

N- and P-Channel 1.8 V (G-S) MOSFET

PRODUCT SUMMARY

	V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A)
N-Channel	12	0.235 at V _{GS} = 4.5 V	1.3
		0.280 at V _{GS} = 2.5 V	1.2
		0.340 at V _{GS} = 1.8 V	1.0
P-Channel	- 12	0.535 at V _{GS} = - 4.5 V	- 0.86
		0.880 at V _{GS} = - 2.5 V	- 0.67
		1.26 at V _{GS} = - 1.8 V	- 0.56

FEATURES

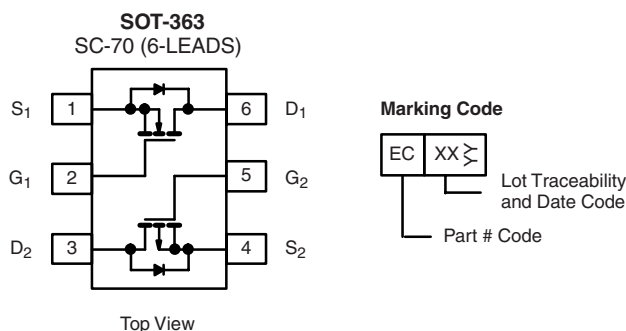
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFETs
- Thermally Enhanced SC-70 Package
- Fast Switching to Minimize Gate and Switching Losses
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

- Baseband dc-to-dc Converter Switch for Portable Electronics



Ordering Information: Si1557DH-T1-E3 (Lead (Pb)-free)
Si1557DH-T1-GE3 (Lead (Pb)-free and Halogen-free)

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}	12		- 12		V
Gate-Source Voltage		V _{GS}	± 8				
Continuous Drain Current (T _J = 150 °C) ^a	T _A = 25 °C	I _D	1.3	1.2	- 0.86	- 0.77	A
	T _A = 85 °C		0.9	0.8	- 0.62	- 0.55	
Pulsed Drain Current		I _{DM}	3		- 2		
Continuous Source Current (Diode Conduction) ^a		I _S	0.5	0.39	- 0.5	- 0.39	W
Maximum Power Dissipation ^a	T _A = 25 °C	P _D	0.6	0.47	0.6	0.47	
	T _A = 85 °C		0.3	0.25	0.3	0.25	
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 ^a	R _{thJA}	170	210	°C/W
		220	265	
Maximum Junction-to-Foot (Drain)	R _{thJF}	105	125	

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	
Static								
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 100 μA	N-Ch	0.45		1	V	
		V _{DS} = V _{GS} , I _D = - 100 μA	P-Ch	- 0.45		1		
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 8 V	N-Ch P-Ch			± 100 ± 100	nA	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 9.6 V, V _{GS} = 0 V	N-Ch			1	μA	
		V _{DS} = - 9.6 V, V _{GS} = 0 V	P-Ch			- 1		
		V _{DS} = 9.6 V, V _{GS} = 0 V, T _J = 85 °C	N-Ch			5		
		V _{DS} = - 9.6 V, V _{GS} = 0 V, T _J = 85 °C	P-Ch			- 5		
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ 5 V, V _{GS} = 4.5 V	N-Ch	3			A	
		V _{DS} ≤ - 5 V, V _{GS} = - 4.5 V	P-Ch	- 2				
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 4.5 V, I _D = 1.2 A	N-Ch		0.195	0.235	Ω	
		V _{GS} = - 4.5 V, I _D = - 0.77 A	P-Ch		0.445	0.535		
		V _{GS} = 2.5 V, I _D = 1.0 A	N-Ch		0.230	0.280		
		V _{GS} = - 2.5 V, I _D = - 0.6 A	P-Ch		0.735	0.880		
		V _{GS} = 1.8 V, I _D = 0.2 A	N-Ch		0.284	0.340		
		V _{GS} = - 1.8 V, I _D = - 0.2 A	P-Ch		1.05	1.26		
Forward Transconductance ^a	g _{fs}	V _{DS} = 5 V, I _D = 1.2 A	N-Ch		0.8		S	
		V _{DS} = - 5 V, I _D = - 0.77 A	P-Ch		1.2			
Diode Forward Voltage ^a	V _{SD}	I _S = 0.39 A, V _{GS} = 0 V	N-Ch		0.8	1.2	V	
		I _S = - 0.39 A, V _{GS} = 0 V	P-Ch		- 0.8	- 1.2		
Dynamic ^b								
Total Gate Charge	Q _g	N-Channel V _{DS} = 6 V, V _{GS} = 4.5 V, I _D = 1.2 A	N-Ch P-Ch		0.8 1.1	1.2 1.8	nC	
Gate-Source Charge	Q _{gs}		N-Ch P-Ch		0.15 0.3			
Gate-Drain Charge	Q _{gd}	P-Channel V _{DS} = - 6 V, V _{GS} = - 4.5 V, I _D = - 0.1 A	N-Ch P-Ch		0.20 0.25			
Turn-On Delay Time	t _{d(on)}	N-Channel V _{DD} = 6 V, R _L = 12 Ω I _D ≅ 0.5 A, V _{GEN} = 4.5 V, R _g = 6 Ω	N-Ch P-Ch		15 17	25 25	ns	
Rise Time	t _r		N-Ch P-Ch		25 30	40 45		
Turn-Off Delay Time	t _{d(off)}		P-Channel V _{DD} = - 6 V, R _L = 12 Ω	N-Ch P-Ch		25 15		40 25
Fall Time	t _f		I _D ≅ - 0.5 A, V _{GEN} = - 4.5 V, R _g = 6 Ω	N-Ch P-Ch		10 10		15 15
Source-Drain Reverse Recovery Time	t _{rr}	I _F = 0.39 A, dI/dt = 100 A/μs	N-Ch		20	40		
		I _F = - 0.39 A, dI/dt = 100 A/μs	P-Ch		25	40		

