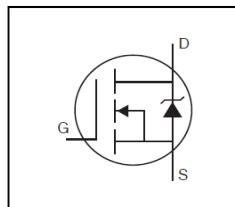


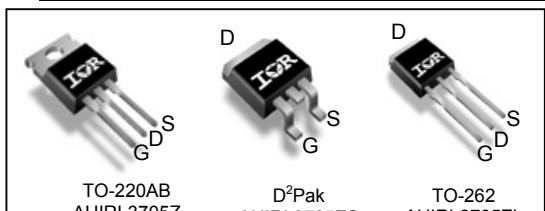
Features

- Logic Level
- 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 *



HEXFET® Power MOSFET

V_{DSS}	55V
$R_{DS(on)}$ typ.	6.5mΩ
	max. 8.0mΩ
I_D (Silicon Limited)	86A ^①
I_D (Package Limited)	75A



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	
AUIRL3705Z	TO-220	Tube	50	AUIRL3705Z
AUIRL3705ZL	TO-262	Tube	50	AUIRL3705ZL
AUIRL3705ZS	D ² -Pak	Tube	50	AUIRL3705ZS
		Tape and Reel Left	800	AUIRL3705ZSTR

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 @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	86 ^①	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	61	
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V (Package Limited)	75	
I_{DM}	Pulsed Drain Current ①	340	
P_D @ $T_C = 25^\circ\text{C}$	Maximum Power Dissipation	130	W
	Linear Derating Factor	0.88	W/°C
V_{GS}	Gate-to-Source Voltage	± 16	V
E_{AS}	Single Pulse Avalanche Energy (Thermally Limited) ②	120	mJ
E_{AS} (tested)	Single Pulse Avalanche Energy Tested Value ⑥	180	
I_{AR}	Avalanche Current ①	See Fig.15,16, 12a, 12b	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)		
	Mounting torque, 6-32 or M3 screw	300	
		10 lbf·in (1.1N·m)	

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑨	—	1.14	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface ⑦	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient ⑦	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state) ⑧	—	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
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{\text{GS}} = 0\text{V}$, $I_D = 250\mu\text{A}$
$\Delta V_{(\text{BR})\text{DSS}}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.055	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1\text{mA}$
$R_{\text{DS}(\text{on})}$	Static Drain-to-Source On-Resistance	—	6.5	8.0	$\text{m}\Omega$	$V_{\text{GS}} = 10\text{V}$, $I_D = 52\text{A}$ ③
		—	—	11		$V_{\text{GS}} = 5.0\text{V}$, $I_D = 43\text{A}$ ③
		—	—	12		$V_{\text{GS}} = 4.5\text{V}$, $I_D = 30\text{A}$ ③
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	1.0	—	3.0	V	$V_{\text{DS}} = V_{\text{GS}}$, $I_D = 250\mu\text{A}$
g_{fs}	Forward Trans conductance	150	—	—	S	$V_{\text{DS}} = 25\text{V}$, $I_D = 52\text{A}$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{\text{DS}} = 55\text{V}$, $V_{\text{GS}} = 0\text{V}$
		—	—	250		$V_{\text{DS}} = 55\text{V}$, $V_{\text{GS}} = 0\text{V}$, $T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{\text{GS}} = 16\text{V}$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{\text{GS}} = -16\text{V}$

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

Q_g	Total Gate Charge	—	40	60	nC	$I_D = 43\text{A}$ $V_{\text{DS}} = 44\text{V}$ $V_{\text{GS}} = 5.0\text{V}$ ③
Q_{gs}	Gate-to-Source Charge	—	12	—		
Q_{qd}	Gate-to-Drain Charge	—	21	—		
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	—	17	—		
t_r	Rise Time	—	240	—	ns	$V_{\text{DD}} = 28\text{V}$ $I_D = 43\text{A}$ $R_G = 4.3\Omega$, $V_{\text{GS}} = 5.0\text{V}$ ③
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time	—	26	—		
t_f	Fall Time	—	83	—		
L_D	Internal Drain Inductance	—	4.5	—		
L_S	Internal Source Inductance	—	7.5	—	pF	Between lead, 6mm (0.25in.) from package and center of die contact
C_{iss}	Input Capacitance	—	2880	—		$V_{\text{GS}} = 0\text{V}$
C_{oss}	Output Capacitance	—	420	—		$V_{\text{DS}} = 25\text{V}$
C_{rss}	Reverse Transfer Capacitance	—	220	—		$f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	1500	—		$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 1.0\text{V}$ $f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	330	—		$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 44\text{V}$ $f = 1.0\text{MHz}$
$C_{\text{oss eff.}}$	Effective Output Capacitance	—	510	—		$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 0\text{V}$ to 44V ④

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_s	Continuous Source Current (Body Diode)	—	—	75	A	MOSFET symbol showing the integral reverse p-n junction diode.
	Pulsed Source Current (Body Diode) ①	—	—	340		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}$, $I_s = 52\text{A}$, $V_{\text{GS}} = 0\text{V}$ ③
t_{rr}	Reverse Recovery Time	—	16	24	ns	$T_J = 25^\circ\text{C}$, $I_F = 43\text{A}$, $V_{\text{DD}} = 28\text{V}$
Q_{rr}	Reverse Recovery Charge	—	7.4	11	nC	$\text{di/dt} = 100\text{A}/\mu\text{s}$ 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 $T_J = 25^\circ\text{C}$, $L = 0.09\text{mH}$, $R_G = 25\Omega$, $I_{\text{AS}} = 52\text{A}$, $V_{\text{GS}} = 10\text{V}$. Part not recommended for use above this value.
- ③ Pulse width $\leq 1.0\text{ms}$; duty cycle $\leq 2\%$.
- ④ $C_{\text{oss eff.}}$ 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.
- ⑦ This is only applied to TO-220AB package.
- ⑧ This is applied to D² Pak, 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_0 is measured at T_J of approximately 90°C
- ⑩ Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 75A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.

