PD - 90372A

International
IOR Rectifier

REPETITIVE AVALANCHE AND dv/dt RATED
HEXFET® TRANSISTORS THRU-HOLE (TO-204AA/AE)

IRF440
500V, N-CHANNEL

Product Summary

Part Number	BVDSS	$R_{DS(on)}$	I_D
IRF440	500V	0.85Ω	8.0A

TO-3

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.

Features:
- Repetitive Avalanche Ratings
- Dynamic dv/dt Rating
- Hermetically Sealed
- Simple Drive Requirements
- Ease of Paralleling

Absolute Maximum Ratings

	Parameter		Units
I_D @ V_{GS} =0V, T_C = 25°C	Continuous Drain Current	8.0	A
I_D @ V_{GS} = 0V, T_C = 100°C	Continuous Drain Current	5.0	
I_{DM}	Pulsed Drain Current ①	32	
P_D @ T_C = 25°C	Max. Power Dissipation	125	W
	Linear Derating Factor	1.0	W/°C
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS}	Single Pulse Avalanche Energy ②	700	mJ
I_{AR}	Avalanche Current ①	8.0	A
E_{AR}	Repetitive Avalanche Energy ①	-	mJ
dv/dt	Peak Diode Recovery dv/dt ③	3.5	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)	
	Weight	11.5(typical)	g

For footnotes refer to the last page

4/20/01

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

	Parameter	Min	Typ	Max	Units	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	500	—	—	V	V_{GS} = 0V, I_D = 1.0mA
$\Delta BV_{DSS}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	—	0.78	—	V/°C	Reference to 25°C, I_D = 1.0mA
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance	—	—	0.85	Ω	V_{GS} = 10V, I_D = 5.0A ④
		—	—	0.98		V_{GS} = 10V, I_D = 8.0A ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	V_{DS} = V_{GS}, I_D = 250µA
g_{fs}	Forward Transconductance	4.7	—	—	S (℧)	V_{DS} > 15V, I_{DS} = 5.0A ④
I_{DSS}	Zero Gate Voltage Drain Current	—	—	25	µA	V_{DS}=400V, V_{GS}=0V
		—	—	250		V_{DS} = 400V V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Leakage Forward	—	—	100	nA	V_{GS} = 20V
I_{GSS}	Gate-to-Source Leakage Reverse	—	—	-100		V_{GS} = -20V
Q_g	Total Gate Charge	27.3	—	68.5	nC	V_{GS} =10V, ID=8.0A V_{DS} = 250V
Q_{gs}	Gate-to-Source Charge	2.0	—	12.5		
Q_{gd}	Gate-to-Drain ('Miller') Charge	11	—	42		
$t_{d(on)}$	Turn-On Delay Time	—	—	21	ns	V_{DD} =250V, I_D =8.0A, R_G =9.1Ω
t_r	Rise Time	—	—	73		
$t_{d(off)}$	Turn-Off Delay Time	—	—	72		
t_f	Fall Time	—	—	51		
$L_S + L_D$	Total Inductance	—	6.1	—	nH	Measured from drain lead (6mm/0.25in. from package) to source lead (6mm/0.25in. from package)
C_{iss}	Input Capacitance	—	1300		pF	V_{GS} = 0V, V_{DS} = 25V f = 1.0MHz
C_{oss}	Output Capacitance	—	310	—		
C_{rss}	Reverse Transfer Capacitance	—	120	—		

Source-Drain Diode Ratings and Characteristics

	Parameter	Min	Typ	Max	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	—	—	8.0	A	
I_{SM}	Pulse Source Current (Body Diode) ①	—	—	32		
V_{SD}	Diode Forward Voltage	—	—	1.5	V	T_j = 25°C, I_S = 8.0A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	—	—	700	nS	T_j = 25°C, I_F = 8.0A, di/dt ≤ 100A/µs V_{DD} ≤ 50V ④
Q_{RR}	Reverse Recovery Charge	—	—	8.9	µC	
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by $L_S + L_D$.				

