

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

PRODUCT SUMMARY			
	V <sub>DS</sub> (V)	r <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)
N-Channel	20	0.060 at V <sub>GS</sub> = 4.5 V	3.4
		0.070 at V <sub>GS</sub> = 2.5 V	3.2
		0.100 at V <sub>GS</sub> = 1.8 V	2.5
P-Channel	- 20	0.110 at V <sub>GS</sub> = - 4.5 V	- 2.5
		0.145 at V <sub>GS</sub> = - 2.5 V	- 2.0
		0.220 at V <sub>GS</sub> = - 1.8V	- 1.0

### FEATURES

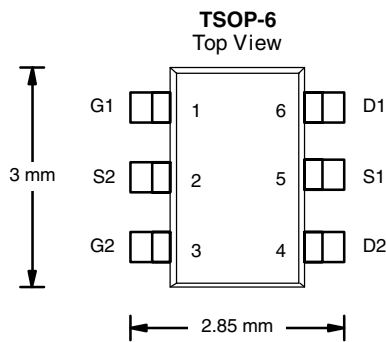
- TrenchFET<sup>®</sup> Power MOSFET
- Fast Switching In Small Footprint
- Very Low r<sub>DS(on)</sub> for Increased Efficiency



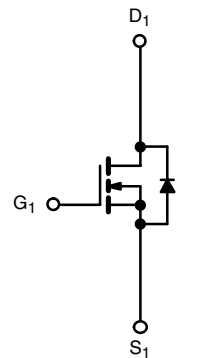
**RoHS**  
COMPLIANT

### APPLICATIONS

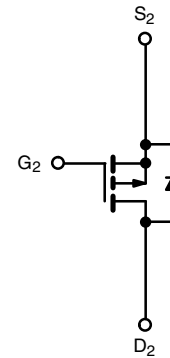
- Load Switch for Portable Devices



Ordering Information: Si3586DV-T1-E3 (Lead (Pb)-free)



N-Channel MOSFET



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted							
Parameter	Symbol	N-Channel		P-Channel		Unit	
		5 sec	Steady State	5 sec	Steady State		
Drain-Source Voltage	V <sub>DS</sub>	20		- 20		V	
Gate-Source Voltage	V <sub>GS</sub>	± 8					
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	I <sub>D</sub>	T <sub>A</sub> = 25 °C	3.4	2.9	- 2.5	- 2.1	A
		T <sub>A</sub> = 70 °C	2.7	2.3	- 2.0	- 1.7	
Pulsed Drain Current	I <sub>DM</sub>	± 8				W	
Continuous Source Current (Diode Conduction) <sup>a</sup>	I <sub>S</sub>	1.05	0.75	- 1.05	- 0.75		
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>A</sub> = 25 °C	1.15	0.83	1.15	0.83	W
		T <sub>A</sub> = 70 °C	0.73	0.53	0.73	0.53	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150				°C	

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a</sup>	t ≤ 5 sec	R <sub>thJA</sub>	93	110	°C/W
	Steady State		130	150	
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	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	0.40		1.1	V
		$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	P-Ch	-0.40		-1.1	
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	$I_{DSS}$	$V_{DS} = 20\ \text{V}, V_{GS} = 0\ \text{V}$	N-Ch			1	$\mu\text{A}$
		$V_{DS} = -20\ \text{V}, V_{GS} = 0\ \text{V}$	P-Ch			-1	
		$V_{DS} = 20\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 85\text{ }^\circ\text{C}$	N-Ch			10	
		$V_{DS} = -20\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 85\text{ }^\circ\text{C}$	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>	$r_{DS(on)}$	$V_{GS} = 4.5\ \text{V}, I_D = 3.4\ \text{A}$	N-Ch		0.047	0.060	$\Omega$
		$V_{GS} = -4.5\ \text{V}, I_D = -2.5\ \text{A}$	P-Ch		0.086	0.110	
		$V_{GS} = 2.5\ \text{V}, I_D = 3.2\ \text{A}$	N-Ch		0.054	0.070	
		$V_{GS} = -2.5\ \text{V}, I_D = -2.0\ \text{A}$	P-Ch		0.116	0.145	
		$V_{GS} = -1.8\ \text{V}, I_D = -2.5\ \text{A}$	N-Ch		0.075	0.100	
		$V_{GS} = -1.8\ \text{V}, I_D = -1.0\ \text{A}$	P-Ch		0.170	0.220	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 5\ \text{V}, I_D = 3.4\ \text{A}$	N-Ch		13		S
		$V_{DS} = -5\ \text{V}, I_D = -2.5\ \text{A}$	P-Ch		6		
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 $V_{DS} = 10\ \text{V}, V_{GS} = 4.5\ \text{V}, I_D = 3.4\ \text{A}$	N-Ch		4.1	6.0	nC
Gate-Source Charge	$Q_{gs}$		P-Ch		5	7.5	
Gate-Drain Charge	$Q_{gd}$	P-Channel $V_{DS} = -10\ \text{V}, V_{GS} = -4.5\ \text{V}, I_D = -2.5\ \text{A}$	N-Ch		0.65		
			P-Ch		0.68		
Gate Resistance	$R_g$		N-Ch		2.6		$\Omega$
			P-Ch		9.8		
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 10\ \text{V}, R_L = 10\ \Omega$ $I_D \cong 1\ \text{A}, V_{GEN} = 4.5\ \text{V}, R_G = 6\ \Omega$	N-Ch		30	45	ns
Rise Time	$t_r$		P-Ch		28	45	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -10\ \text{V}, R_L = 10\ \Omega$ $I_D \cong -1\ \text{A}, V_{GEN} = -4.5\ \text{V}, R_G = 6\ \Omega$	N-Ch		52	85	
			P-Ch		55	85	
Fall Time	$t_f$		N-Ch		25	40	
			P-Ch		55	85	
Source-Drain Reverse Recovery Time	$t_{rr}$		N-Ch		20	30	
			P-Ch		32	50	
			N-Ch		25	40	
			P-Ch		25	40	

