

IRLR120NPbF IRLU120NPbF

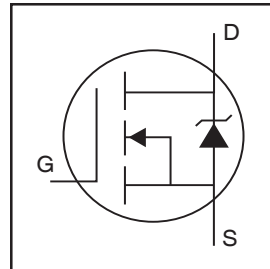
- Surface Mount (IRLR120N)
- Straight Lead (IRLU120N)
- Advanced Process Technology
- Fast Switching
- Fully Avalanche Rated
- Lead-Free

Description

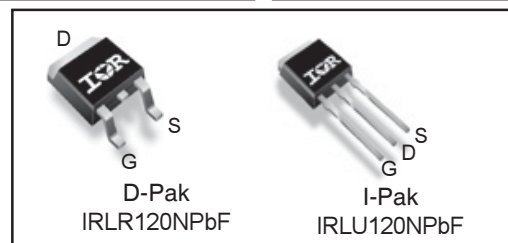
Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve the lowest possible on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer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

The D-PAK is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFU series) is for through-hole mounting applications. Power dissipation levels up to 1.5 watts are possible in typical surface mount applications.

HEXFET® Power MOSFET



$V_{DSS} = 100V$
$R_{DS(on)} = 0.185\Omega$
$I_D = 10A$



Base Part Number	Package Type	Standard Pack		Orderable Part Number	Note
		Form	Quantity		
IRLR120NPbF	D-Pak	Tube	75	IRLR120NPbF	
		Tape and Reel	2000	IRLR120NTRPbF	
		Tape and Reel Left	3000	IRLR120NTRLpbF	
		Tape and Reel Right	3000	IRLR120NTRRPbF	EOL notice # 289
IRLU120NPbF	IPak	Tube	75	IRLU120NPbF	

Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	10	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	7.0	
I_{DM}	Pulsed Drain Current ①⑥	35	
$P_D @ T_C = 25^\circ C$	Power Dissipation	48	W
	Linear Derating Factor	0.32	W/°C
V_{GS}	Gate-to-Source Voltage	± 16	V
E_{AS}	Single Pulse Avalanche Energy②⑥	85	mJ
I_{AR}	Avalanche Current①⑥	6.0	A
E_{AR}	Repetitive Avalanche Energy①⑥	4.8	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	3.1	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB mount) **	—	50	
$R_{\theta JA}$	Junction-to-Ambient	—	110	

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	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.12	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.185	Ω	$V_{GS} = 10V, I_D = 6.0A$ ④
		—	—	0.225		$V_{GS} = 5.0V, I_D = 6.0A$ ④
		—	—	0.265		$V_{GS} = 4.0V, I_D = 5.0A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	2.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
g_{fs}	Forward Transconductance	3.1	—	—	S	$V_{DS} = 25V, I_D = 6.0A$ ⑥
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 100V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 80V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
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	—	—	20	nC	$I_D = 6.0A$
Q_{gs}	Gate-to-Source Charge	—	—	4.6		$V_{DS} = 80V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	10		$V_{GS} = 5.0V$, See Fig. 6 and 13 ④ ⑥
$t_{d(on)}$	Turn-On Delay Time	—	4.0	—	ns	$V_{DD} = 50V$
t_r	Rise Time	—	35	—		$I_D = 6.0A$
$t_{d(off)}$	Turn-Off Delay Time	—	23	—		$R_G = 11\Omega, V_{GS} = 5.0V$
t_f	Fall Time	—	22	—		$R_D = 8.2\Omega$, See Fig. 10 ④ ⑥
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact ③
L_S	Internal Source Inductance	—	7.5	—		
C_{ISS}	Input Capacitance	—	440	—	pF	$V_{GS} = 0V$
C_{OSS}	Output Capacitance	—	97	—		$V_{DS} = 25V$
C_{RSS}	Reverse Transfer Capacitance	—	50	—		$f = 1.0MHz$, See Fig. 5 ⑥

