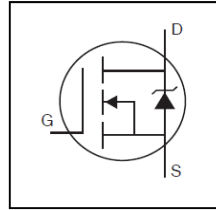




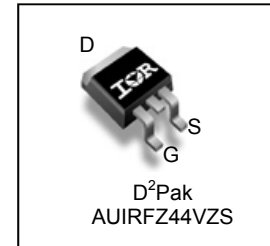
THE DATASHEET OF SM6227JT8R20

Features

- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to T_{jmax}
- Lead-Free, RoHS Compliant
- Automotive Qualified *



V_{DS}	60V
$R_{DS(on)}$ typ.	9.6mΩ
max.	12mΩ
I_D	57A



G	D	S
Gate	Drain	Source

Description

Specifically designed for Automotive applications, this HEXFET® Power MOSFET utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this design are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in Automotive applications and a wide variety of other applications

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRFZ44VZS	D²-Pak	Tube	50	AUIRFZ44VZS
		Tape and Reel Left	800	AUIRFZ44VZSTRL

Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature (T_A) is 25°C, unless otherwise specified.

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	57	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	40	
I_{DM}	Pulsed Drain Current ①	230	
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	92	W
	Linear Derating Factor	0.61	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS} (Thermally Limited)	Single Pulse Avalanche Energy (Thermally Limited) ②	73	mJ
E_{AS} (Tested)	Single Pulse Avalanche Energy (Tested Limited) ③	110	
I_{AR}	Avalanche Current ④	See Fig. 12a, 12b, 15, 16	A
E_{AR}	Repetitive Avalanche Energy ⑤		mJ
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.64	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount), D² Pak ⑦	—	40	

HEXFET® is a registered trademark of Infineon.

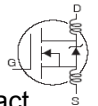
*Qualification standards can be found at www.infineon.com

Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	60	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.061	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	9.6	12	m Ω	$V_{GS} = 10V, I_D = 34A$ ③
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
g_{fs}	Forward Trans conductance	25	—	—	S	$V_{DS} = 25V, I_D = 34A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 60V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 60V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -20V$

