

## N- and P-Channel 20-V (D-S) MOSFET

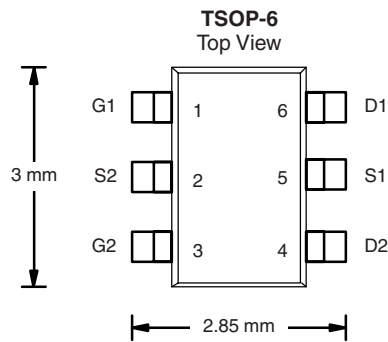
PRODUCT SUMMARY			
	$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
N-Channel	20	0.080 at $V_{GS} = 4.5$ V	3.0
		0.100 at $V_{GS} = 2.5$ V	2.6
		0.128 at $V_{GS} = 1.8$ V	2.3
P-Channel	- 20	0.145 at $V_{GS} = - 4.5$ V	- 2.2
		0.200 at $V_{GS} = - 2.5$ V	- 1.8
		0.300 at $V_{GS} = - 1.8$ V	- 1.5

### FEATURES

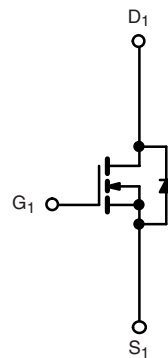
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFETs: 1.8 V Rated
- Compliant to RoHS Directive 2002/95/EC



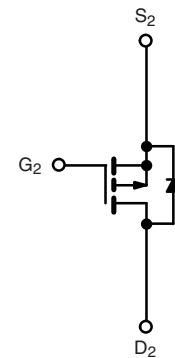
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available



**Ordering Information:** Si3588DV-T1-E3 (Lead (Pb)-free)  
Si3588DV-T1-GE3 (Lead (Pb)-free and Halogen-free)



N-Channel MOSFET



P-Channel MOSFET

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	$V_{DS}$	20		- 20		V	
Gate-Source Voltage	$V_{GS}$	$\pm 8$					
Continuous Drain Current ( $T_J = 150$ °C) <sup>a</sup>	$I_D$	$T_A = 25$ °C	3.0	2.5	- 2.2	- 0.57	A
		$T_A = 70$ °C	2.3	2.0	- 1.8	- 1.5	
Pulsed Drain Current	$I_{DM}$	$\pm 8$				A	
Continuous Source Current (Diode Conduction) <sup>a</sup>	$I_S$	1.05	0.75	- 1.05	- 0.75		
Maximum Power Dissipation <sup>a</sup>	$P_D$	$T_A = 25$ °C	1.15	0.83	1.15	0.083	W
		$T_A = 70$ °C	0.73	0.53	0.73	0.53	
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 <sup>a</sup>	$R_{thJA}$	$t \leq 5$ s	93	110	°C/W
		Steady State	130	150	
Maximum Junction-to-Foot (Drain)	$R_{thJF}$	90	90		

Notes:

a. Surface Mounted on 1" x 1" FR4 board.

SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted							
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
<b>Static</b>							
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	N-Ch	0.45			V
		$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	P-Ch	-0.45			
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\ \text{V}, V_{GS} = \pm 8\ \text{V}$	N-Ch			$\pm 100$	nA
		$V_{DS} = 0\ \text{V}, V_{GS} = \pm 8\ \text{V}$	P-Ch			$\pm 100$	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 16\ \text{V}, V_{GS} = 0\ \text{V}$	N-Ch			1	$\mu\text{A}$
		$V_{DS} = -16\ \text{V}, V_{GS} = 0\ \text{V}$	P-Ch			-1	
		$V_{DS} = 16\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 85\text{ }^\circ\text{C}$	N-Ch			10	
		$V_{DS} = -16\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 85\text{ }^\circ\text{C}$	P-Ch			-10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\ \text{V}, V_{GS} = 4.5\ \text{V}$	N-Ch	5			A
		$V_{DS} \leq -5\ \text{V}, V_{GS} = -4.5\ \text{V}$	P-Ch	-5			
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 4.5\ \text{V}, I_D = 3\ \text{A}$	N-Ch		0.064	0.080	$\Omega$
		$V_{GS} = -4.5\ \text{V}, I_D = -2.2\ \text{A}$	P-Ch		0.115	0.145	
		$V_{GS} = 2.5\ \text{V}, I_D = 2.6\ \text{A}$	N-Ch		0.080	0.100	
		$V_{GS} = -2.5\ \text{V}, I_D = -1.8\ \text{A}$	P-Ch		0.163	0.200	
		$V_{GS} = 1.8\ \text{V}, I_D = 2.3\ \text{A}$	N-Ch		0.104	0.128	
		$V_{GS} = -1.8\ \text{V}, I_D = -1.0\ \text{A}$	P-Ch		0.240	0.300	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 5\ \text{V}, I_D = 3\ \text{A}$	N-Ch		9		S
		$V_{DS} = -5\ \text{V}, I_D = -2.2\ \text{A}$	P-Ch		5		
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = 1.05\ \text{A}, V_{GS} = 0\ \text{V}$	N-Ch		0.8	1.1	V
		$I_S = -1.05\ \text{A}, V_{GS} = 0\ \text{V}$	P-Ch		-0.8	-1.1	
<b>Dynamic<sup>b</sup></b>							
Total Gate Charge	$Q_g$	N-Channel $V_{DS} = 10\ \text{V}, V_{GS} = 4.5\ \text{V}, I_D = 3\ \text{A}$	N-Ch		5	7.5	nC
Gate-Source Charge	$Q_{gs}$		P-Ch		5	7.5	
Gate-Drain Charge	$Q_{gd}$	P-Channel $V_{DS} = -10\ \text{V}, V_{GS} = -4.5\ \text{V}, I_D = -2.2\ \text{A}$	N-Ch		0.65		
			P-Ch		1.0		
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 10\ \text{V}, R_L = 10\ \Omega$ $I_D \cong 0.5\ \text{A}, V_{GEN} = 4.5\ \text{V}, R_g = 6\ \Omega$	N-Ch		12	20	ns
			P-Ch		12	20	
Rise Time	$t_r$	P-Channel $V_{DD} = -4\ \text{V}, R_L = 8\ \Omega$ $I_D \cong -1\ \text{A}, V_{GEN} = -4.5\ \text{V}, R_g = 6\ \Omega$	N-Ch		30	50	
			P-Ch		29	50	
Turn-Off Delay Time	$t_{d(off)}$	N-Channel $V_{DD} = 10\ \text{V}, R_L = 10\ \Omega$ $I_D \cong 0.5\ \text{A}, V_{GEN} = 4.5\ \text{V}, R_g = 6\ \Omega$	N-Ch		28	50	
			P-Ch		24	45	
Fall Time	$t_f$	P-Channel $V_{DD} = -4\ \text{V}, R_L = 8\ \Omega$ $I_D \cong -1\ \text{A}, V_{GEN} = -4.5\ \text{V}, R_g = 6\ \Omega$	N-Ch		12	20	
			P-Ch		30	50	
Source-Drain Reverse Recovery Time	$t_{rr}$	$I_F = 1.05\ \text{A}, dI/dt = 100\ \text{A}/\mu\text{s}$	N-Ch		20	40	
		$I_F = -1.05\ \text{A}, dI/dt = 100\ \text{A}/\mu\text{s}$	P-Ch		20	40	

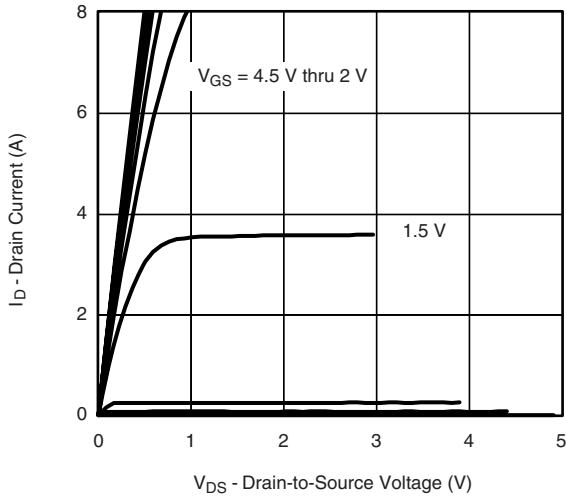
Notes:

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

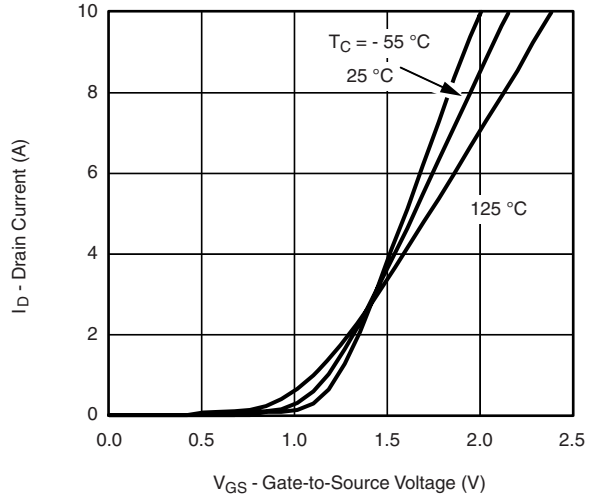
b. Guaranteed by design, not subject to production testing.

