

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

PRODUCT SUMMARY		
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (mA)
- 20	8 at V <sub>GS</sub> = - 4.5 V	- 150
	12 at V <sub>GS</sub> = - 2.5 V	- 125
	15 at V <sub>GS</sub> = - 1.8 V	- 100
	20 at V <sub>GS</sub> = - 1.5 V	- 30

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- High-Side Switching
- Low On-Resistance: 8 Ω
- Low Threshold: 0.9 V (typ.)
- Fast Switching Speed: 45 ns
- TrenchFET® Power MOSFETs: 1.5 V Rated
- ESD Protected: 2000 V
- Compliant to RoHS Directive 2002/95/EC



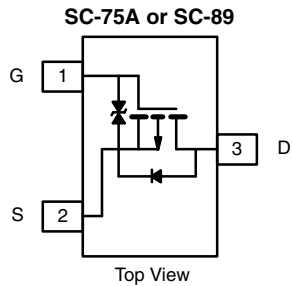
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### 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): Si1031R  
SC-89 (SOT-490): Si1031X

Marking Code: H

#### Ordering Information:

Si1031R-T1-GE3 (SC-75A, Lead (Pb)-free and Halogen-free)  
Si1031X-T1-GE3 (SC-89, Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)							
Parameter	Symbol	Si1031R		Si1031X		Unit	
		5 s	Steady State	5 s	Steady State		
Drain-Source Voltage	V <sub>DS</sub>	- 20				V	
Gate-Source Voltage	V <sub>GS</sub>	± 6					
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	I <sub>D</sub>	T <sub>A</sub> = 25 °C	- 150	- 140	- 165	- 155	mA
		T <sub>A</sub> = 85 °C	- 110	- 100	- 150	- 125	
Pulsed Drain Current <sup>a</sup>	I <sub>DM</sub>	- 500		- 600		mW	
Continuous Source Current (Diode Conduction) <sup>a</sup>	I <sub>S</sub>	- 250	- 200	- 340	- 240		
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>A</sub> = 25 °C	280	250	340	300	mW
		T <sub>A</sub> = 85 °C	145	130	170	150	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150				°C	
Gate-Source ESD Rating (HBM, Method 3015)	ESD	2000				V	

Notes:

a. Surface mounted on FR4 board.

SPECIFICATIONS ( $T_A = 25\text{ }^\circ\text{C}$ , 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		-1.2	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 2.8\text{ V}$		$\pm 0.5$	$\pm 1.0$	$\mu\text{A}$
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$		$\pm 1.0$	$\pm 2.0$	
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	

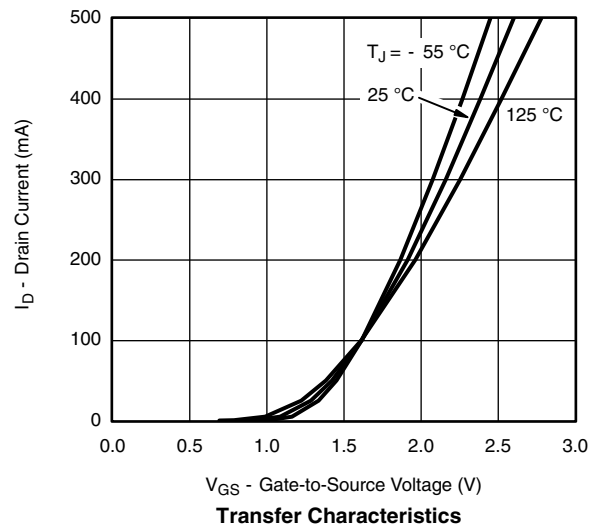
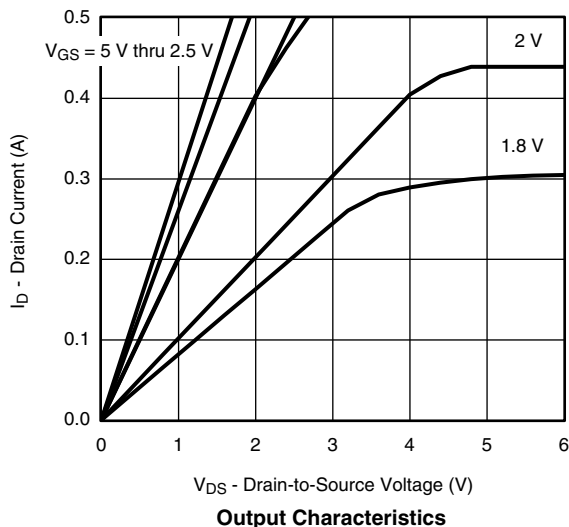
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

