

## P-Channel 1.8-V (G-S) MOSFET

PRODUCT SUMMARY		
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)
- 12	0.048 at V <sub>GS</sub> = - 4.5 V	- 3.6
	0.062 at V <sub>GS</sub> = - 2.5 V	- 3.2
	0.090 at V <sub>GS</sub> = - 1.8 V	- 2.7

### FEATURES

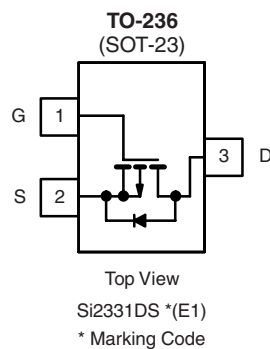
- Halogen-free Option Available
- TrenchFET<sup>®</sup> Power MOSFETS



**RoHS**  
COMPLIANT

### APPLICATIONS

- Load Switch
- PA Switch



**Ordering Information:** Si2331DS-T1-E3 (Lead (Pb)-free)  
Si2331DS-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted				
Parameter	Symbol	5 s	Steady State	Unit
Drain-Source Voltage	V <sub>DS</sub>	- 12		V
Gate-Source Voltage	V <sub>GS</sub>	± 8		
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	I <sub>D</sub>	T <sub>A</sub> = 25 °C	- 3.6	- 3.2
		T <sub>A</sub> = 70 °C	- 2.9	- 2.6
Pulsed Drain Current <sup>a</sup>	I <sub>DM</sub>	- 12		A
Continuous Source Current (Diode Conduction) <sup>a</sup>	I <sub>S</sub>	- 0.74	- 0.59	
Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>A</sub> = 25 °C	0.89	0.71
		T <sub>A</sub> = 70 °C	0.57	0.45
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150		°C

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a</sup>	t ≤ 5 s	R <sub>thJA</sub>	115	140	°C/W
	Steady State		140	175	
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	60	75	

Notes:

a. Surface Mounted on FR4 board.

b. t ≤ 5 s.

For SPICE model information via the Worldwide Web: <http://www.vishay.com/www/product/spice.htm>.

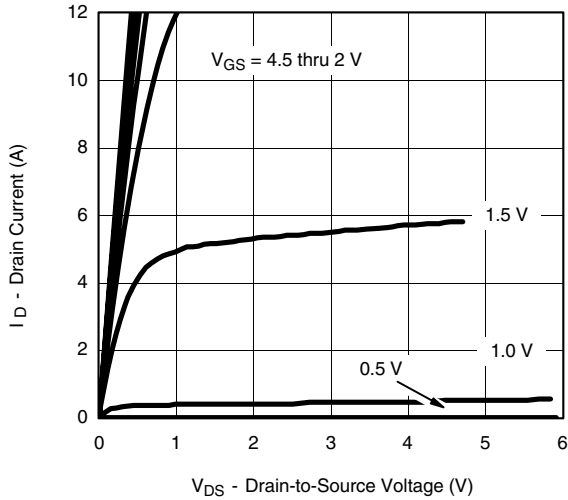
<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$ , $I_D = -10\text{ }\mu\text{A}$	-12			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	-0.45		-0.90	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 8\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -12\text{ V}$ , $V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
		$V_{DS} = -12\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 55\text{ }^\circ\text{C}$			-10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq -5\text{ V}$ , $V_{GS} = -4.5\text{ V}$	-6			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}$ , $I_D = -3.6\text{ A}$		0.038	0.048	$\Omega$
		$V_{GS} = -2.5\text{ V}$ , $I_D = -3.2\text{ A}$		0.049	0.062	
		$V_{GS} = -1.8\text{ V}$ , $I_D = -2.7\text{ A}$		0.070	0.090	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -5\text{ V}$ , $I_D = -3.6\text{ A}$		3		S
Diode Forward Voltage	$V_{SD}$	$I_S = -1.6\text{ A}$ , $V_{GS} = 0\text{ V}$			-1.2	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$Q_g$	$V_{DS} = -6\text{ V}$ , $V_{GS} = -4.5\text{ V}$ $I_D \cong -3.6\text{ A}$		9	14	nC
Gate-Source Charge	$Q_{gs}$			1.3		
Gate-Drain Charge	$Q_{gd}$			2.5		
Input Capacitance	$C_{iss}$	$V_{DS} = -6\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		780		pF
Output Capacitance	$C_{oss}$			290		
Reverse Transfer Capacitance	$C_{rss}$			210		
<b>Switching<sup>b</sup></b>						
Turn-On Time	$t_{d(on)}$	$V_{DD} = -6\text{ V}$ , $R_L = 6\text{ }\Omega$ $I_D \cong -1.0\text{ A}$ , $V_{GEN} = -4.5\text{ V}$ $R_G = 6\text{ }\Omega$		20	30	ns
	$t_r$			35	55	
Turn-Off Time	$t_{d(off)}$			65	100	
	$t_f$			50	75	

