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

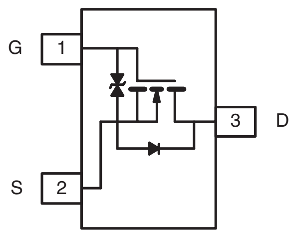
- **Halogen-free According to IEC 61249-2-21 Definition**
- TrenchFET® Power MOSFET: 1.8 V Rated
- ESD Protected: 2000 V
- Compliant to RoHS Directive 2002/95/EC

Pb-free
RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

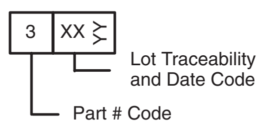
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories
- Battery Operated Systems
- Power Supply Converter Circuits
- Load/Power Switching Cell Phones, Pagers

SC89-3L



Top View

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]	T_A = 25 °C	I_D	0.606[b, c]	A
	T_A = 70 °C		0.485[b, c]	
Pulsed Drain Current		I_{DM}	2.5	
Continuous Source-Drain Diode Current	T_A = 25 °C	I_S	0.21[b, c]	
Maximum Power Dissipation[a]	T_A = 25 °C	P_D	0.25[b, c]	W
	T_A = 70 °C		0.16[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[b, d]	t ≤ 5 s	R_{thJA}	440	530	°C/W
	Steady State		540	650	

Notes:
a. Based on T_C = 25 °C.
b. Surface Mounted on 1" x 1" FR4 board.
c. t = 5 s.
d. Maximum under steady state conditions is 650 °C/W.

Si1046X

Vishay Siliconix

SPECIFICATIONS T_J = 25 °C, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA		20.5		mV/°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 µA	0.35		0.95	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 8 V			± 30	mA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V			1	µA
		V_{DS} = 20 V, V_{GS} = 0 V, T_J = 85 °C			10	
On-State Drain Current[a]	$I_{D(on)}$	V_{DS} = ≥ 5 V, V_{GS} = 4.5 V	2.5			A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 0.606 A		0.336	0.420	Ω
		V_{GS} = 2.5 V, I_D = 0.505 A		0.395	0.501	
		V_{GS} = 1.8 V, I_D = 0.150 A		0.438	0.660	
Forward Transconductance	g_{fs}	V_{DS} = 10 V, I_D = 0.606 A		2.1		S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz		66		pF
Output Capacitance	C_{oss}			17		
Reverse Transfer Capacitance	C_{rss}			7		
Total Gate Charge	Q_g	V_{DS} = 10 V, V_{GS} = 5 V, I_D = 0.606 A		0.99	1.49	nC
		V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 0.606 A		0.92	1.38	
Gate-Source Charge	Q_{gs}			0.15		
Gate-Drain Charge	Q_{gd}			0.30		
Gate Resistance	R_g	f = 1 MHz		212		Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 10 V, R_L = 20.8 Ω I_D ≅ 0.48 A, V_{GEN} = 4.5 V, R_g = 1 Ω		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 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = 1.0 A, dI/dt = 100 A/µs		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 ≤ 300 µs, duty cycle ≤ 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.

