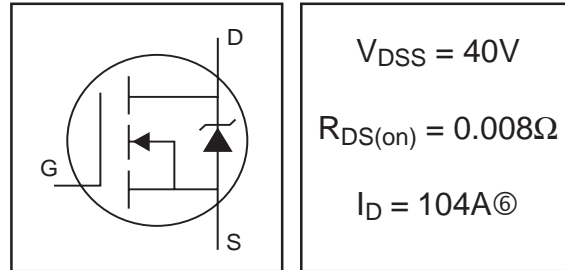


PRELIMINARY

IRL1104S/L

HEXFET® Power MOSFET

- Logic-Level Gate Drive
- Advanced Process Technology
- Surface Mount (IRL1104S)
- Low-profile through-hole (IRL1104L)
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated



Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The D²Pak is a surface mount power package capable of accommodating die sizes up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D²Pak is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0W in a typical surface mount application.

The through-hole version (IRL1104L) is available for low-profile applications.



Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V\text{⑤}$	104⑥	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V\text{⑤}$	74⑥	
I_{DM}	Pulsed Drain Current ①⑤	416	
$P_D @ T_A = 25^\circ C$	Power Dissipation	2.4	W
$P_D @ T_C = 25^\circ C$	Power Dissipation	167	W
	Linear Derating Factor	1.1	W/°C
V_{GS}	Gate-to-Source Voltage	± 16	V
E_{AS}	Single Pulse Avalanche Energy②⑤	340	mJ
I_{AR}	Avalanche Current①	62	A
E_{AR}	Repetitive Avalanche Energy①	17	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑤	5.0	V/ns
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.9	°C/W
$R_{\theta JA}$	Junction-to-Ambient(PCB Mounted, steady-state)**	—	62	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
V _{(BR)DSS}	Drain-to-Source Breakdown Voltage	40	—	—	V	V _{GS} = 0V, I _D = 250μA
ΔV _{(BR)DSS/ΔT_J}	Breakdown Voltage Temp. Coefficient	—	0.04	—	V/°C	Reference to 25°C, I _D = 1mA ^⑤
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	—	0.008	W	V _{GS} = 10V, I _D = 62A ^④
		—	—	0.012		V _{GS} = 4.5V, I _D = 52A ^④
V _{GS(th)}	Gate Threshold Voltage	1.0	—	—	V	V _{DS} = V _{GS} , I _D = 250μA
g _{fs}	Forward Transconductance	53	—	—	S	V _{DS} = 25V, I _D = 62A ^⑤
I _{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	V _{DS} = 40V, V _{GS} = 0V
		—	—	250		V _{DS} = 32V, V _{GS} = 0V, T _J = 150°C
I _{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V _{GS} = 16V
	Gate-to-Source Reverse Leakage	—	—	-100		V _{GS} = -16V
Q _g	Total Gate Charge	—	—	68	nC	I _D = 62A
Q _{gs}	Gate-to-Source Charge	—	—	24		V _{DS} = 32V
Q _{gd}	Gate-to-Drain ("Miller") Charge	—	—	34		V _{GS} = 4.5V, See Fig. 6 and 13 ^{④⑤}
t _{d(on)}	Turn-On Delay Time	—	18	—		V _{DD} = 20V
t _r	Rise Time	—	257	—		I _D = 54A
t _{d(off)}	Turn-Off Delay Time	—	32	—		R _G = 3.6Ω, V _{GS} = 4.5V
t _f	Fall Time	—	64	—		R _D = 0.4Ω, See Fig. 10 ^{④⑤}
L _S	Internal Source Inductance	—	7.5	—	nH	Between lead, and center of die contact
C _{iss}	Input Capacitance	—	3445	—	pF	V _{GS} = 0V
C _{oss}	Output Capacitance	—	1065	—		V _{DS} = 25V
C _{rss}	Reverse Transfer Capacitance	—	270	—		f = 1.0MHz, See Fig. 5 ^⑤

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	104 ^⑥	A	MOSFET symbol showing the integral reverse p-n junction diode.
I _{SM}	Pulsed Source Current (Body Diode) ^①	—	—	416		
V _{SD}	Diode Forward Voltage	—	—	1.3	V	T _J = 25°C, I _S = 62A, V _{GS} = 0V ^④
t _{rr}	Reverse Recovery Time	—	84	126	ns	T _J = 25°C, I _F = 62A
Q _{rr}	Reverse Recovery Charge	—	223	335	nC	di/dt = 100A/μs ^{④⑤}
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 V_{DD} = 15V, starting T_J = 25°C, L = 0.18mH
R_G = 25Ω, I_{AS} = 62A. (See Figure 12)

