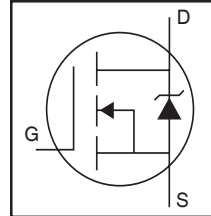


HEXFET® Power MOSFET

Applications

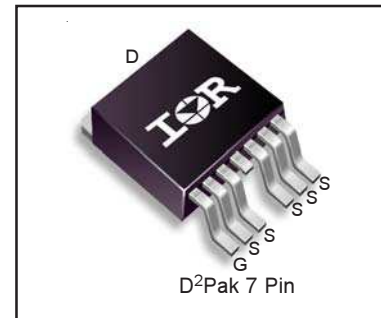
- High Efficiency Synchronous Rectification in SMPS
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits



V_{DSS}		75V
$R_{DS(on)}$	typ.	2.1mΩ
	max.	2.6mΩ
I_D		260A
I_D (Package Limited)		240A

Benefits

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



G	D	S
Gate	Drain	Source

Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	260	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	190	
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Package Limited)	240	
I_{DM}	Pulsed Drain Current ①	1060	
$P_D @ T_C = 25^\circ\text{C}$	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 ③	13	V/ns
T_J	Operating Junction and Storage Temperature Range	-55 to + 175	°C
T_{STG}			
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw	10lb·in (1.1N·m)	

Avalanche Characteristics

E_{AS} (Thermally limited)	Single Pulse Avalanche Energy ②	320	mJ
I_{AR}	Avalanche Current ①	See Fig. 14, 15, 22a, 22b,	A
E_{AR}	Repetitive Avalanche Energy ④		mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑧⑨	—	0.40	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑦⑧	—	40	

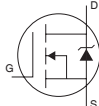
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	75	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.083	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 5mA$ ①
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	2.1	2.6	m Ω	$V_{GS} = 10V, I_D = 160A$ ④
$V_{GS(th)}$	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	$V_{DS} = 75V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 75V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
$R_{G(int)}$	Internal Gate Resistance	—	2.1	—	Ω	

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	260	—	—	S	$V_{DS} = 25V, I_D = 160A$
Q_g	Total Gate Charge	—	160	240	nC	$I_D = 160A$
Q_{gs}	Gate-to-Source Charge	—	38	—		$V_{DS} = 38V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	57	—		$V_{GS} = 10V$ ④
Q_{sync}	Total Gate Charge Sync. ($Q_g - Q_{gd}$)	—	103	—		$I_D = 160A, V_{DS} = 0V, V_{GS} = 10V$
$t_{d(on)}$	Turn-On Delay Time	—	17	—		ns
t_r	Rise Time	—	80	—	$I_D = 160A$	
$t_{d(off)}$	Turn-Off Delay Time	—	100	—	$R_G = 2.7\Omega$	
t_f	Fall Time	—	64	—	$V_{GS} = 10V$ ④	
C_{iss}	Input Capacitance	—	9200	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	850	—		$V_{DS} = 50V$
C_{riss}	Reverse Transfer Capacitance	—	400	—		$f = 1.0MHz$
$C_{oss\ eff. (ER)}$	Effective Output Capacitance (Energy Related) ⑥	—	1150	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 60V$ ⑥
$C_{oss\ eff. (TR)}$	Effective Output Capacitance (Time Related) ⑤	—	1500	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 60V$ ⑤