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.

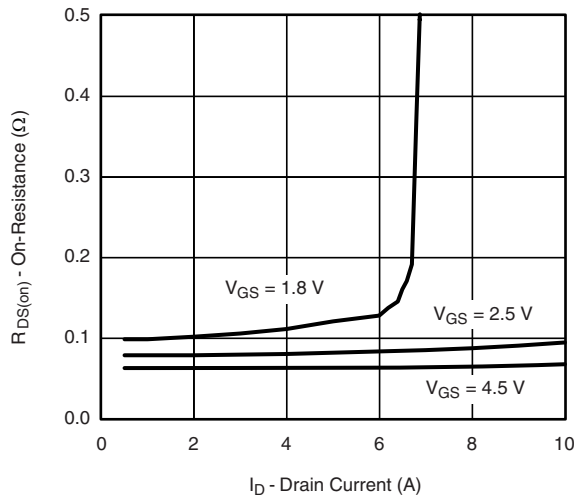
## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



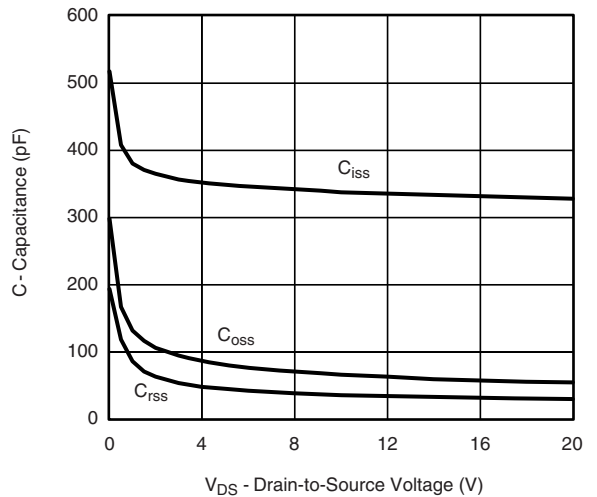
**Output Characteristics**



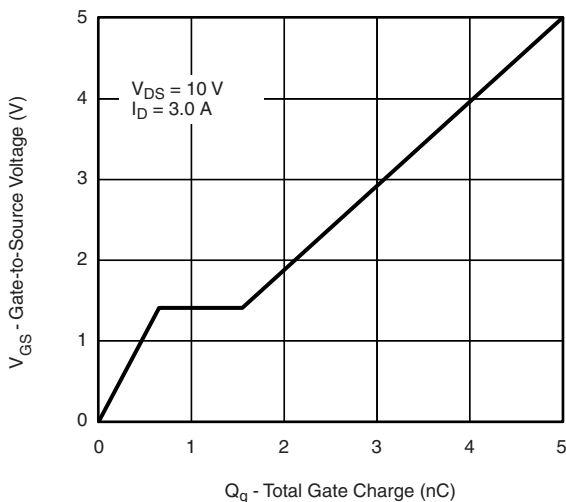
