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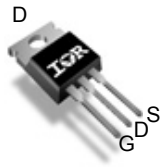
HEXFET® Power MOSFET

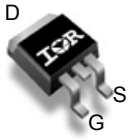
Applications
- High frequency DC-DC converters
- Plasma Display Panel

Benefits
- Low Gate-to-Drain Charge to Reduce Switching Losses
- Fully Characterized Capacitance Including Effective C_{OSS} to Simplify Design, (See App. Note AN1001)
- Fully Characterized Avalanche Voltage and Current
- Lead-Free

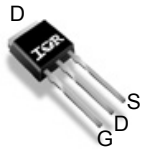
Key Parameters		
V_{DS}	200	V
$V_{DS(Avalanche)}$ min.	260	V
$R_{DS(on)}$ max @ 10V	54	mΩ
T_J max	175	°C



TO-220AB
IRFB38N20DPbF



D2 Pak
IRFS38N20DPbF



TO-262 Pak
IRFSL38N20DPbF

G	D	S
Gate	Drain	Source

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFB38N20DPbF	TO-220	Tube	50	IRFB38N20DPbF
IRFSL38N20DPbF	TO-262	Tube	50	IRFSL38N20DPbF
IRFS38N20DPbF	D2-Pak	Tube	50	IRFS38N20DPbF
		Tape and Reel Left	800	IRFS38N20DTRLPbF

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V ⑦	43*	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V ⑦	30*	
I_{DM}	Pulsed Drain Current ①	180	
P_D @T_A = 25°C	Maximum Power Dissipation ⑦	3.8	W
P_D @T_C = 25°C	Maximum Power Dissipation ⑦	300*	W
	Linear Derating Factor⑦	2.0*	W/°C
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt③	9.5	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw⑥	10 lbf•in (1.1N•m)	

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.47*	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface⑥	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient ⑥	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state) ⑦	—	40	

* $R_{\theta JC}$ (end of life) for D2Pak and TO-262 = 0.50°C/W. This is the maximum measured value after 1000 temperature cycles from -55 to 150°C and is accounted for by the physical wear out of the die attach medium.

Notes ① through ⑦ are on page 2.

Static @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	200	——	——	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	0.22	——	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	——	0.054	Ω	V_{GS} = 10V, I_D = 26A ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	——	5.0	V	V_{DS} = V_{GS}, I_D = 250µA
I_{DSS}	Drain-to-Source Leakage Current	——	——	25	µA	V_{DS} =200 V, V_{GS} = 0V
		——	——	250		V_{DS} = 160V,V_{GS} = 0V,T_J =150°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	100	nA	V_{GS} = 30V
	Gate-to-Source Reverse Leakage	——		-100		V_{GS} = -30V

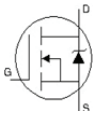
Dynamic @ T_J = 25°C (unless otherwise specified)

gfs	Forward Trans conductance	17	——	——	S	V_{DS} = 50V, I_D = 26A
Q_g	Total Gate Charge	——	60	91	nC	I_D = 26A
Q_{gs}	Gate-to-Source Charge	——	17	25		V_{DS} = 100V
Q_{gd}	Gate-to-Drain Charge	——	28	42		V_{GS} = 10V ④
$t_{d(on)}$	Turn-On Delay Time	——	16	——	ns	V_{DD} = 100V
t_r	Rise Time	——	95	——		I_D =26A
$t_{d(off)}$	Turn-Off Delay Time	——	29	——		R_G= 2.5Ω
t_f	Fall Time	——	47	——		V_{GS} = 10V ④
C_{iss}	Input Capacitance	——	2900	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	450	——		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	——	73	——		f = 1.0MHz
C_{oss}	Output Capacitance	——	3550	——		V_{GS} = 0V, V_{DS} = 1.0V f = 1.0MHz
C_{oss}	Output Capacitance	——	180	——		V_{GS} = 0V, V_{DS} = 160V f = 1.0MHz
$C_{oss\ eff.}$	Effective Output Capacitance	——	380	——		V_{GS} = 0V, V_{DS} = 0V to 160V⑤

Avalanche Characteristics

	Parameter	Min.	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②⑥	——	——	460	mJ
I_{AR}	Avalanche Current ①	——	——	26	A
E_{AR}	Repetitive Avalanche Energy ①	——	390	——	mJ
$V_{DS\ (Avalanche)}$	Repetitive Avalanche Voltage①	260	——	——	V

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	44	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①⑥	——	——	180		
V_{SD}	Diode Forward Voltage	——	——	1.5	V	T_J = 25°C,I_S = 26A,V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	——	160	240	ns	T_J = 25°C ,I_F = 26A
Q_{rr}	Reverse Recovery Charge	——	1.3	2.0	µC	di/dt = 100A/µs ④
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.

② starting T_J = 25°C, L = 1.3mH, R_G = 25Ω, I_{AS} = 26A.

③ I_{SD} ≤ 26A, di/dt ≤ 390A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 175°C.

④ Pulse width ≤ 300µs; duty cycle ≤ 2%.

⑤ 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}.

⑥ This is only applied to TO-220AB package.

