

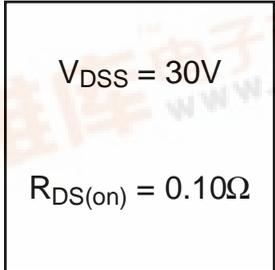
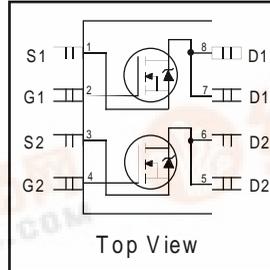
# International Rectifier

PRELIMINARY

# IRF9956

HEXFET® Power MOSFET

- Generation V Technology
- Ultra Low On-Resistance
- Dual N-Channel MOSFET
- Surface Mount
- Very Low Gate Charge and Switching Losses
- Fully Avalanche Rated



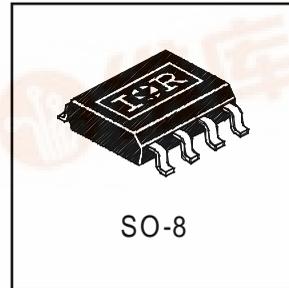
## Description

Fifth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The SO-8 has been modified through a customized leadframe for enhanced thermal characteristics and multiple-die capability making it ideal in a variety of power applications. With these improvements, multiple devices can be used in an application with dramatically reduced board space. The package is designed for vapor phase, infra red, or wave soldering techniques.

Recommended upgrade: IRF7303 or IRF7313

Lower profile/smaller equivalent: IRF7503



## Absolute Maximum Ratings ( $T_A = 25^\circ C$ Unless Otherwise Noted)

	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current <sup>⑤</sup>	$I_D$	$T_A = 25^\circ C$	3.5
		$T_A = 70^\circ C$	2.8
Pulsed Drain Current	$I_{DM}$	16	A
Continuous Source Current (Diode Conduction)	$I_S$	1.7	
Maximum Power Dissipation <sup>⑤</sup>	$P_D$	$T_A = 25^\circ C$	2.0
		$T_A = 70^\circ C$	1.3
Single Pulse Avalanche Energy <sup>②</sup>	$E_{AS}$	44	mJ
Avalanche Current	$I_{AR}$	2.0	A
Repetitive Avalanche Energy	$E_{AR}$	0.20	mJ
Peak Diode Recovery $dv/dt$ <sup>③</sup>	$dv/dt$	5.0	V/ ns
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to + 150	$^\circ C$

## Thermal Resistance Ratings

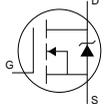
Parameter	Symbol	Limit	Units
Maximum Junction-to-Ambient <sup>⑤</sup>	$R_{\theta JA}$	62.5	$^\circ C/W$



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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.015	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	0.06	0.10	$\Omega$	$V_{GS} = 10V, I_D = 2.2A$ ④
		—	0.09	0.20		$V_{GS} = 4.5V, I_D = 1.0A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	—	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	—	12	—	S	$V_{DS} = 15V, I_D = 3.5A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	2.0	$\mu A$	$V_{DS} = 24V, V_{GS} = 0V$
		—	—	25		$V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 24V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -24V$
$Q_g$	Total Gate Charge	—	6.9	14	nC	$I_D = 1.8A$
$Q_{gs}$	Gate-to-Source Charge	—	1.0	2.0		$V_{DS} = 10V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	1.8	3.5		$V_{GS} = 10V$ , See Fig. 10 ④
$t_{d(on)}$	Turn-On Delay Time	—	6.2	12	ns	$V_{DD} = 10V$
$t_r$	Rise Time	—	8.8	18		$I_D = 1.0A$
$t_{d(off)}$	Turn-Off Delay Time	—	13	26		$R_G = 6.0\Omega$
$t_f$	Fall Time	—	3.0	6.0		$R_D = 10\Omega$ ④
$C_{iss}$	Input Capacitance	—	190	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	120	—		$V_{DS} = 15V$
$C_{rss}$	Reverse Transfer Capacitance	—	61	—		$f = 1.0\text{MHz}$ , See Fig. 9

## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	1.7	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	16		
$V_{SD}$	Diode Forward Voltage	—	0.82	1.2	V	$T_J = 25^\circ\text{C}, I_S = 1.25A, V_{GS} = 0V$ ③
$t_{rr}$	Reverse Recovery Time	—	27	53	ns	$T_J = 25^\circ\text{C}, I_F = 1.25A$
$Q_{rr}$	Reverse Recovery Charge	—	28	57	nC	$di/dt = 100A/\mu s$ ③

### Notes:

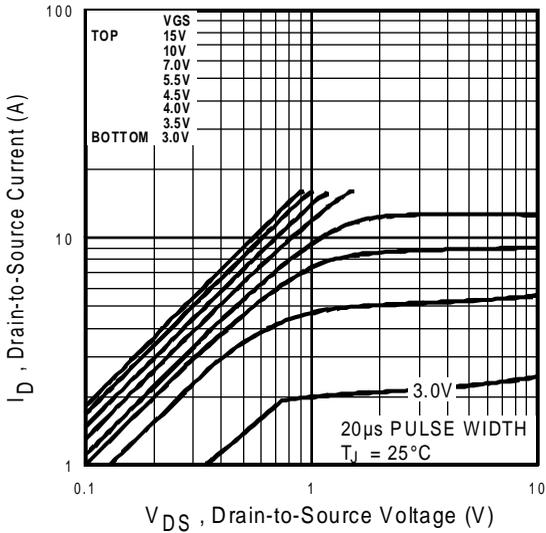
① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )

② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 22\text{mH}$   
 $R_G = 25\Omega, I_{AS} = 2.0A$ .

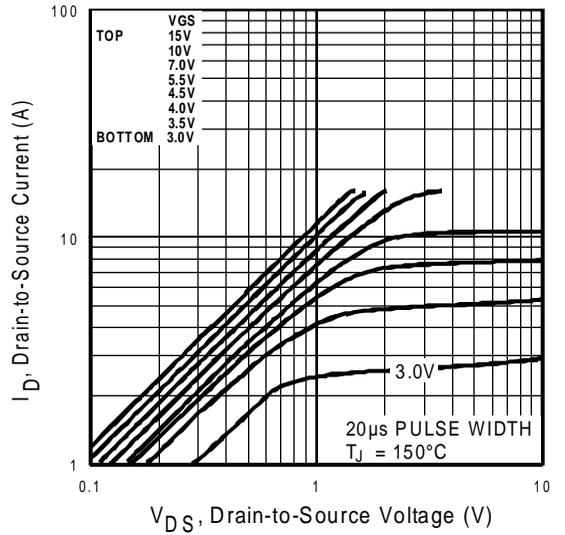
③  $I_{SD} \leq 2.0A, di/dt \leq 100A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 150^\circ\text{C}$

④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .

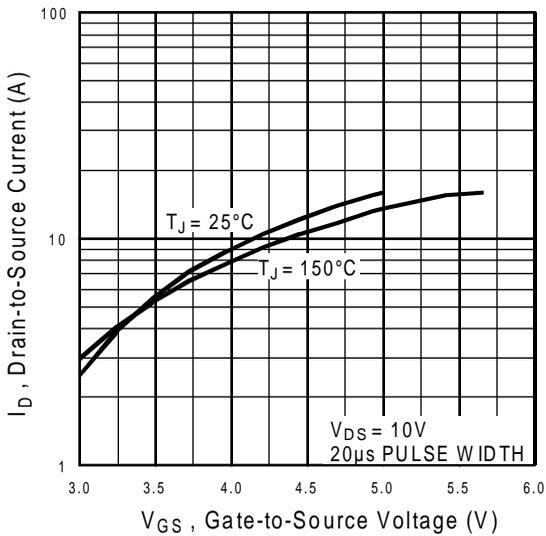
⑤ Surface mounted on FR-4 board,  $t \leq 10\text{sec}$ .