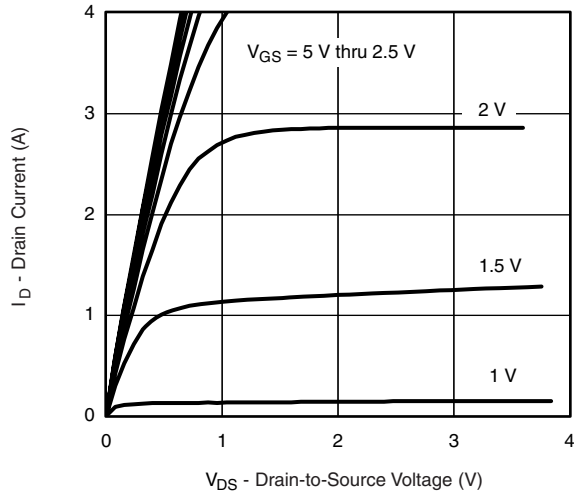
Notes:

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

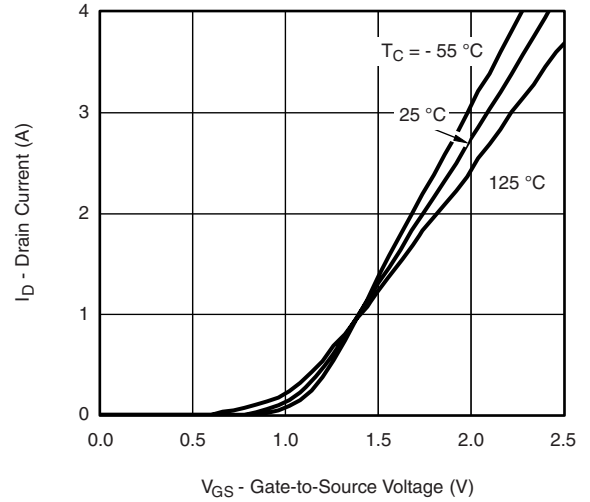
b. Guaranteed by design, not subject to production testing.

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.

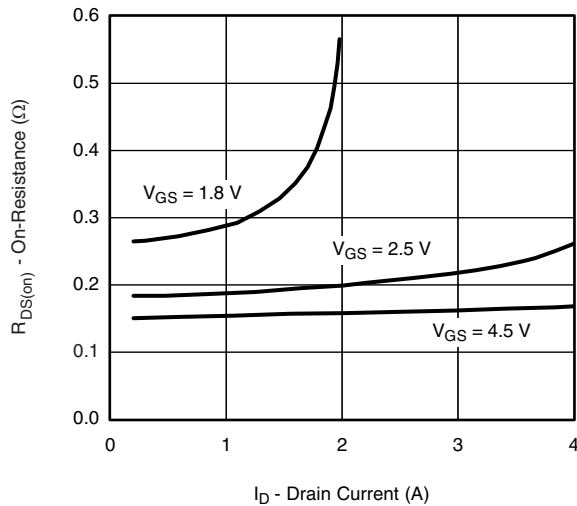
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



