

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

IRFAE50 800V, N-CHANNEL

Product Summary

Part Number	BVDSS	RDS(on)	Id
IRFAE50	800V	1.2 Ω	7.1A

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.



TO-3

Features:

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

Absolute Maximum Ratings

	Parameter		Units
I_D @ $V_{GS} = 0V$, $T_C = 25^\circ C$	Continuous Drain Current	7.1	A
I_D @ $V_{GS} = 0V$, $T_C = 100^\circ C$	Continuous Drain Current	4.5	
I_{DM}	Pulsed Drain Current ①	28	
P_D @ $T_C = 25^\circ C$	Max. Power Dissipation	150	W
	Linear Derating Factor	1.2	W/ $^\circ C$
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy ②	830	mJ
I_{AR}	Avalanche Current ①	7.1	A
E_{AR}	Repetitive Avalanche Energy ①	15	mJ
dv/dt	Peak Diode Recovery dv/dt ③	2.0	V/ns
T_J	Operating Junction	-55 to 150	$^\circ C$
T_{STG}	Storage Temperature Range		
	Lead Temperature	300 (0.063 in. (1.6mm) from case for 10s)	
	Weight	11.5(typical)	g

For footnotes refer to the last page

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

	Parameter	Min	Typ	Max	Units	Test Conditions
BVDSS	Drain-to-Source Breakdown Voltage	800	—	—	V	V _{GS} = 0V, I _D = 1.0mA
ΔBVDSS/ΔT _j	Temperature Coefficient of Breakdown Voltage	—	0.98	—	V/°C	Reference to 25°C, I _D = 1.0mA
RDS(on)	Static Drain-to-Source On-State Resistance	—	—	1.2	Ω	V _{GS} = 10V, I _D = 4.5A④
		—	—	1.4		V _{GS} = 10V, I _D = 7.1A ④
VGS(th)	Gate Threshold Voltage	2.0	—	4.0	V	V _{DS} = V _{GS} , I _D = 250μA
gfs	Forward Transconductance	5.9	—	—	S ()	V _{DS} > 15V, I _{DS} = 4.5A ④
IDSS	Zero Gate Voltage Drain Current	—	—	25	μA	V _{DS} =640V, V _{GS} = 0V
		—	—	250		V _{DS} = 640V V _{GS} = 0V, T _J = 125°C
IGSS	Gate-to-Source Leakage Forward	—	—	100	nA	V _{GS} = 20V
IGSS	Gate-to-Source Leakage Reverse	—	—	-100		V _{GS} = -20V
Qg	Total Gate Charge	84	—	190	nC	V _{GS} = 10V, I _D = 7.1A V _{DS} = 400V
Qgs	Gate-to-Source Charge	6.6	—	15		
Qgd	Gate-to-Drain ('Miller') Charge	48	—	110		
td(on)	Turn-On Delay Time	—	—	32	ns	V _{DD} = 400V, I _D = 7.1A, R _G = 2.35Ω
tr	Rise Time	—	—	68		
td(off)	Turn-Off Delay Time	—	—	78		
tf	Fall Time	—	—	24		
LS + LD	Total Inductance	—	6.1	—	nH	Measured from drain lead (6mm/0.25in. from package) to source lead (6mm/0.25in. from package)
Ciss	Input Capacitance	—	2800	—	pF	V _{GS} = 0V, V _{DS} = 25V f = 1.0MHz
Coss	Output Capacitance	—	400	—		
Crss	Reverse	—	200	—		

Source-Drain Diode Ratings and Characteristics

	Parameter	Min	Typ	Max	Units	Test Conditions
I _S	Continuous Source Current (Body Diode)	—	—	7.1	A	
I _{SM}	Pulse Source Current (Body Diode) ①	—	—	28		
V _{SD}	Diode Forward Voltage	—	—	1.8	V	T _j = 25°C, I _S =7.1A, V _{GS} = 0V ④
t _{rr}	Reverse Recovery Time	—	—	1600	nS	T _j = 25°C, I _F =7.1A, di/dt ≤ 100A/μs V _{DD} ≤ 50V ④
Q _{RR}	Reverse Recovery Charge	—	—	13	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
RthJC	Junction to Case	—	—	0.83	°C/W	
RthJA	Junction to Ambient	—	—	30		Typical socket mount

