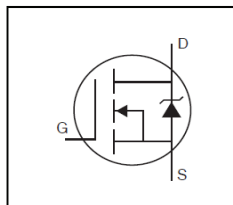


Features

- 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 *

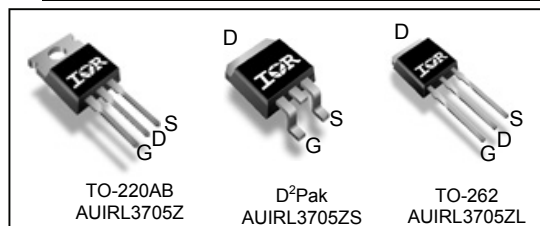
Description

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.



HEXFET® Power MOSFET

V_{DS}	55V
$R_{DS(on)}$ typ. max.	6.5mΩ 8.0mΩ
I_D (Silicon Limited)	86A^⑩
I_D (Package Limited)	75A



G	D	S
Gate	Drain	Source

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	D²-Pak	Tube	50	AUIRL3705ZS
		Tape and Reel Left	800	AUIRL3705ZSTRL

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.

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	86 ^⑩	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	61	
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (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
$E_{AS} \text{ (tested)}$	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)	300	
	Mounting torque, 6-32 or M3 screw	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°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V _{(BR)DSS}	Drain-to-Source Breakdown Voltage	55	—	—	V	V _{GS} = 0V, I _D = 250μA
ΔV _{(BR)DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	0.055	—	V/°C	Reference to 25°C, I _D = 1mA
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	6.5	8.0	mΩ	V _{GS} = 10V, I _D = 52A ③
		—	—	11		V _{GS} = 5.0V, I _D = 43A ③
		—	—	12		V _{GS} = 4.5V, I _D = 30A ③
V _{GS(th)}	Gate Threshold Voltage	1.0	—	3.0	V	V _{DS} = V _{GS} , I _D = 250μA
g _{fs}	Forward Trans conductance	150	—	—	S	V _{DS} = 25V, I _D = 52A
I _{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	V _{DS} = 55V, V _{GS} = 0V
		—	—	250		V _{DS} = 55V, V _{GS} = 0V, T _J = 125°C
I _{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	V _{GS} = 16V
	Gate-to-Source Reverse Leakage	—	—	-200		V _{GS} = -16V

