

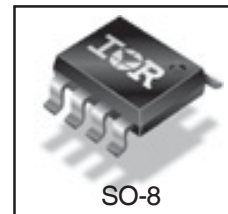
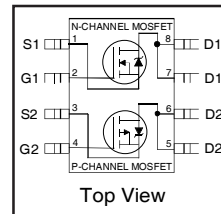


# THE DATASHEET OF IRF9389PBF



	N-CH	P-CH	
$V_{DS}$	30	-30	V
$R_{DS(on) \max}$	27	64	m $\Omega$
$Q_g$ (typical)	6.8	8.1	nC
$I_D$ (@ $T_A = 25^\circ\text{C}$ )	6.8	-4.6	A

HEXFET<sup>®</sup> Power MOSFET



**Applications**

- High and Low Side Switches for Inverter
- High and Low Side Switches for Generic Half-Bridge

**Features**

High and low-side MOSFETs in a single package
High-side P-Channel MOSFET
Industry-standard pinout
Compatible with existing surface mount techniques
RoHS compliant containing no Lead, no Bromide and no Halogen
MSL1, Consumer qualification

results in  
 $\Rightarrow$

**Benefits**

Increased power density
Easier drive circuitry
Multi-vendor compatibility
Easier manufacturing
Environmentally friendlier
Increased reliability

Base Part Number	Package Type	Standard Pack		Orderable part number
		Form	Quantity	
IRF9389PbF	SO-8	Tube/Bulk	95	IRF9389PbF
		Tape and Reel	4000	IRF9389TRPbF

**Absolute Maximum Ratings**

	Parameter	Max.		Units
		N-Channel	P-Channel	
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D @ T_A = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	6.8	-4.6	A
$I_D @ T_A = 70^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	5.4	-3.7	
$I_{DM}$	Pulsed Drain Current <sup>①</sup>	34	-23	
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation	2.0		W
$P_D @ T_A = 70^\circ\text{C}$	Power Dissipation	1.3		
	Linear Derating Factor	0.016		W/ $^\circ\text{C}$
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150		$^\circ\text{C}$

**Thermal Resistance**

	Parameter	Typ.	Max	Units
$R_{\theta JL}$	Junction-to-Drain Lead <sup>④</sup>	—	20	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient <sup>③</sup>	—	62.5	

**Static @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter		Min.	Typ.	Max.	Units	Conditions
BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	N-Ch	30	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
		P-Ch	-30	—	—		V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	N-Ch	—	0.03	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
		P-Ch	—	0.02	—		Reference to 25°C, I <sub>D</sub> = -1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	N-Ch	—	22	27	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 6.8A ②
			—	33	40		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 5.4A ②
		P-Ch	—	51	64	mΩ	V <sub>GS</sub> = -10V, I <sub>D</sub> = -4.6A ②
			—	82	103		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.7A ②
V <sub>GS(th)</sub>	Gate Threshold Voltage	N-Ch	1.3	1.8	2.3	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 10μA
		P-Ch	-1.3	-1.8	-2.3		V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -10μA
I <sub>DSS</sub>	Drain-to-Source Leakage Current	N-Ch	—	—	1.0	μA	V <sub>DS</sub> = 24V, V <sub>GS</sub> = 0V
		P-Ch	—	—	-1.0		V <sub>DS</sub> = -24V, V <sub>GS</sub> = 0V
		N-Ch	—	—	150		V <sub>DS</sub> = 24V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
		P-Ch	—	—	-150		V <sub>DS</sub> = -24V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	N-Ch	—	—	100	nA	V <sub>GS</sub> = 20V
		P-Ch	—	—	-100		V <sub>GS</sub> = -20V
	Gate-to-Source Reverse Leakage	N-Ch	—	—	-100		V <sub>GS</sub> = -20V
		P-Ch	—	—	100		V <sub>GS</sub> = 20V
g <sub>fs</sub>	Forward Transconductance	N-Ch	8.2	—	—	S	V <sub>DS</sub> = 15V, I <sub>D</sub> = 5.4A
		P-Ch	4.1	—	—		V <sub>DS</sub> = -15V, I <sub>D</sub> = -3.7A
Q <sub>g</sub>	Total Gate Charge	N-Ch	—	6.8	14	nC	N-Channel V <sub>GS</sub> = 10V, V <sub>DS</sub> = 15V, I <sub>D</sub> = 6.8A
		P-Ch	—	8.1	16		P-Channel V <sub>GS</sub> = -10V, V <sub>DS</sub> = -15V, I <sub>D</sub> = -4.6A
Q <sub>gs</sub>	Gate-to-Source Charge	N-Ch	—	1.4	—		
		P-Ch	—	1.3	—		
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	N-Ch	—	0.98	—		
		P-Ch	—	2.1	—		
R <sub>G</sub>	Gate Resistance	N-Ch	—	2.2	4.4	Ω	
		P-Ch	—	9.4	19		
t <sub>d(on)</sub>	Turn-On Delay Time	N-Ch	—	5.1	—	ns	N-Channel V <sub>DD</sub> = 15V, V <sub>GS</sub> = 4.5V ③ I <sub>D</sub> = 1.0A, R <sub>G</sub> = 6.2Ω
		P-Ch	—	8.0	—		
t <sub>r</sub>	Rise Time	N-Ch	—	4.8	—		
		P-Ch	—	14	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	N-Ch	—	4.9	—		
		P-Ch	—	17	—		P-Channel V <sub>DD</sub> = -15V, V <sub>GS</sub> = -4.5V ③ I <sub>D</sub> = -1.0A, R <sub>G</sub> = 6.8Ω
t <sub>f</sub>	Fall Time	N-Ch	—	3.9	—		
		P-Ch	—	15	—		
C <sub>iss</sub>	Input Capacitance	N-Ch	—	398	—	pF	N-Channel V <sub>GS</sub> = 0V, V <sub>DS</sub> = 15V, f = 1.0MHz
		P-Ch	—	383	—		
C <sub>oss</sub>	Output Capacitance	N-Ch	—	82	—		
		P-Ch	—	104	—		P-Channel V <sub>GS</sub> = 0V, V <sub>DS</sub> = -15V, f = 1.0KHz
C <sub>riss</sub>	Reverse Transfer Capacitance	N-Ch	—	36	—		
		P-Ch	—	64	—		

