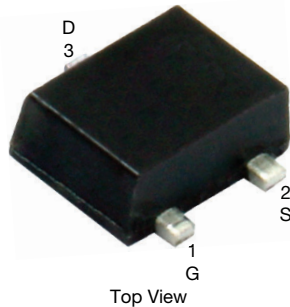


P-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A)	Q _g (TYP.) (nC)
-20	0.760 at V _{GS} = -4.5 V	-0.45	1
	1.040 at V _{GS} = -2.5 V	-0.40	
	1.500 at V _{GS} = -1.8 V	-0.32	

SC-89 (3 leads)


Top View

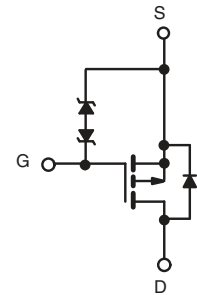
FEATURES

- TrenchFET® power MOSFET
- 100 % R_g tested
- Typical ESD protection: 1000 V (HBM)
- Fast switching speed
- Material categorization:
for definitions of compliance please see www.vishay.com/doc?99912


RoHS
 COMPLIANT
 HALOGEN
FREE

APPLICATIONS

- Load / power switch for portable devices
- Drivers: relays, solenoids, displays
- Battery operated systems



P-Channel MOSFET

Marking Code: 6

Ordering Information:

Si1013CX-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V _{DS}	-20	V
Gate-Source Voltage	V _{GS}	± 8	
Continuous Drain Current (T _J = 150 °C)	T _A = 25 °C	-0.45 ^{b, c}	A
	T _A = 70 °C	-0.36 ^{b, c}	
Pulsed Drain Current (t = 300 μs)	I _{DM}	-1.5	
Continuous Source-Drain Diode Current	T _A = 25 °C	I _S	-0.16 ^{b, c}
Maximum Power Dissipation	T _A = 25 °C	P _D	0.19 ^{b, c}
	T _A = 70 °C		0.12 ^{b, c}
Operating Junction and Storage Temperature Range	T _J , T _{stg}	-55 to +150	°C

THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT	
Maximum Junction-to-Ambient ^{a, b}	t ≤ 5 s	440	530	°C/W	
	Steady State	540	650		

Notes

- Maximum under steady state conditions is 650 °C/W.
- Surface mounted on 1" x 1" FR4 board.
- t = 5 s.



SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0, I_D = -250\text{ }\mu\text{A}$	-20	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$	-	-12	-	mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		-	1.8	-	
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-0.4	-	-1	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$	-	-	± 30	μA
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$	-	-	± 1	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$	-	-	-1	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^\circ\text{C}$	-	-	-10	A
		$V_{DS} = \geq 5\text{ V}, V_{GS} = -4.5\text{ V}$	-1.5	-	-	
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -0.4\text{ A}$	-	0.630	0.760	Ω
		$V_{GS} = -2.5\text{ V}, I_D = -0.2\text{ A}$	-	0.865	1.040	
		$V_{GS} = -1.8\text{ V}, I_D = -0.1\text{ A}$	-	1.200	1.500	
Forward Transconductance	g_{fs}	$V_{DS} = -10\text{ V}, I_D = 0.4\text{ A}$	-	1	-	S
Dynamic ^b						
Input Capacitance	C_{iss}	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	45	-	pF
Output Capacitance	C_{oss}		-	15	-	
Reverse Transfer Capacitance	C_{rss}		-	10	-	
Total Gate Charge	Q_g	$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -0.4\text{ A}$	-	1.65	2.50	nC
		$V_{DS} = -0\text{ V}, V_{GS} = -2.5\text{ V}, I_D = -0.4$	-	1	2	
Gate-Source Charge	Q_{gs}	$V_{DS} = -0\text{ V}, V_{GS} = -2.5\text{ V}, I_D = -0.4$	-	0.2	-	
Gate-Drain Charge	Q_{gd}	$V_{DS} = -0\text{ V}, V_{GS} = -2.5\text{ V}, I_D = -0.4$	-	0.26	-	
Gate Resistance	R_g	$f = 1\text{ MHz}$	2.4	12	24	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 33.3\text{ }\Omega$ $I_D \cong -0.3\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$	-	9	18	ns
Rise Time	t_r		-	10	20	
Turn-Off Delay Time	$t_{d(off)}$		-	10	20	
Fall Time	t_f		-	8	16	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 33.3\text{ }\Omega$ $I_D \cong -0.3\text{ A}, V_{GEN} = -8\text{ V}, R_g = 1\text{ }\Omega$	-	1	2	
Rise Time	t_r		-	8	16	
Turn-Off Delay Time	$t_{d(off)}$		-	9	18	
Fall Time	t_f		-	5	10	
Drain-Source Body Diode Characteristics						
Pulse Diode Forward Current ^a	I_{SM}		-	-	-1.5	A
Body Diode Voltage	V_{SD}	$I_S = -0.3\text{ A}$	-	-0.8	-1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = -0.3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	-	16	24	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	8	16	nC
Reverse Recovery Fall Time	t_a		-	11	-	ns
Reverse Recovery Rise Time	t_b		-	5	-	