**Transfer Characteristics**



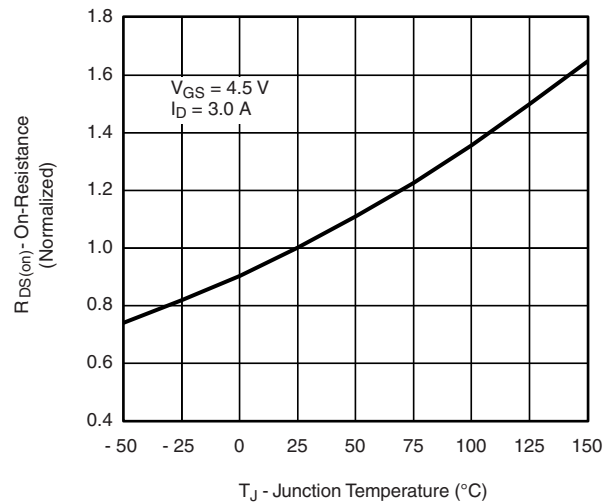
**On-Resistance vs. Drain Current**



**Capacitance**

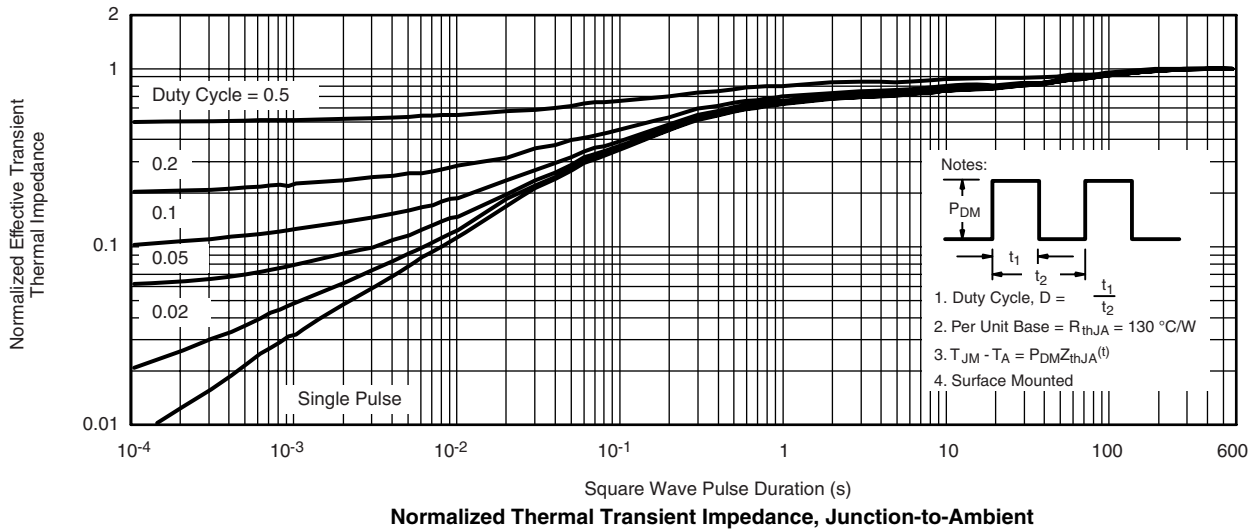
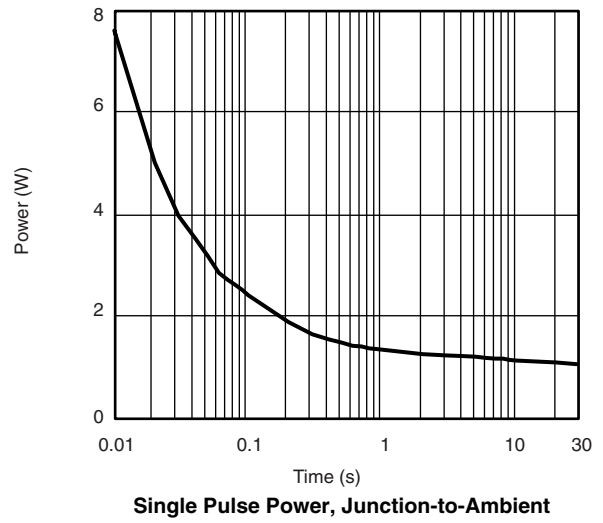
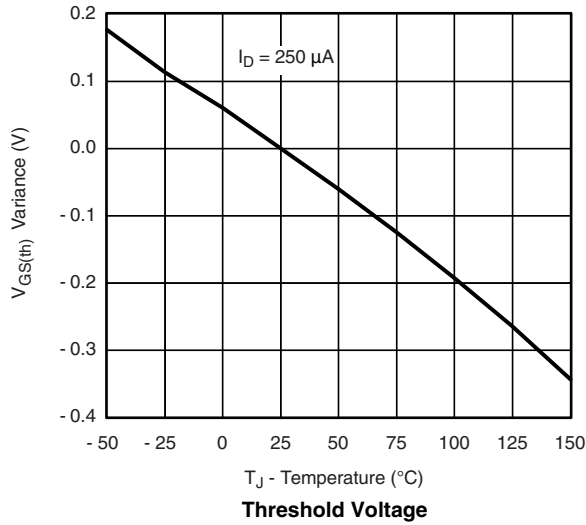
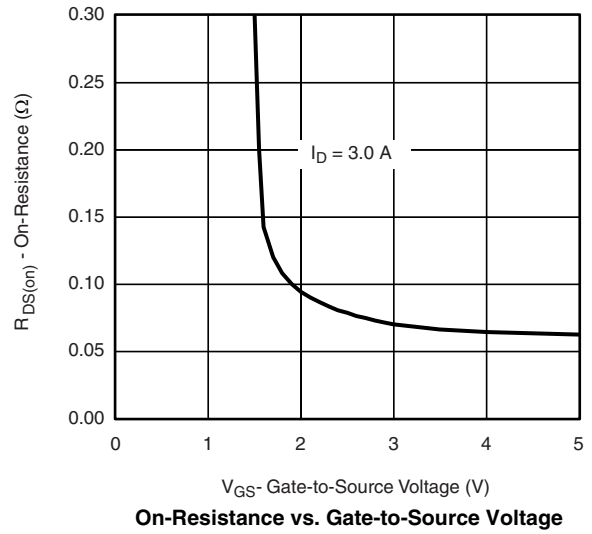
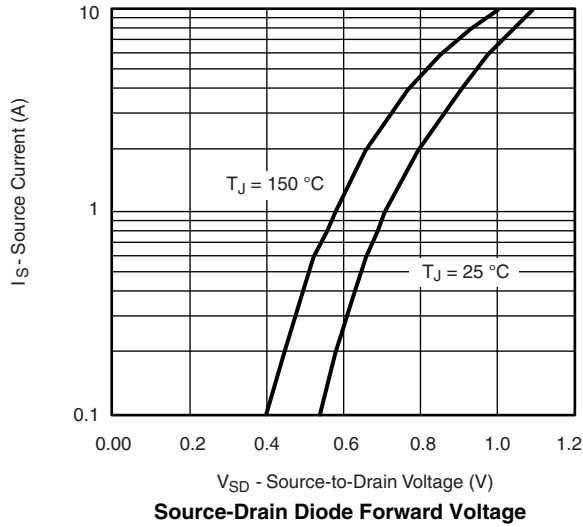


