

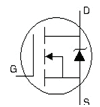
**Static @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	75	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.09	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = 5mA$ ⑤
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	2.5	3.0	m $\Omega$	$V_{GS} = 10V, I_D = 140A$ ⑤
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Trans conductance	230	—	—	S	$V_{DS} = 50V, I_D = 140A$
$R_G$	Gate Resistance	—	1.2	—	$\Omega$	
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	$\mu A$	$V_{DS} = 75V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 75V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$

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

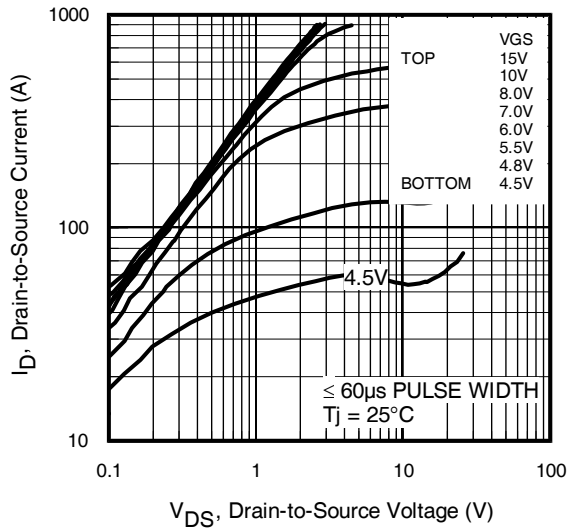
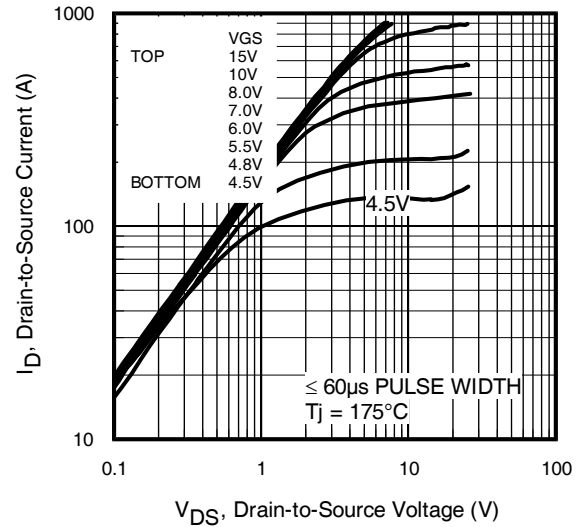
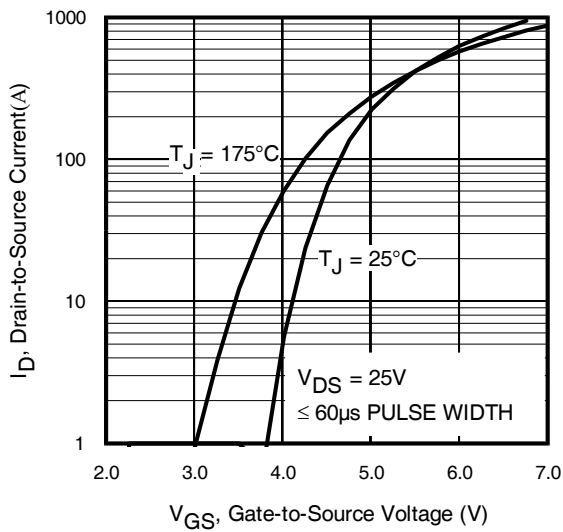
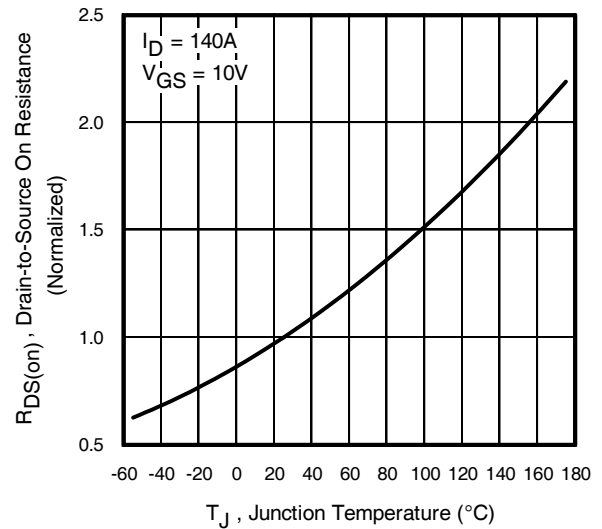
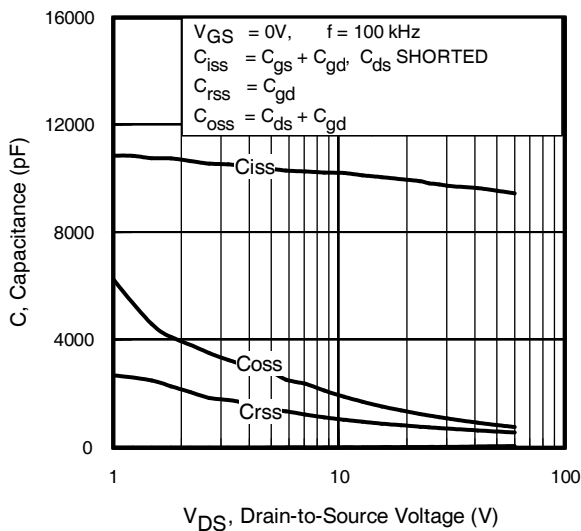
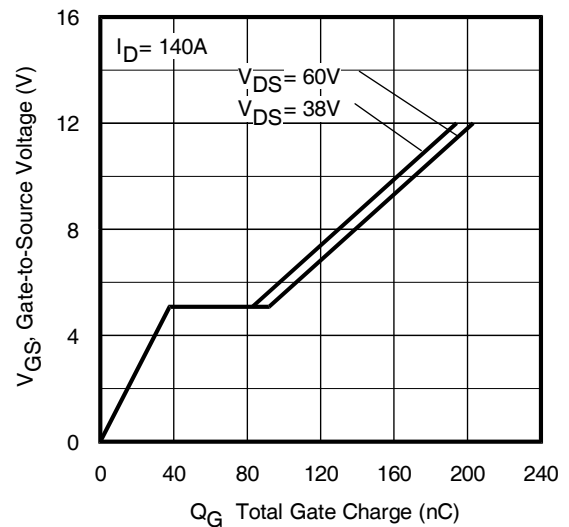
$Q_g$	Total Gate Charge	—	160	240	nC	$I_D = 140A$ $V_{DS} = 38V$ $V_{GS} = 10V$ ⑤
$Q_{gs}$	Gate-to-Source Charge	—	38	—		
$Q_{gd}$	Gate-to-Drain Charge	—	54	—		
$Q_{sync}$	Total Gate Charge Sync. ( $Q_g - Q_{gd}$ )	—	106	—		
$t_{d(on)}$	Turn-On Delay Time	—	19	—	ns	$V_{DD} = 49V$ $I_D = 140A$ $R_G = 2.7\Omega$ $V_{GS} = 10V$ ⑤
$t_r$	Rise Time	—	110	—		
$t_{d(off)}$	Turn-Off Delay Time	—	99	—		
$t_f$	Fall Time	—	100	—		
$C_{iss}$	Input Capacitance	—	9370	—	pF	$V_{GS} = 0V$ $V_{DS} = 50V$ $f = 1.0MHz$ , See Fig. 5
$C_{oss}$	Output Capacitance	—	840	—		
$C_{rss}$	Reverse Transfer Capacitance	—	580	—		
$C_{oss \text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related)	—	1130	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 60V$ ⑦
$C_{oss \text{ eff. (TR)}}$	Effective Output Capacitance (Time Related)	—	1500	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 60V$ ⑧