For footnotes refer to the last page

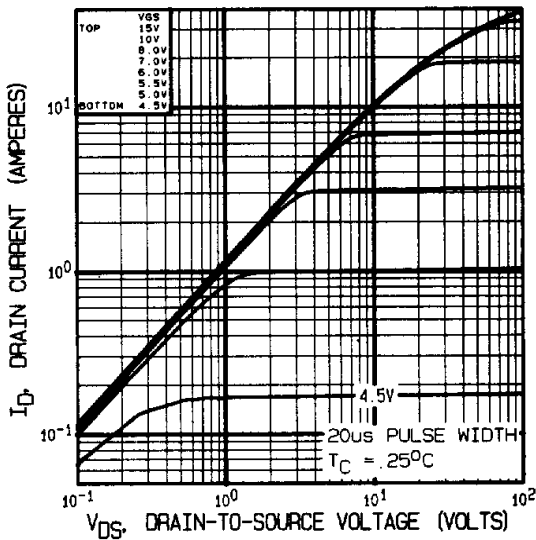


Fig 1. Typical Output Characteristics

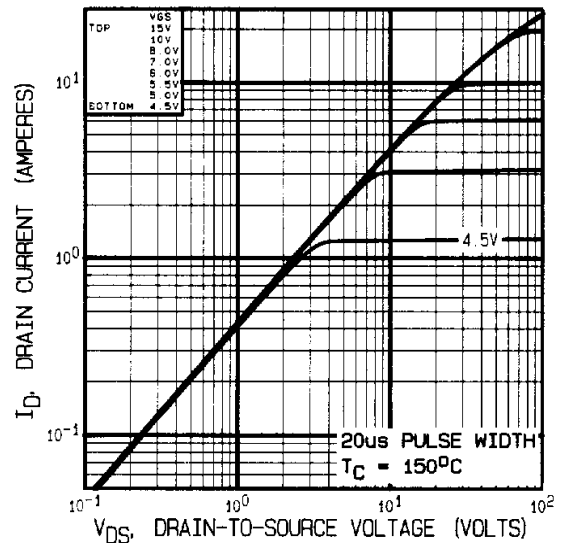


Fig 2. Typical Output Characteristics

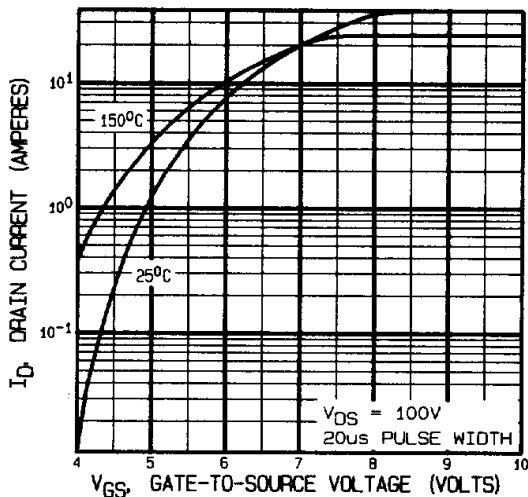


Fig 3. Typical Transfer Characteristics

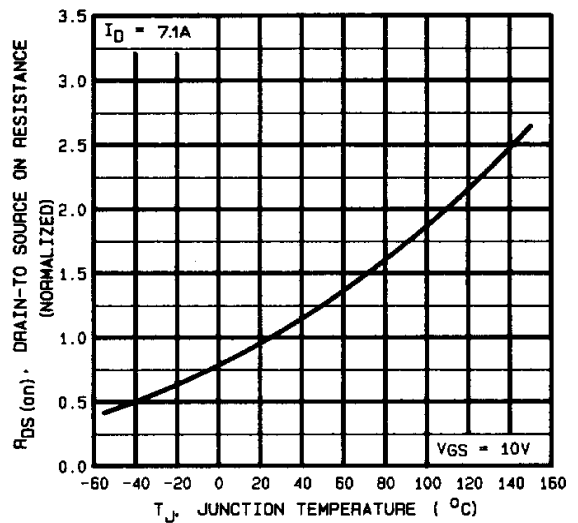


Fig 4. Normalized On-Resistance Vs. Temperature

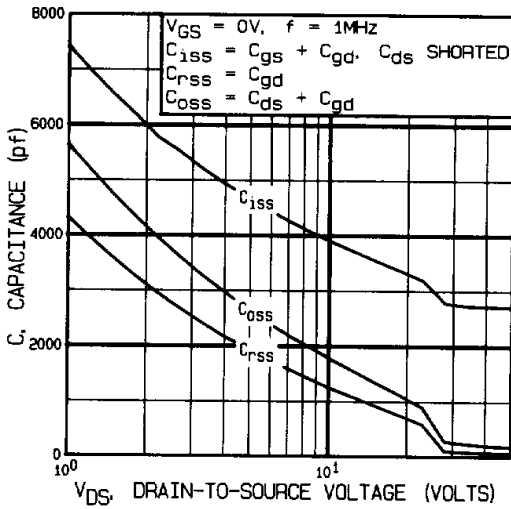


Fig 5. Typical Capacitance Vs.
Drain-to-Source Voltage

