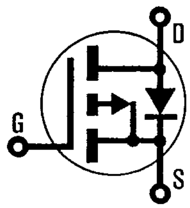
Data Sheet No. PD-9.351E
T-39-19

INTERNATIONAL RECTIFIER IOR

HEXFET® TRANSISTORS IRF9620 IRF9621 IRF9622 IRF9623

P-CHANNEL 200 VOLT POWER MOSFETs



TO-220

-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.

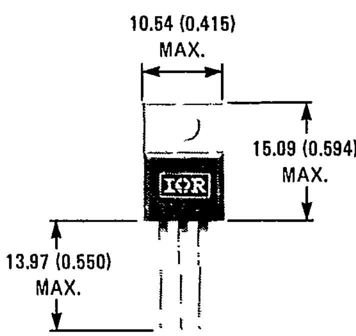
Features:

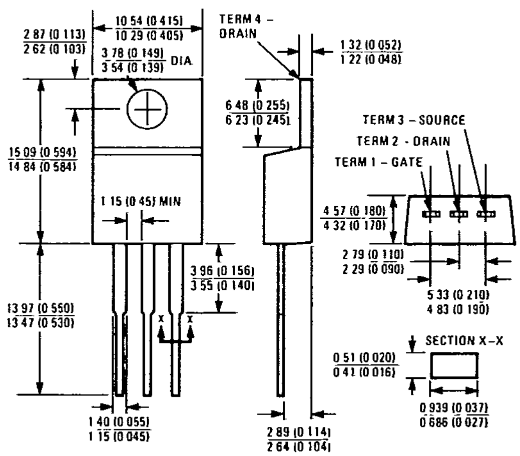
- P-Channel Versatility
- Compact Plastic Package
- Fast Switching
- Low Drive Current
- Ease of Paralleling
- Excellent Temperature Stability

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

CASE STYLE AND DIMENSIONS





Case Style TO-220AB
All Dimensions in Millimeters and (Inches)

IRF9620, IRF9621, IRF9622, IRF9623 Devices

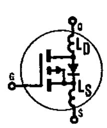
Absolute Maximum Ratings

	Parameter	IRF9620	IRF9621	IRF9622	IRF9623	Units
V_{DS}	Drain - Source Voltage ①	-200	-150	-200	-150	V
V_{DGR}	Drain - Gate Voltage (R_{GS} = 20 kΩ) ①	-200	-150	-200	-150	V
I_D @ T_C = 25°C	Continuous Drain Current	-3.5	-3.5	-3.0	-3.0	A
I_D @ T_C = 100°C	Continuous Drain Current	-2.0	-2.0	-1.5	-1.5	A
I_{DM}	Pulsed Drain Current ③	-14	-14	-12	-12	A
V_{GS}	Gate - Source Voltage	± 20				V
P_D @ T_C = 25°C	Max. Power Dissipation	40 (See Fig. 14)				W
	Linear Derating Factor	0.32 (See Fig. 14)				W/K④
I_{LM}	Inductive Current, Clamped (See Fig. 15 and 16) L = 100μH	-14	-14	-12	-12	A
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to 150				°C
	Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)				°C

Electrical Characteristics @T_C = 25°C (Unless Otherwise Specified)

	Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS}	Drain - Source Breakdown Voltage	IRF9620 IRF9622	-200	–	–	V	V_{GS} = 0V
		IRF9621 IRF9623	-150	–	–	V	I_D = -250μA
$V_{GS(th)}$	Gate Threshold Voltage	ALL	-2.0	–	-4.0	V	V_{DS} = V_{GS}, I_D = -250μA
I_{GSS}	Gate-Source Leakage Forward	ALL	–	–	-500	nA	V_{GS} = -20V
I_{GSS}	Gate-Source Leakage Reverse	ALL	–	–	500	nA	V_{GS} = 20V
I_{DSS}	Zero Gate Voltage Drain Current	ALL	–	–	-250	μA	V_{DS} = Max. Rating, V_{GS} = 0V
			–	–	-1000	μA	V_{DS} = Max. Rating x 0.8, V_{GS} = 0V, T_C = 125°C
$I_{D(on)}$	On-State Drain Current ②	IRF9620 IRF9621	-3.5	–	–	A	V_{DS} > $I_{D(on)}$ x $R_{DS(on)}$ max., V_{GS} = -10V
		IRF9622 IRF9623	-3.0	–	–	A	
$R_{DS(on)}$	Static Drain-Source On-State Resistance ②	IRF9620 IRF9621	–	1.0	1.5	Ω	V_{GS} = -10V, I_D = -1.5A
		IRF9622 IRF9623	–	1.5	2.4	Ω	
g_{fs}	Forward Transconductance ②	ALL	1.0	1.8	–	S (℧)	V_{DS} > $I_{D(on)}$ x $R_{DS(on)}$ max., I_D = -1.5A
C_{iss}	Input Capacitance	ALL	–	350	400	pF	V_{GS} = 0V, V_{DS} = -25V, f = 1.0 MHz See Fig. 10
C_{oss}	Output Capacitance	ALL	–	100	125	pF	
C_{rss}	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 = 1.5A, Z_o = 50Ω 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} = -15V, I_D = -4.0A, V_{DS} = 0.8 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.
			–	4.5	–	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die.
L_S	Internal Source Inductance	ALL	–	7.5	–	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.

Modified MOSFET symbol showing the internal device inductances.



Thermal Resistance

	Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
R_{thJC}	Junction-to-Case	ALL	–	–	3.12	K/W④	
R_{thCS}	Case-to-Sink	ALL	–	1.0	–	K/W④	Mounting surface flat, smooth, and greased.
R_{thJA}	Junction-to-Ambient	ALL	–	–	80	K/W④	Typical socket mount

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Source-Drain Diode Ratings and Characteristics

I_S	Continuous Source Current (Body Diode)	IRF9620 IRF9621	–	–	-3.5	A	Modified MOSFET symbol showing the integral reverse P-N junction rectifier. 
		IRF9622 IRF9623	–	–	-3.0	A	
I_{SM}	Pulse Source Current (Body Diode) ③	IRF9620 IRF9621	–	–	-14	A	
		IRF9622 IRF9623	–	–	-12	A	
V_{SD}	Diode Forward Voltage ②	IRF9620 IRF9621	–	–	-7.0	V	T_C = 25°C, I_S = -3.5A, V_{GS} = 0V
		IRF9622 IRF9623	–	–	-6.8	V	T_C = 25°C, I_S = -3.0A, V_{GS} = 0V
t_{rr}	Reverse Recovery Time	ALL	–	300	–	ns	T_J = 150°C, I_F = -3.5A, dI_F/dt = 100 A/μs
Q_{RR}	Reverse Recovered Charge	ALL	–	1.9	–	μC	T_J = 150°C, I_F = -3.5A, dI_F/dt = 100 A/μs
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°C to 150°C. ② Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%. ③ Repetitive Rating: Pulse width limited by max. junction temperature. See Transient Thermal Impedance Curve (Fig. 5).

④ K/W = °C/W
W/K = W/°C

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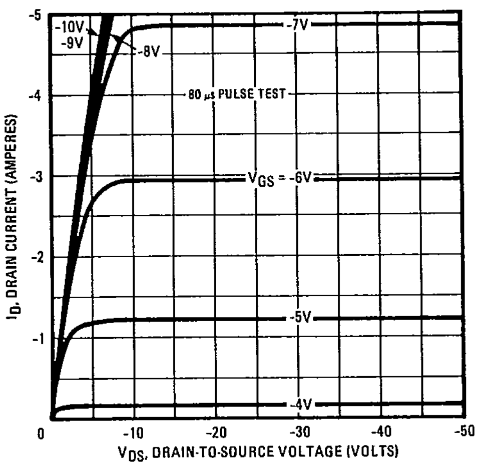