**Diode Characteristics**

	Parameter		Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	N-Ch	—	—	2.0	A	
		P-Ch	—	—	-2.0		
I <sub>SM</sub>	Pulsed Source Current (Body Diode)	N-Ch	—	—	34		
		P-Ch	—	—	-23		
V <sub>SD</sub>	Diode Forward Voltage	N-Ch	—	—	1.2	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 2.0A, V <sub>GS</sub> = 0V ③
		P-Ch	—	—	-1.2		T <sub>J</sub> = 25°C, I <sub>S</sub> = -2.0A, V <sub>GS</sub> = 0V ③
t <sub>rr</sub>	Reverse Recovery Time	N-Ch	—	8.4	13	ns	N-Channel: T <sub>J</sub> = 25°C, I <sub>F</sub> = 2.0A, V <sub>DD</sub> = 15V, di/dt = 102/μs ④
		P-Ch	—	11	17		
Q <sub>rr</sub>	Reverse Recovery Charge	N-Ch	—	2.3	3.5	nC	P-Channel: T <sub>J</sub> = 25°C, I <sub>F</sub> = -2.0A, V <sub>DD</sub> = -15V, di/dt = 102/μs ④
		P-Ch	—	4.8	7.2		

**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 16)  
 ② Pulse width ≤ 400μs; duty cycle ≤ 2%.

- ③ Surface mounted on 1 in square Cu board  
 ④ R<sub>θ</sub> is measured at T<sub>J</sub> approximately 90°C