Dynamic Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

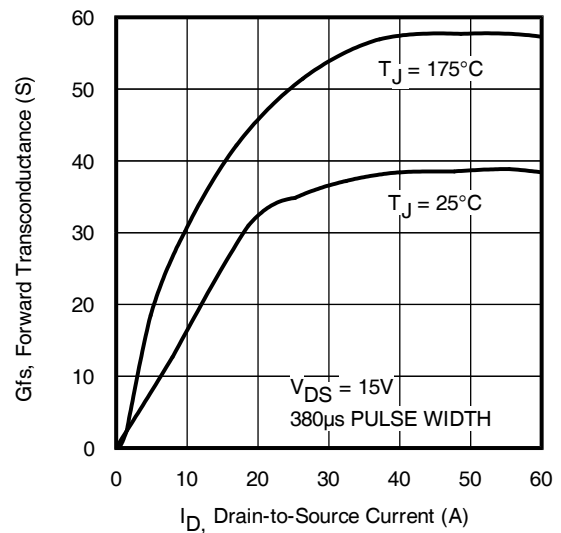
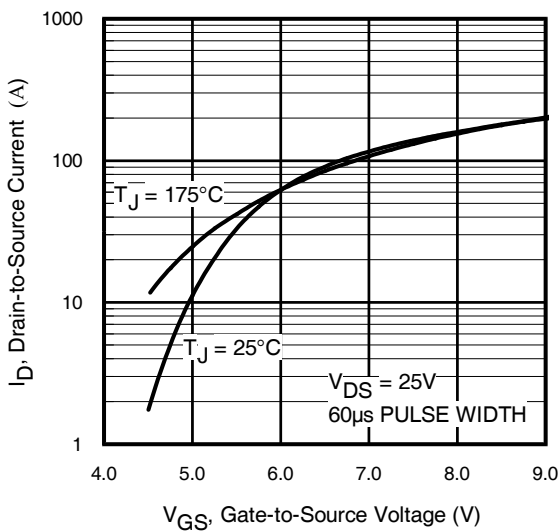
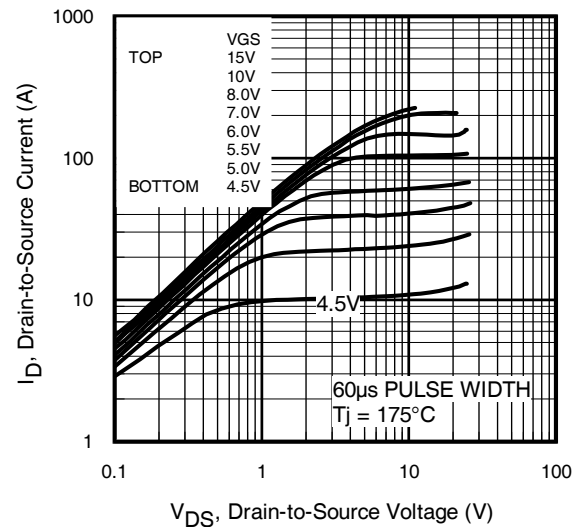
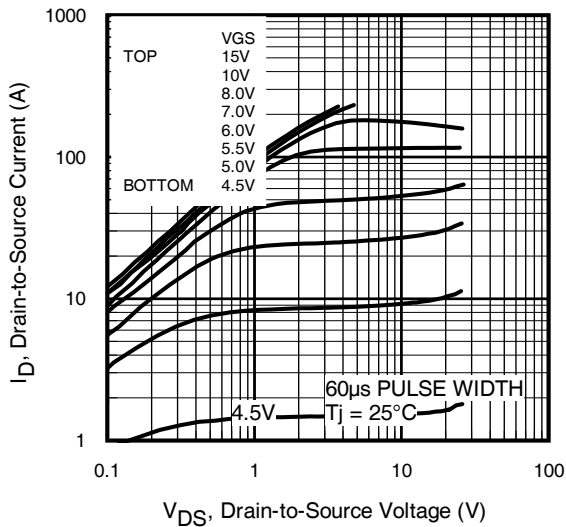
Q_g	Total Gate Charge	—	43	65	nC	$I_D = 34A$
Q_{gs}	Gate-to-Source Charge	—	11	—		$V_{DS} = 48V$
Q_{gd}	Gate-to-Drain Charge	—	18	—		$V_{GS} = 10V$ ③
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	$V_{DD} = 30V$
t_r	Rise Time	—	62	—		$I_D = 34A$
$t_{d(off)}$	Turn-Off Delay Time	—	35	—		$R_G = 12\Omega$
t_f	Fall Time	—	38	—		$V_{GS} = 10V$ ③
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L_S	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	1690	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	270	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	130	—		$f = 1.0MHz$
C_{oss}	Output Capacitance	—	1870	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
C_{oss}	Output Capacitance	—	260	—		$V_{GS} = 0V, V_{DS} = 48V, f = 1.0MHz$
$C_{oss\text{ eff.}}$	Effective Output Capacitance	—	510	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 48V$ ④