⑦ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

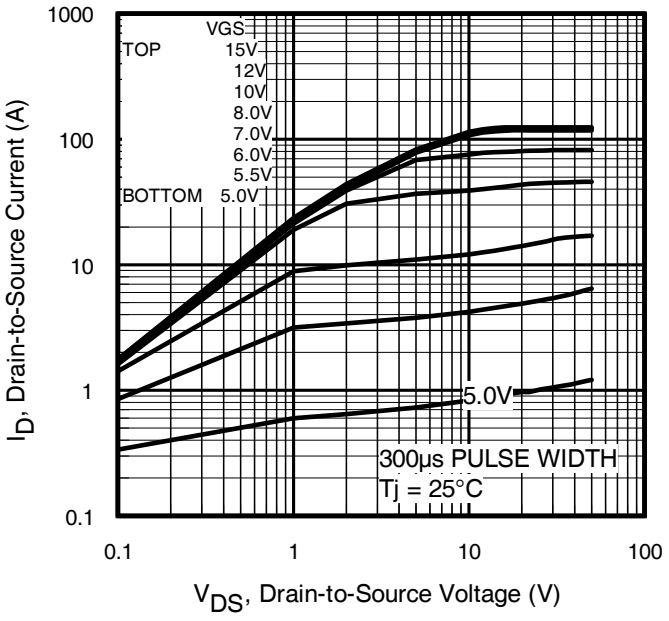


Fig. 1 Typical Output Characteristics

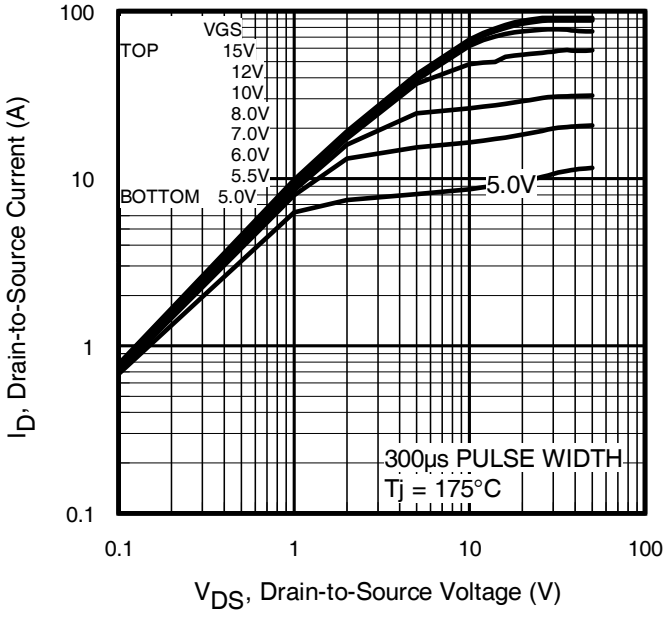


Fig. 2 Typical Output Characteristics

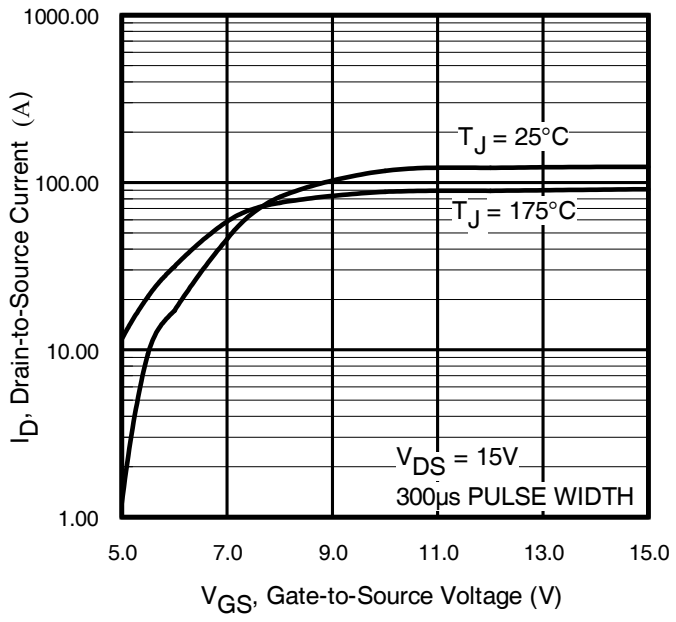


Fig. 3 Typical Transfer Characteristics

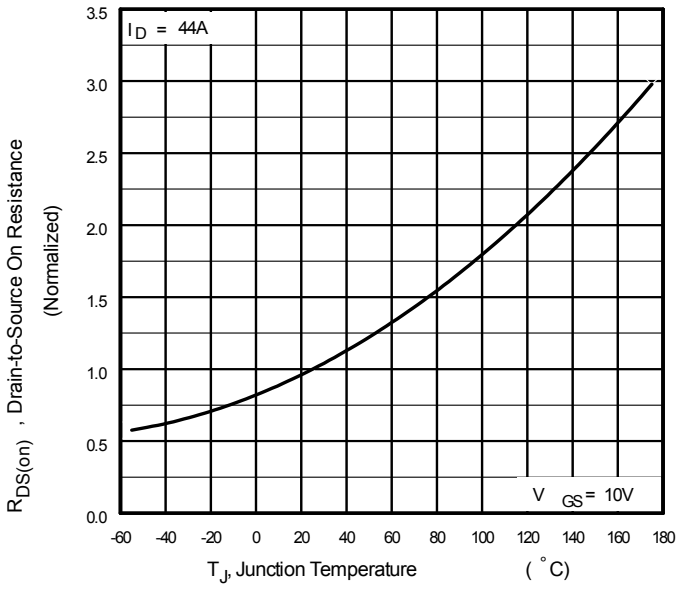


