Data Sheet No. PD-9.443B

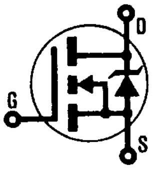
T-39-15

INTERNATIONAL RECTIFIER IOR

REPETITIVE AVALANCHE AND dv/dt RATED*

HEXFET® TRANSISTORS

IRFP250
IRFP251
IRFP252
IRFP253



N-CHANNEL

200 Volt, 0.085 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.

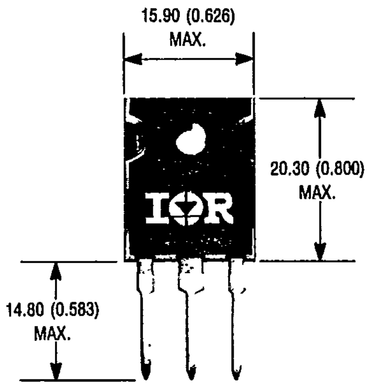
Product Summary

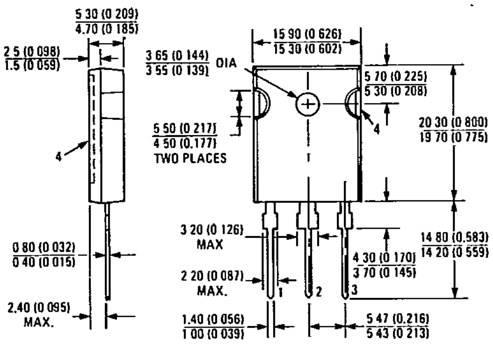
Part Number	BV_{DSS}	$R_{DS(on)}$	I_D
IRFP250	200V	0.085Ω	33A
IRFP251	150V	0.085Ω	33A
IRFP252	200V	0.120Ω	27A
IRFP253	150V	0.120Ω	27A

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)

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*This data sheet applies to product with batch codes that begin with a digit, ie. 2A3B

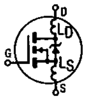
IRFP250, IRFP251, IRFP252, IRFP253 Devices

T-39-15

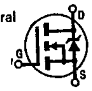
Absolute Maximum Ratings

Parameter		IRFP250, IRFP251	IRFP252, IRFP253	Units
I_D @ T_C = 25°C	Continuous Drain Current	33	27	A
I_D @ T_C = 100°C	Continuous Drain Current	21	17	A
I_{DM}	Pulsed Drain Current ①	130	110	A
P_D @ T_C = 25°C	Max. Power Dissipation	180		W
	Linear Derating Factor	1.4		W/K ⑤
V_{GS}	Gate-to-Source Voltage	±20		V
E_{AS}	Single Pulse Avalanche Energy ②	810 (See Fig. 14)		mJ
I_{AR}	Avalanche Current ① (Repetitive or Non-Repetitive)	33 (See E_{AR})		A
E_{AR}	Repetitive Avalanche Energy ①	18 (See I_{AR})		mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0 (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	IRFP250 IRFP252	200	—	—	V	V_{GS} = 0V, I_D = 250μA
		IRFP251 IRFP253	150				
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance ④	IRFP250 IRFP251	—	0.070	0.085	Ω	V_{GS} = 10V, I_D = 17A
		IRFP252 IRFP253	—	0.085	0.12		
$I_{D(on)}$	On-State Drain Current ④	IRFP250 IRFP251	33	—	—	A	V_{DS}> $I_{D(on)}$ × $R_{DS(on)}$ Max. V_{GS} = 10V
		IRFP252 IRFP253	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	13	19	—	S(℧)	V_{DS} ≥ 50V, I_{DS} = 17A
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	—	80	120	nC	V_{GS} = 10V, I_D = 30A V_{DS} = 0.8 × Max. Rating See Fig. 16 (Independent of operating temperature)
Q_{gs}	Gate-to-Source Charge	ALL	—	12	19	nC	
Q_{gd}	Gate-to-Drain ("Miller") Charge		—	43	64	nC	
$t_{d(on)}$	Turn-On Delay Time	ALL	—	20	30	ns	V_{DD} = 100V, I_D ≈ 30A, R_G = 6.2Ω R_D = 3.3Ω See Fig. 15 (Independent of operating temperature)
t_r	Rise Time	ALL	—	120	180	ns	
$t_{d(off)}$	Turn-Off Delay Time	ALL	—	69	100	ns	
t_f	Fall Time	ALL	—	80	120	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	—	2600	—	pF	V_{GS} = 0V, V_{DS} = 25V f = 1.0 MHz See Fig. 10
C_{oss}	Output Capacitance	ALL	—	650	—	pF	
C_{rss}	Reverse Transfer Capacitance	ALL	—	150	—	pF	