Dynamic Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

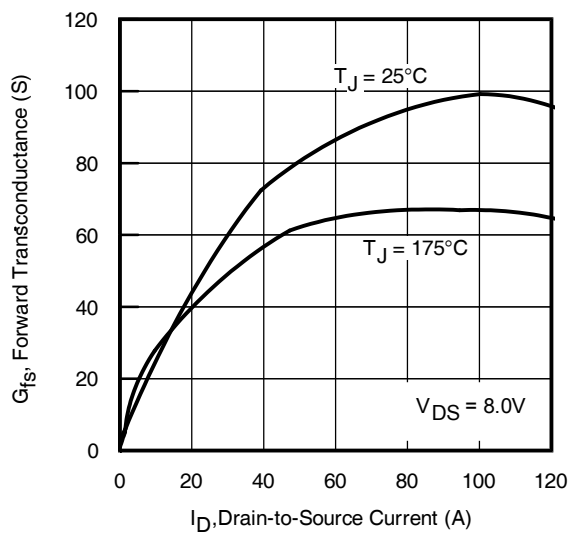
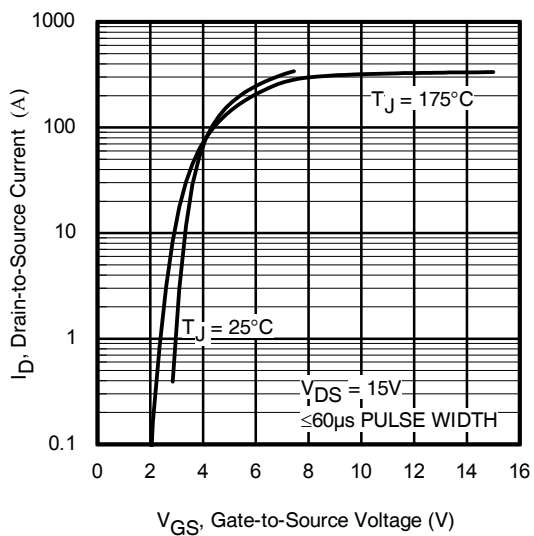
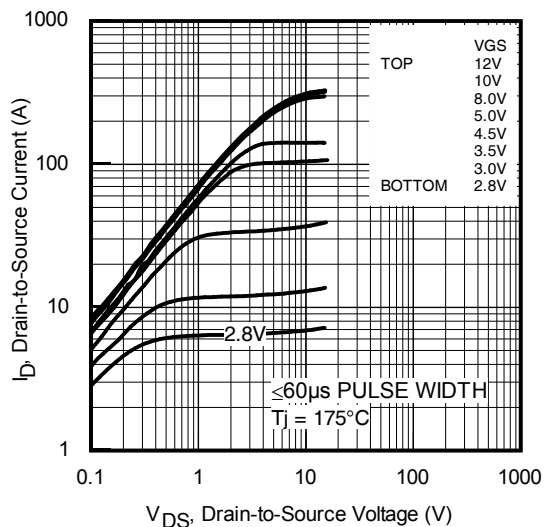
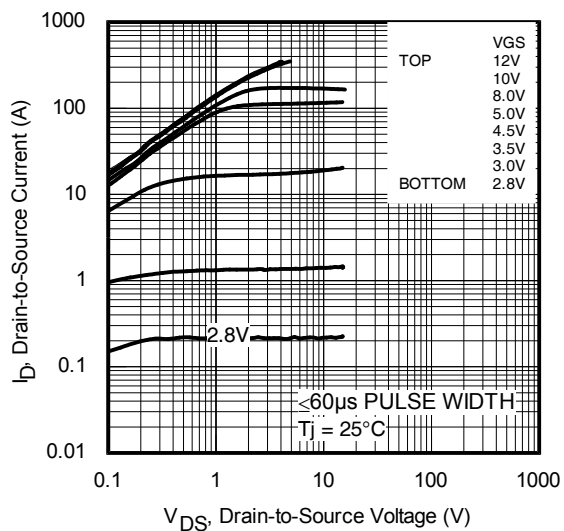
Q _g	Total Gate Charge	—	40	60	nC	I _D = 43A
Q _{gs}	Gate-to-Source Charge	—	12	—		V _{DS} = 44V
Q _{gd}	Gate-to-Drain Charge	—	21	—		V _{GS} = 5.0V ③
t _{d(on)}	Turn-On Delay Time	—	17	—	ns	V _{DD} = 28V
t _r	Rise Time	—	240	—		I _D = 43A
t _{d(off)}	Turn-Off Delay Time	—	26	—		R _G = 4.3Ω,
t _f	Fall Time	—	83	—		V _{GS} = 5.0V ③
L _D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L _S	Internal Source Inductance	—	7.5	—		
