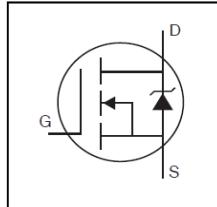


HEXFET® Power MOSFET

**Features**

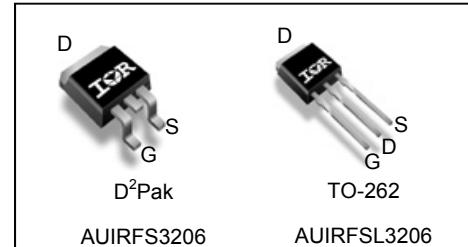
- Advanced Process Technology
- Ultra Low On-Resistance
- Enhanced dV/dT and dl/dT capability
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified \*



$V_{DSS}$	60V
$R_{DS(on)}$	typ. 2.4mΩ
	max. 3.0mΩ
$I_D$ (Silicon Limited)	210A①
$I_D$ (Package Limited)	120A

**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



G	D	S
Gate	Drain	Source

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRFSL3206	TO-262	Tube	50	AUIRFSL3206
AUIRFS3206	D²-Pak	Tube	50	AUIRFS3206
		Tape and Reel Left	800	AUIRFS3206TRL

**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 (TA) is 25°C, unless otherwise specified.

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Silicon Limited)	210①	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Silicon Limited)	150①	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Package Limited)	120	
$I_{DM}$	Pulsed Drain Current ②	840	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	300	W
	Linear Derating Factor	2.0	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 20	V
$E_{AS}$	Single Pulse Avalanche Energy (Thermally Limited) ③	170	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	5.0	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**

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑨	—	0.50	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount), D² Pak®	—	40	

HEXFET® is a registered trademark of Infineon.

\*Qualification standards can be found at [www.infineon.com](http://www.infineon.com)

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	60	—	—	V	$V_{GS} = 0V, I_D = 250\mu\text{A}$
$\Delta V_{(\text{BR})\text{DSS}}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.07	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 5\text{mA}$ ②
$R_{DS(\text{on})}$	Static Drain-to-Source On-Resistance	—	2.4	3.0	$\text{m}\Omega$	$V_{GS} = 10V, I_D = 75\text{A}$ ⑤
$V_{GS(\text{th})}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 150\mu\text{A}$
$g_{fs}$	Forward Trans conductance	210	—	—	S	$V_{DS} = 50V, I_D = 75\text{A}$
$R_G$	Gate Resistance	—	0.7	—	$\Omega$	
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	$\mu\text{A}$	$V_{DS} = 60V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 48V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	$\text{nA}$	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$

