL</b>		
	17	19	20	21	1	30	65	28	1.4	0.005					<b>MMBZ20VCL</b>		
	22	25.65	27	28.35	1	30	48	38	1	0.005					<b>MMBZ27VCL</b>		
	26	31.35	33	34.65	1	30	45	46	0.87	0.005					<b>MMBZ33VCL</b>		

<sup>[1]</sup> acc. to IEC 61643-321 <sup>[2]</sup> acc. to IEC 61000-4-2 (contact discharge)

TVS diodes, 400 W

Power (W) (10/1000 $\mu$ s waveform) <sup>[1]</sup>	$V_{Rmax}$ (V)	$V_{Rmin}$ (V) @ $I_R$	$V_{Rtyp}$ (V) @ $I_R$	$V_{Rmax}$ (V) @ $I_R$	$I_R$ (mA)	$V_{Cl}$ max (V) @ $I_{pp}$	$I_{pp}$ (A)	$I_{Rmax}$ ( $\mu$ A) @ $V_{Rmax}$	$I_{Rmax}$ ( $\mu$ A) @ $V_{Rmax}$	Type	Package	Size (mm)
350	3.5	5.20	5.60	6.00	10	8.0	43.8	5	600	PTVS3V3S1UR	SOD123W	2.6 x 1.7 x 1.0
400	5.0	6.40	6.70	7.00	10	9.2	43.5	5	400	PTVS5V0S1UR		
	6.0	6.67	7.02	7.37	10	10.3	38.8	5	400	PTVS6V0S1UR		
	6.5	7.22	7.60	7.98	10	11.2	35.7	5	250	PTVS6V5S1UR		
	7.0	7.78	8.20	8.60	10	12.0	33.3	3	100	PTVS7V0S1UR		
	7.5	8.33	8.77	9.21	1	12.9	31.0	0.2	50	PTVS7V5S1UR		
	8.0	8.89	9.36	9.83	1	13.6	29.4	0.03	25	PTVS8V0S1UR		
	8.5	9.44	9.92	10.40	1	14.4	27.8	0.01	10	PTVS8V5S1UR		
	9.0	10.00	10.55	11.10	1	15.4	26.0	0.005	5	PTVS9V0S1UR		
	10	11.10	11.70	12.30	1	17.0	23.5	0.005	2.5	PTVS10VS1UR		
	11	12.20	12.85	13.50	1	18.2	22.0	0.005	2.5	PTVS11VS1UR		
	12	13.30	14.00	14.70	1	19.9	20.1	0.005	2.5	PTVS12VS1UR		
	13	14.40	15.15	15.90	1	21.5	18.6	0.001	0.1	PTVS13VS1UR		
	14	15.60	16.40	17.20	1	23.2	17.2	0.001	0.1	PTVS14VS1UR		
	15	16.70	17.60	18.50	1	24.4	16.4	0.001	0.1	PTVS15VS1UR		
	16	17.80	18.75	19.70	1	26.0	15.4	0.001	0.1	PTVS16VS1UR		
	17	18.90	19.90	20.90	1	27.6	14.5	0.001	0.1	PTVS17VS1UR		
	18	20.00	21.00	22.10	1	29.2	13.7	0.001	0.1	PTVS18VS1UR		
	20	22.20	23.35	24.50	1	32.4	12.3	0.001	0.1	PTVS20VS1UR		
	22	24.40	25.60	26.90	1	35.5	11.3	0.001	0.1	PTVS22VS1UR		
	24	26.70	28.10	29.50	1	38.9	10.3	0.001	0.1	PTVS24VS1UR		
	26	28.90	30.40	31.90	1	42.1	9.5	0.001	0.1	PTVS26VS1UR		
	28	31.10	32.80	34.40	1	45.4	8.8	0.001	0.1	PTVS28VS1UR		
	30	33.30	35.10	36.80	1	48.4	8.3	0.001	0.1	PTVS30VS1UR		
	33	36.70	38.70	40.60	1	53.3	7.5	0.001	0.1	PTVS33VS1UR		
	36	40.00	42.10	44.20	1	58.1	6.9	0.001	0.1	PTVS36VS1UR		
	40	44.40	46.80	49.10	1	64.5	6.2	0.001	0.1	PTVS40VS1UR		
	43	47.80	50.30	52.80	1	69.4	5.8	0.001	0.1	PTVS43VS1UR		
	45	50.00	52.65	55.30	1	72.7	5.5	0.001	0.1	PTVS45VS1UR		
	48	53.30	56.10	58.90	1	77.4	5.2	0.001	0.1	PTVS48VS1UR		
	51	56.70	59.70	62.70	1	82.4	4.9	0.001	0.1	PTVS51VS1UR		
	54	60.00	63.15	66.30	1	87.1	4.6	0.001	0.1	PTVS54VS1UR		
58	64.40	67.80	71.20	1	93.6	4.3	0.001	0.1	PTVS58VS1UR			
60	66.70	70.20	73.70	1	96.8	4.1	0.001	0.1	PTVS60VS1UR			
64	71.10	74.85	78.60	1	103.0	3.9	0.001	0.1	PTVS64VS1UR			

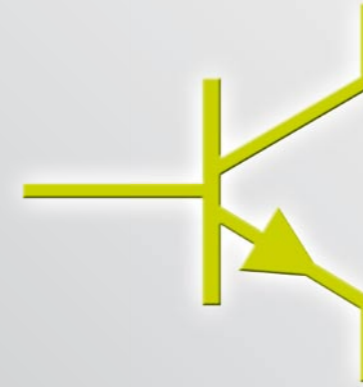
<sup>[1]</sup> 10/1000  $\mu$ s acc. to IEC 61643-321

TVS diodes, 600 W

types in **bold** represent new products

Power (W) (10/1000 $\mu$ s waveform) <sup>[1]</sup>	$V_{Rmax}$ (V)	$V_{Rmin}$ (V) @ $I_R$	$V_{Rtyp}$ (V) @ $I_R$	$V_{Rmax}$ (V) @ $I_R$	$I_R$ (mA)	$V_{Cl}$ max (V) @ $I_{pp}$	$I_{pp}$ (A)	$I_{Rmax}$ ( $\mu$ A) @ $V_{Rmax}$	$I_{Rmax}$ ( $\mu$ A) @ $V_{Rmax}$	Type	Package	Size (mm)
600	3.5	5.20	5.60	6.00	10	8	75	5	600	<b>PTVS3V3P1UP</b>	SOD128	3.8 x 2.6 x 1.0
	5	6.40	6.70	7.00	10	9.2	65.2	5	400	<b>PTVS5V0P1UP</b>		
	6	6.67	7.02	7.37	10	10.3	58.3	5	400	<b>PTVS6V0P1UP</b>		
	6.5	7.22	7.60	7.98	10	11.2	53.6	5	250	<b>PTVS6V5P1UP</b>		
	7	7.78	8.20	8.60	10	12	50	3	100	<b>PTVS7V0P1UP</b>		
	7.5	8.33	8.77	9.21	1	12.9	46.5	0.2	50	<b>PTVS7V5P1UP</b>		
	8	8.89	9.36	9.83	1	13.6	44.1	0.03	25	<b>PTVS8V0P1UP</b>		
	8.5	9.44	9.92	10.40	1	14.4	41.7	0.01	10	<b>PTVS8V5P1UP</b>		
	9	10.00	10.55	11.10	1	15.4	39	0.005	5	<b>PTVS9V0P1UP</b>		
	10	11.10	11.70	12.30	1	17	35.3	0.005	2.5	<b>PTVS10VP1UP</b>		
	11	12.20	12.85	13.50	1	18.2	33	0.005	2.5	<b>PTVS11VP1UP</b>		
	12	13.30	14.00	14.70	1	19.9	30.2	0.005	2.5	<b>PTVS12VP1UP</b>		
	13	14.40	15.15	15.90	1	21.5	27.9	0.001	0.1	<b>PTVS13VP1UP</b>		
	14	15.60	16.40	17.20	1	23.2	25.9	0.001	0.1	<b>PTVS14VP1UP</b>		
	15	16.70	17.60	18.50	1	24.4	24.6	0.001	0.1	<b>PTVS15VP1UP</b>		
	16	17.80	18.75	19.70	1	26	23.1	0.001	0.1	<b>PTVS16VP1UP</b>		
	17	18.90	19.90	20.90	1	27.6	21.7	0.001	0.1	<b>PTVS17VP1UP</b>		
	18	20.00	21.00	22.10	1	29.2	20.5	0.001	0.1	<b>PTVS18VP1UP</b>		
	20	22.20	23.35	24.50	1	32.4	18.5	0.001	0.1	<b>PTVS20VP1UP</b>		
	22	24.40	25.60	26.90	1	35.5	16.9	0.001	0.1	<b>PTVS22VP1UP</b>		
	24	26.70	28.10	29.50	1	38.9	15.4	0.001	0.1	<b>PTVS24VP1UP</b>		
	26	28.90	30.40	31.90	1	42.1	14.2	0.001	0.1	<b>PTVS26VP1UP</b>		
	28	31.10	32.80	34.40	1	45.4	13.2	0.001	0.1	<b>PTVS28VP1UP</b>		
	30	33.30	35.10	36.80	1	48.4	12.4	0.001	0.1	<b>PTVS30VP1UP</b>		
	33	36.70	38.70	40.60	1	53.3	11.3	0.001	0.1	<b>PTVS33VP1UP</b>		
	36	40.00	42.10	44.20	1	58.1	10.3	0.001	0.1	<b>PTVS36VP1UP</b>		
	40	44.40	46.80	49.10	1	64.5	9.3	0.001	0.1	<b>PTVS40VP1UP</b>		
	43	47.80	50.30	52.80	1	69.4	8.6	0.001	0.1	<b>PTVS43VP1UP</b>		
	45	50.00	52.65	55.30	1	72.7	8.3	0.001	0.1	<b>PTVS45VP1UP</b>		
	48	53.30	56.10	58.90	1	77.4	7.8	0.001	0.1	<b>PTVS48VP1UP</b>		
	51	56.70	59.70	62.70	1	82.4	7.3	0.001	0.1	<b>PTVS51VP1UP</b>		
	54	60.00	63.15	66.30	1	87.1	6.9	0.001	0.1	<b>PTVS54VP1UP</b>		
	58	64.40	67.80	71.20	1	93.6	6.4	0.001	0.1	<b>PTVS58VP1UP</b>		
60	66.70	70.20	73.70	1	96.8	6.2	0.001	0.1	<b>PTVS60VP1UP</b>			
64	71.10	74.85	78.60	1	103	5.8	0.001	0.1	<b>PTVS64VP1UP</b>			

<sup>[1]</sup> 10/1000  $\mu$ s acc. to IEC 61643-321



# Small-signal transistors

## General purpose bipolar transistors

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## Low $V_{CEsat}$ (BISS) transistors

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### Single transistors

Package						SOT23	SOT323 (SC-70)	SOT416 (SC-75)	SOT883 (SC-101)
									
Size (mm)						2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	1.6 x 0.8 x 0.77	1.0 x 0.6 x 0.5
P <sub>tot</sub> (mW)						250	200	150	250
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)				
NPN	25	100	450	1200	100		PMST5089		
	30	100	110 - 200	450 - 800	100	BC848B	BC848W		
			350	900	100		PMST5088		
	32	100	110 - 420	220 - 800	100	BCW31 / 32 / 33			
			180 - 380	310 - 630	250	BCW60B / C / D			
	40	100	120 - 270	270 - 560	100				2PC4617QM / RM
	45	100	110 - 420	220 - 800	100	BC847 / A / B / C	BC847W / AW / BW / CW	BC847T / AT / BT / CT	BC847AM / BM / CM
			120 - 380	220 - 630	100	BCX70G / H / J / K			
			110 - 200	220 - 450	100	BCW71 / 72			
	50	100	210 - 290	340 - 460	100 - 150	2PD601ART 2PD601ARL 2PD601ASL	2PD601ARW / SW		
			250	650	100	PMBT6428	PMST6428		
	60	100	110 - 200	220 - 450	100	BCV71 / 72			
	65	100	110 - 200	220 - 450	100	BC846 / A / B	BC846W / AW / BW	BC846T / AT / BT	
	80	100	20	80	60	BSS64			
	50	150	120 - 270	270 - 560	100		2PC4081Q / R / S	2PC4617Q / R	
	45	500	100 - 250	250 - 600	100	BC817 / -16 / -25 / -40	BC817W / -16W / -25W / -40W		
			100	600	100	BCX19			
	50	500	85 - 170	170 - 340	140 - 180	2PD602AQL 2PD602ARL 2PD602ASL	2PD1820AR / S		
	60	500	50	-	100		PMSTA05		
	80	500	100	-	100		PMBTA06		
PNP	30	100	125 - 220	500 - 800	100	BC858B	BC858W		
	32	100	120 - 215	260 - 500	100	BCW29 / 30			
			180 - 380	310 - 630	100	BCW61B / C / D			
	40	100	120 - 270	270 - 560	100				2PA1774QM / RM / SM
	45	100	210 - 290	340 - 460	70 - 80	2PB709ART 2PB709ARL 2PB709ASL	2PB709ARW / SW		
			180 - 380	310 - 630	100	BCX71H / J / K			
			120 - 215	260 - 500	100	BCW69 / 70			
	45	100	125 - 420	250 - 800	100	BC857 / A / B / C	BC857W / AW / BW / CW	BC857T / AT / BT / CT	BC857AM / BM / CM
			120	260	150	BCW89			
	65	100	125 - 200	250 - 475	100	BC856 / A / B	BC856W / AW / BW	BC856T / AT / BT	
	100	100	30	-	50	BSS63			
	50	150	120 - 270	270 - 560	100		2PA1576Q / R / S	2PA1774Q / R / S	
	25	500	100	600	80	BCX18			
	45	500	100 - 250	250 - 600	80	BC807 / -16 / -25 / -40	BC807W / -16W / -25W / -40W		
			100	600	80	BCX17			
50	500	85 - 170	170 - 340	100 - 140	2PB710ARL 2PB710ASL	2PB1219AQ / R / S			
60	500	100	-	50		PMSTA55			
80	500	100	-	50		PMBTA56			








### Double transistors

types in **bold** represent new products

Package						SOT457 (SC-74)	SOT363 (SC-88)	SOT666
								
Size (mm)						2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55
P <sub>tot</sub> (mW)						600	300	300
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)			
NPN	40	100	120	450	100		PUMX1	PEMX1
	45	100	200	450	100	<b>BC847DS</b>	BC847BS	BC847BV
	65	100	110	-	100		BC846S	
			200	450	100	<b>BC846DS</b>	<b>BC846BS</b>	
	50	150	120	560	100		PUMX2	
PNP	45	500	160	400	80	BC817DS		
	40	100	120	450	100	PIMT1	PUMT1	PEMT1
	45	100	200	450	100		BC857BS	BC857BV
NPN/PNP	65	100	110	-	100		BC856S	
	45	500	200	450	100		<b>BC856BS</b>	
			160	400	80	BC807DS		
40	100	120	450	100		PUMZ1	PEMZ1	
45	100	200	450	100			BC847BPN	BC847BPN
50	100	120	560	100		PIMZ2	PUMZ2	
65	100	200	450	100			<b>BC846BPN</b>	
12	500	200	-	250/100				PEMZ7
45	500	160	400	100/80		BC817DPN		

Small-signal transistors

### Single and double switching transistors

Package							SOT223 (SC-73)	SOT89 (SC-62)	SOT23	SOT323 (SC-70)	SOT363 (SC-88)	SOT666	SOT883 (SC-101)	
														
Size (mm)							6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55	1.0 x 0.6 x 0.5	
P <sub>tot</sub> (mW)							1700	1300	250	200	300	300	250	
Configuration							single	single	single	single	double	double	single	
Polarity	V <sub>CEO</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)	t <sub>off</sub> (ns)								
NPN	12	100	40	120	400	20			BSV52					
	40	100	100	300	180	20			PMBS3904	PMSS3904				
			300	250		PXT2222A								
	15	200	40	120	500	20			PMBT2369	PMST2369				
	40	200	100	300	300	250			MMBT3904					
	30	600	100	300	250	250	250			PMBT3904	PMST3904	PMBT3904YS	PMBT3904VS	PMBT3904M
										PMBT2222	PMST2222			
	40	600	100	300	250	250	250	PZT4401	PXT4401	PMBT4401	PMST4401			
	40	600	100	300	300	300	250			MMBT2222A				
								PZT2222A		PMBT2222A	PMST2222A			
40	800	100	300	300	250			BSR14						
40	100	100	300	150	700			PMBS3906	PMSS3906					
PNP	40	200	100	300	250	300			MMBT3906					
	40	600	100	300	200	350			PMBT3906	PMST3906	PMBT3906YS	PMBT3906VS	PMBT3906M	
							PZT4403	PXT4403	PMBT4403	PMST4403				
	60	600	100	300	200	365	300			PMBT2907				
											PMST2907A			
60	600	100	300	200	365			PZT2907A	PXT2907A	PMBT2907A				
NPN/PNP	40	200	100	300	300/250	250/300					PMBT3946YPN	PMBT3946VFN		

### Matched pair transistors

Package		SOT143B	SOT457 (SC-74)	SOT353 (SC-88A)	SOT363 (SC-88)	SOT666
Size (mm)		2.9 x 1.3 x 1.0	2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55
P <sub>tot</sub> (mW)		250	380	300	300	300
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	h <sub>FE1</sub> /h <sub>FE2</sub>	V <sub>BE1</sub> - V <sub>BE2</sub> (mV)
NPN	30	100	110	800	0.7 <sup>1)</sup>	n.a.
	45	100	200	450	0.9 <sup>1)</sup>	2
					0.95	2
					0.98	2
Configuration						
PNP	30	100	100	800	0.7 <sup>1)</sup>	n.a.
	45	100	200	450	0.9 <sup>1)</sup>	2
					0.95	2
					0.98	2
Configuration						

<sup>1)</sup> I<sub>C1</sub>/I<sub>E2</sub>

#### Key features

- ▶ Current gain matching to 10 %, 5 % or 2 %
- ▶ Base-emitter voltage matching to 2 mV
- ▶ Choice of standard double transistor pinout or application-optimized pinout
- ▶ Common-emitter configuration for 5-pin type
- ▶ Range of small, very small and ultra small packages

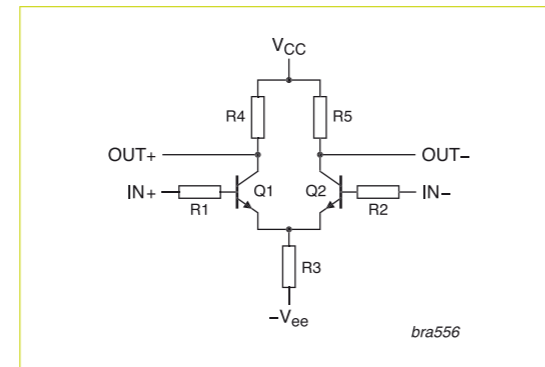
#### Key benefits

- ▶ Improved performance of current mirror and differential amplifier circuits
- ▶ Drop-in replacement for standard double transistors (BCM series)
- ▶ Simplified board layout (PMP series)
- ▶ Eliminates the need for costly additional trimming

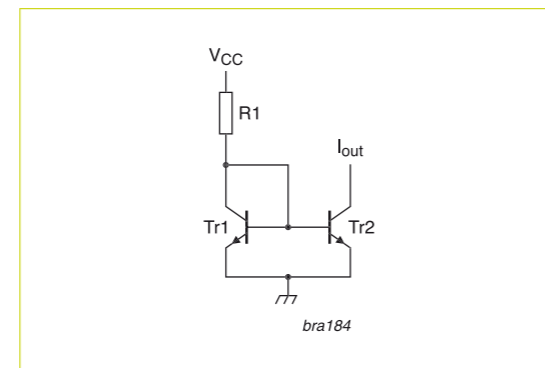
#### Key applications

- ▶ Current mirrors
- ▶ Differential and instrumentation amplifiers
- ▶ Logarithmic amplifiers
- ▶ Comparators

#### Differential amplifier



#### Current mirror



### High voltage transistors

Package		SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)	SOT23	SOT323 (SC-70)			
Size (mm)		6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95			
P <sub>tot</sub> (mW)		1700	1300	600	250	200			
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)				
NPN	80	100	20	-	60	BSS64			
	140	100	60	250	100	PMBT5550			
	160	300	80	250	100	PMBT5551/BSR19A			
	250	100	50	-	60	BF722	BF622		
						BF720	BF620		
	300	100	40	-	50	PZTA42	PXTA42		
	350	100	40	-	70	BSP19	BST39		
400	300	50	200	20	PZTA44				
PNP	100	100	30	-	50	BSS63			
	250	100	50	-	60	BF723			
			50	-	60		BF623	BF823	
	300	100	50	-	60		BF621	BF821	
2 x NPN	300	100	40	-	50	PZTA92	PXTA92	PMBTA92	PMSTA92

For high voltage transistors with increased performance please refer to our high voltage low V<sub>CEsat</sub> (BISS) transistor portfolio on pages 56 - 64.

### Low noise transistors

Package		SOT23	SOT323 (SC-70)			
Size (mm)		2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95			
P <sub>tot</sub> (mW)		250	200			
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	NF max (dB)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> min (MHz)
NPN	30	100	4	200	450	100
				420	800	100
45	100	4	4	200	450	100
				420	800	100
PNP	30	100	4	220	475	100
				420	800	100
45	100	4	4	220	475	100
				420	800	100

### Darlington transistors

Package		SOT223 (SC-73)	SOT89 (SC-62)	SOT23
Size (mm)		6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)		1700	1300	250
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	f <sub>T</sub> typ (MHz)
NPN	30	500	10000	125
			20000	125
	45	1000	2000	200
			500	10000
	60	1000	2000	200
			1000	2000
PNP	30	500	20000	125
			20000	125
	45	1000	2000	200
			500	10000
60	1000	2000	200	
		1000	2000	200

### Medium frequency transistors

Package		SOT23	SOT323 (SC-70)				
Size (mm)		2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95				
P <sub>tot</sub> (mW)		250	200				
Polarity	V <sub>CE0</sub> (V)	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	f <sub>T</sub> typ (MHz)		
NPN	15	100	40	-	500	BF570	
	20	25	40	85	> 275	BFS20	BFS20W
		30	65	225	260	BF519	
PNP	40	25	67	220	380	BF840	
	30	25	25	50	250	BF824	BF824W
	40	25	50	-	> 325	BF550	

### Schmitt trigger

Package		SOT143B				
Size (mm)		2.9 x 1.3 x 1.0				
P <sub>tot</sub> (mW)		250				
Polarity	V <sub>CE0</sub> (V) TR1	V <sub>CE0</sub> (V) TR2	I <sub>C</sub> (mA)	h <sub>FE</sub> min	h <sub>FE</sub> max	V <sub>CEsat</sub> typ (mV)
NPN	30	6	100	110	800	250
PNP	30	6	100	220	475	250

**Key features**

- ▶ Low current (max. 100 mA)
- ▶ Low voltage (max. 30 and 6 V)

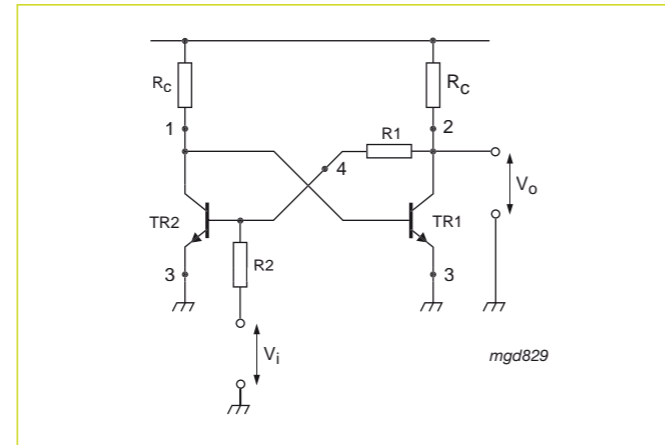
**Key benefits**

- ▶ Reduced component count and pick-and-place costs
- ▶ Smaller designs

**Key applications**

- ▶ General purpose switching and amplification
- ▶ Schmitt trigger applications

**Schmitt trigger**



### MOSFET driver

Package		SOT457 (SC-74)		
Size (mm)		2.9 x 1.5 x 1.0		
P <sub>tot</sub> (mW)		400	400	580
Configuration				
Contains	I <sub>C</sub> (A)	I <sub>CM</sub> (A)	R1 = R2 (kΩ)	
General purpose transistors	0.1	0.2	PMD9050D	BCV65 (SOT143B)
			-	PMD9010D
			2.2	PMD9001D
			4.7	PMD9002D
Switching transistors - reduced storage time	0.6	1.0	10	PMD9003D
			-	PMD2001D
Low V <sub>CEsat</sub> (BISS) transistors - Low V <sub>CEsat</sub> , high h <sub>FE</sub> and I <sub>C</sub>	1.0	2.0	-	PMD3001D

**Key features**

- ▶ Three different configurations
- ▶ Types available with standard, switching and low V<sub>CEsat</sub> (BISS) transistors
- ▶ Small footprint packages

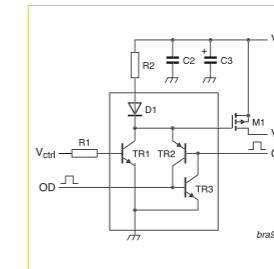
**Key benefits**

- ▶ Reduced component count
- ▶ Smaller end products

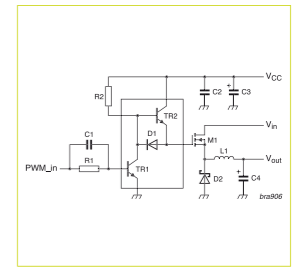
**Key applications**

- ▶ MOSFET driver
- ▶ Bipolar power transistor driver
- ▶ Push-pull driver



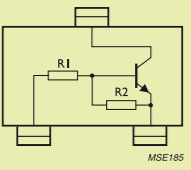
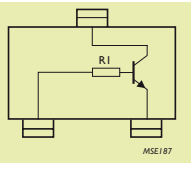
**MOSFET driver with hardware output disable function**



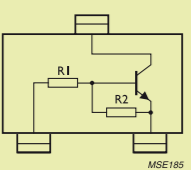
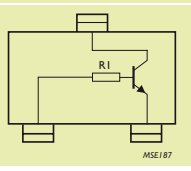


**High-side MOSFET driver with level shifter function**






RETs 100 mA single

Package				SOT23		SOT323 (SC-70)		
								
Size (mm)				2.9 x 1.3 x 1.0		2.0 x 1.25 x 0.95		
P <sub>tot</sub> (mW)				250		200		
V <sub>CE0</sub> (V)	I <sub>c</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN	PNP		
50	100		1	1		PDTA113ET		PDTA113EU
			2.2	2.2	PDTC123ET	PDTA123ET	PDTC123EU	PDTA123EU
			4.7	4.7	PDTC143ET	PDTA143ET	PDTC143EU	PDTA143EU
			10	10	PDTC114ET	PDTA114ET	PDTC114EU	PDTA114EU
			22	22	PDTC124ET	PDTA124ET	PDTC124EU	PDTA124EU
			47	47	PDTC144ET	PDTA144ET	PDTC144EU	PDTA144EU
			100	100	PDTC115ET	PDTA115ET	PDTC115EU	PDTA115EU
			1	10		PDTA113ZT		PDTA113ZU
			2.2	10	PDTC123YT	PDTA123YT	PDTC123YU	PDTA123YU
			2.2	47	PDTC123JT	PDTA123JT	PDTC123JU	PDTA123JU
			4.7	10	PDTC143XT	PDTA143XT	PDTC143XU	PDTA143XU
			4.7	47	PDTC143ZT	PDTA143ZT	PDTC143ZU	PDTA143ZU
			10	47	PDTC114YT	PDTA114YT	PDTC114YU	PDTA114YU
			22	47	PDTC124XT	PDTA124XT	PDTC124XU	PDTA124XU
		47	10	PDTC144VT	PDTA144VT	PDTC144VU	PDTA144VU	
		47	22	PDTC144WT	PDTA144WT	PDTC144WU	PDTA144WU	
			2.2	-	PDTC123TT	PDTA123TT	PDTC123TU	PDTA123TU
			4.7	-	PDTC143TT	PDTA143TT	PDTC143TU	PDTA143TU
			10	-	PDTC114TT	PDTA114TT	PDTC114TU	PDTA114TU
			22	-	PDTC124TT	PDTA124TT	PDTC124TU	PDTA124TU
			47	-	PDTC144TT	PDTA144TT	PDTC144TU	PDTA144TU
			100	-	PDTC115TT	PDTA115TT	PDTC115TU	PDTA115TU

Package				SOT416 (SC-75)		SOT883 (SC-101)		
								
Size (mm)				1.6 x 0.8 x 0.77		1.0 x 0.6 x 0.5		
P <sub>tot</sub> (mW)				150		250		
V <sub>CE0</sub> (V)	I <sub>c</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN	PNP		
50	100		1	1		PDTA113EE		PDTA113EM
			2.2	2.2	PDTC123EE	PDTA123EE	PDTC123EM	PDTA123EM
			4.7	4.7	PDTC143EE	PDTA143EE	PDTC143EM	PDTA143EM
			10	10	PDTC114EE	PDTA114EE	PDTC114EM	PDTA114EM
			22	22	PDTC124EE	PDTA124EE	PDTC124EM	PDTA124EM
			47	47	PDTC144EE	PDTA144EE	PDTC144EM	PDTA144EM
			100	100	PDTC115EE	PDTA115EE	PDTC115EM	PDTA115EM
			1	10		PDTA113ZE		PDTA113ZM
			2.2	10	PDTC123YE	PDTA123YE	PDTC123YM	PDTA123YM
			2.2	47	PDTC123JE	PDTA123JE	PDTC123JM	PDTA123JM
			4.7	10	PDTC143XE	PDTA143XE	PDTC143XM	PDTA143XM
			4.7	47	PDTC143ZE	PDTA143ZE	PDTC143ZM	PDTA143ZM
			10	47	PDTC114YE	PDTA114YE	PDTC114YM	PDTA114YM
			22	47	PDTC124XE	PDTA124XE	PDTC124XM	PDTA124XM
		47	10	PDTC144VE	PDTA144VE	PDTC144VM	PDTA144VM	
		47	22	PDTC144WE	PDTA144WE	PDTC144WM	PDTA144WM	
			2.2	-	PDTC123TE	PDTA123TE	PDTC123TM	PDTA123TM
			4.7	-	PDTC143TE	PDTA143TE	PDTC143TM	PDTA143TM
			10	-	PDTC114TE	PDTA114TE	PDTC114TM	PDTA114TM
			22	-	PDTC124TE	PDTA124TE	PDTC124TM	PDTA124TM
			47	-	PDTC144TE	PDTA144TE	PDTC144TM	PDTA144TM
			100	-	PDTC115TE	PDTA115TE	PDTC115TM	PDTA115TM



RETs 100 mA double

Package				SOT457 (SC-74)		SOT363 (SC-88)			SOT666				
													
Size (mm)				2.9 x 1.5 x 1.0		2.0 x 1.25 x 0.95			1.6 x 1.2 x 0.55				
P <sub>tot</sub> (mW)				600		300			300				
V <sub>CE0</sub> (V)	I <sub>c</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN/NPN	NPN/PNP	NPN/NPN	NPN/PNP	PNP/PNP	NPN/NPN	NPN/PNP	PNP/PNP	
50	100	R1 = R2	2.2	2.2			PUMH20	PUMD20	PUMB20	PEMH20	PEMD20	PEMB20	
			4.7	4.7			PUMH15	PUMD15	PUMB15	PEMH15	PEMD15	PEMB15	
			10	10			PUMH11	PUMD3	PUMB11	PEMH11	PEMD3	PEMB11	
			22	22			PUMH1	PUMD2	PUMB1	PEMH1	PEMD2	PEMB1	
			47	47			PUMH2	PUMD12	PUMB2	PEMH2	PEMD12	PEMB2	
			100	100			PUMH24	PUMD24	PUMB24	PEMH24	PEMD24	PEMB24	
			R1 ≠ R2	2.2	47			PUMH10	PUMD10	PUMB10	PEMH10	PEMD10	PEMB10
				4.7	10			PUMH18	PUMD18	PUMB18	PEMH18	PEMD18	PEMB18
				4.7	47			PUMH13	PUMD13	PUMB13	PEMH13	PEMD13	PEMB13
				10	47	PIMH9		PUMH9	PUMD9	PUMB9	PEMH9	PEMD9	PEMB9
				22	47			PUMH16	PUMD16	PUMB16	PEMH16	PEMD16	PEMB16
				47	22			PUMH17	PUMD17	PUMB17	PEMH17	PEMD17	PEMB17
				47/2.2	47/47					PUMD48		PEMD48	
				Only R1	2.2	-			PUMH30	PUMD30	PUMB30	PEMH30	PEMD30
		4.7			-			PUMH7	PUMD6	PUMB3	PEMH7	PEMD6	PEMB3
		10			-			PUMH4	PUMD4	PUMB4	PEMH4	PEMD4	PEMB4
		22			-			PUMH19	PUMD19	PUMB19	PEMH19	PEMD19	PEMB19
		47			-			PUMH14	PUMD14	PUMB14	PEMH14	PEMD14	PEMB14


