

IRFBA90N20DPbF

HEXFET® Power MOSFET

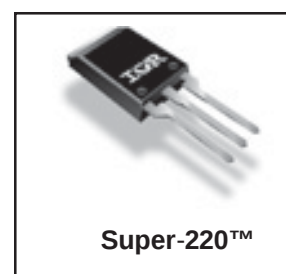
Applications

- High frequency DC-DC converters
- Lead-Free

V_{DSS}	$R_{DS(on) \text{ max}}$	I_D
200V	0.023 Ω	98A ^⑥

Benefits

- Low Gate-to-Drain Charge to Reduce Switching Losses
- Fully Characterized Capacitance Including Effective C_{OSS} to Simplify Design, (See App. Note AN1001)
- Fully Characterized Avalanche Voltage and Current



Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	98 ^⑥	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	71 ^⑥	
I_{DM}	Pulsed Drain Current ^①	390	
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	650	W
	Linear Derating Factor	4.3	W/ $^\circ\text{C}$
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ^③	6.3	V/ns
T_J	Operating Junction and	-55 to + 175	$^\circ\text{C}$
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Recommended Clip Force	20	N

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.23	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	58	

Notes ^① through ^⑥ are on page 8

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	200	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.22	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.023	Ω	$V_{GS} = 10V, I_D = 59A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 200V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 160V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -30V$

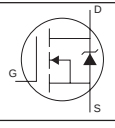
Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
g_{fs}	Forward Transconductance	41	—	—	S	$V_{DS} = 50V, I_D = 59A$
Q_g	Total Gate Charge	—	160	240	nC	$I_D = 59A$
Q_{gs}	Gate-to-Source Charge	—	45	67		$V_{DS} = 160V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	75	110		$V_{GS} = 10V$ ④
$t_{d(on)}$	Turn-On Delay Time	—	23	—	ns	$V_{DD} = 100V$
t_r	Rise Time	—	160	—		$I_D = 59A$
$t_{d(off)}$	Turn-Off Delay Time	—	39	—		$R_G = 1.2\Omega$
t_f	Fall Time	—	77	—		$V_{GS} = 10V$ ④
C_{iss}	Input Capacitance	—	6080	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	1040	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	150	—		$f = 1.0MHz$
C_{oss}	Output Capacitance	—	7500	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
C_{oss}	Output Capacitance	—	410	—		$V_{GS} = 0V, V_{DS} = 160V, f = 1.0MHz$
$C_{oss \text{ eff.}}$	Effective Output Capacitance	—	790	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 160V$ ⑤

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	—	960	mJ
I_{AR}	Avalanche Current①	—	59	A
E_{AR}	Repetitive Avalanche Energy①	—	65	mJ

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	98	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	390		
V_{SD}	Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}, I_S = 59A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	220	340	nS	$T_J = 25^\circ\text{C}, I_F = 59A$
Q_{rr}	Reverse Recovery Charge	—	1.9	2.8	μC	$di/dt = 100A/\mu s$ ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