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

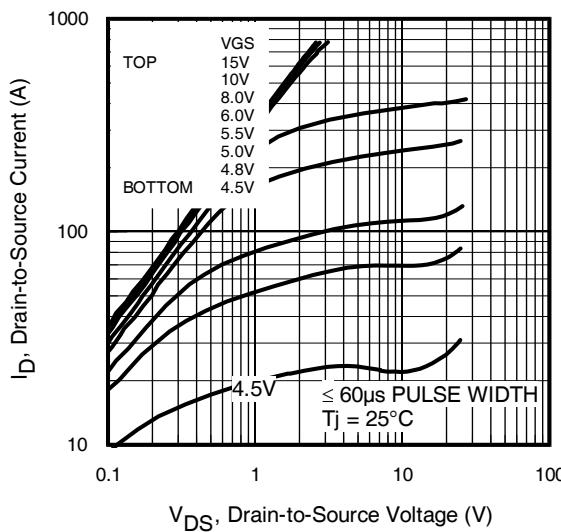
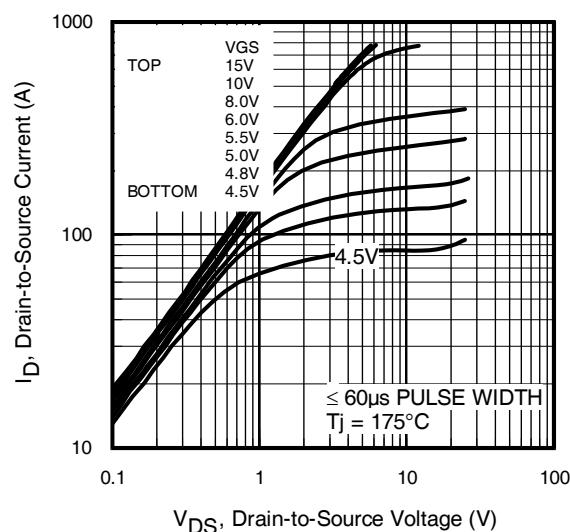
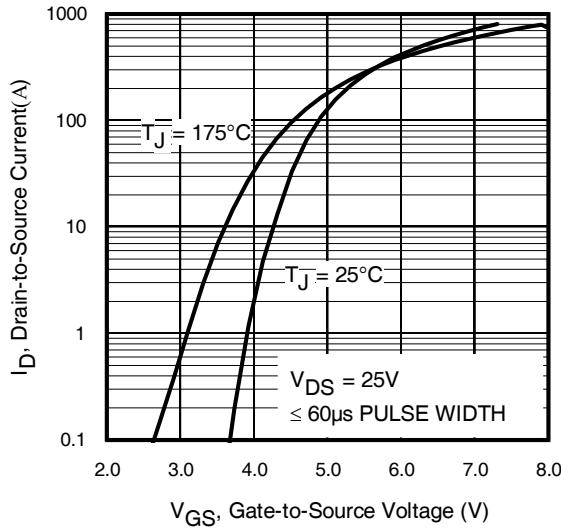
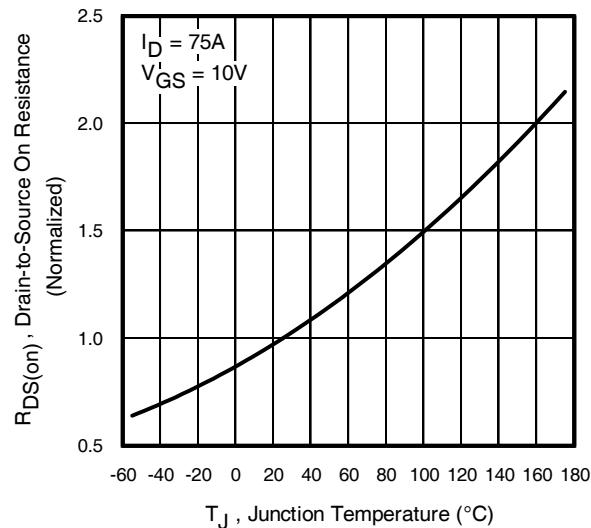
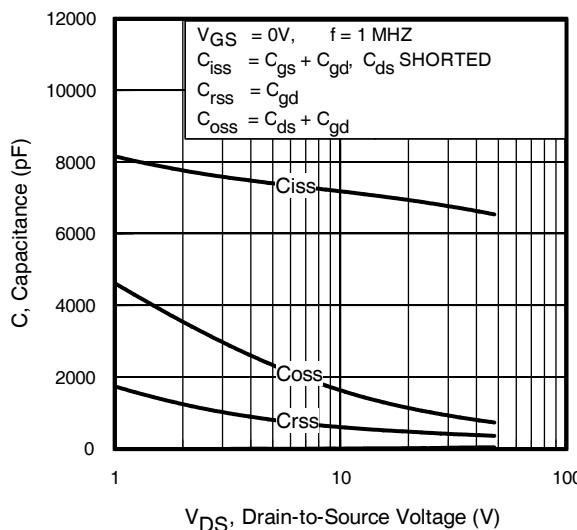
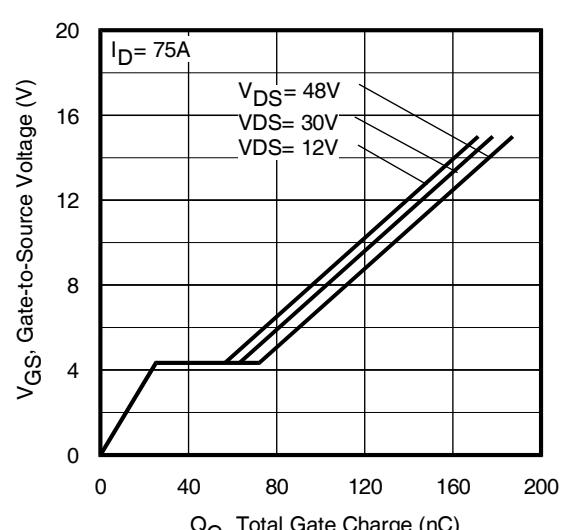
$Q_g$	Total Gate Charge	—	120	170	nC	$I_D = 75\text{A}$ $V_{DS} = 30V$ $V_{GS} = 10V$ ⑤
$Q_{gs}$	Gate-to-Source Charge	—	29	—		
$Q_{gd}$	Gate-to-Drain Charge	—	35	—		
$Q_{\text{sync}}$	Total Gate Charge Sync. ( $Q_g - Q_{gd}$ )	—	85	—		
$t_{d(on)}$	Turn-On Delay Time	—	19	—	ns	$V_{DD} = 30V$ $I_D = 75\text{A}$ $R_G = 2.7\Omega$ $V_{GS} = 10V$ ⑤
$t_r$	Rise Time	—	82	—		
$t_{d(off)}$	Turn-Off Delay Time	—	55	—		
$t_f$	Fall Time	—	83	—		
$C_{iss}$	Input Capacitance	—	6540	—	pF	$V_{GS} = 0V$ $V_{DS} = 50V$
$C_{oss}$	Output Capacitance	—	720	—		$f = 1.0\text{MHz}$ , See Fig. 5
$C_{rss}$	Reverse Transfer Capacitance	—	360	—		
$C_{oss \text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related)	—	1040	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 48V$ ⑦
$C_{oss \text{ eff. (TR)}}$	Effective Output Capacitance (Time Related)	—	1230	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 48V$ ⑥

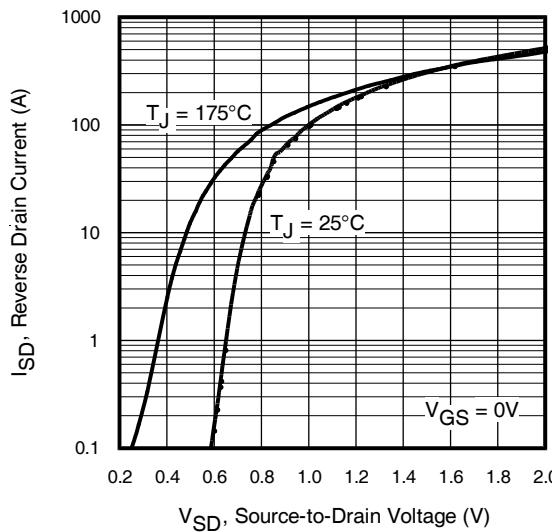
**Diode Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_s$	Continuous Source Current (Body Diode)	—	—	210 ①	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{sM}$	Pulsed Source Current (Body Diode) ②	—	—	840		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_s = 75\text{A}, V_{GS} = 0V$ ⑤
$t_{rr}$	Reverse Recovery Time	—	33	50		$T_J = 25^\circ\text{C} \quad V_{DD} = 51V$
		—	37	56		$T_J = 125^\circ\text{C} \quad I_F = 75\text{A},$
$Q_{rr}$	Reverse Recovery Charge	—	41	62	nC	$T_J = 25^\circ\text{C} \quad \text{di/dt} = 100\text{A}/\mu\text{s}$ ⑤
		—	53	80		$T_J = 125^\circ\text{C}$
$I_{RRM}$	Reverse Recovery Current	—	2.1	—	A	$T_J = 25^\circ\text{C}$
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_s + L_D$ )				