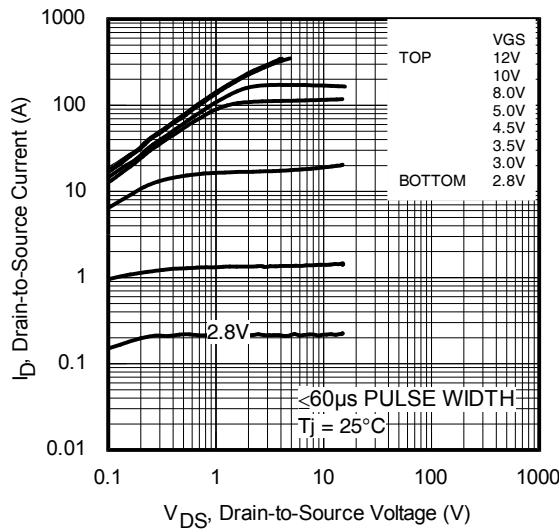


Fig. 1 Typical Output Characteristics

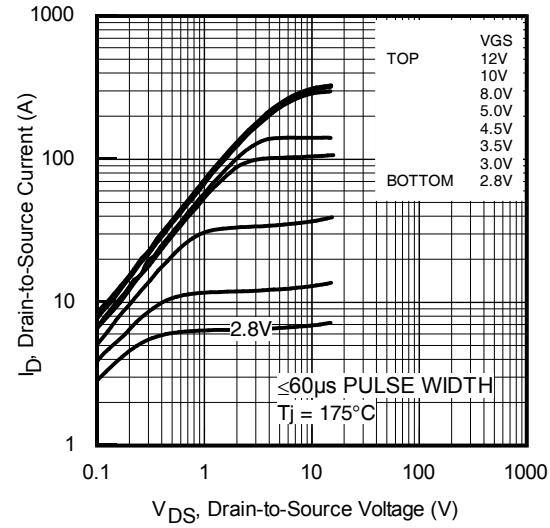


Fig. 2 Typical Output Characteristics

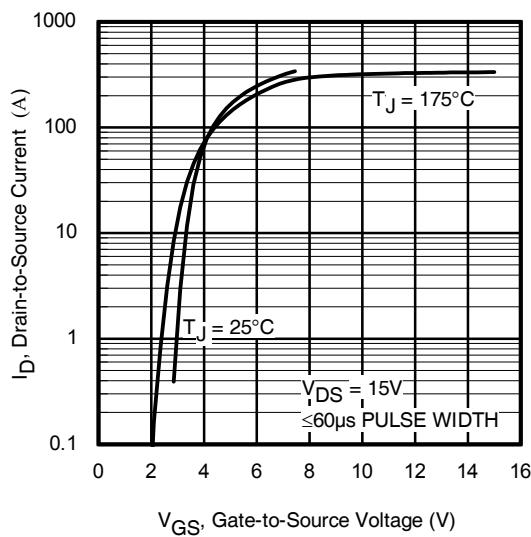


Fig. 3 Typical Transfer Characteristics

