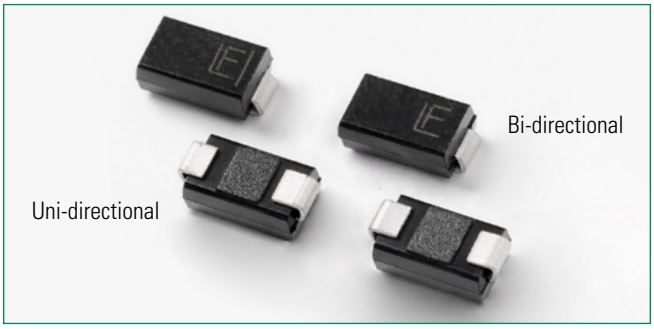
THE DATASHEET OF

P4SMA33CA

TVS Diodes

Surface Mount – 400W > P4SMA series

P4SMA Series



Description

The P4SMA series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

Features

- 400W peak pulse power capability at 10/1000μs waveform, repetition rate (duty cycles):0.01%
- Excellent clamping capability
- Low incremental surge resistance
- Typical I_R less than 1μA when V_{BR} min>12V
- Optimized surface mount footprint for minimal PCB space impact
- Low profile package
- Typical failure mode due to exceeding maximum ratings is a short circuit condition
- Whisker test conducted based on Table 4a and 4c of JEDEC JESD201A
- IEC 61000-4-2 ESD 30kV(Air), 30kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Built-in strain relief
- Fast response time: typically less than 1.0ps from 0V to BV min
- High temperature to reflow soldering guaranteed: 260°C/40sec
- V_{BR} @ T_J= V_{BR}@25°C x (1+αT x (T_J - 25)) (αT:Temperature Coefficient, typical value is 0.1%)
- UL Recognized epoxy meeting flammability classification V-0
- Meet MSL level1, per J-STD-020, LF maximun peak of 260°C
- Matte tin lead–free Plated
- Halogen-free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

Agency Approvals

Agency	Agency File Number
UL	E230531

Maximum Ratings and Thermal Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation at T_A=25°C by 10/1000us Waveform(Fig.2)(Note 1), (Note 2) Single Die Parts	P_{PPM}	400	W
Peak Pulse Power Dissipation at TA=25°C by 10/1000us Waveform(Fig.2)(Note 1), (Note 2) Stacked Die Parts(Note 5)	P_{PPM}	600	W
Power Dissipation on Infinite Heat Sink at T_L=50°C	P_D	3.3	W
Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)	I_{FSM}	60	A
Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only (Note 4)	V_F	3.5/5.0	V
Operating Temperature Range	T_J	-65 to 150	°C
Storage Temperature Range	T_{STG}	-65 to 175	°C
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	30	°C/W
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	120	°C/W

Notes:
1. Non-repetitive current pulse, per Fig.4 and derated above T_J (initial) =25°C per Fig. 3.
2. Mounted on 5.0x5.0mm copper pad to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only.
4. V_F < 3.5V for single die parts and V_F< 5.0V for stacked-die parts.
5. For stacked die component details, please refer to part numbers labeled by * in Electrical Characteristics.

Functional Diagram

Applications

TVS devices are ideal for the protection of I/O Interfaces, V_{CC} bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

Additional Infomarion

Datasheet | Resources | Samples

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TVS Diodes

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Electrical Characteristics (T_A=25°C unless otherwise noted)