Source-Drain Diode Ratings and Characteristics

Parameter		Type	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	ALL	—	—	33	A	Modified MOSFET symbol showing the integral Reverse p-n junction rectifier. 
I_{SM}	Pulsed Source Current (Body Diode) ①	ALL	—	—	130	A	
V_{SD}	Diode Forward Voltage ④	ALL	—	—	2.0	V	$T_J = 25°C, I_S = 33A, V_{GS} = 0V$
t_{rr}	Reverse Recovery Time	ALL	140	300	630	ns	$T_J = 25°C, I_F = 30A, di/dt = 100\ A/\mu s$
Q_{RR}	Reverse Recovery Charge	ALL	1.8	3.8	8.1	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	—	—	0.70	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

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

② @ $V_{DD} = 50V$, Starting $T_J = 25°C$, $L = 1.1mH$, $R_G = 25\Omega$, Peak $I_L = 33A$

③ $I_{SD} \leq 33A$, $di/dt \leq 190\ A/\mu s$, $V_{DD} \leq BV_{DSS}$, $T_J \leq 150°C$ Suggested $R_G = 6.2\Omega$

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

⑤ K/W = °C/W
W/K = W/°C

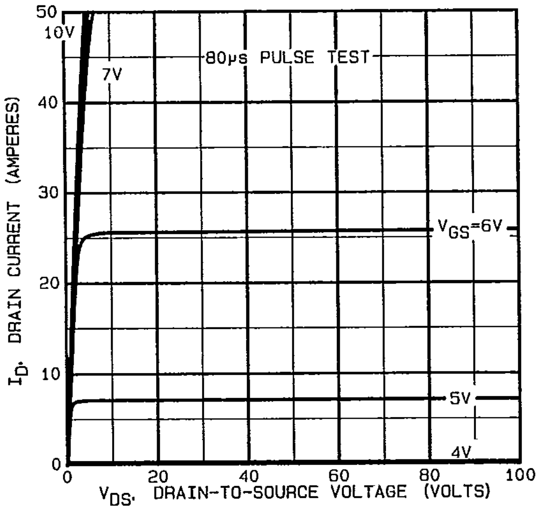


Fig. 1 — Typical Output Characteristics

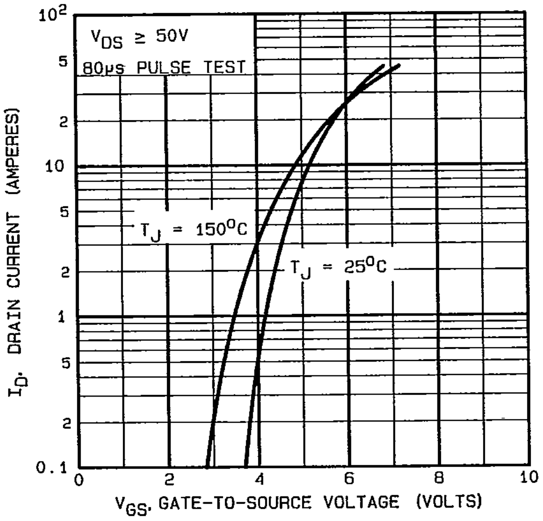


Fig. 2 — Typical Transfer Characteristics