Fig. 4 Normalized On-Resistance vs. Temperature

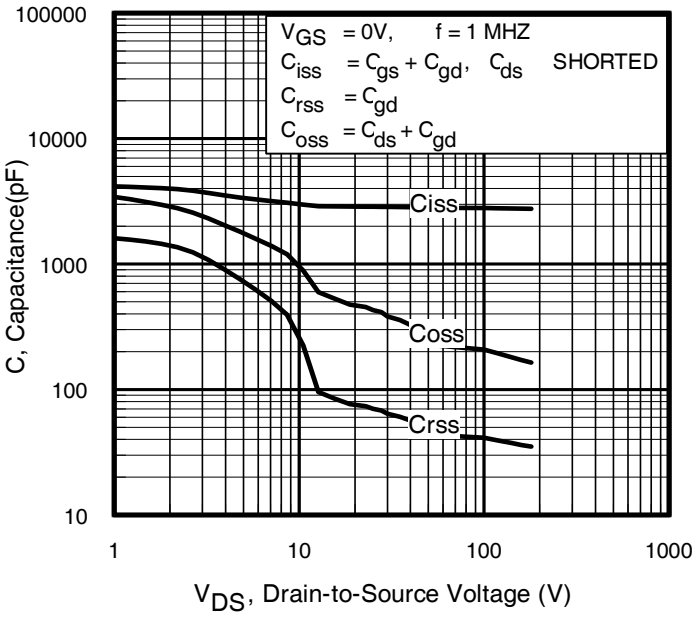


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

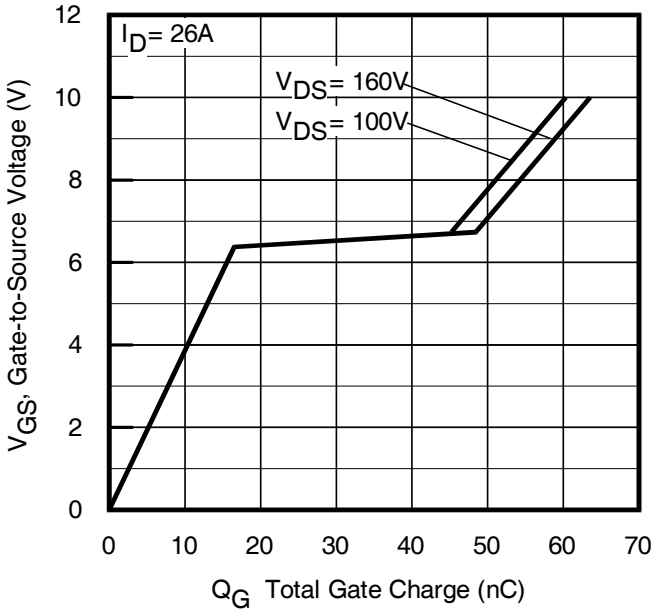


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

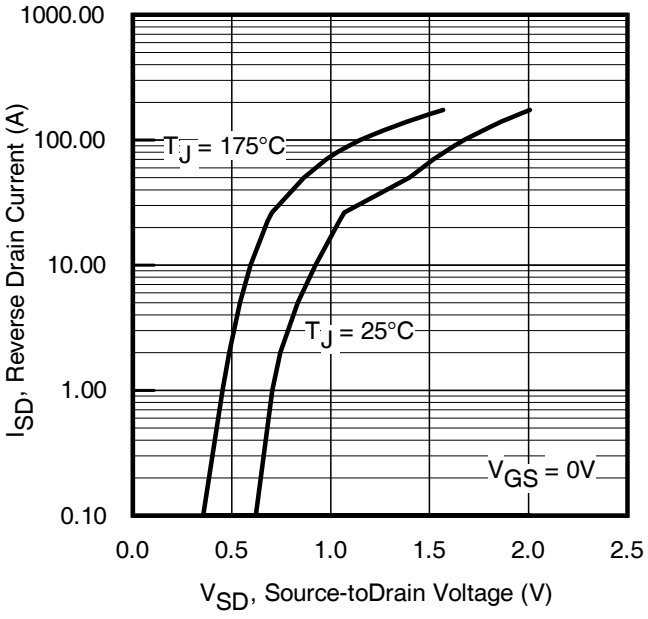


Fig. 7 Typical Source-to-Drain Diode Forward Voltage