N-Channel

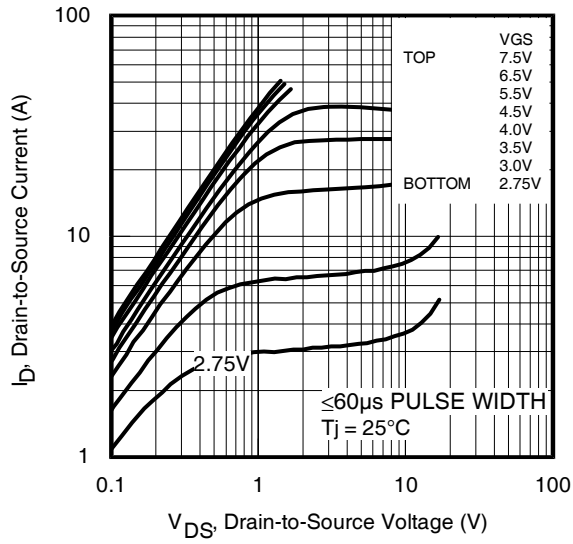


Fig 1. Typical Output Characteristics

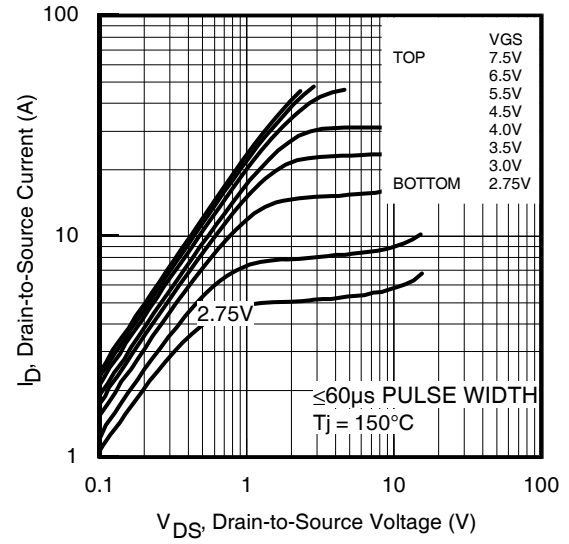


Fig 2. Typical Output Characteristics

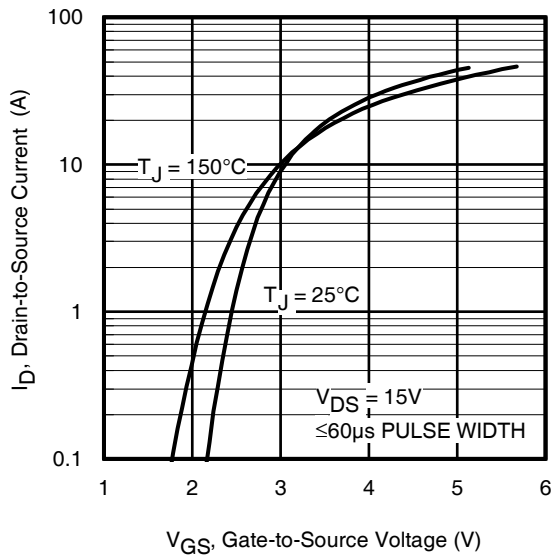


Fig 3. Typical Transfer Characteristics

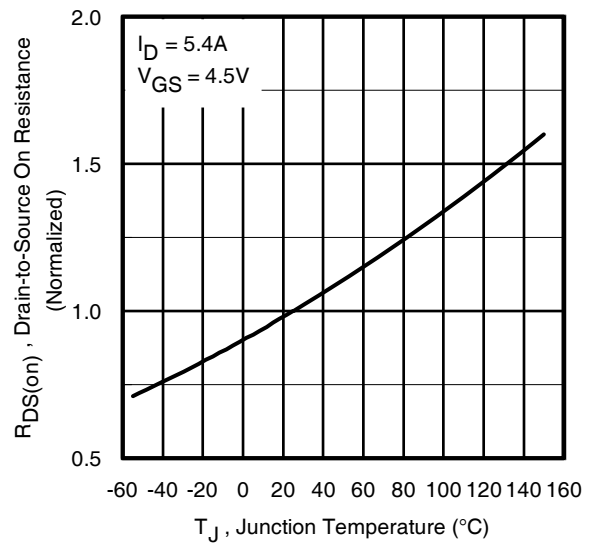
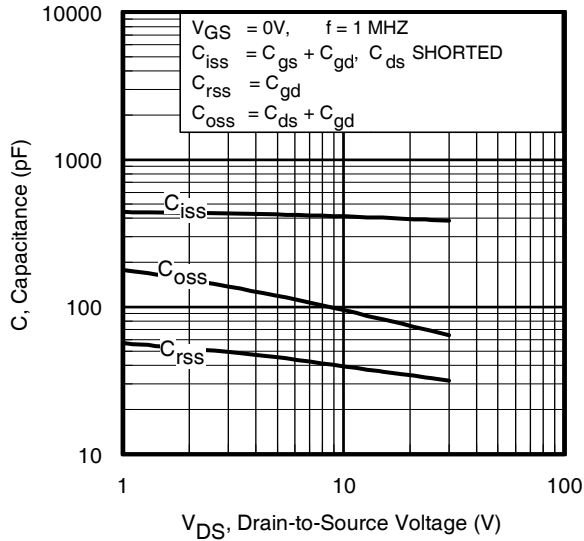
