International IOR Rectifier

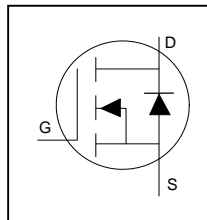## Application

- Brushed Motor drive applications
- BLDC Motor drive applications
- Battery powered circuits
- Half-bridge and full-bridge topologies
- Synchronous rectifier applications
- Resonant mode power supplies
- OR-ing and redundant power switches
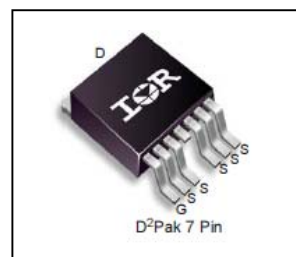- DC/DC and AC/DC converters
- DC/AC Inverters

HEXFET® Power MOSFET

V_{DSS}	40V
$R_{DS(on)}$ typ.	0.70mΩ
max	1.0mΩ
I_{D} (Silicon Limited)	362A①
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, RoHS Compliant

D²Pak 7 Pin

G	D	S
Gate	Drain	Source

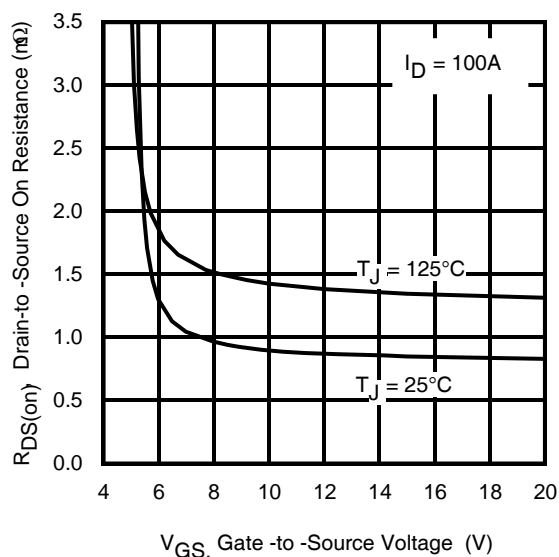| Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFS7434-7PPbF	D²Pak-7Pin	Tube	50	IRFS7434-7PPbF
		Tape and Reel Left	800	IRFS7434TRL7PP

Fig 1. Typical On-Resistance vs. Gate Voltage
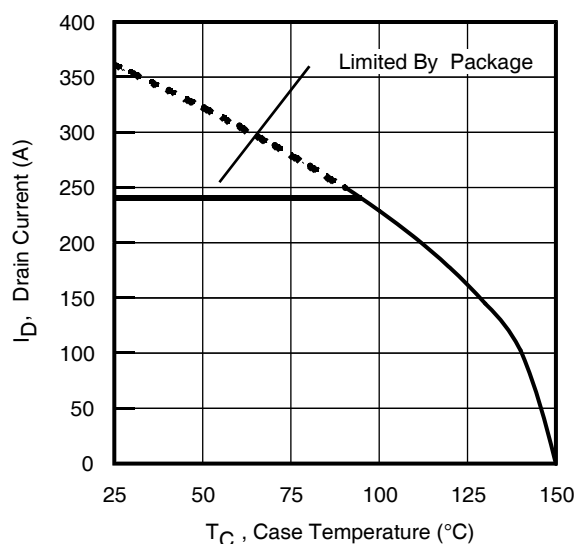
Fig 2. Maximum Drain Current vs. Case Temperature

Absolute Maximum Rating

Symbol	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	362①	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	229①	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Wire Bond Limited)	240	
I_{DM}	Pulsed Drain Current ②	1300⑩	
P_D @T_C = 25°C	Maximum Power Dissipation	245	W
	Linear Derating Factor	1.96	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	

Avalanche Characteristics

$E_{AS\ (Thermally\ limited)}$	Single Pulse Avalanche Energy ③	384	mJ
$E_{AS\ (tested)}$	Single Pulse Avalanche Energy Tested Value ⑨	835	
I_{AR}	Avalanche Current ②	See Fig 15, 16, 23a, 23b	A
E_{AR}	Repetitive Avalanche Energy ②		mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑧	——	0.51	°C/W
$R_{\theta JA}$	Junction-to-Ambient ⑧	——	40	

Static @ T_J = 25°C (unless otherwise specified)

| Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	40	——	——	V	V_{GS} = 0V, I_D = 250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	0.03	——	V/°C	Reference to 25°C, I_D = 1mA ②
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	0.7	1.0	mΩ	V_{GS} = 10V, I_D = 100A
		——	1.5	——		V_{GS} = 6V, I_D = 50A
$V_{GS(th)}$	Gate Threshold Voltage	2.2	3.0	3.9	V	V_{DS} = V_{GS}, I_D = 250μA
I_{DSS}	Drain-to-Source Leakage Current	——	——	1.0	μA	V_{DS} =40 V, V_{GS} = 0V
		——	——	150		V_{DS} =40V, V_{GS} = 0V, T_J =125°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	——	——	-100		V_{GS} = -20V
R_G	Gate Resistance	——	2.0	——	Ω	
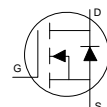
Notes:

① Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 240A by source bonding technology. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements. (Refer to AN-1140)

② Repetitive rating; pulse width limited by max. junction temperature.