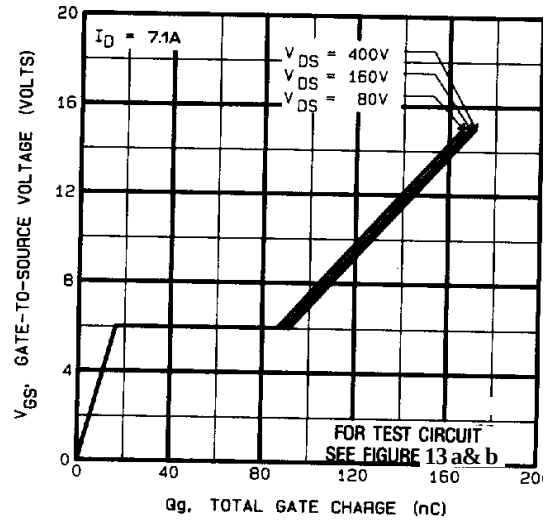


Fig 6. Typical Gate Charge Vs.
Gate-to-Source Voltage

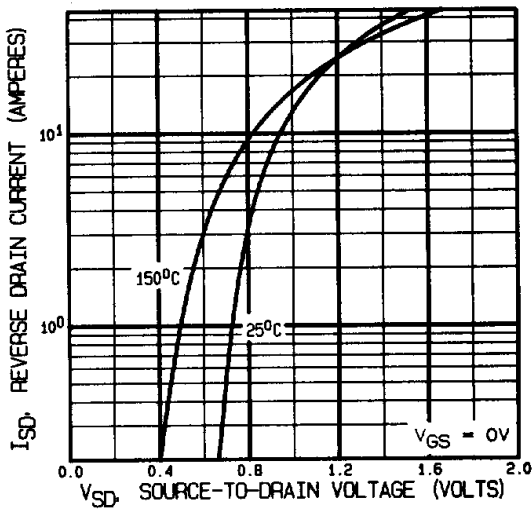


Fig 7. Typical Source-Drain Diode
Forward Voltage

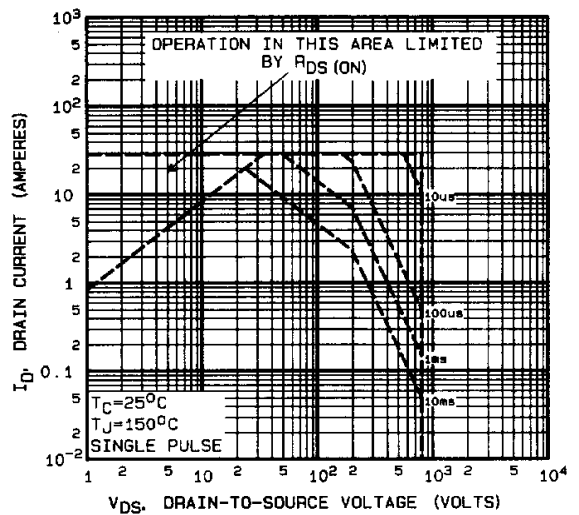


Fig 8. Maximum Safe Operating Area

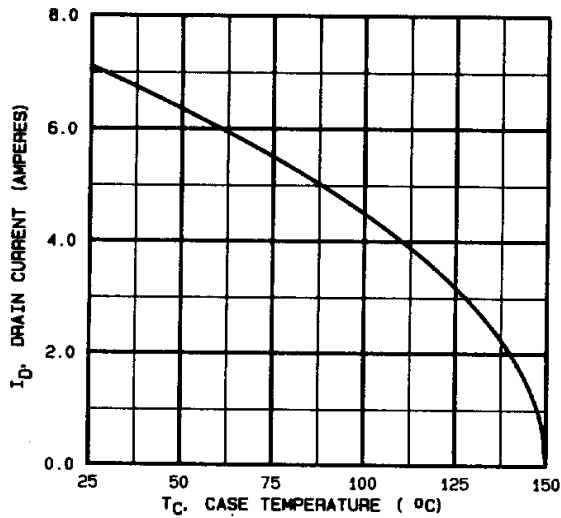


Fig 9. Maximum Drain Current Vs. Case Temperature

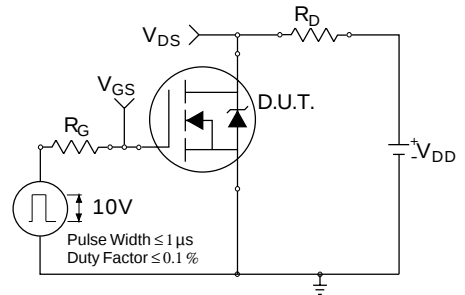


Fig 10a. Switching Time Test Circuit

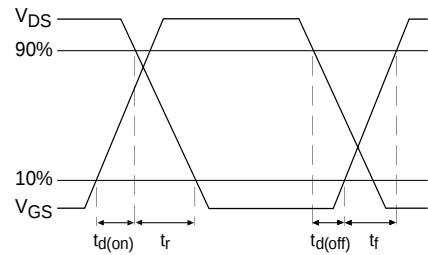