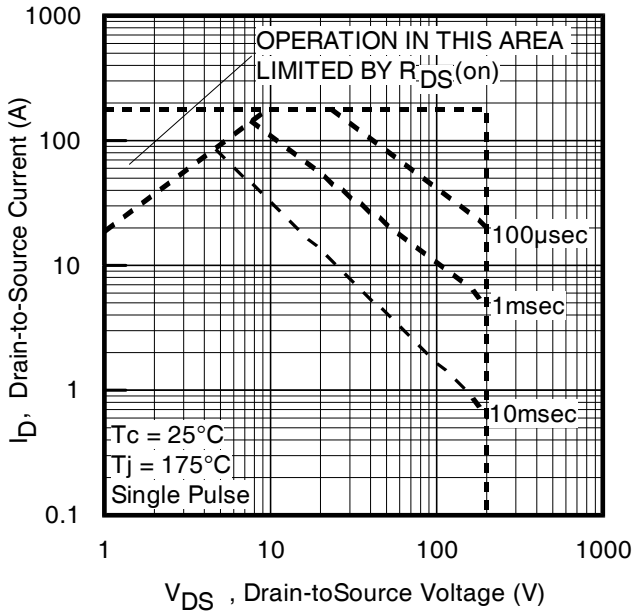


Fig 8. Maximum Safe Operating Area

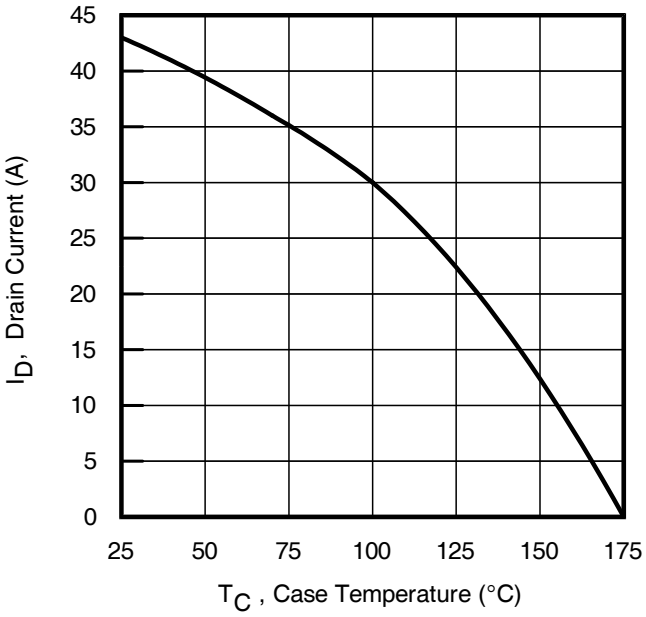


Fig 9. Maximum Drain Current vs. Case Temperature

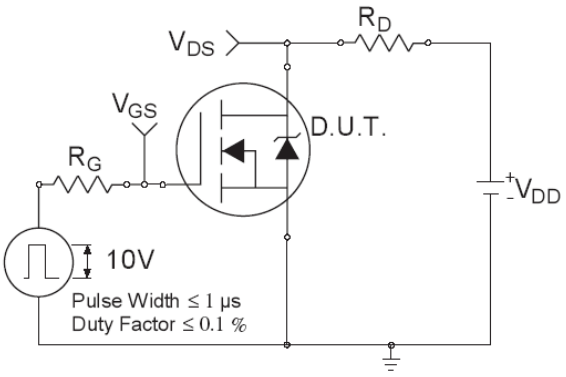


Fig 10a. Switching Time Test Circuit

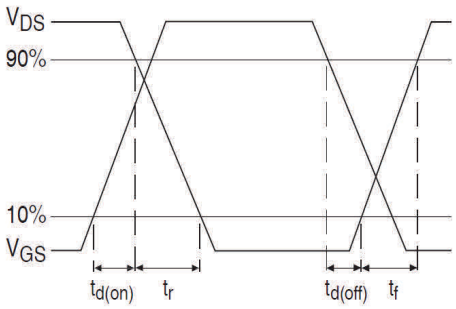


Fig 10b. Switching Time Waveforms

