

## N- and P-Channel MOSFET

PRODUCT SUMMARY			
	V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)
N-Channel	30	0.018 at V <sub>GS</sub> = 10 V	7.8
		0.027 at V <sub>GS</sub> = 4.5 V	6.4
P-Channel	- 8	0.042 at V <sub>GS</sub> = - 4.5 V	- 5.0
		0.060 at V <sub>GS</sub> = - 2.5 V	- 4.0

### FEATURES

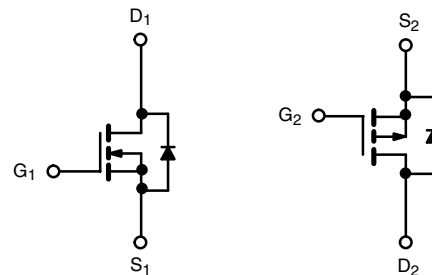
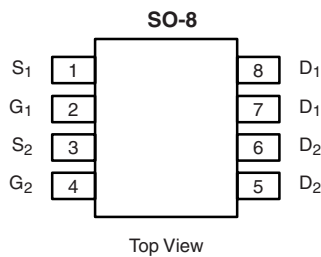
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- Compliant to RoHS Directive 2002/95/EC



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

### APPLICATIONS

- Level Shift
- Load Switch



Ordering Information: Si4505DY-T1-E3 (Lead (Pb)-free)  
Si4505DY-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted							
Parameter	Symbol	N-Channel		P-Channel		Unit	
		10 s	Steady State	10 s	Steady State		
Drain-Source Voltage	V <sub>DS</sub>	30		- 8		V	
Gate-Source Voltage	V <sub>GS</sub>	± 20		± 8			
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a, b</sup>	I <sub>D</sub>	T <sub>A</sub> = 25 °C	7.8	6.0	- 5.0	- 3.8	A
		T <sub>A</sub> = 70 °C	6.0	5.2	- 3.6	- 3.0	
Pulsed Drain Current	I <sub>DM</sub>	30		- 30		A	
Continuous Source Current (Diode Conduction) <sup>a, b</sup>	I <sub>S</sub>	1.8	1.0	- 1.8	- 1.0		
Maximum Power Dissipation <sup>a, b</sup>	P <sub>D</sub>	T <sub>A</sub> = 25 °C	2	1.20	2	1.2	W
		T <sub>A</sub> = 70 °C	1.3	0.75	1.3	0.75	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150				°C	

THERMAL RESISTANCE RATINGS							
Parameter	Symbol	N-Channel		P-Channel		Unit	
		Typ.	Max.	Typ.	Max.		
Maximum Junction-to-Ambient <sup>a</sup>	t ≤ 10 s	R <sub>thJA</sub>	50	62.5	50	62.5	°C/W
	Steady State		85	105	85	105	
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	30	40	30	40	

Notes:

a. Surface Mounted on FR4 board.

b. t ≤ 10 s.

