International IQR Rectifier

IRF9395MPbF

DirectFET™ dual P-Channel Power MOSFET ②

Typical values (unless otherwise specified)

V_{DSS}	V_{GS}	$R_{DS(on)}$	$R_{DS(on)}$	
-30V max	±20V max	5.3mΩ@-10V	9.0mΩ@-4.5V	

$Q_{g\,tot}$	Q_{gd}	Q_{gs2}	Q_{rr}	Q_{oss}	$V_{gs(th)}$
32nC	15nC	3.2nC	62nC	23nC	-1.8V

Applications

● Isolation Switch for Input Power or Battery Application

Features and Benefits

● Environmentaly Friendly Product
● RoHs Compliant Containing no Lead,
   no Bromide and no Halogen
● Dual Common-Drain P-Channel MOSFETs Provides
   High Level of Integration and Very Low RDS(on)

Q1-Q2

MC

DirectFET™ ISOMETRIC
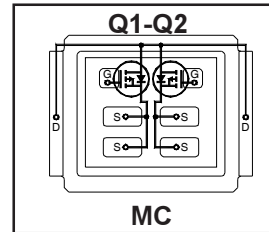
Applicable DirectFET Outline and Substrate Outline (see p.7,8 for details)①

SQ	SX	ST		MQ	MX	MT	MP	**MC**		

Description

The IRF9395MTRPbF combines the latest HEXFET® P-Channel Power MOSFET Silicon technology with the advanced DirectFET™ packaging to achieve the lowest on-state resistance in a package that has the footprint of a SO-8 and only 0.6 mm profile. The DirectFET package is compatible with existing layout geometries used in power applications, PCB assembly equipment and vapor phase, infra-red or convection soldering techniques, when application note AN-1035 is followed regarding the manufacturing methods and processes. The DirectFET package allows dual sided cooling to maximize thermal transfer in power systems, improving previous best thermal resistance by 80%.

Orderable part number	Package Type	Standard Pack		Note
		Form	Quantity	
IRF9395MTRPbF	DirectFET Medium Can	Tape and Reel	4800	"TR" suffix
~~IRF9395MTR1PbF~~	~~DirectFET Medium Can~~	~~Tape and Reel~~	~~1000~~	~~"TR1" suffix~~ EOL notice # 264

Absolute Maximum Ratings

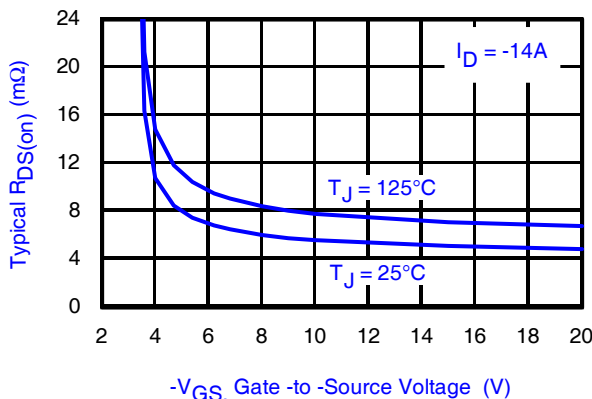|	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	-30	V
V_{GS}	Gate-to-Source Voltage	±20	
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V ③	-14	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V ③	-11	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V ④	-75	
I_{DM}	Pulsed Drain Current ⑤	-110	

Fig 1.   Typical On-Resistance vs. Gate Voltage

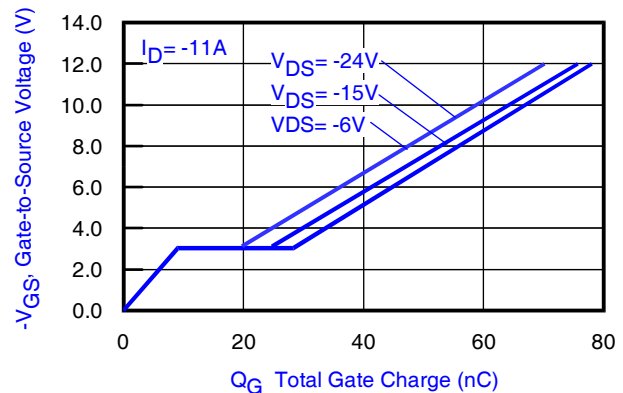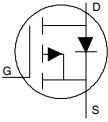**Fig 2.**   Typical Total Gate Charge vs Gate-to-Source Voltage

Notes:
① Click on this section to link to the appropriate technical paper.
② Click on this section to link to the DirectFET Website.
③ Surface mounted on 1 in. square Cu board, steady state.

④ T_C measured with thermocouple mounted to top (Drain) of part.
⑤ Repetitive rating; pulse width limited by max. junction temperature.

