

## N- and P-Channel 30-V (D-S) MOSFET

PRODUCT SUMMARY			
	V <sub>DS</sub> (V)	r <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)
N-Channel	30	0.077 at V <sub>GS</sub> = 4.5 V	3
		0.120 at V <sub>GS</sub> = 2.5 V	2
P-Channel	- 30	0.170 at V <sub>GS</sub> = - 4.5 V	- 2
		0.300 at V <sub>GS</sub> = - 2.5 V	- 1.2

### FEATURES

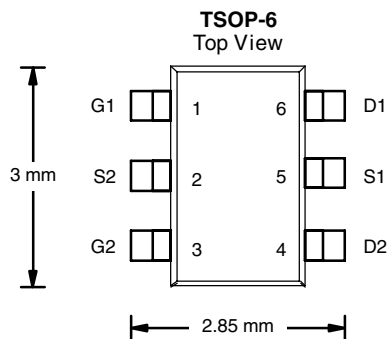
- TrenchFET<sup>®</sup> Power MOSFET
- Ultra Low r<sub>DS(on)</sub> N- and P-Channel for High Efficiency
- Optimized for High-Side/Low-Side
- Minimized Conduction Losses



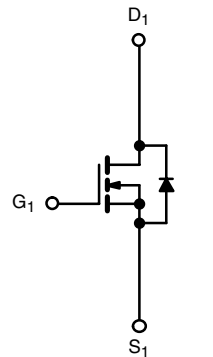
RoHS\*  
COMPLIANT

### APPLICATIONS

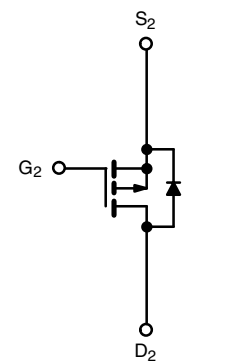
- Portable Devices Including PDAs, Cellular Phones and Pagers



Ordering Information: Si3590DV-T1  
Si3590DV-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	
		10 sec	Steady State	10 sec	Steady State		
Drain-Source Voltage	V <sub>DS</sub>	30		- 30		V	
Gate-Source Voltage	V <sub>GS</sub>	± 12		± 12			
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	I <sub>D</sub>	T <sub>A</sub> = 25 °C	3	2.5	- 2	- 1.7	A
		T <sub>A</sub> = 70 °C	2.3	2.0	- 1.6	- 1.3	
Pulsed Drain Current	I <sub>DM</sub>	8		- 8			
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	0.70	0.53	0.70	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	N-Channel		P-Channel		Unit	
		Typ	Max	Typ	Max		
Maximum Junction-to-Ambient <sup>a</sup>	R <sub>thJA</sub>	t ≤ 10 sec	93	110	93	110	°C/W
		Steady State	130	150	130	150	
Maximum Junction-to-Foot (Drain)	R <sub>thJF</sub>	75	90	75	90		

Notes:

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

\* Pb containing terminations are not RoHS compliant, exemptions may apply.