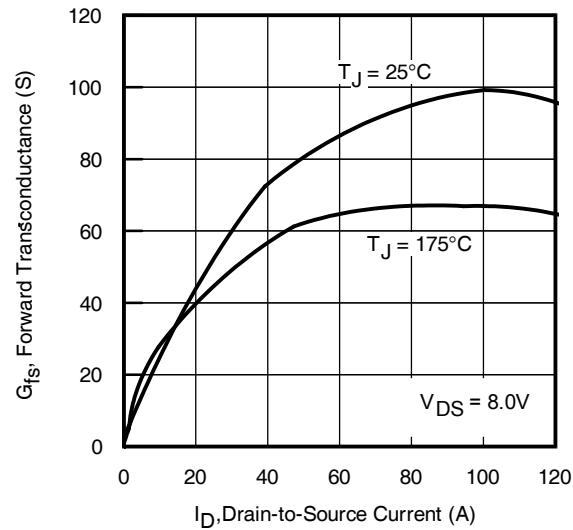


Fig. 4 Typical Forward Transconductance vs. Drain Current

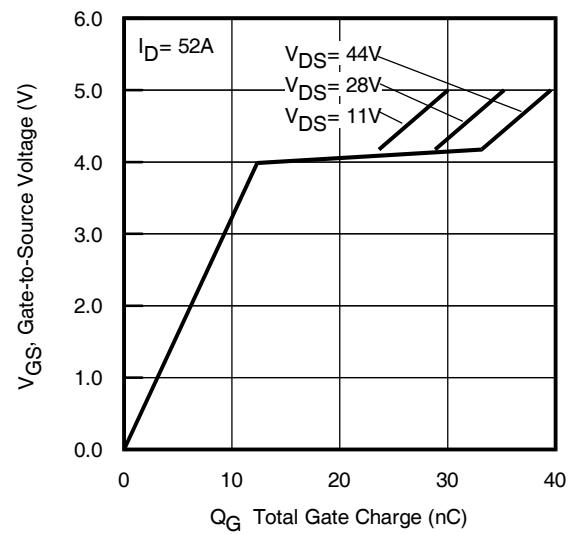
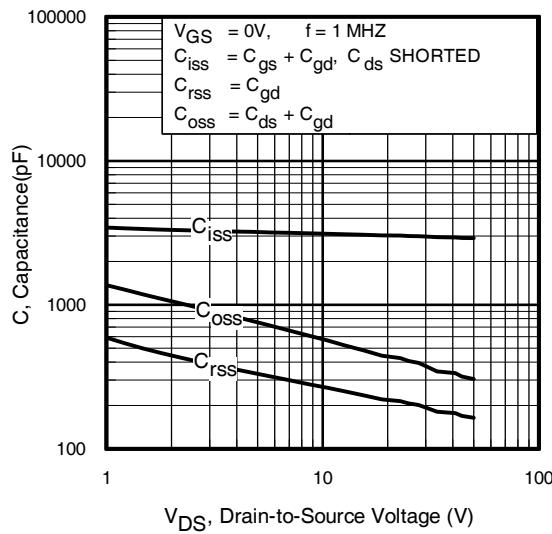
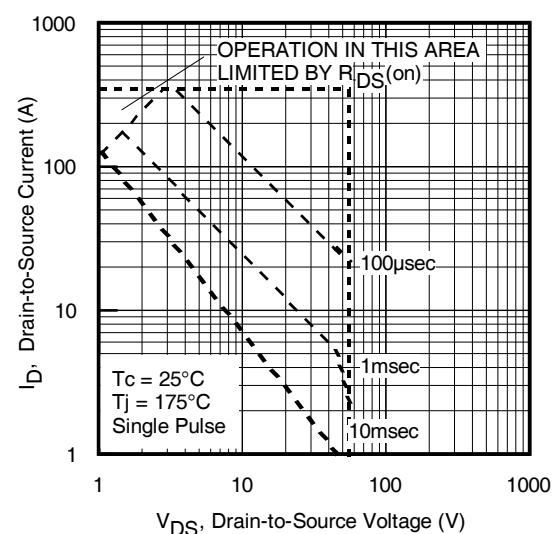
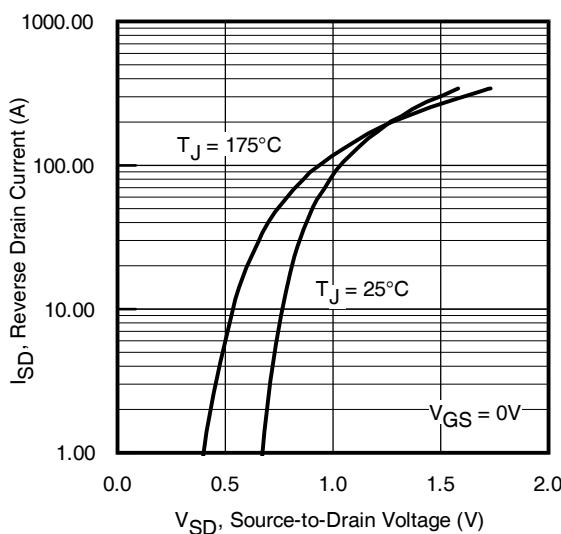


