

Applications

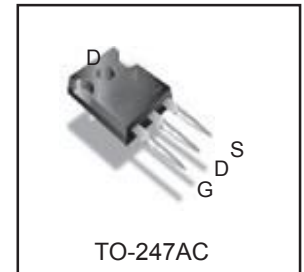
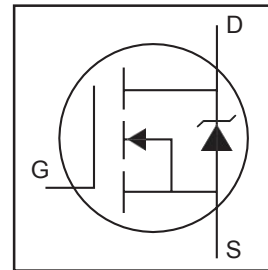
- High Efficiency Synchronous Rectification in SMPS
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits

Benefits

- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche SOA
- Enhanced body diode dV/dt and dI/dt Capability

HEXFET® Power MOSFET

V_{DSS}	100V
R_{DS(on)} typ. max.	3.7mΩ
	4.5mΩ
I_D (Silicon Limited)	180A Ⓢ
I_D (Package Limited)	120A



G	D	S
Gate	Drain	Source

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V (Silicon Limited)	180Ⓢ	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V (Silicon Limited)	130Ⓢ	
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V (Wire Bond Limited)	120	
I _{DM}	Pulsed Drain Current Ⓢ	670	
P _D @ T _C = 25°C	Maximum Power Dissipation	370	W
	Linear Derating Factor	2.5	W/°C
V _{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery Ⓢ	5.3	V/ns
T _J	Operating Junction and	-55 to + 175	°C
T _{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)		
	Mounting torque, 6-32 or M3 screw	10lb·in (1.1N·m)	

Avalanche Characteristics

E _{AS} (Thermally limited)	Single Pulse Avalanche Energy Ⓢ	190	mJ
I _{AR}	Avalanche Current Ⓢ	108	A
E _{AR}	Repetitive Avalanche Energy Ⓢ	37	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case Ⓢ	—	0.402	°C/W
R _{θCS}	Case-to-Sink, Flat Greased Surface	0.24	—	
R _{θJA}	Junction-to-Ambient	—	40	

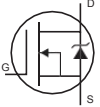
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	100	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.108	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 5mA$ ○
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	3.7	4.5	m Ω	$V_{GS} = 10V, I_D = 75A$ ○
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 100V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 100V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$

Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	160	—	—	S	$V_{DS} = 50V, I_D = 75A$
Q_g	Total Gate Charge	—	150	210	nC	$I_D = 75A$
Q_{gs}	Gate-to-Source Charge	—	35	—		$V_{DS} = 50V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	43	—		$V_{GS} = 10V$ ○
R_G	Gate Resistance	—	1.3	—		Ω
$t_{d(on)}$	Turn-On Delay Time	—	25	—	ns	$V_{DD} = 65V$
t_r	Rise Time	—	67	—		$I_D = 75A$
$t_{d(off)}$	Turn-Off Delay Time	—	78	—		$R_G = 2.6\Omega$
t_f	Fall Time	—	88	—		$V_{GS} = 10V$ ○
C_{iss}	Input Capacitance	—	9620	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	670	—		$V_{DS} = 50V$
C_{rss}	Reverse Transfer Capacitance	—	250	—		$f = 1.0MHz$
$C_{oss \text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related) ○	—	820	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 80V$ ○
$C_{oss \text{ eff. (TR)}}$	Effective Output Capacitance (Time Related) ®	—	950	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 80V$ ®

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	170 ①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ○○	—	—	670		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 75A, V_{GS} = 0V$ ○
t_{rr}	Reverse Recovery Time	—	50	75	ns	$T_J = 25^\circ\text{C}$
		—	60	90		$T_J = 125^\circ\text{C}$
Q_{rr}	Reverse Recovery Charge	—	94	140	nC	$T_J = 25^\circ\text{C}$
		—	140	210		$T_J = 125^\circ\text{C}$
I_{RRM}	Reverse Recovery Current	—	3.5	—	A	$T_J = 25^\circ\text{C}$
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

- ① Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 120A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.
- Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by T_{Jmax} , starting $T_J = 25^\circ\text{C}$, $L = 0.033mH$
 $R_G = 25\Omega, I_{AS} = 108A, V_{GS} = 10V$. Part not recommended for use above this value.
- ® $I_{SD} \leq 75A, di/dt \leq 630A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$.
- Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.
- ® $C_{oss \text{ eff. (TR)}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
- $C_{oss \text{ eff. (ER)}}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
 When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.
- ® R_θ is measured at T_J approximately 90°C .

