

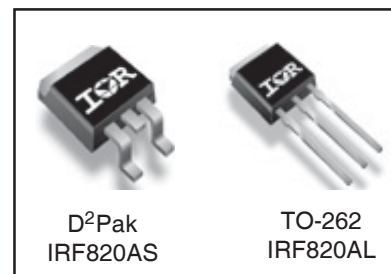
Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptable Power Supply
- High speed power switching
- Lead-Free

Benefits

- Low Gate Charge Qg Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective C_{oss} specified (See AN 1001)

V _{DSS}	R _{DS(on)} max	I _D
500V	3.0Ω	2.5A



Absolute Maximum Ratings

	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V ^⑥	2.5	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V ^⑥	1.6	
I _{DM}	Pulsed Drain Current ^① ^⑥	10	
P _D @ T _C = 25°C	Power Dissipation	50	W
	Linear Derating Factor	0.4	W/°C
V _{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ^③ ^⑥	3.4	V/ns
T _J	Operating Junction and	-55 to + 150	°C
T _{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

Typical SMPS Topologies:

- Two Transistor Forward
- Half Bridge and Full Bridge

Notes ^① through ^⑤ are on page 8
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Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	500	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.60	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ ⑥
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	3.0	Ω	$V_{GS} = 10V, I_D = 1.5A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.5	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 500V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -30V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	1.4	—	—	S	$V_{DS} = 50V, I_D = 1.5A$ ⑥
Q_g	Total Gate Charge	—	—	17	nC	$I_D = 2.5A$
Q_{gs}	Gate-to-Source Charge	—	—	4.3		$V_{DS} = 400V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	8.5		$V_{GS} = 10V$, See Fig. 6 and 13 ④⑥
$t_{d(on)}$	Turn-On Delay Time	—	8.1	—	ns	$V_{DD} = 250V$
t_r	Rise Time	—	12	—		$I_D = 2.5A$
$t_{d(off)}$	Turn-Off Delay Time	—	16	—		$R_G = 21\Omega$
t_f	Fall Time	—	13	—		$R_D = 97\Omega$, See Fig. 10 ④⑥
C_{iss}	Input Capacitance	—	340	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	53	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	2.7	—		$f = 1.0\text{MHz}$, See Fig. 5⑥
C_{oss}	Output Capacitance	—	490	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	15	—		$V_{GS} = 0V, V_{DS} = 400V, f = 1.0\text{MHz}$
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	28	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ ⑤⑥

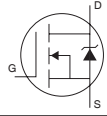
Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②⑥	—	140	mJ
I_{AR}	Avalanche Current①	—	2.5	A
E_{AR}	Repetitive Avalanche Energy①	—	5.0	mJ

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	2.5	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted, steady-state)*	—	62	

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	2.5	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①⑥	—	—	10		
V_{SD}	Diode Forward Voltage	—	—	1.6	V	$T_J = 25^\circ\text{C}, I_S = 2.5A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	330	500	ns	$T_J = 25^\circ\text{C}, I_F = 2.5A$
Q_{rr}	Reverse Recovery Charge	—	760	1140	nC	$di/dt = 100A/\mu s$ ④⑥
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

