Data Sheet No. PD-9.510A
T-39-13

INTERNATIONAL RECTIFIER

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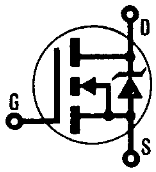
AVALANCHE AND dv/dt RATED

175°C OPERATING TEMPERATURE

HEXFET® TRANSISTORS

IRFZ44
IRFZ45



N-CHANNEL

TO-220

60 Volt, 0.028 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 this latest "State of the Art" design achieves: very low on-state resistance combined with high transconductance; superior reverse energy and diode recovery dv/dt capability.

The HEXFET transistors also feature all of the well established advantages of MOSFETs such as voltage control, very fast switching, ease of paralleling and temperature stability of the electrical parameters.

They are well suited for applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high energy pulse circuits.

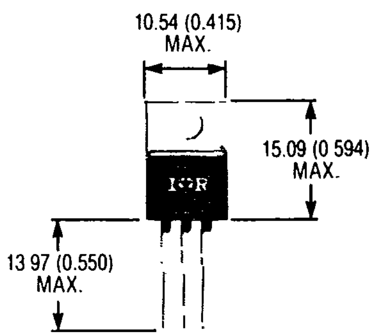
Product Summary

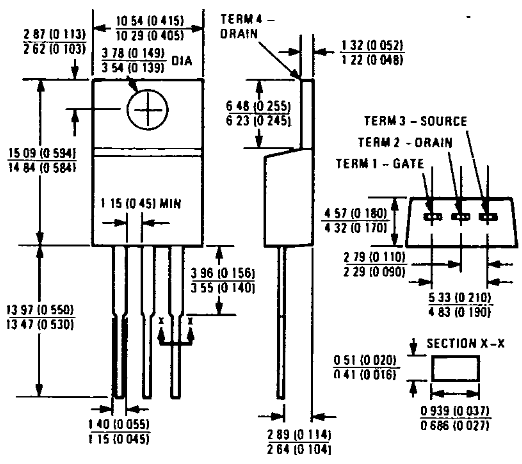
Part Number	BV_{DSS}	$R_{DS(on)}$	I_D
IRFZ44	60V	0.028Ω	35A*
IRFZ45	60V	0.035Ω	35A*

FEATURES:

- Avalanche Rated
- Dynamic dv/dt Rating
- Simple Drive Requirements
- Ease of Paralleling

CASE STYLE AND DIMENSIONS





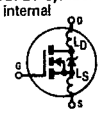
Case Style TO-220AB
Dimensions in Millimeters and (Inches)

*I_D Current limited by pin diameter

Absolute Maximum Ratings

Parameter		IRFZ44	IRFZ45	Units
I_D @ T_C = 25°C	Continuous Drain Current ⑥	35	35	A
I_D @ T_C = 100°C	Continuous Drain Current ⑥	35	33	A
I_{DM}	Pulsed Drain Current ①	210	190	A
P_D @ T_C = 25°C	Max. Power Dissipation	150		W
	Linear Derating Factor	1.0		W/K ⑤
V_{GS}	Gate-to-Source Voltage	±20		V
E_{AS}	Single Pulse Avalanche Energy ②	53 (See Fig. 14)		mJ
dv/dt	Peak Diode Recovery dv/dt ③	4.5 (See Fig. 17)		V/ns
T_J T_{STG}	Operating Junction Storage Temperature Range	−55 to 175		°C
	Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)		°C

