

IRL540NS/L

HEXFET® Power MOSFET

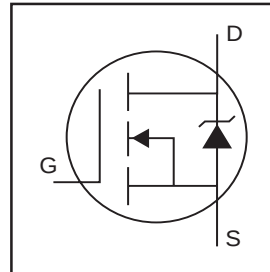
- Advanced Process Technology
- Surface Mount (IRL540NS)
- Low-profile through-hole (IRL540NL)
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated

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.

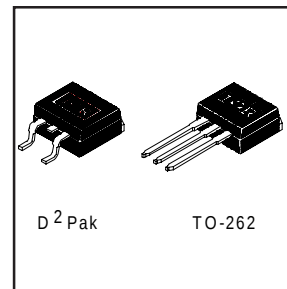
The through-hole version (IRF540NL) is available for low-profile applications.



$$V_{DS} = 100V$$

$$R_{DS(on)} = 0.044\Omega$$

$$I_D = 36A$$



Absolute Maximum Ratings

	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V⑤	36	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V⑤	26	
I _{DM}	Pulsed Drain Current ①⑤	120	
P _D @T _A = 25°C	Power Dissipation	3.8	W
P _D @T _C = 25°C	Power Dissipation	140	W
	Linear Derating Factor	0.91	W/°C
V _{GS}	Gate-to-Source Voltage	± 16	V
E _{AS}	Single Pulse Avalanche Energy②⑤	310	mJ
I _{AR}	Avalanche Current①	18	A
E _{AR}	Repetitive Avalanche Energy①	14	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)	

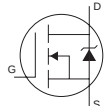
Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.1	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted, steady-state)**	—	40	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
V _{(BR)DSS}	Drain-to-Source Breakdown Voltage	100	—	—	V	V _{GS} = 0V, I _D = 250μA
ΔV _{(BR)DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	0.11	—	V/°C	Reference to 25°C, I _D = 1mA⑤
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	—	0.044	Ω	V _{GS} = 10V, I _D = 18A ④
		—	—	0.053		V _{GS} = 5.0V, I _D = 18A ④
		—	—	0.063		V _{GS} = 4.0V, I _D = 15A ④
V _{GS(th)}	Gate Threshold Voltage	1.0	—	2.0	V	V _{DS} = V _{GS} , I _D = 250μA
g _{fs}	Forward Transconductance	14	—	—	S	V _{DS} = 25V, I _D = 18A⑤
I _{DSS}	Drain-to-Source Leakage Current	—	—	25	A	V _{DS} = 100V, V _{GS} = 0V
		—	—	250		V _{DS} = 80V, 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	—	—	74	nC	I _D = 18A
Q _{gs}	Gate-to-Source Charge	—	—	9.4		V _{DS} = 80V
Q _{gd}	Gate-to-Drain ("Miller") Charge	—	—	38		V _{GS} = 5.0V, See Fig. 6 and 13 ④⑤
t _{d(on)}	Turn-On Delay Time	—	11	—	ns	V _{DD} = 50V
t _r	Rise Time	—	81	—		I _D = 18A
t _{d(off)}	Turn-Off Delay Time	—	39	—		R _G = 5.0Ω, V _{GS} = 5.0V
t _f	Fall Time	—	62	—		R _D = 2.7Ω, See Fig. 10 ④⑤
L _S	Internal Source Inductance	—	7.5	—	nH	Between lead, and center of die contact
C _{iss}	Input Capacitance	—	1800	—	pF	V _{GS} = 0V
C _{oss}	Output Capacitance	—	350	—		V _{DS} = 25V
C _{rss}	Reverse Transfer Capacitance	—	170	—		f = 1.0MHz, See Fig. 5⑤

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	36	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I _{SM}	Pulsed Source Current (Body Diode) ①⑤	—	—	120		
V _{SD}	Diode Forward Voltage	—	—	1.3	V	T _J = 25°C, I _S = 18A, V _{GS} = 0V ④⑤
t _{rr}	Reverse Recovery Time	—	190	290	ns	T _J = 25°C, I _F = 18A
Q _{rr}	Reverse Recovery Charge	—	1.1	1.7	μC	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)

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

② Starting T_J = 25°C, L = 1.9mH
R_G = 25Ω, I_{AS} = 18A. (See Figure 12)