Small-signal transistors

RETs 500 mA

types in bold represent new products

Package				SOT457 (SC-74)		SOT23			
									
Size (mm)				2.9 x 1.5 x 1.0		2.9 x 1.3 x 1.0			
P <sub>tot</sub> (mW)				600		250			
V <sub>CE0</sub> (V)	I <sub>c</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	NPN/NPN	NPN/PNP	PNP		
50	500	R1 = R2	1.0	1.0			PDTD113ET	PDTB113ET	
			2.2	2.2			PDTD123ET	PDTB123ET	
			1.0	10	PIMN31	<b>PIMC31</b>	PDTD113ZT	PDTB113ZT	
		R1 ≠ R2	2.2	10				PDTD123YT	PDTB123YT
			2.2	-				PDTD123TT	PDTB123TT

Low V<sub>CEsat</sub> (BISS) RETs

Package						SOT23
						
Size (mm)						2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)						250
Polarity	V <sub>CE0</sub> (V)	I <sub>c</sub> (mA)	Configuration	R1 (kΩ)	R2 (kΩ)	
NPN	40	600	R1 = R2	1	1	PBRN113ET
				2.2	2.2	PBRN123ET
				1	10	PBRN113ZT
			R1 ≠ R2	2.2	10	PBRN123YT
				1	1	PBRP113ET
				2.2	2.2	PBRP123ET
PNP	40	600	R1 = R2	1	10	PBRP113ZT
				2.2	10	PBRP123YT
				1	10	PBRP113ZT

Low  $V_{CEsat}$  (BISS) transistors single NPN

types in **bold** represent new products











Package											SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)		SOT23	SOT1061	SOT323 (SC-70)	SOT363 (SC-88)	SOT416 (SC-75)	SOT666	SOT883 (SC-101)		
Size (mm)											6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0		2.9 x 1.3 x 1.0	2.0 x 2.0 x 0.65	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.6 x 0.8 x 0.77	1.6 x 1.2 x 0.55	1.0 x 0.6 x 0.5		
$P_{tot}$ (mW)											1700	1650	750		480	1400	350	430	250	500	250		
$V_{CE0}$ (V)	$I_C$ (A)	$I_{CW}$ (A)	$h_{FE}$ min/typ	@ $I_C$ (A)	@ $V_{CE}$ (V)	$R_{CEsat}$ typ (mΩ); $I_C/I_B = 10$	$V_{CEsat}$ typ (mV); $I_C = 0.5$ A; $I_B = 0.05$ A	$V_{CEsat}$ max (mV)	@ $I_C$ (A)	@ $I_B$ (A)													
12	5.3	10.6	300/530	0.5	2	27 <sup>1)</sup>	18	200	5.3	0.265	PBSS301NZ	PBSS301NX											
	5.8	11.6	300/530	0.5	2	29 <sup>1)</sup>	18	235	5.8	0.29													
	6.0	7.0	280/440	0.5	2	33 <sup>1)</sup>	20	275	6	0.3					<b>PBSS4612PA</b>								
15	0.5	1.0	200/325	0.01	2	360	-	250	0.5	0.05											PBSS2515M		
			200/425	0.01	2	300	200	250	0.5	0.05													
20	1.0	3.0	350/470	0.1	2	220	110 <sup>2)</sup>	250	1	0.05											PBSS2515E		
	2.0	4.0	220/410	0.5	2	140	70	350	2	0.2												PBSS4220V	
		5.0	220/330	0.1	2	80	45	310	3	0.3													
	3.0	5.0	220/390	0.5	2	85	40	310	3	0.3													
	4.0	15.0	300/450	0.5	2	50	30	280	4	0.4													
	4.3	8.0	300/550	0.5	2	36	21	220	4	0.2													
	5.0	10.0	300/450	0.5	2	32	35	220	5	0.5													
	5.3	10.6	300/570	0.5	2	27 <sup>1)</sup>	20	200	5.3	0.265													
	5.8	10.2	300/570	0.5	2	30 <sup>1)</sup>	20	250	5.8	0.29													
	6.0	7.0	280/440	0.5	2	33 <sup>1)</sup>	20	275	6	0.3													
30	7.0	15.0	300/550	0.5	2	19	12	210	7	0.35													
	8.0	20.0	300/550	0.5	2	14	9	170	8	0.4													
	1.0	3.0	300/450	0.5	2	240	120 <sup>2)</sup>	270	1	0.05													
	2.0	3.0	300/450	0.5	2	120	70	320	2	0.2													
	2.6	5.0	300/500	0.5	2	76	80	320	3	0.3													
	3.0	5.0	300/490	0.5	2	80	45	300	3	0.3													
	3.5	6.0	300/500	0.5	2	50	70	300	4	0.4													
	4.7	10.0	300/500	0.5	2	45	57	250	4	0.4													
	5.1	10.2	300/480	0.5	2	30 <sup>1)</sup>	20	220	5.1	0.255													
	5.4	10.0	300/500	0.5	2	45	57	340	5.4	0.27													
40	5.5	11.0	300/480	0.5	2	31 <sup>1)</sup>	20	240	5.5	0.275													
	6.0	7.0	280/450	0.5	2	35 <sup>1)</sup>	21	275	6	0.3													
	0.5	1.0	200/550	0.01	2	380	200 <sup>2)</sup>	250	0.5	0.05												PBSS2540M	
			200/350	0.01	2	380	190	250	0.5	0.05													
	1.0	3.0	300/-	0.5	5	150	70	440	2	0.2													
		2.0	300/440	0.5	5	240	130	500	1	0.1													
	2.0	3.0	300/510	0.5	5	230	120	500	1	0.1													
		3.0	300/420	0.5	5	150	130	500	1	0.1													
		3.0	300/400	0.5	5	150	70	400	2	0.2													
		3.0	350/470	0.1	2	120	70	320	2	0.2													
4.0	15.0	300/520	0.5	2	55	35	300	4	0.4														
	10.0	300/500	0.5	2	40	21	355	5	0.5														
	10.0	300/500	0.5	2	42	25	355	5	0.5														
50	2.0	5.0	300/495	0.5	2	100	60	260	2	0.2													
			300/-	0.5	2	160	90 <sup>2)</sup>	320	2	0.2													
	3.0	5.0	200/280	0.5	2	110	65	290	2	0.2													
60	3.0	5.0	300/460	0.5	2	75	50	370	3	0.3													
			200/280	0.5	2	110	60 <sup>1)</sup>	290	2	0.2													
	1.0	2.0	200/400	0.5	5	200	110	250	1	0.1													
			200/420	0.5	5	230	120	280	1	0.1													
			200/350	0.5	5	200	110	250	1	0.1													
	3.0	6.0	345/570	0.5	2	65	40	260	3	0.3													
	3.8	8.0	300/500	0.5	2	46	29	200	3	0.3													
	4.7	9.4	300/520	0.5	2	37 <sup>1)</sup>	25	245	4.7	0.235													
	5.2	10.4	300/520	0.5	2	39 <sup>1)</sup>	25	280	5.2	0.26													
	6.0	7.0	280/440	0.5	2	34 <sup>1)</sup>	22	290	6	0.3													
80	6.2	15.0	300/500	0.5	2	25	17	230	6	0.3													
	7.0	15.0	300/500	0.5	2	17.5	13	195	7	0.35													
	3.0	6.0	240/360	0.5	2	67	40	255	3	0.3													
	4.0	10.0	250/400	0.5	2	43 <sup>1)</sup>	25	230	4	0.2													
	4.6	9.2	300/470	0.5	2	37 <sup>1)</sup>	25	240	4.6	0.23													
	5.1	10.2	300/470	0.5	2	38 <sup>1)</sup>	25	270	5.1	0.255													
	5.6	7.0	270/425	0.5	2	40 <sup>1)</sup>	25	320	5.6	0.28													
	100	1.0	3.0	150/400	0.25	10	160	80	200	1	0.1												
				150/300	0.25	10	165	70	200	1	0.1												
				150/290	0.25	10	160	75	200	1	0.1												
			150/290	0.25	10	165	73	200	1	0.1													
			150/290	0.25	10	160	73	200	1	0.1													
3.0		4.0	170/275	0.5	2	72	45	360	4	0.4													
4.5		9.0	200/330	0.5	2	38 <sup>1)</sup>	27	245	4.5	0.225													
5.1	10.2	200/330	0.5	2	43 <sup>1)</sup>	27	300	5.1	0.255														
5.2	6.0	180/285	0.5	2	48 <sup>1)</sup>	30	340	5.2	0.26														

1)  $I_C/I_B = 20$   
 2)  $V_{CEsat}$  (max)  
 3) optimized for high speed switching

Small-signal transistors

Low V<sub>CEsat</sub> (BISS) transistors single PNP

types in **bold** represent new products

Package												SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)		SOT23	SOT1061	SOT323 (SC-70)	SOT363 (SC-88)	SOT416 (SC-75)	SOT666	SOT883 (SC-101)
																						
Size (mm)												6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0		2.9 x 1.3 x 1.0	2.0 x 2.0 x 0.65	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.6 x 0.8 x 0.77	1.6 x 1.2 x 0.55	1.0 x 0.6 x 0.5
P <sub>tot</sub> (mW)												1700	1650	750		480	1400	350	430	250	500	250
V <sub>CEO</sub> (V)	I <sub>C</sub> (A)	I <sub>CM</sub> (A)	h <sub>FE</sub> min/typ	@ I <sub>C</sub> (V)	@ V <sub>CE</sub> (V)	R <sub>CEsat</sub> typ (mΩ)	V <sub>CEsat</sub> typ (mV)	V <sub>CEsat</sub> max (mV)	@ I <sub>C</sub> (A)	@ I <sub>B</sub> (A)												
12	5.3	10.6	250/400	0.5	2	28 <sup>1)</sup>	20	210	5.3	0.265												
	5.7	11.4	250/400	0.5	2	30 <sup>1)</sup>	20	245	5.7	0.285	PBSS301PZ											
	6.0	7.0	220/335	0.5	2	33 <sup>1)</sup>	20	300	6	0.3				<b>PBSS5612PA</b>								
15	0.5	1.0	200/260	0.01	2	300	150	250	0.5	0.05												
			200/325	0.01	2	300	150	250	0.5	0.05												
20	1.0	2.0	300/450	0.1	2	250	125 <sup>2)</sup>	250	1	0.05												
		4.0	220/440	0.1	2	140	75	390	2	0.2												
	2.0	3.0	225/-	0.5	2	115	80 <sup>2)</sup>	225	2	0.2												
		5.0	220/420	0.5	2	75	50	210	2	0.2												
	3.0	5.0	200/-	0.5	2	85	80 <sup>2)</sup>	400	3	0.3												
			220/450	0.5	2	90	50	300	3	0.3												
	3.5	8.0	250/400	0.5	2	55	35	375	4	0.2												
	4.0	15.0	250/400	0.5	2	50	35	280	4	0.4												
	5.0	10.0	300/430	0.5	2	34	45	270	5	0.5												
	5.1	10.2	250/370	0.5	2	32 <sup>1)</sup>	25	230	5.1	0.255												
	5.5	11.0	250/370	0.5	2	34 <sup>1)</sup>	25	265	5.5	0.275												
	6.0	7.0	230/345	0.5	2	39 <sup>1)</sup>	25	350	6	0.3												
6.2	15.0	250/400	0.5	2	25	18	240	6	0.3													
6.6	20.0	250/400	0.5	2	22	16	240	7	0.35													
30	1.0	3.0	260/350	0.5	2	220	110	225	1	0.05												
	2.0	3.0	300/450	0.1	2	160	70	350	2	0.2												
	2.4	5.0	200/320	0.5	2	110	95	330	2	0.2												
	2.7	5.0	200/350	0.5	2	88	87	395	3	0.3												
	3.0	5.0	200/380	0.5	2	80	50	320	3	0.3												
	4.2	10.0	200/350	0.5	2	58	70	345	4	0.4												
	4.4	10.0	200/350	0.5	2	58	70	400	4	0.2												
	5.1	10.2	250/400	0.5	2	32 <sup>1)</sup>	25	230	5.1	0.255												
	5.3	10.6	250/400	0.5	2	35 <sup>1)</sup>	25	265	5.3	0.265												
	6.0	7.0	200/335	0.5	2	39 <sup>1)</sup>	25	350	6	0.3												
40	0.5	1.0	200/380	0.01	2	440	220	350	0.5	0.05												
			200/380	0.01	2	440	230	350	0.5	0.05												
			300/-	0.1	5	200	120	310	1	0.1												
	1.0	2.0	300/520	0.1	5	230	130	500	1	0.1												
			300/800	0.1	5	250	130	500	1	0.1												
			300/510	0.1	5	230	130	500	1	0.1												
	1.8	3.0	300/450	0.1	5	185	100	530	2	0.2												
	2.0	3.0	300/-	0.1	2	200	110 <sup>2)</sup>	350	2	0.2												
			300/450	0.1	2	150	70	350	2	0.2												
	4.0	15.0	200/310	0.5	2	55	46	300	4	0.4												
10.0	250/370	0.5	2	45	33	375	5	0.5														
5.0	10.0	250/350	0.5	2	55	40 <sup>1)</sup>	160	2	0.2													
50	2.0	3.0	200/-	0.5	2	150	90 <sup>2)</sup>	300	2	0.1												
		5.0	200/360	0.5	2	90	55	270	2	0.2												
			200/-	0.5	2	160	90 <sup>2)</sup>	320	2	0.2												
	3.0	5.0	200/300	0.5	2	120	70	300	2	0.2												
			200/375	0.5	2	120	70	390	3	0.3												
			200/300	0.5	2	120	70	300	2	0.2												
60	1.0	2.0	150/250	0.5	5	220	120	330	1	0.1												
			150/250	0.5	5	255	135	340	1	0.1												
			150/250	0.5	5	220	120	330	1	0.1												
	2.7	8.0	200/300	0.5	2	80	49	360	3	0.3												
	3.0	6.0	180/265	0.5	2	70	55	290	3	0.3												
	4.2	8.4	200/295	0.5	2	53 <sup>1)</sup>	35	310	4.2	0.21												
	4.5	9.0	200/295	0.5	2	59 <sup>1)</sup>	35	375	4.5	0.225												
	5.0	6.0	170/260	0.5	2	35 <sup>1)</sup>	55	450	5	0.25												
5.0	15.0	200/300	0.5	2	40	30	300	5	0.5													
5.7	15.0	200/300	0.5	2	29	22	285	6	0.3													
80	3.0	5.0	155/225	0.5	2	71	55	290	3	0.3												
		5.0	180/265	0.5	2	65 <sup>1)</sup>	40	420	4	0.2												
	4.0	10.0	200/300	0.5	2	50	35	380	5	0.5												
		8.0	200/280	0.5	2	43	36	240	4	0.4												
4.5	9.0	200/280	0.5	2	69 <sup>1)</sup>	36	450	4.5	0.225													
100	1.0	3.0	150/-	0.25	5	170	93	320	1	0.1												
			150/350	0.5	5	170	95	320	1	0.1												
			150/350	0.5	5	170	100	320	1	0.1												
			150/350	0.5	5	170	90	320	1	0.1												
			150/-	0.5	5	170	90	320	1	0.1												
	2.0	3.0	175/275	0.5	2	88	65	250	2	0.2												
	2.7	4.0	180/295	0.5	2	110 <sup>1)</sup>	45	450	2.7	0.135												
	3.7	7.4	200/300	0.5	2	52	45	300	4	0.4												
4.1	8.2	200/300	0.5	5	57	45	325	4.1	0.41													

1) I<sub>C</sub>/I<sub>B</sub> = 20  
 2) V<sub>CEsat</sub> (max)  
 3) optimized for high speed switching

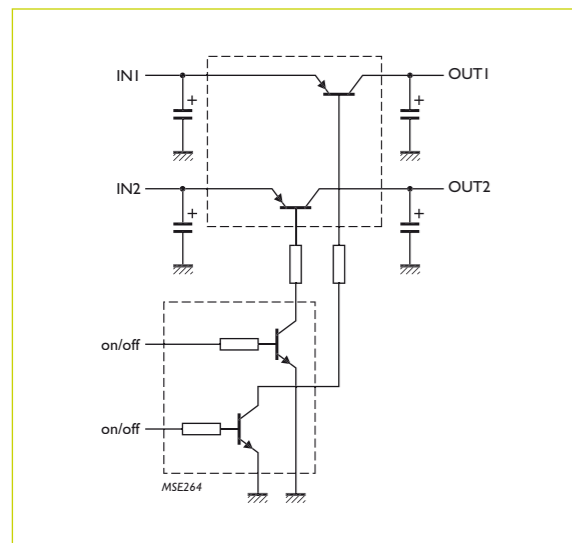
Low  $V_{CEsat}$  (BISS) transistors double

types in **bold** represent new products

Package											SOT96 (SO8)	SOT457 (SC-74)	SOT363 (SC-88)	SOT666
Size (mm)											4.9 x 3.9 x 1.75	2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55
$P_{tot}$ (mW)											2000 <sup>2)</sup>	750	430	500
$V_{CE0}$ (V)	$I_C$ (A)	Polarity	$h_{FE}$ min	@ $I_C$ (A)	@ $V_{CE}$ (V)	$V_{CEsat}$ typ (mV); $I_C = 0.5$ A; $I_B = 0.05$ A	$V_{CEsat}$ max (mV)	@ $I_C$ (A)	@ $I_B$ (A)					
15	0.5	2 x NPN	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05					PBSS2515VS
		2 x PNP	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05					PBSS3515VS
		NPN/PNP	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05					PBSS2515VPN
		NPN/PNP	200	0.01	2	170 <sup>1)</sup>	250	0.5	0.05					PBSS2515YPN
20	7.5	NPN/NPN	300	0.5	2	15	150	4	0.2	<b>PBSS4021SN</b>				
	6.3	PNP/PNP	250	0.5	2	24	225	4	0.2	<b>PBSS4021SP</b>				
	7.5 / 6.3	NPN/PNP	300/250	0.5	2	15/24	150/225	4	0.2	<b>PBSS4021SPN</b>				
30	5.7	NPN/NPN	300	0.5	2	57	250	4	0.4	<b>PBSS4032SN</b> <sup>3)</sup>				
	4.8	PNP/PNP	200	0.5	2	70	390	4	0.4	<b>PBSS4032SP</b> <sup>3)</sup>				
	5.7 / 4.8	NPN/PNP	300/200	0.5	2	57/70	250/390	4	0.4	<b>PBSS4032SPN</b> <sup>3)</sup>				
40	1.0	NPN/PNP	300/250	0.5	5	130/150	500	1	0.1		PBSS4140DPN			
	2.0	NPN/PNP	300/250	0.5	5	80/100	400/530	2	0.2		PBSS4240DPN			
50	2.7	2 x NPN	300	0.5	2	50	340	2.7	0.27	PBSS4350SS				
		2 x PNP	200	0.5	2	60	370	2.7	0.27	PBSS5350SS				
		NPN/PNP	300/200	0.5	2	50/60	340/370	2.7	0.27	PBSS4350SPN				
60	1.0	2 x NPN	200	0.5	5	115	250	1	0.1		PBSS4160DS			
		2 x PNP	150	0.5	5	120	330	1	0.1		PBSS5160DS			
		NPN/PNP	200/150	0.5	5	115/120	250/330	1	0.1		PBSS4160DPN			
	6.7	NPN/NPN	300	0.5	2	20	190	4	0.2	<b>PBSS4041SN</b>				
	5.9	PNP/PNP	200	0.5	2	35	330	4	0.2	<b>PBSS4041SP</b>				
6.7 / 5.9	NPN/PNP	300/200	0.5	2	20/35	190/330	4	0.2	<b>PBSS4041SPN</b>					

<sup>1)</sup>  $I_C/I_B = 20$   
<sup>2)</sup> Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint.  
<sup>3)</sup> Optimized for high speed switching

Dual load switch using double RETs and double BISS transistors



Low  $V_{CEsat}$  (BISS) load switches

types in **bold** represent new products

Package					SOT96 (SO8)	SOT457 (SC-74)	SOT363 (SC-88)	SOT666			
Size (mm)					4.9 x 3.9 x 1.75	2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55			
$P_{tot}$ (mW)					1500 <sup>1)</sup>	750 <sup>1)</sup>	600 <sup>1)</sup>	300 <sup>2)</sup>			
$V_{CE0}$ (V)	$I_C$ (A)	$V_{CEsat}$ max (mV); $I_C = 0.5$ A; $I_B = 0.05$ A	R1, R2 (kΩ)								
15	0.5	250	2.2					PBLS1501Y	PBLS1501V		
			4.7					PBLS1502Y	PBLS1502V		
			10					PBLS1503Y	PBLS1503V		
			22					PBLS1504Y	PBLS1504V		
20	1	150	2.2					PBLS2001D			
			4.7					PBLS2002D			
			10					PBLS2003D			
			22					PBLS2004D			
	1.8	70	2.2					<b>PBLS2021D</b>			
			4.7					<b>PBLS2022D</b>			
			10					<b>PBLS2023D</b>			
			22					<b>PBLS2024D</b>			
3	75	2.2					PBLS2001S				
		4.7					PBLS2002S				
		10					PBLS2003S				
		22									
40	0.5	350	2.2					PBLS4001Y	PBLS4001V		
			4.7					PBLS4002Y	PBLS4002V		
			10					PBLS4003Y	PBLS4003V		
			22					PBLS4004Y	PBLS4004V		
			47					PBLS4005Y	PBLS4005V		
			2.2						PBLS4001D		
	1	170	4.7						PBLS4002D		
			10						PBLS4003D		
			22						PBLS4004D		
			47						PBLS4005D		
			2.2							PBLS6001D	
			4.7							PBLS6002D	
60	1	180	10						PBLS6003D		
			22						PBLS6004D		
			47						PBLS6005D		
			2.2						<b>PBLS6021D</b>		
			4.7						<b>PBLS6022D</b>		
			10						<b>PBLS6023D</b>		
1.5	100	22						<b>PBLS6024D</b>			

<sup>1)</sup> Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint  
<sup>2)</sup> Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint

Key features

- ▶ Low  $V_{CEsat}$  (BISS) transistor and resistor-equipped transistor (RET) in one package
- ▶ Low saturation voltage
- ▶ Low 'threshold' voltage (< 1 V) compared to MOSFET
- ▶ Low drive power required
- ▶ Range of small, very small and ultra small packages

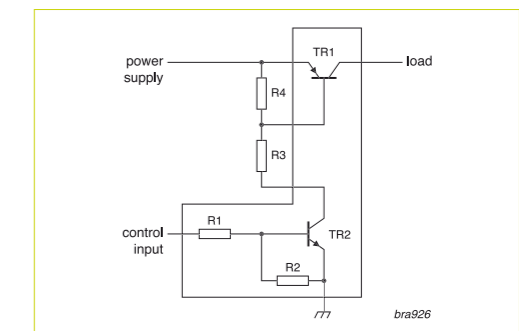
Key benefits

- ▶ Smaller end products
- ▶ Reduced component count
- ▶ Less sourcing effort
- ▶ Fewer solder points increase reliability
- ▶ Cost reduction
- ▶ More efficient, cooler running systems

Key applications

- ▶ Supply line switch
- ▶ Battery charger
- ▶ High-side switch for LEDs, drivers and backlights
- ▶ Portable equipment

BISS load switch



### High voltage low $V_{CEsat}$ (BISS) transistors

types in **bold** represent new products

				SOT223 (SC-73)	SOT89 (SC-62)	SOT23
Package						
Size (mm)				6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.3 x 1.0
$P_{tot}$ (mW)				1700	1300	250
Polarity	$V_{CESM}^{(1)}$	$V_{CEO}$ (V)	$I_C$ (A)			
NPN	-	150	1	PBHV8115Z		PBHV8115T
			<b>2</b>	<b>PBHV8215Z</b>		
		500	400	0.5	PBHV8540Z	
	<b>1</b>			<b>PBHV8140Z</b>		
	500		0.15			<b>PMBTA45</b>
	PNP	-	150	1	PBHV9115Z	<b>PBHV9115X</b>
<b>2</b>				<b>PBHV9215Z</b>		
500			400	0.25	PBHV9040Z	
		<b>0.5</b>		<b>PBHV9540Z</b>		
		500	0.15			<b>PBHV9050T</b>
				0.25	<b>PBHV9050Z</b>	

<sup>1)</sup> Collector-emitter peak voltage

### Low $V_{CEsat}$ modules – Schottky diode / (BISS) transistor

							SOT457 (SC-74)	SOT353 (SC-88A)
Package								
Size (mm)							2.9 x 1.5 x 1.0	2.0 x 1.25 x 0.95
$P_{tot}$ (mW)							500	250
Transistor			Schottky rectifier			Configuration		
$V_{CEO}$ max (V)	$I_C$ max (A)	$V_{CEsat}$ max (mV)	$I_F$ max (A)	$V_R$ max (V)	$V_F$ max (mV)			
15	0.5	250	0.5	20	390			PMEM1505NG
40	1.0	210	1	20	550			PMEM4010ND
	2.0	400	1	40	640			PMEM4020ND
15	0.5	250	0.5	20	390			PMEM1505PG
40	1.0	410	1	20	550			PMEM4010PD
	2.0	530	1	40	640			PMEM4020PD
								PMEM4020APD

#### Key features

- ▶ Combination of low  $V_F$  (MEGA) Schottky rectifier and low  $V_{CEsat}$  (BISS) transistor in one package
- ▶ High forward current capability
- ▶ Low power dissipation

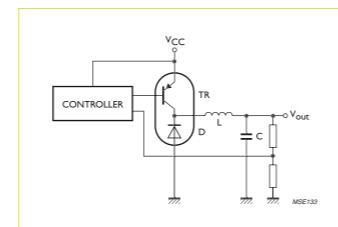
#### Key benefits

- ▶ Reduced component count
- ▶ Space savings of up to 32 %
- ▶ Higher efficiency
- ▶ Higher power density
- ▶ Cost reduction potential
- ▶ Simplified circuit design

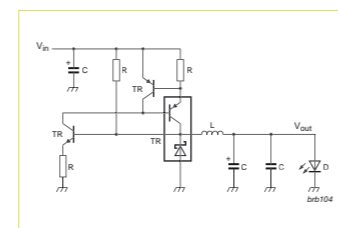
#### Key applications

- ▶ DC/DC conversion
- ▶ Inductive load driver
- ▶ Push-pull driver

#### Step-down DC/DC converter



#### Power LED driver



### Low $V_{CEsat}$ (BISS) RETs

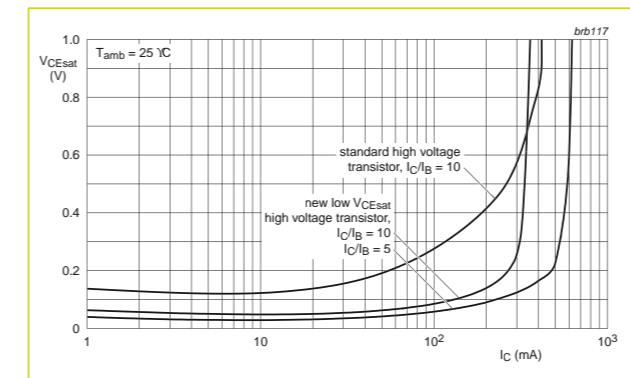
						SOT23	
Package							
Size (mm)						2.9 x 1.3 x 1.0	
$P_{tot}$ (mW)						250	
$V_{CEO}$ (V)	$I_C$ (mA)		R1 (k $\Omega$ )	R2 (k $\Omega$ )	NPN	PNP	
40	600	R1 = R2	1	1	PBRN113ET	PBRP113ET	
			2.2	2.2	PBRN123ET	PBRP123ET	
		R1 $\neq$ R2	1	10	PBRN113ZT	PBRP113ZT	
			2.2	10	PBRN123YT	PBRP123YT	

### Advantages of low $V_{CEsat}$ (BISS) technology

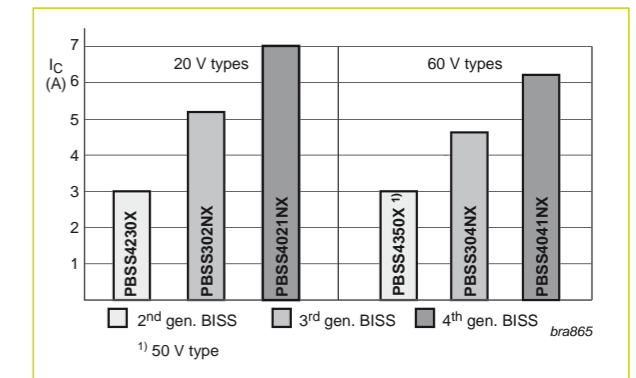
Our BISS (Breakthrough In Small-Signal) transistors show lowest  $V_{CEsat}$  values due to an innovative mesh-emitter technology and further technology improvement.

#### High voltage low $V_{CEsat}$ (BISS)

$V_{CEsat}$  improvement leads to higher  $I_C$  capability

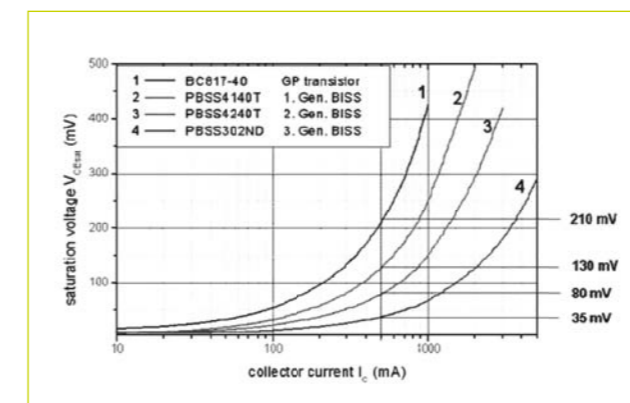


#### Improved collector current capabilities

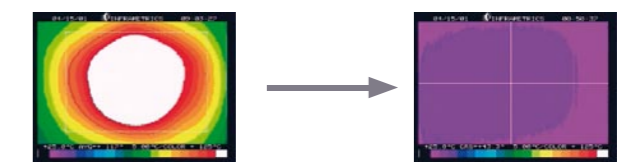


#### Saturation voltage:

General purpose versus low  $V_{CEsat}$  (BISS) transistors (NPN in SOT23/SOT457)



#### 65 % heat reduction by BISS transistors



General purpose transistor  $T_{case} = 110^\circ\text{C}$

3<sup>rd</sup> generation BISS transistor  $T_{case} = 40^\circ\text{C}$

Temperature profile of device surface ( $T_{case}$ ). Comparison of a general purpose transistor and a 3<sup>rd</sup> generation BISS transistor.