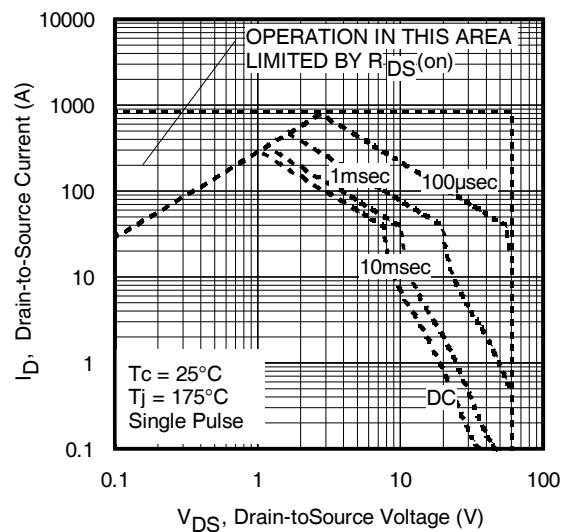
**Notes:**

- ① Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 120A. 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  $T_{J\text{max}}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.023\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 120\text{A}$ ,  $V_{GS} = 10V$ . Part not recommended for use above this value.
- ④  $I_{SD} \leq 75\text{A}$ ,  $\text{di/dt} \leq 360\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(\text{BR})\text{DSS}}$ ,  $T_J \leq 175^\circ\text{C}$ .
- ⑤ Pulse width  $\leq 400\mu\text{s}$ ; 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  $90^\circ\text{C}$ .

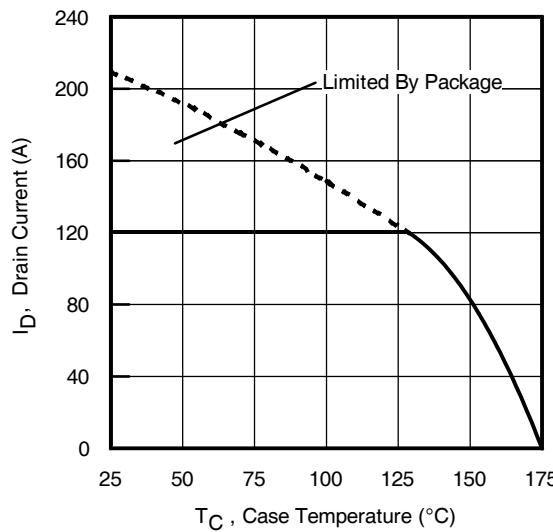

**Fig. 1** Typical Output Characteristics

**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



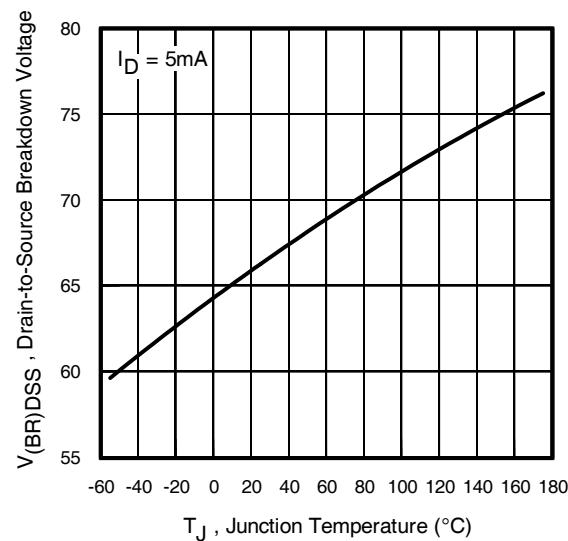
**Fig. 7** Typical Source-to-Drain Diode