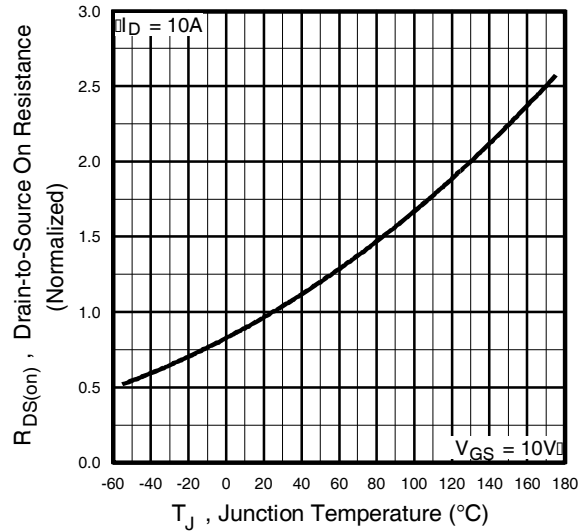
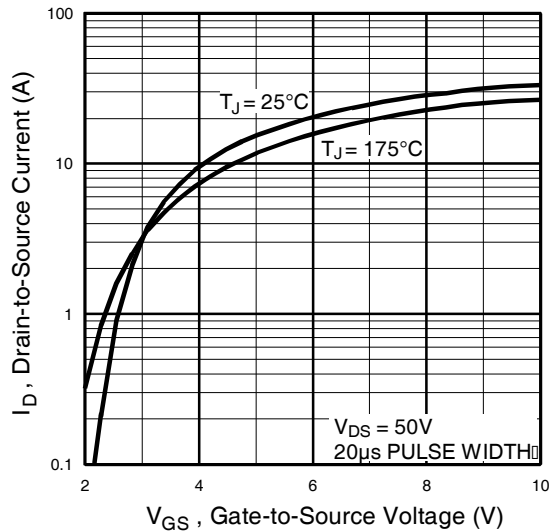
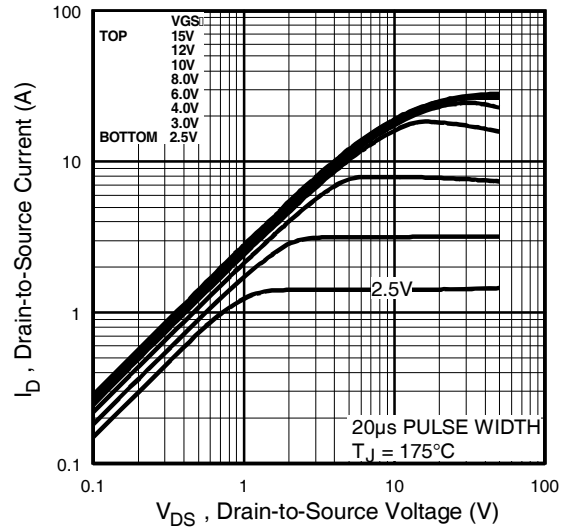
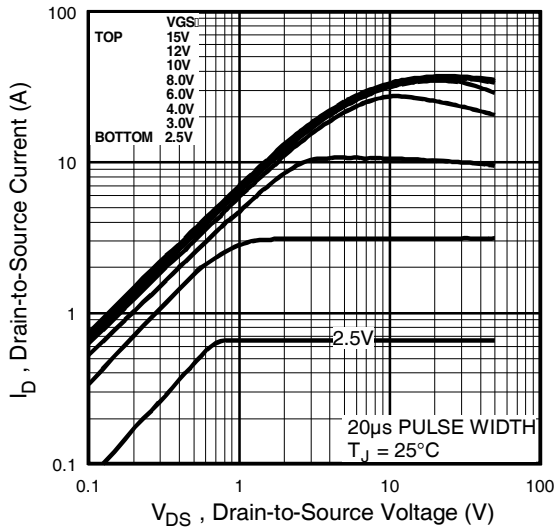
Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	10	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ① ⑥	—	—	35		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 6.0A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	110	160	ns	$T_J = 25^\circ\text{C}, I_F = 6.0A$
Q_{rr}	Reverse Recovery Charge	—	410	620	nC	$di/dt = 100A/\mu s$ ④ ⑥
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 $V_{DD} = 25V$, starting $T_J = 25^\circ\text{C}$, $L = 4.7mH$, $R_G = 25\Omega$, $I_{AS} = 6.0A$. (See Figure 12)
- ③ $I_{SD} \leq 6.0A$, $di/dt \leq 340A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175^\circ\text{C}$
- ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.
- ⑤ This is applied for I-PAK, L_S of D-PAK is measured between lead and center of die contact
- ⑥ Uses IRL520N 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



