

IRFBA90N20DPbF

HEXFET® Power MOSFET

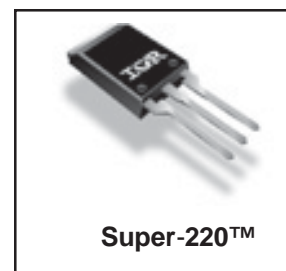
Applications

- 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	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	58	

Notes ^① through ^⑥ are on page 8

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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°C , $I_D = 1\text{mA}$
$R_{DS(on)}$	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		$V_{GS} = -30V$

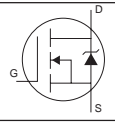
Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	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	—		$f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	7500	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	410	—		$V_{GS} = 0V, V_{DS} = 160V, f = 1.0\text{MHz}$
$C_{oss \text{ eff.}}$	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 $L_S + L_D$)				

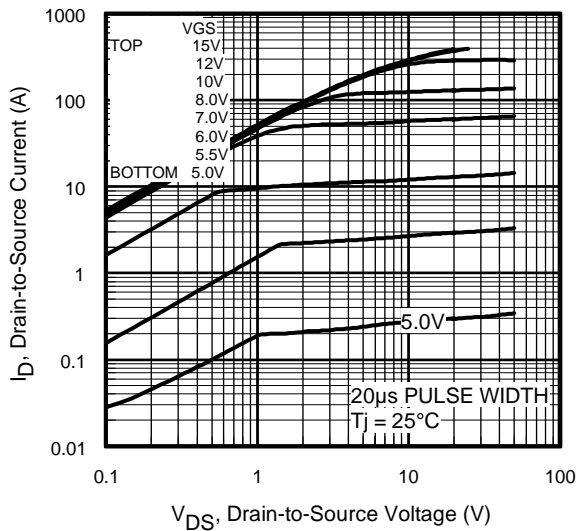


Fig 1. Typical Output Characteristics

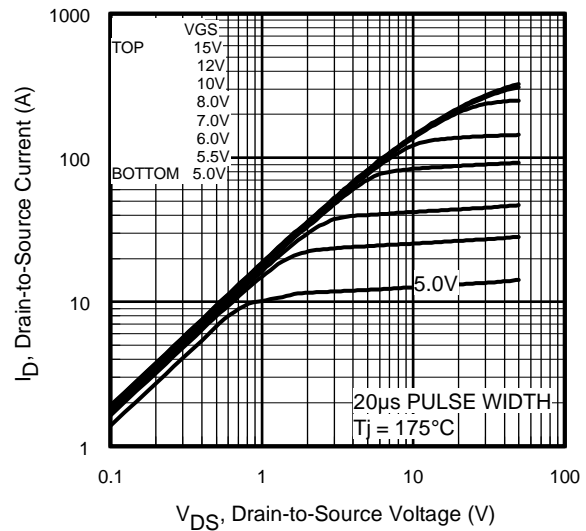