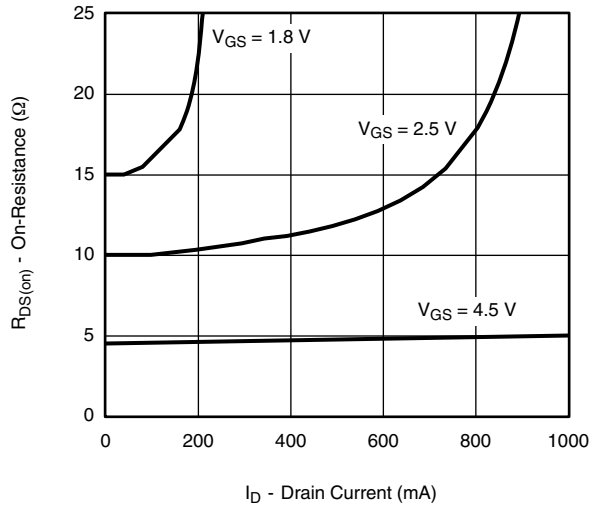
b. Guaranteed by design, not subject to production testing.

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.

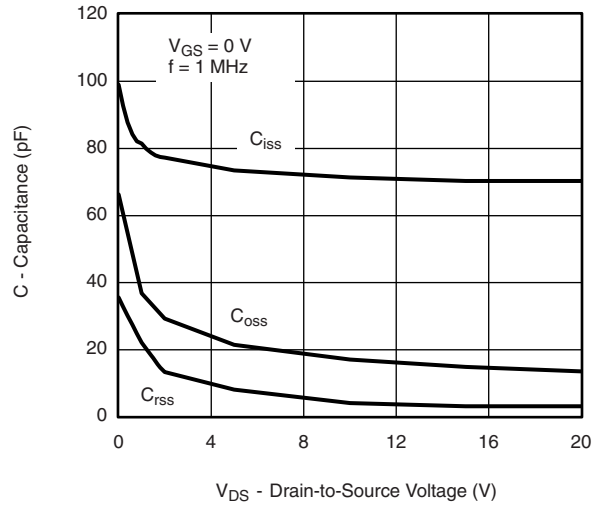
### TYPICAL CHARACTERISTICS ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



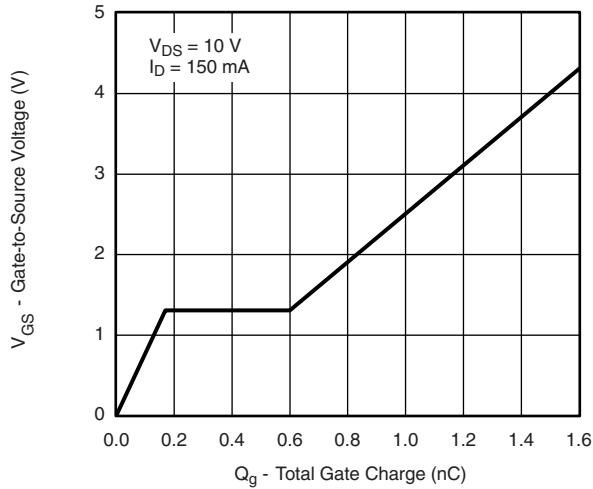
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