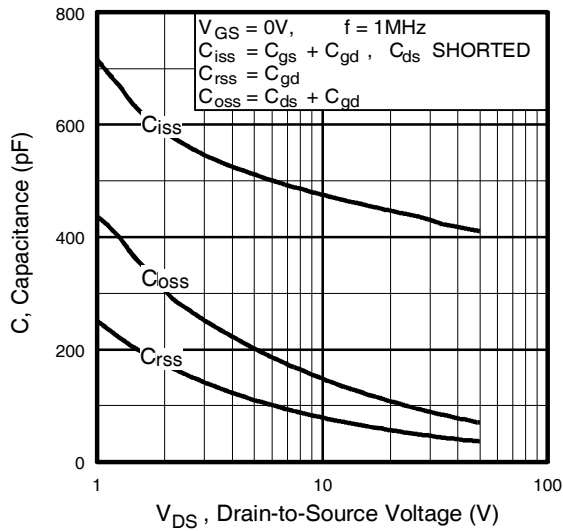


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

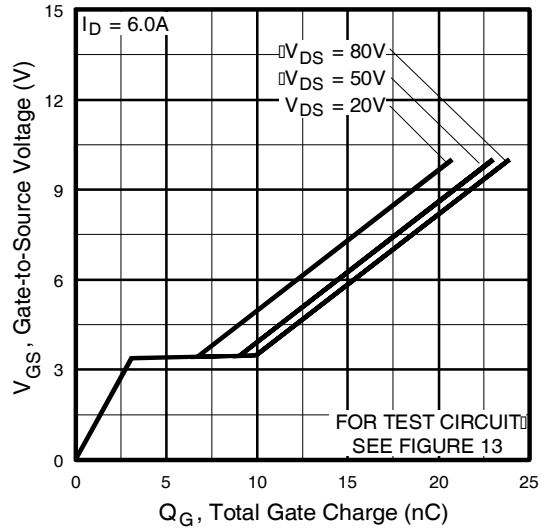


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

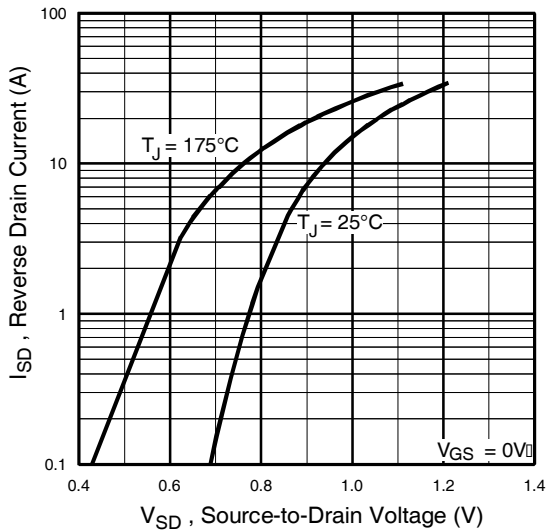


Fig 7. Typical Source-Drain Diode Forward Voltage

