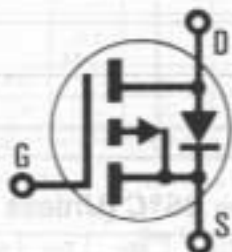


INTERNATIONAL RECTIFIER



HEXFET® TRANSISTORS IRF9620

**P-CHANNEL
200 VOLT
POWER MOSFETs**



**IRF9621
IRF9622
IRF9623**

-200 Volt, 1.5 Ohm HEXFET TO-220AB Plastic Package

The HEXFET® technology is the key to International Rectifier's advanced line of power MOSFET transistors. The efficient geometry and unique processing of the HEXFET design achieve very low on-state resistance combined with high transconductance and extreme device ruggedness.

The P-Channel HEXFETs are designed for applications which require the convenience of reverse polarity operation. They retain all of the features of the more common N-Channel HEXFETs such as voltage control, very fast switching, ease of paralleling, and excellent temperature stability. The P-Channel IRF9620 device is an approximate electrical complement to the N-Channel IRF610 HEXFET.

P-Channel HEXFETs are intended for use in power stages where complementary symmetry with N-Channel devices offers circuit simplification. They are also very useful in drive stages because of the circuit versatility offered by the reverse polarity connection. Applications include motor control, audio amplifiers, switched mode converters, control circuits and pulse amplifiers.

Features:

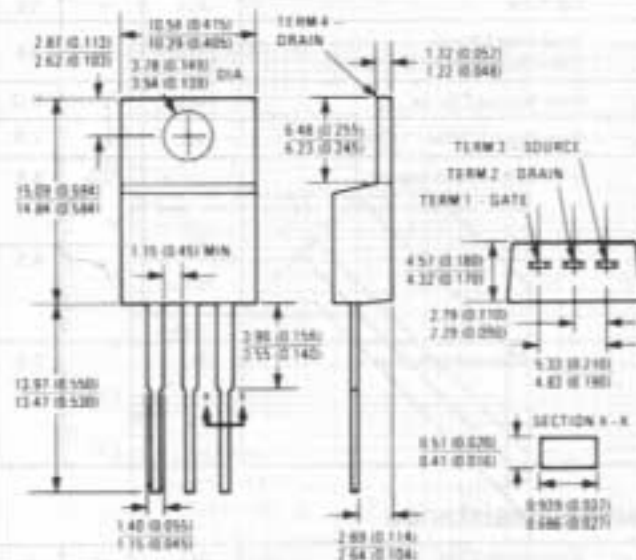
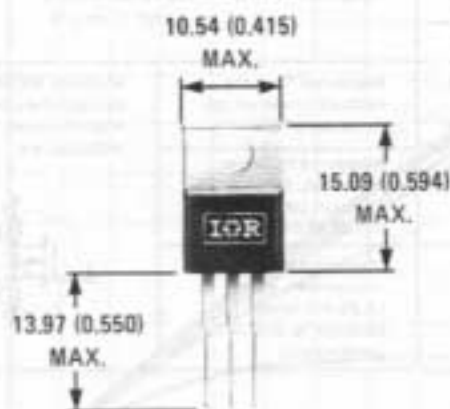
- P-Channel Versatility
- Compact Plastic Package
- Fast Switching
- Low Drive Current
- Ease of Paralleling
- Excellent Temperature Stability

Product Summary

Part Number	V _{DS}	R _{DS(on)}	I _D
IRF9620	-200V	1.5Ω	-3.5A
IRF9621	-150V	1.5Ω	-3.5A
IRF9622	-200V	2.4Ω	-3.0A
IRF9623	-150V	2.4Ω	-3.0A

TO-220

CASE STYLE AND DIMENSIONS



Case Style TO-220AB

All Dimensions in Millimeters and (Inches)

IRF9620, IRF9621, IRF9622, IRF9623 Devices

Absolute Maximum Ratings

Parameter	IRF9620	IRF9621	IRF9622	IRF9623	Units
V_{DS} Drain - Source Voltage (1)	-200	-150	-200	-150	V
V_{DGS} Drain - Gate Voltage ($R_{GS} = 20 \text{ k}\Omega$) (1)	-200	-150	-200	-150	V
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	-3.5	-3.5	-3.0	-3.0	A
$I_D @ T_C = 100^\circ\text{C}$ Continuous Drain Current	-2.0	-2.0	-1.5	-1.5	A
I_{DM} Pulsed Drain Current (2)	-14	-14	-12	-12	A
V_{GS} Gate - Source Voltage					± 20 V
$P_D @ T_C = 25^\circ\text{C}$ Max. Power Dissipation	40 (See Fig. 14)				W
Linear Derating Factor	0.32 (See Fig. 14)				W/K (3)
I_{LM} Inductive Current, Clamped	(See Fig. 15 and 16) $L = 100 \mu\text{H}$				A
T_J Operating Junction and Storage Temperature Range	-55 to 150				$^\circ\text{C}$
T_{stg} Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				$^\circ\text{C}$

