

# AUIRFS3107 AUIRFSL3107

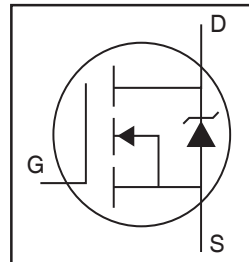
HEXFET® Power MOSFET

## Features

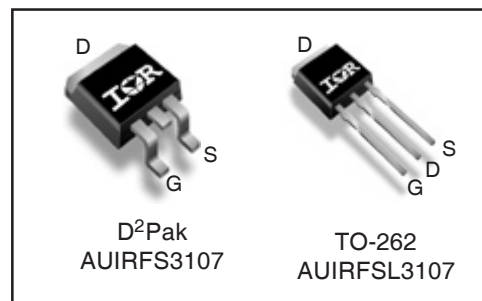
- Advanced Process Technology
- Ultra Low On-Resistance
- Enhanced dV/dT and dI/dT capability
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified \*

## 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.



$V_{DSS}$		<b>75V</b>
$R_{DS(on)}$	typ.	<b>2.5mΩ</b>
	max.	<b>3.0mΩ</b>
$I_D$ (Silicon Limited)		<b>230A</b> ①
$I_D$ (Package Limited)		<b>195A</b>



<b>G</b>	<b>D</b>	<b>S</b>
Gate	Drain	Source

## 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.

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	230①	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	160	
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Package Limited)	195	
$I_{DM}$	Pulsed Drain Current ②	900	
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	370	W
	Linear Derating Factor	2.5	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 20	V
$E_{AS}$	Single Pulse Avalanche Energy (Thermally Limited) ③	300	mJ
$I_{AR}$	Avalanche Current ②	See Fig. 14, 15, 22a, 22b	A
$E_{AR}$	Repetitive Avalanche Energy ②		mJ
dv/dt	Peak Diode Recovery ④	14	V/ns
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)		

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑤⑥	—	0.40	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑧	—	40	

HEXFET® is a registered trademark of International Rectifier.

\*Qualification standards can be found at <http://www.irf.com/>

**Static Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	75	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS/ΔT<sub>J</sub></sub>	Breakdown Voltage Temp. Coefficient	—	0.09	—	V/°C	Reference to 25°C, I <sub>D</sub> = 5mA②
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	2.5	3.0	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 140A ⑤
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	—	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
g <sub>fs</sub>	Forward Transconductance	230	—	—	S	V <sub>DS</sub> = 50V, I <sub>D</sub> = 140A
R <sub>G</sub>	Internal Gate Resistance	—	1.2	—	Ω	
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	20	μA	V <sub>DS</sub> = 75V, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 75V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	100	nA	V <sub>GS</sub> = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V <sub>GS</sub> = -20V

**Dynamic Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge	—	160	240	nC	I <sub>D</sub> = 140A
Q <sub>gs</sub>	Gate-to-Source Charge	—	38	—		V <sub>DS</sub> = 38V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	54	—		V <sub>GS</sub> = 10V ⑤
Q <sub>sync</sub>	Total Gate Charge Sync. (Q <sub>g</sub> - Q <sub>gd</sub> )	—	106	—		I <sub>D</sub> = 140A, V <sub>DS</sub> = 0V, V <sub>GS</sub> = 10V
t <sub>d(on)</sub>	Turn-On Delay Time	—	19	—	ns	V <sub>DD</sub> = 49V
t <sub>r</sub>	Rise Time	—	110	—		I <sub>D</sub> = 140A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	99	—		R <sub>G</sub> = 2.7Ω
t <sub>f</sub>	Fall Time	—	100	—		V <sub>GS</sub> = 10V ⑤
C <sub>iss</sub>	Input Capacitance	—	9370	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	840	—		V <sub>DS</sub> = 50V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	580	—		f = 1.0 MHz, See Fig. 5
C <sub>oss eff. (ER)</sub>	Effective Output Capacitance (Energy Related)	—	1130	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 60V ②, See Fig. 11
C <sub>oss eff. (TR)</sub>	Effective Output Capacitance (Time Related)	—	1500	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 60V ③

**Diode Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	230①	A	MOSFET symbol showing the integral reverse p-n junction diode.
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ②	—	—	900		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 140A, V <sub>GS</sub> = 0V ③
t <sub>rr</sub>	Reverse Recovery Time	—	54	—	ns	T <sub>J</sub> = 25°C V <sub>R</sub> = 64V,
		—	60	—		T <sub>J</sub> = 125°C I <sub>F</sub> = 140A
Q <sub>rr</sub>	Reverse Recovery Charge	—	103	—	nC	T <sub>J</sub> = 25°C di/dt = 100A/μs ⑤
		—	132	—		T <sub>J</sub> = 125°C
I <sub>RRM</sub>	Reverse Recovery Current	—	3.6	—	A	T <sub>J</sub> = 25°C
t <sub>on</sub>	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

**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. (Refer to AN-1140)
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L = 0.045mH  
R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 140A, V<sub>GS</sub> = 10V. Part not recommended for use above this value .
- ④ I<sub>SD</sub> ≤ 140A, di/dt ≤ 1380A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ 175°C.
- ⑤ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ⑥ C<sub>oss eff. (TR)</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>.
- ⑦ C<sub>oss eff. (ER)</sub> is a fixed capacitance that gives the same energy as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>.
- 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<sub>θ</sub> is measured at T<sub>J</sub> approximately 90°C
- ⑩ R<sub>θJC</sub> value shown is at time zero.