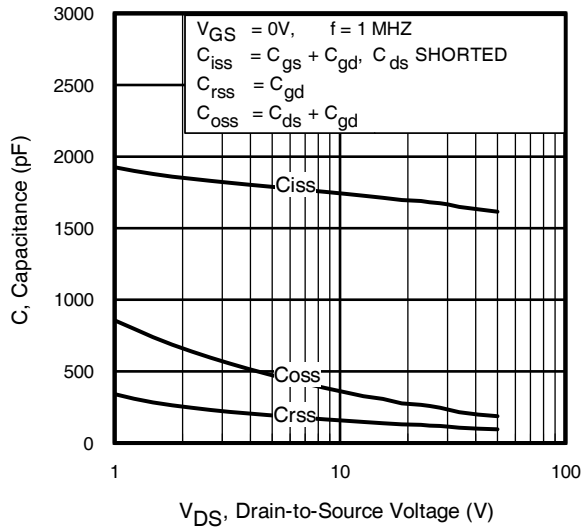
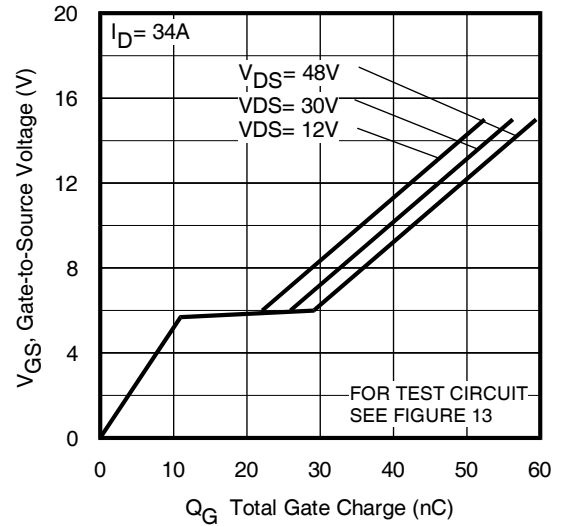
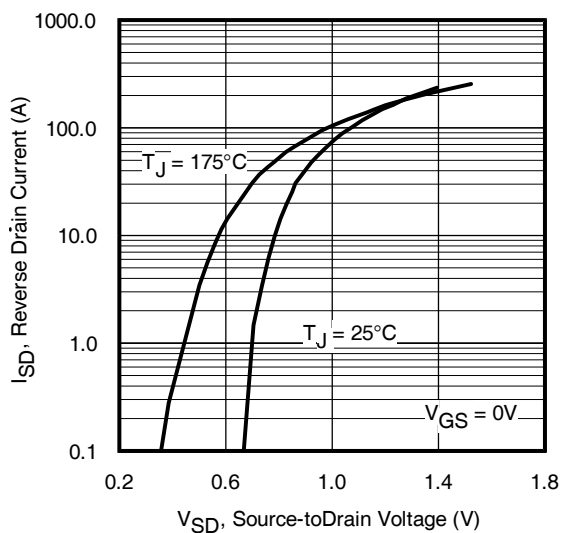
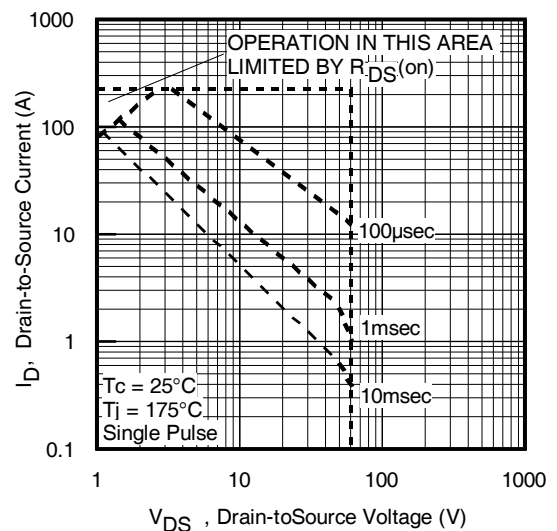

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	57	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	230		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 34A, V_{GS} = 0V$ ③
t_{rr}	Reverse Recovery Time	—	23	35	ns	$T_J = 25^\circ\text{C}, I_F = 34A, V_{DD} = 30V$
Q_{rr}	Reverse Recovery Charge	—	17	26	nC	$di/dt = 100A/\mu s$ ③
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig.11)
- ② Limited by T_{Jmax} , starting $T_J = 25^\circ\text{C}$, $L = 0.12mH$, $R_G = 25\Omega$, $I_{AS} = 34A$, $V_{GS} = 10V$. Part not recommended for use above this value.
- ③ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.
- ④ $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
- ⑤ Limited by T_{Jmax} , see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- ⑥ This value determined from sample failure population. 100% tested to this value in production, starting $T_J = 25^\circ\text{C}$, $L = 0.12mH$, $R_G = 25\Omega$, $I_{AS} = 34A$, $V_{GS} = 10V$.
- ⑦ This is applied to D²Pak, when mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994..




Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

Fig. 7 Typical Source-to-Drain Diode Forward Voltage

Fig 8. Maximum Safe Operating Area

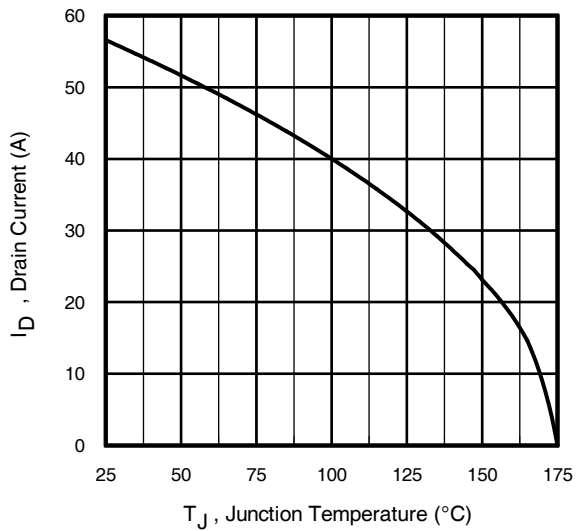


Fig 9. Maximum Drain Current Vs. Case Temperature

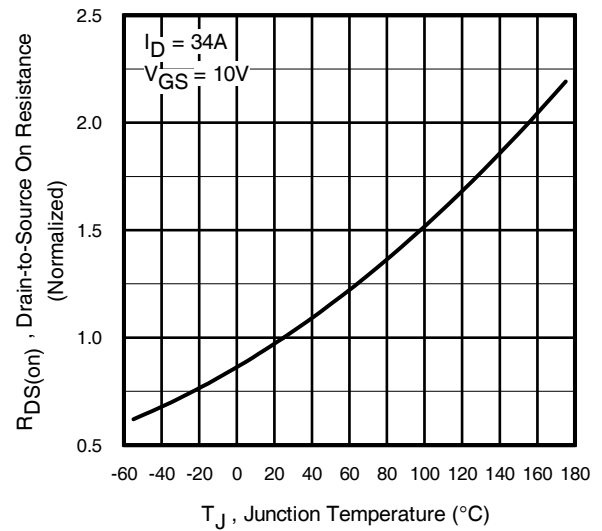


Fig 10. Normalized On-Resistance Vs. Temperature