Electrical Characteristics @ $T_C = 25^\circ\text{C}$ (Unless Otherwise Specified)

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions	
BV_{DSS} Drain - Source Breakdown Voltage	IRF9620 IRF9622	-200	-	-	V	$V_{GS} = 0\text{V}$ $I_D = -250 \mu\text{A}$	
	IRF9621 IRF9623	-150	-	-	V		
$V_{GS(th)}$ Gate Threshold Voltage	ALL	-2.0	-	-4.0	V	$V_{DS} = -V_{GS}$, $I_D = -250 \mu\text{A}$	
I_{GSS} Gate-Source Leakage Forward	ALL	-	-	-500	nA	$V_{GS} = -20\text{V}$	
I_{GSS} Gate-Source Leakage Reverse	ALL	-	-	500	nA	$V_{GS} = 20\text{V}$	
I_{DSS} Zero Gate Voltage Drain Current	ALL	-	-	-250	μA	$V_{DS} = \text{Max. Rating}$, $V_{GS} = 0\text{V}$	
		-	-	-1000	μA	$V_{DS} = \text{Max. Rating} \times 0.8$, $V_{GS} = 0\text{V}$, $T_C = 125^\circ\text{C}$	
$I_{D(on)}$ On-State Drain Current (2)	IRF9620 IRF9621	-3.5	-	-	A	$V_{DS} \leq I_{D(on)} \times R_{DS(on) \text{ max.}}$, $V_{GS} = -10\text{V}$	
	IRF9622 IRF9623	-3.0	-	-	A		
$R_{DS(on)}$ Static Drain-Source On-State Resistance (2)	IRF9620 IRF9621	-	1.0	1.5	Ω	$V_{GS} = -10\text{V}$, $I_D = -1.5\text{A}$	
	IRF9622 IRF9623	-	1.5	2.4	Ω		
g_{fs} Forward Transconductance (2)	ALL	1.0	1.8	-	S (Ω)	$V_{DS} \leq I_{D(on)} \times R_{DS(on) \text{ max.}}$, $I_D = -1.5\text{A}$	
C_{iss} Input Capacitance	ALL	-	350	400	pF	$V_{GS} = 0\text{V}$, $V_{DS} = -25\text{V}$, $f = 1.0\text{MHz}$ See Fig. 10	
C_{oss} Output Capacitance	ALL	-	100	125	pF		
C_{riss} Reverse Transfer Capacitance	ALL	-	30	45	pF		
$t_{d(on)}$ Turn-On Delay Time	ALL	-	15	40	ns	$V_{DD} = 0.5 BV_{DSS}$, $I_D = 1.5\text{A}$, $Z_\theta = 500$ See Fig. 17 (MOSFET switching times are essentially independent of operating temperature.)	
t_r Rise Time	ALL	-	25	50	ns		
$t_{d(off)}$ Turn-Off Delay Time	ALL	-	20	50	ns		
t_f Fall Time	ALL	-	15	40	ns		
Q_g Total Gate Charge (Gate-Source Plus Gate-Drain)	ALL	-	16	22	nC	$V_{GS} = -15\text{V}$, $I_D = -4.0\text{A}$, $V_{DS} = 0.8 \text{ Max. Rating}$. See Fig. 18 for test circuit. (Gate charge is essentially independent of operating temperature.)	
Q_{gs} Gate-Source Charge	ALL	-	9.0	-	nC		
Q_{gd} Gate-Drain ("Miller") Charge	ALL	-	7.0	-	nC		
L_D Internal Drain Inductance	ALL	-	3.5	-	nH	Measured from the contact screw on tab to center of die.	Modified MOSFET symbol showing the internal device inductances.
		-	4.5	-	nH		
L_S Internal Source Inductance	ALL	-	7.5	-	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.	