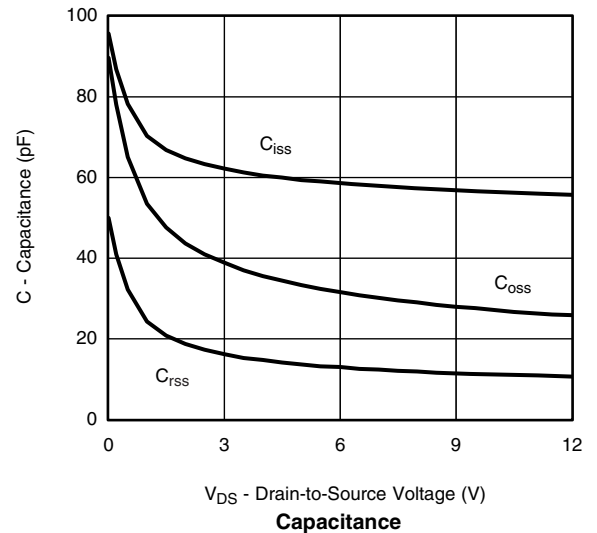
Output Characteristics



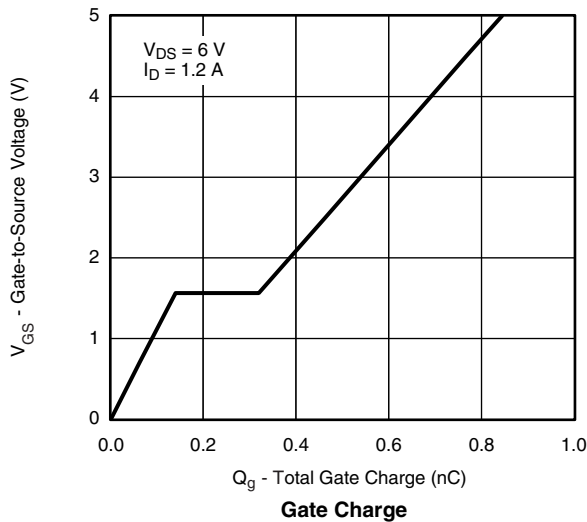
Transfer Characteristics



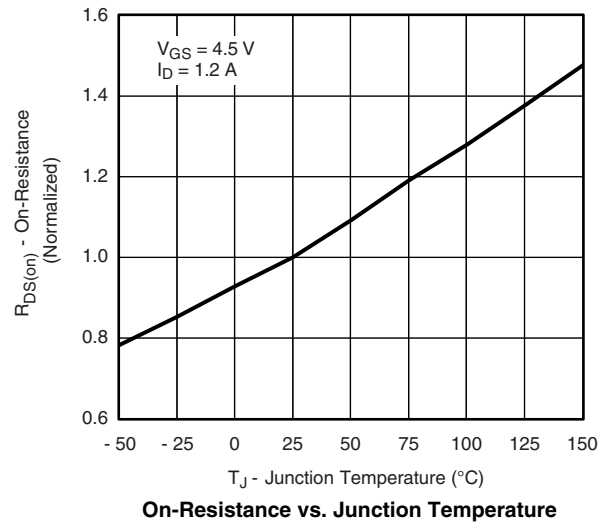
On-Resistance vs. Drain Current