**Qualification Information<sup>†</sup>**

<b>Qualification Level</b>		Automotive (per AEC-Q101) <sup>††</sup>	
		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
<b>Moisture Sensitivity Level</b>		3L-D2 PAK	MSL1
		3L-TO-262	N/A
<b>ESD</b>	Machine Model	Class M4(+/- 800V) <sup>†††</sup> (per AEC-Q101-002)	
	Human Body Model	Class H3A(+/- 6000V) <sup>†††</sup> (per AEC-Q101-001)	
	Charged Device Model	Class C5(+/- 2000V) <sup>†††</sup> (per AEC-Q101-005)	
<b>RoHS Compliant</b>		Yes	

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

†† Exceptions (if any) to AEC-Q101 requirements are noted in the qualification report.

††† Highest passing voltage

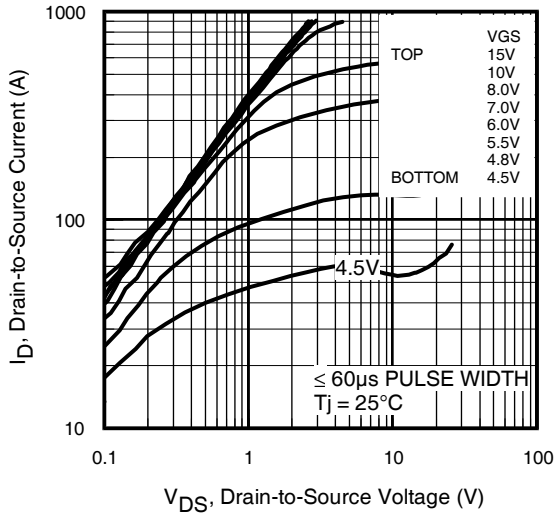


Fig 1. Typical Output Characteristics

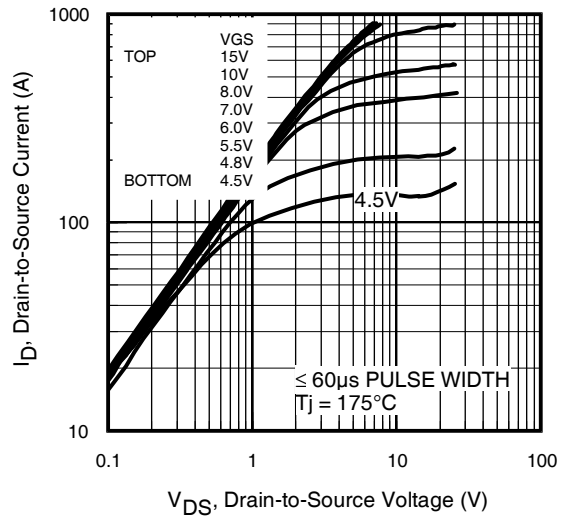


Fig 2. Typical Output Characteristics

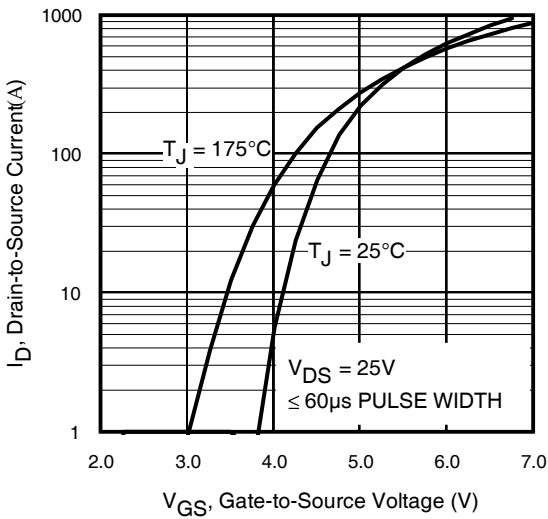


Fig 3. Typical Transfer Characteristics

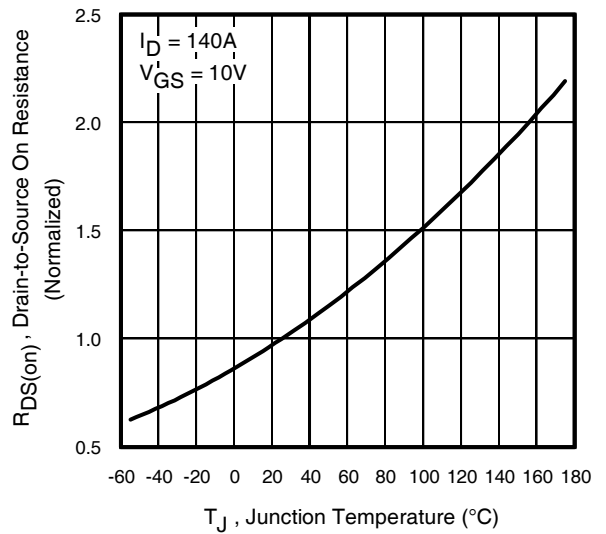


Fig 4. Normalized On-Resistance vs. Temperature

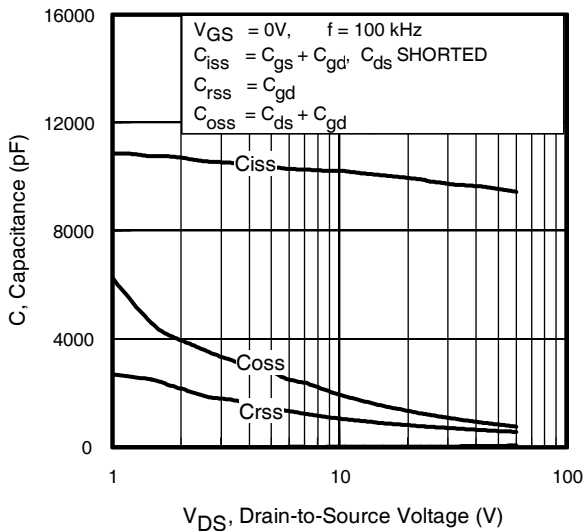


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

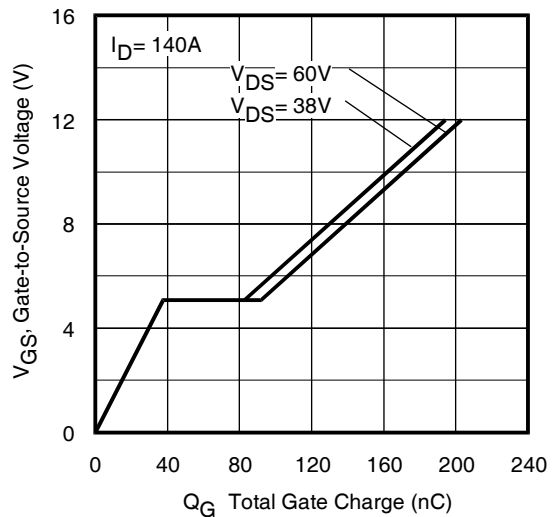


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

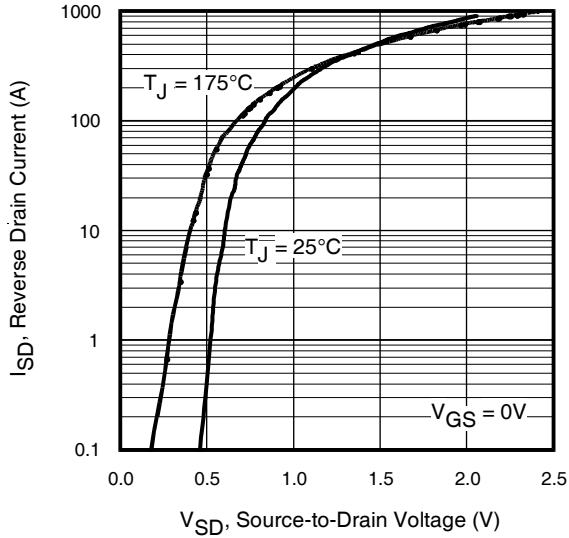


Fig 7. Typical Source-Drain Diode Forward Voltage

