

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

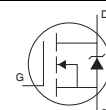
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	40	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.033	—	V/°C	Reference to $25^\circ\text{C}, I_D = 5mA$ ⓐ
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	2.6	3.3	mΩ	$V_{GS} = 10V, I_D = 70A$ ⓑ
$V_{GS(th)}$	Gate Threshold Voltage	2.2	3.0	3.9	V	$V_{DS} = V_{GS}, I_D = 100\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	1.0	μA	$V_{DS} = 40V, V_{GS} = 0V$
		—	—	150		$V_{DS} = 40V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{OSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
R_G	Internal Gate Resistance	—	1.6	—	Ω	

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	269	—	—	S	$V_{DS} = 10V, I_D = 70A$
Q_g	Total Gate Charge	—	62	93	nC	$I_D = 70A$
Q_{gs}	Gate-to-Source Charge	—	16	—		$V_{DS} = 20V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	20	—		$V_{GS} = 10V$ ⓑ
Q_{sync}	Total Gate Charge Sync. ($Q_g - Q_{gd}$)	—	42	—		$I_D = 70A, V_{DS} = 0V, V_{GS} = 10V$
$t_{d(on)}$	Turn-On Delay Time	—	10	—	ns	$V_{DD} = 26V$
t_r	Rise Time	—	77	—		$I_D = 70A$
$t_{d(off)}$	Turn-Off Delay Time	—	26	—		$R_G = 1\Omega$
t_f	Fall Time	—	43	—		$V_{GS} = 10V$ ⓑ
C_{iss}	Input Capacitance	—	3183	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	475	—		$V_{DS} = 25V$
C_{riss}	Reverse Transfer Capacitance	—	331	—		$f = 1.0\text{ MHz}$, See Fig. 5
$C_{oss\text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related)	—	596	—		$V_{GS} = 0V, V_{DS} = 0V\text{ to }32V$ ⓐ, See Fig. 11
$C_{oss\text{ eff. (TR)}}$	Effective Output Capacitance (Time Related)	—	688	—		$V_{GS} = 0V, V_{DS} = 0V\text{ to }32V$ ⓑ

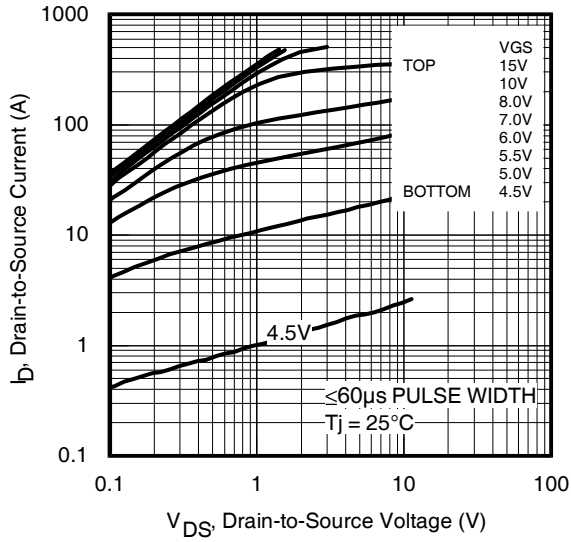
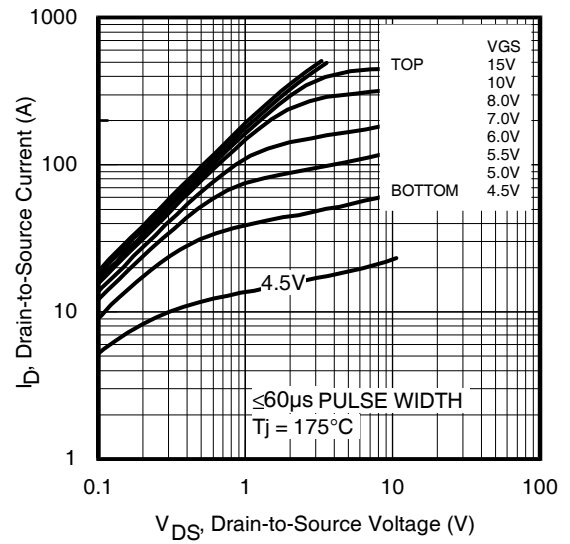
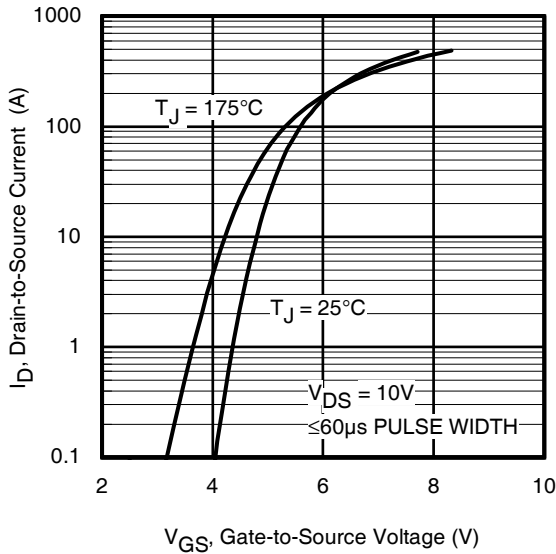
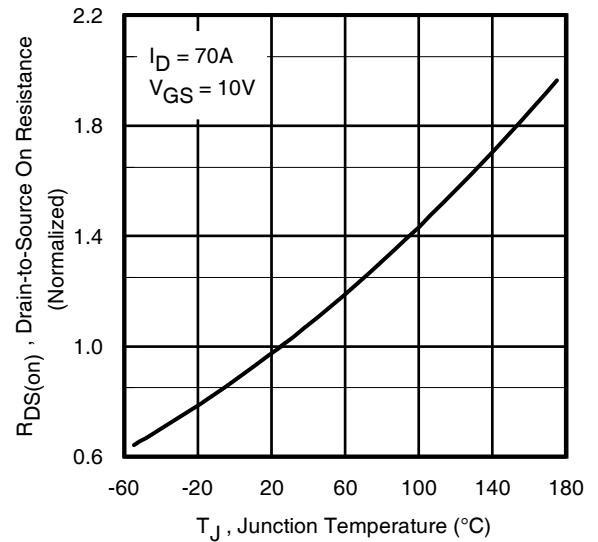
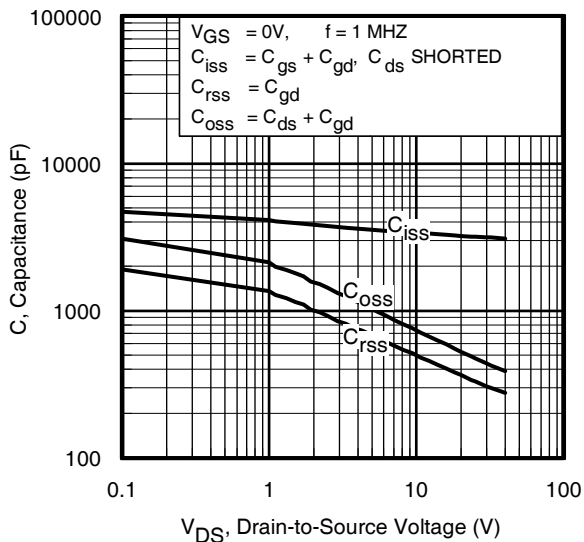
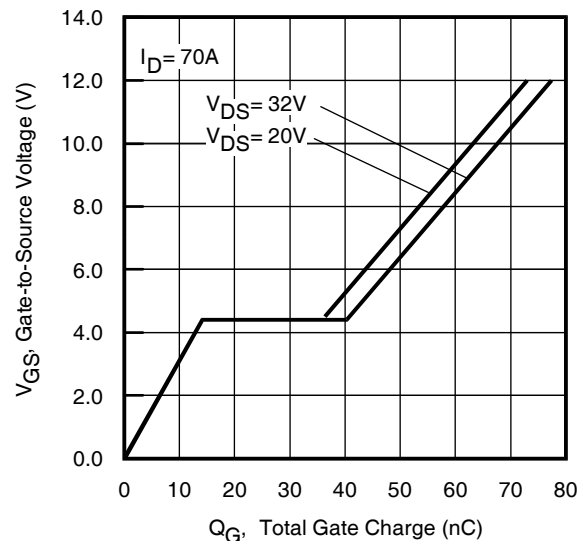
Diode Characteristics