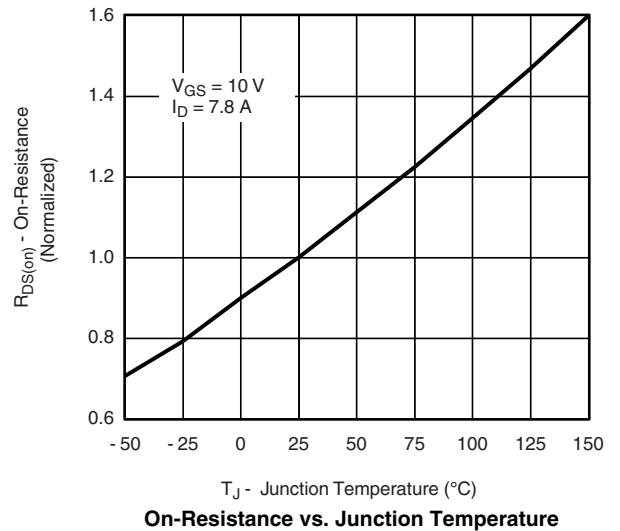
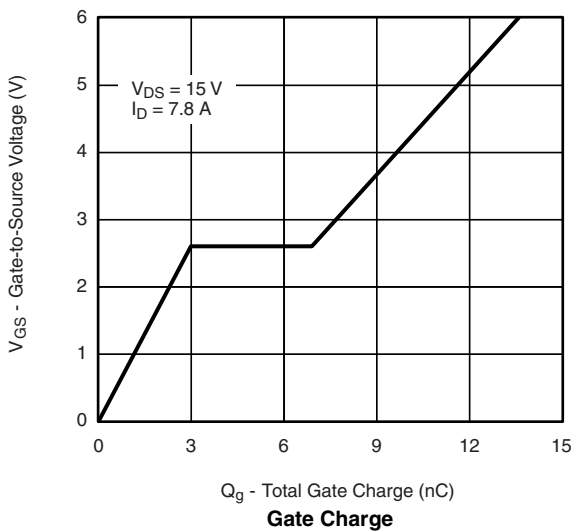
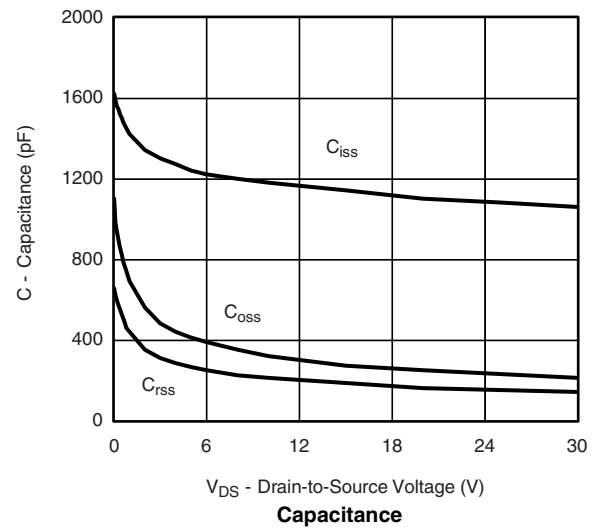
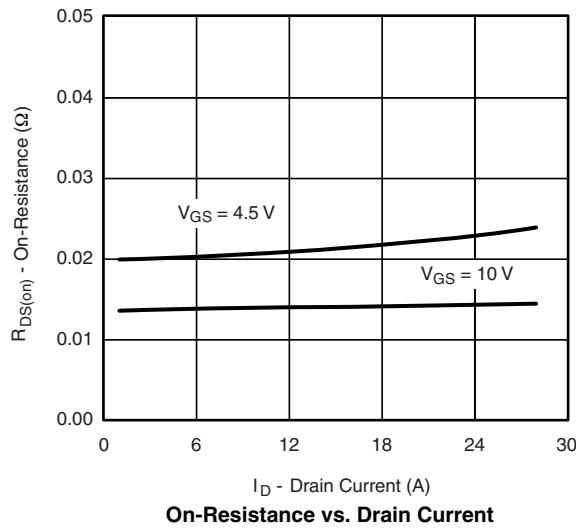
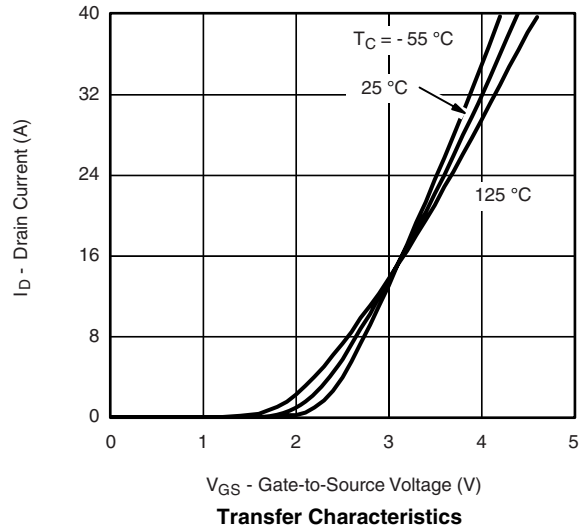
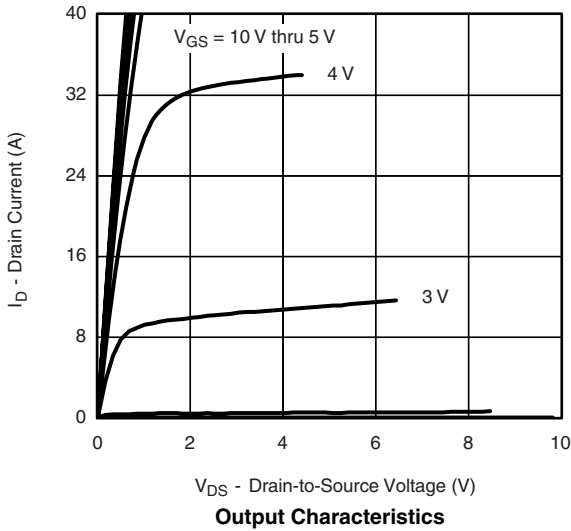
SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted								
Parameter	Symbol	Test Conditions		Min.	Typ. <sup>a</sup>	Max.	Unit	
<b>Static</b>								
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	N-Ch	0.8		1.8	V	
		$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	P-Ch	-0.45		-1.0		
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\ \text{V}, V_{GS} = \pm 20\ \text{V}$	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	$I_{DSS}$	$V_{DS} = 30\ \text{V}, V_{GS} = 0\ \text{V}$	N-Ch			1	$\mu\text{A}$	
		$V_{DS} = -8\ \text{V}, V_{GS} = 0\ \text{V}$	P-Ch			-1		
		$V_{DS} = 30\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 55\text{ }^\circ\text{C}$	N-Ch			5		
		$V_{DS} = -8\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 55\text{ }^\circ\text{C}$	P-Ch			-5		
On-State Drain Current <sup>b</sup>	$I_{D(on)}$	$V_{DS} = 5\ \text{V}, V_{GS} = 10\ \text{V}$	N-Ch	20			A	
		$V_{DS} = -5\ \text{V}, V_{GS} = -4.5\ \text{V}$	P-Ch	-20				
Drain-Source On-State Resistance <sup>b</sup>	$R_{DS(on)}$	$V_{GS} = 10\ \text{V}, I_D = 7.8\ \text{A}$	N-Ch		0.015	0.018	$\Omega$	
		$V_{GS} = -4.5\ \text{V}, I_D = -5.0\ \text{A}$	P-Ch		0.030	0.042		
		$V_{GS} = 4.5\ \text{V}, I_D = 6.4\ \text{A}$	N-Ch		0.022	0.027		
		$V_{GS} = -2.5\ \text{V}, I_D = -4.0\ \text{A}$	P-Ch		0.048	0.060		