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

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions	
BV_{DSS}	Drain-to-Source Breakdown Voltage	IRFZ44 IRFZ45	60	—	—	V	V_{GS} = 0V, I_D = 250 μA	
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance ④	IRFZ44	—	0.021	0.028	Ω	V_{GS} = 10V, I_D = 33A	
		IRFZ45	—	0.028	0.035			
$I_{D(on)}$	On-State Drain Current ④⑥	IRFZ44	35	—	—	A	V_{DS} > $I_{D(on)}$ x $R_{DS(on)}$ Max. V_{GS} = 10V	
		IRFZ45	35					
$V_{GS(th)}$	Gate Threshold Voltage	ALL	2.0	—	4.0	V	V_{DS} = V_{GS}, I_D = 250 μA	
g_{fs}	Forward Transconductance ④	ALL	15	23	—	S (℧)	V_{DS} ≥ 50V, I_{DS} = 33A	
I_{DSS}	Zero Gate Voltage Drain Current	ALL	—	—	250	μA	V_{DS} = Max. Rating, V_{GS} = 0V	
			—	—	1000		V_{DS} = 0.8 x Max. Rating V_{GS} = 0V, T_J = 150°C	
I_{GSS}	Gate-to-Source Leakage Forward	ALL	—	—	500	nA	V_{GS} = 20V	
I_{GSS}	Gate-to-Source Leakage Reverse	ALL	—	—	−500	nA	V_{GS} = −20V	
Q_g	Total Gate Charge	ALL	—	69	100	nC	V_{GS} = 10V, I_D = 52A V_{DS} = 0.5 x Max. Rating See Fig. 16 (Independent of operating temperature)	
Q_{gs}	Gate-to-Source Charge	ALL	—	14	21	nC		
Q_{gd}	Gate-to-Drain ("Miller") Charge		—	39	58	nC		
$t_{d(on)}$	Turn-On Delay Time	ALL	—	21	32	ns	V_{DD} = 30V, I_D ≈ 52A, R_G = 9.1Ω R_D = 0.56Ω See Fig. 15 (Independent of operating temperature)	
t_r	Rise Time	ALL	—	140	210	ns		
$t_{d(off)}$	Turn-Off Delay Time	ALL	—	50	75	ns		
t_f	Fall Time	ALL	—	88	130	ns		
L_D	Internal Drain Inductance	ALL	—	4.5	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die	Modified MOSFET symbol showing the internal inductances 
L_S	Internal Source Inductance	ALL	—	7.5	—	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad	
C_{iss}	Input Capacitance	ALL	—	2500	—	pF	V_{GS} = 0V, V_{DS} = 25V f = 1.0 MHz See Fig. 10	
C_{oss}	Output Capacitance	ALL	—	1200	—	pF		
C_{rss}	Reverse Transfer Capacitance	ALL	—	310	—	pF		

IRFZ44, IRFZ45 Devices

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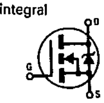
Source-Drain Diode Ratings and Characteristics

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	ALL	–	–	35	A	Modified MOSFET symbol showing the integral Reverse p-n junction rectifier 
I_{SM}	Pulsed Source Current (Body Diode) ①	ALL	–	–	210	A	
V_{SD}	Diode Forward Voltage ④	ALL	–	–	2.5	V	T_J = 25°C, I_S = 52A, V_{GS} = 0V
t_{rr}	Reverse Recovery Time	ALL	54	110	250	ns	T_J = 25°C, I_F = 52A, di/dt = 100 A/μs
Q_{RR}	Reverse Recovery Charge	ALL	0.23	0.53	1.20	μC	
t_{on}	Forward Turn-On Time	ALL	Intrinsic turn on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$				

Thermal Resistance

R_{thJC}	Junction-to-Case	ALL	–	–	1.0	K/W ⑤	
R_{thCS}	Case-to-Sink	ALL	–	0.50	–	K/W ⑤	Mounting surface flat, smooth, and greased
R_{thJA}	Junction-to-Ambient	ALL	–	–	80	K/W ⑤	Typical socket mount

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① Repetitive Rating; Pulse width limited by maximum junction temperature (see figure 5) Refer to current HEXFET reliability report

② @ V_{DD} = 25V, Starting T_J = 25°C, L = 50 μH, R_G = 25Ω, Peak I_L = 35A

③ $I_{SD} \leq$ 30A di/dt ≤ 250A/μs, $V_{DD} \leq$ 50V, $T_J \leq$ 175°C Suggested R_G = 9.1Ω