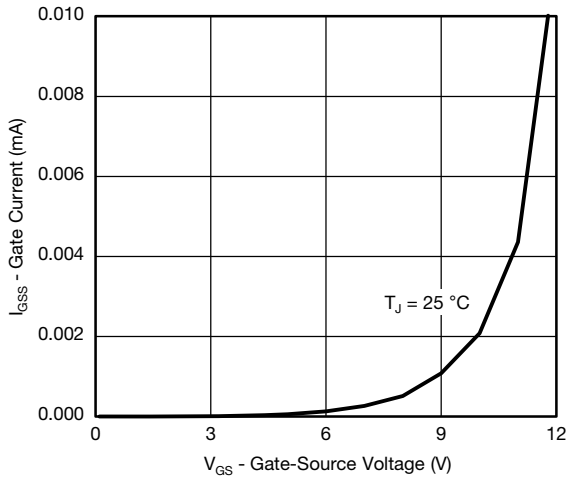
Notes

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

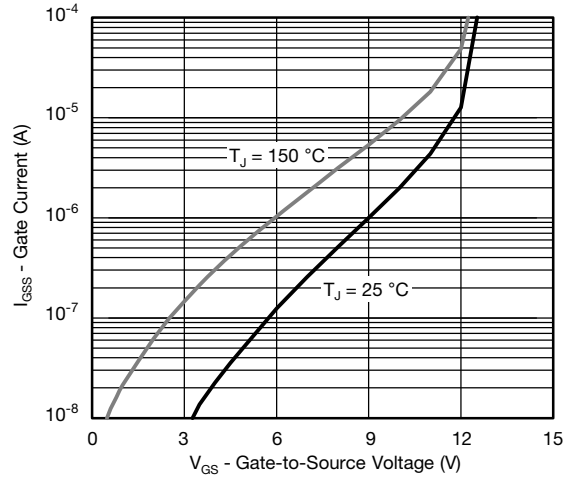
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



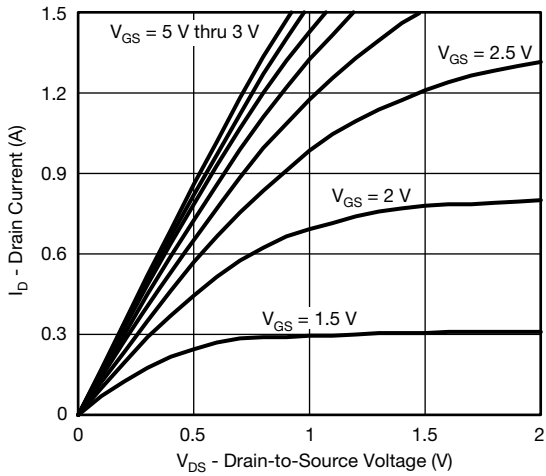
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



