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IR Rectifier

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PD - 97001A

SMPS MOSFET

IRFB38N20DPbF

IRFS38N20DPbF

IRFSL38N20DPbF

HEXFET® Power MOSFET

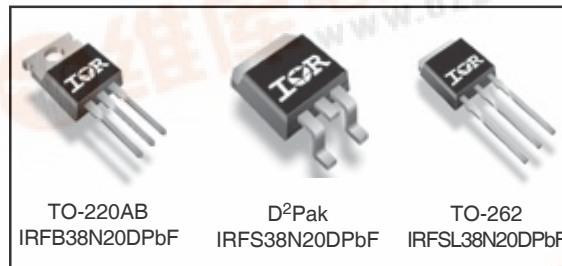
Applications

- High frequency DC-DC converters
- Plasma Display Panel
- Lead-Free

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

Key Parameters		
V _{DS}	200	V
V _{DS (Avalanche) min.}	260	V
R _{DS(ON) max @ 10V}	54	mΩ
T _{J max}	175	°C



Absolute Maximum Ratings

	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V ⑦	38*	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V ⑦	27*	
I _{DM}	Pulsed Drain Current ①	180	
P _D @ T _A = 25°C	Power Dissipation ⑦	3.8	W
P _D @ T _C = 25°C	Power Dissipation ⑦	230*	
	Linear Derating Factor ⑦	1.5*	W/°C
V _{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③	9.5	V/ns
T _J	Operating Junction and	-55 to + 175	°C
T _{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		
	Mounting torque, 6-32 or M3 screw ⑥	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case	—	0.47*	°C/W
R _{θCS}	Case-to-Sink, Flat, Greased Surface ⑥	0.50	—	
R _{θJA}	Junction-to-Ambient ⑥	—	62	
R _{θJA}	Junction-to-Ambient ⑦	—	40	

* R_{θJC} (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 wearout of the die attach medium.

Notes ① through ⑦ are on page 11

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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
ΔV _{(BR)DSS/ΔT_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} = 200V, 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

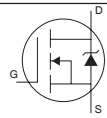
Dynamic @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
g _{fs}	Forward Transconductance	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 ("Miller") Charge	—	28	42	ns	V _{GS} = 10V, ④
t _{d(on)}	Turn-On Delay Time	—	16	—		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 160V ⑤

Avalanche Characteristics

	Parameter	Min.	Typ.	Max.	Units
E _{AS}	Single Pulse Avalanche Energy ②③	—	—	460	mJ
I _{AR}	Avalanche Current ①	—	—	26	A
E _{AR}	Repetitive Avalanche Energy ①	—	390	—	mJ
V _{DS (Avalanche)}	Repetitive Avalanche Voltage ①	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) ①③	—	—	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)				

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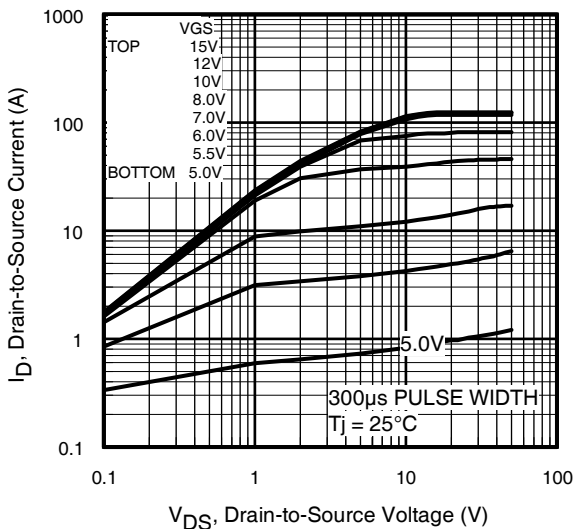