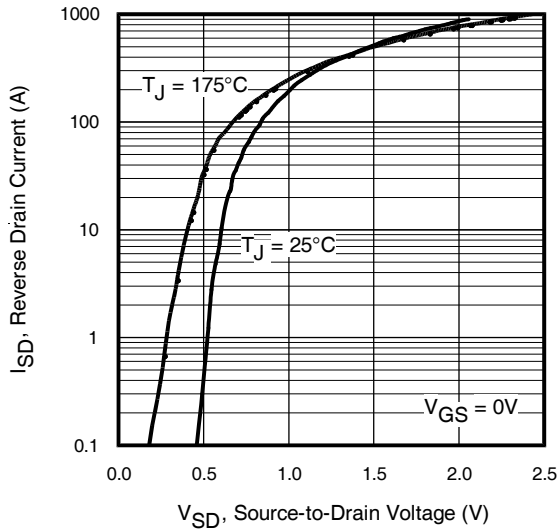
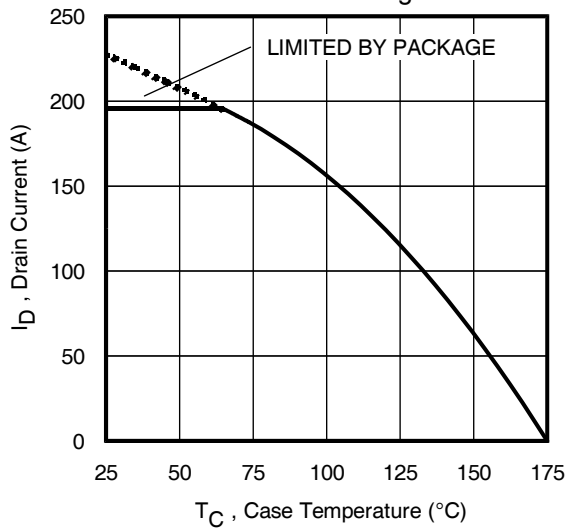
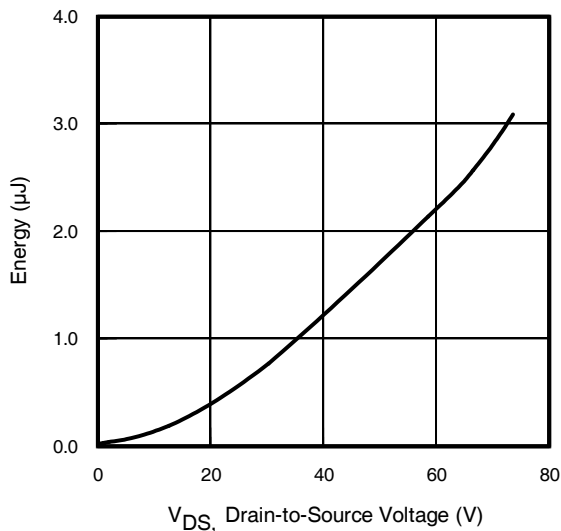
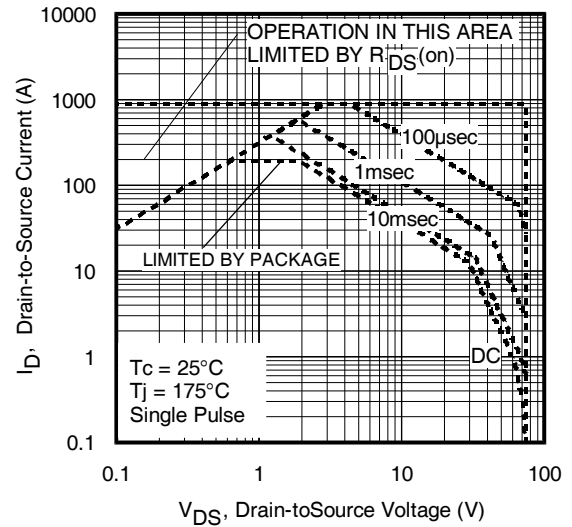
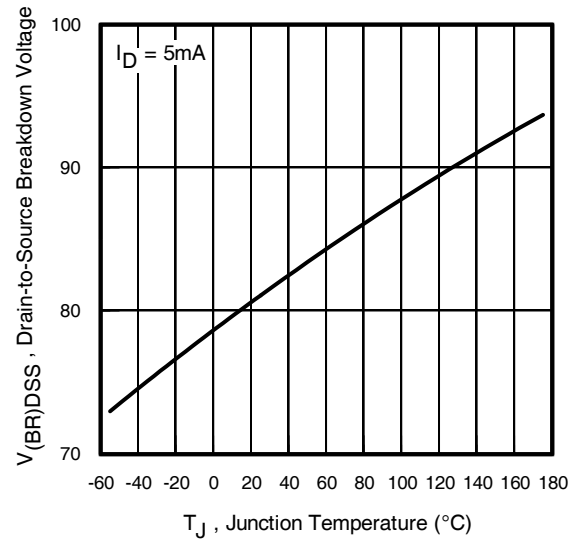
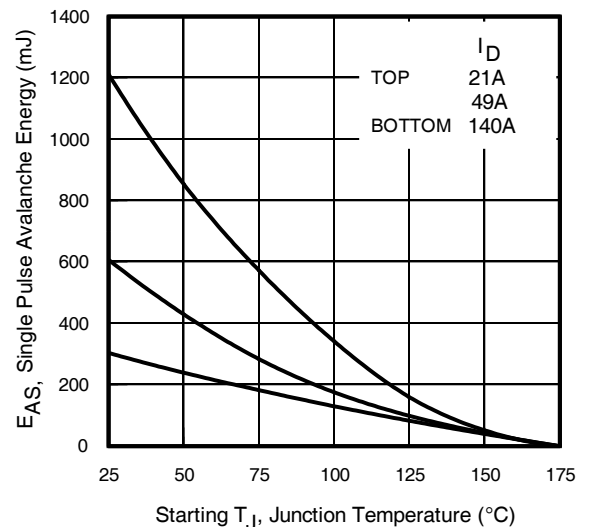
**Diode Characteristics**