Part Number (Uni)	Part Number (Bi)	Marking		Reverse Stand off Voltage V_R (Volts)	Breakdown Voltage V_{BR} (Volts) @ I_T		Test Current I_T (mA)	Maximum Clamping Voltage V_C @ I_{PP} (V)	Maximum Peak Pulse Current I_{PP} (A)	Maximum Reverse Leakage I_R @ V_R (µA)	Maximum Temperature Coefficient of V_{BR} (%/C)	Agency Approval
		Uni	Bi		Min	Max						
P4SMA6.8A	P4SMA6.8CA	6V8A	6V8C	5.80	6.45	7.14	10	10.5	39.0	1000	0.041	X
P4SMA7.5A	P4SMA7.5CA	7V5A	7V5C	6.40	7.13	7.88	10	11.3	36.3	500	0.052	X
P4SMA8.2A	P4SMA8.2CA	8V2A	8V2C	7.02	7.79	8.61	10	12.1	33.9	200	0.058	X
P4SMA9.1A	P4SMA9.1CA	9V1A	9V1C	7.78	8.65	9.55	1	13.4	30.6	50	0.063	X
P4SMA10A	P4SMA10CA	10A	10C	8.55	9.50	10.50	1	14.5	28.3	10	0.066	X
P4SMA11A	P4SMA11CA	11A	11C	9.40	10.50	11.60	1	15.6	26.3	5	0.069	X
P4SMA12A	P4SMA12CA	12A	12C	10.20	11.40	12.60	1	16.7	24.6	5	0.071	X
P4SMA13A	P4SMA13CA	13A	13C	11.10	12.40	13.70	1	18.2	22.5	1	0.074	X
P4SMA15A	P4SMA15CA	15A	15C	12.80	14.30	15.80	1	21.2	19.3	1	0.076	X
P4SMA16A	P4SMA16CA	16A	16C	13.60	15.20	16.80	1	22.5	18.2	1	0.080	X
P4SMA18A	P4SMA18CA	18A	18C	15.30	17.10	18.90	1	25.5	16.1	1	0.083	X
P4SMA20A	P4SMA20CA	20A	20C	17.10	19.00	21.00	1	27.7	14.8	1	0.085	X
P4SMA22A	P4SMA22CA	22A	22C	18.80	20.90	23.10	1	30.6	13.4	1	0.088	X
P4SMA24A	P4SMA24CA	24A	24C	20.50	22.80	25.20	1	33.2	12.3	1	0.091	X
P4SMA27A	P4SMA27CA	27A	27C	23.10	25.70	28.40	1	37.5	10.9	1	0.092	X
P4SMA30A	P4SMA30CA	30A	30C	25.60	28.50	31.50	1	41.4	9.9	1	0.093	X
P4SMA33A	P4SMA33CA	33A	33C	28.20	31.40	34.70	1	45.7	9.0	1	0.094	X
P4SMA36A	P4SMA36CA	36A	36C	30.80	34.20	37.80	1	49.9	8.2	1	0.096	X
P4SMA39A	P4SMA39CA	39A	39C	33.30	37.10	41.00	1	53.9	7.6	1	0.097	X
P4SMA43A	P4SMA43CA	43A	43C	36.80	40.90	45.20	1	59.3	6.9	1	0.098	X
P4SMA47A	P4SMA47CA	47A	47C	40.20	44.70	49.40	1	64.8	6.3	1	0.099	X
P4SMA51A	P4SMA51CA	51A	51C	43.60	48.50	53.60	1	70.1	5.8	1	0.100	X
P4SMA56A	P4SMA56CA	56A	56C	47.80	53.20	58.80	1	77.0	5.3	1	0.101	X
P4SMA62A	P4SMA62CA	62A	62C	53.00	58.90	65.10	1	85.0	4.8	1	0.102	X
P4SMA68A	P4SMA68CA	68A	68C	58.10	64.60	71.40	1	92.0	4.5	1	0.103	X
P4SMA75A	P4SMA75CA	75A	75C	64.10	71.30	78.80	1	103.0	4.0	1	0.104	X
P4SMA82A	P4SMA82CA	82A	82C	70.10	77.90	86.10	1	113.0	3.6	1	0.105	X
P4SMA91A	P4SMA91CA	91A	91C	77.80	86.50	95.50	1	125.0	3.3	1	0.106	X
P4SMA100A	P4SMA100CA	100A	100C	85.50	95.00	105.00	1	137.0	3.0	1	0.106	X
P4SMA110A	P4SMA110CA	110A	110C	94.00	105.00	116.00	1	152.0	2.7	1	0.107	X
P4SMA120A	P4SMA120CA	120A	120C	102.00	114.00	126.00	1	165.0	2.5	1	0.107	X
P4SMA130A	P4SMA130CA	130A	130C	111.00	124.00	137.00	1	179.0	2.3	1	0.107	X
P4SMA150A	P4SMA150CA	150A	150C	128.00	143.00	158.00	1	207.0	2.0	1	0.108	X
P4SMA160A	P4SMA160CA	160A	160C	136.00	152.00	168.00	1	219.0	1.9	1	0.108	X
P4SMA170A	P4SMA170CA	170A	170C	145.00	162.00	179.00	1	234.0	1.8	1	0.108	X
P4SMA180A	P4SMA180CA	180A	180C	154.00	171.00	189.00	1	246.0	1.7	1	0.108	X
P4SMA200A	P4SMA200CA	200A	200C	171.00	190.00	210.00	1	274.0	1.5	1	0.108	X
P4SMA220A	P4SMA220CA	220A	220C	185.00	209.00	231.00	1	328.0	1.3	1	0.110	-
P4SMA250A	-	250A	-	214.00	237.00	263.00	1	344.0	1.2	1	0.110	-
-	P4SMA250CA*	-	250C	214.00	237.00	263.00	1	344.0	1.8	1	0.110	-
P4SMA300A	-	300A	-	256.00	285.00	315.00	1	414.0	1.0	1	0.110	-
-	P4SMA300CA*	-	300C	256.00	285.00	315.00	1	414.0	1.5	1	0.110	-
P4SMA350A*	P4SMA350CA*	350A	350C	300.00	332.00	368.00	1	482.0	1.3	1	0.112	-
P4SMA400A*	P4SMA400CA*	400A	400C	342.00	380.00	420.00	1	548.0	1.1	1	0.112	-
P4SMA440A*	P4SMA440CA*	440A	440C	376.00	418.00	462.00	1	602.0	1.0	1	0.112	-
P4SMA480A*	P4SMA480CA*	480A	480C	408.00	456.00	504.00	1	658.0	1.0	1	0.112	-
P4SMA510A*	P4SMA510CA*	510A	510C	434.00	485.00	535.00	1	698.0	0.9	1	0.112	-
P4SMA530A*	P4SMA530CA*	530A	530C	451.00	503.50	556.50	1	725.0	0.9	1	0.112	-
P4SMA540A*	P4SMA540CA*	540A	540C	460.00	513.00	567.00	1	740.0	0.9	1	0.112	-
P4SMA550A*	P4SMA550CA*	550A	550C	468.00	522.50	577.50	1	760.0	0.8	1	0.112	-