Fig 1. Typical Output Characteristics

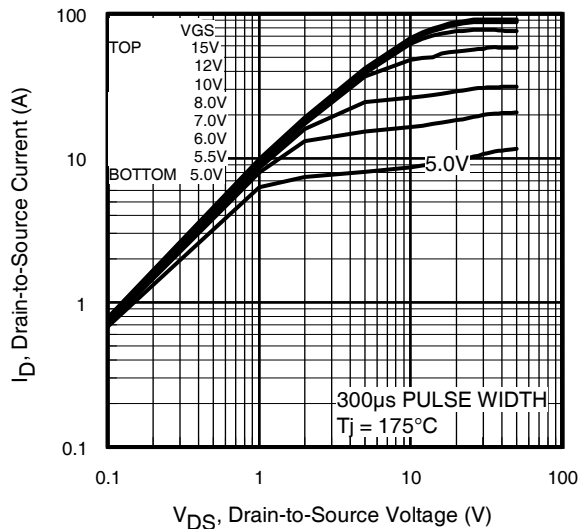


Fig 2. Typical Output Characteristics

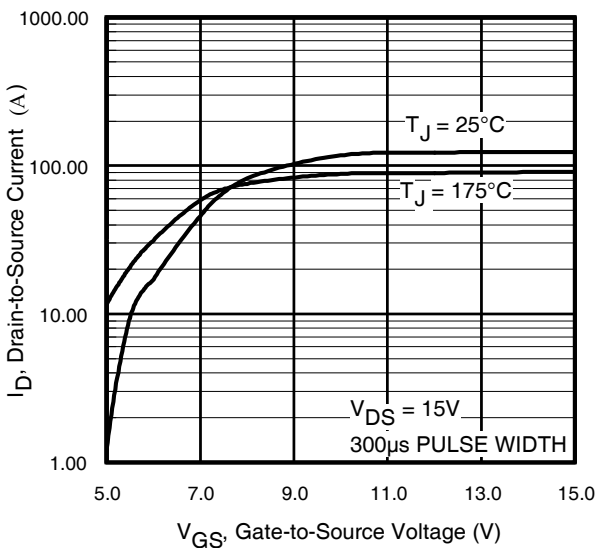


Fig 3. Typical Transfer Characteristics

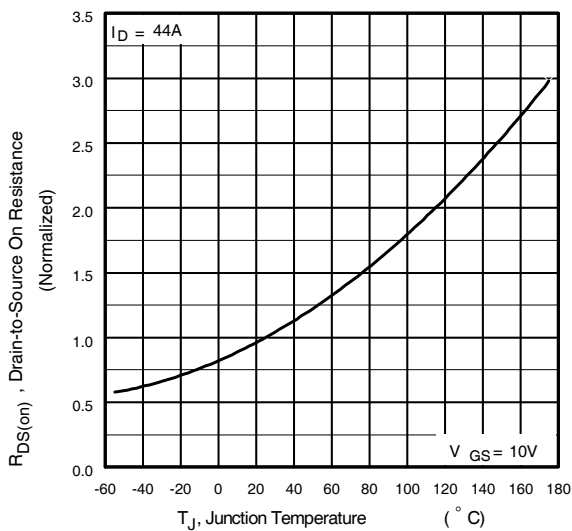


Fig 4. Normalized On-Resistance Vs. Temperature

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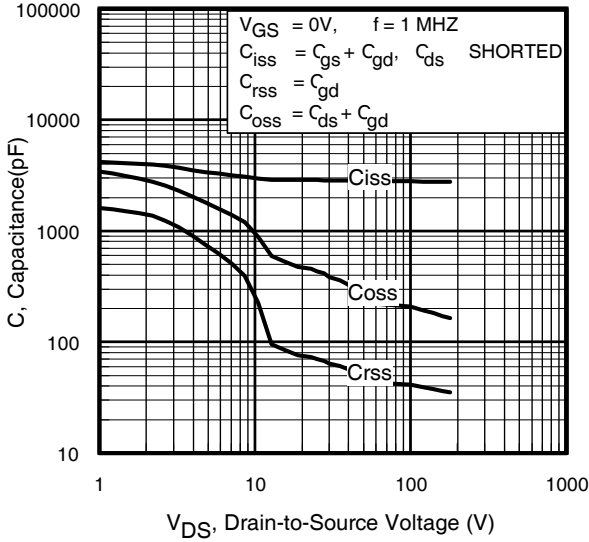