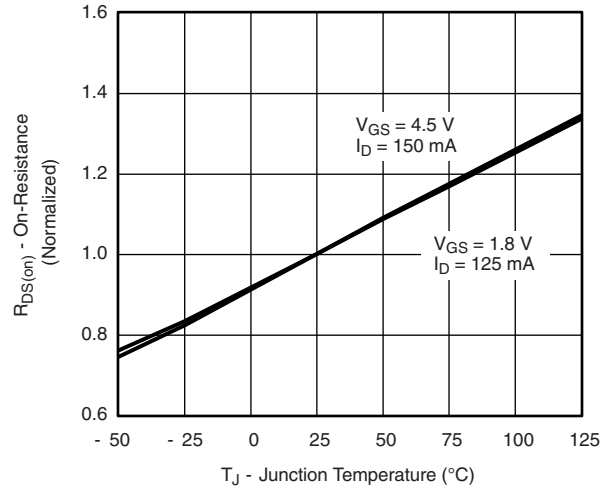
**On-Resistance vs. Drain Current**



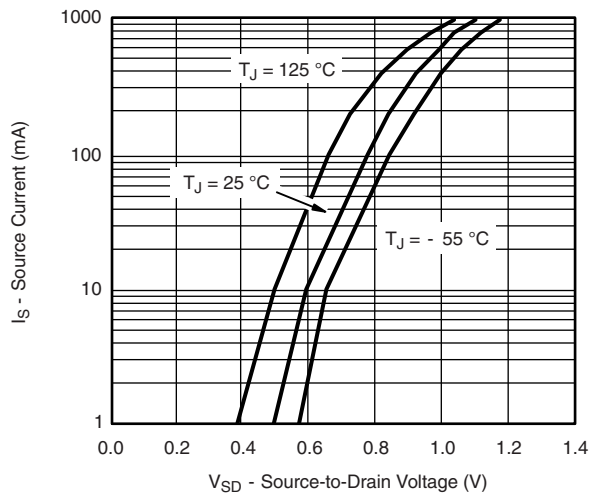
**Capacitance**



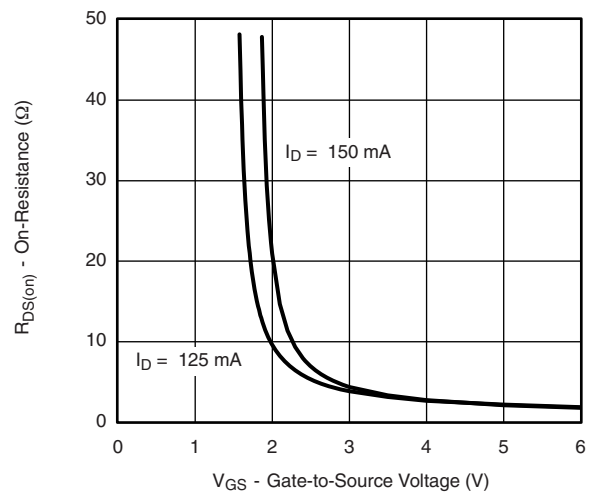
**Gate Charge**



**On-Resistance vs. Junction Temperature**

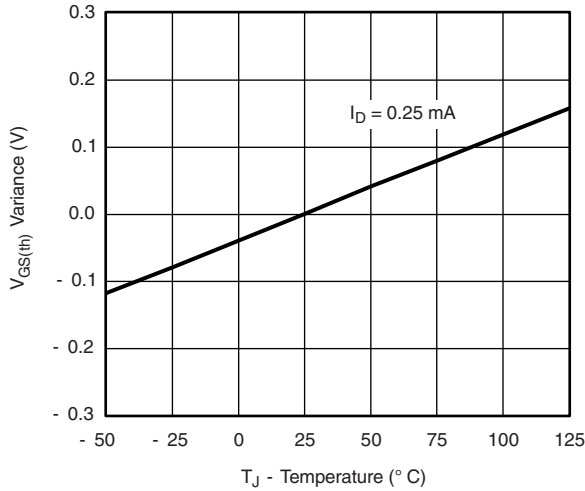