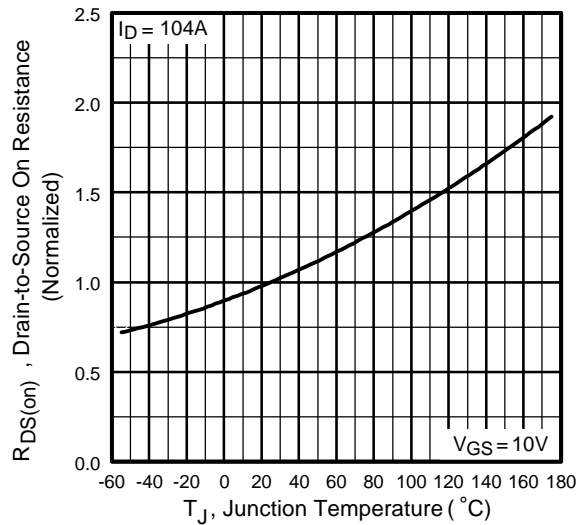
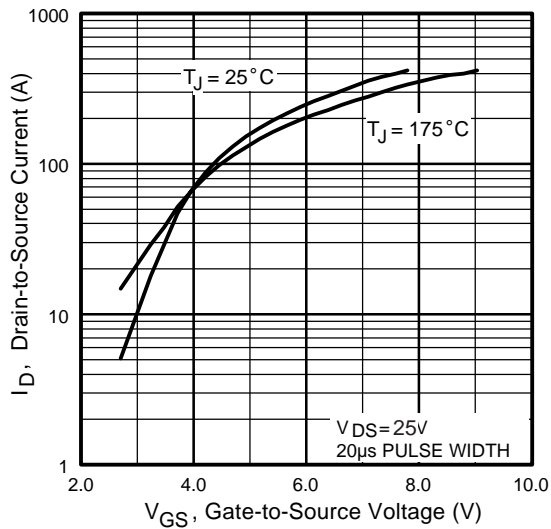
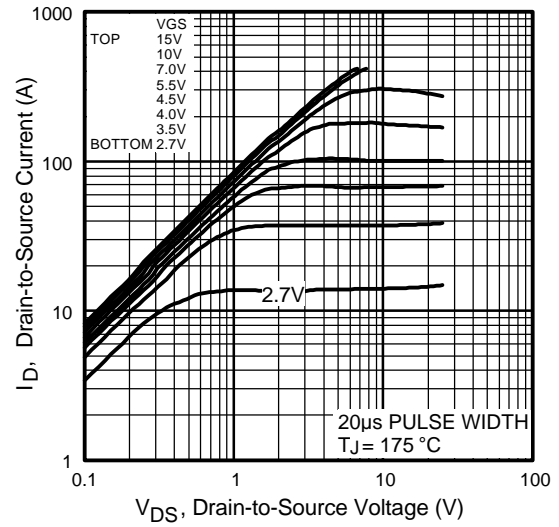
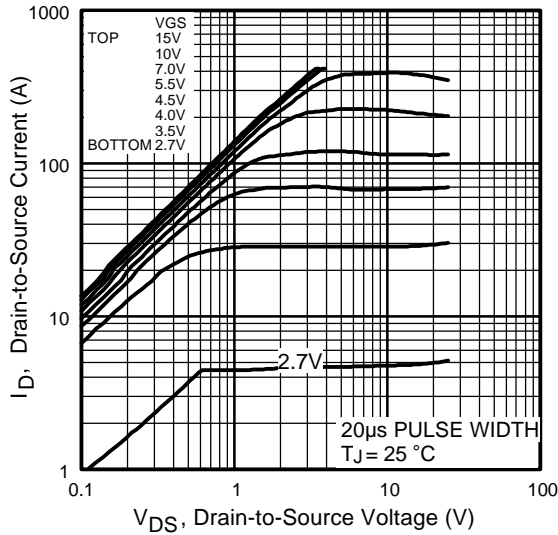
③ I_{SD} ≤ 62A, di/dt ≤ 217A/μs, V_{DD} ≤ V_{(BR)DSS},
T_J ≤ 175°C

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

⑤ Uses IRL1104 data and test conditions.