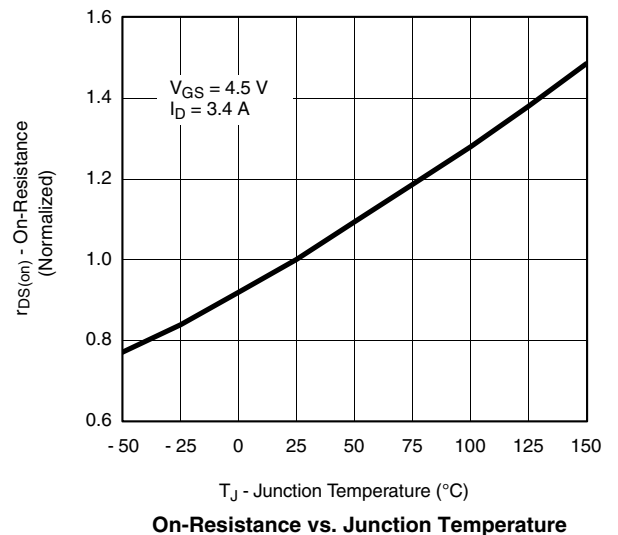
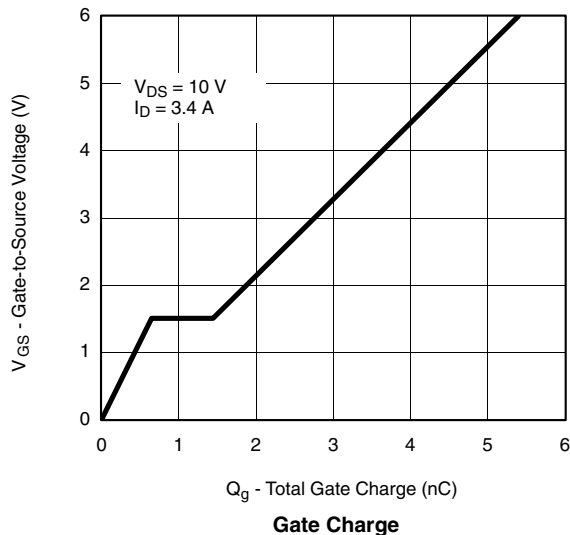
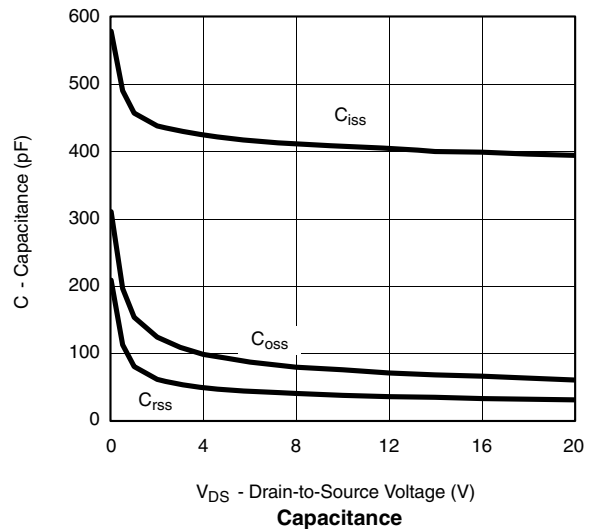