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 15\ \text{V}, I_D = 7.8\ \text{A}$	N-Ch		18		S	
		$V_{DS} = -15\ \text{V}, I_D = -5.0\ \text{A}$	P-Ch		12			
Diode Forward Voltage <sup>b</sup>	$V_{SD}$	$I_S = 1.8\ \text{A}, V_{GS} = 0\ \text{V}$	N-Ch		0.73	1.1	V	
		$I_S = -1.8\ \text{A}, V_{GS} = 0\ \text{V}$	P-Ch		-0.75	-1.1		
<b>Dynamic<sup>a</sup></b>								
Total Gate Charge	$Q_g$	N-Channel $V_{DS} = 15\ \text{V}, V_{GS} = 5\ \text{V}, I_D = 7.8\ \text{A}$	N-Ch		11.5	20	nC	
			P-Ch		13.5	20		
Gate-Source Charge	$Q_{gs}$	P-Channel $V_{DS} = -4\ \text{V}, V_{GS} = -5\ \text{V}, I_D = -5.0\ \text{A}$	N-Ch		3		nC	
			P-Ch		2.2			
Gate-Drain Charge	$Q_{gd}$	P-Channel $V_{DS} = -4\ \text{V}, V_{GS} = -5\ \text{V}, I_D = -5.0\ \text{A}$	N-Ch		4		nC	
			P-Ch		3			
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 15\ \text{V}, R_L = 15\ \Omega$ $I_D \cong 1\ \text{A}, V_{GEN} = 10\ \text{V}, R_G = 6\ \Omega$	N-Ch		15	25	ns	
Rise Time	$t_r$		P-Ch		21	40		
		Turn-Off Delay Time	$t_{d(off)}$	N-Ch		8		15
Fall Time	$t_f$			P-Ch		45		70
		Source-Drain Reverse Recovery Time	$t_{rr}$	P-Channel $V_{DD} = -4\ \text{V}, R_L = 4\ \Omega$ $I_D \cong -1\ \text{A}, V_{GEN} = -4.5\ \text{V}, R_g = 6\ \Omega$	N-Ch			35
P-Ch					60	100		
Source-Drain Reverse Recovery Time	$t_{rr}$	N-Channel $I_F = 1.8\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$	N-Ch		10	20		ns
			P-Ch		55	85		
Source-Drain Reverse Recovery Time	$t_{rr}$	P-Channel $I_F = 1.8\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$	N-Ch		30	60	ns	
			P-Ch		50	100		

