Data Sheet No. PD-9.511A

T-39-13

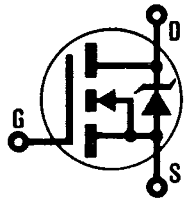
INTERNATIONAL RECTIFIER IOR

REPETITIVE AVALANCHE AND dv/dt RATED

HEXFET® TRANSISTORS

IRFPC40
IRFPC42

N-CHANNEL POWER MOSFETs TO-247AC PACKAGE



TO-3P

600 Volt, 1.2 Ohm HEXFET TO-247AC (TO-3P) 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.

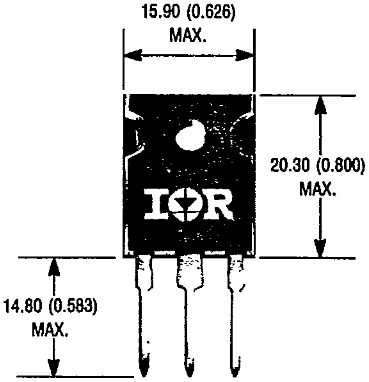
Product Summary

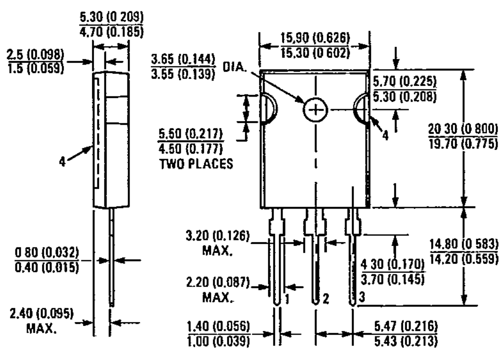
Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRFPC40	600V	1.2Ω	6.8A
IRFPC42	600V	1.6Ω	5.9A

Features:

- Isolated Central Mounting Hole
- Repetitive Avalanche Ratings
- Dynamic dv/dt Rating
- Simple Drive Requirements
- Ease of Paralleling

CASE STYLE AND DIMENSIONS





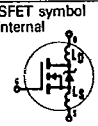
TERM 1 – GATE
TERM 2 – DRAIN
TERM 3 – SOURCE
TERM 4 – DRAIN

Conforms to JEDEC Outline TO-247AC (TO-3P)
Dimensions in Millimeters and (Inches)

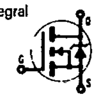
Absolute Maximum Ratings

	Parameter	IRFPC40	IRFPC42	Units
I_D @ T_C = 25°C	Continuous Drain Current	6.8	5.9	A
I_D @ T_C = 100°C	Continuous Drain Current	4.3	3.7	A
I_{DM}	Pulsed Drain Current ①	27	24	A
P_D @ T_C = 25°C	Max. Power Dissipation	150		W
	Linear Derating Factor	1.2		W/K ⑤
V_{GS}	Gate-to-Source Voltage	±20		V
E_{AS}	Single Pulse Avalanche Energy ②	410 (See Fig. 14)		mJ
I_{AR}	Avalanche Current ① (Repetitive or Non-Repetitive)	6.8 (See E_{AR})		A
E_{AR}	Repetitive Avalanche Energy ①	15 (See I_{AR})		mJ
dv/dt	Peak Diode Recovery dv/dt ③	3.0 (See Fig. 17)		V/ns
T_J T_{STG}	Operating Junction Storage Temperature Range	−55 to 150		°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	ALL	600	–	–	V	V_{GS} = 0V, I_D = 250 μA
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance ④	IRFPC40	–	0.97	1.2	Ω	V_{GS} = 10V, I_D = 3.7A
		IRFPC42	–	1.2	1.6		
$I_{D(on)}$	On-State Drain Current ④	IRFPC40	6.8	–	–	A	$V_{DS} > I_{D(on)} \times R_{DS(on)}$ Max. V_{GS} = 10V
		IRFPC42	5.9				
$V_{GS(th)}$	Gate Threshold Voltage	ALL	2.0	–	4.0	V	$V_{DS} = V_{GS}$, I_D = 250 μA
g_{fs}	Forward Transconductance ④	ALL	4.9	7.3	–	S (℧)	$V_{DS} \geq$ 100V, I_{DS} = 3.7A
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 = 125°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	–	40	60	nC	V_{GS} = 10V, I_D = 6.2A V_{DS} = 0.6 x Max. Rating See Fig. 16 (Independent of operating temperature)
Q_{gs}	Gate-to-Source Charge	ALL	–	5.5	8.3	nC	
Q_{gd}	Gate-to-Drain ("Miller") Charge	ALL	–	20	30	nC	
$t_{d(on)}$	Turn-On Delay Time	ALL	–	13	20	ns	V_{DD} = 200V, I_D ≈ 6.2A, R_G = 9.1Ω R_D = 47Ω See Fig. 15 (Independent of operating temperature)
t_r	Rise Time	ALL	–	18	27	ns	
$t_{d(off)}$	Turn-Off Delay Time	ALL	–	55	83	ns	
t_f	Fall Time	ALL	–	20	30	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	–	1300	–	pF	V_{GS} = 0V, V_{DS} = 25V f = 1.0 MHz See Fig. 10
C_{oss}	Output Capacitance	ALL	–	160	–	pF	
C_{rss}	Reverse Transfer Capacitance	ALL	–	45	–	pF	