Thermal Resistance

	Parameter	Min	Typ	Max	Units	Test Conditions
R_{thJC}	Junction to Case	—	—	1.0	°C/W	
R_{thJA}	Junction to Ambient	—	—	30		Typical socket mount

For footnotes refer to the last page

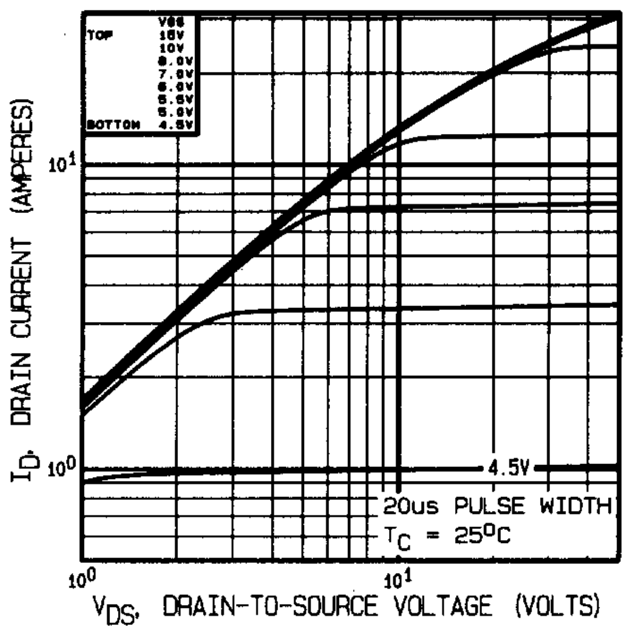


Fig 1. Typical Output Characteristics

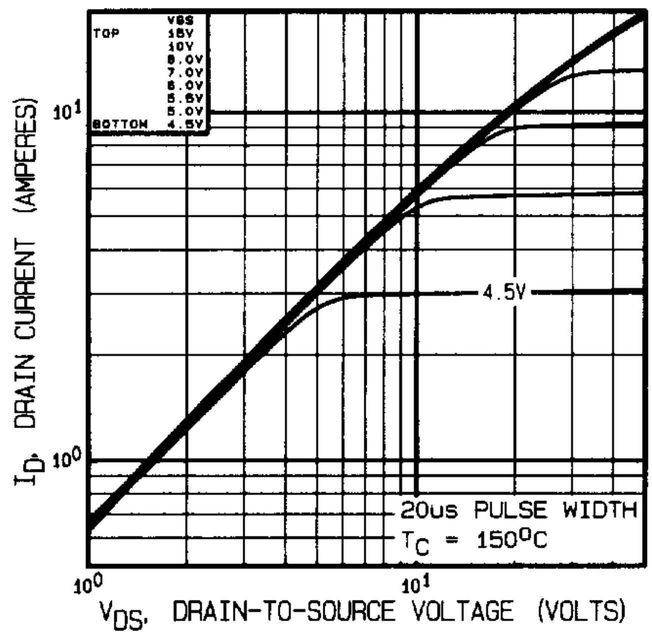


Fig 2. Typical Output Characteristics

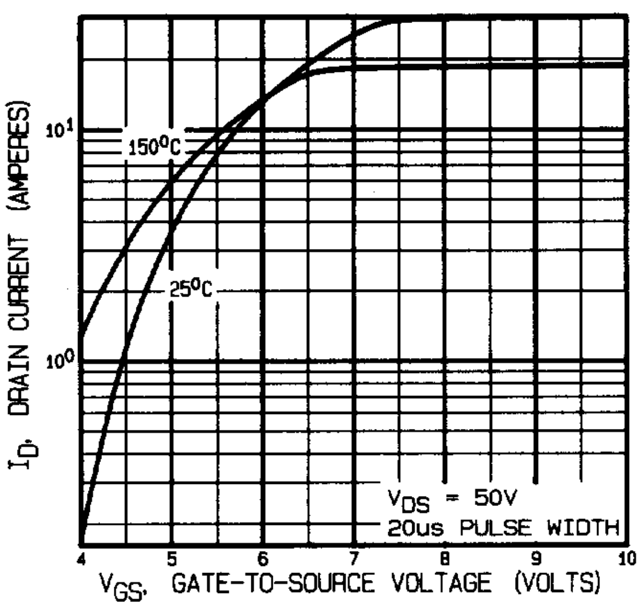