④ Pulse width ≤ 300 μs; Duty Cycle ≤ 2%

⑤ K/W = °C/W W/K = W/°C

⑥ I_D current limited by pin diameter

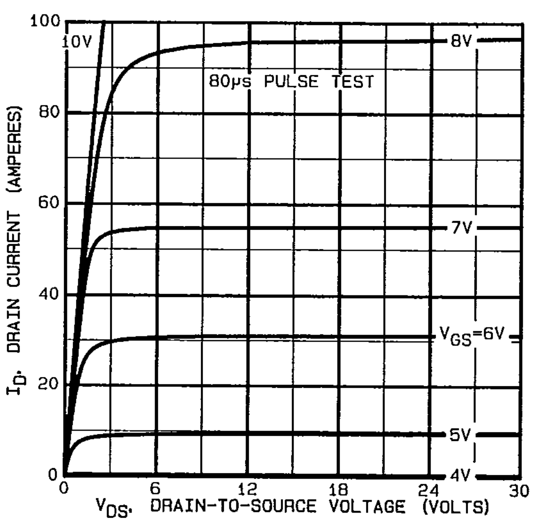

Fig. 1 — Typical Output Characteristics

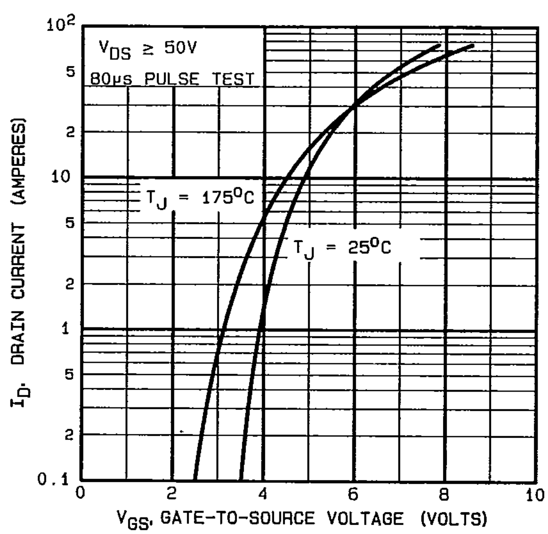

Fig. 2 — Typical Transfer Characteristics

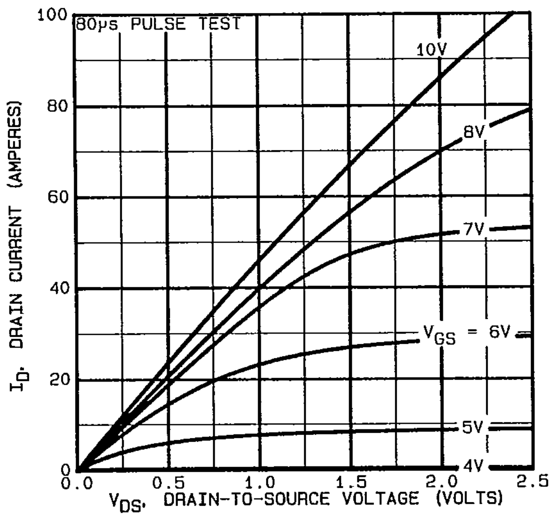

Fig. 3 — Typical Saturation Characteristics

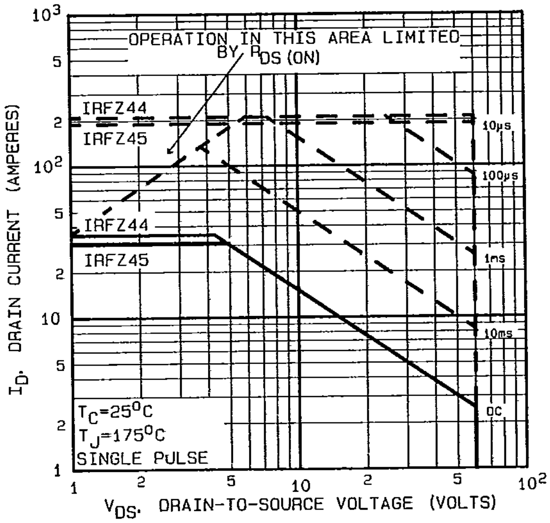

Fig. 4 — Maximum Safe Operating Area

