

## N- and P-Channel 12-V (D-S) MOSFET

PRODUCT SUMMARY			
	V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)
N-Channel	12	0.017 at V <sub>GS</sub> = 4.5 V	11.8
		0.025 at V <sub>GS</sub> = 2.5 V	9.8
P-Channel	- 12	0.032 at V <sub>GS</sub> = - 4.5 V	- 8.9
		0.053 at V <sub>GS</sub> = - 2.5 V	- 6.9

### FEATURES

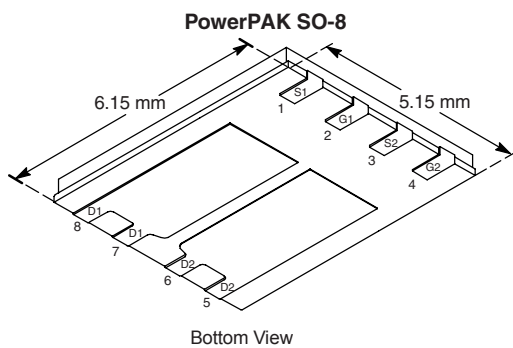
- Halogen-free According to IEC 61249-2-21 Available
- TrenchFET<sup>®</sup> Power MOSFETs
- New Low Thermal Resistance PowerPAK<sup>®</sup> Package with Low 1.07 mm Profile
- PWM Optimized for High Efficiency
- 100 % R<sub>g</sub> Tested



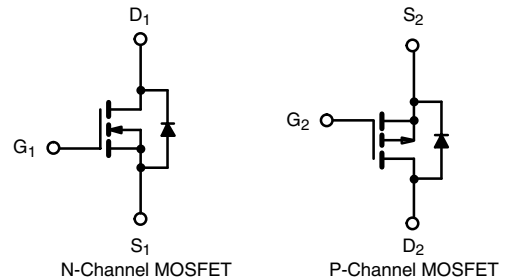
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### APPLICATIONS

- Point-of-Load Synchronous Rectifier  
- 5 V or 3.3 V BUS Step Down  
- Q<sub>g</sub> Optimized for 500 kHz Operation
- Synchronous Buck, Shoot-Thru Resistant



Ordering Information: Si7540DP-T1-E3 (Lead (Pb)-free)  
Si7540DP-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	10 s	Steady		
Drain-Source Voltage	V <sub>DS</sub>	12		- 12		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	11.8	7.6	- 8.9	- 5.7	A
		T <sub>A</sub> = 70 °C	9.5	6.1	- 7.1	- 4.6	
Pulsed Drain Current	I <sub>DM</sub>	20				A	
Continuous Source Current (Diode Conduction) <sup>a</sup>	I <sub>S</sub>	2.9	1.1	- 2.9	- 1.1		
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>A</sub> = 25 °C	3.5	1.4	3.5	1.4	W
		T <sub>A</sub> = 70 °C	2.2	0.9	2.2	0.9	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150				°C	
Soldering Recommendations (Peak Temperature) <sup>b,c</sup>		260					

THERMAL RESISTANCE RATINGS							
Parameter	Symbol	N-Channel		P-Channel		Unit	
		Typical	Maximum	Typical	Maximum		
Maximum Junction-to-Ambient <sup>a</sup>	R <sub>thJA</sub>	t ≤ 10 s	26	35	26	35	°C/W
		Steady State	60	85	60	85	
Maximum Junction-to-Case (Drain)	R <sub>thJC</sub>	3.9	5.5	3.9	5.5		

Notes:

- Surface Mounted on 1" x 1" FR4 board.
- See Solder Profile ([www.vishay.com/ppg?73257](http://www.vishay.com/ppg?73257)). The PowerPAK SO-8 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
- Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.