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

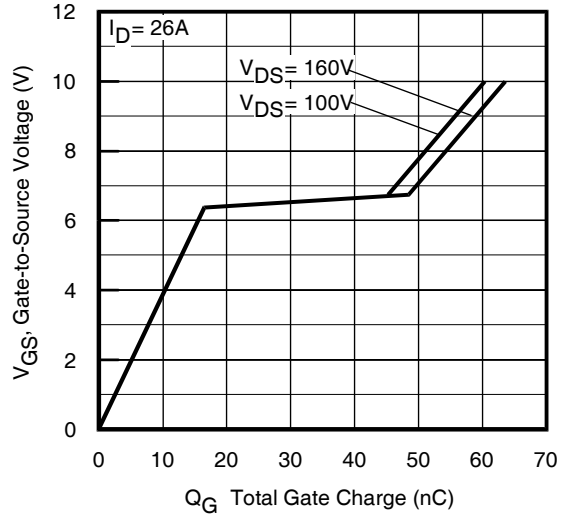


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

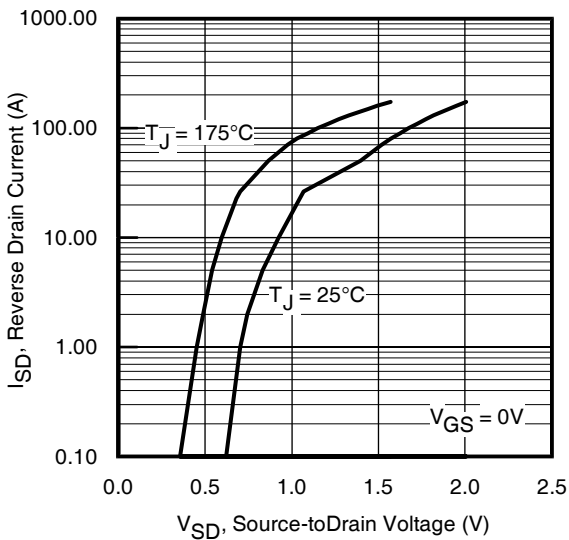


Fig 7. Typical Source-Drain Diode Forward Voltage

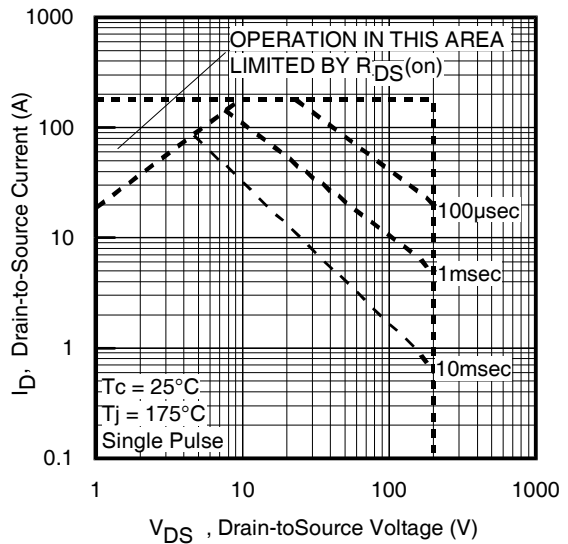


Fig 8. Maximum Safe Operating Area

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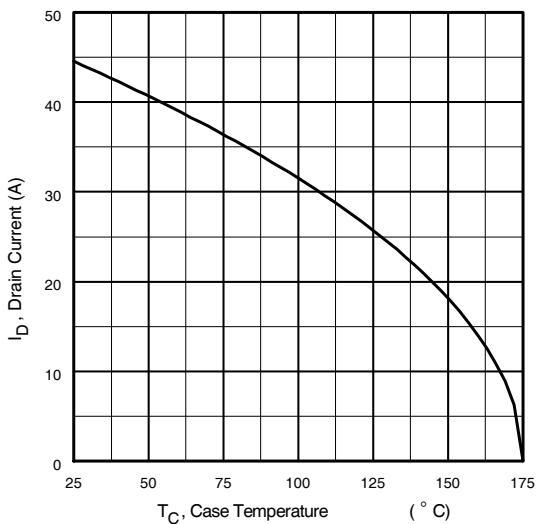