C _{iss}	Input Capacitance	—	2880	—	pF	V _{GS} = 0V
C _{oss}	Output Capacitance	—	420	—		V _{DS} = 25V
C _{rss}	Reverse Transfer Capacitance	—	220	—		f = 1.0MHz
C _{oss}	Output Capacitance	—	1500	—		V _{GS} = 0V, V _{DS} = 1.0V f = 1.0MHz
C _{oss}	Output Capacitance	—	330	—		V _{GS} = 0V, V _{DS} = 44V f = 1.0MHz
C _{oss eff.}	Effective Output Capacitance	—	510	—		V _{GS} = 0V, V _{DS} = 0V to 44V ④

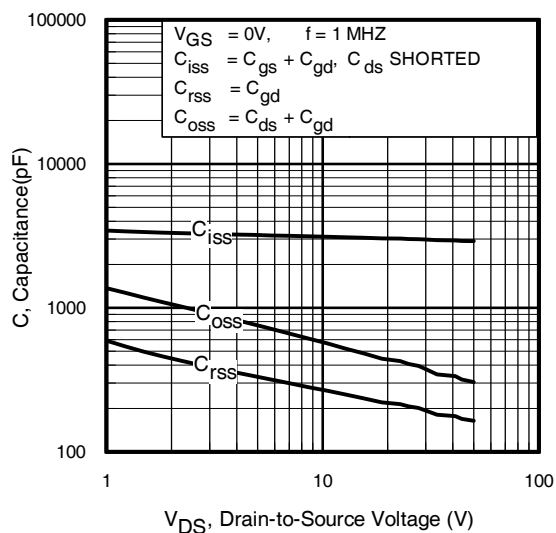
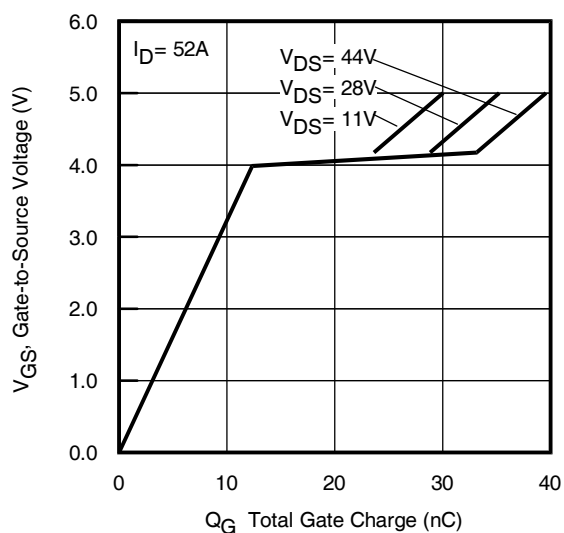
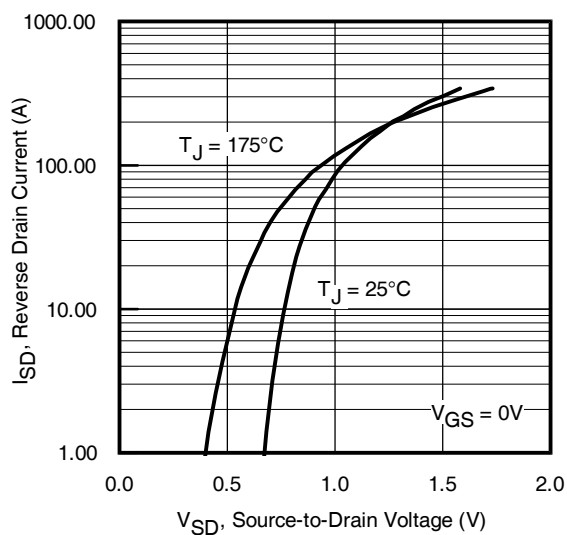
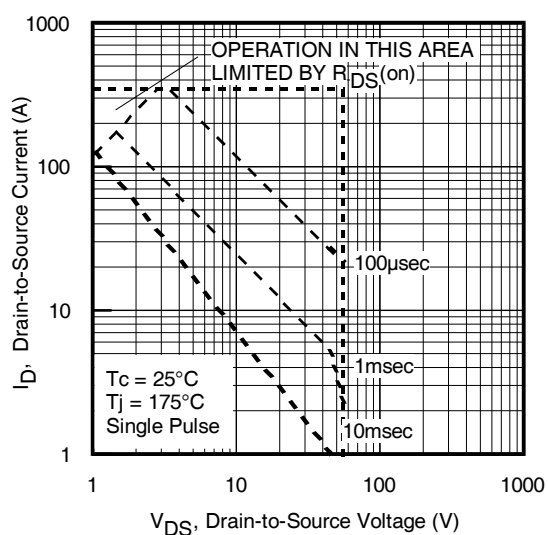
Diode Characteristics