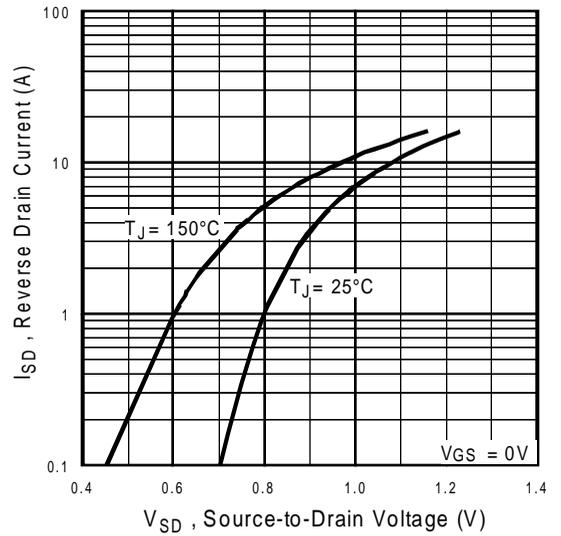
**Fig 1.** Typical Output Characteristics



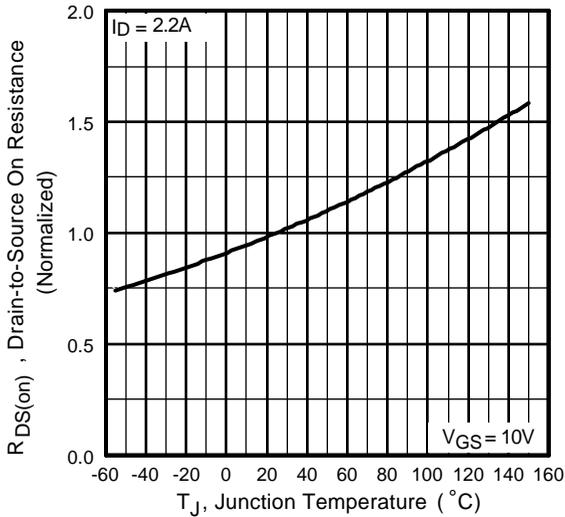
**Fig 2.** Typical Output Characteristics



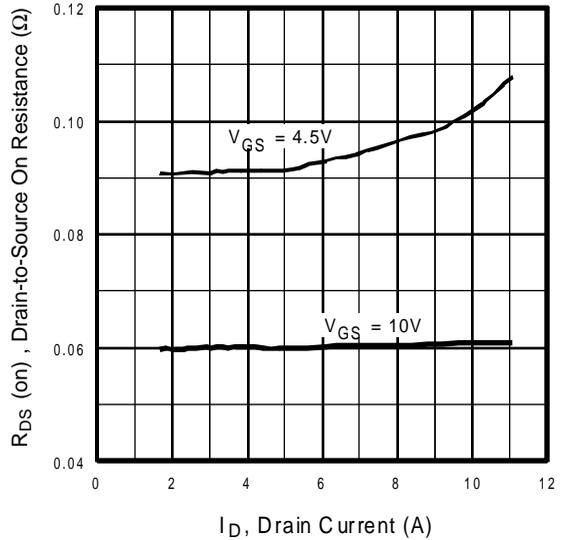
**Fig 3.** Typical Transfer Characteristics



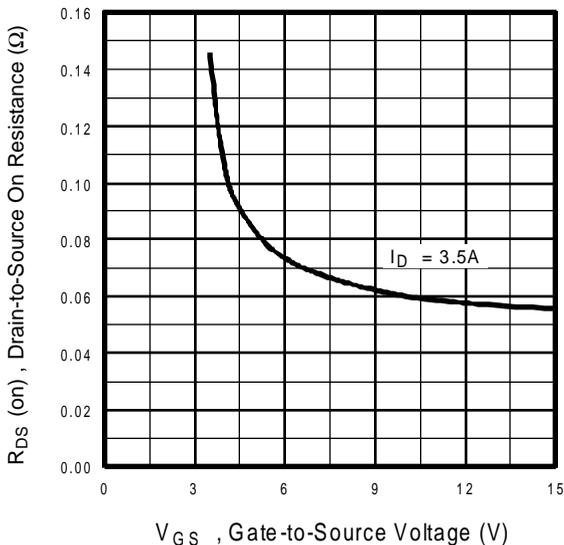
**Fig 4.** Typical Source-Drain Diode Forward Voltage