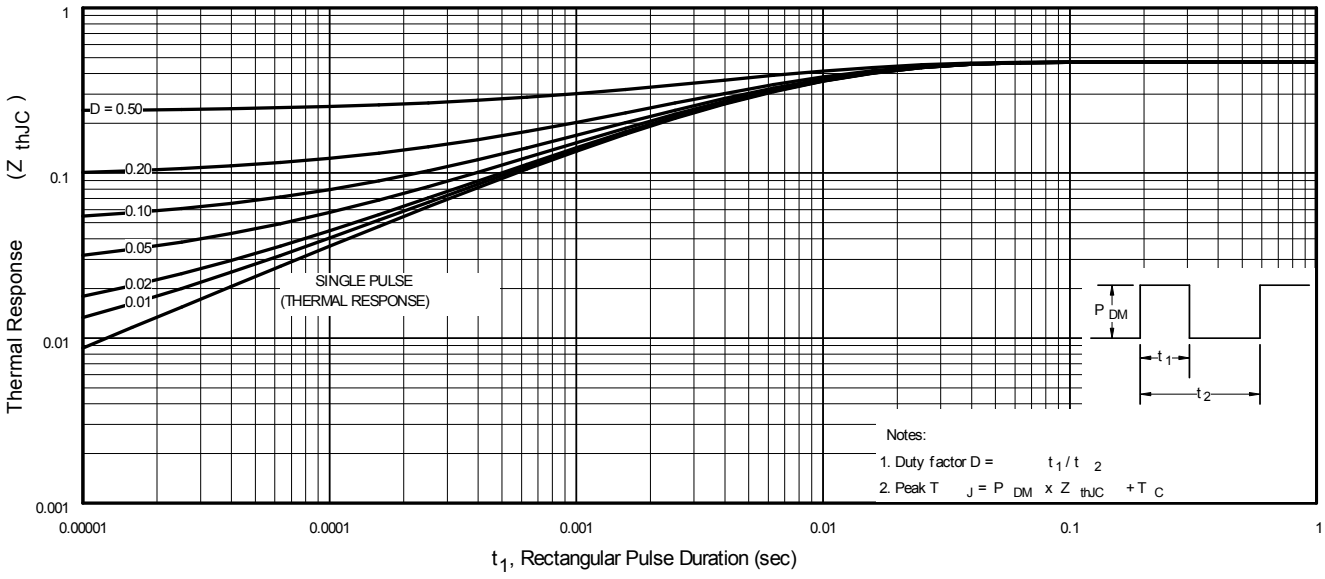


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

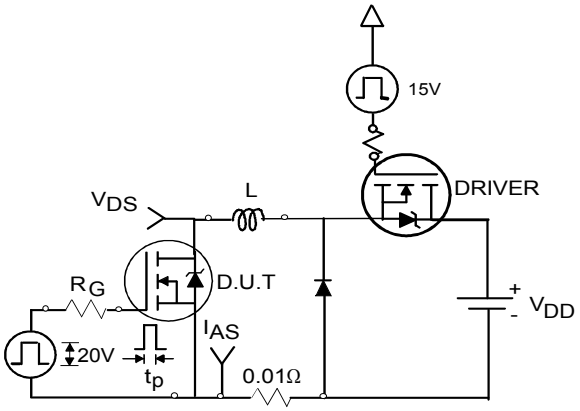


Fig 12a. Unclamped Inductive Test Circuit

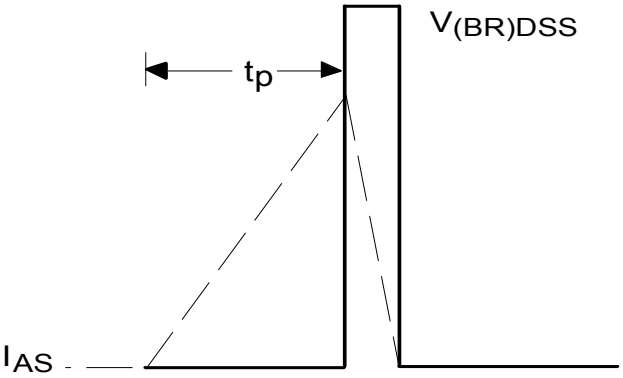


Fig 12b. Unclamped Inductive Waveforms

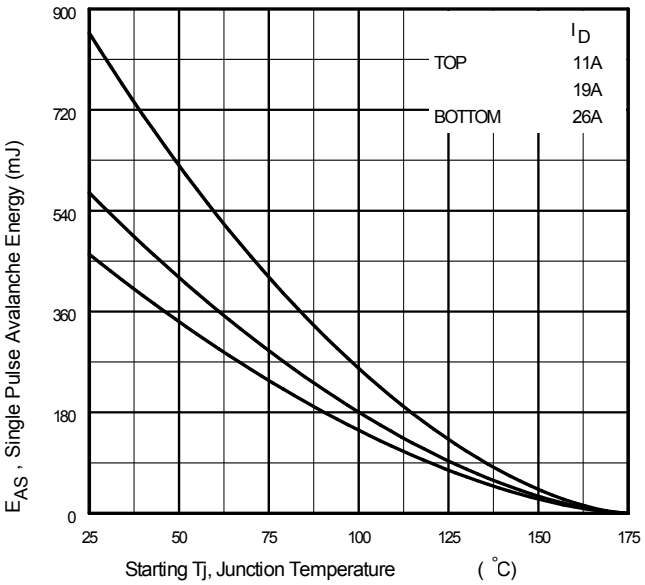