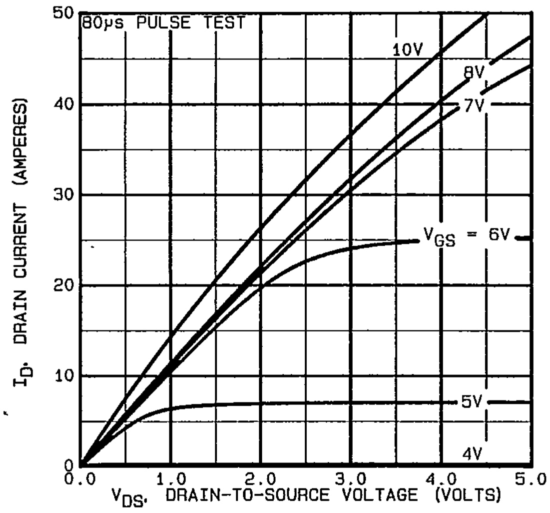


Fig. 3 — Typical Saturation Characteristics

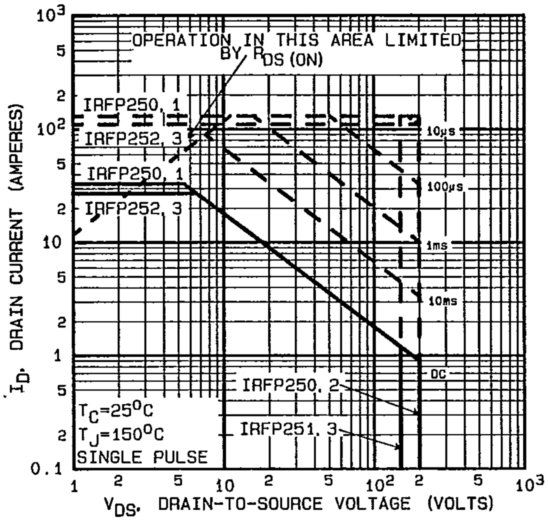


Fig. 4 — Maximum Safe Operating Area

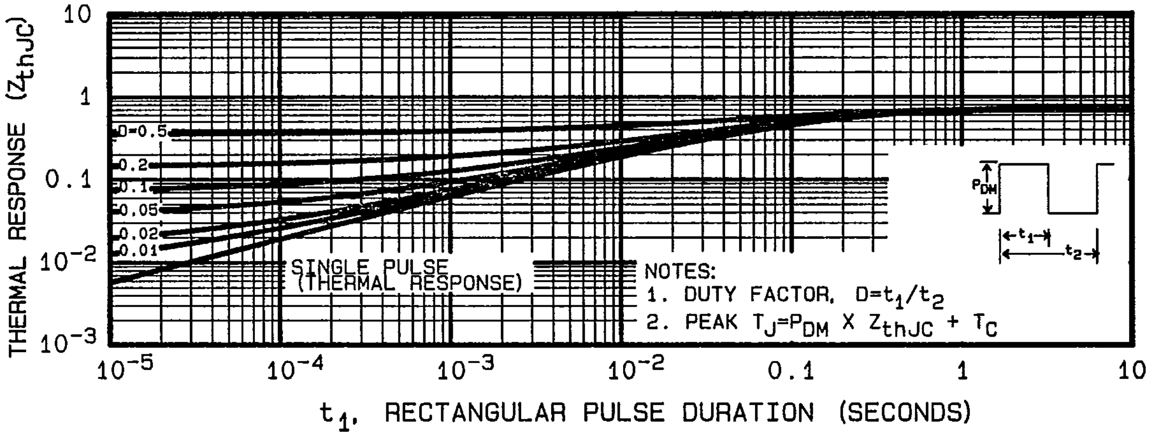


Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

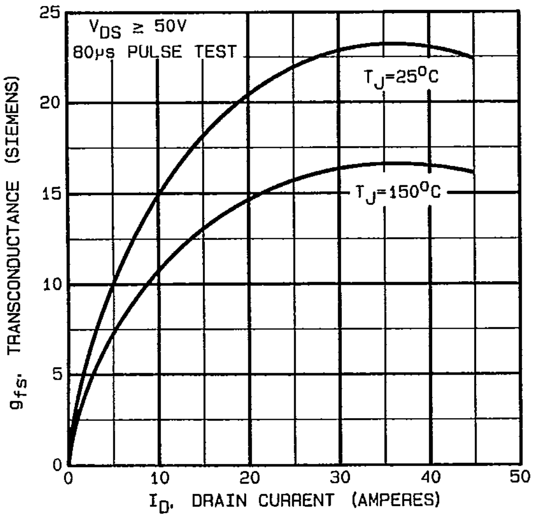


Fig. 6 — Typical Transconductance Vs. Drain Current

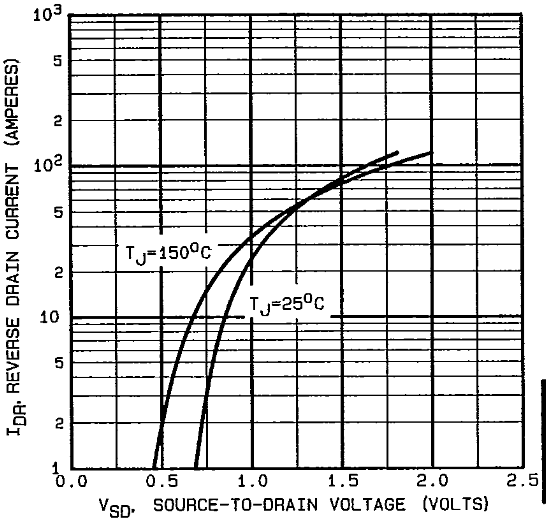


Fig. 7 — Typical Source-Drain Diode Forward Voltage

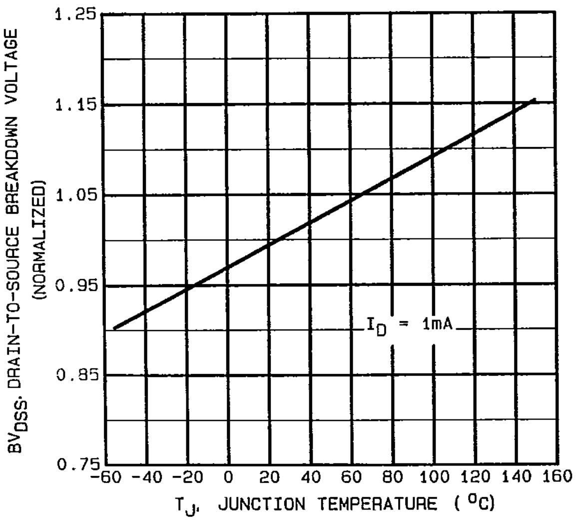


Fig. 8 — Breakdown Voltage Vs. Temperature

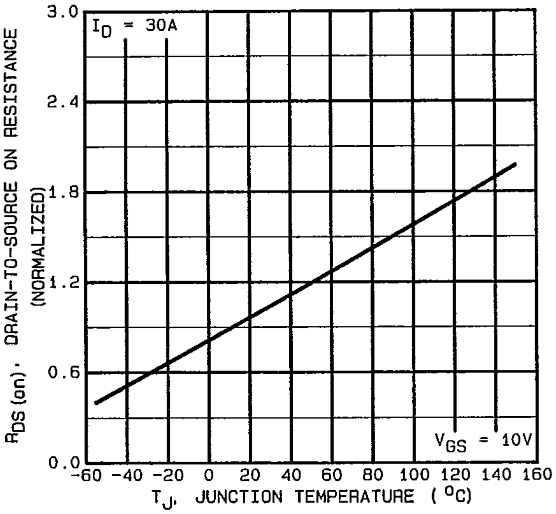