⑥ Calculated continuous current based on maximum allowable junction temperature; for recommended current-handling of the package refer to Design Tip # 93-4

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



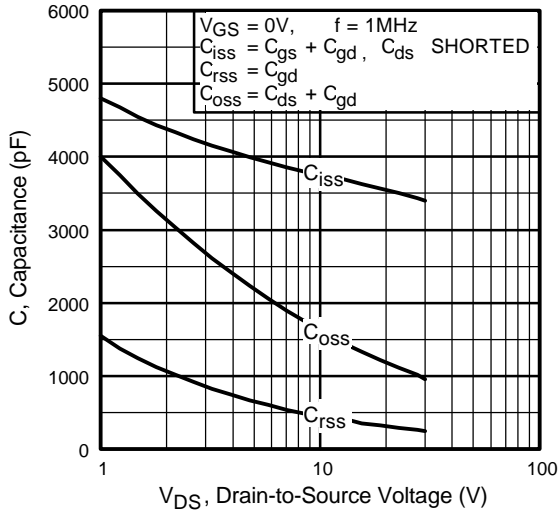


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

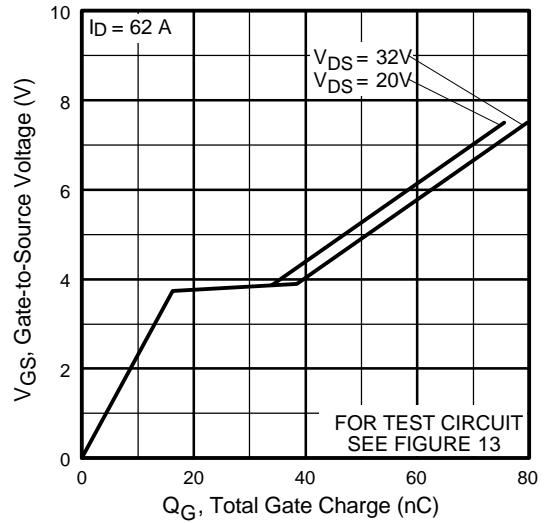


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

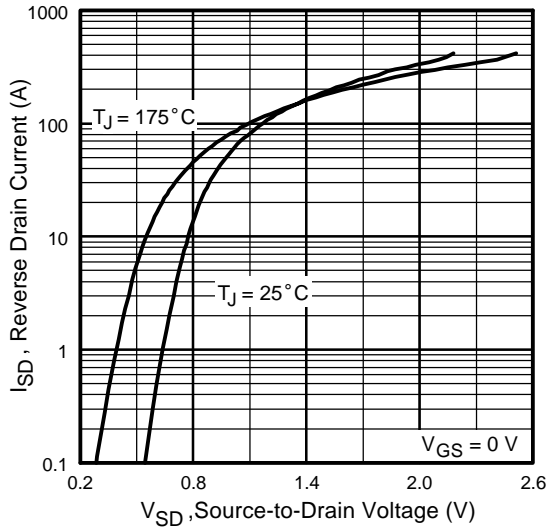