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	-30	——	——	V	V_{GS} = 0V, I_D = -250µA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	0.012	——	V/°C	Reference to 25°C, I_D = -1.0mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	5.3	7.0	mΩ	V_{GS} = -10V, I_D = -14A ⑥
		——	9.0	11.9		V_{GS} = -4.5V, I_D = -11 A ⑥
$V_{GS(th)}$	Gate Threshold Voltage	-1.3	-1.8	-2.4	V	V_{DS} = V_{GS}, I_D = -50µA
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	——	-6.1	——	mV/°C	
I_{DSS}	Drain-to-Source Leakage Current	——	——	-1.0	µA	V_{DS} = -24V, V_{GS} = 0V
		——	——	-150		V_{DS} = -24V, 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
gfs	Forward Transconductance	40	——	——	S	V_{DS} = -15V, I_D = -11A
Q_g	Total Gate Charge	——	64	——	nC	V_{DS} = -15V, V_{GS} = -10V, I_D = -11A
Q_g	Total Gate Charge	——	32	——		V_{DS} = -15V
Q_{gs1}	Pre- Vth Gate-to-Source Charge	——	6.5	——		V_{GS} = -4.5V
Q_{gs2}	Post -Vth Gate-to-Source Charge	——	3.2	——		I_D = -11A
Q_{gd}	Gate-to-Drain Charge	——	15	——		See Fig.15
Q_{godr}	Gate Charge Overdrive	——	7.3	——		
Q_{sw}	Switch charge (Q_{gs2} + Q_{gd})	——	18.2	——		
Q_{oss}	Output Charge	——	23	——	nC	V_{DS} = -16V, V_{GS} = 0V
R_G	Gate Resistance	——	15	——	Ω	
$t_{d(on)}$	Turn-On Delay Time	——	16	——	ns	V_{DD} = -15V, V_{GS} = -4.5V ⑥
t_r	Rise Time	——	142	——		I_D = -11A
$t_{d(off)}$	Turn-Off Delay Time	——	76	——		R_G = 1.8Ω
t_f	Fall Time	——	121	——		See Fig.17
C_{iss}	Input Capacitance	——	3241	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	820	——		V_{DS} = -15V
C_{rss}	Reverse Transfer Capacitance	——	466	——		f = 1.0KHz

Diode Characteristics

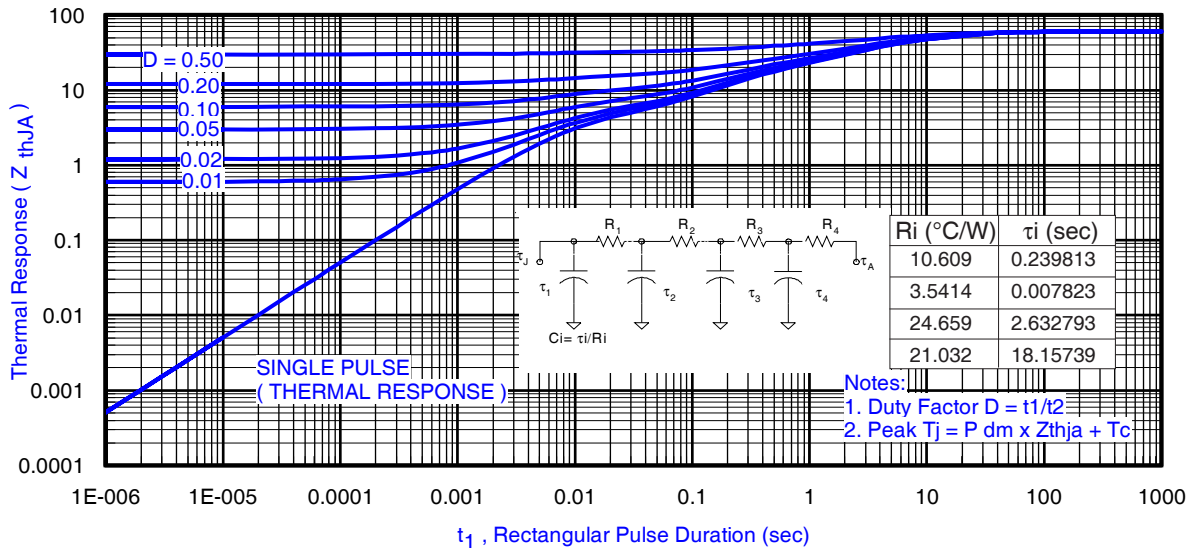|	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	——	——	-57	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ⑤	——	——	-110		
V_{SD}	Diode Forward Voltage	——	——	-1.2	V	T_J = 25°C, I_S = -11A, V_{GS} = 0V ⑥
t_{rr}	Reverse Recovery Time	——	43	65	ns	T_J = 25°C, I_F = -11A, ,V_{DD} = -15V
Q_{rr}	Reverse Recovery Charge	——	62	93	nC	di/dt = 260A/µs ⑥

Notes:

⑥ Pulse width ≤ 400µs; duty cycle ≤ 2%.

Absolute Maximum Ratings

	Parameter	Max.	Units
P_D @T_A = 25°C	Power Dissipation ③	2.1	
P_D @T_A = 70°C	Power Dissipation ③	1.3	W
P_D @T_C = 25°C	Power Dissipation ④	57	
T_P	Peak Soldering Temperature	270	
T_J	Operating Junction and	-40 to + 150	°C
T_{STG}	Storage Temperature Range		

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient ③	——	60	
$R_{\theta JA}$	Junction-to-Ambient ⑦	12.5	——	
$R_{\theta JA}$	Junction-to-Ambient ⑧	20	——	°C/W
$R_{\theta JC}$	Junction-to-Case ④,⑨	——	2.2	
$R_{\theta J\text{-}PCB}$	Junction-to-PCB Mounted	1.0	——	
	Linear Derating Factor ③	0.02		W/°C

Ri (°C/W)	τi (sec)
10.609	0.239813
3.5414	0.007823
24.659	2.632793
21.032	18.15739

SINGLE PULSE
(THERMAL RESPONSE)

$C_i = \tau_i / R_i$

Notes:
1. Duty Factor D = t1/t2
2. Peak Tj = P dm x Zthja + Tc

Fig 3. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient ①

Notes:

⑦ Used double sided cooling, mounting pad with large heatsink.
⑧ Mounted on minimum footprint full size board with metalized
  back and with small clip heatsink.