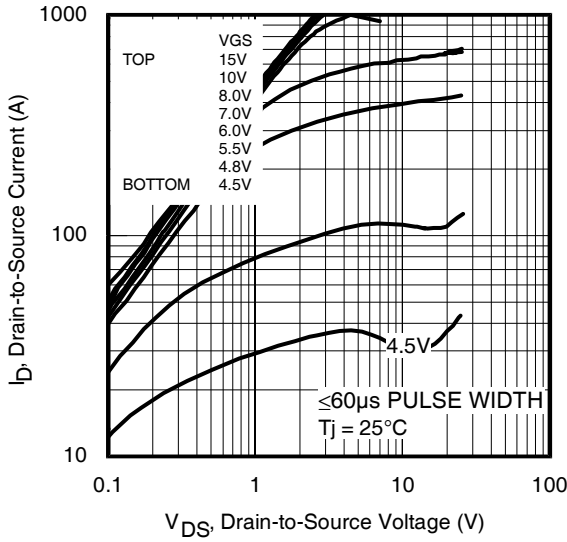
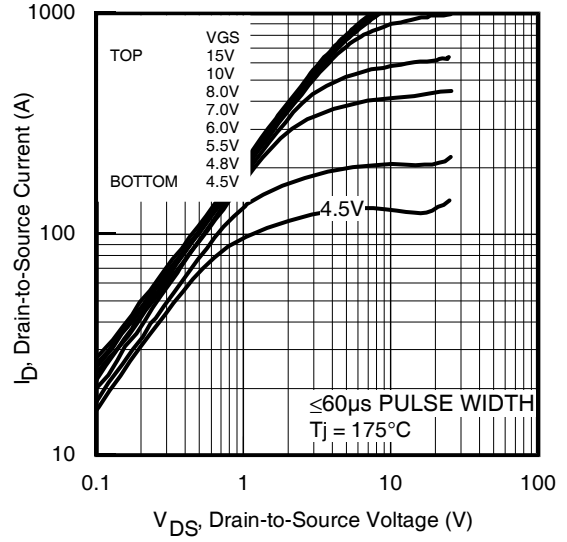
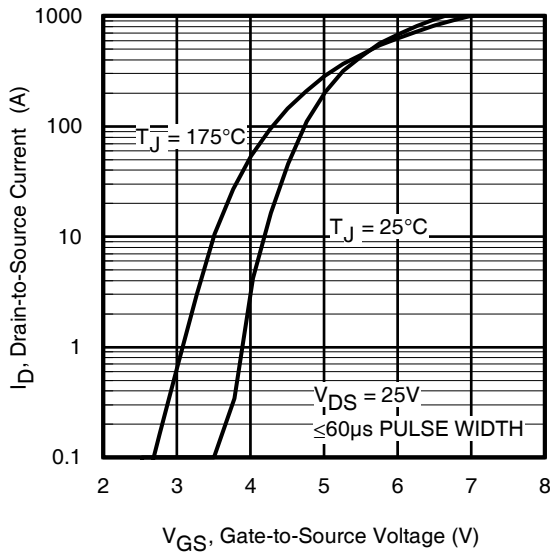
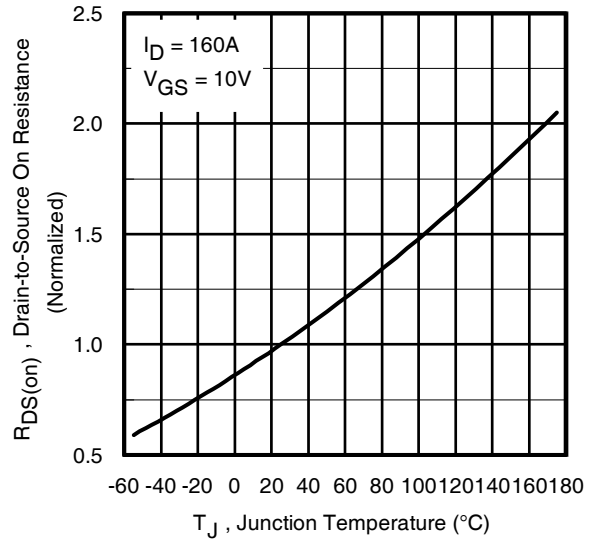
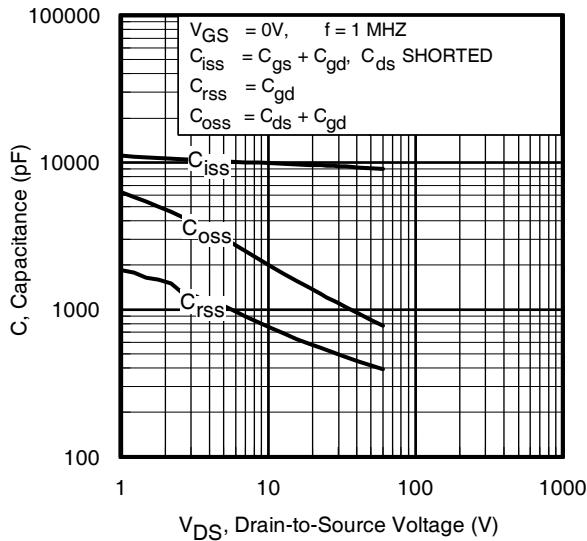
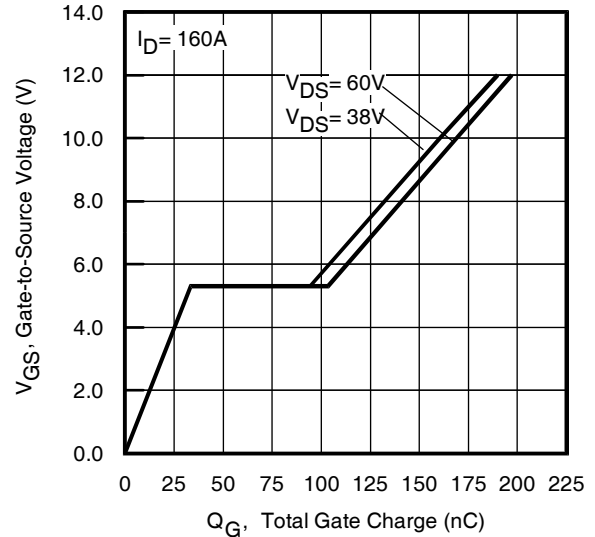
Diode Characteristics

