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

Pb-free
RoHS COMPLIANT

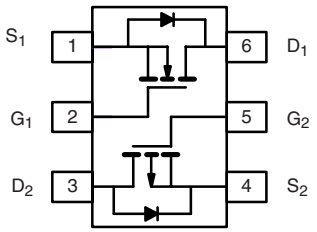
BENEFITS

- 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

SC-89



Top View

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

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 °C)[a]	T_A = 25 °C	I_D	320	305	- 200	- 190	mA
	T_A = 85 °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 °C	P_D	280	250	280	250	mW
	T_A = 85 °C		145	130	145	130	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150				°C
Gate-Source ESD Rating (HBM, Method 3015)		ESD	2000				V

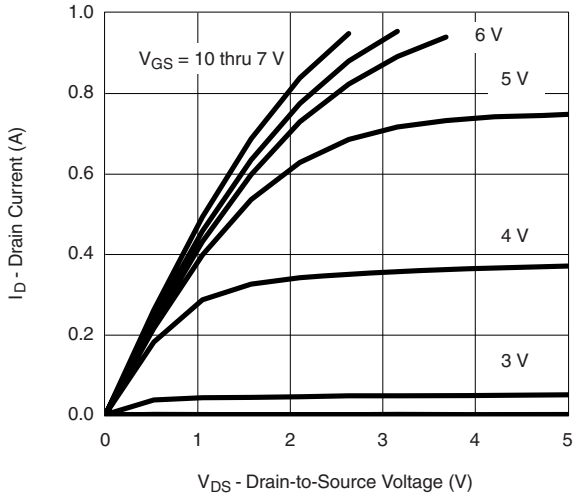
Notes:
a. Surface Mounted on FR4 board.
b. Pulse width limited by maximum junction temperature.

SPECIFICATIONS T_J = 25 °C, unless otherwise noted							
Parameter	**Symbol**	**Test Conditions**		**Min.**	**Typ.**	**Max.**	**Unit**
Static							
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 10 µA	N-Ch	60			V
		V_{GS} = 0 V, I_D = - 10 µA	P-Ch	- 60			
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	N-Ch	1		2.5	
		V_{DS} = V_{GS}, I_D = - 250 µA	P-Ch	- 1		- 3.0	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 5 V	N-Ch			± 50	nA
			P-Ch			± 100	
		V_{DS} = 0 V, V_{GS} = ± 10 V	N-Ch			± 150	
			P-Ch			± 200	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 50 V, V_{GS} = 0 V	N-Ch			10	
		V_{DS} = - 50 V, V_{GS} = 0 V	P-Ch			- 25	
		V_{DS} = 50 V, V_{GS} = 0 V, T_J = 85 °C	N-Ch			100	
		V_{DS} = - 50 V, V_{GS} = 0 V, T_J = 85 °C	P-Ch			- 250	
On-State Drain Current[a]	$I_{D(on)}$	V_{DS} = 10 V, V_{GS} = 4.5 V	N-Ch	500			mA
		V_{DS} = - 10 V, V_{GS} = - 4.5 V	P-Ch	- 50			
		V_{DS} = 7.5 V, V_{GS} = - 4.5 V	N-Ch	800			
		V_{DS} = - 10 V, V_{GS} = - 10 V	P-Ch	- 600			
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 200 mA	N-Ch			3	Ω
		V_{GS} = - 4.5 V, I_D = - 25 mA	P-Ch			8	
		V_{GS} = 10 V, I_D = 500 mA	N-Ch			1.40	
		V_{GS} = - 10 V, I_D = - 500 mA	P-Ch			4	
		V_{GS} = 10 V, I_D = 500 mA, T_J = 125 °C	N-Ch			2.50	
		V_{GS} = - 10 V, I_D = - 500 mA, T_J = 125 °C	P-Ch			6	
Forward Transconductance[a]	g_{fs}	V_{DS} = 10 V, I_D = 200 mA	N-Ch		200		ms
		V_{DS} = - 10 V, I_D = - 100 mA	P-Ch		100		
Diode Forward Voltage[a]	V_{SD}	I_S = 200 mA, V_{GS} = 0 V	N-Ch			1.4	V
		I_S = - 200 mA, V_{GS} = 0 V	P-Ch			- 1.4	
Dynamic[b]							
Total Gate Charge	Q_g	N-Channel V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 250 mA P-Channel V_{DS} = - 30 V, V_{GS} = - 15 V, I_D = - 500 mA	N-Ch		750		pC
			P-Ch		1700		
Gate-Source Charge	Q_{gs}		N-Ch		75		
			P-Ch		260		
Gate-Drain Charge	Q_{gd}		N-Ch		225		
			P-Ch		460		
Input Capacitance	C_{iss}	N-Channel V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz P-Channel V_{DS} = - 25 V, V_{GS} = 0 V, f = 1 MHz	N-Ch		30		pF
			P-Ch		23		
Output Capacitance	C_{oss}		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 V, R_L = 150 Ω I_D ≅ 200 mA, V_{GEN} = 10 V, R_G = 10 Ω P-Channel V_{DD} = - 25 V, R_L = 150 Ω I_D ≅ - 165 mA, V_{GEN} = - 10 V, R_G = 10 Ω	N-Ch		15		ns
			P-Ch		20		
Turn-Off Time[c]	t_{OFF}		N-Ch		20		
			P-Ch		35		