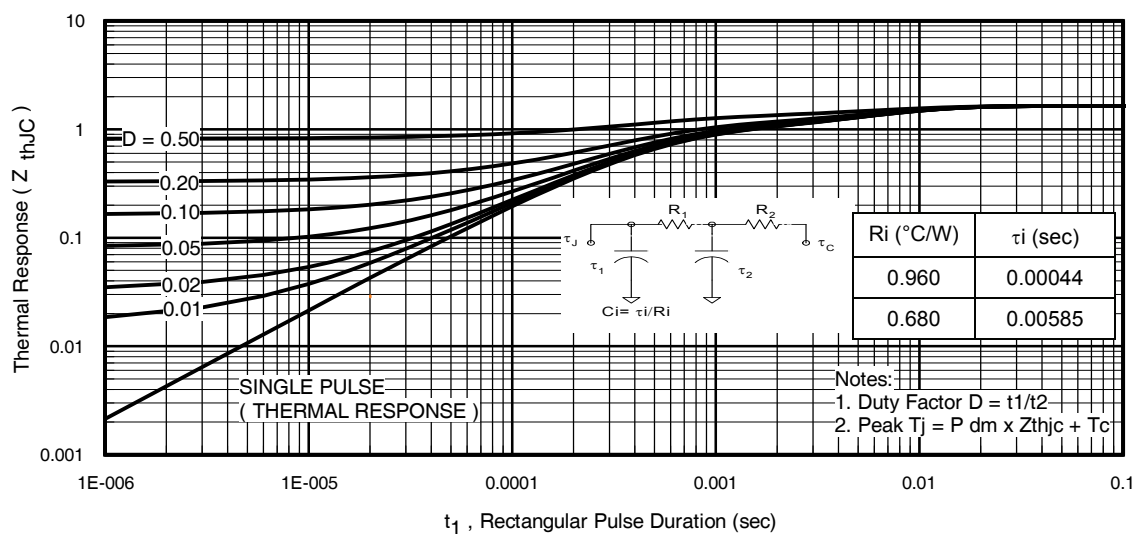
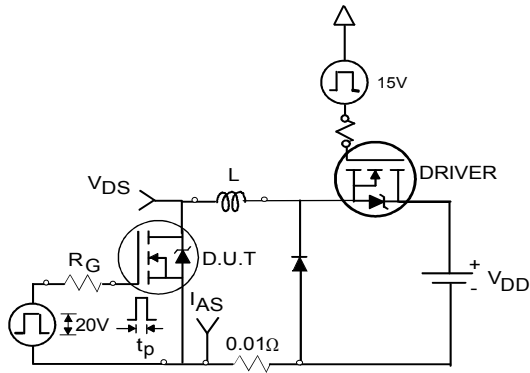
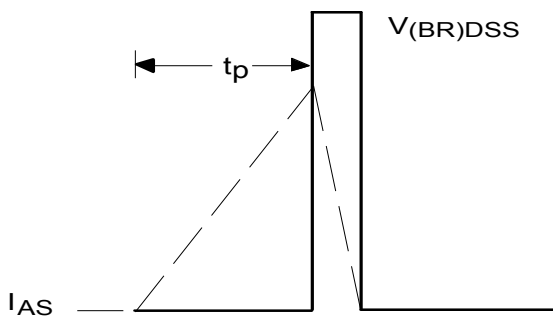
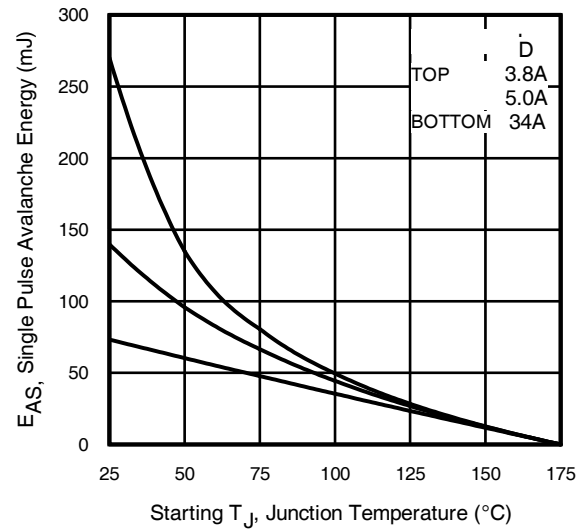
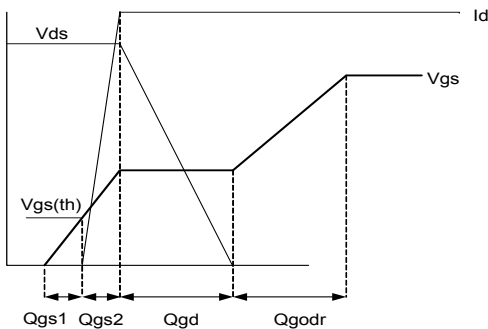
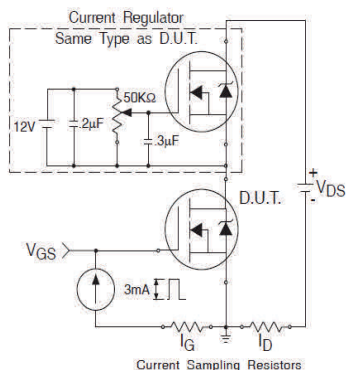
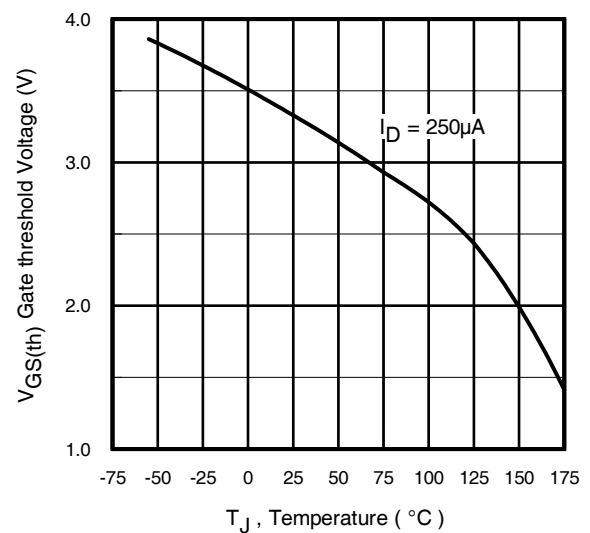