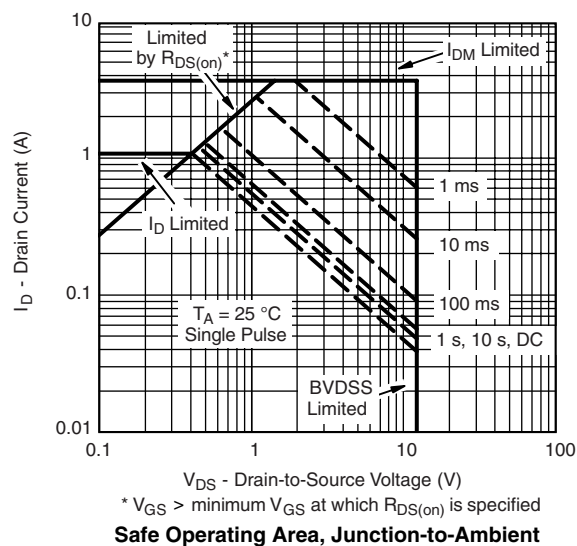
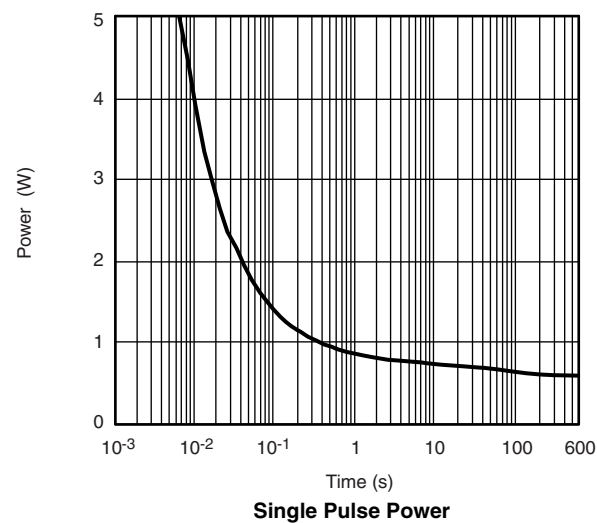
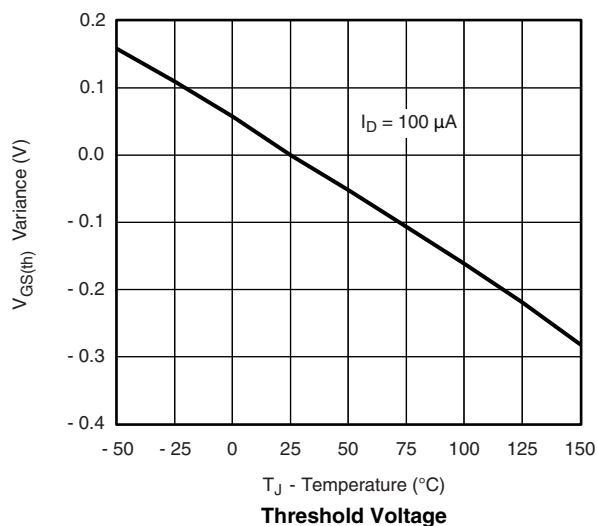
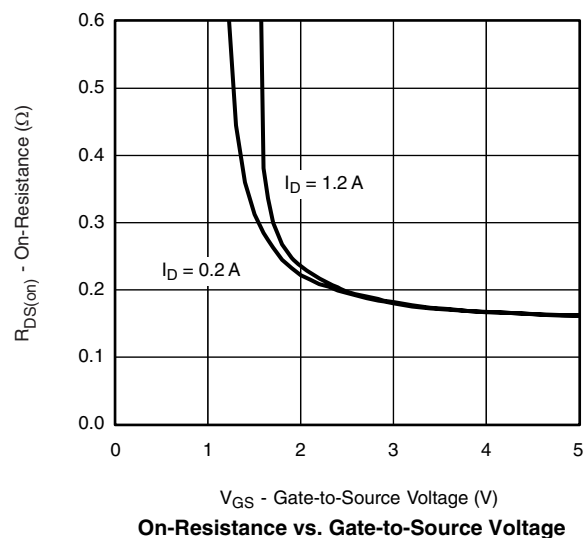
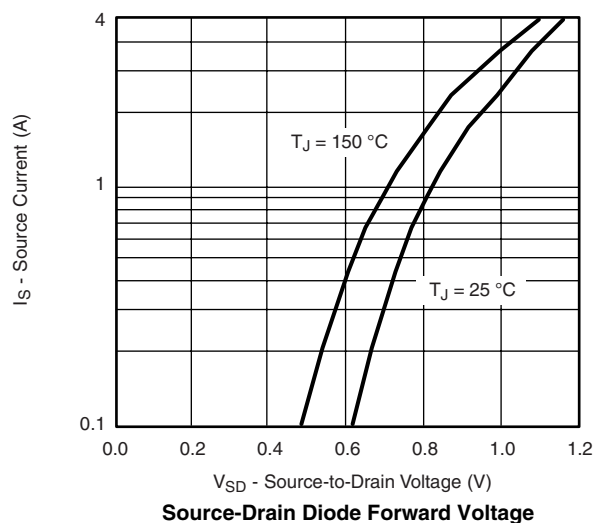
Capacitance