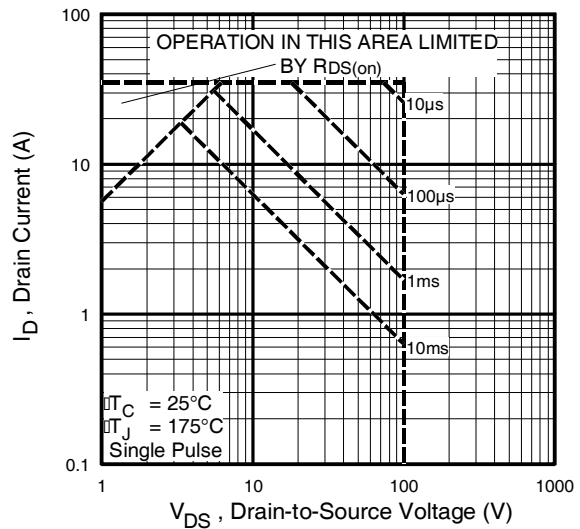


Fig 8. Maximum Safe Operating Area

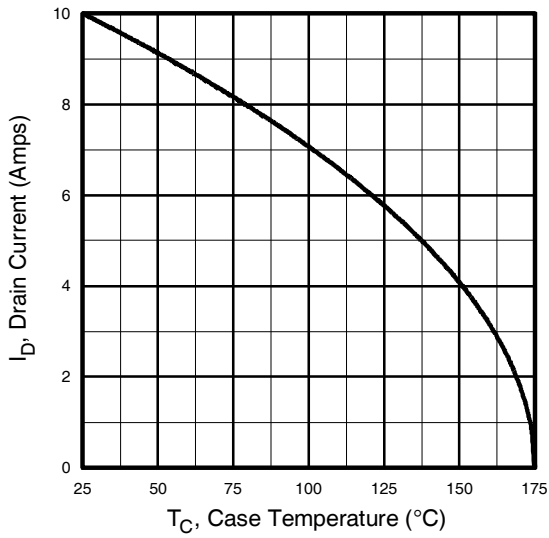


Fig 9. Maximum Drain Current Vs. Case Temperature

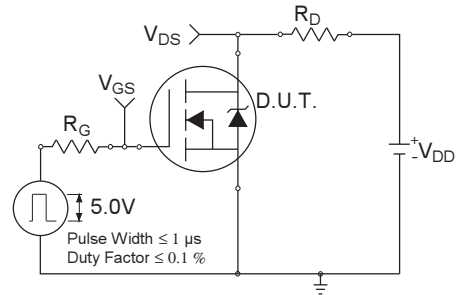


Fig 10a. Switching Time Test Circuit

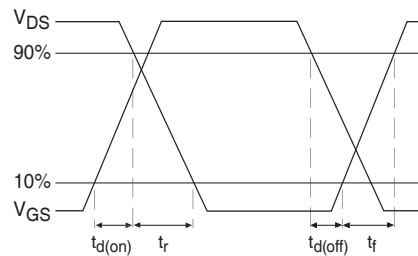