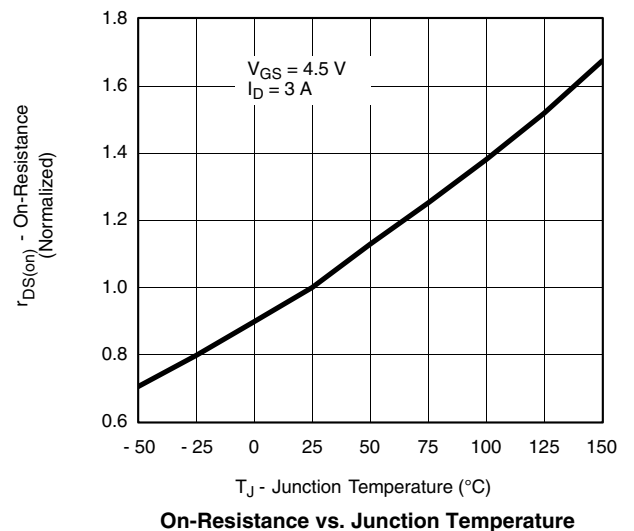
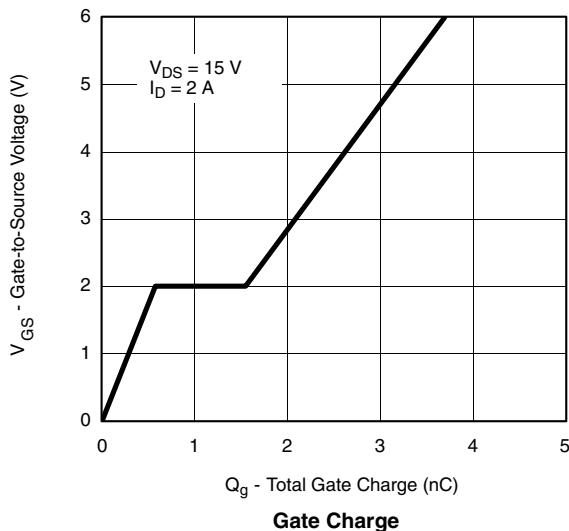
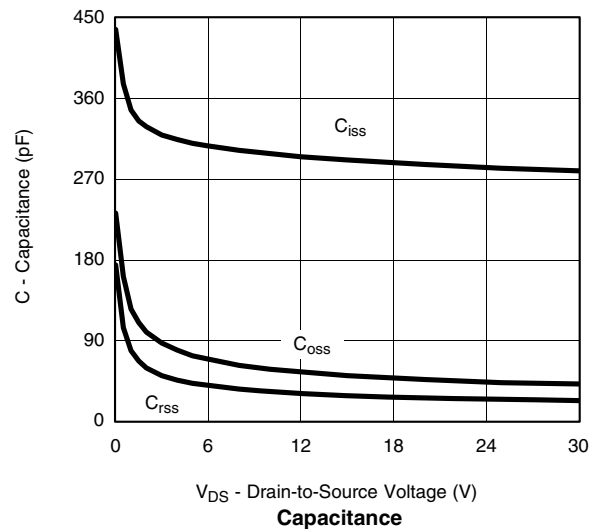
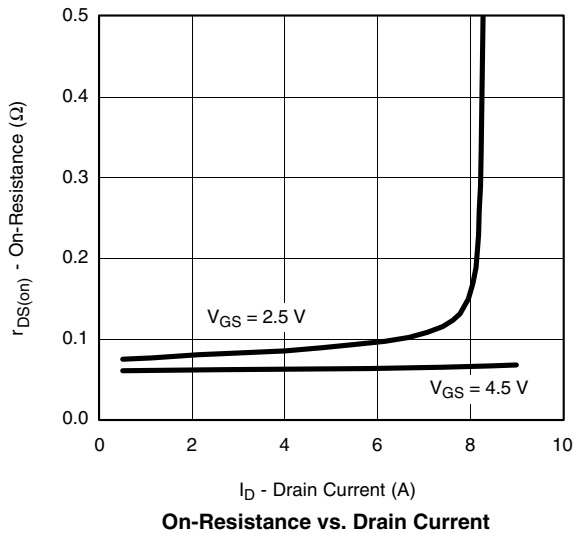
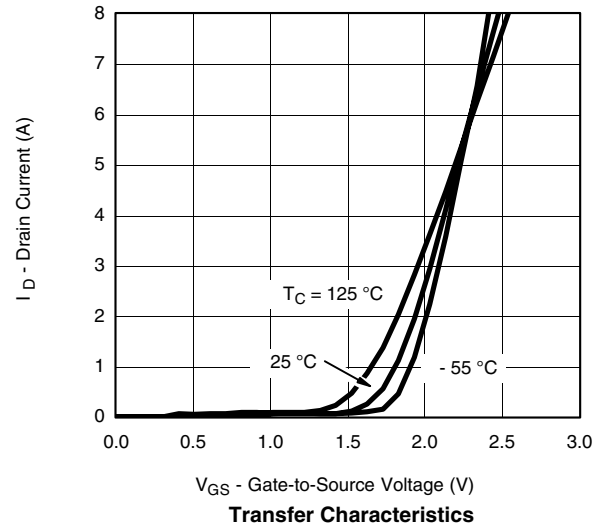
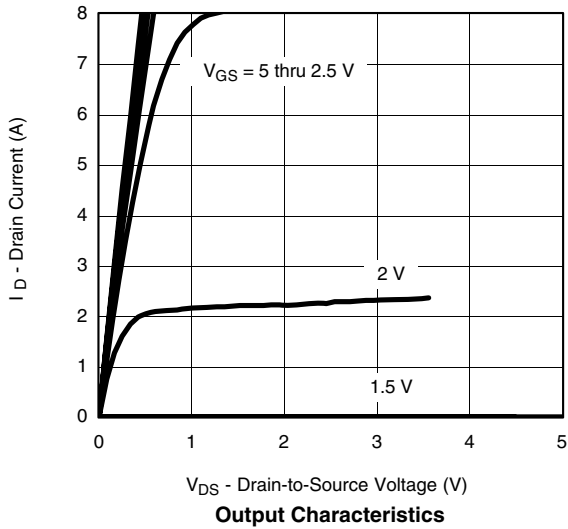
SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted							
Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
<b>Static</b>							
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	N-Ch	0.6		1.5	V
		$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	P-Ch	-0.6		-1.5	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\ \text{V}, V_{GS} = \pm 12\ \text{V}$	N-Ch P-Ch			$\pm 100$ $\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 30\ \text{V}, V_{GS} = 0\ \text{V}$	N-Ch			1	$\mu\text{A}$
		$V_{DS} = -30\ \text{V}, V_{GS} = 0\ \text{V}$	P-Ch			-1	
		$V_{DS} = 30\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 55\text{ }^\circ\text{C}$	N-Ch			5	
		$V_{DS} = -30\ \text{V}, V_{GS} = 0\ \text{V}, T_J = 55\text{ }^\circ\text{C}$	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	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		0.062	0.077	$\Omega$
		$V_{GS} = -4.5\ \text{V}, I_D = -2\ \text{A}$	P-Ch		0.135	0.170	
		$V_{GS} = 2.5\ \text{V}, I_D = 2\ \text{A}$	N-Ch		0.095	0.120	