**Surge-Drain Diode Forward Voltage**

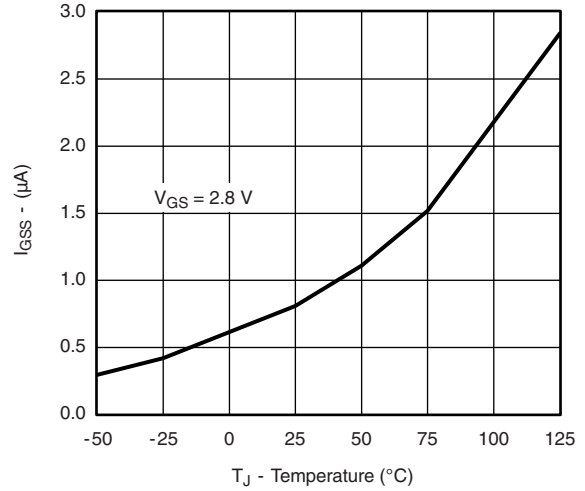


**On-Resistance vs. Gate-to-Source Voltage**

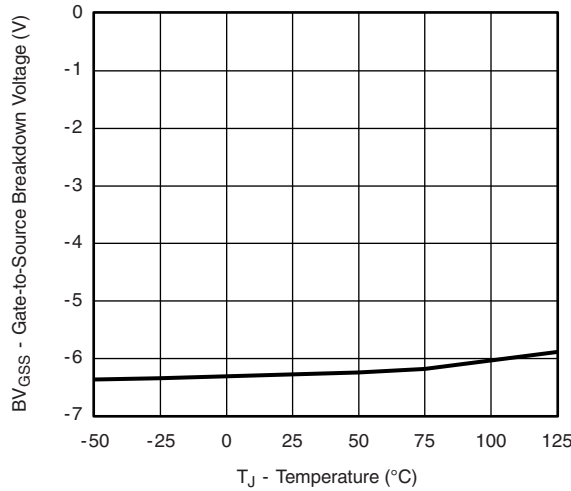
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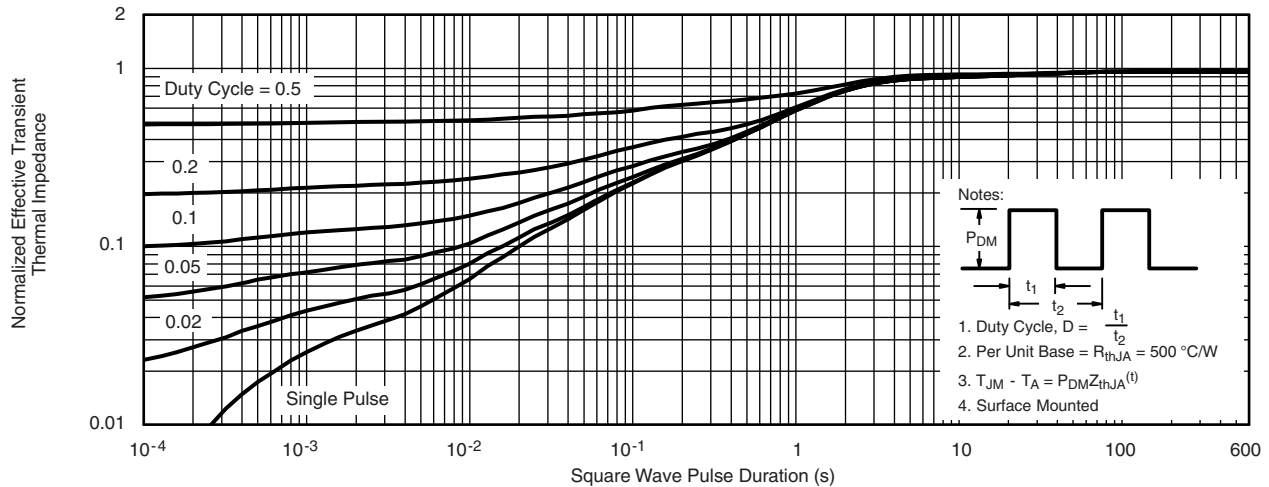
**Threshold Voltage Variance vs. Temperature**