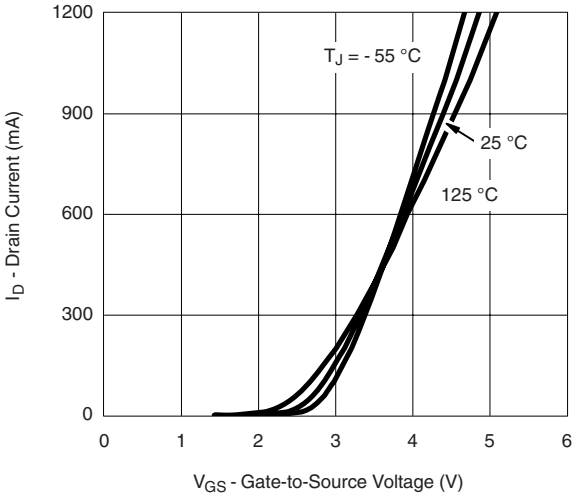
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Switching time is essentially independent of operating temperature.

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.

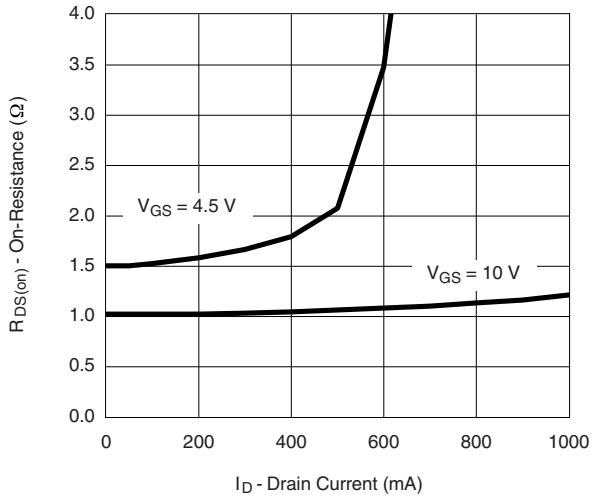
N-CHANNEL TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