Thermal Resistance

$R_{\theta JC}$ Junction-to-Case	ALL	-	-	3.12	K/W (4)	
$R_{\theta CS}$ Case-to-Sink	ALL	-	1.0	-	K/W (4)	Mounting surface flat, smooth, and greased.
$R_{\theta JA}$ Junction-to-Ambient	ALL	-	-	80	K/W (4)	Typical socket mount

Source-Drain Diode Ratings and Characteristics

I_S	Continuous Source Current (Body Diode)	IRF9620	-	-	-3.5	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier.
		IRF9621	-	-	-3.0	A	
I_{SM}	Pulse Source Current (Body Diode) ③	IRF9620	-	-	-14	A	
		IRF9621	-	-	-12	A	
V_{SD}	Diode Forward Voltage ②	IRF9620	-	-	-7.0	V	$T_C = 25^\circ\text{C}, I_S = -3.5\text{A}, V_{GS} = 0\text{V}$
		IRF9621	-	-	-6.8	V	$T_C = 25^\circ\text{C}, I_S = -3.0\text{A}, V_{GS} = 0\text{V}$
t_{rr}	Reverse Recovery Time	ALL	-	300	-	ns	$T_J = 150^\circ\text{C}, I_F = -3.5\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$
Q_{RR}	Reverse Recovered Charge	ALL	-	1.9	-	μC	$T_J = 150^\circ\text{C}, I_F = -3.5\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$
t_{on}	Forward Turn-on Time	ALL	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$.				



- ① $T_J = 25^\circ\text{C}$ to 150°C .
- ② Pulse Test: Pulse width $< 300\mu\text{s}$, Duty Cycle $< 2\%$.
- ③ Repetitive Rating: Pulse width limited by max. junction temperature. See Transient Thermal Impedance Curve (Fig. 5).
- ④ $KW = ^\circ\text{C}/\text{W}$
 $WK = \text{W}/^\circ\text{C}$