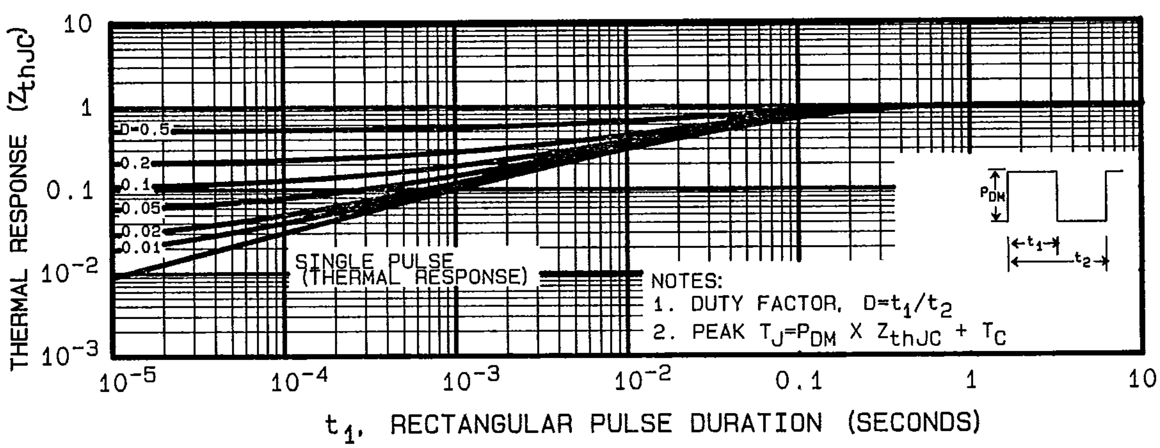

Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

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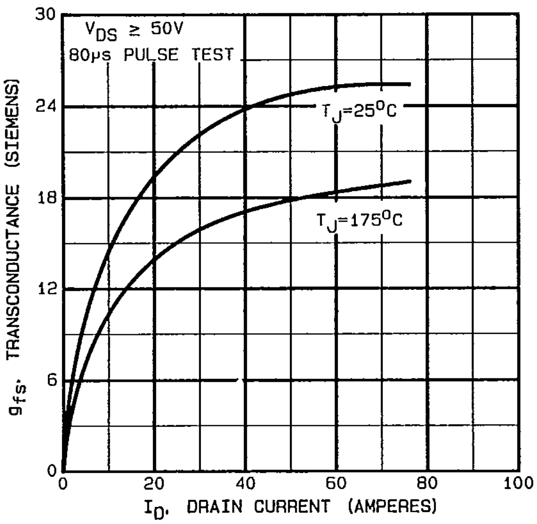

Fig. 6 — Typical Transconductance Vs. Drain Current

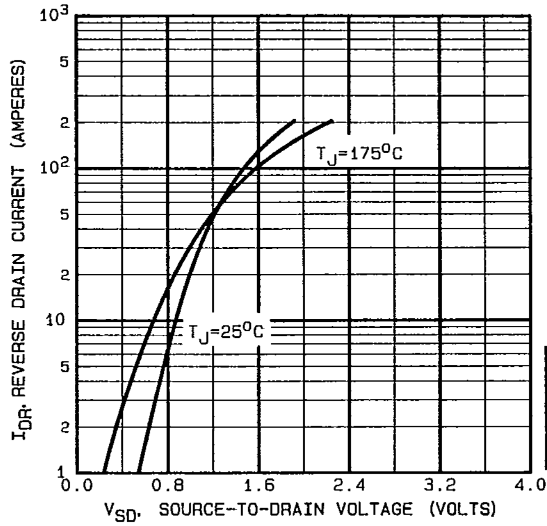

Fig. 7 — Typical Source-Drain Diode Forward Voltage

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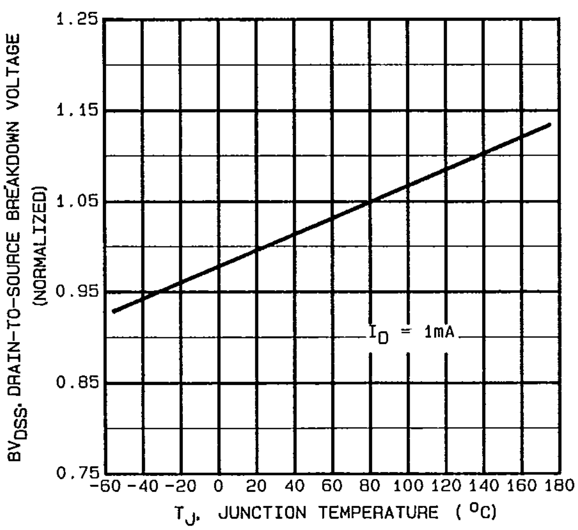