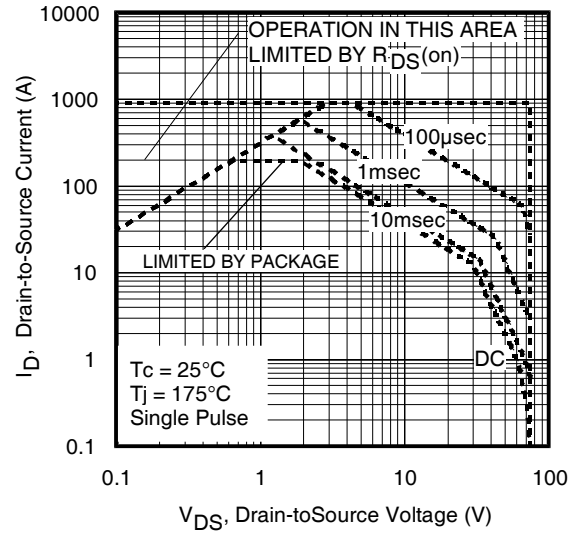


Fig 8. Maximum Safe Operating Area

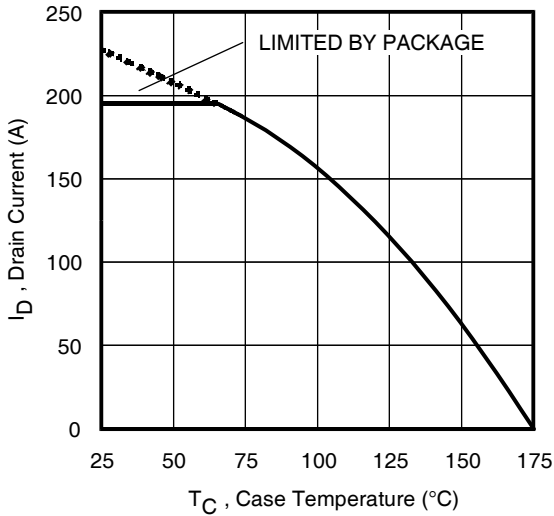


Fig 9. Maximum Drain Current vs. Case Temperature

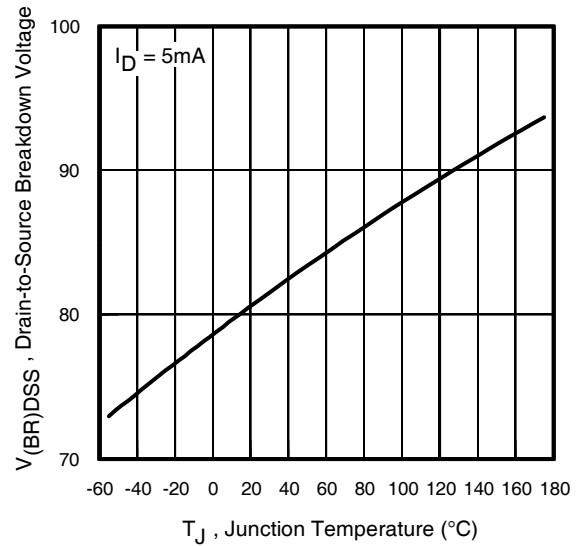


Fig 10. Drain-to-Source Breakdown Voltage

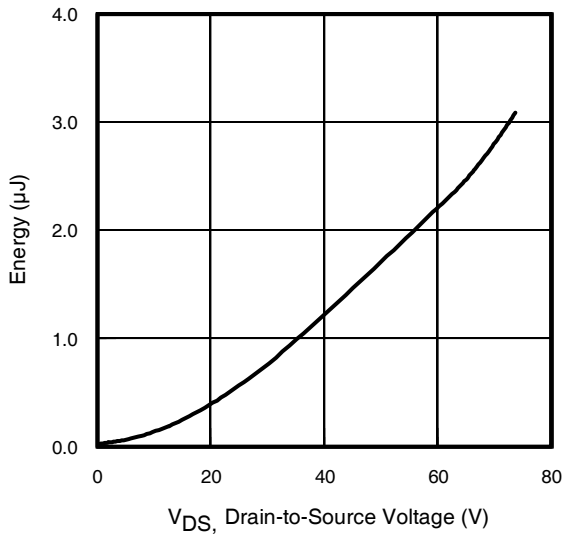


Fig 11. Typical  $C_{OSS}$  Stored Energy

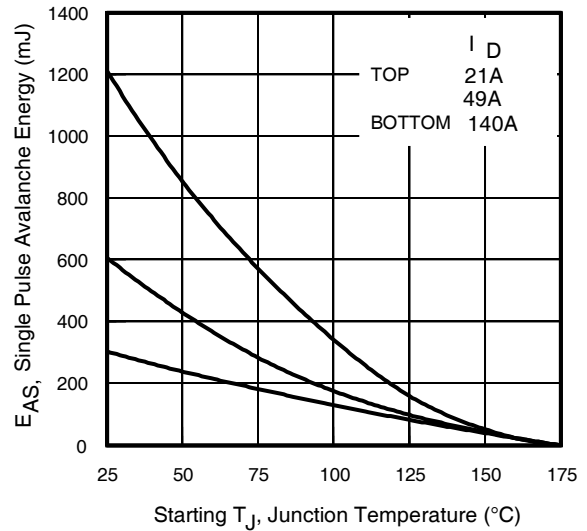


Fig 12. Maximum Avalanche Energy Vs. Drain Current

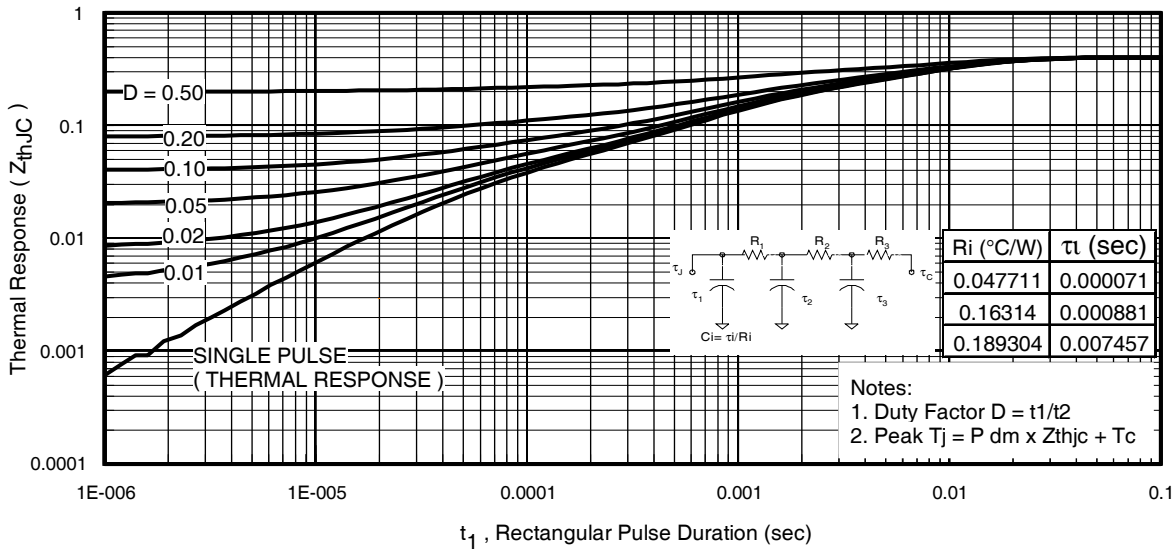


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

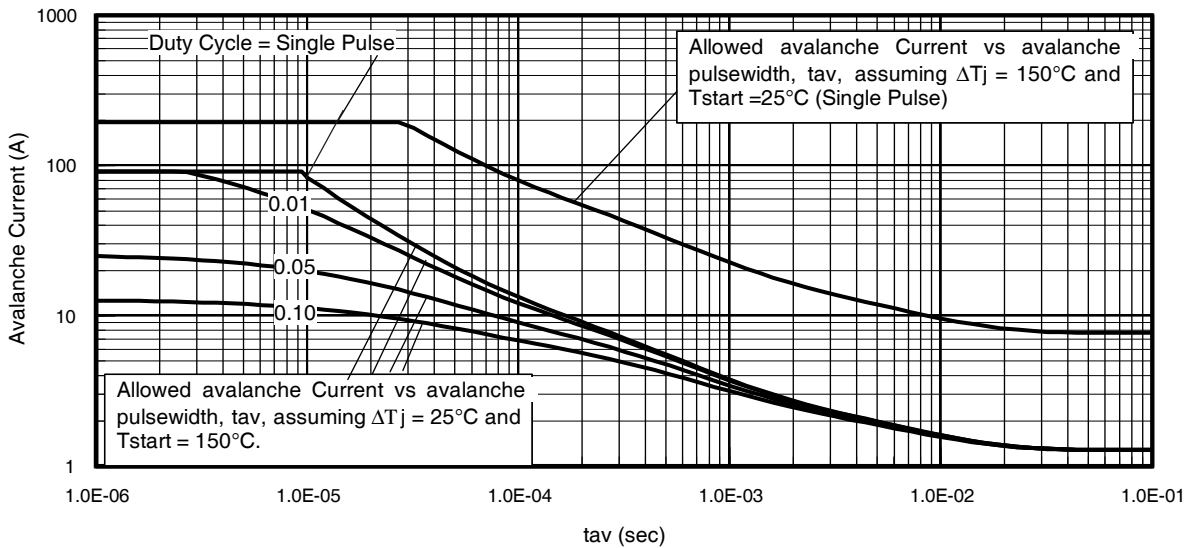
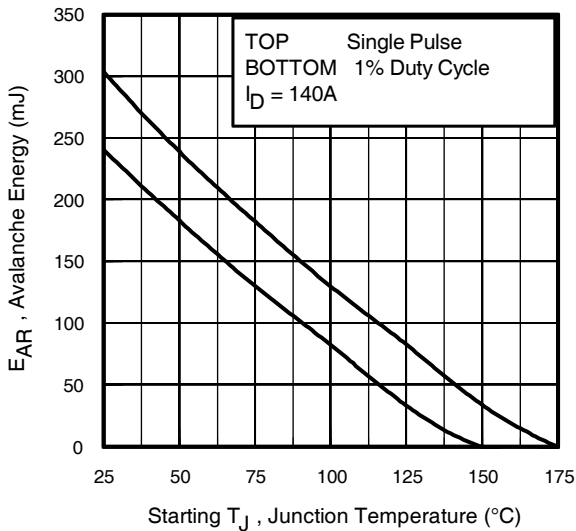