⑨ R_θ is measured at T_J of approximately 90°C.
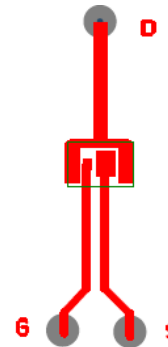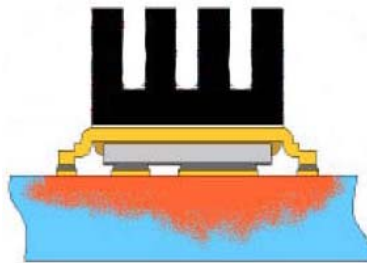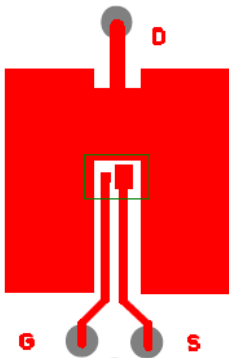
③ Surface mounted on 1 in. square Cu board (still air).

⑨ Mounted to a PCB with small clip heatsink (still air)

⑨ Mounted on minimum footprint full size board with metalized back and with small clip heatsink (still air)

     Submit Datasheet Feedback   February 24, 2014
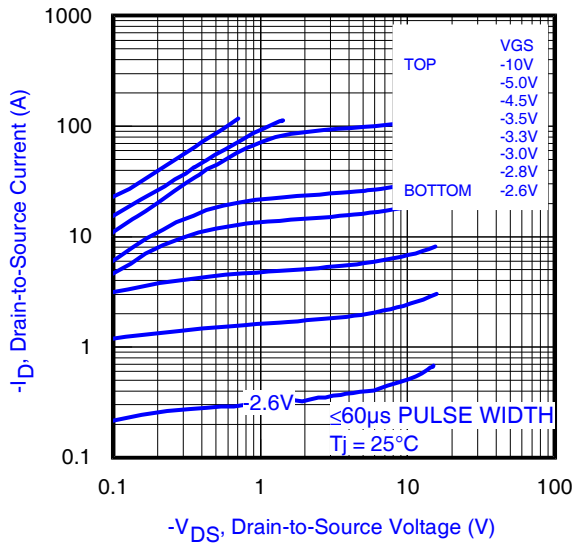
Fig 4. Typical Output Characteristics
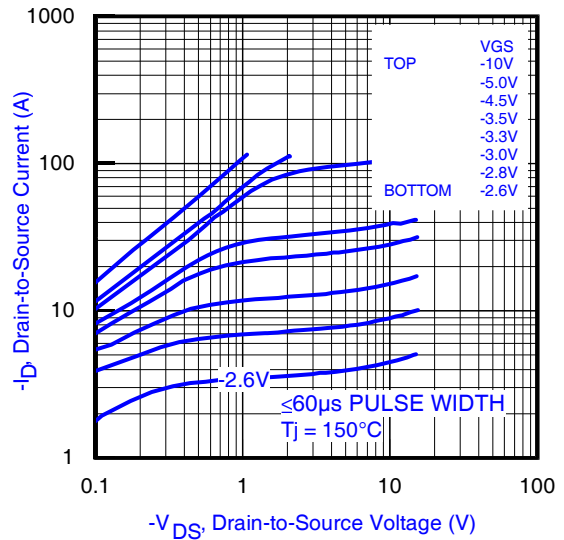
Fig 5. Typical Output Characteristics
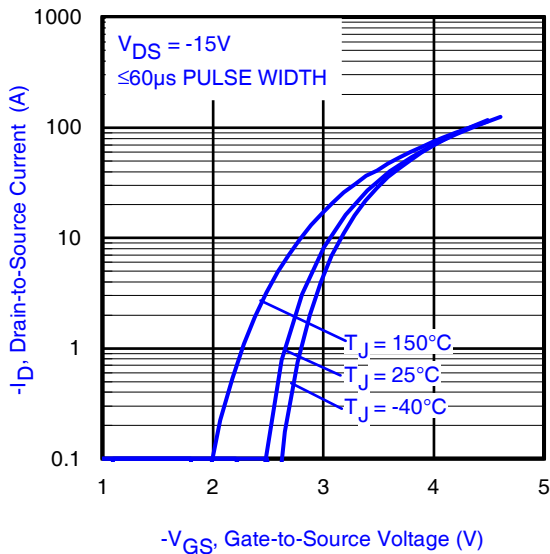
Fig 6. Typical Transfer Characteristics
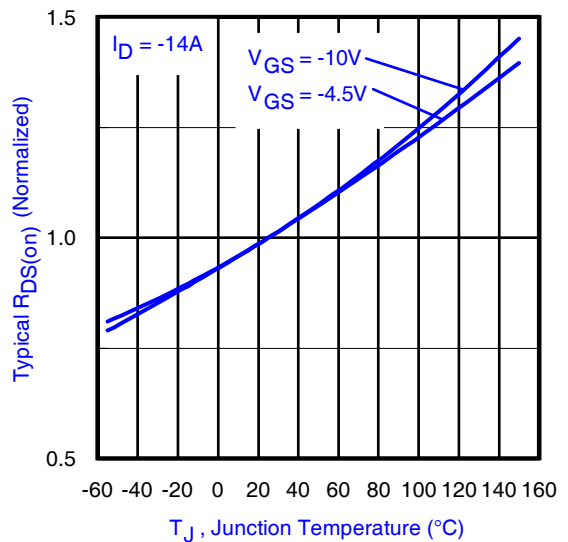
Fig 7. Normalized On-Resistance vs. Temperature
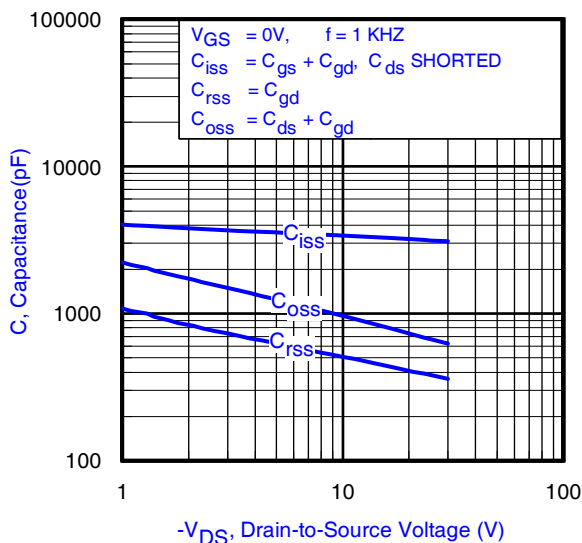
Fig 8. Typical Capacitance vs.Drain-to-Source Voltage
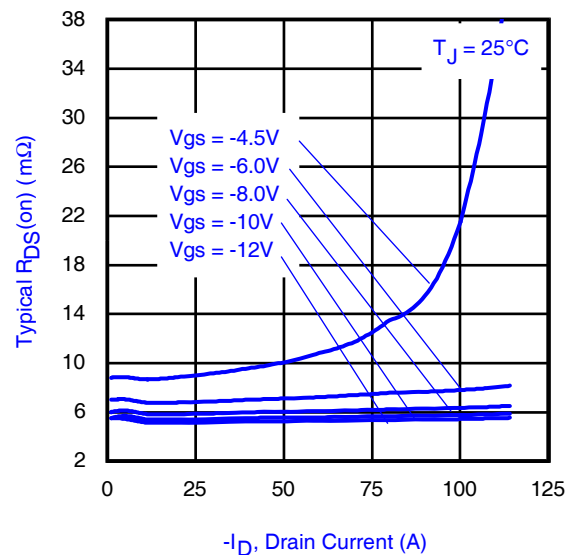
Fig 9. Typical On-Resistance vs.
Drain Current and Gate Voltage