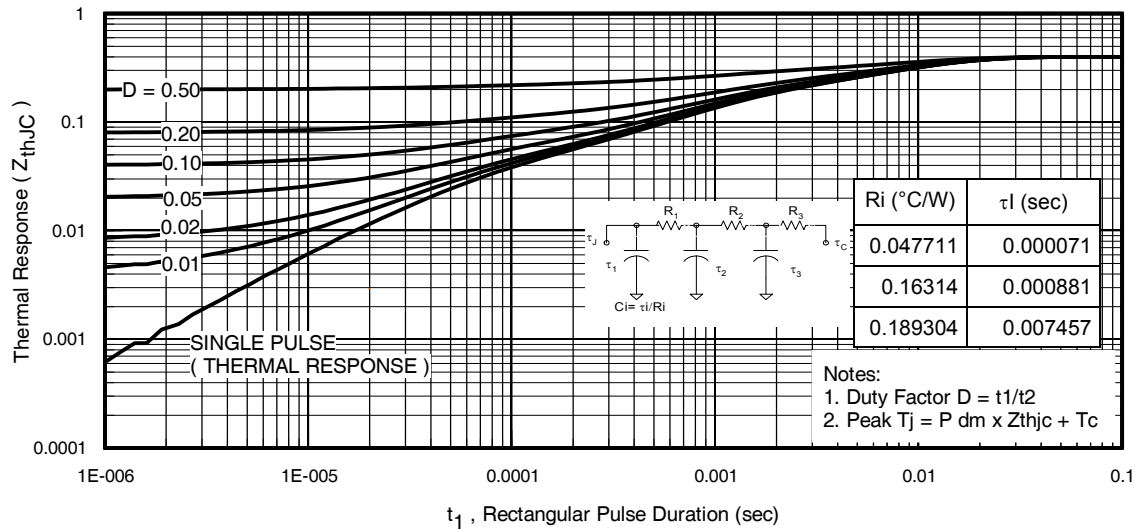
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	230 ①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ②	—	—	900		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 140A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	54	—	ns	$T_J = 25^\circ\text{C}$ $V_{DD} = 64V$
		—	60	—		$T_J = 125^\circ\text{C}$ $I_F = 140A$ ,
$Q_{rr}$	Reverse Recovery Charge	—	103	—	nC	$T_J = 25^\circ\text{C}$ $di/dt = 100A/\mu s$ ⑤
		—	132	—		$T_J = 125^\circ\text{C}$
$I_{RRM}$	Reverse Recovery Current	—	3.6	—	A	$T_J = 25^\circ\text{C}$
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )				