Fig 9. Maximum Drain Current Vs. Case Temperature

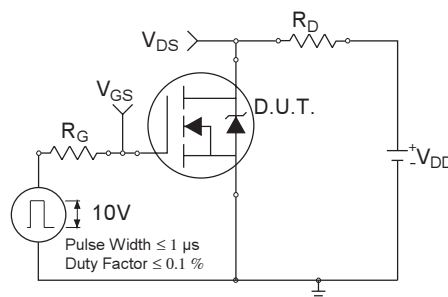


Fig 10a. Switching Time Test Circuit

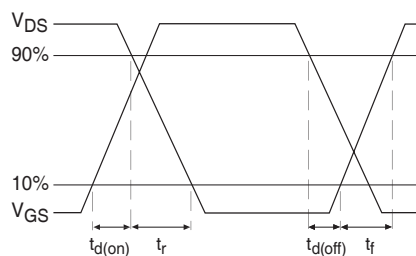


Fig 10b. Switching Time Waveforms

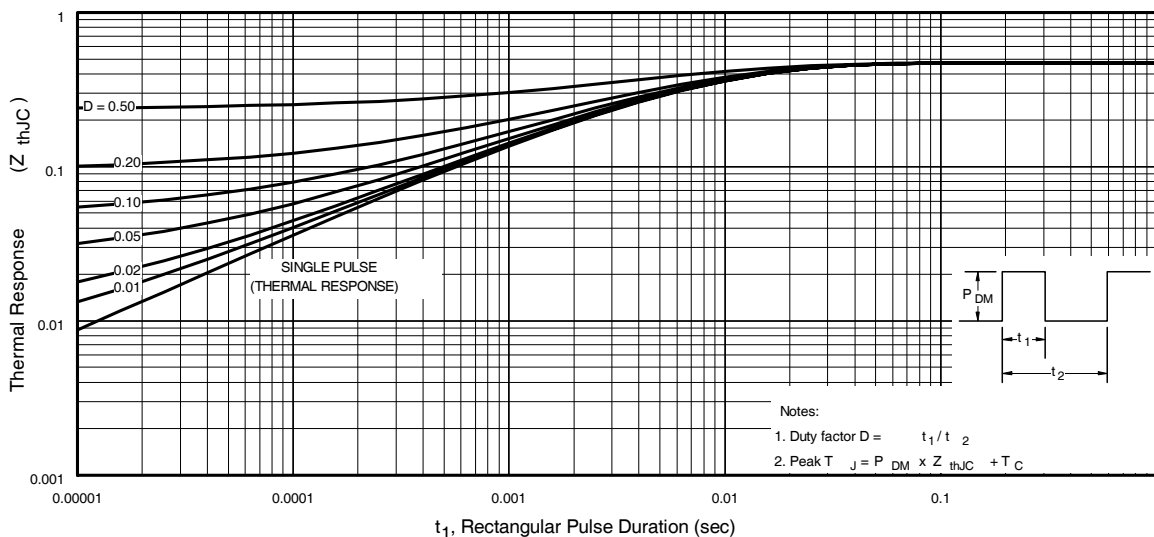


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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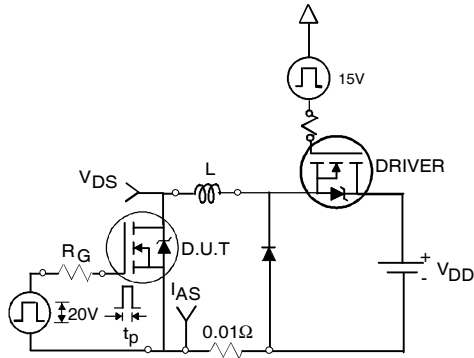