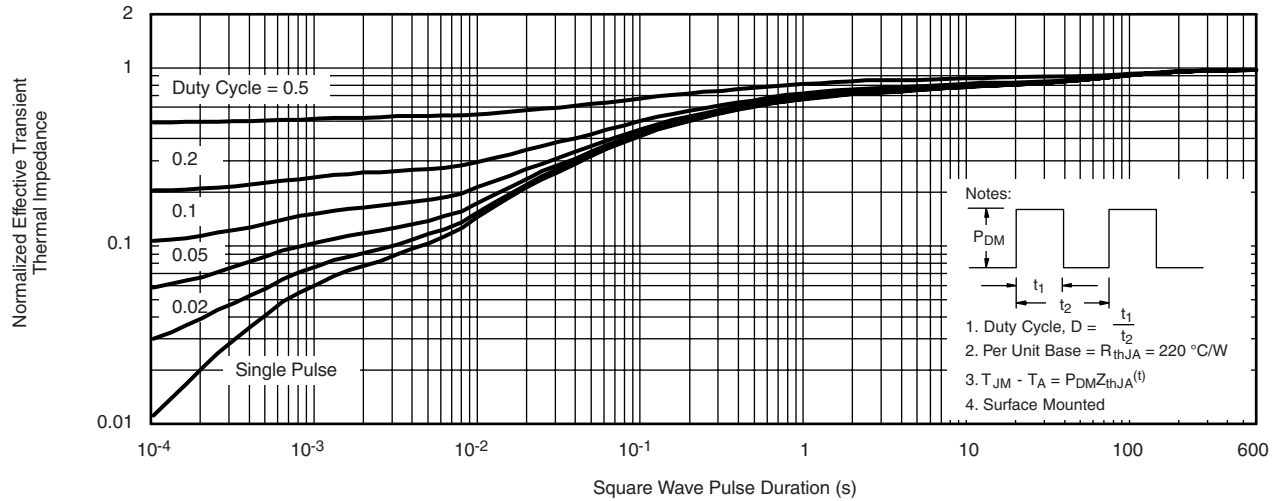
Gate Charge



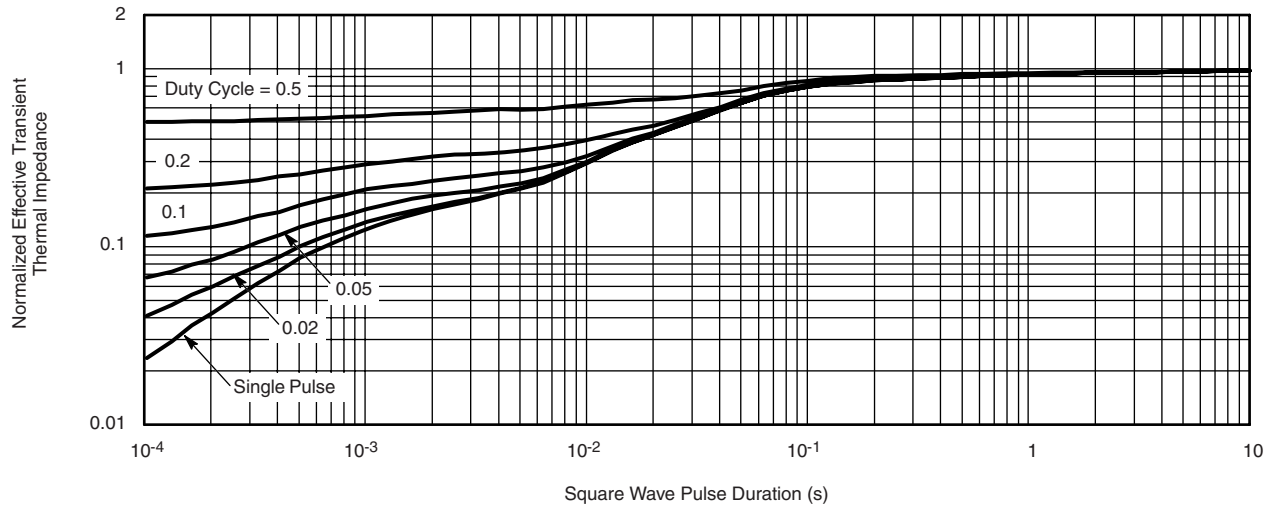
On-Resistance vs. Junction Temperature

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

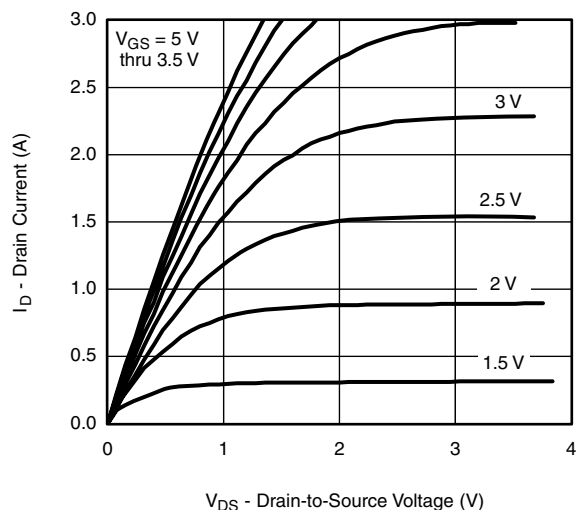
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