Fig. 1 – Typical Output Characteristics

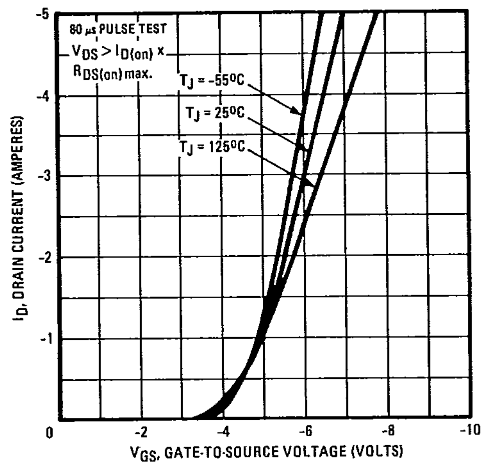

Fig. 2 – Typical Transfer Characteristics

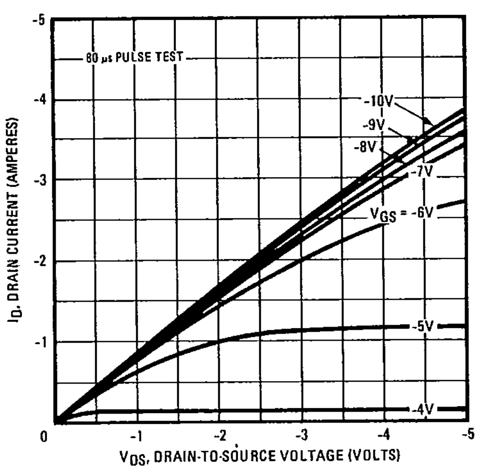

Fig. 3 – Typical Saturation Characteristics

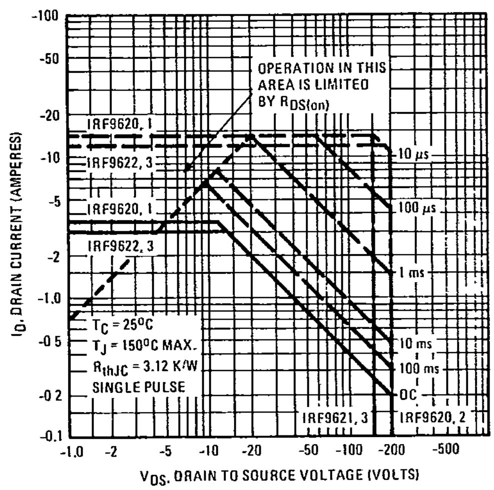

Fig. 4 – Maximum Safe Operating Area

IRF9620, IRF9621, IRF9622, IRF9623 Devices

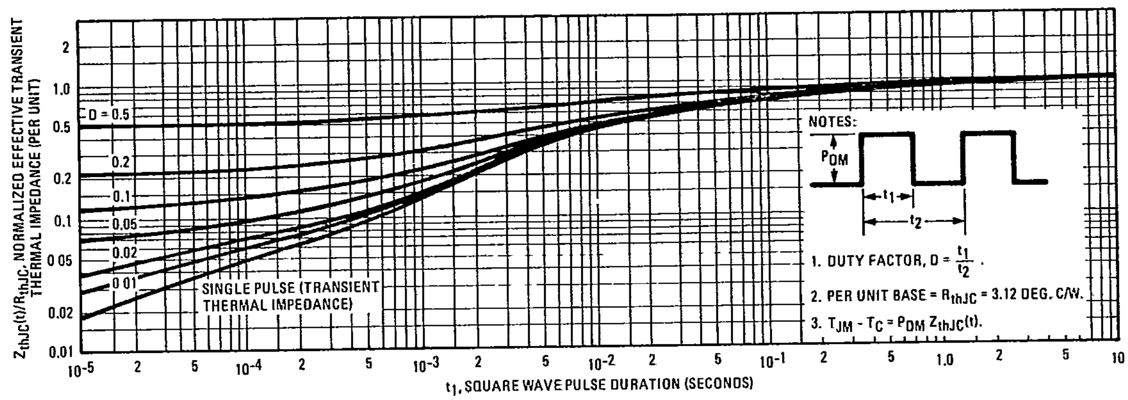

Fig. 5 – Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