**Notes:**

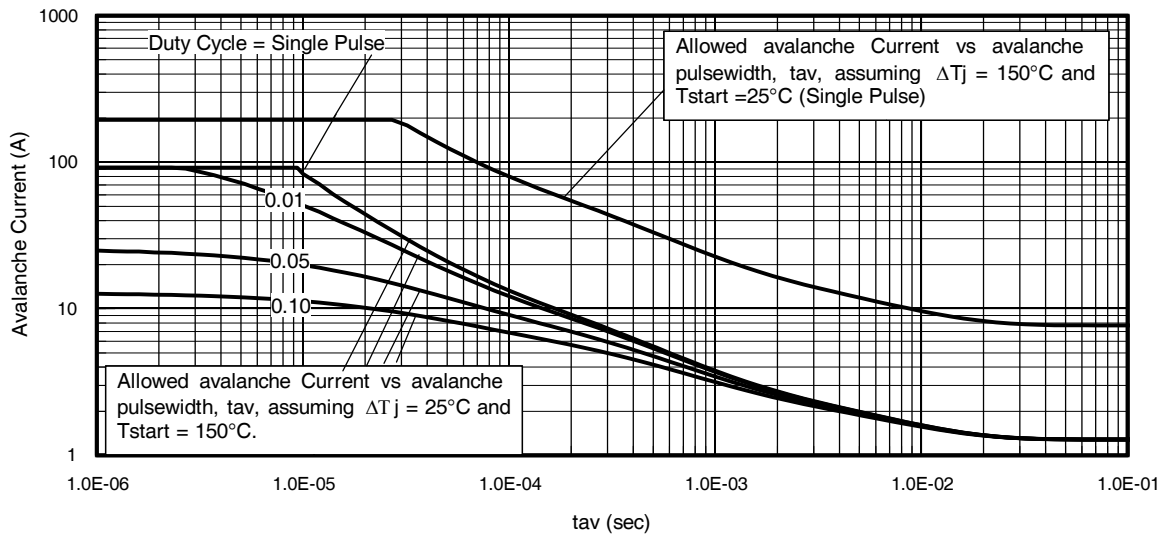
- ① Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 195A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ Limited by  $T_{Jmax}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.045mH$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 140A$ ,  $V_{GS} = 10V$ . Part not recommended for use above this value.
- ④  $I_{SD} \leq 140A$ ,  $di/dt \leq 1380A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 175^\circ\text{C}$ .
- ⑤ Pulse width  $\leq 400\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑥  $C_{oss \text{ eff. (TR)}}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .
- ⑦  $C_{oss \text{ eff. (ER)}}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .
- ⑧ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994
- ⑨  $R_\theta$  is measured at  $T_J$  approximately  $90^\circ\text{C}$ .
- ⑩  $R_{\theta JC}$  value shown is at time zero


**Fig. 1** Typical Output Characteristics

**Fig. 2** Typical Output Characteristics

**Fig. 3** Typical Transfer Characteristics

**Fig. 4** Normalized On-Resistance vs. Temperature

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

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

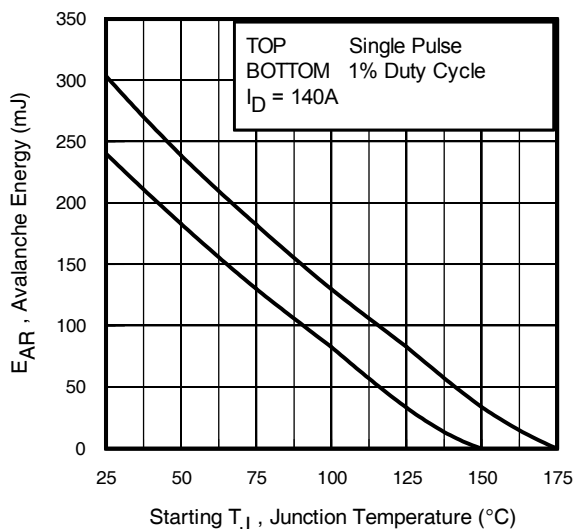

**Fig. 7** Typical Source-to-Drain Diode Forward Voltage

**Fig 9.** Maximum Drain Current vs. Case Temperature

**Fig 11.** Typical Coss Stored Energy

**Fig 8.** Maximum Safe Operating Area

**Fig 10.** Drain-to-Source Breakdown Voltage

**Fig 12.** Maximum Avalanche Energy vs. Drain Current



**Fig 13.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



**Fig 14.** Avalanche Current vs. Pulse width



**Notes on Repetitive Avalanche Curves , Figures 14, 15:**  
**(For further info, see AN-1005 at [www.infineon.com](http://www.infineon.com))**