Fig 3. Typical Transfer Characteristics

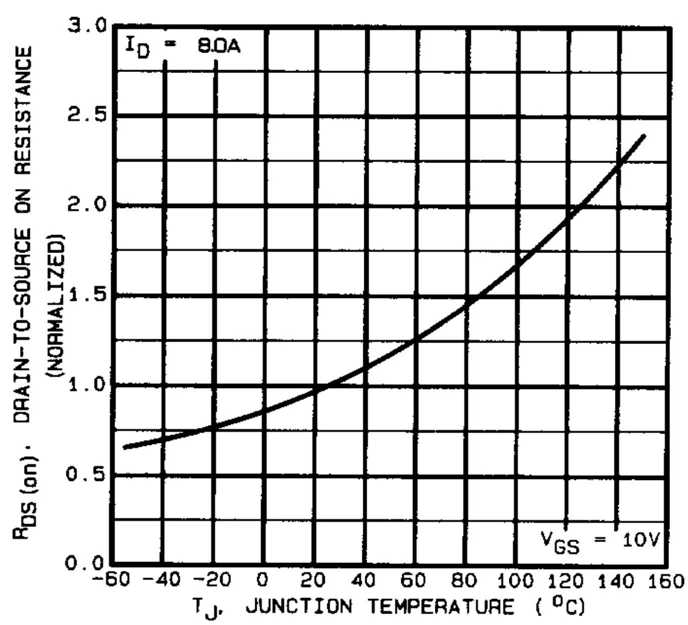


Fig 4. Normalized On-Resistance Vs. Temperature

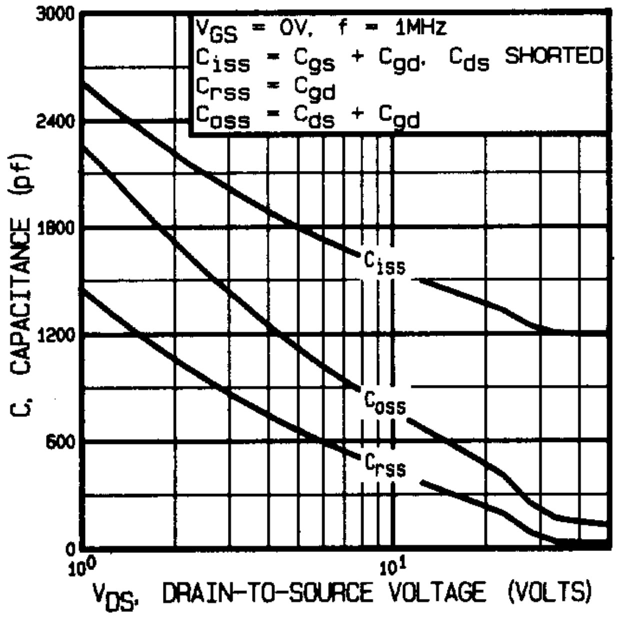


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

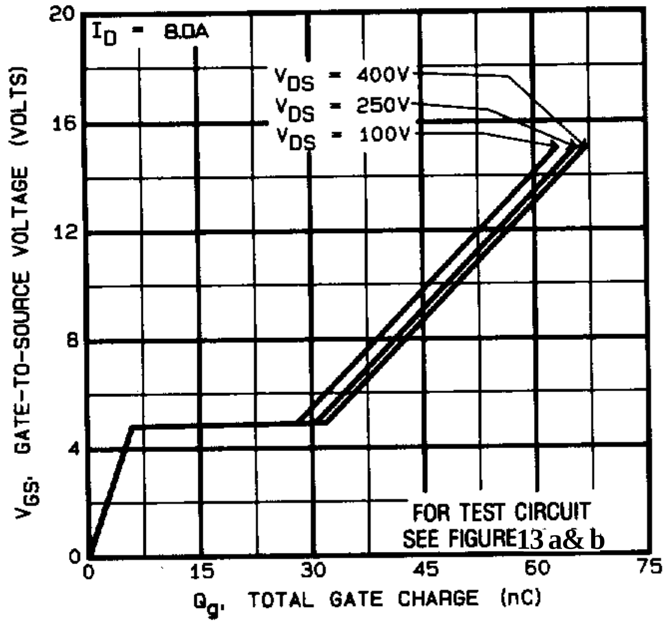


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

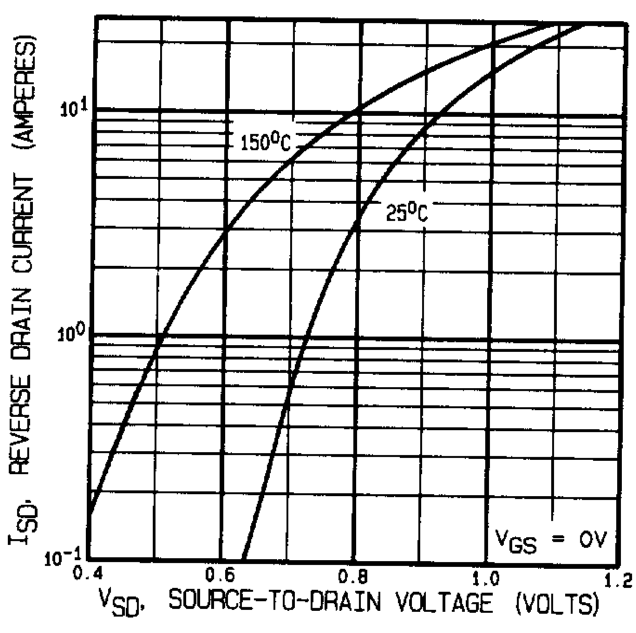


Fig 7. Typical Source-Drain Diode Forward Voltage

