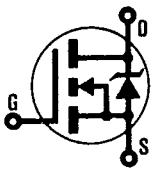
INTERNATIONAL RECTIFIER IOR

T-39-15

REPETITIVE AVALANCHE AND dv/dt RATED*

HEXFET® TRANSISTORS



N-CHANNEL

IRFP140
IRFP141
IRFP142
IRFP143

TO-3P

100 Volt, 0.077 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.

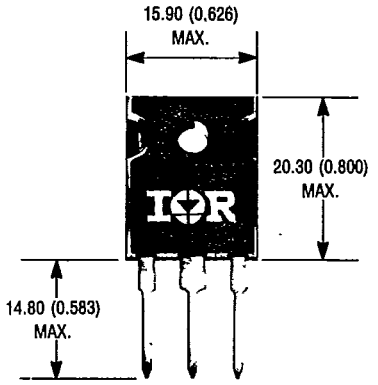
Product Summary

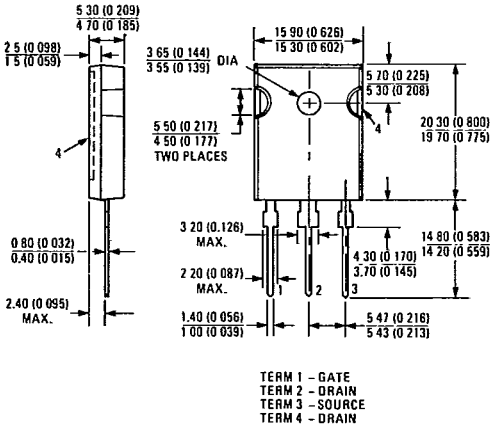
Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRFP140	100V	0.077Ω	31A
IRFP141	80V	0.077Ω	31A
IRFP142	100V	0.099Ω	27A
IRFP143	80V	0.099Ω	27A

FEATURES:

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

CASE STYLE AND DIMENSIONS





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

*This data sheet applies to product with batch codes that begin with a digit, ie. 2 ₹3B

Absolute Maximum Ratings

Parameter		IRFP140, IRFP141	IRFP142, IRFP143	Units
I_D @ T_C = 25°C	Continuous Drain Current	31	27	A
I_D @ T_C = 100°C	Continuous Drain Current	22	19	A
I_{DM}	Pulsed Drain Current ①	120	110	A
P_D @ T_C = 25°C	Max. Power Dissipation	180		W
	Linear Derating Factor	1.2		W/K ⑤
V_{GS}	Gate-to-Source Voltage	±20		V
E_{AS}	Single Pulse Avalanche Energy ②	100 (See Fig. 14)		mJ
I_{AR}	Avalanche Current ① (Repetitive or Non-Repetitive)	31 (See E_{AR})		A
E_{AR}	Repetitive Avalanche Energy ①	18 (See I_{AR})		mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.5 (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	IRFP140 IRFP142	100	—	—	V	V_{GS} = 0V, I_D = 250μA
		IRFP141 IRFP143	80				
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance ④	IRFP140 IRFP141	—	0.055	0.077	Ω	V_{GS} = 10V, I_D = 19A
		IRFP142 IRFP143	—	0.077	0.099		
$I_{D(on)}$	On-State Drain Current ④	IRFP140 IRFP141	31	—	—	A	V_{DS} > $I_{D(on)}$ × $R_{DS(on)}$ Max. V_{GS} = 10V
		IRFP142 IRFP143	27				
$V_{GS(th)}$	Gate Threshold Voltage	ALL	2.0	—	4.0	V	V_{DS} = V_{GS}, I_D = 250μA
g_{fs}	Forward Transconductance ④	ALL	9.3	14	—	S(℧)	V_{DS} ≥ 50V, I_{DS} = 19A
I_{DSS}	Zero Gate Voltage Drain Current	ALL	—	—	250	μA	V_{DS} = Max. Rating, V_{GS} = 0V
			—	—	1000		V_{DS} = 0.8 × 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	—	39	59	nC	V_{GS} = 10V, I_D = 28A V_{DS} = 0.8 × Max. Rating See Fig. 16 (Independent of operating temperature)
Q_{gs}	Gate-to-Source Charge	ALL	—	7.8	12	nC	
Q_{gd}	Gate-to-Drain ("Miller") Charge		—	19	28	nC	
$t_{d(on)}$	Turn-On Delay Time	ALL	—	15	23	ns	V_{DD} = 50V, I_D = 28A, R_G = 9.1Ω R_D = 1.8Ω See Fig. 15 (Independent of operating temperature)
t_r	Rise Time	ALL	—	72	110	ns	
$t_{d(off)}$	Turn-Off Delay Time	ALL	—	40	60	ns	
t_f	Fall Time	ALL	—	50	75	ns	
L_D	Internal Drain Inductance	ALL	—	5.0	—	nH	Measured from the drain lead, 6mm (0.25 in.) from package to center of die.
L_S	Internal Source Inductance	ALL	—	13	—	nH	Measured from the source lead, 6mm (0.25 in.) from package to source bonding pad.
C_{iss}	Input Capacitance	ALL	—	1500	—	pF	V_{GS} = 0V, V_{DS} = 25V f = 1.0 MHz See Fig. 10
C_{oss}	Output Capacitance	ALL	—	500	—	pF	
C_{rss}	Reverse Transfer Capacitance	ALL	—	90	—	pF	