Fig 7. Typical Source-Drain Diode Forward Voltage

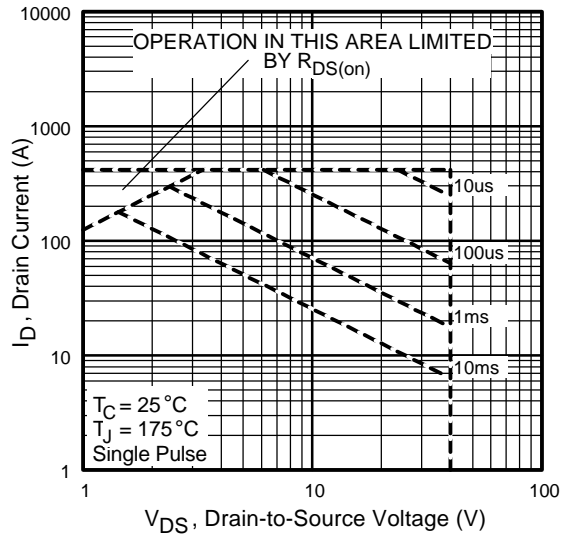


Fig 8. Maximum Safe Operating Area

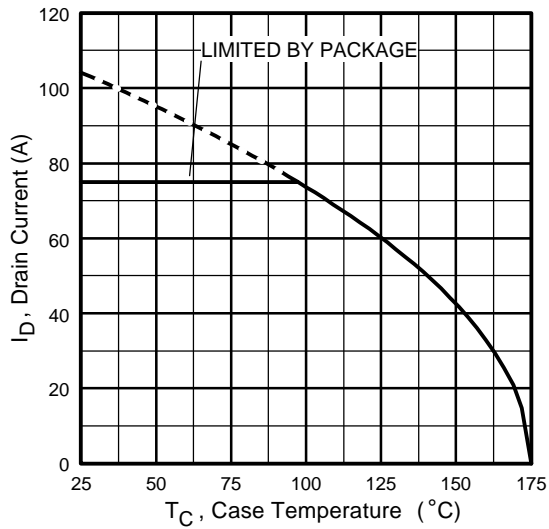


Fig 9. Maximum Drain Current Vs. Case Temperature

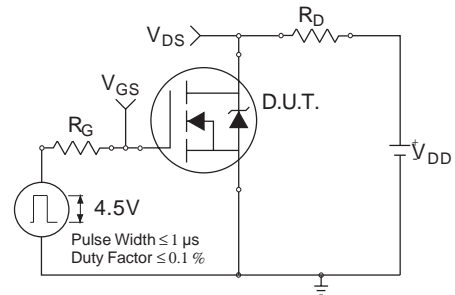


Fig 10a. Switching Time Test Circuit

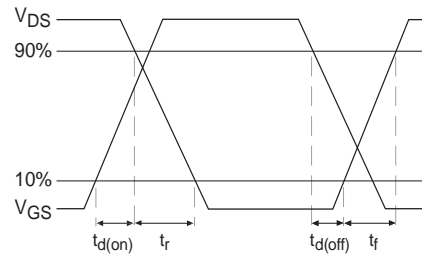


Fig 10b. Switching Time Waveforms

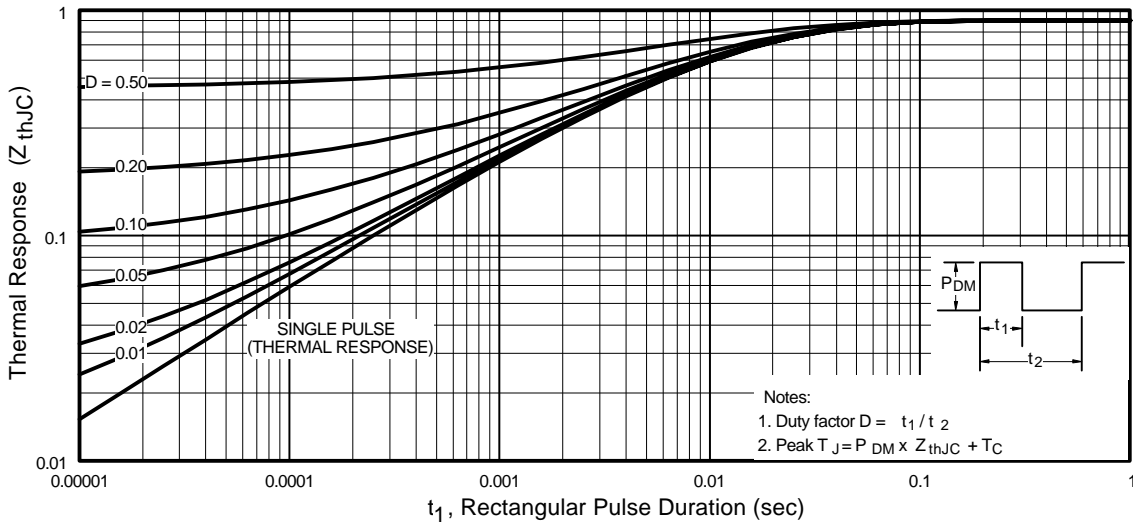


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