	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.
I _{SM}	Pulsed Source Current (Body Diode) ①	—	—	340		
V _{SD}	Diode Forward Voltage	—	—	1.3	V	T _J = 25°C, I _S = 52A, V _{GS} = 0V ③
t _{rr}	Reverse Recovery Time	—	16	24	ns	T _J = 25°C, I _F = 43A, V _{DD} = 28V
Q _{rr}	Reverse Recovery Charge	—	7.4	11	nC	di/dt = 100A/μs 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°C, L = 0.09mH, R_G = 25Ω, I_{AS} = 52A, V_{GS} = 10V. Part not recommended for use above this value.
- ③ Pulse width ≤ 1.0ms; duty cycle ≤ 2%.
- ④ C_{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 D²Pak, 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_θ 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 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 8. Maximum Safe Operating Area

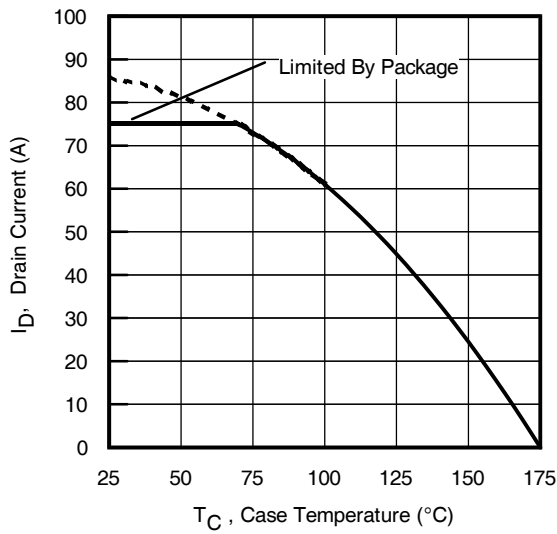


Fig 9. Maximum Drain Current vs. Case Temperature

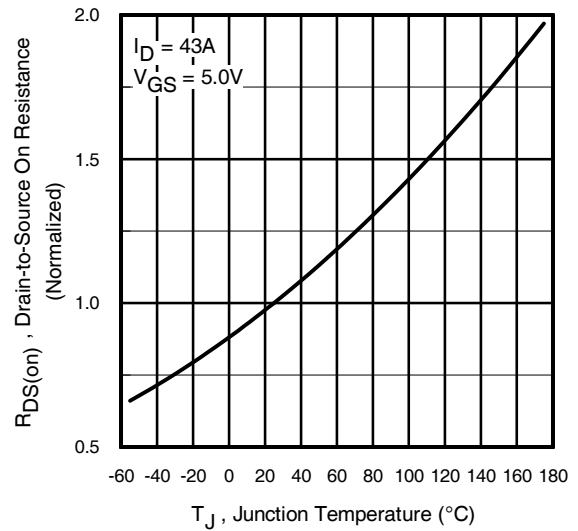


Fig 10. Normalized On-Resistance vs. Temperature

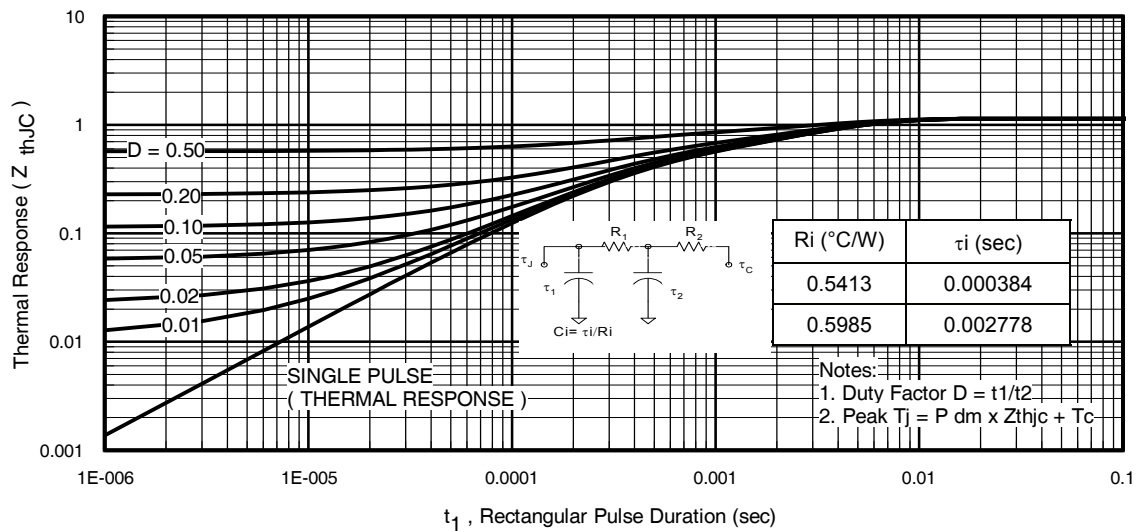
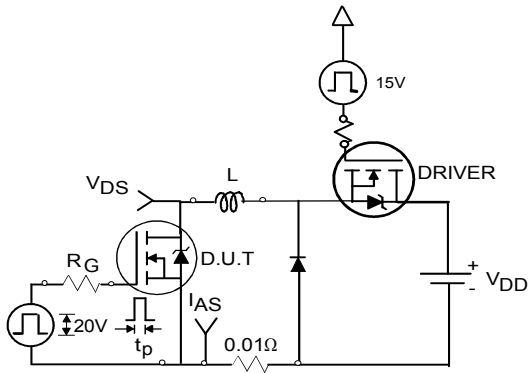
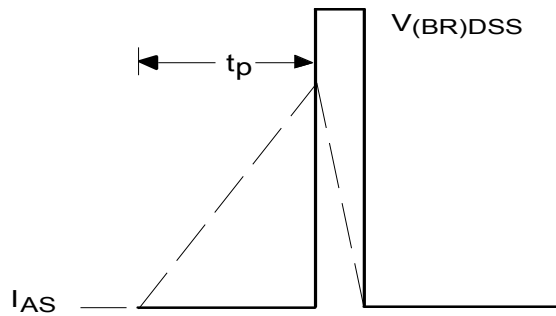
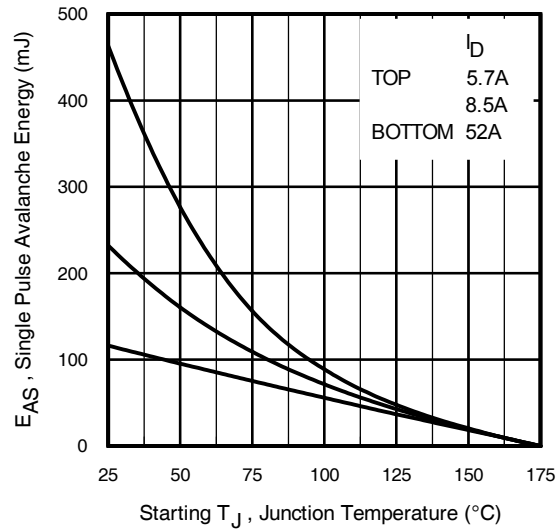
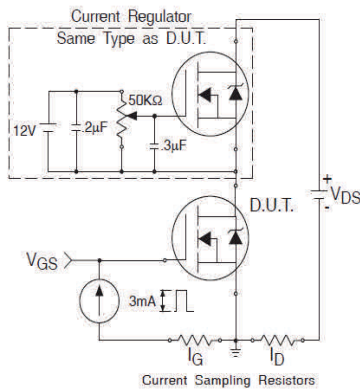
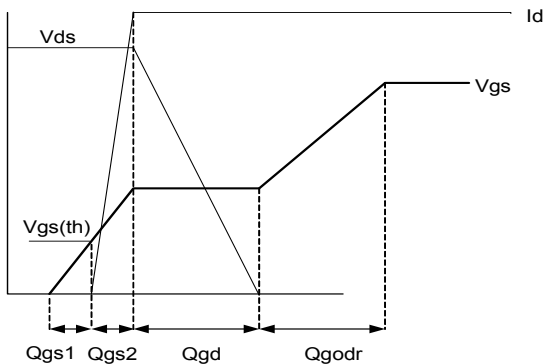
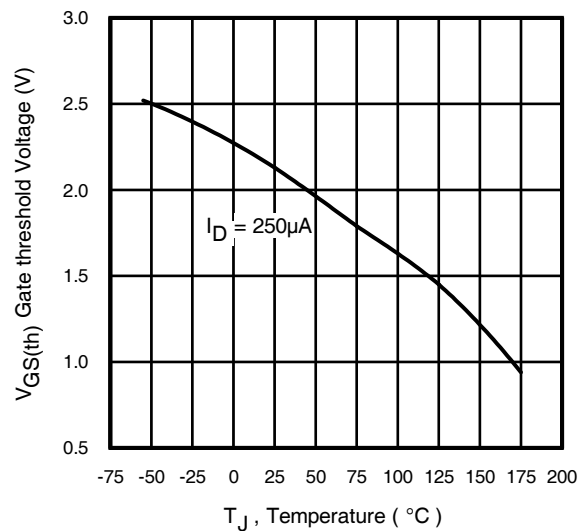


