

REPETITIVE AVALANCHE AND dv/dt RATED HEXFET[®] 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[®] 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 @ $V_{GS} = 10V$, $T_C = 25^\circ C$	Continuous Drain Current	14	A
I_D @ $V_{GS} = 10V$, $T_C = 100^\circ C$	Continuous Drain Current	9.0	
I_{DM}	Pulsed Drain Current ①	56	
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	11.3	mJ
I_{AR}	Avalanche Current ①	14	A
E_{AR}	Repetitive Avalanche Energy ①	15	mJ
dv/dt	Peak Diode Recovery dv/dt ③	4.0	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 @ $T_j = 25^\circ\text{C}$ (Unless Otherwise Specified)

	Parameter	Min	Typ	Max	Units	Test Conditions
BVDSS	Drain-to-Source Breakdown Voltage	400	—	—	V	$V_{GS} = 0\text{V}$, $I_D = 1.0\text{mA}$
$\Delta BVDSS/\Delta T_j$	Temperature Coefficient of Breakdown Voltage	—	0.46	—	$^\circ\text{C}$	Reference to 25°C , $I_D = 1.0\text{mA}$
RDS(on)	Static Drain-to-Source On-State Resistance	—	—	0.300	Ω	$V_{GS} = 10\text{V}$, $I_D = 9.0\text{A}$ ④
		—	—	0.400		$V_{GS} = 10\text{V}$, $I_D = 14\text{A}$ ④
VGS(th)	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$
gfs	Forward Transconductance	6.0	—	—	S (S)	$V_{DS} > 15\text{V}$, $I_{DS} = 9.0\text{A}$ ④
IDSS	Zero Gate Voltage Drain Current	—	—	25	μA	$V_{DS} = 320\text{V}$, $V_{GS} = 0\text{V}$
		—	—	250		$V_{DS} = 320\text{V}$ $V_{GS} = 0\text{V}$, $T_j = 125^\circ\text{C}$
IGSS	Gate-to-Source Leakage Forward	—	—	100	nA	$V_{GS} = 20\text{V}$
IGSS	Gate-to-Source Leakage Reverse	—	—	-100		$V_{GS} = -20\text{V}$
Qg	Total Gate Charge	52	—	110	nC	$V_{GS} = 10\text{V}$, $I_{D1} = 14\text{A}$ $V_{DS} = 200\text{V}$
Qgs	Gate-to-Source Charge	5.0	—	18		
Qgd	Gate-to-Drain ('Miller') Charge	25	—	65		
td(on)	Turn-On Delay Time	—	—	35	ns	$V_{DD} = 200\text{V}$, $I_D = 14\text{A}$, $R_G = 2.35\Omega$
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	$V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$ $f = 1.0\text{MHz}$
Coss	Output Capacitance	—	680	—		
Crss	Reverse Transfer Capacitance	—	250	—		

Source-Drain Diode Ratings and Characteristics

	Parameter	Min	Typ	Max	Units	Test Conditions
I _S	Continuous Source Current (Body Diode)	—	—	14	A	
I _{SM}	Pulse Source Current (Body Diode) ①	—	—	56		
V _{SD}	Diode Forward Voltage	—	—	1.7	V	T _j = 25°C, I _S =14A, V _{GS} = 0V ④
t _{rr}	Reverse Recovery Time	—	—	1200	nS	T _j = 25°C, I _F =14A, di/dt ≤100A/μs V _{DD} ≤50V ④
Q _{RR}	Reverse Recovery Charge	—	—	250	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	$^\circ\text{C}/\text{W}$	
RthJA	Junction to Ambient	—	—	30		Typical socket mount