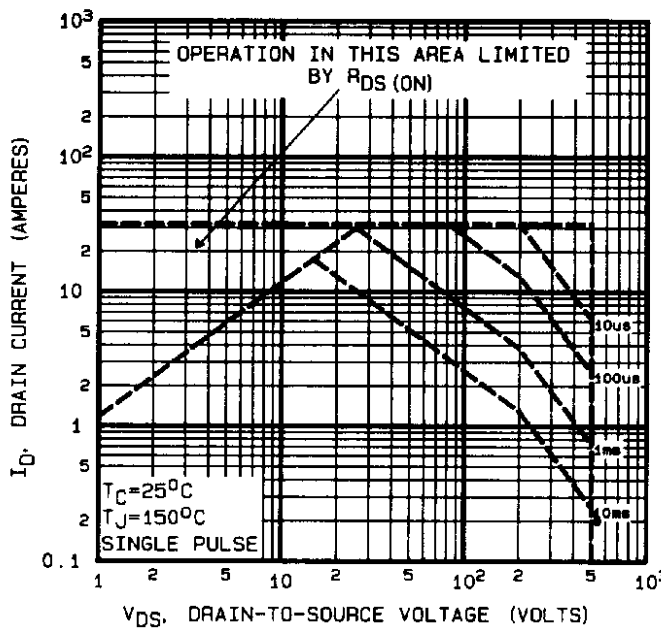


Fig 8. Maximum Safe Operating Area

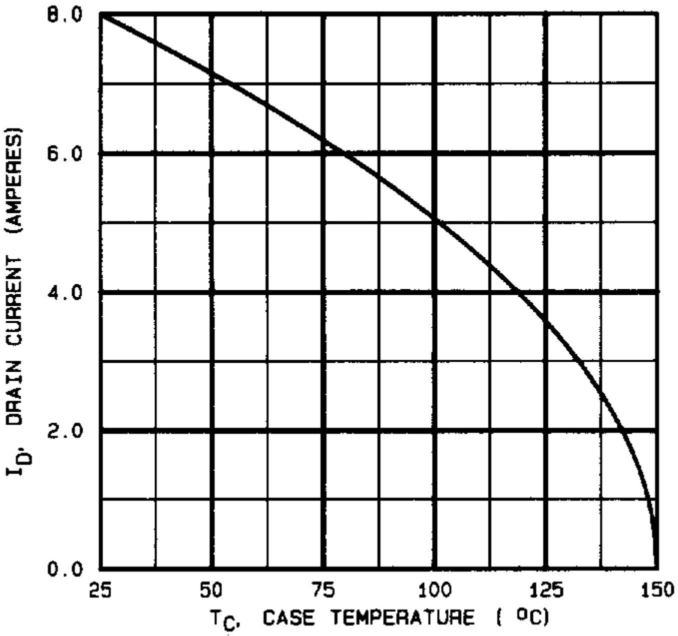


Fig 9. Maximum Drain Current Vs. Case Temperature

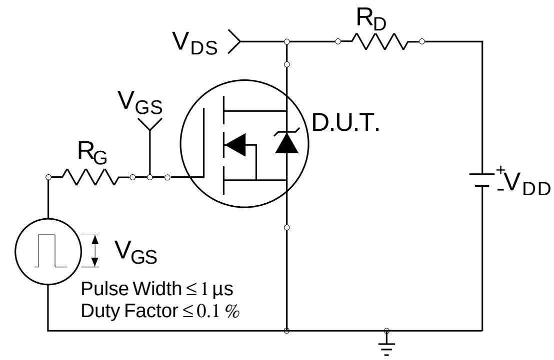


Fig 10a. Switching Time Test Circuit

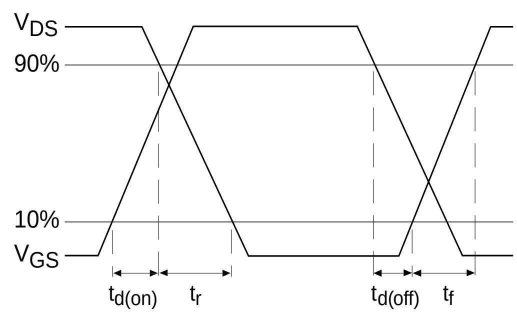


Fig 10b. Switching Time Waveforms

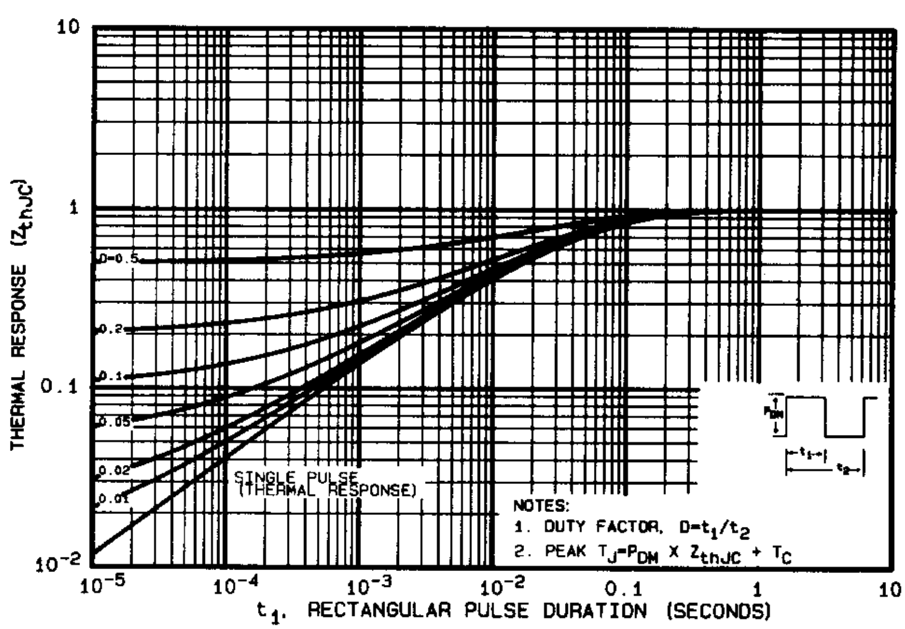


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