③ Limited by T_{Jmax}, starting T_J = 25°C, L = 0.077mH, R_G = 50Ω, I_{AS} = 100A, V_{GS} =10V.

④ I_{SD} ≤ 100A, di/dt ≤ 969A/μs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 150°C.

⑤ Pulse width ≤ 400μs; duty cycle ≤ 2%.

⑥ 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}.

⑦ 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}.

⑧ R_θ is measured at T_J approximately 90°C.

⑨ This value determined from sample failure population, starting T_J =25°C, L=0.077mH, R_G = 50Ω, I_{AS} =100A, V_{GS} =10V.

⑩ Pulse drain current is limited by source bonding technology.

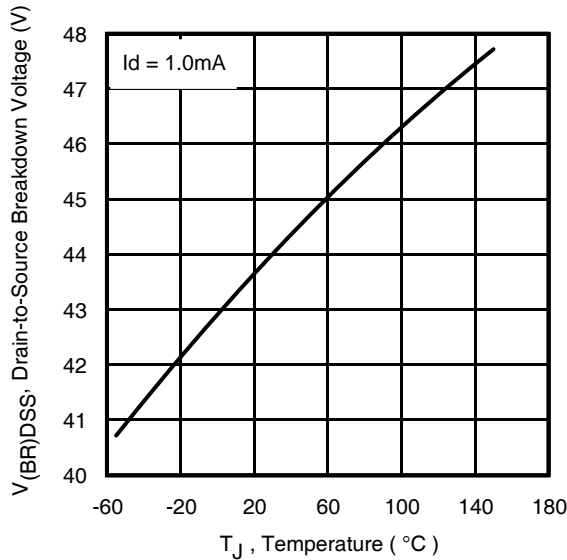**Dynamic Electrical Characteristics @ T_J = 25°C (unless otherwise specified)**

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	156	——	——	S	V_{DS} = 10V, I_D =100A
Q_g	Total Gate Charge	——	210	315	nC	I_D = 100A
Q_{gs}	Gate-to-Source Charge	——	55	——		V_{DS} = 20V
Q_{gd}	Gate-to-Drain Charge	——	66	——		V_{GS} = 10V
Q_{sync}	Total Gate Charge Sync. (Qg– Qgd)	——	144	——		
$t_{d(on)}$	Turn-On Delay Time	——	23	——	ns	V_{DD} = 26V
t_r	Rise Time	——	125	——		I_D = 100A
$t_{d(off)}$	Turn-Off Delay Time	——	107	——		R_G= 2.6Ω
t_f	Fall Time	——	85	——		V_{GS} = 10V⑤
C_{iss}	Input Capacitance	——	10250	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	1540	——		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	——	1060	——		f = 1.0MHz, See Fig.7
$C_{oss\ eff.(ER)}$	Effective Output Capacitance (Energy Related)	——	1880	——		V_{GS} = 0V, VDS = 0V to 32V⑦ See Fig.11
$C_{oss\ eff.(TR)}$	Output Capacitance (Time Related)	——	2147	——		V_{GS} = 0V, VDS = 0V to 32V⑥