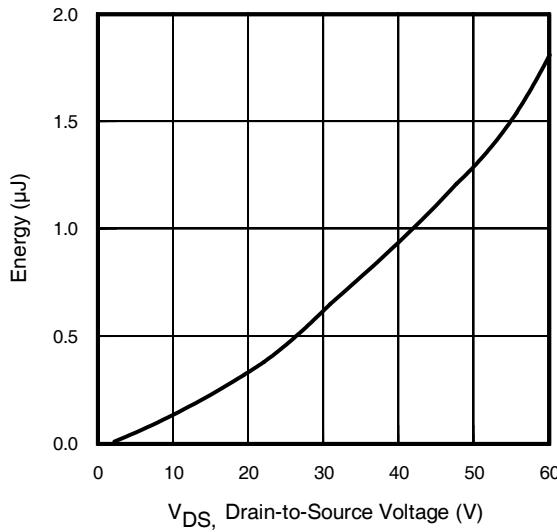
**Fig 8.** Maximum Safe Operating Area



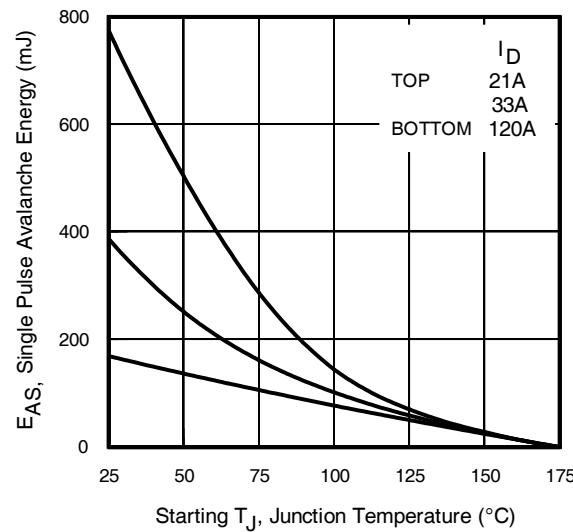
**Fig 9.** Maximum Drain Current vs. Case Temperature



