



N-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
20	0.420 at $V_{GS} = 4.5$ V	0.606	0.92
	0.501 at $V_{GS} = 2.5$ V	0.505	
	0.660 at $V_{GS} = 1.8$ V	0.15	

FEATURES

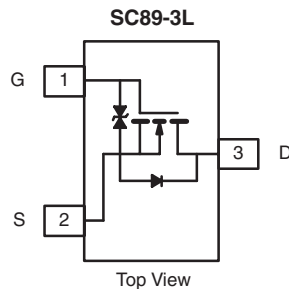
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET[®] Power MOSFET: 1.8 V Rated
- ESD Protected: 2000 V
- Compliant to RoHS Directive 2002/95/EC



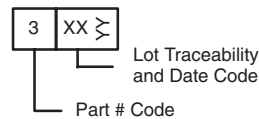
RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

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



Marking Code



Ordering Information: Si1046X-T1-E3 (Lead (Pb)-free)
Si1046X-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) ^a	I_D	$T_A = 25$ °C	A
		$T_A = 70$ °C	
Pulsed Drain Current	I_{DM}	2.5	
Continuous Source-Drain Diode Current	I_S	$T_A = 25$ °C	W
		$T_A = 70$ °C	
Maximum Power Dissipation ^a	P_D	$T_A = 25$ °C	W
		$T_A = 70$ °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 ^{b, d}	R_{thJA}	$t \leq 5$ s	440	530	°C/W
		Steady State	540	650	

Notes:

- Based on $T_C = 25$ °C.
- Surface Mounted on 1" x 1" FR4 board.
- $t = 5$ s.
- Maximum under steady state conditions is 650 °C/W.

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}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		20.5		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-2.12		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.35		0.95	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$			± 30	mA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^\circ\text{C}$			10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$	2.5			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 0.606\text{ A}$		0.336	0.420	Ω
		$V_{GS} = 2.5\text{ V}, I_D = 0.505\text{ A}$		0.395	0.501	
		$V_{GS} = 1.8\text{ V}, I_D = 0.150\text{ A}$		0.438	0.660	
Forward Transconductance	g_{fs}	$V_{DS} = 10\text{ V}, I_D = 0.606\text{ A}$		2.1		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		66		pF
Output Capacitance	C_{oss}			17		
Reverse Transfer Capacitance	C_{rss}			7		
Total Gate Charge	Q_g	$V_{DS} = 10\text{ V}, V_{GS} = 5\text{ V}, I_D = 0.606\text{ A}$		0.99	1.49	nC
				0.92	1.38	
Gate-Source Charge	Q_{gs}	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 0.606\text{ A}$		0.15		
Gate-Drain Charge	Q_{gd}			0.30		
Gate Resistance	R_g	$f = 1\text{ MHz}$		212		Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 20.8\text{ }\Omega$ $I_D \cong 0.48\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		17	26	ns
Rise Time	t_r			19	28.5	
Turn-Off Delay Time	$t_{d(off)}$			76	114	
Fall Time	t_f			27	41	
Drain-Source Body Diode Characteristics						
Pulse Diode Forward Current ^a	I_{SM}				2.5	A
Body Diode Voltage	V_{SD}	$I_S = 0.48\text{ A}$		0.8	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 1.0\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}$		16	24	ns
Body Diode Reverse Recovery Charge	Q_{rr}			4.8	7.2	nC
Reverse Recovery Fall Time	t_a			12.3		ns
Reverse Recovery Rise Time	t_b			3.7		

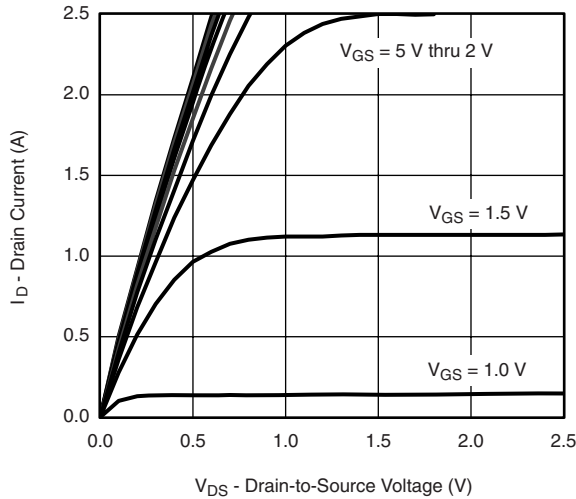
Notes:

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

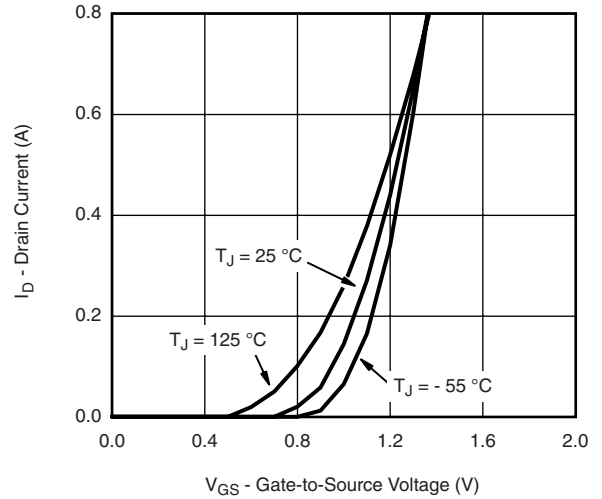
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



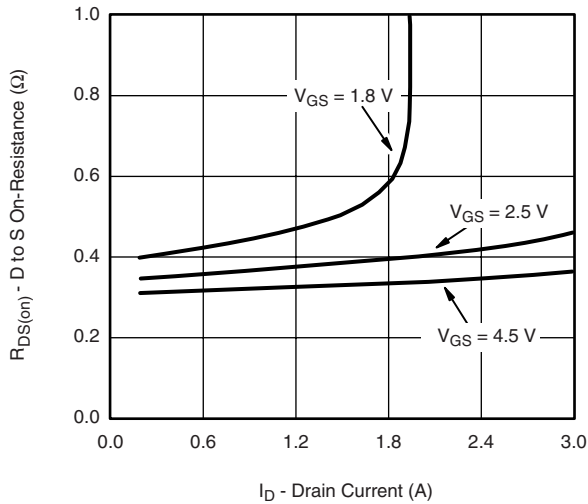
TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