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)①	——	——	362①	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	1300⑩		
V_{SD}	Diode Forward Voltage	——	0.9	1.3	V	T_J = 25°C,I_S = 100A,V_{GS} = 0V ⑤
dv/dt	Peak Diode Recovery dv/dt④	——	3.0	——	V/ns	T_J = 150°C,I_S =100A,V_{DS} = 40V⑤
t_{rr}	Reverse Recovery Time	——	44	——	ns	T_J = 25°C V_{DD} = 34V
		——	46	——		T_J = 125°C I_F = 100A,
Q_{rr}	Reverse Recovery Charge	——	43	——	nC	T_J = 25°C di/dt = 100A/µs ⑤
		——	44	——		T_J = 125°C
I_{RRM}	Reverse Recovery Current	——	1.9	——	A	T_J = 25°C
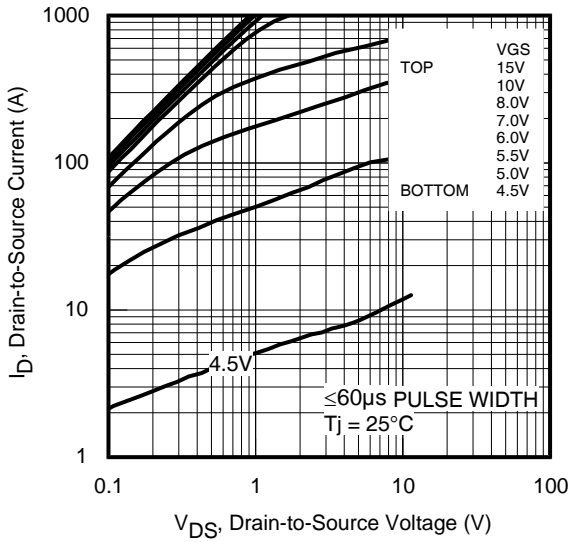
Fig 3. Typical Output Characteristics