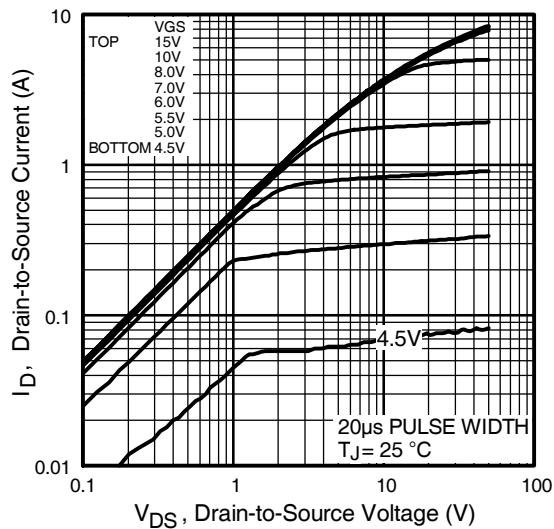


Fig 1. Typical Output Characteristics

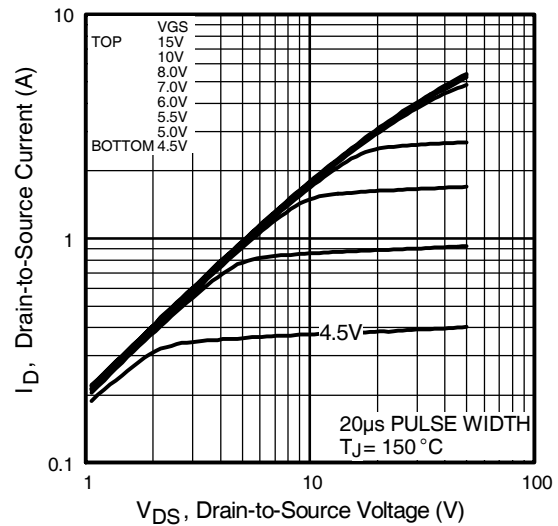


Fig 2. Typical Output Characteristics

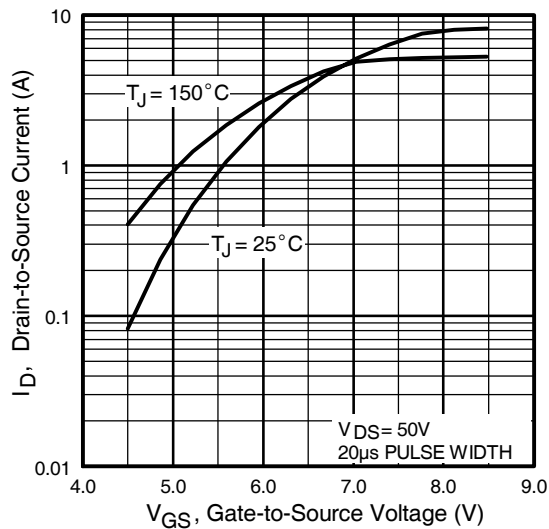


Fig 3. Typical Transfer Characteristics

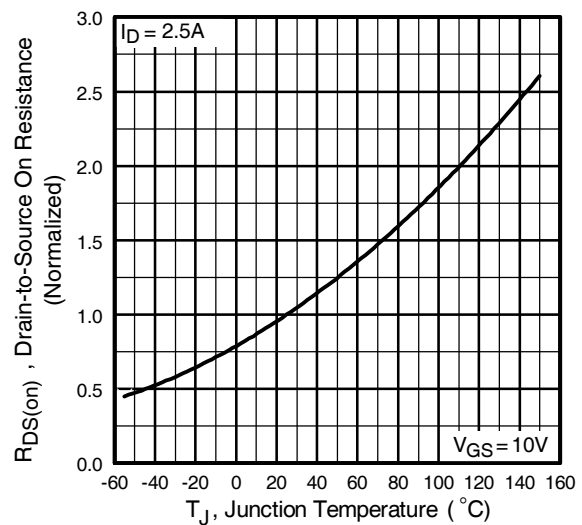


Fig 4. Normalized On-Resistance Vs. Temperature

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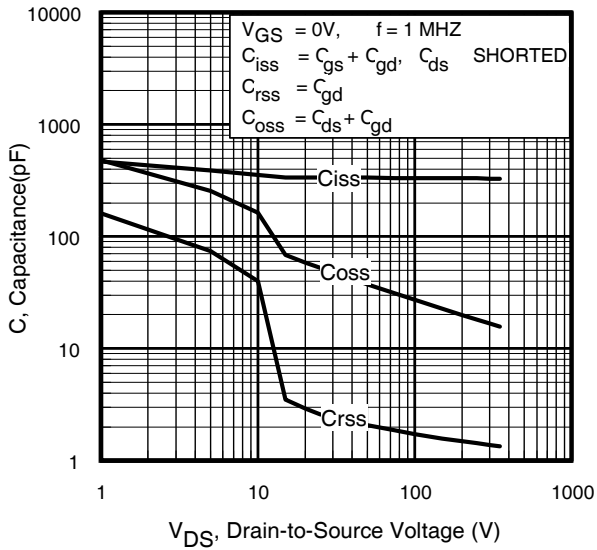