Fig 10b. Switching Time Waveforms

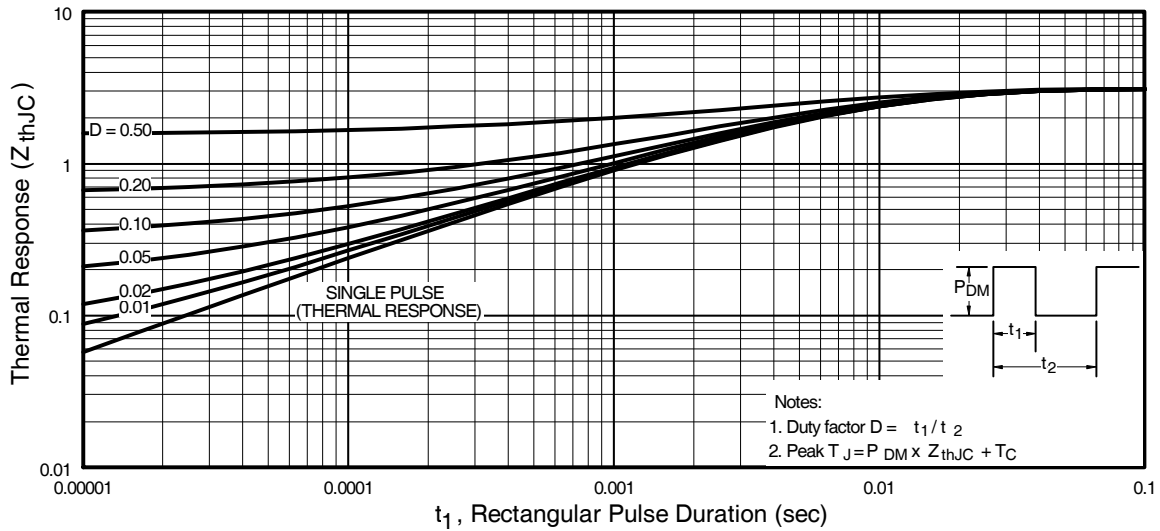


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

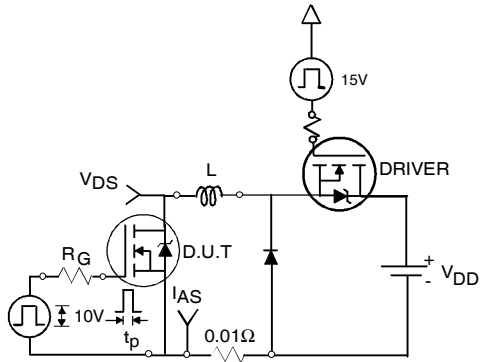


Fig 12a. Unclamped Inductive Test Circuit

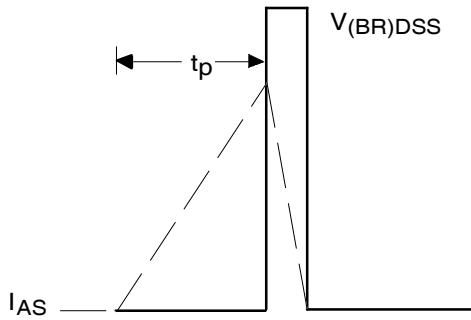


Fig 12b. Unclamped Inductive Waveforms