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case


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

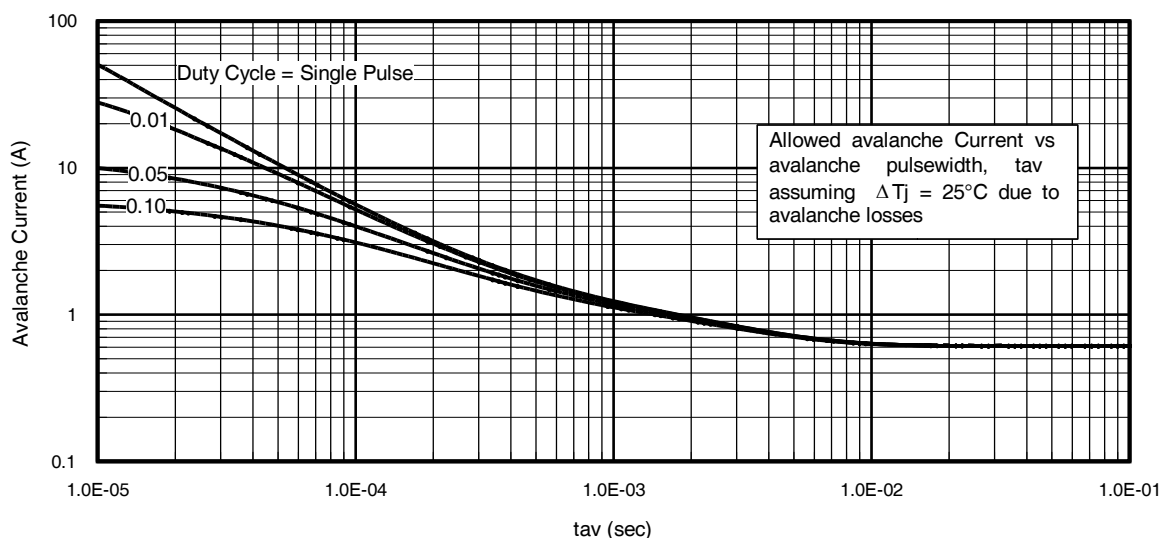
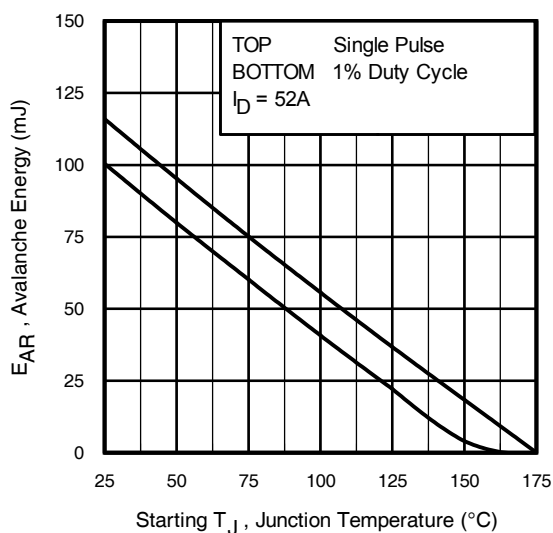