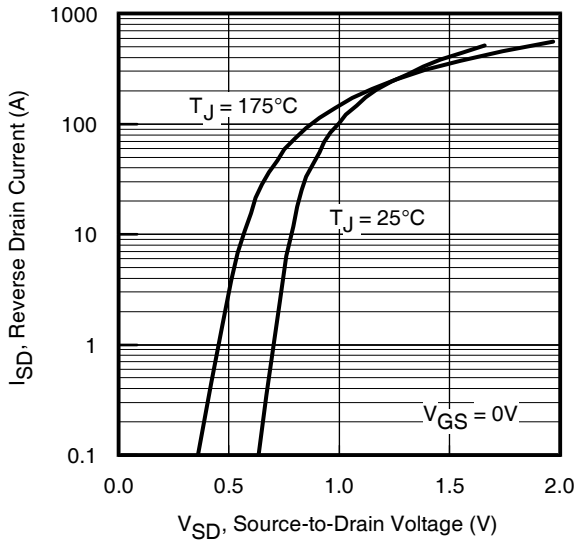
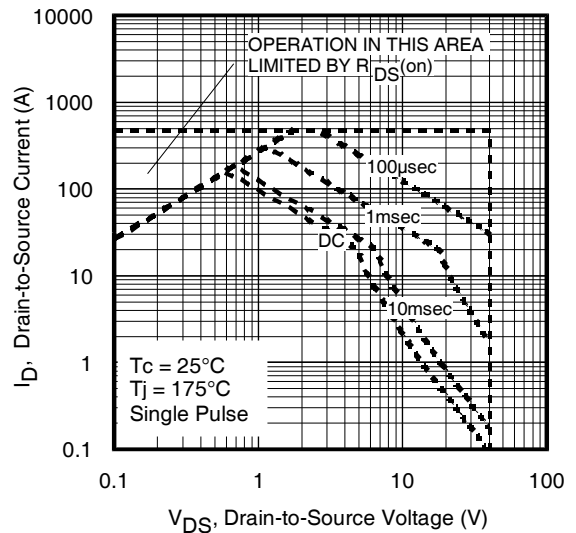
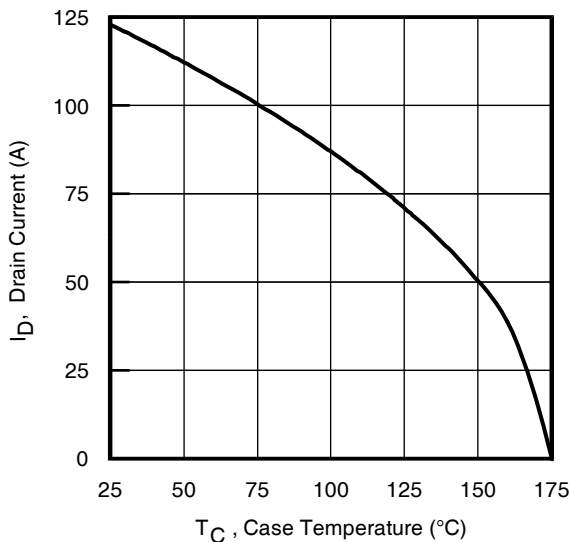
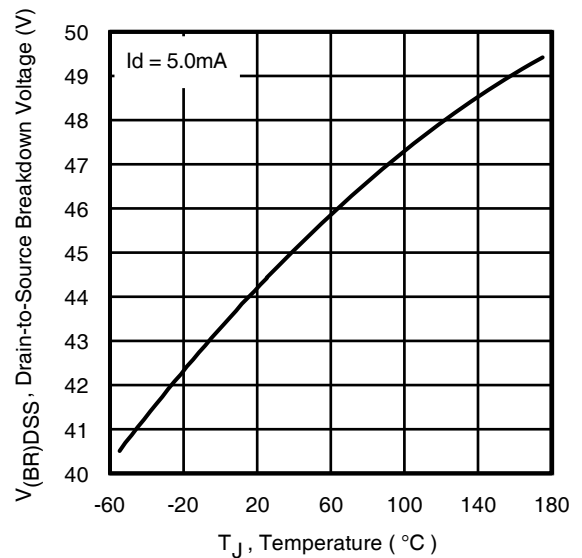
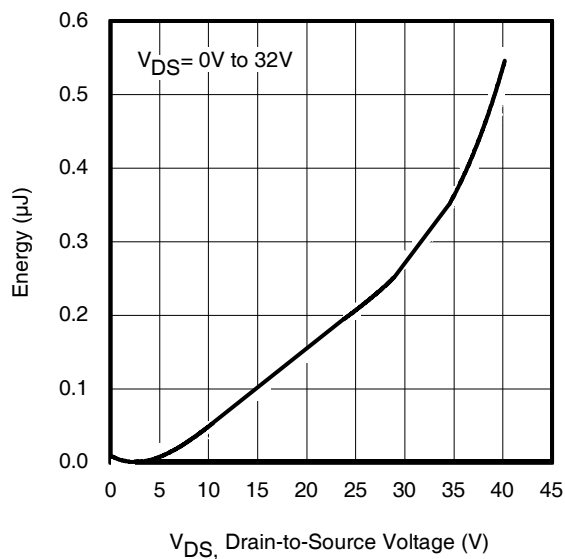
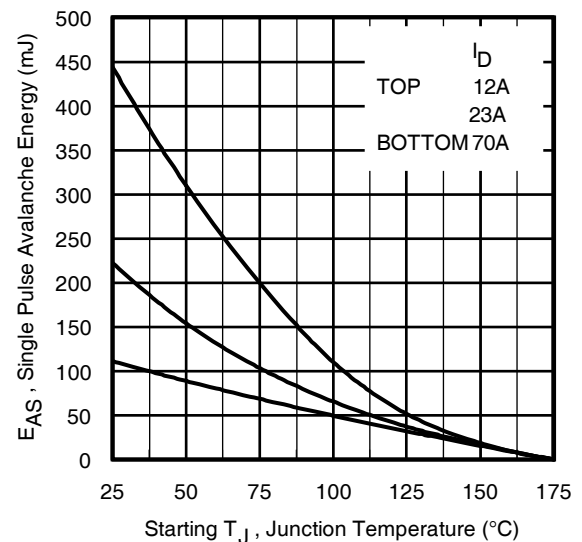
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	118	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ⓐ	—	—	472		
V_{SD}	Diode Forward Voltage	—	0.9	1.3	V	$T_J = 25^\circ\text{C}, I_S = 70A, V_{GS} = 0V$ ⓑ
dv/dt	Peak Diode Recovery ⓐ	—	7.6	—	V/ns	$T_J = 175^\circ\text{C}, I_S = 70A, V_{DS} = 40V$
t_{rr}	Reverse Recovery Time	—	22	—	ns	$T_J = 25^\circ\text{C}$
		—	24	—		$T_J = 125^\circ\text{C}$
Q_{rr}	Reverse Recovery Charge	—	15	—	nC	$T_J = 25^\circ\text{C}$
		—	15	—		$T_J = 125^\circ\text{C}$
I_{RRM}	Reverse Recovery Current	—	1.0	—	A	$T_J = 25^\circ\text{C}$