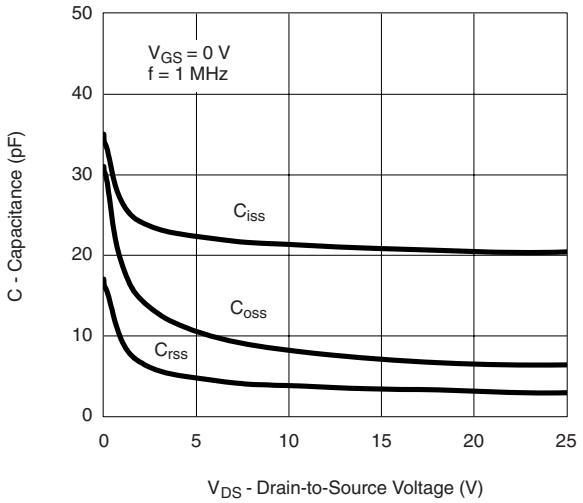
Output Characteristics



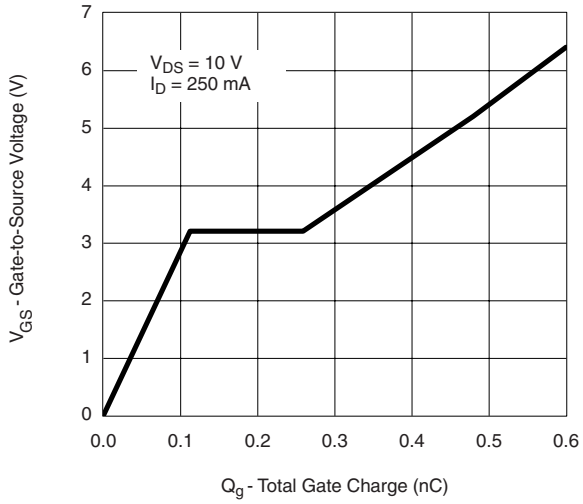
Transfer Characteristics



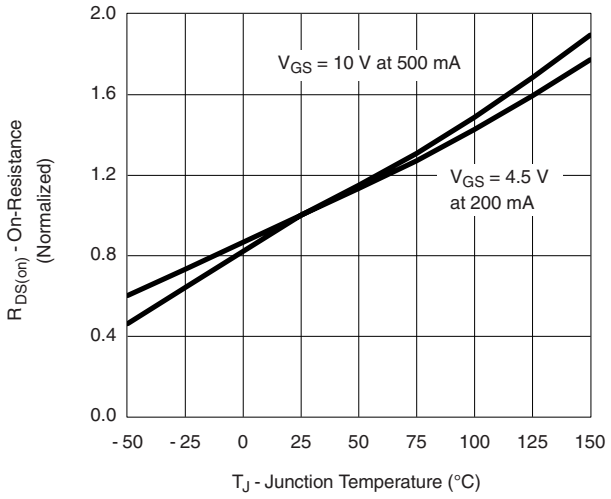
On-Resistance vs. Drain Current



Capacitance

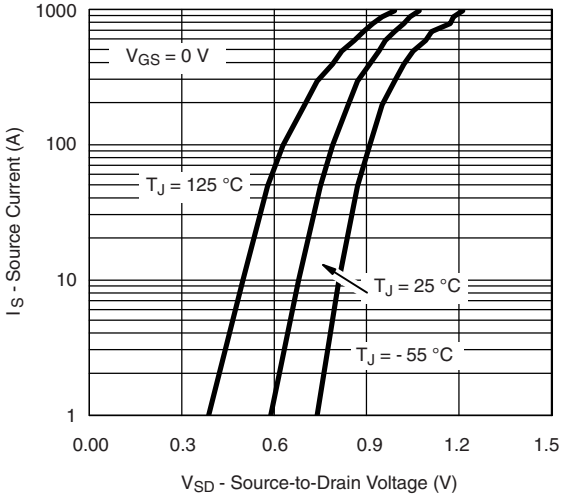


Gate Charge

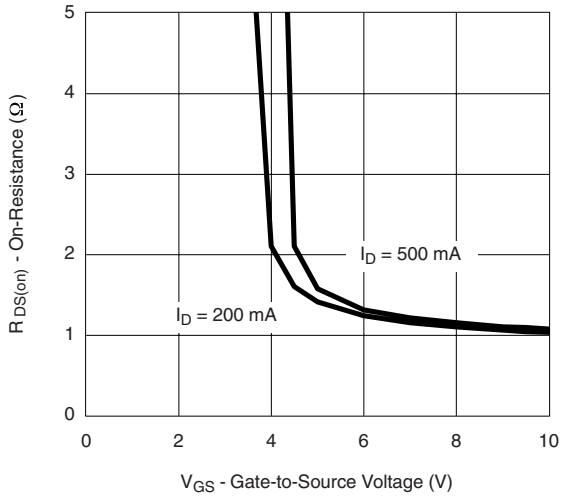


On-Resistance vs. Junction Temperature

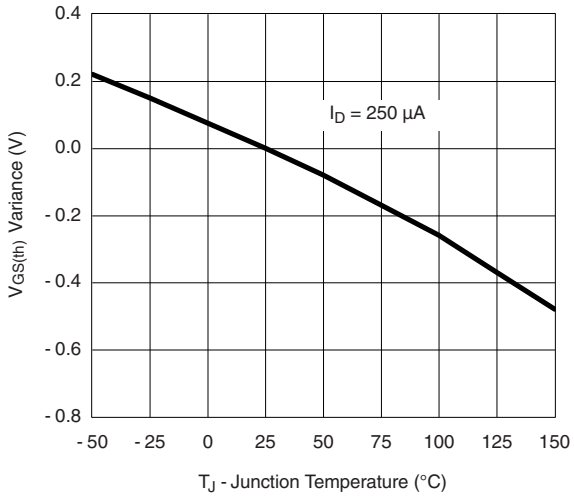
