

## REPETITIVE AVALANCHE AND $dv/dt$ RATED HEXFET<sup>®</sup> TRANSISTORS THRU-HOLE (TO-204AA/AE)

## IRF350 JANTX2N6768 JANTXV2N6768 [REF:MIL-PRF-19500/543] 400V, N-CHANNEL

### Product Summary

Part Number	BVDSS	RDS(on)	ID
IRF350	400V	0.300Ω	14A



The HEXFET<sup>®</sup> 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
ID @ VGS = 10V, TC = 25°C	Continuous Drain Current	14	A
ID @ VGS = 10V, TC = 100°C	Continuous Drain Current	9.0	
IDM	Pulsed Drain Current ①	56	
PD @ TC = 25°C	Max. Power Dissipation	150	W
	Linear Derating Factor	1.2	W/°C
VGS	Gate-to-Source Voltage	±20	V
EAS	Single Pulse Avalanche Energy ②	11.3	mJ
IAR	Avalanche Current ①	14	A
EAR	Repetitive Avalanche Energy ①	15	mJ
dv/dt	Peak Diode Recovery $dv/dt$ ③	4.0	V/ns
TJ	Operating Junction	-55 to 150	°C
TSTG	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 @ Tj = 25°C (Unless Otherwise Specified)**

	Parameter	Min	Typ	Max	Units	Test Conditions
BVDSS	Drain-to-Source Breakdown Voltage	400	—	—	V	VGS = 0V, ID = 1.0mA
ΔBVDSS/ΔTj	Temperature Coefficient of Breakdown Voltage	—	0.46	—	V/°C	Reference to 25°C, ID = 1.0mA
RDS(on)	Static Drain-to-Source On-State Resistance	—	—	0.300	Ω	VGS = 10V, ID = 9.0A④
		—	—	0.400		VGS = 10V, ID = 14A ④
VGS(th)	Gate Threshold Voltage	2.0	—	4.0	V	VDS = VGS, ID = 250μA
gfs	Forward Transconductance	6.0	—	—	S (Ω)	VDS > 15V, IDS = 9.0A④
IDSS	Zero Gate Voltage Drain Current	—	—	25	μA	VDS = 320V, VGS = 0V
		—	—	250		VDS = 320V VGS = 0V, Tj = 125°C
IGSS	Gate-to-Source Leakage Forward	—	—	100	nA	VGS = 20V
IGSS	Gate-to-Source Leakage Reverse	—	—	-100		VGS = -20V
Qg	Total Gate Charge	52	—	110	nC	VGS = 10V, ID = 14A
Qgs	Gate-to-Source Charge	5.0	—	18		VDS = 200V
Qgd	Gate-to-Drain ('Miller') Charge	25	—	65		
td(on)	Turn-On Delay Time	—	—	35	ns	VDD = 200V, ID = 14A, RG = 2.35Ω
tr	Rise Time	—	—	190		
td(off)	Turn-Off Delay Time	—	—	170		
tf	Fall Time	—	—	130		
LS + LD	Total Inductance	—	6.1	—	nH	Measured from the center of drain pad to center of source pad
Ciss	Input Capacitance	—	2600	—	pF	VGS = 0V, VDS = 25V f = 1.0MHz
Coss	Output Capacitance	—	680	—		
Crss	Reverse Transfer Capacitance	—	250	—		

**Source-Drain Diode Ratings and Characteristics**

	Parameter	Min	Typ	Max	Units	Test Conditions
IS	Continuous Source Current (Body Diode)	—	—	14	A	
ISM	Pulse Source Current (Body Diode) ①	—	—	56		
VSD	Diode Forward Voltage	—	—	1.7	V	Tj = 25°C, IS = 14A, VGS = 0V ④
trr	Reverse Recovery Time	—	—	1200	nS	Tj = 25°C, IF = 14A, di/dt ≤ 100A/μs
QRR	Reverse Recovery Charge	—	—	250	μc	VDD ≤ 50V ④
ton	Forward Turn-On Time	Intrinsic turn-on time is negligible. Turn-on speed is substantially controlled by LS + LD.				