Source-Drain Diode Ratings and Characteristics

	Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	ALL	—	—	6.8	A	Modified MOSFET symbol showing the integral Reverse p-n junction rectifier 
I_{SM}	Pulsed Source Current (Body Diode) ①	ALL	—	—	27	A	
V_{SD}	Diode Forward Voltage ④	ALL	—	—	1.5	V	T_J = 25°C, I_S = 6.2A, V_{GS} = 0V
t_{rr}	Reverse Recovery Time	ALL	200	450	940	ns	T_J = 25°C, I_F = 6.2A, di/dt = 100 A/μs
Q_{RR}	Reverse Recovery Charge	ALL	1.8	3.8	7.9	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	—	—	0.83	K/W ⑤	
R_{thCS}	Case-to-Sink	ALL	—	0.24	—	K/W ⑤	Mounting surface flat, smooth, and greased
R_{thJA}	Junction-to-Ambient	ALL	—	—	40	K/W ⑤	Typical socket mount
	Mounting Torque	ALL	—	—	10	in. • lbs.	Standard 6-32 screw

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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} = 50V, Starting T_J = 25°C, L = 16 mH, R_G = 25Ω, Peak I_L = 6.8A

③ $I_{SD} \le$ 6.8A, di/dt $\le$ 80 A/μs, $V_{DD} \le BV_{DSS}$, $T_J \le$ 150°C Suggested R_G = 9.1Ω