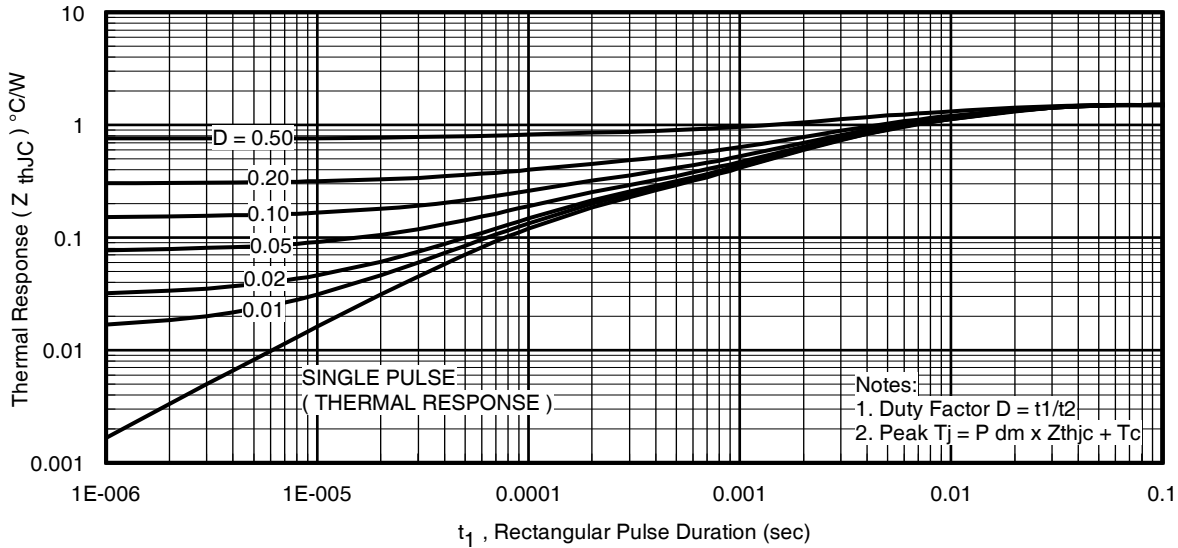
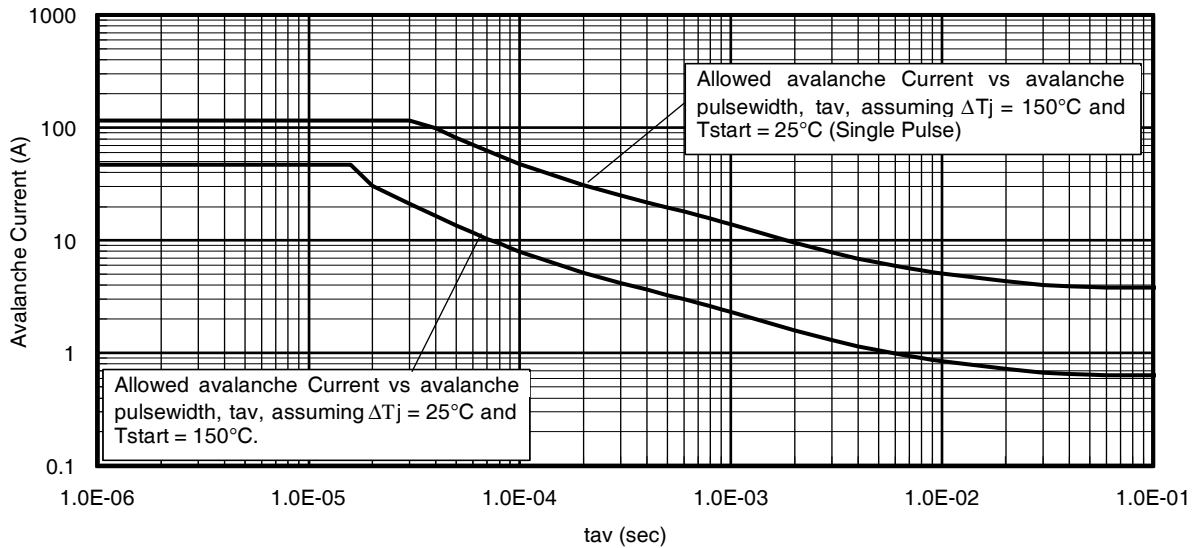
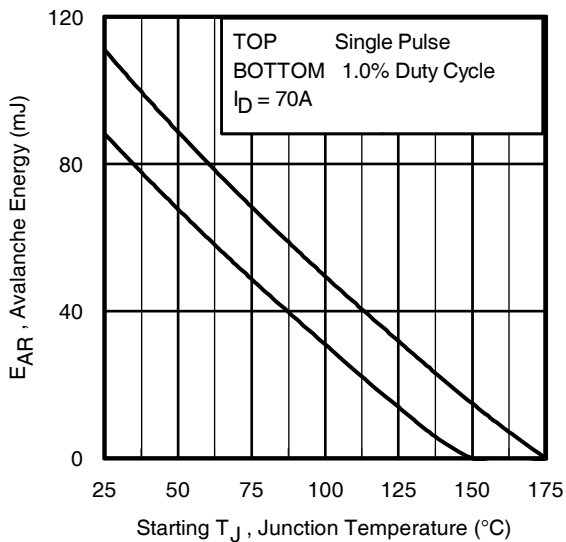