     Submit_Datasheet Feedback   February 24, 2014
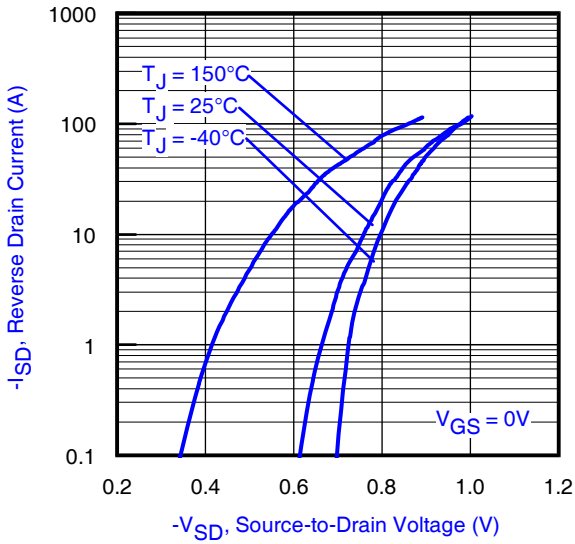
Fig 10. Typical Source-Drain Diode Forward Voltage
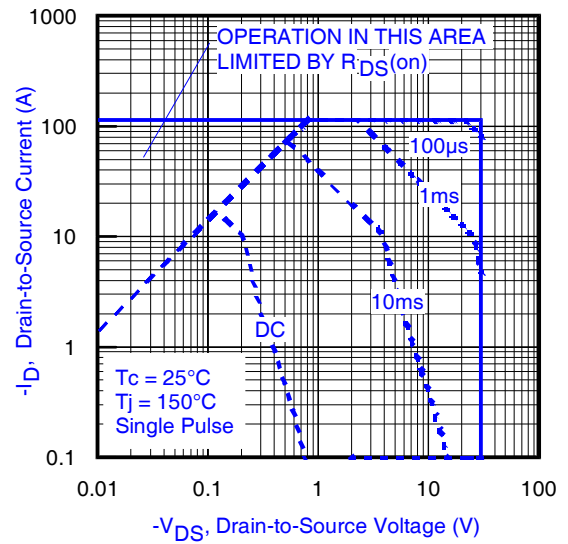
Fig 11. Maximum Safe Operating Area
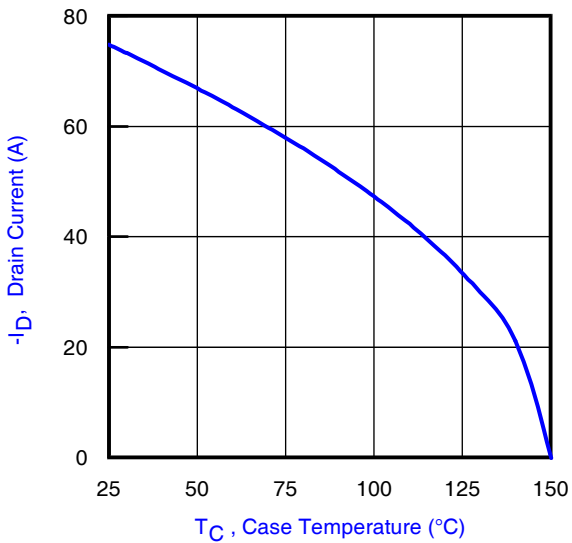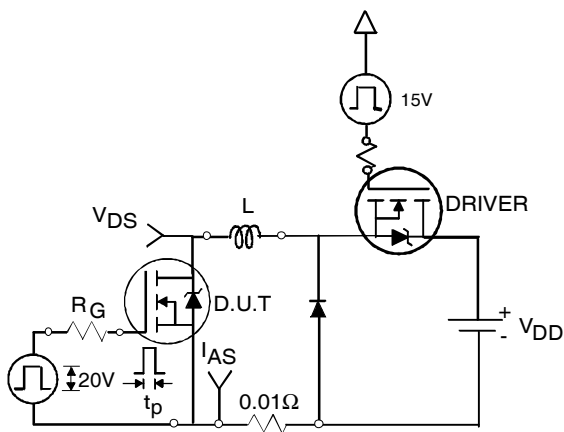

