

SM1600DSCS-VB Datasheet

Dual N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
20	0.086 at $V_{GS} = 4.5$ V	2.6 ^a	5.0 nC
	0.110 at $V_{GS} = 2.5$ V	2.5 ^a	
	0.180 at $V_{GS} = 1.8$ V	2.3 ^a	

FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC


RoHS
 COMPLIANT

APPLICATIONS

- Load Switch for Portable Applications



ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	20	V
Gate-Source Voltage		V_{GS}	± 12	
Continuous Drain Current ($T_J = 150$ °C)	$T_C = 25$ °C	I_D	2.6 ^a	A
	$T_C = 70$ °C		2.2 ^a	
	$T_A = 25$ °C		2.3 ^{a, b, c}	
	$T_A = 70$ °C		1.8 ^{b, c}	
Pulsed Drain Current		I_{DM}	8	A
Continuous Source-Drain Diode Current	$T_C = 25$ °C	I_S	2.3	
	$T_A = 25$ °C		2.10 ^{b, c}	
Maximum Power Dissipation	$T_C = 25$ °C	P_D	2.70	W
	$T_C = 70$ °C		1.70	
	$T_A = 25$ °C		1.5 ^{b, c}	
	$T_A = 70$ °C		1.0 ^{b, c}	
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 ^{b, d}	$t \leq 5$ s	R_{thJA}	130	170	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	80	100	

Notes:

a. Package limited.

b. Surface mounted on 1" x 1" FR4 board.

 c. $t = 5$ s.

d. Maximum under steady state conditions is 220 °C/W.

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	20			V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA		20		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			- 2.3		
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	0.5		2.0	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 8 V			± 25	μA
		V _{DS} = 0 V, V _{GS} = ± 4.5 V			1	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 20 V, V _{GS} = 0 V			1	μA
		V _{DS} = 20 V, V _{GS} = 0 V, T _J = 55 °C			10	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≤ 5 V, V _{GS} = 4.5 V	4			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 4.5 V, I _D = 1 A		0.086		Ω
		V _{GS} = 2.5 V, I _D = 1 A		0.110		
		V _{GS} = 1.8 V, I _D = 0.2 A		0.180		
Forward Transconductance ^a	g _{fs}	V _{DS} = 4 V, I _D = 1.5 A		4		S
Dynamic ^b						
Total Gate Charge	Q _g	V _{DS} = 10 V, V _{GS} = 8 V, I _D = 1.5 A		5.0		nC
		V _{DS} = 10 V, V _{GS} = 4.5 V, I _D = 1.5 A		3.0		
Gate-Source Charge	Q _{gs}			1.0		
Gate-Drain Charge	Q _{gd}			2.0		
Gate Resistance	R _g	f = 1 MHz	0.4	1.9	3.8	kΩ
Turn-On Delay Time	t _{d(on)}	V _{DD} = 10 V, R _L = 8.3 Ω I _D ≅ 1.2 A, V _{GEN} = 4.5 V, R _g = 1 Ω		43	65	ns
Rise Time	t _r			80	120	
Turn-Off Delay Time	t _{d(off)}			480	720	
Fall Time	t _f			220	330	
Turn-on Delay Time	t _{d(on)}	V _{DD} = 10 V, R _L = 8.3 Ω I _D ≅ 1.2 A, V _{GEN} = 8 V, R _g = 1 Ω		22	33	
Rise Time	t _r			46	70	
Turn-Off Delay Time	t _{d(off)}			645	968	
Fall Time	t _r			215	323	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C		2.6		A
Pulse Diode Forward Current	I _{SM}			4		
Body Diode Voltage	V _{SD}	I _S = 1.2 A, V _{GS} = 0 V		0.8	1.2	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = 1.2 A, dI/dt = 100 A/μs, T _J = 25 °C		9	18	ns
Body Diode Reverse Recovery Charge	Q _{rr}			2	4	nC
Reverse Recovery Fall Time	t _a			5		ns
Reverse Recovery Rise Time	t _b			4		