Fig 2. Typical Output Characteristics

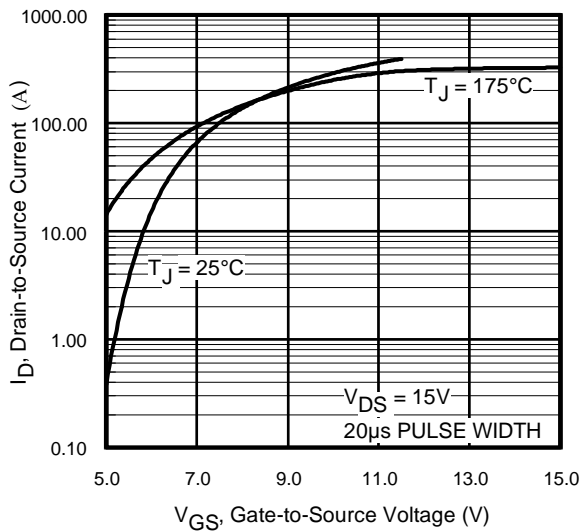


Fig 3. Typical Transfer Characteristics

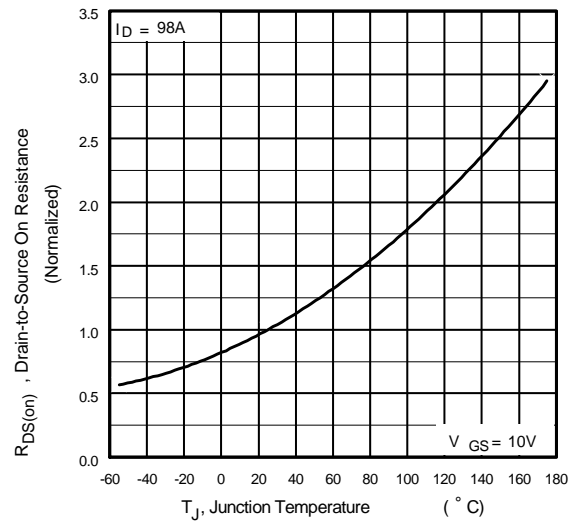


Fig 4. Normalized On-Resistance Vs. Temperature

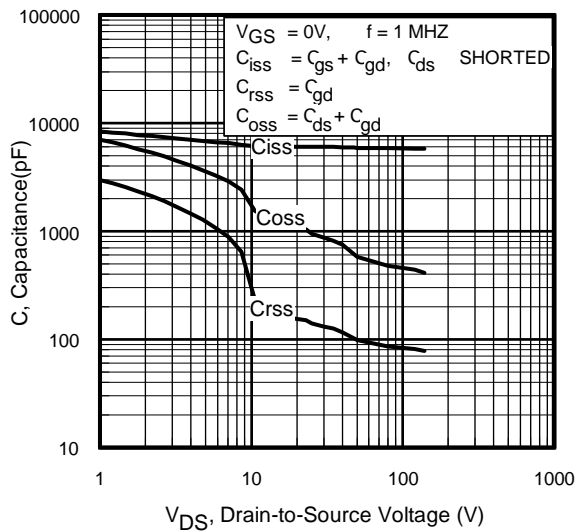


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

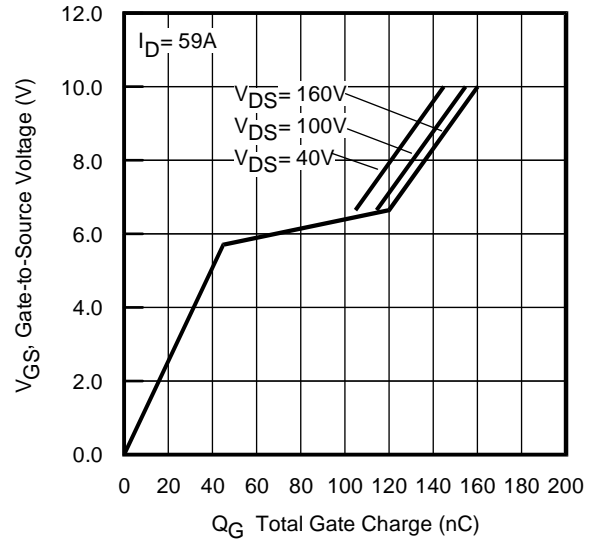


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

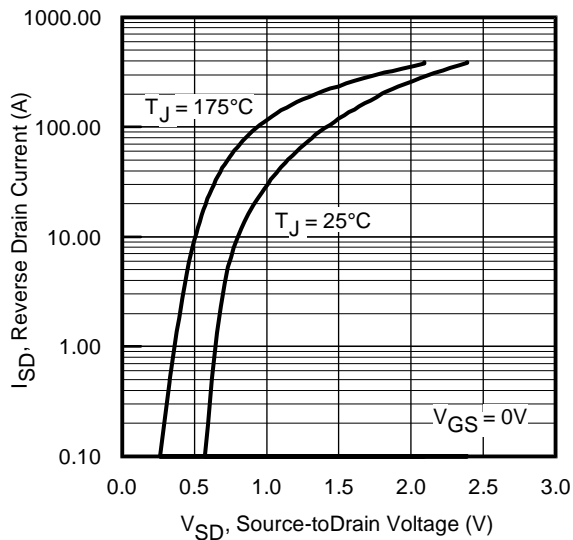


Fig 7. Typical Source-Drain Diode Forward Voltage