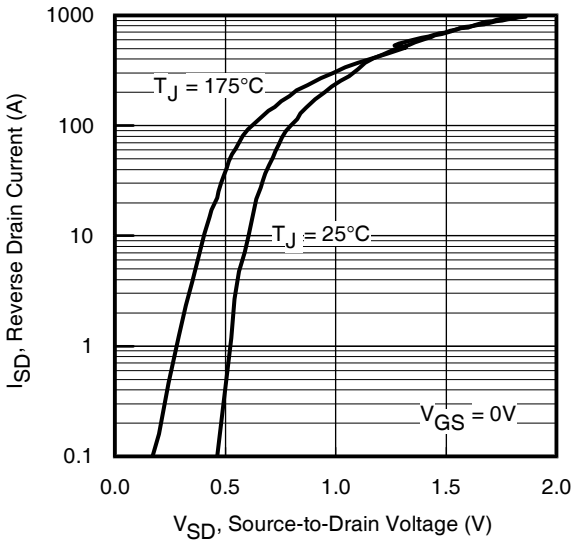
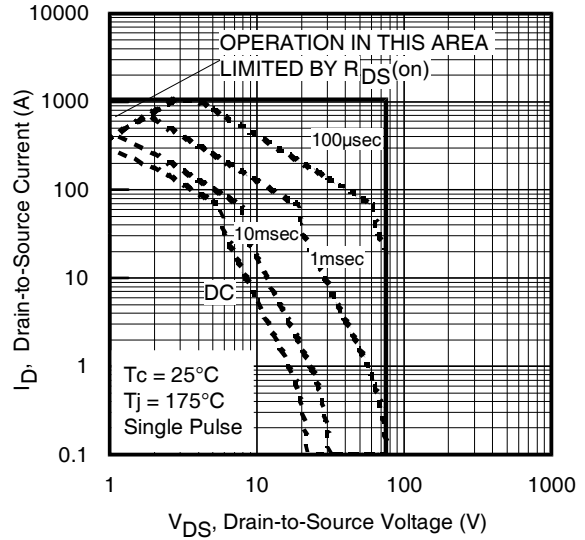
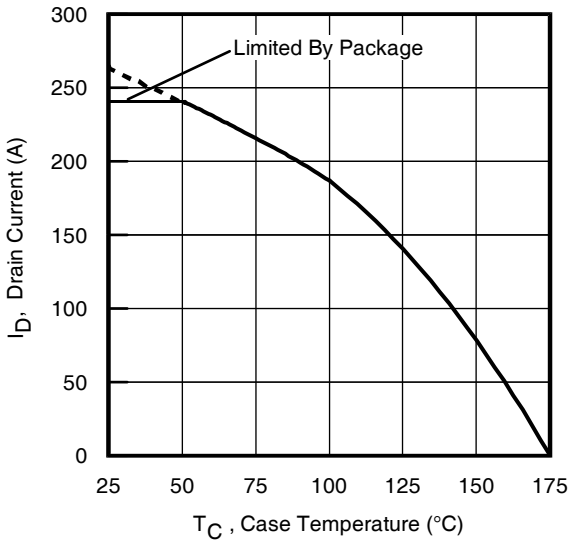
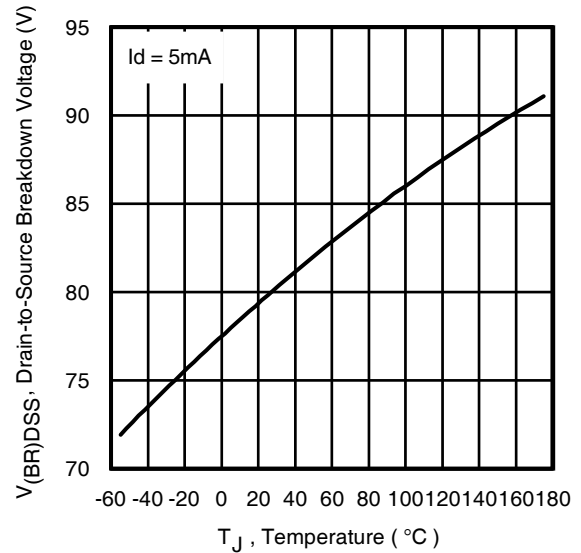
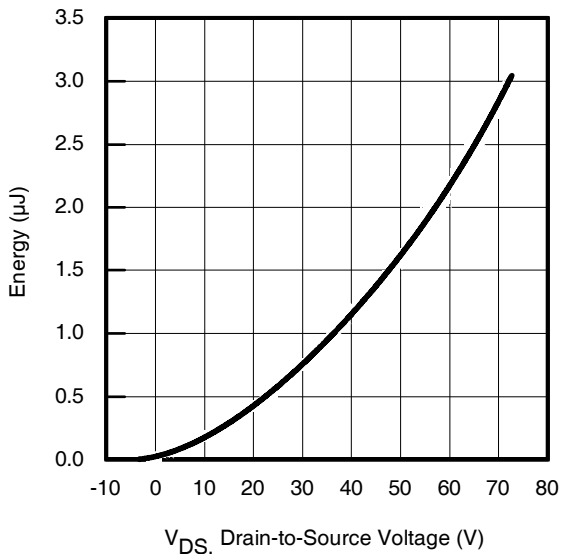
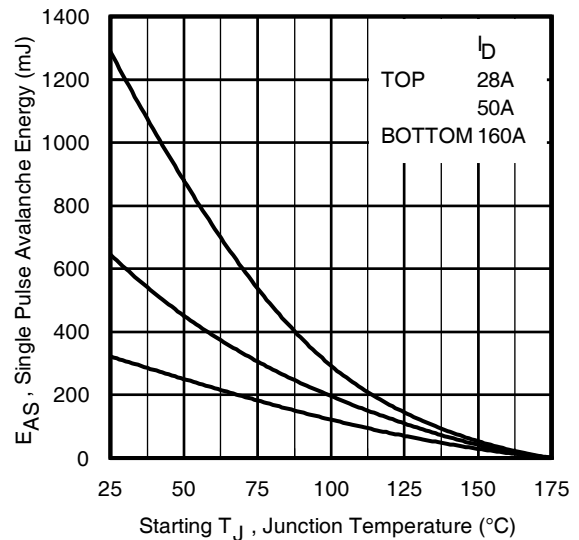
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	260	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	1060		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 160A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	52	—	ns	$T_J = 25^\circ\text{C}$ $V_R = 64V,$
		—	63	—		$T_J = 125^\circ\text{C}$ $I_F = 160A$
Q_{rr}	Reverse Recovery Charge	—	110	—	nC	$T_J = 25^\circ\text{C}$ $di/dt = 100A/\mu s$ ④
		—	160	—		$T_J = 125^\circ\text{C}$
I_{RRM}	Reverse Recovery Current	—	3.8	—	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)				