Notes:

- ⓐ Repetitive rating; pulse width limited by max. junction temperature.
- ⓑ Limited by T_{Jmax} , starting $T_J = 25^\circ\text{C}$, $L = 0.046\text{mH}, R_G = 50\Omega$, $I_{AS} = 70A, V_{GS} = 10V$.
- ⓒ $I_{SD} \leq 70A, di/dt \leq 1174A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$.
- ⓓ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.
- ⓔ $C_{oss\text{ eff. (TR)}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

- ⓐ $C_{oss\text{ eff. (ER)}}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
- ⓑ R_θ is measured at T_J approximately 90°C .
- ⓒ This value determined from sample failure population, starting $T_J = 25^\circ\text{C}, L = 0.046\text{mH}, R_G = 50\Omega, I_{AS} = 70A, V_{GS} = 10V$.


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-Drain Diode Forward Voltage

Fig 8. Maximum Safe Operating Area

Fig 9. Maximum Drain Current vs. Case Temperature

Fig 10. Drain-to-Source Breakdown Voltage

Fig 11. Typical C_{OSS} Stored Energy

Fig 12. Maximum Avalanche Energy vs. Drain Current

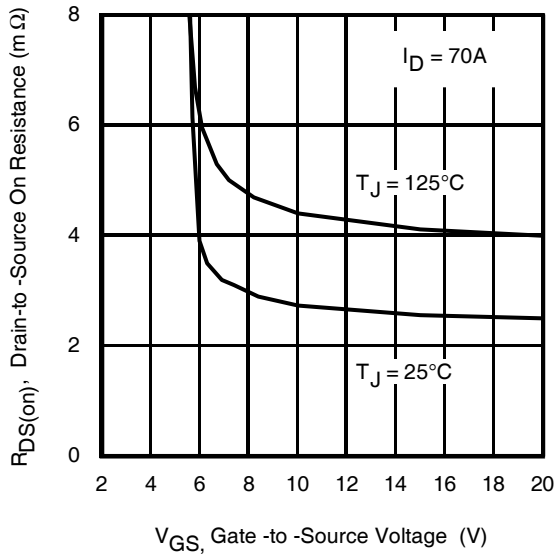
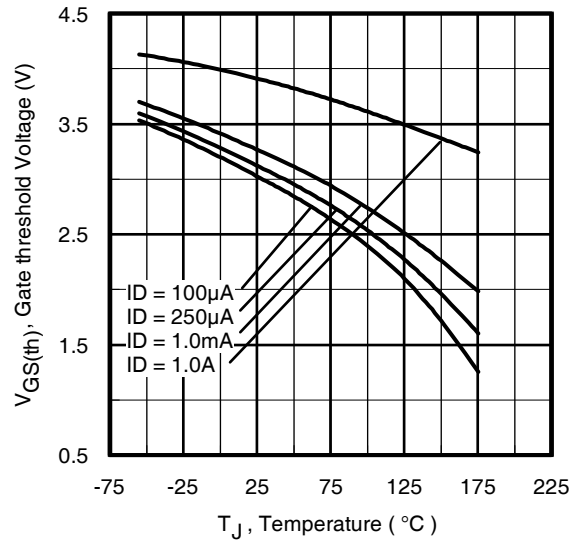
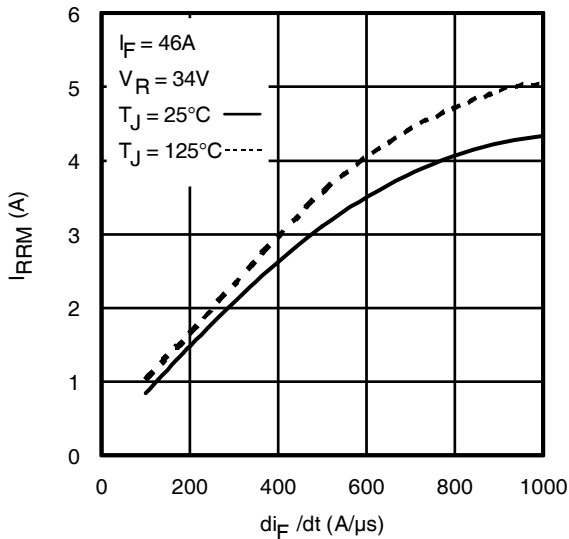
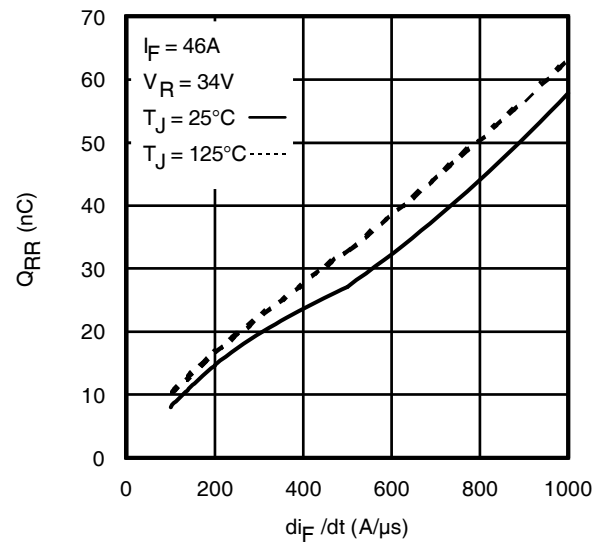
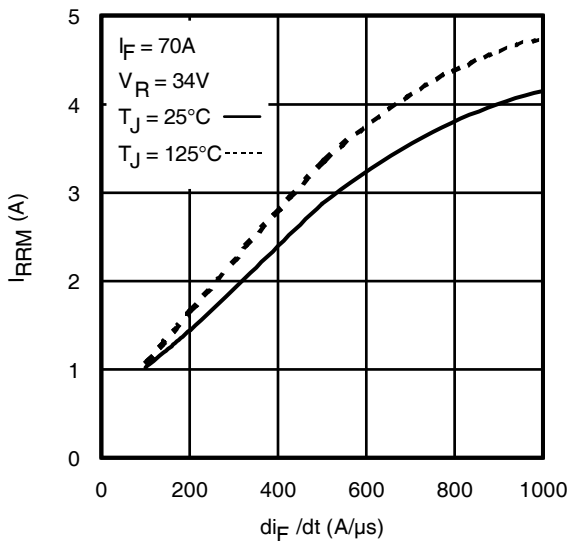
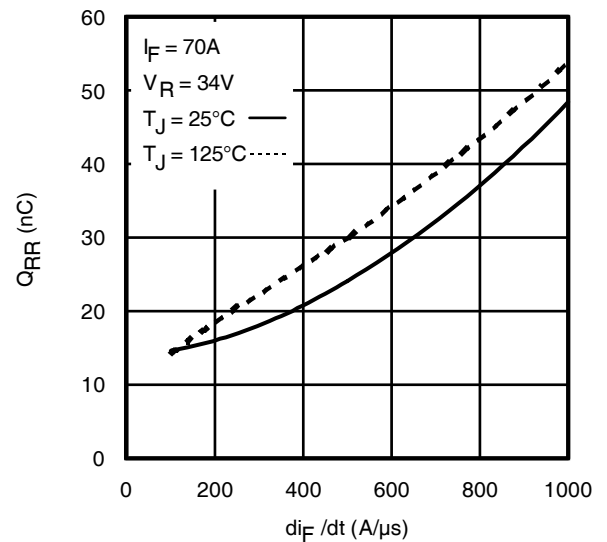

Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

Fig 14. Typical Avalanche Current vs. Pulsewidth

Fig 15. Maximum Avalanche Energy vs. Temperature
**Notes on Repetitive Avalanche Curves , Figures 14, 15
(For further info, see AN-1005 at www.irf.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 24a, 24b.
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. On-Resistance vs. Gate Voltage