**Gate Charge**

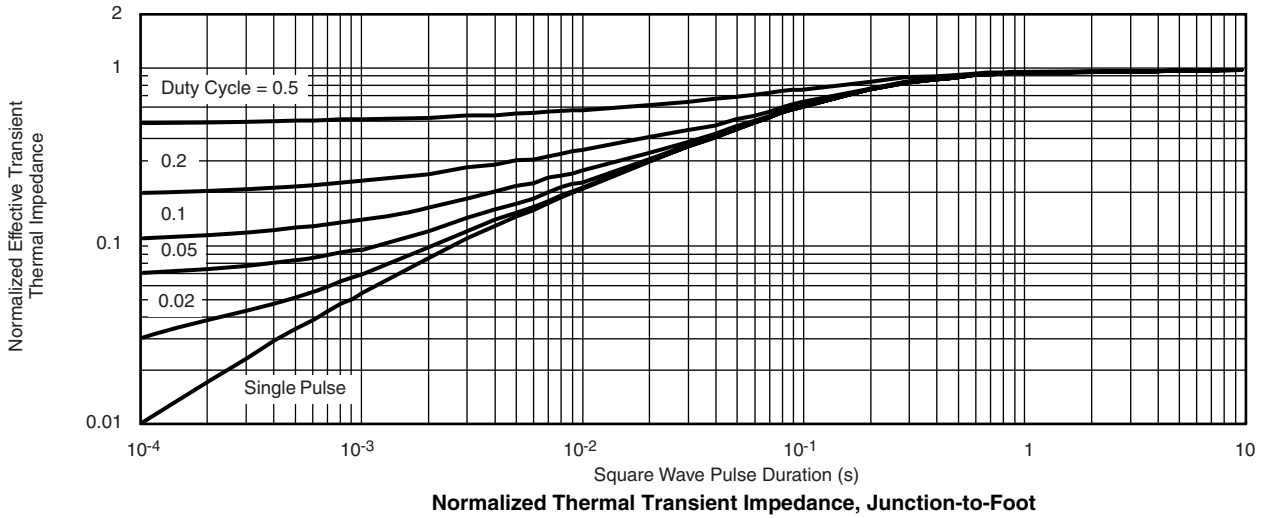


**On-Resistance vs. Junction Temperature**

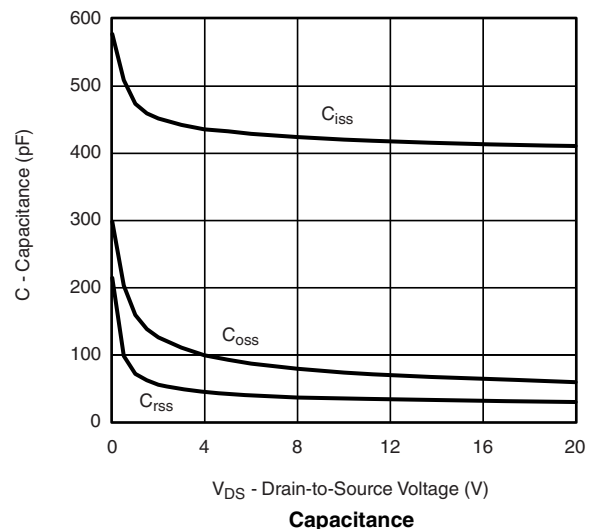
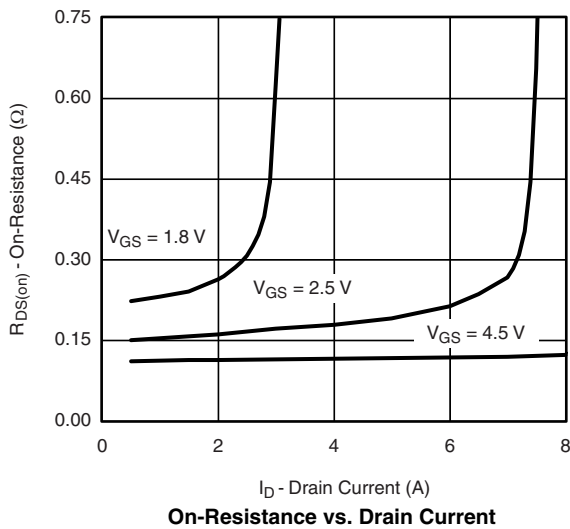
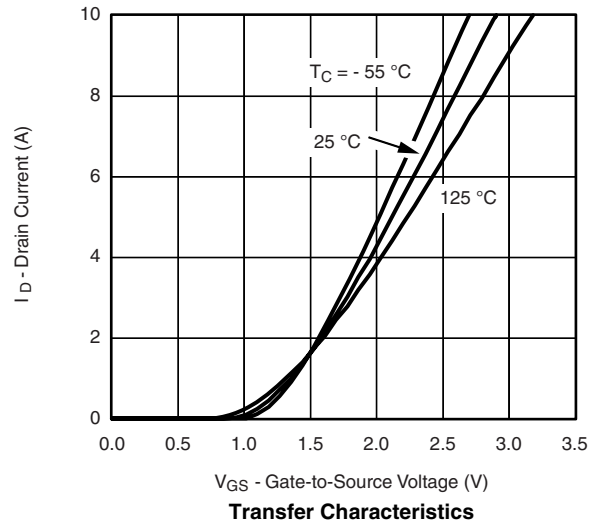