## Notes:

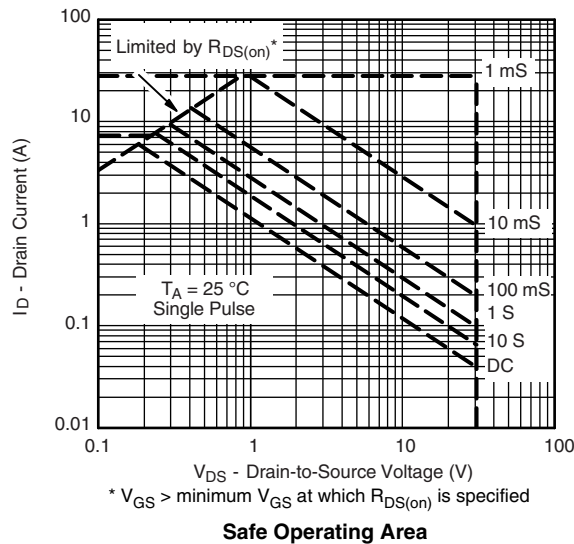
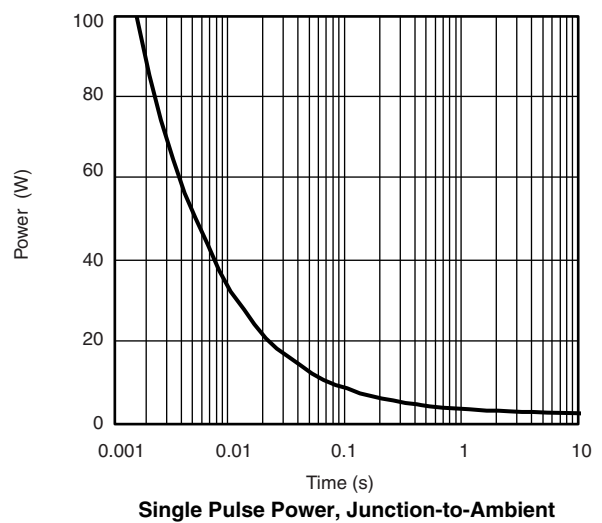
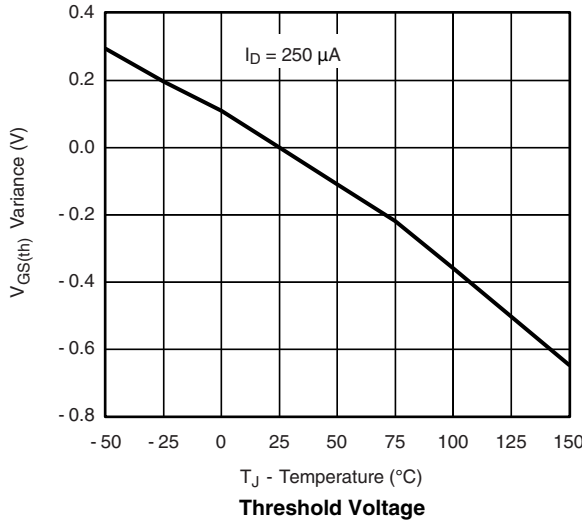
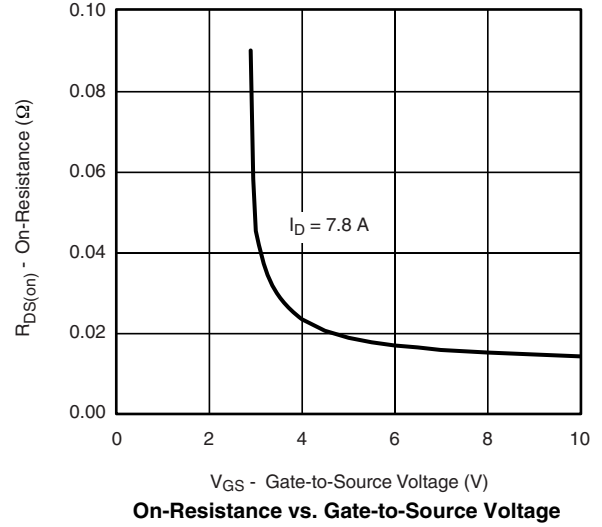
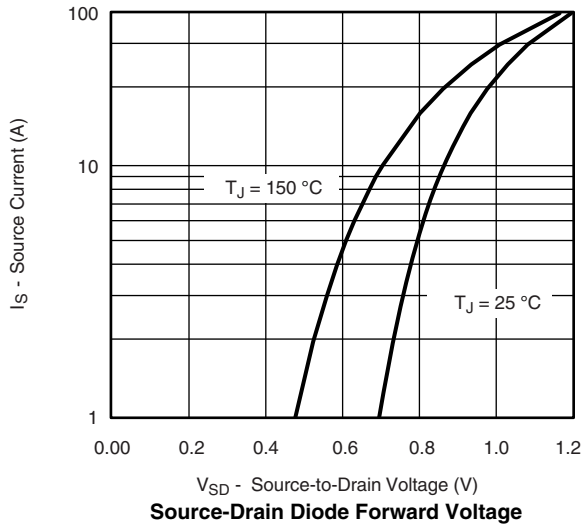
- a. Guaranteed by design, not subject to production testing.  
b. Pulse test; pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

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.