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



**Fig 11.** Typical Coss Stored Energy



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

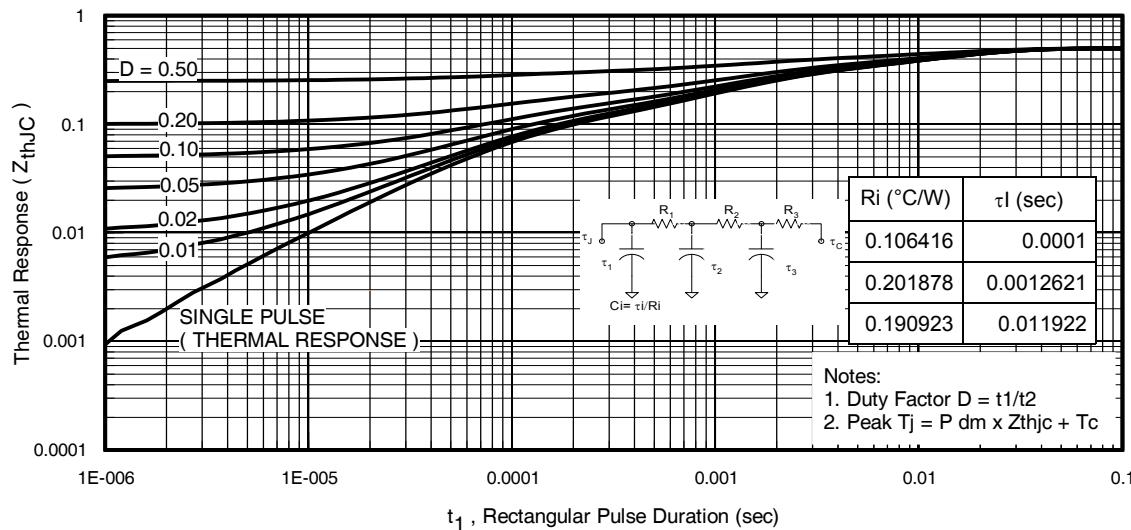


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

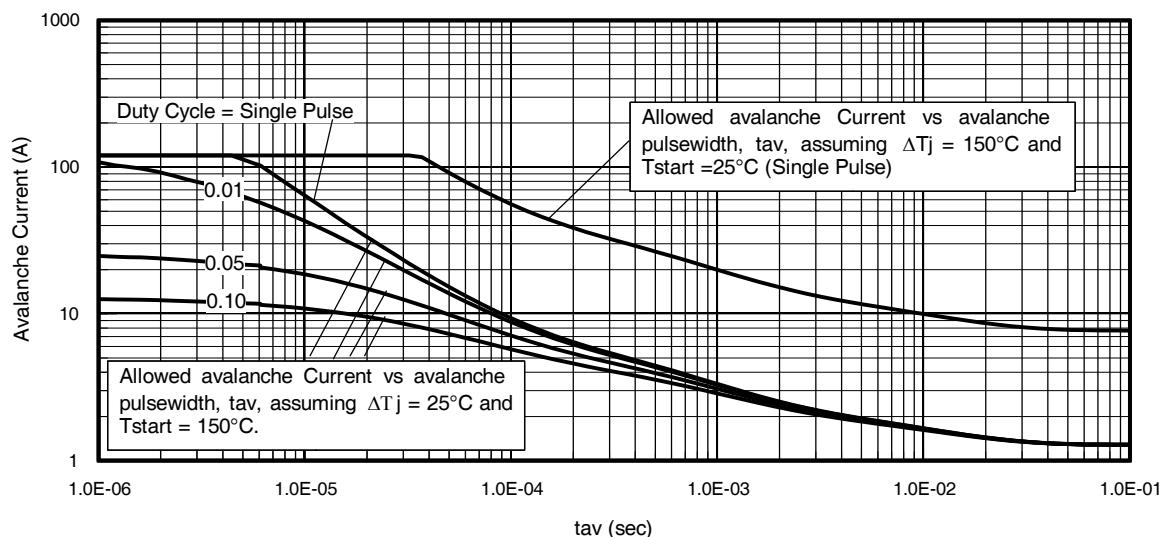


Fig 14. Avalanche Current vs. Pulse width

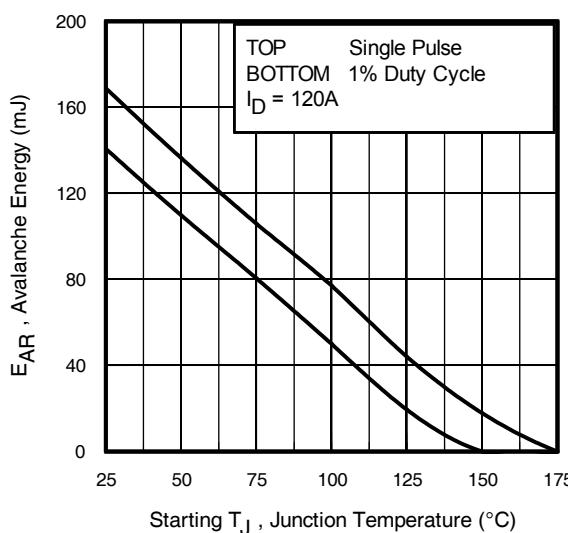


Fig 15. Maximum Avalanche Energy vs. Temperature

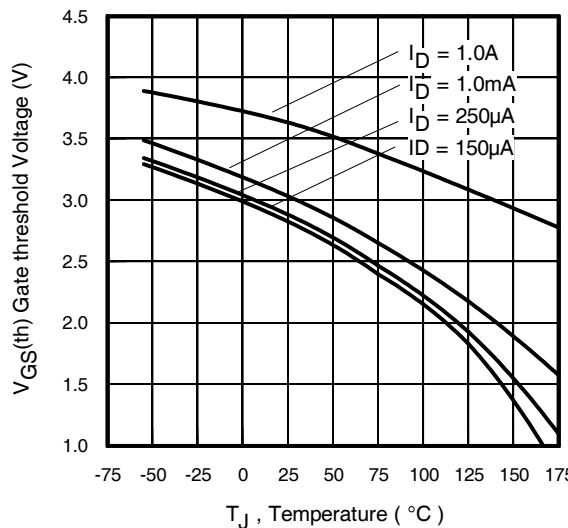
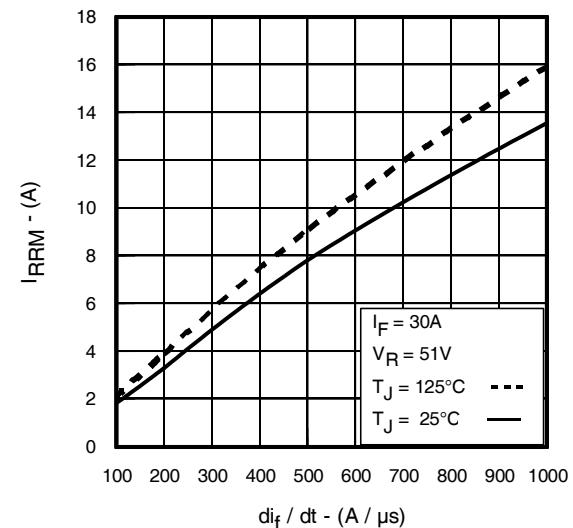
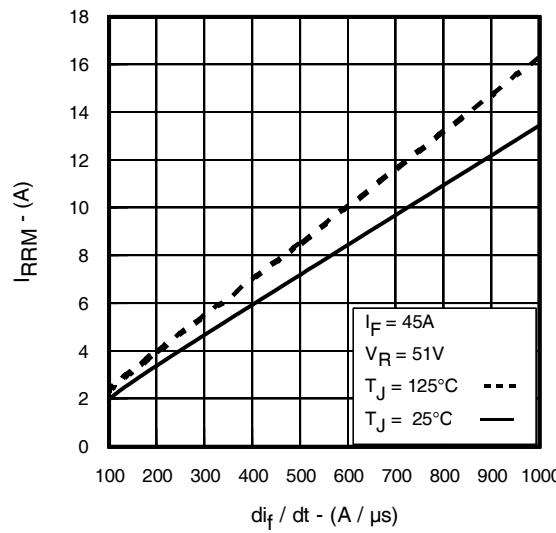
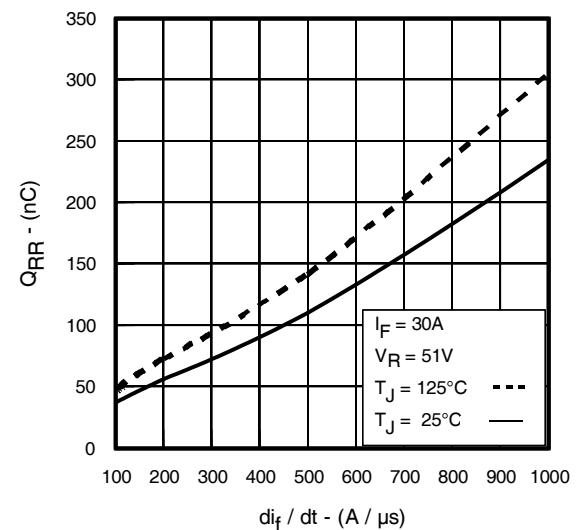
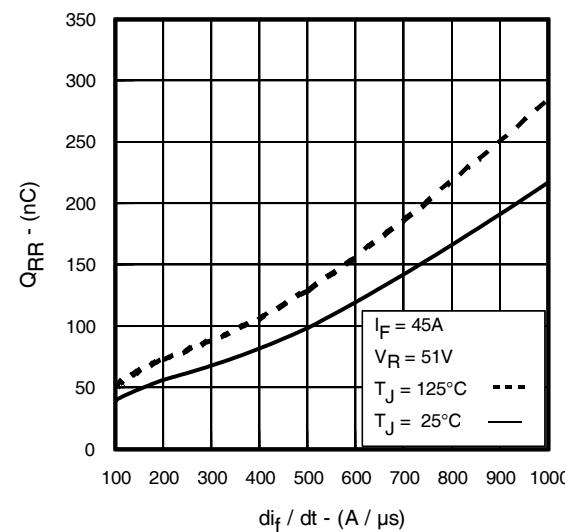
#### Notes on Repetitive Avalanche Curves , Figures 14, 15: (For further info, see AN-1005 at [www.infineon.com](http://www.infineon.com))