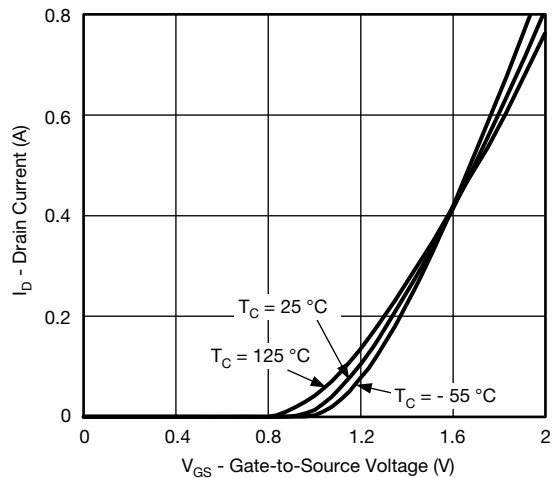
Gate Current vs. Gate-Source Voltage



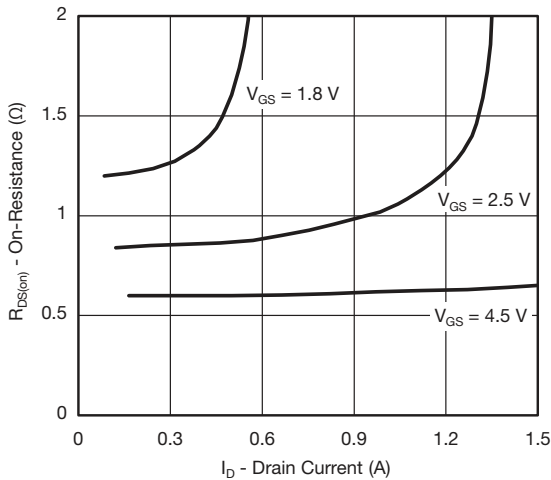
Gate Current vs. Gate-Source Voltage



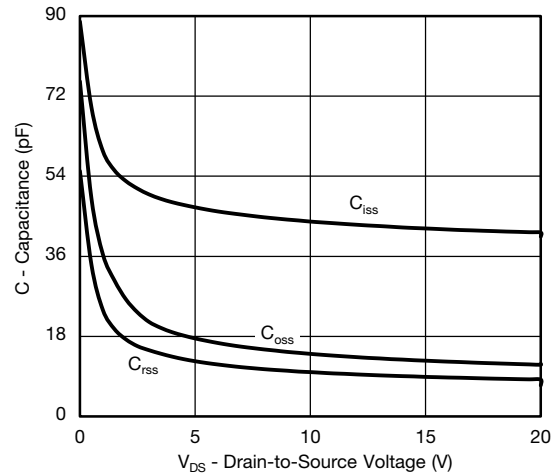
Output Characteristics



Transfer Characteristics



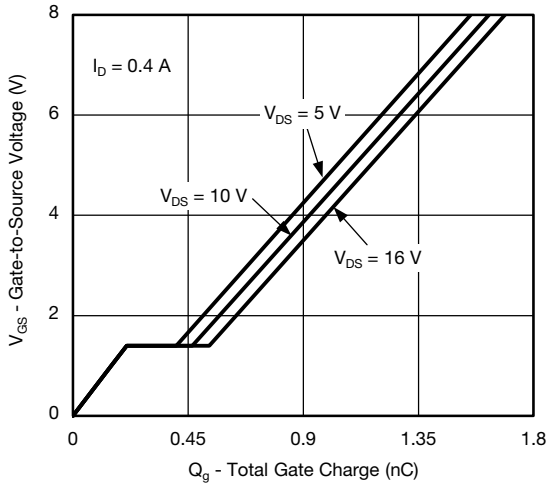
On-Resistance vs. Drain Current



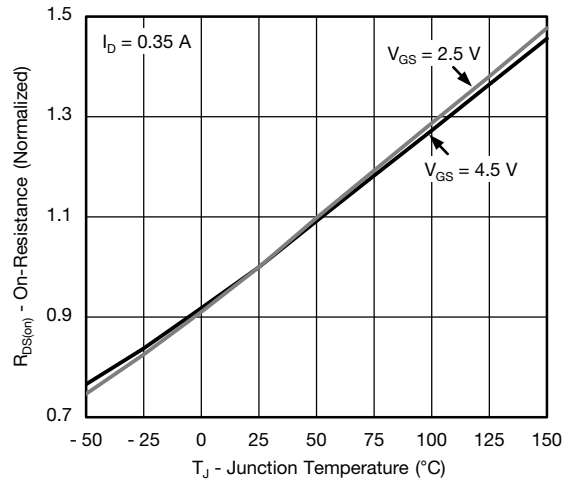