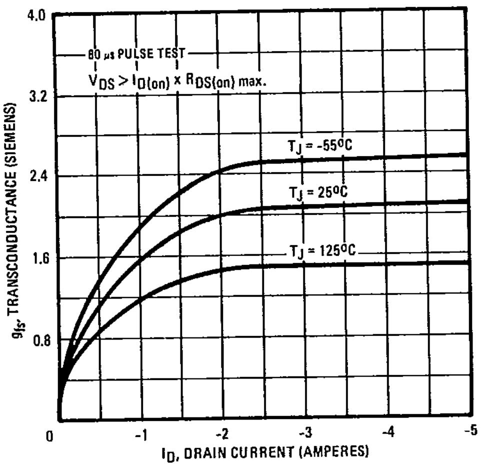

Fig. 6 – Typical Transconductance Vs. Drain Current

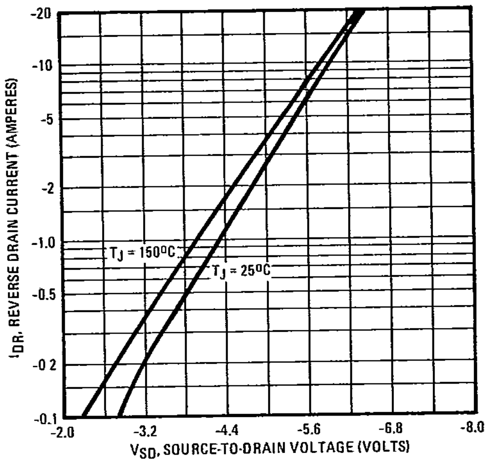

Fig. 7 – Typical Source-Drain Diode Forward Voltage

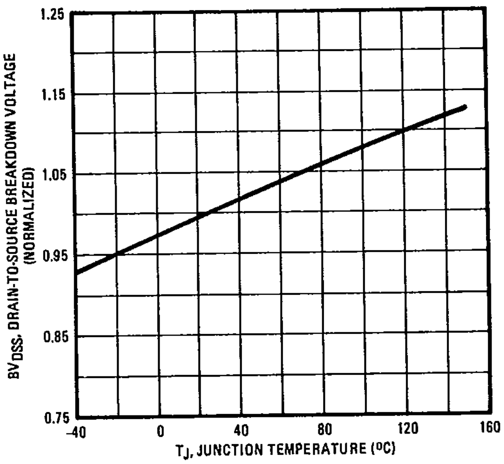

Fig. 8 – Breakdown Voltage Vs. Temperature

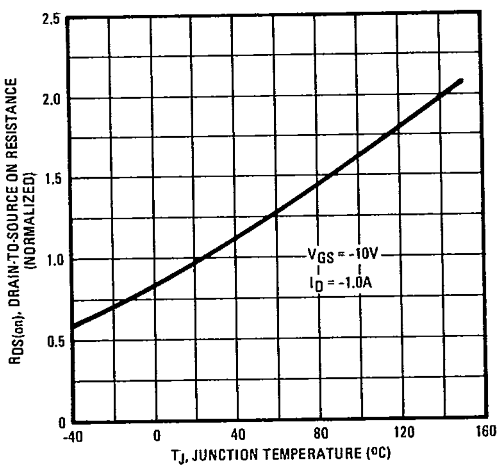

Fig. 9 – Normalized On-Resistance Vs. Temperature

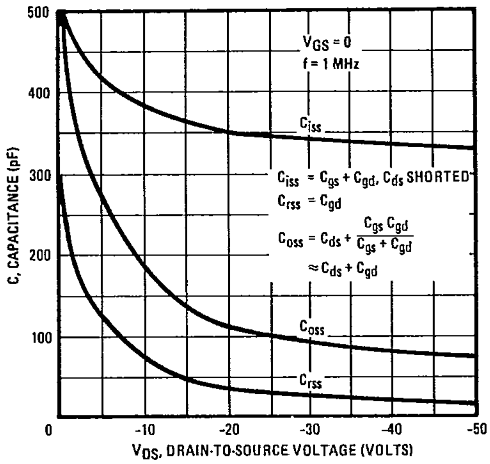

Fig. 10 – Typical Capacitance Vs. Drain-to-Source Voltage