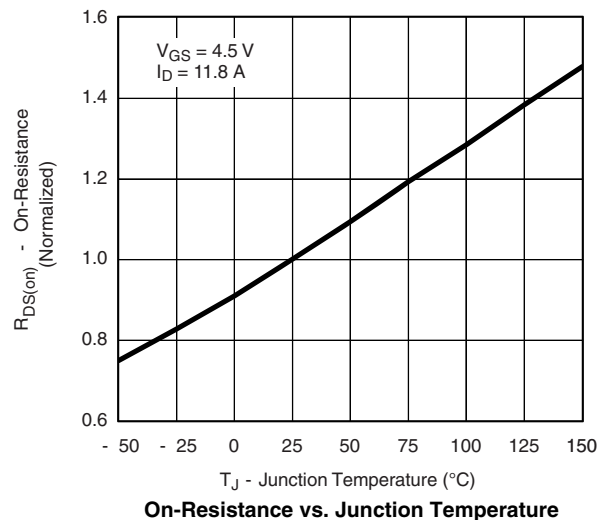
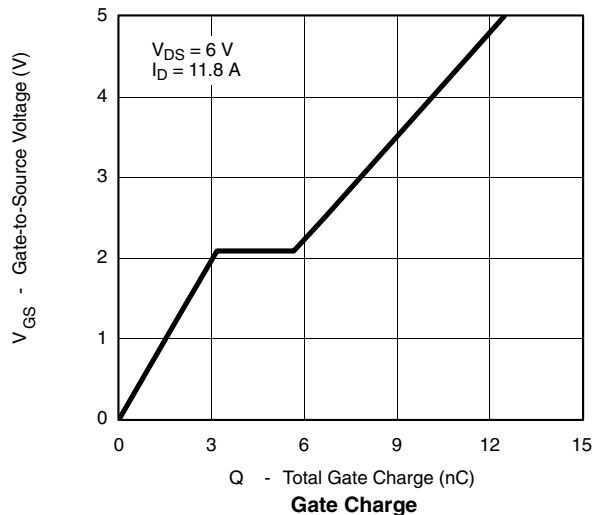
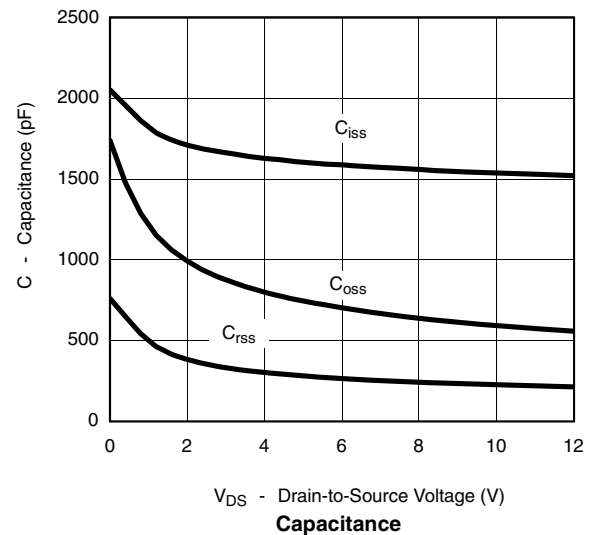
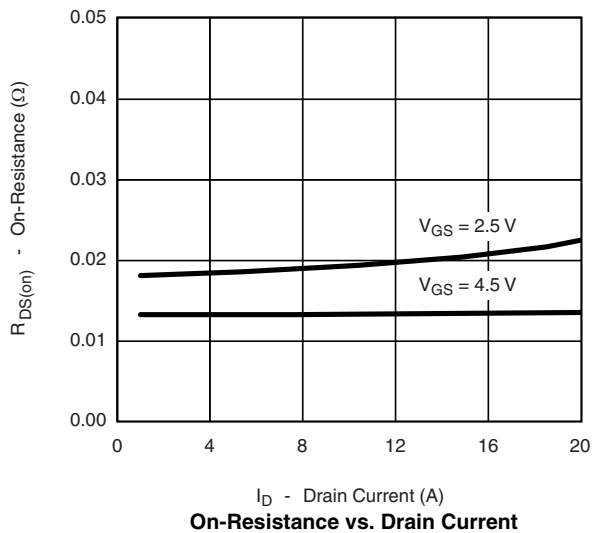
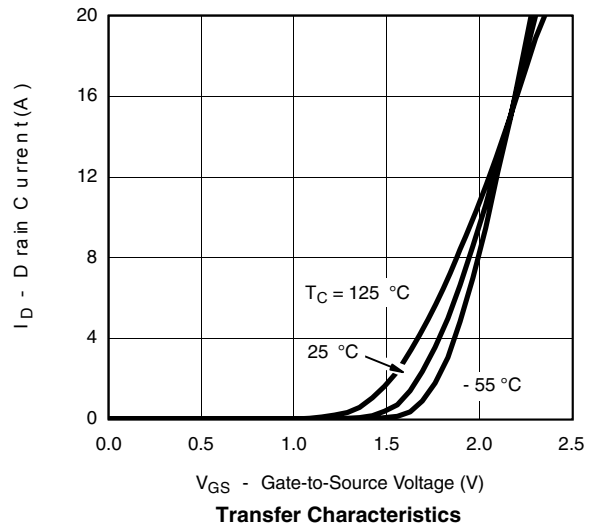
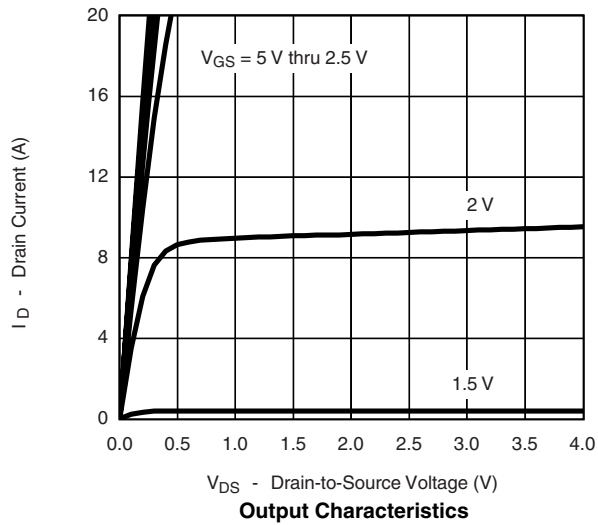
SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted							
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
<b>Static</b>							
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	N-Ch	0.6	1.5	V	
		$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	P-Ch	-0.6	-1.5		
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$	N-Ch P-Ch		$\pm 100$ $\pm 100$	nA	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 12\text{ V}, V_{GS} = 0\text{ V}$	N-Ch		1	$\mu\text{A}$	
		$V_{DS} = -12\text{ V}, V_{GS} = 0\text{ V}$	P-Ch		-1		
		$V_{DS} = 12\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	N-Ch		5		
		$V_{DS} = -12\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	P-Ch		-5		
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$	N-Ch	20		A	
		$V_{DS} \leq -5\text{ V}, V_{GS} = -4.5\text{ V}$	P-Ch	-20			
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 11.8\text{ A}$	N-Ch		0.014	0.017	$\Omega$
		$V_{GS} = -4.5\text{ V}, I_D = -8.9\text{ A}$	P-Ch		0.026	0.032	
		$V_{GS} = 2.5\text{ V}, I_D = 9.8\text{ A}$	N-Ch		0.020	0.025	
		$V_{GS} = -2.5\text{ V}, I_D = -6.9\text{ A}$	P-Ch		0.043	0.053	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 5\text{ V}, I_D = 11.8\text{ A}$	N-Ch		32	S	