## Medium power low $V_{CEsat}$ (BISS) transistors NPN

types in **bold** represent new products

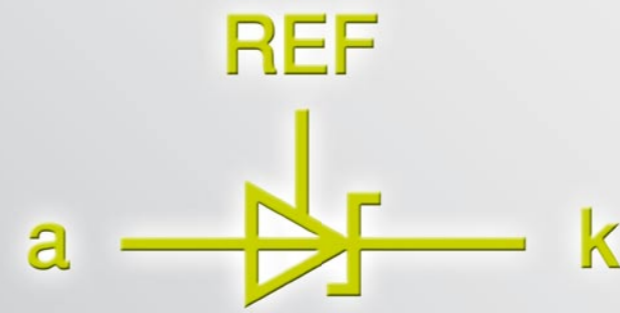
Package											SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)	SOT1061			
Size (mm)											6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.0 x 2.0 x 0.65			
$P_{tot}$ (mW)											1700	1650	750	1400			
Polarity	$V_{CE0}$ (V)	$I_C$ (A)	$I_{CM}$ (A)	$h_{FE}$ min/typ	@ $I_C$ (A)	@ $V_{CE}$ (V)	$R_{CEsat, typ}$ (mΩ); $I_C/I_B = 10$	$V_{CEsat, typ}$ (mV); $I_C = 0.5A$ ; $I_B = 0.05A$	$V_{CEsat, max}$ (mV)	@ $I_C$ (A)	@ $I_B$ (A)						
NPN	12	5.3	10.6	300/530	0.5	2	27 <sup>1)</sup>	18	200	5.3	0.265						
		5.8	11.6	300/530	0.5	2	29 <sup>1)</sup>	18	235	5.8	0.29						
		6.0	7.0	280/440	0.5	2	33 <sup>1)</sup>	20	275	6	0.3						
		3.0	5.0	220/390	0.5	2	85	40	310	3	0.3						
		4.0	15.0	300/450	0.5	2	50	30	280	4	0.4						
	20	4.0	15.0	300/450	0.5	2	50	30	280	4	0.4						
		5.0	10.0	300/450	0.5	2	32	35	220	5	0.5						
		5.3	10.6	300/570	0.5	2	27 <sup>1)</sup>	20	200	5.3	0.265						
		5.8	10.2	300/570	0.5	2	30 <sup>1)</sup>	20	250	5.8	0.29						
		6.0	7.0	280/440	0.5	2	33 <sup>1)</sup>	20	275	6	0.3						
		7.0	15.0	300/550	0.5	2	19	12	210	7	0.35						
		8.0	20.0	300/550	0.5	2	14	9	170	8	0.4						
		3.0	5.0	300/490	0.5	2	80	45	300	3	0.3						
		3.5	6.0	300/500	0.5	2	50	70	300	4	0.4						
		4.7	10.0	300/500	0.5	2	45	57	250	4	0.4						
	30	5.1	10.2	300/480	0.5	2	30 <sup>1)</sup>	20	220	5.1	0.255						
		5.4	10.0	300/500	0.5	2	45	57	340	5.4	0.27						
		5.5	11.0	300/480	0.5	2	31 <sup>1)</sup>	20	240	5.5	0.275						
		6.0	7.0	280/450	0.5	2	35	21	275	6	0.3						
		4.0	15.0	300/520	0.5	2	55	35	300	4	0.4						
	40	5.0	10.0	300/500	0.5	2	40	21	355	5	0.5						
		5.0	10.0	300/500	0.5	2	42	25	355	5	0.5						
		2.0	5.0	300/495	0.5	2	100	60	260	2	0.2						
		300/-	0.5	2	160	90 <sup>2)</sup>	320	2	0.2								
		200/280	0.5	2	110	65	290	2	0.2								
		3.0	5.0	300/460	0.5	2	75	50	370	3	0.3						
		200/280	0.5	2	110	60 <sup>1)</sup>	290	2	0.2								
		3.0	6.0	345/570	0.5	2	65	40	260	3	0.3						
		4.7	9.4	300/520	0.5	2	37 <sup>1)</sup>	25	245	4.7	0.235						
		5.2	10.4	300/520	0.5	2	39 <sup>1)</sup>	25	280	5.2	0.26						
	60	6.0	7.0	280/440	0.5	2	34 <sup>1)</sup>	22	290	6	0.3						
		6.2	15.0	300/500	0.5	2	25	17	230	6	0.3						
		7.0	15.0	300/500	0.5	2	17.5	13	195	7	0.35						
		3.0	6.0	240/360	0.5	2	67	40	255	3	0.3						
		4.0	10.0	250/400	0.5	2	43 <sup>1)</sup>	25	230	4	0.2						
		4.6	9.2	300/470	0.5	2	37 <sup>1)</sup>	25	240	4.6	0.23						
		5.1	10.2	300/470	0.5	2	38 <sup>1)</sup>	25	270	5.1	0.255						
		5.6	7.0	270/425	0.5	2	40 <sup>1)</sup>	25	320	5.6	0.28						
		1.0	3.0	150/290	0.25	10	160	75	200	1	0.1						
		150/290	0.25	10	165	73	200	1	0.1								
	100	3.0	4.0	170/275	0.5	2	72	45	360	4	0.4						
		4.5	9.0	200/330	0.5	2	38 <sup>1)</sup>	27	245	4.5	0.225						
		5.1	10.2	200/330	0.5	2	43 <sup>1)</sup>	27	300	5.1	0.255						
		5.2	6.0	180/285	0.5	2	48 <sup>1)</sup>	30	340	5.2	0.26						

<sup>1)</sup>  $I_C/I_B = 20$   
<sup>2)</sup>  $V_{CEsat}$  (max)  
<sup>3)</sup> optimized for high speed switching

## Medium power low $V_{CEsat}$ (BISS) transistors PNP

types in **bold** represent new products

Package											SOT223 (SC-73)	SOT89 (SC-62)	SOT457 (SC-74)	SOT1061			
Size (mm)											6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.0 x 2.0 x 0.65			
$P_{tot}$ (mW)											1700	1650	750	1400			
Polarity	$V_{CE0}$ (V)	$I_C$ (A)	$I_{CM}$ (A)	$h_{FE}$ min/typ	@ $I_C$ (V)	@ $V_{CE}$ (V)	$R_{CEsat, typ}$ (mΩ); $I_C/I_B = 10$	$V_{CEsat, typ}$ (mV); $I_C = 0.5A$ ; $I_B = 0.05A$	$V_{CEsat, max}$ (mV)	@ $I_C$ (A)	@ $I_B$ (A)						
PNP	12	5.3	10.6	250/400	0.5	2	28 <sup>1)</sup>	20	210	5.3	0.265						
		5.7	11.4	250/400	0.5	2	30 <sup>1)</sup>	20	245	5.7	0.285						
		6.0	7.0	220/335	0.5	2	33 <sup>1)</sup>	20	300	6	0.3						
		3.0	5.0	200/-	0.5	2	85	80 <sup>2)</sup>	400	3	0.3						
		4.0	15.0	250/400	0.5	2	50	35	280	4	0.4						
	20	4.0	15.0	250/400	0.5	2	50	35	280	4	0.4						
		5.0	10.0	300/430	0.5	2	34	45	270	5	0.5						
		5.1	10.2	250/370	0.5	2	32 <sup>1)</sup>	25	230	5.1	0.255						
		5.5	11.0	250/370	0.5	2	34 <sup>1)</sup>	25	265	5.5	0.275						
		6.0	7.0	230/345	0.5	2	39 <sup>1)</sup>	25	350	6	0.3						
		6.2	15.0	250/400	0.5	2	25	18	240	6	0.3						
		6.6	20.0	250/400	0.5	2	22	16	240	7	0.35						
		2.7	5.0	200/350	0.5	2	88	87	395	3	0.3						
		3.0	5.0	200/380	0.5	2	80	50	320	3	0.3						
		4.2	10.0	200/350	0.5	2	58	70	345	4	0.4						
	30	4.4	10.0	200/350	0.5	2	58	70	400	4	0.2						
		5.1	10.2	250/400	0.5	2	32 <sup>1)</sup>	25	230	5.1	0.255						
		5.3	10.6	250/400	0.5	2	35 <sup>1)</sup>	25	265	5.3	0.265						
		6.0	7.0	230/345	0.5	2	39 <sup>1)</sup>	25	350	6	0.3						
		4.0	15.0	200/310	0.5	2	55	46	300	4	0.4						
	40	5.0	10.0	250/370	0.5	2	45	33	375	5	0.5						
		5.0	10.0	250/350	0.5	2	55	40 <sup>1)</sup>	160	2	0.2						
		2.0	5.0	200/-	0.5	2	160	90 <sup>2)</sup>	320	2	0.2						
		200/300	0.5	2	120	70	300	2	0.2								
		3.0	5.0	200/375	0.5	2	120	70	390	3	0.3						
	50	200/300	0.5	2	120	70	300	2	0.2								
		3.0	6.0	180/265	0.5	2	70	55	290	3	0.3						
		4.2	8.4	200/295	0.5	2	53 <sup>1)</sup>	35	310	4.2	0.21						
		4.5	9.0	200/295	0.5	2	59 <sup>1)</sup>	35	375	4.5	0.225						
		5.0	6.0	180/265	0.5	2	35 <sup>1)</sup>	55	450	5	0.25						
	60	5.0	15.0	200/300	0.5	2	40	30	300	5	0.5						
		5.7	15.0	200/300	0.5	2	29	22	285	6	0.3						
		3.0	5.0	155/225	0.5	2	71	55	290	3	0.3						
		4.0	5.0	180/265	0.5	2	65 <sup>1)</sup>	40	420	4	0.2						
		4.5	9.0	200/280	0.5	2	69 <sup>1)</sup>	36	450	4.5	0.225						
	80	5.7	15.0	200/300	0.5	2	29	22	285	6	0.3						
		3.0	6.0	150/350	0.5	5	170	100	320	1	0.1						
		2.7	4.0	150/350	0.5	5	170	90	320	1	0.1						
		150/-															



## Standard linear products

Adjustable shunt voltage regulator IC	68
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## Adjustable shunt voltage regulator IC

types in **bold** represent new products

Package				SOT23					
Size (mm)				2.9 x 1.3 x 1.0					
P <sub>tot</sub> (mW)				580					
Pinning configuration				normal pinning <sup>1)</sup>	mirrored pinning <sup>1)</sup>				
V <sub>KA</sub> (V)	I <sub>K</sub> (mA)	V <sub>ref</sub>	T <sub>amb</sub> (°C)						
20	80	1.24 V	1.5%	0 to 70	<b>TLVH431CDBZR</b>				
				-40 to 85	<b>TLVH431IDBZR</b>				
				-40 to 125	<b>TLVH431QDBZR</b>	<b>TLVH431MQDBZR</b>			
			1%	0 to 70	<b>TLVH431ACDBZR</b>				
				-40 to 85	<b>TLVH431AIDBZR</b>				
				-40 to 125	<b>TLVH431AQDBZR</b>	<b>TLVH431AMQDBZR</b>			
		0.5%	0 to 70	<b>TLVH431BCDBZR</b>					
			-40 to 85	<b>TLVH431BIDBZR</b>					
			-40 to 125	<b>TLVH431BQDBZR</b>	<b>TLVH431BMQDBZR</b>				
			36	100	2.495 V	2%	0 to 70	TL431CDBZR	
							-40 to 85	TL431IDBZR	
							-40 to 125	TL431QDBZR	TL431MSDT <sup>1)</sup>
1%	0 to 70	TL431ACDBZR							
	-40 to 85	TL431AIDBZR							
	-40 to 125	TL431AQDBZR				TL431ASDT <sup>1)</sup>			
0.5%	0 to 70	TL431BCDBZR							
	-40 to 85	TL431BIDBZR							
	-40 to 125	TL431BQDBZR	<b>TL431BSDT <sup>1)</sup></b>						
				<b>TL431BMSDT <sup>1)</sup></b>					

<sup>1)</sup> optimized for use with dedicated capacitive load

### \* Normal pinning vs. mirrored pinning

	Pin	Symbol	Description	Simplified outline	Grafic symbol
normal pinning	1	k	cathode		
	2	REF	reference		
	3	a	anode		
mirrored pinning	1	REF	reference		
	2	k	cathode		
	3	a	anode		

## Low-dropout adjustable and fixed linear voltage regulator

types in **bold** represent new products

Package				SOT223 (SC-73)			
Size (mm)				6.5 x 3.5 x 1.65			
P <sub>tot</sub> (mW)				1700			
				T <sub>amb</sub> (°C)			
V <sub>max</sub> (V)	I <sub>max</sub> (A)	V <sub>out</sub> (V)	V <sub>tolerance</sub>				
20	1	1.25 adj	1%	<b>NX1117CADJZ</b>	<b>NX1117IADJZ</b>		
		1.2		<b>NX1117C12Z</b>	<b>NX1117I12Z</b>		
		1.5		<b>NX1117C15Z</b>	<b>NX1117I15Z</b>		
		1.8		<b>NX1117C18Z</b>	<b>NX1117I18Z</b>		
		1.9		<b>NX1117C19Z</b>	<b>NX1117I19Z</b>		
		2.0		<b>NX1117C20Z</b>	<b>NX1117I20Z</b>		
		2.5		<b>NX1117C25Z</b>	<b>NX1117I25Z</b>		
		2.85		<b>NX1117C285Z</b>	<b>NX1117I285Z</b>		
		3.3		<b>NX1117C33Z</b>	<b>NX1117I33Z</b>		
		5.0		<b>NX1117C50Z</b>	<b>NX1117I50Z</b>		
		12.0		<b>NX1117C120Z</b>	<b>NX1117I120Z</b>		

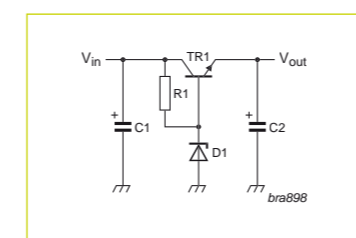
### Discrete voltage regulator

Package					SOT223 (SC-73)	SOT457 (SC-74)
Size (mm)					6.5 x 3.5 x 1.65	2.9 x 1.5 x 1.0
P <sub>tot</sub> (mW)					1300	380
Zener diode		Transistor				
V <sub>out</sub> (V)	V <sub>Z</sub> min - V <sub>Z</sub> max (V)	V <sub>CE0</sub> (V)	I <sub>C</sub> (A)	h <sub>FE</sub> min		
	@ I <sub>Z</sub> = 5 mA			@ I <sub>C</sub> = 100 mA		
2.5	3.23 - 3.37	45	0.1	160	PVR100AZ-B2V5	PVR100AD-B2V5
3.0	3.53 - 3.67	45	0.1	160	PVR100AZ-B3V0	PVR100AD-B3V0
3.3	3.82 - 3.98	45	0.1	160	PVR100AZ-B3V3	PVR100AD-B3V3
5.0	5.49 - 5.71	45	0.1	160	PVR100AZ-B5V0	PVR100AD-B5V0
12.3	12.7 - 13.3	45	0.1	160	PVR100AZ-B12V	PVR100AD-B12V

#### Key features

- ▶ A bipolar transistor and an integrated Zener diode, internally connected to build a voltage regulator
- ▶ Output voltage options V<sub>out</sub>: 2.5 V, 3 V, 3.3 V, 5 V and 12 V
- ▶ Output power dissipation capability: 1300 mW in SOT223 and 380 mW in SOT457
- ▶ SMD plastic packages

Standard voltage regulator. PVR-series already include TR1 and D1, internally connected



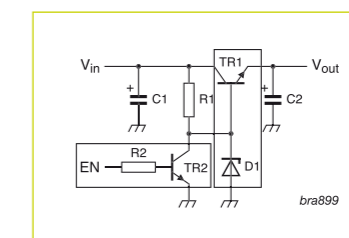
#### Key benefits

- ▶ Component count reduction
- ▶ Board space reduction
- ▶ Improved reliability

#### Key applications


- ▶ Linear voltage regulation

A resistor-equipped transistor (RET) adds an output enable function



Constant current source

## Constant current source

SOT353 (SC-88A)							
Package							
Size (mm)	2.0 x 1.25 x 0.95						
P <sub>tot</sub> (mW)	335						
Type	PSSI2021SAY						
Description	maximum supply voltage	maximum supply current	typical stabilized output current	minimum stabilized output current	maximum stabilized output current	typical load stability of stabilized output current	typical output current change over ambient temperature
Parameter	V <sub>S</sub> max (V)	I <sub>S</sub> max (mA)	I <sub>out</sub> typ (μA)	I <sub>out</sub> min (mA)	I <sub>out</sub> max (mA)	ΔI <sub>out</sub> /I <sub>out</sub> typ (%)	ΔI <sub>out</sub> /I <sub>out</sub> typ (ΔT <sub>amb</sub> )
Condition		@ V <sub>S</sub> = 12 V; I <sub>out</sub> = 15 μA; V <sub>out</sub> = 1 V to 10 V	@ V <sub>S</sub> = 12 V; V <sub>out</sub> = 1 V to 10 V; R <sub>ext</sub> = open			@ V <sub>S</sub> = 12 V; V <sub>out</sub> = 1 V to 10 V	@ V <sub>S</sub> = 12 V; V <sub>out</sub> = 1 V; T <sub>amb</sub> = -55 °C to 150 °C
Value	75>	2.2	15	0.015	50	0.5	0.15

### Key features

- ▶ Single-chip constant current source
- ▶ Output current set by an external resistor
- ▶ Very small footprint package

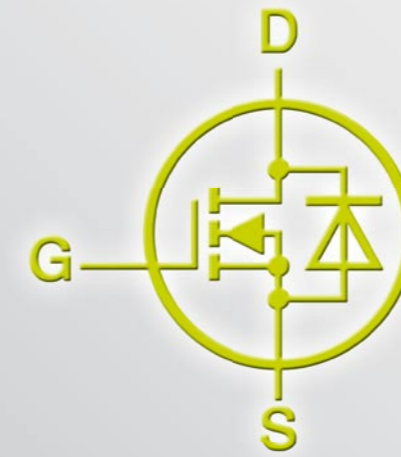
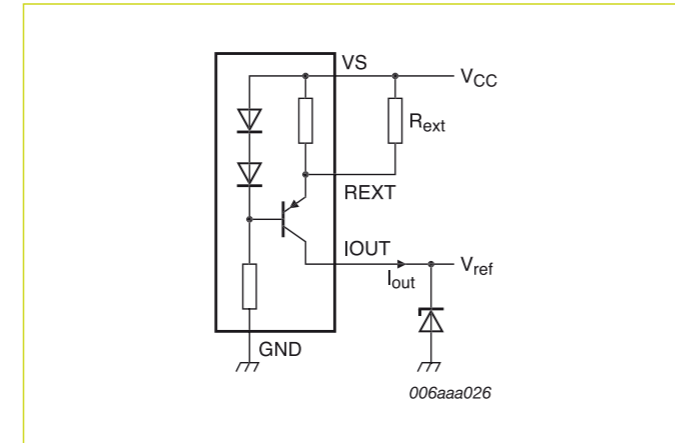
### Key benefits

- ▶ Reduced component count and pick-and-place costs
- ▶ Smaller designs

### Key applications

- ▶ Constant current LED driver
- ▶ Generic constant current source
- ▶ Active bias control for audio amplifiers

### Voltage reference



## MOSFETs

### Small-signal MOSFETs

72

- Small-signal MOSFETs single (N-channel) < 50 V
- Small-signal MOSFETs single (N-channel) ≥ 50 V
- Small-signal MOSFETs dual (N-channel)
- Small-signal MOSFETs single (P-Channel)
- Small-signal MOSFET dual (P-channel) and FET-KYs

72  
74  
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76  
76

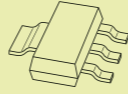
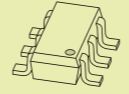





### Power MOSFETs

78

- Power MOSFETs single (N-channel)
- Power MOSFETs single (P-channel)
- Power MOSFETs dual (N- and P-channel)

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84  
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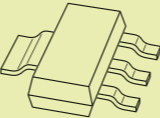
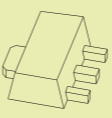
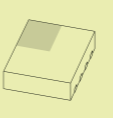
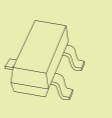



Small-signal MOSFETs single (N-channel) < 50V

													SOT223 (SC-73)		TSOP6 SOT457 (SC-74)	SOT23	SOT363 (SC-88)	SOT323 (SC-70)	SOT416 (SC-75)	SOT883 (SC-101)
Package																				
Size (mm)													6.5 x 3.5 x 1.65		2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	2.0 x 1.25 x 0.95	1.6 x 0.8 x 0.77	1.0 x 0.6 x 0.5
P <sub>tot</sub> (mW)													1700		600	250	300	200	150	250
V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th) min</sub> (V)	V <sub>GS(th) max</sub> (V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection	R <sub>DSon</sub> typ (mΩ) @ V <sub>gs</sub> =											
									10 V	4.5 V	2.5 V	1.8 V								
12	8	5.7	0.4	-	23	67	10.1	-	-	28	-	39								
20	8	6.3	2	4	23	71	10.6	-	-	23	-	37			PMN28UN					
		5.7	0.4	-	23	71	10.6	-	-	27	-	39			PMN23UN					
		5.7	0.45	-	20	66	7.4	-	-	30	-	44			PMN27UN					
		3.76	0.65	-	35	84	5.4	-	-	56	77	-			PMV30UN <sup>1)</sup>					
		2.5	0.65	-	35	84	5.4	-	-	56	77	-			PMV56XN <sup>1)</sup>					
		1.05	0.4	-	6.5	65	-	-	-	140	-	240			SI2302DS					
	2.28	0.45	0.95	14.5	23.5	0.89	-	-	250	-	420			BSH105						
	1	0.45	1	14.5	23.5	0.89	-	-	280	-	460				PMF280UN	PMR280UN		PMZ250UN		
	5.9	0.5	1.5	25	37	5.8	-	-	31	44	-			PMV31XN <sup>1)</sup>						
	12	2.15	0.5	1.5	16	17	0.72	-	-	270	440	-						PMZ270XN		
	1	0.5	1.5	16	17	0.72	-	-	290	460	-					PMF290XN	PMR290XN			
	15	5.7	1	2	24	35	13.1	-	28	34	-	-			PMN34LN					
4.1	1	2	24	35	13.1	-	55	70	-	-			PMN55LN							
30	8	4.9	0.45	-	22	60	9.9	-	-	38	-	54			PMN34UN					
		4.9	0.45	-	18	50	9.3	-	-	40	-	55			PMV40UN <sup>1)</sup>					
		1.78	0.45	0.95	11.5	22.5	0.89	-	-	390	-	550						PMZ390UN		
		0.85	0.4	-	6	27	-	-	-	400 <sup>2)</sup>	-	600 <sup>2)</sup>			BSH103					
	0.8	0.45	1	11.5	22.5	0.89	-	-	400	-	580					PMF400UN	PMR400UN			
	12	1.87	0.5	1.5	16	19.5	0.65	-	-	350	520	-						PMZ350XN		
	0.87	0.35		16	19.5	-	-	-	370	550	-					PMF370XN				
	0.9	0.5	1.5	16	19.5	0.65	-	-	370	550	-					PMG370XN		PMR370XN		
	15	5.4	1	2	12	27	13.8	-	32	40	-	-			PMN40LN					
	20	10	1	2.8	18	44	24	-	20	30	-	-			BSP030					
		5.4	1	2	33	44	6.1	-	31	38	-	-			PMN38EN					
		5.2	1	2	33	44	6.1	-	32	42	-	-			PMN45EN					
5.4		1	2	12	21.5	9.4	-	35	45	-	-			PMV45EN <sup>1)</sup>						
4.6		1	2	8.4	17.8	8.8	-	40	49	-	-			PMN49EN						
4.7		1	2	12	23.5	9.4	-	47	60	-	-			PMV60EN <sup>1)</sup>						
1.9		1	2	11	41	6.4	-	77	102	-	-			BSH108						
2.5		1.5	-	12	23.5	4.6	-	74	117	-	-			PMV117EN						
6	1	2.8	14	36	-	-	80	120	-	-			BSP100							
1.7	1.5	-	11.5	31	4.6	-	117 <sup>2)</sup>	190 <sup>2)</sup>	-	-			SI2304DS							

<sup>1)</sup> enhanced thermal capability  
<sup>2)</sup> max values

Small-signal MOSFETs single (N-channel) ≥ 50V

types in **bold** represent new products

													SOT223 (SC-73)		SOT89 (SC-62)	SOT873	SOT23	SOT323 (SC-70)	SOT416 (SC-75)	SOT883 (SC-101)
Package																				
Size (mm)													6.5 x 3.5 x 1.65		4.5 x 2.5 x 1.5	3.3 x 3.3 x 0.85	2.9 x 1.3 x 1.0	2.0 x 1.25 x 0.95	1.6 x 0.8 x 0.77	1.0 x 0.6 x 0.5
P <sub>tot</sub> (mW)													1700		1300	250	250	200	150	250
V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>b</sub> (A)	V <sub>GS(th)</sub> min(V)	V <sub>GS(th)</sub> max(V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>g</sub> typ (nC)	ESD protection	R <sub>Dson</sub> typ (mΩ) @ V <sub>gs</sub> =											
									10 V	4.5 V	2.5 V	1.8 V								
50	20	0.1	0.4	1.8	2	5	-	-	2800	3800 <sup>3)</sup>	-	-					BSN20			
55	8	0.3	0.4	1.3	4	11	1	-	-	2300	2400	3100					BSH121			
	10	0.335	0.4	1.3	4	11	1	-	-	2300	2400	3100					BSH111			
	13	4.9	1	2	-	-	-	-	2KV	-	30	-	-	PHT11N06LT						
3.5		1	2	-	-	-	-	2KV	-	65	-	-	PHT8N06LT							
2.5		1	2	-	-	-	-	2KV	-	120	-	-	PHT6N06LT							
2.5		2	4	-	-	-	-	2KV	120	-	-	-	PHT6N06T							
60	15	0.26	1	3.3	3	9	-	1KV	2800	3800	-	-					PMF3800SN			
		0.34	1	-	3	9	-	1KV	2800	3800	-	-					2N7002K			
		0.3	1	-	3	9	-	yes	2800	3800	-	-					BSH112			
		0.3	1	2.5	16	60	1.09	3KV	1100	1300	-	-					<b>2N7002CK</b>			
		0.3	1	2.5	tbd	tbd	tbd	-	-	2000 <sup>2)</sup>	3000 <sup>2)</sup>	-	-					<b>2N7002P</b>		
		0.3	1	2.5	tbd	tbd	tbd	2KV	1600 <sup>2)</sup>	3000 <sup>2)</sup>	-	-						<b>2N7002PW</b>		
		0.57	1	-	6	7.2	-	-	780	1100	-	-						<b>2N7002PT</b>		
		0.55	1	3	6	7.2	1.05	-	780	1100	-	-						<b>2N7002PM</b>		
	1.22	1	3	6	7.2	1.05	-	760	1100	-	-						<b>2N7002BKM</b>			
	0.25	0.8	3	-	-	-	-	-	2500	-	-	-						PMF780SN		
30	0.385	1	2.5	2.5	11	0.69	-	780	1200	-	-						PMR780SN			
	0.475	1	2.5	2.5	11	0.69	-	780	1200	-	-									
	0.3	1	2.5	2.5	11	-	-	2800	3800	-	-						PMZ760SN			
	0.25	0.8	3	-	-	-	-	2500	-	-	-									
100	16	3.5	1	2	14	73	-	-	-	200	-	-	PHT4NQ10LT							
	20	0.19	1	-	3	12	-	-	-	5000	-	-						BST82		
		0.52	1	-	3	12	-	-	-	5000	-	-	BSP110							
		0.85	2	4	19	13	4.6	-	400	-	-	-						BSH114		
		0.15	1	2.8	3	12	-	-	3500	-	-	-						BSS123		
		3.5	2	4	21	31	7.4	-	200	-	-	-	PHT4NQ10T							
	3	2	4	-	-	-	-	57	-	-	-	PHT6NQ10T								
30	1.9	2	4	10.5	12.5	7	-	213	-	-	-						PMV213SN <sup>1)</sup>			
200	20	0.55	0.4	2	10	45	-	-	1700	-	3000	-	BSP122							
		0.4	0.8	2.8	6	49	-	-	1600	-	-	-						BSS87		
		8.8	2	4	18	26	13.3	-	250	-	-	-						PML260SN		
220	20	7.3	2	4	20.8	24.3	13.2	-	320	-	-						PML340SN			
240	20	0.375	0.8	2	6	47	-	-	2800	7500 <sup>2)</sup>	-	-	BSP89							
250	20	0.35	0.8	2	6	47	-	-	2800	-	-	-	BSP126							
300	20	0.35	0.8	2	6	46	-	-	3700	-	4800	-	BSP130							

<sup>1)</sup> enhanced thermal capability  
<sup>2)</sup> max values  
<sup>3)</sup> @ V<sub>gs</sub> = 5 V

Small-signal MOSFETs dual (N-channel)

types in **bold** represent new products

Package										SOT363 (SC-88)	SOT666 (SC-88)			
Size (mm)										2.0 x 1.25 x 0.95	1.6 x 1.2 x 0.55			
P <sub>tot</sub> (mW)										300	300			
V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th)</sub> min(V)	V <sub>GS(th)</sub> max(V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection	R <sub>DS(on)</sub> typ (mΩ) @ V <sub>GS</sub> =					
									10 V	4.5 V	2.5 V	1.8 V		
20	8	0.87	0.45	1	14.5	23.5	-	-	-	280	-	460	PMGD280UN	
	12	0.86	0.5	1.5	16	17	0.72	-	-	290	460	-	PMGD290XN	
30	8	0.71	0.45	1	11.5	22.5	0.89	-	-	400	-	580	PMGD400UN	
	12	0.74	0.5	1.5	17	19.5	0.65	-	-	370	550	-	PMGD370XN	
	15	0.125	0.8	1.5	17	22	0.35	-	-	1800	2900	-	PMGD8000LN	
60	20	0.3	1	2.5	tbd	tbd	tbd	-	2000 <sup>2)</sup>	3000 <sup>2)</sup>	-	-	<b>2N7002PS</b>	<b>2N7002PV</b>
		0.3	1	2.5	tbd	tbd	tbd	2KV	1600 <sup>2)</sup>	3000 <sup>2)</sup>	-	-	<b>2N7002BKS</b>	<b>2N7002BKV</b>
		0.49	1	-	6	7.2	1.05	-	780	1100	-	-	PMGD780SN	

<sup>1)</sup> enhanced thermal capability <sup>2)</sup> max values

Small-signal MOSFETs single (P-channel)

Package										SOT223 (SC-73)	SOT89 (SC-62)	TSOP6 SOT457 (SC-74)	SOT23
Size (mm)										6.5 x 3.5 x 1.65	4.5 x 2.5 x 1.5	2.9 x 1.5 x 1.0	2.9 x 1.3 x 1.0
P <sub>tot</sub> (mW)										1700	1300	600	250
V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th)</sub> min(V)	V <sub>GS(th)</sub> max(V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection	R <sub>DS(on)</sub> typ (mΩ) @ V <sub>GS</sub> =				
									10 V	4.5 V	2.5 V	1.8 V	
12	8	1.52	0.4	-	6.5	65	-	-	-	80	-	140	
		0.75	0.4	-	6.5	65	-	-	-	180	-	420	BSH207
20	12	4.8	0.55	0.95	16	117	10	-	-	48	65	-	PMN50XP
		3.9	0.55	0.95	28	101	7.6	-	-	65	90	-	PMV65XP <sup>1)</sup>
30	8	0.47	0.4	-	6.5	65	-	-	-	660	-	1100	BSH203
	20	3	1	2.8	20	50	-	-	220	330	-	-	BSP250
50	20	0.52	1	-	6.5	65	-	-	630	890	-	-	BSH202
		0.13	0.8	2	3	7	-	-	6000	-	-	-	BSS84
60	20	0.3	1	-	6.5	65	-	-	2100	2700	-	-	BSH201
200	20	0.225	0.8	2.8	5	20	-	-	10000	-	-	-	BSP220
240	20	0.2	0.8	2.8	5	20	-	-	10000	-	-	-	BSS192
250	20	0.225	0.8	2.8	5	10	-	-	10000	-	-	-	BSP225
300	20	0.21	1.95	2.8	5	15	-	-	17000 <sup>2)</sup>	-	-	-	BSP230

<sup>1)</sup> enhanced thermal capability <sup>2)</sup> max values


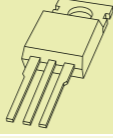
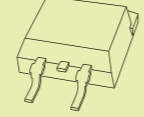
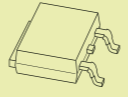
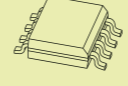
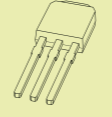
Small-signal MOSFET dual (P-channel) and FET-KYs

types in **bold** represent new products

Package													SOT1118			
Size (mm)													2.0 x 2.0 x 0.65			
P <sub>tot</sub> (mW)													>500			
Configuration	V <sub>DS</sub> (V)	V <sub>GS</sub> (V)	I <sub>D</sub> (A)	V <sub>GS(th)</sub> min(V)	V <sub>GS(th)</sub> max(V)	t <sub>on</sub> typ (ns)	t <sub>off</sub> typ (ns)	Q <sub>G</sub> typ (nC)	ESD protection	I <sub>F</sub> (A)	V <sub>R</sub> (V)	V <sub>F</sub> typ. (mA)	R <sub>DS(on)</sub> typ (mΩ) @ V <sub>GS</sub> =			
													4.5 V	2.5 V	1.8 V	
dual	20	8	3.3	0.5	1.5	tbd	tbd	tbd	800 V	-	-	-	65	95	130	<b>PMDPB65UP</b>
single + schottky	20	8	3.3	0.5	1.5	tbd	tbd	tbd	800 V	2	30	455	65	95	130	<b>PMFPB6545UP</b>
			3.3	0.5	1.5	tbd	tbd	tbd	800 V	2.2	30	325	65	95	130	<b>PMFPB6532UP</b>