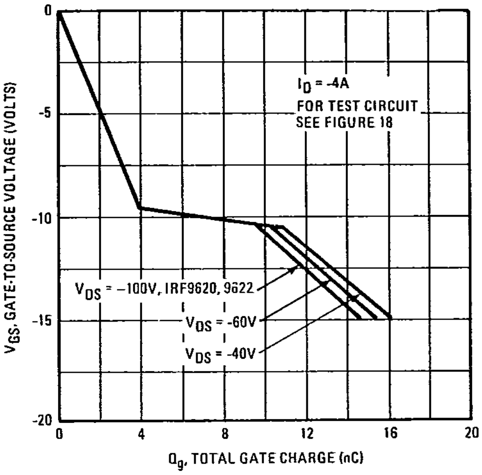

Fig. 11 – Typical Gate Charge Vs. Gate-to-Source Voltage

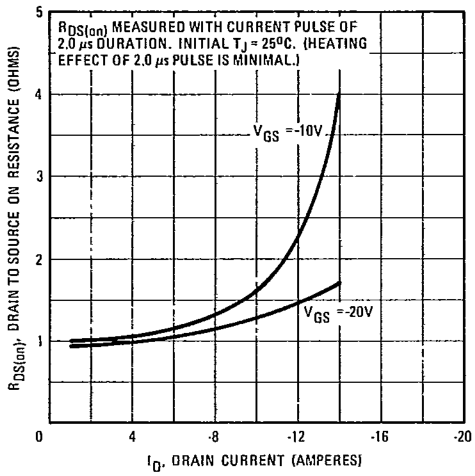

Fig. 12 – Typical On-Resistance Vs. Drain Current

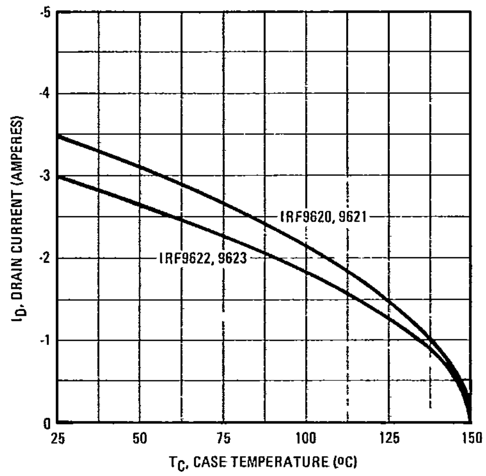

Fig. 13 – Maximum Drain Current Vs. Case Temperature

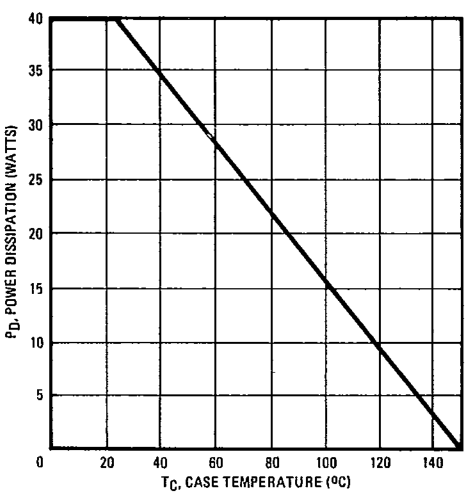

Fig. 14 – Power Vs. Temperature Derating Curve

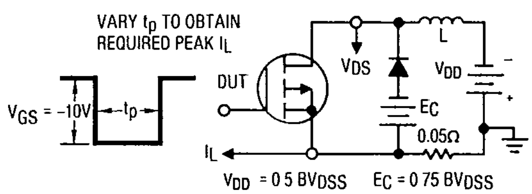

Fig. 15 — Clamped Inductive Test Circuit

