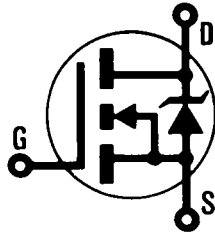


INTERNATIONAL RECTIFIER REPETITIVE AVALANCHE AND dv/dt RATEDHEXFET[®] TRANSISTORS

IRF254

IRF255



N-CHANNEL

250 Volt, 0.14 Ohm, HEXFET
TO-204AE (TO-3) Hermetic 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.

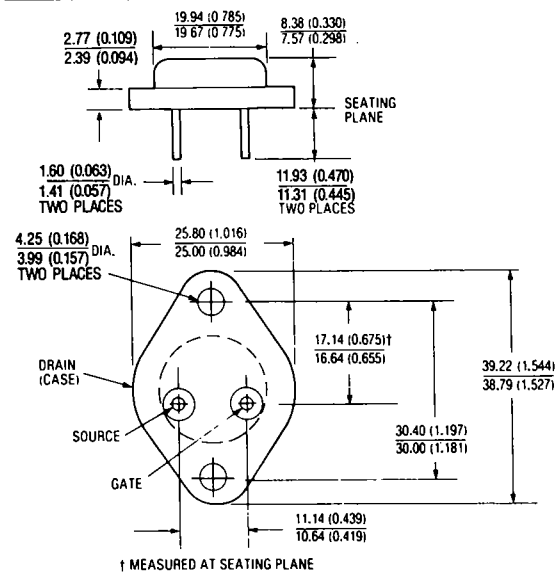
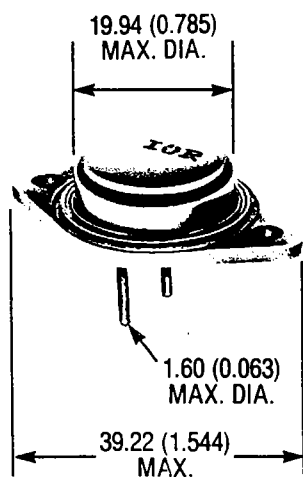
Product Summary

Part Number	V_{DS}	$R_{DS(on)}$	I_D
IRF254	250V	0.14 Ω	22A
IRF255	250V	0.17 Ω	20A

FEATURES:

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

CASE STYLE AND DIMENSIONS



Conforms to JEDEC Outline TO-204AE (Modified TO-3)
Dimensions in Millimeters and (Inches)

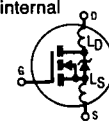
IRF254, IRF255 Devices

Absolute Maximum Ratings


Parameter	IRF254	IRF255	Units
$I_D @ T_C = 25^\circ\text{C}$ Continuous Drain Current	22	20	A
$I_D @ T_C = 100^\circ\text{C}$ Continuous Drain Current	14	12	A
I_{DM} Pulsed Drain Current ①	88	80	A
$P_D @ T_C = 25^\circ\text{C}$ 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 ⑥	1000 (See Fig. 14)		mJ
I_{AR} Avalanche Current ⑦ (Repetitive or Non-Repetitive)	22 (See E_{AR})		A
E_{AR} Repetitive Avalanche Energy ⑧	15 (See I_{AR})		mJ
dv/dt Peak Diode Recovery dv/dt ⑨	4.8 (See Fig. 17)		V/ns
T_J Operating Junction T_{STG} Storage Temperature Range	-55 to 150		$^\circ\text{C}$
Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)		$^\circ\text{C}$

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (Unless Otherwise Specified)

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS} Drain-to-Source Breakdown Voltage	IRF254 IRF255	250	—	—	V	$V_{GS} = 0V, I_D = 250 \mu\text{A}$
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance ④	IRF254	—	0.11	0.14	Ω	$V_{GS} = 10V, I_D = 12A$
	IRF255	—	0.14	0.17		
$I_{D(on)}$ On-State Drain Current ④	IRF254	22	—	—	A	$V_{DS} > I_{D(on)} \times R_{DS(on)}$ Max. $V_{GS} = 10V$
	IRF255	20	—	—		
$V_{GS(th)}$ Gate Threshold Voltage	ALL	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$
g_{fs} Forward Transconductance ④	ALL	11	17	—	S (⑩)	$V_{DS} \geq 50V, I_{DS} = 12A$
I_{DSS} Zero Gate Voltage Drain Current	ALL	—	—	250	μA	$V_{DS} = \text{Max. Rating}, V_{GS} = 0V$
		—	—	1000		$V_{DS} = 0.8 \times \text{Max. Rating}$ $V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS} Gate-to-Source Leakage Forward	ALL	—	—	100	nA	$V_{GS} = 20V$
I_{GSS} Gate-to-Source Leakage Reverse	ALL	—	—	-100	nA	$V_{GS} = -20V$
Q_g Total Gate Charge	ALL	—	87	130	nC	$V_{GS} = 10V, I_D = 22A$ $V_{DS} = 0.8 \times \text{Max. Rating}$ See Fig. 16
Q_{gs} Gate-to-Source Charge	ALL	—	14	20	nC	(Independent of operating temperature)
Q_{gd} Gate-to-Drain ("Miller") Charge	ALL	—	73	110	nC	(Independent of operating temperature)
$t_{d(on)}$ Turn-On Delay Time	ALL	—	19	29	ns	$V_{DD} = 125V, I_D \approx 22A, R_G = 6.2\Omega$
t_r Rise Time	ALL	—	84	130	ns	$R_D = 5.6\Omega$
$t_{d(off)}$ Turn-Off Delay Time	ALL	—	75	110	ns	See Fig. 15
t_f Fall Time	ALL	—	65	98	ns	(Independent of operating temperature)
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	—	2700	—	pF	$V_{GS} = 0V, V_{DS} = 25V$
C_{oss} Output Capacitance	ALL	—	580	—	pF	$f = 1.0 \text{ MHz}$
C_{rss} Reverse Transfer Capacitance	ALL	—	130	—	pF	See Fig. 10



