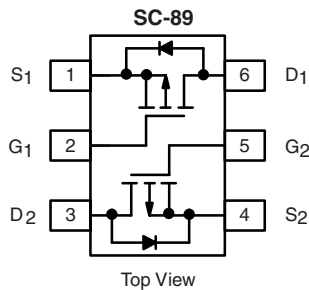


## P-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (mA)
- 20	8 at $V_{GS} = - 4.5$ V	- 150
	12 at $V_{GS} = - 2.5$ V	- 125
	15 at $V_{GS} = - 1.8$ V	- 100
	20 at $V_{GS} = - 1.5$ V	- 30



Marking Code: K

Ordering Information: Si1033X-T1-E3 (Lead (Pb)-free)  
 Si1033X-T1-GE3 (Lead (Pb)-free and Halogen-free)

### FEATURES

- Halogen-free Option Available
- TrenchFET<sup>®</sup> Power MOSFET: 1.5 V Rated
- High-Side Switching
- Low On-Resistance: 8  $\Omega$
- Low Threshold: 0.9 V (typ.)
- Fast Switching Speed: 45 ns (typ.)
- 1.5 V Operation
- Gate-Source ESD Protected: 2000 V


**RoHS**  
 COMPLIANT

### BENEFITS

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

### APPLICATIONS

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

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	$V_{GS}$	$\pm 5$		
Continuous Drain Current ( $T_J = 150$ °C) <sup>a</sup>	$I_D$	$T_A = 25$ °C	- 155	- 145
		$T_A = 85$ °C	- 110	- 105
Pulsed Drain Current <sup>b</sup>	$I_{DM}$	- 650		mA
Continuous Source Current (Diode Conduction) <sup>a</sup>	$I_S$	- 450	- 380	
Maximum Power Dissipation <sup>a</sup>	$P_D$	$T_A = 25$ °C	280	250
		$T_A = 85$ °C	145	130
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:

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



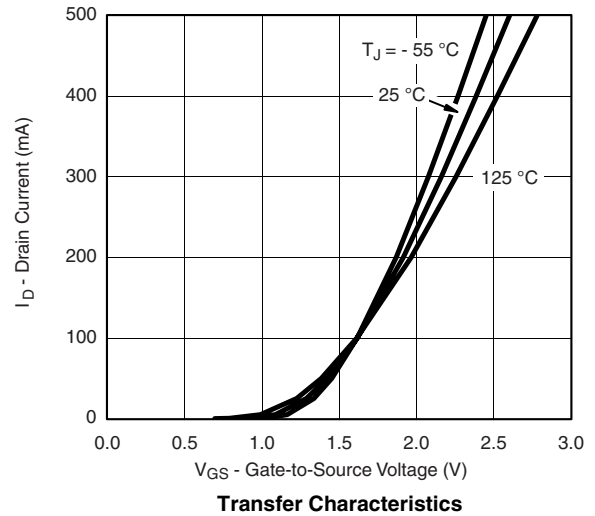
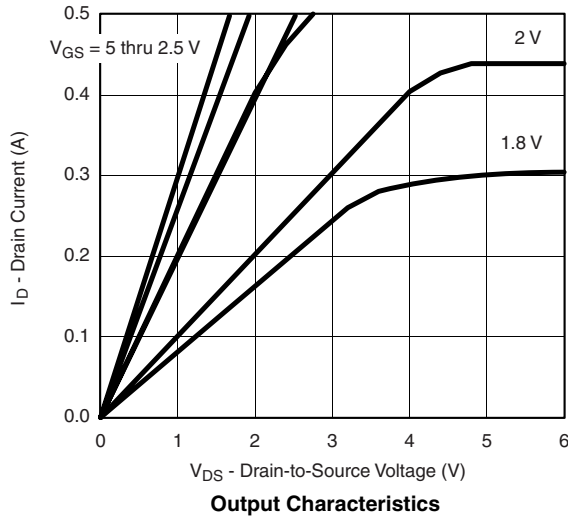
<b>SPECIFICATIONS</b> $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit
<b>Static</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-0.40		-1.20	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 2.8\text{ V}$		$\pm 0.5$	$\pm 1$	$\mu\text{A}$
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$		$\pm 1$	$\pm 2$	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$		-1	-500	nA
		$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^\circ\text{C}$			-10	$\mu\text{A}$
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = -5\text{ V}, V_{GS} = -4.5\text{ V}$	-200			mA
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -150\text{ mA}$			8	$\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -125\text{ mA}$			12	
		$V_{GS} = -1.8\text{ V}, I_D = -100\text{ mA}$			15	
		$V_{GS} = -1.5\text{ V}, I_D = -30\text{ mA}$			20	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}, I_D = -150\text{ mA}$		0.4		S
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = -150\text{ mA}, V_{GS} = 0\text{ V}$			-1.2	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$Q_g$	$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -150\text{ mA}$		1500		$\mu\text{C}$
Gate-Source Charge	$Q_{gs}$			150		
Gate-Drain Charge	$Q_{gd}$			450		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 65\text{ }\Omega$ $I_D \cong -150\text{ mA}, V_{GEN} = -4.5\text{ V}, R_G = 10\text{ }\Omega$			55	ns
Rise Time	$t_r$				30	
Turn-Off Delay Time	$t_{d(off)}$				60	
Fall Time	$t_f$				30	