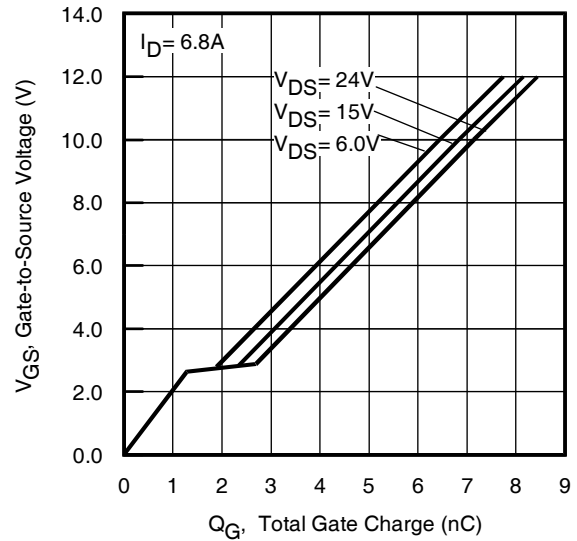
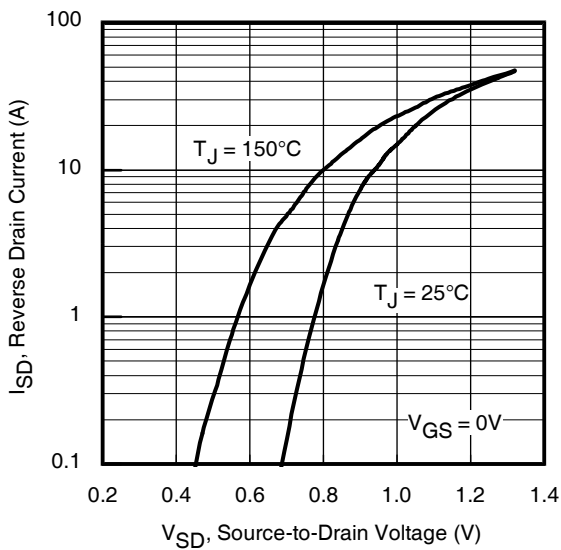
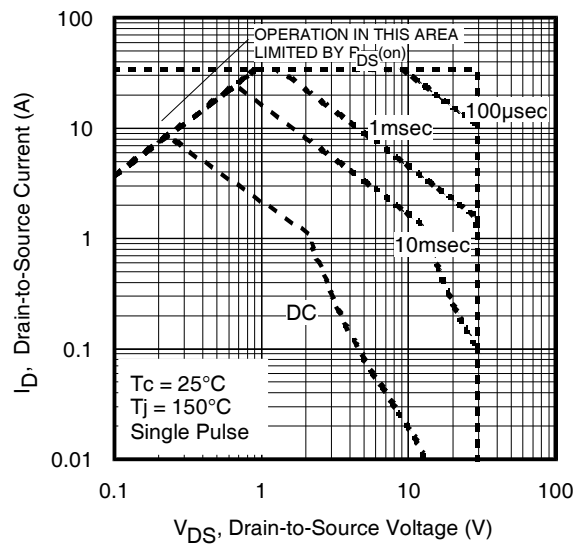
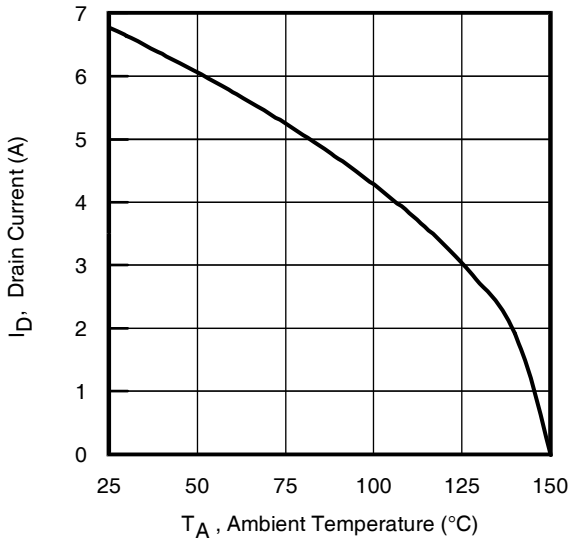
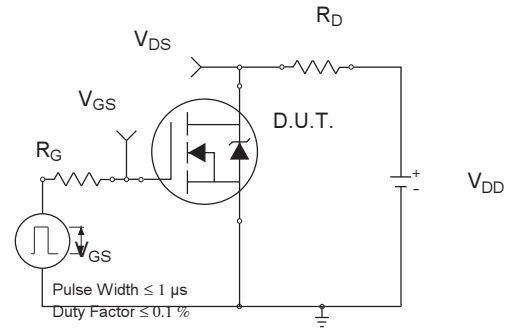
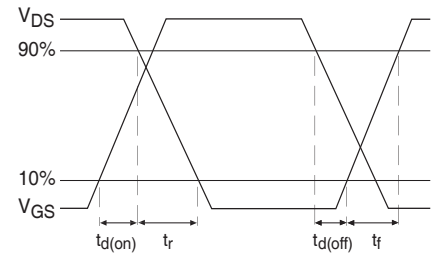
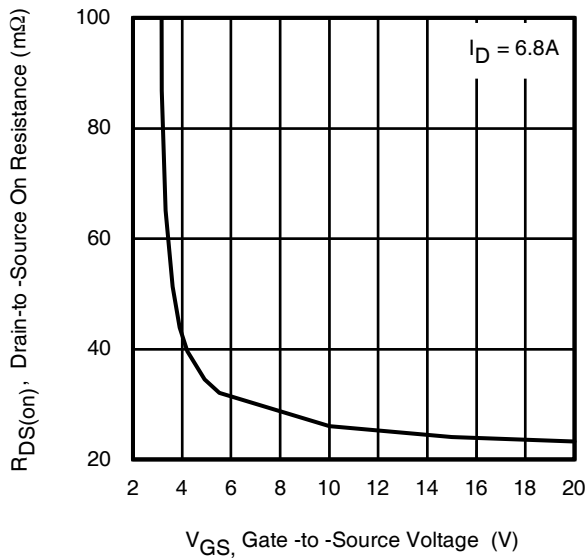
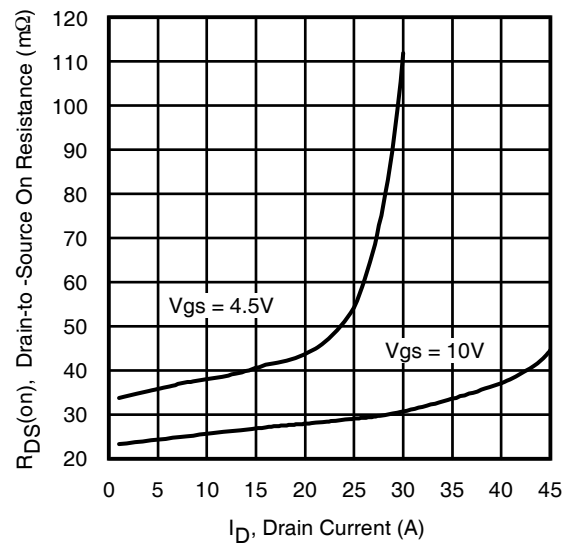