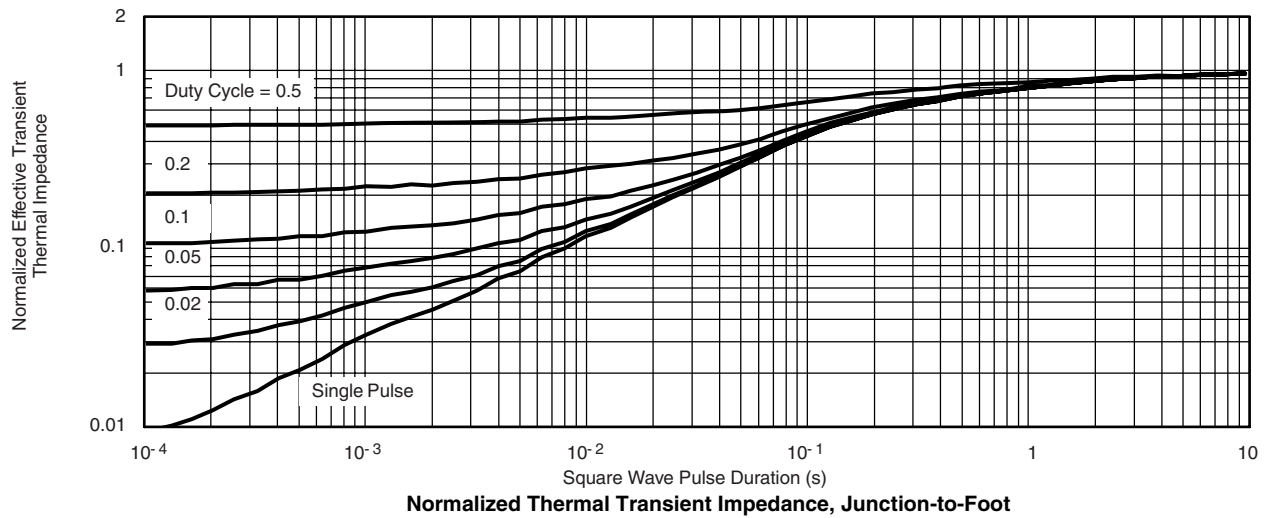
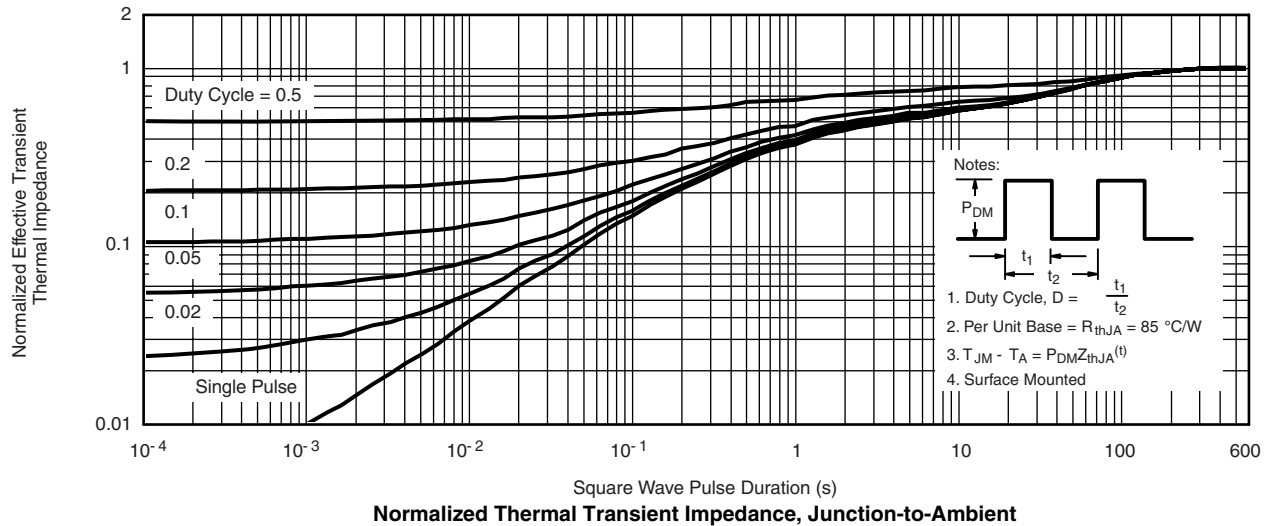
## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