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

⑤ K/W = °C/W W/K = W/°C

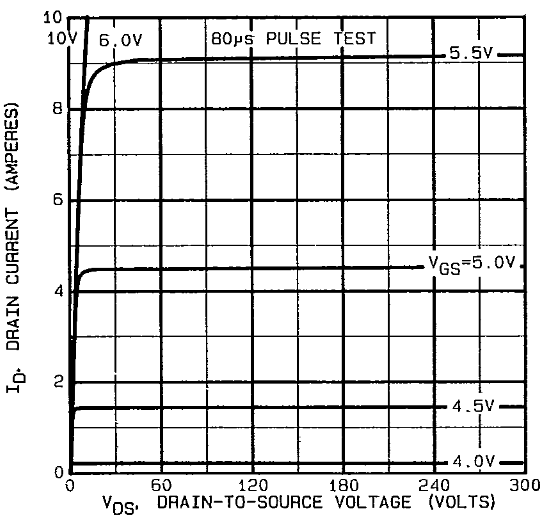

Fig. 1 — Typical Output Characteristics

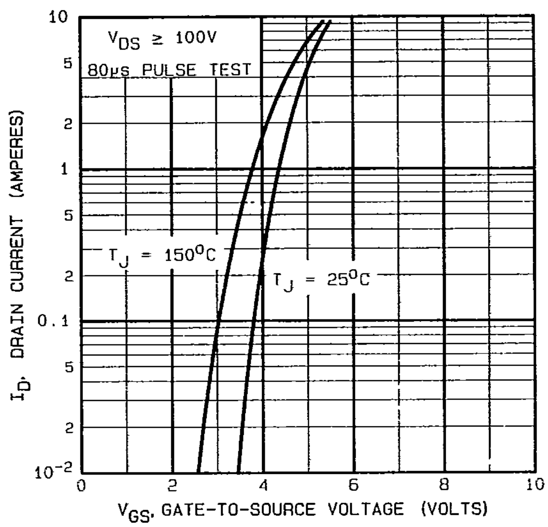

Fig. 2 — Typical Transfer Characteristics

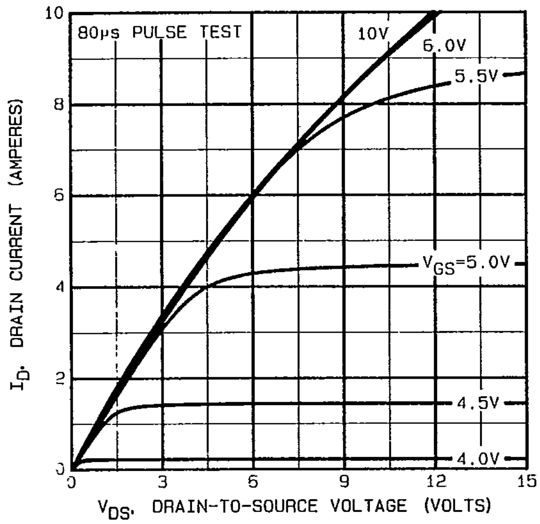

Fig. 3 — Typical Saturation Characteristics

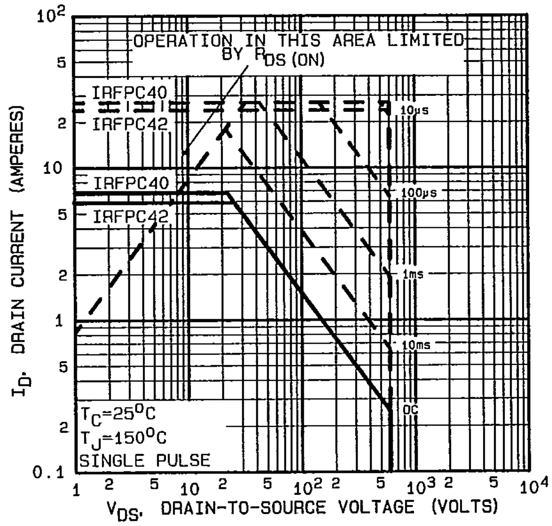

Fig. 4 — Maximum Safe Operating Area