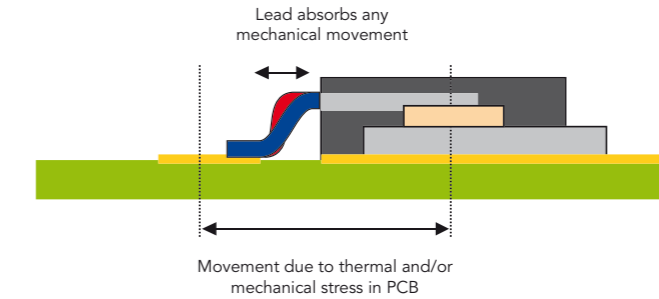
Power MOSFETs single (N-channel)

types in **bold** represent new products

$V_{DS}$ (max) (V)	$R_{DS(on)}$ (max) (m $\Omega$ ) @ $V_{gs} = 10$ V	$R_{DS(on)}$ (max) (m $\Omega$ ) @ $V_{gs} = 4.5$ V	$I_D$ (max) (A) @ 25 °C	Power-SO8 (LFPAK)	TO-220AB (SOT78)	D2PAK (SOT404)	DPAK (SOT428)	SO8 (SOT96-1)	IPAK (SOT533)
									
				3.95 x 4.9 x 1.1	15.6 x 10 x 4.4	11 x 10 x 4.3	6 x 6.6 x 2.3	4.9 x 3.9 x 1.75	6 x 6.6 x 2.3
20	2.65	3.7	100	PH3120L					
	-	2.7	100	PH2520U					
	-	5	32					PSMN006-20K	
	-	16 @ 5 V	44.7				PHD38N02LT		
	-	20 @ 5 V	10.9					PHKD6N02LT	
25	1.2	1.85	100	<b>PSMN1R2-25YL</b>					
	1.5	2.2	100	<b>PSMN1R5-25YL</b>					
	2.5	3.9	100	PH2525L					
	2.8	4.1	100	PH2625L					
	4	-	99	PH4025L					
	4.95	-	75				PHD96NQ03LT		
	5.5	8.2	81.7	PH5525L					
	5.8	-	75				PSMN005-25D		
	6	-	75				PHD108NQ03LT		
	6.3	9.5	78.7	PH6325L					
	6.3	10.6	75				PHD97NQ03LT		
	6.6	-	75						PHU97NQ03LT
	9	13	66	PH9025L					
	9	-	66.4				PHD78NQ03LT		PHU78NQ03LT
	9	-	61		PHP78NQ03LT				
	9.5	-	75				PHD77NQ03T		PHU77NQ03T
	10.5	-	66			PHB66NQ03LT	PHD66NQ03LT		
	-	3	100	PH2925U					

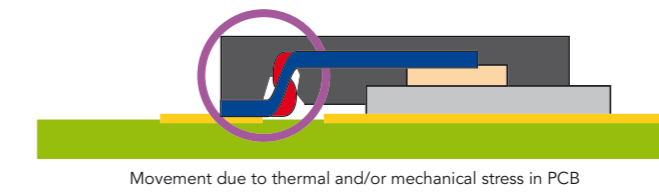
LFPAK for mechanical & thermal ruggedness

NXP LFPAK



LFPAK pins provide compliance and allow for thermal expansion due to temperature difference between the MOSFET & PCB and also mechanical strain due to PCB bending & flexing






QFN Based Power-SO8



QFN sawn or micro-lead pins are fully encapsulated and do not allow for movement. Cracks in the mould compound can lead to moisture ingress & ionic contamination causing early failure of the MOSFET





Power MOSFETs single (N-channel)

types in **bold** represent new products





$V_{DS}$ (max) (V)	$R_{DSon}$ (max) (m $\Omega$ ) @ $V_{gs} = 10$ V	$R_{DSon}$ (max) (m $\Omega$ ) @ $V_{gs} = 4.5$ V	$I_D$ (max) (A) @ 25 °C	Power-SO8 (LFPAK)	TO-220AB (SOT78)	DPAK (SOT428)	SO8 (SOT96-1)	IPAK (SOT533)
								
				3.95 x 4.9 x 1.1	15.6 x 10 x 4.4	6 x 6.6 x 2.3	4.9 x 3.9 x 1.75	6 x 6.6 x 2.3
30	1.3	1.95	100	<b>PSMN1R3-30YL</b>				
	1.7	2.1	100		<b>PSMN1R6-30PL</b>			
	1.7	2.6	100	<b>PSMN1R7-30YL</b>				
	1.8	-	-		<b>PSMN1R8-30PL</b>			
	2	3.2	100	<b>PSMN2R0-30YL</b>				
	2.1	2.8	100		<b>PSMN2R0-30PL</b>			
	2.4	3.9	100	<b>PSMN2R5-30YL</b>				
	2.7	-	-		<b>PSMN2R7-30PL</b>			
	2.8	-	75		PSMN003-30P			
	3	4.8	100	<b>PSMN3R0-30YL</b>				
	3.2	-	100	PH3230S				
	3.3	4.5	100	PH3330L				
	3.4	-	-		<b>PSMN3R4-30PL</b>			
	3.5	5.6	100	<b>PSMN3R5-30YL</b>				
	3.8	-	98	PH3830L				
	4	6.5	99	<b>PSMN4R0-30YL</b>				
	4.3	6.2	100		<b>PSMN4R3-30PL</b>			
	4.3	-	95.9	PH4330L				
	4.4	-	30.4					PHK31NQ03LT
	4.8	-	84	PH4830L				
	5	8	84	<b>PSMN5R0-30YL</b>				
	5.5	-	20 @ 80 °C					PSMN005-30K
	5.5	-	75		PHP101NQ03LT	PHD101NQ03LT		PHU101NQ03LT
	5.7	-	80	PH5330E				
	5.9	-	76.7	PH8030L				
	6	9.7	76.7	PH6030L				
	6	9.7	73	<b>PSMN6R0-30YL</b>				
	6.5	-	23.7					PHK28NQ03LT
7	11.3	65	<b>PSMN7R0-30YL</b>					
7.9	11	68	PH7030L					
8	13.8	55	<b>PSMN9R0-30YL</b>					
8.2	-	67	PH8230E					
8.9	-	20.3					PHK18NQ03LT	
9	12.5	63	PH9030L					
9.9	-	63	PH9930L					

Power MOSFETs single (N-channel)

types in **bold** represent new products


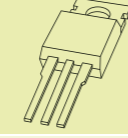
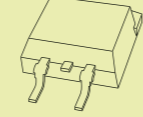

$V_{DS}$ (max) (V)	$R_{DSon}$ (max) (m $\Omega$ ) @ $V_{gs} = 10$ V	$R_{DSon}$ (max) (m $\Omega$ ) @ $V_{gs} = 4.5$ V	$I_D$ (max) (A) @ 25 °C	TO-220AB (SOT78)	D2PAK (SOT404)	DPAK (SOT428)	SO8 (SOT96-1)
							
				15.6 x 10 x 4.4	11 x 10 x 4.3	6 x 6.6 x 2.3	4.9 x 3.9 x 1.75
30	10	-	75			PHD71NQ03LT	
	13	-	68.9			PHD63NQ03LT	
	13.5	20	10				SI4410DY
	17	-	43.4	PHP36N03LT		PHD36N03LT	
	20	26	13.8				PHK13N03LT
	20	26	10.4				PHKD13N03LT
	22.0	-	-	<b>PSMN022-30PL</b>			
	30	-	6.3				PHN203
	100	200	3.4				PHN210
	100	200	3.4				PHN210T
	-	14	11.8				PHK12NQ03LT
	36	4	-	75		PSMN004-36B	

types in **bold** represent new products

$V_{DS}$ (max) (V)	$R_{DSon}$ (max) (m $\Omega$ ) @ $V_{gs} = 10$ V	$R_{DSon}$ (max) (m $\Omega$ ) @ $V_{gs} = 4.5$ V	$I_D$ (max) (A) @ 25 °C	Power-SO8 (LFPAK)	TO-220AB (SOT78)	D2PAK (SOT404)	DPAK (SOT428)	
								
				3.95 x 4.9 x 1.1	15.6 x 10 x 4.4	11 x 10 x 4.3	6 x 6.6 x 2.3	
40	2	-	-	<b>PSMN2R0-40YS</b>				
	2.1	-	100		<b>PSMN2R2-40PS</b>			
	2.8	-	-		<b>PSMN2R8-40PS</b>			
	2.8	-	100	<b>PSMN2R6-40YS</b>				
	3.3	-	-	<b>PSMN3R3-40YS</b>				
	4.1	-	94.5	PH4840S				
	4.2	-	100	<b>PSMN4R0-40YS</b>				
	4.3	-	75		PHP176NQ04T			
	4.6	-	100		<b>PSMN4R5-40PS</b>			
	5.2	-	75		PHP143NQ04T			
	5.7	-	-	<b>PSMN5R8-40YS</b>				
	7.6	-	77		<b>PSMN8R0-40PS</b>			
	8	-	75		PHP101NQ04T	PHB101NQ04T		
	8.6	-	70	<b>PSMN8R3-40YS</b>				
	14	-	-	<b>PSMN014-40YS</b>				
	55	3.7	-	75		PHP191NQ06LT	PHB191NQ06LT	
		5.8	-	75		PSMN005-55P	PSMN005-55B	
		7	-	75		PHP110NQ06LT	PHB110NQ06LT	
7.1		-	75		PHP119NQ06T	PHB119NQ06T		
8.3		9.9	62.5	PH955L				
10.5		-	75				PSMN010-55D	
17.3		21	40	PH1955L				
20		-	54		PHP54N06T			
36		45	24	PH3855L				
70		-	19		PHP21N06LT	PHB21N06LT	PHD21N06LT	
75		-	21		PHP21N06T			
75		-	20.3		PHP20N06T	PHB20N06T		
77		-	18				PHD20N06T	

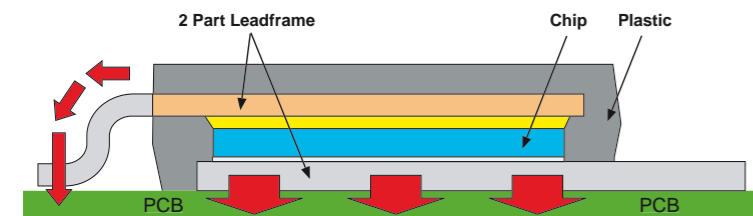
Power MOSFETs single (N-channel)


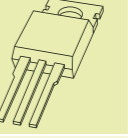
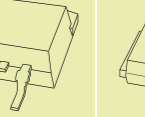
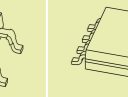

types in **bold** represent new products

V <sub>DS</sub> (max) (V)	R <sub>DSon</sub> (max) (mΩ) @ V <sub>gs</sub> = 10 V	R <sub>DSon</sub> (max) (mΩ) @ V <sub>gs</sub> = 4.5 V	I <sub>D</sub> (max) (A) @ 25 °C	Power-SO8 (LFPAK)	TO-220AB (SOT78)	D2PAK (SOT404)	DPAK (SOT428)
							
				3.95 x 4.9 x 1.1	15.6 x 10 x 4.4	11 x 10 x 4.3	6 x 6.6 x 2.3
60	3.6	-	75			PSMN004-60B	
	22	-	52		PHP52N06T		
	150	-	10.3		PHP3055E		PHD3055E
	-	43	34		PHP32N06LT	PHB32N06LT	
75	5	-	75		PHP165NQ08T		
	5	-	75		PSMN005-75P	PSMN005-75B	
	5.6	-	75		PHP160NQ08T	PHB160NQ08T	
	8.5	-	75		PSMN008-75P	PSMN008-75B	
	9	-	75		PHP110NQ08T	PHB110NQ08T	
	13	-	75		PHP75NQ08T		
	16	-	73		PHP79NQ08LT		
	16.5	-	45.8		PH1875L		
	28	34	30		PH3075L		
	50 @ 11 V	-	27			PHP29N08T	PHB29N08T
80	4.1	-	100		<b>PSMN4R4-80PS</b>		
	4.7	-	100		<b>PSMN5R0-80PS</b>		
	6.4	-	-		<b>PSMN6R0-80YS</b>		
	6.5	-	-			<b>PSMN6R5-80PS</b>	
	8.5	-	82		<b>PSMN8R2-80YS</b>		
	8.7	-	-			<b>PSMN8R7-80PS</b>	
	11	-	-		<b>PSMN011-80YS</b>		
	11	-	74			<b>PSMN012-80PS</b>	
	12.9	-	60		<b>PSMN013-80YS</b>		
	17.0	-	-			<b>PSMN017-80PS</b>	
	19.5	-	-		<b>PSMN018-80YS</b>		
	27.5	-	34		<b>PSMN026-80YS</b>		
	46	-	-		<b>PSMN045-80YS</b>		
	46	-	22			<b>PSMN050-80PS</b>	

Power-SO8 (LFPAK) Design

- ▶ Low Thermal resistance
- ▶ Low Electrical resistance
- ▶ Low Inductance



V <sub>DS</sub> (max) (V)	R <sub>DSon</sub> (max) (mΩ) @ V <sub>gs</sub> = 10 V	R <sub>DSon</sub> (max) (mΩ) @ V <sub>gs</sub> = 4.5 V	I <sub>D</sub> (max) (A) @ 25 °C	Power-SO8 (LFPAK)	TO-220AB (SOT78)	D2PAK (SOT404)	DPAK (SOT428)	SO8 (SOT96-1)
								
				3.95 x 4.9 x 1.1	15.6 x 10 x 4.4	11 x 10 x 4.3	6 x 6.6 x 2.3	4.9 x 3.9 x 1.75
100	8.8	-	75		PSMN009-100P	PSMN009-100B		
	15	-	75		PSMN015-100P	PSMN015-100B		
	23	-	34.3		PH20100S			
	25	-	47			PHP45NQ10T	PHB45NQ10T	
	25	-	47			PHP45NQ10TA		
	25	-	47					PSMN025-100D
	28	-	47				PHB47NQ10T	
	28	-	11.6					PHK12NQ10T
	38	-	6.3 @ 80 °C					PSMN038-100K
	40	-	35					PHD34NQ10T
	50	-	28				PHB27NQ10T	
	90	-	18			PHP18NQ10T	PHB18NQ10T	PHD18NQ10T
	90	-	3					
	90	-	3					PHKD3NQ10T
105	25	-	47		PHP45NQ11T			
110	15	-	75		PSMN015-110P			
	40	-	35		PHP34NQ11T			
	50	-	27.6		PHP27NQ11T			
	70	-	23		PHP23NQ11T			
	90	-	18		PHP18NQ11T			

NXP Power solutions make your PC Energy Efficient

MOSFETs for high efficiency power management


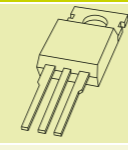
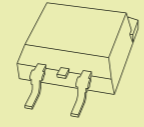
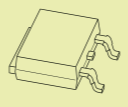
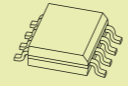

Smaller, faster, cooler

- ▶ Class leading LFPAK package with state of the art Trench 6 silicon technology
  - **Smaller:** Power-SO8 form factor LFPAK
  - **Faster:** Best in class switching performance
  - **Cooler:** Higher efficiency equals lower temperatures
  - **Easier:** easier to use in development and production than other Power-SO8 packages

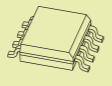
High performance MOSFETs for DC-DC converters, OR-ing and load switching

- ▶ Supported by Secure supply/Capacity availability (Silicon & Package)

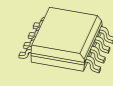
Power MOSFETs single (N-channel)

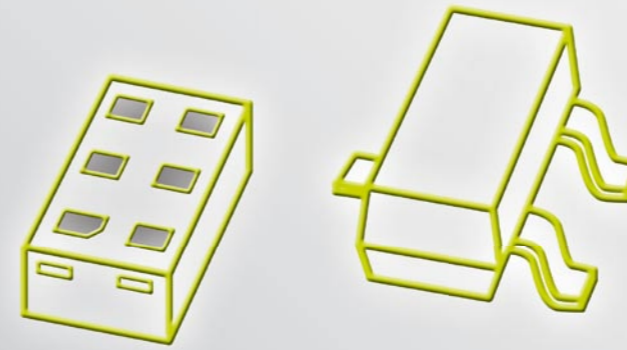
$V_{DS}$ (max) (V)	$R_{DSon}$ (max) (mΩ) @ $V_{gs} = 10\text{ V}$	$R_{DSon}$ (max) (mΩ) @ $V_{gs} = 4.5\text{ V}$	$I_D$ (max) (A) @ 25 °C	Power-SO8 (LFPAK)	TO-220AB (SOT78)	D2PAK (SOT404)	DPAK (SOT428)	SO8 (SOT96-1)	HVSON8 (SOT873-1)
				 3.95 x 4.9 x 1.1	 15.6 x 10 x 4.4	 11 x 10 x 4.3	 6 x 6.6 x 2.3	 4.9 x 3.9 x 1.75	 3.3 x 3.3 x 0.85
150	30	-	55.5		PSMN030-150P	PSMN030-150B			
	35	-	50		PSMN035-150P	PSMN035-150B			
	42	-	45.1			PHB45NQ15T			
	59	-	43	PSMN059-150Y					
	63	-	29		PHP30NQ15T		PSMN063-150D		
	65	-	28.5		PHP28NQ15T				
	75	-	5					PHK5NQ15T	
200	85	-	3.5 @ 80 °C					PSMN085-150K	
	57	-	39		PSMN057-200P	PSMN057-200B			
	70	-	35		PSMN070-200P	PSMN070-200B			
	77	-	32.7		PHP33NQ20T	PHB33NQ20T			
	102	-	21.5	PSMN102-200Y					
	130	-	20		PHP20NQ20T	PHB20NQ20T	PSMN130-200D		
	165	-	2.9 @ 80 °C					PSMN165-200K	
220	294	-	8.8						PML260SN
	400	-	8.7		PHP9NQ20T		PHD9NQ20T		
386	-	7.3						PML340SN	

Power MOSFETs single (P-channel)

$V_{DS}$ (max) (V)	$R_{DSon}$ (max) (mΩ) @ $V_{gs} = 10\text{ V}$	$R_{DSon}$ (max) (mΩ) @ $V_{gs} = 4.5\text{ V}$	$I_D$ (max) (A) @ 25 °C	SO8 (SOT96-1)
				 4.9 x 3.9 x 1.75
-16	-	120	-4.66	PHK04P02T
-20	-	50	-7.9	PMK50XP
-30	19	-	-14.9	PMK30EP PMK35EP

Power MOSFETs dual (N- and P-channel)

$V_{DS}$ (max) (V)	$R_{DSon}$ (max) (mΩ) @ $V_{gs} = 10\text{ V}$	$R_{DSon}$ (max) (mΩ) @ $V_{gs} = 4.5\text{ V}$	$I_D$ (max) (A) @ 25 °C	Configuration	SO8 (SOT96-1)
					 4.9 x 3.9 x 1.75
20	-	20 @ 5 V	10.9	dual N-channel	PHKD6N02LT
30	20	26	10.4	dual N-channel	PHKD13N03LT
30	30	-	6.3	dual N-channel	PHN203
30	100	200	3.4	dual N-channel	PHN210 PHN210T
30, -30	100, 250	-	3.5, -2.3 @ 80 °C	complementary pair	PHC21025
-30	250	-	-2.3 @ 80 °C	dual P-channel	PHP225
100	90	-	3	dual N-channel	PHKD3NQ10T
300, -300	6000, 17000	-	0.34, -0.235 @ 80 °C	complementary pair	PHC2300



## Packages

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### Package cross reference

types in **bold** represent new products

NXP	Industry standard names	Size (l x w x h)	Pins/leads	P <sub>tot</sub> (mW)	Package	Competitor synonyms							
						Rohm	Toshiba	ON Semi	Renesas	Infineon	Diodes Inc	KEC	Vishay
SOD27	DO-35	4.25 x 1.85 x 0.56	2	500		GSD			DO-35		DO-35		DO-204AH
SOD66	DO-41	4.8 x 2.6 x 0.81	2	1300		GSR	DO-41				DO-41		DO-204AL
SOD68	DO-34	3.04 x 1.6 x 0.55	2	500		MSD							
SOD80C	MiniMelf	3.5 x 1.5 x 1.5	2	300		LLDS			LLD		MiniMELF		MiniMELF
SOD87	Melf	3.5 x 2.05 x 2.05	2	1000									
SOD123F	-	2.6 x 1.6 x 1.1	2	830		PMDU	S-Flat	SOD-123-FL			Power-DI123	SMF	
SOD123W	-	2.6 x 1.7 x 1.0	2	900			S-Flat	SOD-123-FL			Power-DI123		
SOD128	-	3.8 x 2.6 x 1.0	2	1000		PMDT	M-Flat						
SOD323	SC-76	1.7 x 1.25 x 0.95	2	400			USC	SOD-323	URP	SOD323	SOD-323	USC	SOD323
SOD323F	SC-90	1.7 x 1.25 x 0.7	2	830		UMD2	US-Flat				Power-DI323		
SOD523	SC-79	1.2 x 0.8 x 0.6	2	500		EMD2	ESC/TESS	SOD-523	UFP	SC79		ESC	SOD523
SOD882	-	1.0 x 0.6 x 0.5	2	250			CTS2			TSLP-2	DFN1006-2		
<b>SOD882D</b>	-	1.0 x 0.6 x 0.37	2	250						TSLP-2-7	DFN1006H4-2		
<b>SOD131 SMA</b>	DO-214AC	4.25 x 2.67 x 2.14	2	900		PMDS (SOD-106)		SMA Case 403D-02			SMA	SMA	
<b>SOD132 SMB</b>	DO-214AA	4.32 x 3.62 x 2.29	2	1000				SMB Case 403A-03			SMB		
<b>SOD133 SMC</b>	DO-214AB	6.86 x 5.91 x 2.34	2	1200				SMC Case 403-03			SMC		
<b>SOT1061</b>	HUSON3	2.0 x 2.0 x 0.65	3	1300				WDFN3			DFN2020-3		PowerPAK SC706L
SOT23	-	2.9 x 1.3 x 1.0	3	250		SSD3/SST3		SOT-23		SOT23	SOT-23	SOT-23	SOT23
SOT323	SC-70	2.0 x 1.25 x 0.95	3	200		UMD3/UMT3	USM	SC-70	CMAK/CMPAK	SOT323	SOT-323	USM	SC-70 3 leads
SOT416	SC-75	1.6 x 0.8 x 0.77	3	150		EMD3/EMT3	SSM	SC-75	SMPAK	SC75			SC-75A
SOT663	-	1.6 x 1.2 x 0.55	3	300									
SOT883	SC-101	1.0 x 0.6 x 0.5	3	250			SS CSP2			TSLP-3-1	DFN1006-3		
SOT89	SC-62	4.5 x 2.5 x 1.5	3	1300		MPT3	PW-Mini	SOT-89	UPAK (SOT89)	SOT89		SOT-89	
SOT143B	-	2.9 x 1.3 x 1.0	4	250			CP4		MPAK-4R	SOT143	SOT-143		
SOT223	SC-73	6.5 x 3.5 x 1.65	4	1700				SOT-223		SOT223	SOT-223	SOT-223	SOT223

types in **bold** represent new products

NXP	Industry standard names	Size (l x w x h)	Pins/leads	P <sub>tot</sub> (mW)	Package	Competitor synonyms							
						Rohm	Toshiba	ON Semi	Renesas	Infineon	Diodes Inc	KEC	Vishay
SOT353	SC-88A	2.0 x 1.25 x 0.95	5	300		UMD5/UMT5	USV	SC-88A	CMPAK-5(T)			USV	SOT353
SOT665	-	1.6 x 1.2 x 0.55	5	300		EMD5/EMT5	ESV	SOT-553	VSON-5			TESV	
SOT1082	VSON6U	2.3 x 3.5 x 0.85	6	-									
SOT363	SC-88	2.0 x 1.25 x 0.95	6	300		UMD6/UMT6	US6	SC-88	CMPAK-6	SOT363	SOT-363	US6	SOT363
SOT457	SC-74	2.9 x 1.5 x 1.0	6	750		SMD6/SMT6	SM6	SC-74	TSOP-6	SC74		TSOP6	TSOP-6
SOT666	-	1.6 x 1.2 x 0.55	6	300		EMD6/EMT6	ES6	SOT-563	SMFPAK-6	SOT666	SOT563	TES6	SC89-6lead
<b>SOT1118</b>	-	2.0 x 2.0 x 0.65	6	1300				6 Lead DFN			DFN2020B-6		
SOT886	XSON6	1.45 x 1.0 x 0.5	6	250									
SOT891	XSON6	1.0 x 1.0 x 0.5	6	-					CS6				
SOT505	TSSOP8	3.0 x 3.0 x 1.1	8	-						TSSOP-8			TSSOP8
SOT873	HVSON8	3.3 x 3.3 x 0.85	8	1500									
SOT96	SO8	4.9 x 3.9 x 1.75	8	1500		SOP8	FM8	SOIC-8 NB	SOP-8			FLP-8	SO8
SOT983	HXSON8	1.7 x 1.35 x 0.5	8	-							TSSOP38		
SOT1059	XSON10U	1.0 x 2.5 x 0.5	10	-									
SOT552	TSSOP10	3.0 x 3.0 x 1.1	10	-						Micro10		TSSOP10	
SOT984	HXSON12	2.5 x 1.35 x 0.5	12	-									
SOT108	SO14	8.65 x 3.9 x 1.75	14	-		SOP14					DSO14		
SOT402	TSSOP14	5.0 x 4.4 x 1.1	14	-									
SOT109	SO16	9.9 x 3.9 x 1.75	16	-		SOP16		SOIC-16			DSO16		FLP-16
SOT519	SSOP16	4.9 x 3.9 x 1.73	16	-									
SOT985	HXSON16	3.3 x 1.35 x 0.5	16	-						Micro10		TSSOP10	
SOT163	SO20	12.8 x 7.5 x 2.65	20	1250									
SOT360	TSSOP20	6.5 x 4.4 x 1.1	20	-						TSSOP20		TSSOP20	
SOT510	TSSOP38	9.7 x 4.4 x 1.1	38	-								TSSOP38	
SOT357	TQFP64	10 x 10 x 1	64	-									

### Packing methods

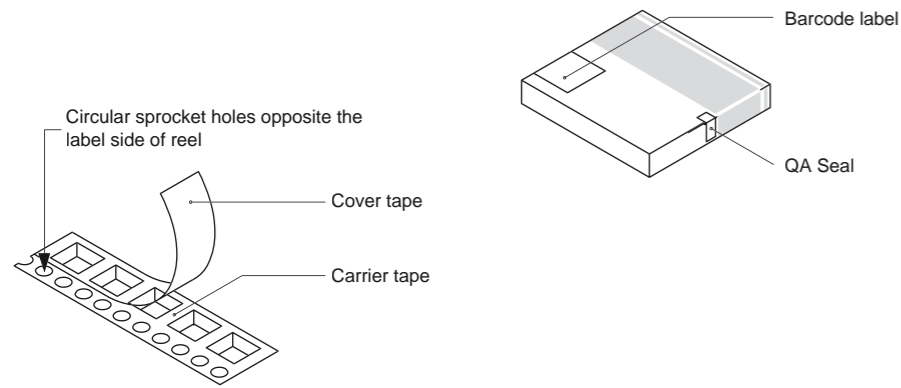
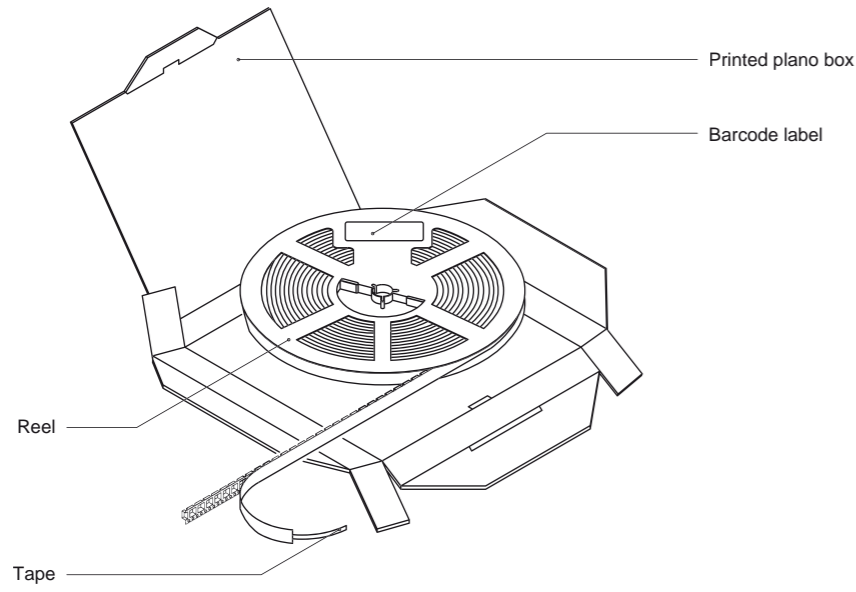
types in **bold** represent new products

Package	Packing method and tape dimension	Reel dimension (d x w)	Package	Packing quantity						
				2000	2500	3000	4000	5000	8000	10000
SOD27	26 mm tape ammo pack, axial			-	-	-	-	-143	-	-
	52 mm tape ammo pack, axial			-	-	-	-	-	-	-133
	52 mm reel pack, axial			-	-	-	-	-	-	-113
SOD66	52 mm tape ammo pack, axial			-	-	-	-	-	-	-133
	52 mm reel pack, axial			-	-	-	-	-	-	-113
SOD68	26 mm tape ammo pack, axial			-	-	-	-	-143	-	-
	52 mm reel pack, axial			-	-	-	-	-	-	-113
	52 mm tape ammo pack, axial			-	-	-	-	-	-	-133
SOD80C	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-115	-	-	-	-	-
	4 mm pitch, 8 mm tape and reel	330 x 8 mm		-	-	-	-	-	-	-135
SOD87	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-115	-	-	-	-	-	-
	4 mm pitch, 8 mm tape and reel	330 x 8 mm		-	-	-	-	-	-135	-
SOD123F	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-115	-	-	-	-
SOD123W	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-115	-	-	-	-
SOD128	4 mm pitch, 12 mm tape and reel	180 x 12 mm		-	-	-115	-	-	-	-
SOD323	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-115	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm		-	-	-	-	-	-	-135
SOD323F	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-115	-	-	-	-
SOD523	2 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-	-	-	-315	-
	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-115	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm		-	-	-	-	-	-	-135
SOD882	2 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-	-	-	-	-315
<b>SOD882D</b>	2 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-	-	-	-	-315
<b>SOT1061</b>	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-115	-	-	-	-
SOT23	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-215	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm		-	-	-	-	-	-	-235
SOT323	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-115	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm		-	-	-	-	-	-	-135
SOT416	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-115	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm		-	-	-	-	-	-	-135
SOT663	4 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-	-115	-	-	-
SOT883	2 mm pitch, 8 mm tape and reel	180 x 8 mm		-	-	-	-	-	-	-315

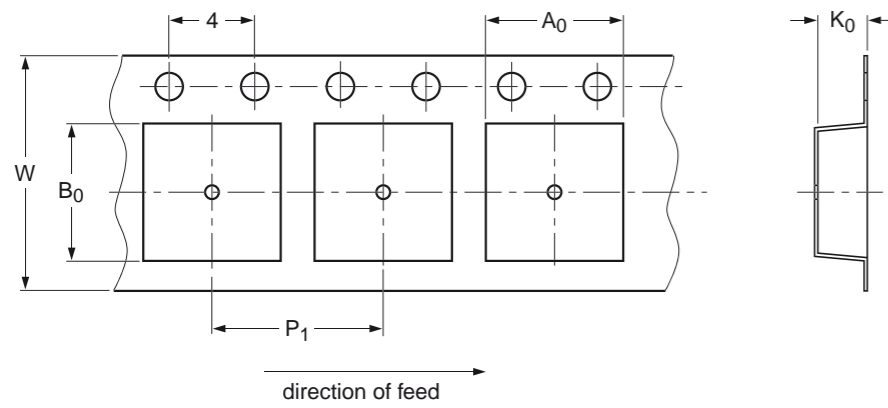
types in **bold** represent new products