Fig 14. Typical Avalanche Current vs. Pulsewidth



Notes on Repetitive Avalanche Curves, Figures 14, 15:  
 (For further info, see AN-1005 at [www.irf.com](http://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 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  $25^\circ C$  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 15. Maximum Avalanche Energy vs. Temperature

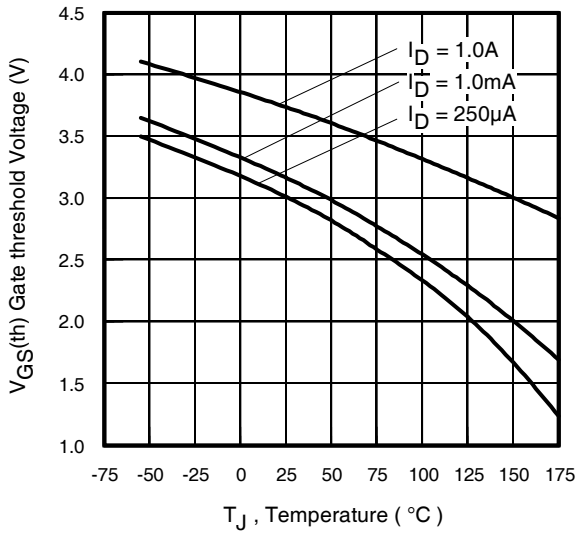


Fig 16. Threshold Voltage Vs. Temperature

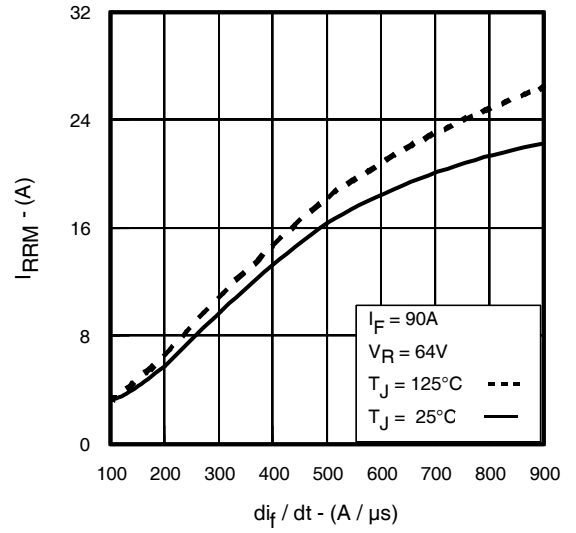


Fig. 17 - Typical Recovery Current vs.  $di_T/dt$

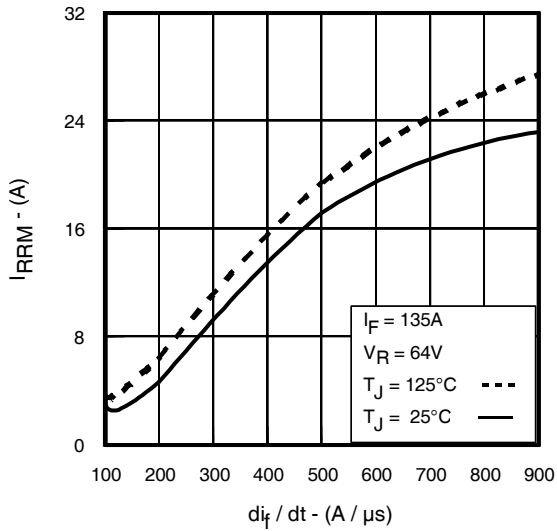


Fig. 18 - Typical Recovery Current vs.  $di_T/dt$

