

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

PRODUCT SUMMARY		
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (mA)
- 20	1.2 at $V_{GS} = - 4.5$ V	- 350
	1.6 at $V_{GS} = - 2.5$ V	- 300
	2.7 at $V_{GS} = - 1.8$ V	- 150

### FEATURES

- Halogen-free Option Available
- High-Side Switching
- Low On-Resistance: 1.2  $\Omega$
- Low Threshold: 0.8 V (Typ.)
- Fast Switching Speed: 14 ns
- 1.8 V Operation
- TrenchFET<sup>®</sup> Power MOSFETs
- 2000 V ESD Protection



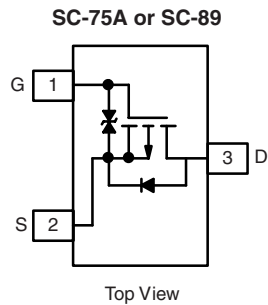
**RoHS**  
COMPLIANT

### APPLICATIONS

- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories
- Battery Operated Systems
- Power Supply Converter Circuits
- Load/Power Switching Cell Phones, Pagers

### BENEFITS

- Ease in Driving Switches
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Circuits
- Low Battery Voltage Operation



SC-75A (SOT-416):  
Si1013R - Marking Code D  
SC-89 (SOT-490):  
Si1013X - Marking Code B

#### Ordering Information:

Si1013R-T1-E3 (SC-75A, Lead (Pb)-free)  
Si1013R-T1-GE3 (SC-75A, Lead (Pb)-free and Halogen-free)  
Si1013X-T1-E3 (SC-89, Lead (Pb)-free)  
Si1013X-T1-GE3 (SC-89, Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted					
Parameter	Symbol	5 s	Steady State	Unit	
Drain-Source Voltage	$V_{DS}$	- 20		V	
Gate-Source Voltage	$V_{GS}$	$\pm 6$			
Continuous Drain Current ( $T_J = 150$ °C) <sup>b</sup>	$I_D$	$T_A = 25$ °C	- 400	- 350	mA
		$T_A = 85$ °C	- 300	- 275	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	- 1000			
Continuous Source Current (diode conduction) <sup>b</sup>	$I_S$	- 275	- 250		
Maximum Power Dissipation <sup>b</sup> for SC-75	$P_D$	$T_A = 25$ °C	175	150	mW
		$T_A = 85$ °C	90	80	
Maximum Power Dissipation <sup>b</sup> for SC-89	$P_D$	$T_A = 25$ °C	275	250	
		$T_A = 85$ °C	160	140	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150		°C	
Gate-Source ESD Rating (HBM, Method 3015)	ESD	2000		V	

Notes:

- a. Pulse width limited by maximum junction temperature.  
b. Surface Mounted on FR4 board.

<b>SPECIFICATIONS</b> $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	-0.45			V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 4.5\text{ V}$		$\pm 1$	$\pm 2$	$\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -16\text{ V}$ , $V_{GS} = 0\text{ V}$		-0.3	-100	nA
		$V_{DS} = -16\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 85\text{ }^\circ\text{C}$			-5	$\mu\text{A}$
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = -5\text{ V}$ , $V_{GS} = -4.5\text{ V}$	-700			mA
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}$ , $I_D = -350\text{ mA}$		0.8	1.2	$\Omega$
		$V_{GS} = -2.5\text{ V}$ , $I_D = -300\text{ mA}$		1.2	1.6	
		$V_{GS} = -1.8\text{ V}$ , $I_D = -150\text{ mA}$		1.8	2.7	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}$ , $I_D = -250\text{ mA}$		0.4		S
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = -150\text{ mA}$ , $V_{GS} = 0\text{ V}$		-0.8	-1.2	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$Q_g$	$V_{DS} = -10\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -250\text{ mA}$		1500		pC
Gate-Source Charge	$Q_{gs}$			150		
Gate-Drain Charge	$Q_{gd}$			450		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}$ , $R_L = 47\text{ }\Omega$ $I_D \cong -200\text{ mA}$ , $V_{GEN} = -4.5\text{ V}$ , $R_G = 10\text{ }\Omega$		5		ns
Rise Time	$t_r$			9		
Turn-Off Delay Time	$t_{d(off)}$			35		
Fall Time	$t_f$			11		