For bidirectional type having V_R of 10 volts and less, the I_R limit is double.
V_{BR} @ T_J= V_{BR}@25°C x (1+aT x (TJ - 25)) (aT:Temperature Coefficient)
For stack-die parts, use * to label the part number.

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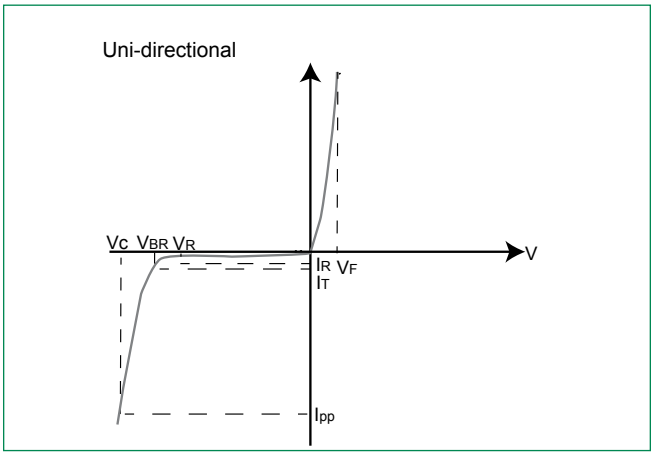
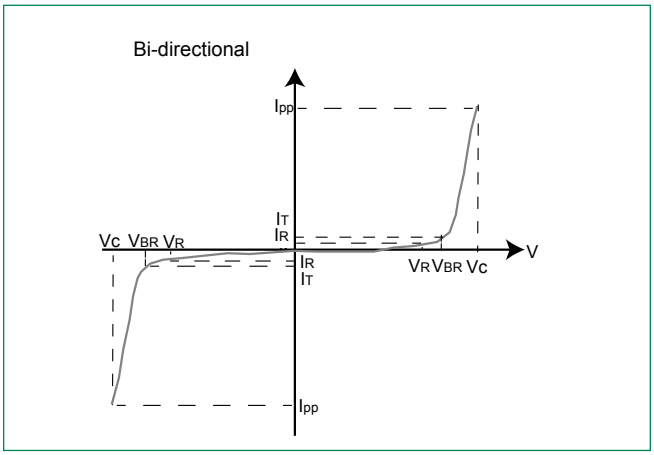
I-V Curve Characteristics