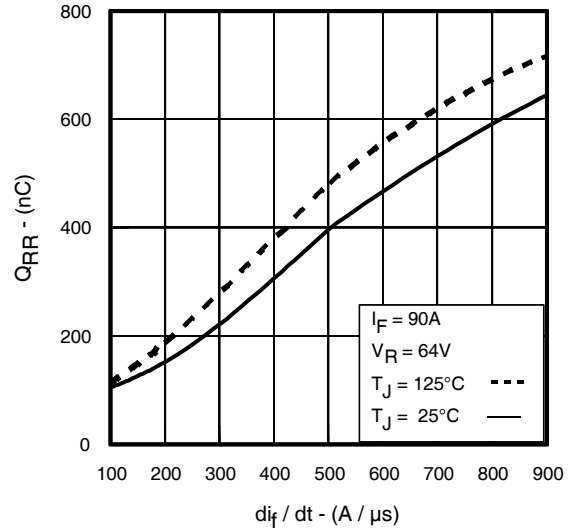


Fig. 19 - Typical Stored Charge vs.  $di_T/dt$

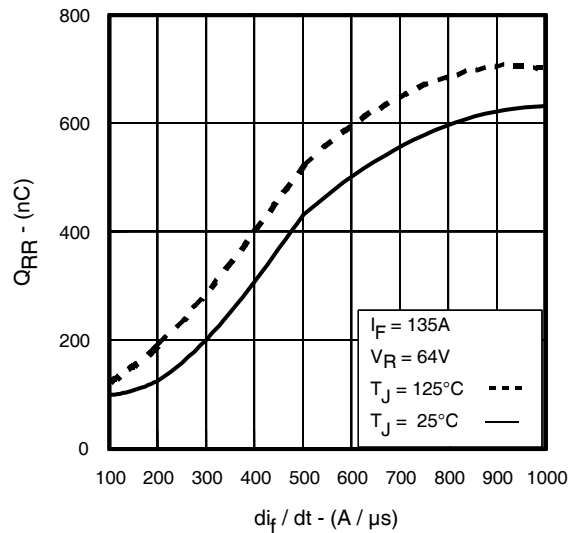
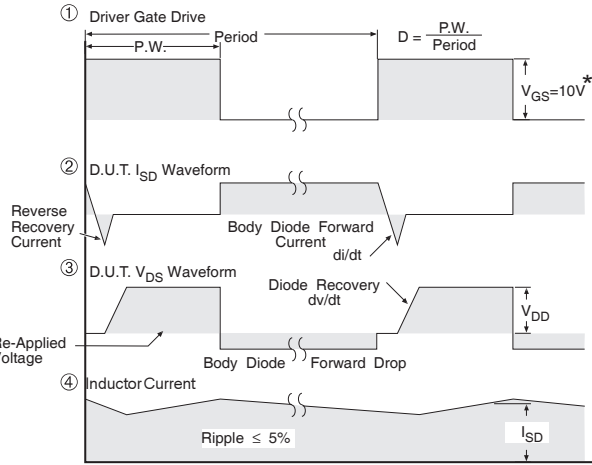
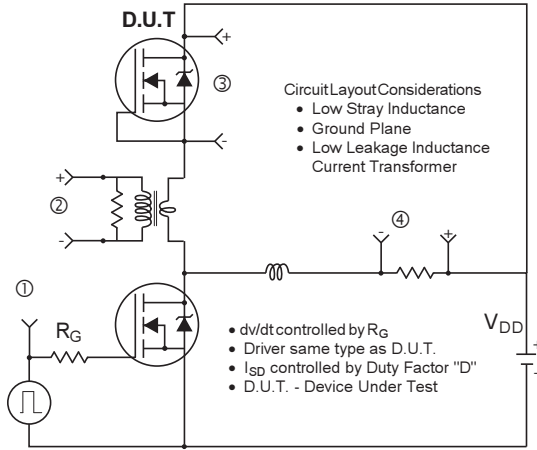
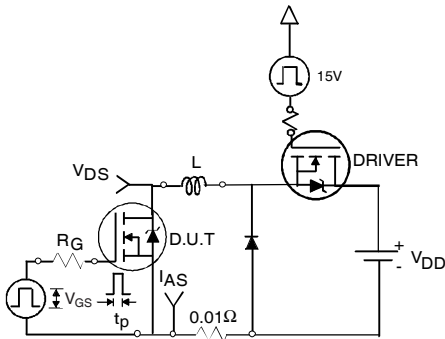


Fig. 20 - Typical Stored Charge vs.  $di_T/dt$



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

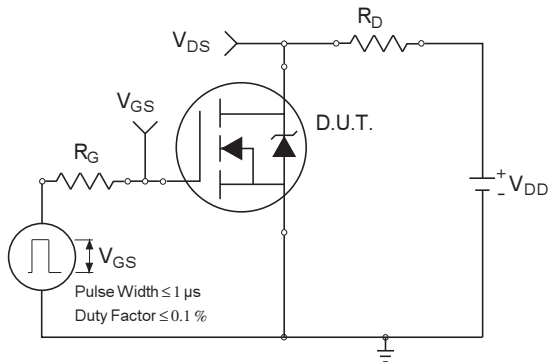
**Fig 21. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs**



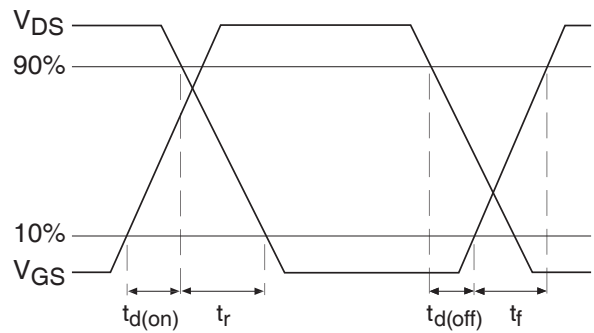
**Fig 22a. Unclamped Inductive Test Circuit**



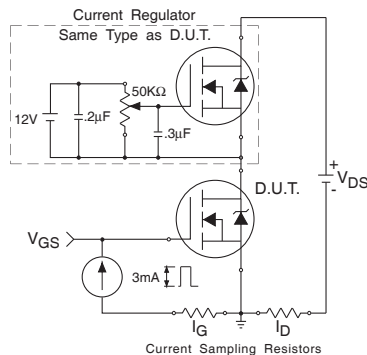
**Fig 22b. Unclamped Inductive Waveforms**