N-CHANNEL TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



Source-Drain Diode Forward Voltage

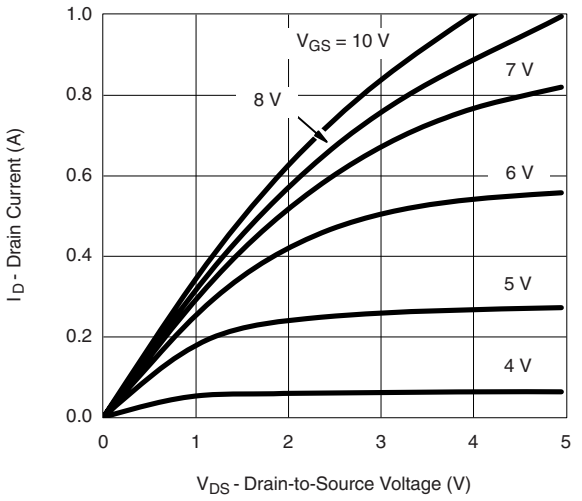


On-Resistance vs. Gate-to-Source Voltage

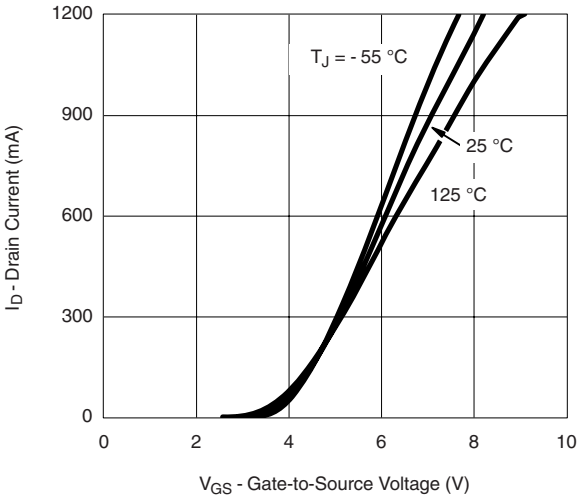


Threshold Voltage Variance Over Temperature

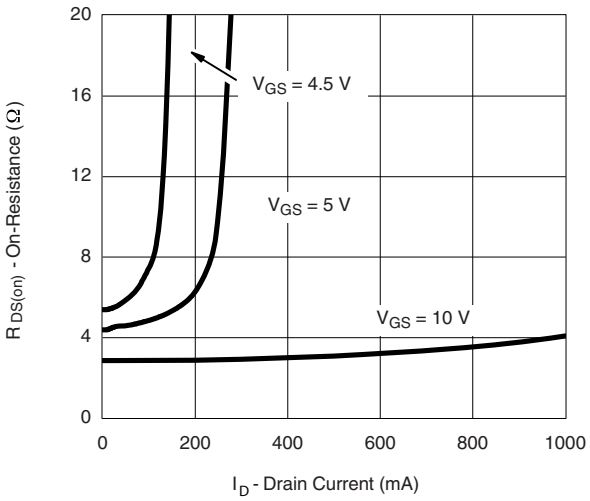
P-CHANNEL TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