Package	Packing method and tape dimension	Reel dimension (d x w)	Taping	Package	Packing quantity								
					1000	1400	2500	3000	4000	5000	8000	10000	
SOT89	8 mm pitch, 12 mm tape and reel	180 x 12 mm	T1		-115	-	-	-	-	-	-	-	-
	8 mm pitch, 12 mm tape and reel	330 x 12 mm	T1		-	-	-	-	-135	-	-	-	-
	8 mm pitch, 12 mm tape and reel	180 x 12 mm	T3		-146	-	-	-	-	-	-	-	-
	8 mm pitch, 12 mm tape and reel	180 x 12 mm	T4		-147	-	-	-	-	-	-	-	-
SOT143B	4 mm pitch, 8 mm tape and reel	180 x 8 mm			-	-	-	-215	-	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm			-	-	-	-	-	-	-	-	-235
SOT223	8 mm pitch, 12 mm tape and reel	180 x 12 mm			-115	-	-	-	-	-	-	-	-
	8 mm pitch, 12 mm tape and reel	330 x 12 mm			-	-	-	-	-135	-	-	-	-
SOT353	4 mm pitch, 8 mm tape and reel	180 x 8 mm	T1		-	-	-	-115	-	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm	T1		-	-	-	-	-	-	-	-	-135
	4 mm pitch, 8 mm tape and reel	180 x 8 mm	T2		-	-	-	-	-125	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm	T2		-	-	-	-	-	-	-	-	-165
SOT665	2 mm pitch, 8 mm tape and reel	180 x 8 mm			-	-	-	-	-	-	-	-315	-
	4 mm pitch, 8 mm tape and reel	180 x 8 mm			-	-	-	-	-115	-	-	-	-
SOT363	4 mm pitch, 8 mm tape and reel	180 x 8 mm	T1		-	-	-	-115	-	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm	T1		-	-	-	-	-	-	-	-	-135
	4 mm pitch, 8 mm tape and reel	180 x 8 mm	T2		-	-	-	-	-125	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm	T2		-	-	-	-	-	-	-	-	-165
SOT457	4 mm pitch, 8 mm tape and reel	180 x 8 mm	T1		-	-	-	-115	-	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm	T1		-	-	-	-	-	-	-	-	-135
	4 mm pitch, 8 mm tape and reel	180 x 8 mm	T2		-	-	-	-	-125	-	-	-	-
	4 mm pitch, 8 mm tape and reel	286 x 8 mm	T2		-	-	-	-	-	-	-	-	-165
SOT666	2 mm pitch, 8 mm tape and reel	180 x 8 mm			-	-	-	-	-	-	-	-315	-
	4 mm pitch, 8 mm tape and reel	180 x 8 mm			-	-	-	-	-115	-	-	-	-
<b>SOT1118</b>	4 mm pitch, 8 mm tape and reel	180 x 8 mm			-	-	-	-115	-	-	-	-	-
SOT886	4 mm pitch, 8 mm tape and reel	180 x 8 mm	T1		-	-	-	-	-	-	-115	-	-
	4 mm pitch, 8 mm tape and reel	180 x 8 mm	T4		-	-	-	-	-	-	-132	-	-
SOT891	4 mm pitch, 8 mm tape and reel	180 x 8 mm	T4		-	-	-	-	-	-	-132	-	-
SOT505	8 mm pitch, 12 mm tape and reel	330 x 12 mm			-	-	-118	-	-	-	-	-	-
SOT873	8 mm pitch, 12 mm tape and reel	180 x 12 mm			-	-118	-	-	-	-	-	-	-
SOT96	8 mm pitch, 12 mm tape and reel	180 x 12 mm			-115	-	-	-	-	-	-	-	-
	8 mm pitch, 12 mm tape and reel	330 x 12 mm			-	-	-118	-	-	-	-	-	-

### Tape and reel pack for SMD packages



### Carrier tape - tape and reel

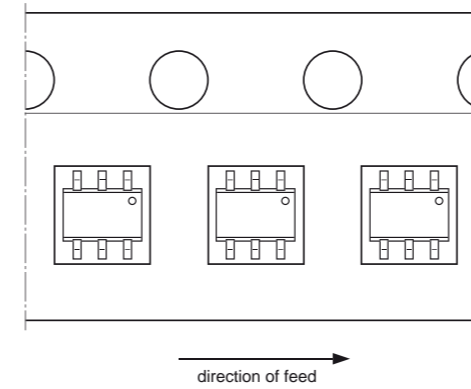


P1 = pitch (see table packing methods)  
W = tape width (see table packing methods)

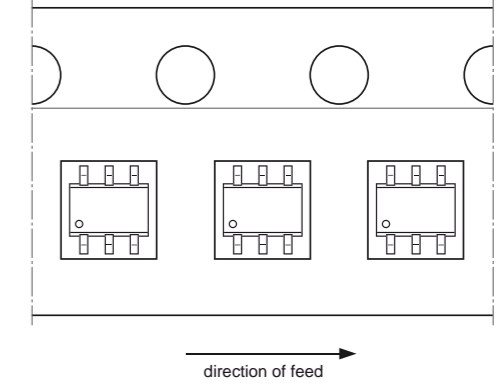
Compartment width ( $A_0$ ), length ( $B_0$ ) and depth ( $K_0$ ) depending on package

### Product orientation (tape and reel pack) T1-T4

#### T1 taping

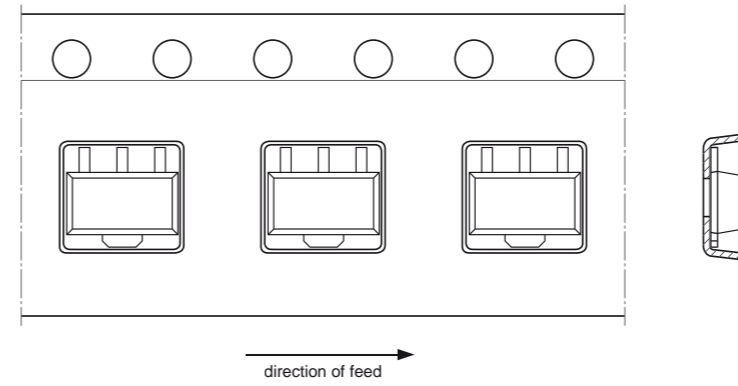


#### T2 taping

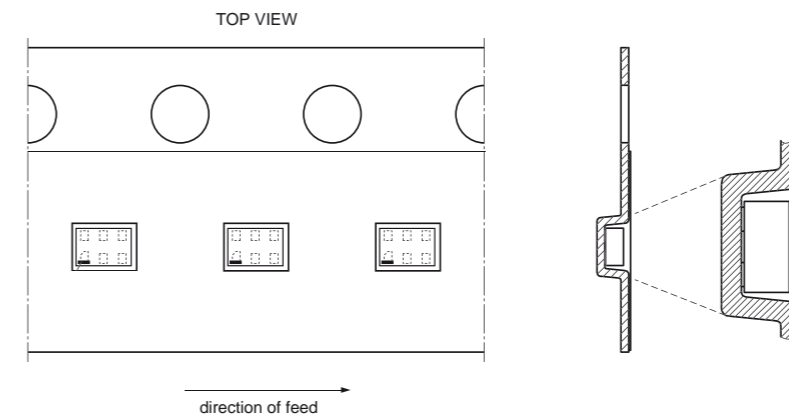


#### T3 taping

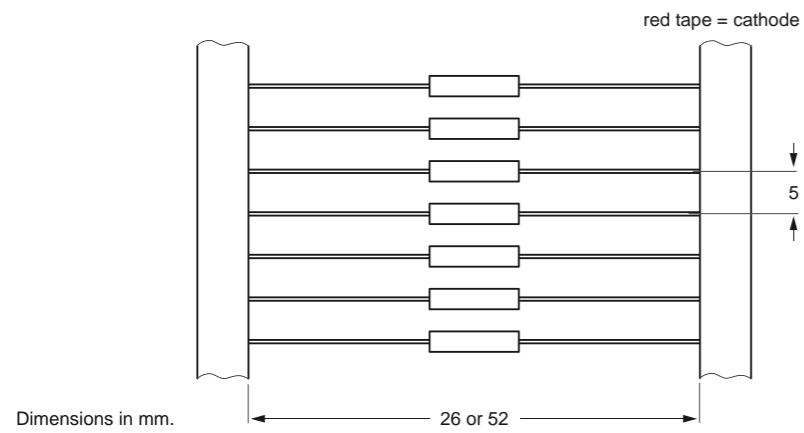
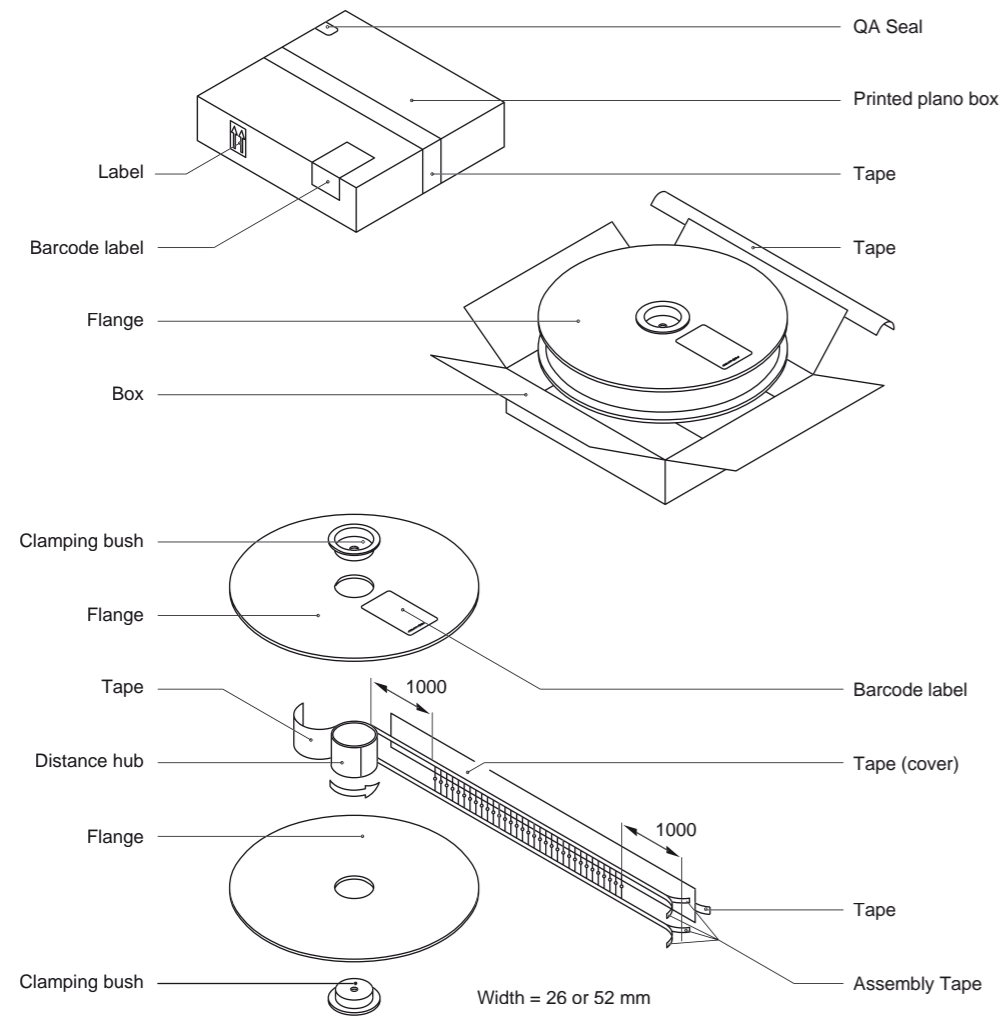
Standard product orientation SOT89 (T3)



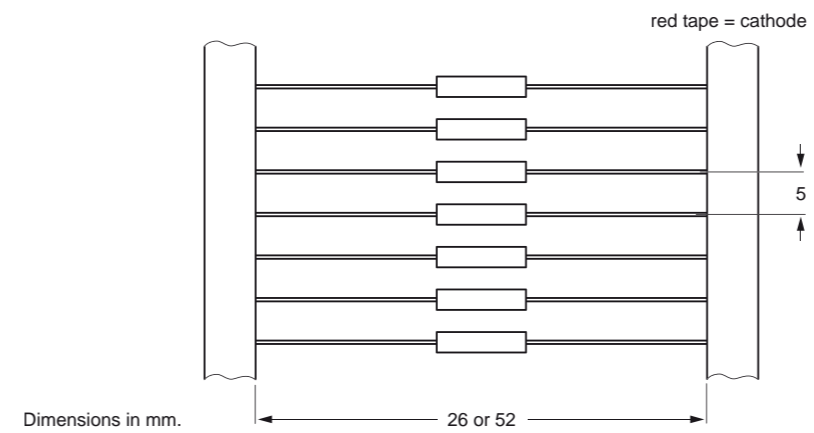
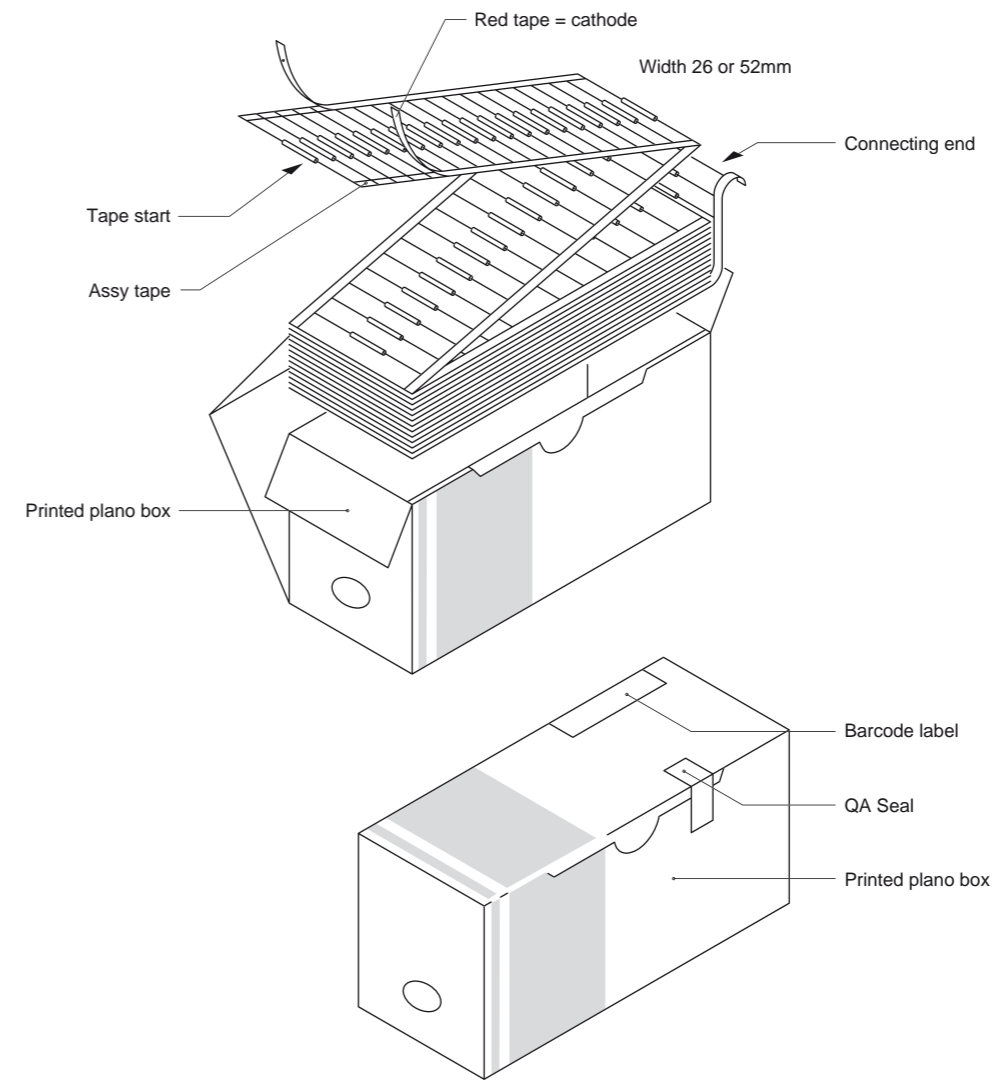
#### T4 taping



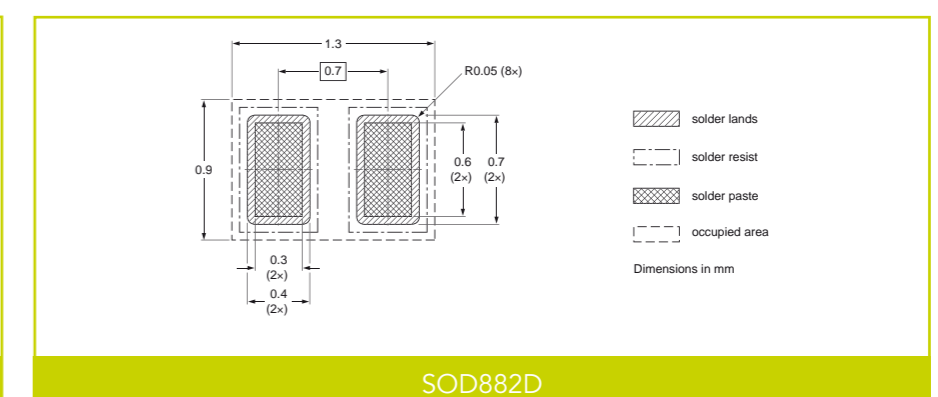
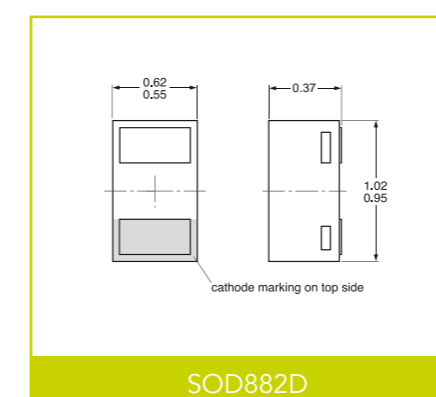
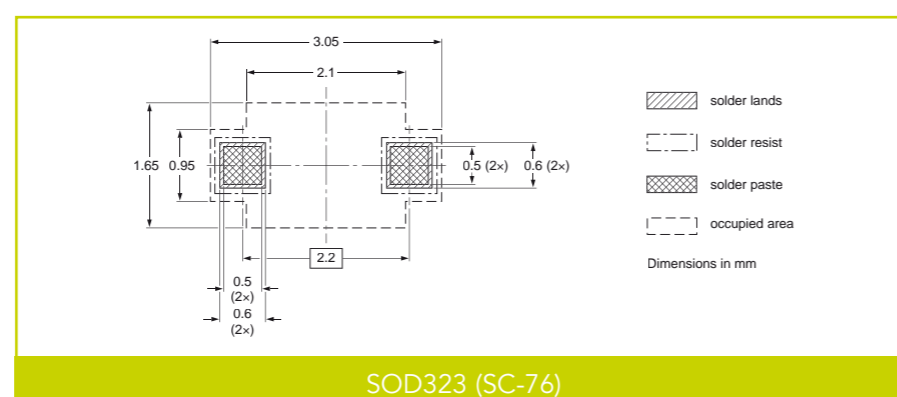
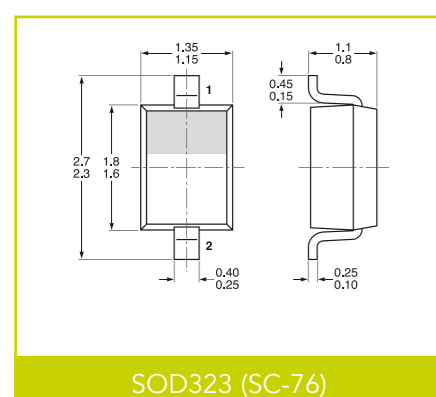
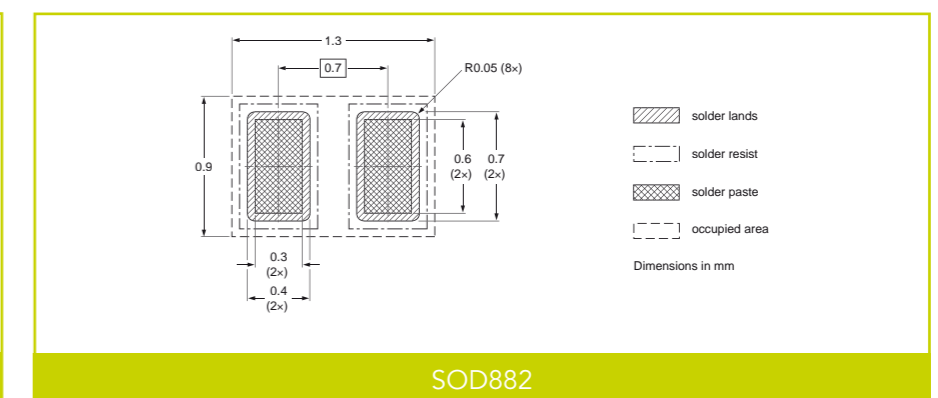
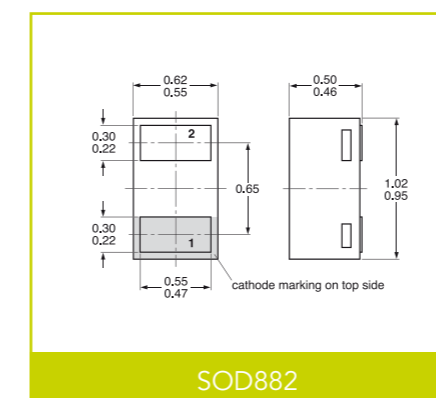
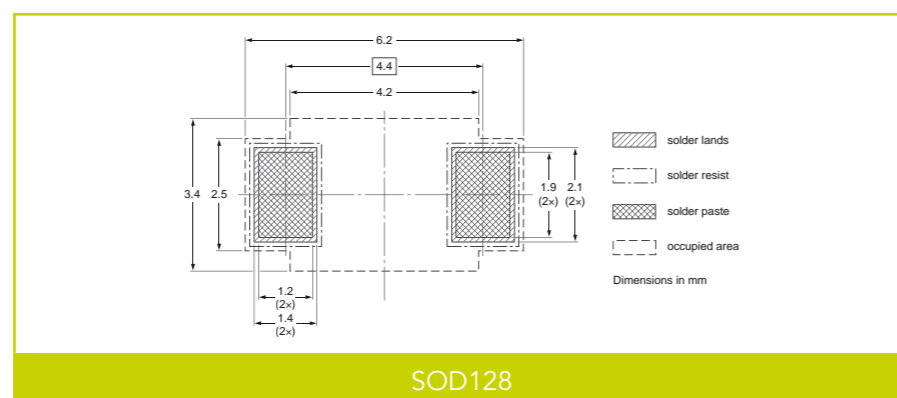
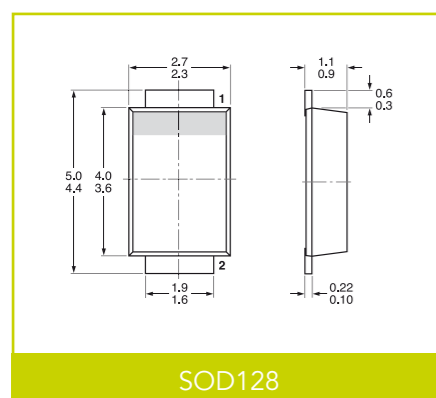
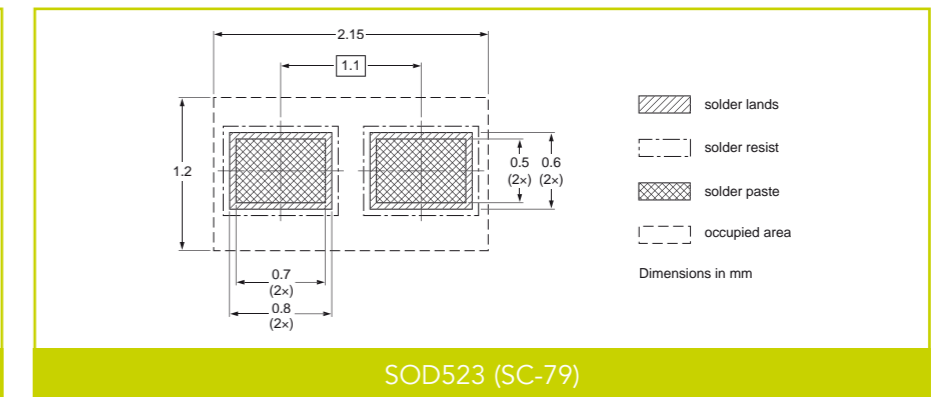
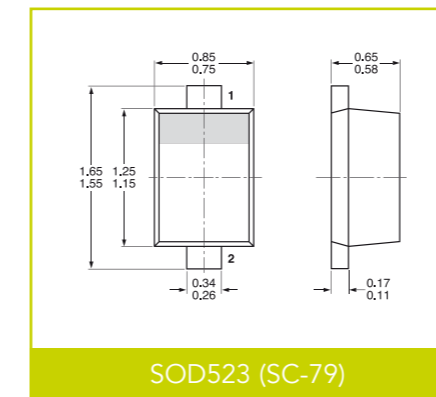
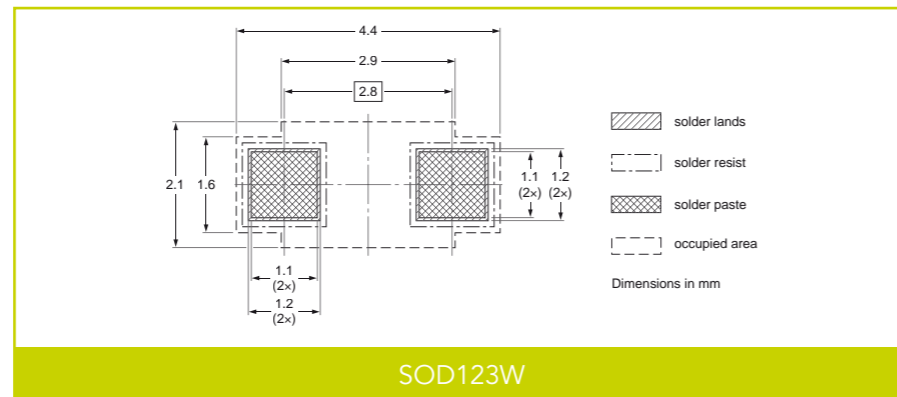
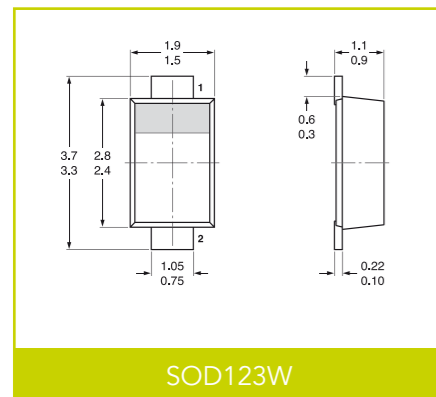
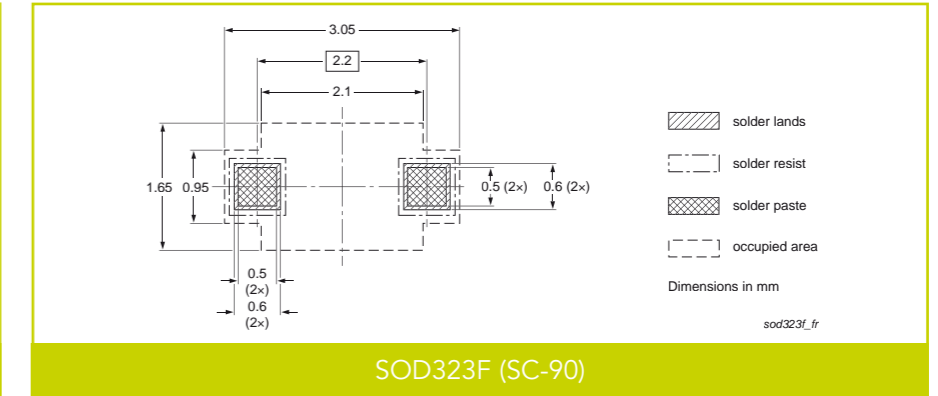
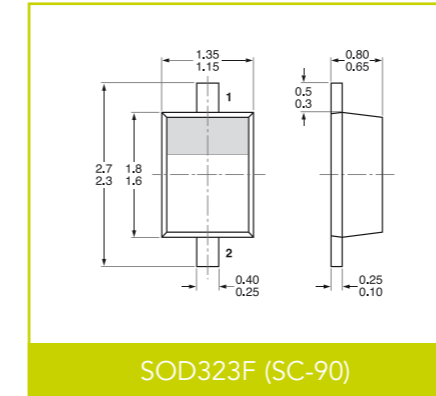
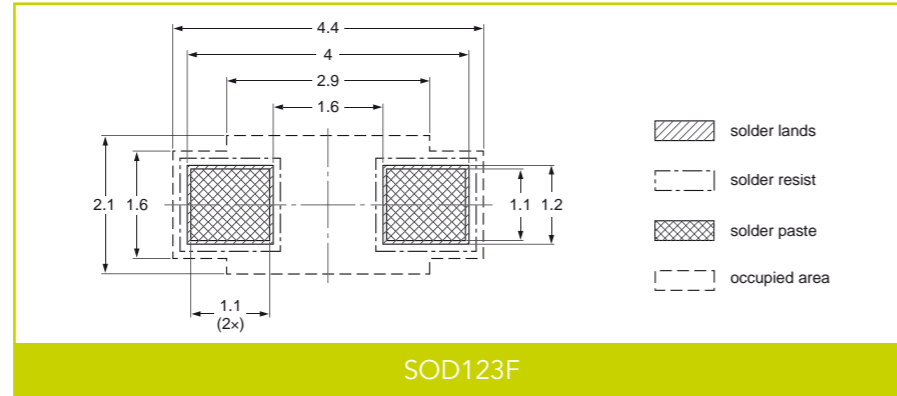
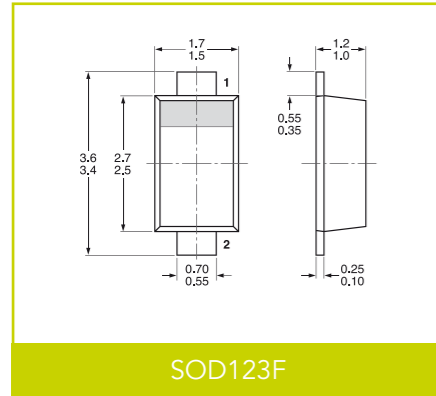
### Reel pack axial tape for glass diodes