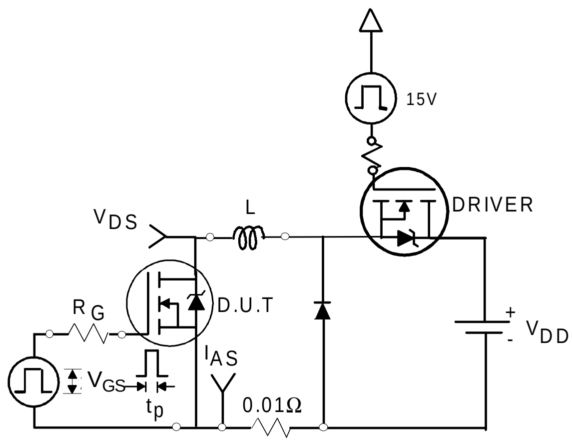


Fig 12a. Unclamped Inductive Test Circuit

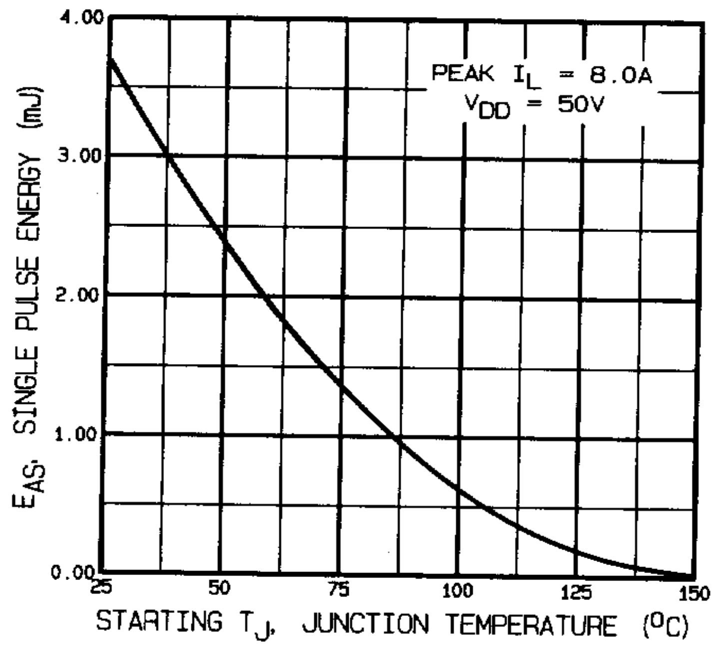


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

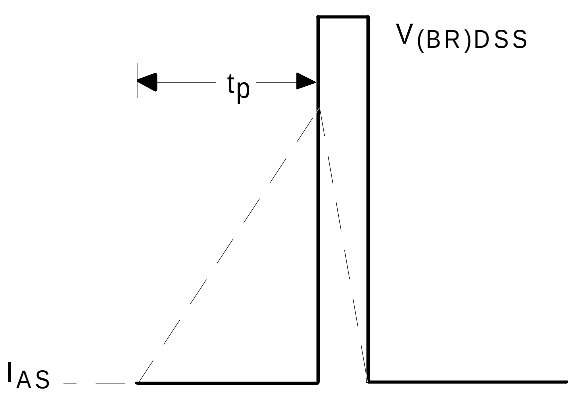


Fig 12b. Unclamped Inductive Waveforms

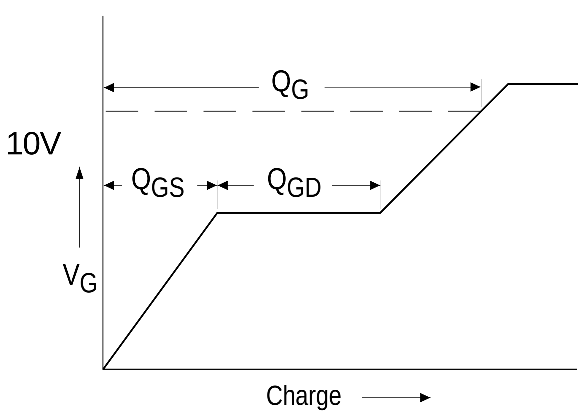


Fig 13a. Basic Gate Charge Waveform

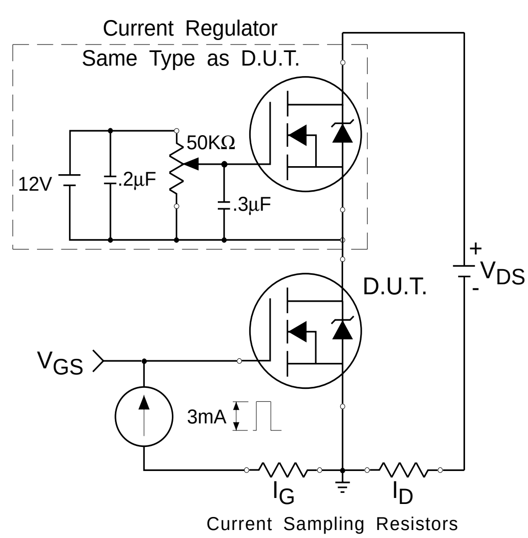


Fig 13b. Gate Charge Test Circuit