Capacitance



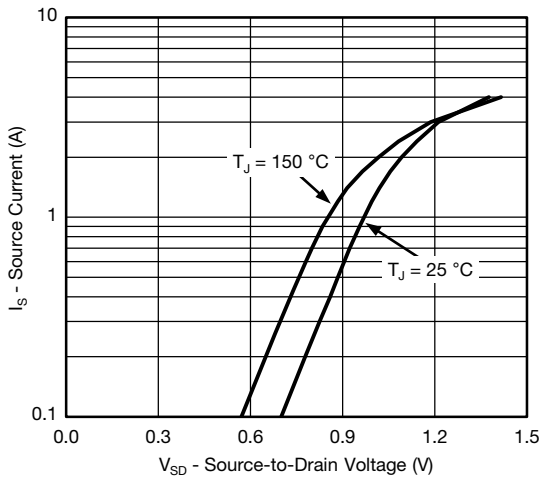
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



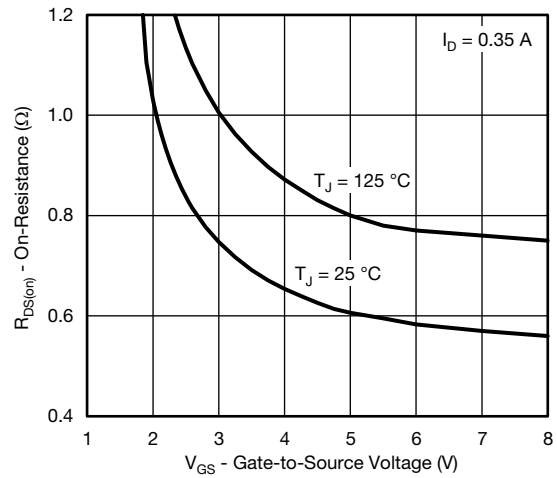
Gate Charge



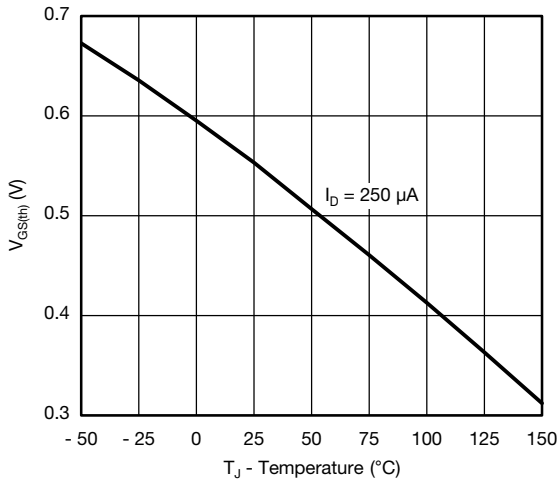
On-Resistance vs. Junction Temperature



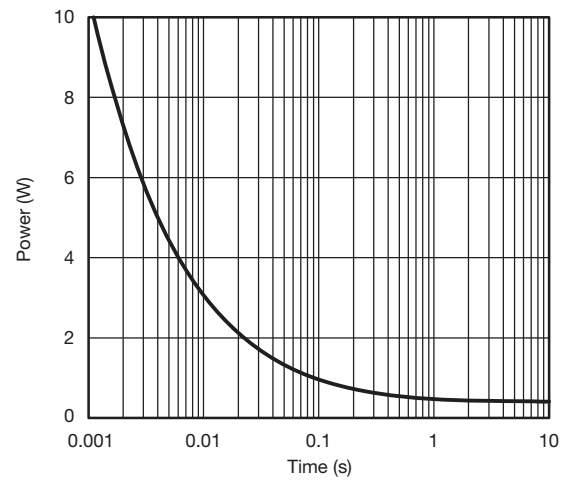
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