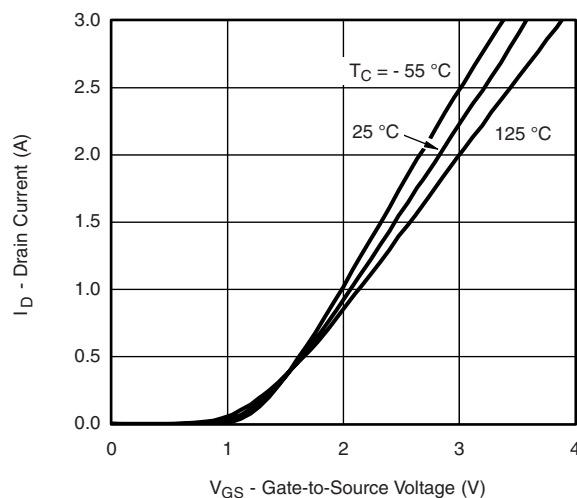
Normalized Thermal Transient Impedance, Junction-to-Ambient



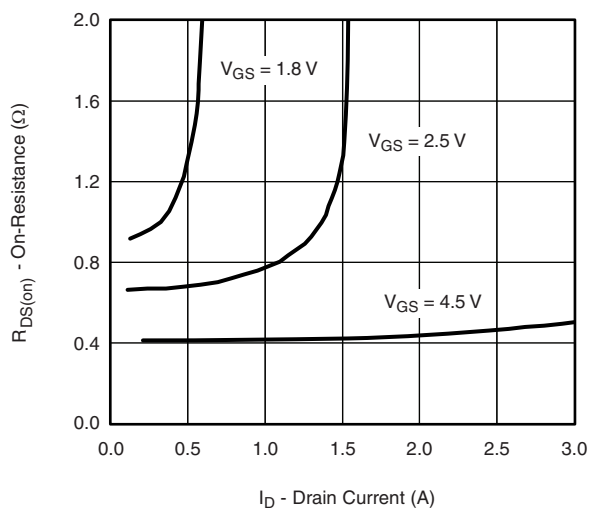
Normalized Thermal Transient Impedance, Junction-to-Foot

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

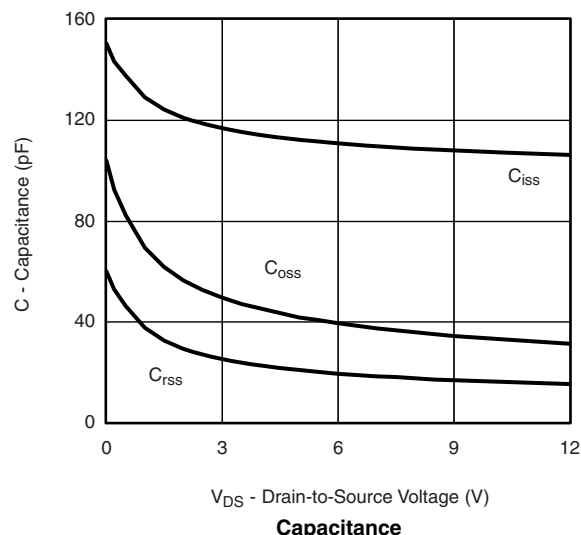
V_{DS} - Drain-to-Source Voltage (V)
Output Characteristics



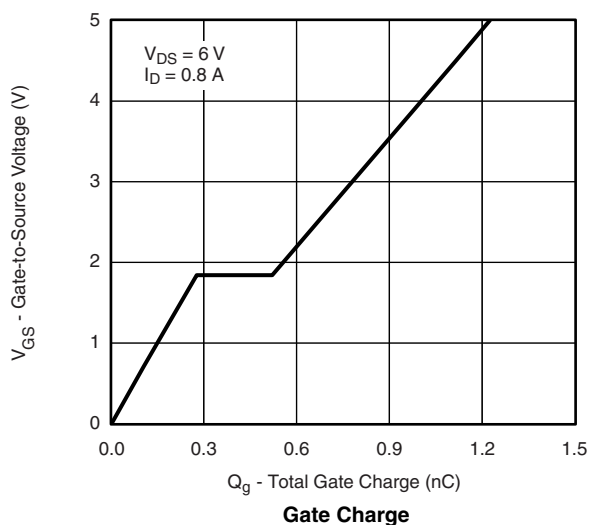
V_{GS} - Gate-to-Source Voltage (V)
Transfer Characteristics