Fig. 9 — Normalized On-Resistance Vs. Temperature

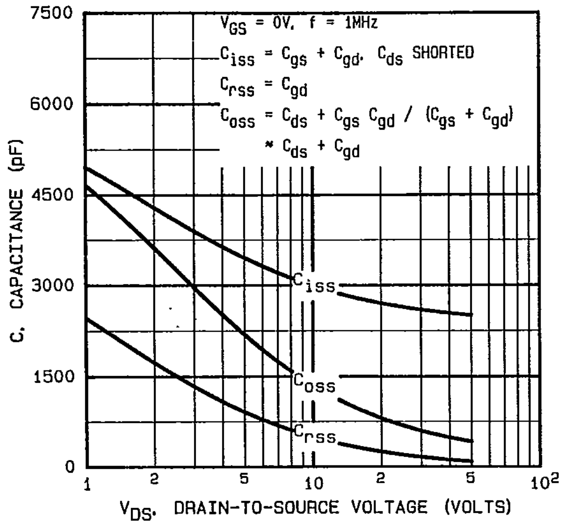


Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

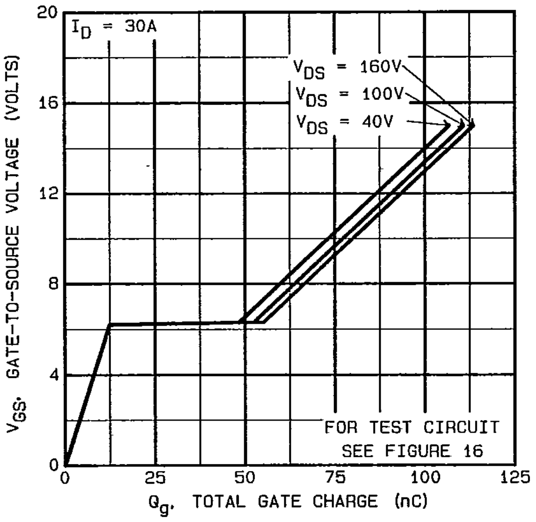


Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

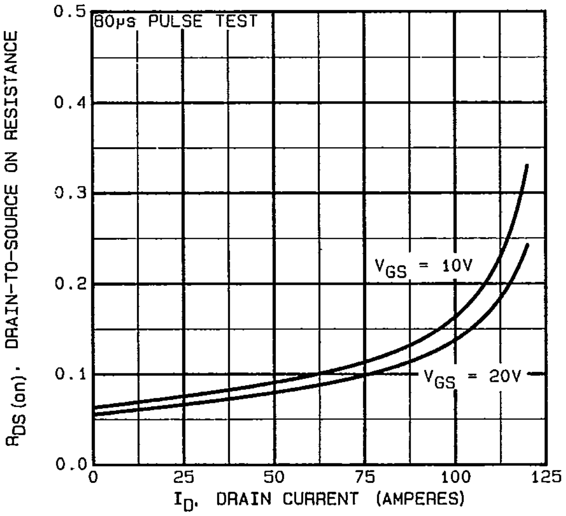


Fig. 12 — Typical On-Resistance Vs. Drain Current

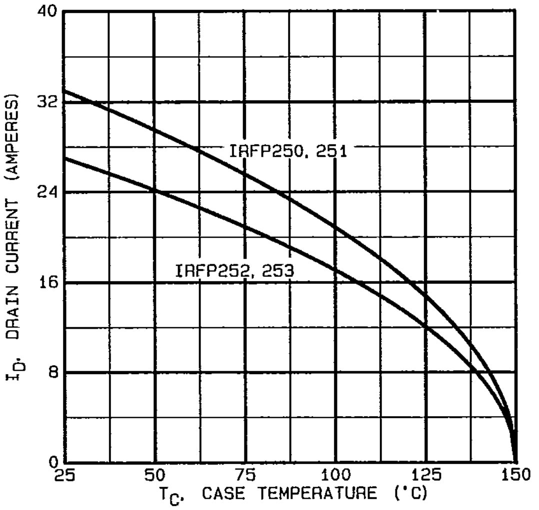


Fig. 13 — Maximum Drain Current Vs. Case Temperature

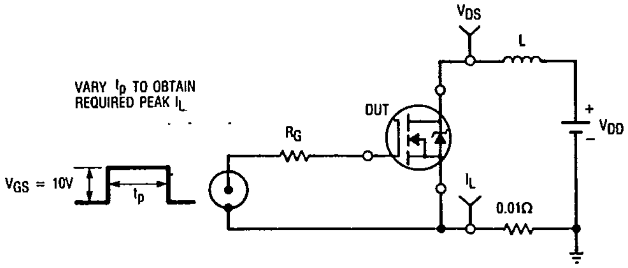


Fig. 14a — Unclamped Inductive Test Circuit

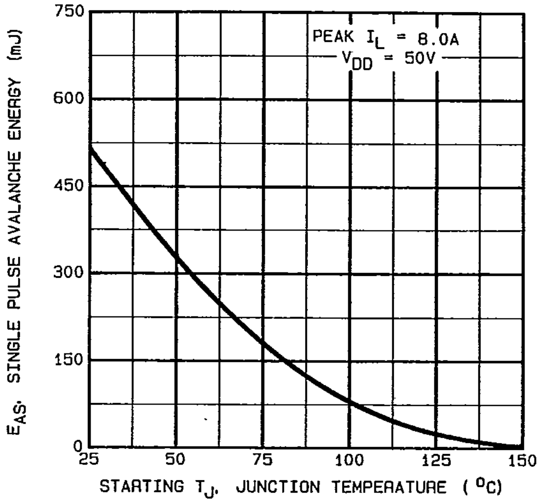