Fig 15. Avalanche Current vs. Pulse width



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

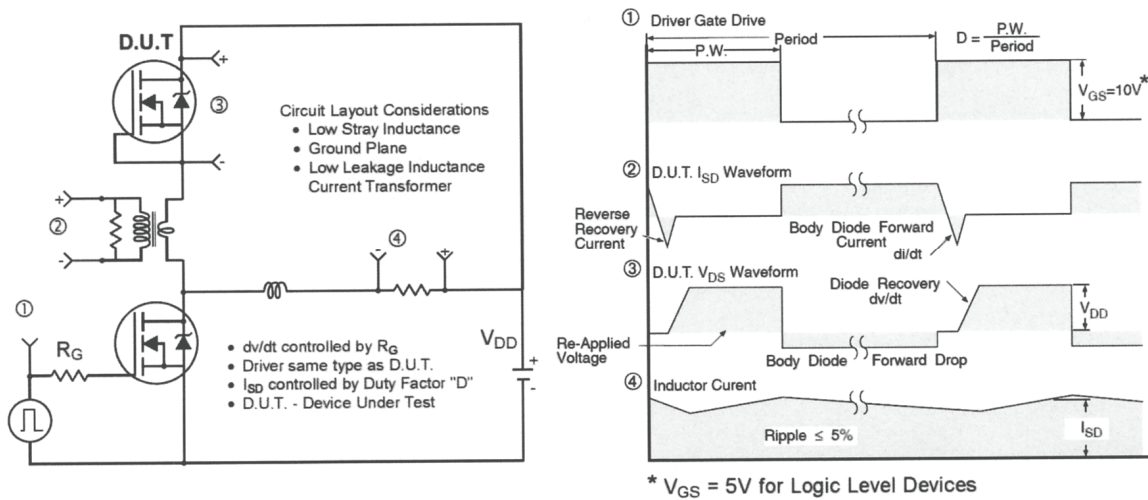


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

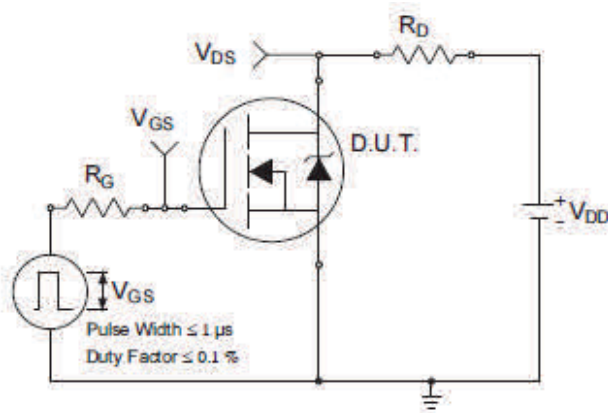


Fig 18a. Switching Time Test Circuit

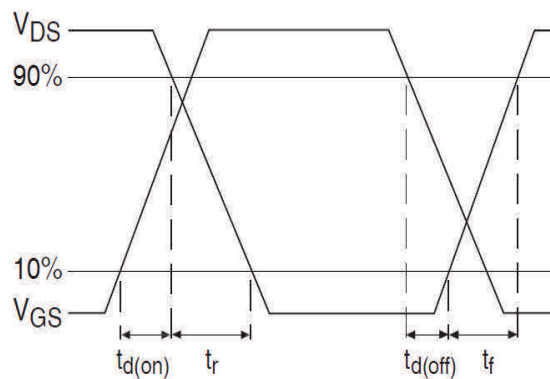
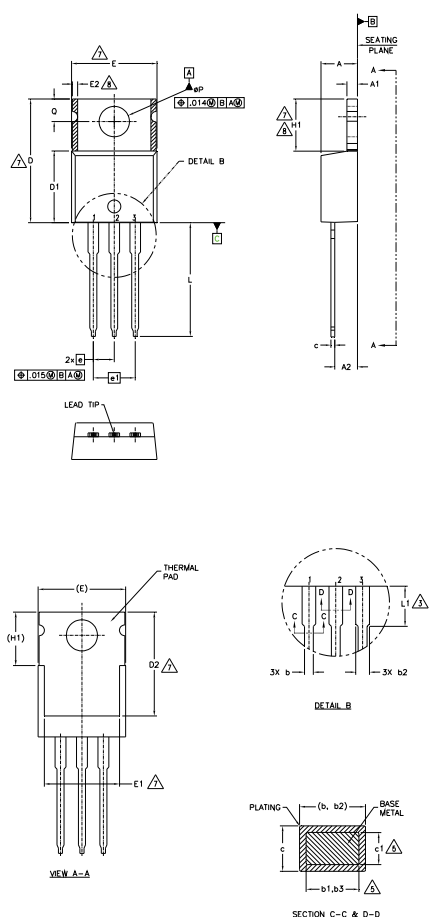


Fig 18b. Switching Time Waveforms

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	5	
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		
b2	1.14	1.78	.045	.070	5	
b3	1.14	1.73	.045	.068		
c	0.36	0.61	.014	.024		
c1	0.36	0.56	.014	.022		
D	14.22	16.51	.560	.650		4
D1	8.38	9.02	.330	.355	7	
D2	11.68	12.88	.460	.507		
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		7,8	
e1	5.08 BSC		.200 BSC			
H1	5.84	6.86	.230	.270		
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