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

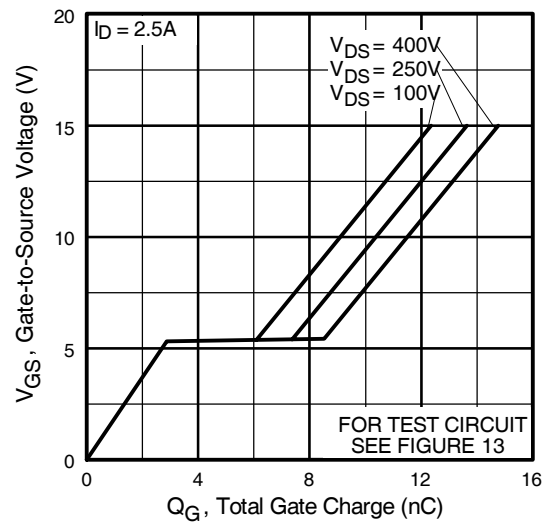


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

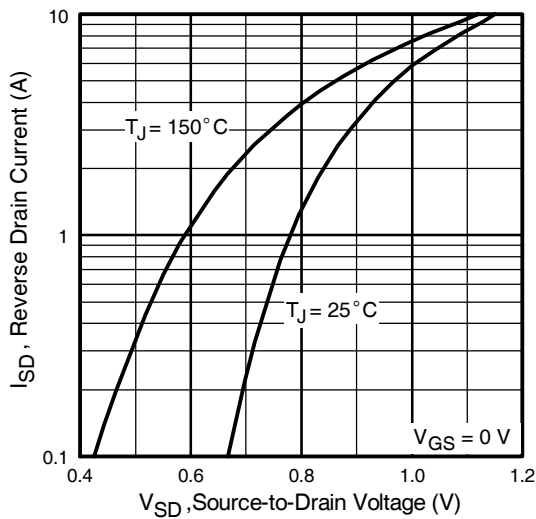


Fig 7. Typical Source-Drain Diode Forward Voltage

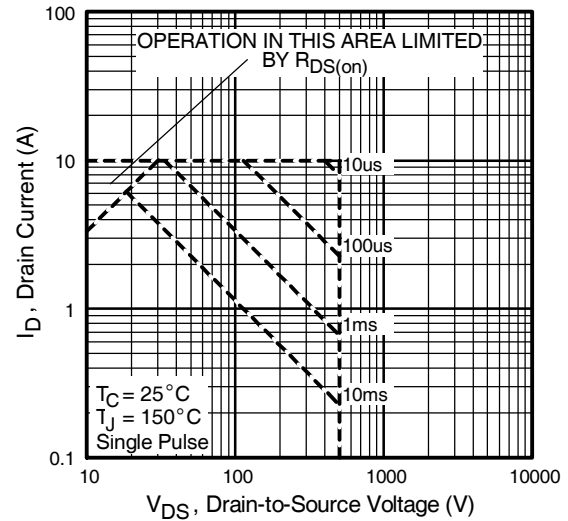


Fig 8. Maximum Safe Operating Area

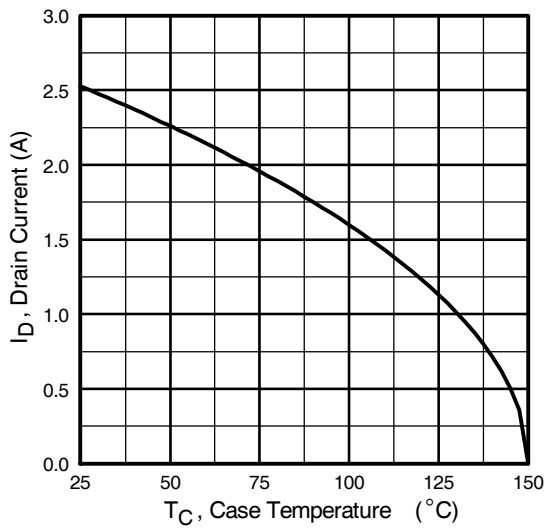


