

## K1593-VB Datasheet

### N-Channel 100 V (D-S) MOSFET

#### MOSFET PRODUCT SUMMARY

V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω) Typ.	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)
100	0.102 at V <sub>GS</sub> = 10 V	4.2	2.9 nC
	0.120 at V <sub>GS</sub> = 6 V	3.8	
	0.125 at V <sub>GS</sub> = 4.5 V	3.6	

#### FEATURES

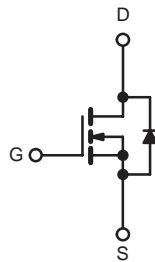
- Trench Power MOSFET
- 100 % R<sub>g</sub> and UIS Tested



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

#### APPLICATIONS

- DC/DC Converters / Boost Converters
- Load Switch
- LED Backlighting in LCD TVs
- Power Management for Mobile Computing



N-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V <sub>DS</sub>	100	V
Gate-Source Voltage	V <sub>GS</sub>	± 20	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	A
		T <sub>C</sub> = 70 °C	
		T <sub>A</sub> = 25 °C	
		T <sub>A</sub> = 70 °C	
Pulsed Drain Current (t = 300 μs)	I <sub>DM</sub>	15	A
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	
		T <sub>A</sub> = 25 °C	
Single Pulse Avalanche Current	I <sub>AS</sub>	3	
Single Pulse Avalanche Energy	E <sub>AS</sub>	0.45	mJ
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	W
		T <sub>C</sub> = 70 °C	
		T <sub>A</sub> = 25 °C	
		T <sub>A</sub> = 70 °C	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	R <sub>thJA</sub>	75	100	°C/W
Maximum Junction-to-Foot (Drain)	R <sub>thJF</sub>	40	50	

Notes:

a. Based on T<sub>C</sub> = 25 °C.

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

c. t = 5 s.

d. Maximum under steady state conditions is 166 °C/W.

MOSFET SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)							
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	100			V	
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA		59		mV/°C	
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 4.8			
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.2		3	V	
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V			- 1	μA	
		V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			- 10		
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 10 V	5			A	
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2 A		0.102		Ω	
		V <sub>GS</sub> = 6 V, I <sub>D</sub> = 1 A		0.120			
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 1 A		0.125			
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 20 V, I <sub>D</sub> = 2 A		5		S	
Dynamic <sup>b</sup>							
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 50 V, V <sub>GS</sub> = 0 V, f = 1 MHz		196		pF	
Output Capacitance	C <sub>oss</sub>			67			
Reverse Transfer Capacitance	C <sub>rss</sub>			14			
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 50 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.2 A		5.2	10.4	nC	
Gate-Source Charge	Q <sub>gs</sub>	V <sub>DS</sub> = 50 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 2.2 A		2.9	5.8		
Gate-Drain Charge	Q <sub>gd</sub>			1			
Gate Resistance	R <sub>g</sub>			1.4			
Turn-On Delay Time	t <sub>d(on)</sub>	f = 1 MHz	0.9	4.3	8.6	Ω	
Rise Time	t <sub>r</sub>		V <sub>DD</sub> = 50 V, R <sub>L</sub> = 27.7 Ω I <sub>D</sub> = 1.8 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω		40		60
Turn-Off Delay Time	t <sub>d(off)</sub>				68		102
Fall Time	t <sub>f</sub>				14		21
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 50 V, R <sub>L</sub> = 27.7 Ω I <sub>D</sub> = 1.8 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω			20	30	
Gate Resistance	R <sub>g</sub>			8	16		
Turn-On Delay Time	t <sub>d(on)</sub>			10	20		
Rise Time	t <sub>r</sub>			10	20		
Turn-Off Delay Time	t <sub>d(off)</sub>			7	14		
Fall Time	t <sub>f</sub>						
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			- 2.1	A	
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				- 8		
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 1.8 A		- 0.8	- 1.2	V	
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 1.8 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C		23	35	ns	
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			21	32	nC	
Reverse Recovery Fall Time	t <sub>a</sub>			17		ns	
Reverse Recovery Rise Time	t <sub>b</sub>			6			

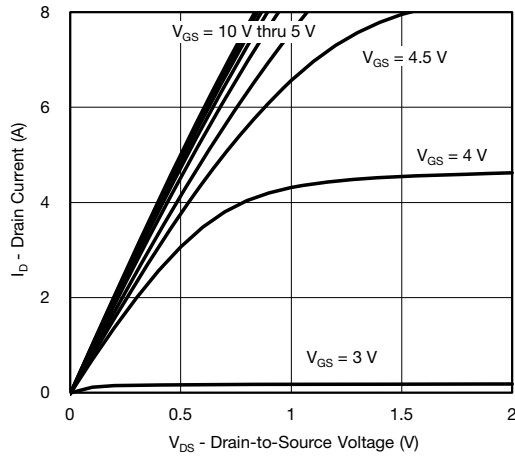
Notes:

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

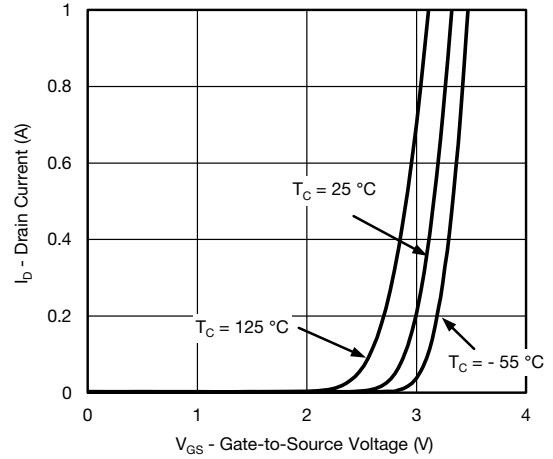
b. Guaranteed by design, not subject to production testing.

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.

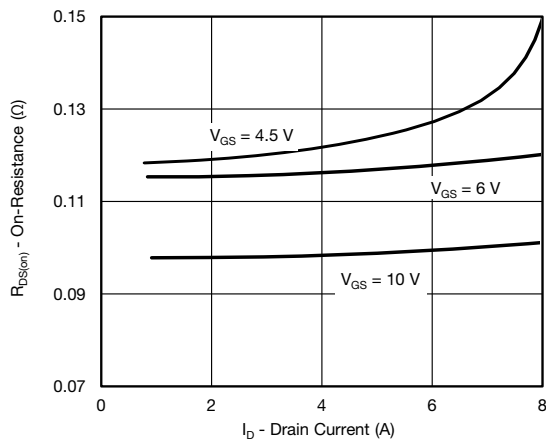
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