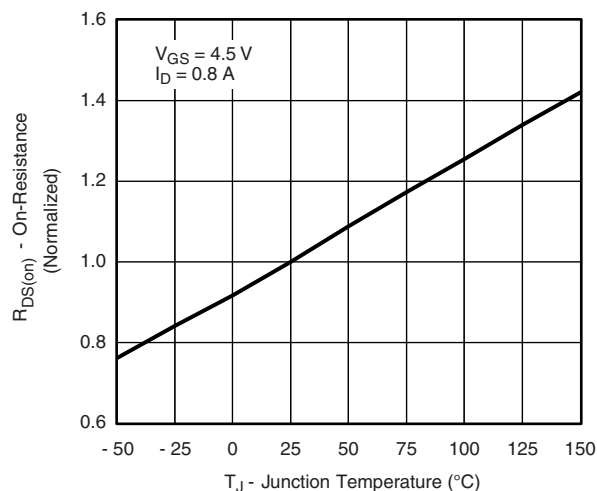
I_D - Drain Current (A)
On-Resistance vs. Drain Current



V_{DS} - Drain-to-Source Voltage (V)
Capacitance



Q_g - Total Gate Charge (nC)
Gate Charge



T_J - Junction Temperature ($^{\circ}\text{C}$)
On-Resistance vs. Junction Temperature

A graph showing the Source Current (I_S) in Amperes (A) on the Y-axis versus the Source-to-Drain Voltage (V_{SD}) in Volts (V) on the X-axis. The Y-axis is logarithmic, ranging from 0.1 to 3 A. The X-axis is linear, ranging from 0.0 to 1.2 V. Two curves are plotted, representing the device's characteristics at different temperatures:

- $T_J = 150\text{ }^{\circ}\text{C}$ (Upper curve)
- $T_J = 25\text{ }^{\circ}\text{C}$ (Lower curve)

The graph shows that the source current increases with both source-to-drain voltage and temperature. The curves are approximately as follows:

V_{SD} (V)	I_S (A) at $T_J = 150\text{ }^{\circ}\text{C}$	I_S (A) at $T_J = 25\text{ }^{\circ}\text{C}$
0.55	0.1	-
0.60	0.2	0.1
0.70	0.5	0.2
0.80	1.0	0.5
0.90	1.5	1.0
1.00	2.0	1.5
1.10	2.5	2.0
1.15	3.0	2.5

The graph shows the relationship between the on-resistance and the gate-to-source voltage for the 2N7000 MOSFET. The y-axis represents the on-resistance $R_{DS(on)}$ in Ohms (Ω), ranging from 0.0 to 3.0. The x-axis represents the gate-to-source voltage V_{GS} in Volts (V), ranging from 0 to 5. Two curves are plotted for different drain currents: $I_D = 0.2$ A and $I_D = 0.8$ A. Both curves show a sharp decrease in on-resistance as the gate voltage increases, with the on-resistance for $I_D = 0.8$ A being higher than for $I_D = 0.2$ A.