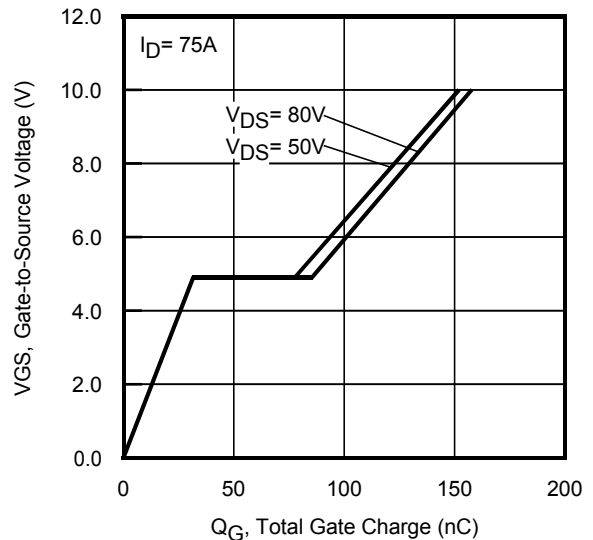
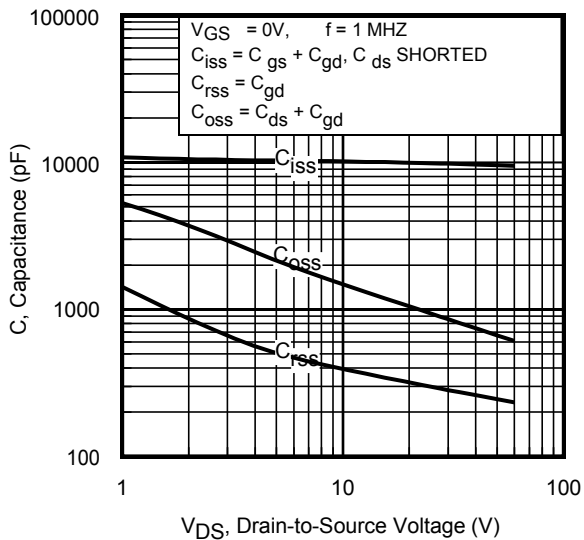
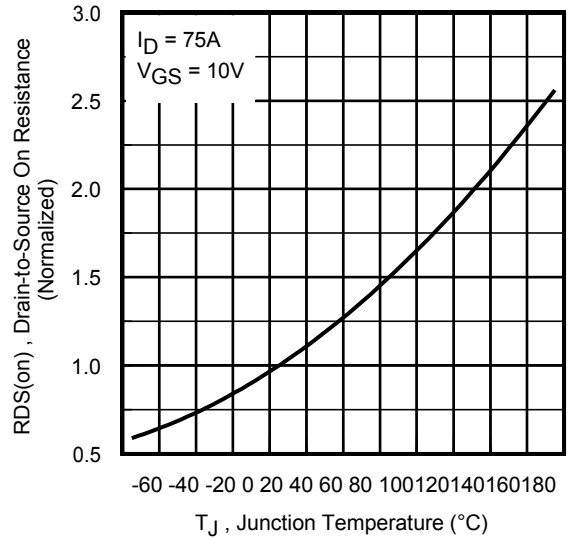
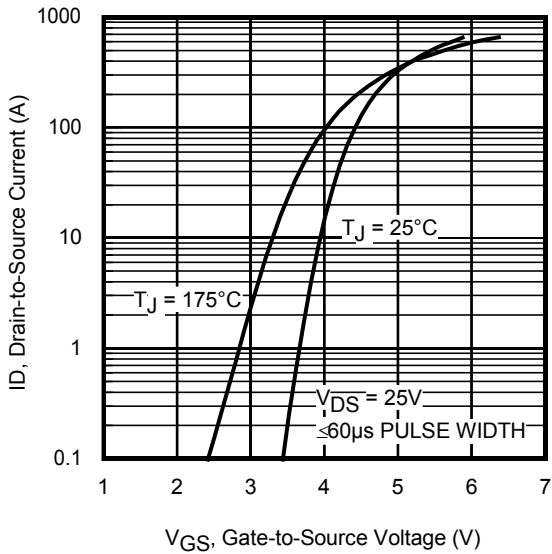
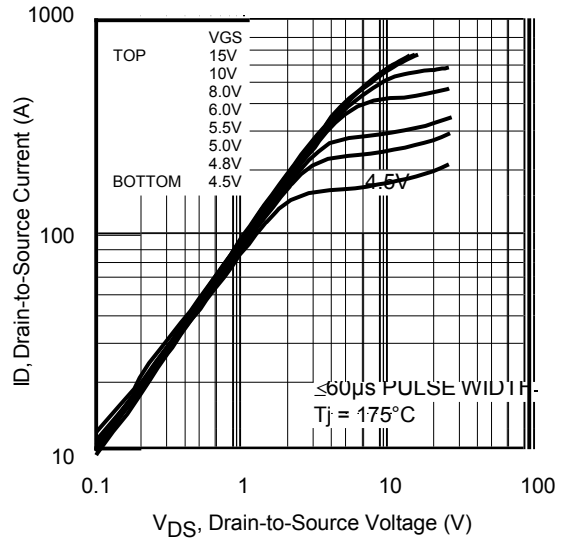
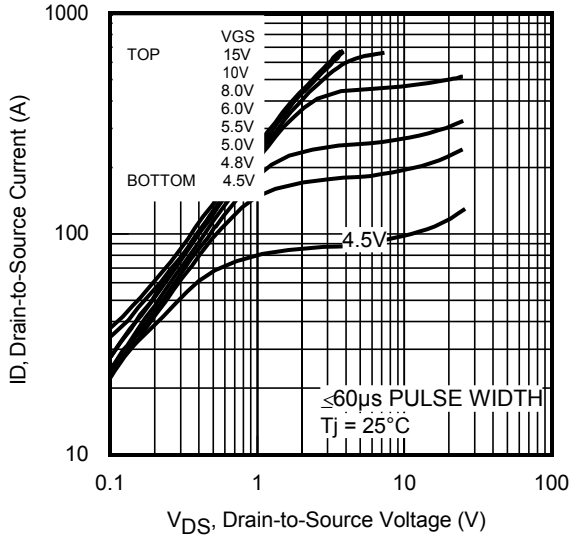