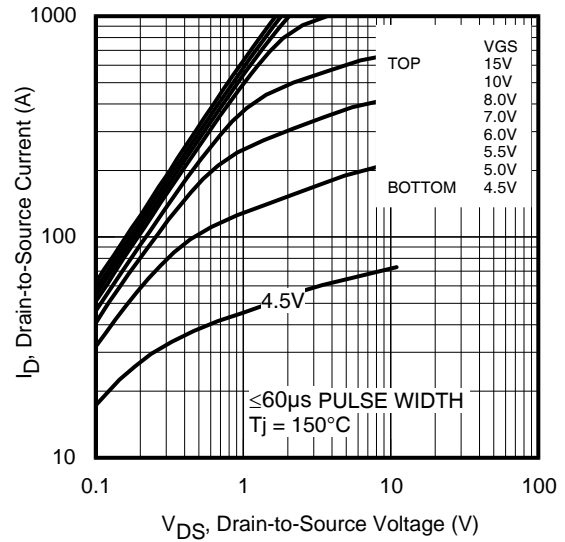
Fig 4. Typical Output Characteristics
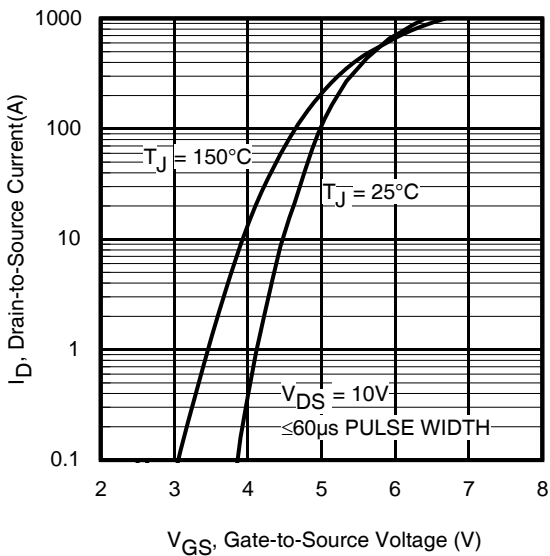
Fig 5. Typical Transfer Characteristics
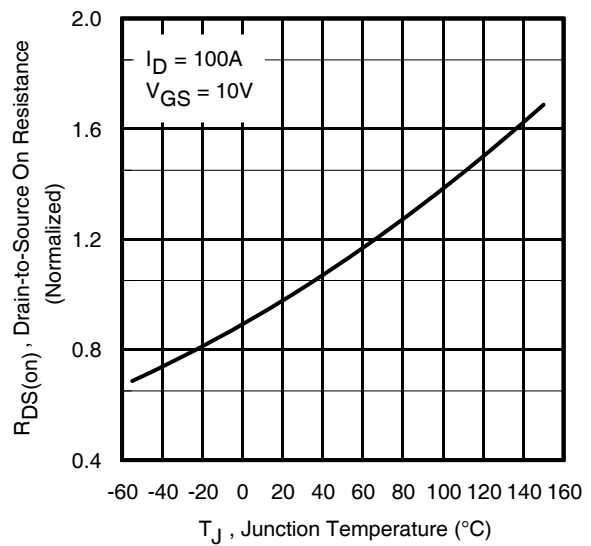
Fig 6. Normalized On-Resistance vs. Temperature
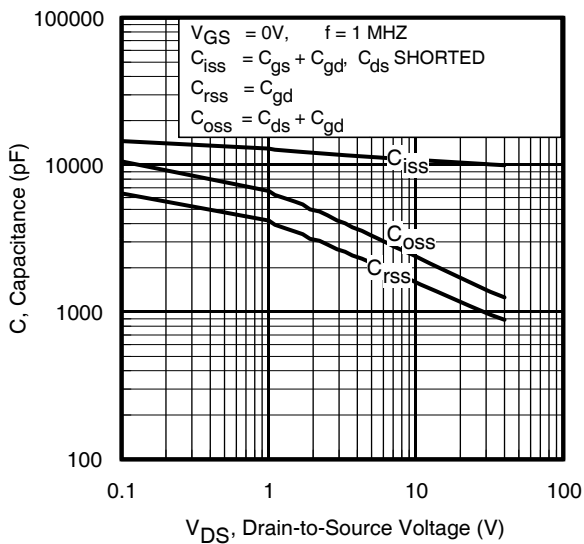
Fig 7. Typical Capacitance vs. Drain-to-Source Voltage
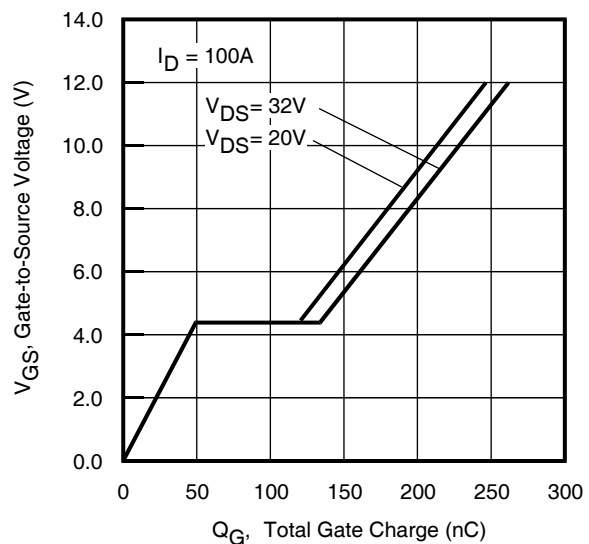
Fig 8. Typical Gate Charge vs. Gate-to-Source Voltage
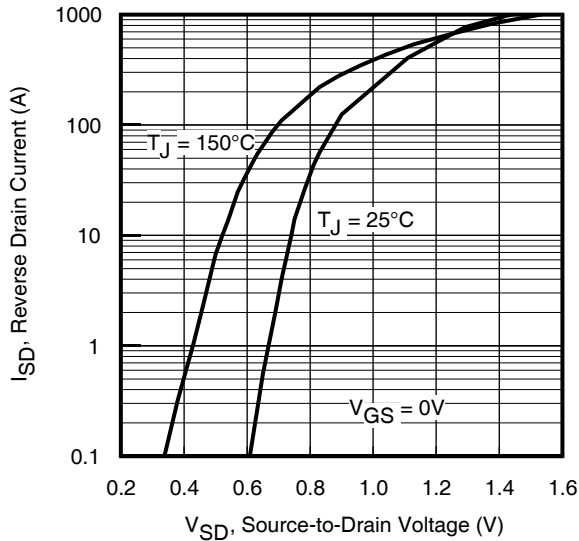
Fig 9. Typical Source-Drain Diode Forward Voltage
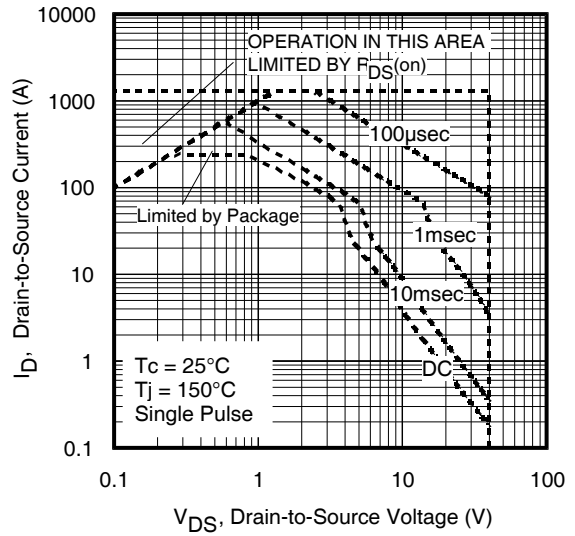
Fig 10. Maximum Safe Operating Area