Fig. 8 — Breakdown Voltage Vs. Temperature

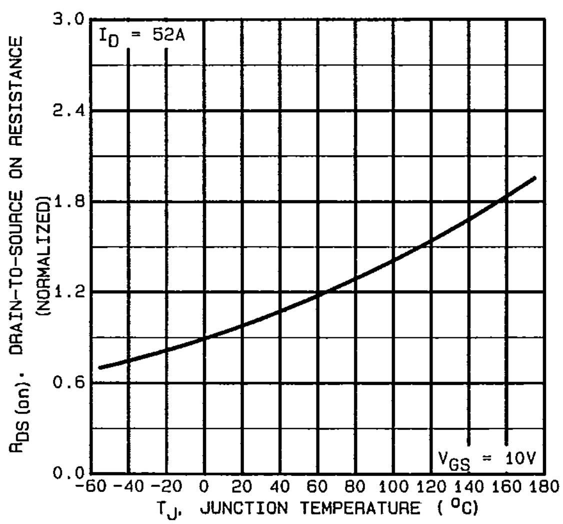

Fig 9 — Normalized On-Resistance Vs. Temperature

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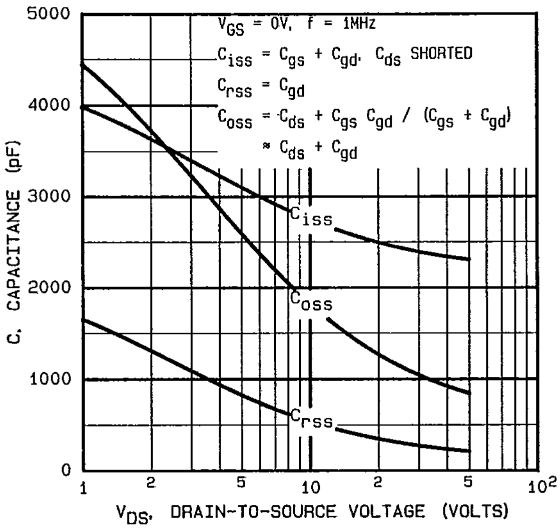

Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

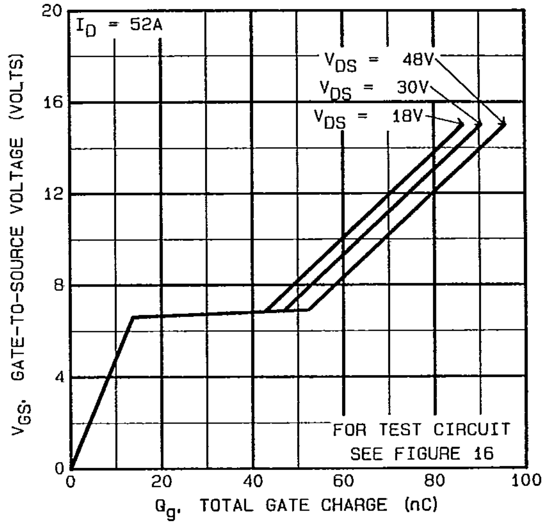

Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

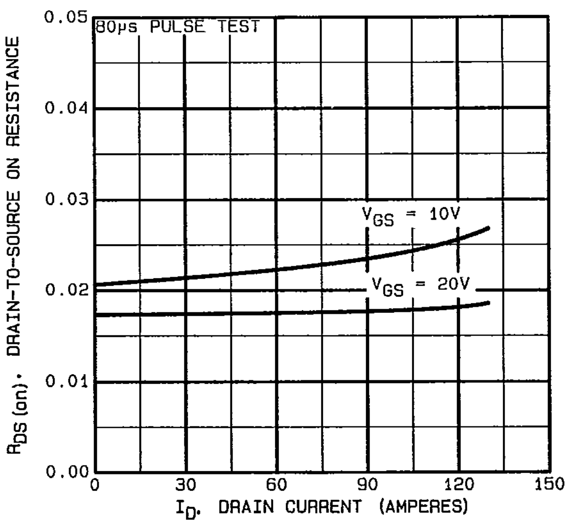

Fig. 12 — Typical On-Resistance Vs. Drain Current

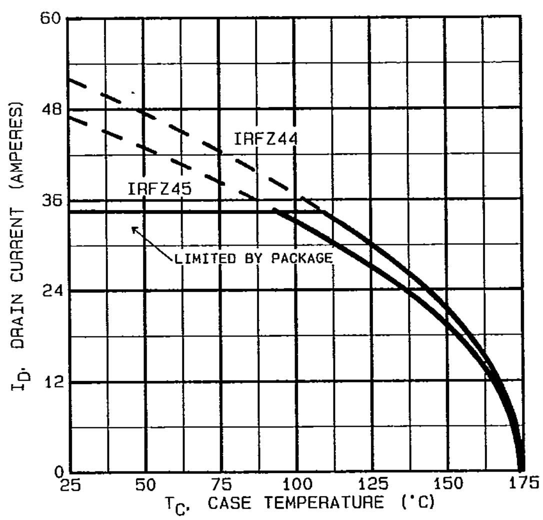

Fig. 13 — Maximum Drain Current Vs. Case Temperature

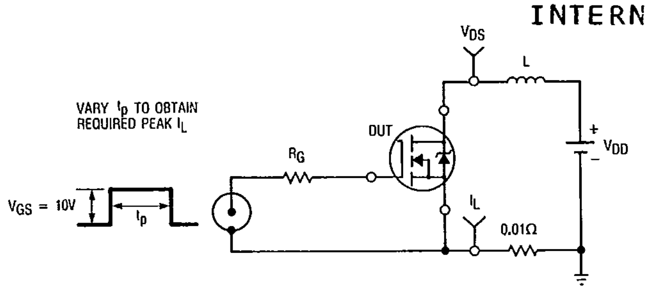

Fig. 14a — Unclamped Inductive Test Circuit

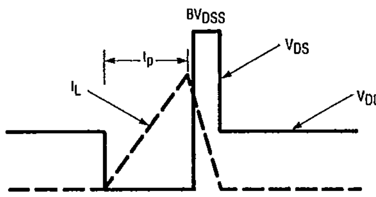

Fig. 14b — Unclamped Inductive Waveforms

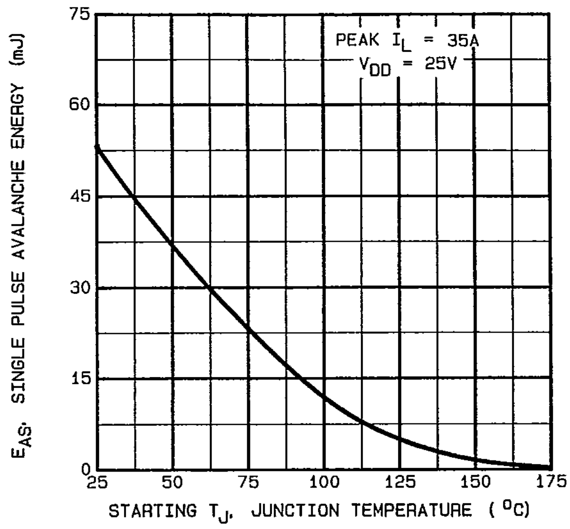

Fig. 14c — Maximum Avalanche Energy Vs. Starting Junction Temperature

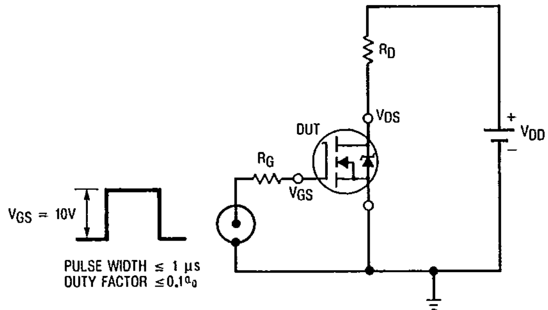