Fig 17. Threshold Voltage vs. Temperature

Fig. 18 - Typical Recovery Current vs. di_f/dt

Fig. 19 - Typical Stored Charge vs. di_f/dt

Fig. 20 - Typical Recovery Current vs. di_f/dt

Fig. 21 - Typical Stored Charge vs. di_f/dt

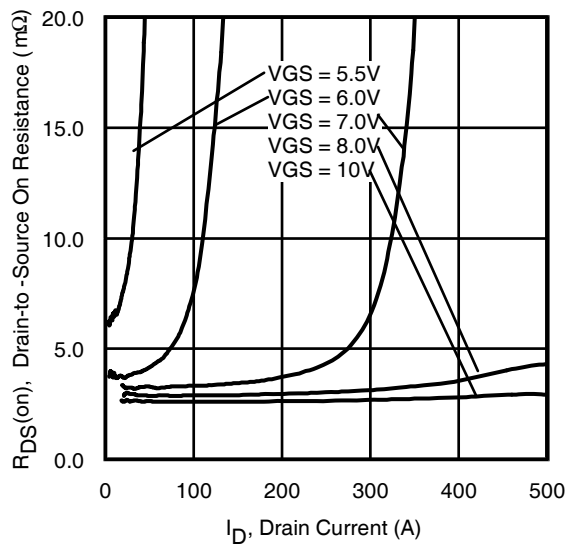


Fig 22. Typical On-Resistance vs. Drain Current

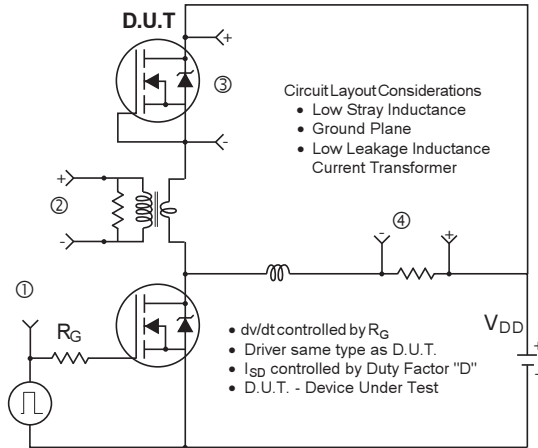
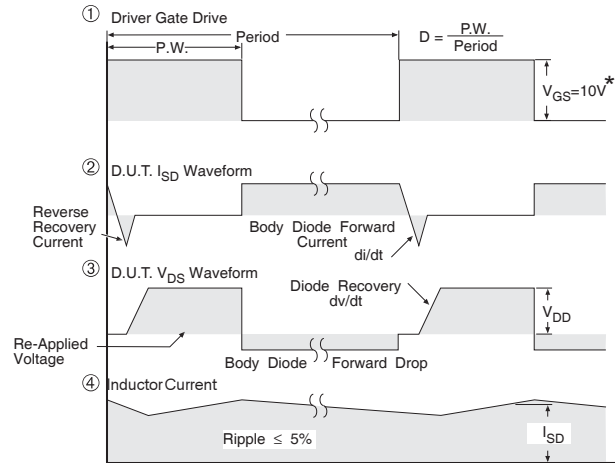