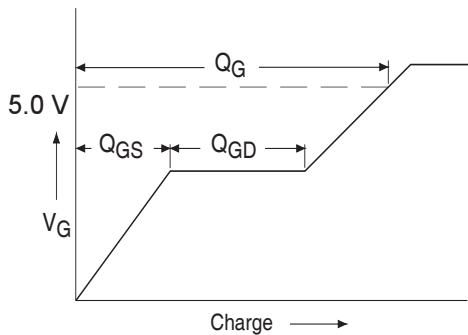


Fig 13a. Basic Gate Charge Waveform

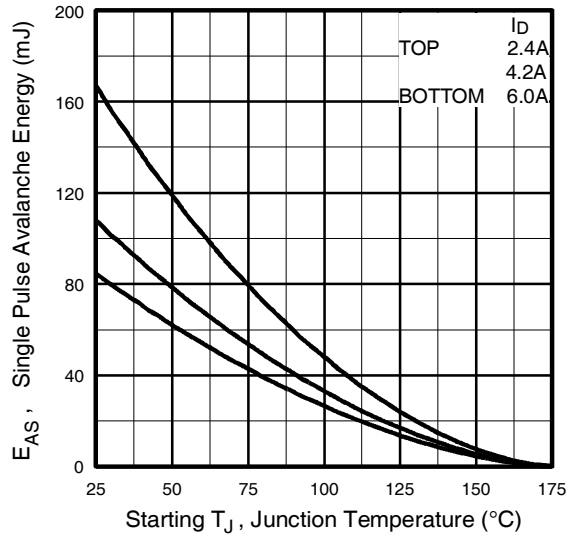


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

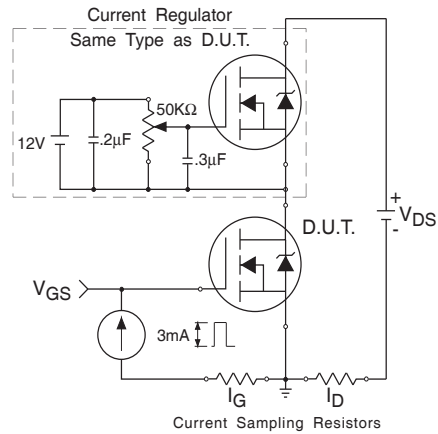
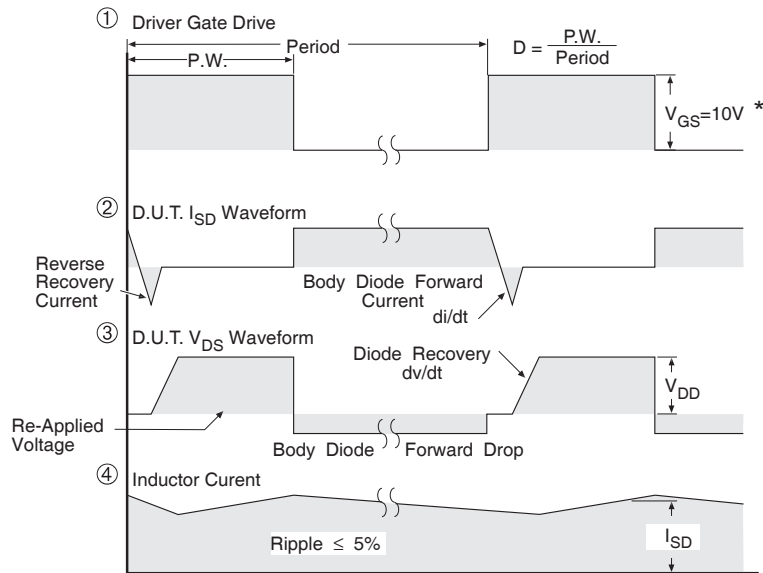
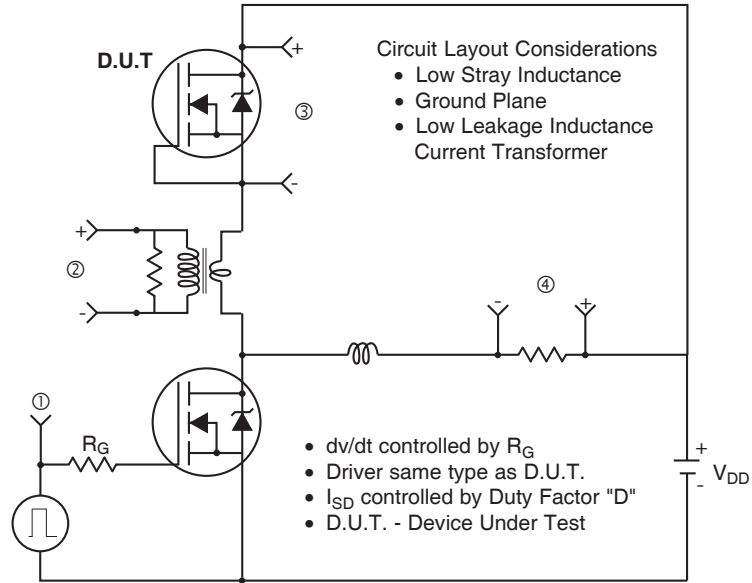


