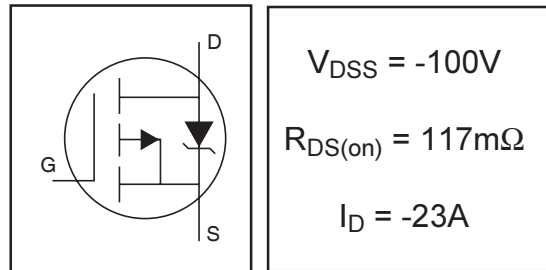


**IRF9540NSPbF**  
**IRF9540NLPbF**

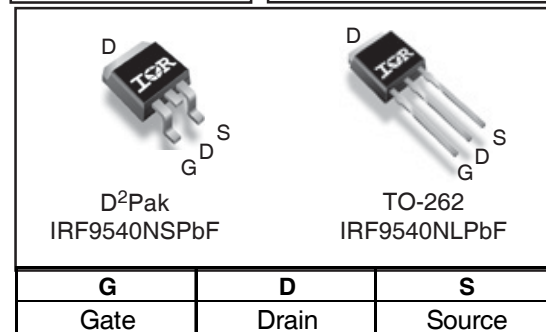
HEXFET® Power MOSFET

- Advanced Process Technology
- Ultra Low On-Resistance
- 150°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Some Parameters are Different from IRF9540NS/L
- P-Channel
- Lead-Free



**Description**

Features of this design are a 150°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in a wide variety of other applications.



**Absolute Maximum Ratings**

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{V}$	-23	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{V}$	-14	
$I_{DM}$	Pulsed Drain Current ①	-92	
$P_D @ T_A = 25^\circ\text{C}$	Maximum Power Dissipation	3.1	W
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	110	
	Linear Derating Factor	0.9	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy ②	84	mJ
$I_{AR}$	Avalanche Current ①	-14	A
$E_{AR}$	Repetitive Avalanche Energy ①	11	mJ
dv/dt	Peak Diode Recovery dv/dt ③	-13	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)	

**Thermal Resistance**

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.1	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state) ⑤	—	40	

# IRF9540NS/LPbF

International  
IR Rectifier

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	-100	—	—	V	$V_{GS} = 0V, I_D = -250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	-0.11	—	V/°C	Reference to $25^\circ\text{C}$ , $I_D = -1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	117	mΩ	$V_{GS} = -10V, I_D = -14A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	-2.0	—	-4.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
$g_{fs}$	Forward Transconductance	5.6	—	—	S	$V_{DS} = -50V, I_D = -14A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	-50	μA	$V_{DS} = -100V, V_{GS} = 0V$
		—	—	-250		$V_{DS} = -80V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = -20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = 20V$
$Q_g$	Total Gate Charge	—	73	110	nC	$I_D = -14A$
$Q_{gs}$	Gate-to-Source Charge	—	13	20		$V_{DS} = -80V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	38	57		$V_{GS} = -10V$ ④
$t_{d(on)}$	Turn-On Delay Time	—	13	—	ns	$V_{DD} = -50V$
$t_r$	Rise Time	—	64	—		$I_D = -14A$
$t_{d(off)}$	Turn-Off Delay Time	—	40	—		$R_G = 5.1\Omega$
$t_f$	Fall Time	—	45	—		$V_{GS} = -10V$ ④
$L_D$	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
$L_S$	Internal Source Inductance	—	7.5	—		
$C_{iss}$	Input Capacitance	—	1450	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	430	—		$V_{DS} = -25V$
$C_{rss}$	Reverse Transfer Capacitance	—	230	—		$f = 1.0MHz$ , See Fig. 5

## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	-23	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	-92		
$V_{SD}$	Diode Forward Voltage	—	—	-1.6	V	$T_J = 25^\circ\text{C}, I_S = -14A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	140	210	ns	$T_J = 25^\circ\text{C}, I_F = -14A, V_{DD} = -25V$
$Q_{rr}$	Reverse Recovery Charge	—	890	1340	nC	$di/dt = -100A/\mu s$ 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. ( See Fig. 11)
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.88mH$   
 $R_G = 25\Omega, I_{AS} = -14A$ . (See Figure 12)
- ③  $I_{SD} \leq -14A, di/dt \leq -620A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 150^\circ\text{C}$ .