Fig 9. Maximum Drain Current Vs. Case Temperature

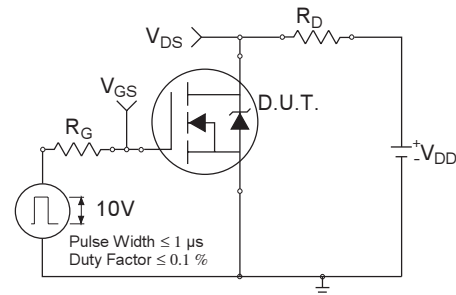


Fig 10a. Switching Time Test Circuit

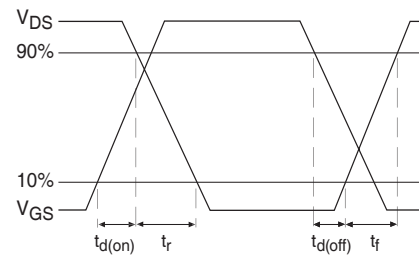


Fig 10b. Switching Time Waveforms

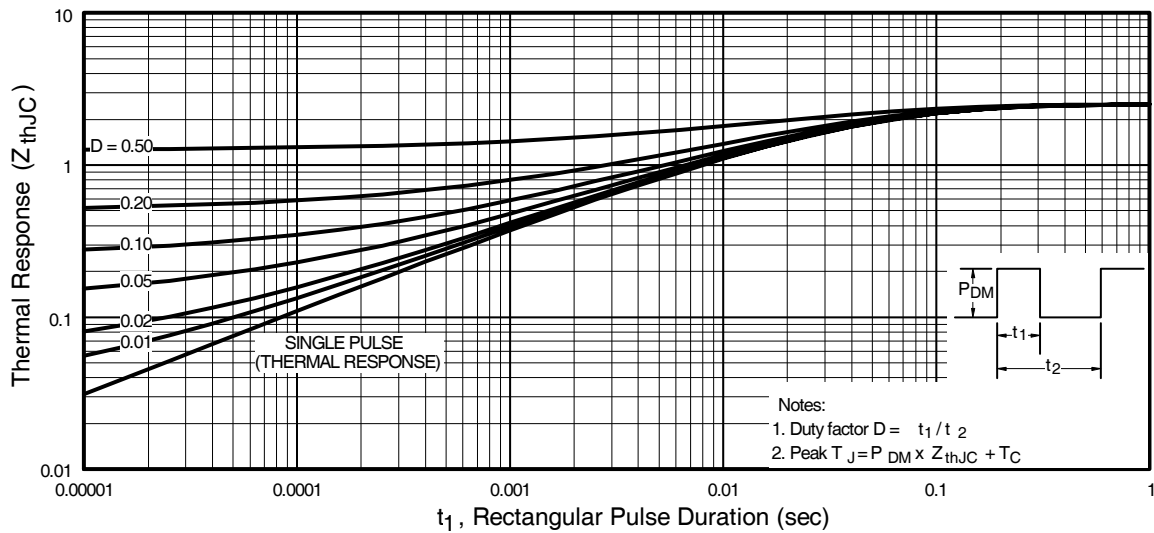


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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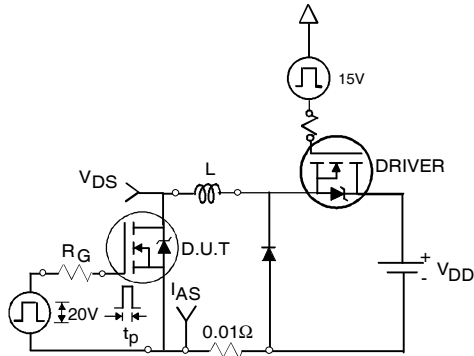