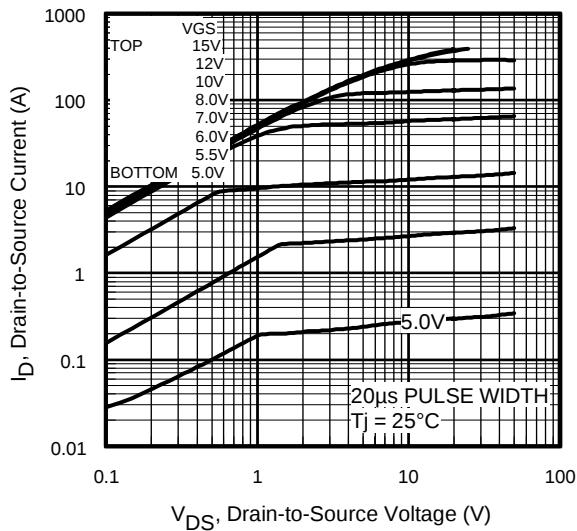


Fig 1. Typical Output Characteristics

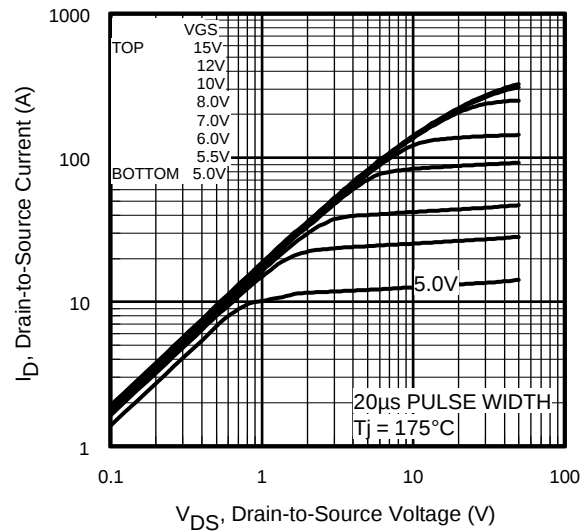


Fig 2. Typical Output Characteristics

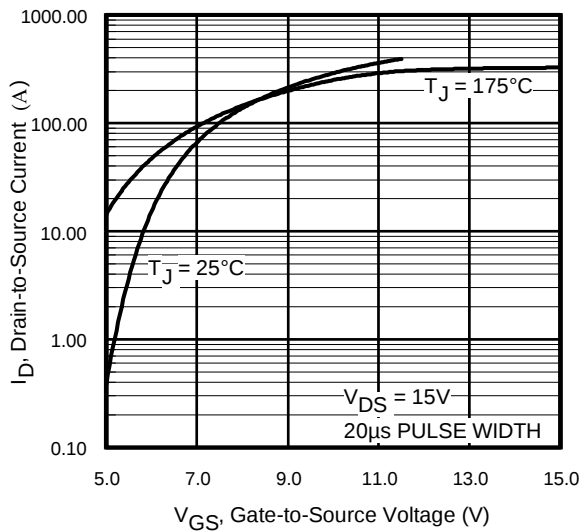


Fig 3. Typical Transfer Characteristics

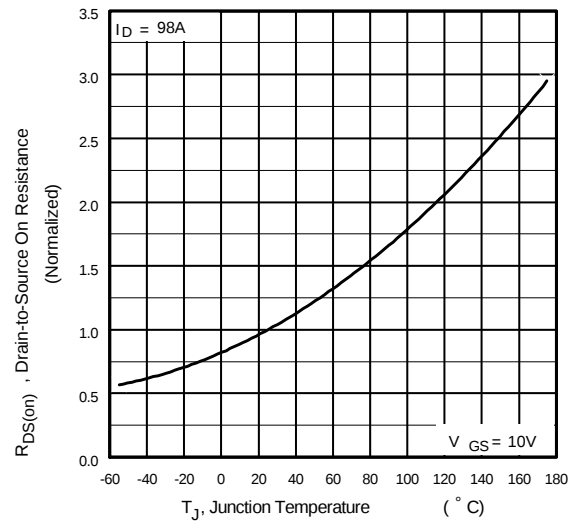


Fig 4. Normalized On-Resistance Vs. Temperature

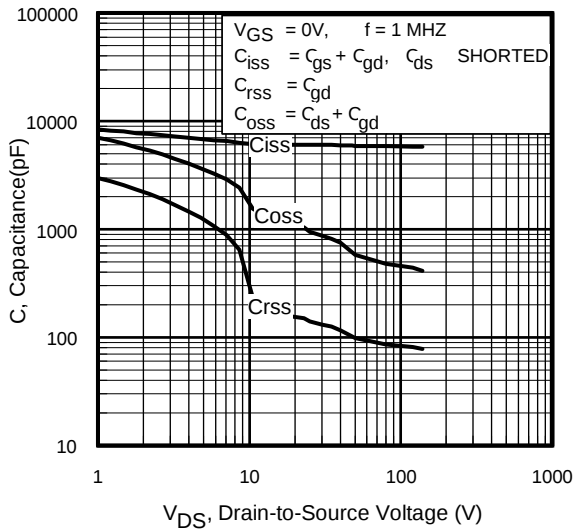


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