## Notes:

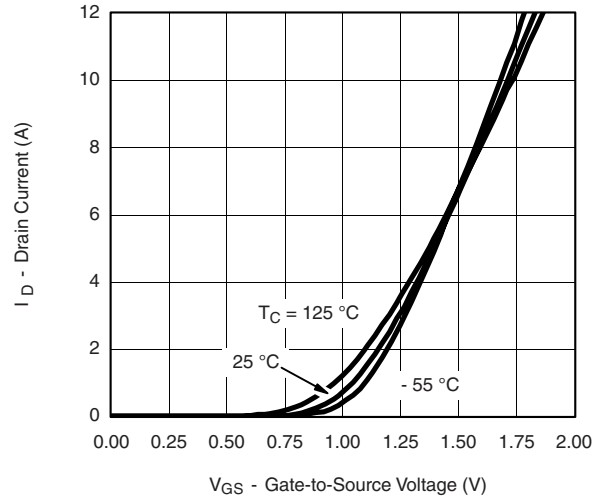
- a. For DESIGN AID ONLY, not subject to production testing.  
 b. Pulse test:  $PW \leq 300\text{ }\mu\text{s}$  duty cycle  $\leq 2\%$ .  
 c. Switching time is essentially independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

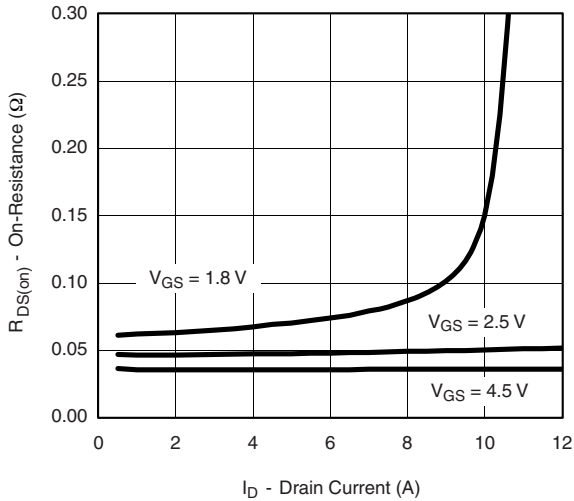
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