Fig 4. Normalized On-Resistance vs. Temperature

**N-Channel**

**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

**N-Channel**

**Fig 9.** Maximum Drain Current vs. Ambient Temperature

**Fig 10a.** Switching Time Test Circuit

**Fig 10b.** Switching Time Waveforms

**Fig 11.** Typical On-Resistance vs. Gate Voltage

**Fig 12.** Typical On-Resistance vs. Drain Current

N-Channel

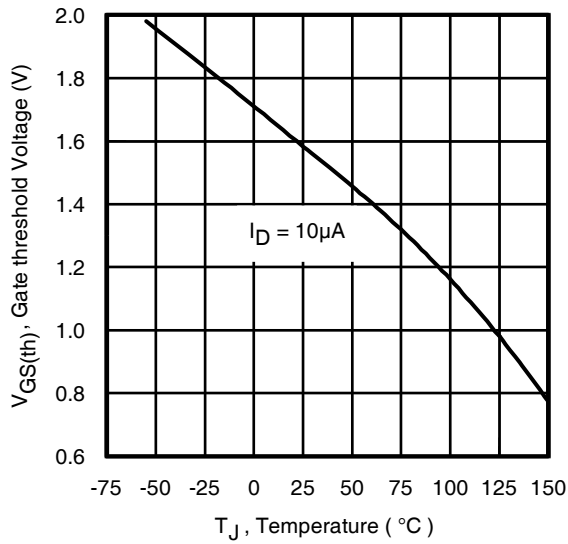


Fig 13. Threshold Voltage vs. Temperature

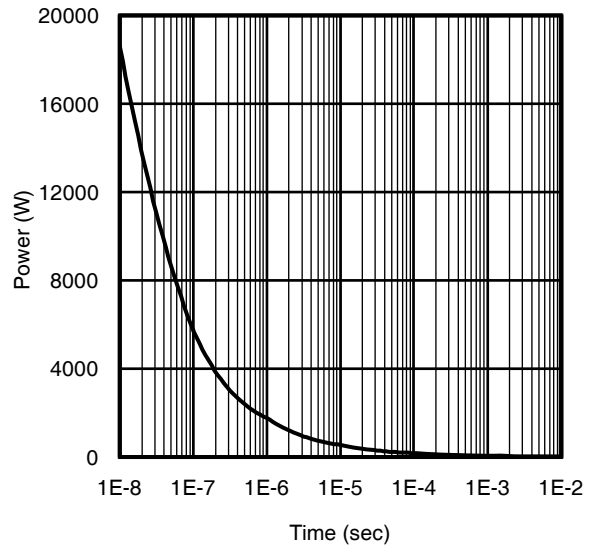


Fig 14. Typical Power vs. Time

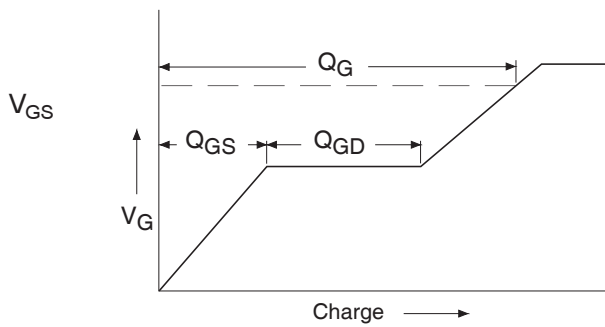