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



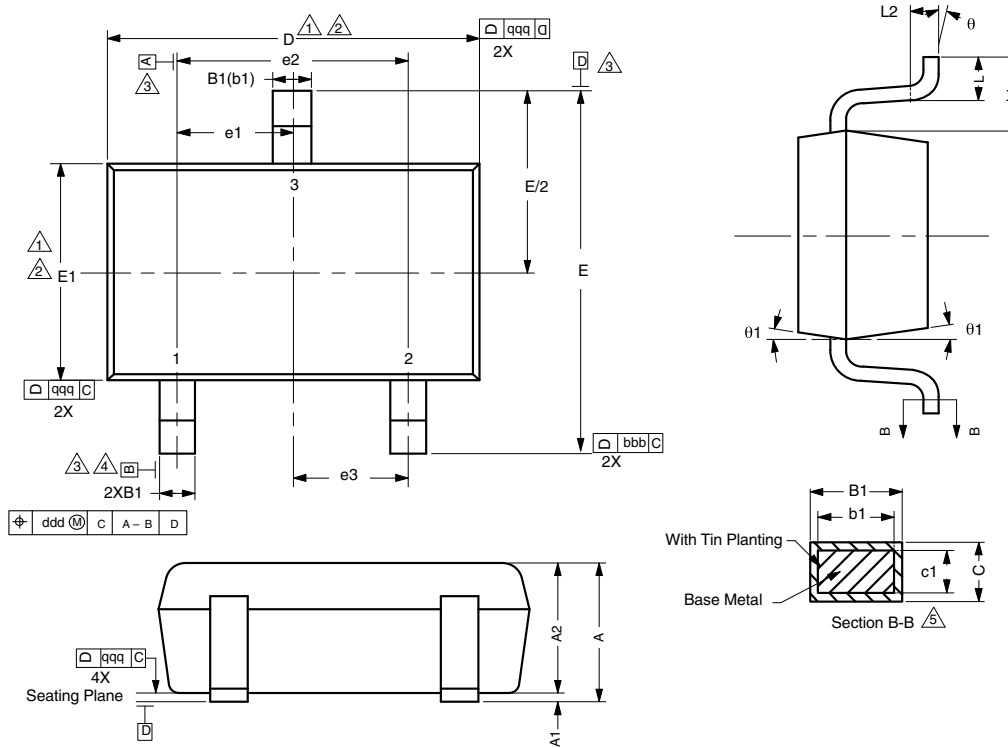
**BV<sub>GSS</sub> vs. Temperature**



**Normalized Thermal Transient Impedance, Junction-to-Ambient (SC-75A, Si1031R Only)**

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### SC-75A: 3 Leads



DWG: 5868

**Notes**

Dimensions in millimeters will govern.

- 1. Dimension D does not include mold flash, protrusions or gate burrs. Mold flash protrusions or gate burrs shall not exceed 0.10 mm per end. Dimension E1 does not include Interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.10 mm per side.
- 2. Dimensions D and E1 are determined at the outmost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.
- 3. Datums A, B and D to be determined 0.10 mm from the lead tip.
- 4. Terminal positions are shown for reference only.
- 5. These dimensions apply to the flat section of the lead between 0.08 mm and 0.15 mm from the lead tip.

DIMENSIONS	TOLERANCES
aaa	0.10
bbb	0.10
ccc	0.10
ddd	0.10

DIM.	MILLIMETERS			NOTE
	MIN.	NOM.	MAX.	
A	-	-	0.80	
A1	0.00	-	0.10	
A2	0.65	0.70	0.80	
B1	0.19	-	0.24	5
b1	0.17	-	0.21	
c	0.13	-	0.15	5
c1	0.10	-	0.12	5
D	1.48	1.575	1.68	1, 2
E	1.50	1.60	1.70	
E1	0.66	0.76	0.86	1, 2
e1	0.50 BSC			
e2	1.00 BSC			
e3	0.50 BSC			
L	0.15	0.205	0.30	
L1	0.40 ref.			
L2	0.15 BSC			
q	0°	-	8°	
q1	4°	-	10°	

## RECOMMENDED MINIMUM PADS FOR SC-75A: 3-Lead



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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