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case


Fig 12a. Unclamped Inductive Test Circuit

Fig 12b. Unclamped Inductive Waveforms

Fig 12c. Maximum Avalanche Energy vs. Drain Current

Fig 13a. Gate Charge Waveform

Fig 13b. Gate Charge Test Circuit

Fig 14. Threshold Voltage Vs. Temperature

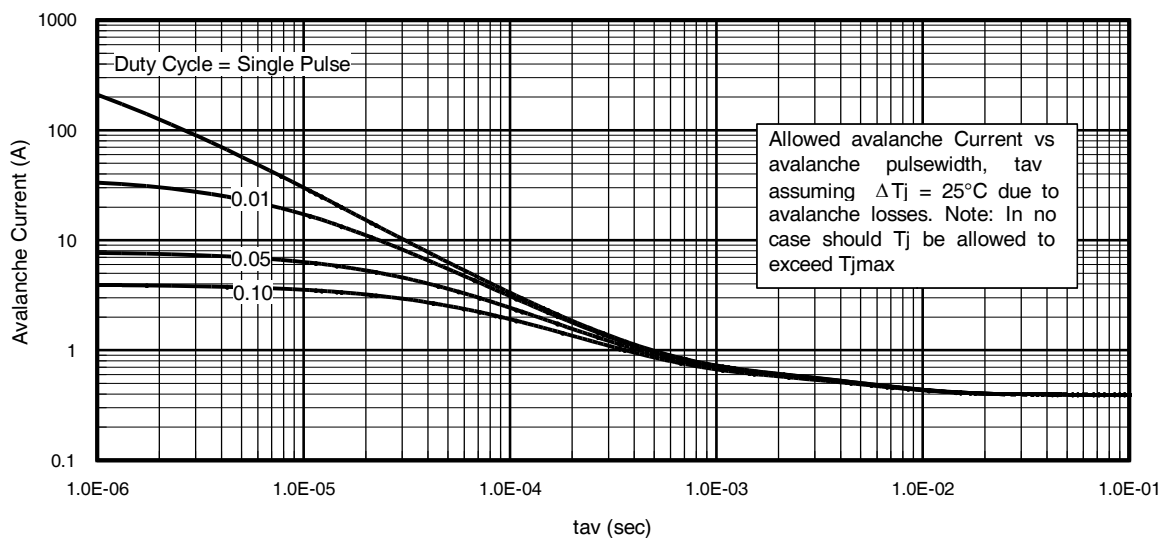
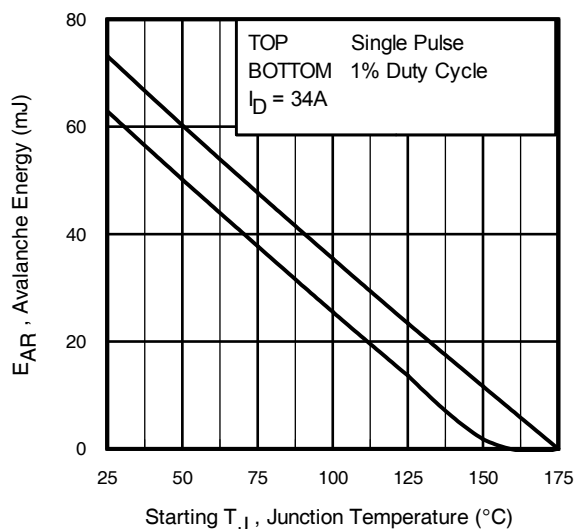


Fig 15. Typical Avalanche Current Vs. Pulse width



Notes on Repetitive Avalanche Curves , Figures 15, 16:
(For further info, see AN-1005 at www.infineon.com)

1. Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax} . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4. $P_{D(ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. I_{av} = Allowable avalanche current.
7. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°C in Figure 14, 15).
 t_{av} = Average time in avalanche.
 D = Duty cycle in avalanche = $t_{av} \cdot f$
 $Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see Figures 13)