		$V_{DS} = -5\text{ V}, I_D = -8.9\text{ A}$	P-Ch		23		
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = 2.9\text{ A}, V_{GS} = 0\text{ V}$	N-Ch		0.77	1.2	V
		$I_S = -2.9\text{ A}, V_{GS} = 0\text{ V}$	P-Ch		-0.8	-1.2	
<b>Dynamic<sup>b</sup></b>							
Total Gate Charge	$Q_g$	N-Channel $V_{DS} = 6\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 11.8\text{ A}$	N-Ch		11.5	17	nC
Gate-Source Charge	$Q_{gs}$		P-Ch		13	20	
Gate-Drain Charge	$Q_{gd}$	P-Channel $V_{DS} = -6\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -8.9\text{ A}$	N-Ch		3.2		
			P-Ch		4.1		
Gate Resistance	$R_g$		N-Ch	0.5	1.7	2.5	$\Omega$
			P-Ch	1.5	3.5	5.6	
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 6\text{ V}, R_L = 6\text{ }\Omega$ $I_D \cong 1\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 6\text{ }\Omega$	N-Ch		30	45	ns
Rise Time	$t_r$		P-Ch		35	55	
		Turn-Off Delay Time	$t_{d(off)}$	N-Ch		50	
P-Ch				42	65		
Fall Time	$t_f$	P-Channel $V_{DD} = -6\text{ V}, R_L = 6\text{ }\Omega$ $I_D \cong -1\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 6\text{ }\Omega$	N-Ch		60	90	
			P-Ch		54	85	
Source-Drain Reverse Recovery Time	$t_{rr}$	$I_F = 2.9\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	N-Ch		40	80	
		$I_F = -2.9\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	P-Ch		40	80	