Source-Drain Diode Ratings and Characteristics

Parameter	Type	Min.	Typ.	Max.	Units	Test Conditions
I_S Continuous Source Current (Body Diode)	ALL	—	—	22	A	Modified MOSFET symbol showing the Integral Reverse p-n junction rectifier 
I_{SM} Pulsed Source Current (Body Diode) ①	ALL	—	—	88	A	
V_{SD} Diode Forward Voltage ④	ALL	—	—	1.8	V	$T_J = 25^\circ\text{C}, I_S = 22\text{A}, V_{GS} = 0\text{V}$
t_{rr} Reverse Recovery Time	ALL	150	310	650	ns	$T_J = 25^\circ\text{C}, I_F = 22\text{A}, di/dt = 100\text{ A}/\mu\text{s}$
Q_{RR} Reverse Recovery Charge	ALL	1.9	4.0	8.4	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	—	0.12	—	K/W ⑤	Mounting surface flat, smooth, and greased
R_{thJA} Junction-to-Ambient	ALL	—	—	30	K/W ⑤	Typical socket mount

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

② @ $V_{DD} = 50\text{V}$, Starting $T_J = 25^\circ\text{C}$, $L = 3.3\text{ mH}$, $R_G = 25\Omega$ Peak $I_L = 22\text{A}$

③ $I_{SD} \leq 22\text{A}$, $di/dt \leq 180\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, $T_J \leq 150^\circ\text{C}$ Suggested $R_G = 6.2\Omega$