Fig. 15a — Switching Time Test Circuit

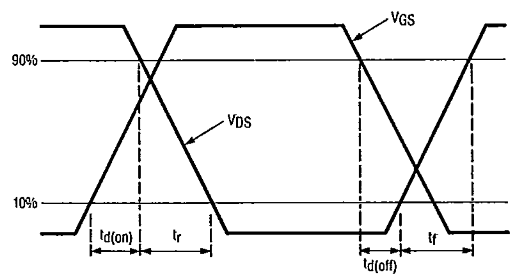

Fig. 15b — Switching Time Waveforms

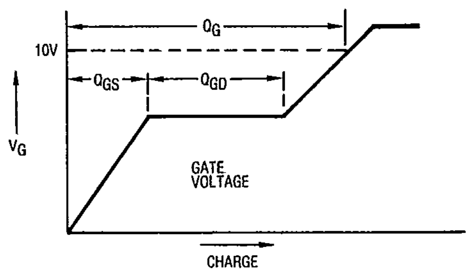

Fig. 16a — Basic Gate Charge Waveform

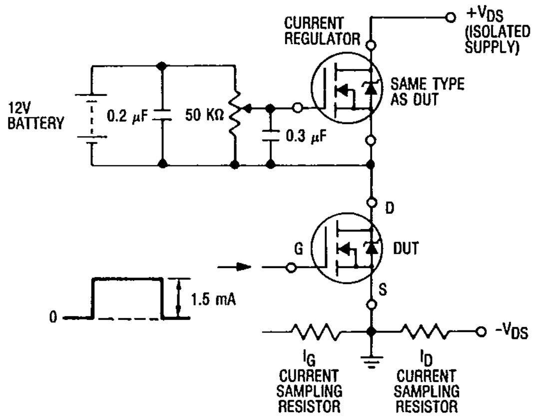

Fig. 16b — Gate Charge Test Circuit

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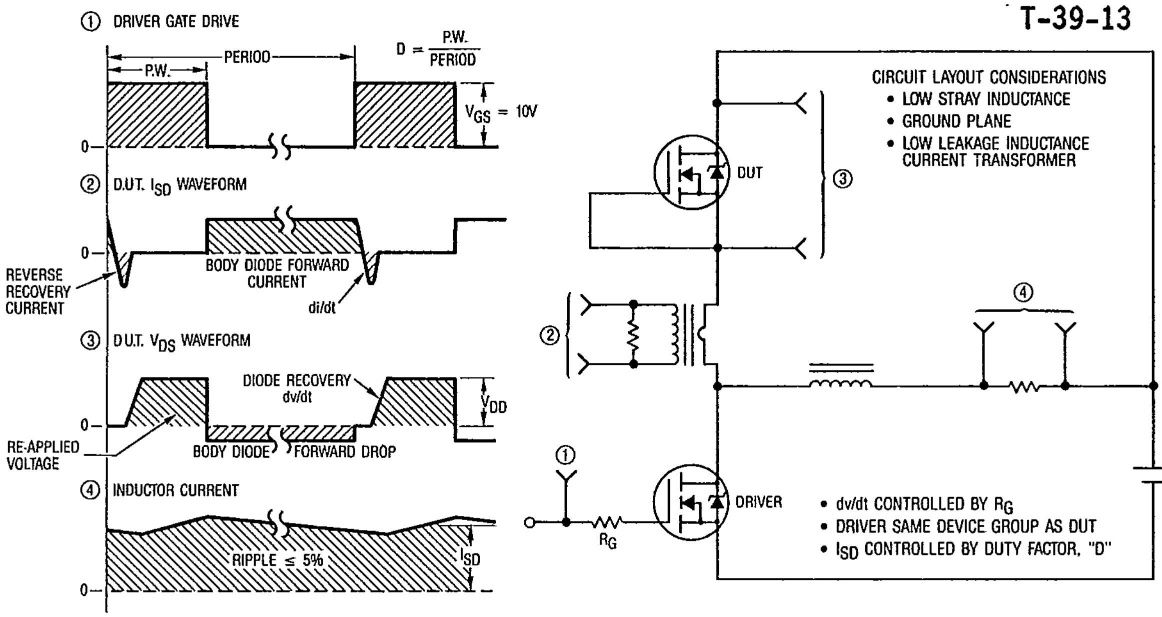

Fig. 17 — Peak Diode Recovery dv/dt Test Circuit

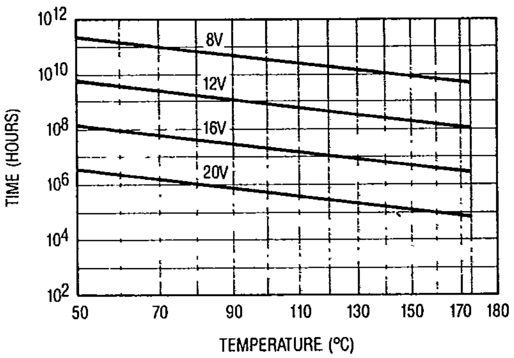

***Fig. 18 — Typical Time to Accumulated 1% Gate Failure**

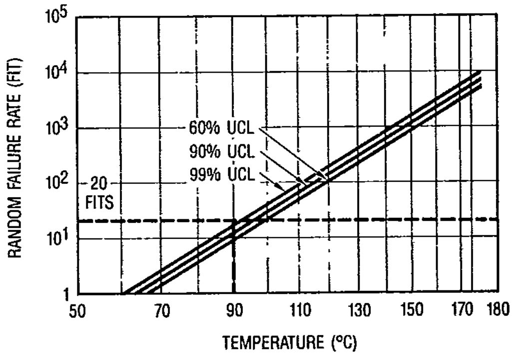

***Fig. 19 — Typical High Temperature Reverse Bias (HTRB) Failure Rate**

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