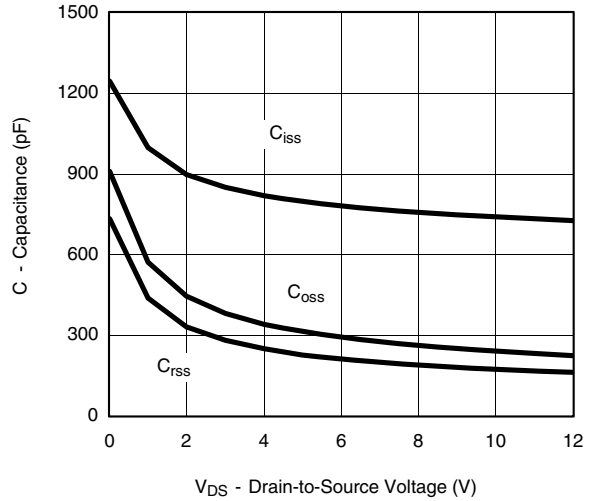
**Output Characteristics**



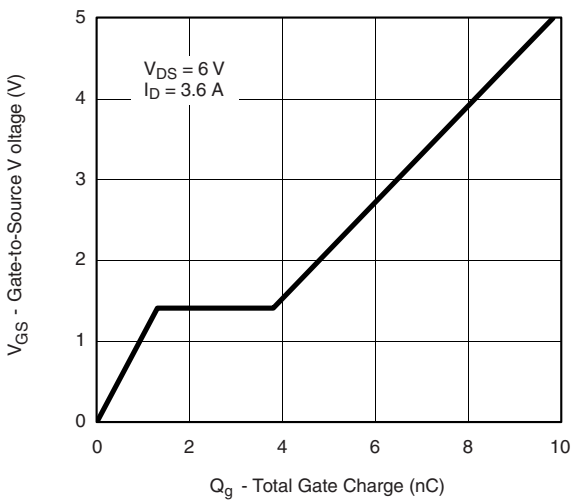
**Transfer Characteristics**



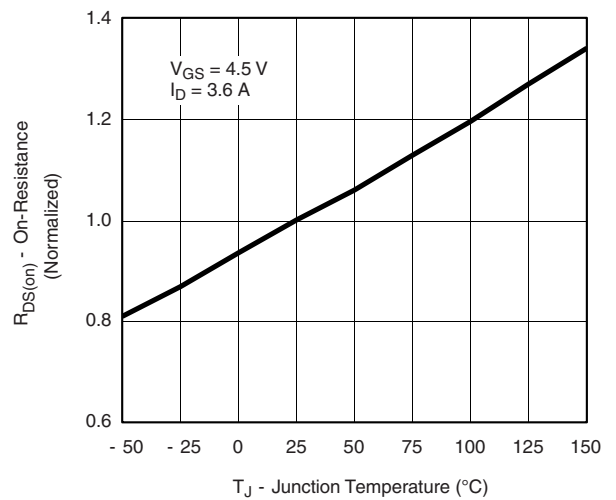
**On-Resistance vs. Drain Current**



**Capacitance**

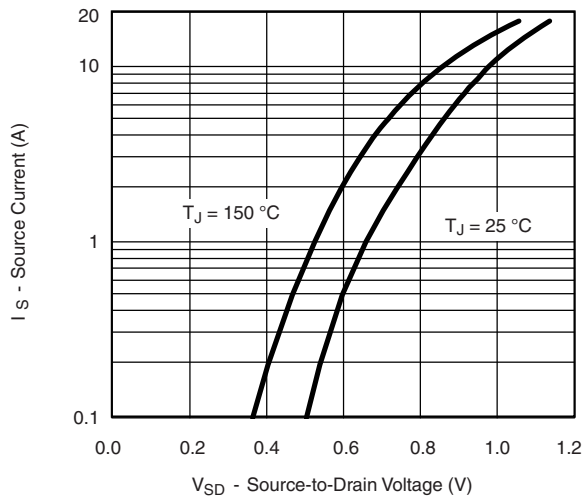


**Gate Charge**

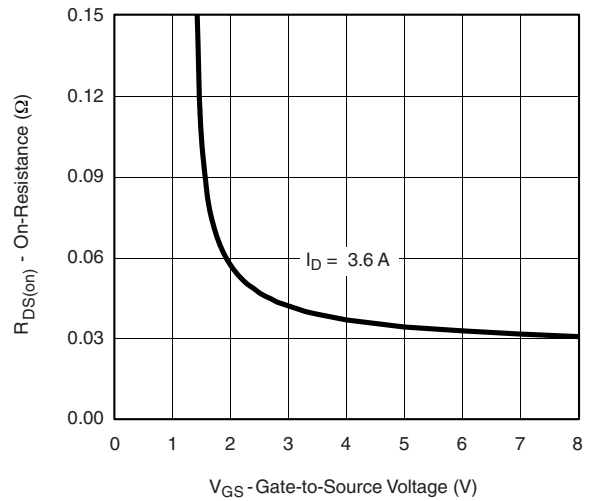


**On-Resistance vs. Junction Temperature**

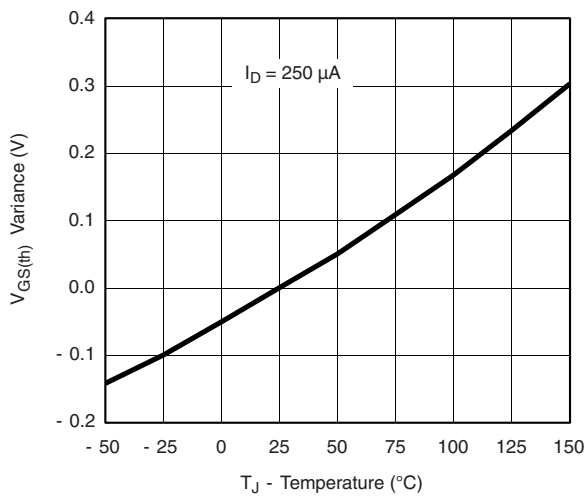
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



