

Complementary N- and P-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY

	V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (mA)
N-Channel	60	1.40 at $V_{GS} = 10$ V	500
		3 at $V_{GS} = 4.5$ V	200
P-Channel	- 60	4 at $V_{GS} = - 10$ V	- 500
		8 at $V_{GS} = - 4.5$ V	- 25

FEATURES

- Halogen-free Option Available
- TrenchFET® Power MOSFETs
- Very Small Footprint
- High-Side Switching
- Low On-Resistance:
N-Channel, 1.40 Ω
P-Channel, 4 Ω
- Low Threshold: ± 2 V (typ.)
- Fast Switching Speed: 15 ns (typ.)
- Gate-Source ESD Protected: 2000 V

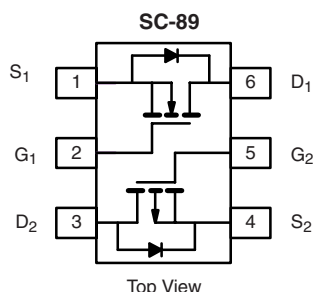

RoHS
COMPLIANT

BENEFITS

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

APPLICATIONS

- Replace Digital Transistor, Level-Shifter
- Battery Operated Systems
- Power Supply Converter Circuits



Marking Code: H

Ordering Information: Si1029X-T1-E3 (Lead (Pb)-free)
Si1029X-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

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Parameter		Symbol	N-Channel		P-Channel		Unit
			5 s	Steady State	5 s	Steady State	
Drain-Source Voltage		V_{DS}	60		- 60		V
Gate-Source Voltage		V_{GS}	± 20				
Continuous Drain Current ($T_J = 150\text{ }^{\circ}\text{C}$) ^a	$T_A = 25\text{ }^{\circ}\text{C}$	I_D	320	305	- 200	- 190	mA
	$T_A = 85\text{ }^{\circ}\text{C}$		230	220	- 145	- 135	
Pulsed Drain Current ^b		I_{DM}	650		- 650		
Continuous Source Current (Diode Conduction) ^a		I_S	450	380	- 450	- 380	
Maximum Power Dissipation ^a	$T_A = 25\text{ }^{\circ}\text{C}$	P_D	280	250	280	250	mW
	$T_A = 85\text{ }^{\circ}\text{C}$		145	130	145	130	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150				$^{\circ}\text{C}$
Gate-Source ESD Rating (HBM, Method 3015)		ESD	2000				V

Notes:

a. Surface Mounted on FR4 board.

b. Pulse width limited by maximum junction temperature.

SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted							
Parameter	Symbol	Test Conditions		Min.	Typ.	Max.	Unit
Static							
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 10\text{ }\mu\text{A}$	N-Ch	60			V
		$V_{GS} = 0\text{ V}, I_D = -10\text{ }\mu\text{A}$	P-Ch	- 60			
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	N-Ch	1		2.5	
		$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	P-Ch	- 1		- 3.0	
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 5\text{ V}$	N-Ch			± 50	nA
			P-Ch			± 100	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$	N-Ch			± 150	
			P-Ch			± 200	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$	N-Ch			10	
		$V_{DS} = -50\text{ V}, V_{GS} = 0\text{ V}$	P-Ch			- 25	
		$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^{\circ}\text{C}$	N-Ch			100	
		$V_{DS} = -50\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^{\circ}\text{C}$	P-Ch			- 250	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}$	N-Ch	500			mA
		$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}$	P-Ch	- 50			
		$V_{DS} = 7.5\text{ V}, V_{GS} = -4.5\text{ V}$	N-Ch	800			
		$V_{DS} = -10\text{ V}, V_{GS} = -10\text{ V}$	P-Ch	- 600			
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 200\text{ mA}$	N-Ch			3	Ω
		$V_{GS} = -4.5\text{ V}, I_D = -25\text{ mA}$	P-Ch			8	
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	N-Ch			1.40	
		$V_{GS} = -10\text{ V}, I_D = -500\text{ mA}$	P-Ch			4	
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}, T_J = 125\text{ }^{\circ}\text{C}$	N-Ch			2.50	
		$V_{GS} = -10\text{ V}, I_D = -500\text{ mA}, T_J = 125\text{ }^{\circ}\text{C}$	P-Ch			6	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$	N-Ch		200		ms
		$V_{DS} = -10\text{ V}, I_D = -100\text{ mA}$	P-Ch		100		
Diode Forward Voltage ^a	V_{SD}	$I_S = 200\text{ mA}, V_{GS} = 0\text{ V}$	N-Ch			1.4	V
		$I_S = -200\text{ mA}, V_{GS} = 0\text{ V}$	P-Ch			- 1.4	
Dynamic ^b							
Total Gate Charge	Q_g	N-Channel $V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 250\text{ mA}$	N-Ch		750		pC
Gate-Source Charge	Q_{gs}		P-Ch		1700		
Gate-Drain Charge	Q_{gd}	P-Channel $V_{DS} = -30\text{ V}, V_{GS} = -15\text{ V}, I_D = -500\text{ mA}$	N-Ch		75		
			P-Ch		260		
Input Capacitance	C_{iss}	N-Channel $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	N-Ch		30		pF
			P-Ch		23		
Output Capacitance	C_{oss}	P-Channel $V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	N-Ch		6		
			P-Ch		10		
Reverse Transfer Capacitance	C_{rss}		N-Ch		3		
			P-Ch		5		
Turn-On Time ^c	t_{ON}	N-Channel $V_{DD} = 30\text{ V}, R_L = 150\text{ }\Omega$ $I_D \cong 200\text{ mA}, V_{GEN} = 10\text{ V}, R_G = 10\text{ }\Omega$	N-Ch		15		ns
			P-Ch		20		
Turn-Off Time ^c	t_{OFF}	P-Channel $V_{DD} = -25\text{ V}, R_L = 150\text{ }\Omega$ $I_D \cong -165\text{ mA}, V_{GEN} = -10\text{ V}, R_G = 10\text{ }\Omega$	N-Ch		20		
			P-Ch		35		

Notes:

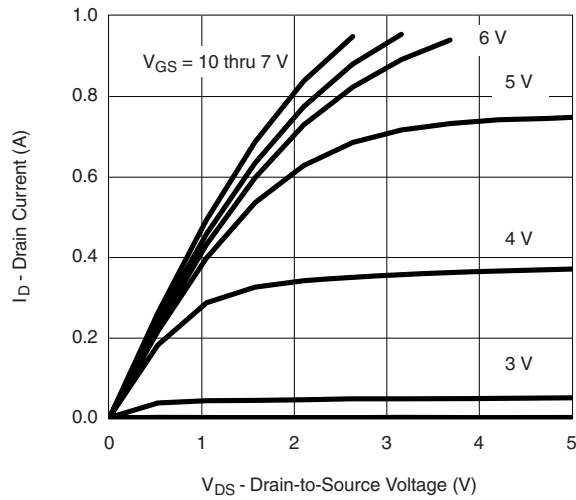
a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

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

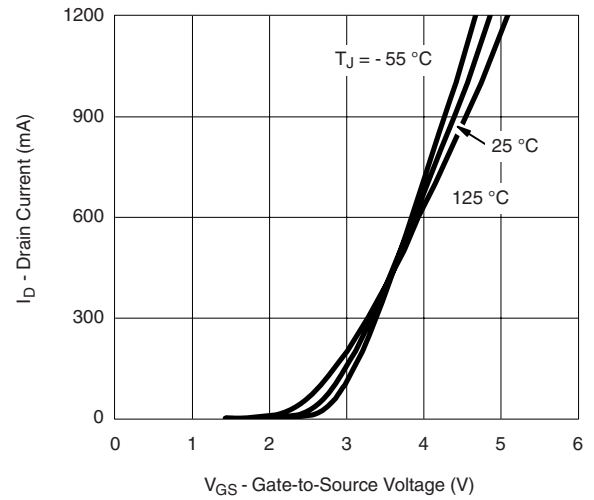
c. Switching time is essentially independent of operating temperature.