		$V_{GS} = -2.5\ \text{V}, I_D = -1.2\ \text{A}$	P-Ch		0.235	0.300	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 5\ \text{V}, I_D = 3\ \text{A}$	N-Ch		10		S
		$V_{DS} = -5\ \text{V}, I_D = -2\ \text{A}$	P-Ch		5		
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = 1.05\ \text{A}, V_{GS} = 0\ \text{V}$	N-Ch		0.80	1.10	V
		$I_S = -1.05\ \text{A}, V_{GS} = 0\ \text{V}$	P-Ch		-0.83	-1.10	
<b>Dynamic<sup>b</sup></b>							
Total Gate Charge	$Q_g$	N-Channel $V_{DS} = 15\ \text{V}, V_{GS} = 4.5\ \text{V}, I_D = 2\ \text{A}$	N-Ch		3	4.5	nC
Gate-Source Charge	$Q_{gs}$		P-Ch		3.8	6	
Gate-Drain Charge	$Q_{gd}$	P-Channel $V_{DS} = -15\ \text{V}, V_{GS} = -4.5\ \text{V}, I_D = -2\ \text{A}$	N-Ch		0.6		
			P-Ch		0.6		
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		5	8	ns
			P-Ch		5	8	
Rise Time	$t_r$		N-Ch		12	23	
			P-Ch		15	23	
Turn-Off Delay Time	$t_{d(off)}$	P-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		13	23	
			P-Ch		20	30	
Fall Time	$t_f$		N-Ch		7	12	
			P-Ch		20	30	
Source-Drain Reverse Recovery Time	$t_{rr}$	$I_F = 1.05\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$	N-Ch		15	25	
		$I_F = -1.05\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$	P-Ch		18	30	