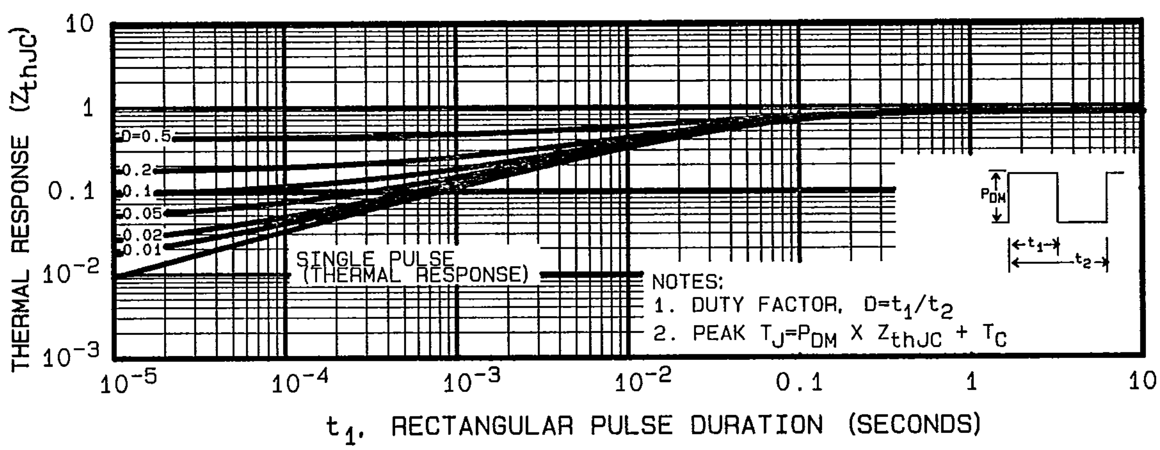

Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

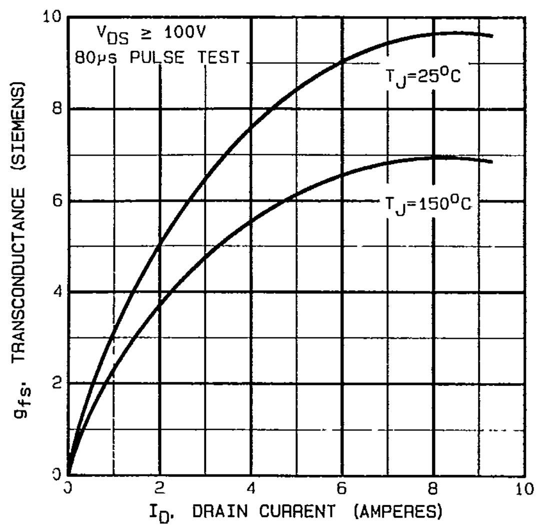

Fig. 6 — Typical Transconductance Vs. Drain Current

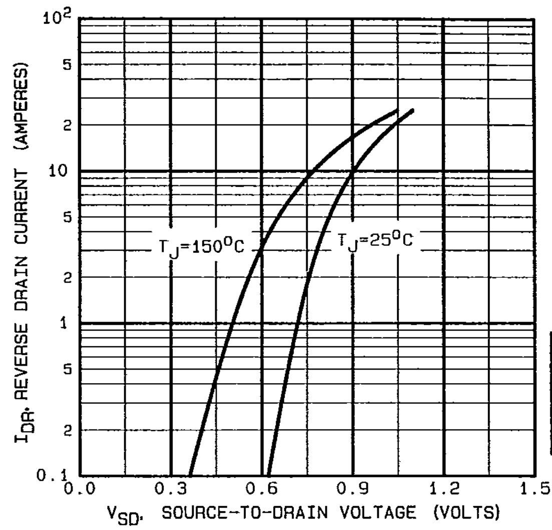

Fig. 7 — Typical Source-Drain Diode Forward Voltage

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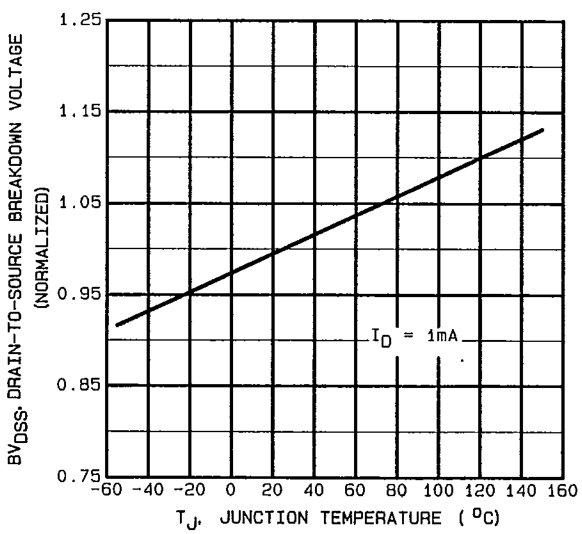