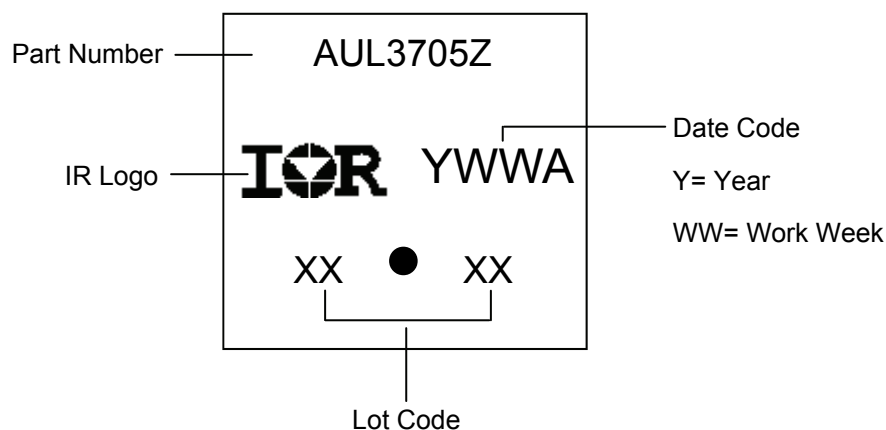
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE

IGBTs, CoPACK

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

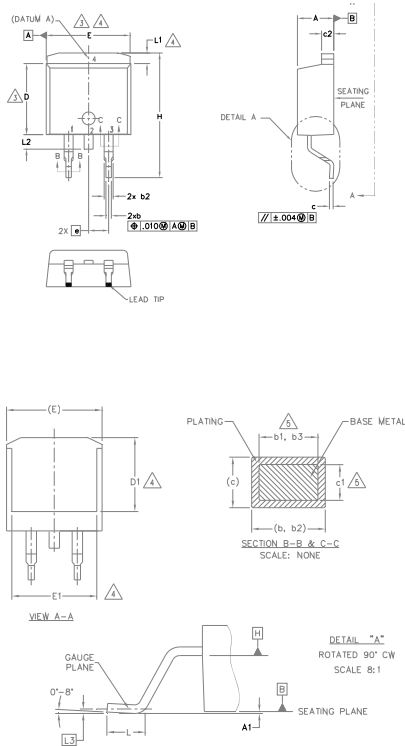
DIODES

- 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))



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

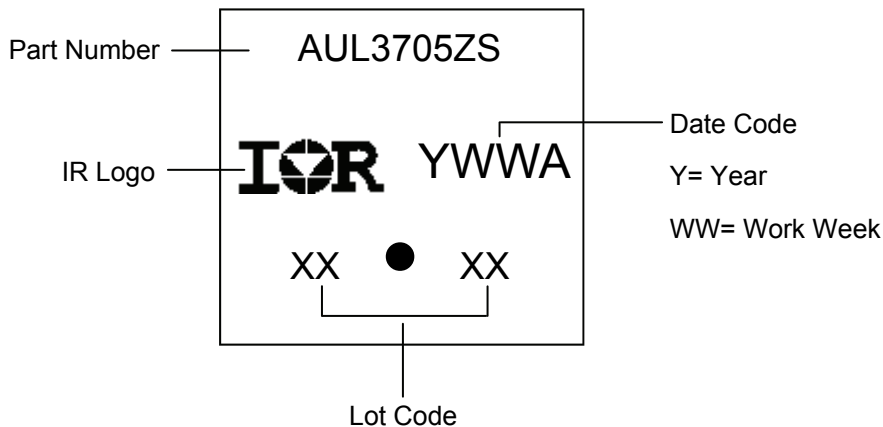
HEXFET

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

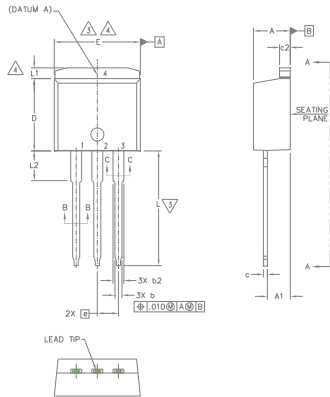
IGBTs, CoPACK

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

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 [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

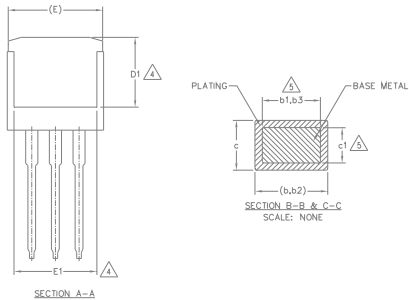
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- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