Fig 12a. Unclamped Inductive Test Circuit

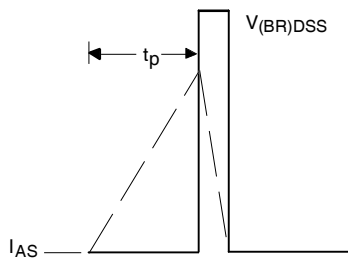


Fig 12b. Unclamped Inductive Waveforms

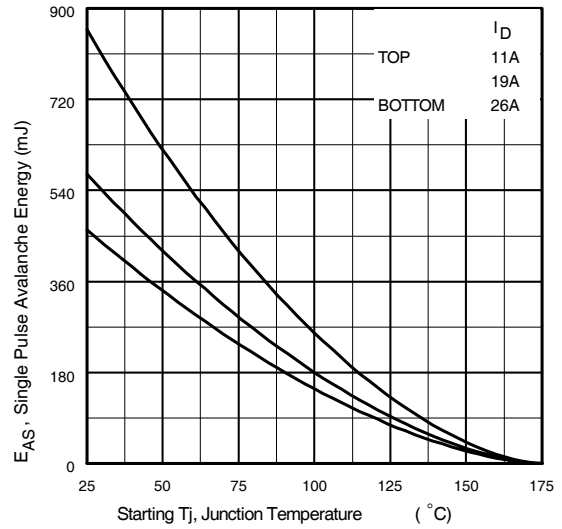


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

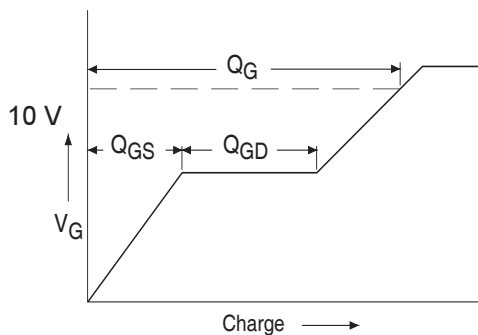


Fig 13a. Basic Gate Charge Waveform

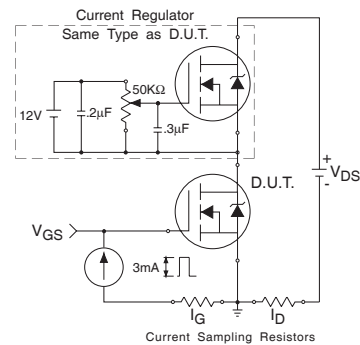
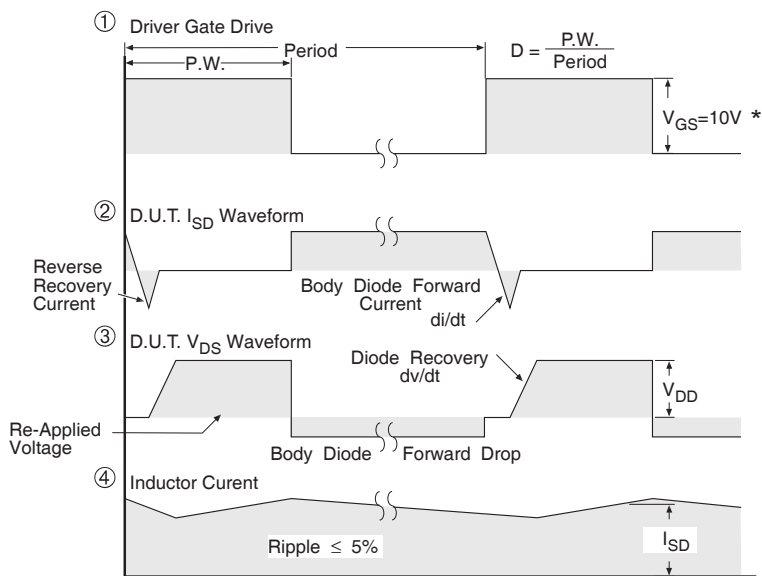
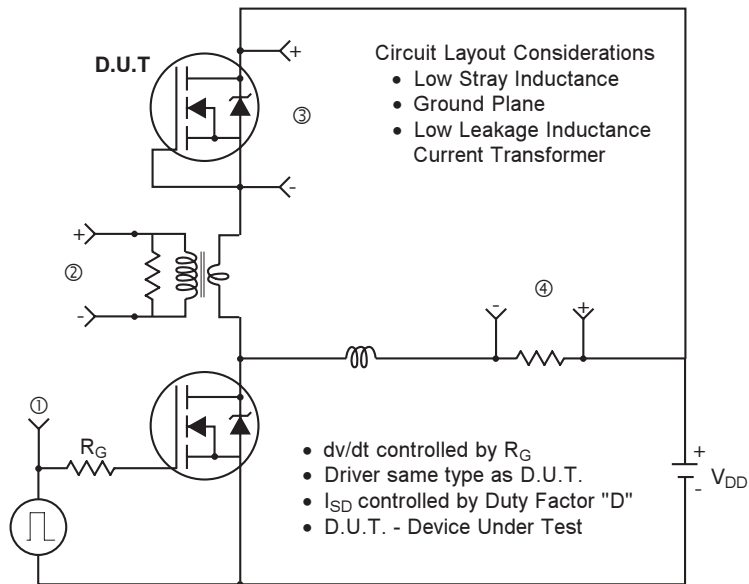


Fig 13b. Gate Charge Test Circuit

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Peak Diode Recovery dv/dt Test Circuit