Modified MOSFET symbol showing the internal inductances.

Source-Drain Diode Ratings and Characteristics

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	ALL	–	–	31	A	Modified MOSFET symbol showing the integral Reverse p-n junction rectifier. 
I_{SM}	Pulsed Source Current (Body Diode) ①	ALL	–	–	120	A	
V_{SD}	Diode Forward Voltage ④	ALL	–	–	2.5	V	T_J = 25°C, I_S = 31A, V_{GS} = 0V
t_{rr}	Reverse Recovery Time	ALL	70	150	300	ns	T_J = 25°C, I_F = 28A, di/dt = 100 A/µs
Q_{RR}	Reverse Recovery Charge	ALL	0.44	0.91	1.9	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/W⑤	
R_{thCS}	Case-to-Sink	ALL	–	0.24	–	K/W⑤	Mounting surface flat, smooth, and greased
R_{thJA}	Junction-to-Ambient	ALL	–	–	40	K/W⑤	Typical socket mount
	Mounting Torque	ALL	–	–	10	In. • lbs.	Standard 6-32 screw

TO-3P

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 = 160 µH, R_G = 25Ω, Peak I_L = 31A

③ I_{SD} ≤ 31A, di/dt ≤ 170 A/µs, V_{DD} ≤ BV_{DSS}, T_J ≤ 175°C Suggested R_G = 9.1Ω