⑤ Uses IRL540N data and test conditions

③ I_{SD} ≤ 18A, di/dt ≤ 180A/μs, V_{DD} ≤ V_{(BR)DSS},
T_J ≤ 175°C

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

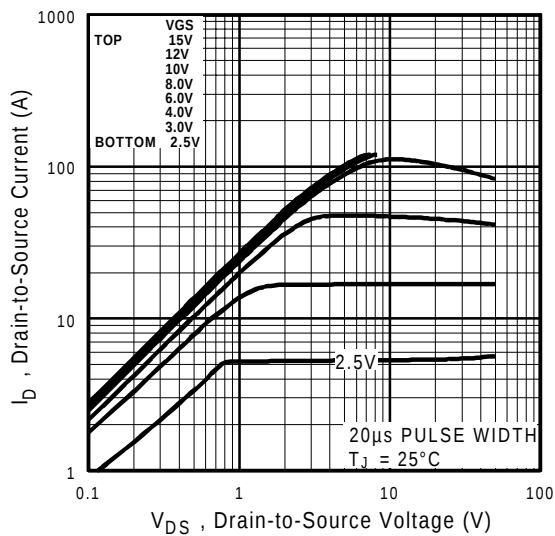


Fig 1. Typical Output Characteristics

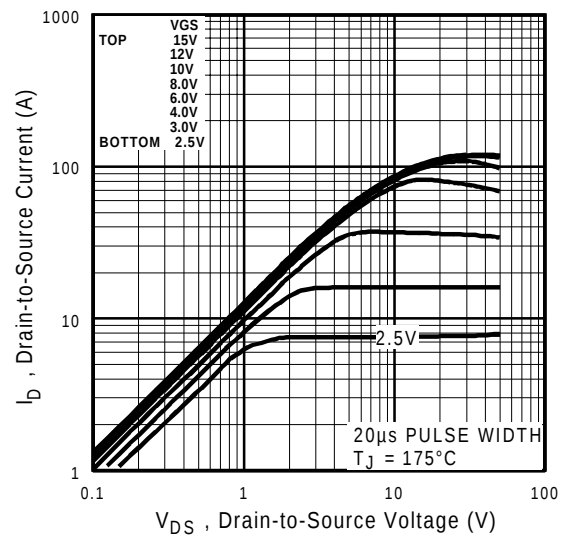


Fig 2. Typical Output Characteristics

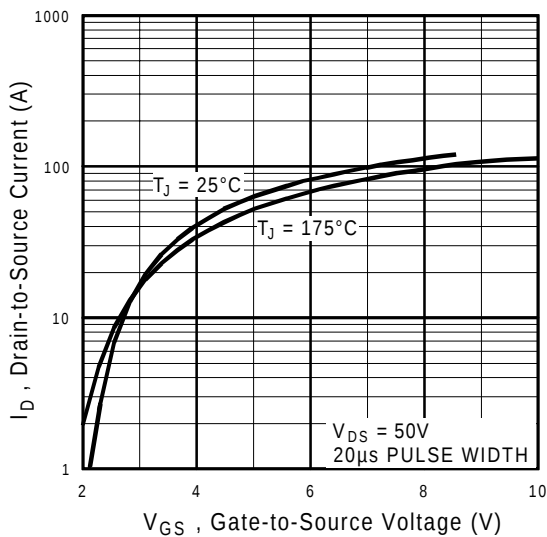


Fig 3. Typical Transfer Characteristics

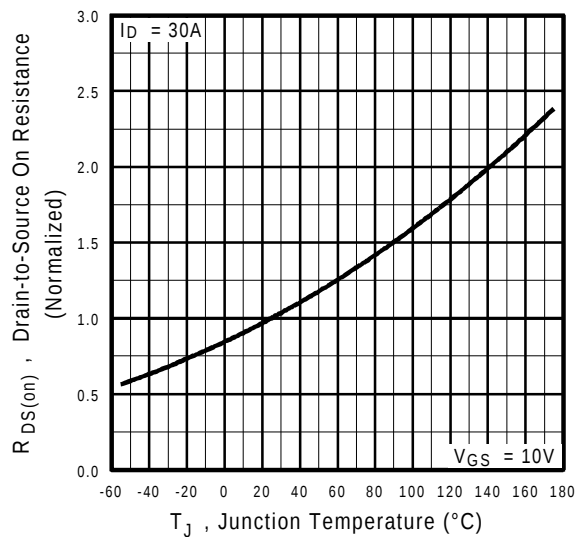


Fig 4. Normalized On-Resistance Vs. Temperature