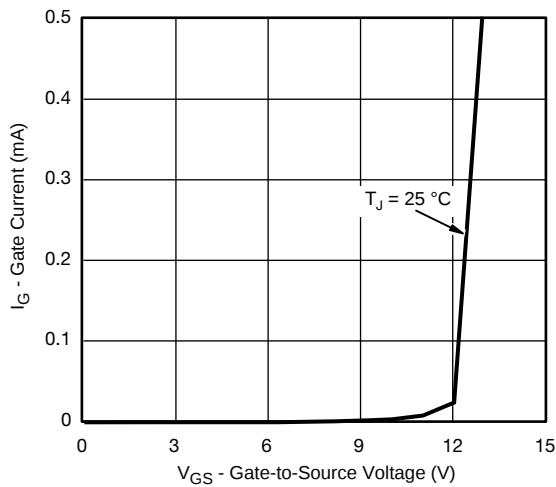
Notes:

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

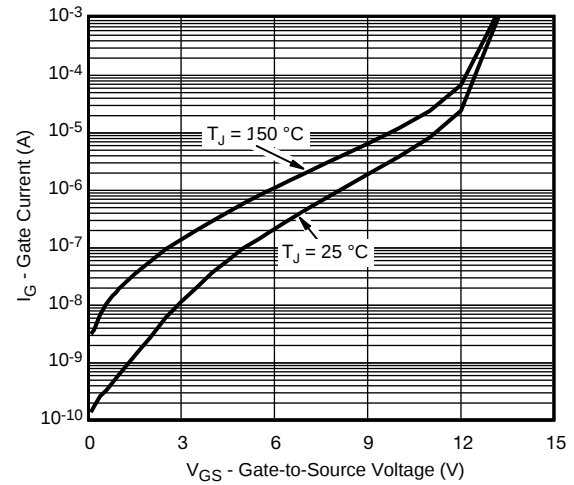
b. Guaranteed by design, not subject to production testing.

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.

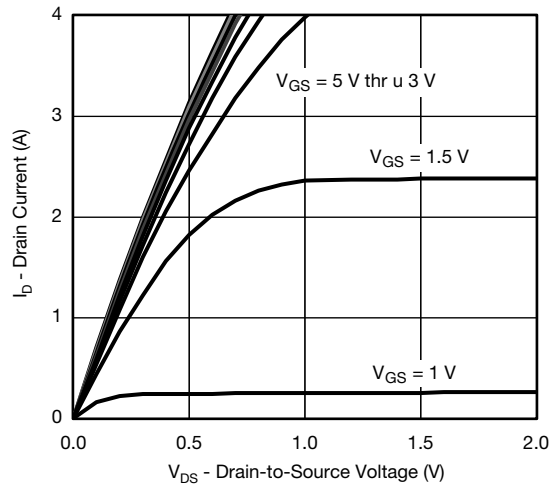
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