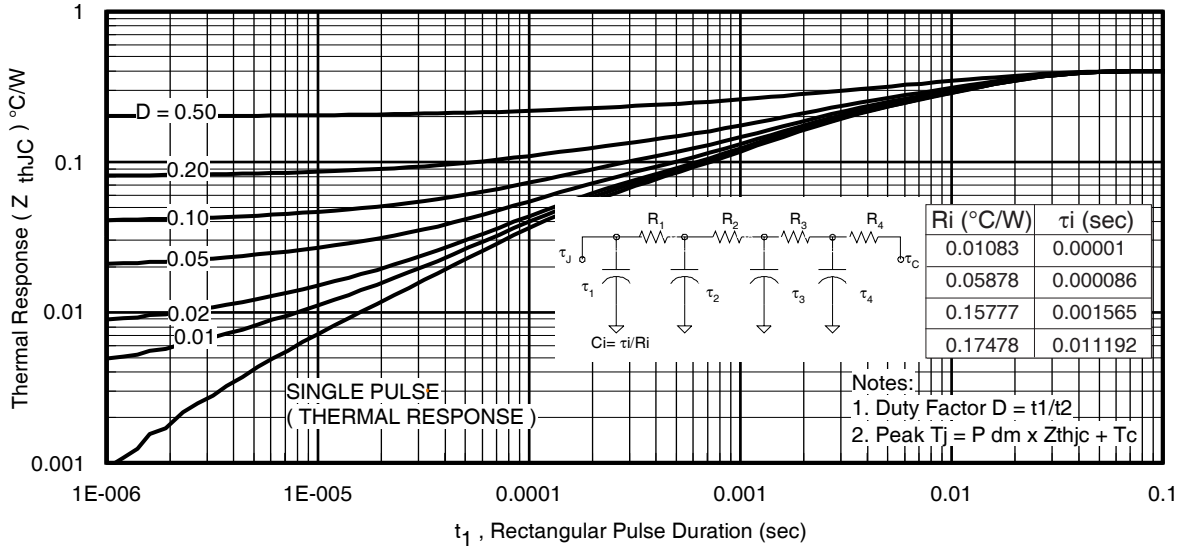
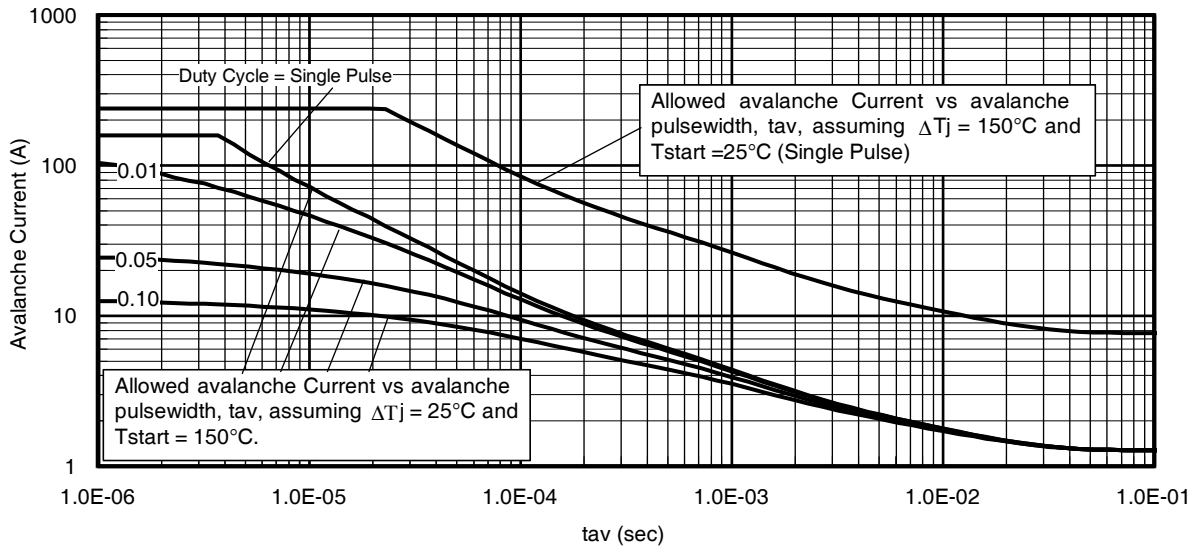
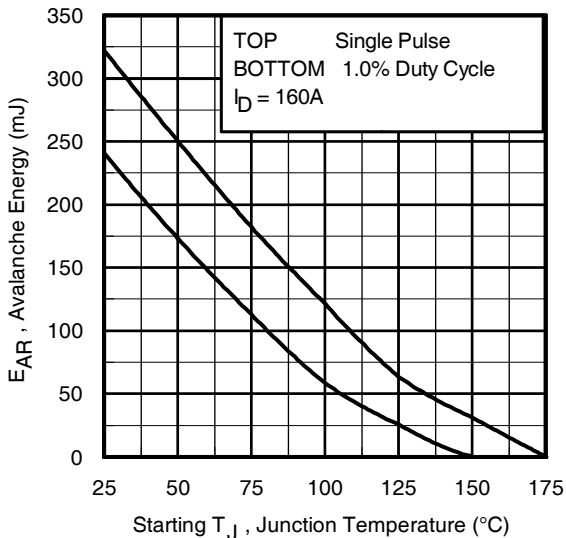
Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by T_{Jmax} , starting $T_J = 25^\circ\text{C}$, $L = 0.026mH$
 $R_G = 25\Omega, I_{AS} = 160A, V_{GS} = 10V$. Part not recommended for use above this value.
- ③ $I_{SD} \leq 160A, di/dt \leq 1420A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$.
- ④ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.