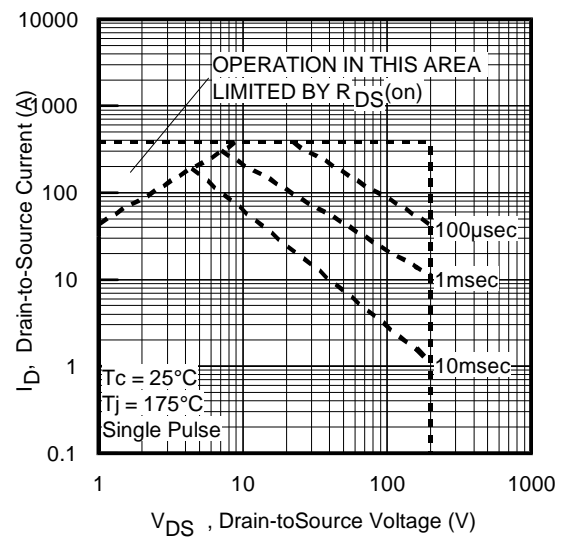


Fig 8. Maximum Safe Operating Area

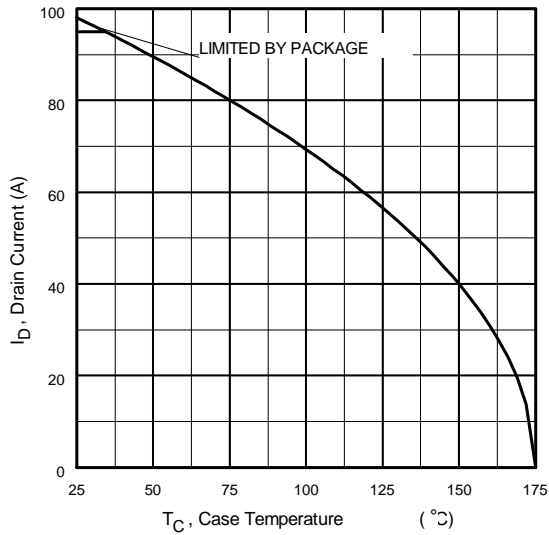


Fig 9. Maximum Drain Current Vs. Case Temperature

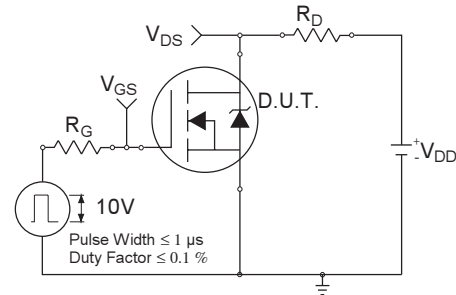


Fig 10a. Switching Time Test Circuit

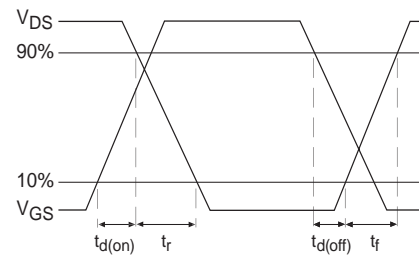


Fig 10b. Switching Time Waveforms

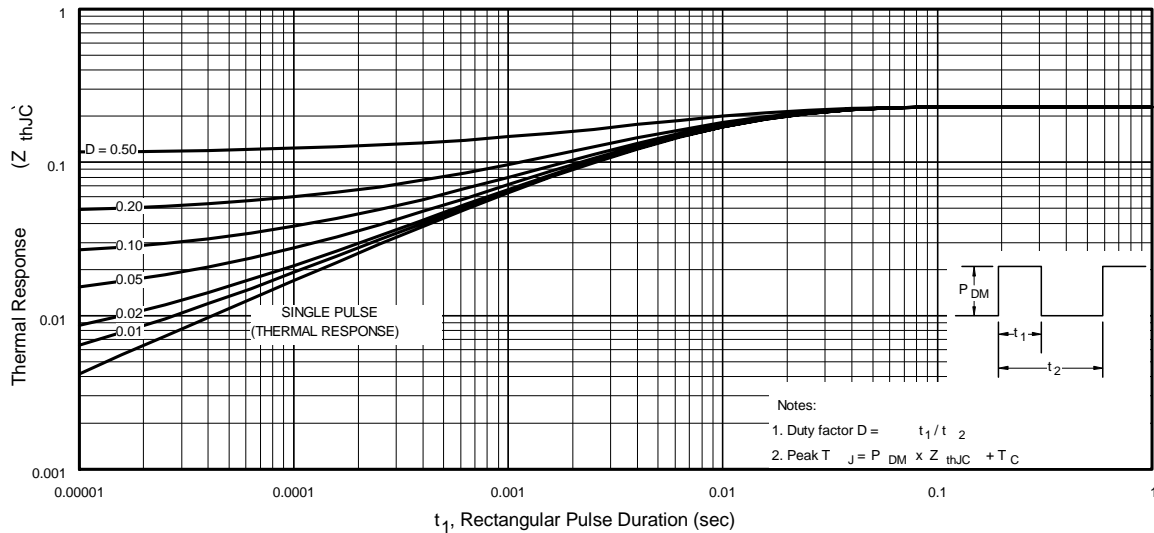


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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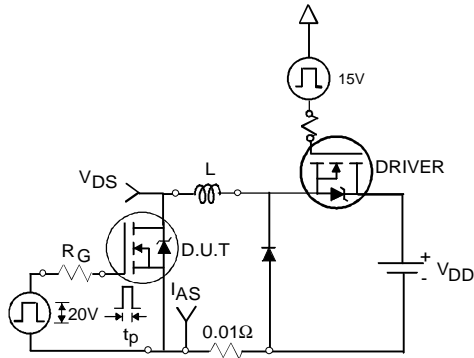