## Notes:

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

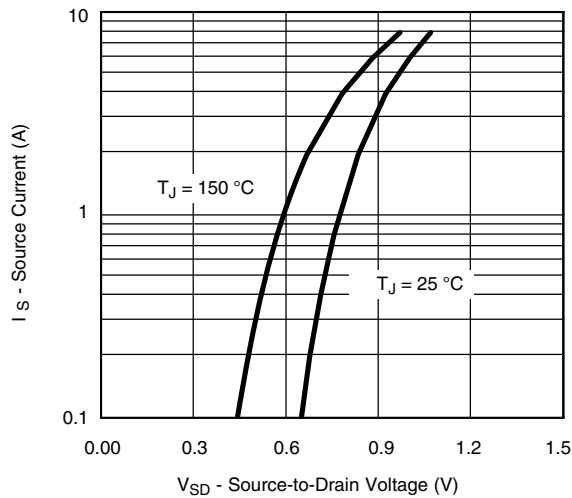
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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

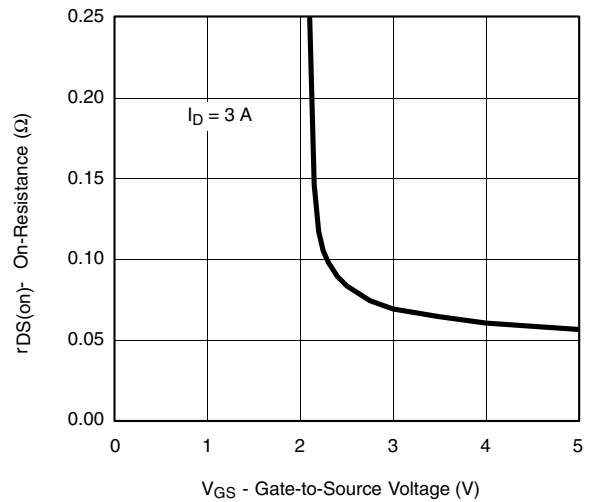




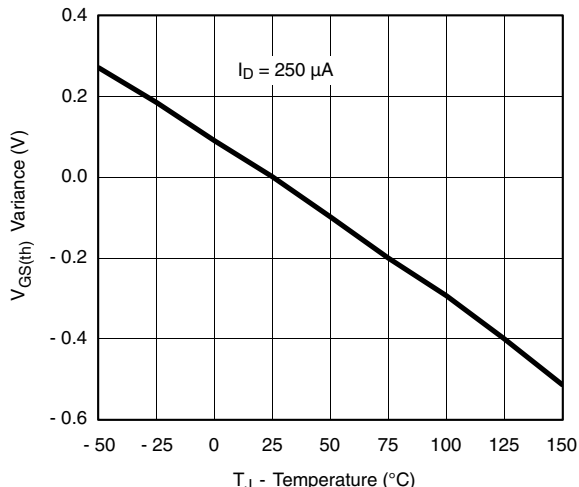
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C unless noted



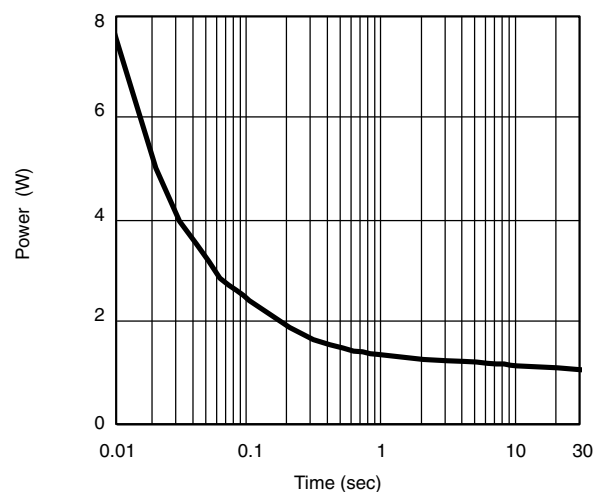
**Source-Drain Diode Forward Voltage**



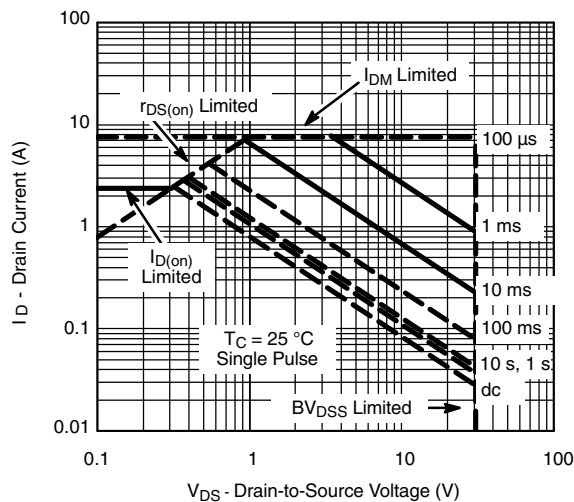
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