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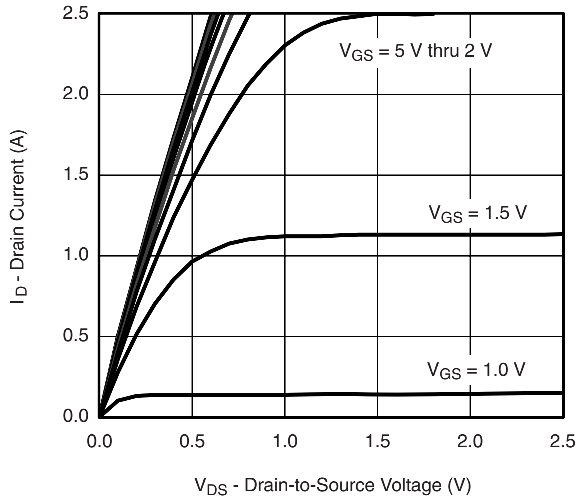
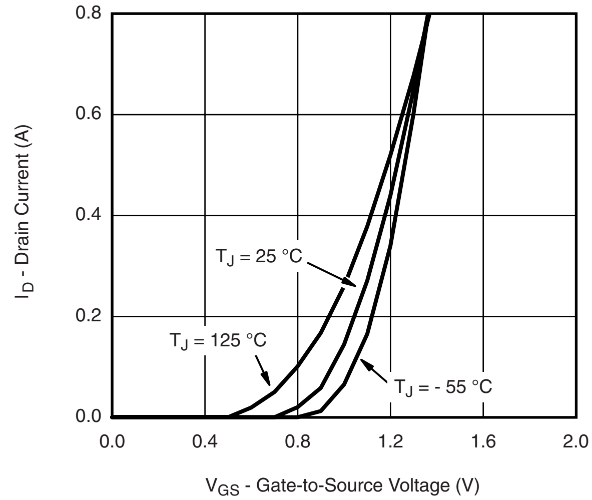
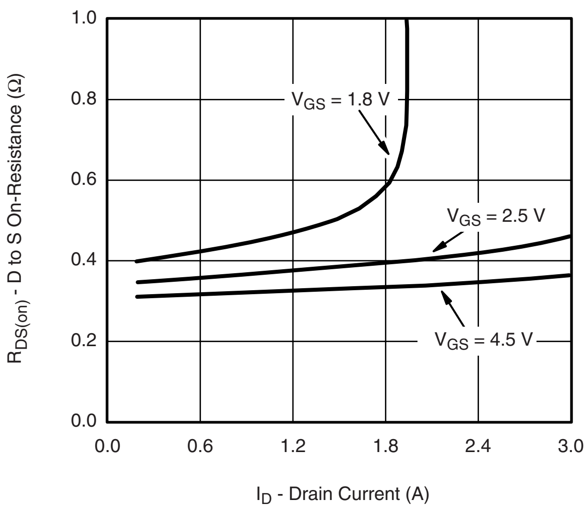
TYPICAL CHARACTERISTICS $T_A = 25\ °C$, unless otherwise noted