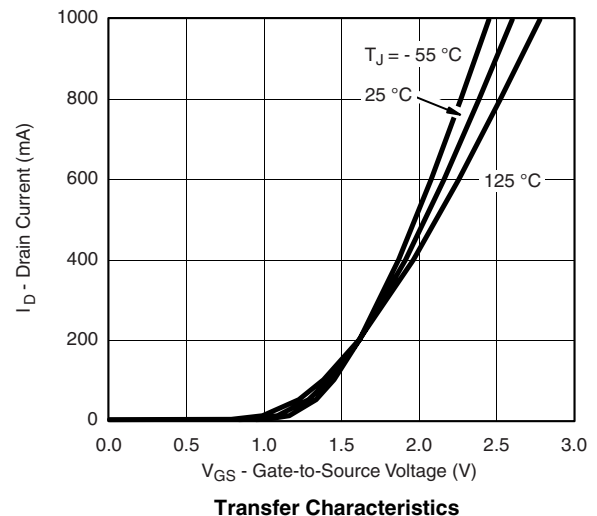
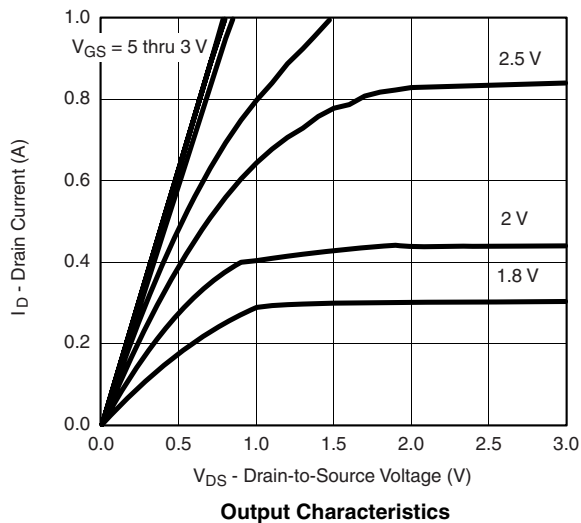
Notes:

- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.

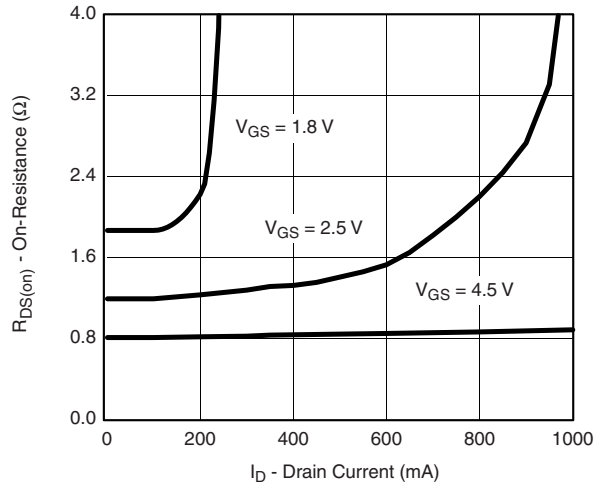
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

### TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted

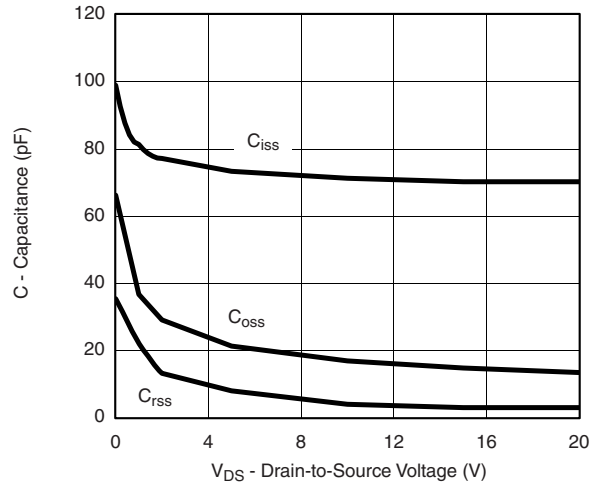
For the following graphs, P-Channel negative polarities for all voltage and current values are represented as positive values.