Fig 12a. Unclamped Inductive Test Circuit

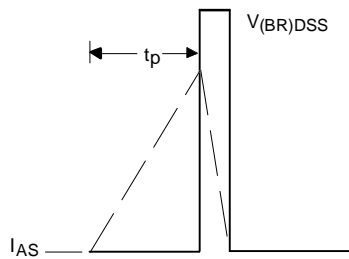


Fig 12b. Unclamped Inductive Waveforms

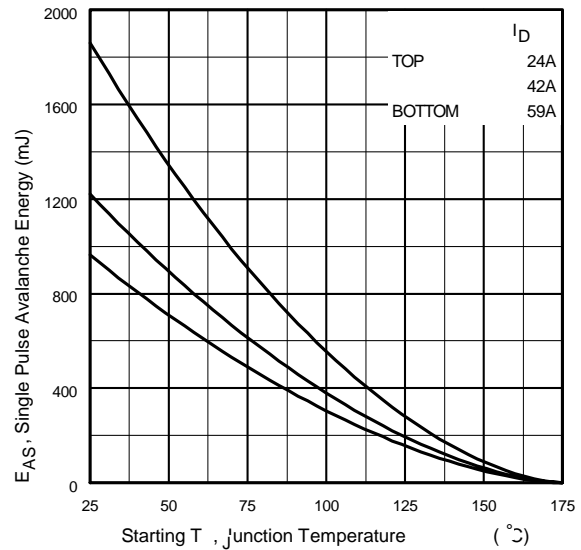


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

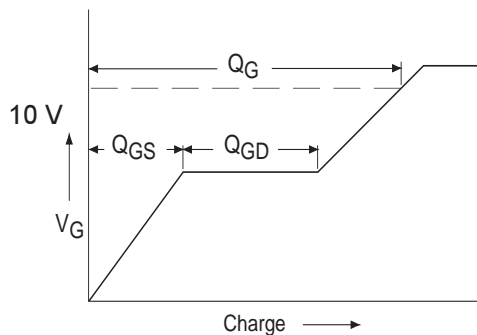


Fig 13a. Basic Gate Charge Waveform

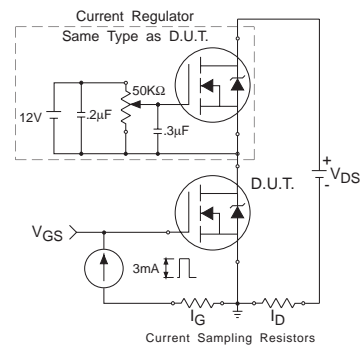


Fig 13b. Gate Charge Test Circuit

The diagram shows a Class D amplifier circuit. A square-wave voltage source (1) is connected in series with a resistor R_G to the gate of a MOSFET (D.U.T.). The MOSFET's source is grounded, and its drain is connected to a load network consisting of a transformer (2) and a series combination of an inductor and a parallel LC network (3). The output of the LC network is connected to the D.U.T. (4). The D.U.T. is represented by a MOSFET symbol with a circle around it. The output of the D.U.T. is connected to a load resistor and a DC voltage source V_{DD} .

Circuit Layout Considerations

- Low Stray Inductance
- Ground Plane
- Low Leakage Inductance

Current Transformer

①: Input voltage source
 ②: Transformer
 ③: Inductor and parallel LC network
 ④: Output filter network (inductor and parallel LC network)

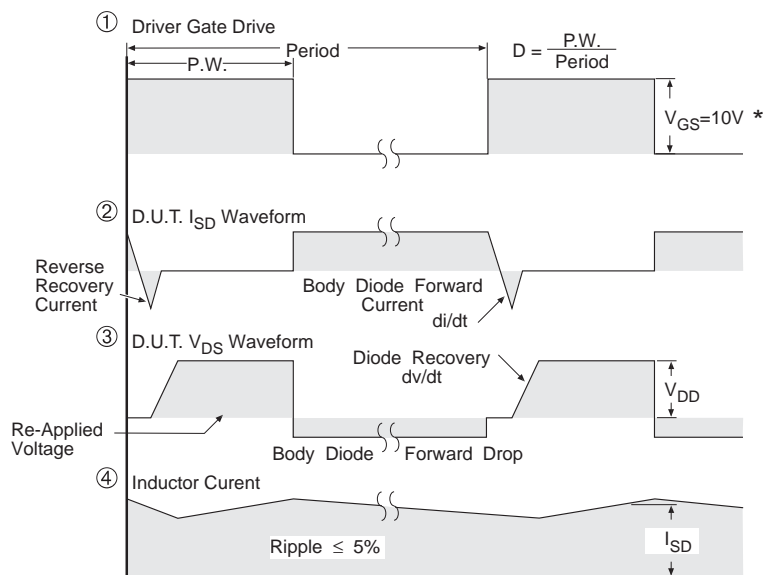


Fig 14. For N-Channel HEXFET® Power MOSFETs

International
IOR Rectifier

Technical drawings of the 1000 Series probe tip and probe body. The left drawing shows the probe tip with dimensions for the main body (11.00 [0.433] total width, 10.00 [0.394] width at the base), the three fingers (14.50 [0.570] total length, 13.00 [0.512] length to the tip), and the base (4.00 [0.157] total height, 3.50 [0.138] height to the top of the fingers). The right drawing shows the probe body with dimensions for the main body (9.00 [0.354] total width, 8.00 [0.315] width at the base), the three fingers (13.50 [0.531] total length, 12.50 [0.492] length to the tip), and the base (3.00 [0.118] total height, 2.50 [0.099] height to the top of the fingers). Both drawings include a table with dimensions in inches and millimeters.