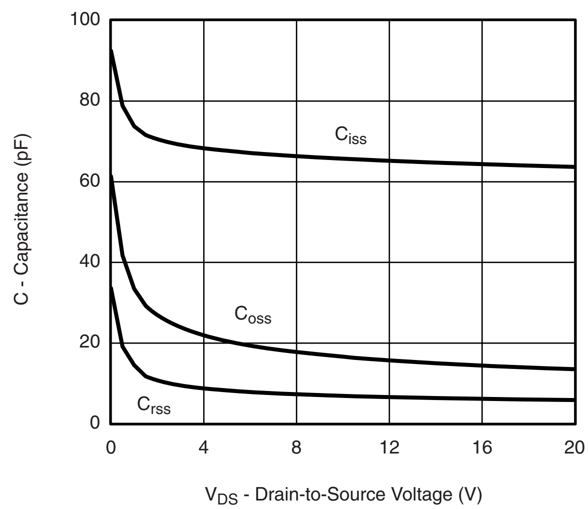
Output Characteristics



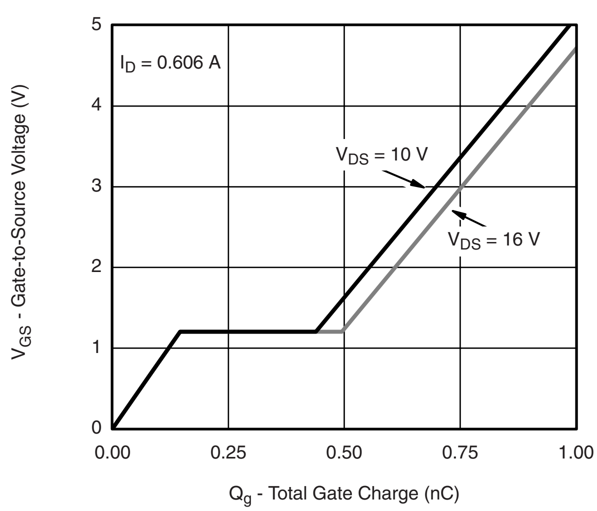
Transfer Characteristics



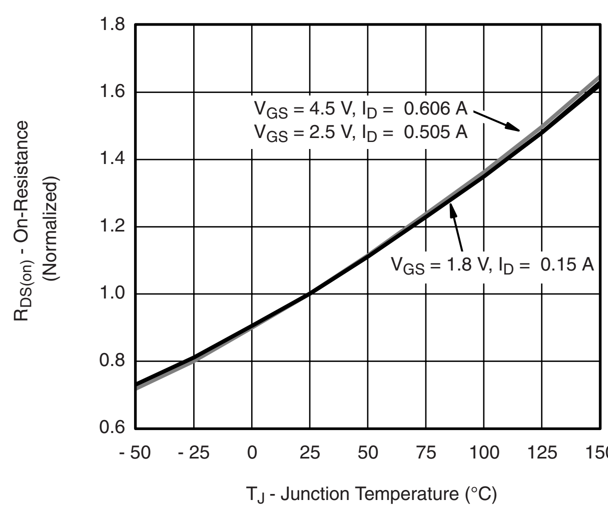
On-Resistance vs. Drain Current



Capacitance

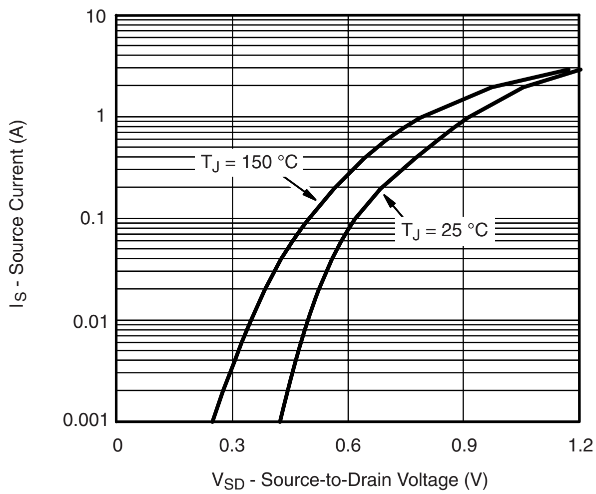


Gate Charge

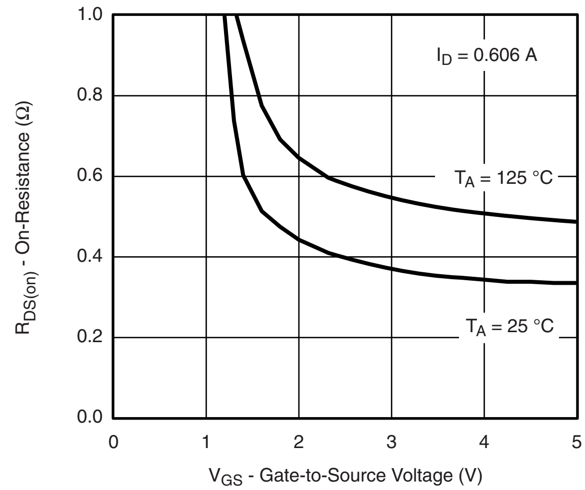


On-Resistance vs. Junction Temperature

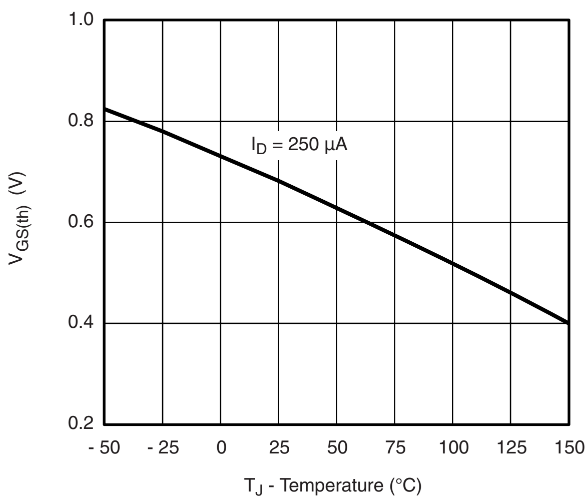