Fig 15a. Basic Gate Charge Waveform

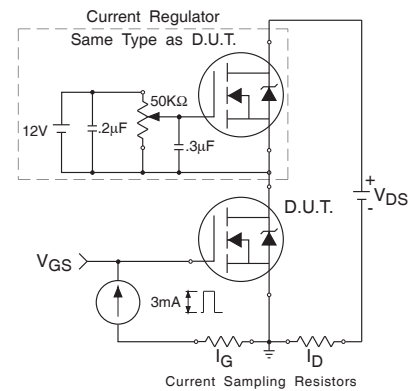


Fig 15b. Gate Charge Test Circuit

N and P-Channel

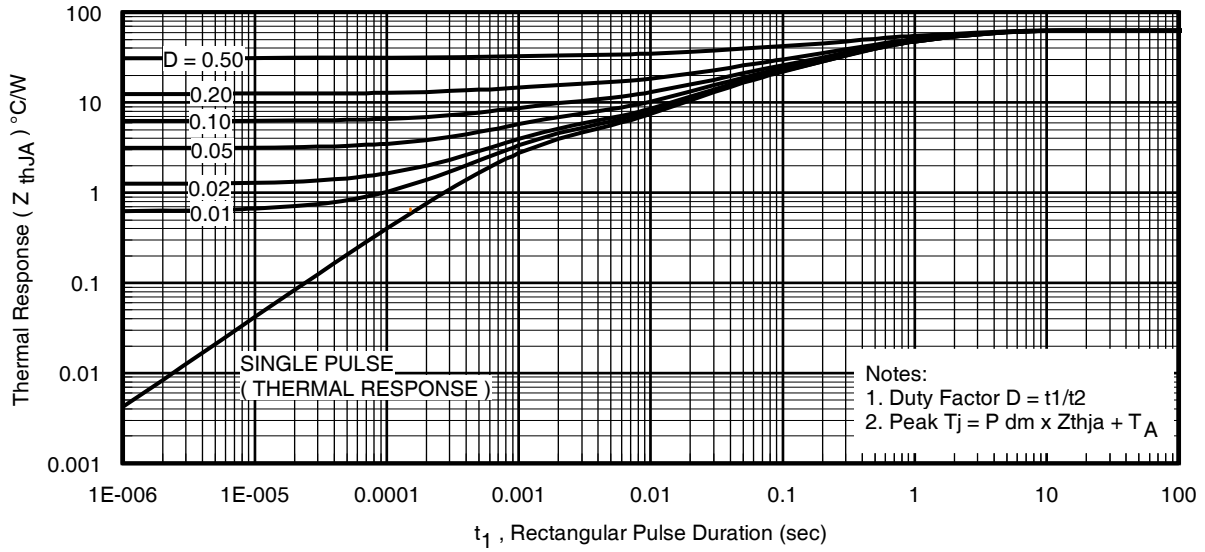


Fig 16. Typical Effective Transient Thermal Impedance, Junction-to-Ambient

P-Channel

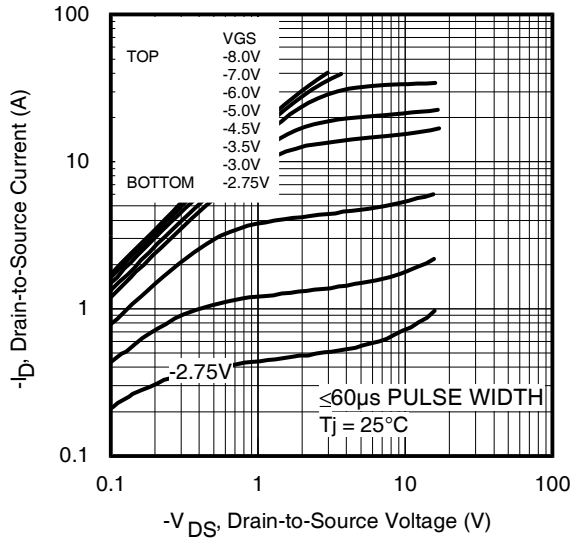


Fig 17. Typical Output Characteristics

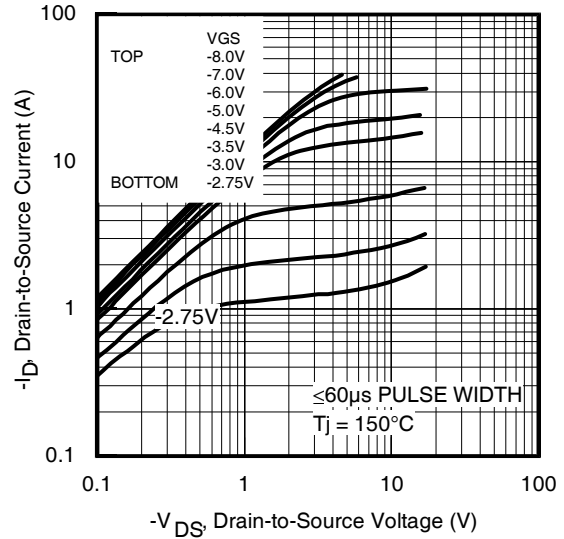


Fig 18. Typical Output Characteristics

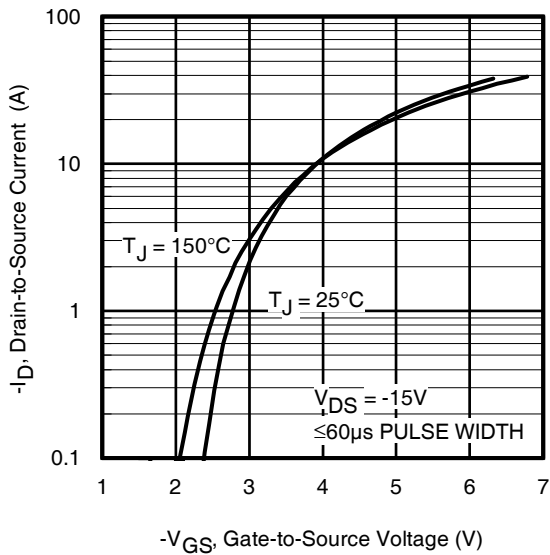


Fig 19. Typical Transfer Characteristics

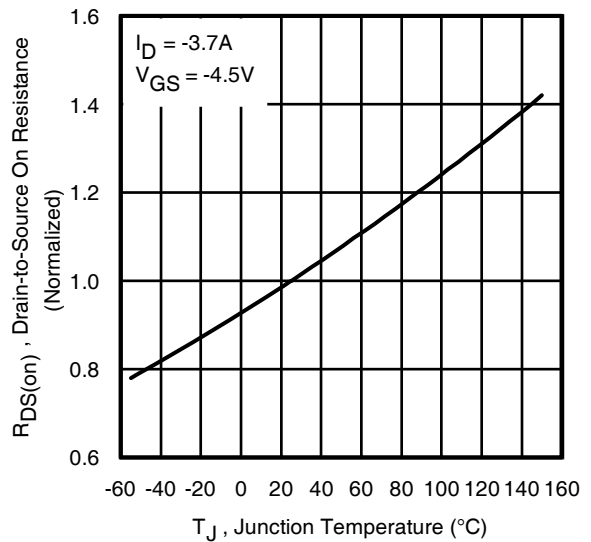