Fig 12c. Maximum Avalanche Energy vs. Drain Current

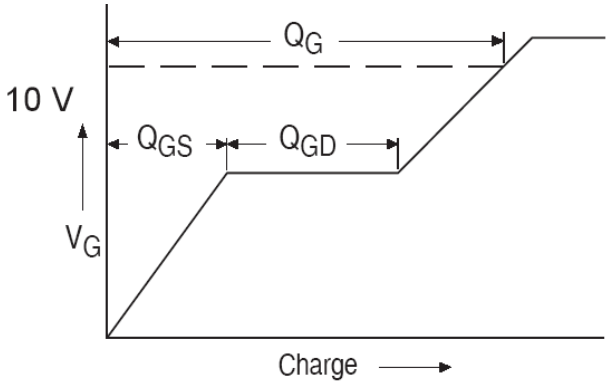


Fig 13a. Gate Charge Waveform

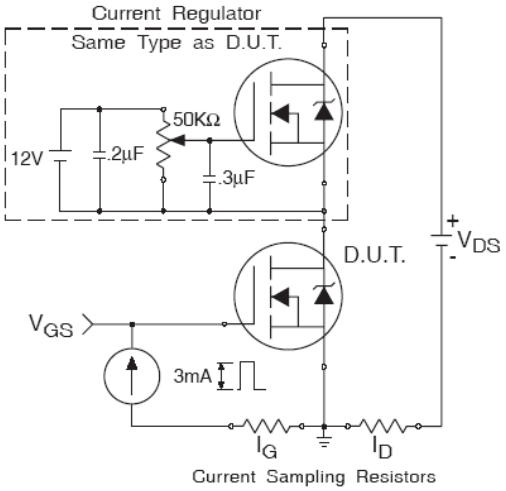
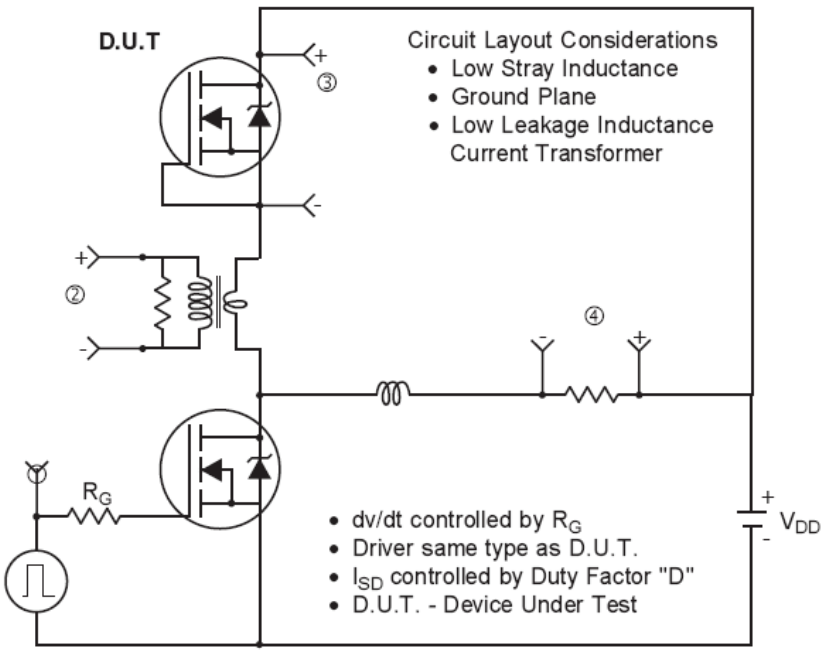


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



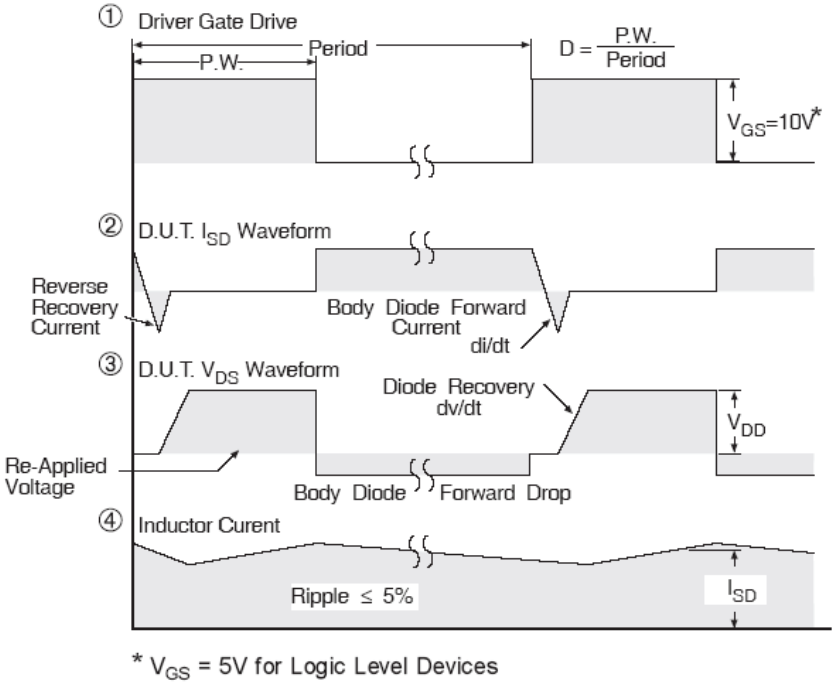
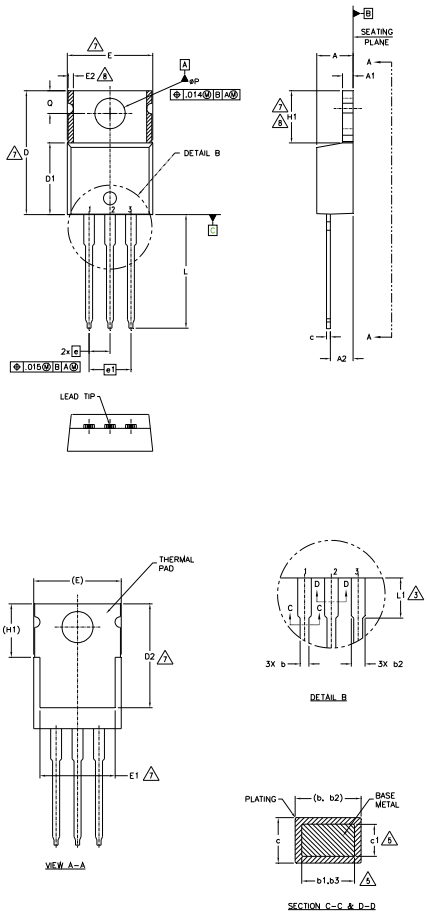