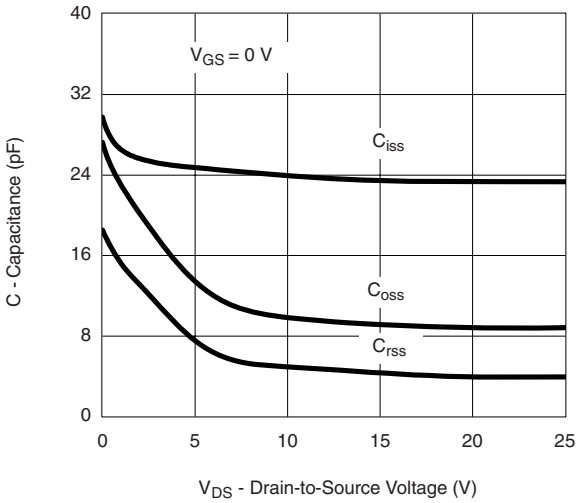
Output Characteristics



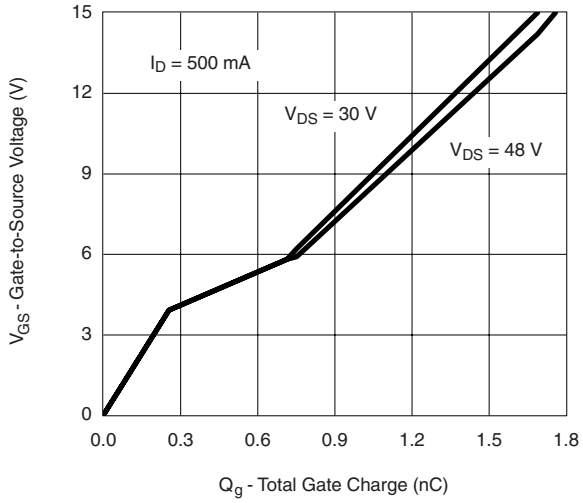
Transfer Characteristics



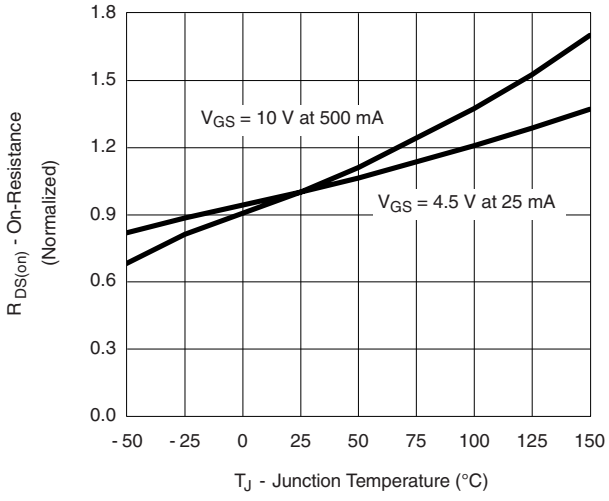
On-Resistance vs. Drain Current



Capacitance

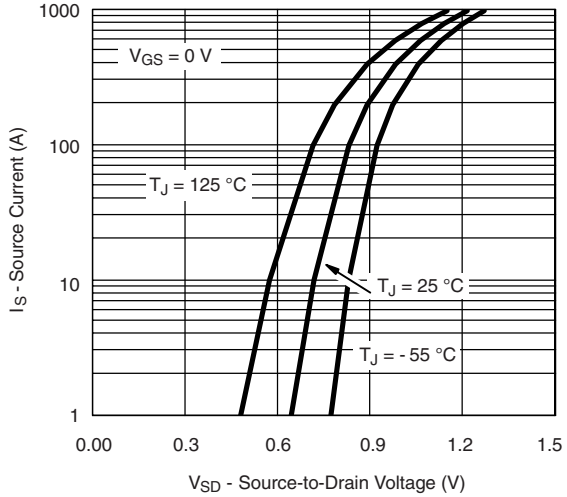


Gate Charge

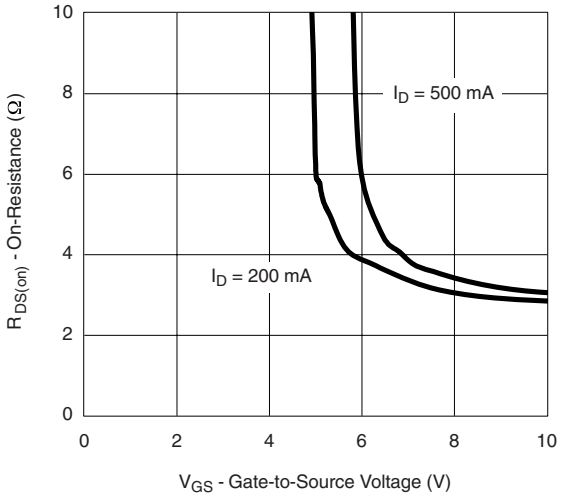


On-Resistance vs. Junction Temperature

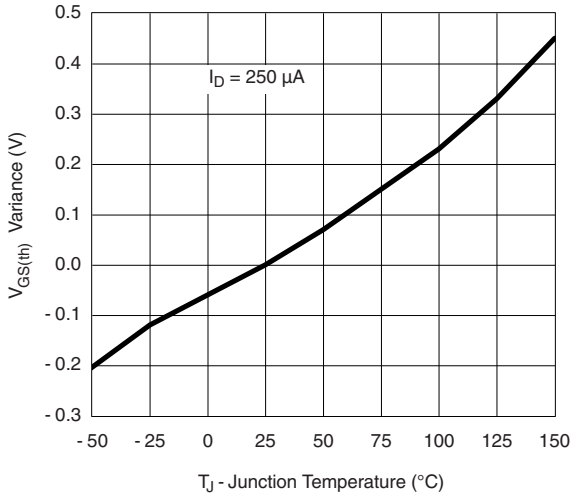