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

⑤ K/W = °C/W W/K = W/°C

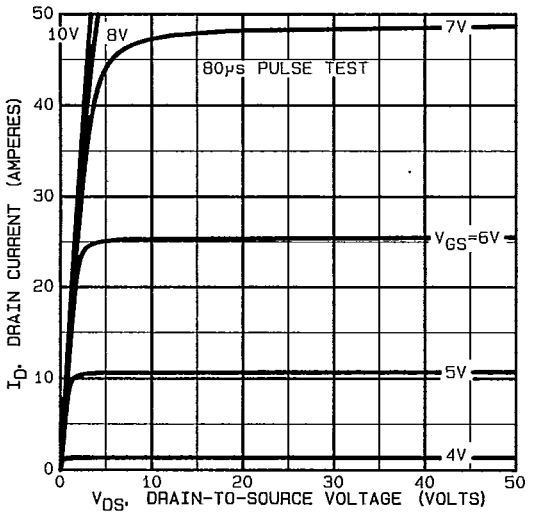


Fig. 1 — Typical Output Characteristics

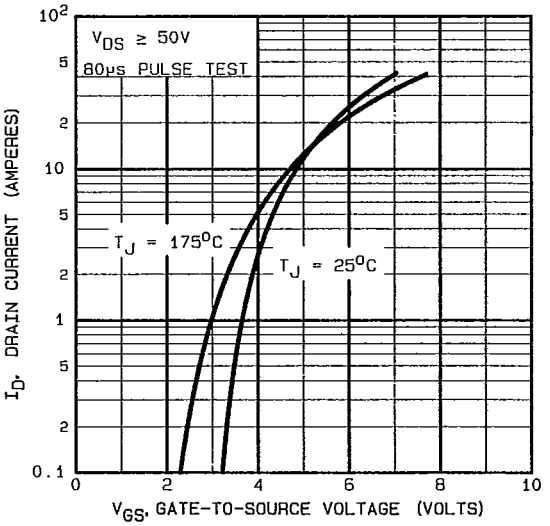


Fig. 2 — Typical Transfer Characteristics

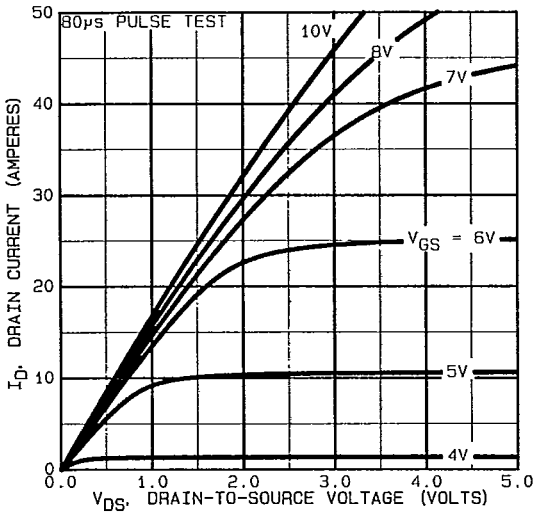


Fig. 3 — Typical Saturation Characteristics

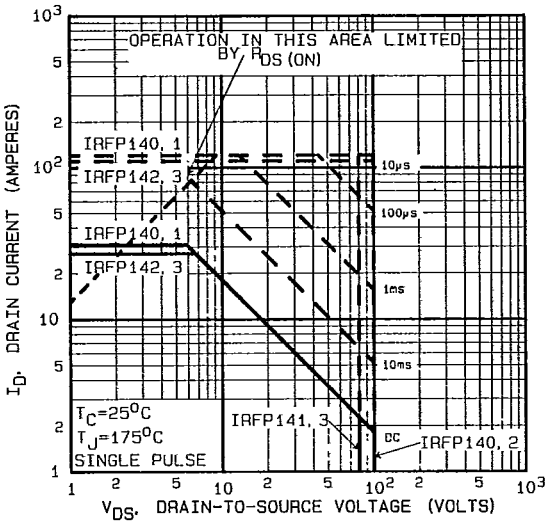


Fig. 4 — Maximum Safe Operating Area