Fig 20. Normalized On-Resistance vs. Temperature

P-Channel

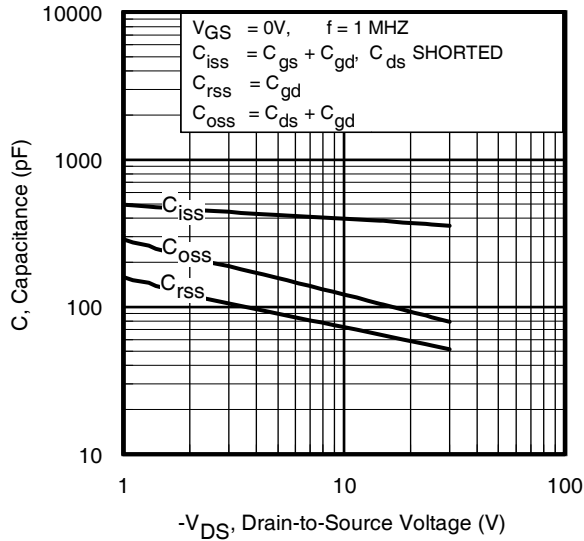


Fig 21. Typical Capacitance vs. Drain-to-Source Voltage

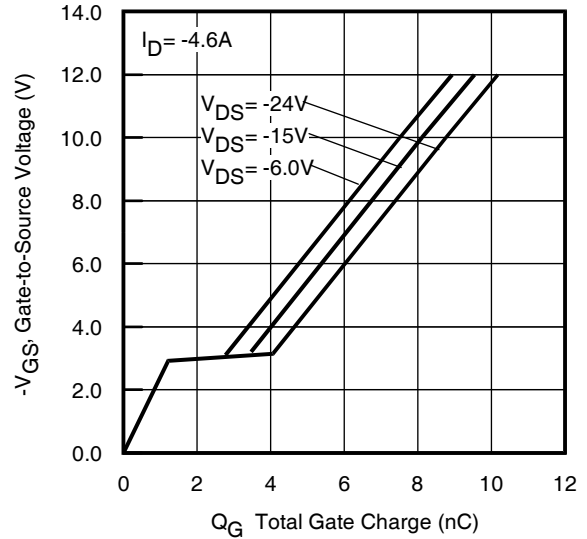


Fig 22. Typical Gate Charge vs. Gate-to-Source Voltage

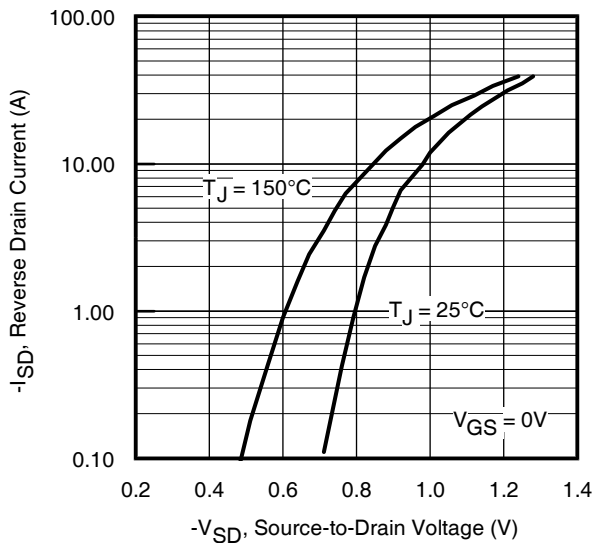


Fig 23. Typical Source-Drain Diode Forward Voltage

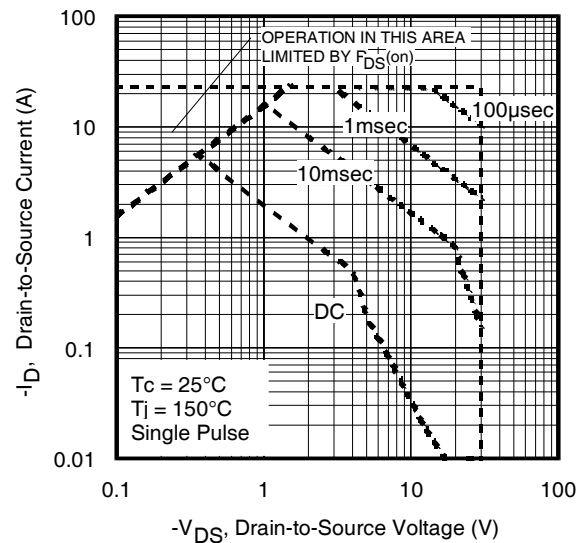
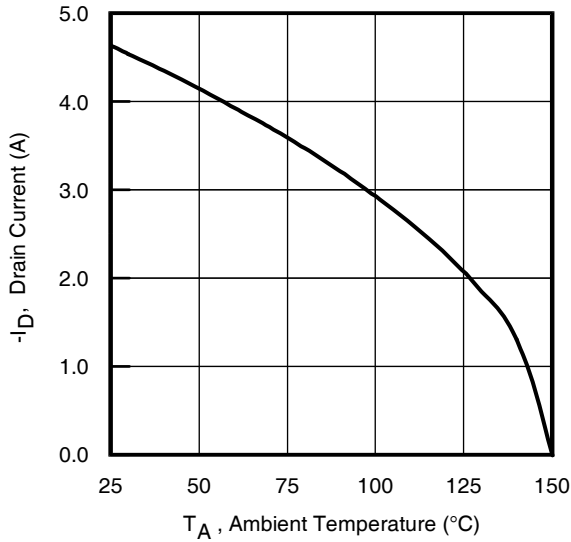
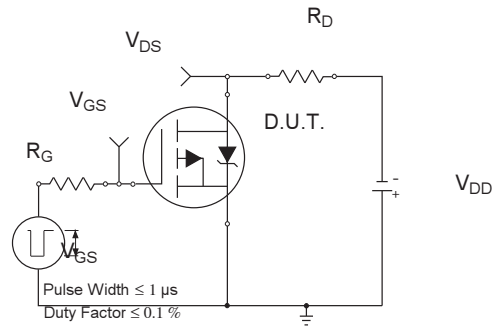
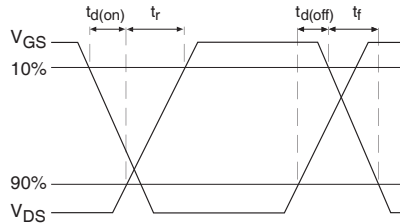
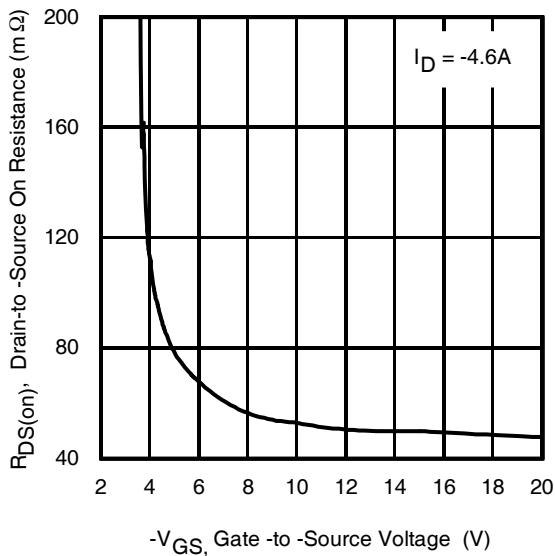
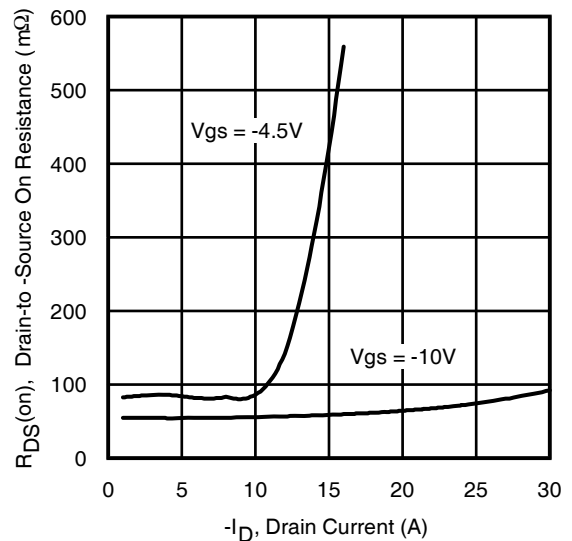