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

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

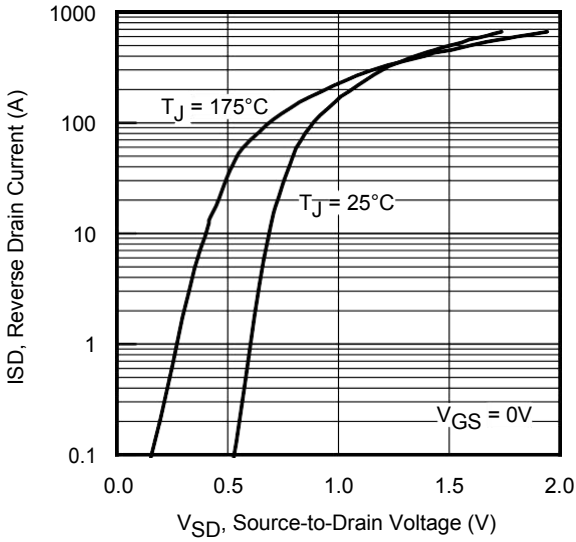


Fig 7. Typical Source-Drain Diode Forward Voltage

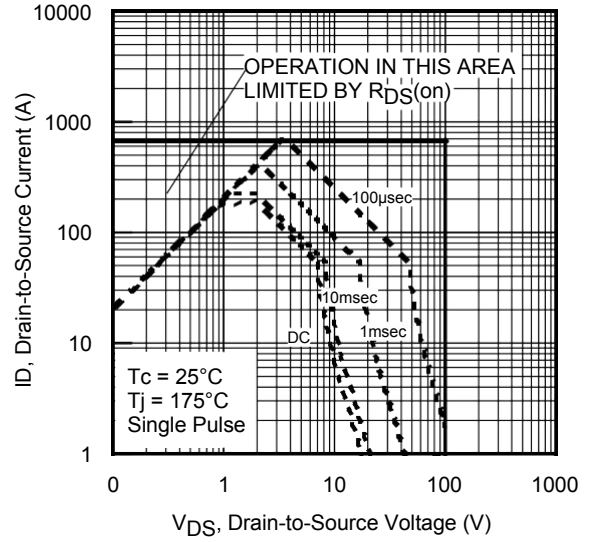


Fig 8. Maximum Safe Operating Area

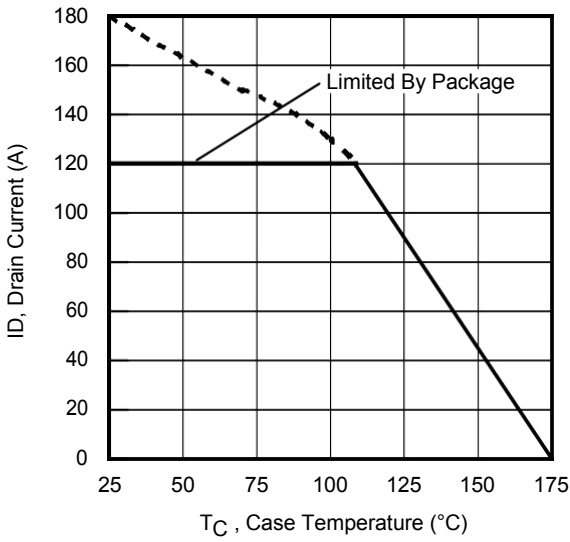