P_{PPM} Peak Pulse Power Dissipation -- Max power dissipation
V_R Stand-off Voltage -- Maximum voltage that can be applied to the TVS without operation
V_{BR} Breakdown Voltage -- Maximum voltage that flows though the TVS at a specified test current (I_T)
V_C Clamping Voltage -- Peak voltage measured across the TVS at a specified Ippm (peak impulse current)
I_R Reverse Leakage Current -- Current measured at V_R
V_F Forward Voltage Drop for Uni-directional

Ratings and Characteristic Curves (T_A=25°C unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform

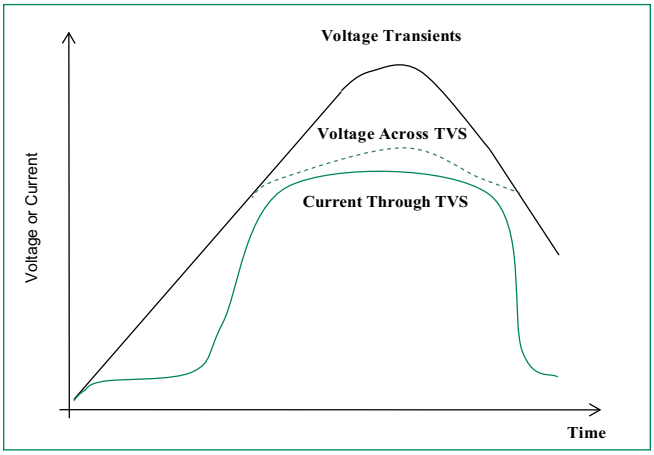
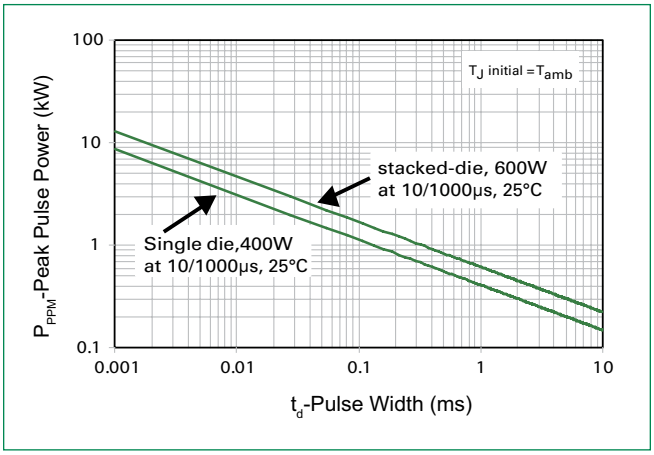


Figure 2 - Peak Pulse Power Rating Curve



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Ratings and Characteristic Curves (T_A=25°C unless otherwise noted) (Continued)