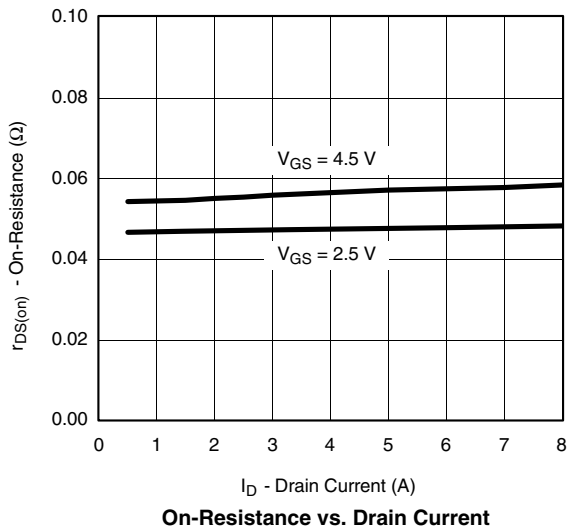
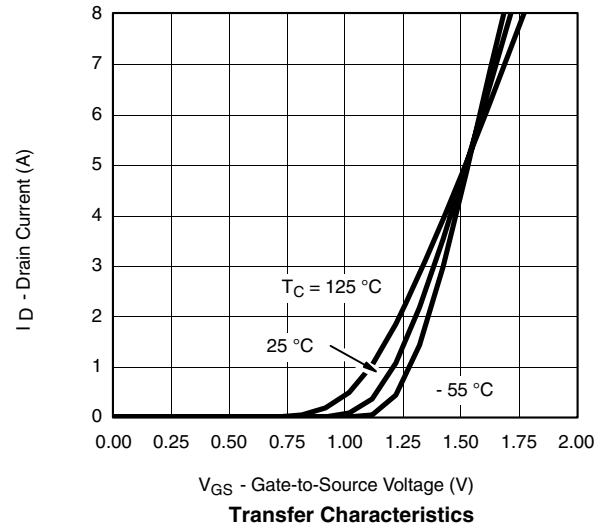
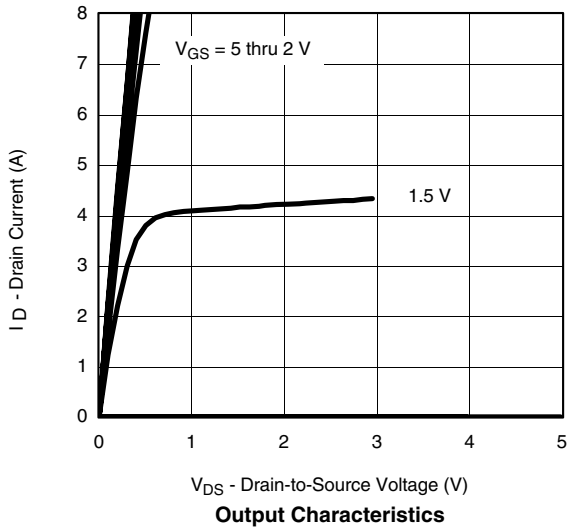
## Notes:

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

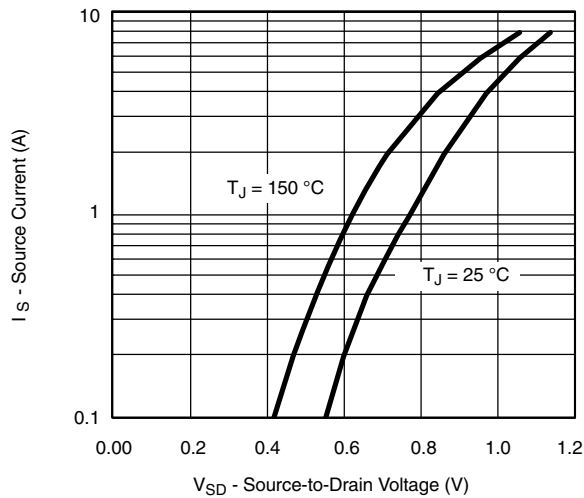
b. Guaranteed by design, not subject to production testing.

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.

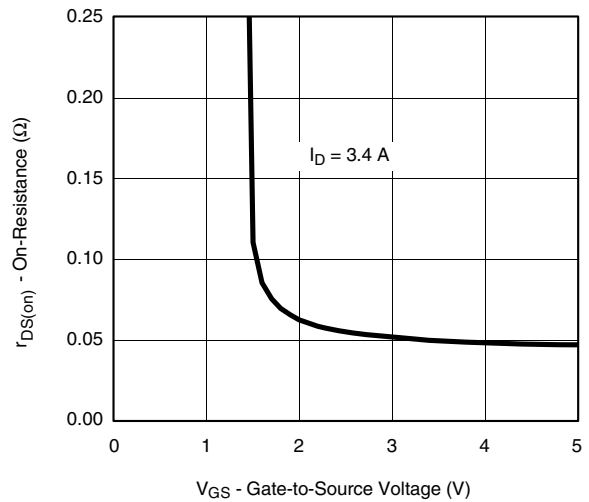
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C unless noted



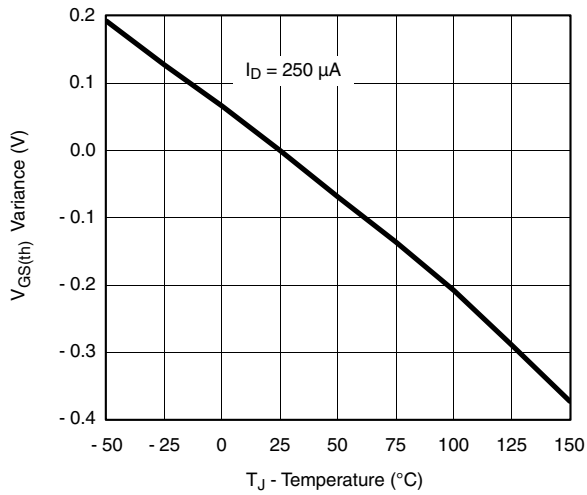
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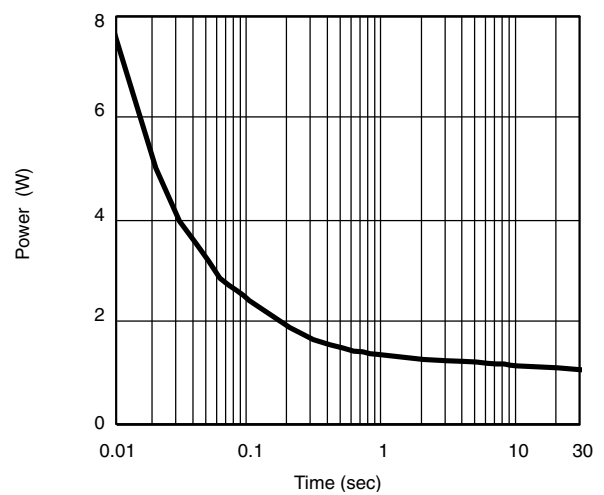
Source-Drain Diode Forward Voltage



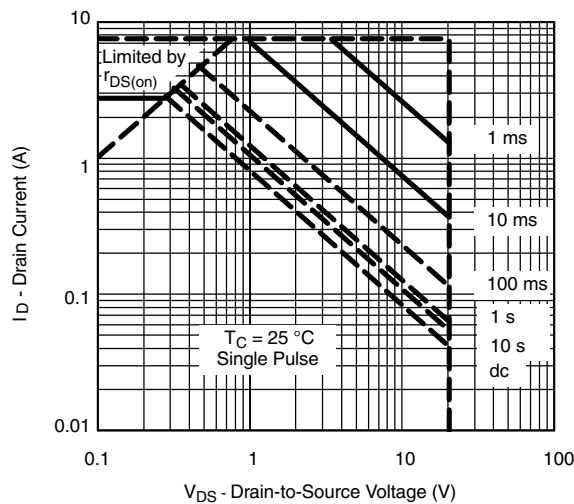
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