④ Pulse width $\leq 300\ \mu\text{s}$; Duty Cycle $\leq 2\%$

⑤ $\text{K/W} = ^\circ\text{C/W}$
 $\text{W/K} = \text{W}/^\circ\text{C}$

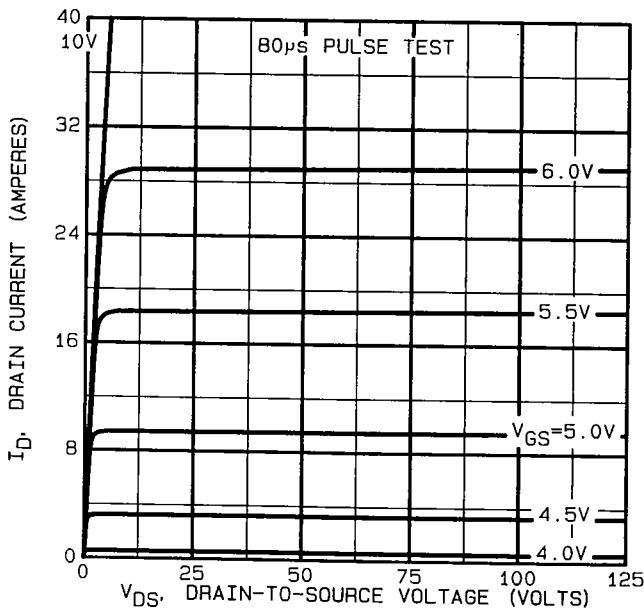


Fig. 1 — Typical Output Characteristics

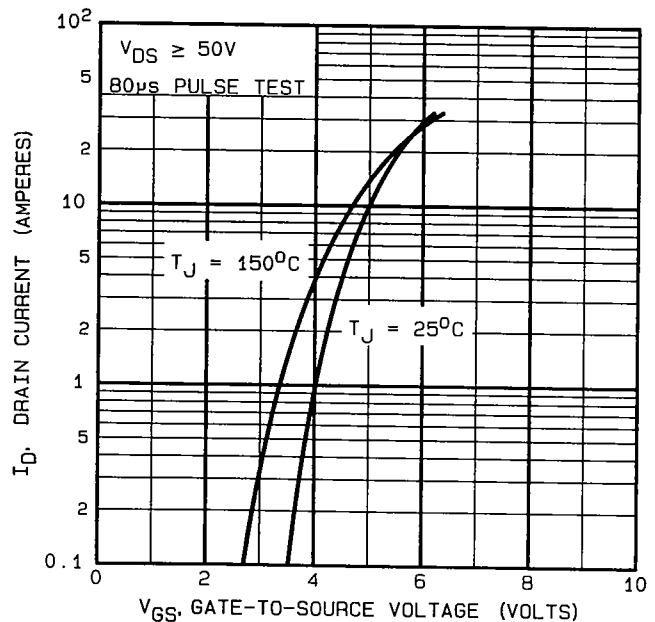


Fig. 2 — Typical Transfer Characteristics

IRF254, IRF255 Devices

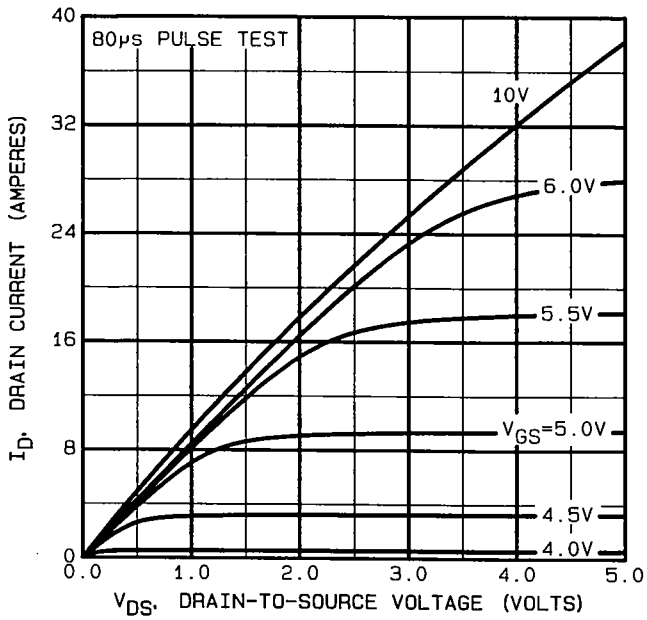


Fig. 3 — Typical Saturation Characteristics

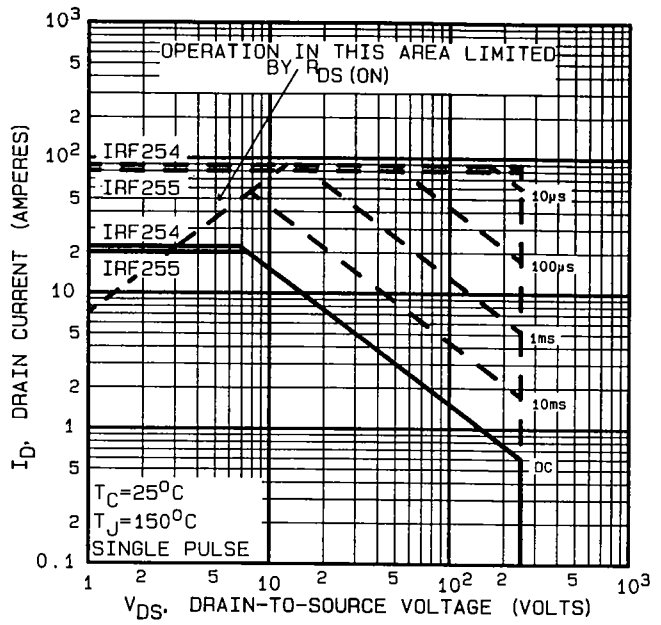


Fig. 4 — Maximum Safe Operating Area

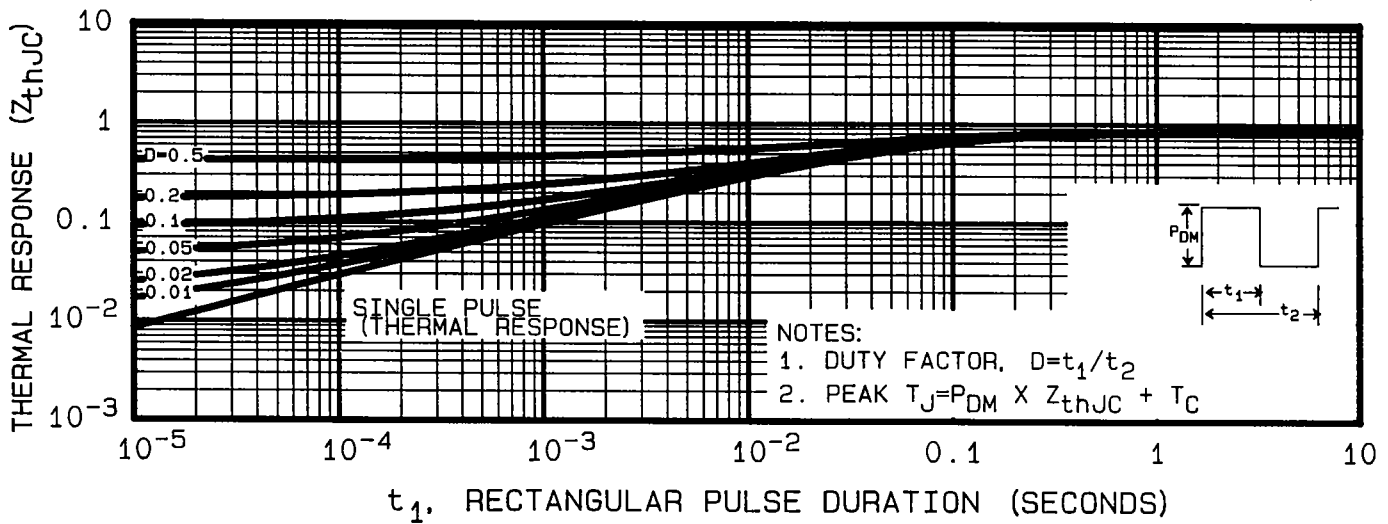


Fig. 5 — Maximum Effective Transient Thermal Impedance, Junction-to-Case Vs. Pulse Duration