Fig 12. Maximum Drain Current vs. Case Temperature
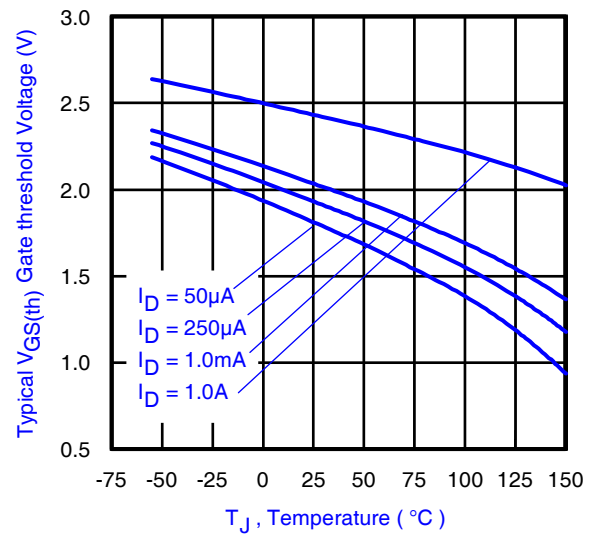
Fig 13. Typical Threshold Voltage vs. Junction Temperature
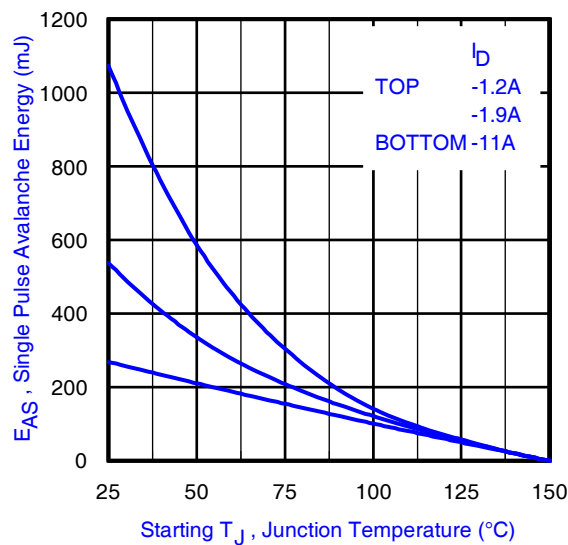
Fig 14. Maximum Avalanche Energy vs. Drain Current

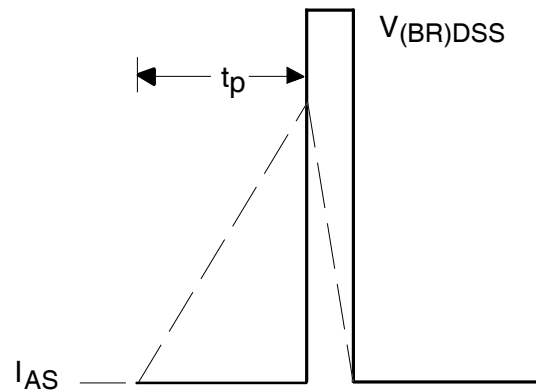Submit Datasheet Feedback   February 24, 2014
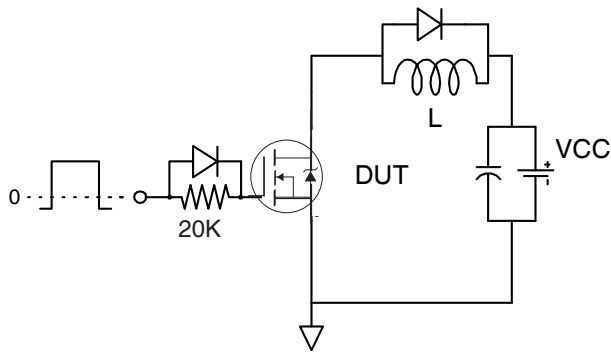
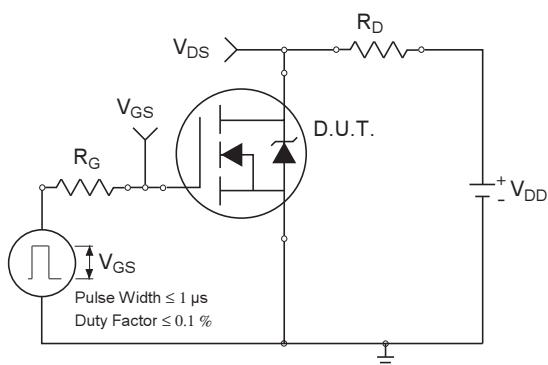**Fig 15a.** Gate Charge Test Circuit
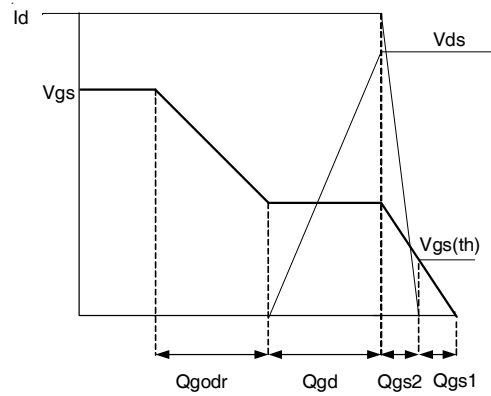
Fig 15b. Gate Charge Waveform