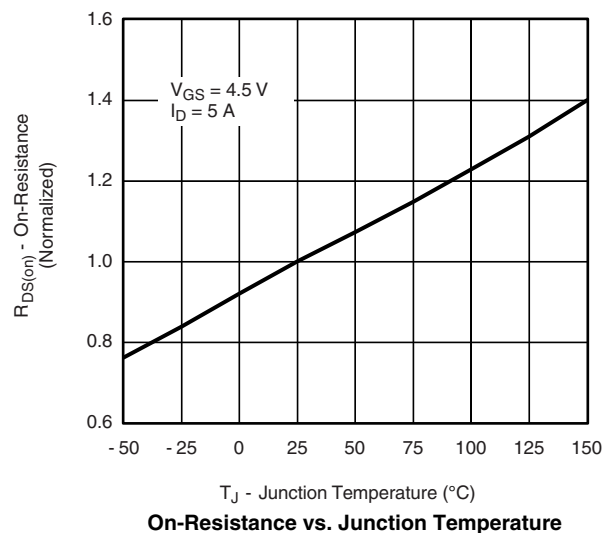
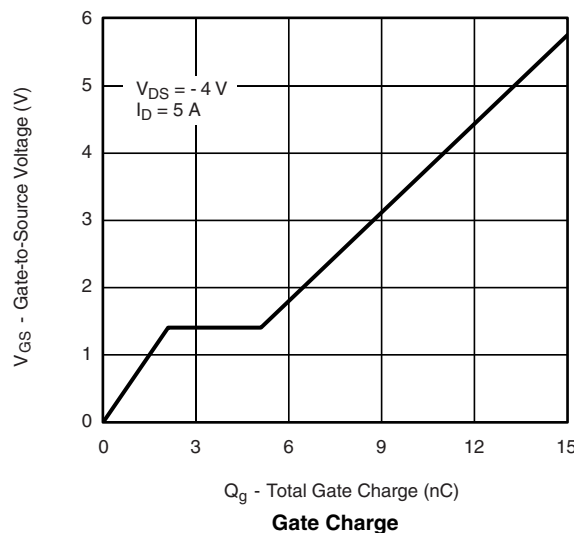
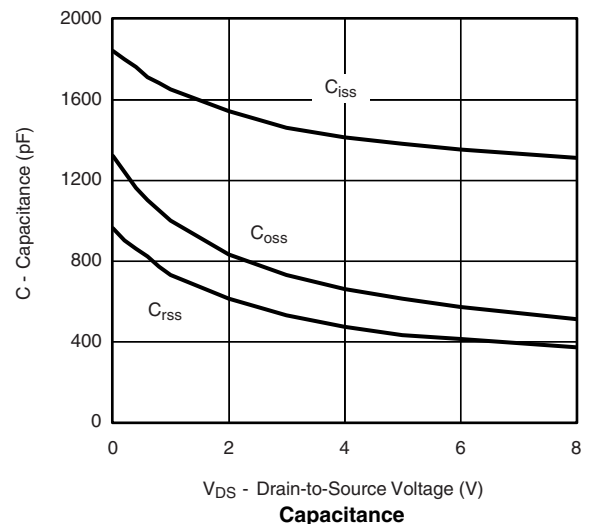
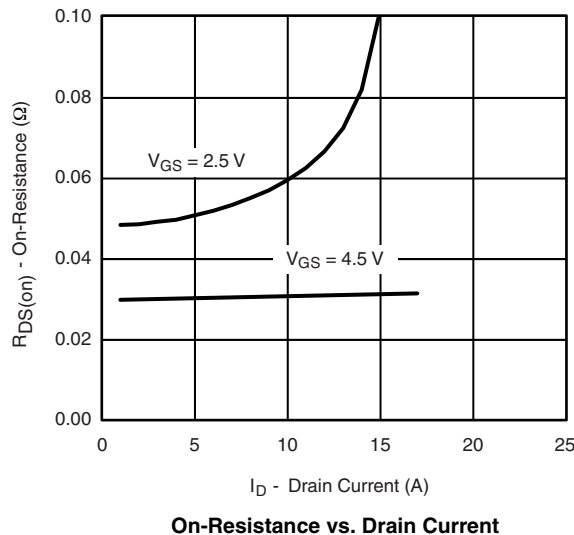
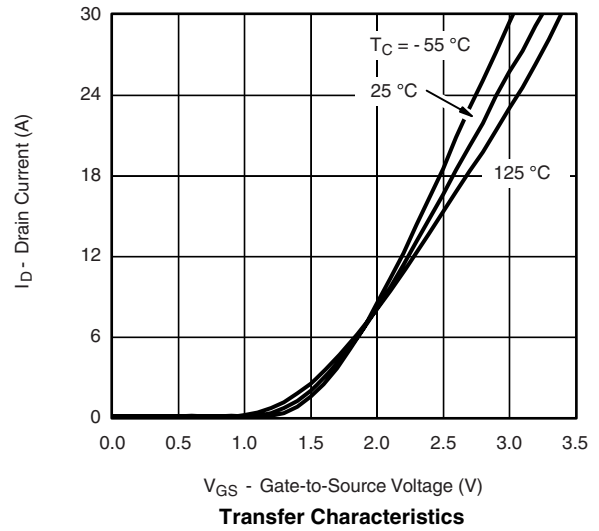
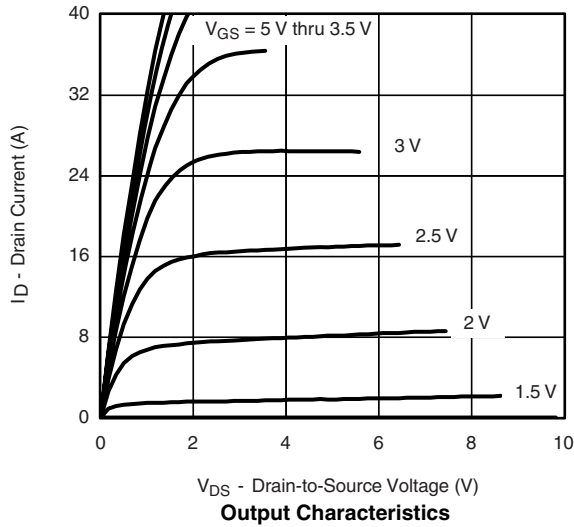
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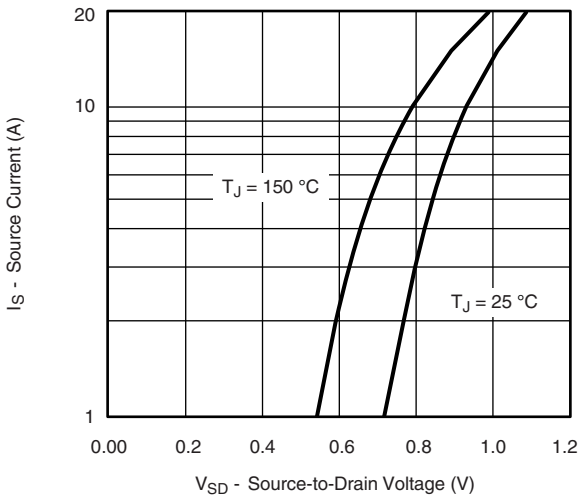