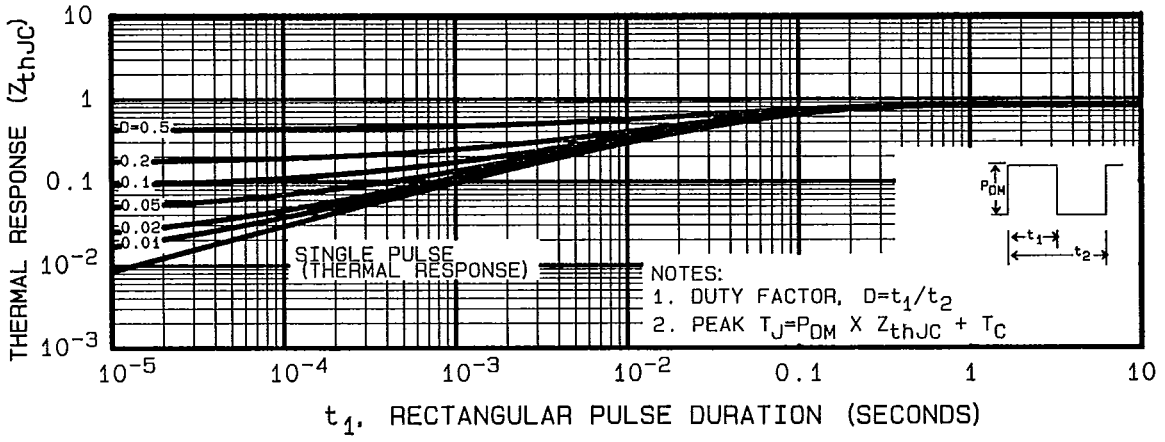


Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

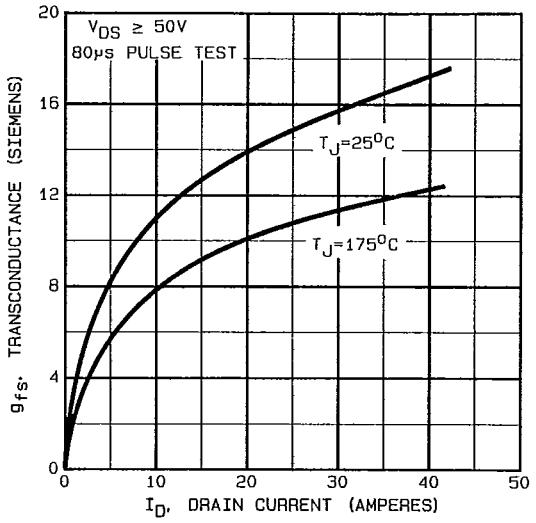


Fig. 6 — Typical Transconductance Vs. Drain Current

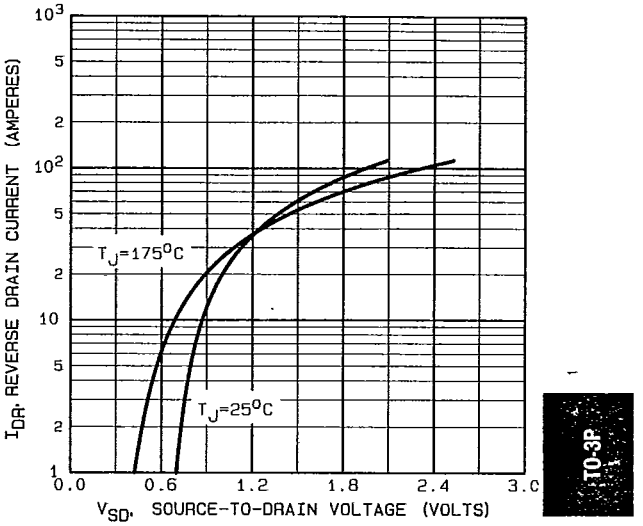


Fig. 7 — Typical Source-Drain Diode Forward Voltage

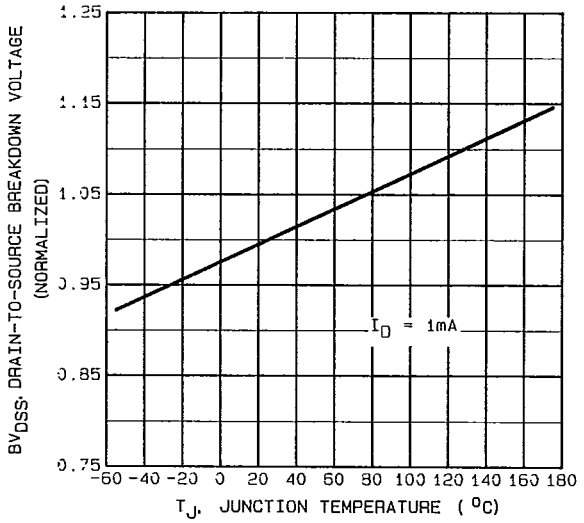


Fig. 8 — Breakdown Voltage Vs. Temperature