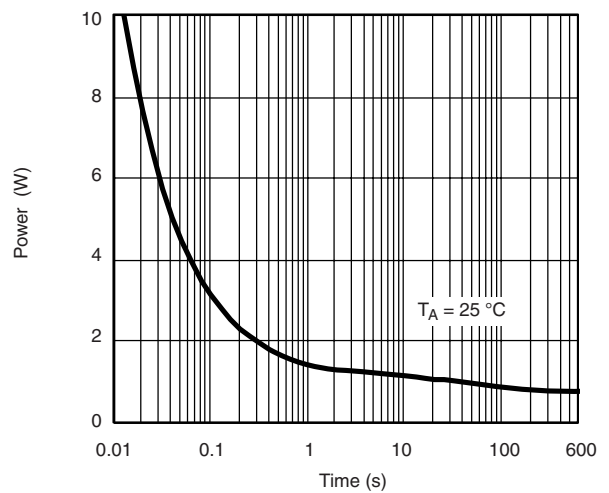
**Source-Drain Diode Forward Voltage**



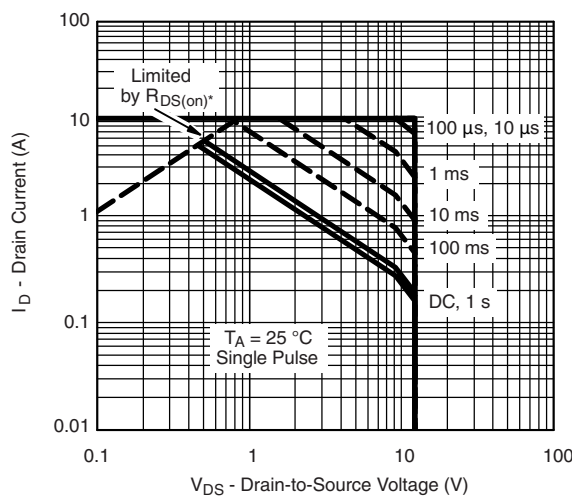
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



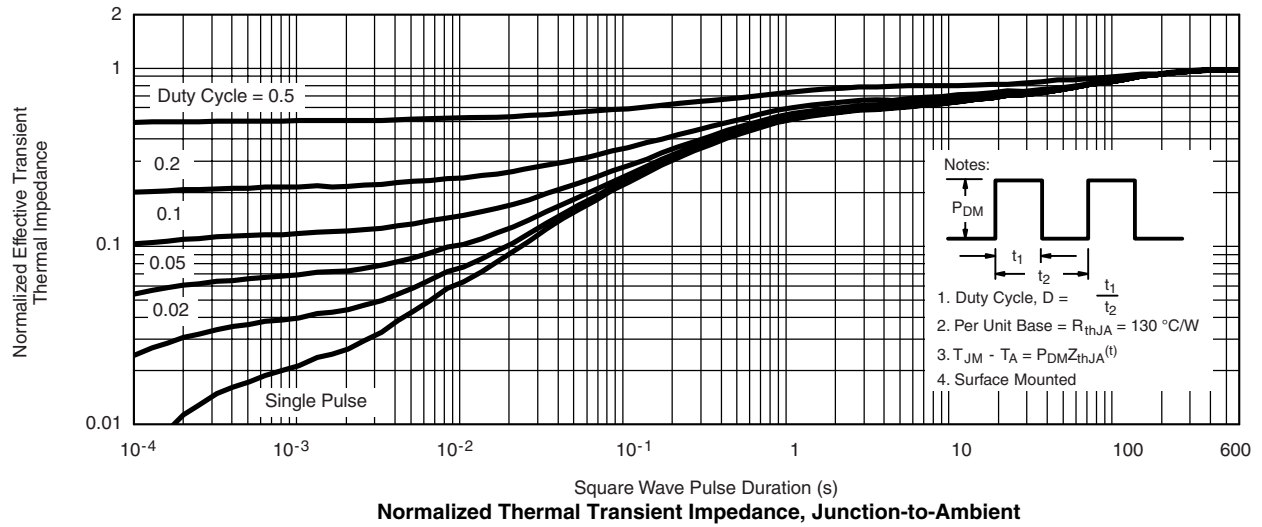
**Single Pulse Power**



\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

**Safe Operating Area**

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



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