Fig 11. Drain-to–Source Breakdown Voltage
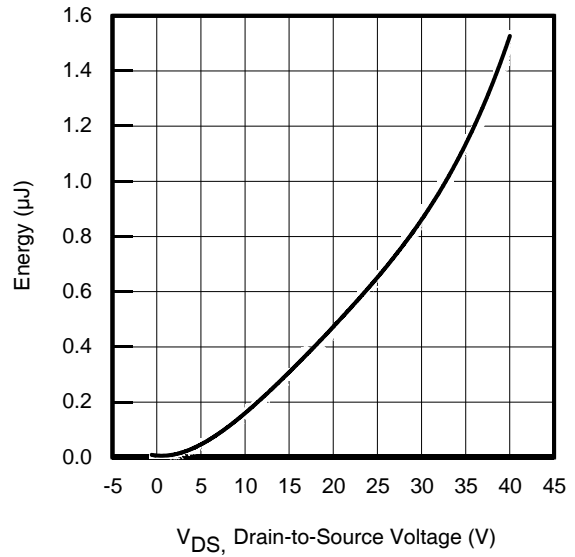
Fig 12. Typical C_{oss} Stored Energy
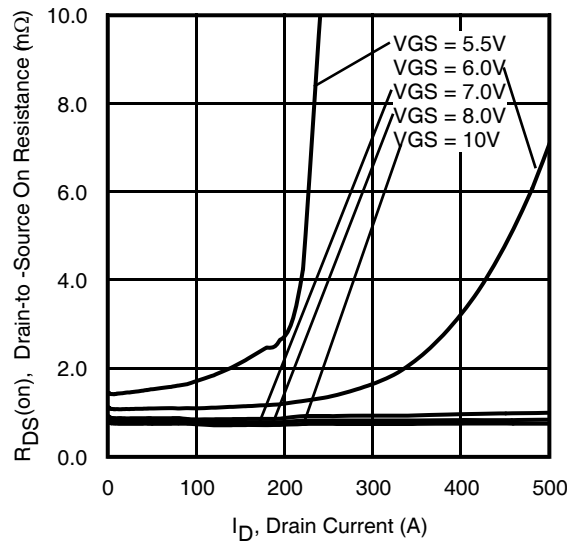
Fig 13. Typical On-Resistance vs. Drain Current
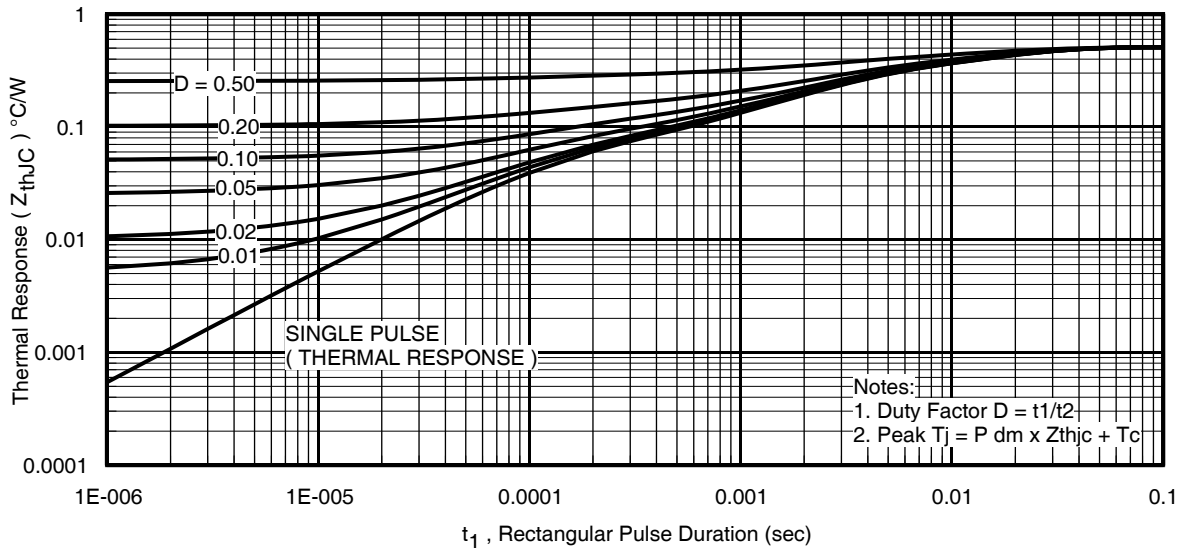
Fig 14. Maximum Effective Transient Thermal Impedance, Junction-to-Case
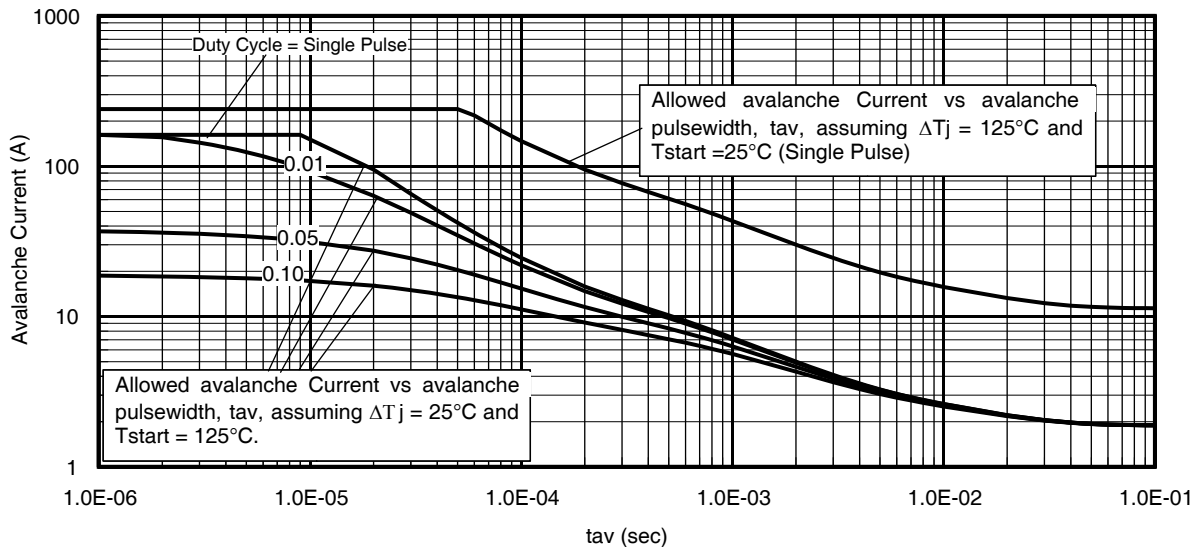
Fig 15. Typical Avalanche Current vs. Pulse width
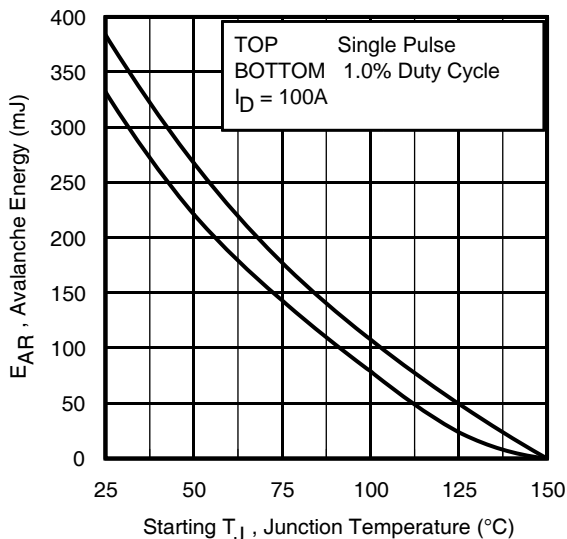
Fig 16. Maximum Avalanche Energy vs. Temperature