Fig 23. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs



* $V_{GS} = 5V$ for Logic Level Devices

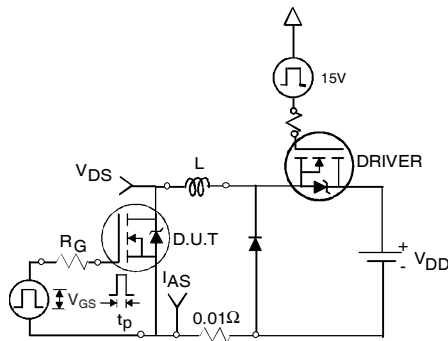


Fig 24a. Unclamped Inductive Test Circuit

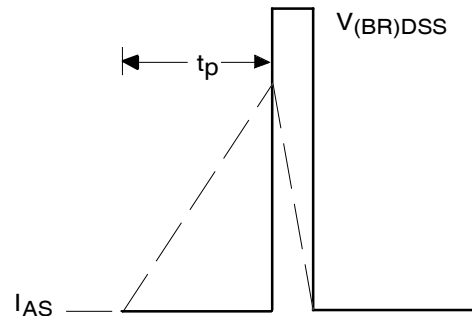


Fig 24b. Unclamped Inductive Waveforms

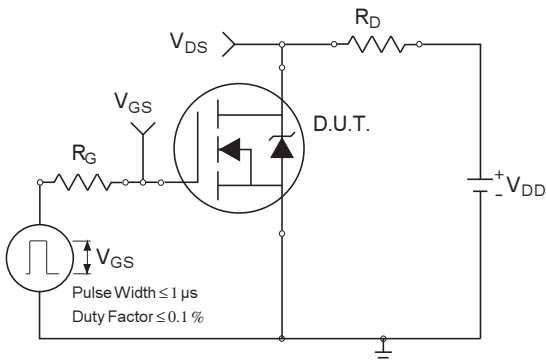


Fig 25a. Switching Time Test Circuit

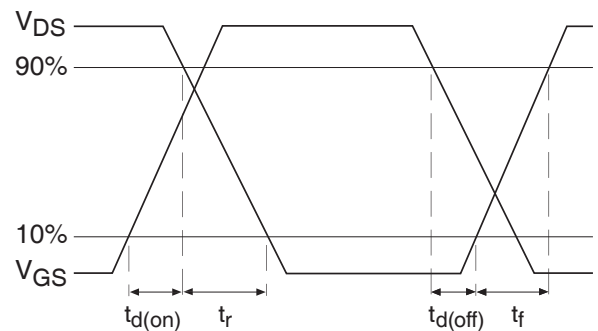


Fig 25b. Switching Time Waveforms

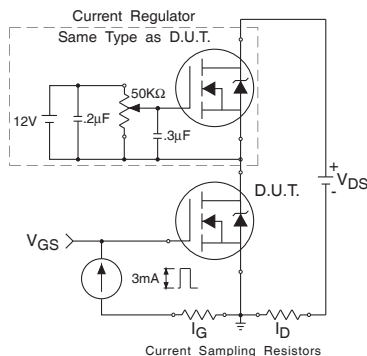


Fig 26a. Gate Charge Test Circuit

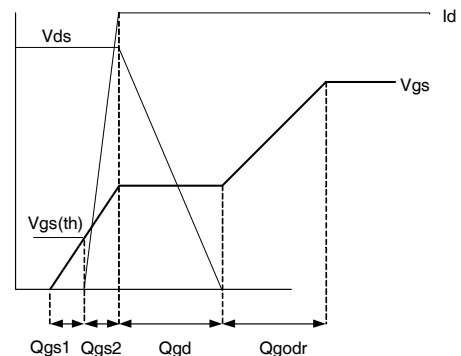
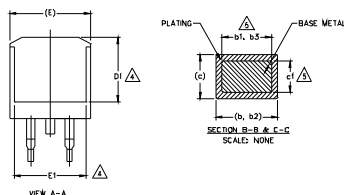
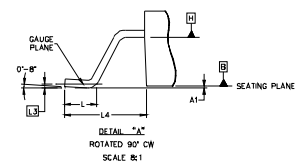
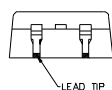
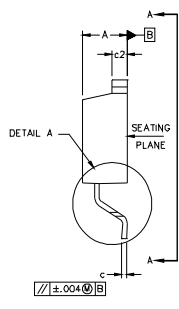
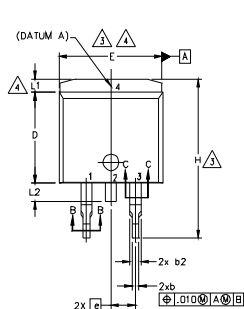


Fig 26b. Gate Charge Waveform

D²Pak Package Outline (Dimensions are shown in millimeters (inches))


NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
- 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.
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
- DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
- DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
- CONTROLLING DIMENSION: INCH.
- OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
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		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	-	1.65	-	.066	4
L2	1.27	1.78	-	.070	
L3	0.25 BSC		.010 BSC		
L4	4.78	5.28	.188	.208	

LEAD ASSIGNMENTS
HEXFET

- GATE
- DRAIN
- SOURCE

IGBTs, CoPACK

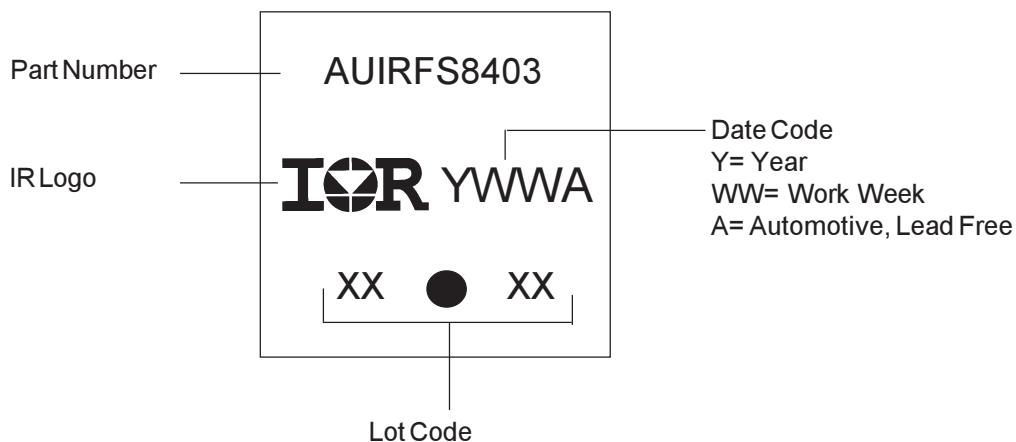
- GATE
- COLLECTOR
- EMITTER

DIODES

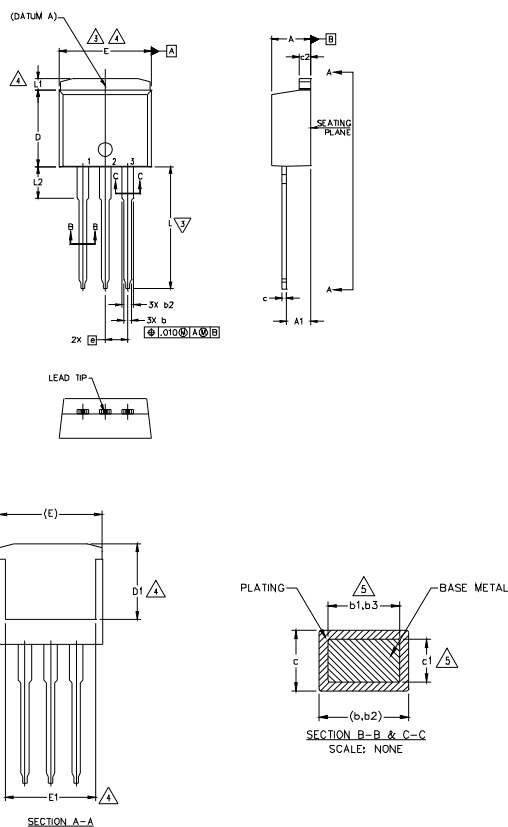
- ANODE *
- CATHODE
- ANODE

* PART DEPENDENT.

D²Pak Part Marking Information



Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

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 [.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.

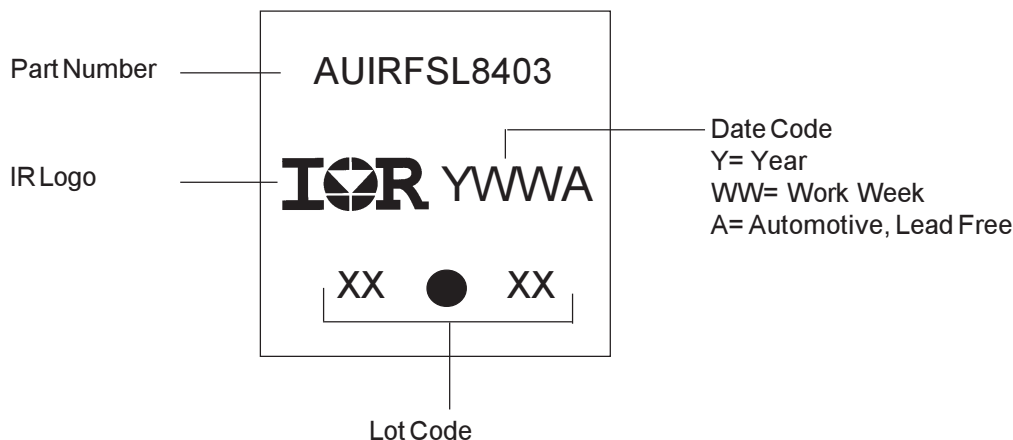
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	3.02	.080	.119	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.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	
L1	-	1.65	-	.065	4
L2	3.56	3.71	.140	.146	