TYPICAL CHARACTERISTICS $T_A = 25\ °C$, unless otherwise noted



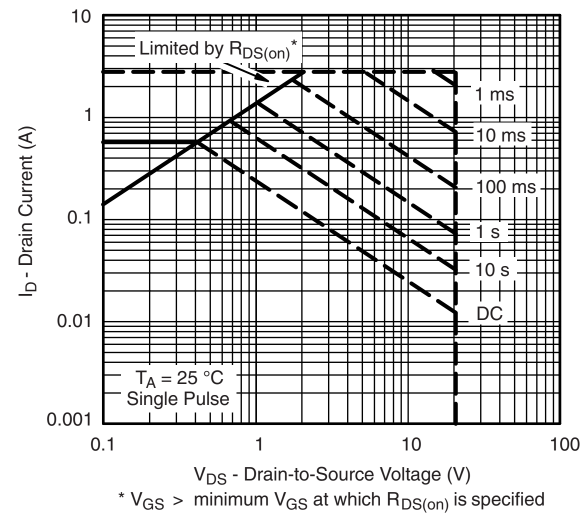
Source-Drain Diode Forward Voltage



$R_{DS(on)}$ vs. V_{GS} vs Temperature

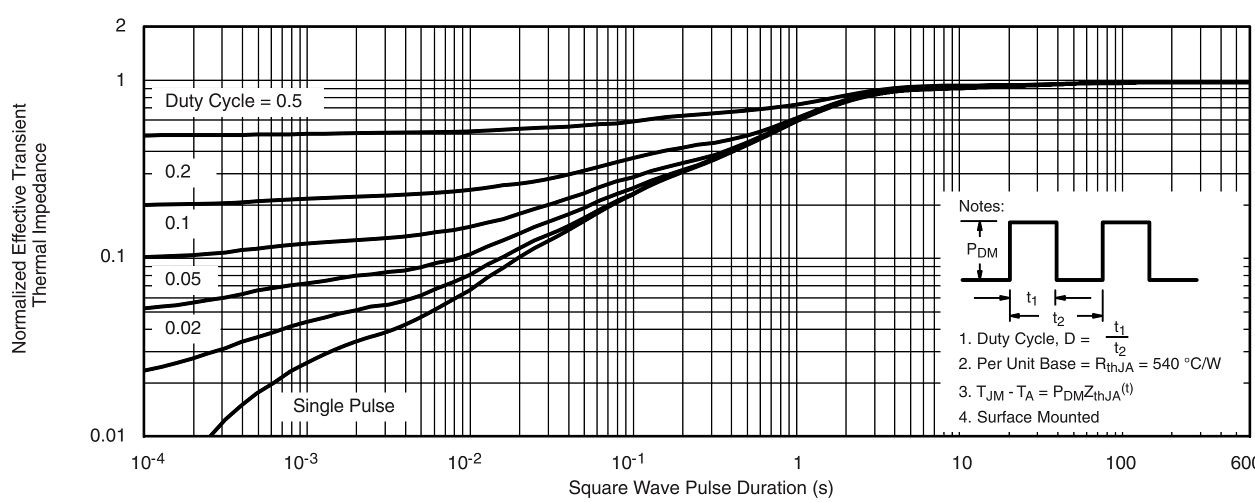


Threshold Voltage



* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Ambient

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