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.

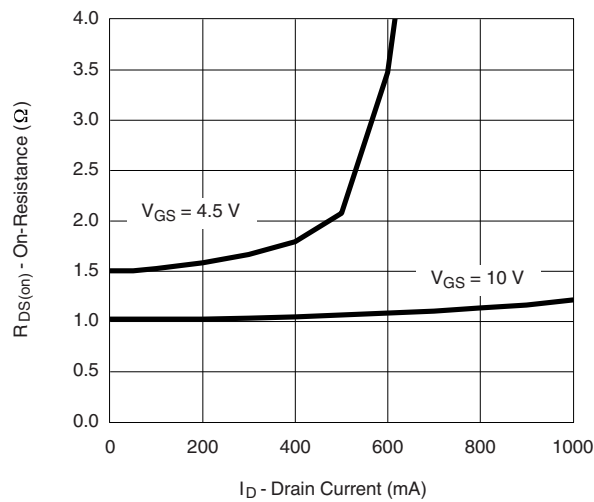
N-CHANNEL TYPICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$, unless otherwise noted



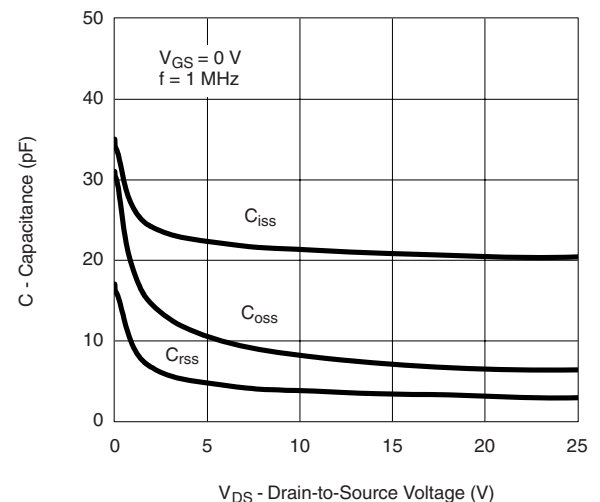
Output Characteristics