Fig 12a. Unclamped Inductive Test Circuit

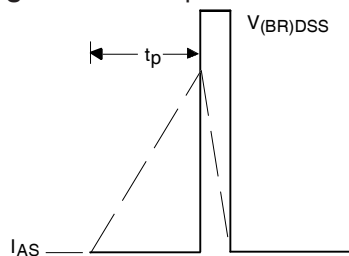


Fig 12b. Unclamped Inductive Waveforms

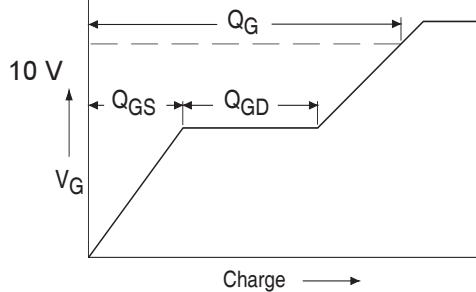


Fig 13a. Basic Gate Charge Waveform

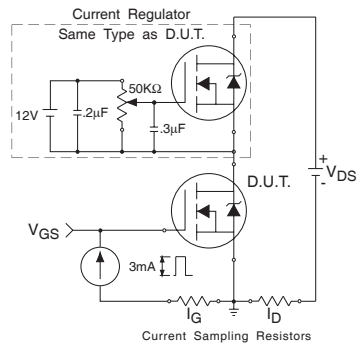


Fig 13b. Gate Charge Test Circuit

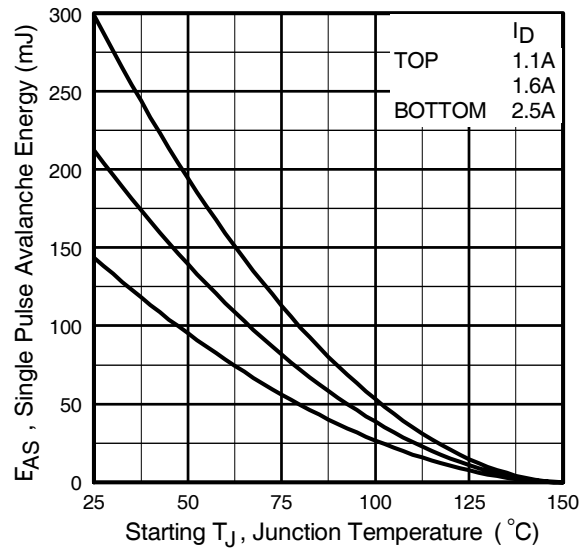


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

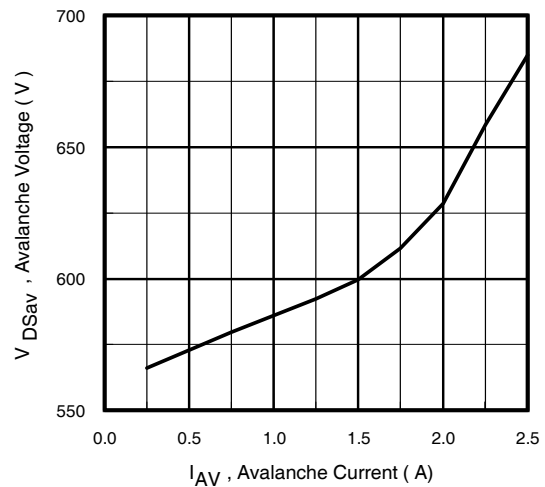
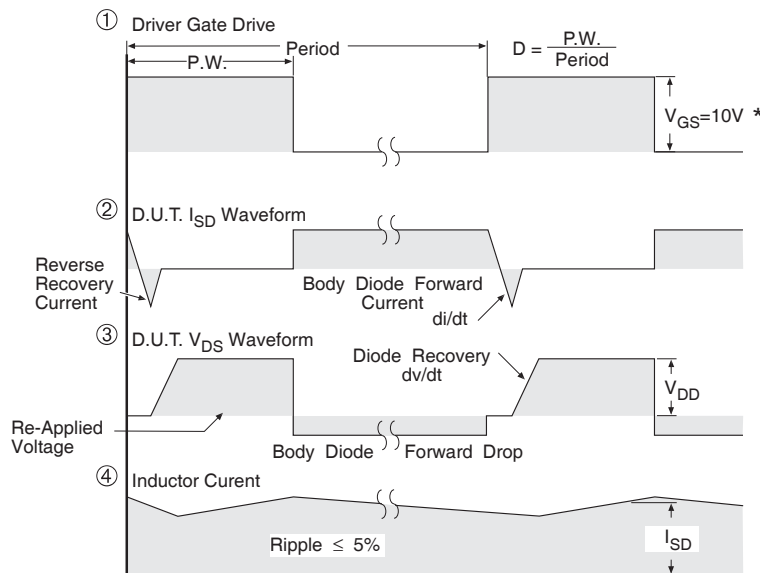
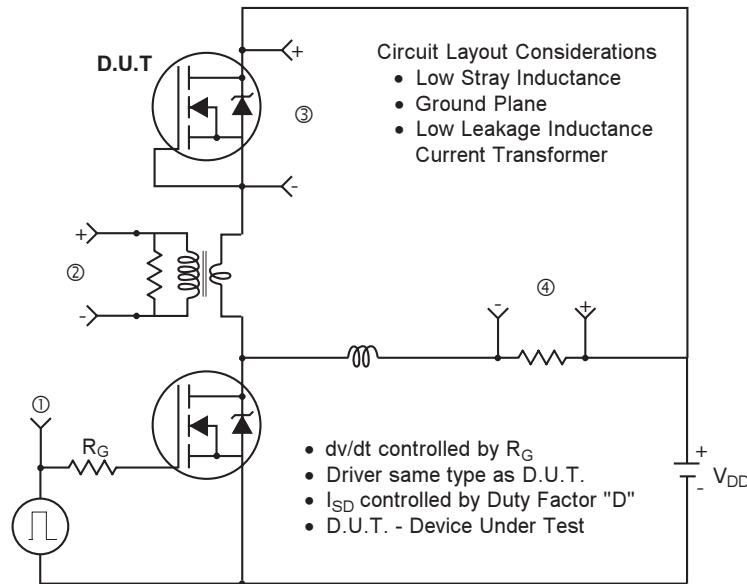


Fig 12d. Typical Drain-to-Source Voltage Vs. Avalanche Current

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Peak Diode Recovery dv/dt Test Circuit



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