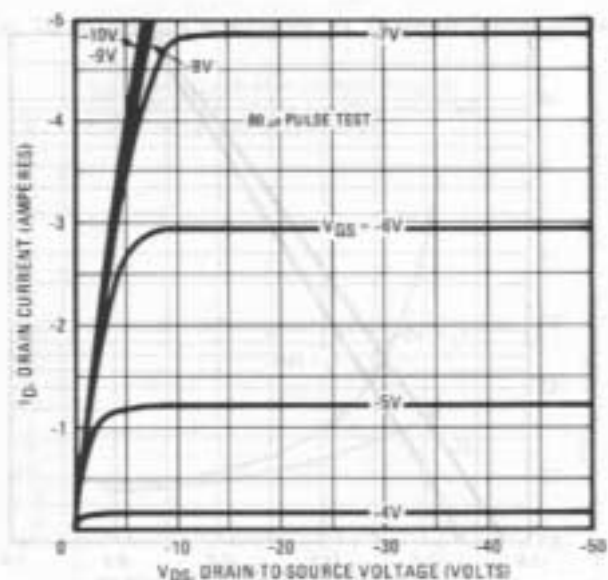


Fig. 1 - Typical Output Characteristics

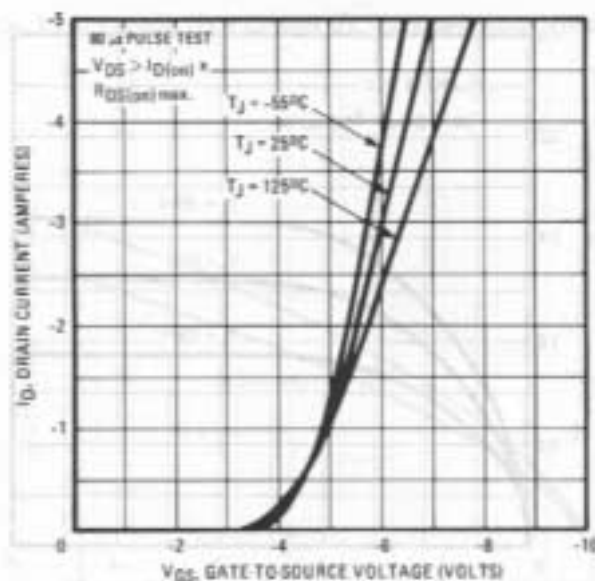


Fig. 2 - Typical Transfer Characteristics

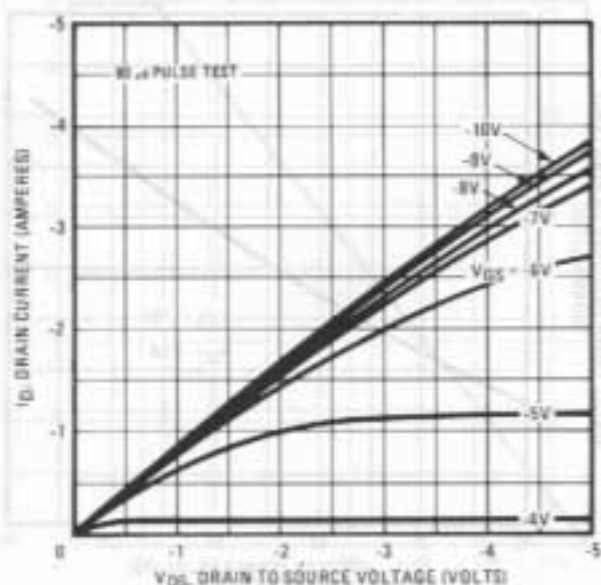


Fig. 3 - Typical Saturation Characteristics

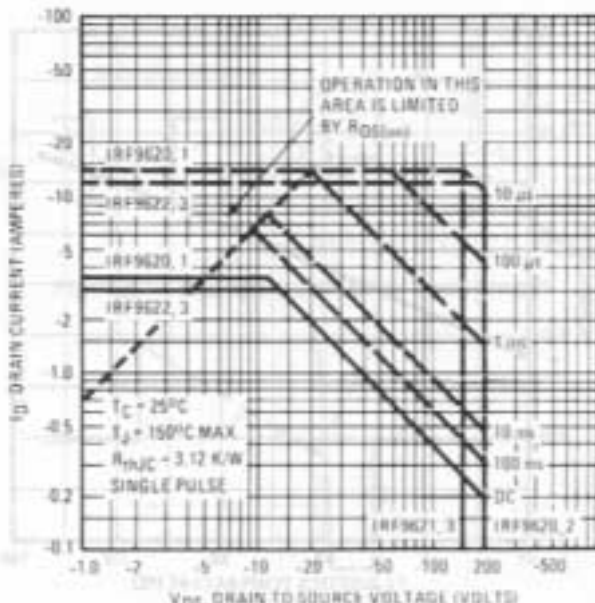


Fig. 4 - Maximum Safe Operating Area

TO-220

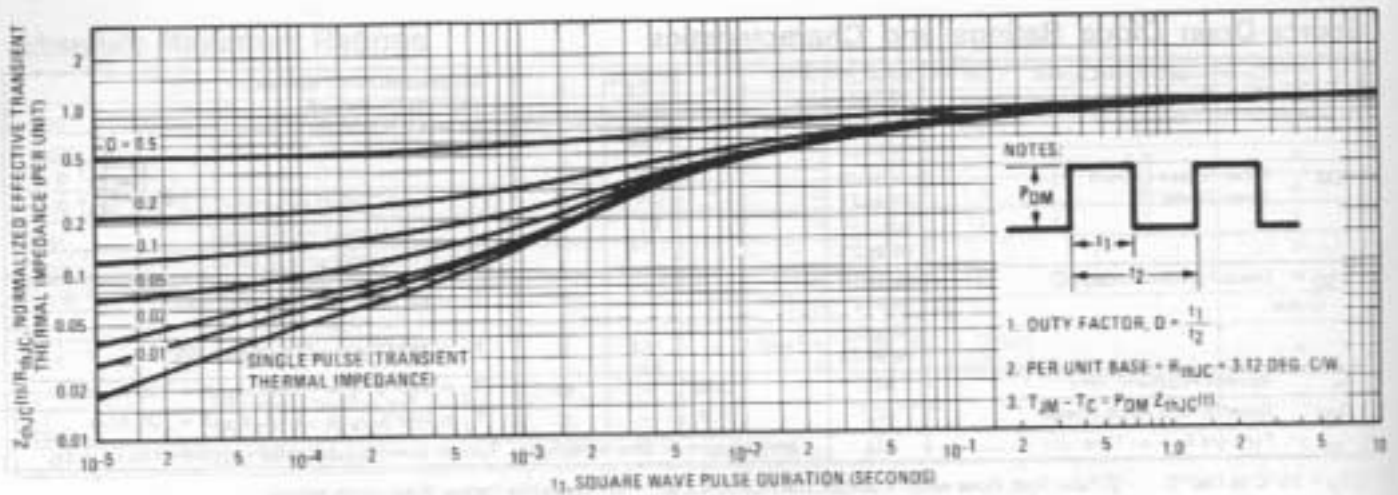


Fig. 5 – Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