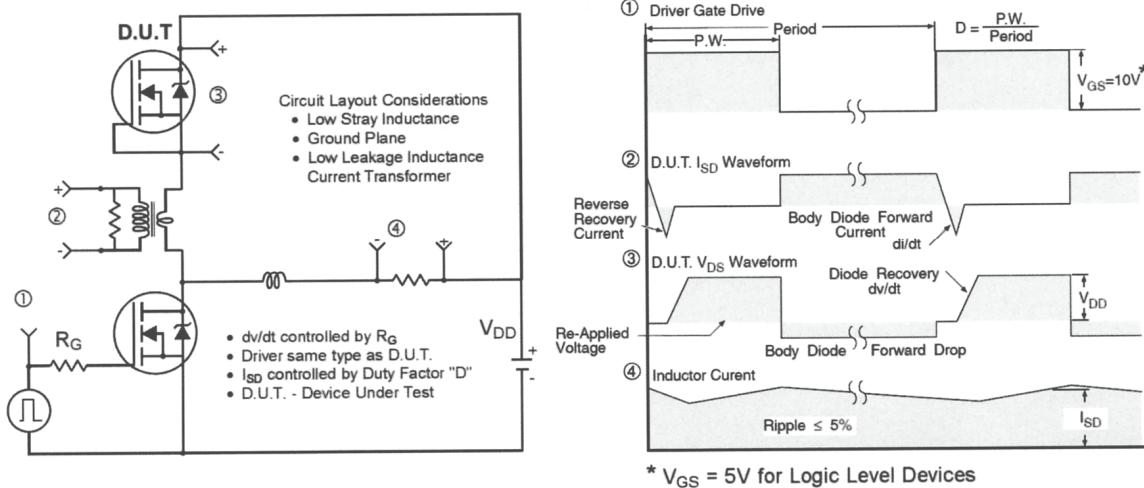
1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
  2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
  3. Equation below based on circuit and waveforms shown in Figures 18a, 18b.
  4.  $P_D(\text{ave})$  = 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 =  $t_{av}/f$   
 $Z_{thJC}(D, t_{av})$  = Transient thermal resistance, see Figures 13)

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

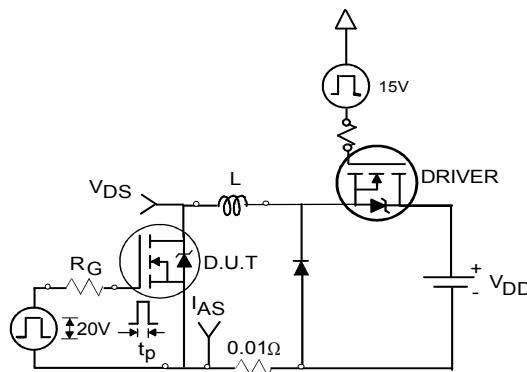
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

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

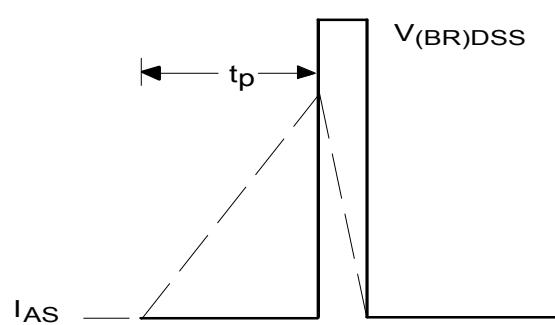

**Fig. 16.** Threshold Voltage vs. Temperature

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

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

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

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



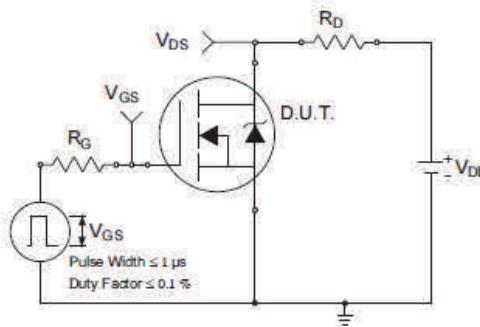
**Fig 21.** Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs



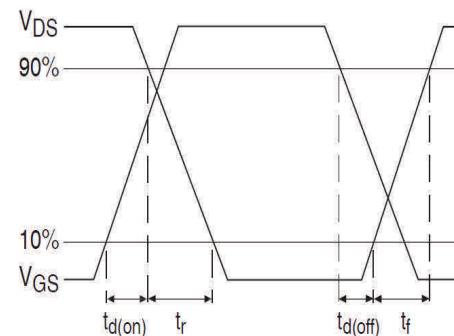
**Fig 22a.** Unclamped Inductive Test Circuit