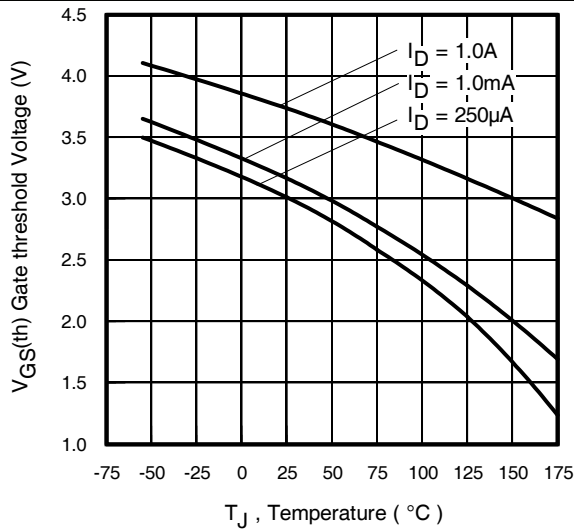
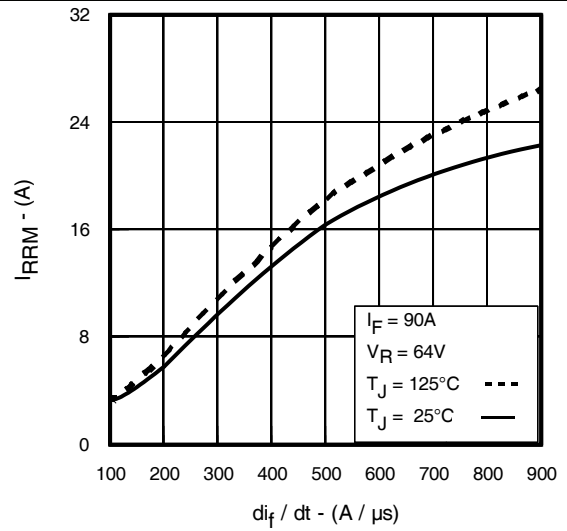
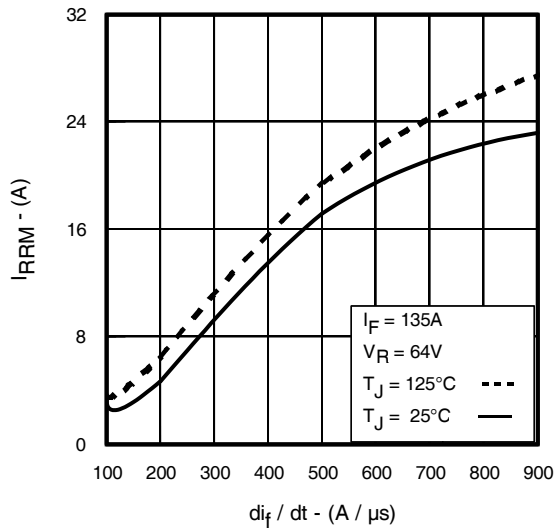
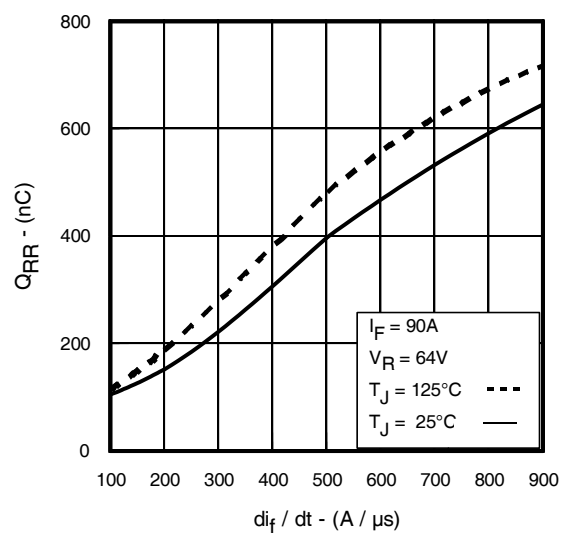
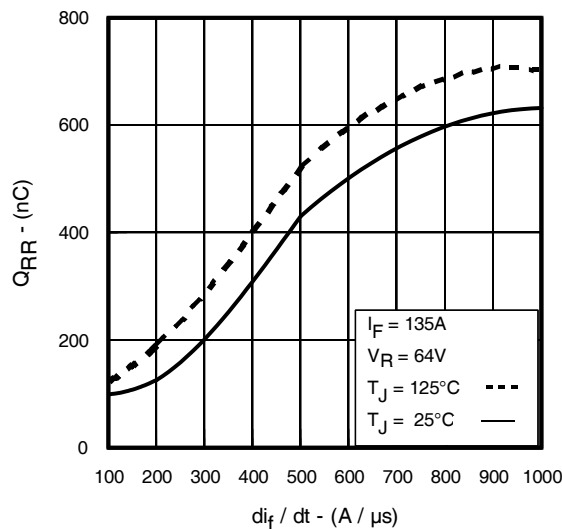
1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 22a, 22b.
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.  $\Delta T$  = Allowable rise in junction temperature, not to exceed  $T_{jmax}$  (assumed as  $25^{\circ}\text{C}$  in Figure 13, 14).  
 $t_{av}$  = Average time in avalanche.  
 $D$  = Duty cycle in avalanche =  $t_{av} \cdot f$   
 $Z_{thJC}(D, t_{av})$  = Transient thermal resistance, see Figures 13)