HEXFET

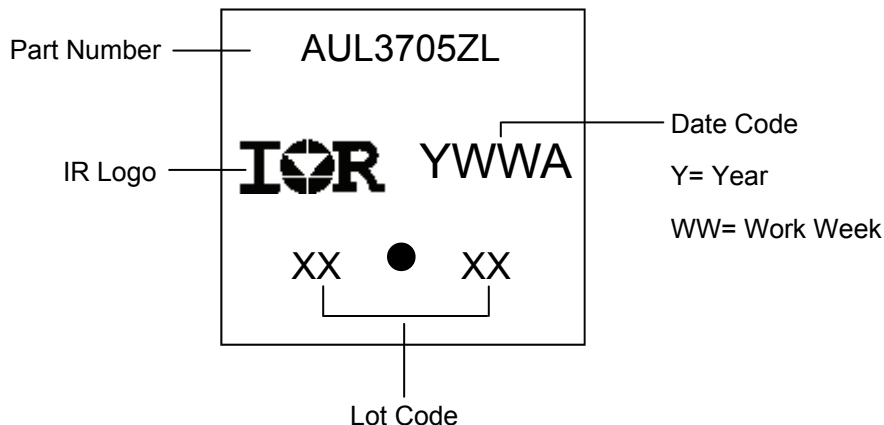
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- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

DIODES

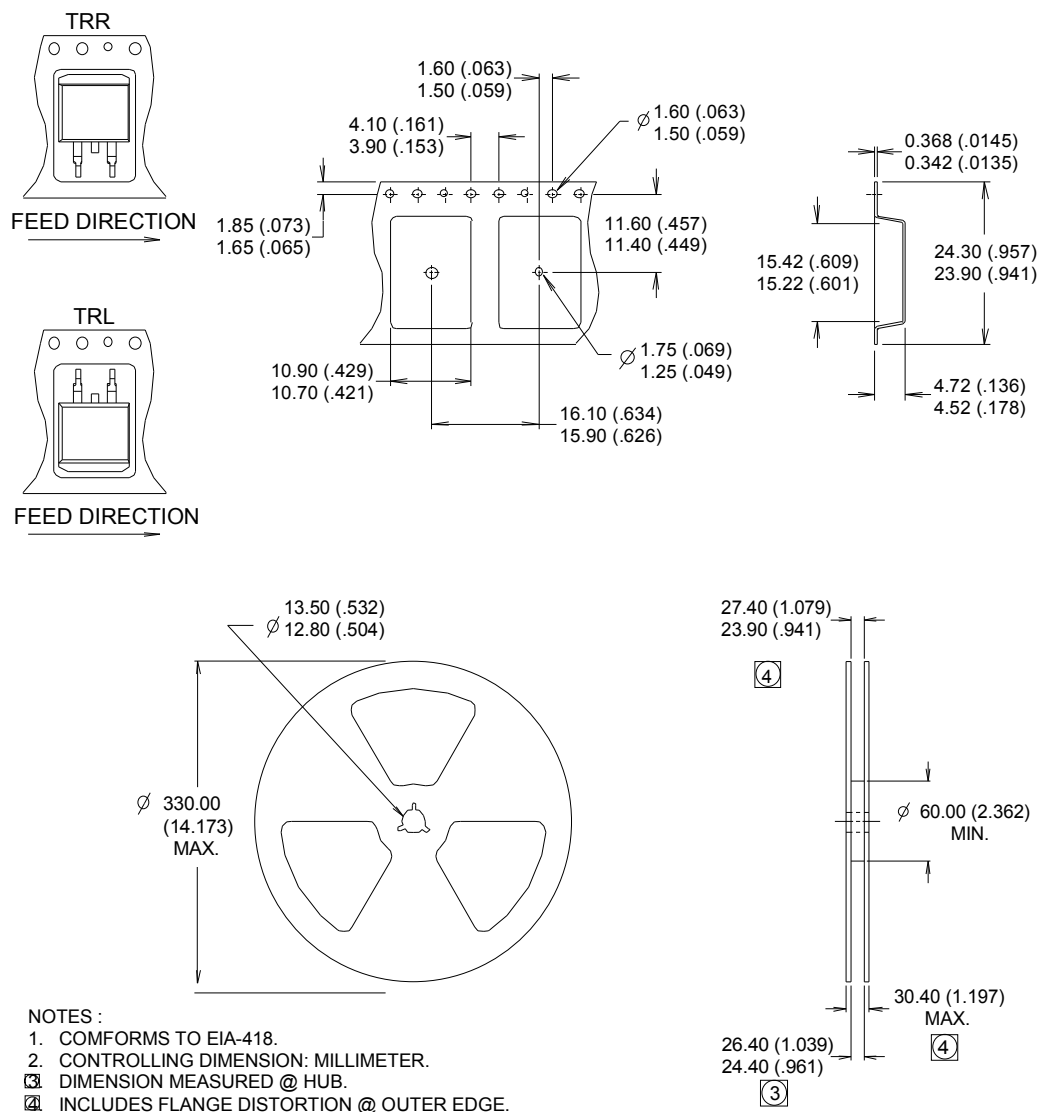
- 1.- ANODE (TWO DIE) / OPEN (ONE DIE)
- 2, 4.- CATHODE
- 3.- ANODE



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	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	
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
L	13.46	14.10	.530	.555	
L1	—	1.65	—	.065	
L2	3.56	3.71	.140	.146	

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	- Updated datasheet with corporate template - Corrected ordering table on page 1.

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