**Thermal Resistance**

	Parameter	Min	Typ	Max	Units	Test Conditions
RthJC	Junction to Case	—	—	0.83	°C/W	Typical socket mount
RthJA	Junction to Ambient	—	—	30		

For footnotes refer to the last page

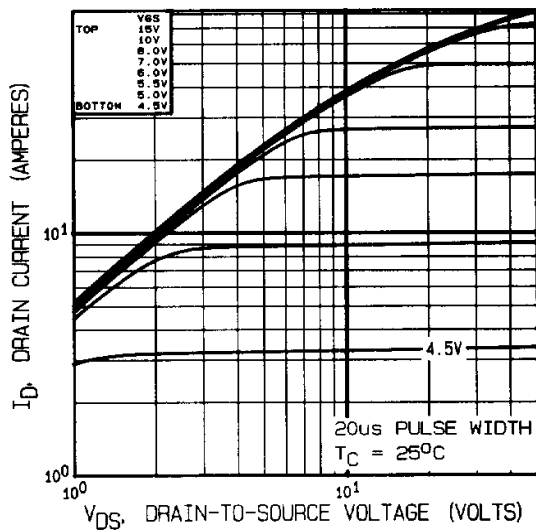


Fig 1. Typical Output Characteristics

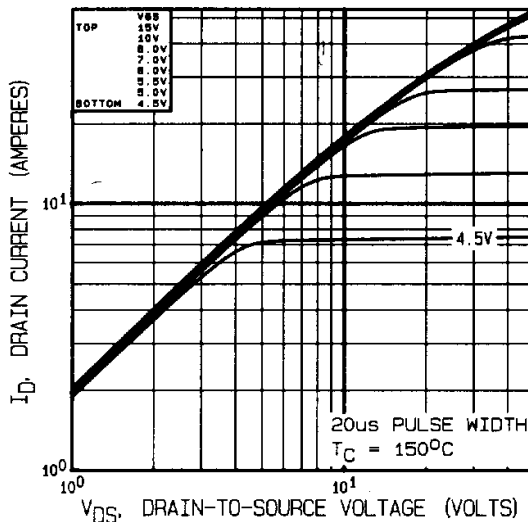


Fig 2. Typical Output Characteristics

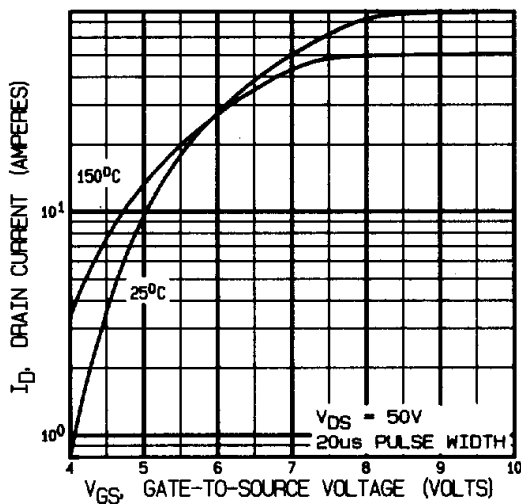


Fig 3. Typical Transfer Characteristics

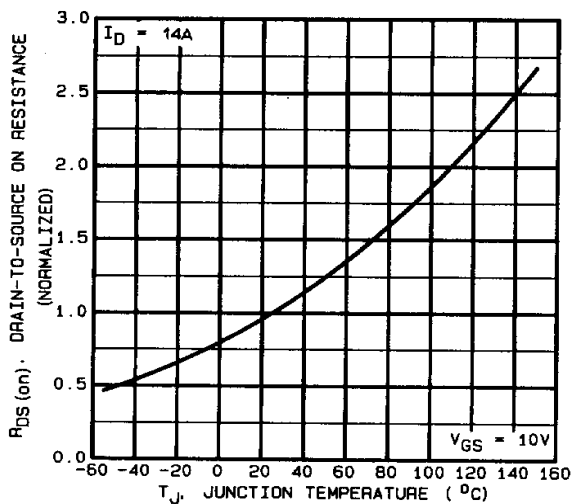