For footnotes refer to the last page

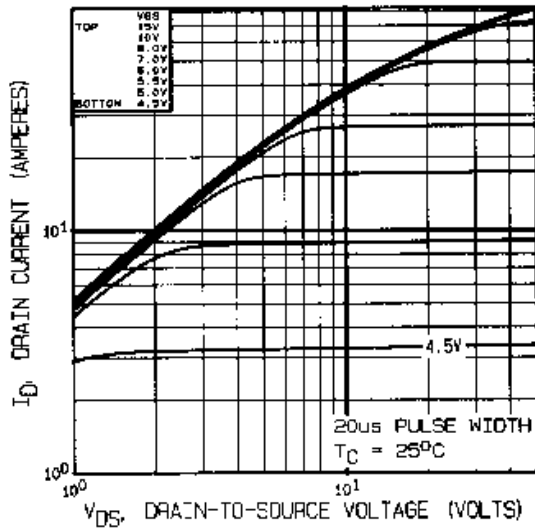


Fig 1. Typical Output Characteristics

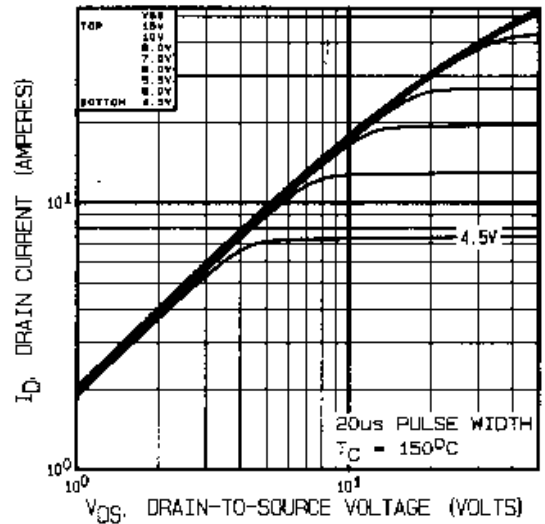


Fig 2. Typical Output Characteristics

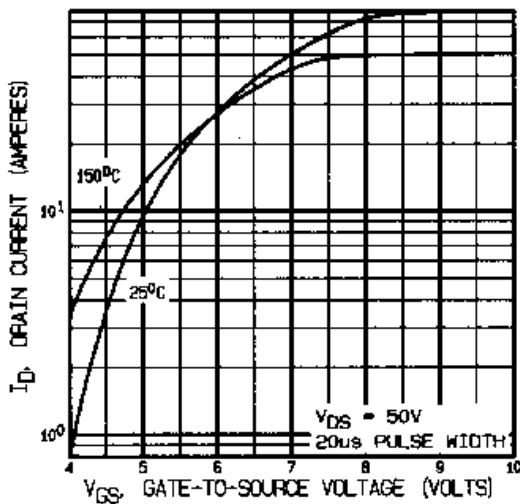


Fig 3. Typical Transfer Characteristics

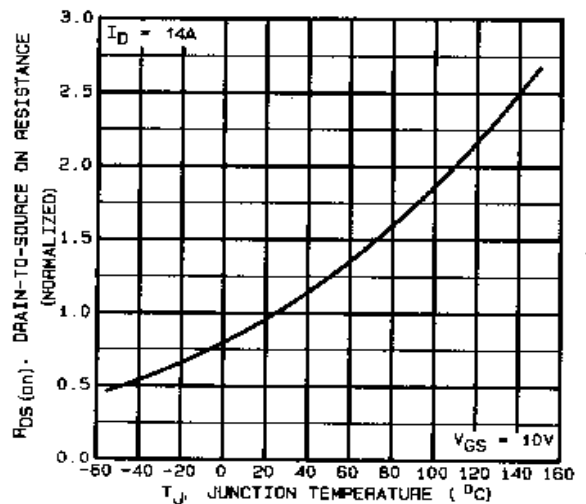


Fig 4. Normalized On-Resistance
Vs. Temperature

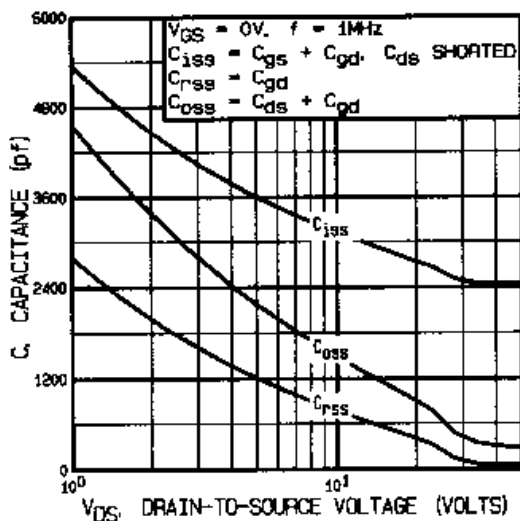


Fig 5. Typical Capacitance Vs.
Drain-to-Source Voltage