## Notes:

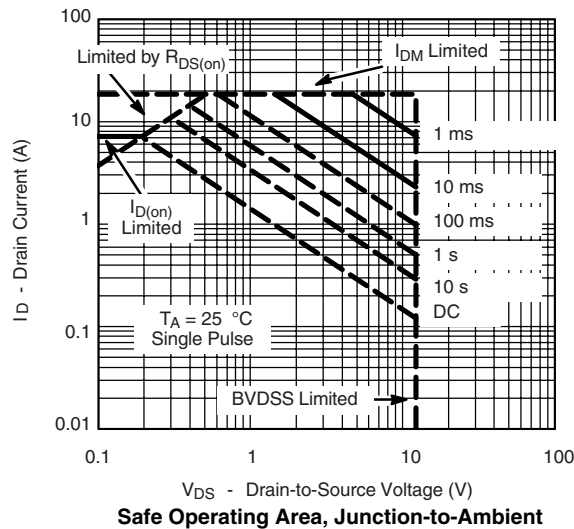
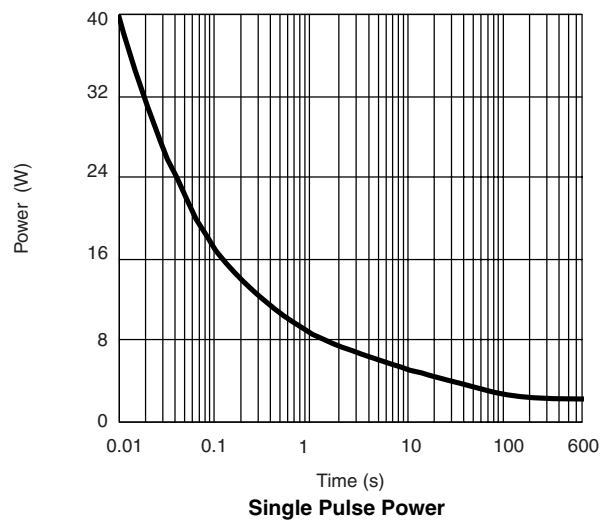
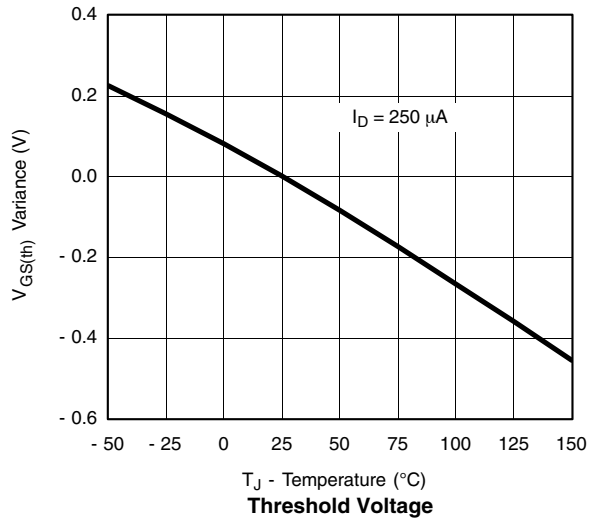
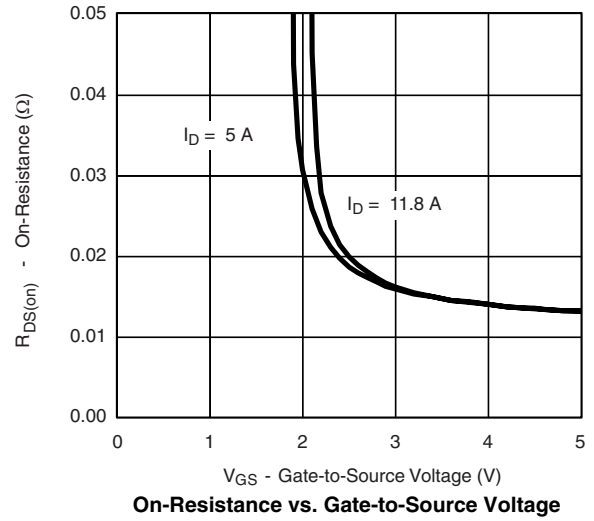
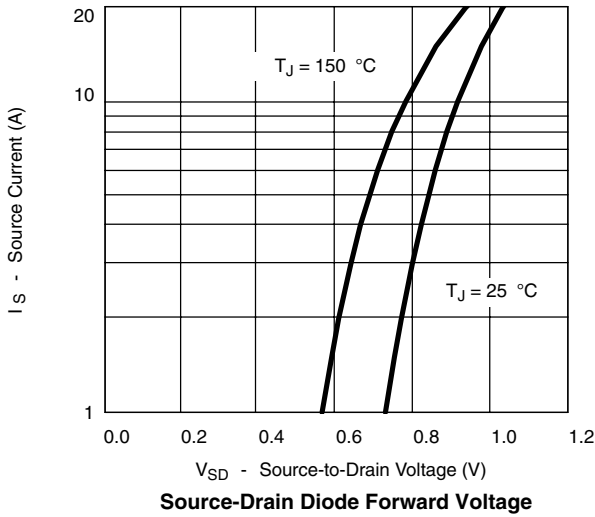
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
b. Guaranteed by design, not subject to production testing.

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.