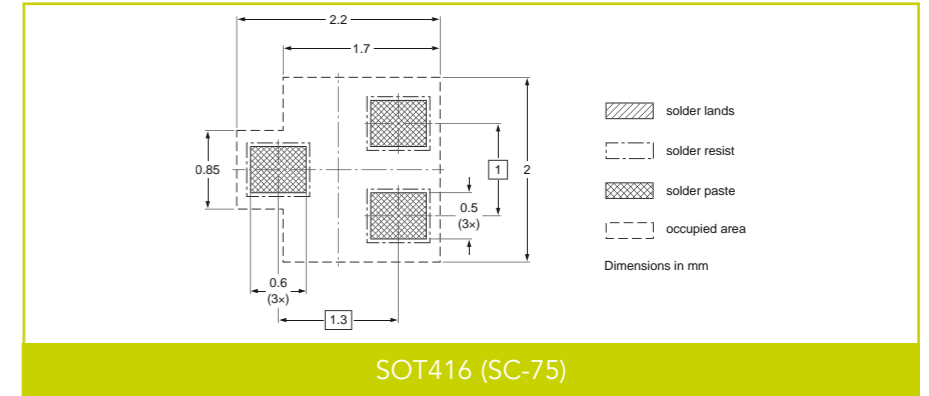
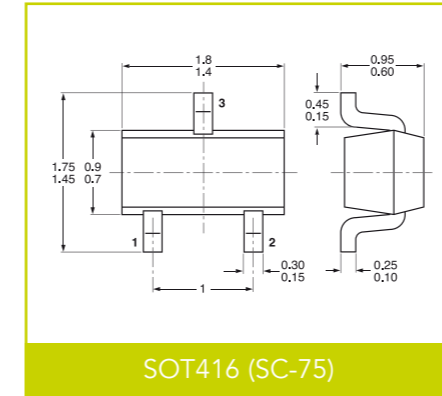
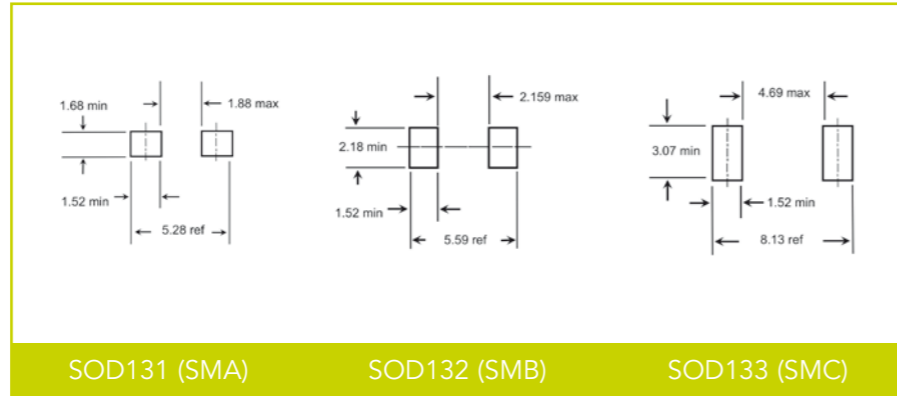
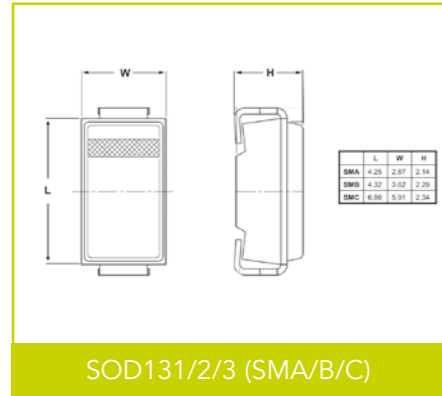


### Ammo pack axial tape for glass diodes

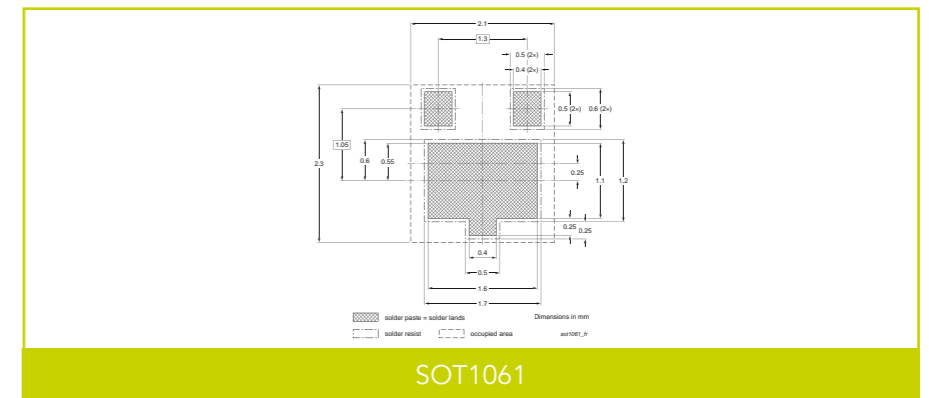
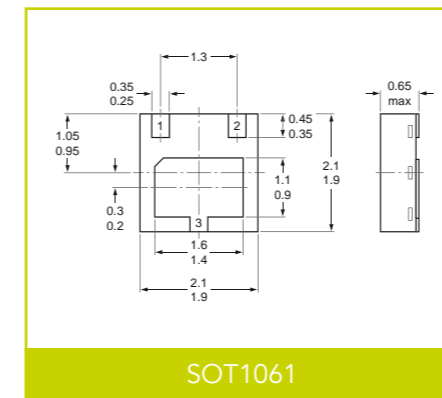
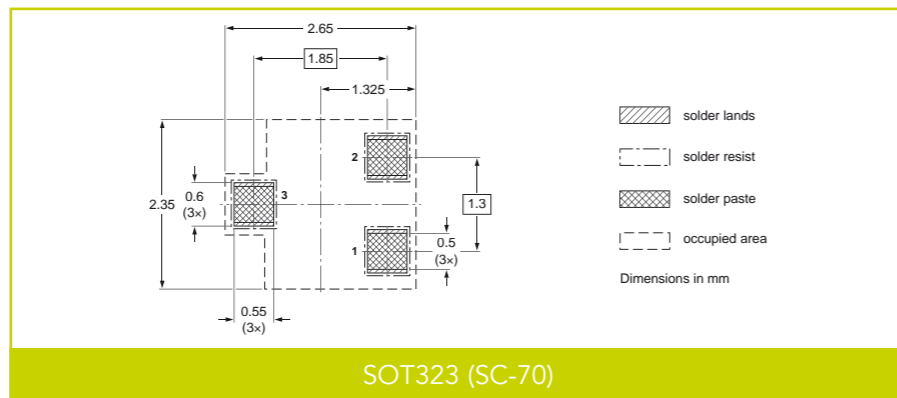
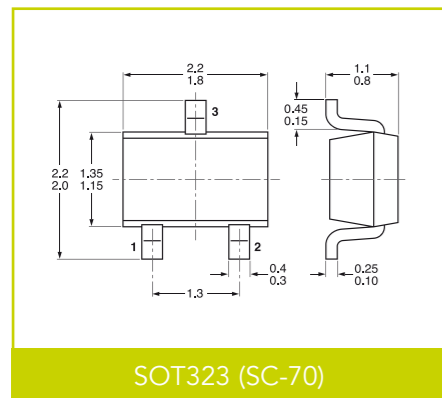
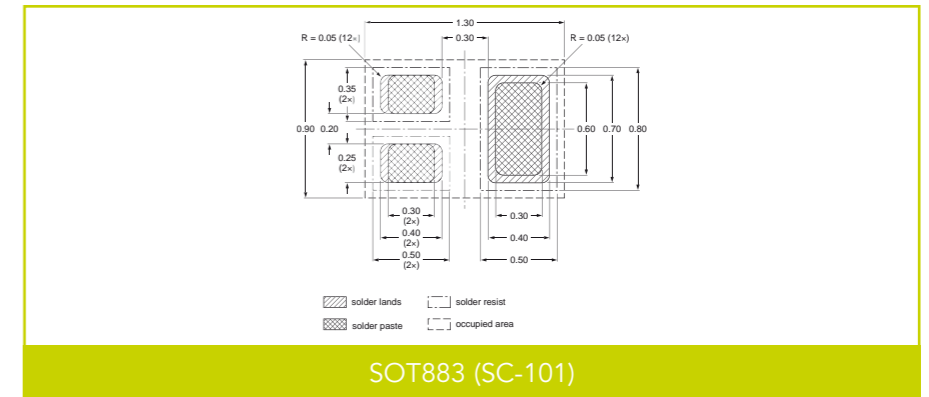
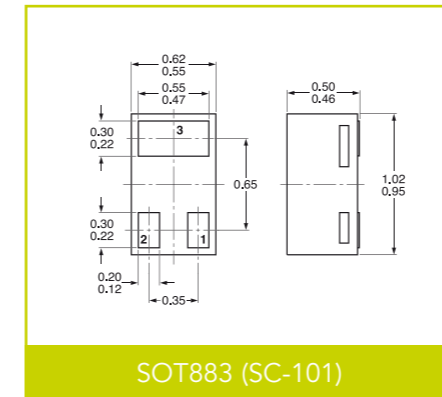
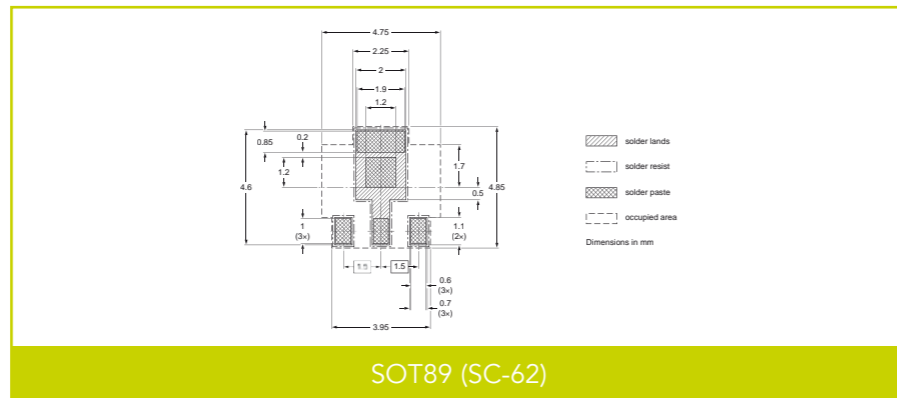
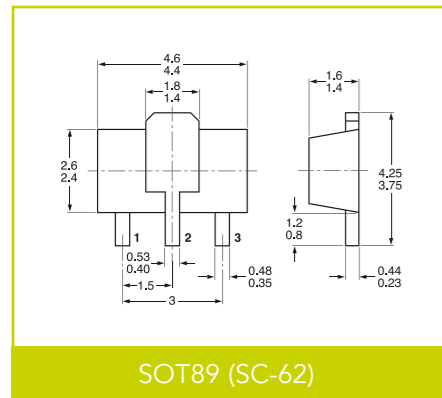
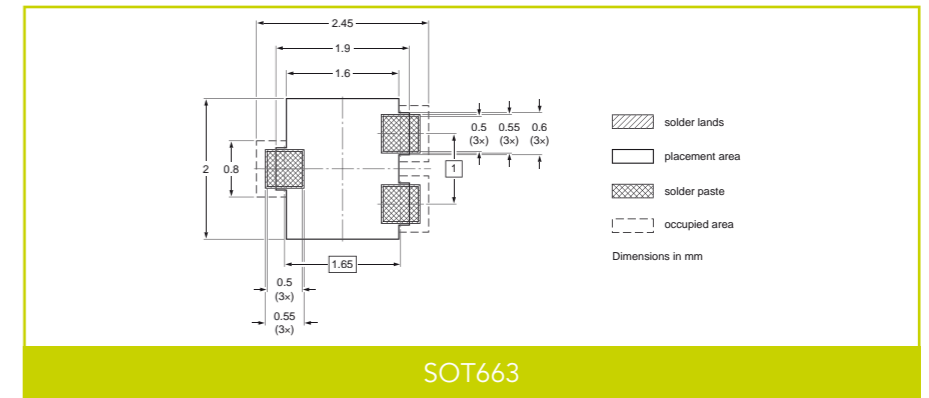
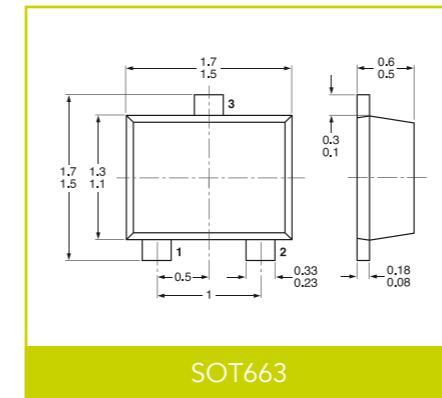
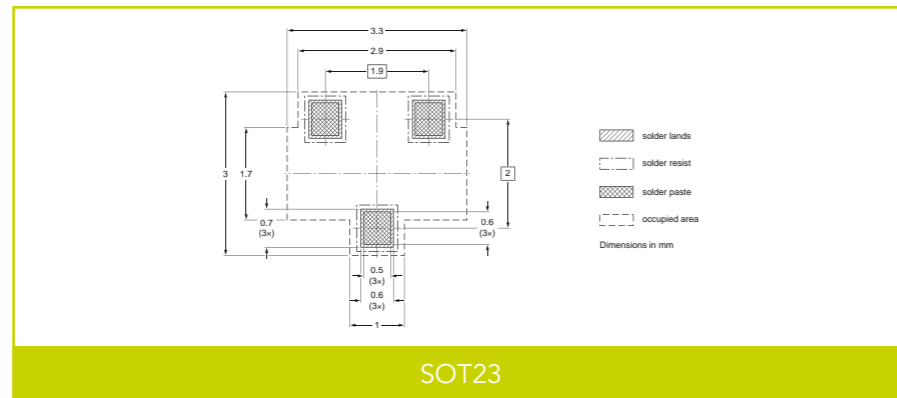
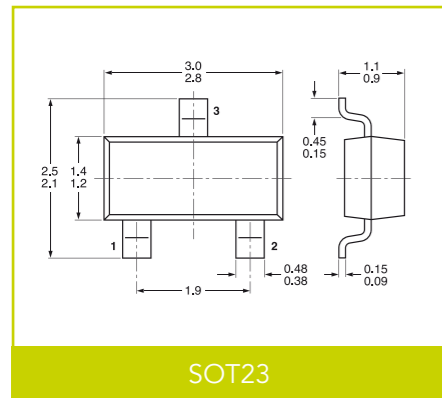


## 2-Pin SMD Packages





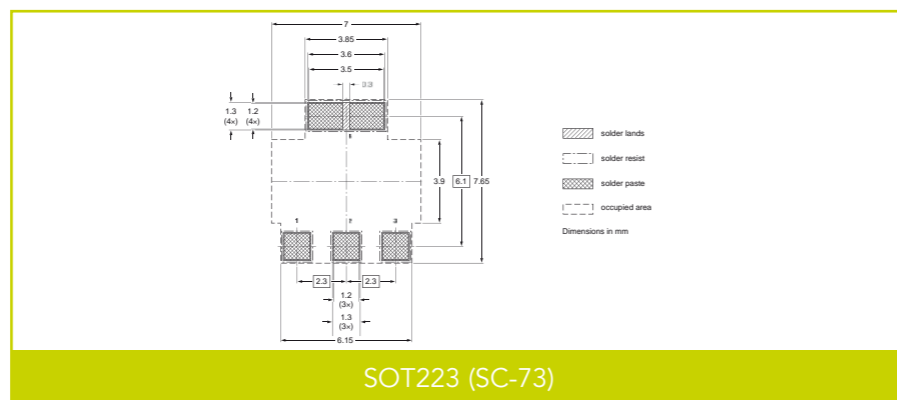
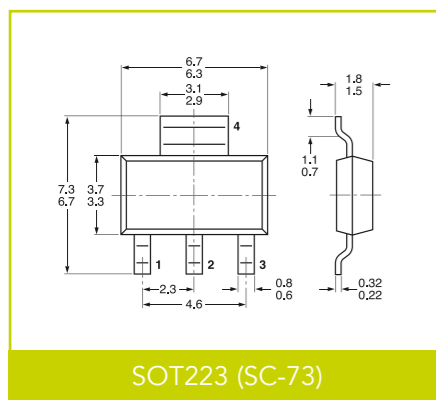
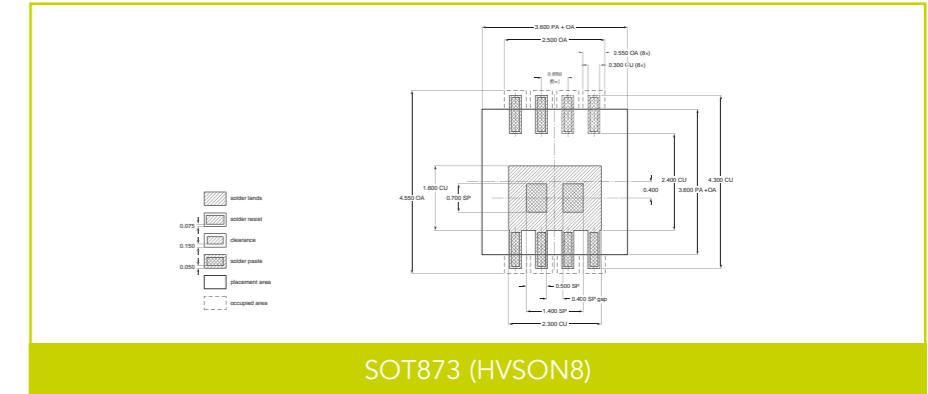
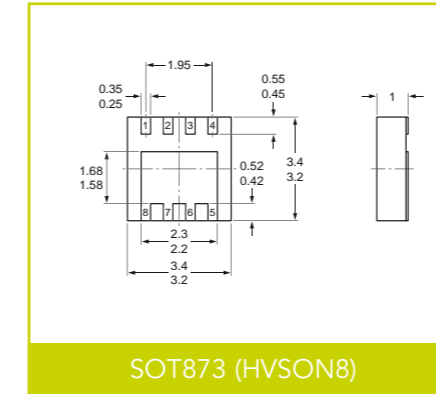
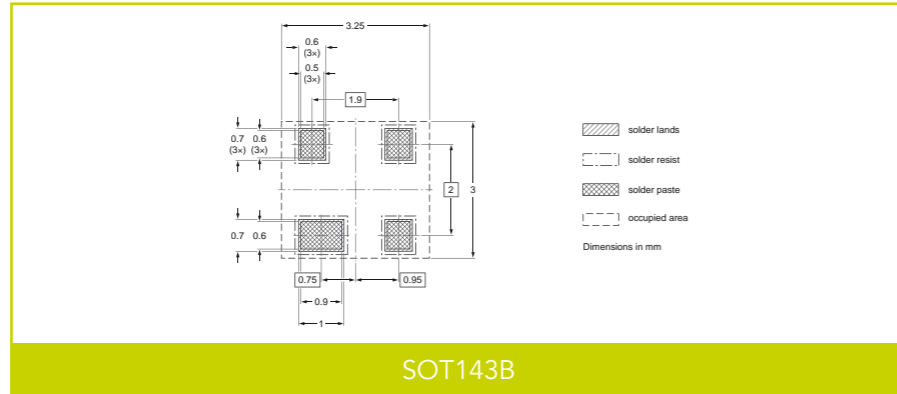
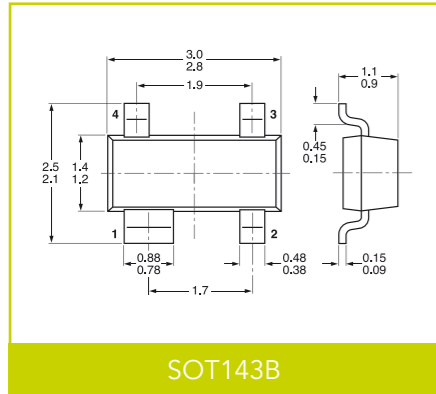
3-Pin SMD Packages



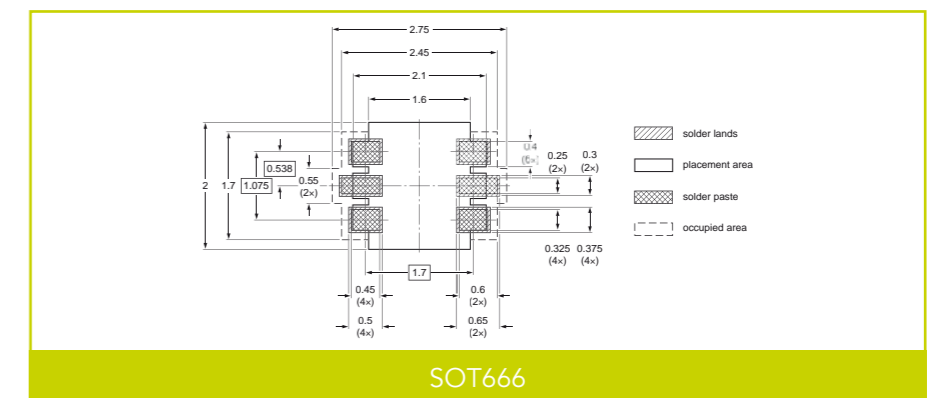
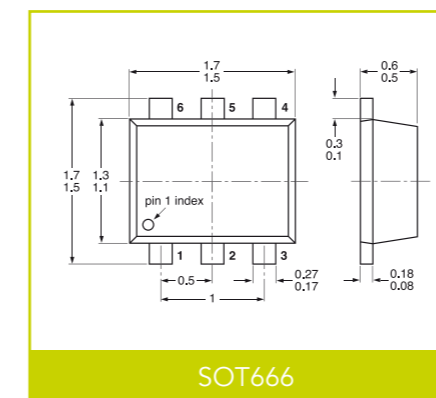
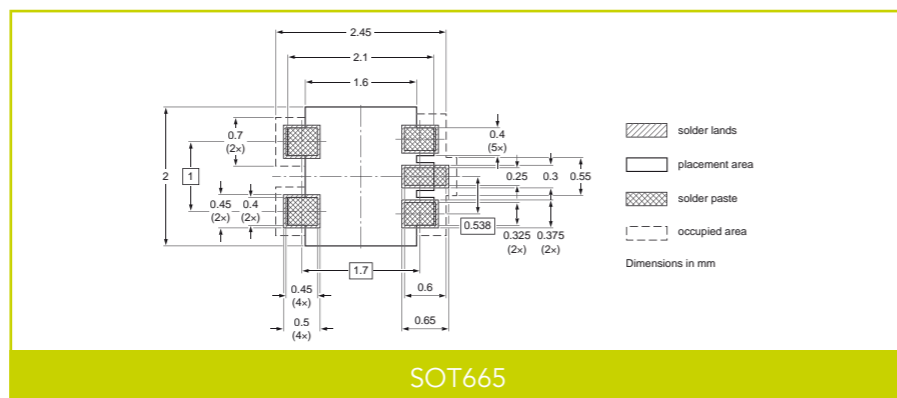
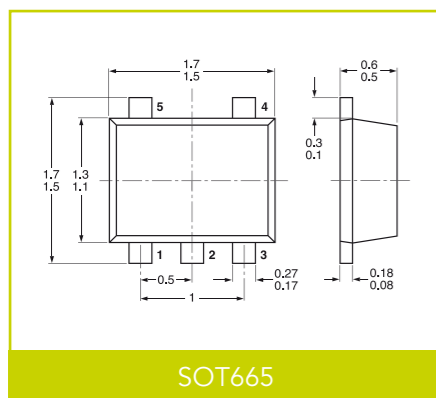
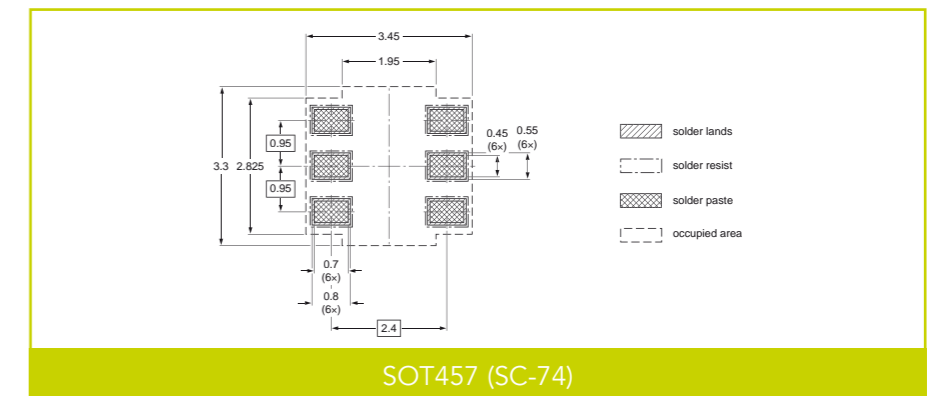
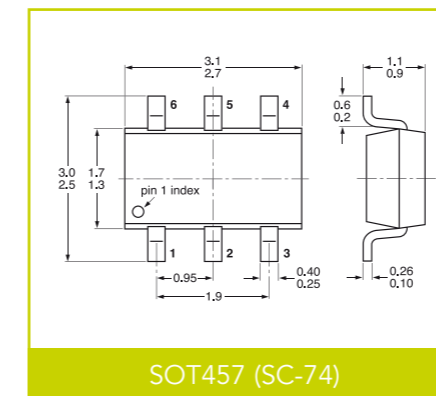
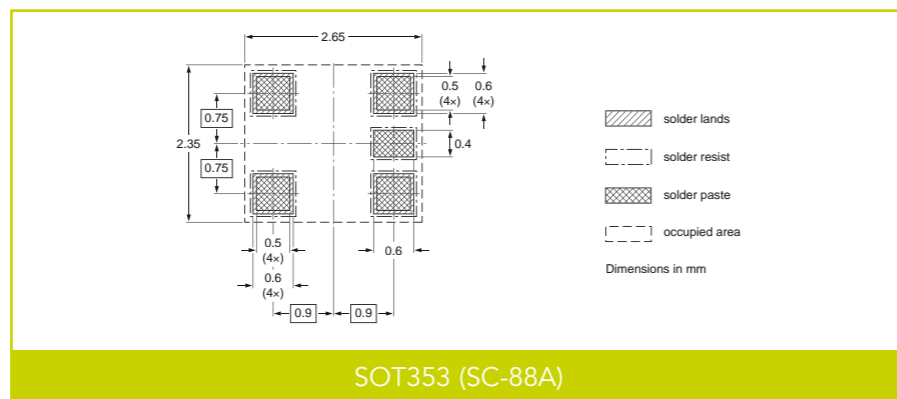
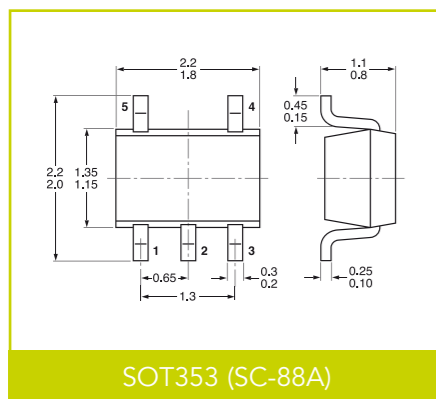
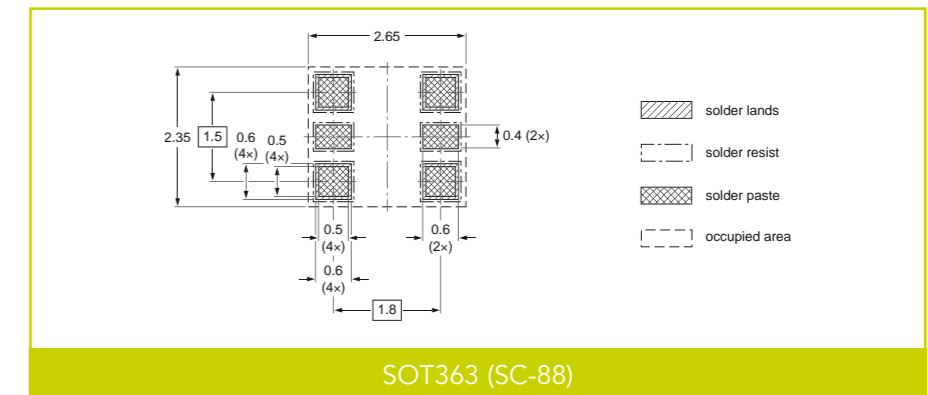
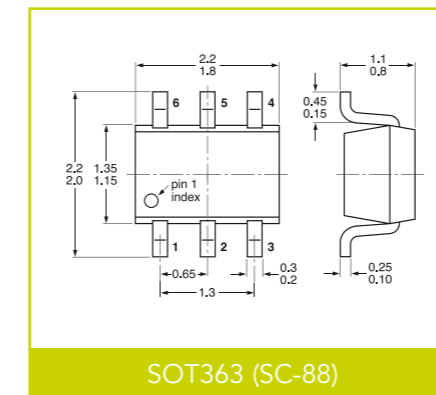
Dimensions in mm

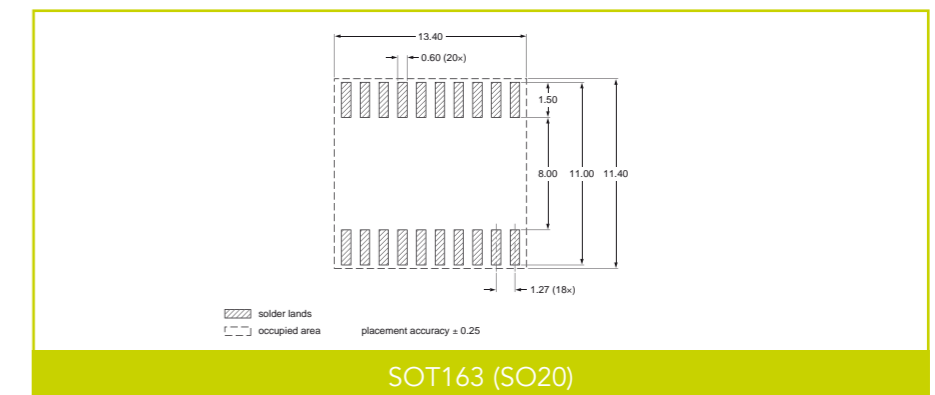
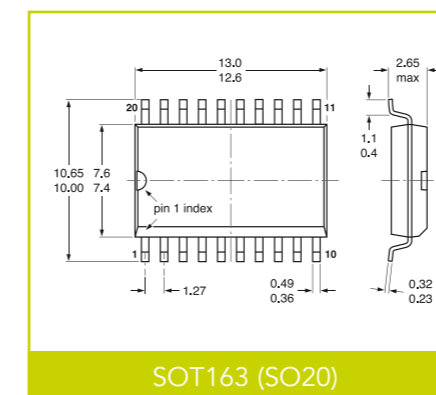
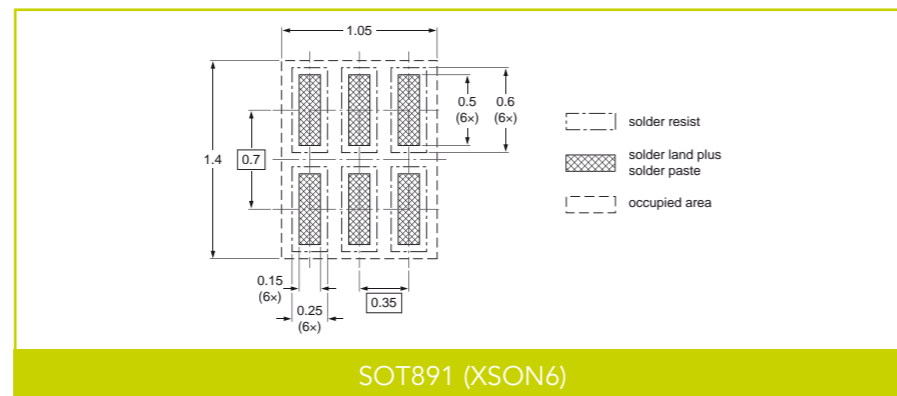
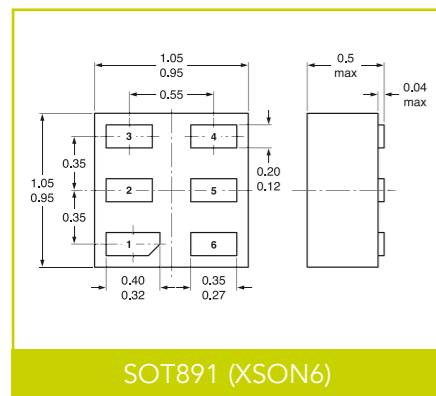
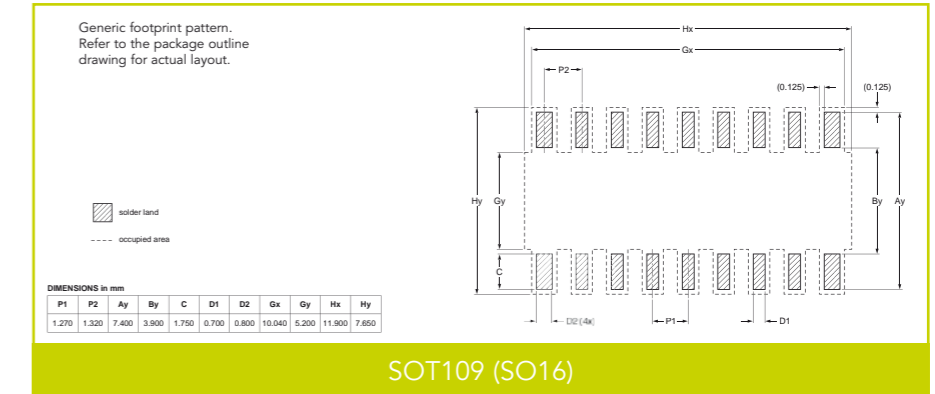
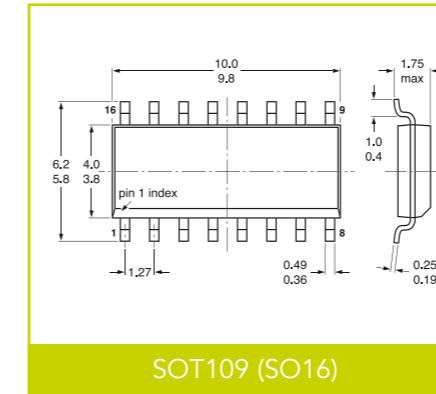
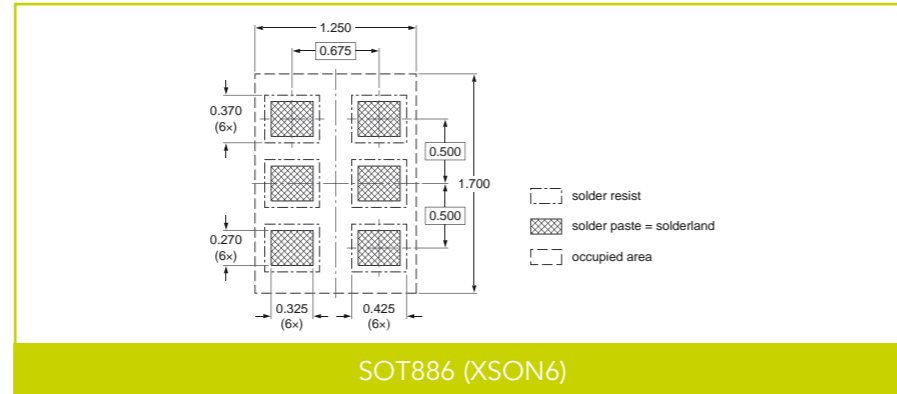
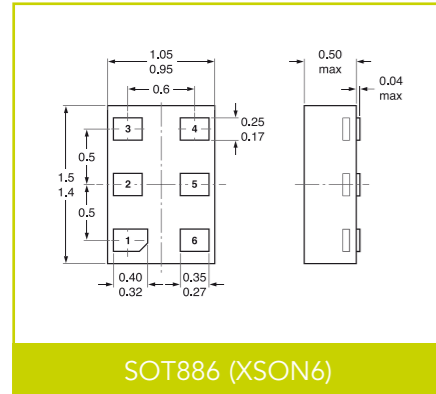
Dimensions in mm