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

Fig 14. For N-Channel HEXFET® Power MOSFETs

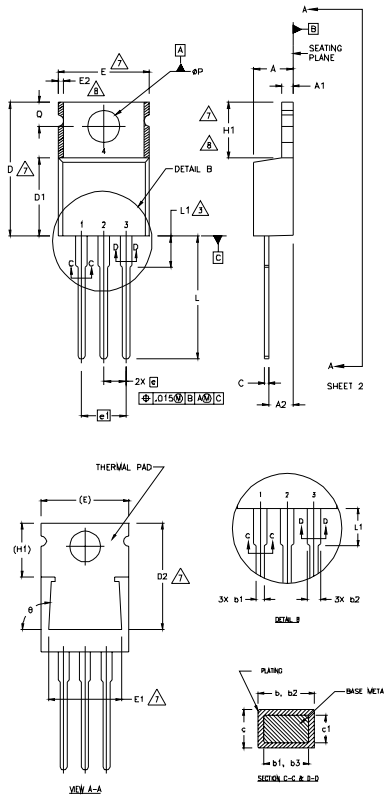
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TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2 DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS).
- 3 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4 DIMENSION D & 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 CONTROLLING DIMENSION : INCHES.
- 6 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E, H1, D2 & E1
- 7 DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.

LEAD ASSIGNMENTS

HERFET

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

IGBTs, CoPACK

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

DIODES

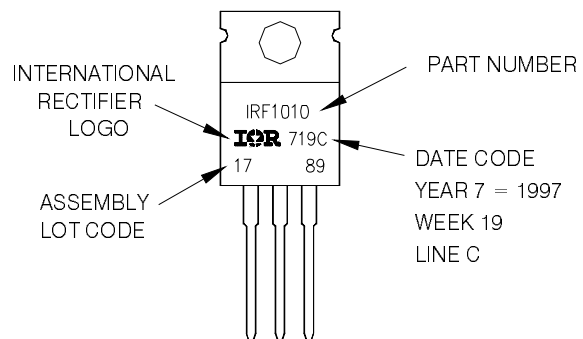
- 1- ANODE/OPEN
- 2- CATHODE
- 3- ANODE

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.82	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.04	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.96	.015	.038	5
b2	1.15	1.77	.045	.070	
b3	1.15	1.73	.045	.068	
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	12.19	12.88	.480	.507	7
E	9.66	10.66	.380	.420	4,7
E1	8.38	8.89	.330	.350	7
e	2.54 BSC		.100 BSC		
e1	5.08		.200 BSC		
H1	5.85	6.55	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	-	6.35	-	.250	3
øP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	
ø	9.0°-9.3°		9.0°-9.3°		

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"

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



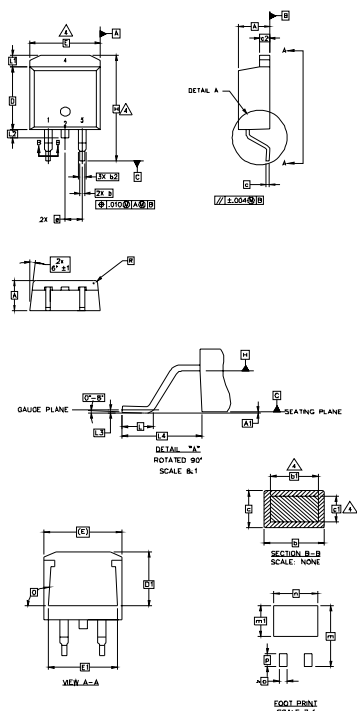
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IRFB38N20DPbF/IRFS38N20DPbF/IRFSL38N20DPbF

D²Pak 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. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

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	4
b2	1.14	1.78	.045	.070	
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	4
c2	1.14	1.65	.045	.065	
D	8.51	9.65	.335	.380	3
D1	6.86		.270		
E	9.65	10.67	.380	.420	3
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		1.65		.065	
L2	1.27	1.78	.050	.070	
L3	0.25 BSC		.010 BSC		
L4	4.78	5.28	.188	.208	
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
R	0.51	0.71	.020	.028	
θ	90°	93°	90°	93°	

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

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

DiODES

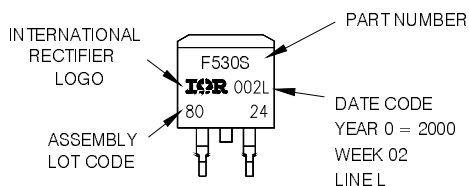
- 1.- ANODE *
- 2, 4.- CATHODE
- 3.- ANODE

* PART DEPENDENT.