Figure 3 - Peak Pulse Power Derating Curve

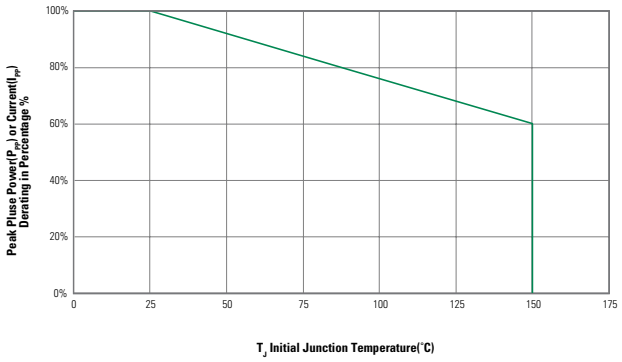


Figure 4 - Pulse Waveform

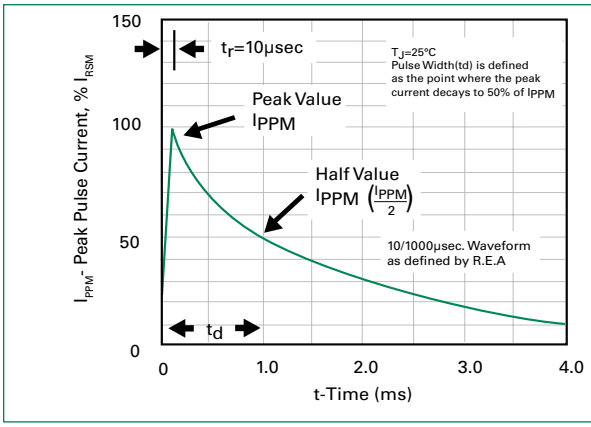


Figure 5 - Typical Junction Capacitance

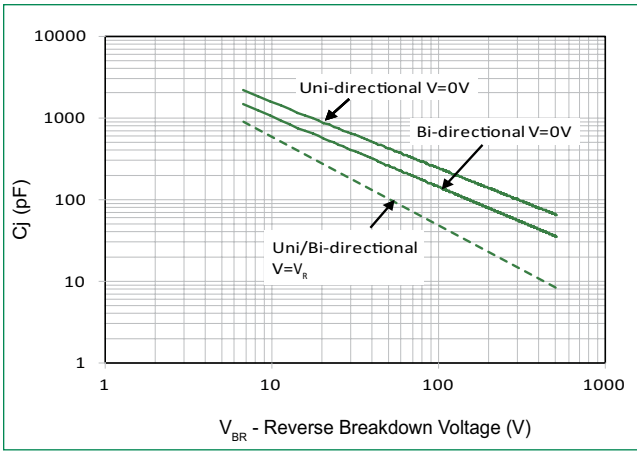


Figure 6 - Typical Transient Thermal Impedance

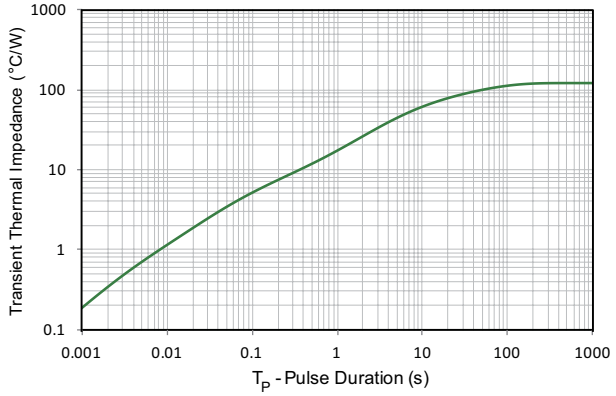


Figure 7 - Maximum Non-Repetitive Forward Surge Current Uni-Directional Only

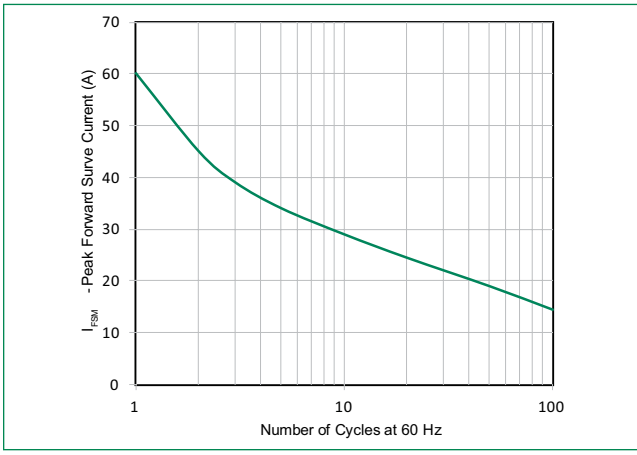
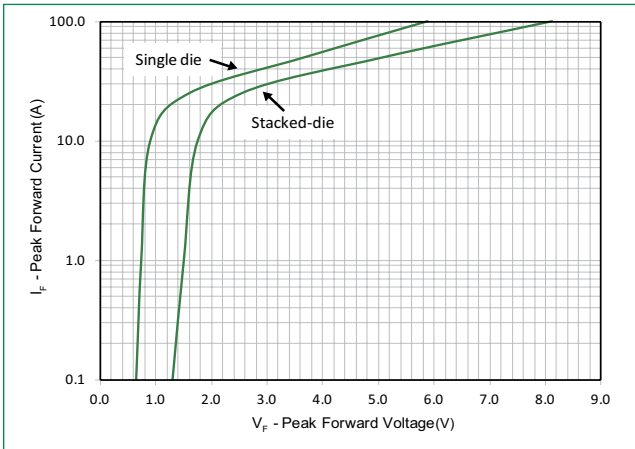


Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)



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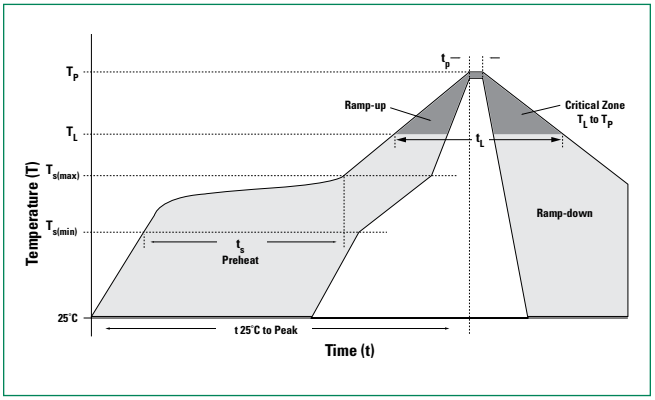
Surface Mount – 400W > P4SMA series

Soldering Parameters

Reflow Condition		Lead–free assembly
Pre Heat	**- Temperature Min ($T_{s(min)}$)**	150°C