Fig 24. Maximum Safe Operating Area

**P-Channel**

**Fig 25.** Maximum Drain Current vs. Ambient Temperature

**Fig 26a.** Switching Time Test Circuit

**Fig 26b.** Switching Time Waveforms

**Fig 27.** Typical On-Resistance vs. Gate Voltage

**Fig 28.** Typical On-Resistance vs. Drain Current

P-Channel

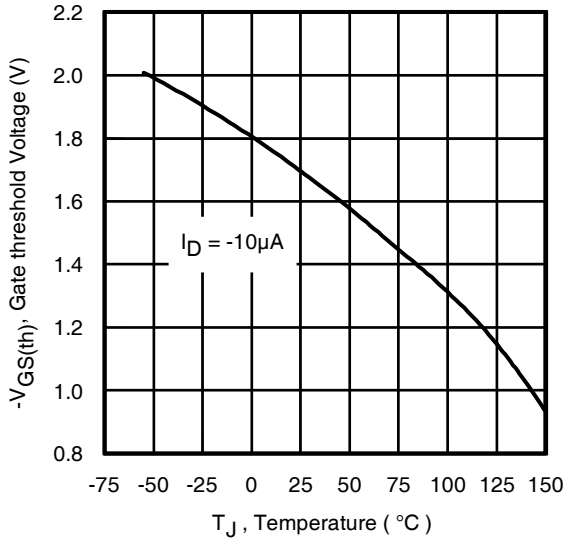


Fig 29. Threshold Voltage vs. Temperature

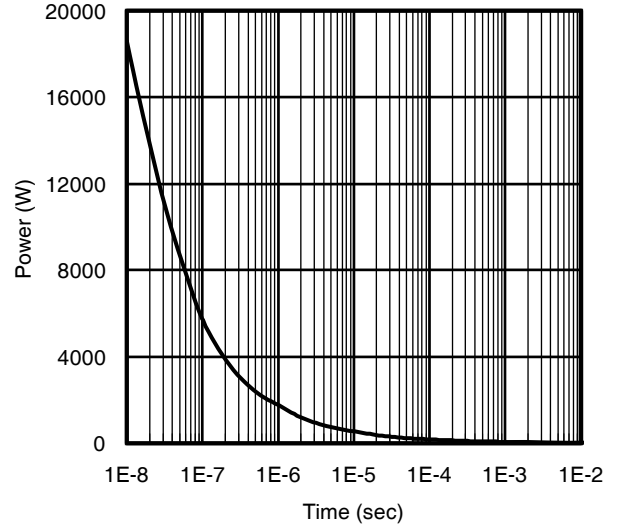


Fig 30. Typical Power vs. Time

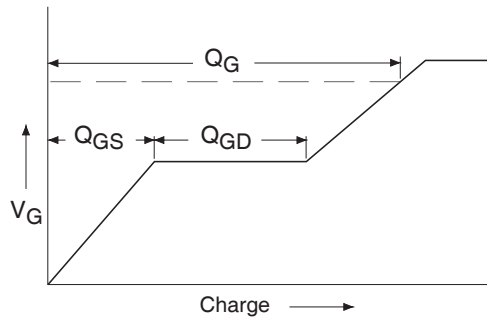


Fig 31a. Basic Gate Charge Waveform

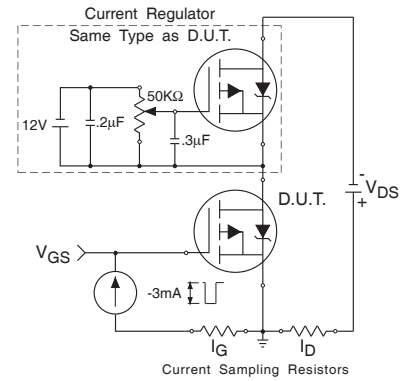
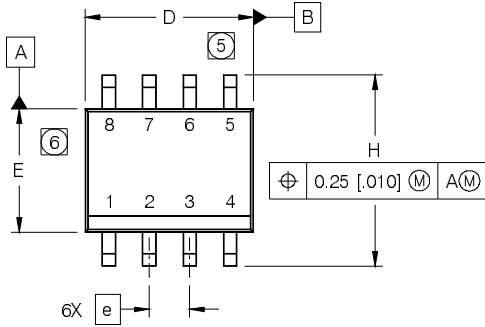
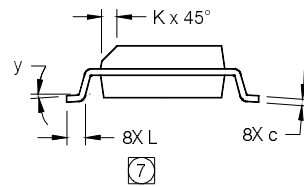
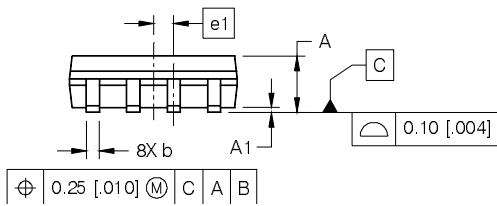


Fig 31b. Gate Charge Test Circuit

### SO-8 Package Details

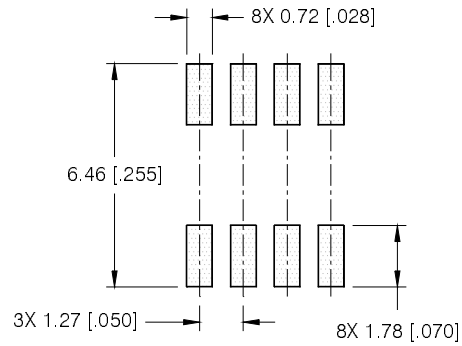


DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.0532	.0688	1.35	1.75
A1	.0040	.0098	0.10	0.25
b	.013	.020	0.33	0.51
c	.0075	.0098	0.19	0.25
D	.189	.1968	4.80	5.00
E	.1497	.1574	3.80	4.00
e	.050 BASIC		1.27 BASIC	
e1	.025 BASIC		0.635 BASIC	
H	.2284	.2440	5.80	6.20
K	.0099	.0196	0.25	0.50
L	.016	.050	0.40	1.27
y	0°	8°	0°	8°

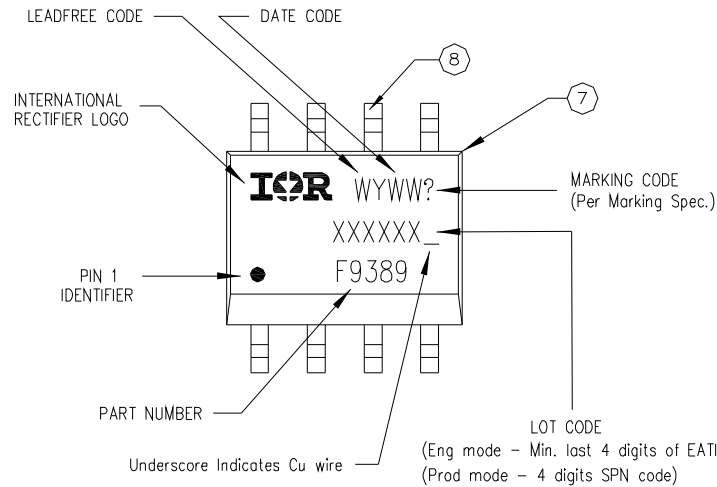


- NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
  2. CONTROLLING DIMENSION: MILLIMETER
  3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
  4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
  5. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 [0.006].
  6. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 [0.010].
  7. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

**FOOTPRINT**

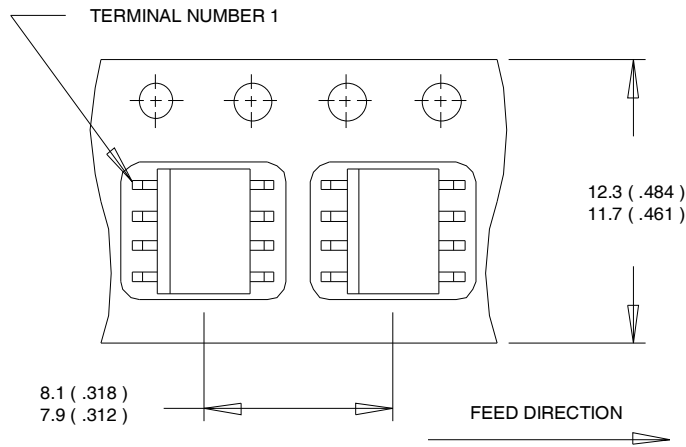


### SO-8 Part Marking

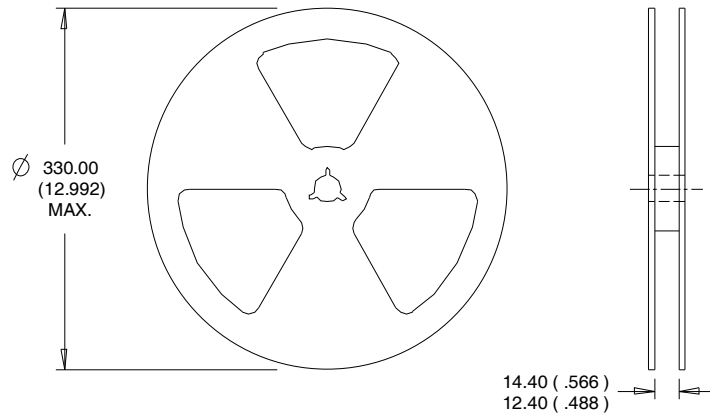


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

Tape and Reel



- NOTES:
1. CONTROLLING DIMENSION : MILLIMETER.
  2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS(INCHES).
  3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



- NOTES :
1. CONTROLLING DIMENSION : MILLIMETER.
  2. OUTLINE CONFORMS TO EIA-481 & EIA-541.

**Qualification information<sup>†</sup>**

Qualification level	Consumer (per JEDEC JES D47F <sup>††</sup> guidelines)	
Moisture Sensitivity Level	SO-8	MSL1 (per JEDEC J-S TD-020D <sup>††</sup> )
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.

## **IMPORTANT NOTICE**

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffheitsgarantie").

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