$$P_{D(ave)} = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$

Fig 16. Maximum Avalanche Energy vs. Temperature

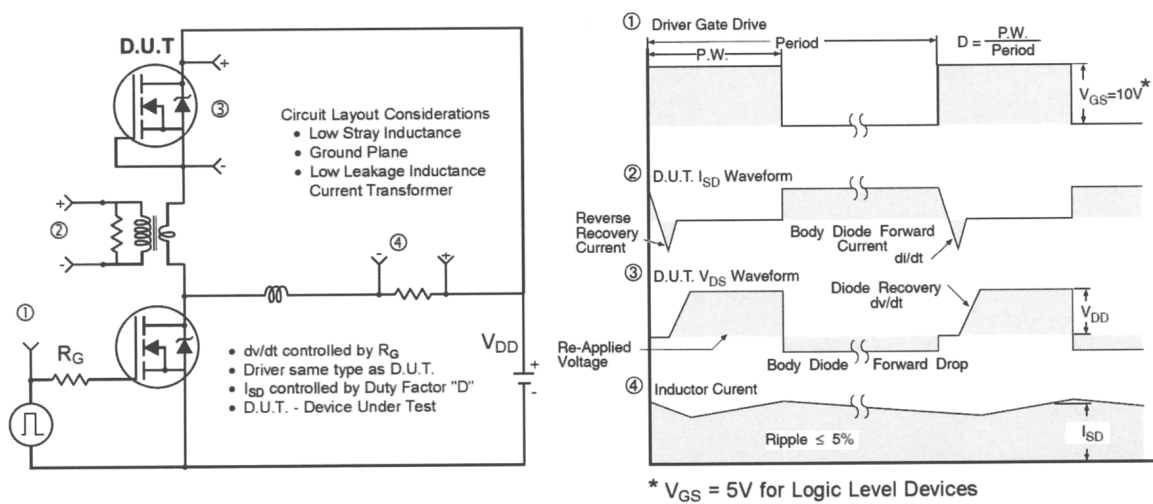


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

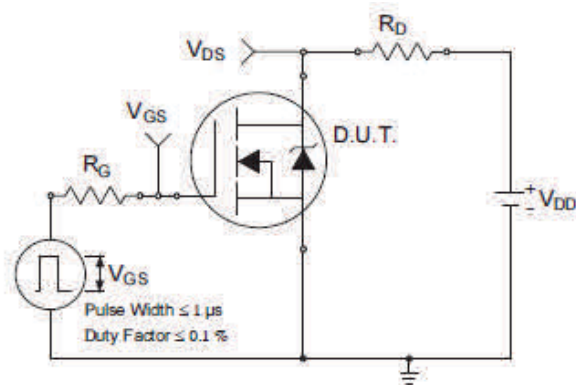


Fig 18a. Switching Time Test Circuit

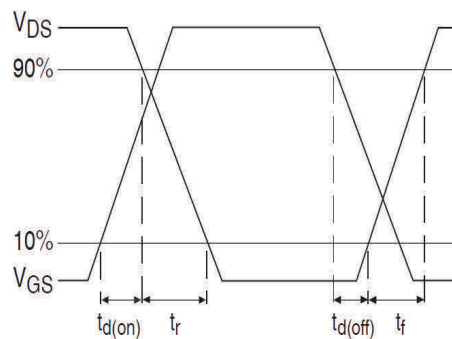
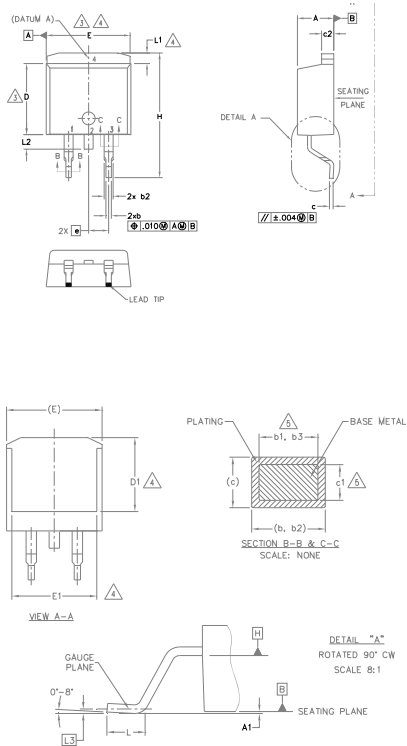


Fig 18b. Switching Time Waveforms

D²-Pak (TO-263AB) Package Outline (Dimensions are shown in millimeters (inches))



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1, b3 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

S Y M B O L	DIMENSIONS				N O T E S
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	5
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	5
c1	0.38	0.58	.015	.023	
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	
D1	6.86	—	.270	—	
E	9.65	10.67	.380	.420	3,4
E1	6.22	—	.245	—	4
e	2.54 BSC		.100 BSC		4
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	—	1.68	—	.066	
L2	—	1.78	—	.070	
L3	0.25 BSC		.010 BSC		