Fig 4. Normalized On-Resistance Vs. Temperature

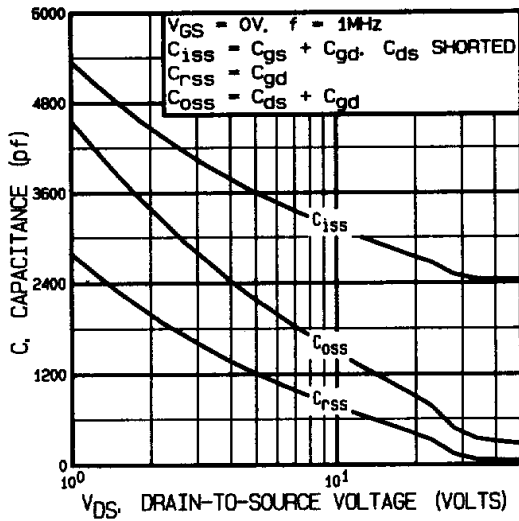


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

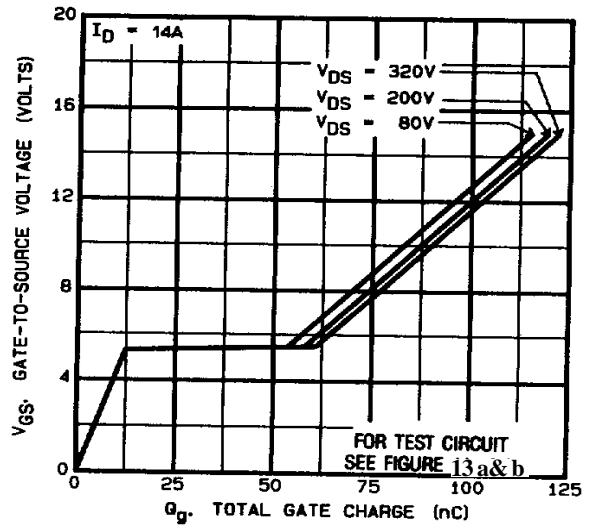


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

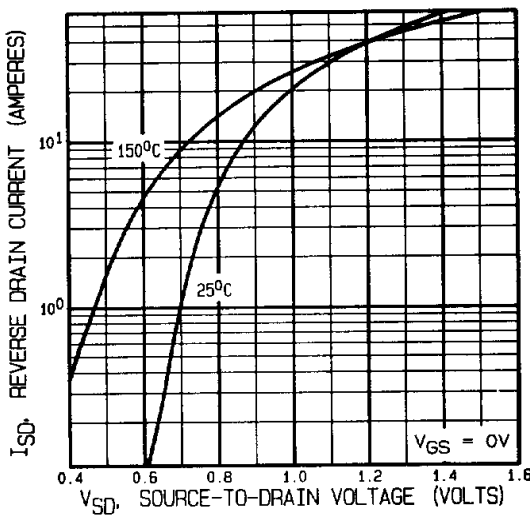


Fig 7. Typical Source-Drain Diode Forward Voltage

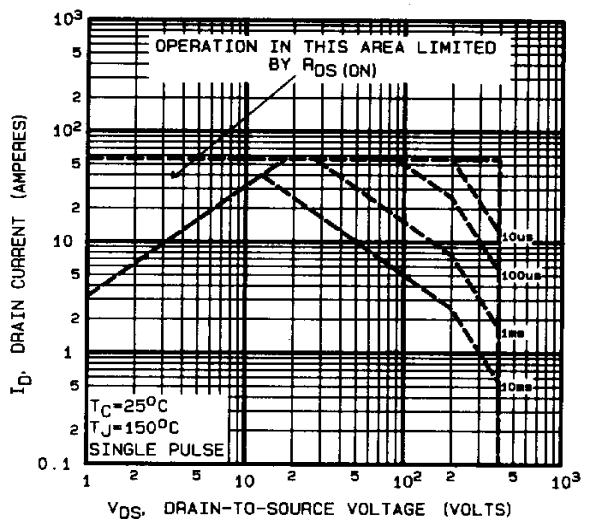


Fig 8. Maximum Safe Operating Area

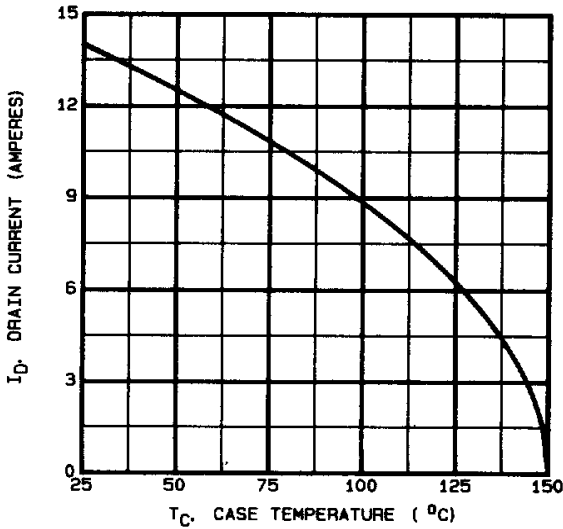


Fig 9. Maximum Drain Current Vs. Case Temperature