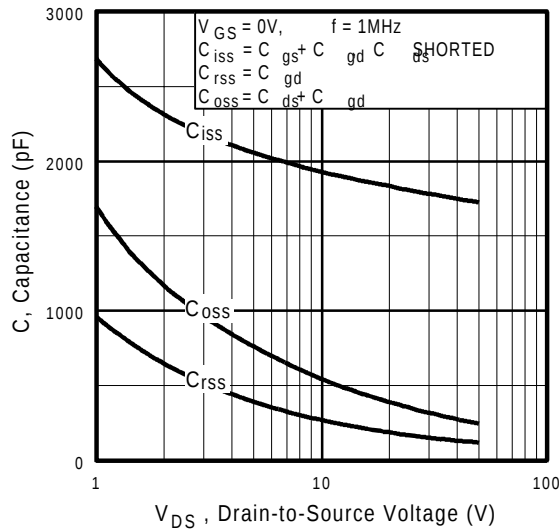


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

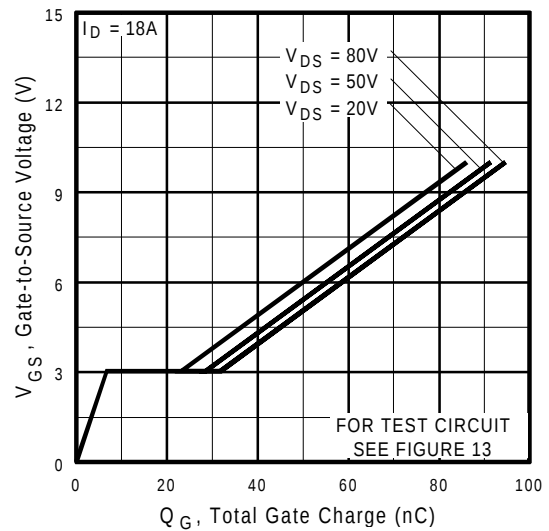


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

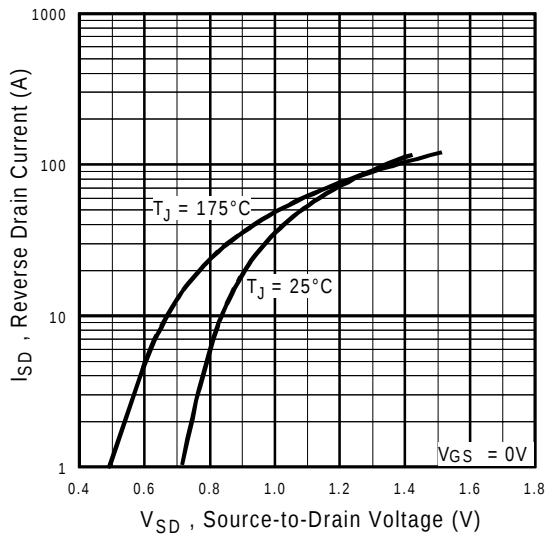


Fig 7. Typical Source-Drain Diode Forward Voltage

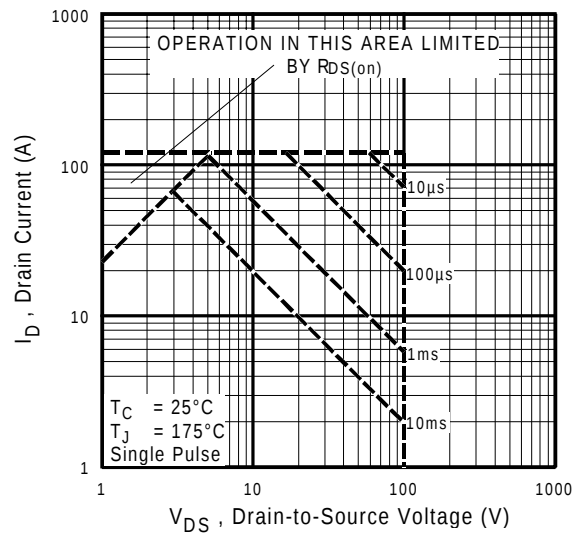


Fig 8. Maximum Safe Operating Area

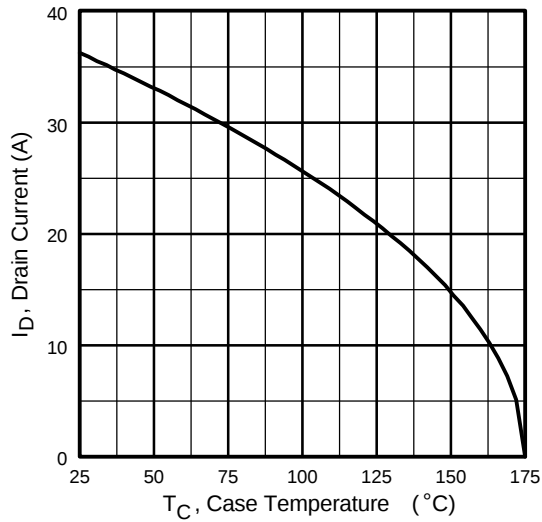


Fig 9. Maximum Drain Current Vs. Case Temperature

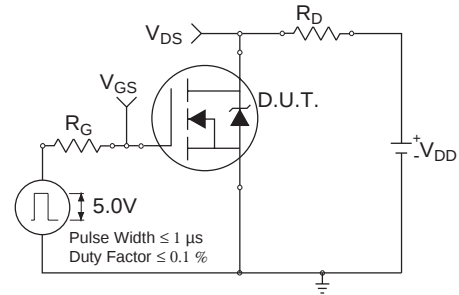


Fig 10a. Switching Time Test Circuit