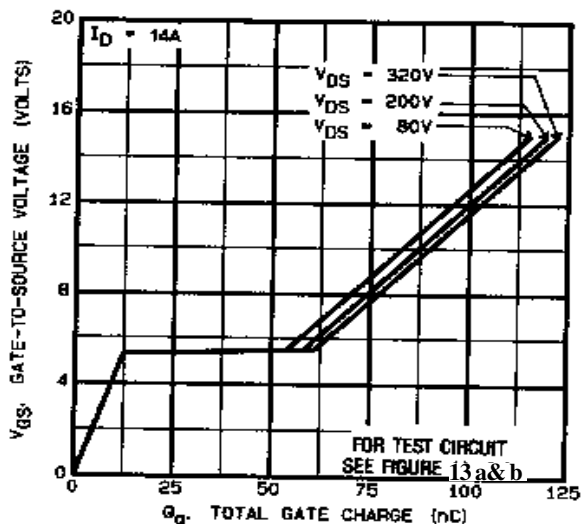


Fig 6. Typical Gate Charge Vs.
Gate-to-Source Voltage

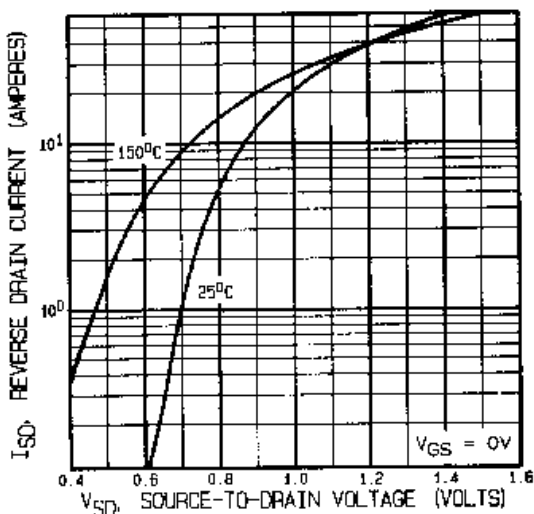


Fig 7. Typical Source-Drain Diode
Forward Voltage

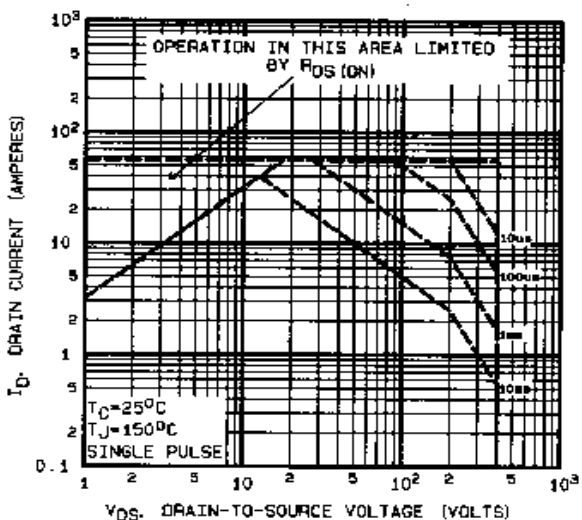


Fig 8. Maximum Safe Operating Area

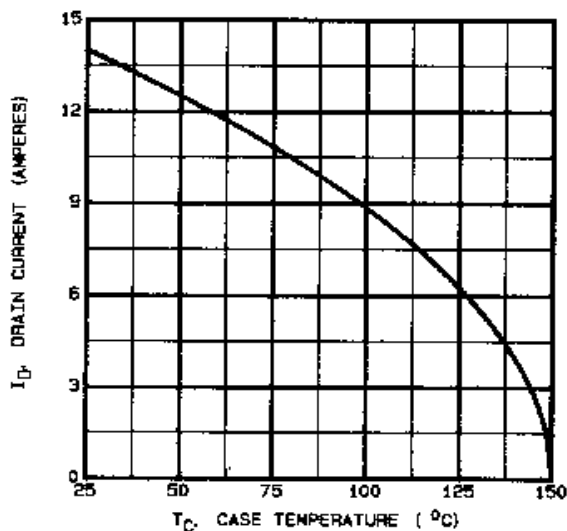


Fig 9. Maximum Drain Current Vs. Case Temperature

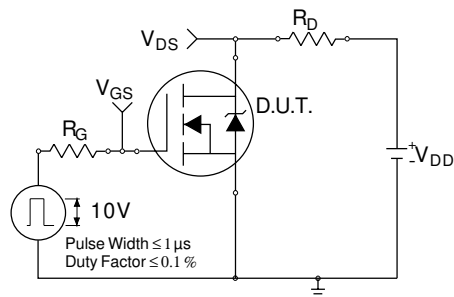


Fig 10a. Switching Time Test Circuit

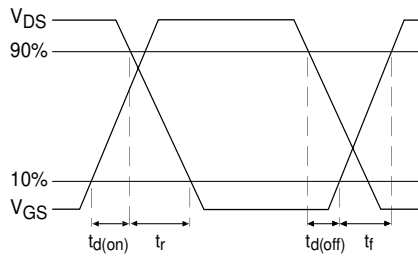


Fig 10b. Switching Time Waveforms