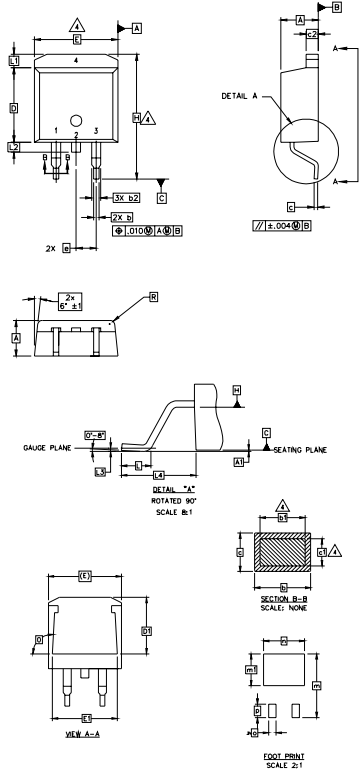
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤ When mounted on 1" square PCB (FR-4or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

# IRF9540NS/LPbF

## D<sup>2</sup>Pak Package Outline

Dimensions are shown in millimeters (inches)

International  
**IR** Rectifier



**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.

SYMBOLO	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.78	.045	.070	4
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	3
c2	1.14	1.65	.045	.065	
D	8.51	9.65	.335	.380	3
D1	6.86	9.65	.270		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		IGBTs, CoPACK
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	1.- GATE 2, 4.- CATHODE 3.- EMITTER
L1		1.65		.065	
L2	1.27	1.78	.050	.070	
L3	0.25 BSC		.010 BSC		DIODES
L4	4.78	5.28	.188	.208	
m	17.78		.700		1.- ANODE * 2, 4.- CATHODE 3.- ANODE
m1	8.89		.350		
n	11.43		.450		* PART DEPENDENT.
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**

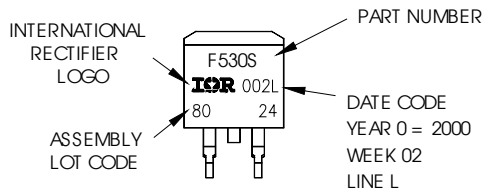
- 1.- ANODE \*
- 2, 4.- CATHODE
- 3.- ANODE

\* PART DEPENDENT.

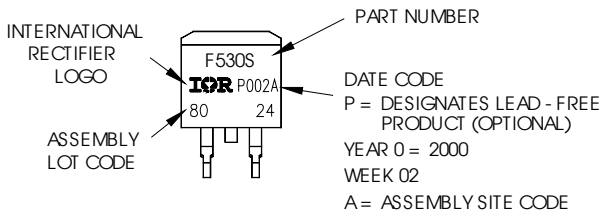
## D<sup>2</sup>Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH  
LOT CODE 8024  
ASSEMBLED ON VV02, 2000  
IN THE ASSEMBLY LINE "L"

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



OR

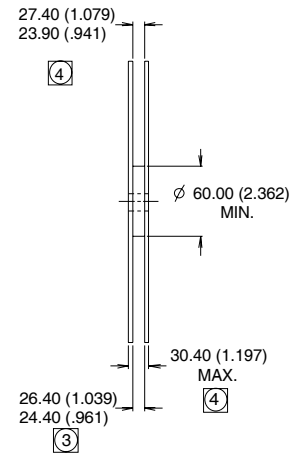
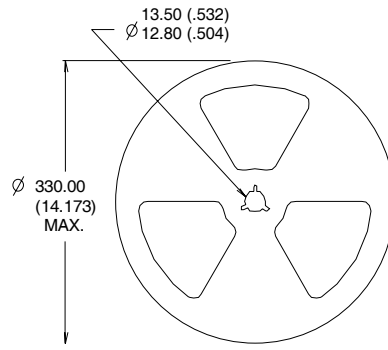
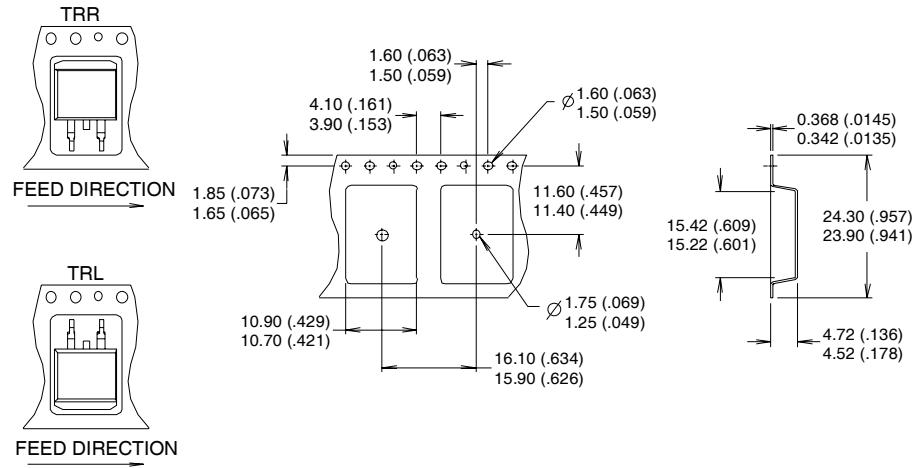


# IRF9540NS/LPbF

## D<sup>2</sup>Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)

International  
**IOR** Rectifier



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

Data and specifications subject to change without notice.  
This product has been designed and qualified for the Industrial market.

International  
**IOR** Rectifier