Fig. 5. Typical Capacitance vs. Drain-to-Source Voltage

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



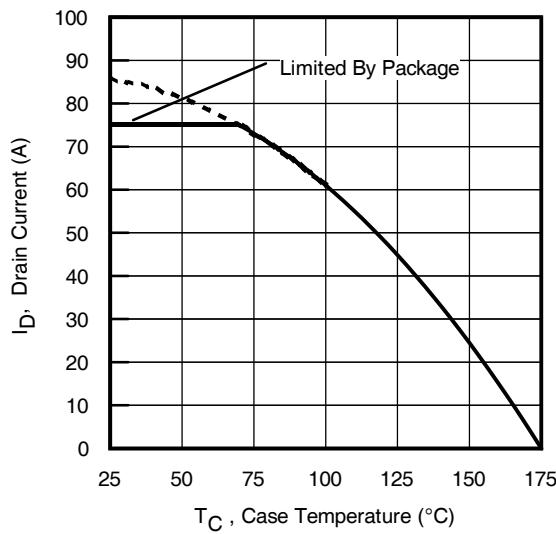


Fig 9. Maximum Drain Current vs. Case Temperature

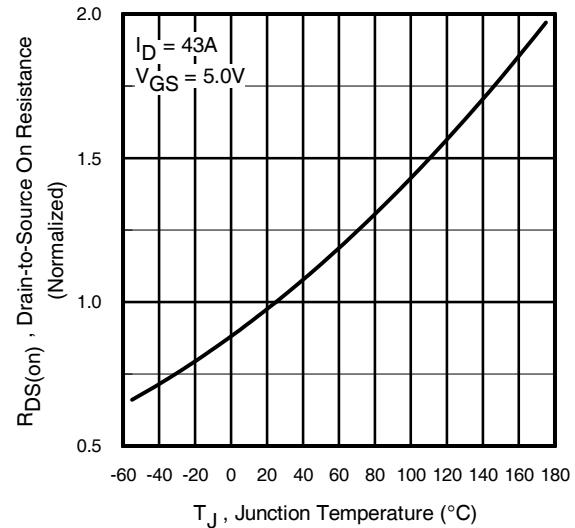


Fig 10. Normalized On-Resistance vs. Temperature

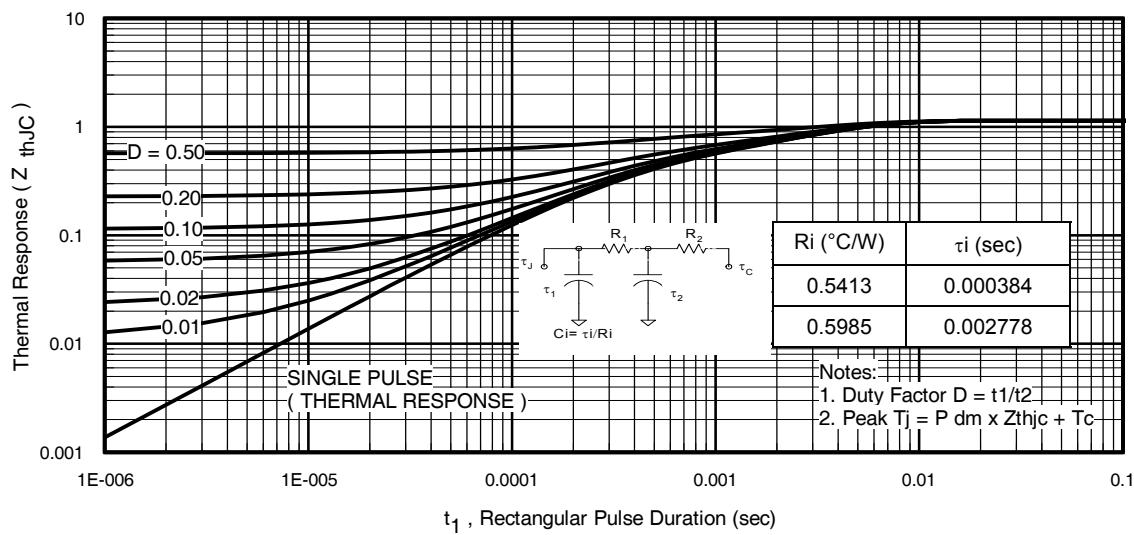


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

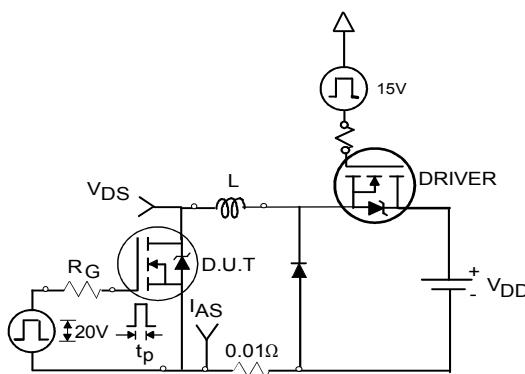


Fig 12a. Unclamped Inductive Test Circuit