Fig. 8 — Breakdown Voltage Vs. Temperature

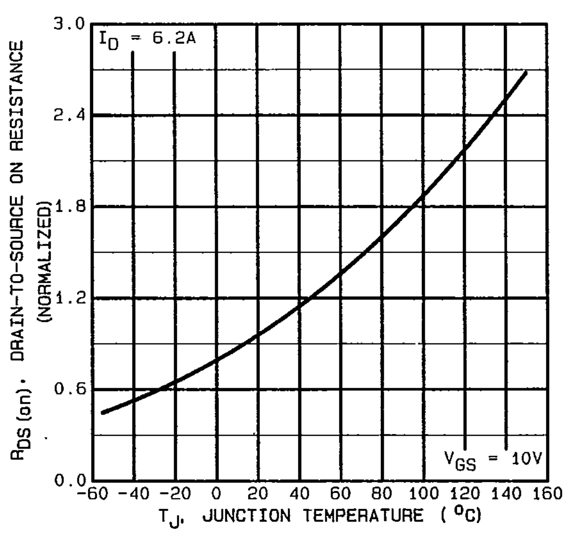

Fig. 9 — Normalized On-Resistance Vs. Temperature

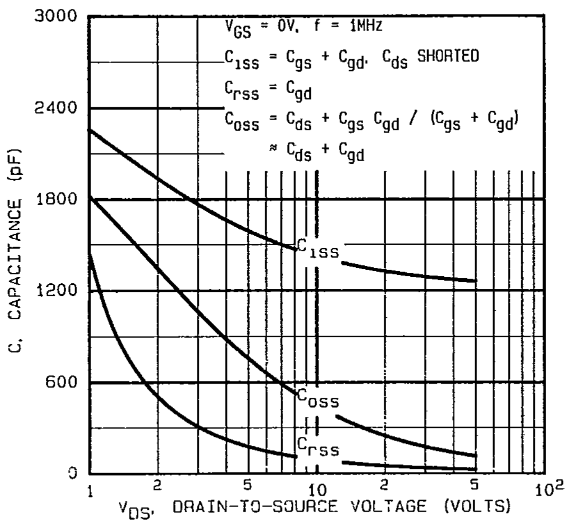

Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

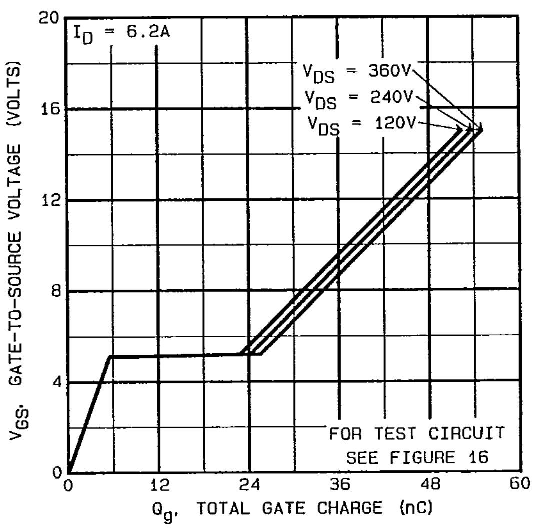

Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

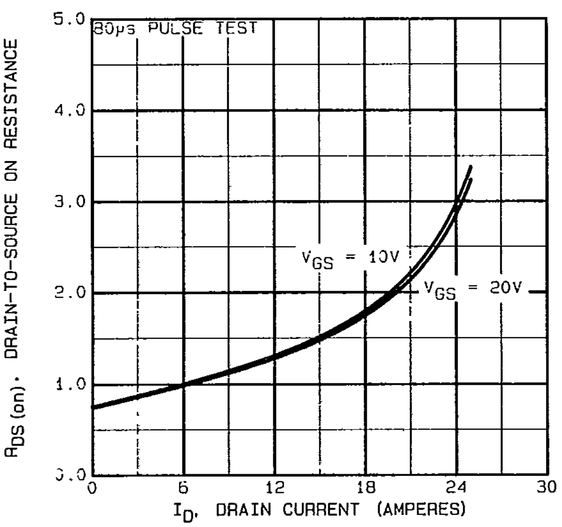

Fig. 12 — Typical On-Resistance Vs. Drain Current

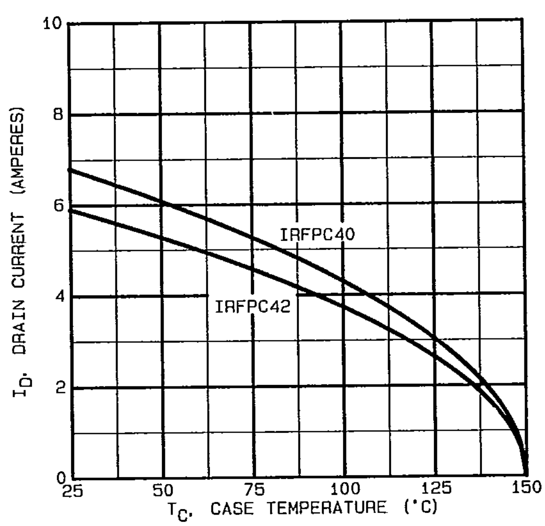

Fig. 13 — Maximum Drain Current Vs. Case Temperature

IRFPC40, IRFPC42 Devices

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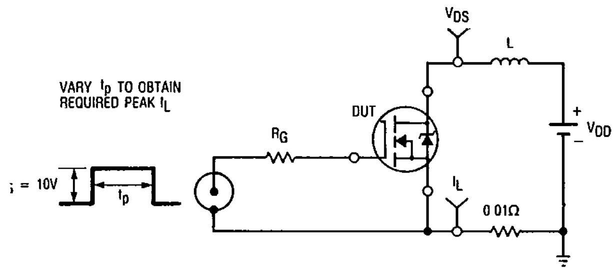