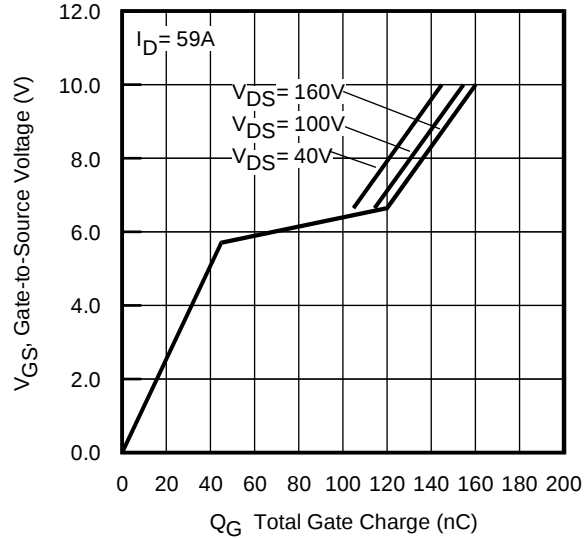


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

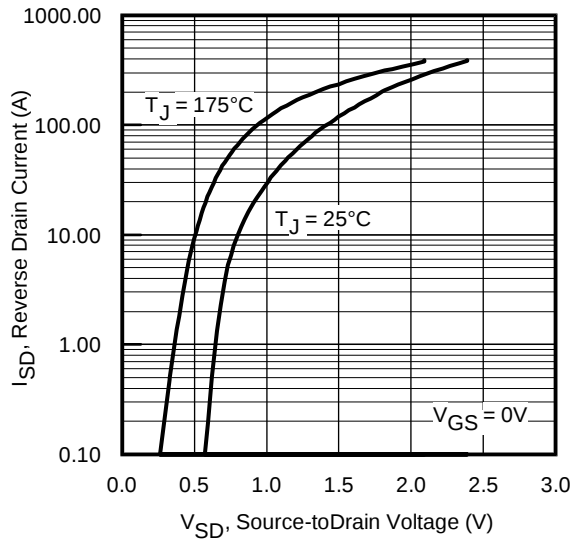


Fig 7. Typical Source-Drain Diode Forward Voltage

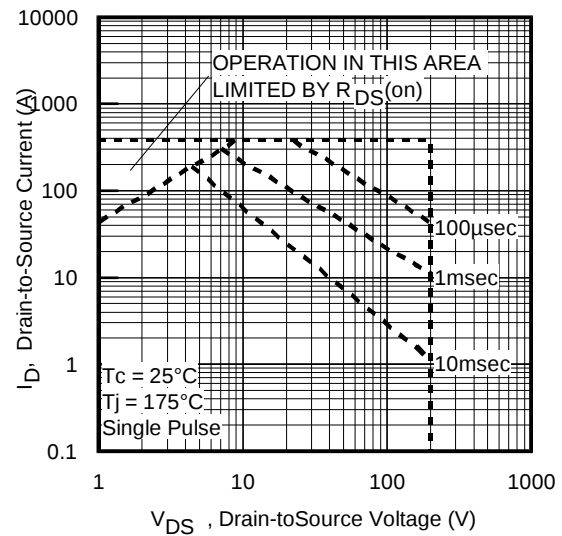


Fig 8. Maximum Safe Operating Area

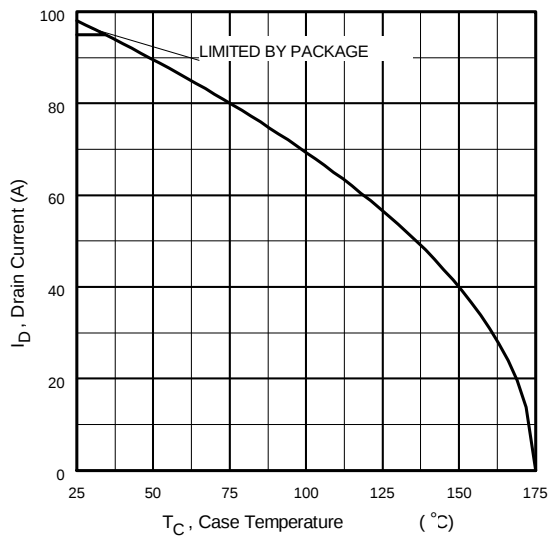


Fig 9. Maximum Drain Current Vs. Case Temperature

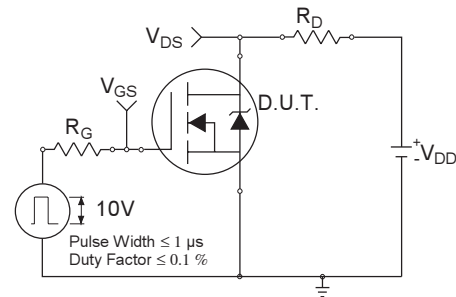