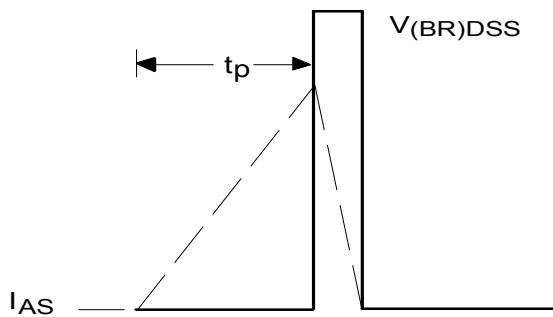


Fig 12b. Unclamped Inductive Waveforms

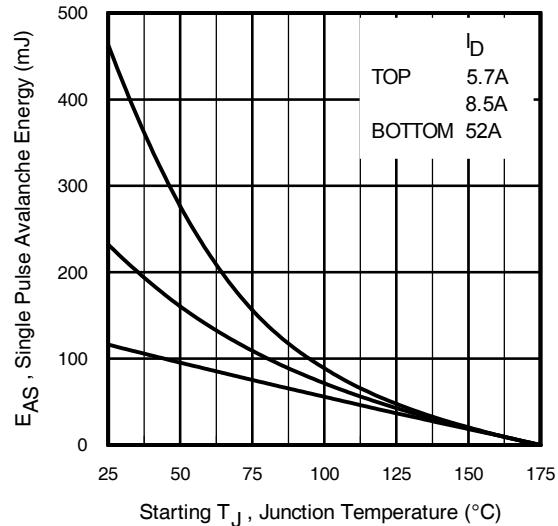


Fig 12c. Maximum Avalanche Energy vs. Drain Current

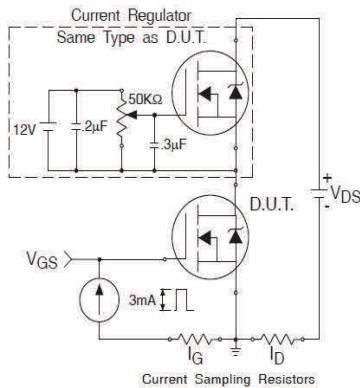


Fig 13a. Gate Charge Test Circuit

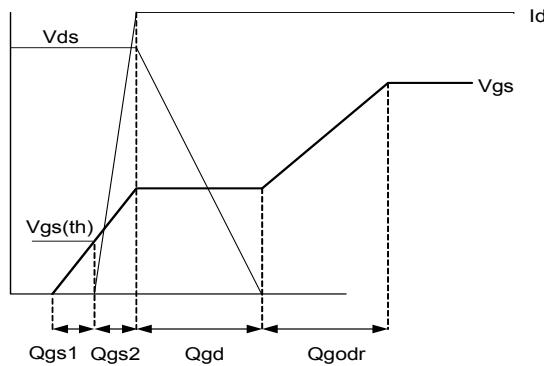


Fig 13b. Gate Charge Waveform

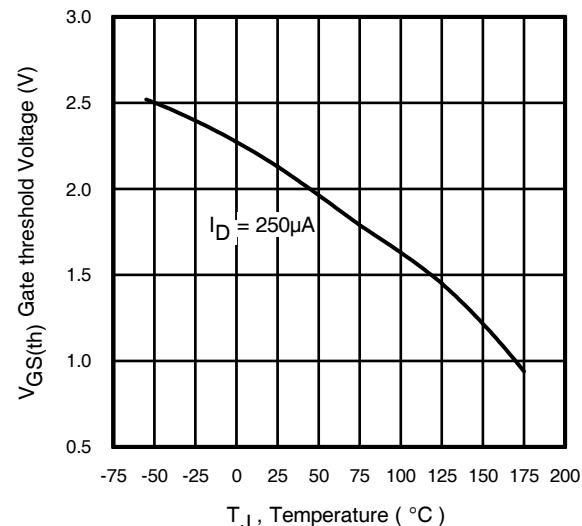


Fig 14. Threshold Voltage vs. Temperature

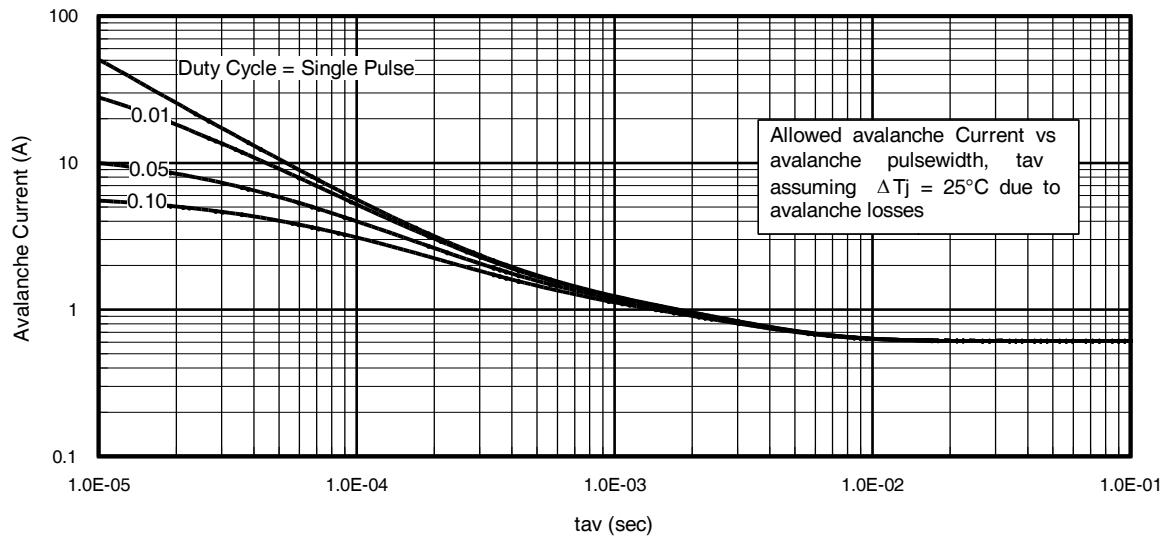
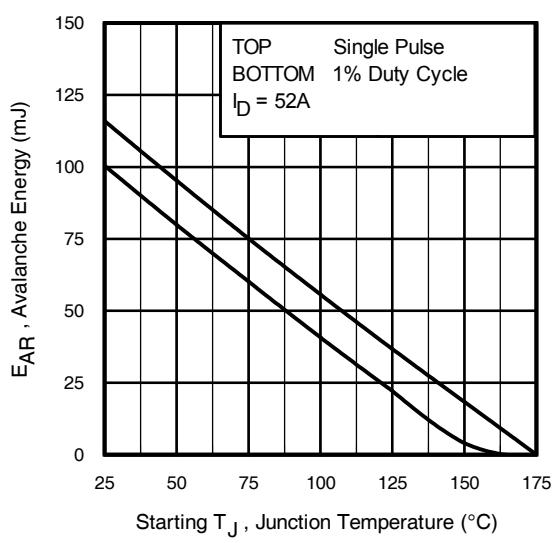