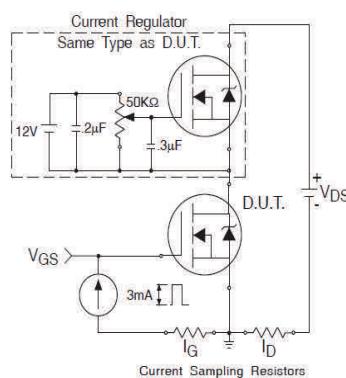
**Fig 22b.** Unclamped Inductive Waveforms



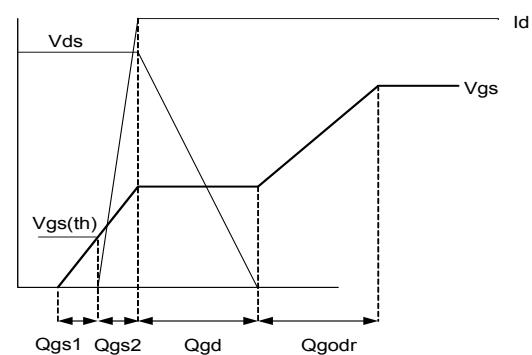
**Fig 23a.** Switching Time Test Circuit



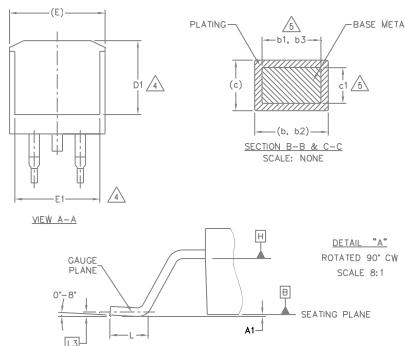
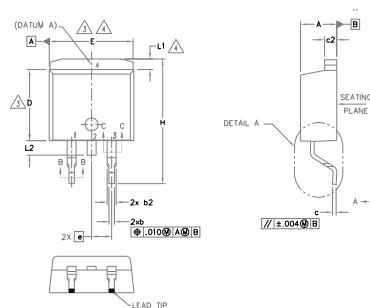
**Fig 23b.** Switching Time Waveforms



**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))

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		
c	0.38	0.74	.015	.029		
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		
E1	6.22	—	.245	—		
e	2.54 BSC		.100 BSC			
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

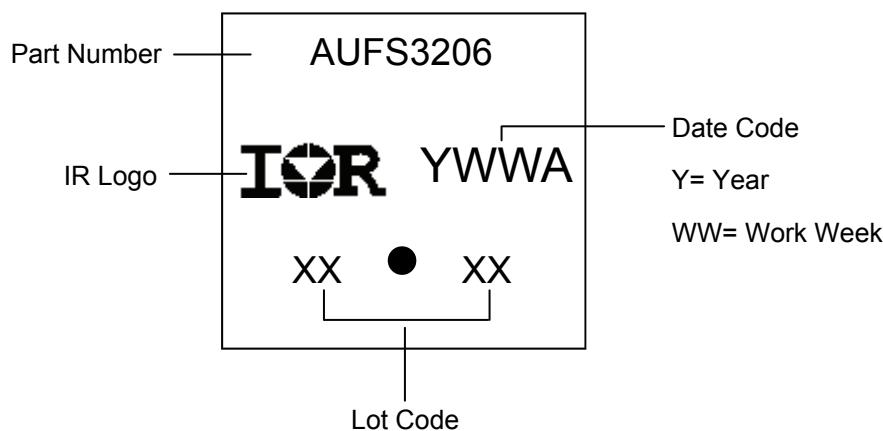
- 1.- ANODE (TWO DIE) / OPEN (ONE DIE)
- 2, 4.- CATHODE
- 3.- ANODE

## HEXFET

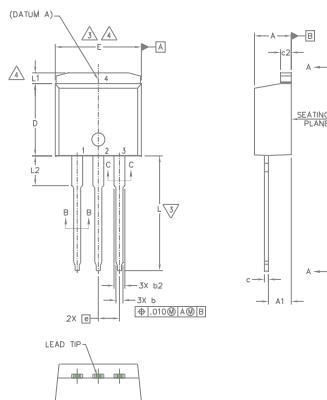
- 1.- GATE
- 2, 4.- DRAIN
- 3.- SOURCE

## IGRTs, CoPACK

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

D<sup>2</sup>Pak (TO-263AB) 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.