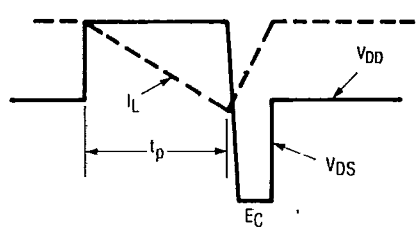

Fig. 16 — Clamped Inductive Waveforms

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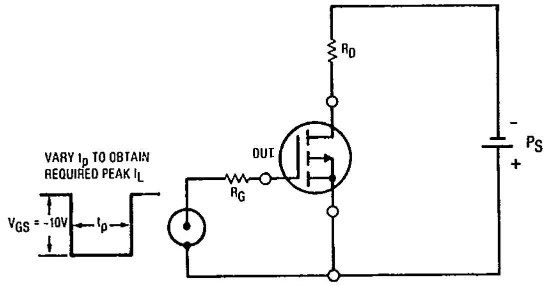


Fig. 17 – Switching Time Test Circuit

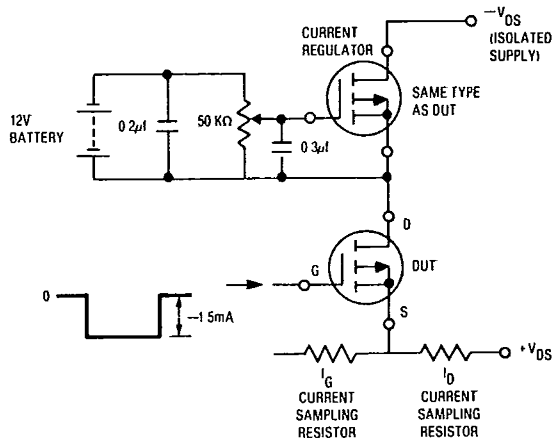
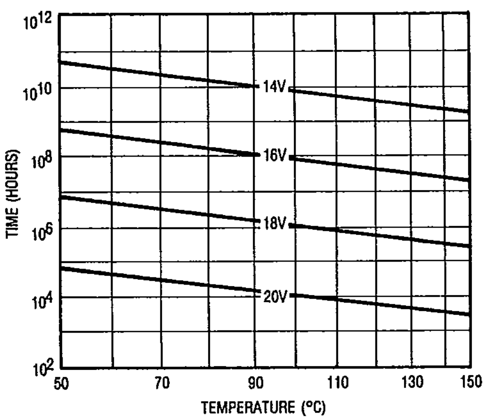
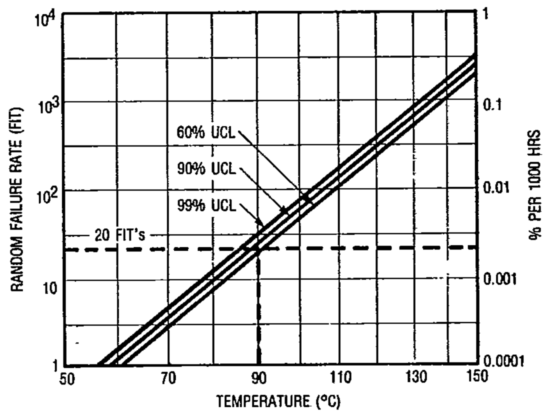


Fig. 18 – Gate Charge Test Circuit



* 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.