Fig 15. Avalanche Current vs. Pulse width



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

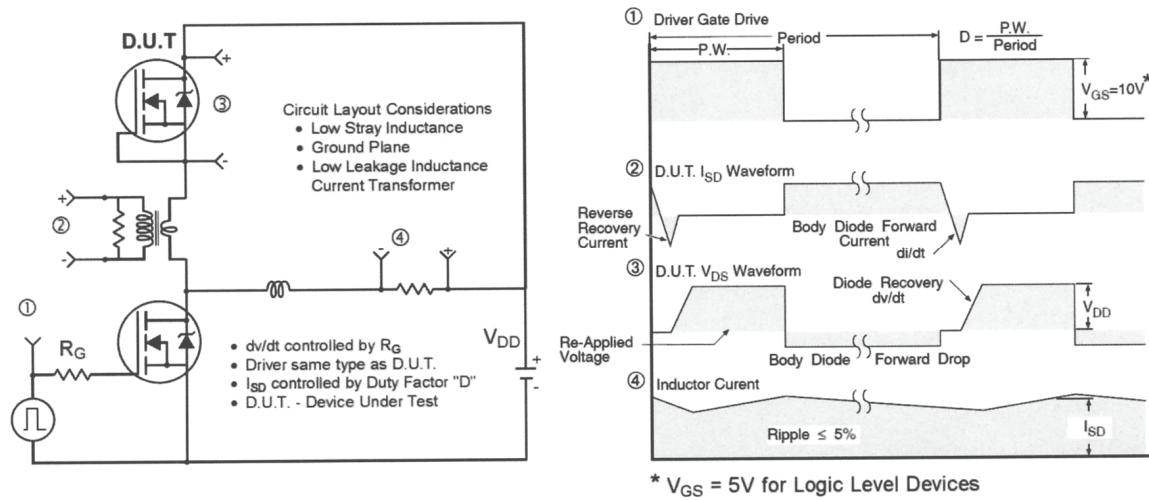


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

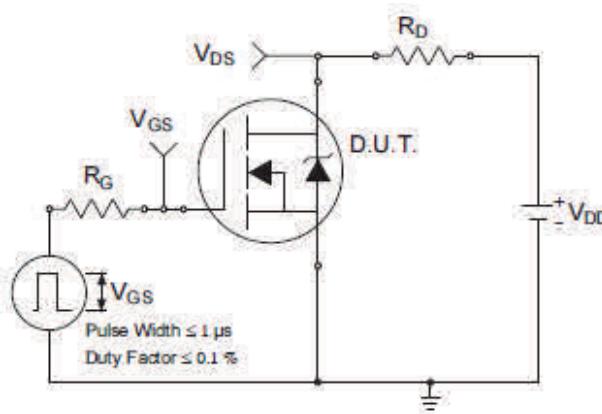


Fig 18a. Switching Time Test Circuit

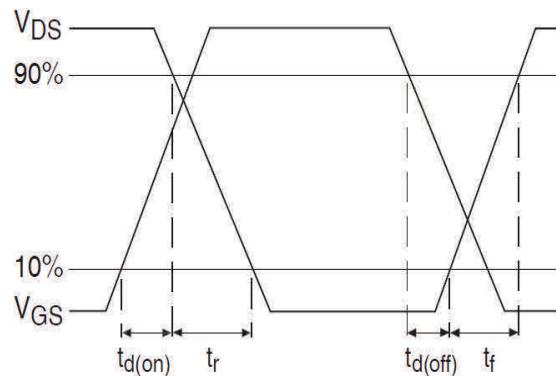
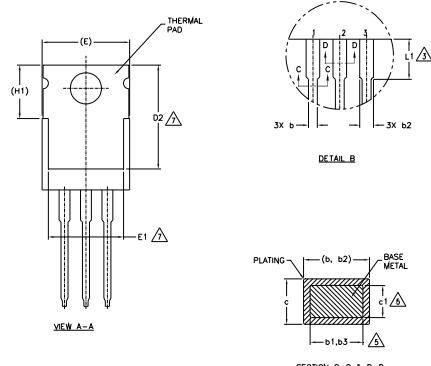
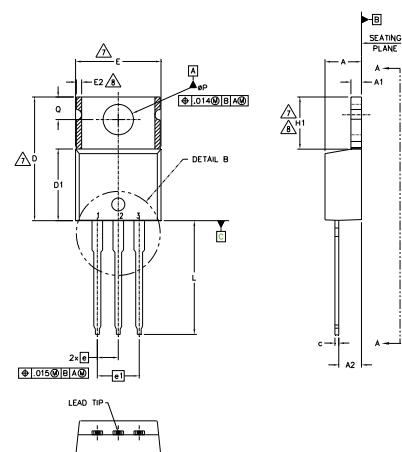


Fig 18b. Switching Time Waveforms

TO-220AB Package Outline (Dimensions are shown in millimeters (inches))

NOTES:

1. - DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
2. - DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3. - LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4. - DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. - DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
6. - CONTROLLING DIMENSION : INCHES.
7. - THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8. - DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
9. - OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES	
	MILLIMETERS		INCHES			
	MIN.	MAX.	MIN.	MAX.		
A	3.56	4.83	.140	.190		
A1	1.14	1.40	.045	.055		
A2	2.03	2.92	.080	.115		
b	0.38	1.01	.015	.040		
b1	0.38	0.97	.015	.038	5	
b2	1.14	1.78	.045	.070	5	
b3	1.14	1.73	.045	.068	5	
c	0.36	0.61	.014	.024		
c1	0.36	0.56	.014	.022	5	
D	14.22	16.51	.560	.650	4	
D1	8.38	9.02	.330	.355		
D2	11.68	12.88	.460	.507	7	
E	9.65	10.67	.380	.420	4,7	
E1	6.86	8.89	.270	.350	7	
E2	—	0.76	—	.030	8	
e	2.54 BSC		.100 BSC			
e1	5.08 BSC		.200 BSC			
H1	5.84	6.86	.230	.270	7,8	
L	12.70	14.73	.500	.580		
L1	3.56	4.06	.140	.160	3	
ØP	3.54	4.08	.139	.161		
Q	2.54	3.42	.100	.135		