### 4-/5-Pin SMD Packages

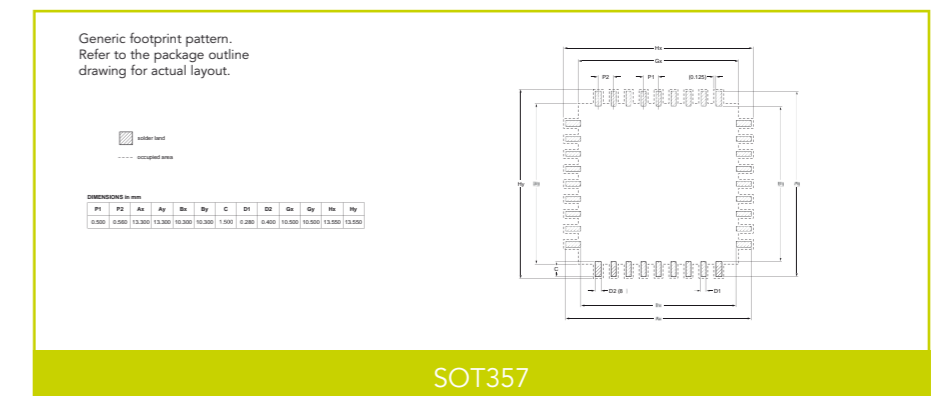
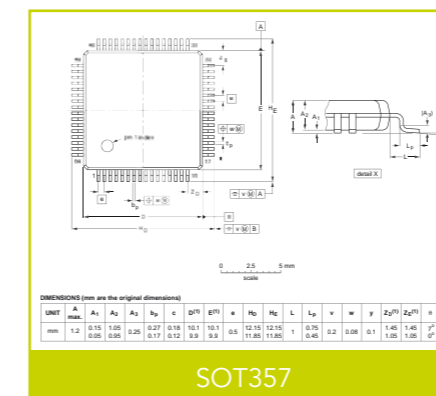
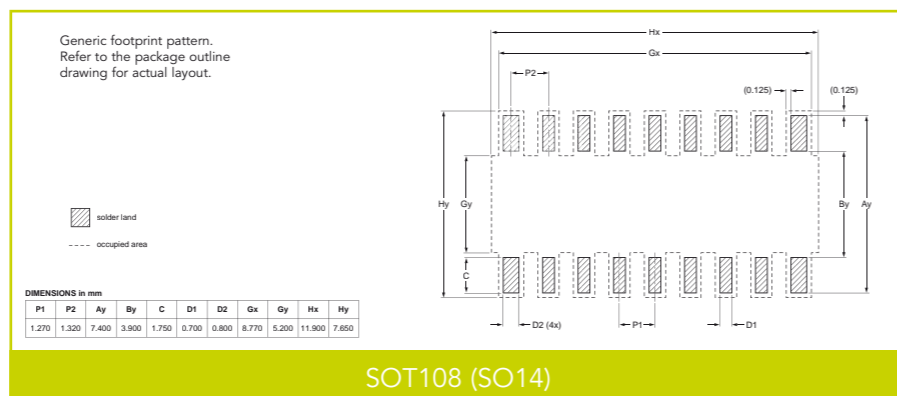
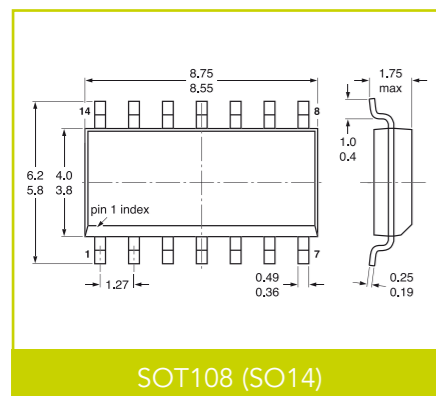
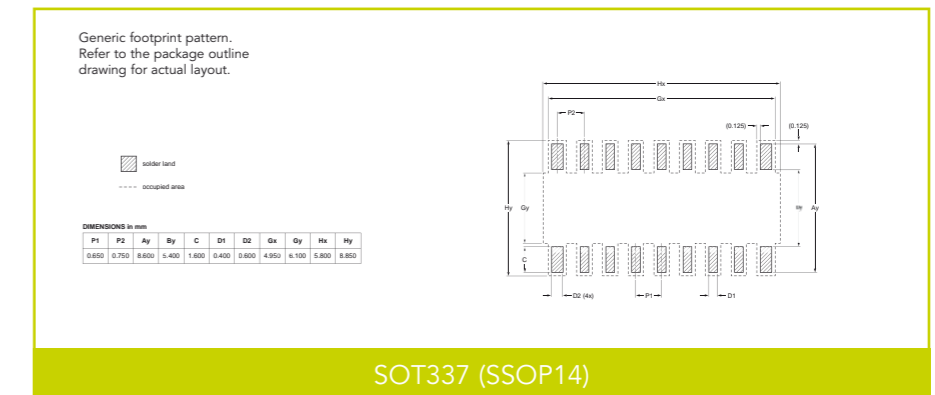
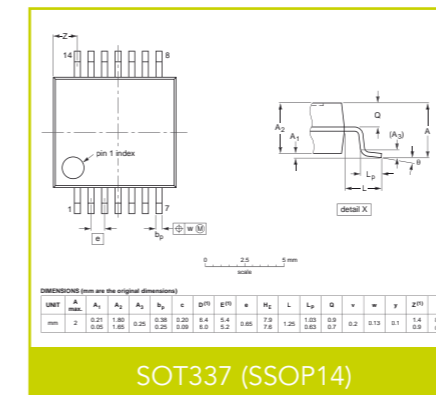
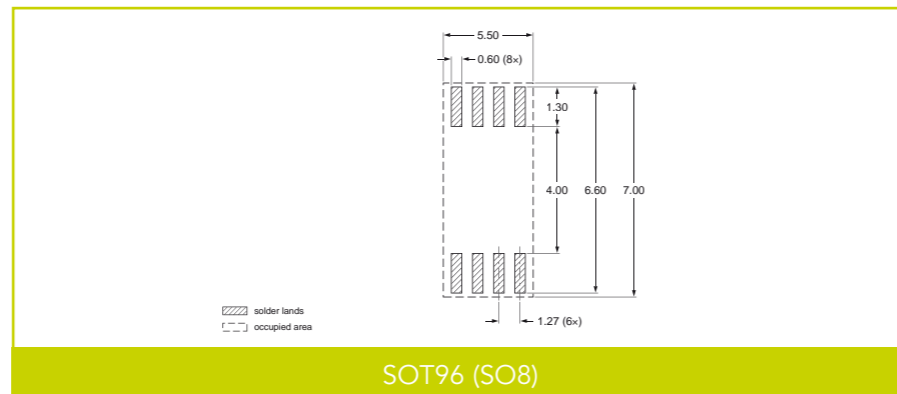
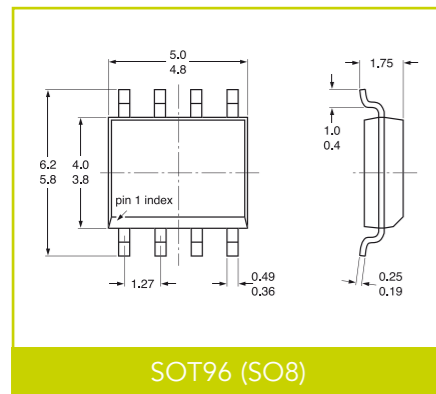


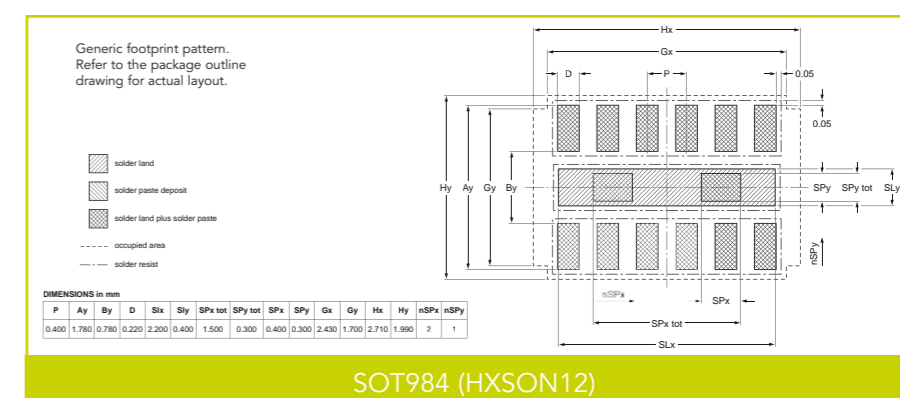
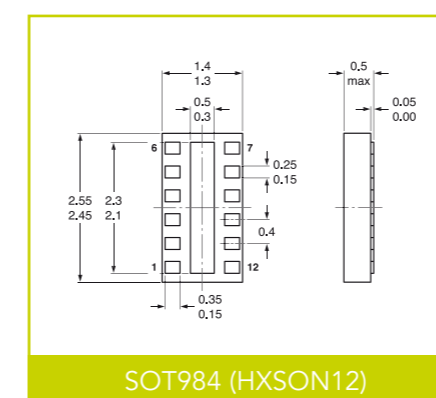
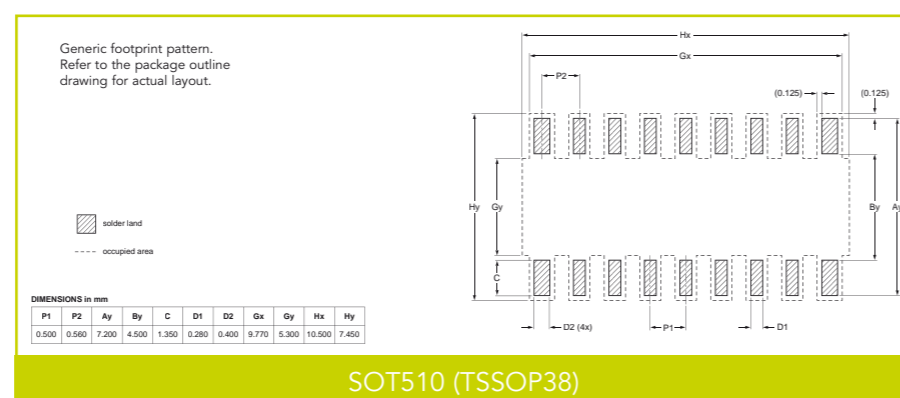
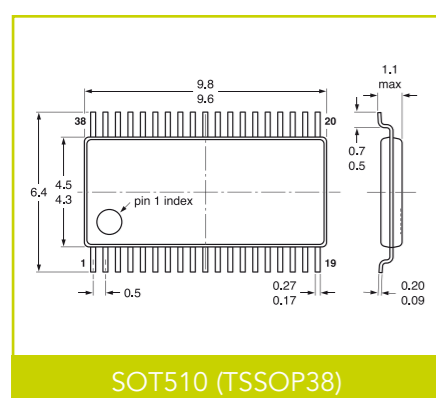
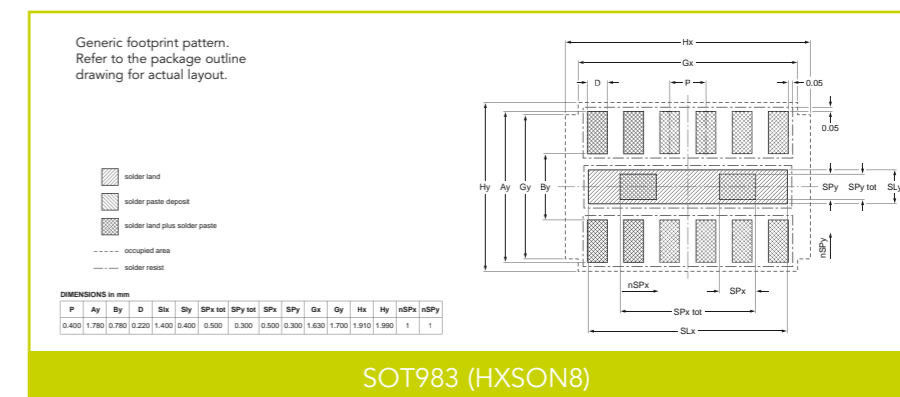
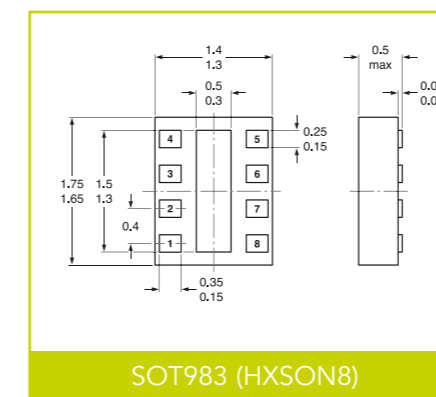
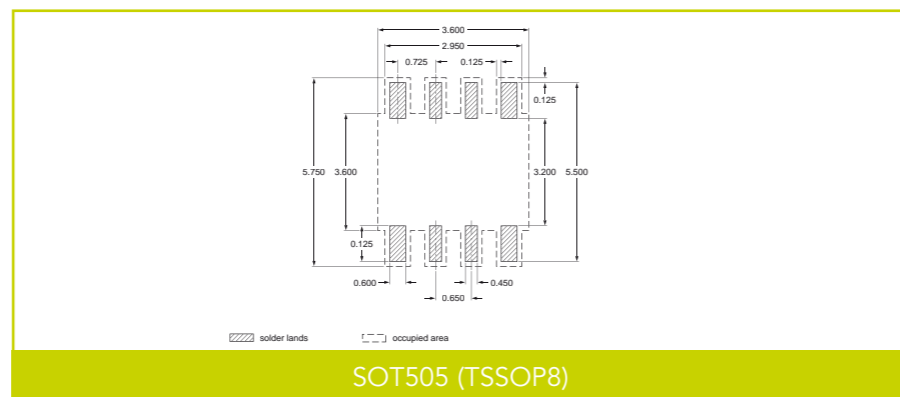
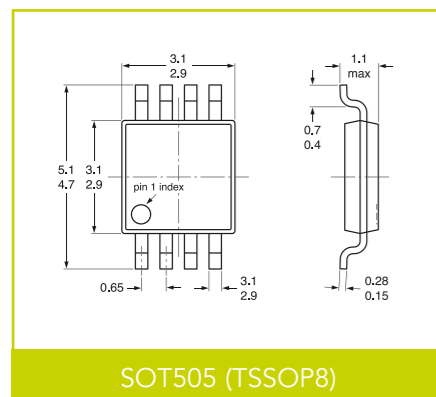
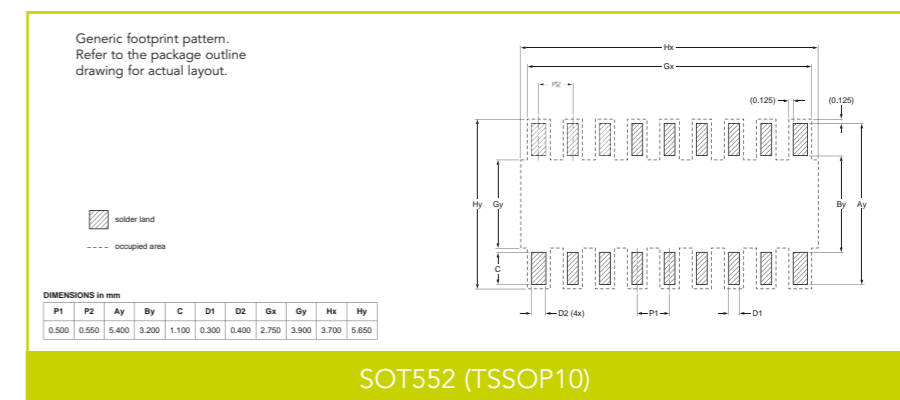
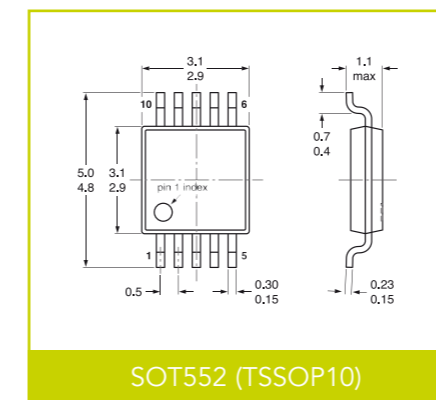
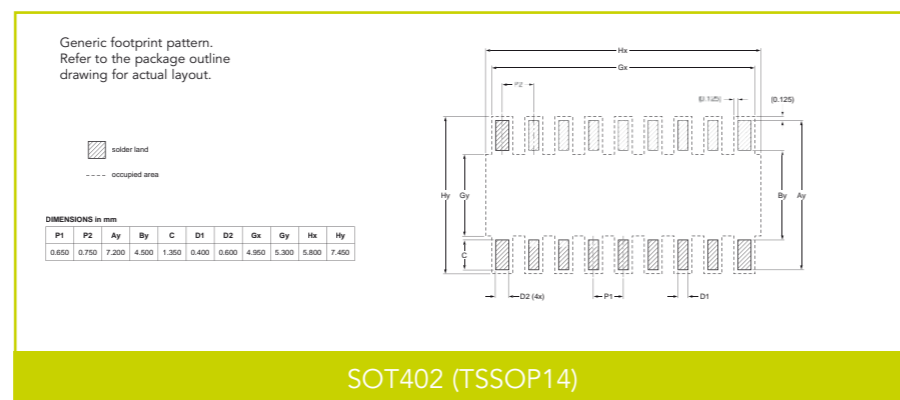
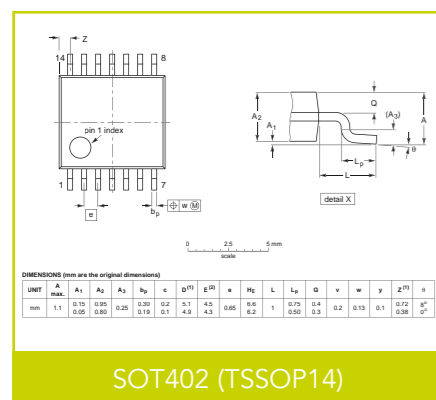
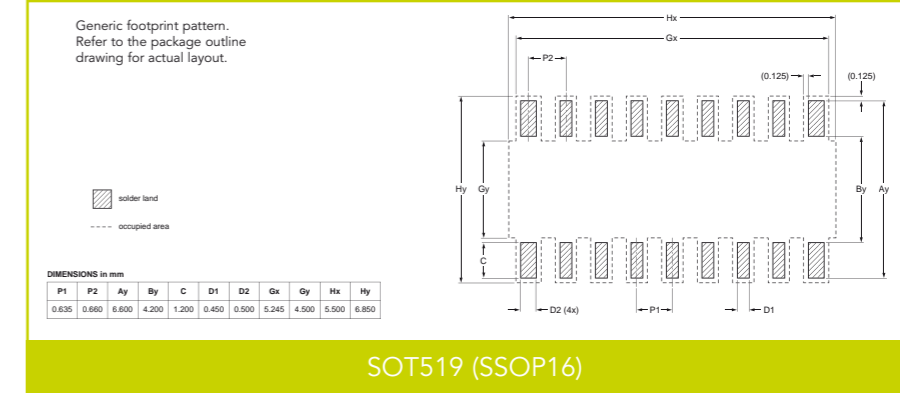
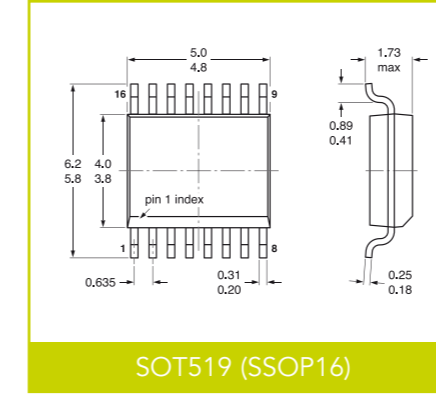
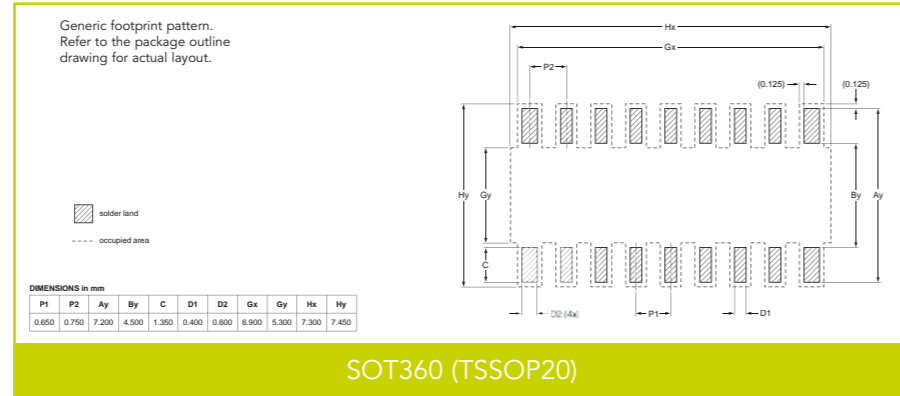
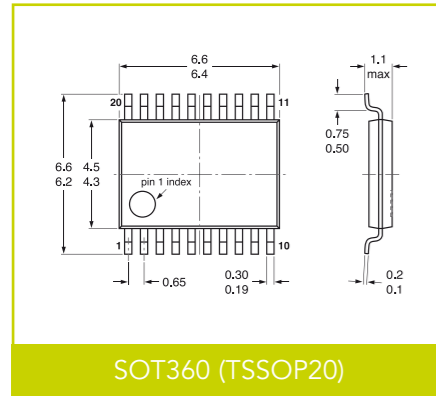
### 6-Pin SMD Packages



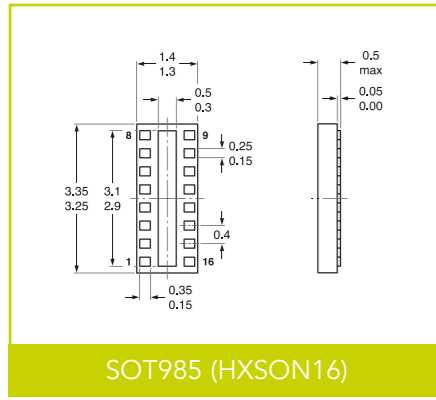


Multi-Pin SMD Packages

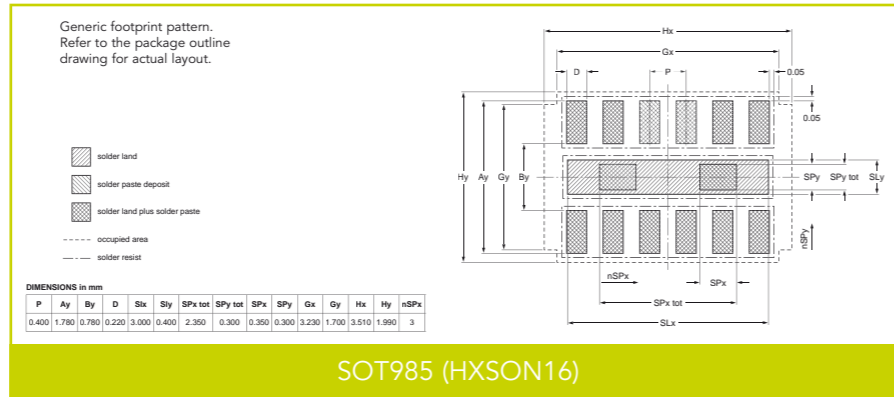




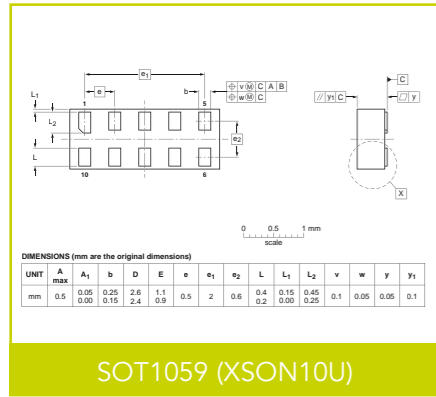
## Minimized outline drawings and reflow soldering footprint



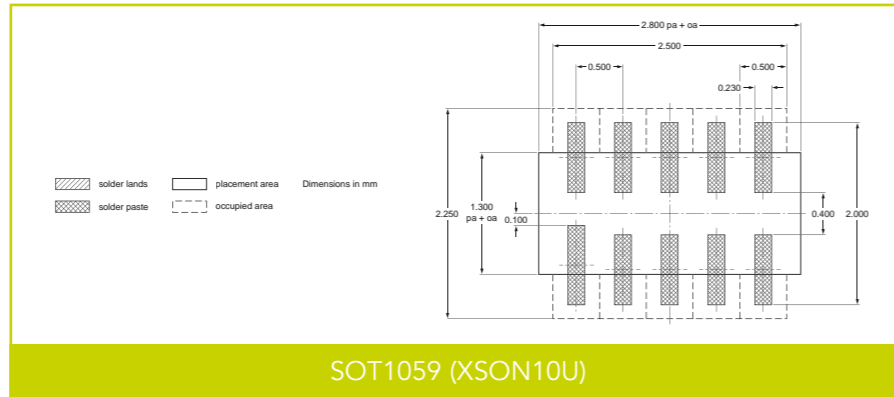
SOT985 (HXSON16)



SOT985 (HXSON16)

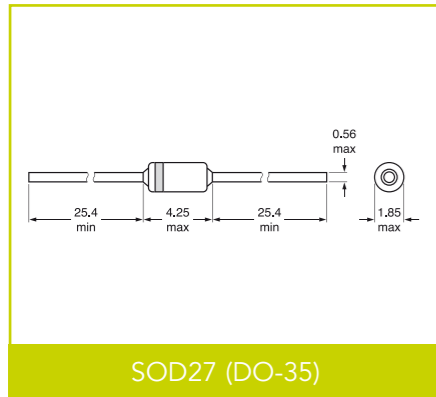


SOT1059 (XSON10U)

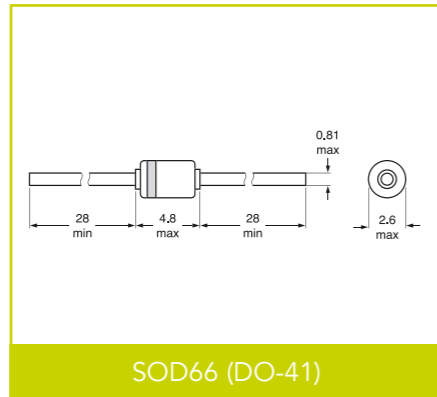


SOT1059 (XSON10U)

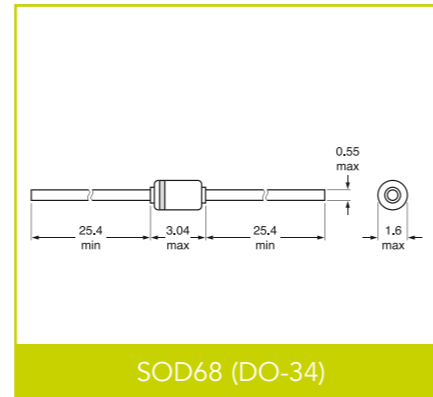
## Glass diodes



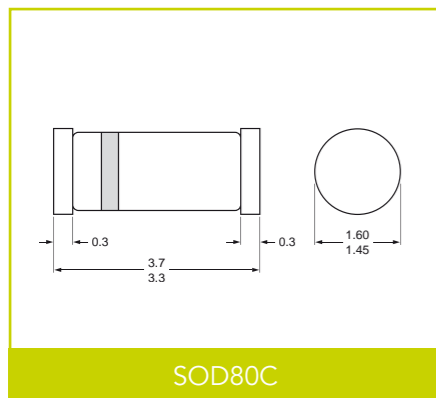
SOD27 (DO-35)



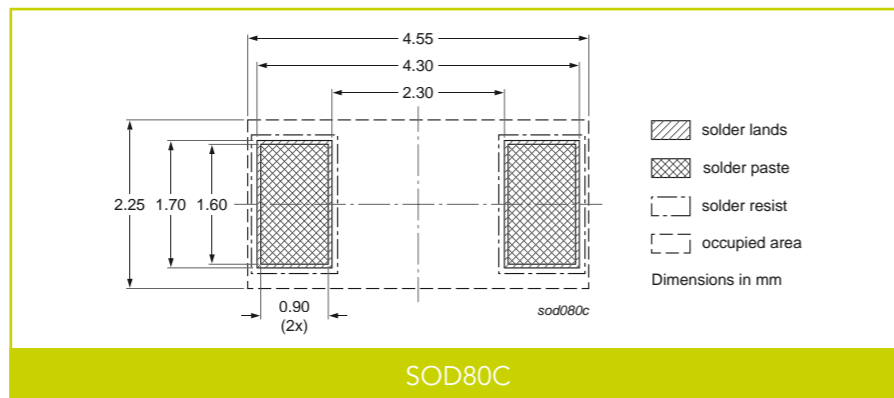
SOD66 (DO-41)



SOD68 (DO-34)