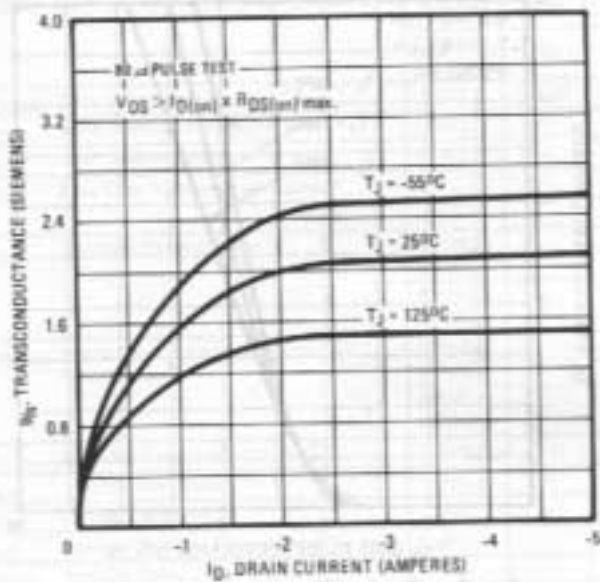


Fig. 6 – Typical Transconductance Vs. Drain Current

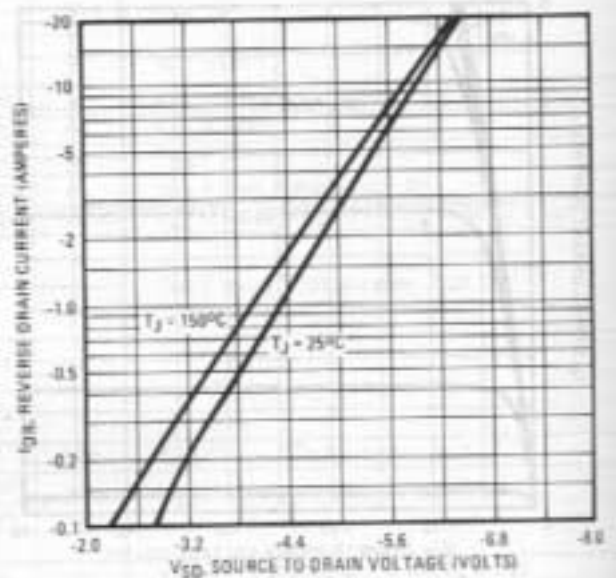


Fig. 7 – Typical Source-Drain Diode Forward Voltage

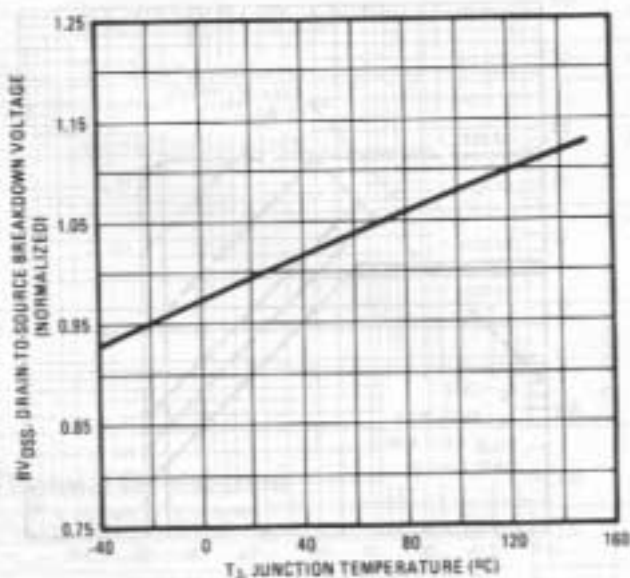


Fig. 8 – Breakdown Voltage Vs. Temperature

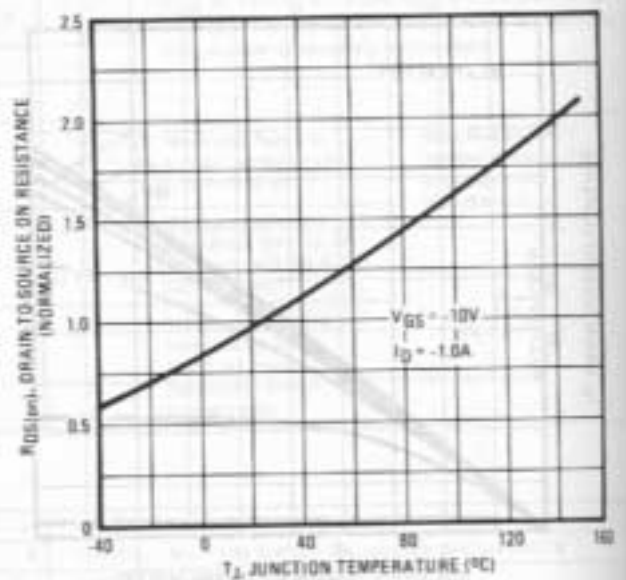


Fig. 9 – Normalized On-Resistance Vs. Temperature

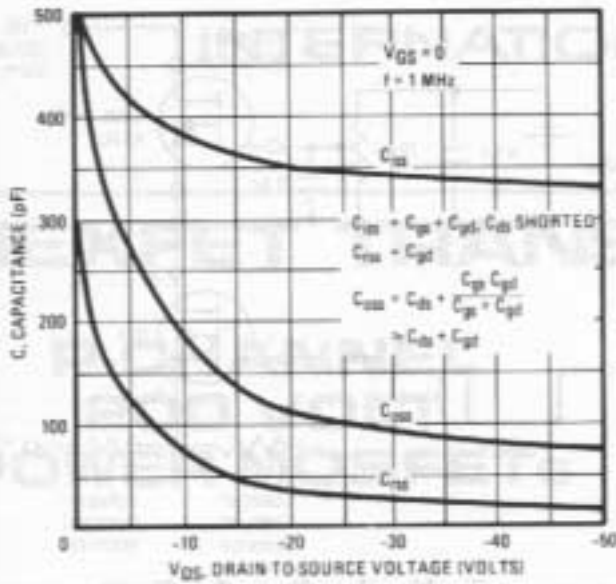