LEAD ASSIGNMENTS
HEXFET

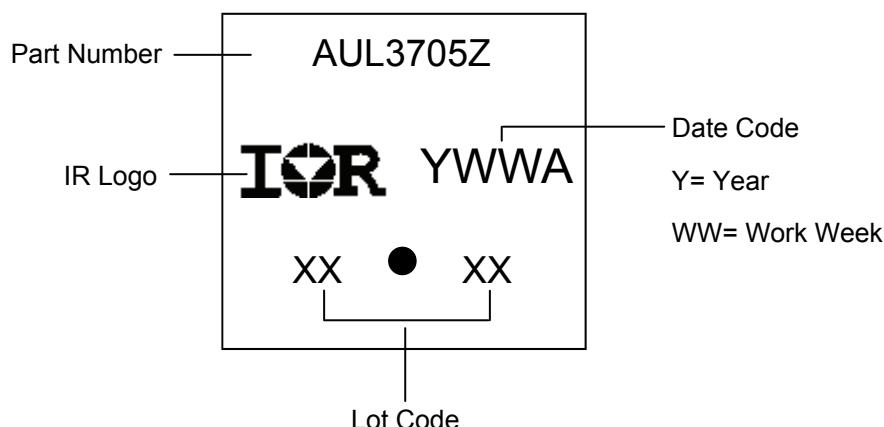
1. - GATE
2. - DRAIN
3. - SOURCE

IGBTs, CoPACK

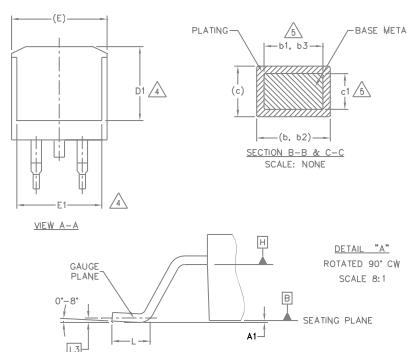
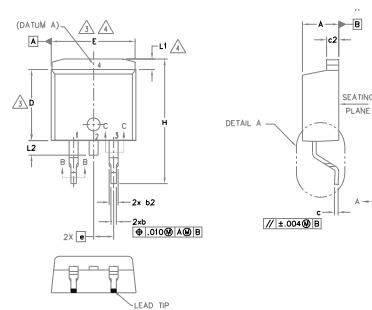
1. - GATE
2. - COLLECTOR
3. - Emitter

DIODES

1. - ANODE
2. - CATHODE
3. - ANODE

TO-220AB Part Marking Information


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

D²Pak (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		
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	—	1.68	—	.066	4	
L2	—	1.78	—	.070		
L3	0.25 BSC		.010 BSC			

LEAD ASSIGNMENTS

DIODES

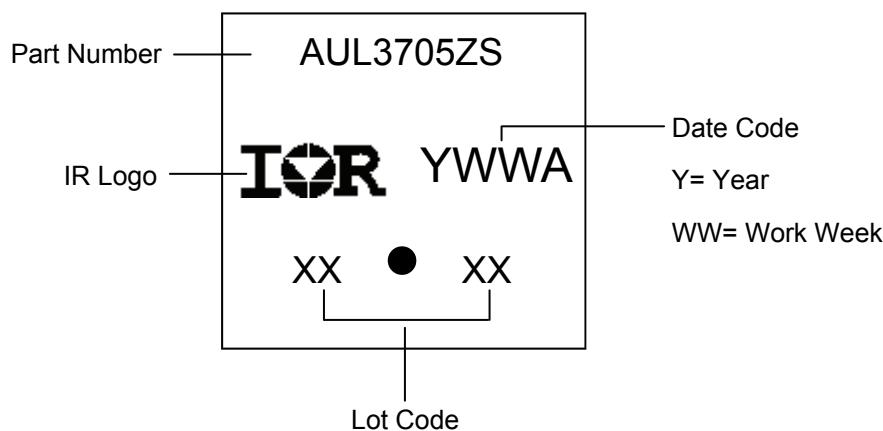
1. - ANODE (TWO DIE) / OPEN (ONE DIE)
2. 4. - CATHODE
3. - ANODE

HEXFET

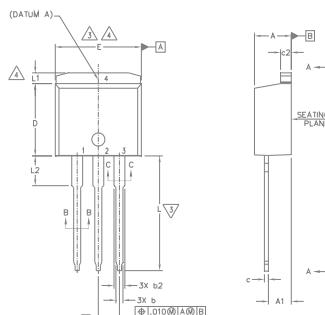
1. - GATE
2. 4. - DRAIN
3. - SOURCE

IGRTs, CoPACK

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

D²Pak (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

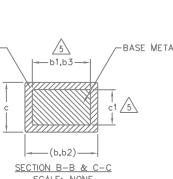
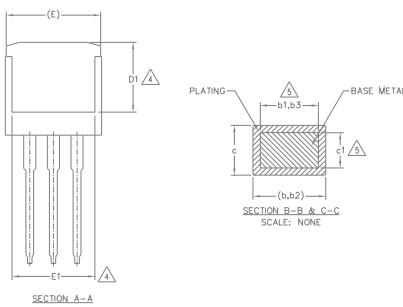
IGBTs, CoPACK