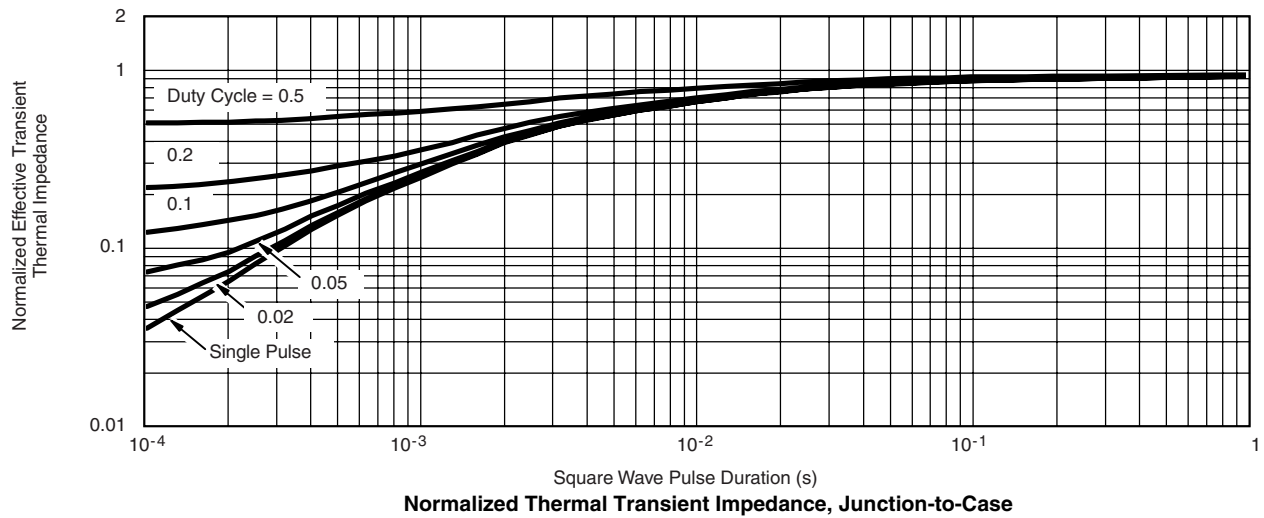
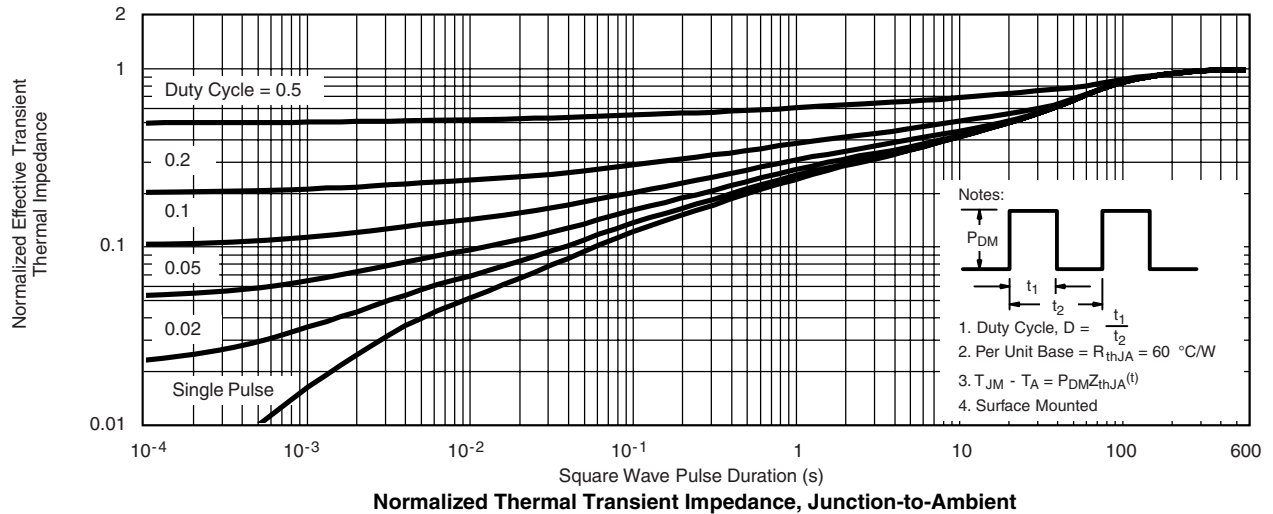
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