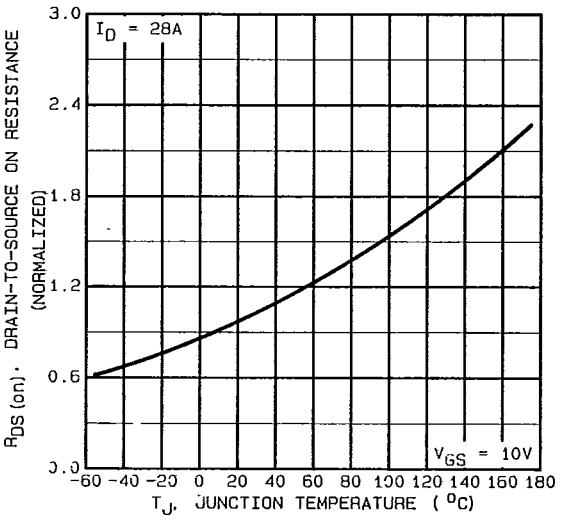


Fig. 9 — Normalized On-Resistance Vs. Temperature

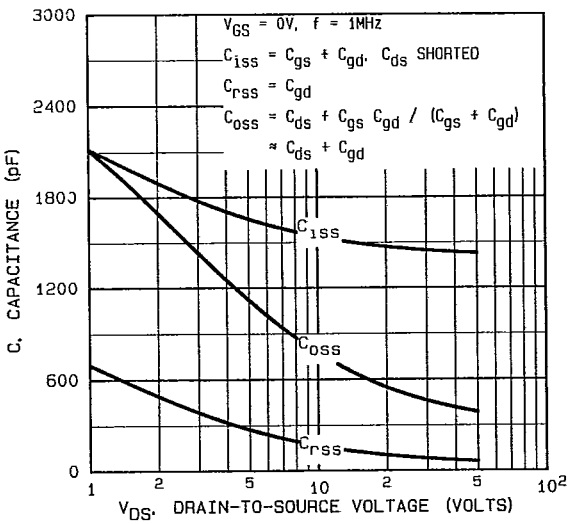


Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

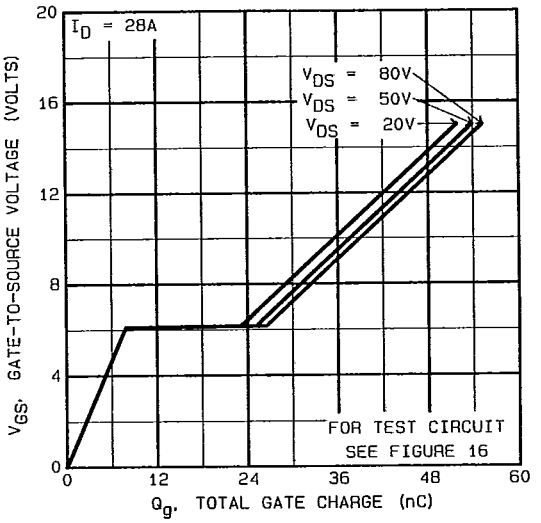


Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

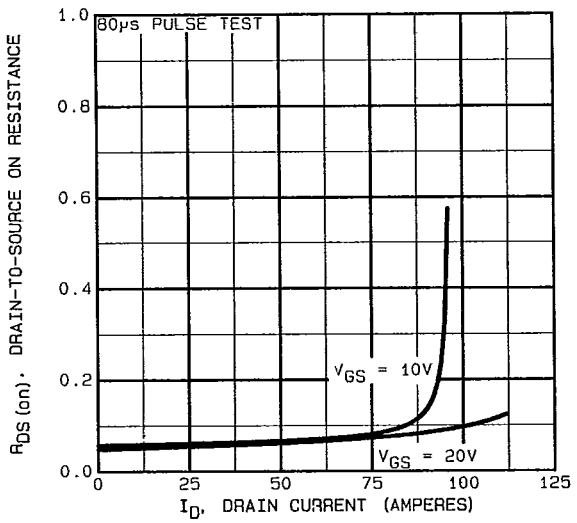


Fig. 12 — Typical On-Resistance Vs. Drain Current

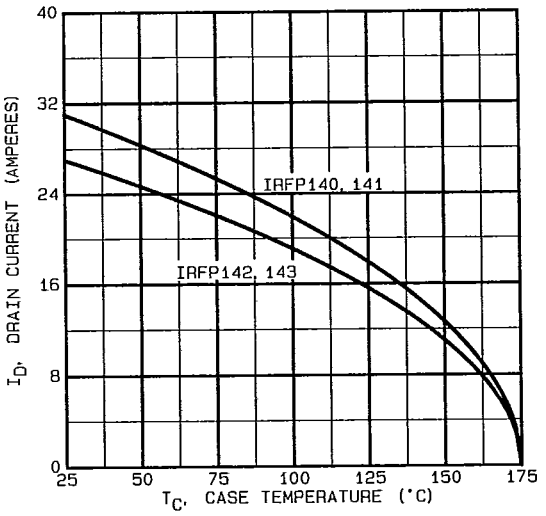