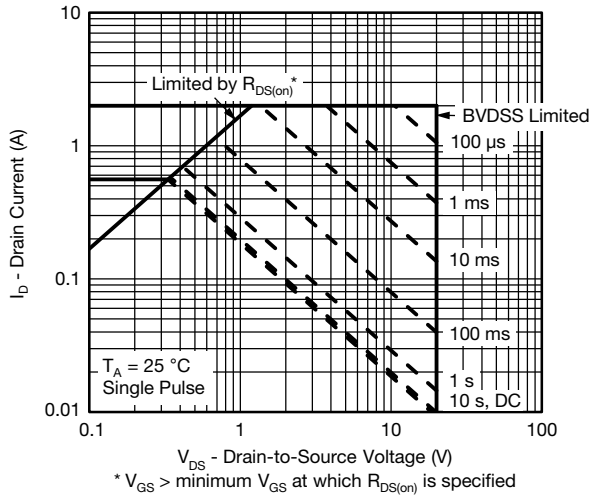
Threshold Voltage



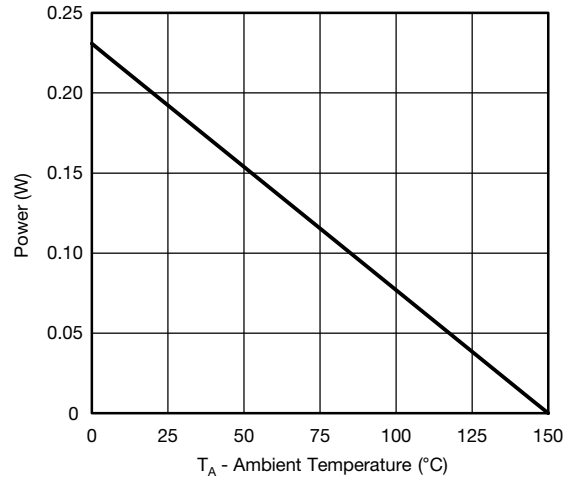
Single Pulse Power, Junction-to-Ambient



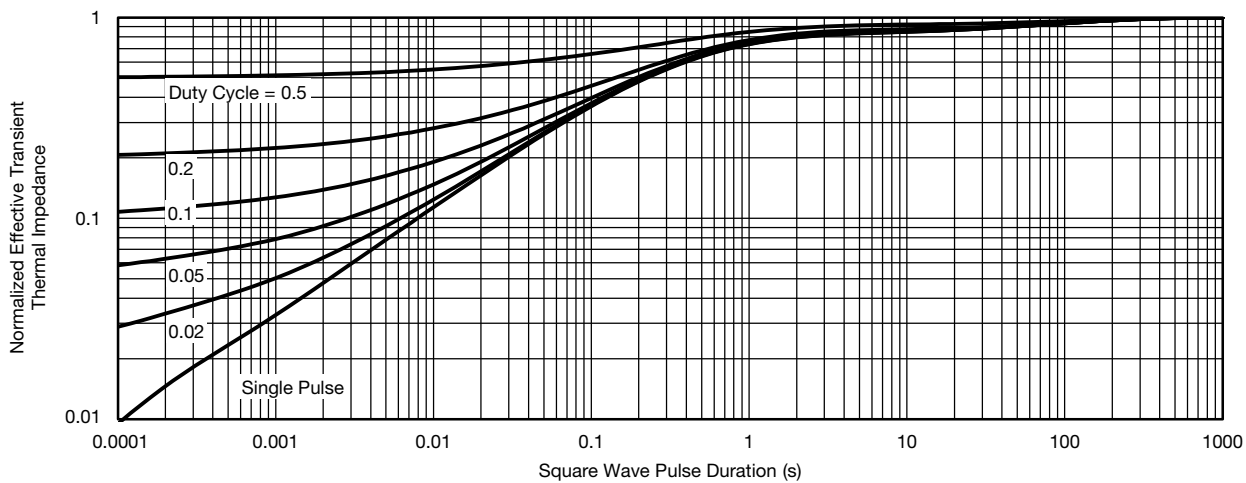
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Safe Operating Area, Junction-to-Ambient



Power Derating, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Ambient

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SC89-3



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.60	0.80	0.024	0.031
b	0.23	0.33	0.009	0.013
C	0.10	0.20	0.004	0.008
D	1.50	1.70	0.059	0.067
E	0.75	0.95	0.030	0.037
e	1.00 BSC		0.040 BSC	
e₁	0.50 BSC		0.020 BSC	
H	1.50	1.70	0.059	0.067
L	0.30	0.50	0.012	0.020

ECN: S-03946—Rev. B, 09-Jul-01
DWG: 5869

RECOMMENDED MINIMUM PADS FOR SC-89: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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