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 23a, 23b.
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)
   $PD (ave) = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$
   $I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$
   $E_{AS (AR)} = P_{D (ave)} \cdot t_{av}$
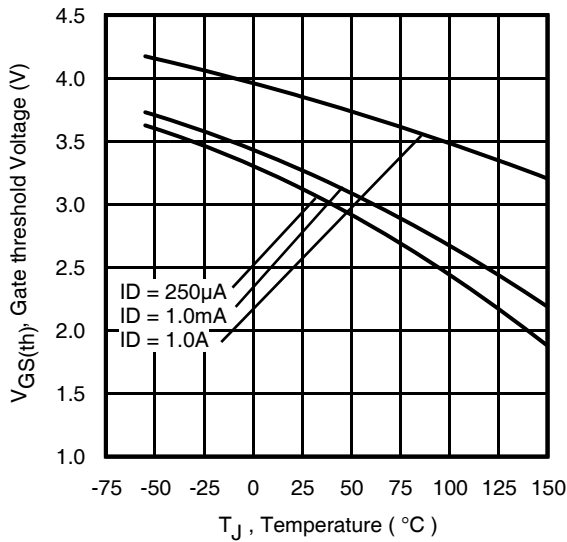
Fig 17. Threshold Voltage vs. Temperature
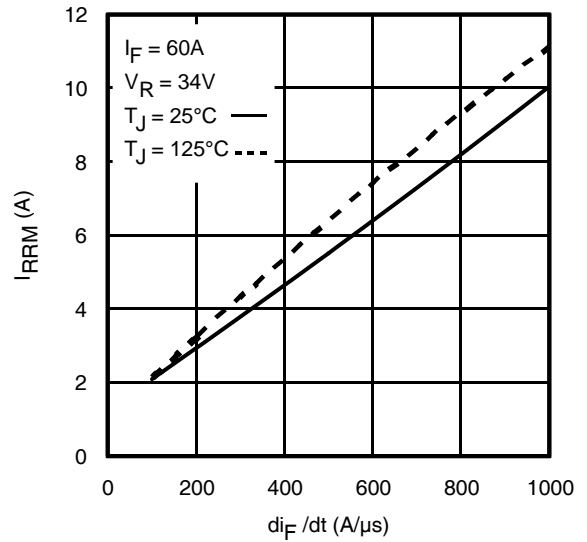
Fig 18. Typical Recovery Current vs. dif/dt
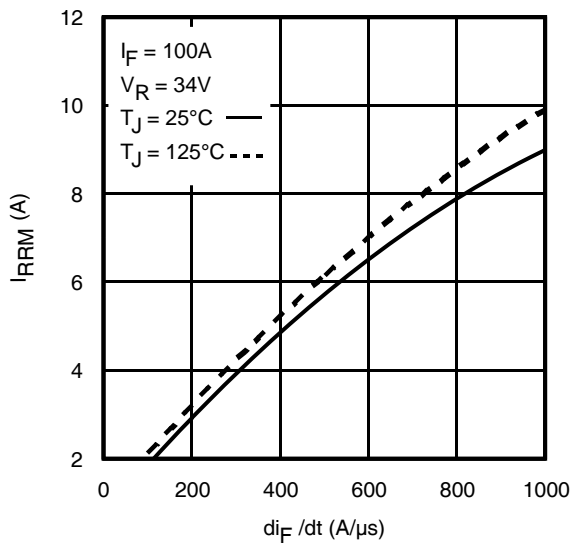
Fig 19. Typical Recovery Current vs. dif/dt
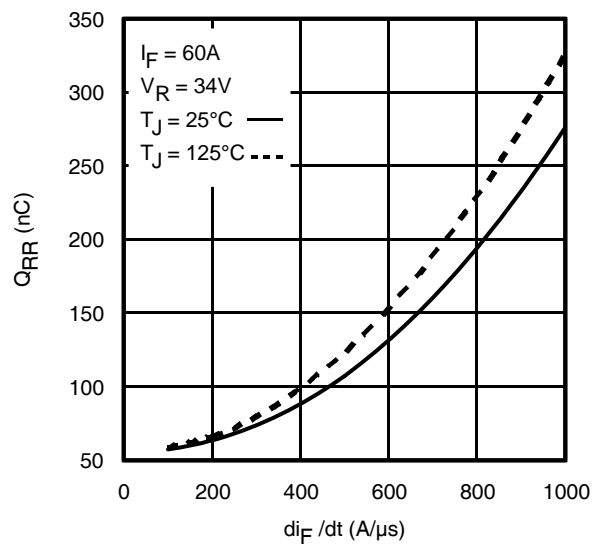
Fig 20. Typical Stored Charge vs. dif/dt
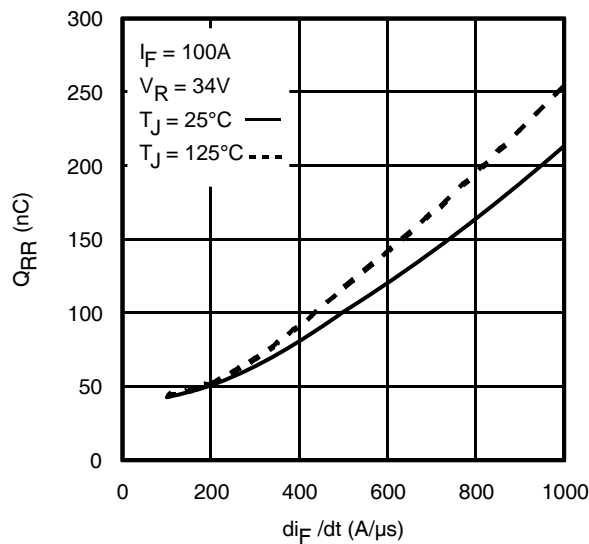
Fig 21. Typical Stored Charge vs. dif/dt
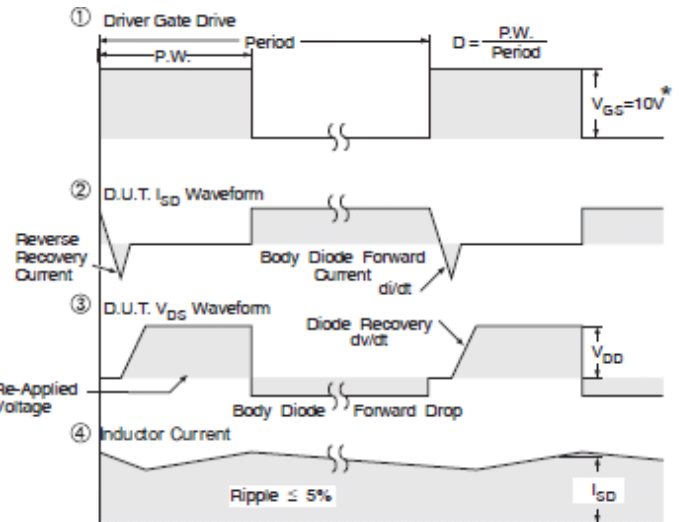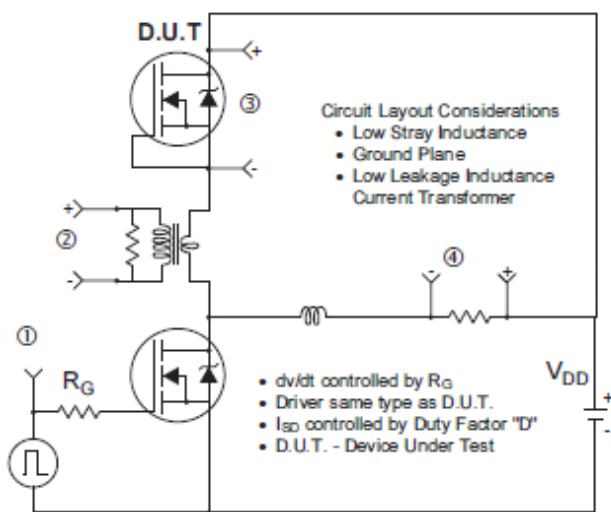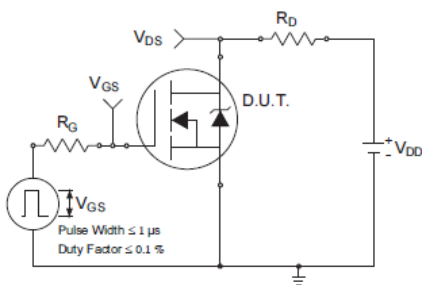
Fig 22. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs
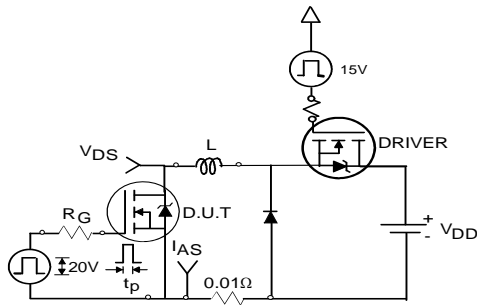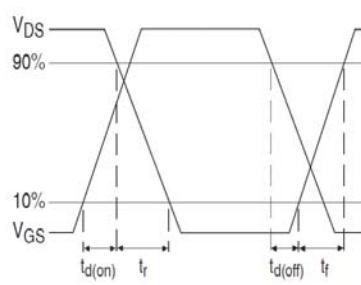