Fig 16a. Unclamped Inductive Test Circuit

Fig 16b. Unclamped Inductive Waveforms

Fig 17a. Switching Time Test Circuit
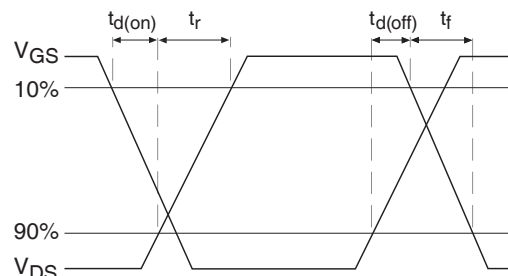
Fig 17b. Switching Time Waveforms

     Submit Datasheet Feedback   February 24, 2014
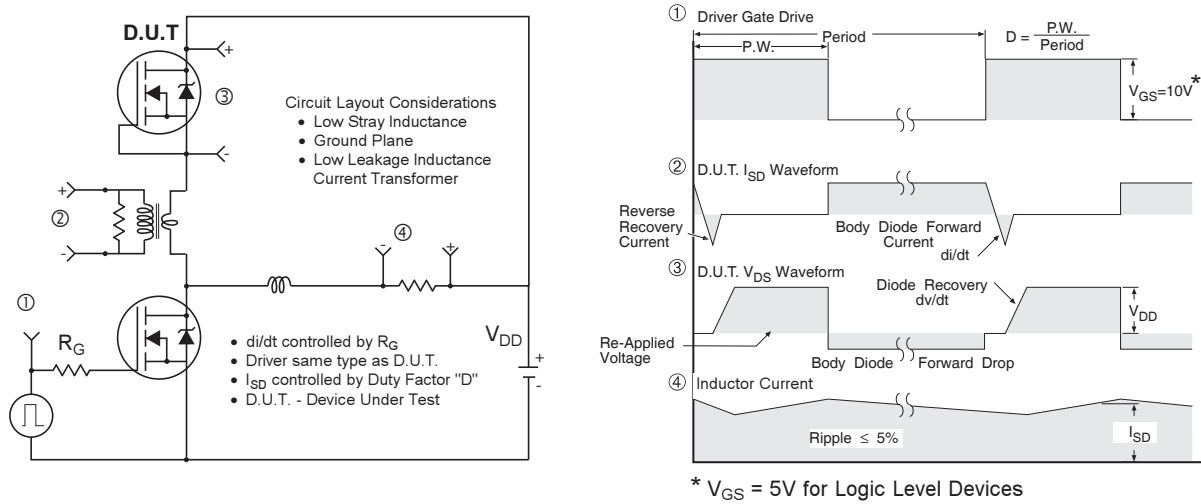
Fig 18. Diode Reverse Recovery Test Circuit for N-Channel HEXFET® Power MOSFETs

DirectFET™ Board Footprint, MC Outline (Medium Size Can, C-Designation).

Please see DirectFET application note AN-1035 for all details regarding the assembly of DirectFET.

This includes all recommendations for stencil and substrate designs.

G = GATE
D = DRAIN
S = SOURCE

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

   Submit Datasheet Feedback   February 24, 2014
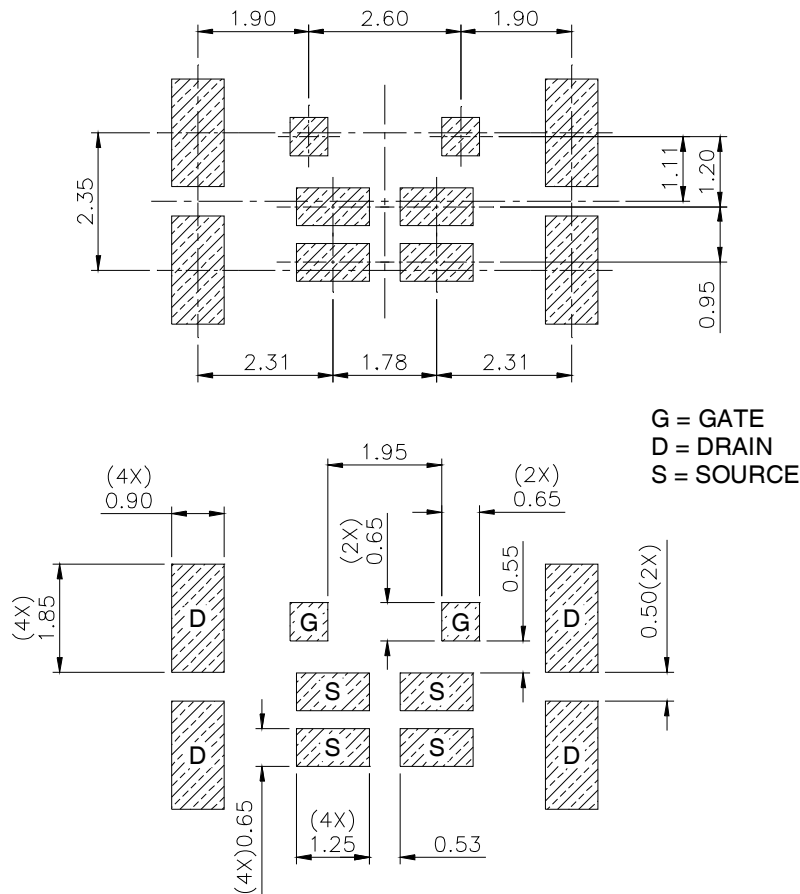
DirectFET™ Outline Dimension, MC Outline (Medium Size Can, C-Designation).