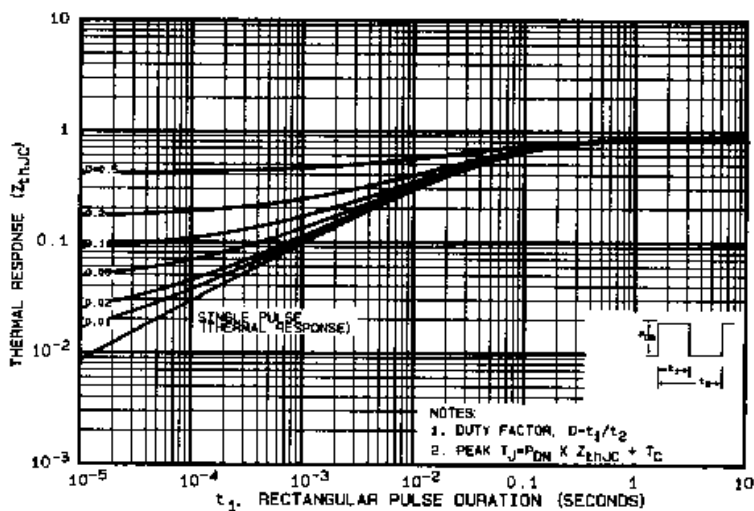


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

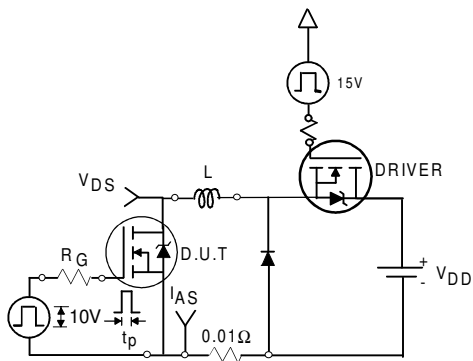


Fig 12a. Unclamped Inductive Test Circuit

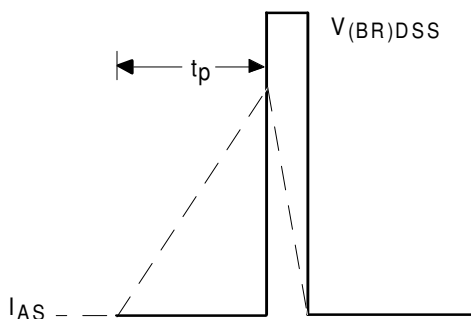


Fig 12b. Unclamped Inductive Waveforms

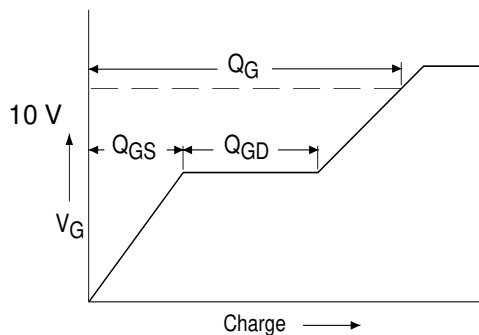


Fig 13a. Basic Gate Charge Waveform

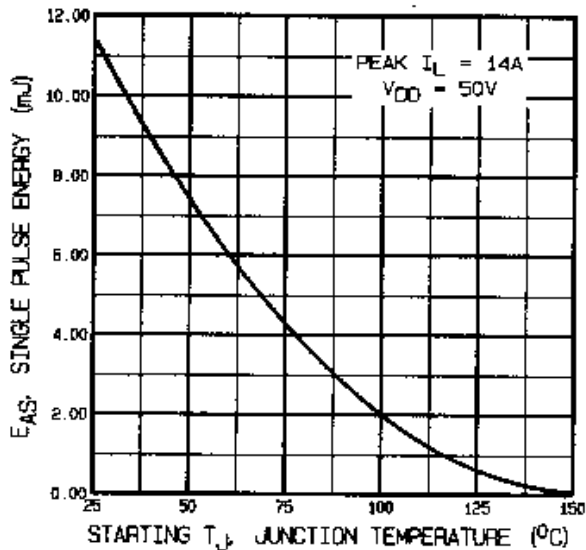


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

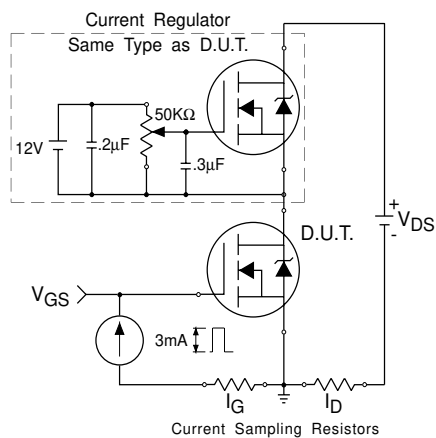