Notes:

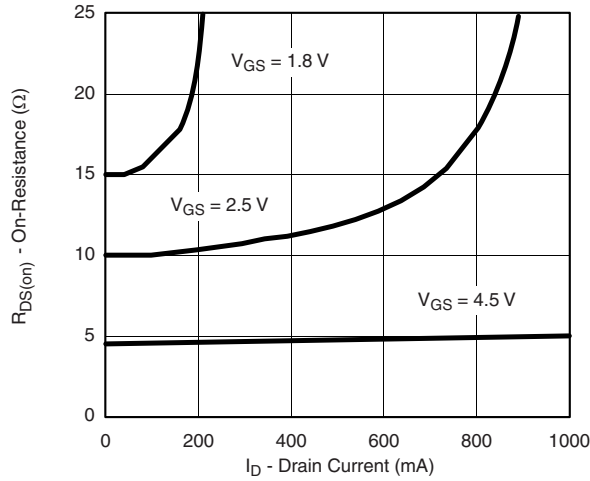
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- b. Guaranteed by design, not subject to production testing.

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.

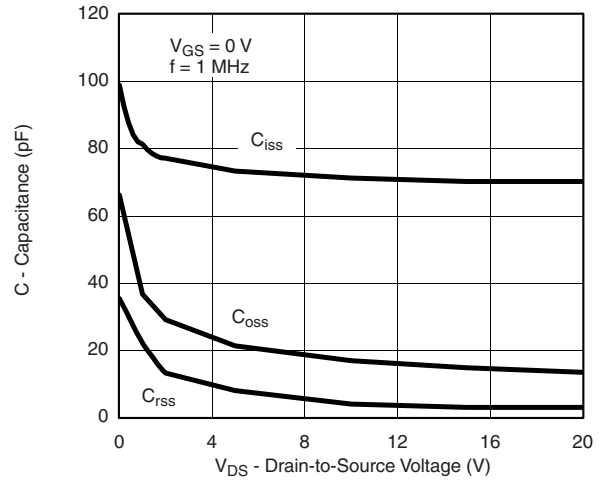
**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



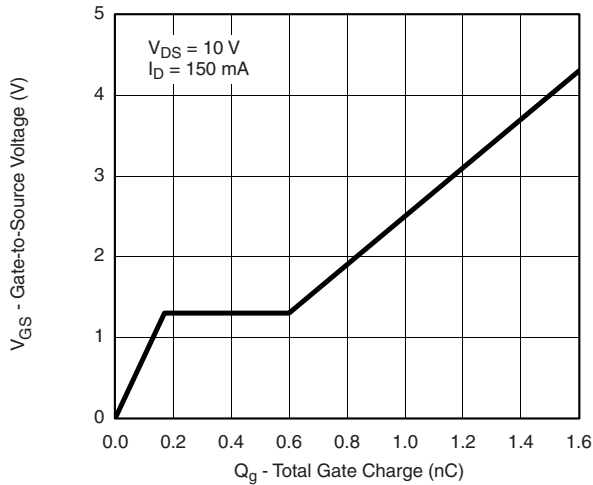
**TYPICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$ , unless otherwise noted