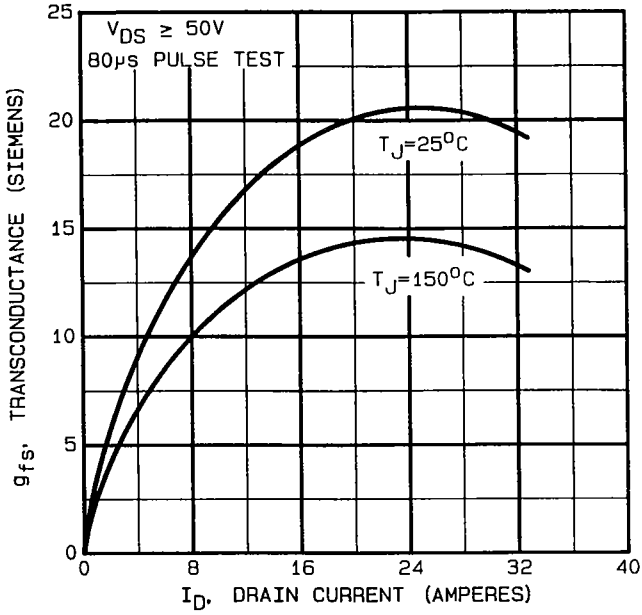


Fig. 6 — Typical Transconductance Vs. Drain Current

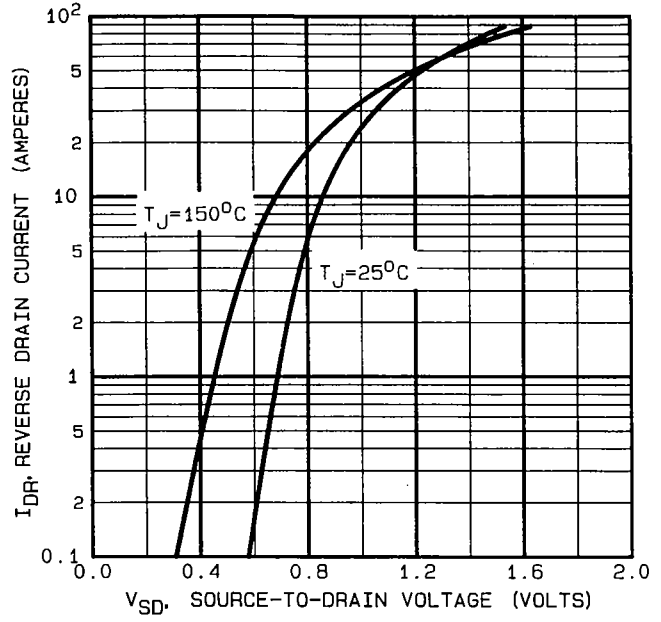


Fig. 7 — Typical Source-Drain Diode Forward Voltage

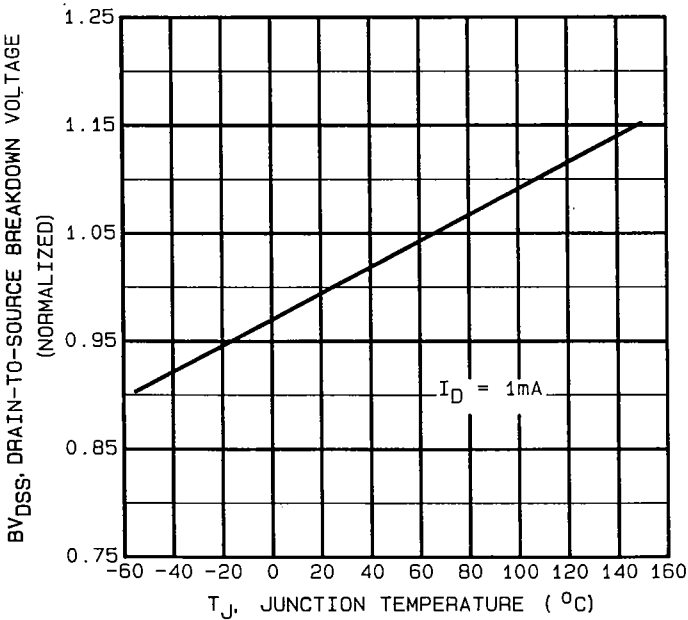


Fig. 8 — Breakdown Voltage Vs. Temperature

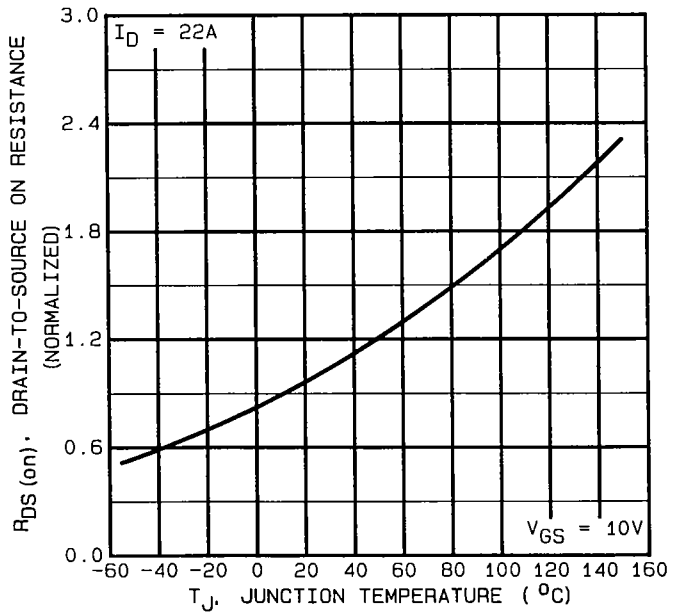


Fig. 9 — Normalized On-Resistance Vs. Temperature

IRF254, IRF255 Devices

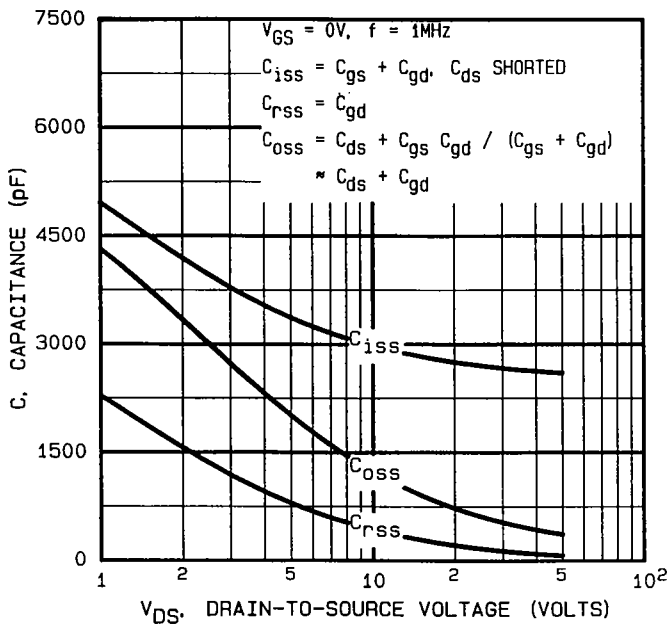


Fig. 10 — Typical Capacitance Vs. Drain-to-Source Voltage

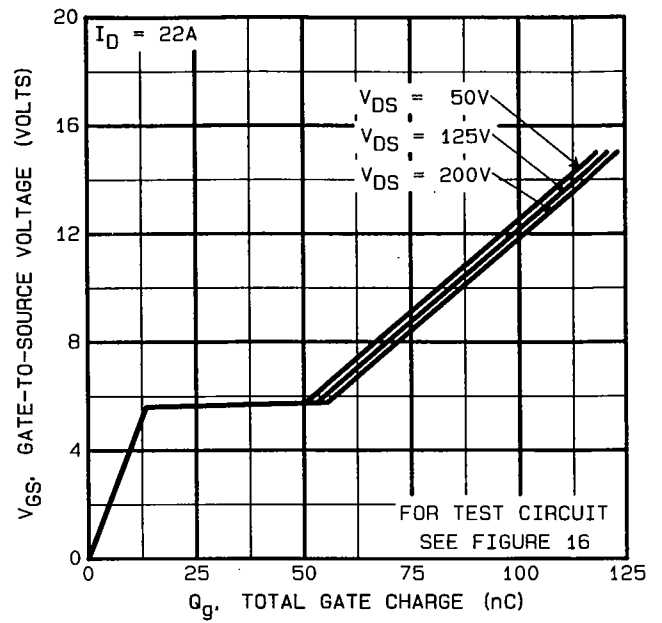