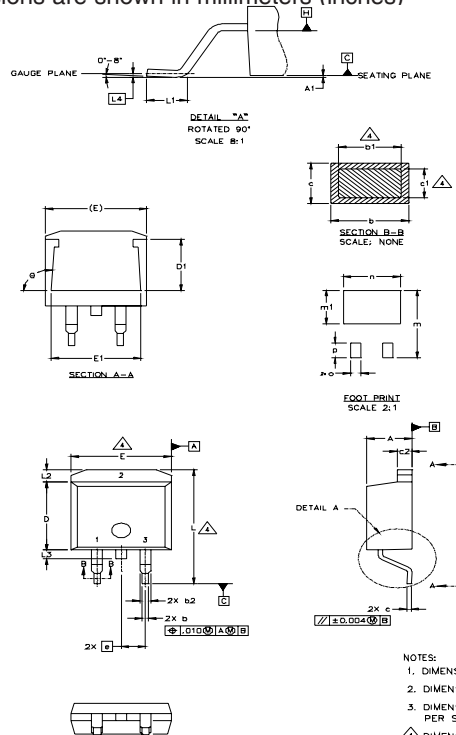
Fig 14. For N-Channel HEXFET® power MOSFETs

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D²Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1		0.127		.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	
c2	1.14	1.40	.045	.055	
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	14.61	15.88	.575	.625	
L1	1.78	2.79	.070	.110	
L2		1.65		.065	
L3	1.27	1.78	.050	.070	
L4	0.25 BSC		.010 BSC		
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
θ	90°	93°	90°	93°	

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

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

DIODES

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

* PART DEPENDENT.