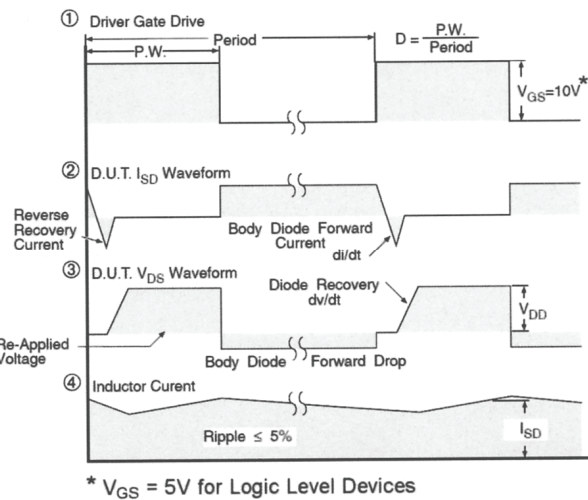
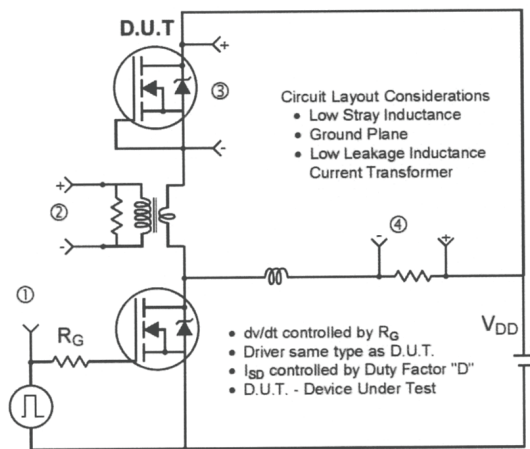
$$P_{D(ave)} = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

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

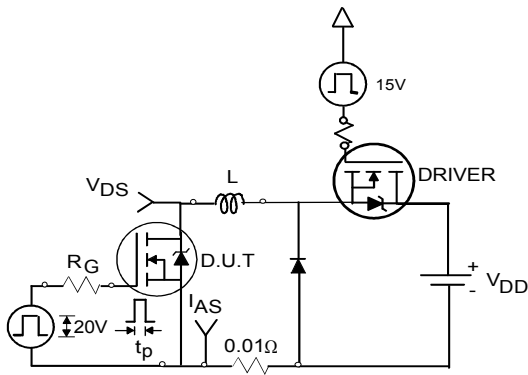
$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$

**Fig 15.** Maximum Avalanche Energy vs. Temperature

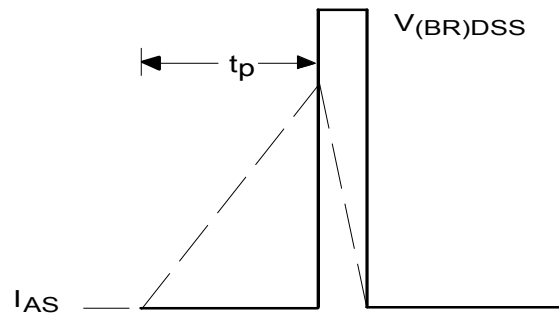

**Fig. 16.** Threshold Voltage vs. Temperature

**Fig. 17 -** Typical Recovery Current vs.  $di_F/dt$ 

**Fig. 18 -** Typical Recovery Current vs.  $di_F/dt$ 

**Fig. 19 -** Typical Stored Charge vs.  $di_F/dt$ 

**Fig. 20 -** Typical Stored Charge vs.  $di_F/dt$



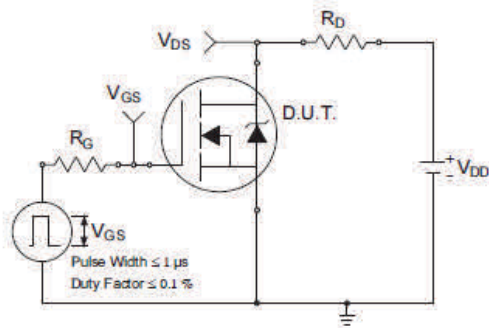
**Fig 21. Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs**



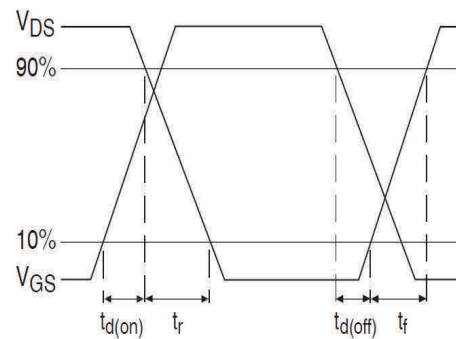
**Fig 22a. Unclamped Inductive Test Circuit**



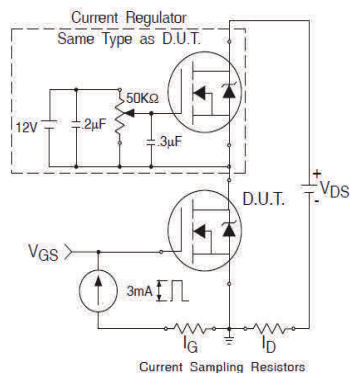
**Fig 22b. Unclamped Inductive Waveforms**