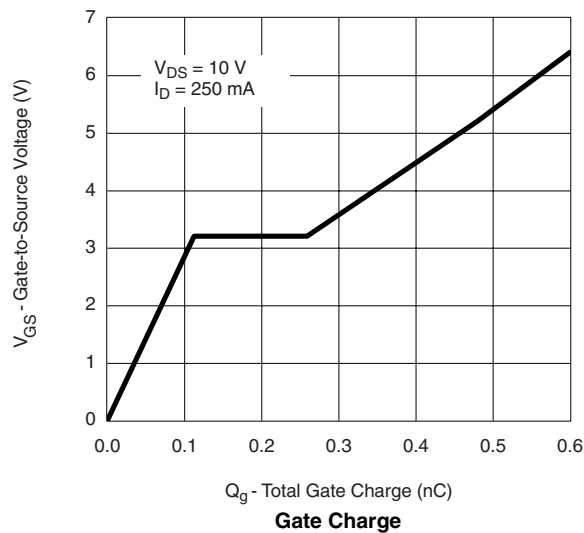
Transfer Characteristics



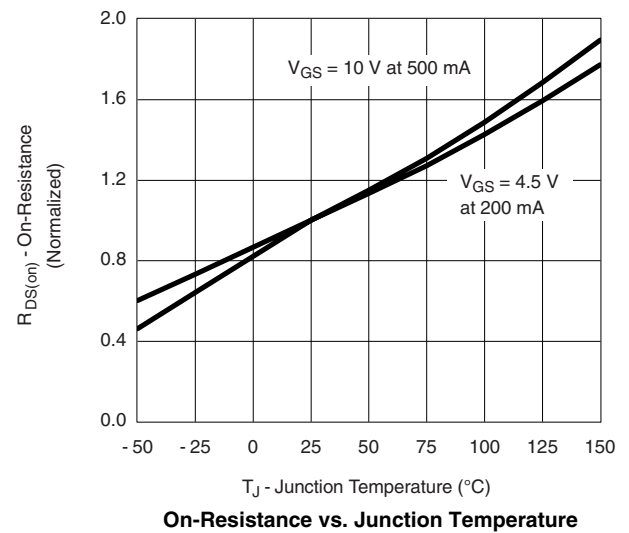
On-Resistance vs. Drain Current



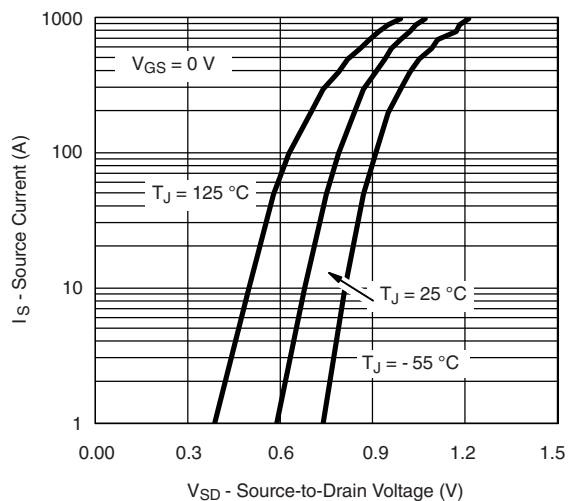
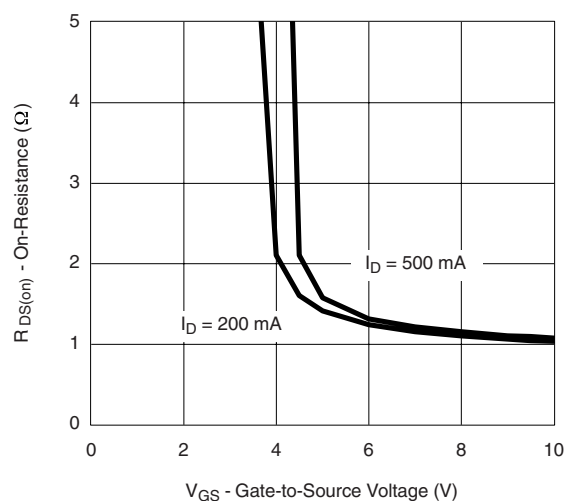
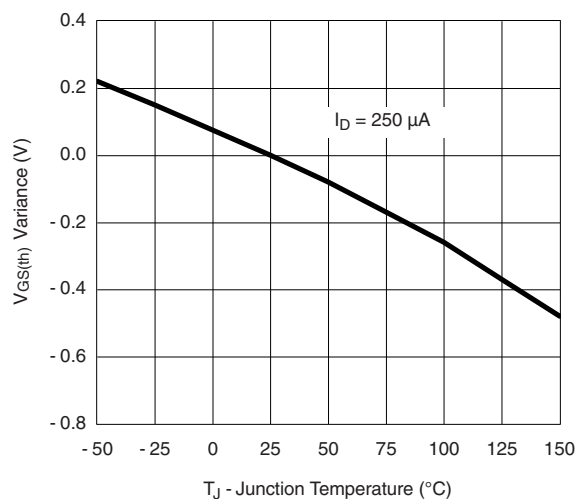
Capacitance