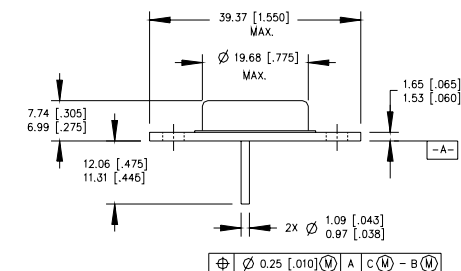


Fig 13b. Gate Charge Test Circuit

Foot Notes:

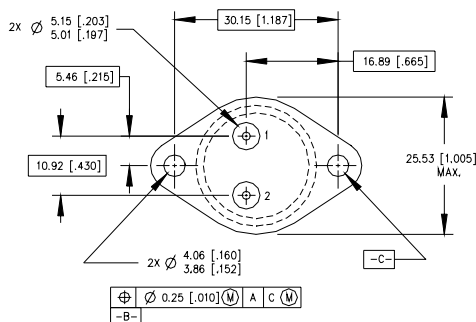
- ① Repetitive Rating; Pulse width limited by maximum junction temperature.
- ② $V_{DD} = 50V$, starting $T_J = 25^\circ C$,
Peak $I_L = 14A$,
- ③ $I_{SD} \leq 14A$, $di/dt \leq 145A/\mu s$,
 $V_{DD} \leq 400V$, $T_J \leq 150^\circ C$
Suggested $R_G = 2.35 \Omega$
- ④ Pulse width $\leq 300 \mu s$; Duty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