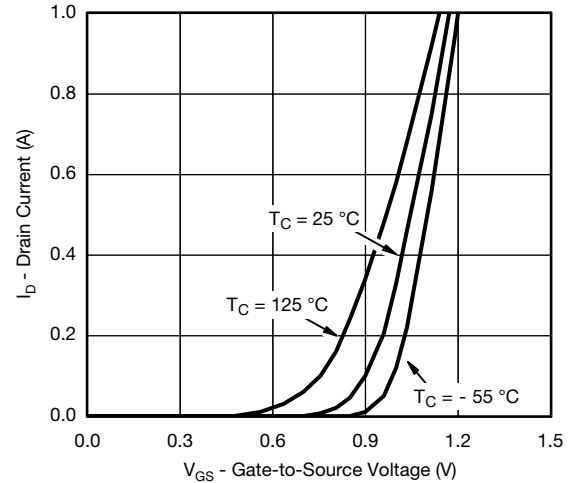
Gate Current vs. Gate-to-Source Voltage



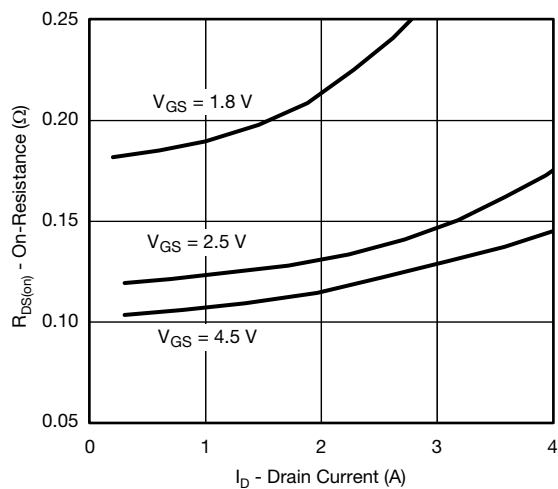
Gate Current vs. Gate-to-Source Voltage



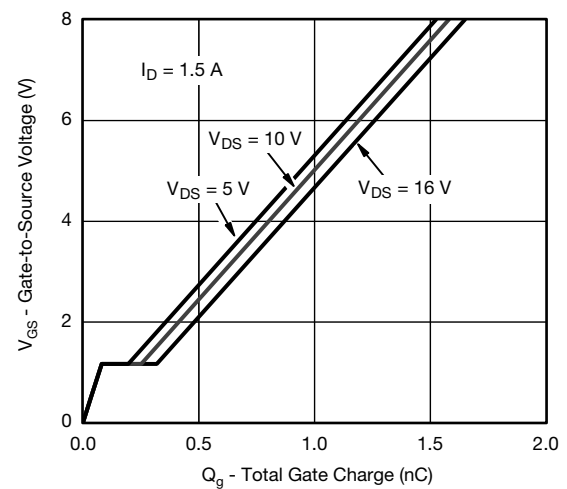
Output Characteristics



Transfer Characteristics

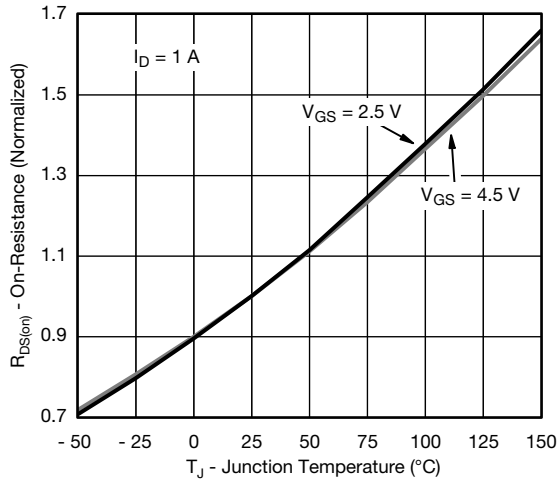


On-Resistance vs. Drain Current

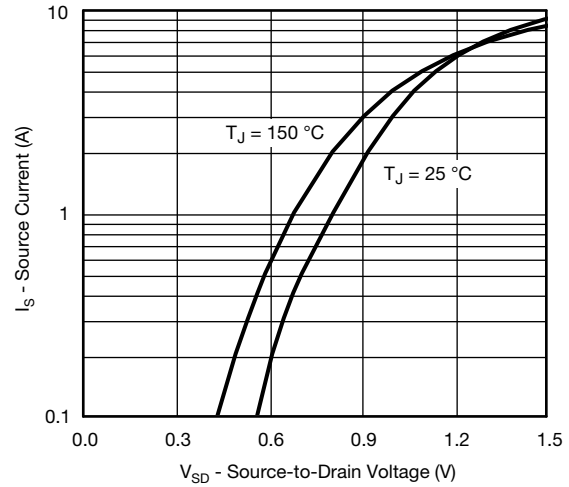


Gate Charge

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