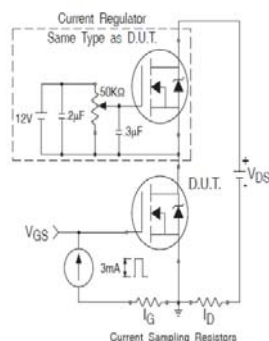**Fig 23a.** Unclamped Inductive Test Circuit
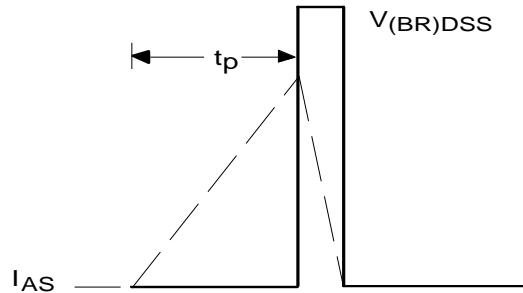
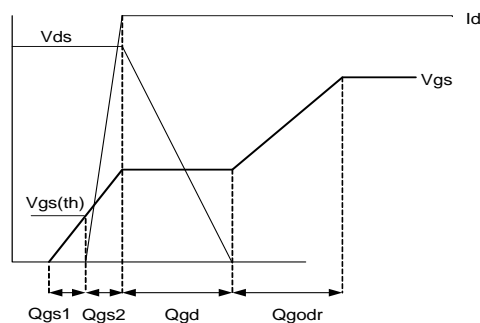**Fig 23b.** Unclamped Inductive Waveforms