Fig. 13 — Maximum Drain Current Vs. Case Temperature

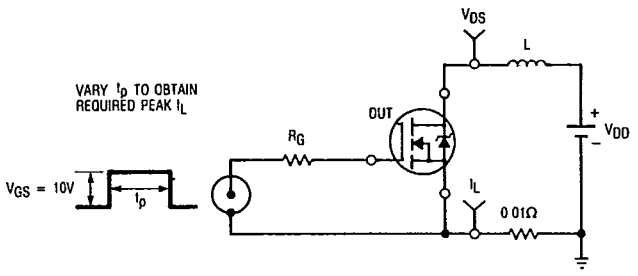


Fig. 14a — Unclamped Inductive Test Circuit

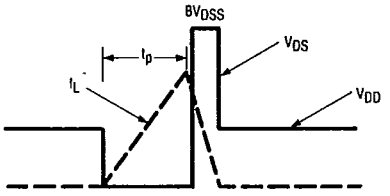


Fig. 14b — Unclamped Inductive Waveforms

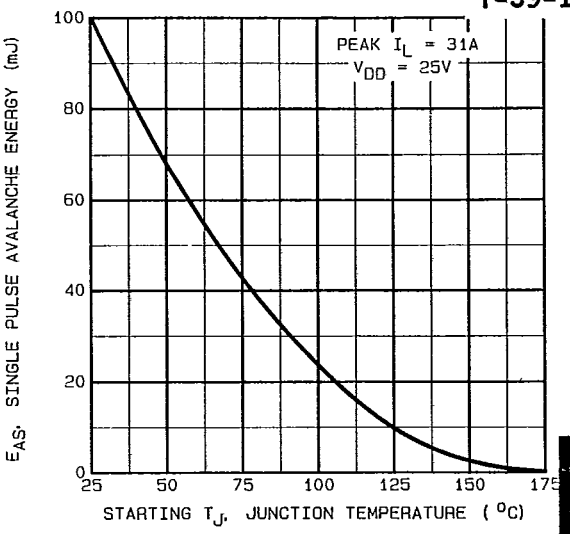


Fig. 14c — Maximum Avalanche Energy Vs. Starting Junction Temperature

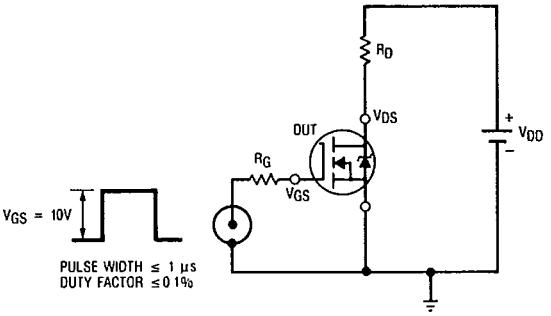