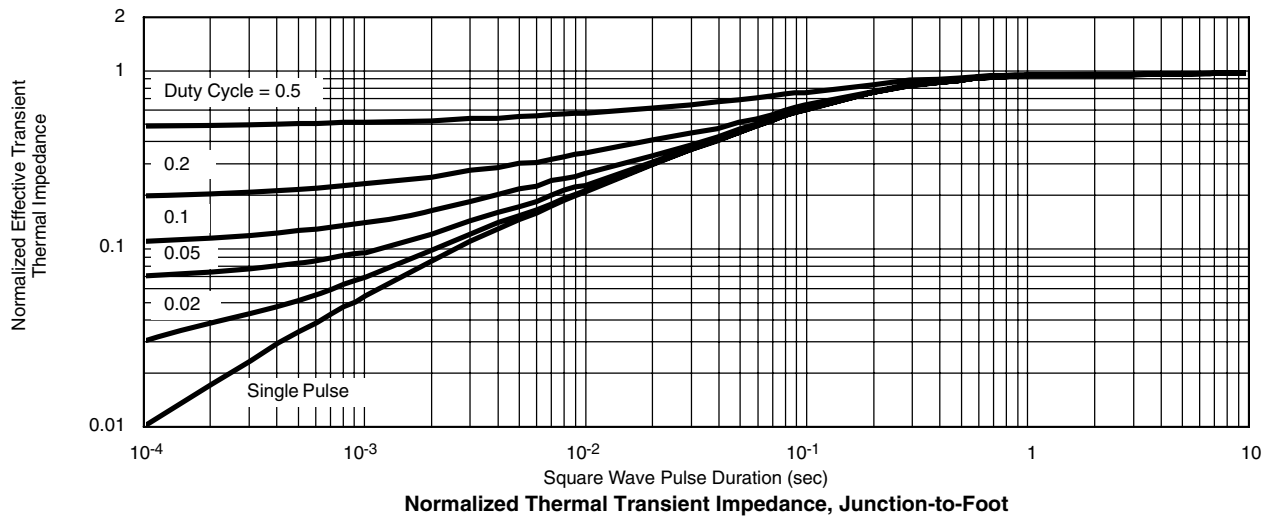
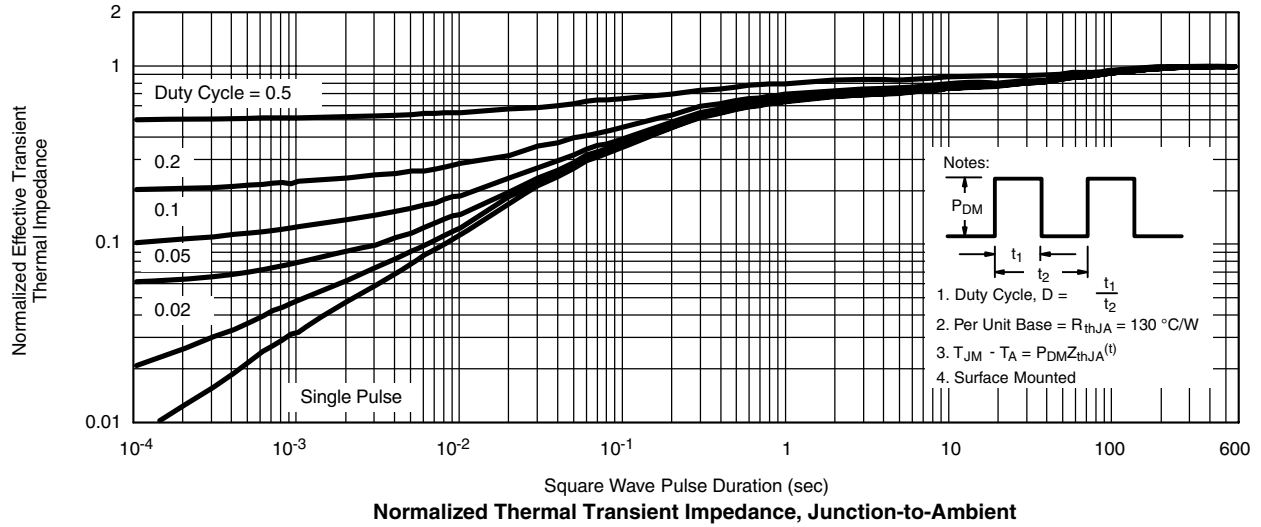
Single Pulse Power (Junction-to-Ambient)