LEAD ASSIGNMENTS

DIODES

- 1.- ANODE (TWO DIE) / OPEN (ONE DIE)
- 2.- CATHODE
- 3.- ANODE

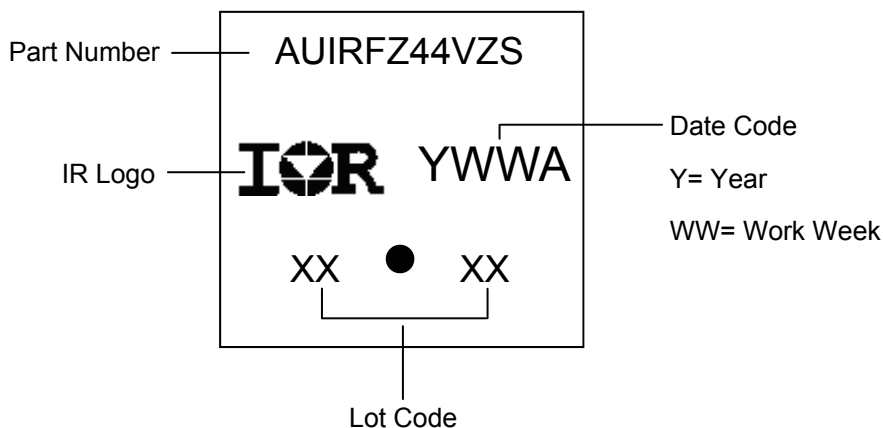
HEXFET

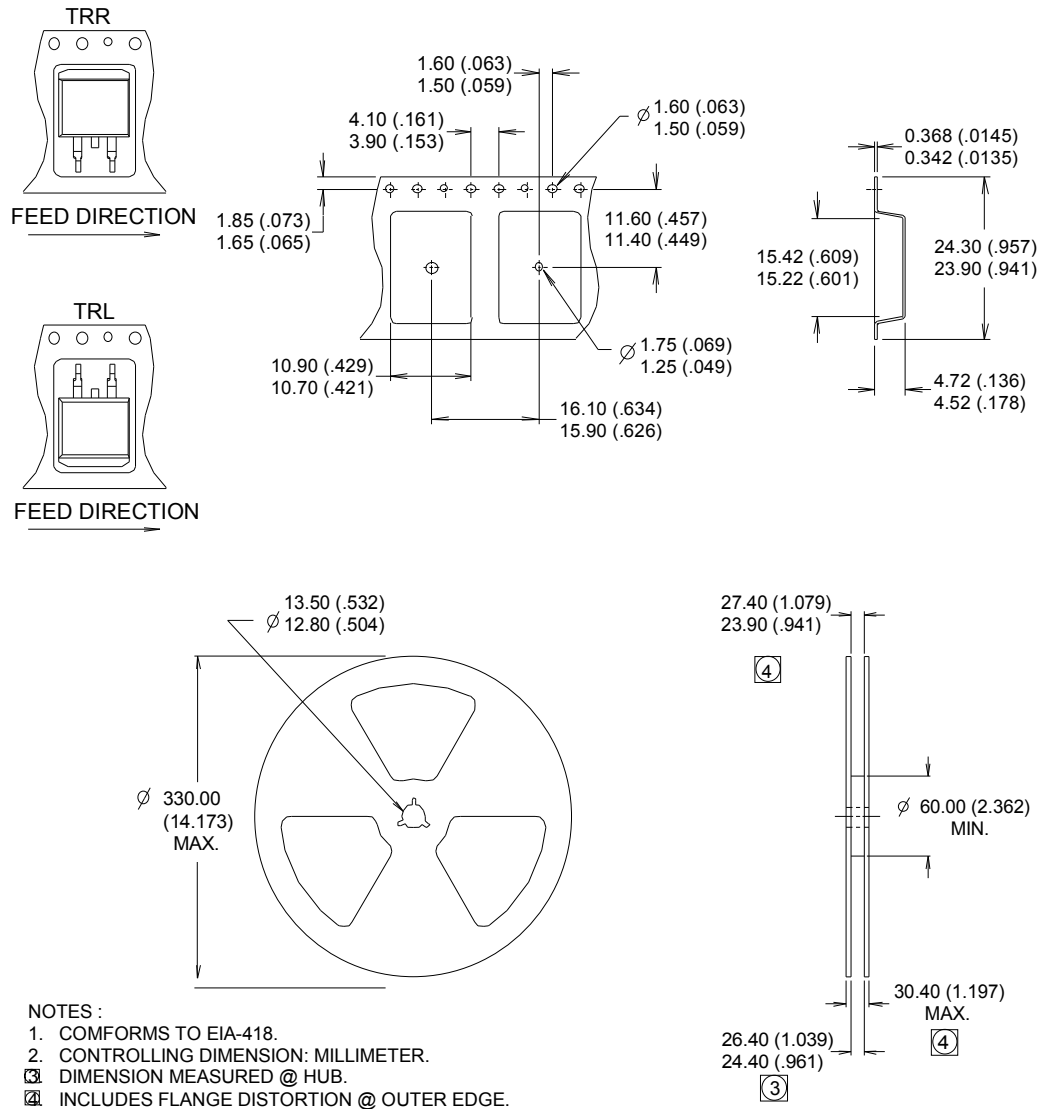
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE

IGBTs, CoPACK

- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER

D²-Pak (TO-263AB) Part Marking Information



D²-Pak (TO-263AB) Tape & Reel Information (Dimensions are shown in millimeters (inches))


Qualification Information

Qualification Level		Automotive (per AEC-Q101)	
		Comments: This part number(s) passed Automotive qualification. Infineon's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
Moisture Sensitivity Level		D ² -Pak	MSL1
ESD	Machine Model	Class M4 (+/- 425V) [†] AEC-Q101-002	
	Human Body Model	Class H1B (+/- 1000V) [†] AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 1125V) [†] AEC-Q101-005	
RoHS Compliant		Yes	

† Highest passing voltage.

Revision History

Date	Comments
10/27/2015	- Updated datasheet with corporate template - Corrected ordering table on page 1.
10/13/2017	Corrected typo error on part marking on page 9.

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