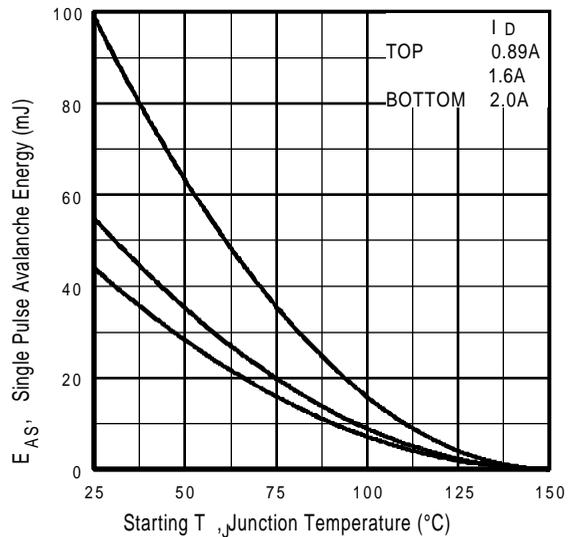
**Fig 4.** Normalized On-Resistance Vs. Temperature



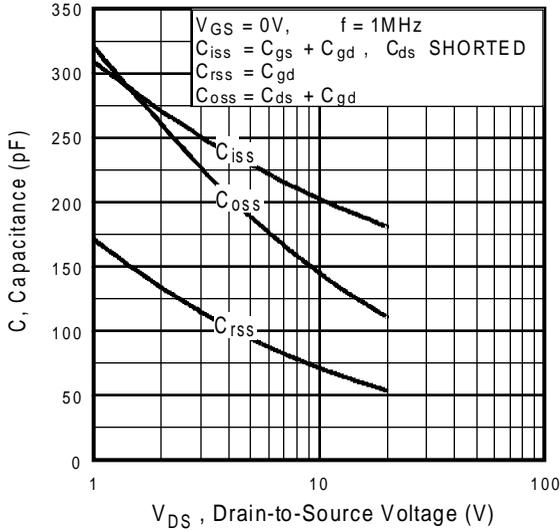
**Fig 6.** Typical On-Resistance Vs. Drain Current



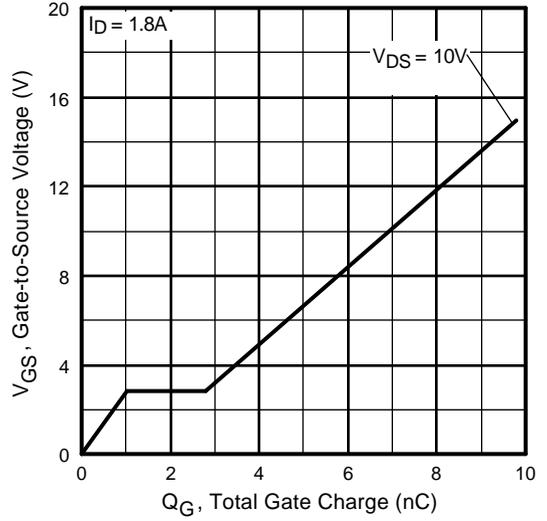
**Fig 7.** Typical On-Resistance Vs. Gate Voltage