Foot Notes:

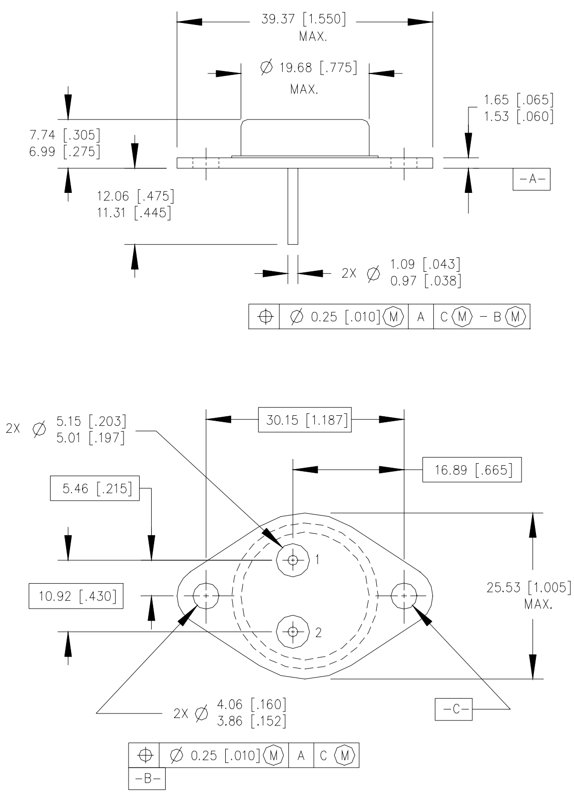
① Repetitive Rating; Pulse width limited by maximum junction temperature.

② V_{DD} = 50V, starting T_J = 25°C, Peak I_L = 8.0A,

③ $I_{SD} \leq 8.0$, di/dt ≤ 100A/μs, $V_{DD} \leq$ 500V, $T_J \leq$ 150°C
Suggested RG =9.1 Ω

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

Case Outline and Dimensions —TO-204AA (Modified TO-3)



PIN ASSIGNMENTS

HEXFET	SCHOTTKY	IGBT
1 - SOURCE	1 - ANODE 1	1 - GATE
2 - GATE	2 - ANODE 2	2 - EMITTER
3 - DRAIN (CASE)	3 - COMMON CATHODE (CASE)	3 - COLLECTOR (CASE)

NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
2. CONTROLLING DIMENSION : INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-204-AA.

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Data and specifications subject to change without notice. 04/01