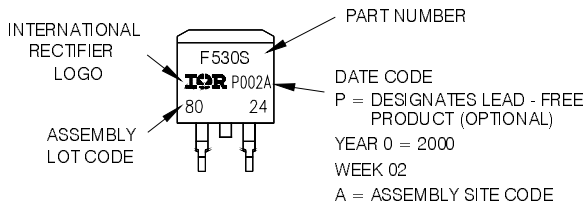
D²Pak Part Marking Information

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



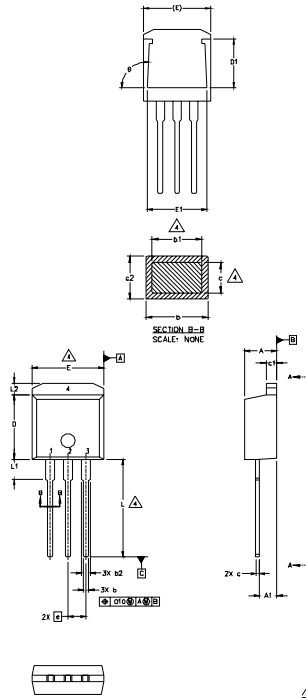
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IRFB38N20DPbF/IRFS38N20DPbF/IRFSL38N20DPbF



TO-262 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	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.38	0.63	.015	.025	4
c1	1.14	1.40	.045	.055	
c2	0.43	.063	.017	.029	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	13.46	14.09	.530	.555	
L1	3.56	3.71	.140	.146	
L2			1.65	.065	

LEAD ASSIGNMENTS

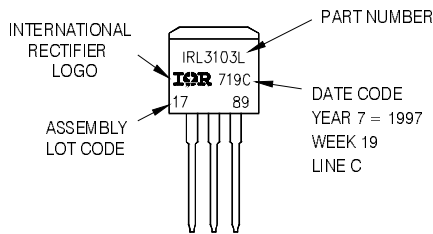
- HEXFET — IGBT
 1.- GATE 1- GATE
 2.- DRAIN
 3.- SOURCE
 4.- DRAIN

- 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. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
 5. CONTROLLING DIMENSION: INCH.

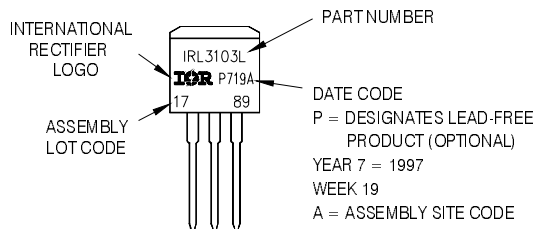
TO-262 Part Marking Information

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

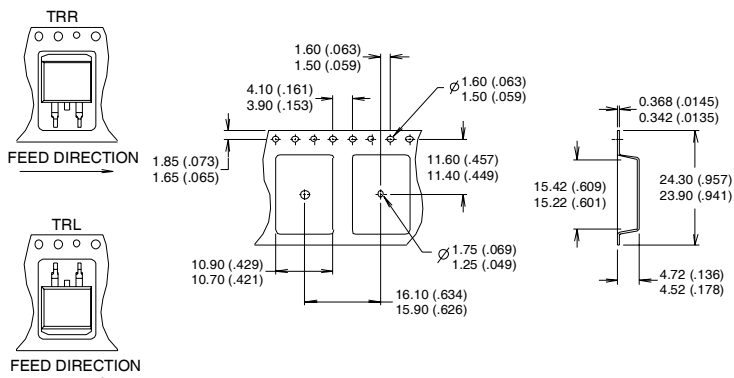


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D²Pak Tape & Reel Information



- NOTES:
1. CONFORMS TO EIA-418.
 2. CONTROLLING DIMENSION: MILLIMETER.
 - ③ DIMENSION MEASURED @ HUB.
 - ④ INCLUDES FLANGE DISTORTION @ OUTER EDGE.

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 1.3\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 26\text{A}$.
- ③ $I_{SD} \leq 26\text{A}$, $di/dt \leq 390\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$.
- ④ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.
- 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 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.

TO-220 package is not recommended for Surface Mount Application.

Data and specifications subject to change without notice.
 This product has been designed and qualified for the Automotive [Q101] (IRFB38N20DPbF),
 & Industrial (IRFS38N20DPbF/IRFSL38N20D) market.
 Qualification Standards can be found on IR's Web site.

International


IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
 TAC Fax: (310) 252-7903

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