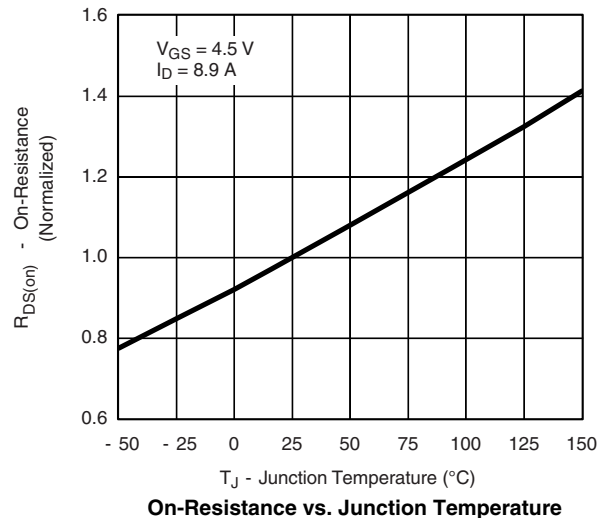
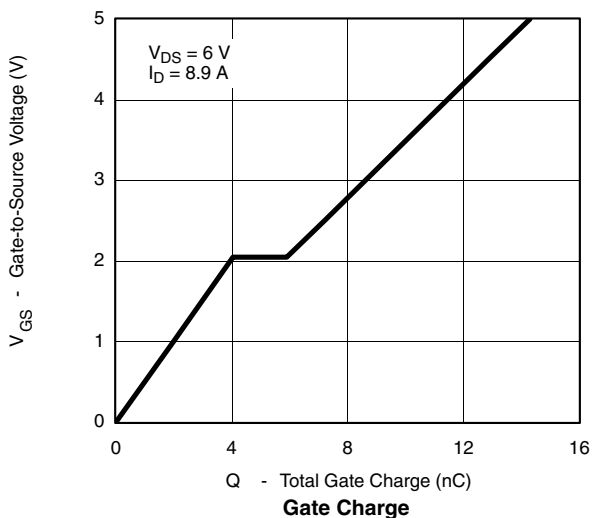
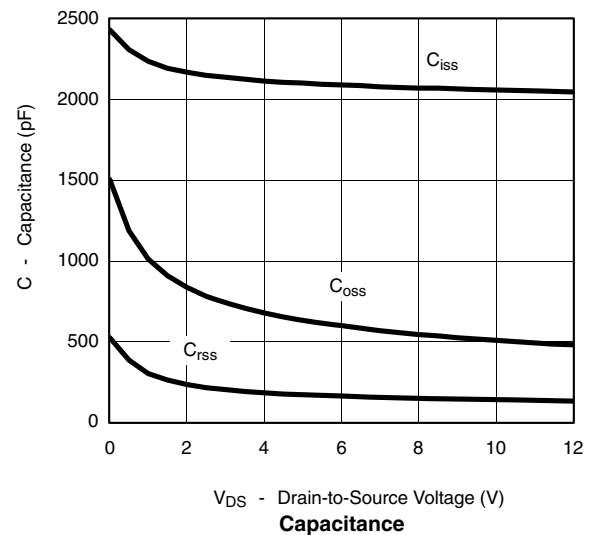
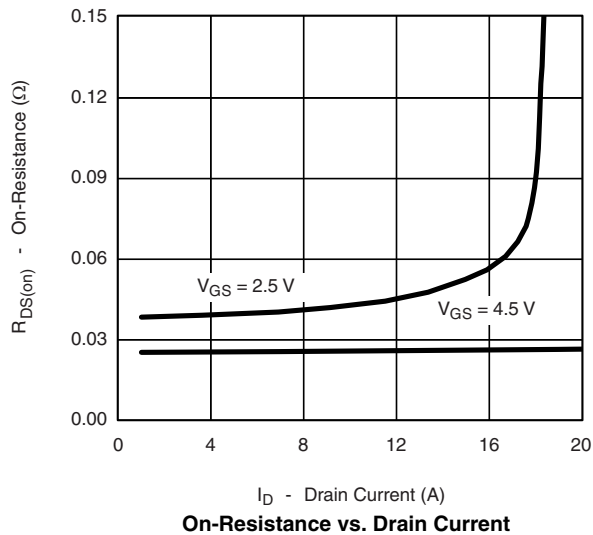
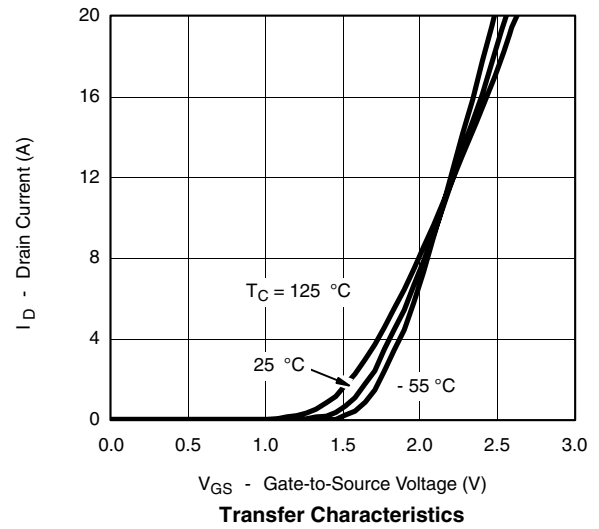
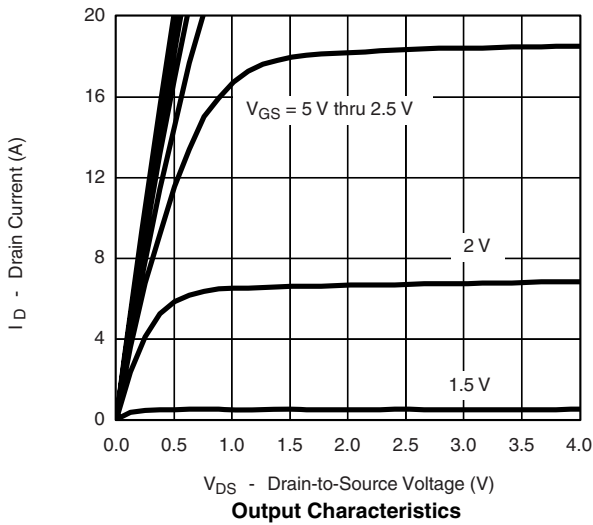
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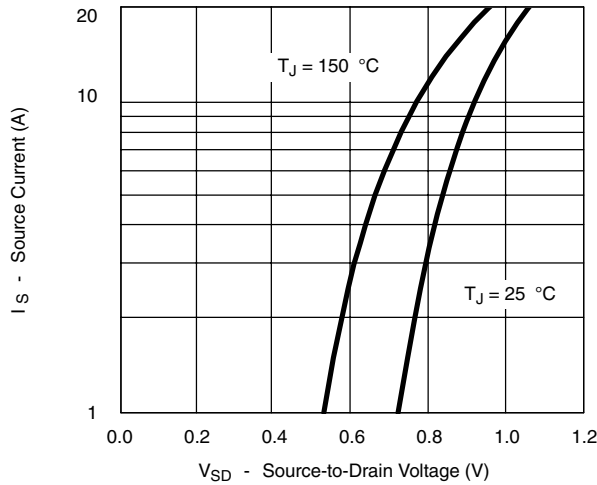
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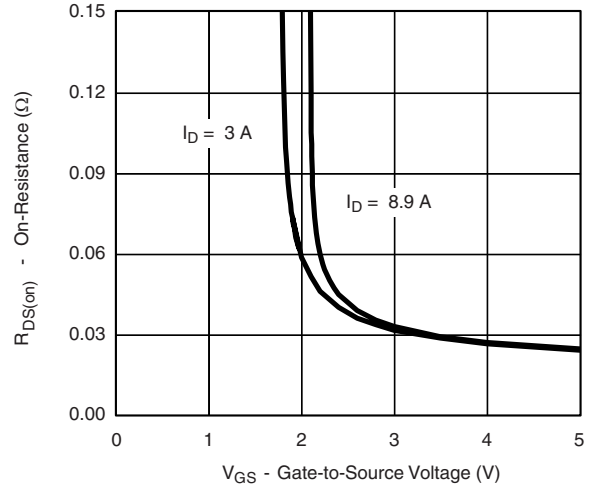
## P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