## LEAD ASSIGNMENTS

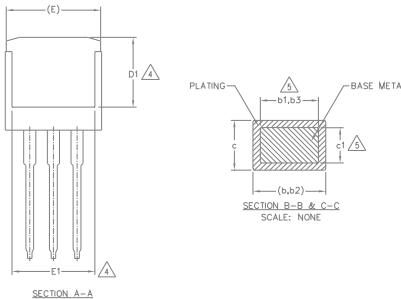
## IGBTs, CoPACK

1. GATE
2. COLLECTOR
3. Emitter
4. COLLECTOR

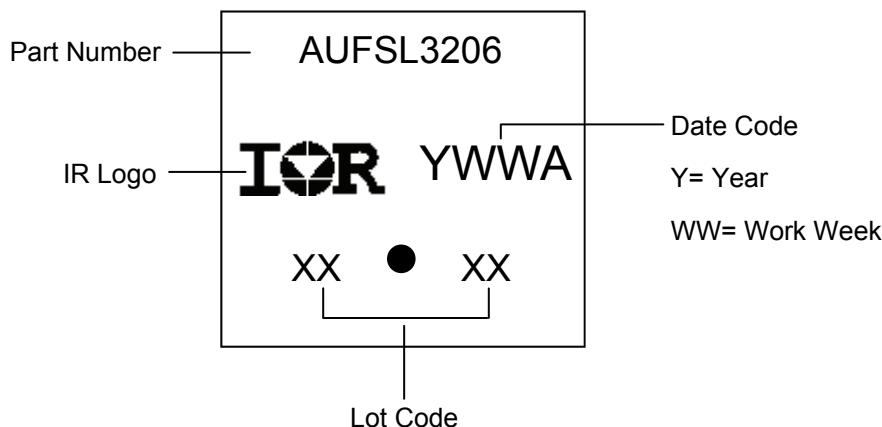
## HEXFET

## DIODES

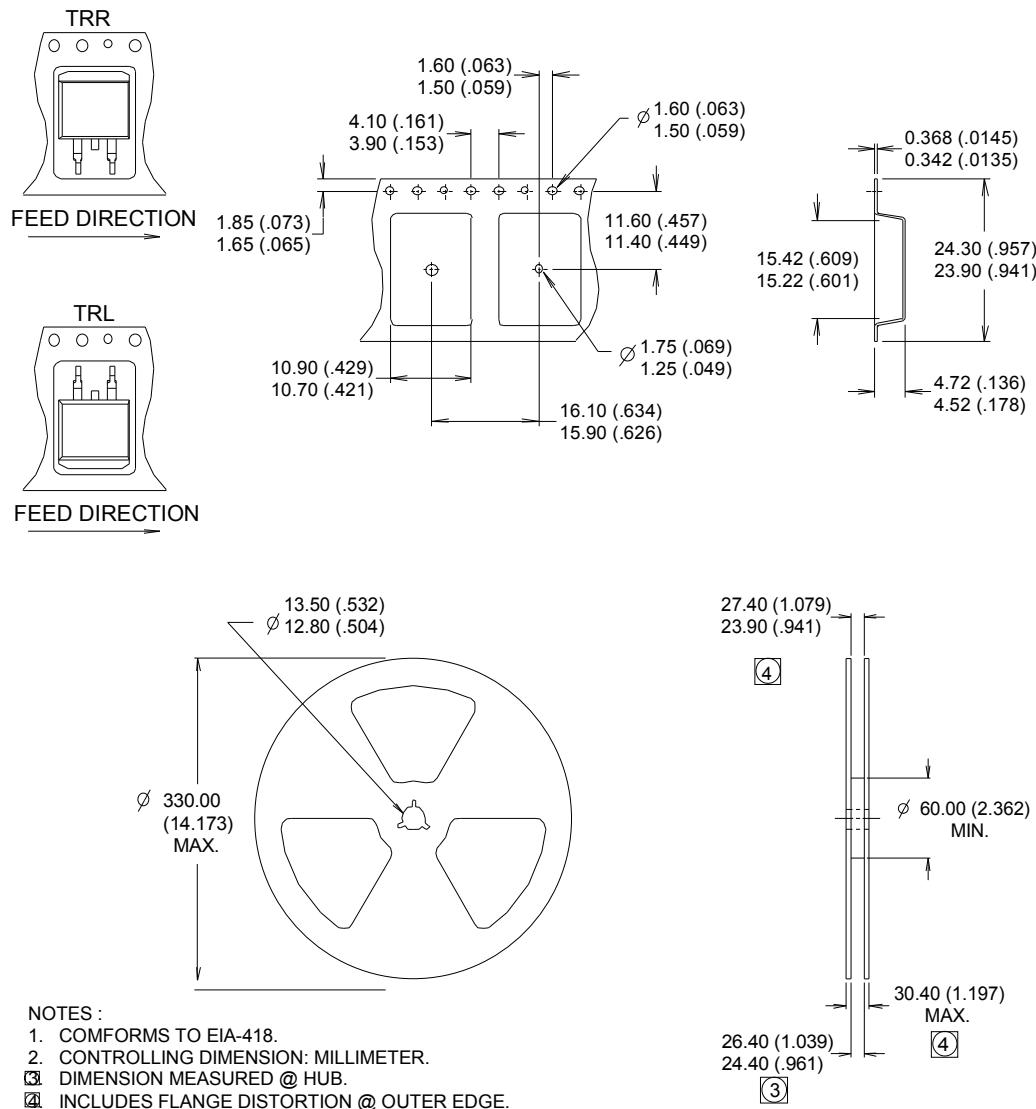
- |           |                                      |
|-----------|--------------------------------------|
| 1. GATE   | 1 - ANODE (TWO DIE) / OPEN (ONE DIE) |
| 2. DRAIN  | 2, 4. - CATHODE                      |
| 3. SOURCE | 3. - ANODE                           |
| 4. DRAIN  |                    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



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		
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		
L2	3.56	3.71	.140	.146	4	

**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))

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

**Qualification Information**

<b>Qualification Level</b>		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.	
<b>Moisture Sensitivity Level</b>		D <sup>2</sup> -Pak	MSL1
		TO-262	
<b>ESD</b>	Machine Model	Class M4 (+/- 800V) <sup>†</sup> AEC-Q101-002	
	Human Body Model	Class H2 (+/- 4000V) <sup>†</sup> AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V) <sup>†</sup> AEC-Q101-005	
<b>RoHS Compliant</b>		Yes	

<sup>†</sup> Highest passing voltage.

**Revision History**

Date	Comments
10/27/2015	<ul style="list-style-type: none"> <li>• Updated datasheet with corporate template</li> <li>• Corrected ordering table on page 1.</li> </ul>

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ООО "ЛайфЭлектроникс"

"LifeElectronics" LLC

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибуторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибуторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помочь разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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