**Single Pulse Power, Junction-to-Ambient**

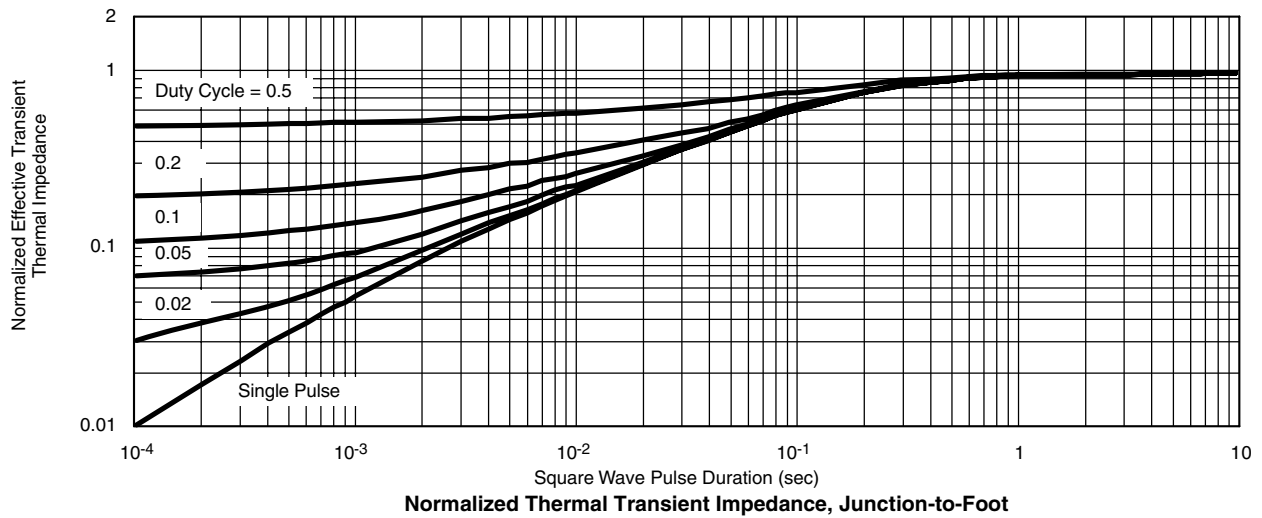
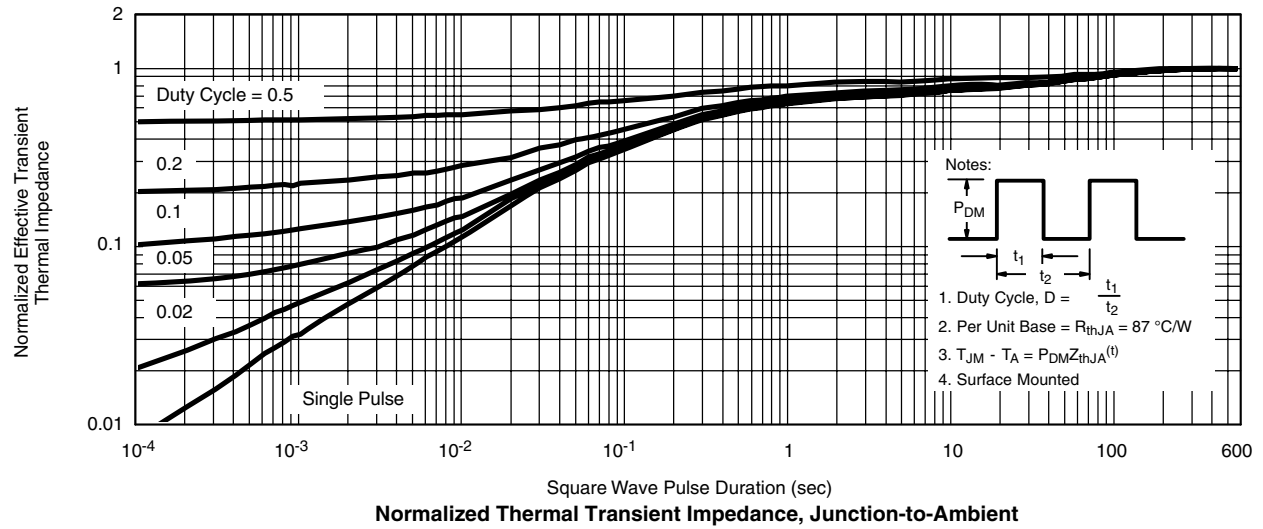