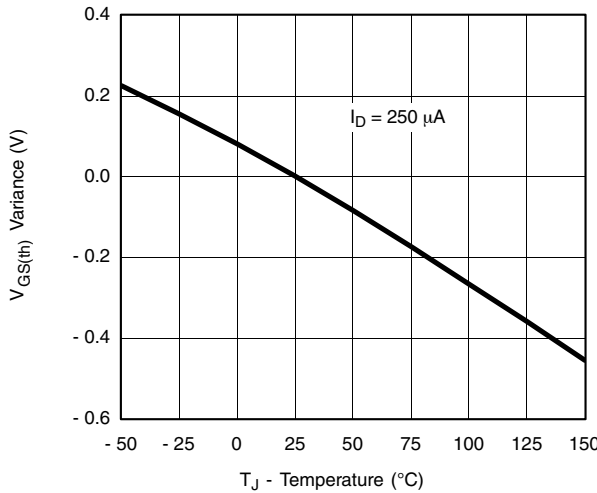
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



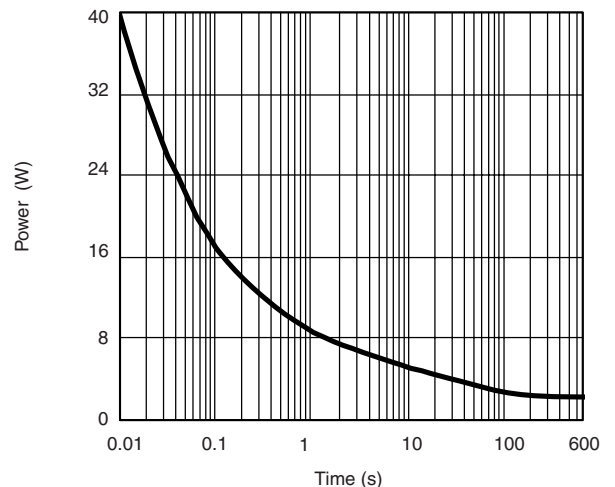
**Source-Drain Diode Forward Voltage**



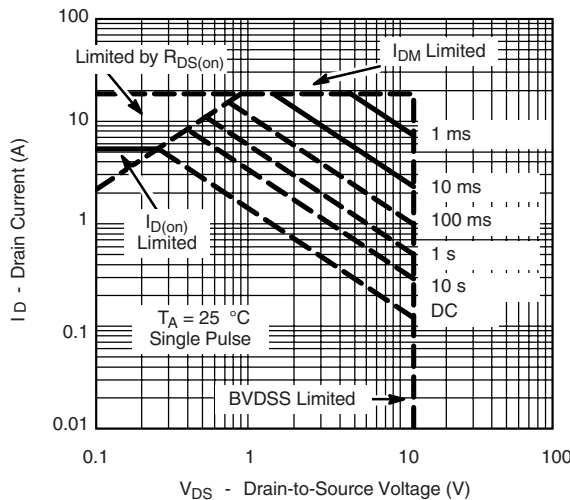
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