- ⑤ $C_{oss\ eff. (TR)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
- ⑥ $C_{oss\ eff. (ER)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
- ⑦ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.
- ⑧ R_{θ} is measured at T_J approximately 90°C .
- ⑨ $R_{\theta JC}$ value shown is at time zero.


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 10. Drain-to-Source Breakdown Voltage

Fig 11. Typical C_{OSS} Stored Energy

Fig 12. Maximum Avalanche Energy vs. Drain Current

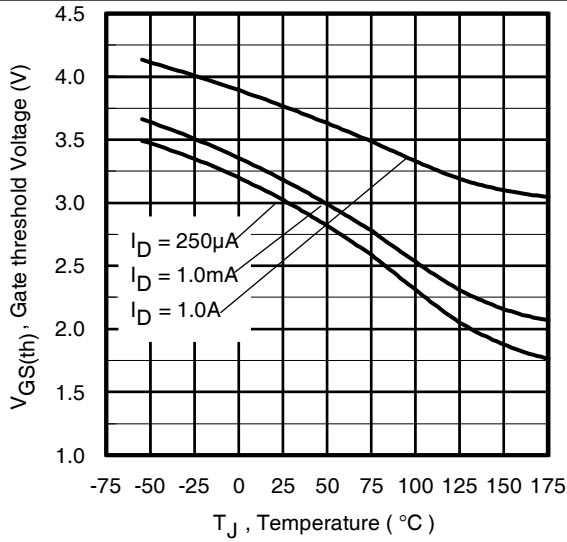
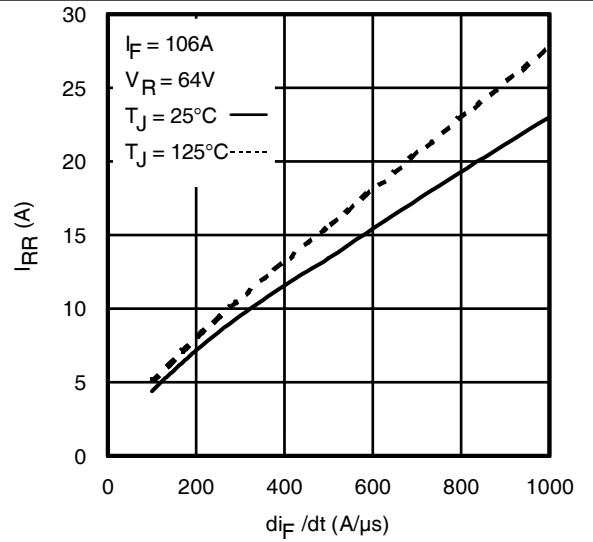
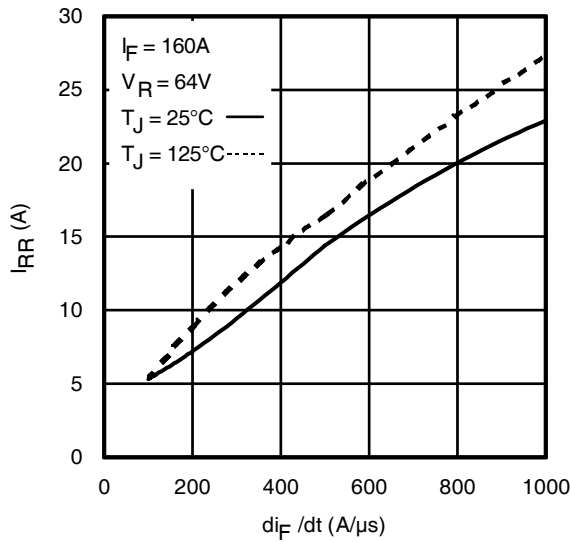
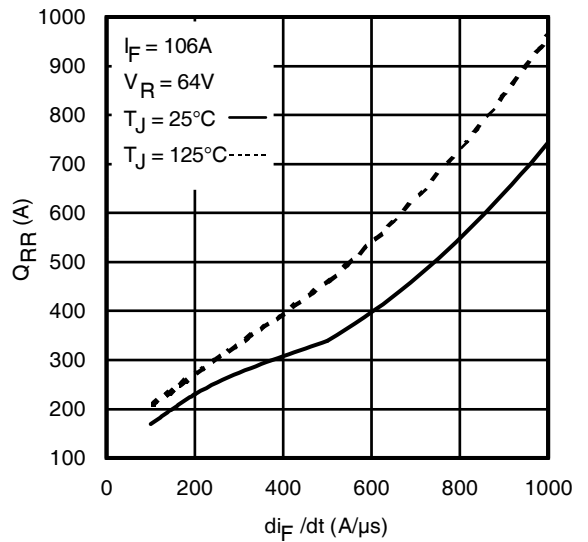
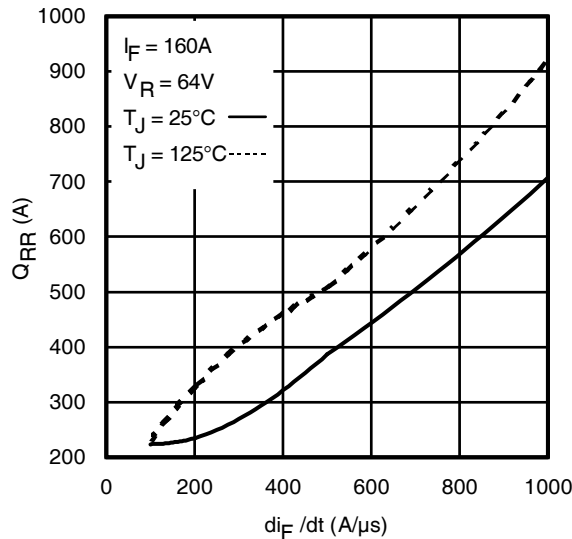

Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

Fig 14. Typical Avalanche Current vs. Pulsewidth

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

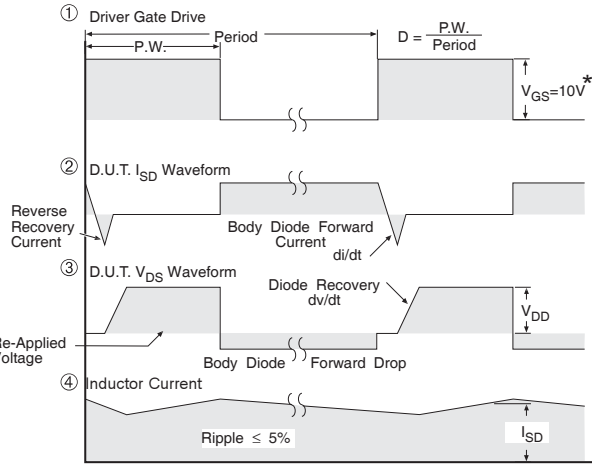
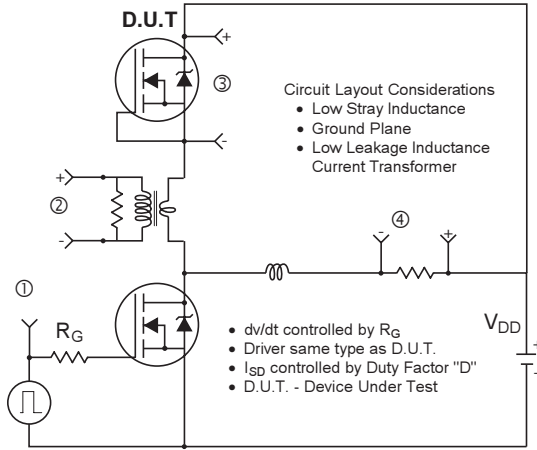
- Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax} . This is validated for every part type.
- Safe operation in Avalanche is allowed as long as T_{jmax} is not exceeded.
- Equation below based on circuit and waveforms shown in Figures 16a, 16b.
- $P_{D(ave)}$ = Average power dissipation per single avalanche pulse.
- BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
- I_{av} = Allowable avalanche current.
- 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 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 21. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