Fig 10a. Switching Time Test Circuit



Fig 10b. Switching Time Waveforms

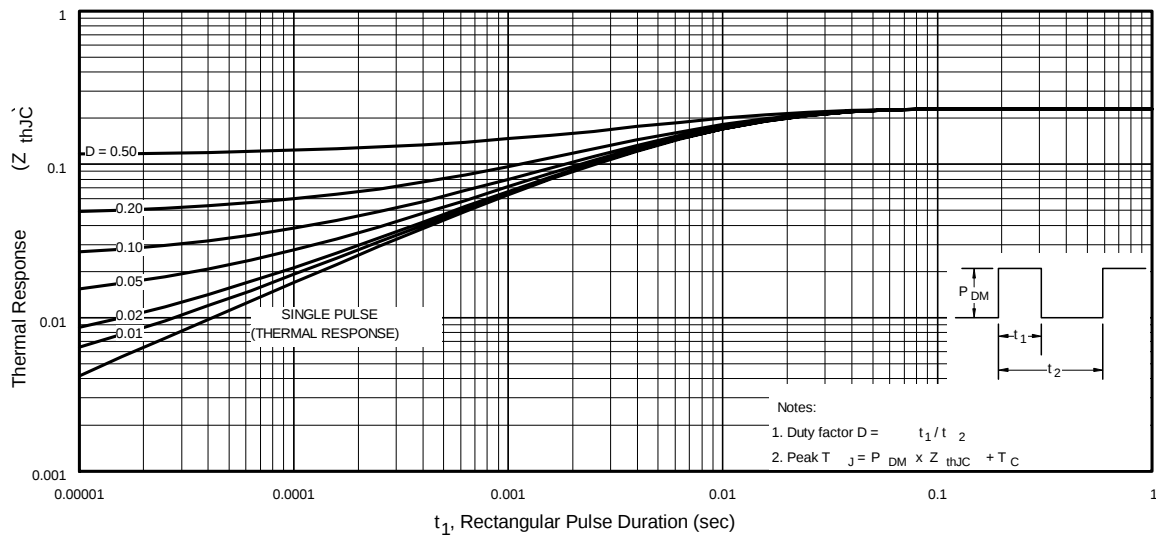


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

IRFBA90N20DPbF

International
IR Rectifier

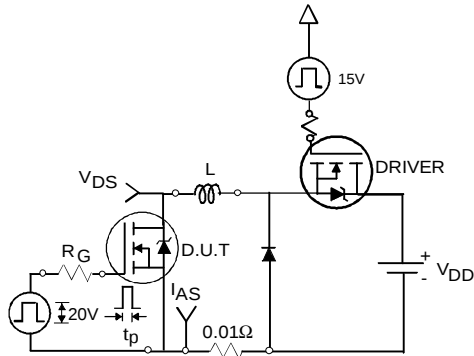


Fig 12a. Unclamped Inductive Test Circuit

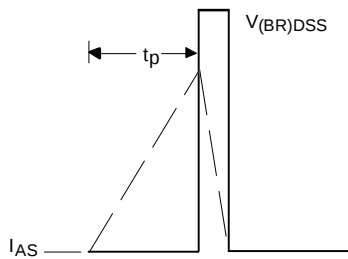


Fig 12b. Unclamped Inductive Waveforms

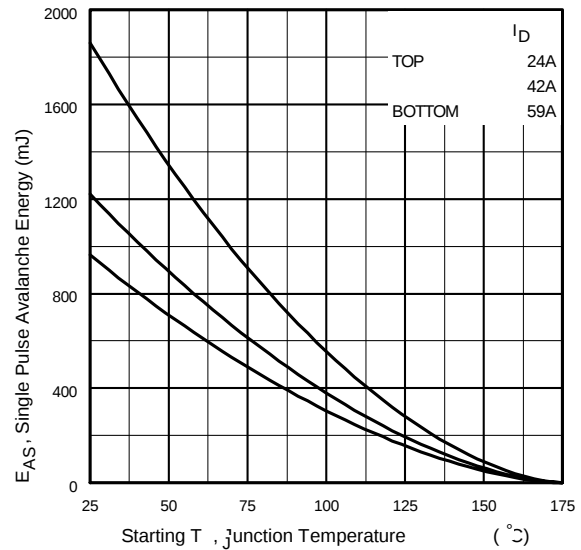


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

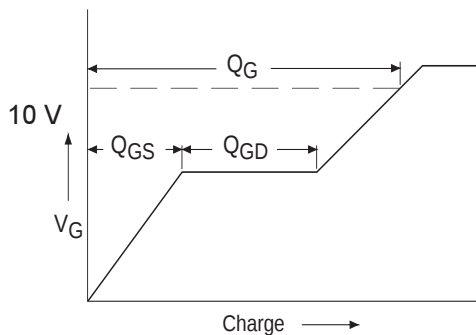


Fig 13a. Basic Gate Charge Waveform

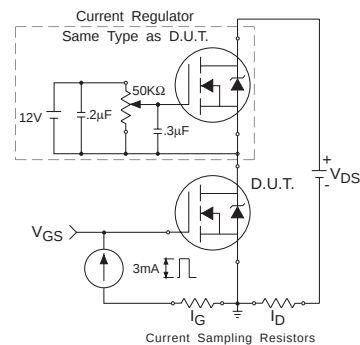


Fig 13b. Gate Charge Test Circuit

Circuit Layout Considerations

- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance

Current Transformer

- dv/dt controlled by R_G
- Driver same type as D.U.T.
- I_{SD} controlled by Duty Factor "D"
- D.U.T. - Device Under Test