Fig 9. Maximum Drain Current vs. Case Temperature

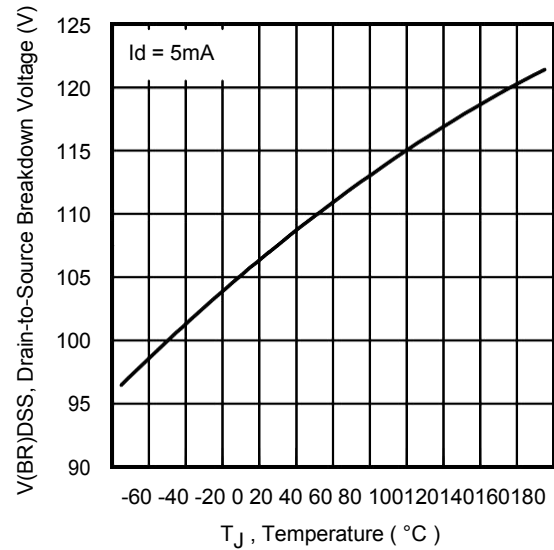


Fig 10. Drain-to-Source Breakdown Voltage

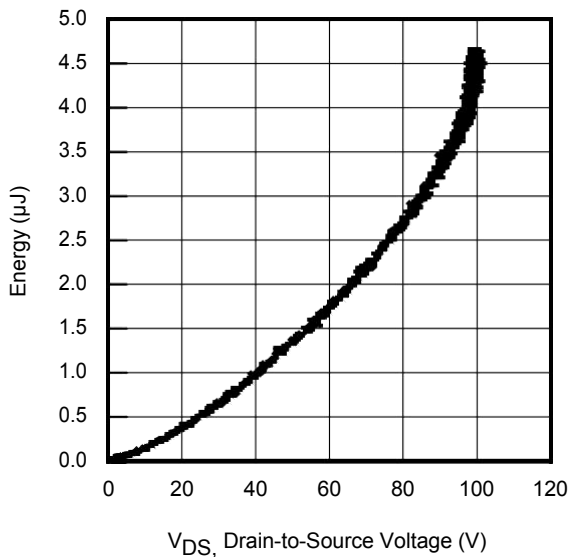


Fig 11. Typical C_{OSS} Stored Energy

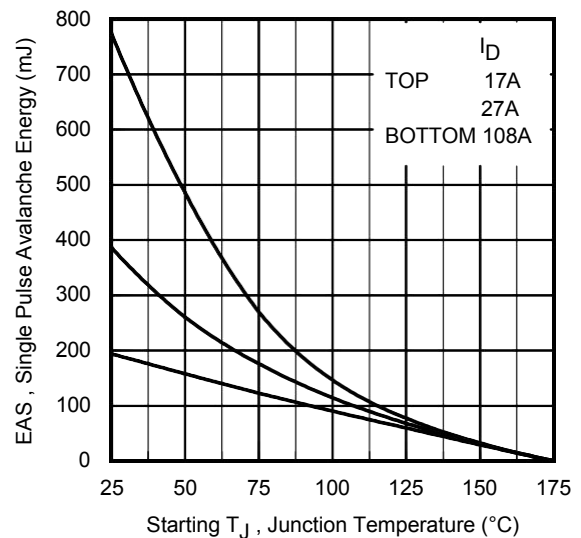


Fig 12. Maximum Avalanche Energy vs. Drain Current