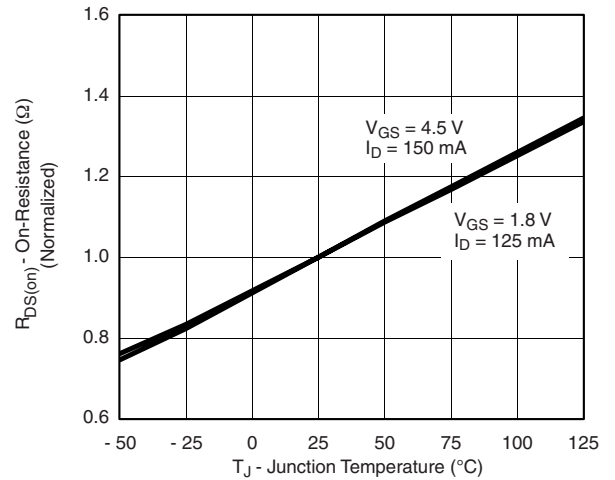
**On-Resistance vs. Drain Current**



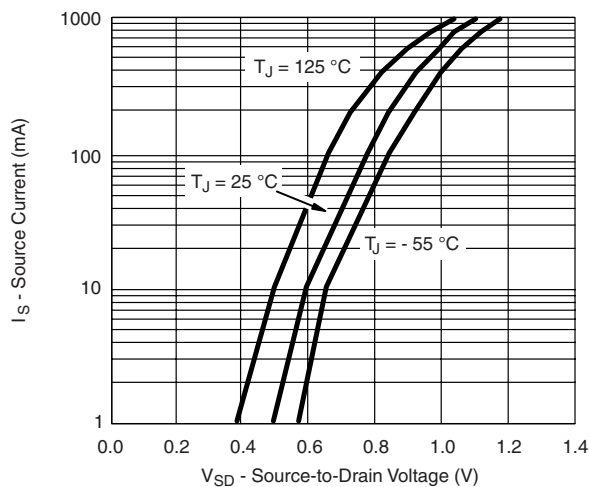
**Capacitance**



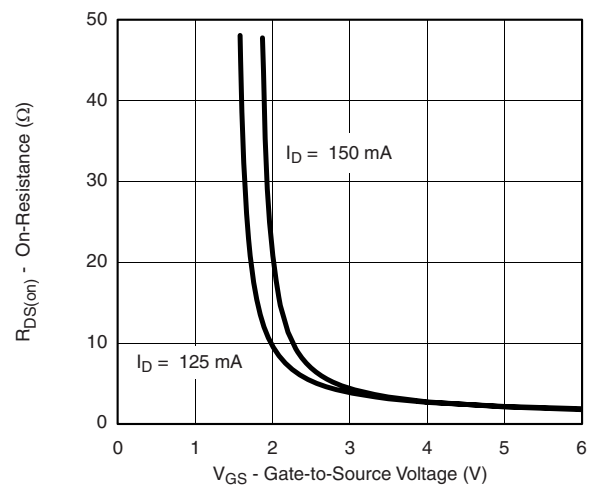
**Gate Charge**



**On-Resistance vs. Junction Temperature**

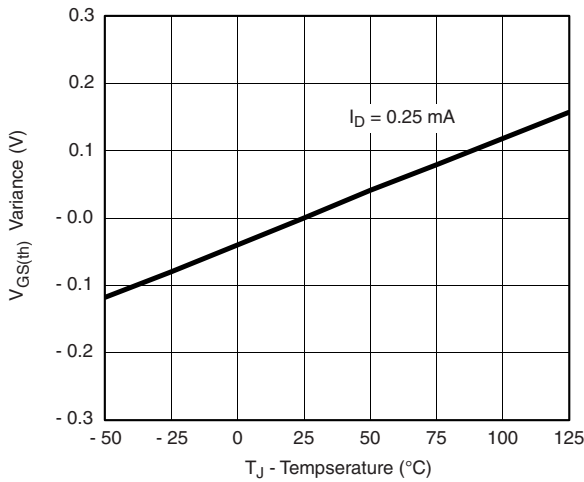


**Surge-Drain Diode Forward Voltage**

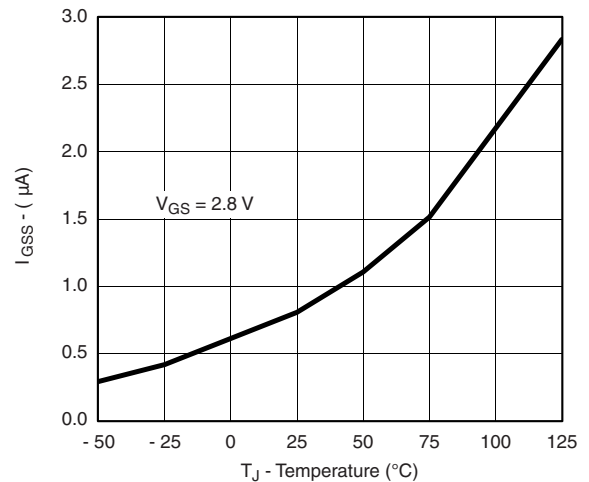


**On-Resistance vs. Gate-to-Source Voltage**

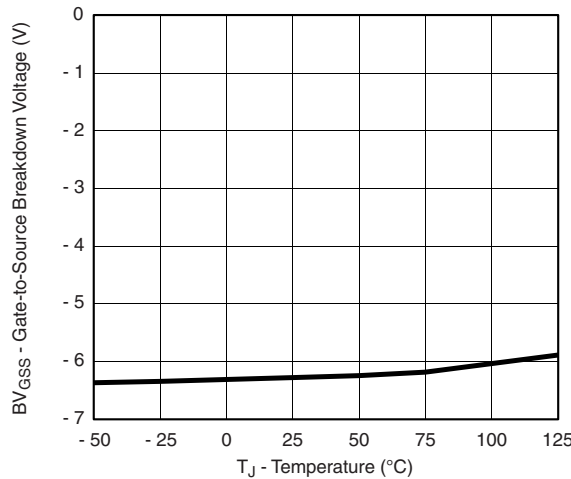
**TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



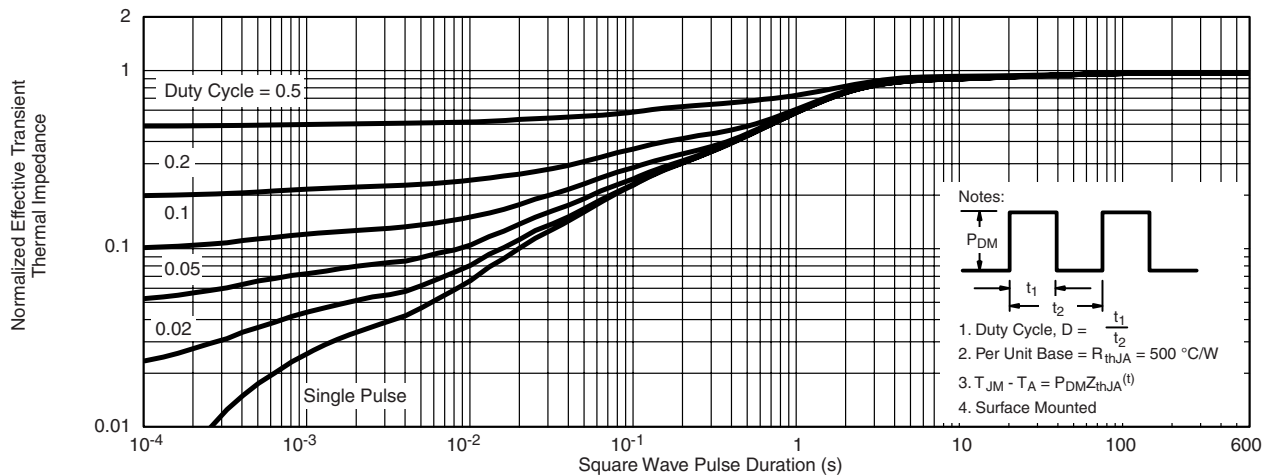
**Threshold Voltage Variance vs. Temperature**



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



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



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

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