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

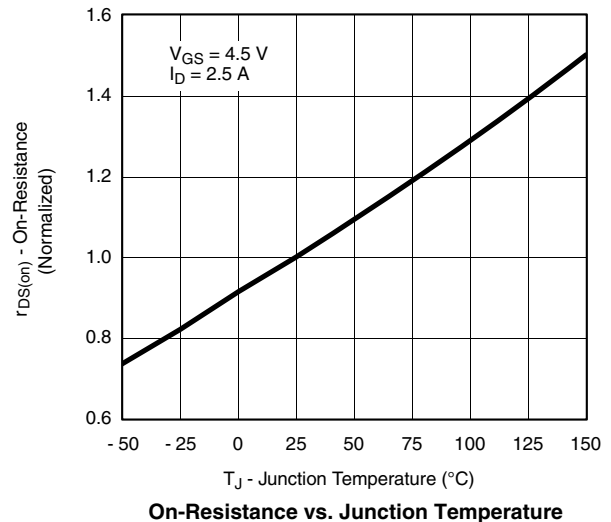
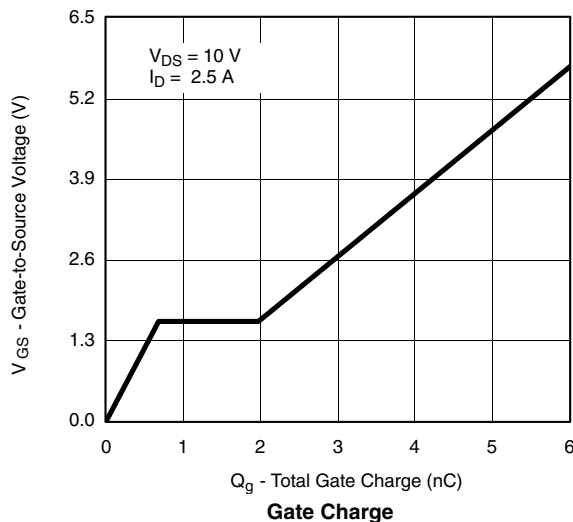
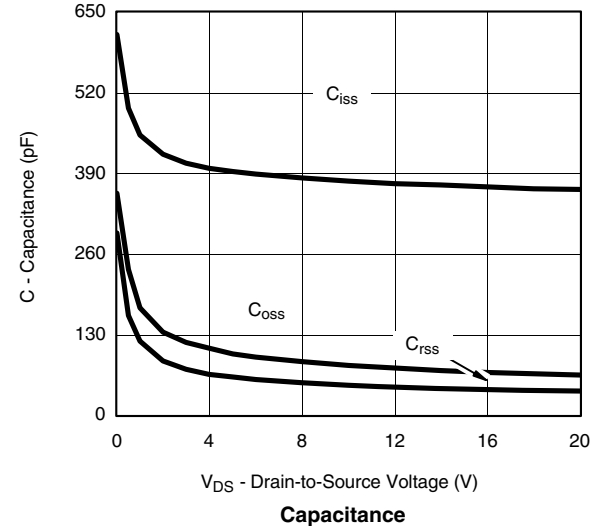
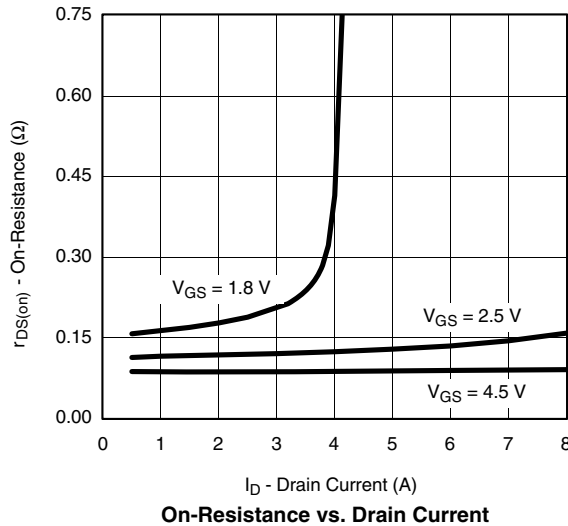
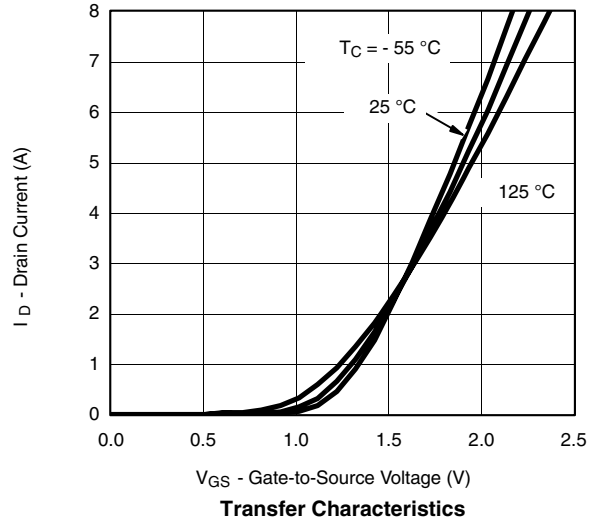
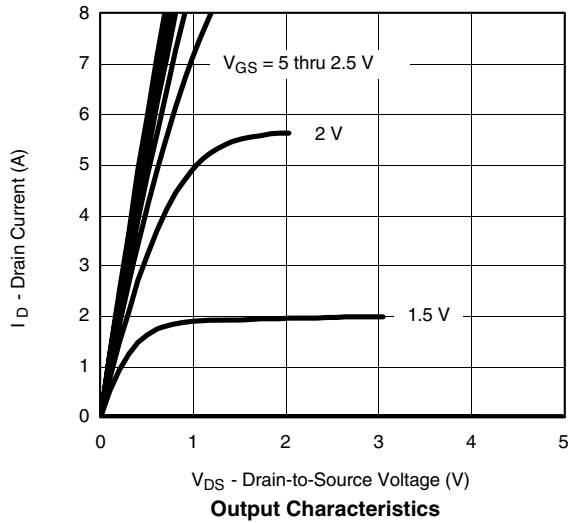
Safe Operating Area, Junction-to-Case