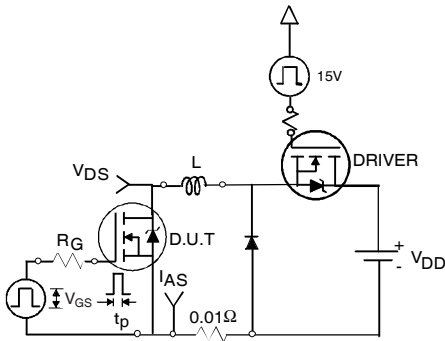


Fig 22a. Unclamped Inductive Test Circuit



Fig 22b. Unclamped Inductive Waveforms

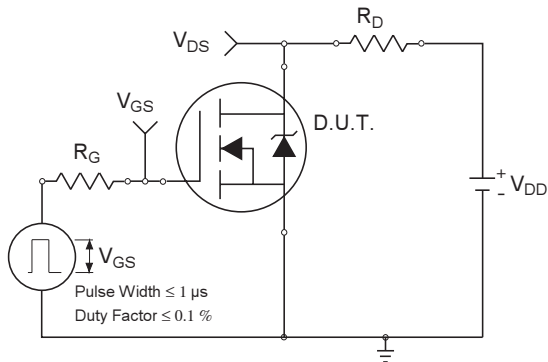


Fig 23a. Switching Time Test Circuit

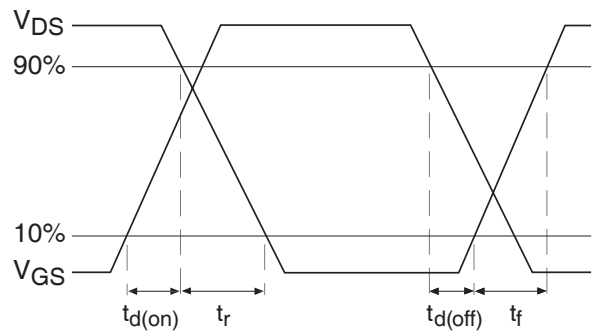


Fig 23b. Switching Time Waveforms

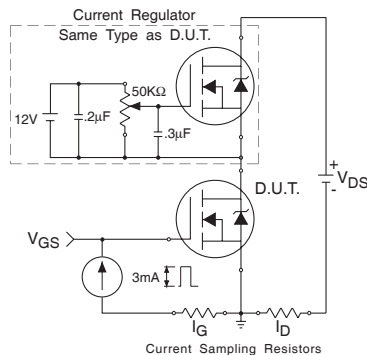


Fig 24a. Gate Charge Test Circuit

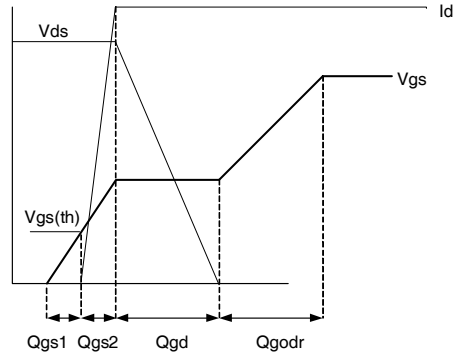
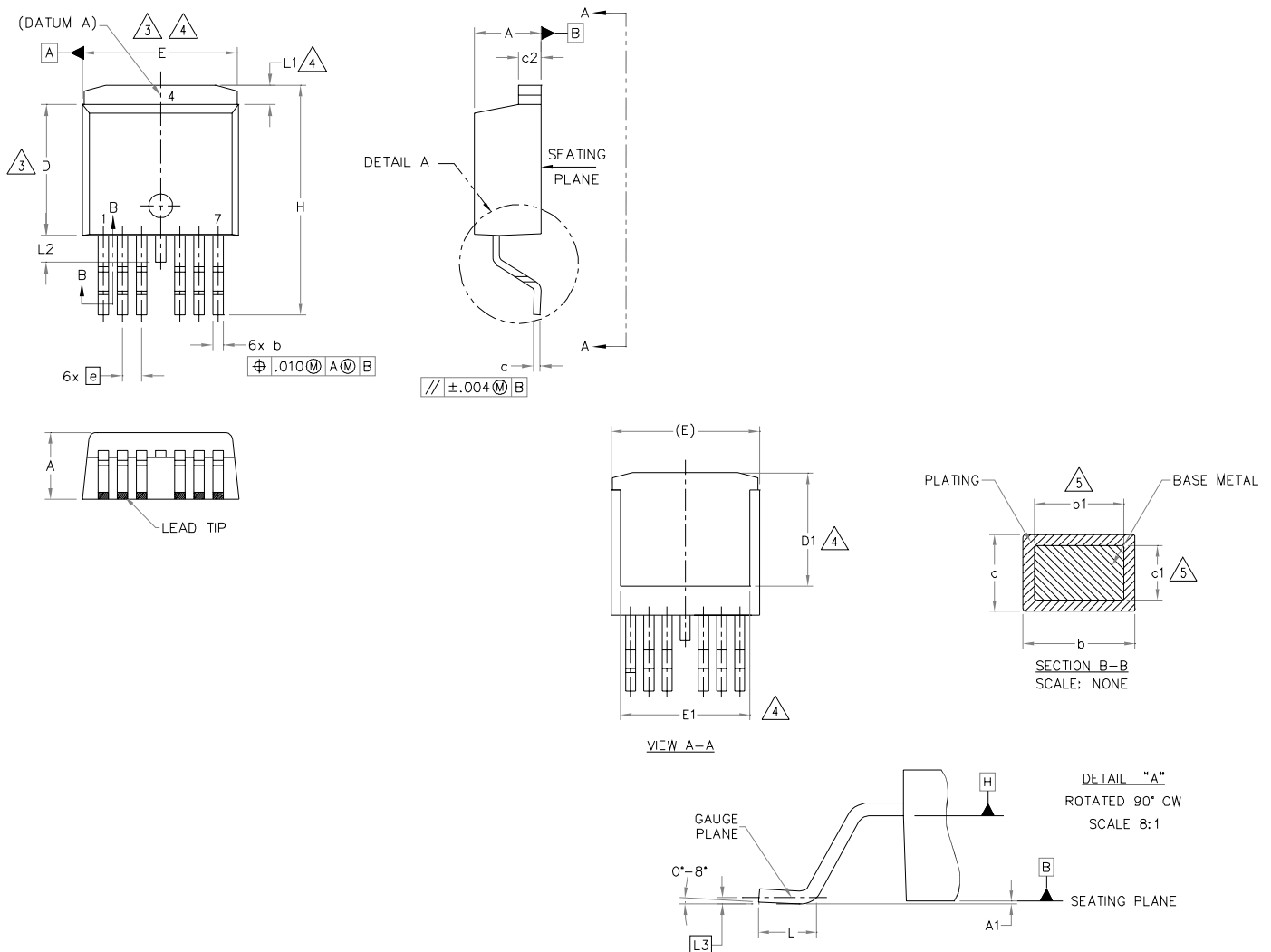