Fig. 10 - Typical Capacitance Vs. Drain-to-Source Voltage

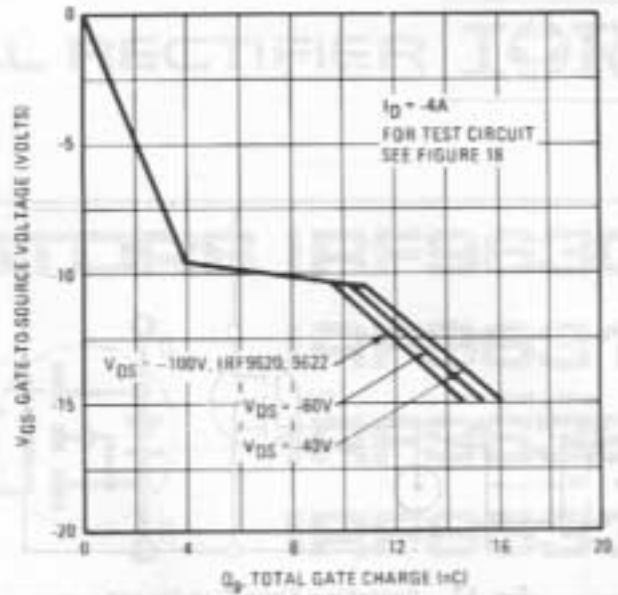


Fig. 11 - Typical Gate Charge Vs. Gate-to-Source Voltage

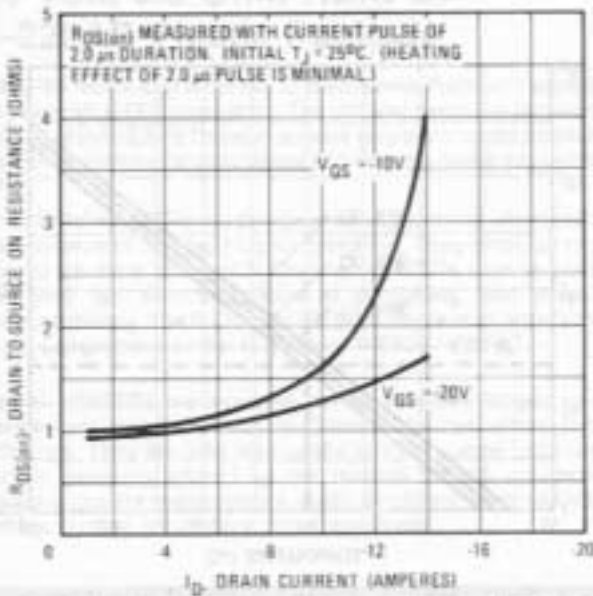


Fig. 12 - Typical On-Resistance Vs. Drain Current

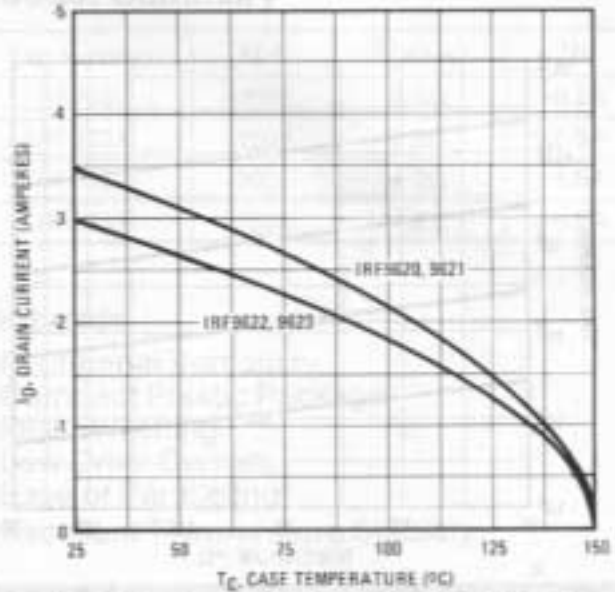


Fig. 13 - Maximum Drain Current Vs. Case Temperature

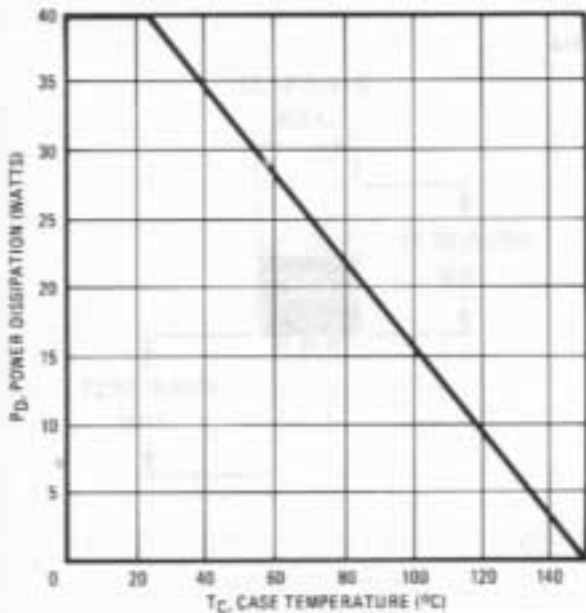