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

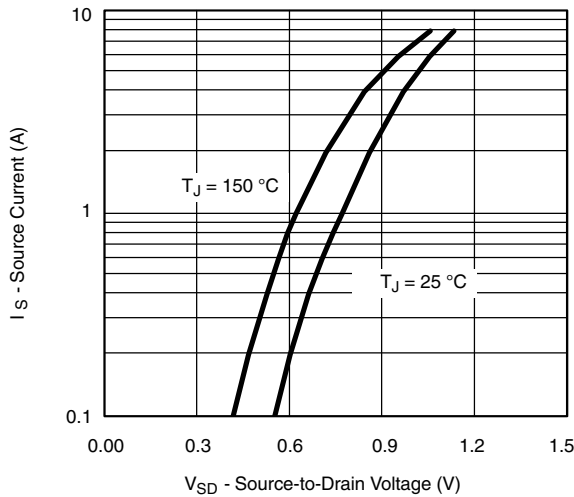




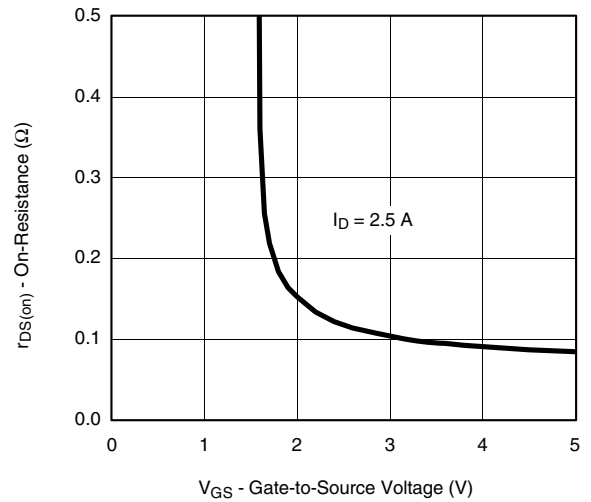
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C unless noted



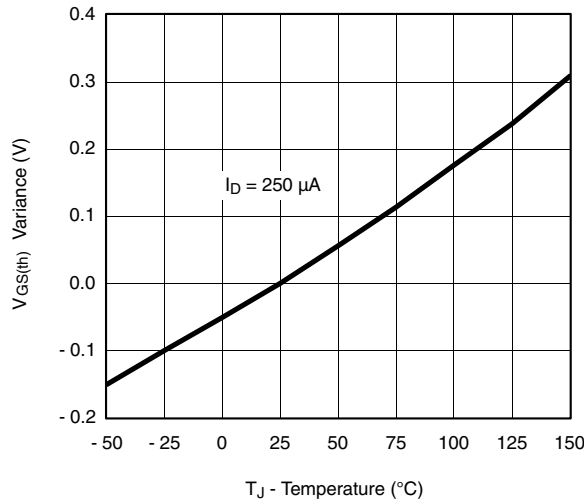
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C unless noted



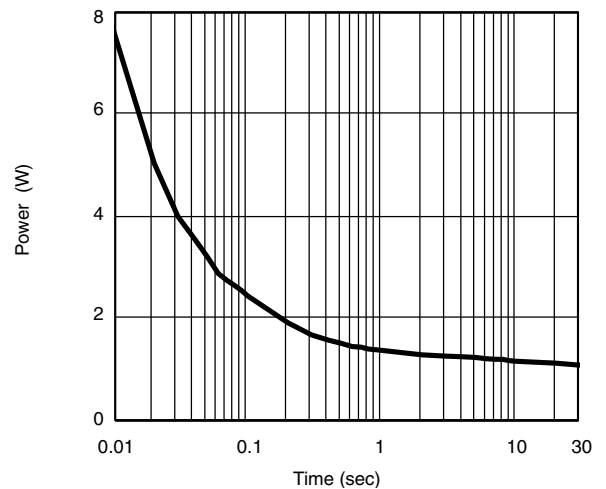
Source-Drain Diode Forward Voltage



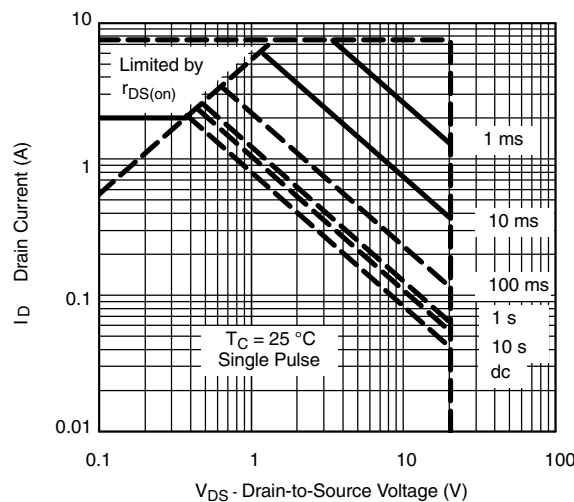
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power (Junction-to-Ambient)