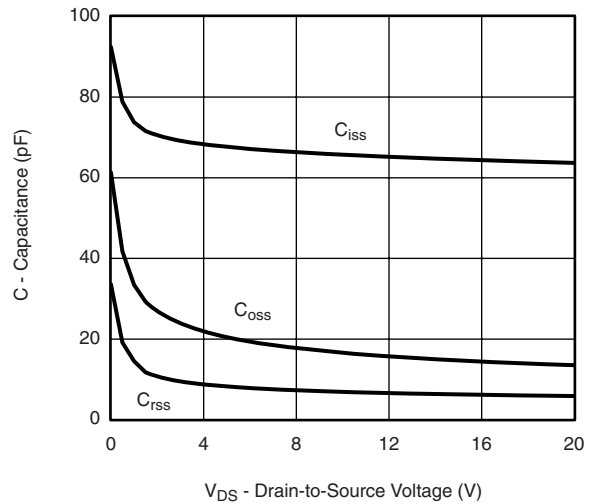
Output Characteristics



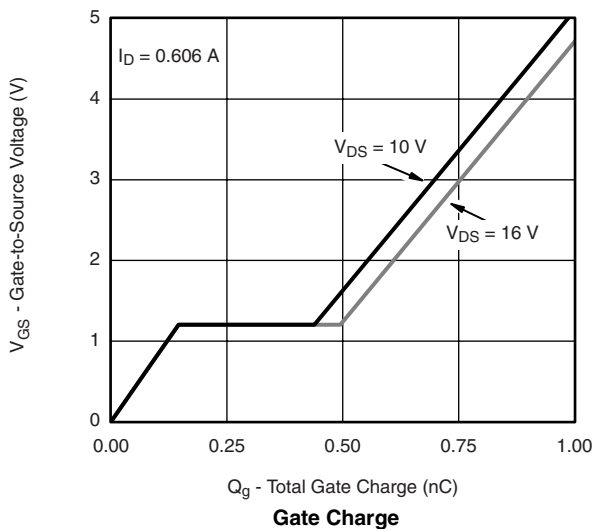
Transfer Characteristics



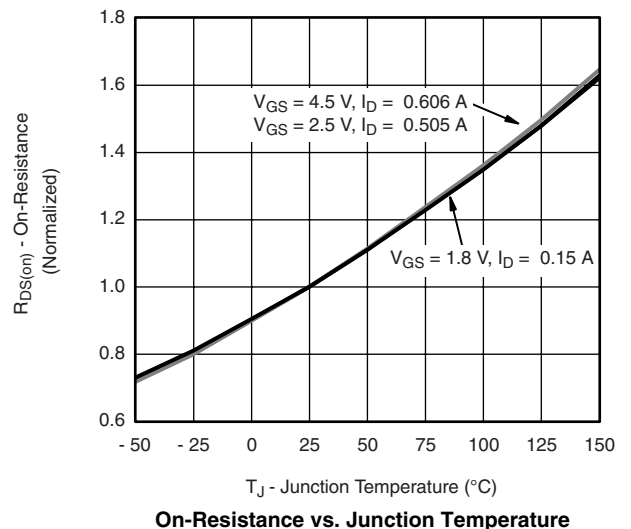
On-Resistance vs. Drain Current



Capacitance



Gate Charge



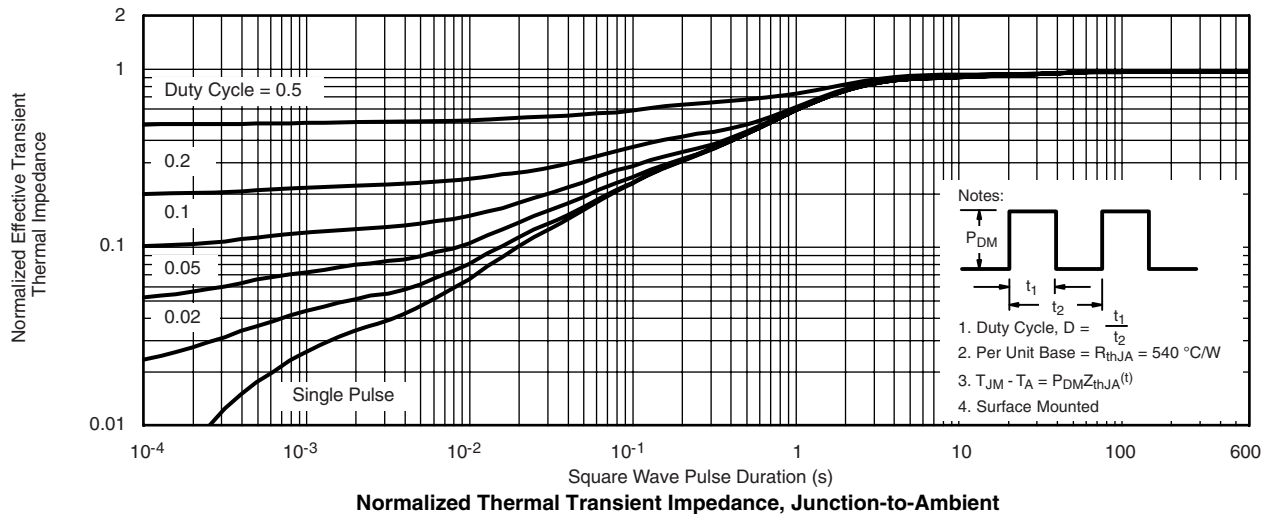
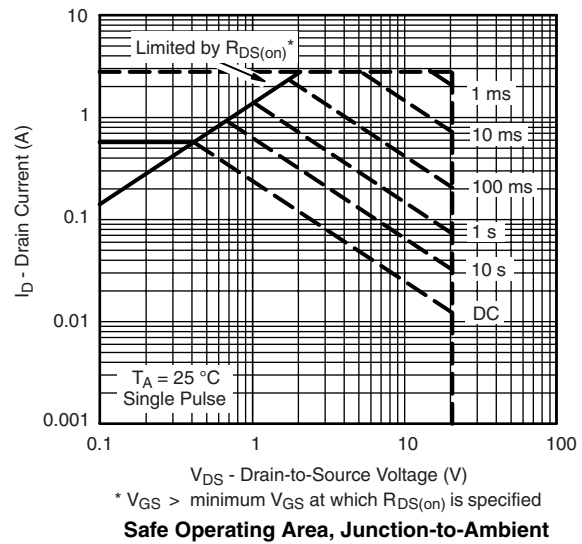