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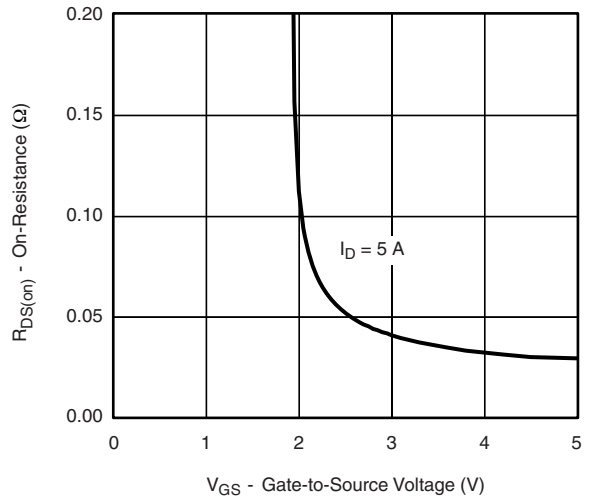
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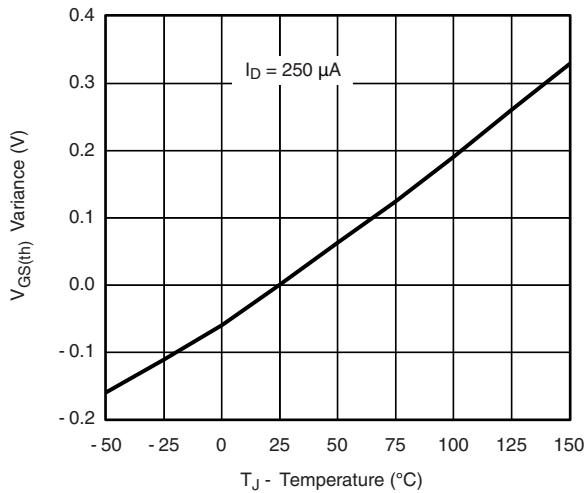
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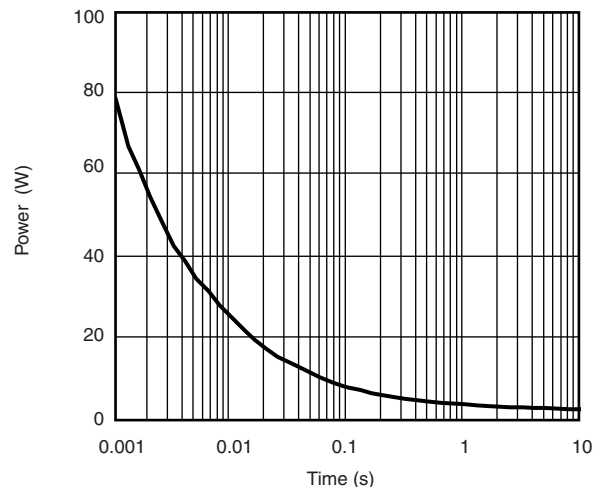
Source-Drain Diode Forward Voltage