Fig 14. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

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	
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

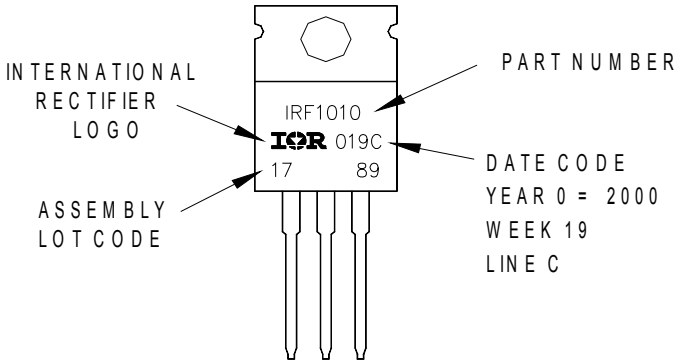
IGBTs, CoPACK
1.– GATE
2.– COLLECTOR
3.– EMITTER

DIODES
1.– ANODE
2.– CATHODE
3.– ANODE

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 2000
IN THE ASSEMBLY LINE "C"

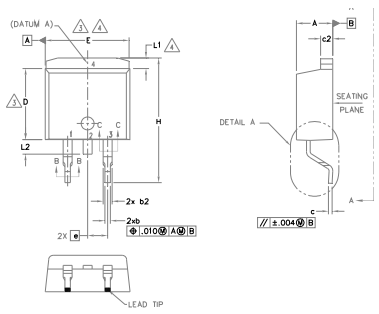
Note: "P" in assembly line position indicates "Lead - Free"



TO-220AB packages are not recommended for Surface Mount Application.

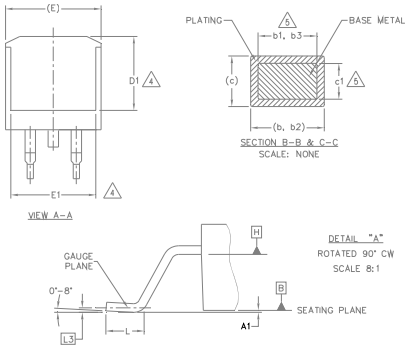
Notes:
1. For an Automotive Qualified version of this part please see http://www.infineon.com/product-info/auto/
2. For the most current drawing please refer to Infineon website at http://www.infineon.com/package/

D2-Pak (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 [.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	
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

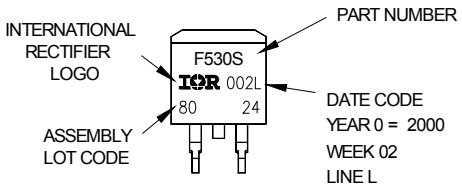
IGBTs, CoPACK

1.– GATE
2, 4.– COLLECTOR
3.– EMITTER

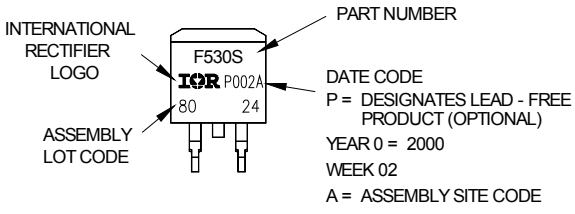
D2-Pak (TO-263AB) Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW 02, 2000
IN THE ASSEMBLY LINE "L"

Note: "P" in assembly line position
indicates "Lead – Free"



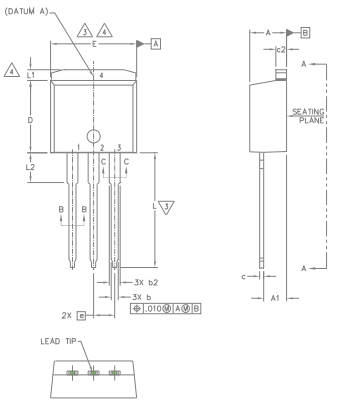
OR

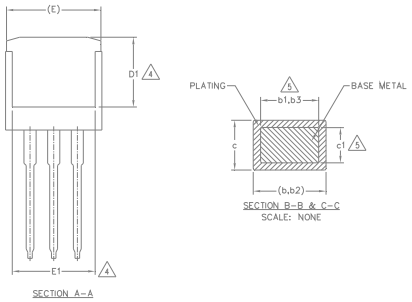


Notes:

1. **For an Automotive Qualified version of this part please see http://www.infineon.com/product-info/auto/**
2. **For the most current drawing please refer to Infineon website at http://www.infineon.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