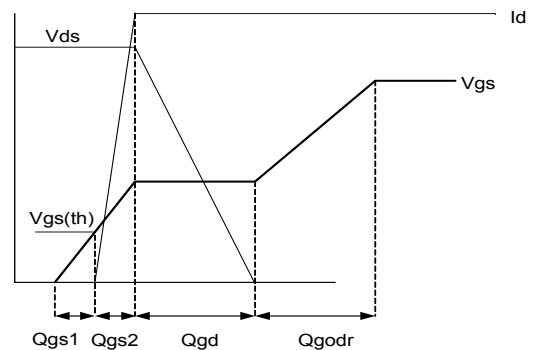
**Fig 23a. Switching Time Test Circuit**



**Fig 23b. Switching Time Waveforms**

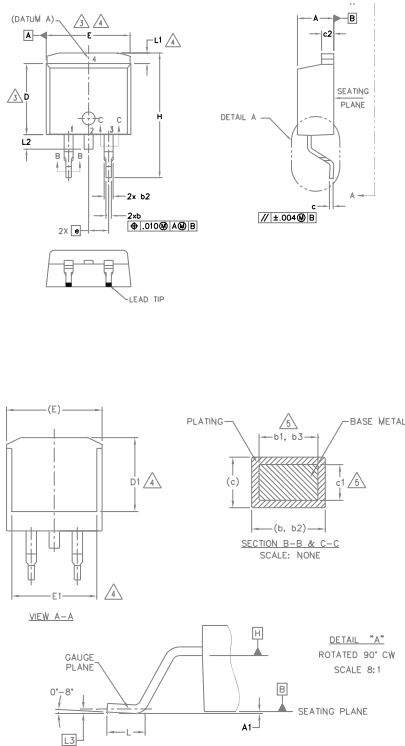


**Fig 24a. Gate Charge Test Circuit**



**Fig 24b. Gate Charge Waveform**

## D<sup>2</sup> 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.

SYMBOL	DIMENSIONS				NOTES
	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

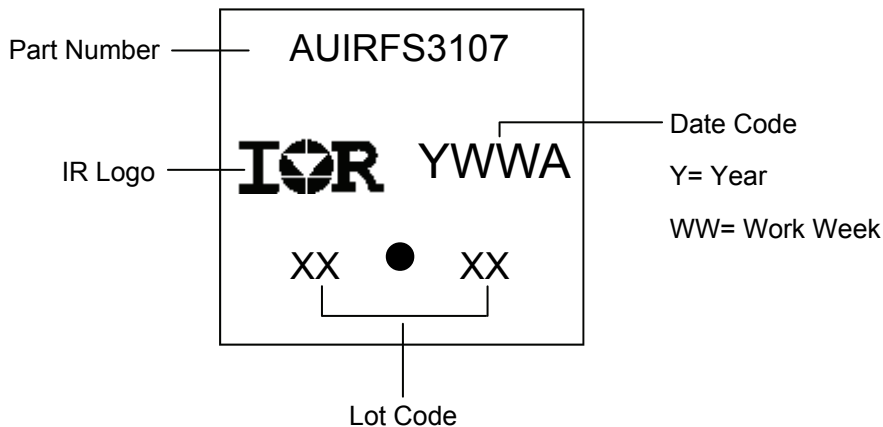
#### HEXFET

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

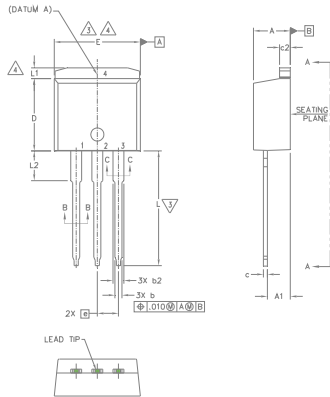
#### IGBTs, CoPACK

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

## D<sup>2</sup> Pak (TO-263AB) Part Marking Information



## TO-262 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.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. CONTROLLING DIMENSION: INCH.
7. OUTLINE CONFORM TO JEDEC TO-262 EXCEPT A1(max.), b(min.) AND D1(min.) WHERE DIMENSIONS DERIVED THE ACTUAL PACKAGE OUTLINE.

### LEAD ASSIGNMENTS

#### IGBTs, CoPACK

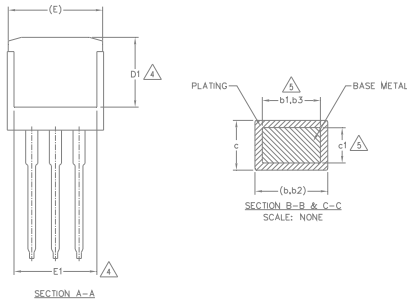
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