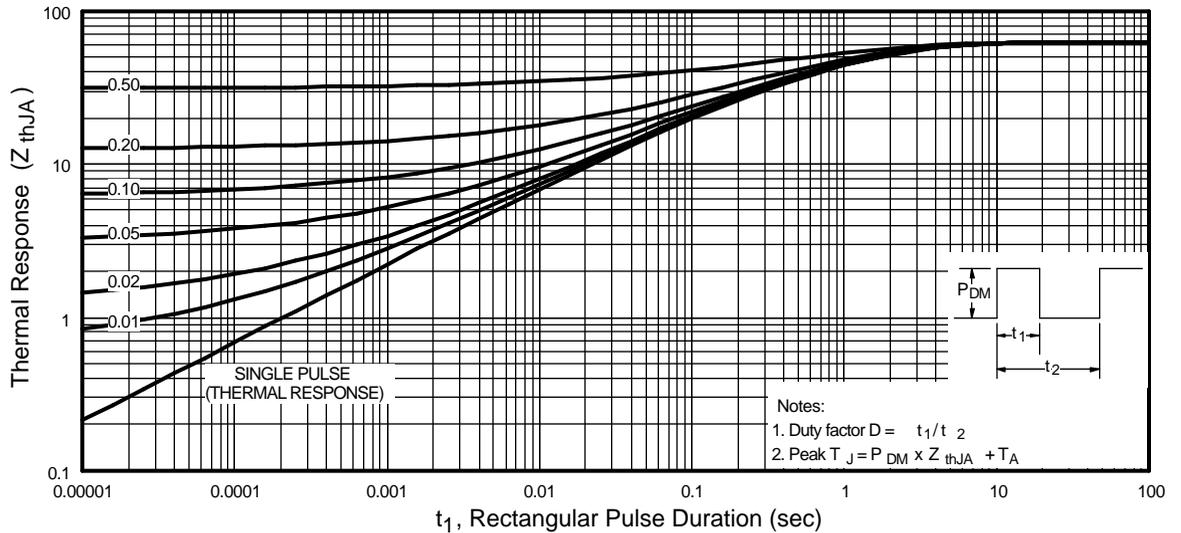
**Fig 8.** Maximum Avalanche Energy Vs. Drain Current



**Fig 9.** Typical Capacitance Vs. Drain-to-Source Voltage



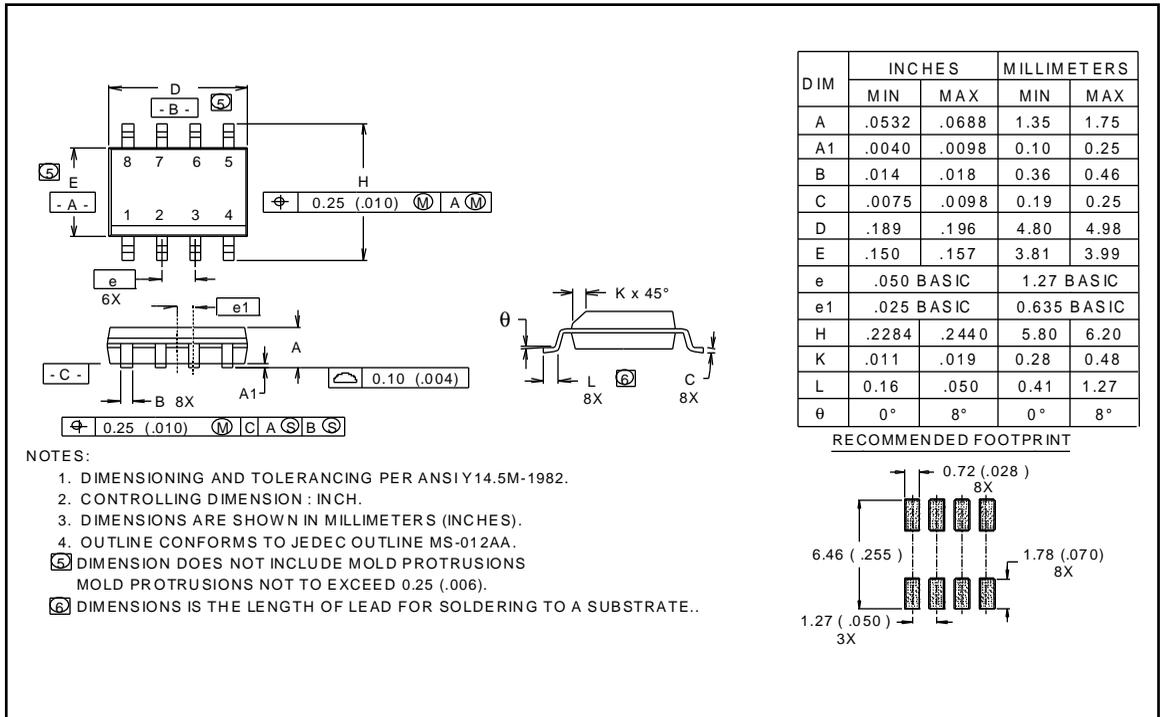
**Fig 10.** Typical Gate Charge Vs. Gate-to-Source Voltage