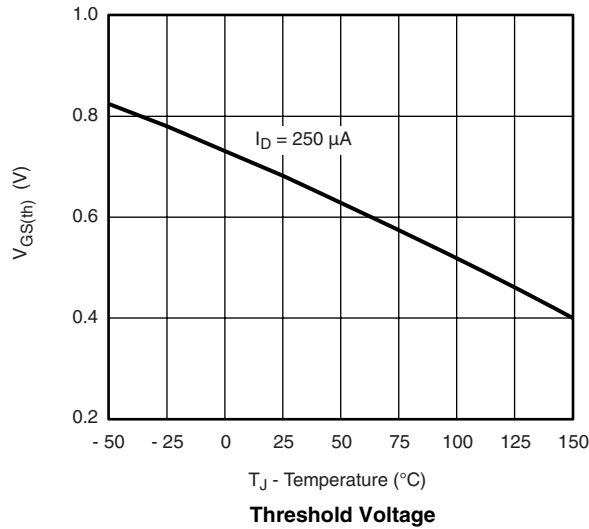
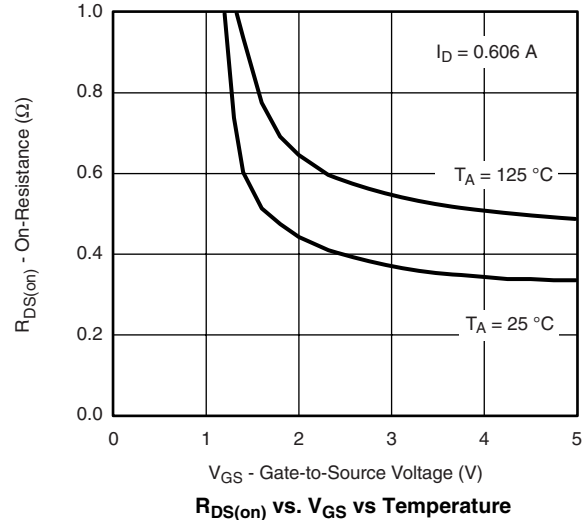
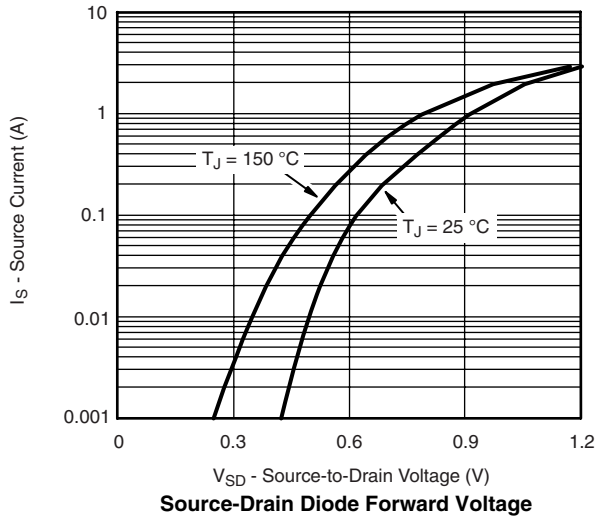
On-Resistance vs. Junction Temperature

Si1046X

Vishay Siliconix



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



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