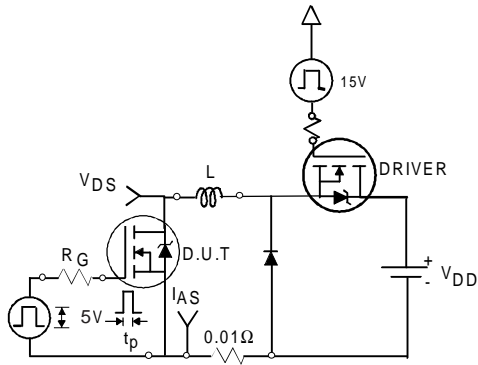


Fig 12a. Unclamped Inductive Test Circuit

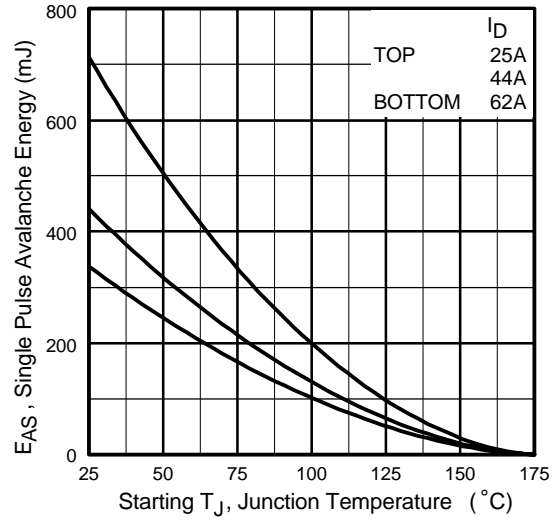


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

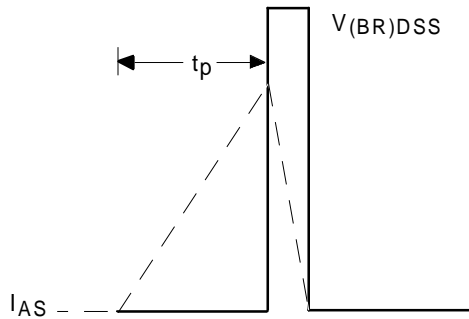


Fig 12b. Unclamped Inductive Waveforms

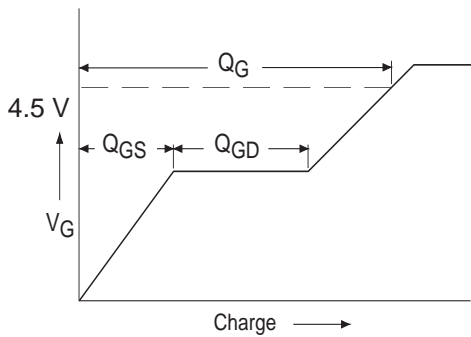


Fig 13a. Basic Gate Charge Waveform

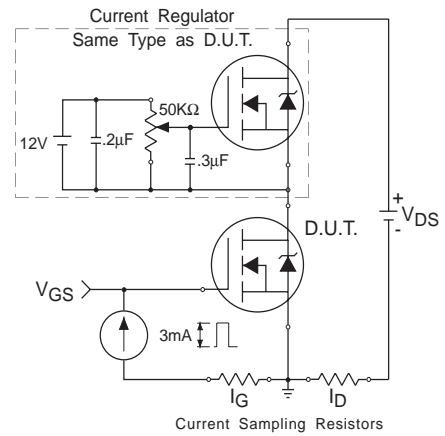
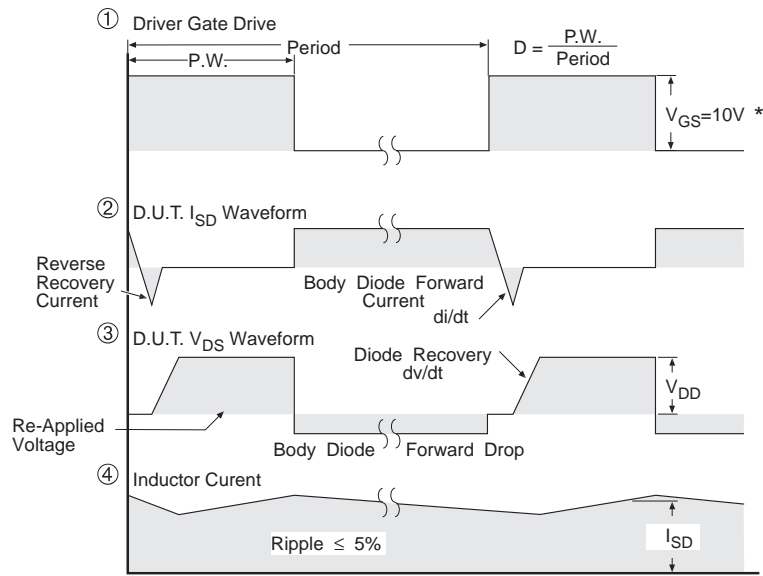
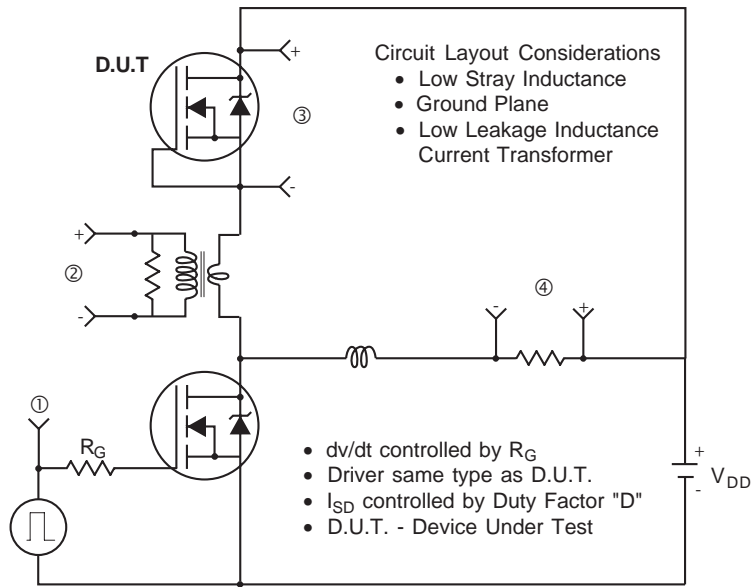