Fig. 14a — Unclamped Inductive Test Circuit

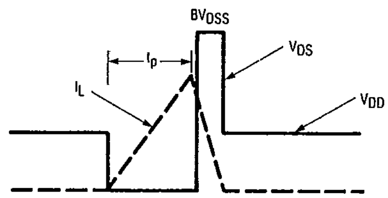

Fig. 14b — Unclamped Inductive Waveforms

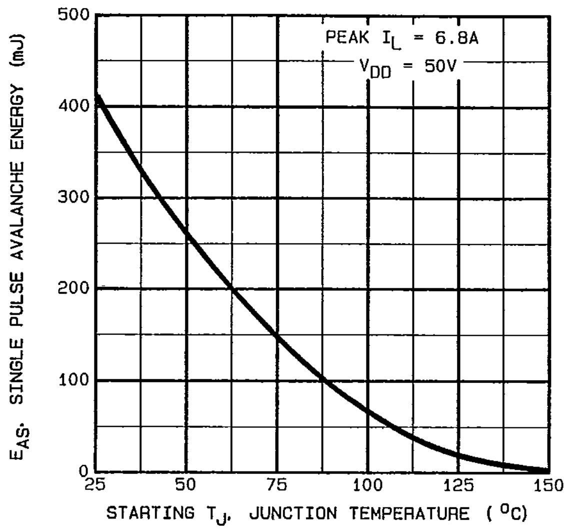

Fig. 14c — Maximum Avalanche Energy Vs. Starting Junction Temperature

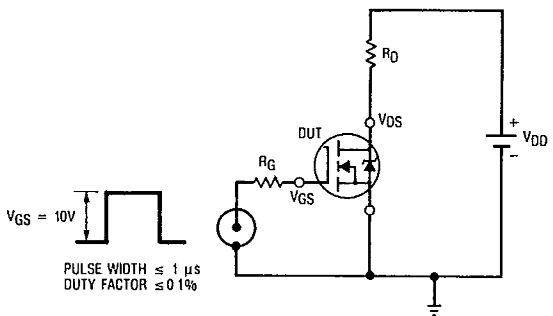

Fig. 15a — Switching Time Test Circuit