Feature	Dimension (mm)	Dimension (inches)
Main Body Width	11.00	0.433
Main Body Width at Base	10.00	0.394
Main Body Height	15.00	0.590
Main Body Height to Tip	14.00	0.552
Main Body Height to Tip (Finger)	14.50	0.570
Main Body Height to Tip (Finger)	13.00	0.512
Main Body Height to Tip (Finger)	13.50	0.531
Main Body Height to Tip (Finger)	12.50	0.492
Main Body Height to Tip (Finger)	12.00	0.472
Main Body Height to Tip (Finger)	11.50	0.453
Main Body Height to Tip (Finger)	11.00	0.433
Main Body Height to Tip (Finger)	10.50	0.413
Main Body Height to Tip (Finger)	10.00	0.394
Main Body Height to Tip (Finger)	9.50	0.375
Main Body Height to Tip (Finger)	9.00	0.354
Main Body Height to Tip (Finger)	8.50	0.335
Main Body Height to Tip (Finger)	8.00	0.315
Main Body Height to Tip (Finger)	7.50	0.295
Main Body Height to Tip (Finger)	7.00	0.276
Main Body Height to Tip (Finger)	6.50	0.256
Main Body Height to Tip (Finger)	6.00	0.236
Main Body Height to Tip (Finger)	5.50	0.217
Main Body Height to Tip (Finger)	5.00	0.197
Main Body Height to Tip (Finger)	4.50	0.177
Main Body Height to Tip (Finger)	4.00	0.157
Main Body Height to Tip (Finger)	3.50	0.138
Main Body Height to Tip (Finger)	3.00	0.118
Main Body Height to Tip (Finger)	2.50	0.099
Main Body Height to Tip (Finger)	2.00	0.079
Main Body Height to Tip (Finger)	1.50	0.059
Main Body Height to Tip (Finger)	1.00	0.039
Main Body Height to Tip (Finger)	0.50	0.019
Main Body Height to Tip (Finger)	0.00	0.000

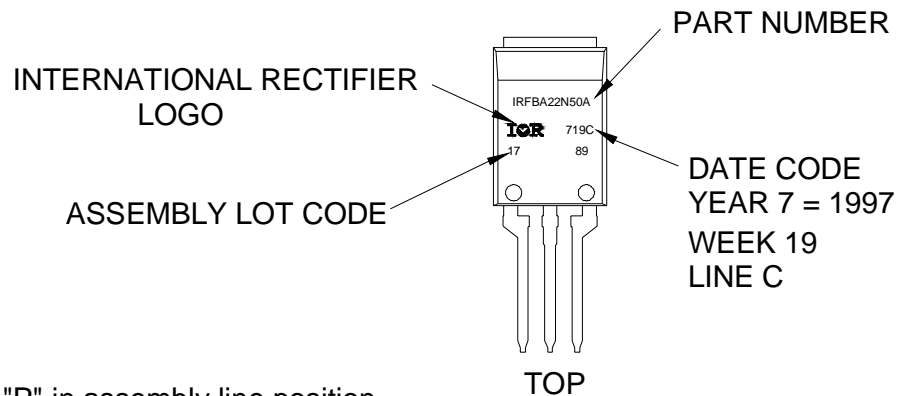
LEAD ASSIGNMENTS

- | <u>MOSFET</u> | <u>IGBT</u> |
|---------------|---------------|
| 1 – GATE | 1 – GATE |
| 2 – DRAIN | 2 – COLLECTOR |
| 3 – SOURCE | 3 – EMITTER |
| 4 – DRAIN | 4 – COLLECTOR |

- 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.

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