P-CHANNEL TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



Source-Drain Diode Forward Voltage

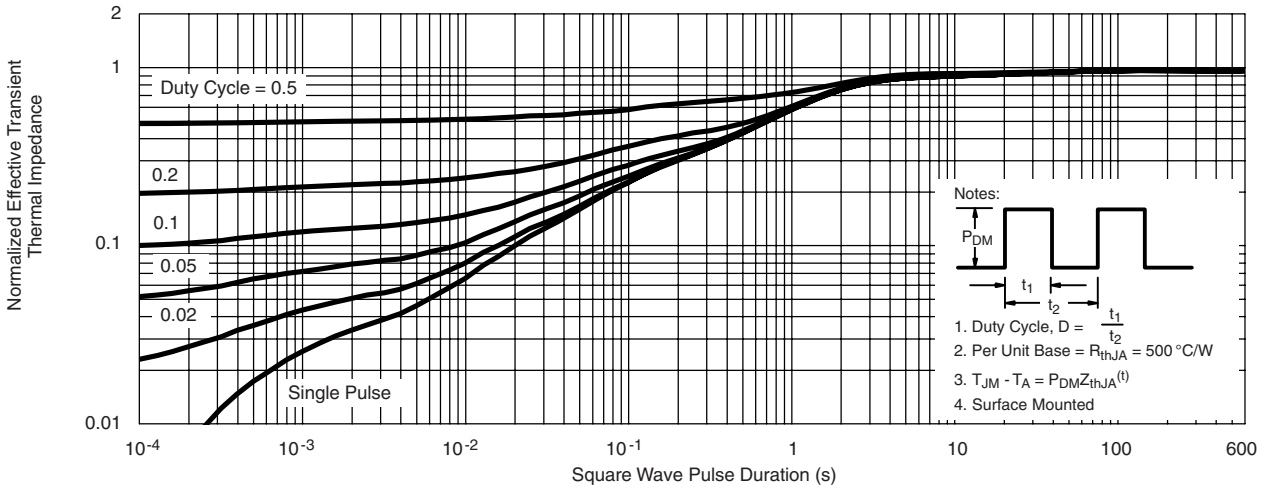


On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage Variance Over Temperature

N- OR P-CHANNEL TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



Normalized Thermal Transient Impedance, Junction-to-Ambient

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