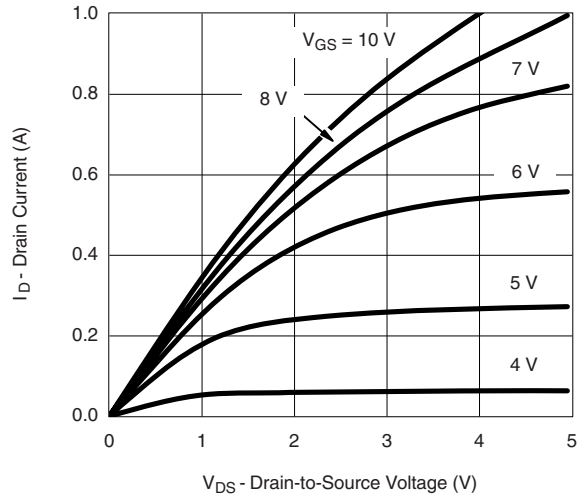
Gate Charge



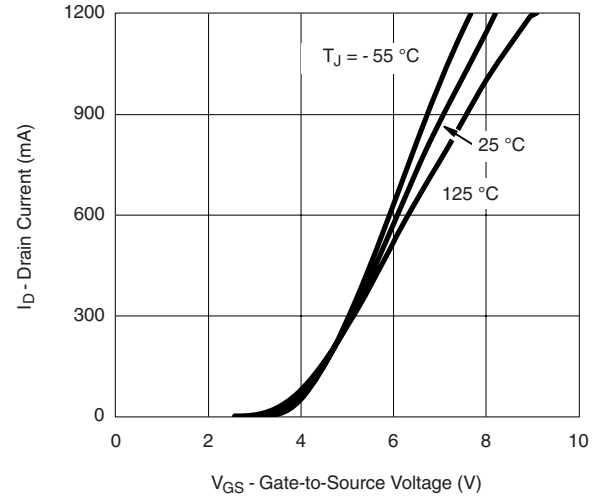
On-Resistance vs. Junction Temperature

N-CHANNEL TYPICAL CHARACTERISTICS $T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted**Source-Drain Diode Forward Voltage****On-Resistance vs. Gate-to-Source Voltage****Threshold Voltage Variance Over Temperature**

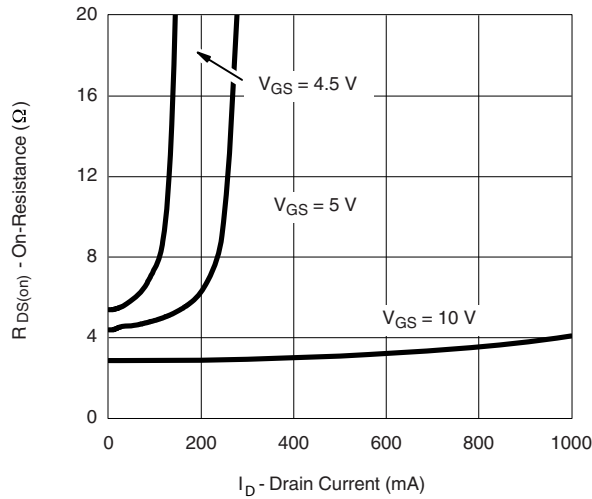
P-CHANNEL TYPICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$, unless otherwise noted