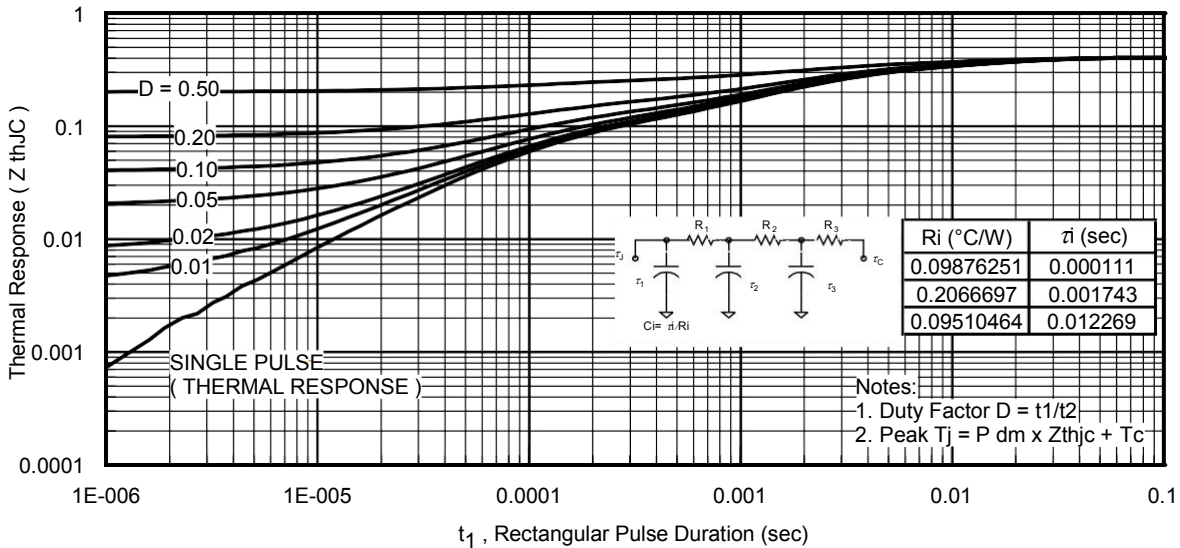


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

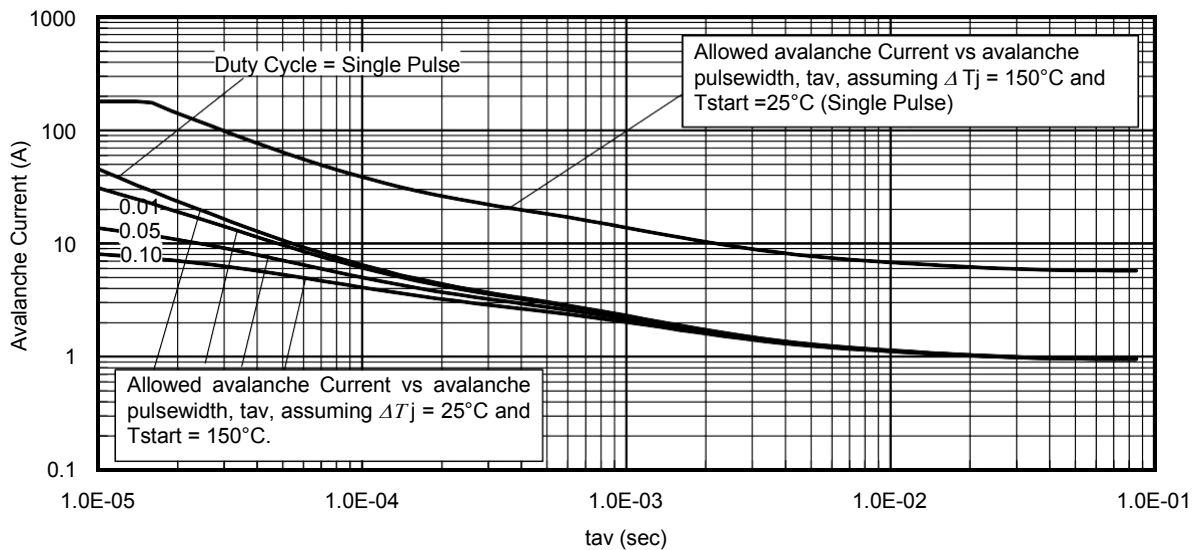
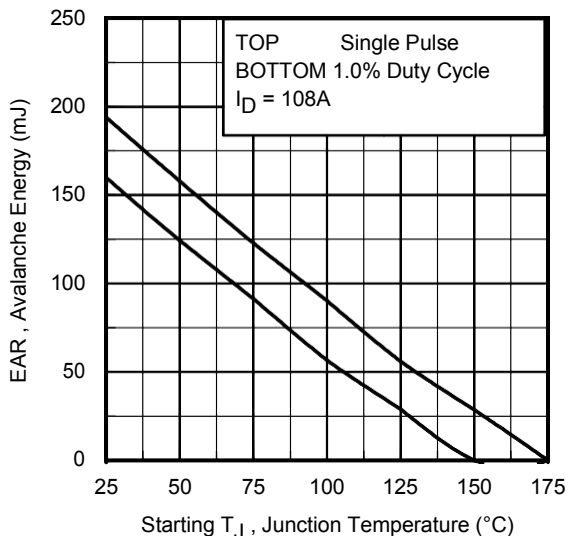


Fig 14. Typical Avalanche Current vs.Pulsewidth



Notes on Repetitive Avalanche Curves , Figures 14, 15:
 (For further info, see AN-1005 at www.irf.com)

1. Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax} . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 16a, 16b.
4. $P_{D(ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. I_{av} = Allowable avalanche current.
7. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°C in Figure 14, 15).
 t_{av} = Average time in avalanche.
 D = Duty cycle in avalanche = $t_{av} \cdot f$
 $Z_{thjc}(D, t_{av})$ = Transient thermal resistance, see Figures 13)

$$P_{D(ave)} = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thjc}$$

$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$

Fig 15. Maximum Avalanche Energy vs. Temperature

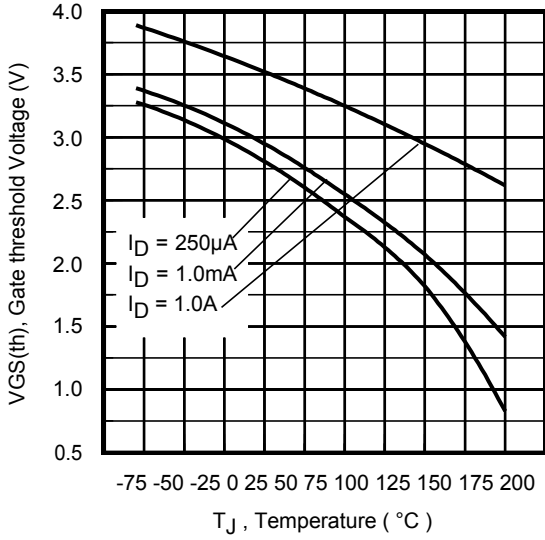


Fig 16. Threshold Voltage vs. Temperature

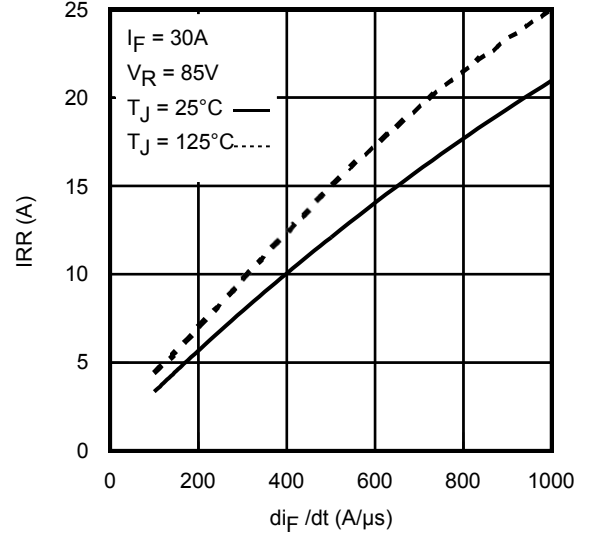


Fig. 17 - Typical Recovery Current vs. di_F/dt

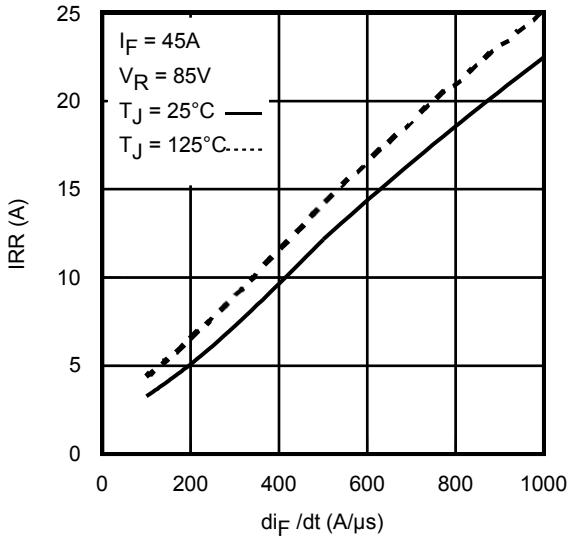


Fig. 18 - Typical Recovery Current vs. di_F/dt

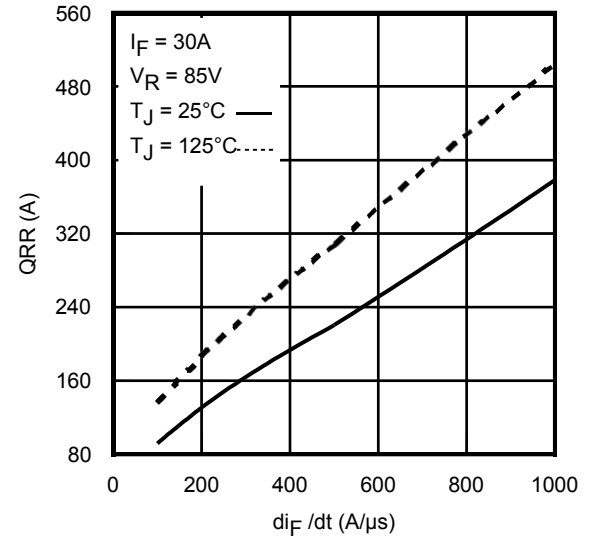


Fig. 19 - Typical Stored Charge vs. di_F/dt

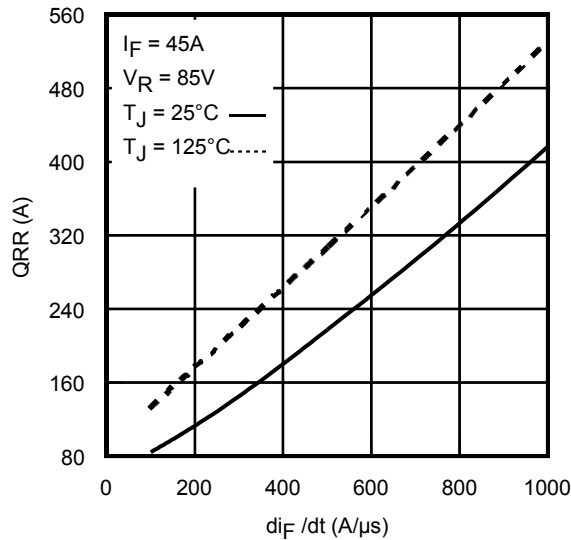
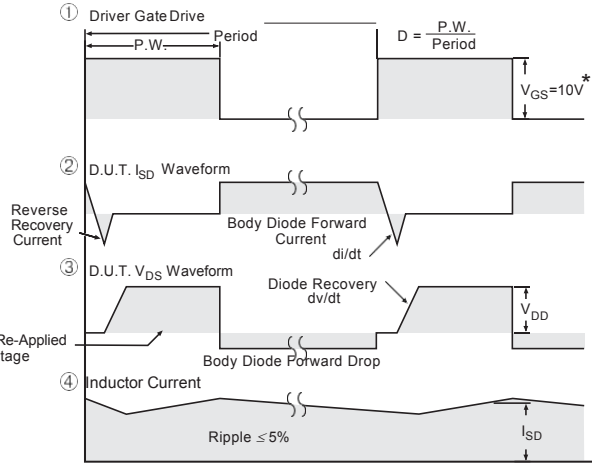
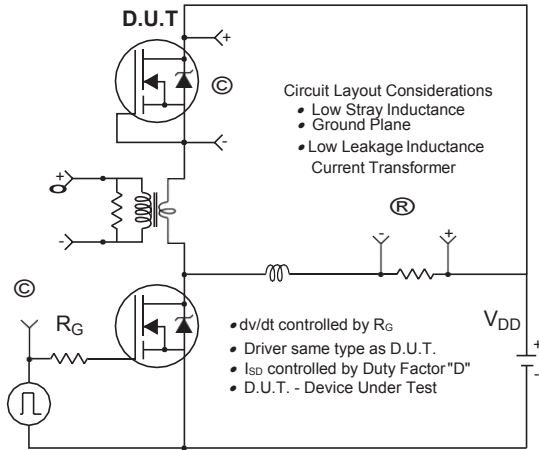