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

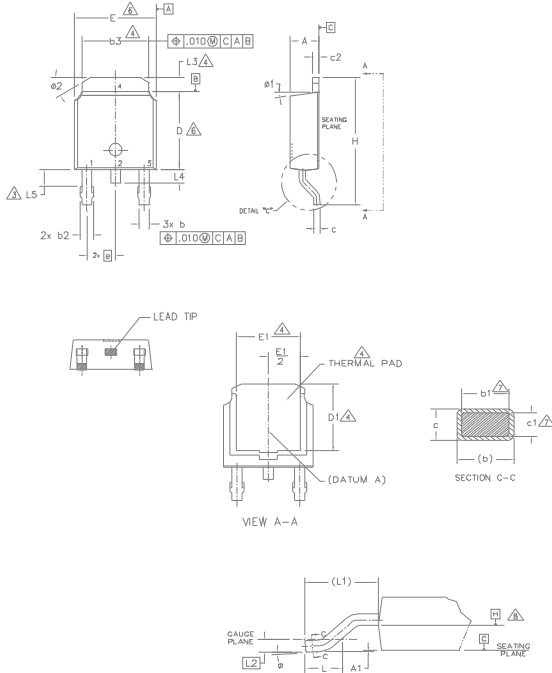


* $V_{GS} = 5V$ for Logic Level Devices

Fig 14. For N-Channel HEXFETS

D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



- NOTES
- 1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
 - 2.- DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS).
 - 3.- LEAD DIMENSION UNCONTROLLED IN L5.
 - 4.- DIMENSION D1, E1, L3 & b3 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
 - 5.- SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 AND 0.10 [0.13 AND 0.25] FROM THE LEAD TIP.
 - 6.- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .006 [0.15] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
 - 7.- DIMENSION b1 & c1 APPLIED TO BASE METAL ONLY.
 - 8.- DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
 - 9.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	.086	.094	
A1	-	0.13	-	.005	
b	0.64	0.89	.025	.035	
b1	0.64	0.79	.025	.031	7
b2	0.76	1.14	.030	.045	
b3	4.95	5.46	.195	.215	4
c	0.46	0.61	.018	.024	
c1	0.41	0.56	.016	.022	7
c2	0.46	0.89	.018	.035	
D	5.97	6.22	.235	.245	6
D1	5.21	-	.205	-	4
E	6.35	6.73	.250	.265	6
E1	4.32	-	.170	-	4
e	2.29 BSC	-	.090 BSC	-	
H	9.40	10.41	.370	.410	
L	1.40	1.78	.055	.070	
L1	2.74 BSC	-	.108 REF.	-	
L2	0.51 BSC	-	.020 BSC	-	
L3	0.89	1.27	.035	.050	4
L4	-	1.02	-	.040	
L5	1.14	1.52	.045	.060	3
phi	0"	10"	0"	10"	
phi 1	0"	15"	0"	15"	
phi 2	25"	35"	25"	35"	

LEAD ASSIGNMENTS

HEXFET

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

IGBT & CoPAK

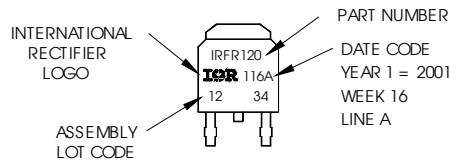
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

D-Pak (TO-252AA) Part Marking Information

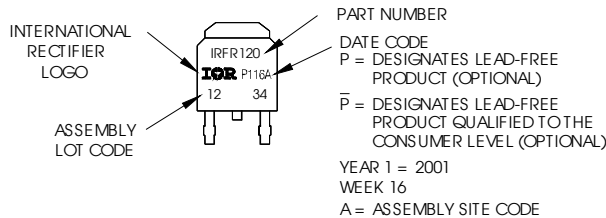
EXAMPLE: THIS IS AN IRFR120
WITH ASSEMBLY
LOT CODE 1234
ASSEMBLED ON WW 16, 2001
IN THE ASSEMBLY LINE "A"

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

"P̄" in assembly line position indicates
"Lead-Free" qualification to the consumer-level



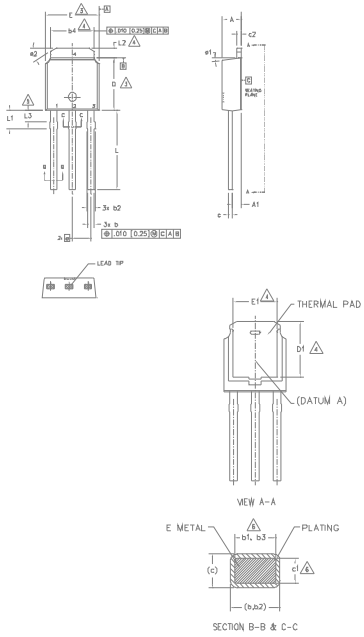
OR



PART NUMBER
DATE CODE
P = DESIGNATES LEAD-FREE PRODUCT (OPTIONAL)
P̄ = DESIGNATES LEAD-FREE PRODUCT QUALIFIED TO THE CONSUMER LEVEL (OPTIONAL)
YEAR 1 = 2001
WEEK 16
A = ASSEMBLY SITE CODE