Fig. 14 - Power Vs. Temperature Derating Curve

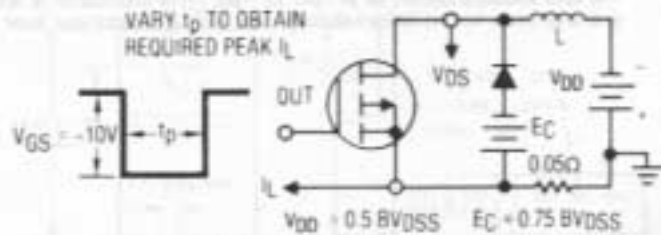


Fig. 15 - Clamped Inductive Test Circuit

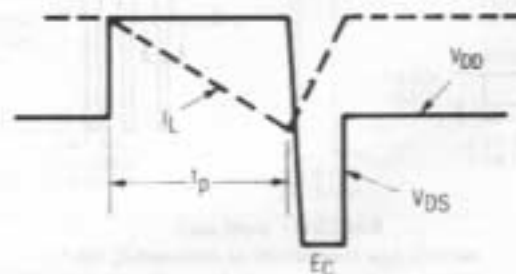


Fig. 16 - Clamped Inductive Waveforms

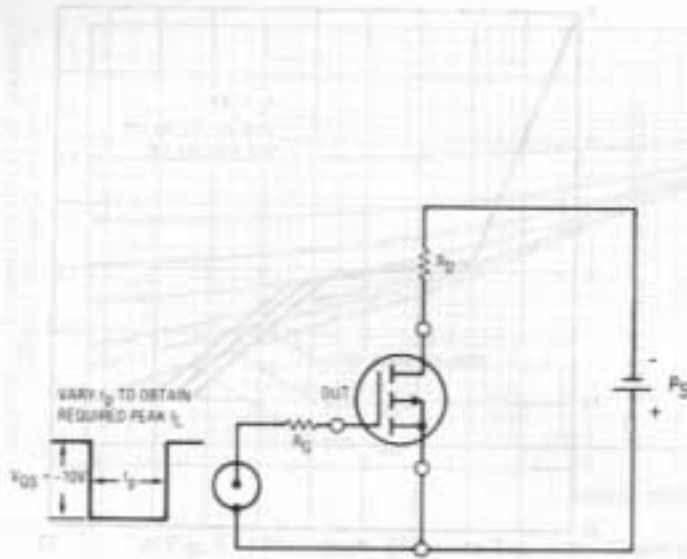


Fig. 17 - Switching Time Test Circuit

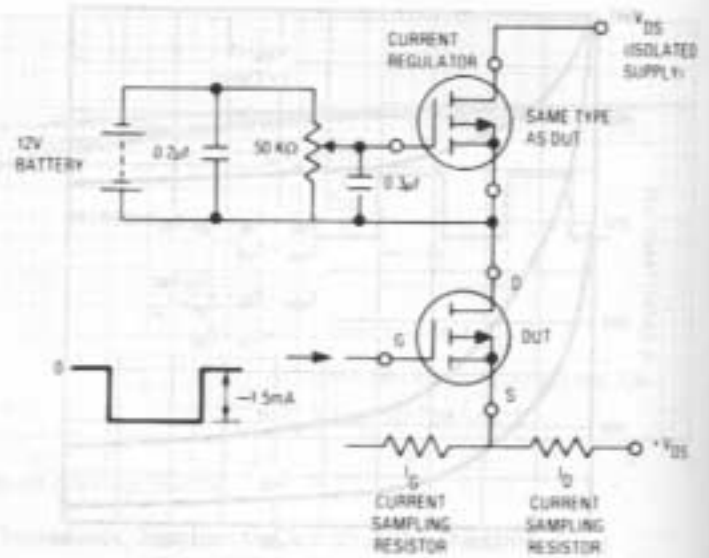
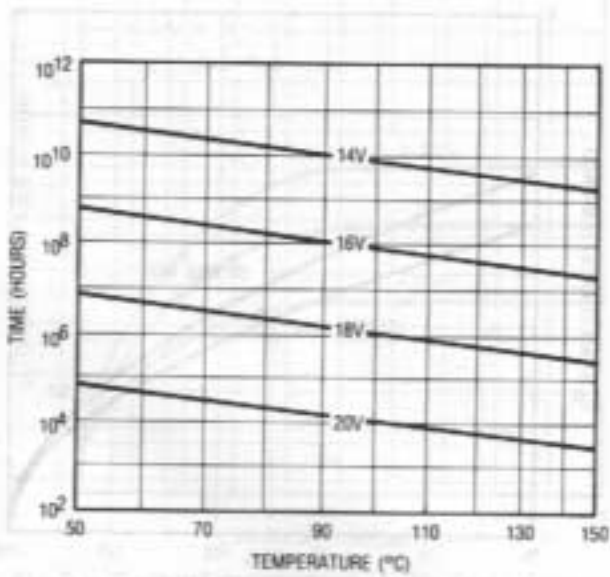
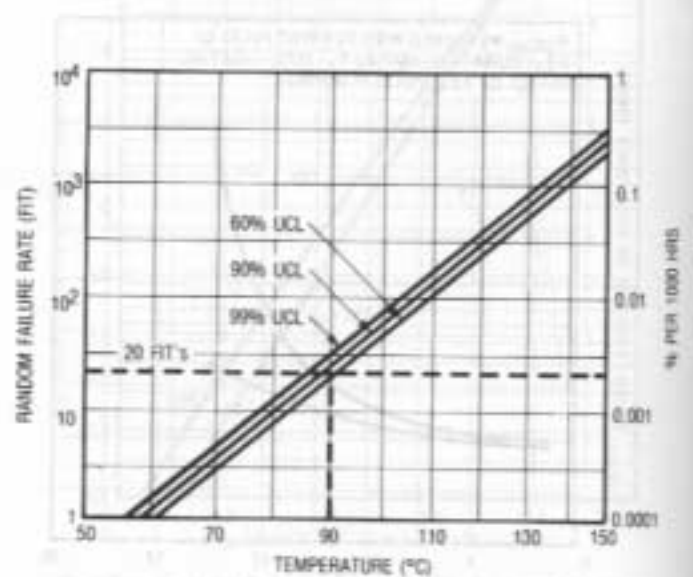


Fig. 18 - Gate Charge Test Circuit