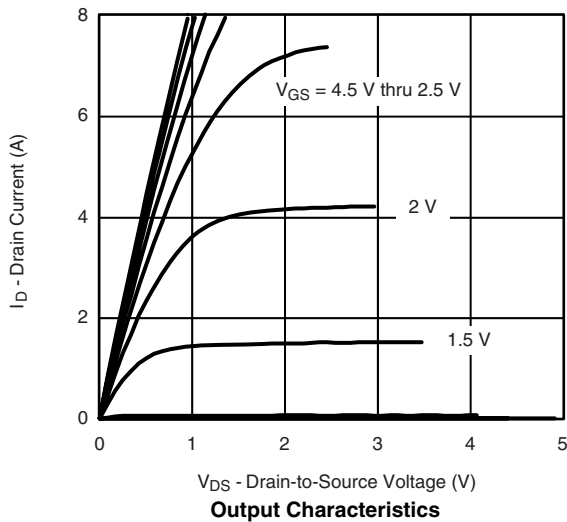
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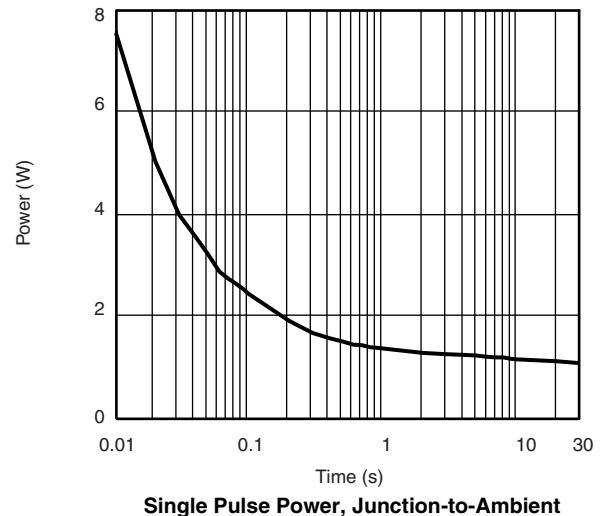
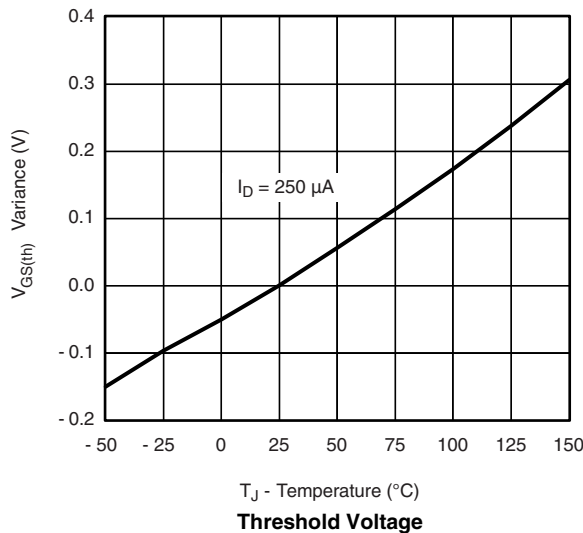