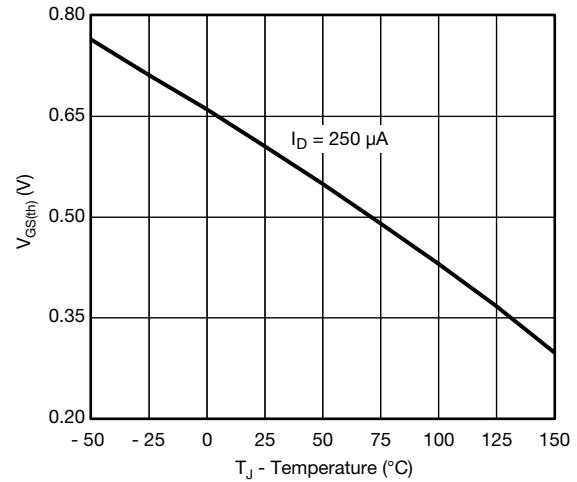
On-Resistance vs. Junction Temperature



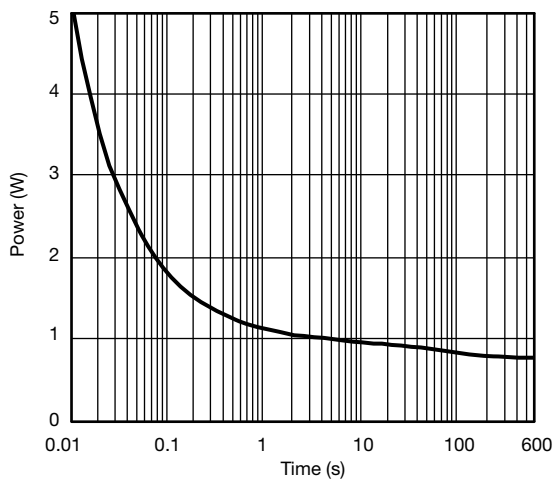
Source-Drain Diode Forward Voltage



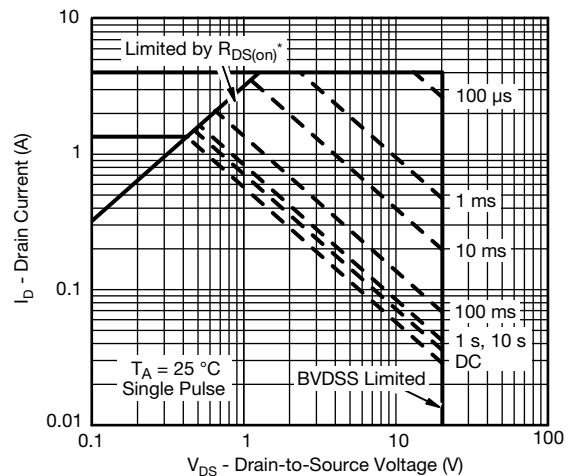
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient



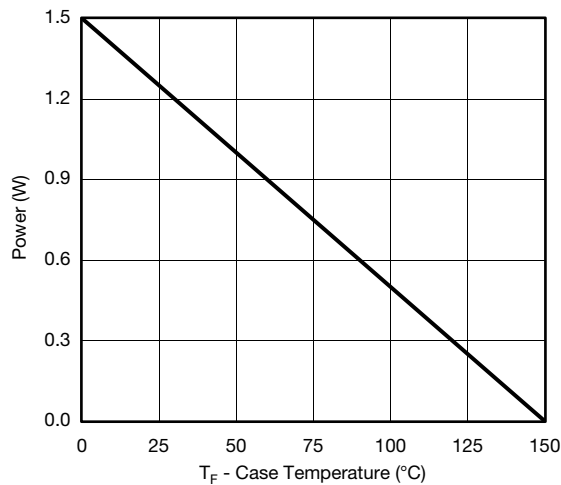
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

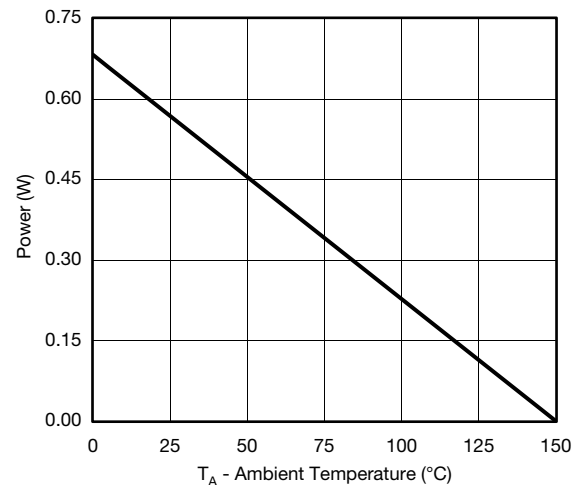
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating*