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

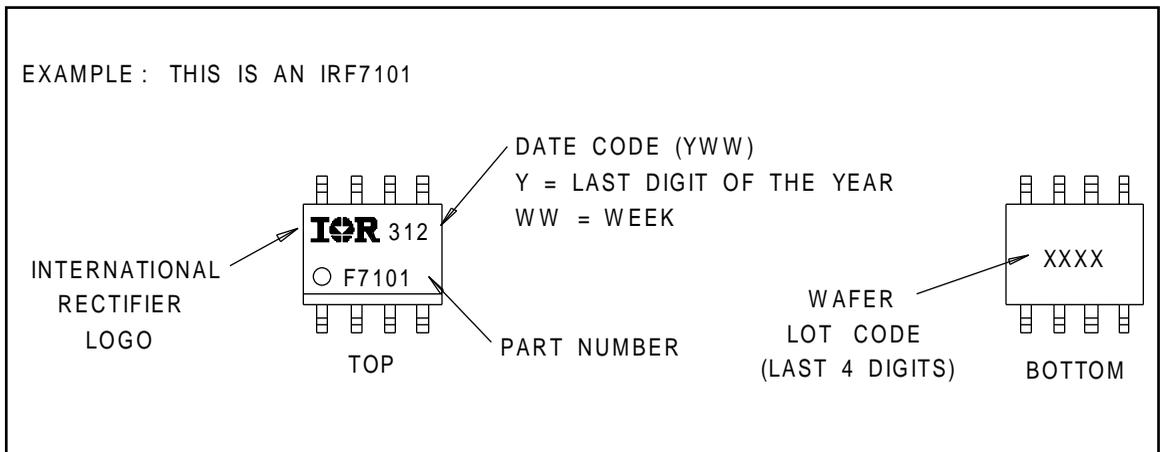
## Package Outline

### SO8 Outline



## Part Marking Information

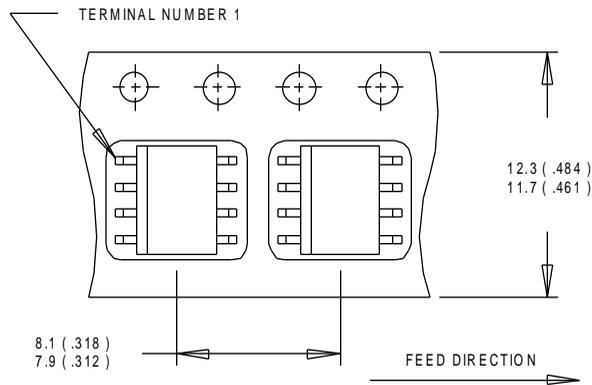
### SO8



**Tape & Reel Information**

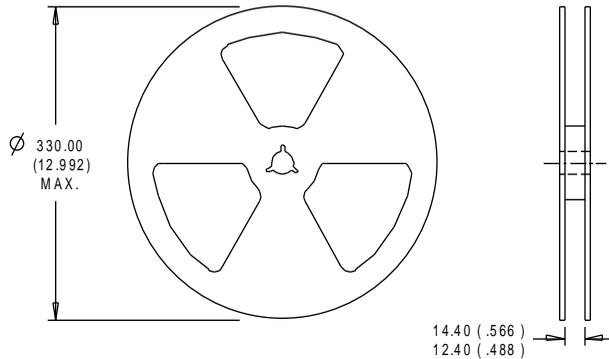
**S08**

Dimensions are shown in millimeters (inches)



**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.
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