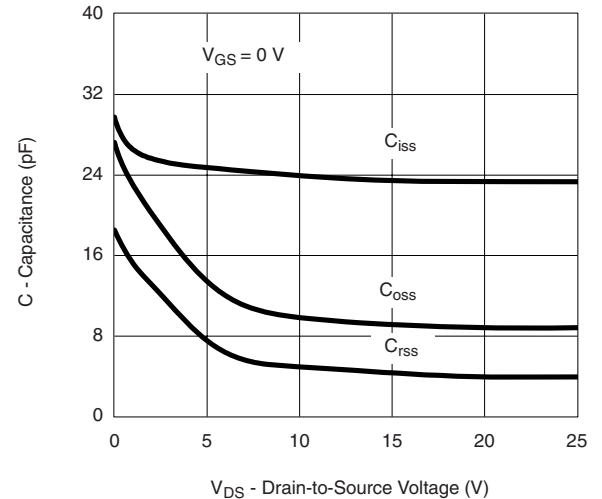
Output Characteristics



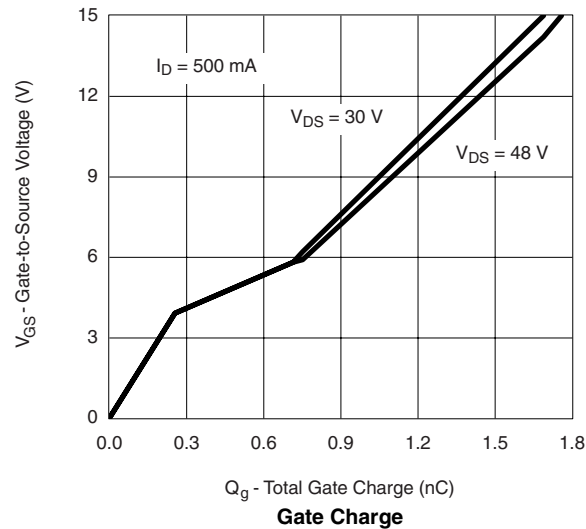
Transfer Characteristics



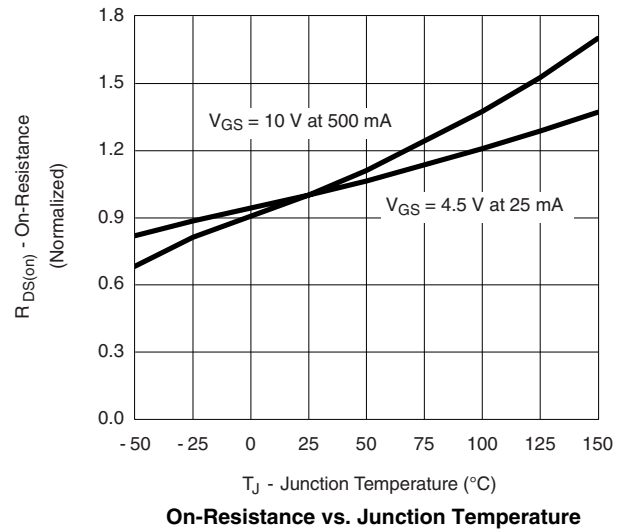
On-Resistance vs. Drain Current



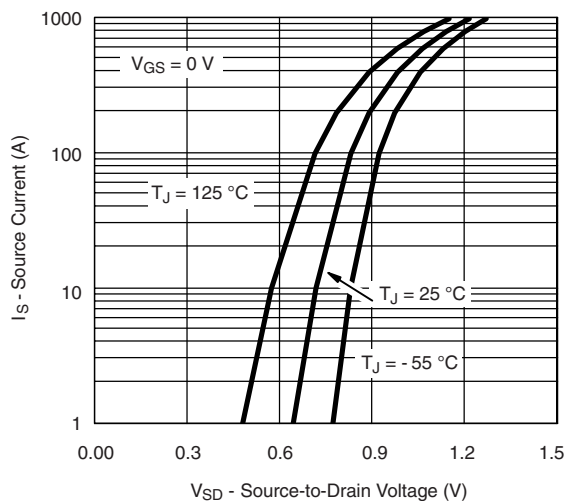
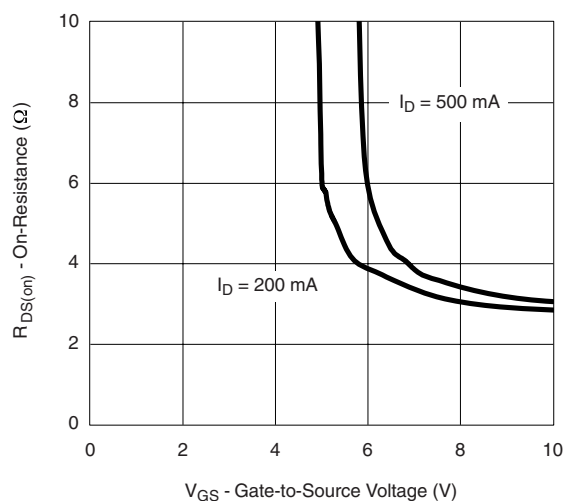
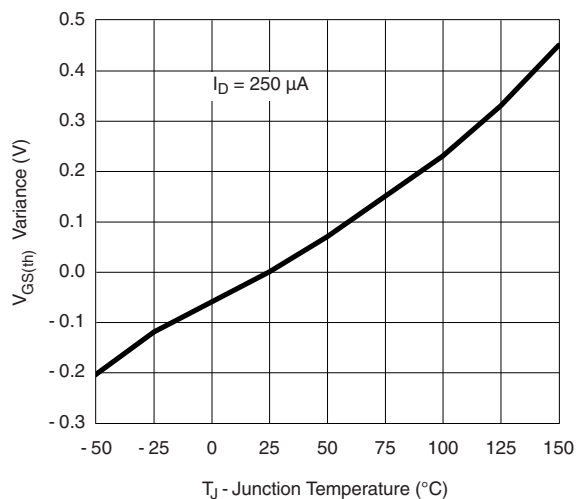
Capacitance



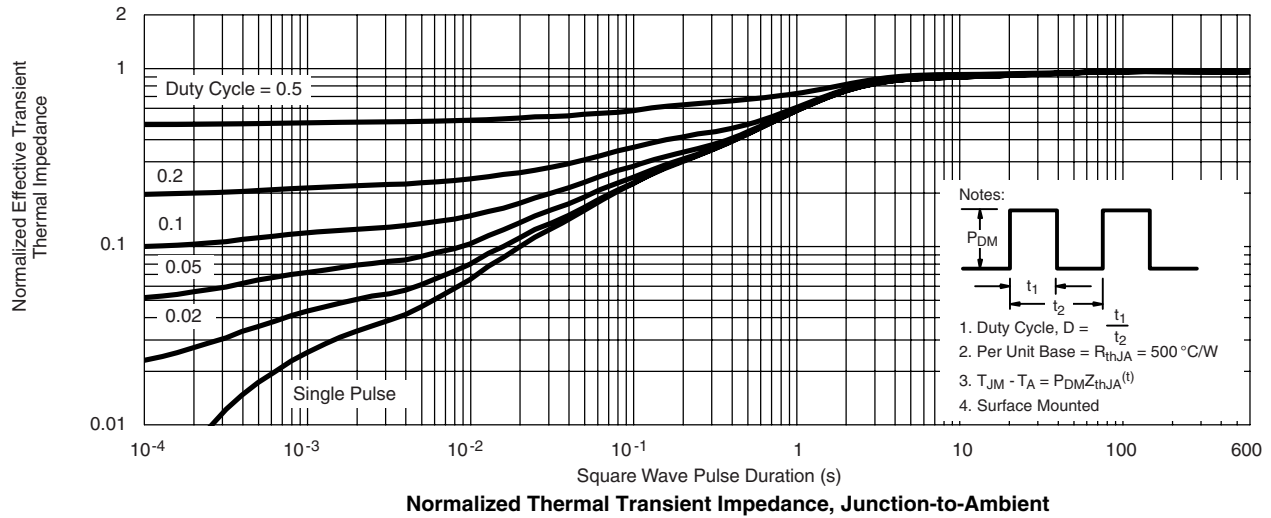
Gate Charge



On-Resistance vs. Junction Temperature

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

Source-Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

Threshold Voltage Variance Over Temperature

N- OR P-CHANNEL TYPICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$, unless otherwise noted



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