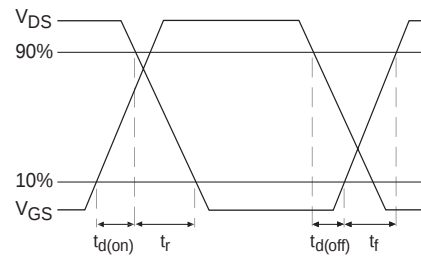


Fig 10b. Switching Time Waveforms

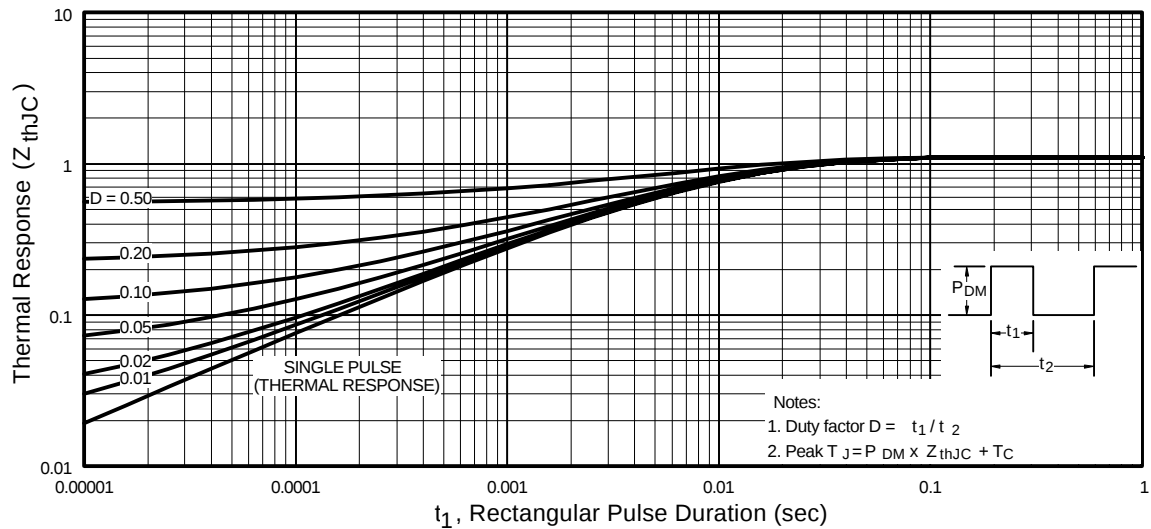


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

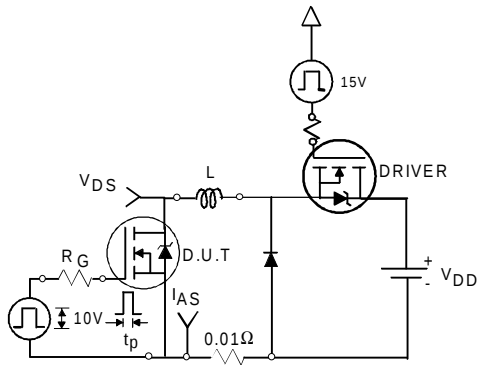


Fig 12a. Unclamped Inductive Test Circuit

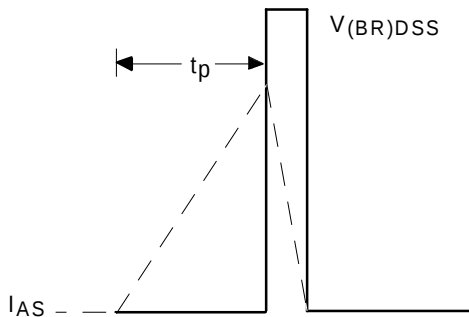


Fig 12b. Unclamped Inductive Waveforms

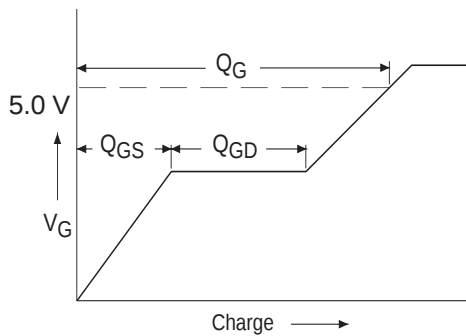


Fig 13a. Basic Gate Charge Waveform

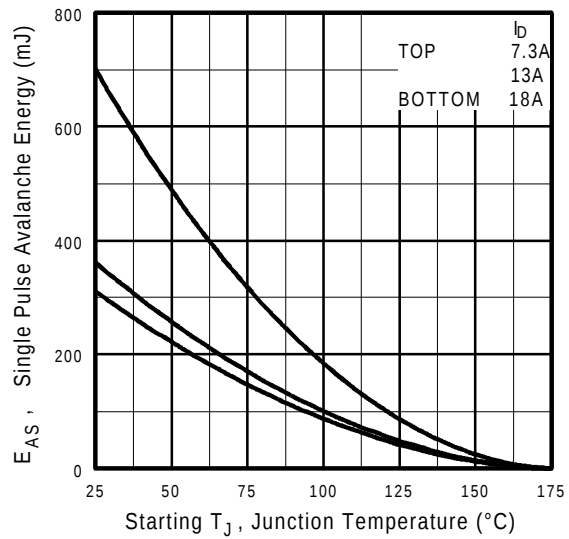


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

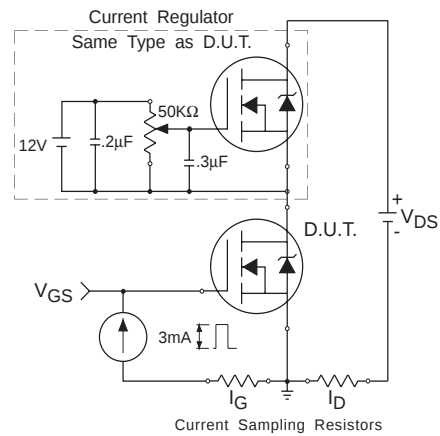


Fig 13b. Gate Charge Test Circuit

Circuit Diagram:

- 1:** Pulse generator connected to the gate of the driver MOSFET through a resistor R_G .
- 2:** Gate of the driver MOSFET.
- 3:** Drain of the driver MOSFET, which is connected to the gate of the D.U.T. MOSFET.
- 4:** Drain of the D.U.T. MOSFET, connected to a load inductor and a current transformer.
- The D.U.T. MOSFET's source is connected to ground.
- The load inductor is connected to a DC supply V_{DD} .