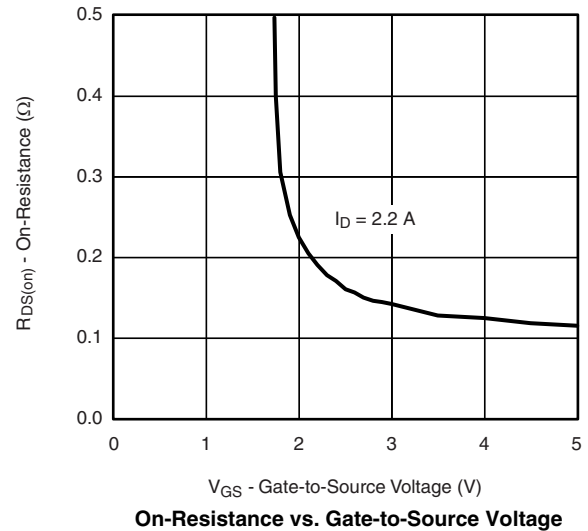
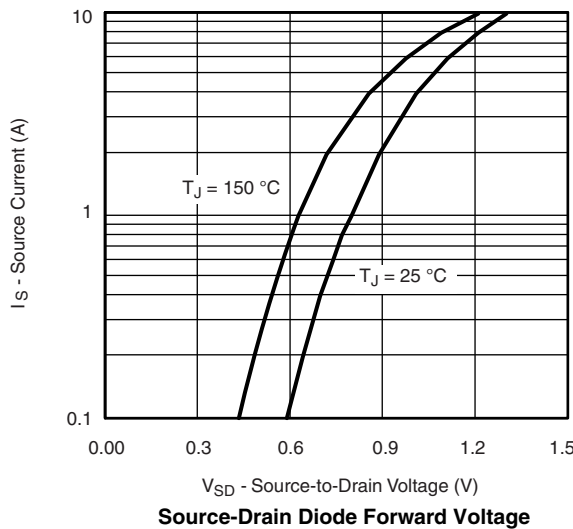
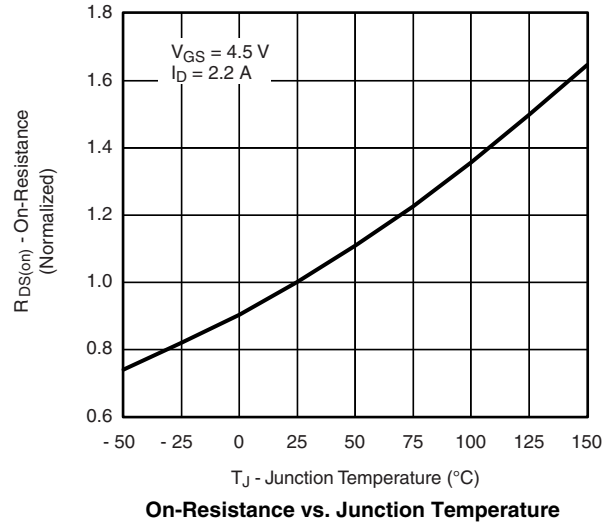
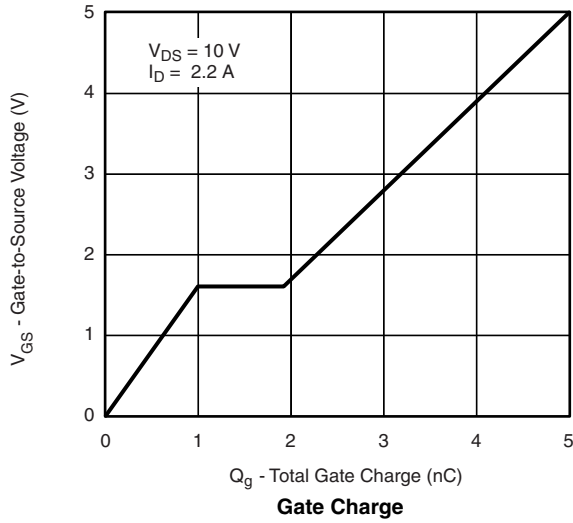
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