	- Temperature Max ($T_{s(max)}$)	200°C
	- Time (min to max) (t_s)	60 – 120 secs
Average ramp up rate (Liquidus Temp (T_L) to peak		3°C/second max
$T_{S(max)}$ to T_L - Ramp-up Rate		3°C/second max
Reflow	**- Temperature (T_L) (Liquidus)**	217°C
	- Time (min to max) (t_L)	60 – 150 seconds
Peak Temperature (T_p)		$260^{+0/-5}$ °C
Time within 5°C of actual peak Temperature (t_p)		30 seconds max
Ramp-down Rate		6°C/second max
Time 25°C to peak Temperature (T_p)		8 minutes Max.
Do not exceed		260°C



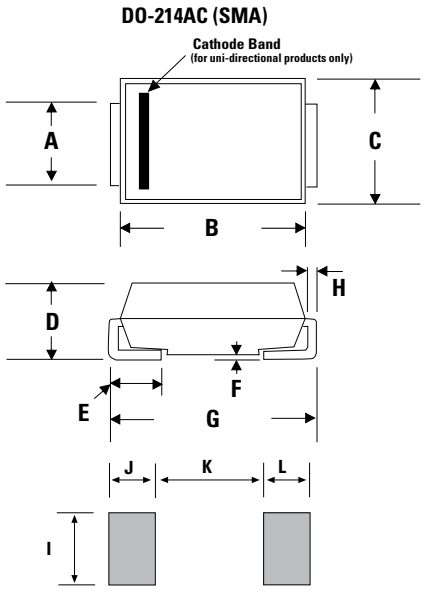
Physical Specifications

Weight	0.002 ounce, 0.061 gram
Case	JEDEC DO-214AC. Molded plastic body over glass passivated junction
Polarity	Color band denotes positive end (cathode) except bidirectional
Terminal	Matte Tin-plated leads, Solderable per JESD22-B102