Fig 24a. Switching Time Test Circuit
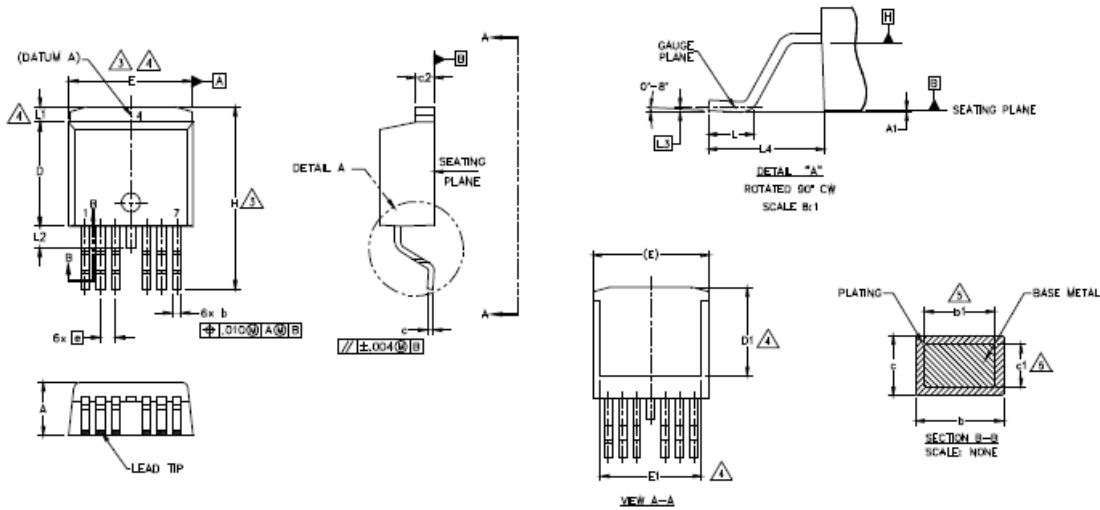

Fig 24b. Switching Time Waveforms

Fig 25a. Gate Charge Test Circuit

Fig 25b. Gate Charge Waveform

D²Pak-7Pin Package Outline (Dimensions are shown in millimeters (inches))

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.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
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	–	.270		4
E	9.65	10.67	.380	.420	3,4
E1	6.22	–	.245		4
e	1.27 BSC		.050 BSC		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	–	1.68	–	.066	4
L2	–	1.78	–	.070	
L3	0.25 BSC		.010 BSC		
L4	4.78	5.28	.188	.208	

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

D²Pak-7Pin Part Marking Information

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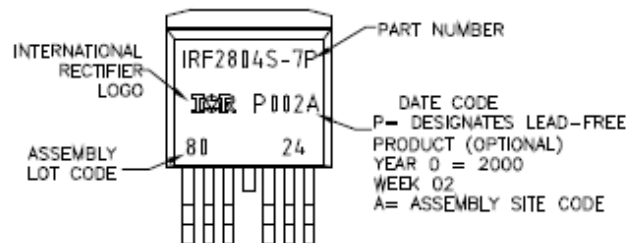ASSEMBLED ON WW02,2000
IN THE ASSEMBLY LINE "L"

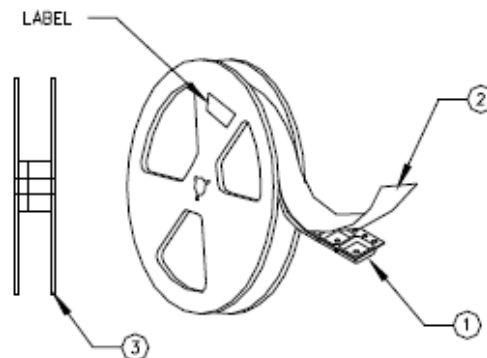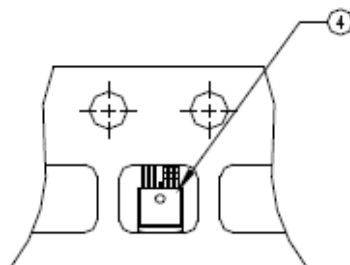Note: "P" in assembly line
position indicates "Lead Free"

INTERNATIONAL
RECTIFIER
LOGO

PART NUMBER

IRF2804S-7P

IOR   002L

ASSEMBLY
LOT CODE

80   24

DATE CODE
YEAR 0 = 2000
WEEK 02
LINE L

OR

INTERNATIONAL
RECTIFIER
LOGO

PART NUMBER

IRF2804S-7P

IOR P002A

ASSEMBLY
LOT CODE

80   24

DATE CODE
P- DESIGNATES LEAD-FREE
PRODUCT (OPTIONAL)
YEAR 0 = 2000
WEEK 02
A= ASSEMBLY SITE CODE
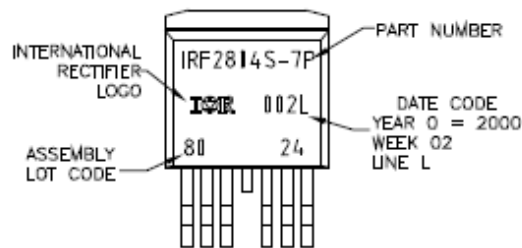
D2Pak-7Pin Tape and Reel

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:

LABEL

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

Qualification Information[†]

Qualification Level	Industrial (per JEDEC JESD47F) [††]	
Moisture Sensitivity Level	D^{2}Pak-7Pin	MSL1
RoHS Compliant	Yes	

†   Qualification standards can be found at International Rectifier's web site: http://www.irf.com/product-info/reliability/

††   Applicable version of JEDEC standard at the time of product release.

International
I☰R Rectifier

IR WORLD HEADQUARTERS: 101 N. Sepulveda Blvd., El Segundo, California 90245, USA
To contact International Rectifier, please visit http://www.irf.com/whoto-call/