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

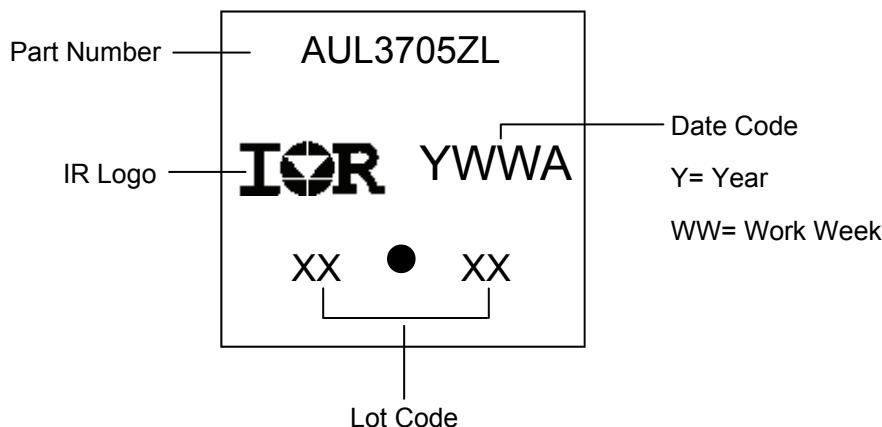
HEXFET

DIODES

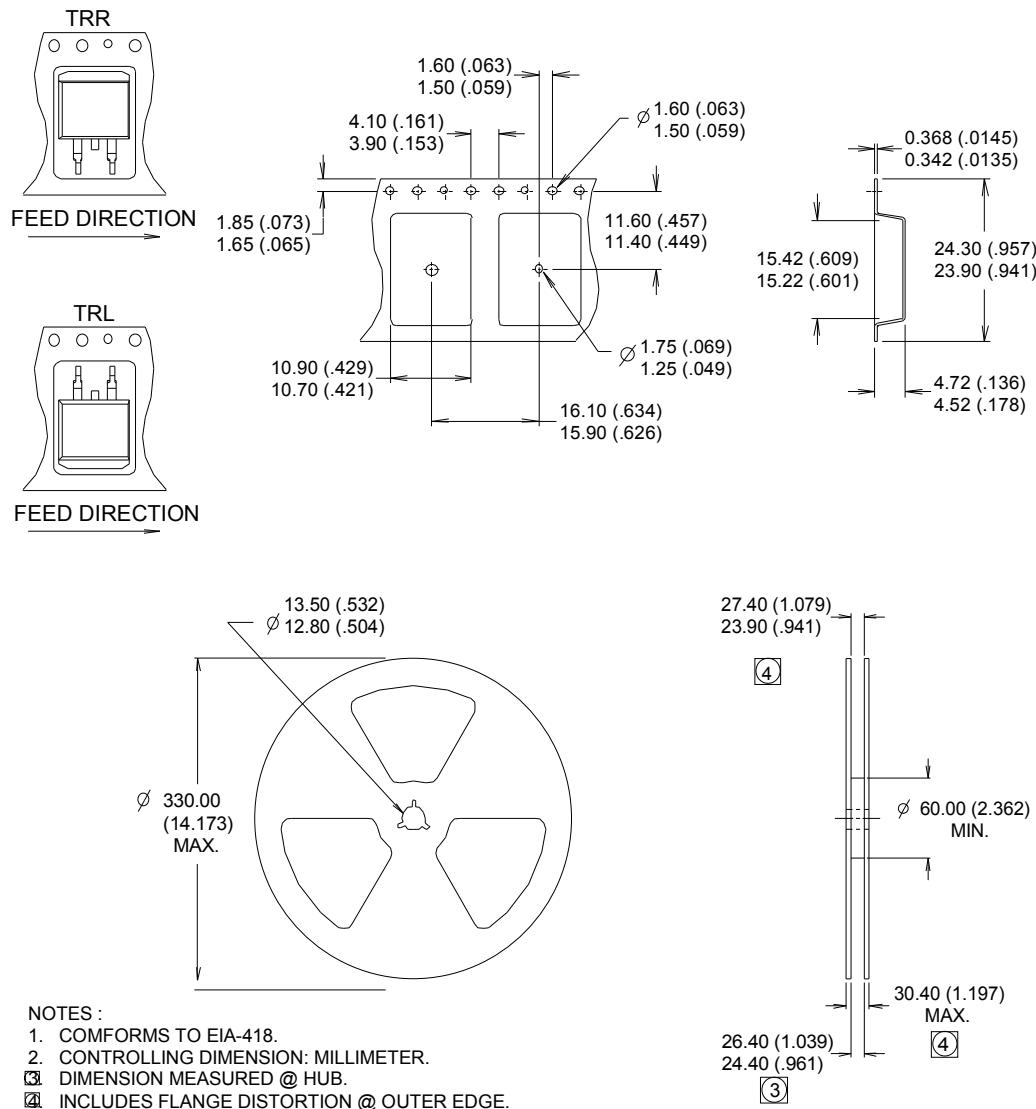
1. GATE	1 - ANODE (TWO DIE) / OPEN (ONE DIE)
2. DRAIN	2, 4. - CATHODE
3. SOURCE	3. - ANODE
4. DRAIN	



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/>

D²Pak (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

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	TO-220 Pak	N/A	
	D ² -Pak		MSL1
	TO-262		
ESD	Machine Model	Class M4 (+/- 425V) [†] AEC-Q101-002	
	Human Body Model	Class H1C (+/- 2000V) [†] AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 1125V) [†] AEC-Q101-005	
RoHS Compliant		Yes	

Revision History

Date	Comments
10/29/2015	<ul style="list-style-type: none"> • Updated datasheet with corporate template • Corrected ordering table on page 1.

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