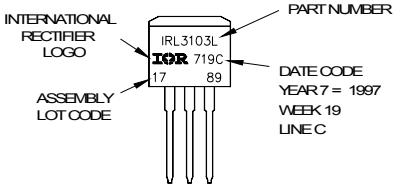
HEXFET	DIODES
1.- GATE	1.- ANODE (TWO DIE) / OPEN (ONE DIE)
2.- DRAIN	2, 4.- CATHODE
3.- SOURCE	3.- ANODE
4.- DRAIN	

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	

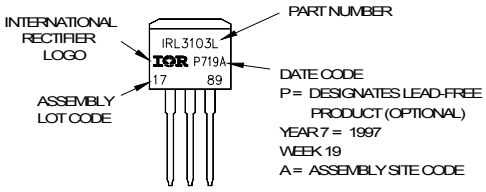
TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position indicates "Lead – Free"

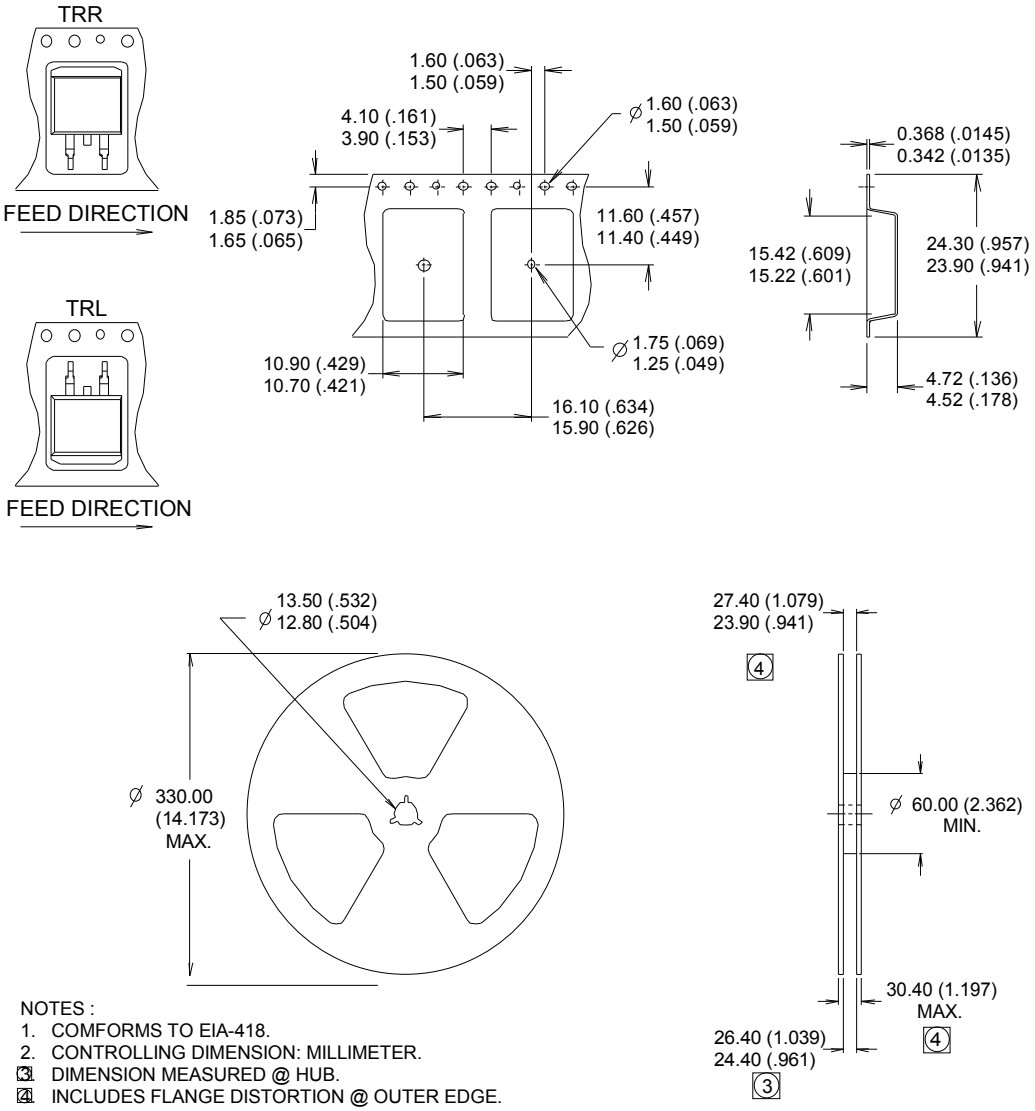


OR



Notes:
1. For an Automotive Qualified version of this part please see http://www.infineon.com/product-info/auto/
2. For the most current drawing please refer to Infineon website at http://www.infineon.com/package/

D2-Pak (TO-263AB) Tape & Reel Information (Dimensions are shown in millimeters (inches))



NOTES :
1. COMFORMS 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	Industrial (per JEDEC JESD47F) ††	
Moisture Sensitivity Level	TO-220AB	N/A
	D2-Pak	MSL1 (per JEDEC J-STD-020D) ††
	TO-262	N/A
RoHS Compliant	Yes	

† Qualification standards can be found at Infineon's web site www.infineon.com

†† Applicable version of JEDEC standard at the time of product release.

Revision History

Date	Comments
5/31/2016	• Updated datasheet with corporate template. • Added disclaimer on last page.

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