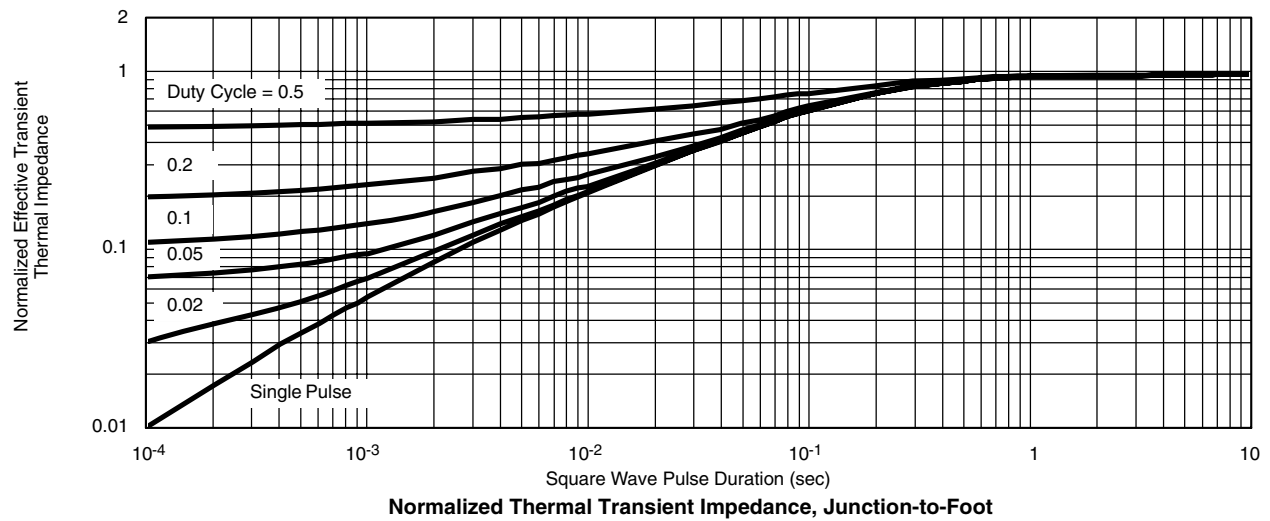
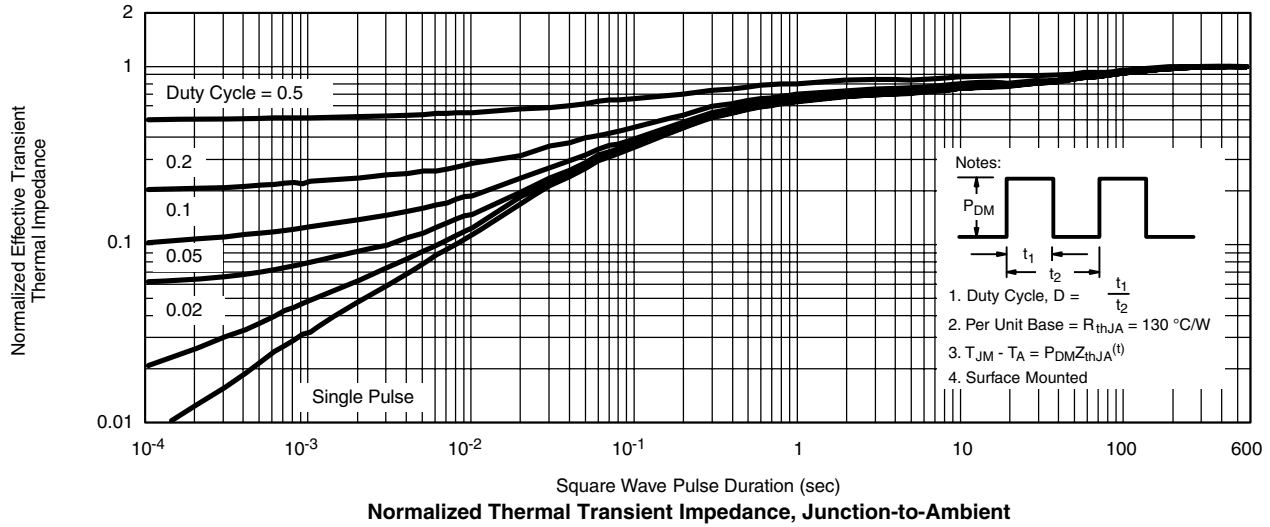


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $r_{DS(on)}$  is specified

Safe Operating Area, Junction-to-Case



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



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