Circuit Layout Considerations:

- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance
- Current Transformer

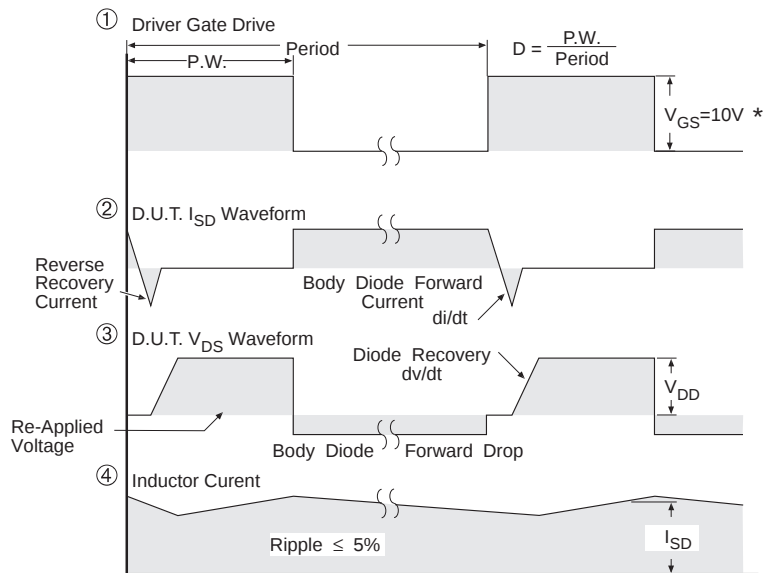
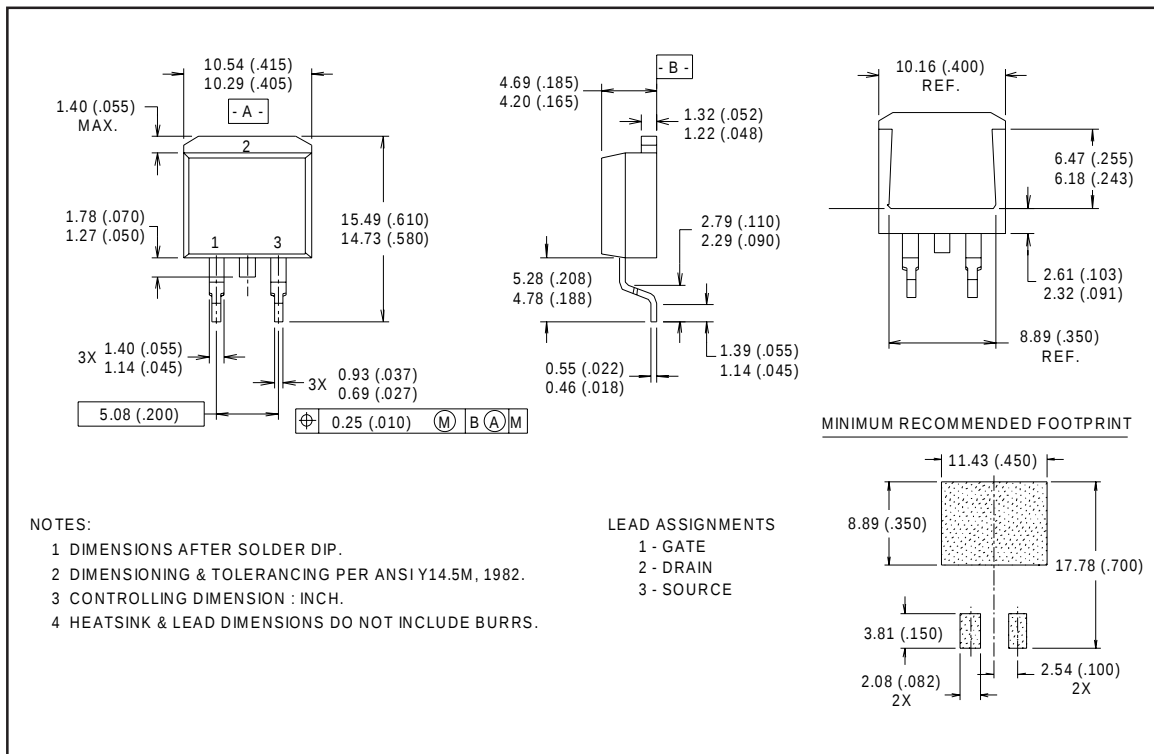