Please see DirectFET application note AN-1035 for all details regarding the assembly of DirectFET. This includes all recommendations for stencil and substrate designs.

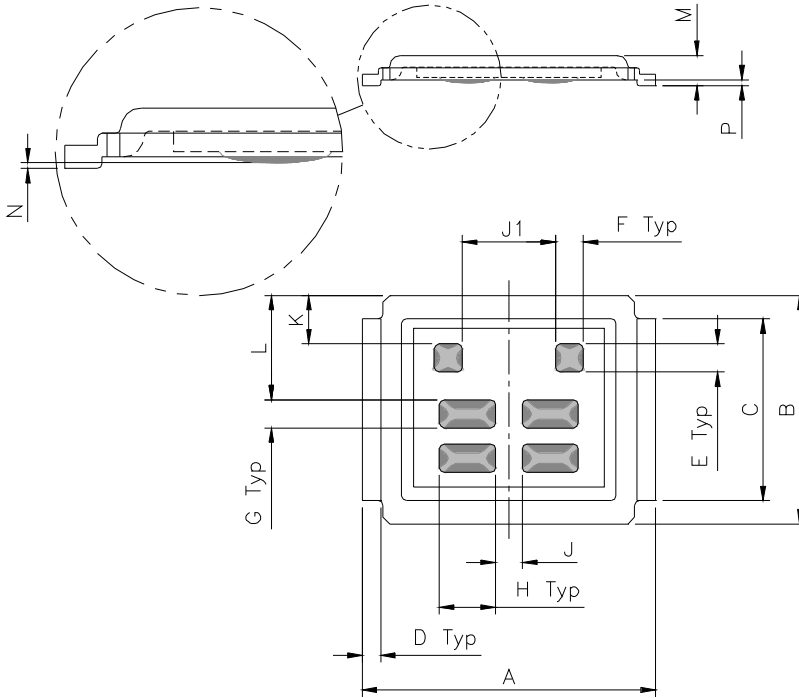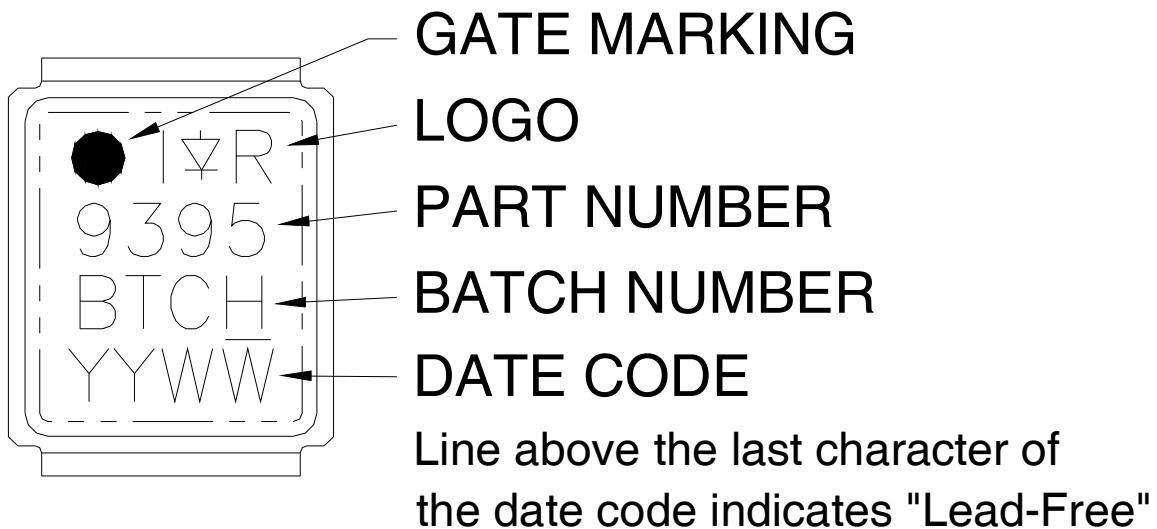| DIMENSIONS				
	METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX
A	6.25	6.35	0.246	0.250
B	4.80	5.05	0.189	0.201
C	3.85	3.95	0.152	0.156
D	0.35	0.45	0.014	0.018
E	0.58	0.62	0.023	0.024
F	0.58	0.62	0.023	0.024
G	0.58	0.62	0.023	0.024
H	1.18	1.22	0.047	0.048
J	0.56	0.60	0.022	0.023
J1	1.98	2.02	0.078	0.079
K	1.02	1.06	0.040	0.041
L	2.22	2.26	0.088	0.089
M	0.59	0.70	0.023	0.028
N	0.03	0.08	0.001	0.003
P	0.08	0.17	0.003	0.007

DirectFET™ Part Marking

GATE MARKING

LOGO

PART NUMBER

BATCH NUMBER

DATE CODE

Line above the last character of the date code indicates "Lead-Free"

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

DirectFET™ Tape & Reel Dimension (Showing component orientation).