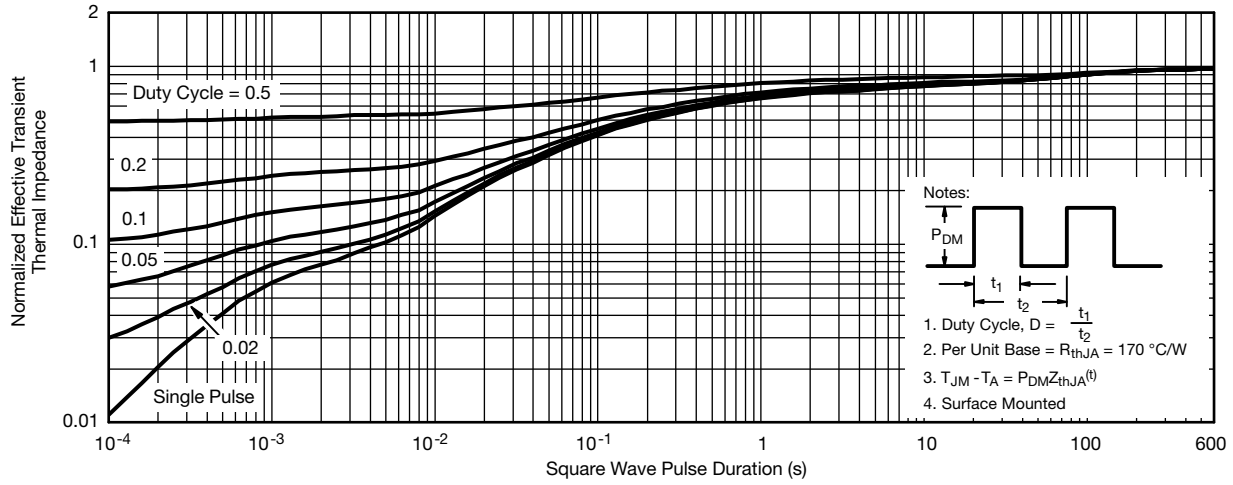
Power, Junction-to-Foot



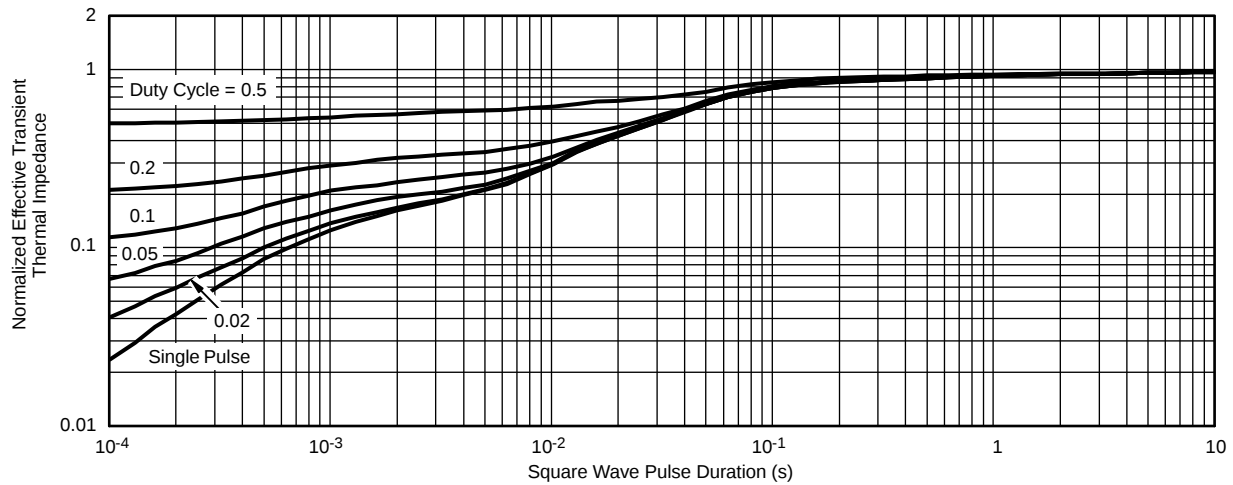
Power, Junction-to-Ambient

* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

SC-70: 6-LEADS



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.90	—	1.10	0.035	—	0.043
A ₁	—	—	0.10	—	—	0.004
A ₂	0.80	—	1.00	0.031	—	0.039
b	0.15	—	0.30	0.006	—	0.012
c	0.10	—	0.25	0.004	—	0.010
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E ₁	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65BSC			0.026BSC		
e ₁	1.20	1.30	1.40	0.047	0.051	0.055
L	0.10	0.20	0.30	0.004	0.008	0.012
α	7°Nom			7°Nom		

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