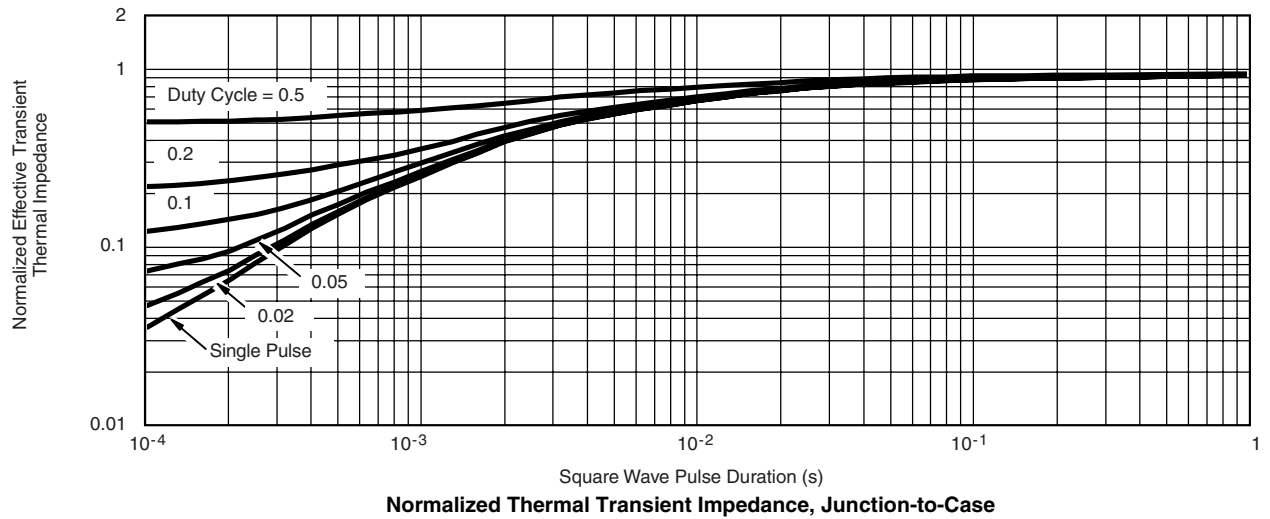
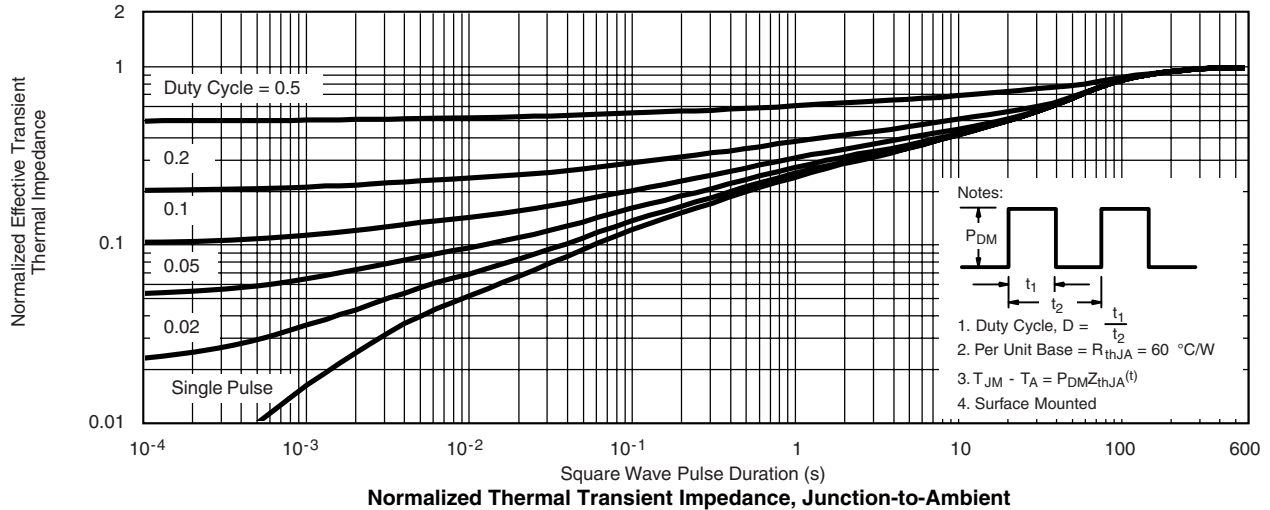
**Single Pulse Power**



**Safe Operating Area, Junction-to-Ambient**



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



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