Fig. 20 - Typical Stored Charge vs. di_F/dt



* $V_{GS} = 5V$ for Logic Level Devices

Fig 20. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET[®] Power MOSFETs

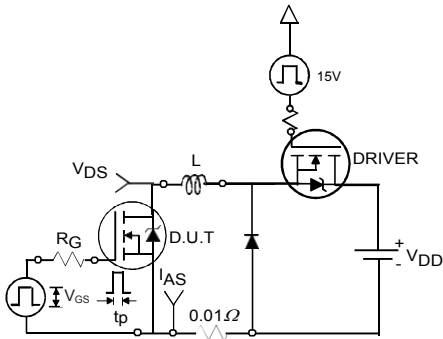


Fig 21a. Unclamped Inductive Test Circuit

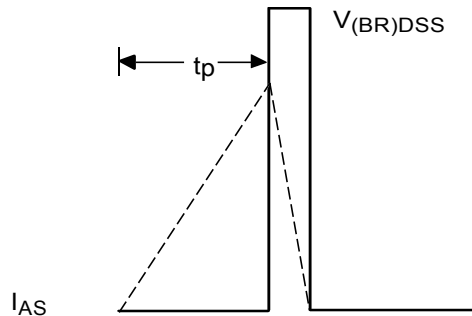


Fig 21b. Unclamped Inductive Waveforms

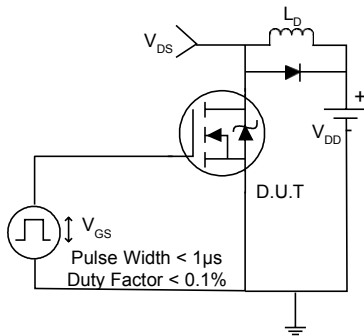


Fig 22a. Switching Time Test Circuit

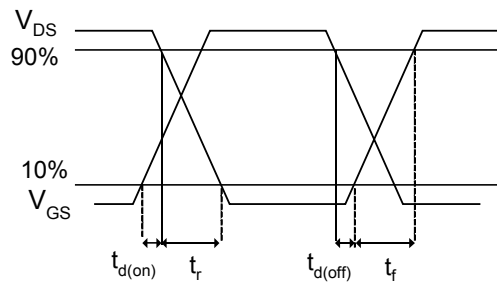


Fig 22b. Switching Time Waveforms

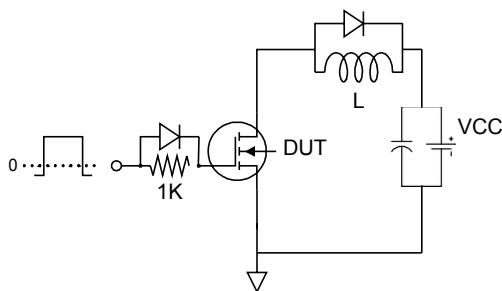


Fig 23a. Gate Charge Test Circuit

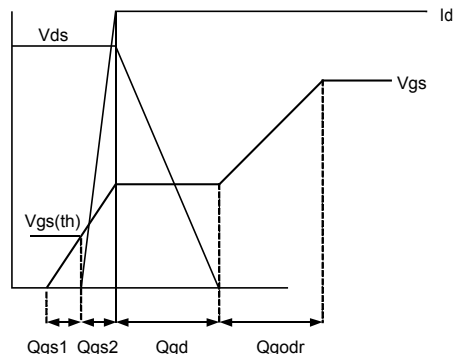
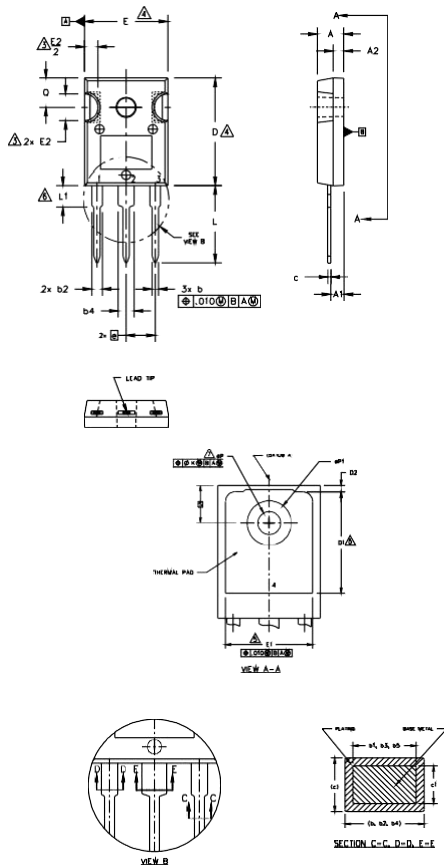


Fig 23b. Gate Charge Waveform

TO-247AC Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
 2. DIMENSIONS ARE SHOWN IN INCHES.
 3. CONTOUR OF SLOT OPTIONAL.
 4. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
 5. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
 6. LEAD FINISH UNCONTROLLED IN L1.
 7. ØP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.
- B. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247AC .

SYMBOL	DIMENSIONS				NOTES
	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	.183	.209	4.65	5.31	
A1	.087	.102	2.21	2.59	
A2	.059	.098	1.50	2.49	
b	.039	.055	0.99	1.40	
b1	.039	.053	0.99	1.35	
b2	.065	.094	1.65	2.39	
b3	.065	.092	1.65	2.34	
b4	.102	.135	2.59	3.43	
b5	.102	.133	2.59	3.38	
c	.015	.035	0.38	0.89	
c1	.015	.033	0.38	0.84	
D	.776	.815	19.71	20.70	4
D1	.515	-	13.08	-	5
D2	.020	.053	0.51	1.35	
E	.602	.625	15.29	16.87	4
E1	.530	-	13.46	-	
E2	.178	.216	4.52	5.49	
e	.215 BSC		5.46 BSC		
Øk	.010		0.25		
L	.559	.634	14.20	16.10	
L1	.146	.169	3.71	4.29	
ØP	.140	.144	3.56	3.66	
ØP1	-	.291	-	7.39	
Q	.209	.224	5.31	5.69	
S	.217 BSC		5.51 BSC		

LEAD ASSIGNMENTS

- HEXACITE**
 2.- DRAIN
 3.- SOURCE
 4.- DRAIN

IGBTs, CoPACK

- 1.- GATE
 2.- COLLECTOR
 3.- EMITTER
 4.- COLLECTOR

DIODES

- 1.- ANODE/OPEN
 2.- CATHODE
 3.- ANODE