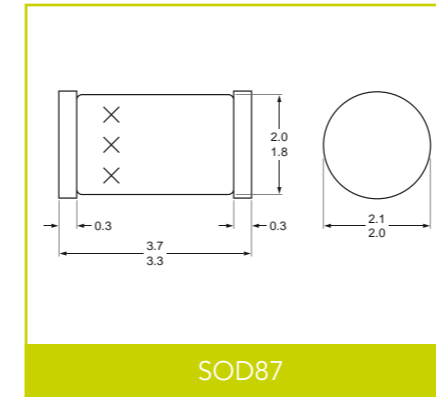
SOD80C



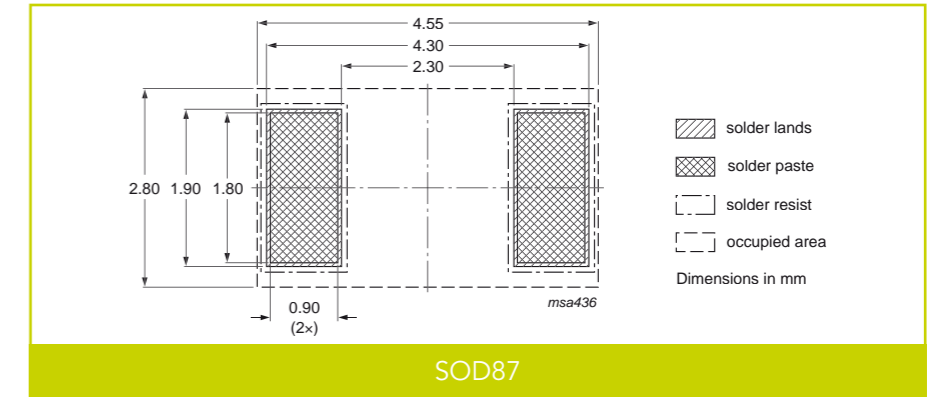
SOD80C

Dimensions in mm

## Minimized outline drawings and reflow soldering footprint



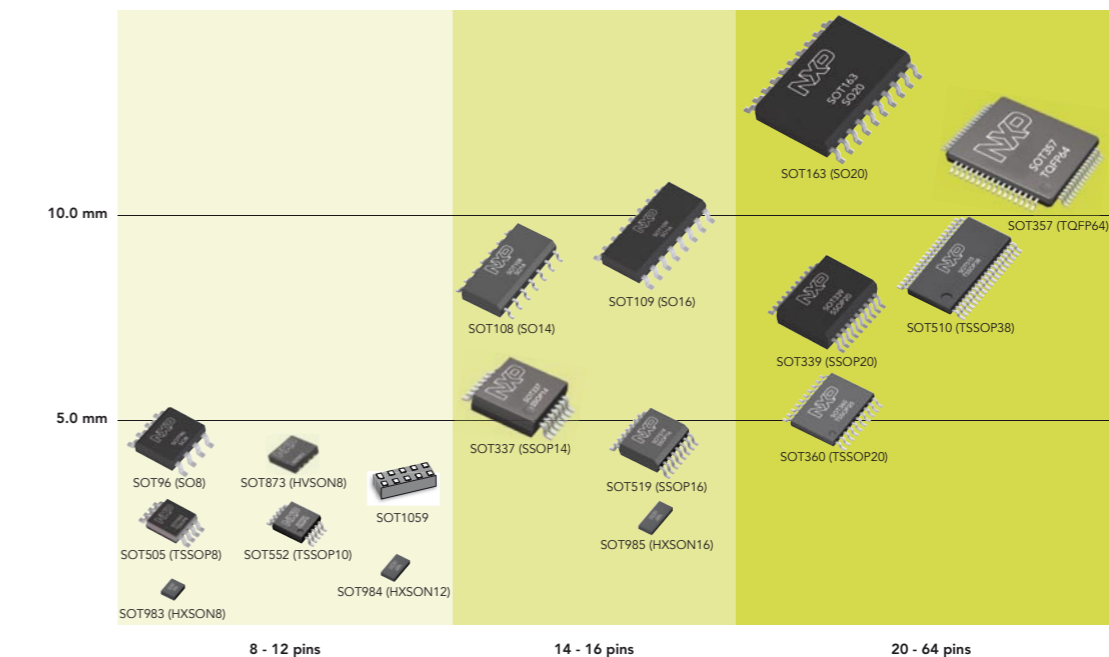
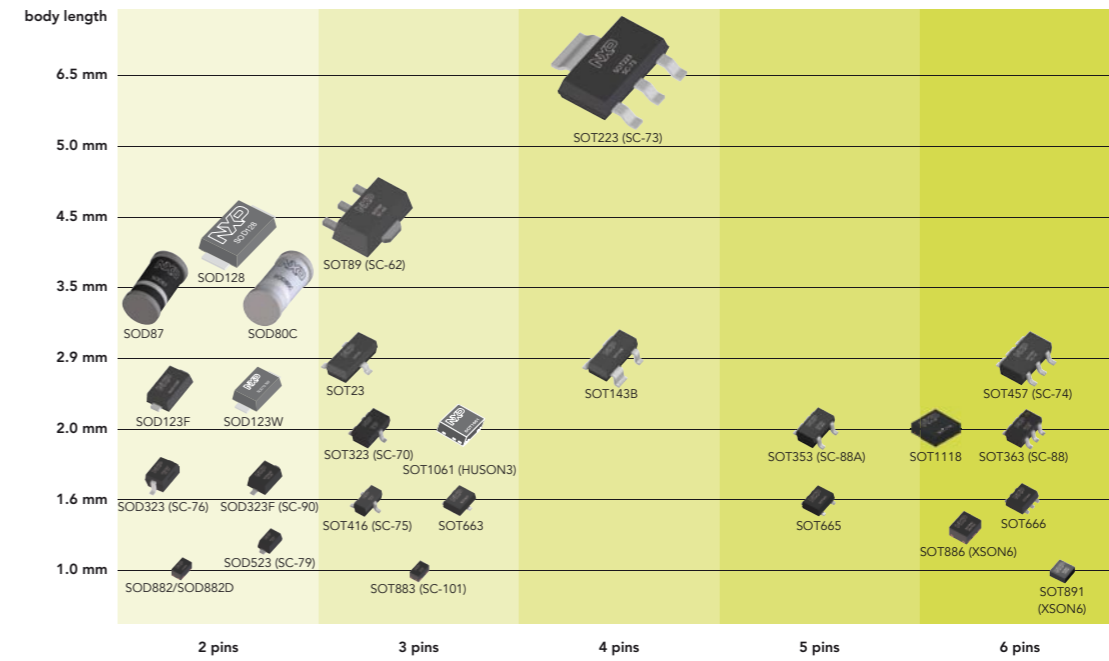
SOD87



SOD87

Dimensions in mm

## Package overview



Packages

Type Number	Page Number	Type Number	Page Number	Type Number	Page Number	Type Number	Page Number	Type Number	Page Number
1N4148	18	2PD601ARW / SW	48	BAS70-06	8	BAV103	20	BC850CW	51
1N4531	18	2PD601ASL	48	BAS70-06W	9	BAV170	21	BC856 / A / B	48
1N47xxA series	16	2PD602AQL	48	BAS70-07	8	BAV199	21	BC856BS	49
1PS105B82	14	2PD602ARL	48	BAS70-07S	9	BAV199W	21	BC856S	49
1PS665B17	14	2PD602ASL	48	BAS70-07V	9	BAV20	20	BC856T / AT / BT	48
1PS665B82	14	BAL74	18	BAS70H	9	BAV21	20	BC856W / AW / BW	48
1PS705B20	11	BAL99	18	BAS70L	9	BAV23	20	BC857 / A / B / C	48
1PS705B82	14	BAS101	20	BAS70VV	9	BAV23A	20	BC857AM / BM / CM	48
1PS705B84	14	BAS101S	20	BAS70W	9	BAV23C	20	BC857BS	49
1PS705B85	14	BAS116	21	BAS70XY	9	BAV23S	20	BC857BV	49
1PS705B86	14	BAS116H	21	BAS716	21	BAV70	18	BC857T / AT / BT / CT	48
1PS745B23	10	BAS116T	21	BAS85	8	BAV70M	19	BC857W / AW / BW / CW	48
1PS755B45	9	BAS16	18	BAS86	8	BAV70S	19	BC858B	48
1PS765B10	9	BAS16H	19	BAT120A	12	BAV70T	19	BC858W	48
1PS765B17	14	BAS16J	19	BAT120C	12	BAV70W	19	BC859B	51
1PS765B21	9	BAS16L	19	BAT120S	12	BAV756S	19	BC859BW	51
1PS765B40	9	BAS16T	19	BAT160A	12	BAV99	18	BC859C	51
1PS765B70	9	BAS16VV	19	BAT160C	12	BAV99S	19	BC859CW	51
1PS795B10	9	BAS16VY	19	BAT160S	12	BAV99W	19	BC860B	51
1PS795B17	14	BAS16W	19	BAT17	14	BAW101	20	BC860BW	51
1PS795B30	9	BAS21	20	BAT46WH	9	BAW101S	20	BC860C	51
1PS795B31	9	BAS21AW	20	BAT46WJ	9	BAW156	21	BC860CW	51
1PS795B40	9	BAS21H	20	BAT54	8	BAW56	18	BC868 / -25	65
1PS795B70	9	BAS21J	20	BAT54A	8	BAW56M	19	BC869 / -16 / -25	65
1PS885B48	9	BAS21SW	20	BAT54AW	9	BAW56S	19	BCM61B	50
1PS885B82	14	BAS21VD	20	BAT54C	8	BAW56T	19	BCM62B	50
2N7002	77	BAS21W	20	BAT54CM	9	BAW56W	19	BCM847BS	50
2N7002BK	77	BAS28	19	BAT54CV	9	BC807 / -16 / -25 / -40	48	BCM847BV	50
2N7002BKM	77	BAS29	21	BAT54CW	9	BC807DS	49	BCM847DS	50
2N7002BKS	79	BAS31	21	BAT54H	9	BC807W / -16W / -25W / -40W	48	BCM856BS	50
2N7002BKT	77	BAS316	19	BAT54J	9	BC817 / -16 / -25 / -40	48	BCM856DS	50
2N7002BKV	79	BAS321	20	BAT54L	9	BC817DPN	49	BCM857BS	50
2N7002BKW	77	BAS32L	18	BAT54S	8	BC817DS	49	BCM857BV	50
2N7002CK	77	BAS35	21	BAT54SW	9	BC817W / -16W / -25W / -40W	48	BCM857DS	50
2N7002E	77	BAS40	8	BAT54T	9	BC846 / A / B	48	BCP51 / -10 / -16	65
2N7002F	77	BAS40-04	8	BAT54VV	9	BC846BPN	49	BCP52 / -10 / -16	65
2N7002K	77	BAS40-04W	9	BAT54W	9	BC846BS	49	BCP53 / -10 / -16	65
2N7002P	77	BAS40-05	8	BAT54XY	9	BC846DS	49	BCP54 / -10 / -16	65
2N7002PM	77	BAS40-05V	9	BAT720	10	BC846S	49	BCP55 / -10 / -16	65
2N7002PS	79	BAS40-05W	9	BAT721	8	BC846T / AT / BT	48	BCP56 / -10 / -16	65
2N7002PT	77	BAS40-06	8	BAT721A	8	BC846W / AW / BW	48	BCP68 / -25	65
2N7002PV	79	BAS40-06W	9	BAT721C	8	BC847 / A / B / C	48	BCP69 / -16 / -25	65
2N7002PW	77	BAS40-07	8	BAT721S	8	BC847AM / BM / CM	48	BCV26	51
2PA1576Q / R / S	48	BAS40-07V	9	BAT74	8	BC847BPN	49	BCV27	51
2PA1774Q / R / S	48	BAS40H	9	BAT74S	9	BC847BS	49	BCV28	51
2PA1774QM / RM / SM	48	BAS40L	9	BAT74V	9	BC847BV	49	BCV29	51
2PB1219AQ / R / S	48	BAS40W	9	BAT754	8	BC847BVN	49	BCV46	51
2PB709ARL	48	BAS40XY	9	BAT754A	8	BC847DS	49	BCV47	51
2PB709ART	48	BAS416	21	BAT754C	8	BC847T / AT / BT / CT	48	BCV48	51
2PB709ARW / SW	48	BAS45A	21	BAT754L	9	BC847W / AW / BW / CW	48	BCV49	51
2PB709ASL	48	BAS45AL	21	BAT754S	8	BC848B	48	BCV61/A/B/C	50
2PB710ARL	48	BAS516	19	BAT760	11	BC848W	48	BCV62/A/B/C	50
2PB710ASL	48	BAS521	20	BAT85	8	BC849B	51	BCV63 / B	52
2PC4081Q / R / S	48	BAS56	21	BAT854AW	9	BC849BW	51	BCV64B	52
2PC4617Q / R	48	BAS70	8	BAT854CW	9	BC849C	51	BCV65 (SOT143B)	53
2PC4617QM / RM	48	BAS70-04	8	BAT854SW	9	BC849CW	51	BCV71 / 72	48
2PD1820AR / S	48	BAS70-04W	9	BAT854W	9	BC850B	51	BCW29 / 30	48
2PD601ARL	48	BAS70-05	8	BAT86	8	BC850BW	51	BCW31 / 32 / 33	48
2PD601ART	48	BAS70-05W	9	BAT960	11	BC850C	51	BCW60B / C / D	48

Type Number	Page Number	Type Number	Page Number	Type Number	Page Number	Type Number	Page Number	Type Number	Page Number
BCW61B / C / D	48	BSP32 / 33	65	BZX79 series	16	IP3254CZ12	36	IP4263CZ14	33
BCW69 / 70	48	BSP41	65	BZX84 series	16	IP3254CZ16	36	IP4264CZ8-20	38
BCW71 / 72	48	BSP43	65	BZX84J series	16	IP3254CZ8	36	IP4264CZ8-40	38
BCW89	48	BSP50	51	BZX84-y10	17	IP3337CX18/LF	36	IP4280CZ10	30
BCX17	48	BSP51	51	BZX84-y11	17	IP3338CX24/LF	36	IP4281CZ10	30
BCX18	48	BSP52	51	BZX84-y12	17	IP4025CX20/LF	32	IP4282CZ6	33
BCX19	48	BSP60	51	BZX84-y13	17	IP4027CX20/LF	32	IP4282CZ6	30
BCX51 / -10 / -16	65	BSP61	51	BZX84-y15	17	IP4041CX25/LF	36	IP4283CZ10-TB	30
BCX52 / -10 / -16	65	BSP62	51	BZX84-y16	17	IP4042CX5/LF	37	IP4283CZ10-TT	30
BCX53 / -10 / -16	65	BSP89	76	BZX84-y18	17	IP4043CX5/LF	37	IP4284CZ10-TB	31
BCX54 / -10 / -16	65	BSR14	49	BZX84-y20	17	IP4044CX8/LF	38	IP4284CZ10-TT	31
BCX55 / -10 / -16	65	BSR16	49	BZX84-y22	17	IP4047CX6/LF	32	IP4286CZ6-TBF	31
BCX56 / -10 / -16	65	BSR30 / 31	65	BZX84-y24	17	IP4048CX5/LF	32	IP4286CZ6-TTY	31
BCX70G / H / J / K	48	BSR33	65	BZX84-y27	17	IP4049CX5/LF	32	IP4302CX2/LF	37
BCX71H / J / K	48	BSR41	65	BZX84-y2V4	17	IP4051CX11/LF	38	IP4303CX4/LF	37
BF550	52	BSR42 / 43	65	BZX84-y2V7	17	IP4052CX20/LF	38	IP4305CX4/LF	37
BF570	52	BSS123	77	BZX84-y30	17	IP4053CX15/LF	36	IP4306CX2/LF	37
BF620	51	BSS192	79	BZX84-y33	17	IP4054CX15/LF	36	IP4307CX4/LF	36
BF621	51	BSS63	48	BZX84-y36	17	IP4055CX6/LF	32	IP4309CX9	31
BF622	51	BSS64	48	BZX84-y39	17	IP4056CX8	39	IP4310CX8	31
BF623	51	BSS84	79	BZX84-y3V0	17	IP4057CX10	39	IP4332CX5/LF	37
BF720	51	BSS87	77	BZX84-y3V3	17	IP4058CX8	39	IP4337CX18/LF/E	36
BF722	51	BST39	51	BZX84-y3V6	17	IP4059CX5	39	IP4338CX24/LF	36
BF723	51	BST50	51	BZX84-y3V9	17	IP4060CX16/LF	38	IP4342CX5/LF	37
BF820	51	BST51	51	BZX84-y43	17	IP4064CX8/LF/S	38	IP4343CX5/LF	37
BF820W	51	BST52	51	BZX84-y47	17	IP4065CX11	39	IP4350CX24/LF	38
BF821	51	BST60	51	BZX84-y4V3	17	IP4067CX9/LF	38	IP4352CX24/LF	38
BF822	51	BST61	51	BZX84-y4V7	17	IP4078CX6	39	IP4353CX15/LF	36
BF823	51	BST62	51	BZX84-y51	17	IP4085CX4	38	IP4355CX6/LF	32
BF824	52	BST82	77	BZX84-y56	17	IP4088CX20/LF	36	IP4358CX6	31
BF824W	52	BSV52	49	BZX84-y5V1	17	IP4110CX20/LF	32	IP4359CX4	30
BF840	52	BZA100	25	BZX84-y5V6	17	IP4125CX20/LF	32	IP4359CX4	39
BFS19	52	BZA408B	25	BZX84-y62	17	IP4142CX5/LF	37	IP4361CX4/LF	37
BFS20W	52	BZA420A	25	BZX84-y6V2	17	IP4153CX15/LF	36	IP4363CX10/LF	32
BSH103	75	BZA456A	25	BZX84-y6V8	17	IP4158CX8	39	IP4364CX8/LF	38
BSH105	75	BZA462A	25	BZX84-y75	17	IP4220CZ6	43	IP4365CX11	38
BSH108	75	BZA820A	25	BZX84-y7V5	17	IP4220CZ6	40	IP4366CX8/LF	38
BSH111	77	BZA856A	25	BZX84-y8V2	17	IP4221CZ6-S	30	IP4385CX4	38
BSH112	77	BZA856AL	25	BZX84-y9V1	17	IP4221CZ6-XS	30	IP4387CX4	38
BSH114	77	BZA862A	25	BZX884 series	16	IP4224CZ6	42	IP4769CZ14	35
BSH121	77	BZA862AL	25	ES1A	15	IP4225CZ10	40	IP4770CZ16	35
BSH201	79	BZA868A	25	ES1B	15	IP4233CZ6	30	IP4771CZ16	35
BSH202	79	BZA868AL	25	ES1D	15	IP4234CZ6	29	IP4772CZ16	35
BSH203	79	BZA956A	25	ES1G	15	IP4251CZ12-6	36	IP4773CZ14	35
BSH205	79	BZA962A	25	ES2A	15	IP4251CZ16-8	36	IP4774CZ14	35
BSH207	79	BZA968A	25	ES2B	15	IP4251CZ8-4	36	IP4776CZ38	34
BSN20	77	BZB100A	16	ES2D	15	IP4252CZ12-6	36	IP4777CZ38	34
BSP030	74	BZB784 series	16	ES2G	15	IP4252CZ16-8	36	IP4778CZ38	34
BSP100	74	BZB84 series	16	ES3A	15	IP4252CZ8-4	36	IP4790CZ38	31
BSP122	76	BZB984 series	16	ES3B	15	IP4253CZ12-6	36	IP4852CX25/LF	38
BSP126	76	BZT52H series	16	ES3D	15	IP4253CZ16-8	36	IP4853CX24/LF	38
BSP130	76	BZV49 series	16	ES3G	15	IP4253CZ8-4	36	IP5002CX8/LF	32
BSP19	51	BZV55 series	16	IP3047CX6	32	IP4254CZ12-6	36	IP5006CX11/LF	32
BSP220	79	BZV85 series	16	IP3048CX5	32	IP4254CZ16-8	36	IP5020CX16/LF	32
BSP225	79	BZV90 series	16	IP3219CZ6	29	IP4254CZ8-4	36	IP5040CX11/LF	32
BSP230	79	BZX100A	16	IP3253CZ12	36	IP4256CZ3-M	36	IP5306CX8	32
BSP250	79	BZX384 series	16	IP3253CZ16	36	IP4256CZ5-W	36	IP5311CX5/LF	32
BSP31	65	BZX585 series	16	IP3253CZ8	36	IP4256CZ6-F	36	MMBT2222A	49

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MMBT3904	49	NZX13C	17	NZX4V3D	17	PBLS2001D	61	PBSS302PX	58
MMBT3906	49	NZX14A	17	NZX4V7A	17	PBLS2001S	61	PBSS302PZ	58
MMBZ10VAL	44	NZX14B	17	NZX4V7B	17	PBLS2002D	61	PBSS303ND	56
MMBZ12VAL	44	NZX14C	17	NZX4V7C	17	PBLS2002S	61	PBSS303NX	56
MMBZ12VDL	44	NZX15A	17	NZX4V7D	17	PBLS2003D	61	PBSS303NZ	56
MMBZ15VAL	44	NZX15B	17	NZX5V1A	17	PBLS2003S	61	PBSS303PD	58
MMBZ15VDL	44	NZX15C	17	NZX5V1B	17	PBLS2004D	61	PBSS303PX	58
MMBZ18VAL	44	NZX15X	17	NZX5V1C	17	PBLS2021D	61	PBSS303PZ	58
MMBZ18VCL	44	NZX16A	17	NZX5V1D	17	PBLS2022D	61	PBSS304ND	56
MMBZ20VAL	44	NZX16B	17	NZX5V6A	17	PBLS2023D	61	PBSS304NX	56
MMBZ20VCL	44	NZX16C	17	NZX5V6B	17	PBLS2024D	61	PBSS304NZ	56
MMBZ27VAL	44	NZX18A	17	NZX5V6C	17	PBLS4001D	61	PBSS304PD	58
MMBZ27VCL	44	NZX18B	17	NZX5V6D	17	PBLS4001V	61	PBSS304PX	58
MMBZ33VAL	44	NZX18C	17	NZX5V6E	17	PBLS4001Y	61	PBSS304PZ	58
MMBZ33VCL	44	NZX20A	17	NZX6V2A	17	PBLS4002D	61	PBSS305ND	56
MMBZ5V6AL	44	NZX20B	17	NZX6V2B	17	PBLS4002V	61	PBSS305NX	56
MMBZ6V2AL	44	NZX20C	17	NZX6V2C	17	PBLS4002Y	61	PBSS305NZ	56
MMBZ6V8AL	44	NZX22A	17	NZX6V2D	17	PBLS4003D	61	PBSS305PD	58
MMBZ9V1AL	44	NZX22B	17	NZX6V2E	17	PBLS4003V	61	PBSS305PX	58
NUP1301	29	NZX22C	17	NZX6V8A	17	PBLS4003Y	61	PBSS305PZ	58
NX1117C120Z	69	NZX24A	17	NZX6V8B	17	PBLS4004D	61	PBSS306NX	56
NX1117C12Z	69	NZX24B	17	NZX6V8C	17	PBLS4004V	61	PBSS306NZ	56
NX1117C15Z	69	NZX24C	17	NZX6V8D	17	PBLS4004Y	61	PBSS306PX	58
NX1117C18Z	69	NZX24X	17	NZX7V5A	17	PBLS4005D	61	PBSS306PZ	58
NX1117C19Z	69	NZX27A	17	NZX7V5B	17	PBLS4005V	61	PBSS3515E	59
NX1117C20Z	69	NZX27B	17	NZX7V5C	17	PBLS4005Y	61	PBSS3515M	59
NX1117C25Z	69	NZX27C	17	NZX7V5D	17	PBLS6001D	61	PBSS3515VS	60
NX1117C285Z	69	NZX27X	17	NZX7V5X	17	PBLS6002D	61	PBSS3540E	59
NX1117C33Z	69	NZX2V4A	17	NZX8V2A	17	PBLS6003D	61	PBSS3540M	59
NX1117C50Z	69	NZX2V4B	17	NZX8V2B	17	PBLS6004D	61	PBSS4021NT	57
NX1117CADJZ	69	NZX2V7A	17	NZX8V2C	17	PBLS6005D	61	PBSS4021NX	56
NX1117I120Z	69	NZX2V7B	17	NZX8V2D	17	PBLS6021D	61	PBSS4021NZ	56
NX1117I12Z	69	NZX2V7C	17	NZX9V1A	17	PBLS6022D	61	PBSS4021PT	59
NX1117I15Z	69	NZX30A	17	NZX9V1B	17	PBLS6023D	61	PBSS4021PX	58
NX1117I18Z	69	NZX30B	17	NZX9V1C	17	PBLS6024D	61	PBSS4021PZ	58
NX1117I19Z	69	NZX30C	17	NZX9V1D	17	PBRN113ET	55	PBSS4021SN	60
NX1117I20Z	69	NZX30X	17	NZX9V1E	17	PBRN113ZT	55	PBSS4021SP	60
NX1117I25Z	69	NZX33A	17	PBHV8115T	62	PBRN123ET	55	PBSS4021SPN	60
NX1117I285Z	69	NZX33B	17	PBHV8115Z	62	PBRN123YT	55	PBSS4032ND	56
NX1117I33Z	69	NZX33C	17	PBHV8140Z	62	PBRP113ET	55	PBSS4032NT	57
NX1117I50Z	69	NZX36A	17	PBHV8215Z	62	PBRP113ZT	55	PBSS4032NX	56
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NZX series	16	NZX36X	17	PBHV8550Z	62	PBSS2515E	57	PBSS4032PD	65
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NZX10B	17	NZX3V0B	17	PBHV9040Z	62	PBSS2515VPN	60	PBSS4032PX	58
NZX10C	17	NZX3V0C	17	PBHV9050T	62	PBSS2515VS	60	PBSS4032PZ	58
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NZX11A	17	NZX3V3B	17	PBHV9115T	62	PBSS2540M	57	PBSS4032SN	60
NZX11B	17	NZX3V3C	17	PBHV9115X	62	PBSS301ND	56	PBSS4032SP	60
NZX11C	17	NZX3V6A	17	PBHV9115Z	62	PBSS301NX	56	PBSS4032SPN	60
NZX11D	17	NZX3V6B	17	PBHV9215Z	62	PBSS301NZ	56	PBSS4041NT	57
NZX12A	17	NZX3V6C	17	PBLS1501Y	61	PBSS301PD	58	PBSS4041NX	56
NZX12B	17	NZX3V9A	17	PBLS1502V	61	PBSS301PX	58	PBSS4041NZ	56
NZX12C	17	NZX3V9B	17	PBLS1502Y	61	PBSS301PZ	58	PBSS4041PT	59
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NZX12X	17	NZX4V3A	17	PBLS1503Y	61	PBSS302NX	56	PBSS4041PZ	58
NZX13A	17	NZX4V3B	17	PBLS1504V	61	PBSS302NZ	56	PBSS4041SN	60
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PBSS4130T	57	PBSS5350S	60	PDTA123JT	54	PDTC114ET	54	PDTC143ZM	54
PBSS4140DPN	60	PBSS5350T	59	PDTA123JU	54	PDTC114EU	54	PDTC143ZT	54
PBSS4140T	57	PBSS5350X	58	PDTA123TE	54	PDTC114TE	54	PDTC143ZU	54
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PBSS4160U	57	PBSS5560PA	59	PDTA123YT	54	PDTC114YT	54	PDTC144TM	54
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PBSS4220V	57	PBSS5612PA	59	PDTA124EE	54	PDTC115EE	54	PDTC144TU	54
PBSS4230T	57	PBSS5620PA	59	PDTA124EM	54	PDTC115EM	54	PDTC144VE	54
PBSS4240DPN	60	PBSS5630PA	59	PDTA124ET	54	PDTC115ET	54	PDTC144VM	54
PBSS4240T	57	PBSS8110D	56	PDTA124EU	54	PDTC115EU	54	PDTC144VT	54
PBSS4240V	57	PBSS8110T	57	PDTA124TE	54	PDTC115TE	54	PDTC144VU	54
PBSS4240Y	57	PBSS8110X	56	PDTA124TM	54	PDTC115TM	54	PDTC144WE	54
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PBSS4350Z	56	PDTA113EM	54	PDTA143TE	54	PDTC123TE	54	PEMB10	55
PBSS4480X	56	PDTA113ET	54	PDTA143TM	54	PDTC123TM	54	PEMB11	55
PBSS4520X	56	PDTA113EU	54	PDTA143TT	54	PDTC123TT	54	PEMB13	55
PBSS4540X	56	PDTA113ZE	54	PDTA143TU	54	PDTC123TU	54	PEMB14	55
PBSS4540Z	56	PDTA113ZM	54	PDTA143XE	54	PDTC123YE	54	PEMB15	55
PBSS4560PA	57	PDTA113ZT	54	PDTA143XM	54	PDTC123YM	54	PEMB16	55
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PBSS4612PA	57	PDTA114EE	54	PDTA143XU	54	PDTC123YU	54	PEMB18	55
PBSS4620PA	57	PDTA114EM	54	PDTA143ZE	54	PDTC124EE	54	PEMB19	55
PBSS4630PA	57	PDTA114ET	54	PDTA143ZM	54	PDTC124EM	54	PEMB2	55
PBSS5120T	59	PDTA114EU	54	PDTA143ZT	54	PDTC124ET	54	PEMB20	55
PBSS5130T	59	PDTA114TE	54	PDTA143ZU	54	PDTC124EU	54	PEMB24	55
PBSS5140T	59	PDTA114TM	54	PDTA144EE	54	PDTC124TE	54	PEMB3	55
PBSS5140U	59	PDTA114TT	54	PDTA144EM	54	PDTC124TM	54	PEMB30	55
PBSS5140V	59	PDTA114TU	54	PDTA144ET	54	PDTC124TT	54	PEMB4	55
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PBSS5160T	59	PDTA114YM	54	PDTA144TE	54	PDTC124XE	54	PEMD10	55
PBSS5160U	59	PDTA114YT	54	PDTA144TM	54	PDTC124XM	54	PEMD12	55
PBSS5160V	59	PDTA114YU	54	PDTA144TT	54	PDTC124XT	54	PEMD13	55
PBSS5220T	59	PDTA115EE	54	PDTA144TU	54	PDTC124XU	54	PEMD14	55
PBSS5220V	59	PDTA115EM	54	PDTA144VE	54	PDTC143EE	54	PEMD15	55
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PBSS5240T	59	PDTA115EU	54	PDTA144VT	54	PDTC143ET	54	PEMD17	55
PBSS5240V	59	PDTA115TE	54	PDTA144VU	54	PDTC143EU	54	PEMD18	55
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PBSS5320D	58	PDTA123EE	54	PDTB113ZT	55	PDTC143TU	54	PEMD24	55
PBSS5320T	59	PDTA123EM	54	PDTB123ET	55	PDTC143XE	54	PEMD3	55
PBSS5320X	58	PDTA123ET	54	PDTB123TT	55	PDTC143XM	54	PEMD30	55
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PMBT2907	49	PMEG2010EH	11	PMEG4005AEA	11	PMK35EP	86	PMV31XN	75
PMBT2907A	49	PMEG2010EJ	11	PMEG4005AEV	11	PMK50XP	86	PMV40UN	75
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PMBTA13	51	PMEG3005AEA	11	PMEG4030EP	10	PMP4201Y	50	PRTR5V0U2X	29
PMBTA14	51	PMEG3005AEV	11	PMEG4030ER	10	PMP4501G	50	PRTR5V0U4AD	30
PMBTA42	51	PMEG3005CT	12	PMEG4050EP	10	PMP4501V	50	PRTR5V0U4D	30
PMBTA42DS	51	PMEG3005EB	11	PMEG6002EB	11	PMP4501Y	50	PRTR5V0U4Y	30
PMBTA44	51	PMEG3005EH	11	PMEG6002EJ	11	PMP5201G	50	PRTR5V0U8S	31
PMBTA45	62	PMEG3005EJ	11	PMEG6002TV	12	PMP5201V	50	PSMN003-30P	83
PMBTA56	48	PMEG3005EL	11	PMEG6010AED	10	PMP5201Y	50	PSMN004-36B	82
PMBTA64	51	PMEG3005ET	10	PMEG6010CEH	11	PMP5501G	50	PSMN004-60B	84
PMBTA92	51	PMEG3010BEA	11	PMEG6010CEJ	11	PMP5501V	50	PSMN005-25D	80
PMD2001D	53	PMEG3010BEP	10	PMEG6010CPA	12	PMP5501Y	50	PSMN005-30K	82
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PMD9001D	53	PMEG3010BEV	11	PMEG6010ER	10	PMR290XN	75	PSMN005-55P	83
PMD9002D	53	PMEG3010CEH	11	PMEG6020EP	10	PMR370XN	75	PSMN005-75B	84
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PMEG2005AEV	11	PMEG3020CEP	10	PMF290XN	75	PMST5088	48	PSMN015-100P	85
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