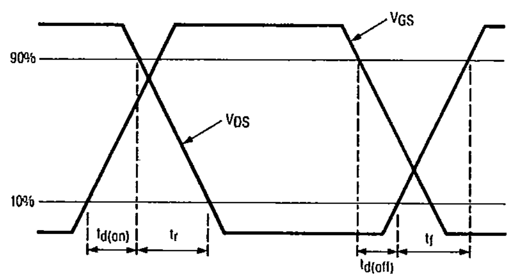

Fig. 15b — Switching Time Waveforms

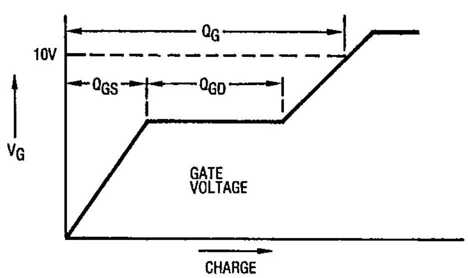

Fig. 16a — Basic Gate Charge Waveform

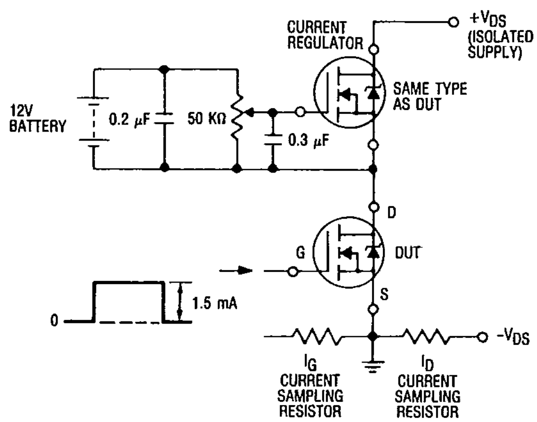

Fig. 16b — Gate Charge Test Circuit

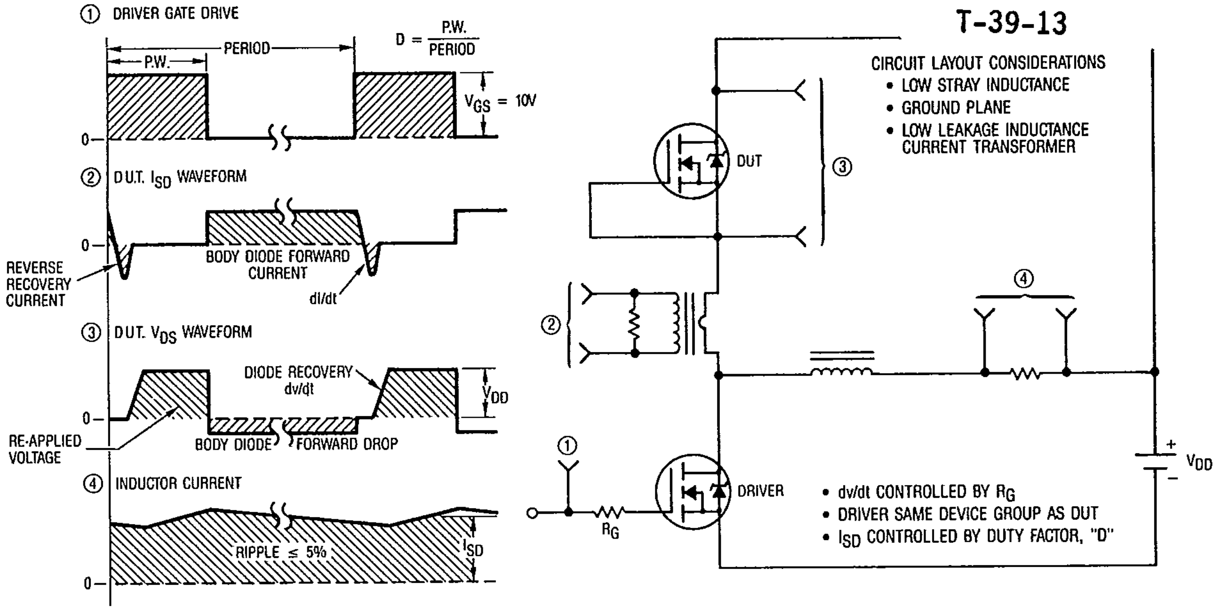

Fig. 17 — Peak Diode Recovery dv/dt Test Circuit