Fig 10a. Switching Time Test Circuit



Fig 10b. Switching Time Waveforms

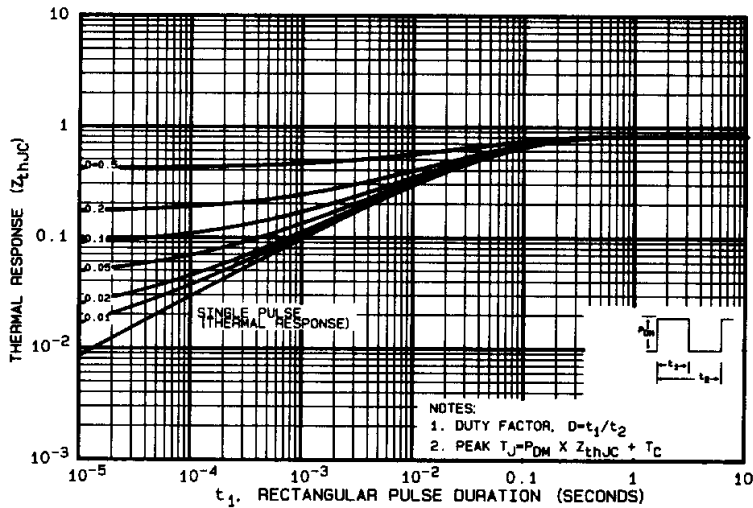


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

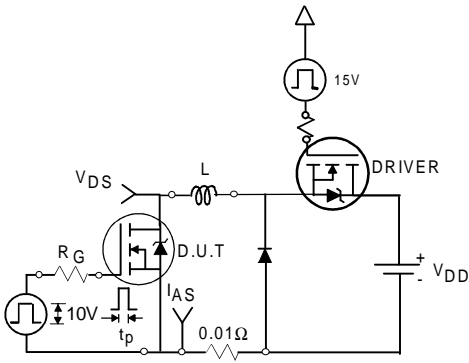


Fig 12a. Unclamped Inductive Test Circuit

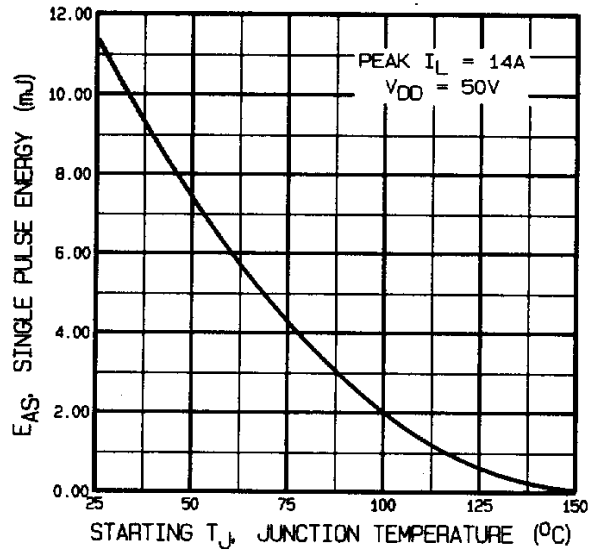


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

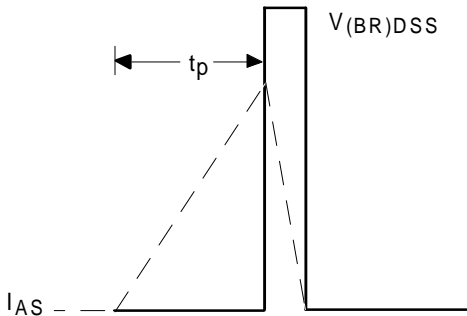


Fig 12b. Unclamped Inductive Waveforms

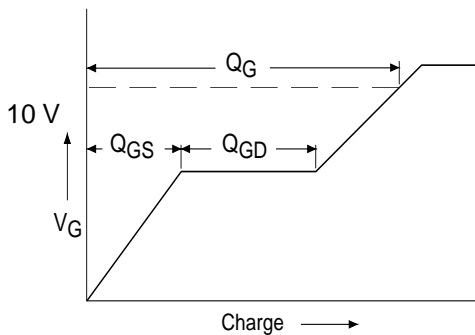


Fig 13a. Basic Gate Charge Waveform