Fig 24b. Gate Charge Waveform

D²Pak - 7 Pin Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES	
	MILLIMETERS		INCHES			
	MIN.	MAX.	MIN.	MAX.		
A	4.06	4.83	.160	.190	4	
A1	-	0.254	-	.010		
b	0.51	0.99	.020	.036		
b1	0.51	0.89	.020	.032		5
c	0.38	0.74	.015	.029		
c1	0.38	0.58	.015	.023		5
c2	1.14	1.65	.045	.065		
D	8.38	9.65	.330	.380		3
D1	6.86	7.26	.270	.286		4
E	9.65	10.54	.380	.415		3,4
E1	8.24	8.64	.324	.340		4
e	1.27 BSC		.050 BSC			
H	14.61	15.88	.575	.625		
L	1.78	2.79	.070	.110	4	
L1	-	1.68	-	.066		
L2	-	1.78	-	.070		
L3	0.25 BSC		.010 BSC			

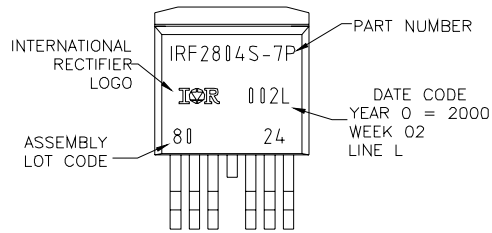
NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263CB, EXCEPT FOR DIMS. E, E1 & D1.

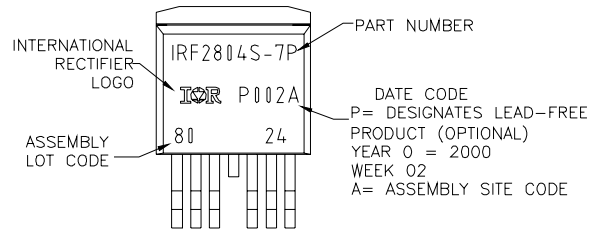
D²Pak - 7 Pin Part Marking Information

EXAMPLE: THIS IS AN IRF2804S-7P WITH LOT CODE 8024 ASSEMBLED ON WW02,2000 IN THE ASSEMBLY LINE "L"

Note: "P" in assembly line position indicates "Lead Free"



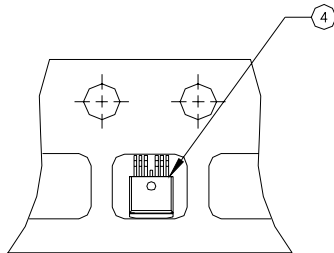
OR



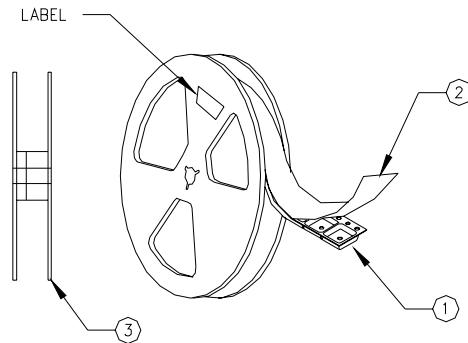
D²Pak - 7 Pin Tape and Reel

NOTES, TAPE & REEL, LABELLING:

1. TAPE AND REEL.
 - 1.1 REEL SIZE 13 INCH DIAMETER.
 - 1.2 EACH REEL CONTAINING 800 DEVICES.
 - 1.3 THERE SHALL BE A MINIMUM OF 42 SEALED POCKETS CONTAINED IN THE LEADER AND A MINIMUM OF 15 SEALED POCKETS IN THE TRAILER.
 - 1.4 PEEL STRENGTH MUST CONFORM TO THE SPEC. NO. 71-9667.
 - 1.5 PART ORIENTATION SHALL BE AS SHOWN BELOW.
 - 1.6 REEL MAY CONTAIN A MAXIMUM OF TWO UNIQUE LOT CODE/DATE CODE COMBINATIONS. REWORKED REELS MAY CONTAIN A MAXIMUM OF THREE UNIQUE LOT CODE/DATE CODE COMBINATIONS. HOWEVER, THE LOT CODES AND DATE CODES WITH THEIR RESPECTIVE QUANTITIES SHALL APPEAR ON THE BAR CODE LABEL FOR THE AFFECTED REEL.



2. LABELLING (REEL AND SHIPPING BAG).
 - 2.1 CUST. PART NUMBER (BAR CODE): IRFXXXXSTRL-7P
 - 2.2 CUST. PART NUMBER (TEXT CODE): IRFXXXXSTRL-7P
 - 2.3 I.R. PART NUMBER: IRFXXXXSTRL-7P
 - 2.4 QUANTITY:
 - 2.5 VENDOR CODE: IR
 - 2.6 LOT CODE:
 - 2.7 DATE CODE:



Note: For the most current drawing please refer to IR website at: <http://www.irf.com/package/>