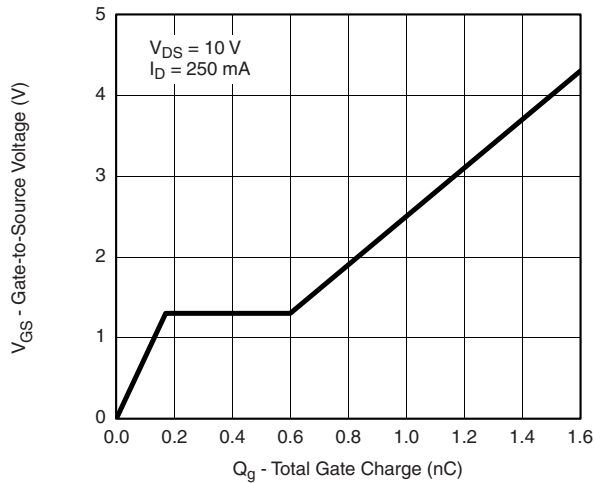
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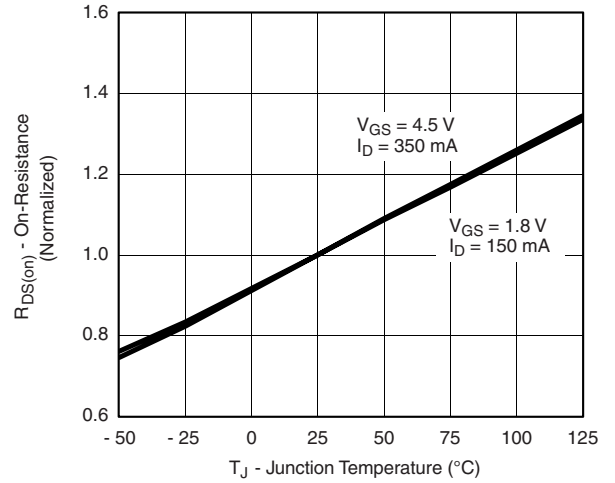
**On-Resistance vs. Drain Current**