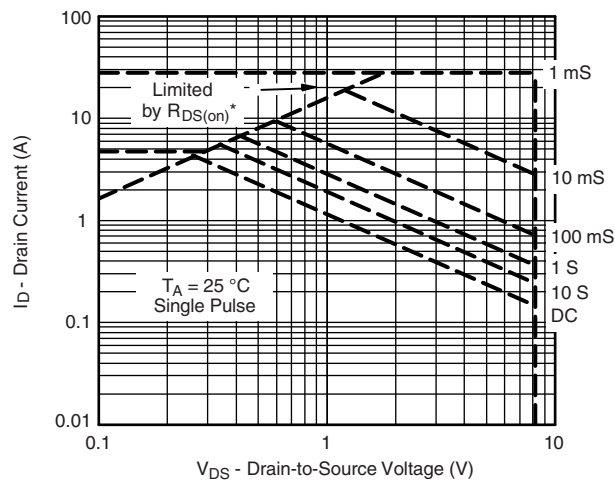
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



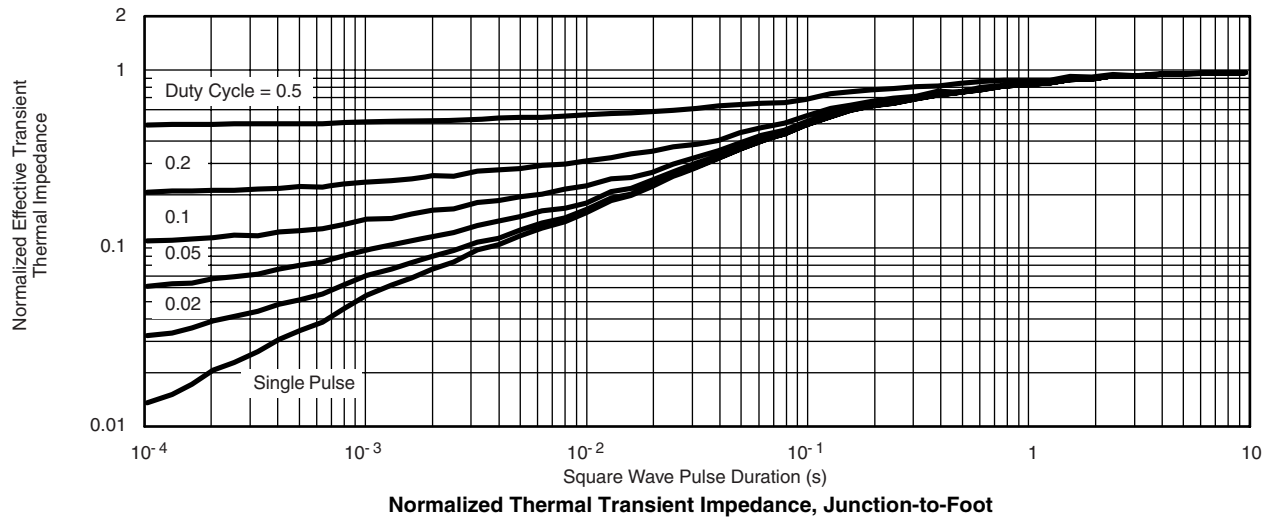
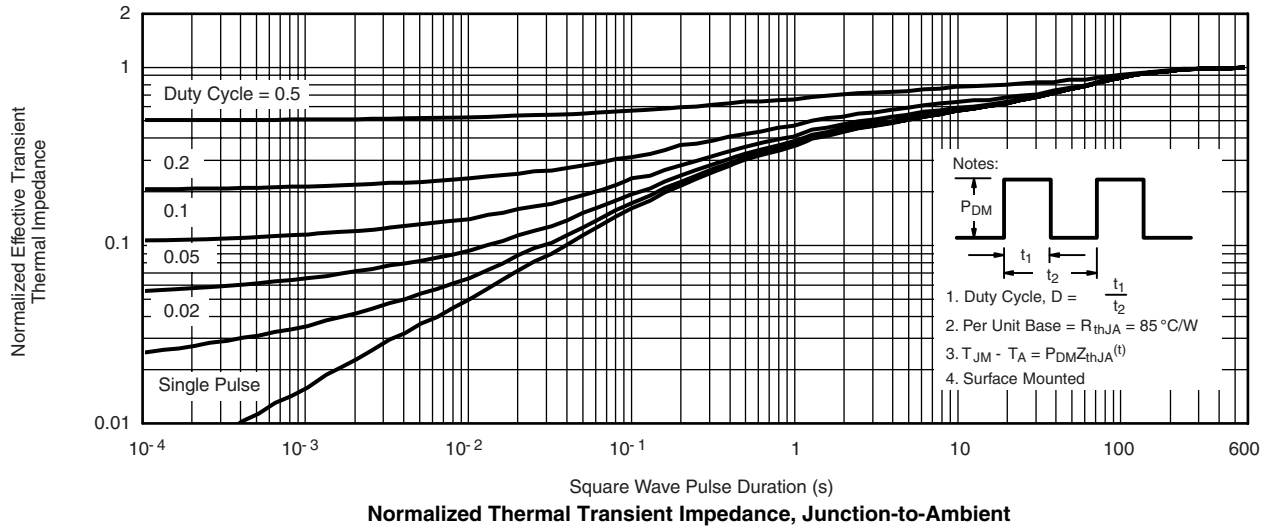
Single Pulse Power, Junction-to-Ambient



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

Safe Operating Area

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



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