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

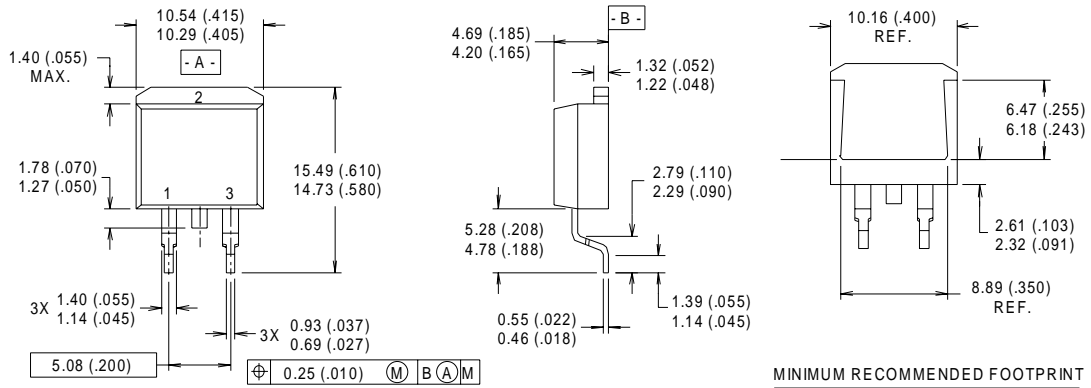


* $V_{GS} = 5V$ for Logic Level Devices

Fig 14. For N-Channel HEXFETS

IRL1104S/L

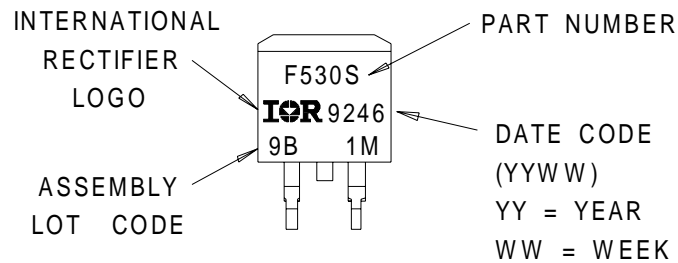
D²Pak Package Details



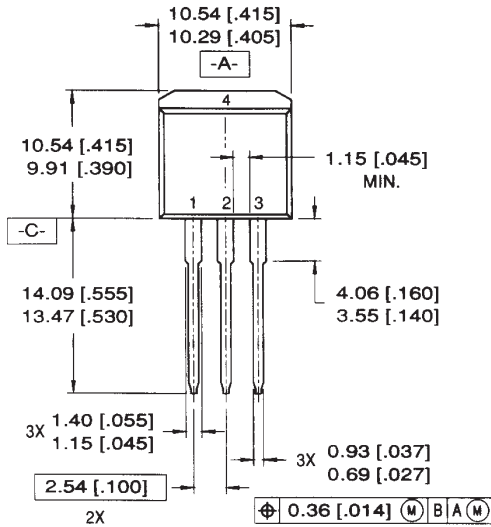
- NOTES:
- 1 DIMENSIONS AFTER SOLDER DIP.
 - 2 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
 - 3 CONTROLLING DIMENSION : INCH.
 - 4 HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

- LEAD ASSIGNMENTS
- 1 - GATE
 - 2 - DRAIN
 - 3 - SOURCE

Part Marking

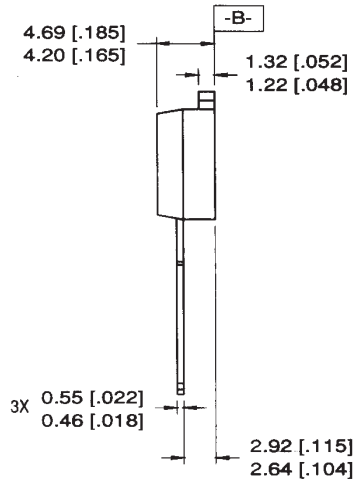