Fig. 11 — Typical Gate Charge Vs. Gate-to-Source Voltage

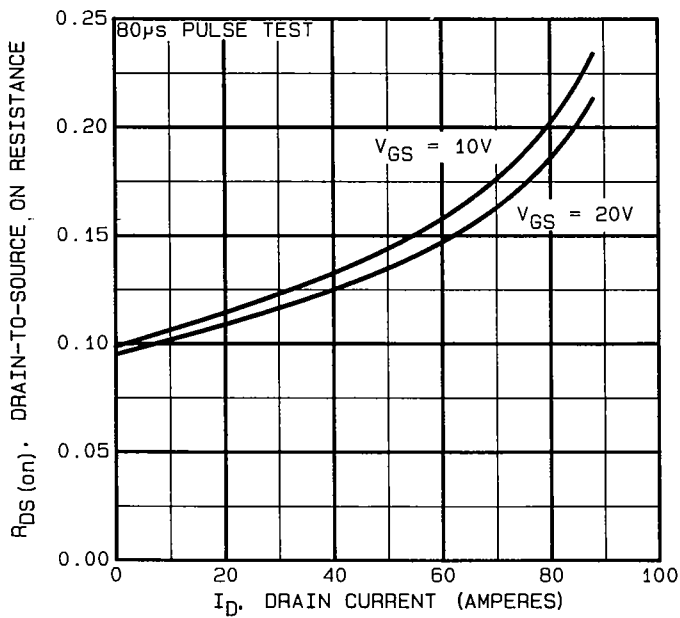


Fig. 12 — Typical On-Resistance Vs. Drain Current

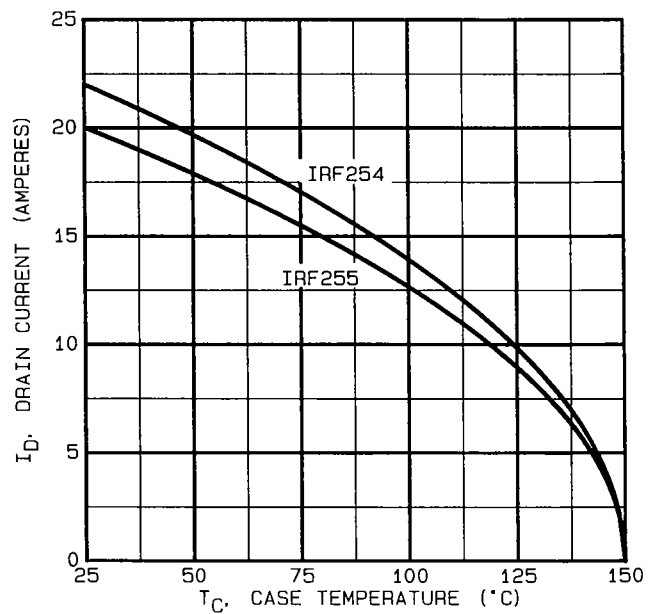


Fig. 13 — Maximum Drain Current Vs. Case Temperature

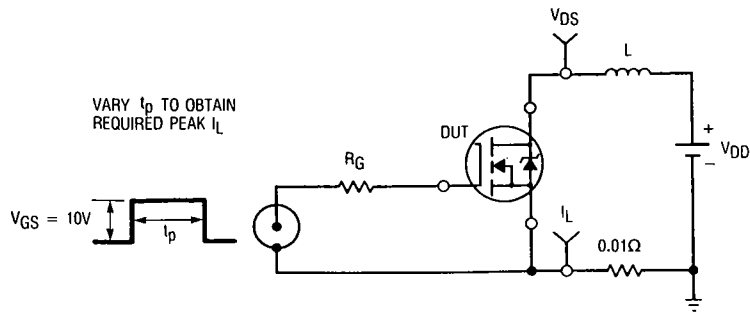


Fig. 14a — Unclamped Inductive Test Circuit

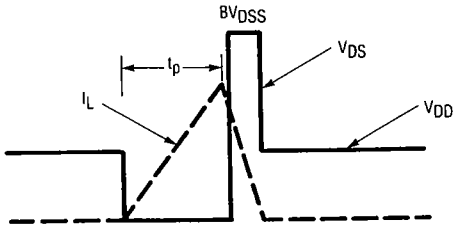


Fig. 14b — Unclamped Inductive Waveforms

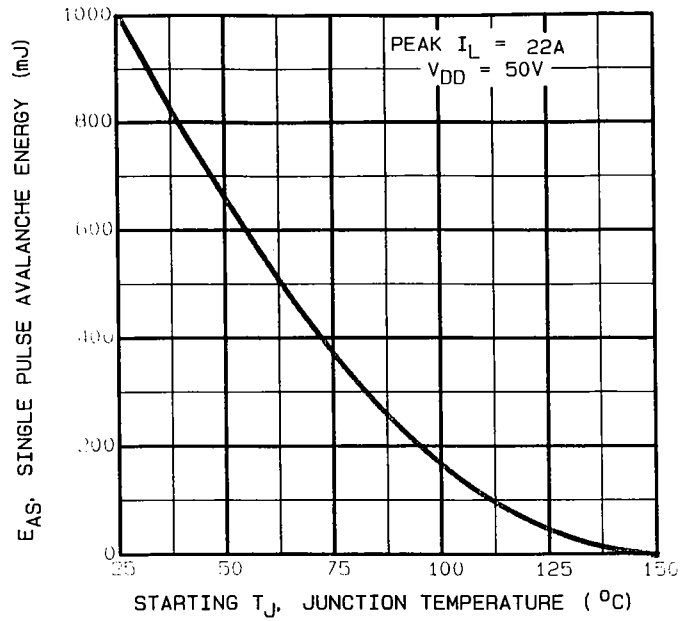


Fig. 14c — Maximum Avalanche Energy Vs. Starting Junction Temperature

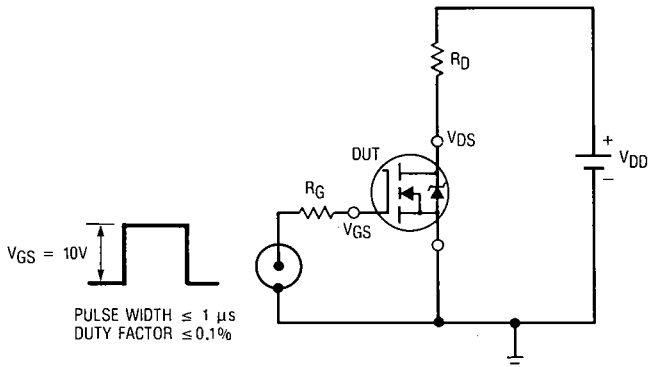