LEAD ASSIGNMENTS
HEXFET

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

IGBTs, CoPACK

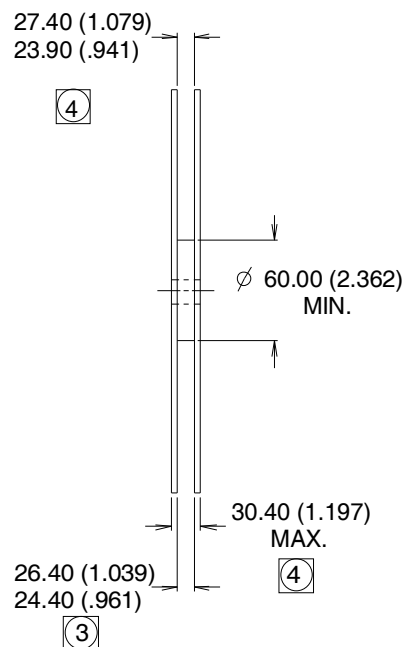
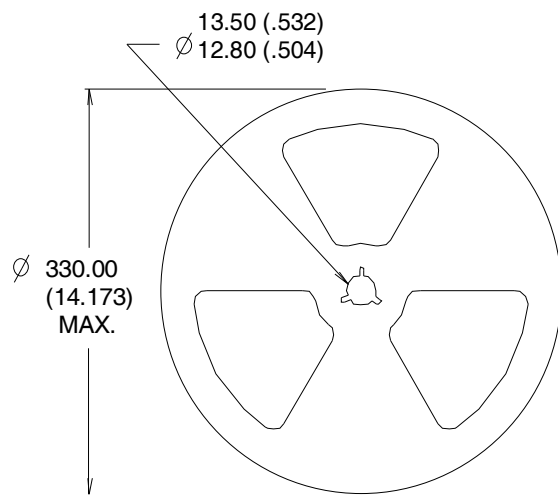
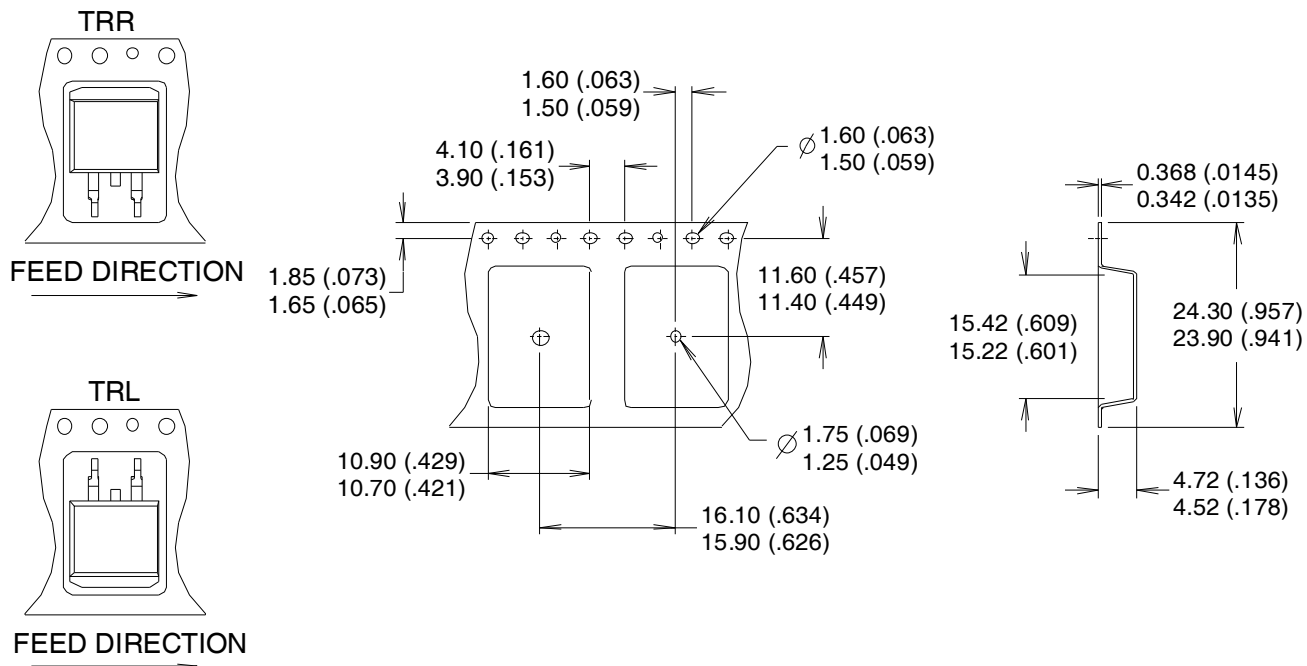
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

TO-262 Part Marking Information


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

D²Pak (TO-263AB) Tape & Reel Information

Dimensions are shown in millimeters (inches)



NOTES :

1. CONFORMS TO EIA-418.
2. CONTROLLING DIMENSION: MILLIMETER.
- ③ DIMENSION MEASURED @ HUB.
- ④ INCLUDES FLANGE DISTORTION @ OUTER EDGE.

Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

Qualification Information[†]

Qualification Level		Automotive (per AEC-Q101)	
		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
Moisture Sensitivity Level		3L-D ² PAK	MSL1
		3L-TO-262-PAK	N/A
ESD	Machine Model	Class M4 (+/- 600) ^{††} AEC-Q101-002	
	Human Body Model	Class H1C (+/- 2000) ^{††} AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000) ^{††} AEC-Q101-005	
RoHS Compliant		Yes	

[†] Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

^{††} Highest passing voltage.

IMPORTANT NOTICE

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