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



**Fig 23b. Switching Time Waveforms**



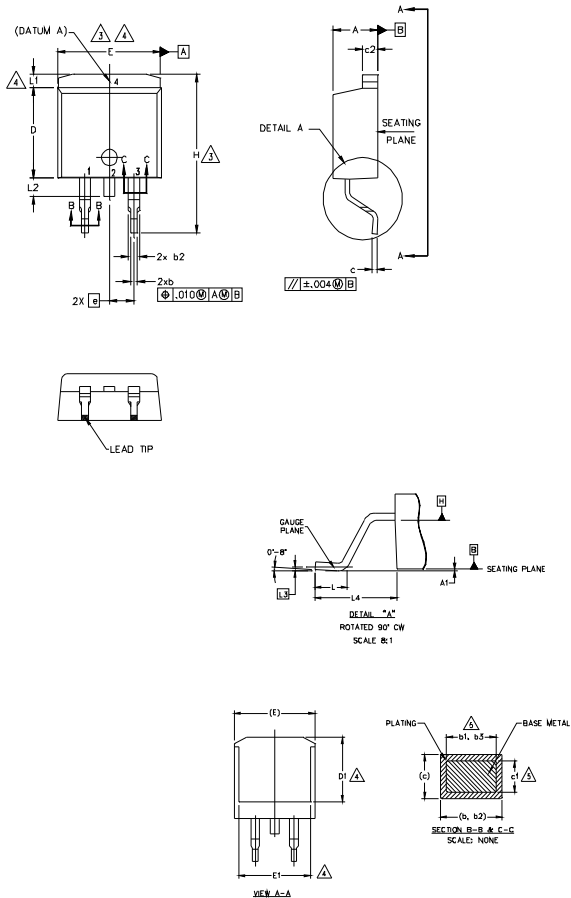
**Fig 24a. Gate Charge Test Circuit**



**Fig 24b. Gate Charge Waveform**



D<sup>2</sup>Pak 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 AT DATUM H.
  4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
  5. DIMENSION b1 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	
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

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

IGBTs, CoPACK

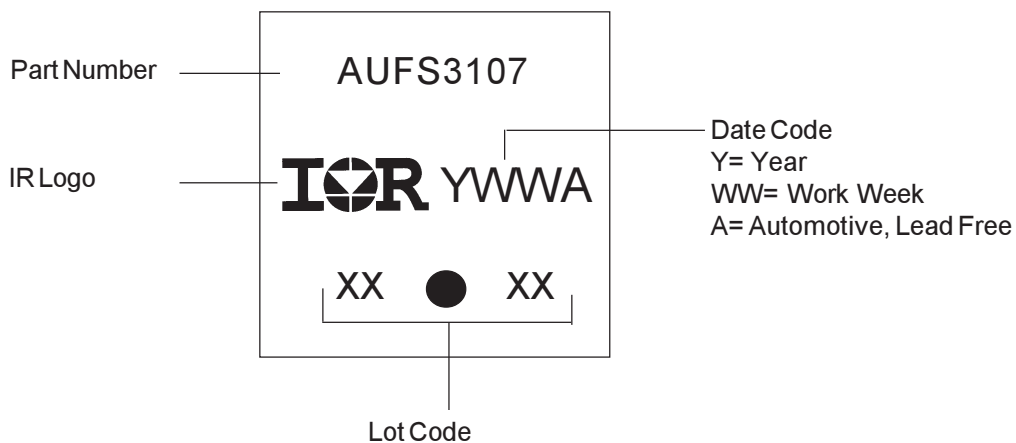
- 1.- GATE
- 2, 4.- COLLECTOR
- 3.- EMITTER

DIODES

- 1.- ANODE \*
- 2, 4.- CATHODE
- 3.- ANODE

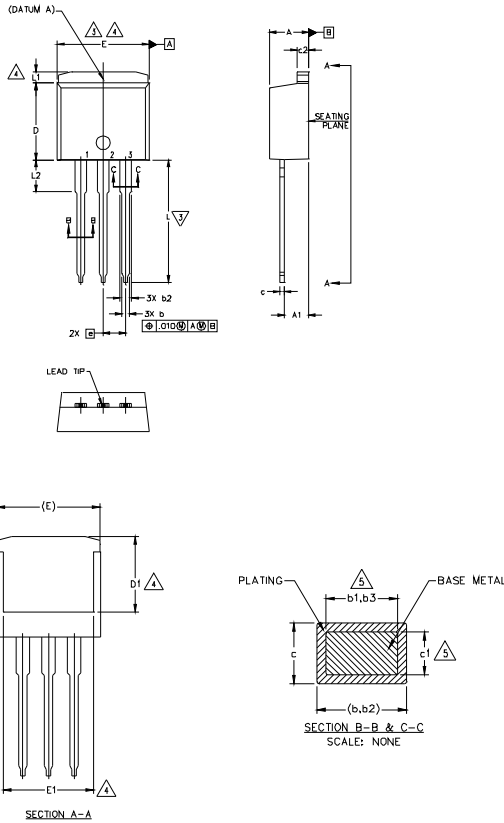
\* PART DEPENDENT.

D<sup>2</sup>Pak 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 [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.