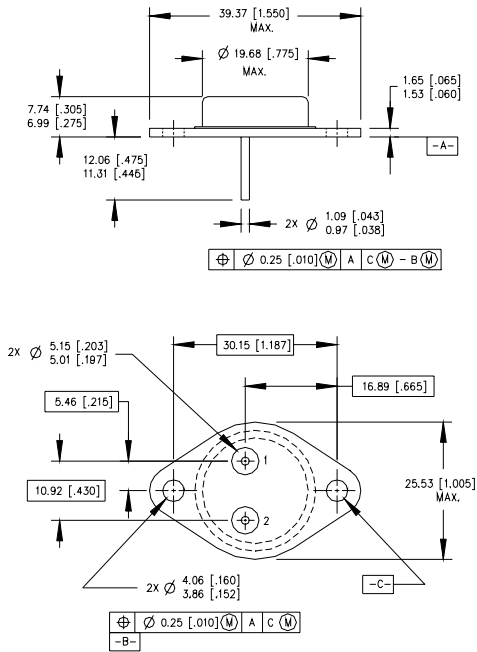


Fig 13b. Gate Charge Test Circuit

**Foot Notes:**

- ① Repetitive Rating; Pulse width limited by maximum junction temperature.
- ②  $V_{DD} = 50V$ , starting  $T_J = 25^\circ C$ ,  
 Peak  $I_L = 14A$ ,
- ③  $I_{SD} \leq 14A$ ,  $di/dt \leq 145A/\mu s$ ,  
 $V_{DD} \leq 400V$ ,  $T_J \leq 150^\circ C$   
 Suggested  $R_G = 2.35 \Omega$
- ④ Pulse width  $\leq 300 \mu s$ ; Duty Cycle  $\leq 2\%$

**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.