Fig. 15a — Switching Time Test Circuit

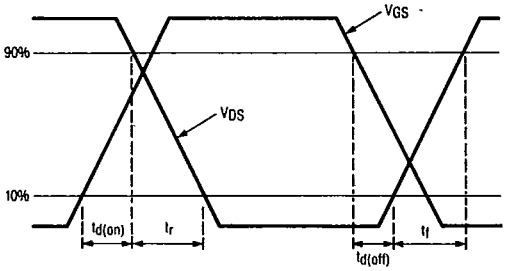


Fig. 15b — Switching Time Waveforms

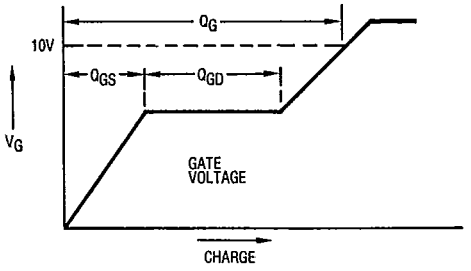


Fig. 16a — Basic Gate Charge Waveform

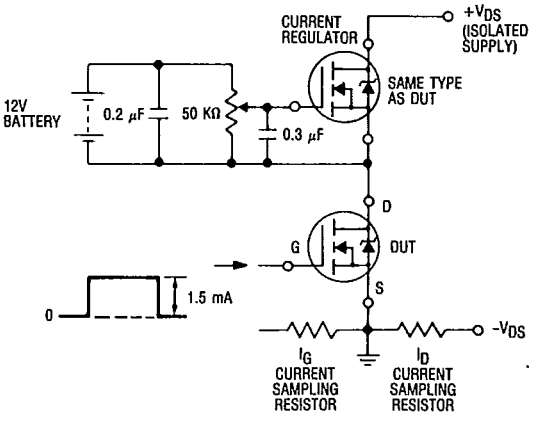


Fig. 16b — Gate Charge Test Circuit

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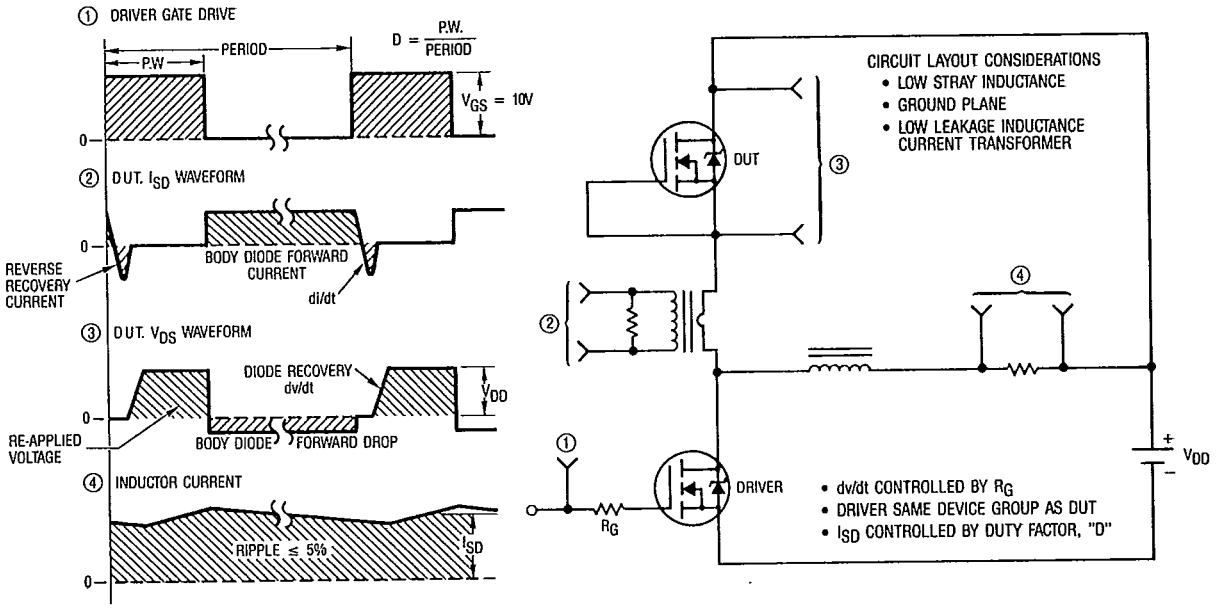

Fig. 17 — Peak Diode Recovery dv/dt Test Circuit