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $r_{DS(on)}$  is specified

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

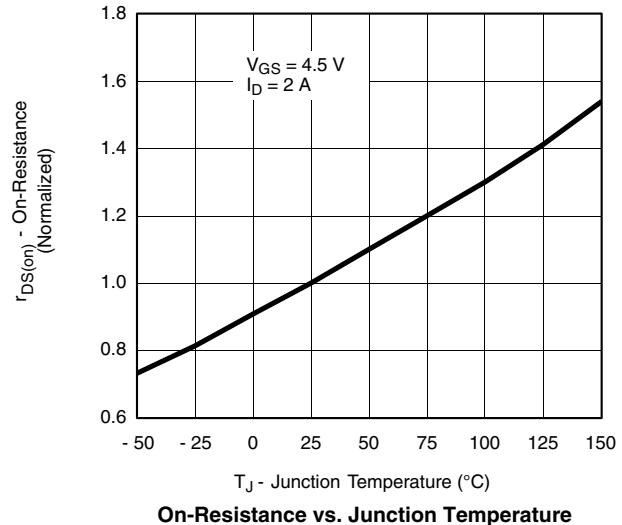
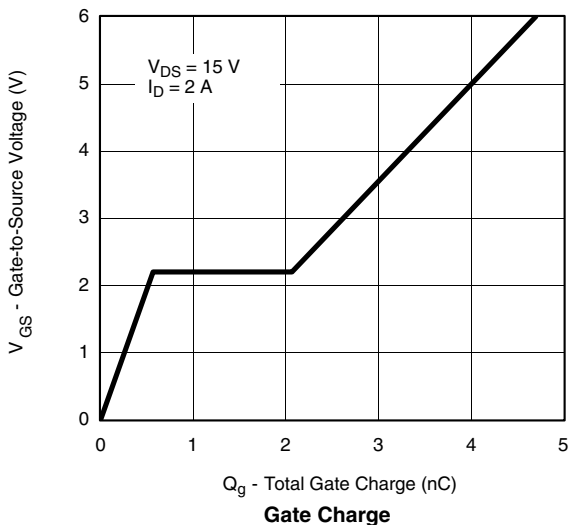
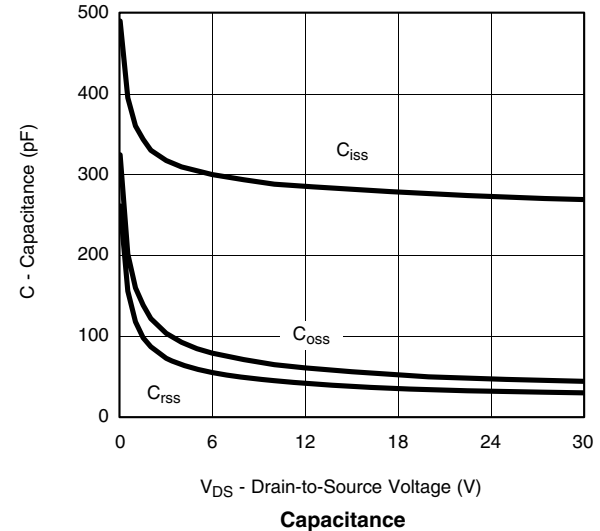
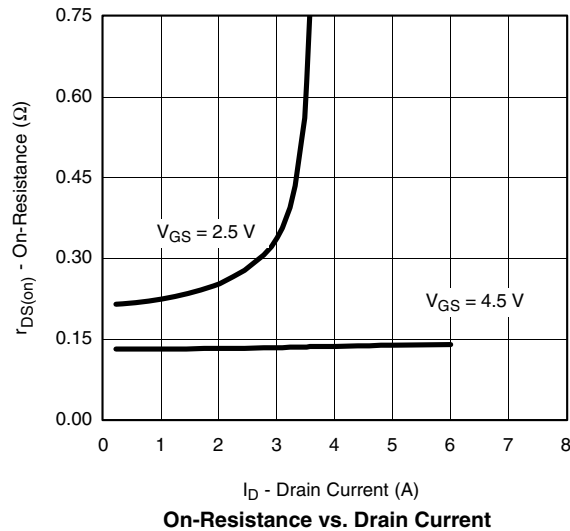
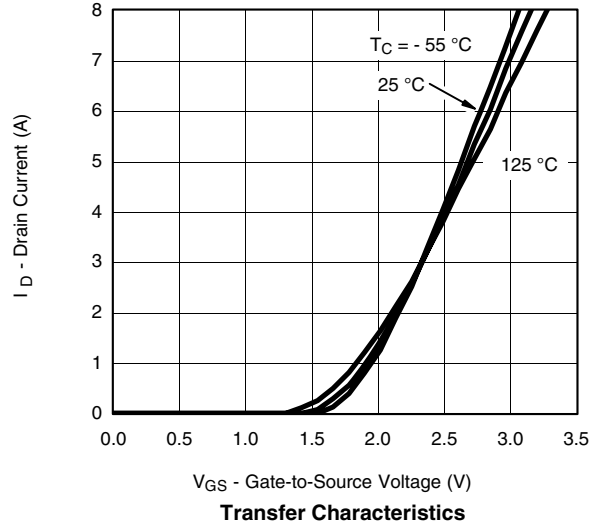
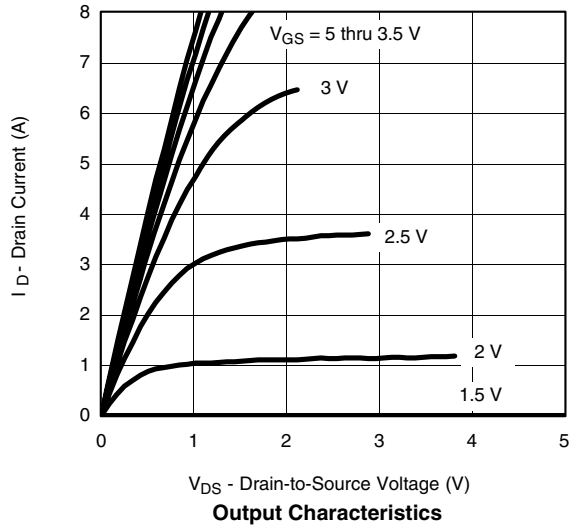