I-Pak (TO-251AA) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- 2.- DIMENSION ARE SHOWN IN INCHES [MILLIMETERS]
- 3.- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
- 4.- THERMAL PAD CONTOUR OPTION WITHIN DIMENSION b4, L2, E1 & D1.
- 5.- LEAD DIMENSION UNCONTROLLED IN L3.
- 6.- DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
- 7.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-251AA (Date 06/02).
- 8.- CONTROLLING DIMENSION : INCHES.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	.086	.094	
A1	0.89	1.14	.035	.045	
b	0.64	0.89	.025	.035	
b1	0.65	0.79	.025	.031	6
b2	0.76	1.14	.030	.045	
b3	0.76	1.04	.030	.041	6
b4	4.95	5.46	.195	.215	4
c	0.46	0.61	.018	.024	
c1	0.41	0.56	.016	.022	6
c2	0.46	0.89	.018	.035	
D	5.97	6.22	.235	.245	3
D1	5.21	-	.205	-	4
E	6.35	6.73	.250	.265	3
E1	4.32	-	.170	-	4
e	2.29 BSC	-	.090 BSC	-	
L	8.89	9.65	.350	.380	
L1	1.91	2.29	.045	.090	
L2	0.89	1.27	.035	.050	4
L3	0.89	1.52	.035	.060	5
ø1	0"	15"	0"	15"	
ø2	25"	35"	25"	35"	

LEAD ASSIGNMENTS

HEXFET

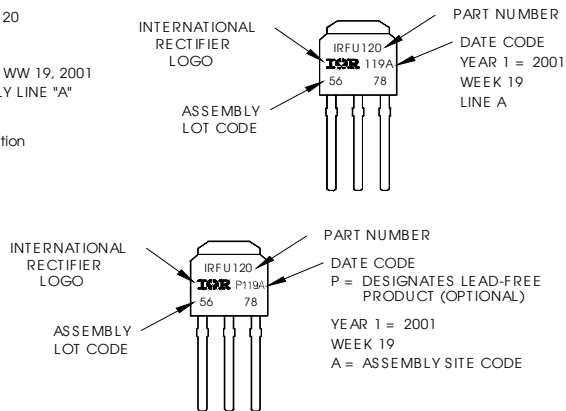
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

I-Pak (TO-251AA) Part Marking Information

EXAMPLE: THIS IS AN IRFU120 WITH ASSEMBLY LOT CODE 5678 ASSEMBLED ON WW 19, 2001 IN THE ASSEMBLY LINE "A"

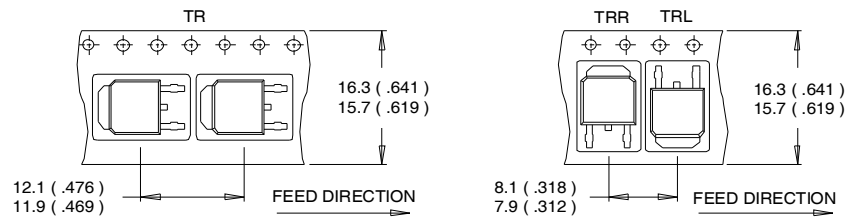
Note: "P" in assembly line position indicates Lead-Free"

OR



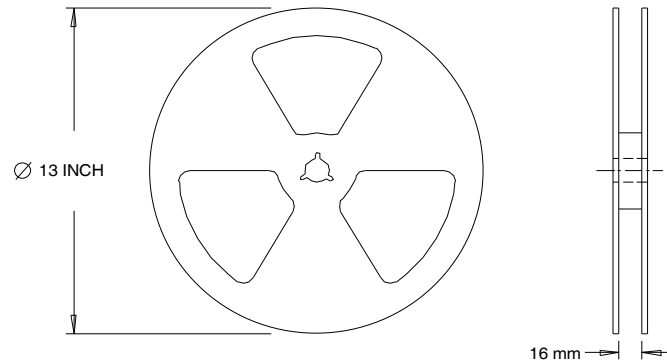
D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)



NOTES :

1. CONTROLLING DIMENSION : MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



NOTES :

1. OUTLINE CONFORMS TO EIA-481.