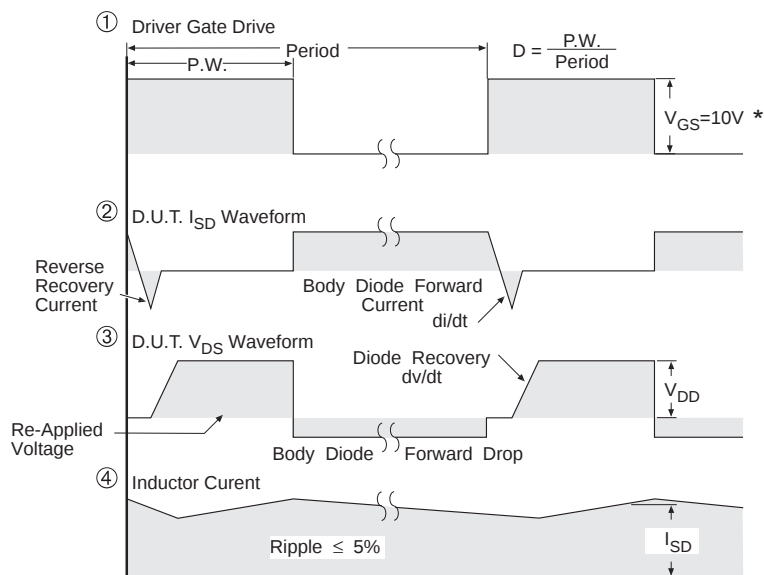
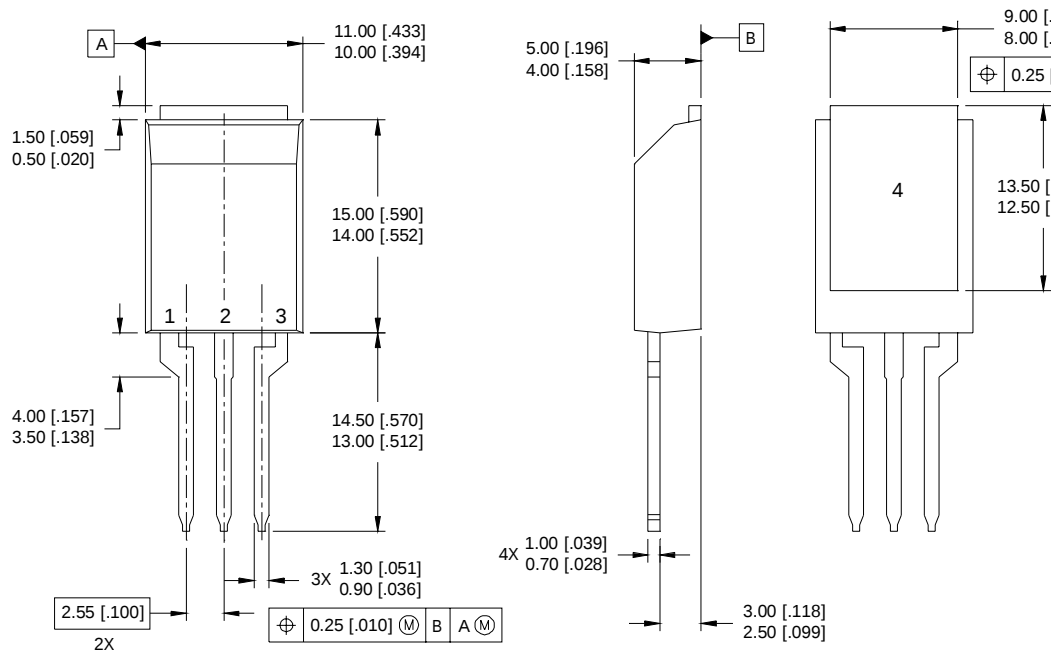


Fig 14. For N-Channel HEXFET® Power MOSFETs

IRFBA90N20DPbF

International
IR Rectifier

Super-220™ (TO-273AA) Package Outline



NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-273AA.

LEAD ASSIGNMENTS

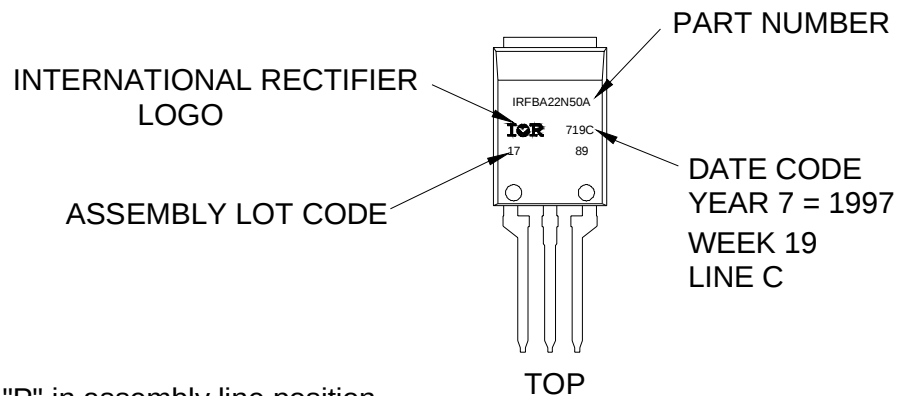
MOSFET	IGBT
1 - GATE	1 - GATE
2 - DRAIN	2 - COLLECTOR
3 - SOURCE	3 - EMITTER
4 - DRAIN	4 - COLLECTOR

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.55\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 59\text{A}$.
- ③ $I_{SD} \leq 59\text{A}$, $di/dt \leq 170\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$
- 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 Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 95A.

Super-220 (TO-273AA) Part Marking Information

EXAMPLE: THIS IS AN IRFBA22N50A WITH
ASSEMBLY LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"



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

Super-220™ not recommended for surface mount application.

Data and specifications subject to change without notice.
This product has been designed and qualified for the Industrial market.
Qualification Standards can be found on IR's Web site.