LOADED TAPE FEED DIRECTION
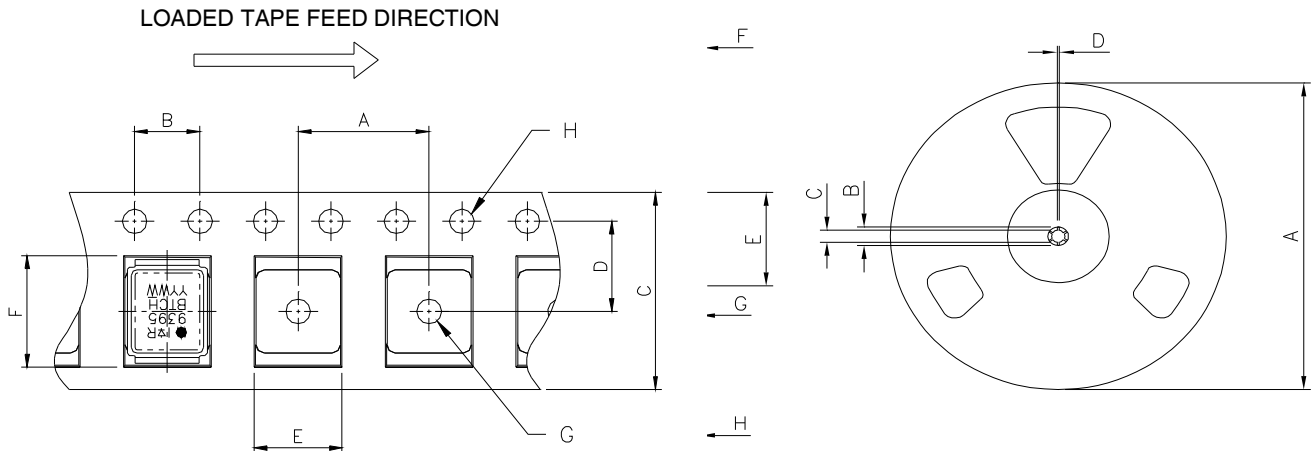
NOTE: CONTROLLING
DIMENSIONS IN MM

DIMENSIONS				
	METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX
A	7.90	8.10	0.311	0.319
B	3.90	4.10	0.154	0.161
C	11.90	12.30	0.469	0.484
D	5.45	5.55	0.215	0.219
E	5.10	5.30	0.201	0.209
F	6.50	6.70	0.256	0.264
G	1.50	N.C	0.059	N.C
H	1.50	1.60	0.059	0.063

NOTE: Controlling dimensions in mm
Std reel quantity is 4800 parts (ordered as IRF9395MTRPBF).

REEL DIMENSIONS				
STANDARD OPTION (QTY 4800)				
	METRIC		IMPERIAL	
CODE	MIN	MAX	MIN	MAX
A	330.0	N.C	12.992	N.C
B	20.2	N.C	0.795	N.C
C	12.8	13.2	0.504	0.520
D	1.5	N.C	0.059	N.C
E	100.0	N.C	3.937	N.C
F	N.C	18.4	N.C	0.724
G	12.4	14.4	0.488	0.567
H	11.9	15.4	0.469	0.606

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[††]guidelines)	
Moisture Sensitivity Level	DirectFET	MSL1
		(per JEDEC J-STD-020D[††])
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.

Revision History

Date	Comments
10/25/2013	• Updated Qualification level from "Consumer" to "Industrial" on page 9 • Updated data sheet with new IR corporate template
2/24/2014	• Updated ordering information to reflect the End-Of-life (EOL) of the mini-reel option (EOL notice #264)

International **IQR** *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/

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for MOSFET *category:*

Click to view products by Infineon *manufacturer:*

Other Similar products are found below :

IRFD120 JANTX2N5237 BUK455-60A/B MIC4420CM-TR VN1206L NDP4060 SI4482DY IPS70R2K0CEAKMA1 SQD23N06-31L-GE3   TK16J60W,S1VQ(O 2SK2614(TE16L1,Q) DMN1017UCP3-7 DMN1053UCP4-7 SQJ469EP-T1-GE3 NTE2384 DMC2700UDMQ-7 DMN2080UCB4-7 DMN61D9UWQ-13 US6M2GTR DMN31D5UDJ-7 DMP22D4UFO-7B DMN1006UCA6-7 DMN16M9UCA6-7 STF5N65M6 IRF40H233XTMA1 STU5N65M6 DMN6022SSD-13 DMN13M9UCA6-7 DMTH10H4M6SPS-13 DMN2990UFB-7B IPB80P04P405ATMA2 2N7002W-G MCAC30N06Y-TP MCQ7328-TP BXP7N65D BXP4N65F AOL1454G WMJ80N60C4 BXP2N20L BXP2N65D BXT1150N10J BXT1700P06M TSM60NB380CP ROG RQ7L055BGTCR DMNH15H110SK3-13 SLF10N65ABV2 BSO203SP BSO211P IPA60R230P6 IPA60R460CE