* Fig. 19 - Typical Time to Accumulated 1% Failure



* Fig. 20 - Typical High Temperature Reverse Bias (HTRB) Failure Rate

*The data shown is correct as of April 15, 1987. This information is updated on a quarterly basis; for the latest reliability data, please contact your local IR field office.



Fig. 21 - Typical HTRB Test Circuit

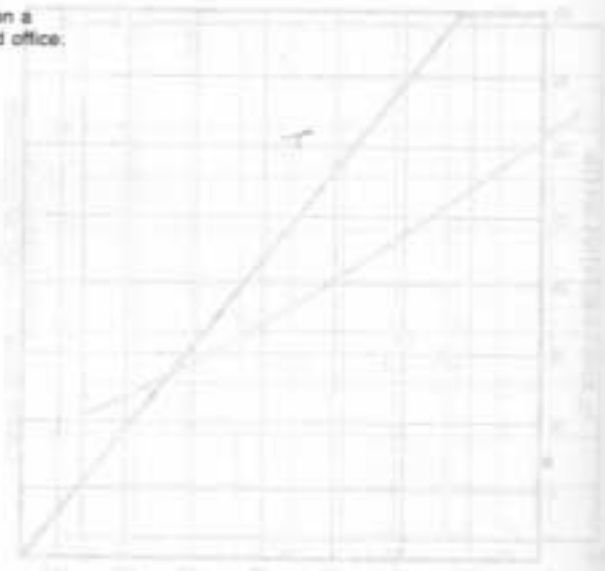


Fig. 22 - Typical HTRB Failure Rate