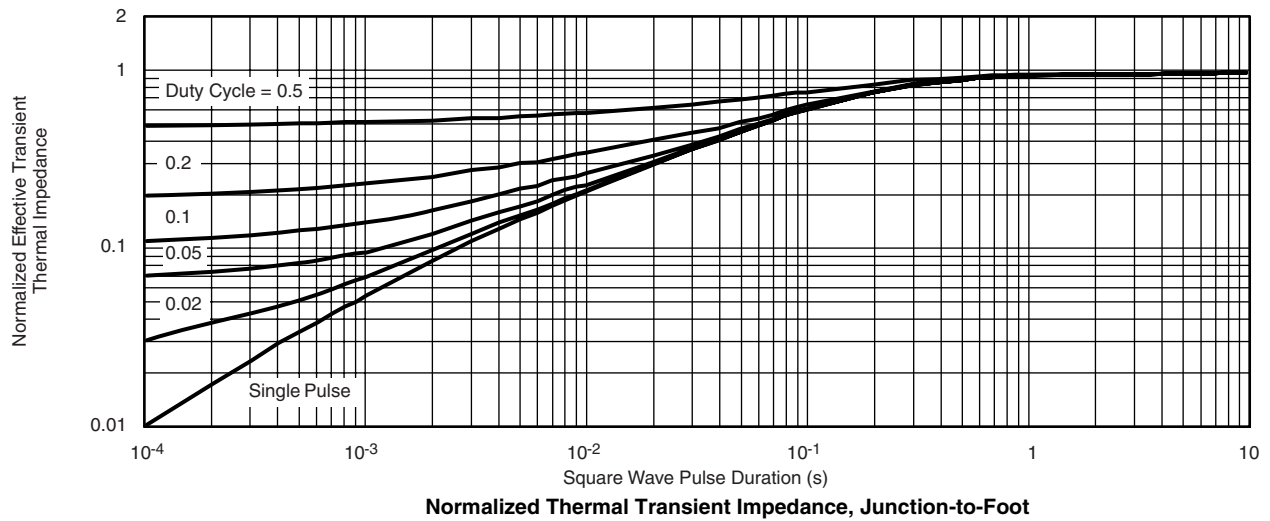
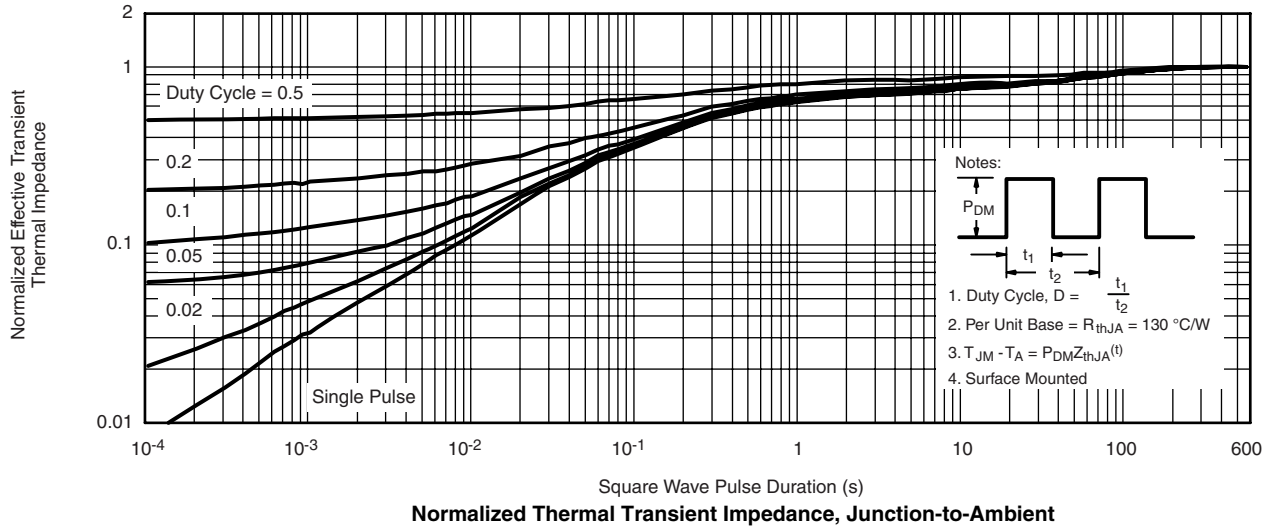
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



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