#### HEXFET

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

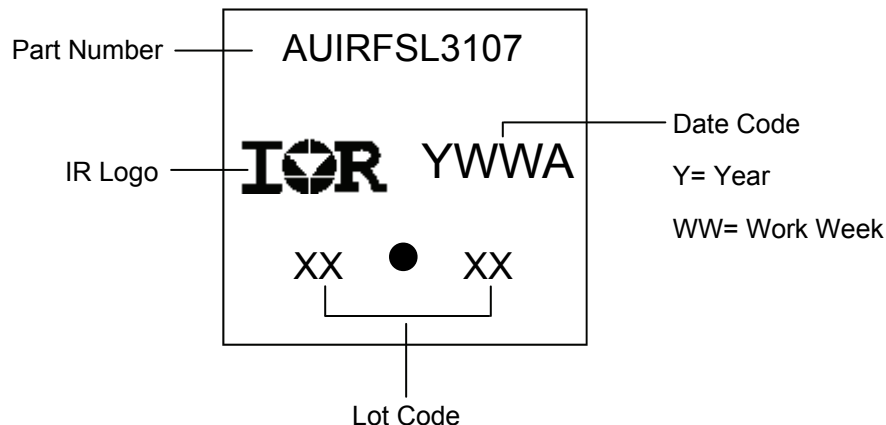
#### DIODES

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

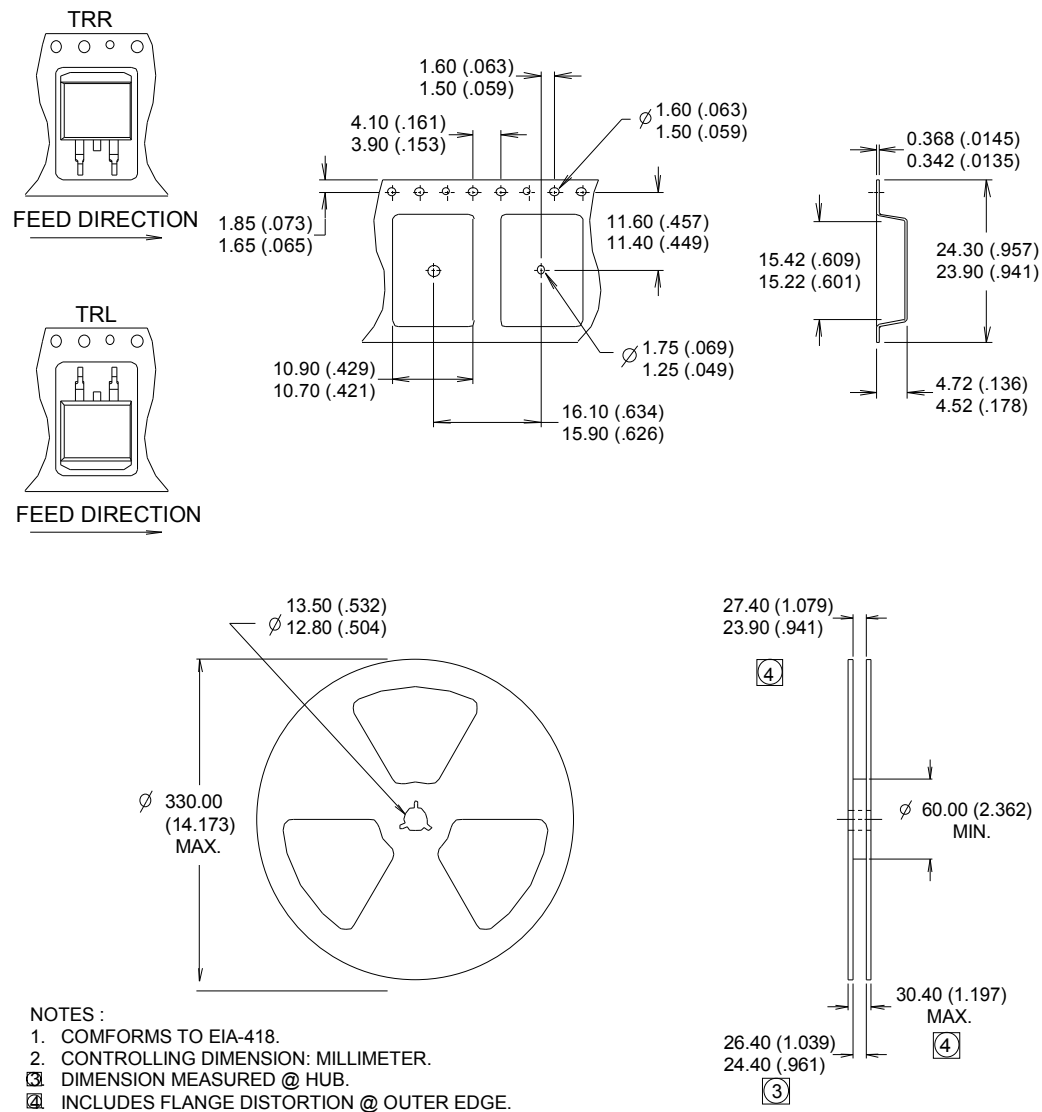


SYM-BOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	5
A1	2.03	3.02	.080	.119	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.78	.045	.070	5
b3	1.14	1.73	.045	.068	
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	—	.270	—	4
E	9.65	10.67	.380	.420	3,4
E1	6.22	—	.245	—	4
e	2.54 BSC		.100 BSC		
L	13.46	14.10	.530	.555	4
L1	—	1.65	—	.065	
L2	3.56	3.71	.140	.146	

## TO-262 Part Marking Information





**D<sup>2</sup> 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 <sup>2</sup> -Pak	MSL1
		TO-262	
ESD	Machine Model	Class M4 (+/- 800V) <sup>†</sup> AEC-Q101-002	
	Human Body Model	Class H3A (+/- 6000V) <sup>†</sup> AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V) <sup>†</sup> AEC-Q101-005	
RoHS Compliant		Yes	

† Highest passing voltage.

**Revision History**

Date	Comments
10/08/2015	<ul style="list-style-type: none"> <li>Updated datasheet with corporate template</li> <li>Corrected ordering table on page 1.</li> </ul>
10/11/2017	<ul style="list-style-type: none"> <li>Corrected typo error on part marking on page 8,9.</li> </ul>

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