Fig. 15a — Switching Time Test Circuit

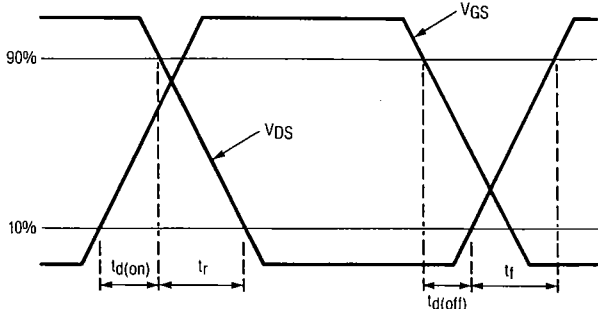


Fig. 15b — Switching Time Waveforms

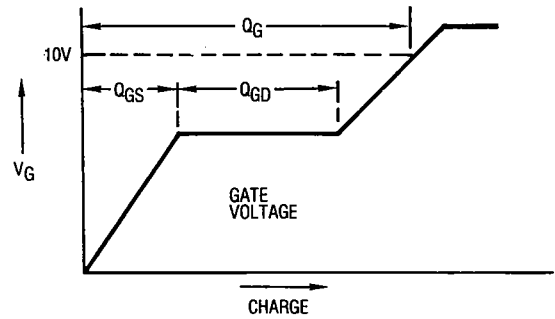


Fig. 16a — Basic Gate Charge Waveform

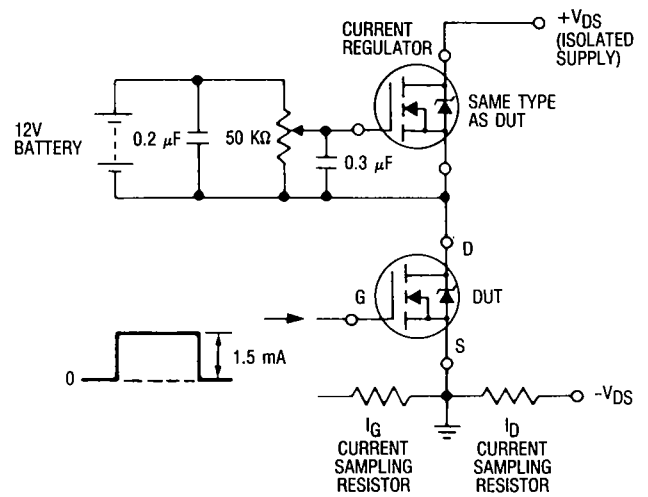


Fig. 16b — Gate Charge Test Circuit

IRF254, IRF255 Devices

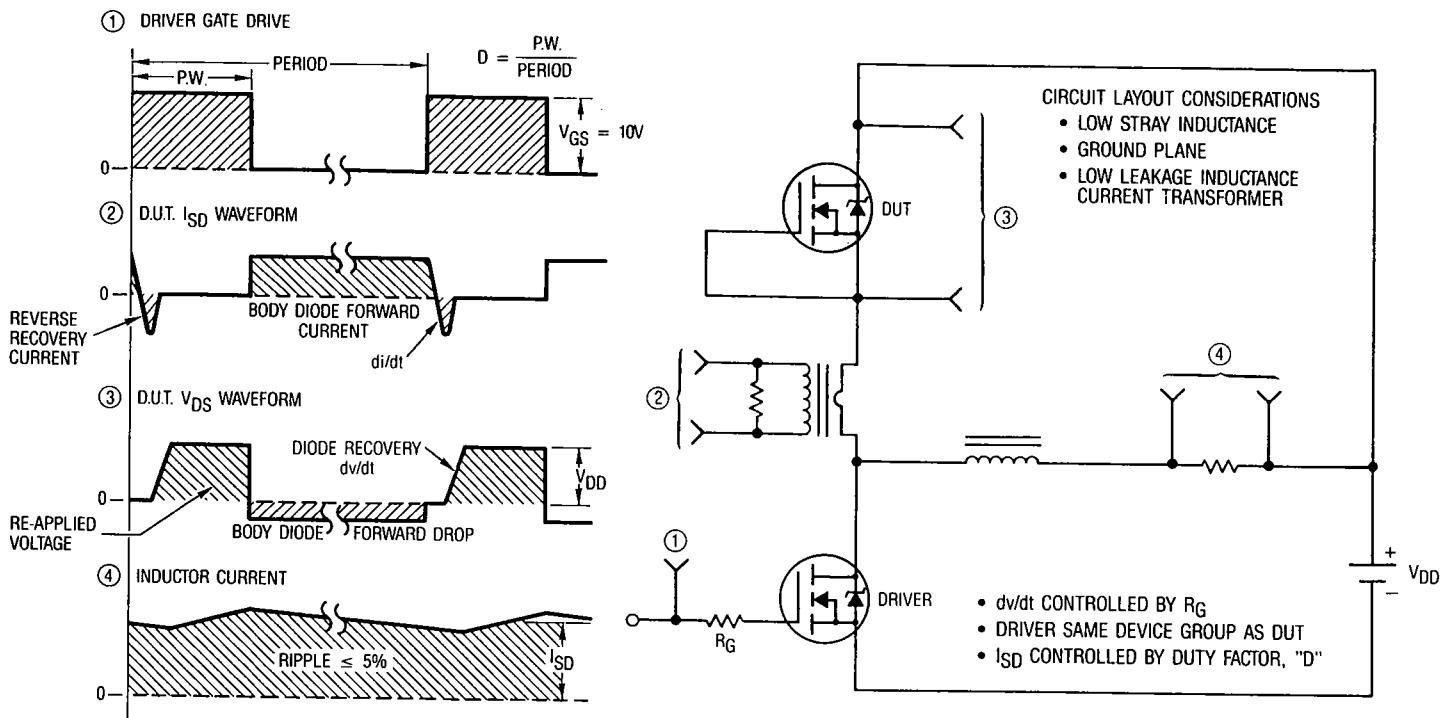
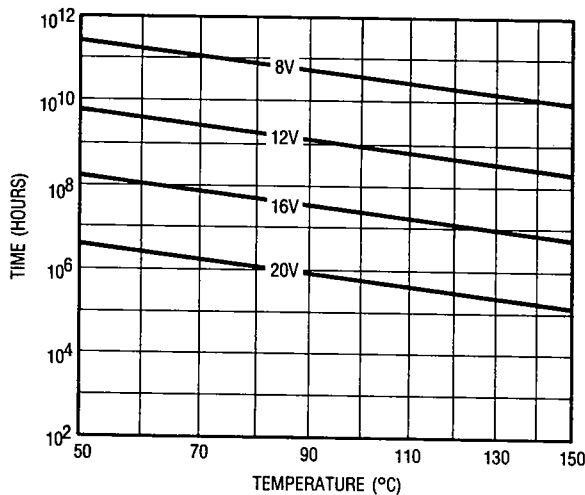
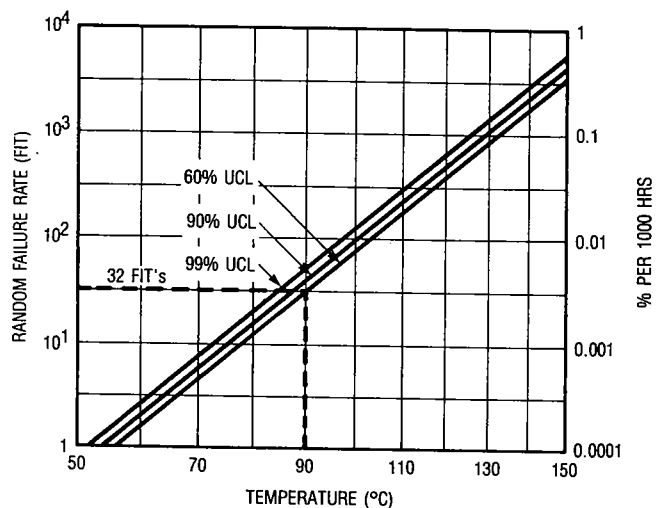


Fig. 17 — Peak Diode Recovery dv/dt Test Circuit