Fig 10b. Switching Time Waveforms

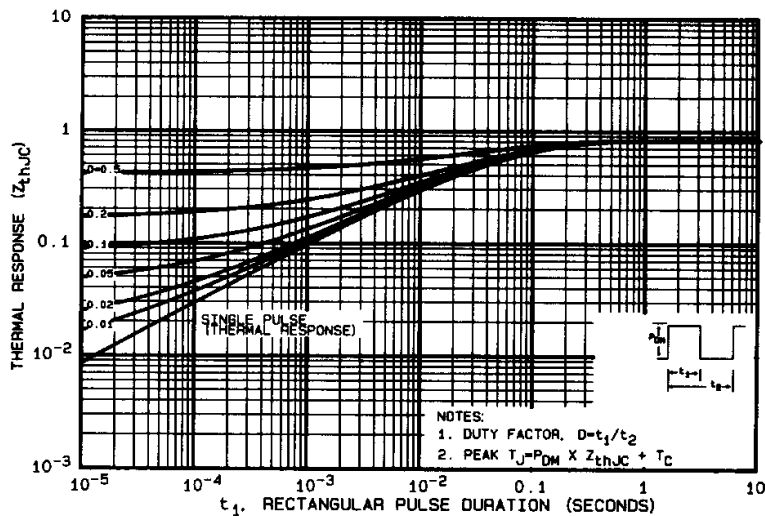


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

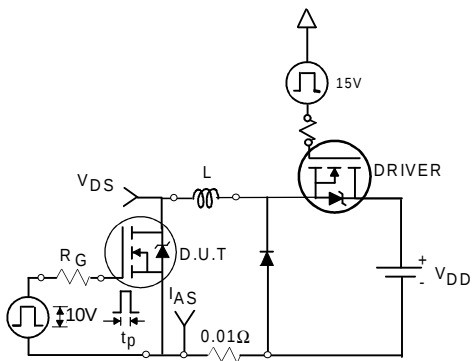


Fig 12a. Unclamped Inductive Test Circuit

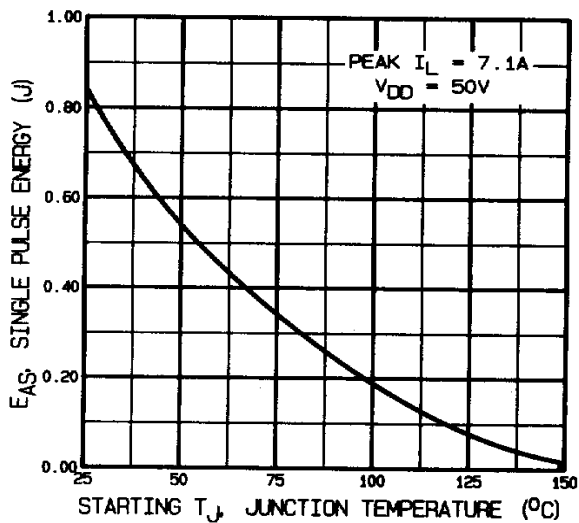
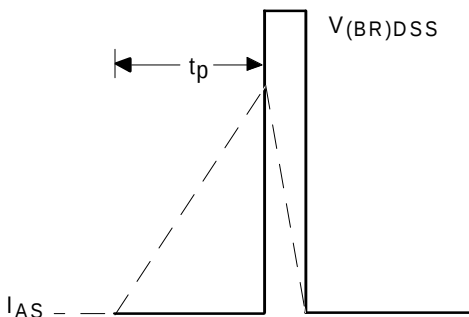
Fig 12c. Maximum Avalanche Energy
Vs. Drain Current

Fig 12b. Unclamped Inductive Waveforms

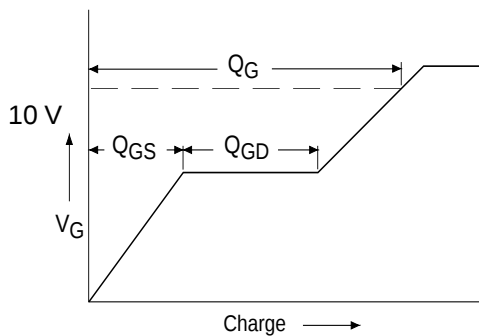


Fig 13a. Basic Gate Charge Waveform