TO-262 Package Details



LEAD ASSIGNMENTS

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

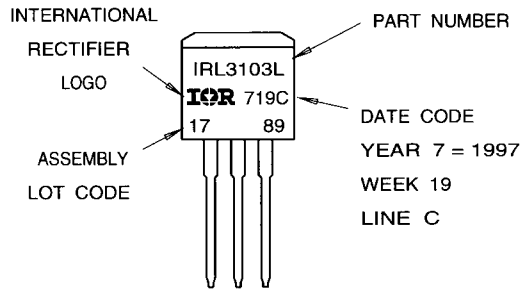


NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

Part Marking

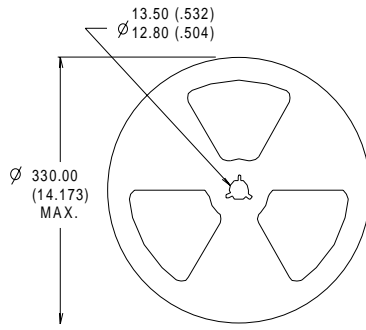
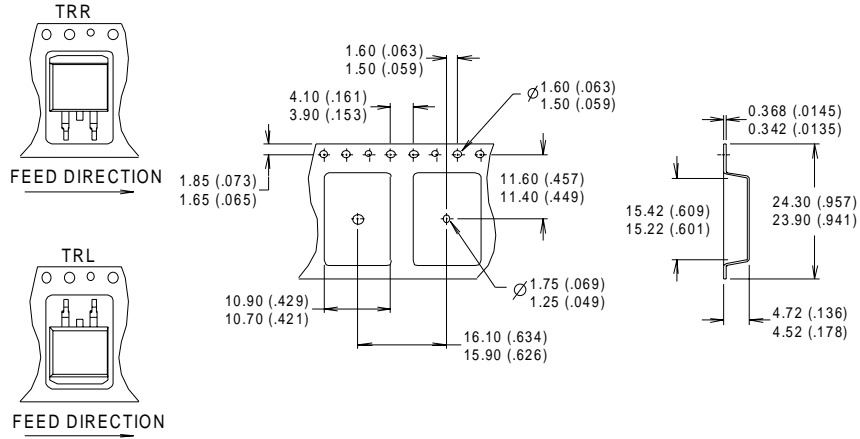
EXAMPLE: THIS IS AN IRL3103L
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"



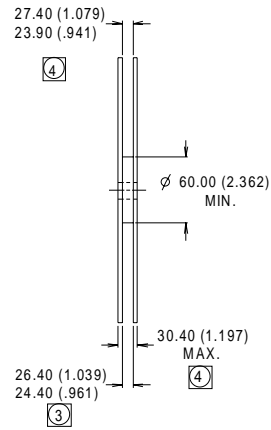
IRL1104S/L

International
IR Rectifier

D²Pak Tape and Reel



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



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