* 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 April 15, 1987. This information is updated on a quarterly basis; for the latest reliability data, please contact your local IR field office.

International Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245. Tel: (213) 772-2000. Tlx: 4720403
EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB. Tel: (0883) 713215. Tlx: 95219

IR CANADA: 101 Bentley St., Markham, Ontario L3R 3L1. Tel: (416) 475-1897; 280 Dorval Ave., Suite 201A, Dorval, Quebec H93 3H4, Tel: (514) 631-4696. IR FRANCE: 123, rue de Petit Vaux, 91360 Epligny Sur Orge. Tel: 33.1.64.54.83.29. IR GERMANY: Savignystrasse 55, D-8000 Frankfurt/Main 1, Tel: (0611) 745074. IR ITALY: Via Ligulia 49, 10071 Borgaro, Torino, Tel: (011) 470 1484. IR FAR EAST: 3-30-4 Nishi-Ikebukuro Toshima-ku, K&H Building 2F, Tokyo 171, Tel: (03) 983 0641. U.S. Central Zone Office: 2100 Manchester Rd., Suite 601, Wheaton, IL 60187, Tel: (312) 690-7700. U.S. Eastern Zone Office: 71 Grand Ave., Passaic Park, NJ 07650. Tel: (201) 943-4554.

Printed in U.S.A. 8/87

Sales Offices, Agents and Distributors in Major Cities Throughout the World.

Data and specifications subject to change without notice.