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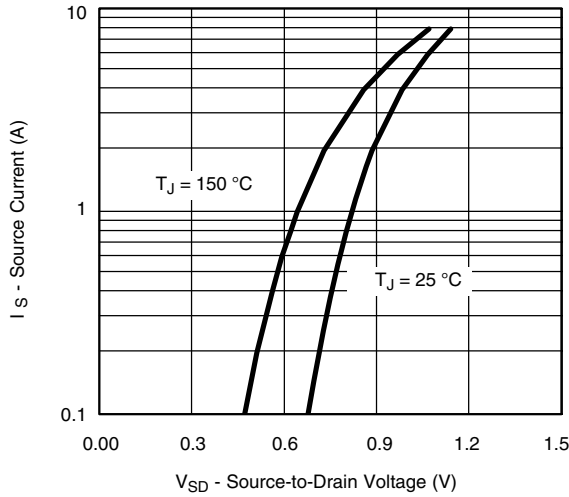




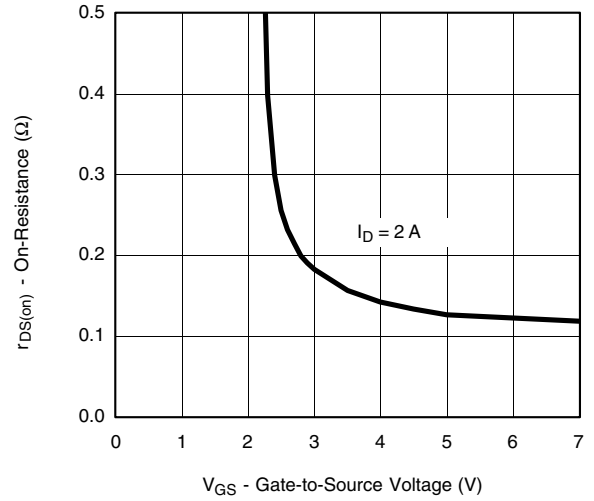
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C unless noted



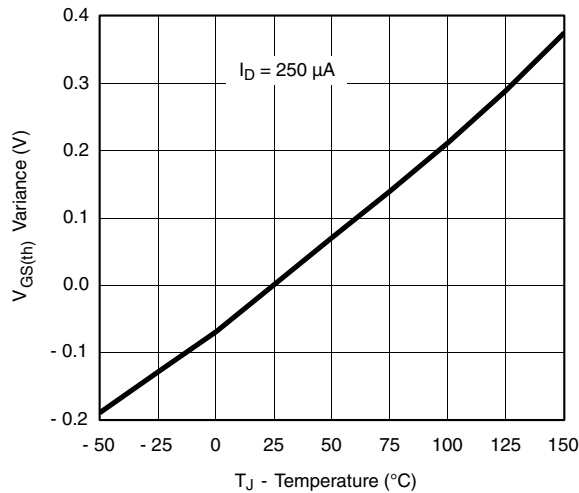
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C unless noted



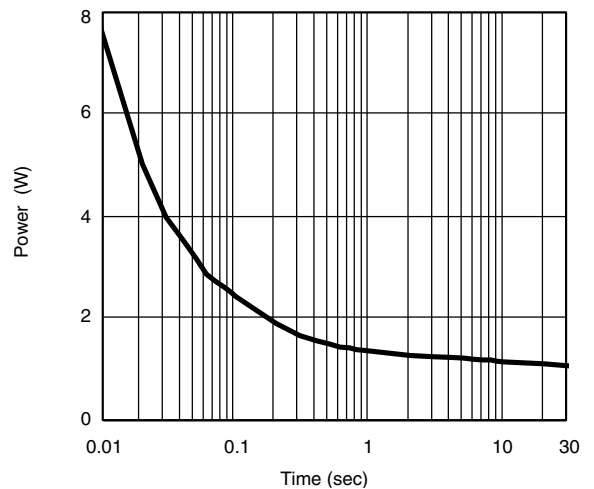
Source-Drain Diode Forward Voltage



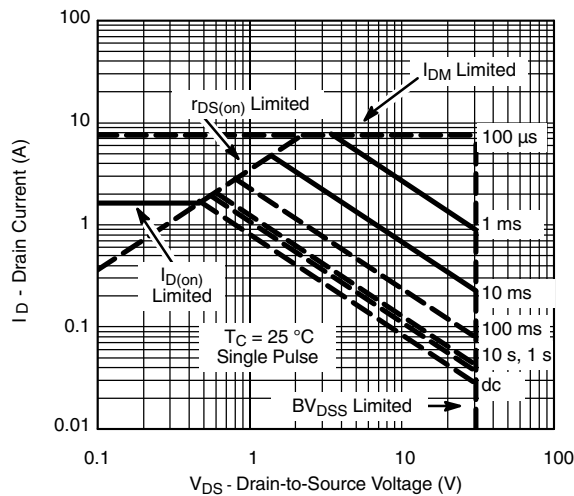
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient

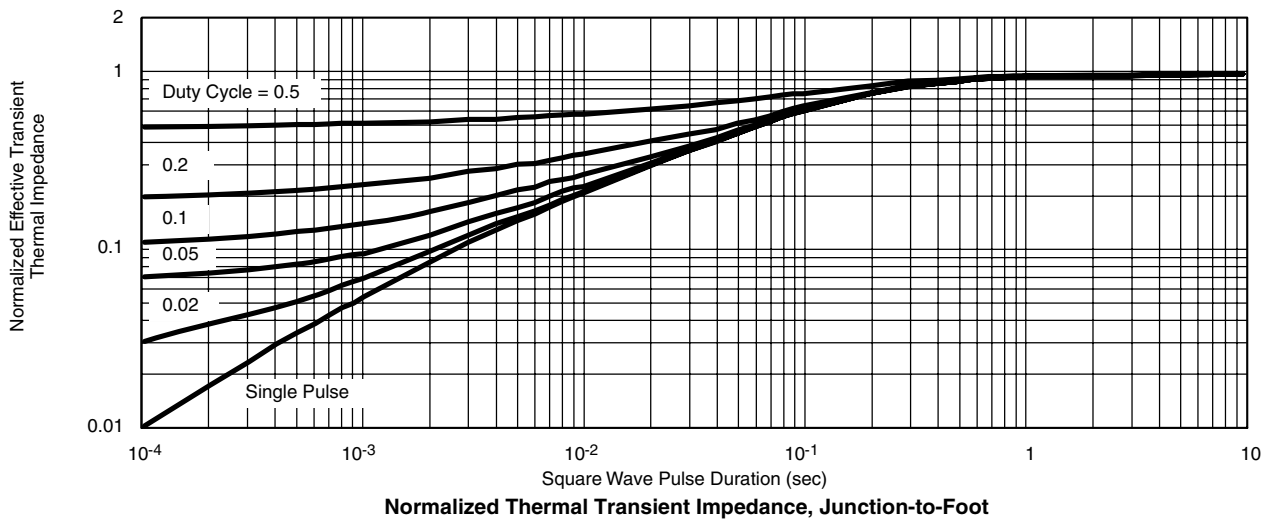
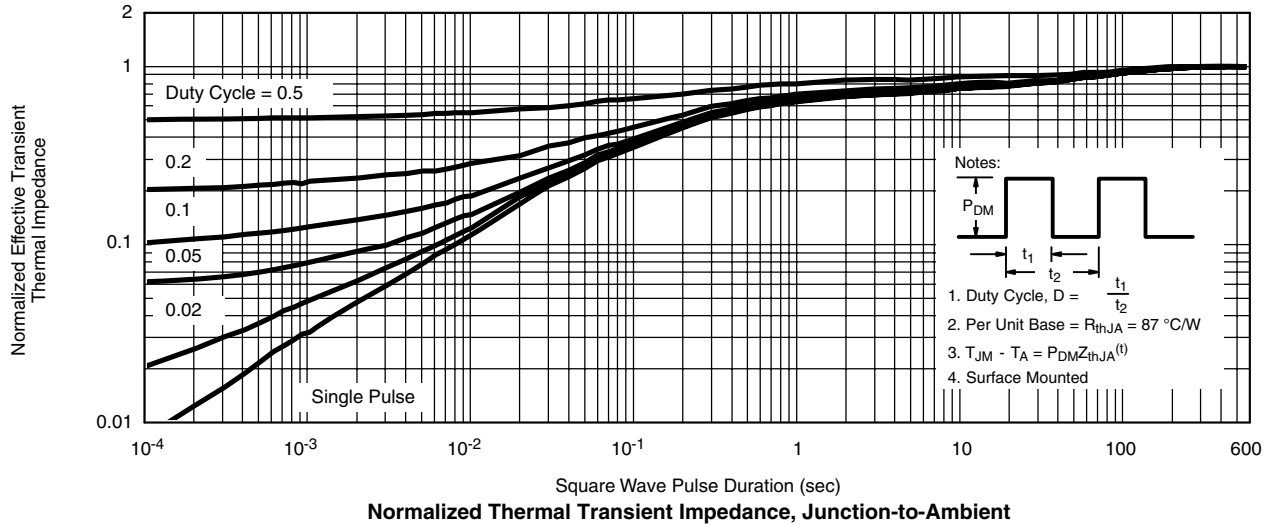


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $r_{DS(on)}$  is specified

Safe Operating Area, Junction-to-Case



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



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