Fig. 14c — Maximum Avalanche Energy Vs. Starting Junction Temperature

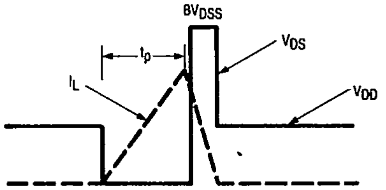


Fig. 14b — Unclamped Inductive Waveforms

TO-3P

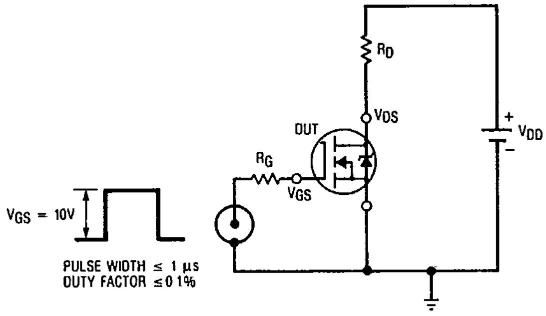


Fig. 15a — Switching Time Test Circuit

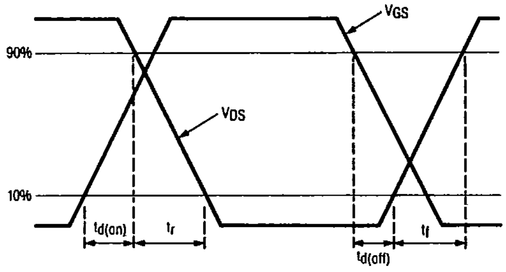


Fig. 15b — Switching Time Waveforms

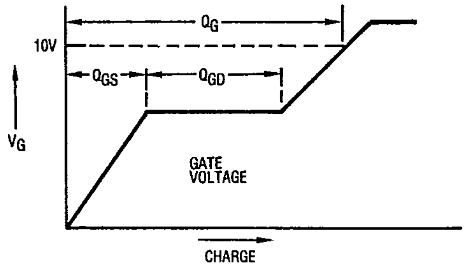


Fig. 16a — Basic Gate Charge Waveform

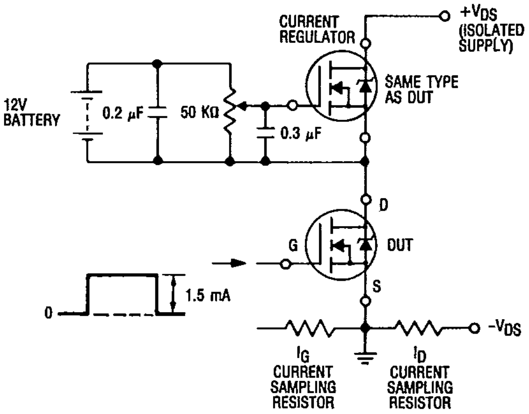


Fig. 16b — Gate Charge Test Circuit

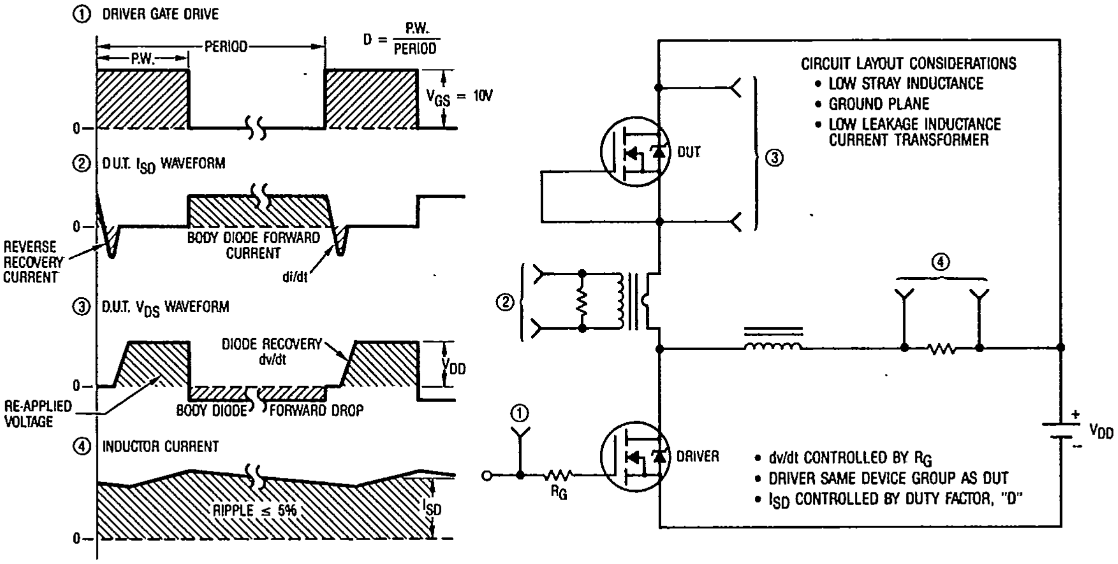


Fig. 17 — Peak Diode Recovery dv/dt Test Circuit