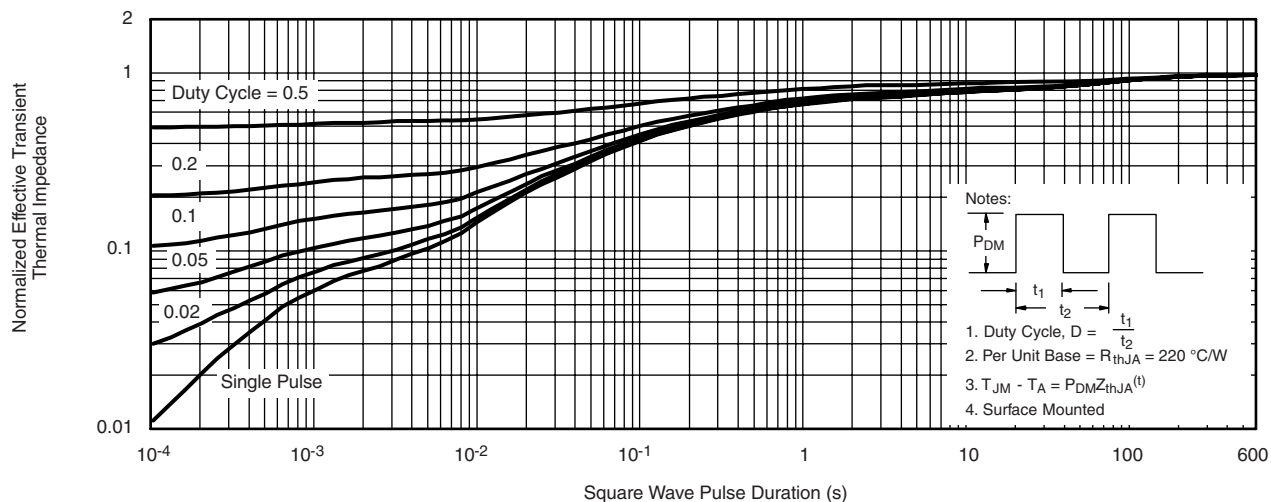
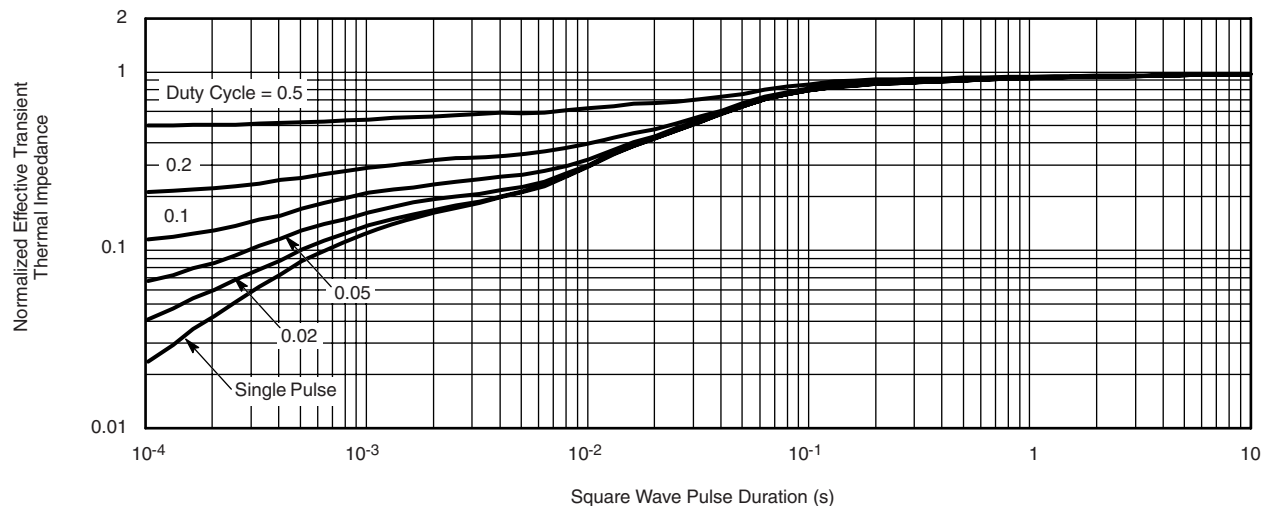
V_{GS} (V)	$R_{DS(on)}$ (Ω) at $I_D = 0.2$ A	$R_{DS(on)}$ (Ω) at $I_D = 0.8$ A
1.5	> 3.0	> 3.0
2.0	~0.8	~1.5
3.0	~0.5	~0.6
4.0	~0.4	~0.45
5.0	~0.35	~0.4

Graph showing the variation of $V_{GS(th)}$ (V) versus T_J - Temperature ($^{\circ}C$) for $I_D = 100 \mu A$. The graph shows a linear relationship with a positive slope.

T_J - Temperature ($^{\circ}C$)	$V_{GS(th)}$ (V)
-50	-0.13
-25	-0.10
0	-0.05
25	0.00
50	0.05
75	0.10
100	0.15
125	0.20
150	0.25

Figure 1 is a line graph showing the power spectrum of the signal. The vertical axis is labeled 'Power (W)' and ranges from 0 to 5. The horizontal axis is labeled 'Time (s)' and is on a logarithmic scale, ranging from 10^{-3} to 600. The curve starts at a power of 5 W at 10^{-2} s and decays rapidly, reaching approximately 0.5 W at 600 s.

Safe Operating Area, Junction-to-Ambient

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted**Normalized Thermal Transient Impedance, Junction-to-Ambient****Normalized Thermal Transient Impedance, Junction-to-Foot**

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?71944.



Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.