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.

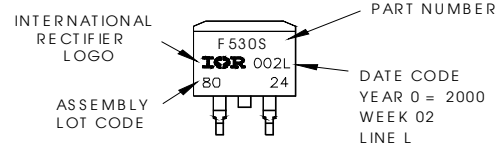
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.

5. CONTROLLING DIMENSION: INCH.

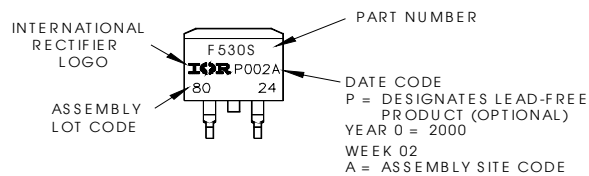
D²Pak Part Marking Information (Lead-Free)

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

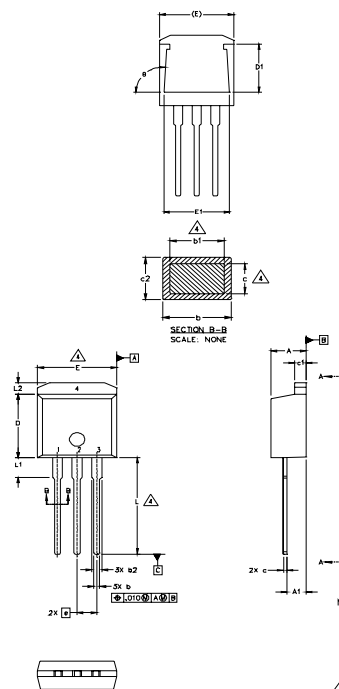
Note: "P" in assembly line
position indicates "Lead-Free"



OR



TO-262 Package Outline



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.38	0.63	.015	.025	
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	
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

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

IGBT

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

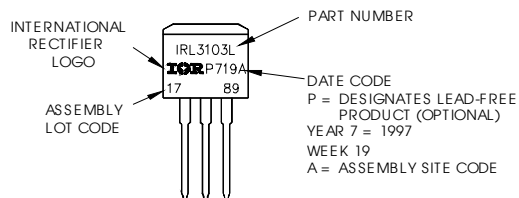
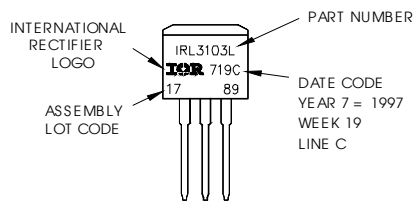
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
 2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
 3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
 4. DIMENSION b1 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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TRR

FEED DIRECTION →

TRL

FEED DIRECTION →

1.60 (.063)
1.50 (.059)
4.10 (.161)
3.90 (.153)
1.85 (.073)
1.65 (.065)
11.60 (.457)
11.40 (.449)
1.80 (.063)
1.50 (.059)
15.42 (.609)
15.22 (.601)
24.30 (.957)
23.90 (.941)
0.368 (.0145)
0.342 (.0135)
4.72 (.136)
4.52 (.178)
16.10 (.634)
15.90 (.626)
1.75 (.069)
1.25 (.049)
10.90 (.429)
10.70 (.421)
13.50 (.532)
12.80 (.504)
Ø 330.00 (14.173) MAX.
27.40 (1.079)
23.90 (.941)
Ø 60.00 (2.362) MIN.
30.40 (1.197) MAX.
26.40 (1.039)
24.40 (.961)

NOTES :

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

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)
- ② Starting $T_J = 25^{\circ}\text{C}$, $L = 45\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 2.5\text{A}$. (See Figure 12)
- ③ $I_{SD} \leq 2.5\text{A}$, $di/dt \leq 270\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 150^{\circ}\text{C}$
- 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 Uses IRF820A data and test conditions

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

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