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

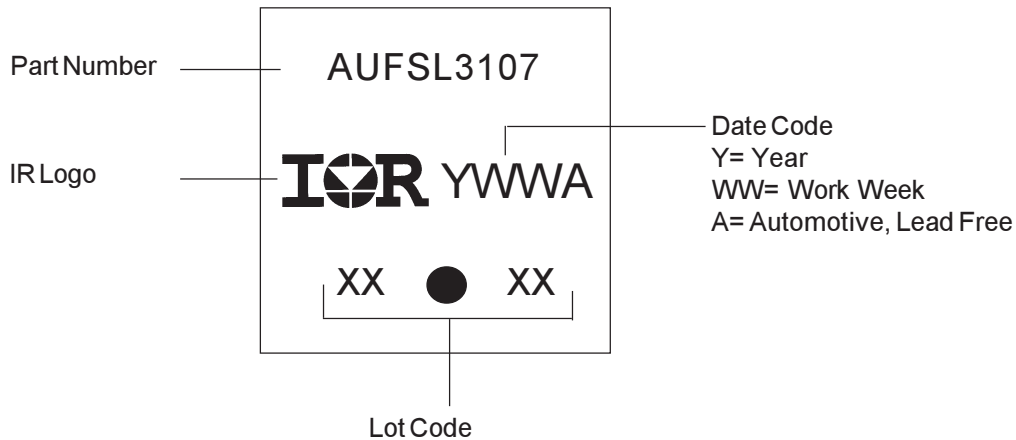
HEXFET

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

IGBTs, CoPACK

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

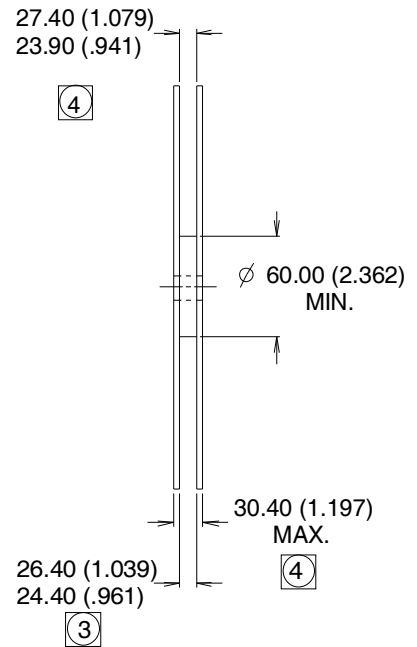
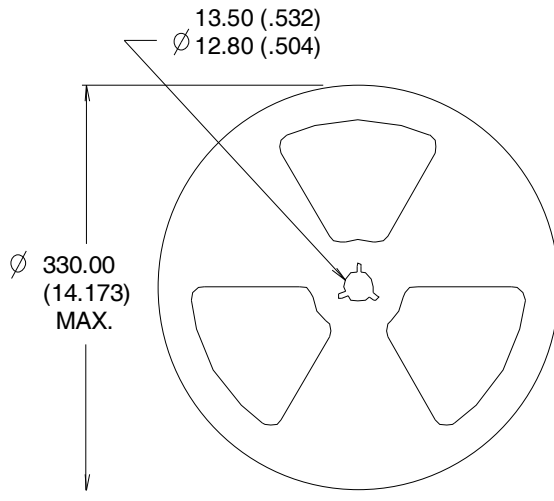
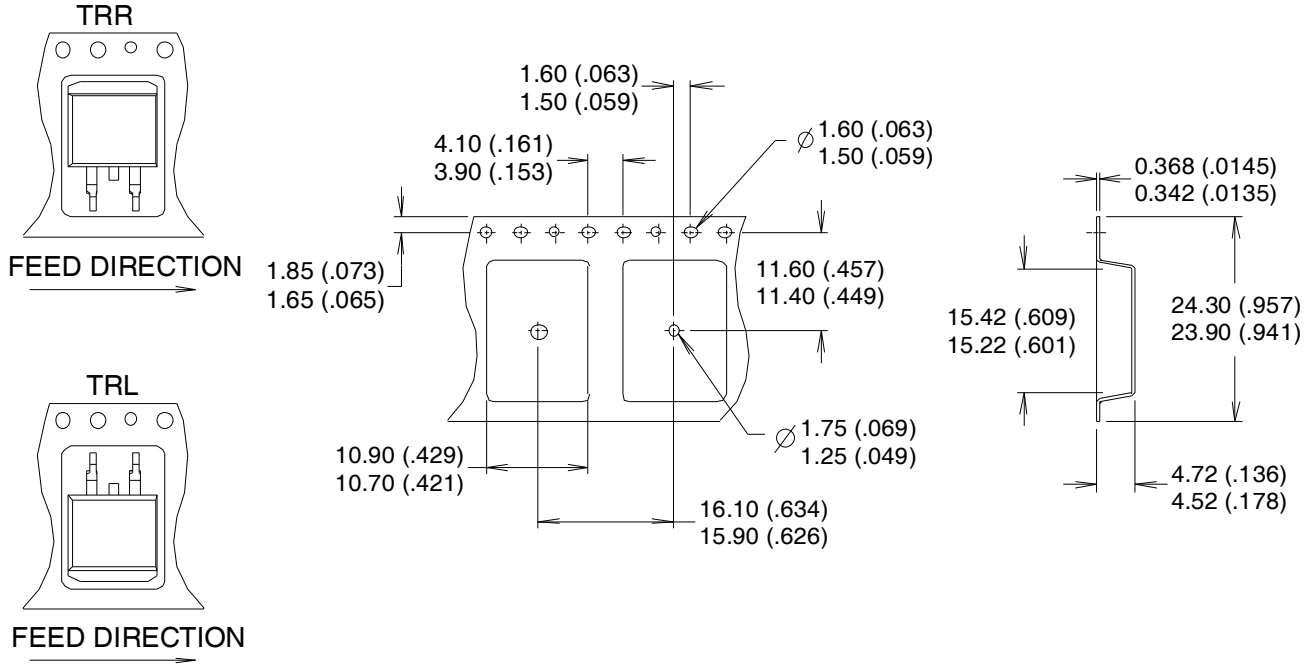
TO-262 Part Marking Information



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

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

**Ordering Information**

Base part	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRFSL3107	TO-262	Tube	50	AUIRFSL3107
AUIRFS3107	D2Pak	Tube	50	AUIRFS3107
		Tape and Reel Left	800	AUIRFS3107TRL
		Tape and Reel Right	800	AUIRFS3107TRR

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