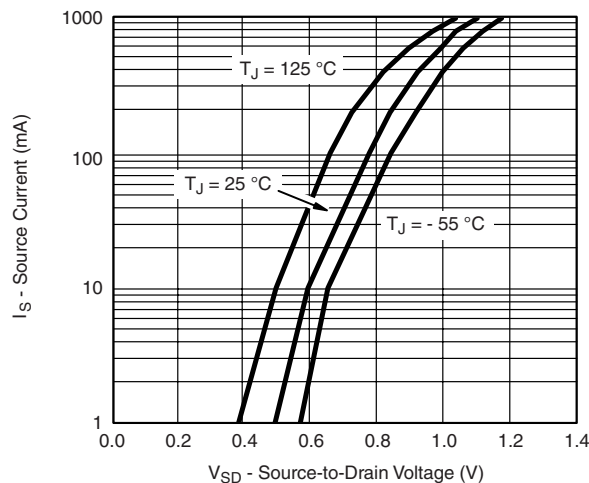
**Capacitance**



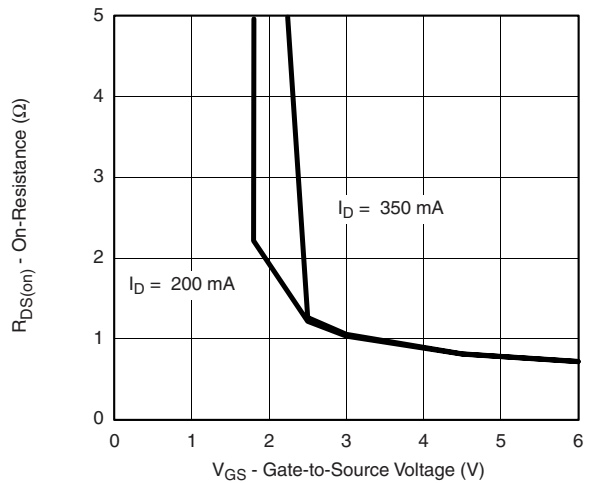
**Gate Charge**



**On-Resistance vs. Junction Temperature**

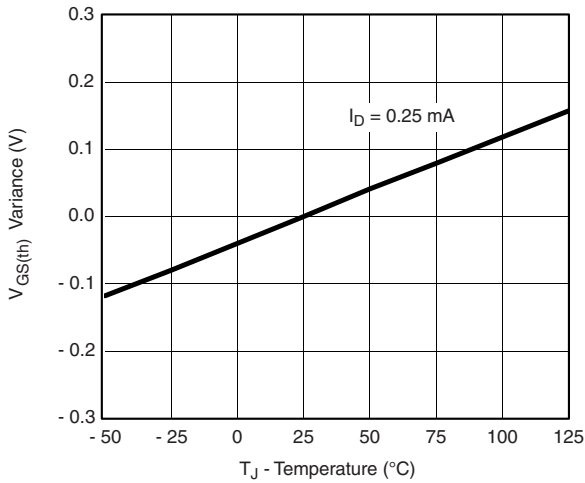


**Surge-Drain Diode Forward Voltage**

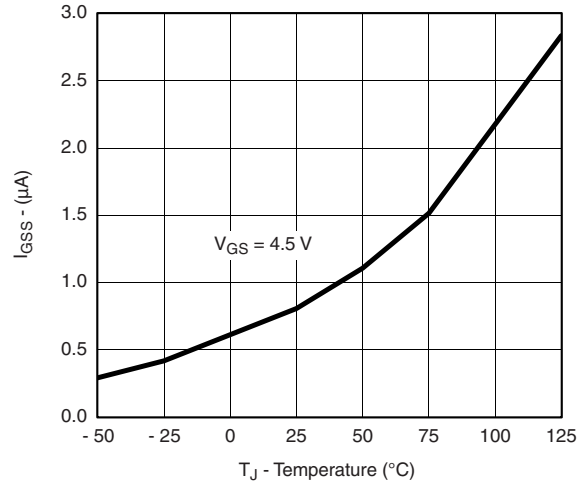


**On-Resistance vs. Gate-to-Source Voltage**

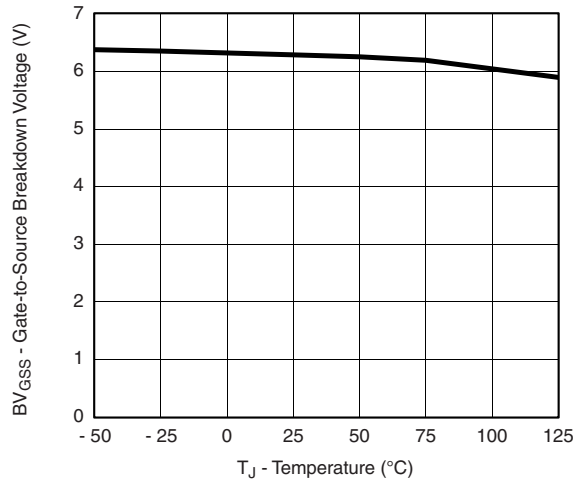
**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