Fig 14. For N-Channel HEXFETS

IRL540NS/L

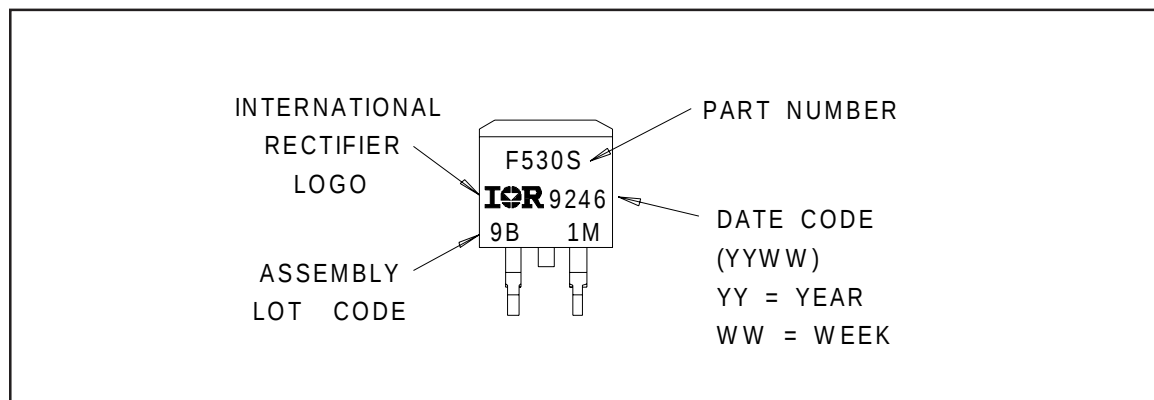
International
IOR Rectifier

D²Pak Package Outline



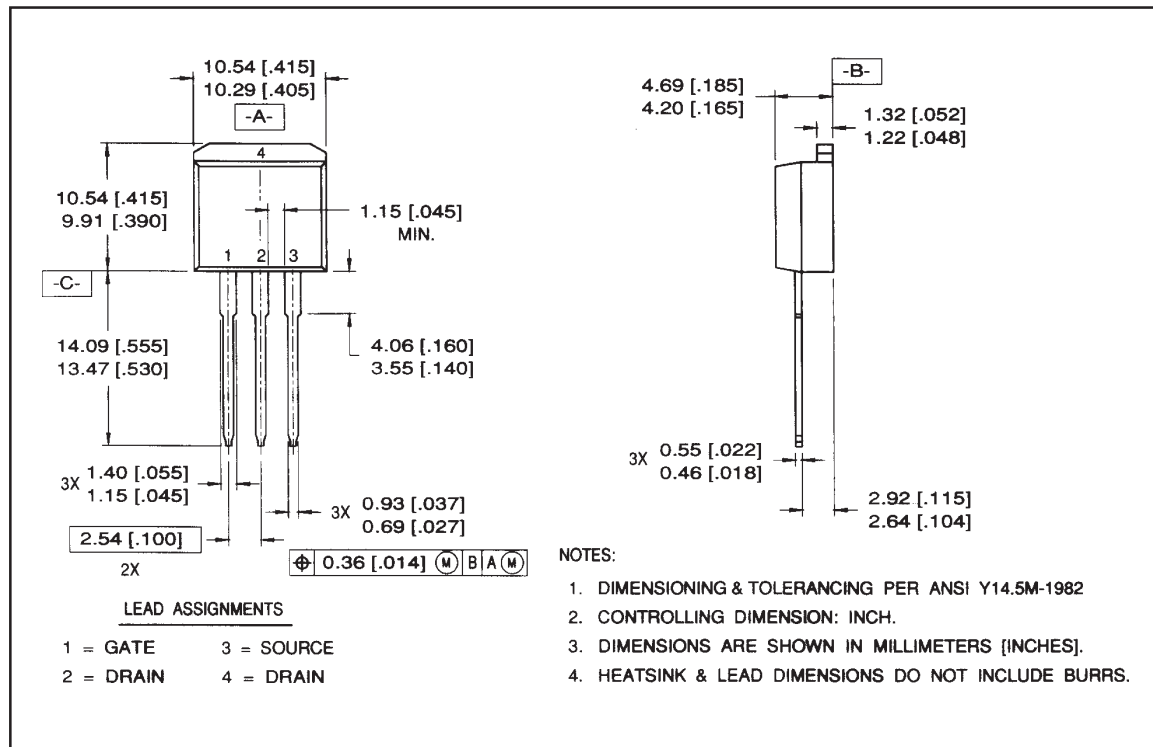
Part Marking Information

D²Pak



Package Outline

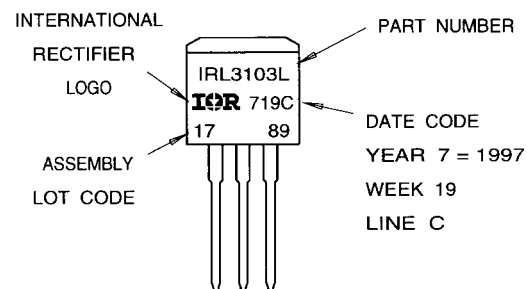
TO-262 Outline



Part Marking Information

TO-262

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

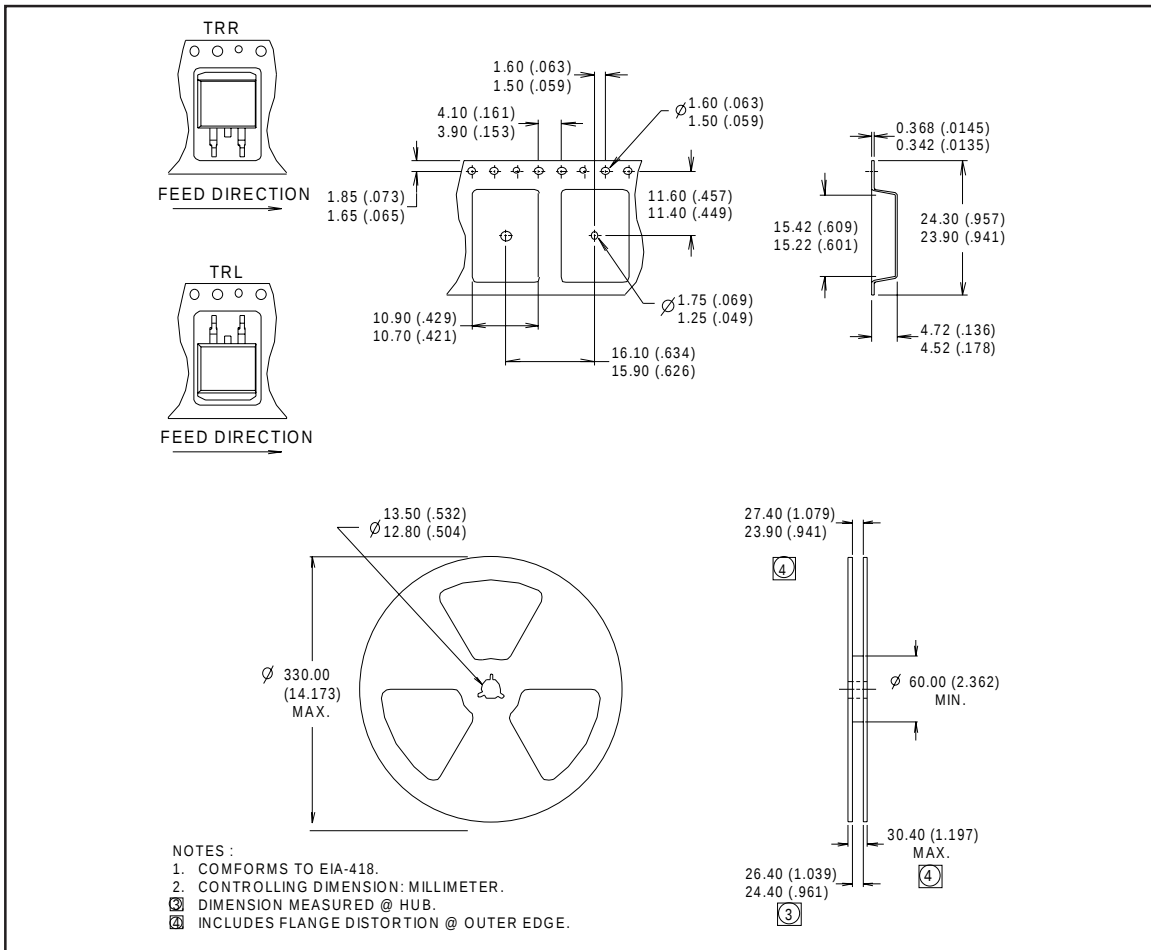


IRL540NS/L

International
IR Rectifier

Tape & Reel Information

D²Pak



International
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IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590

IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111

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Data and specifications subject to change without notice.

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