Environmental Specifications

High Temp. Storage	JESD22-A103
HTRB	JESD22-A108
Temperature Cycling	JESD22-A104
MSL	JEDEC-J-STD-020, Level 1
H3TRB	JESD22-A101
RSH	JESD22-A111

Dimensions



Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	0.049	0.065	1.250	1.650
B	0.157	0.181	3.990	4.600
C	0.095	0.110	2.400	2.790
D	0.075	0.090	1.900	2.290
E	0.030	0.060	0.780	1.520
F	-	0.008	-	0.203
G	0.189	0.208	4.800	5.280
H	0.006	0.012	0.152	0.305
I	0.070	-	1.800	-
J	0.082	-	2.100	-
K	-	0.090	-	2.300
L	0.082	-	2.100	-

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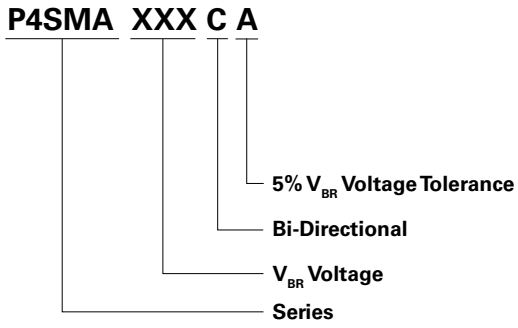
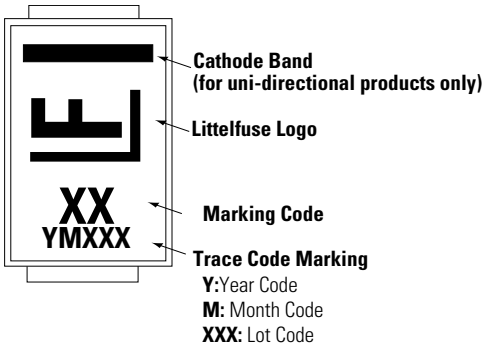
Part Numbering System



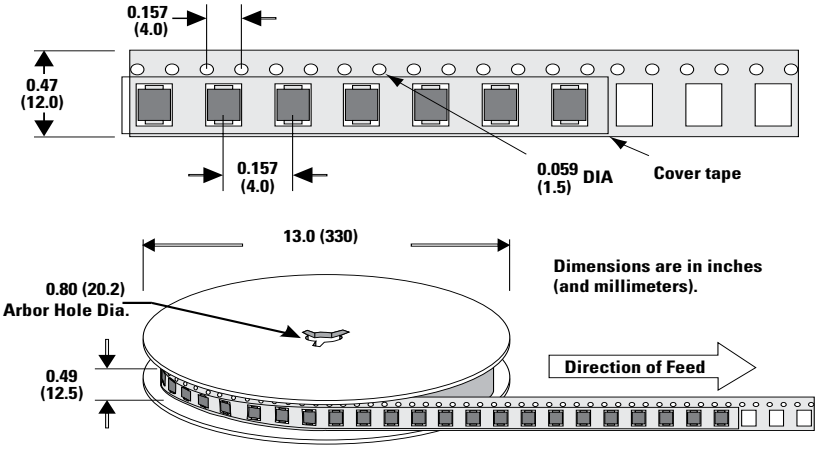
Part Marking System

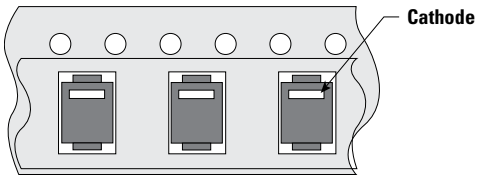


Packaging

Part number	Component Package	Quantity	Packaging Option	Packaging Specification
P4SMAxxxXX	DO-214AC	5000	Tape & Reel - 12mm tape/13" reel	EIA STD RS-481

Tape and Reel Specification





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