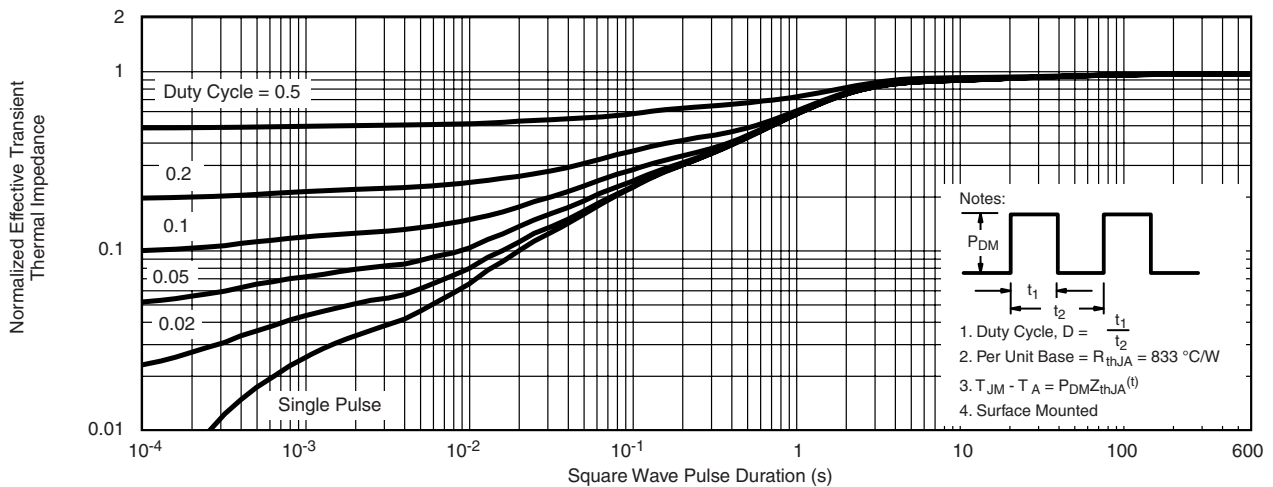
**Threshold Voltage Variance vs. Temperature**



**I<sub>GSS</sub> vs. Temperature**



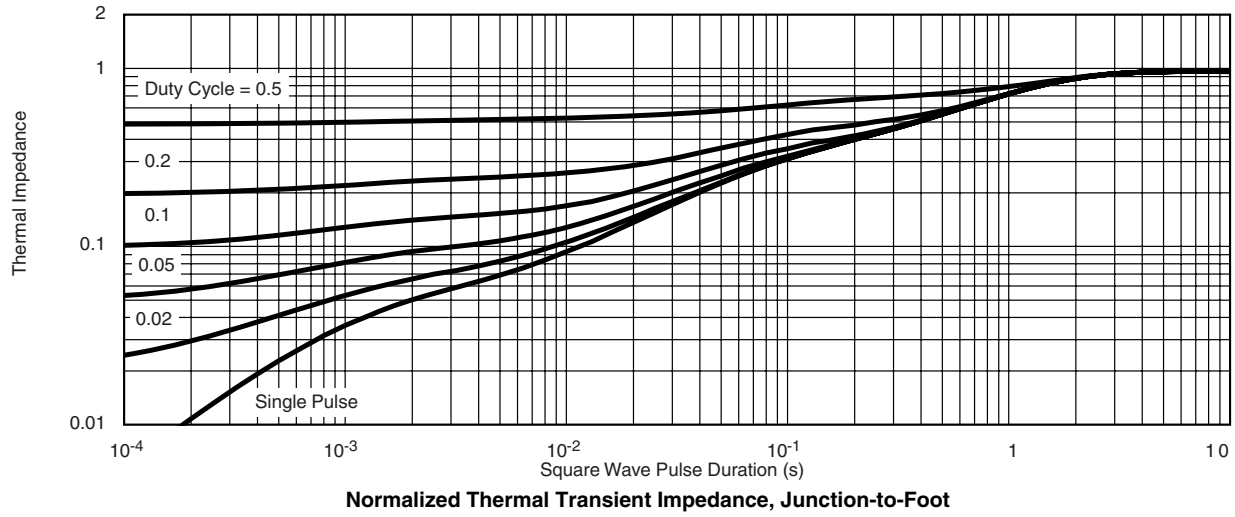
**BV<sub>GSS</sub> vs. Temperature**



**Normalized Thermal Transient Impedance, Junction-to-Ambient (SC-75A)**



**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



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