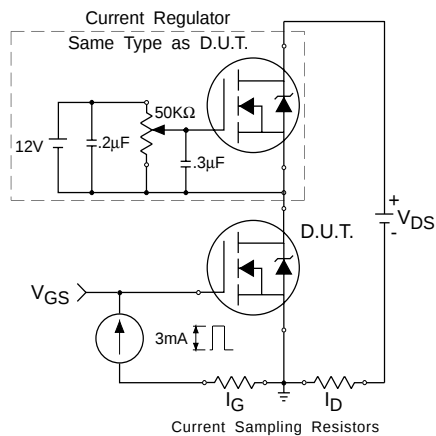


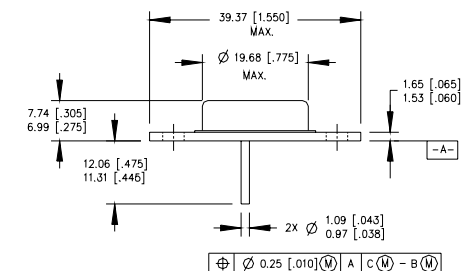
Fig 13b. Gate Charge Test Circuit

Foot Notes:

- ① Repetitive Rating; Pulse width limited by maximum junction temperature.
- ② $V_{DD} = 50V$, starting $T_J = 25^{\circ}C$,
Peak $I_L = 7.1A$,

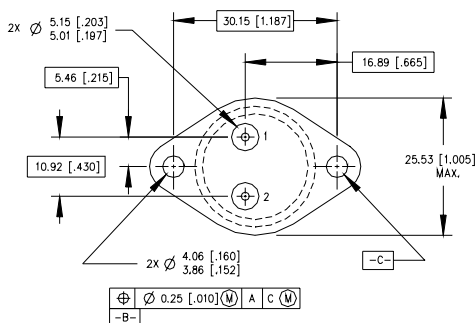
- ③ $I_{SD} \leq 7.1A$, $di/dt \leq 120A/\mu s$,
 $V_{DD} \leq 800V$, $T_J \leq 150^{\circ}C$
Suggested $R_G = 2.35\Omega$

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.