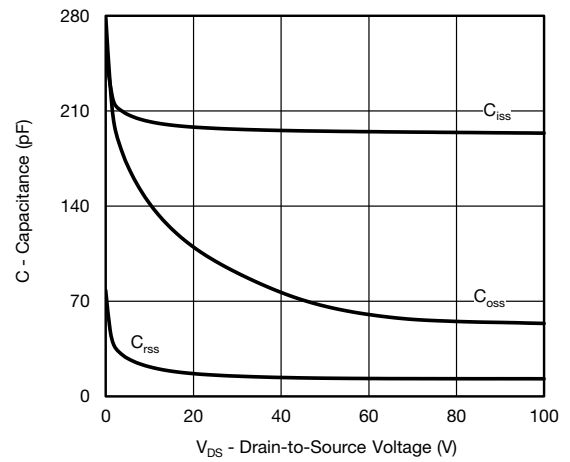
**Output Characteristics**



**Transfer Characteristics**



**On-Resistance vs. Drain Current and Gate Voltage**



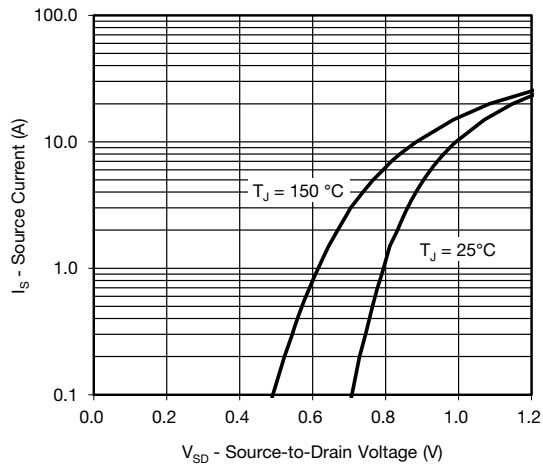
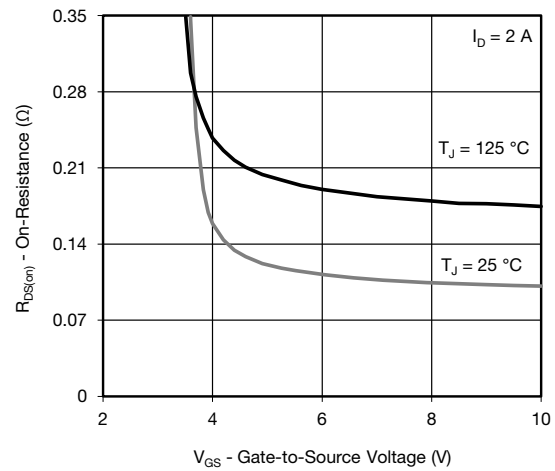
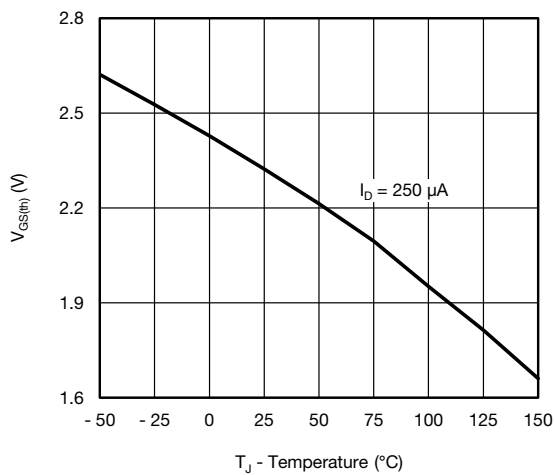
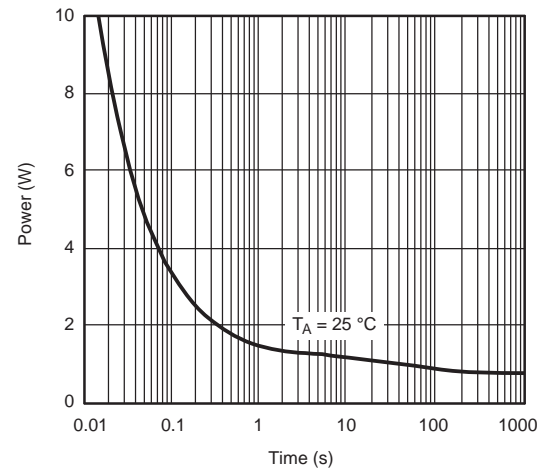
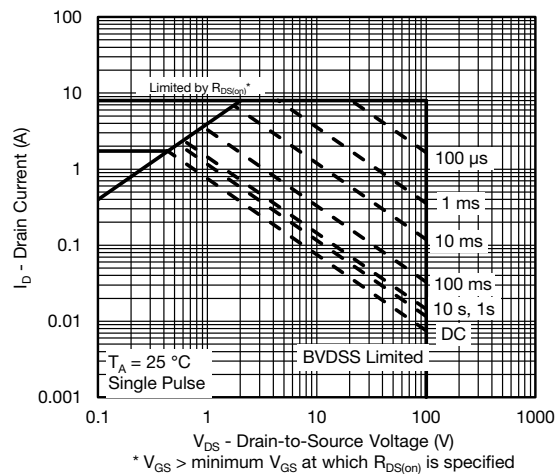
**Capacitance**



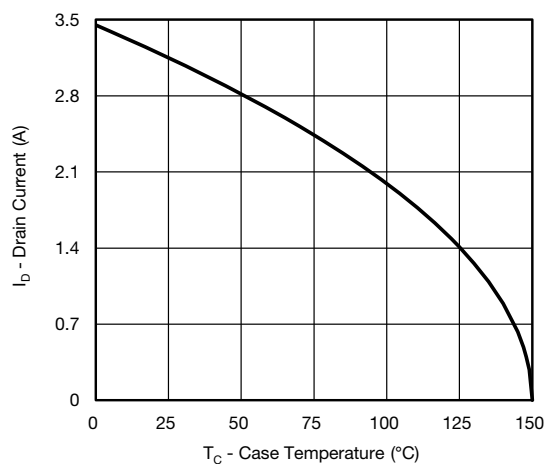
**Gate Charge**

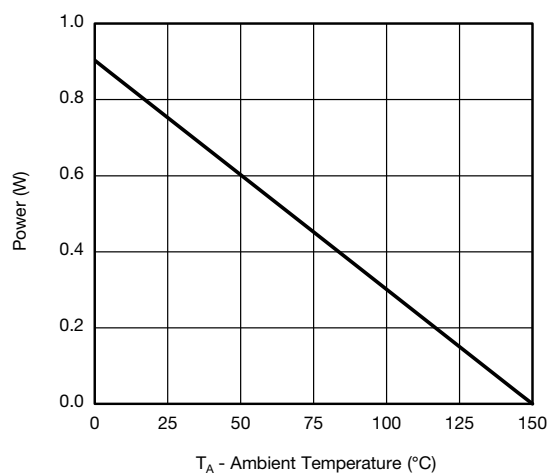


**On-Resistance vs. Junction Temperature**

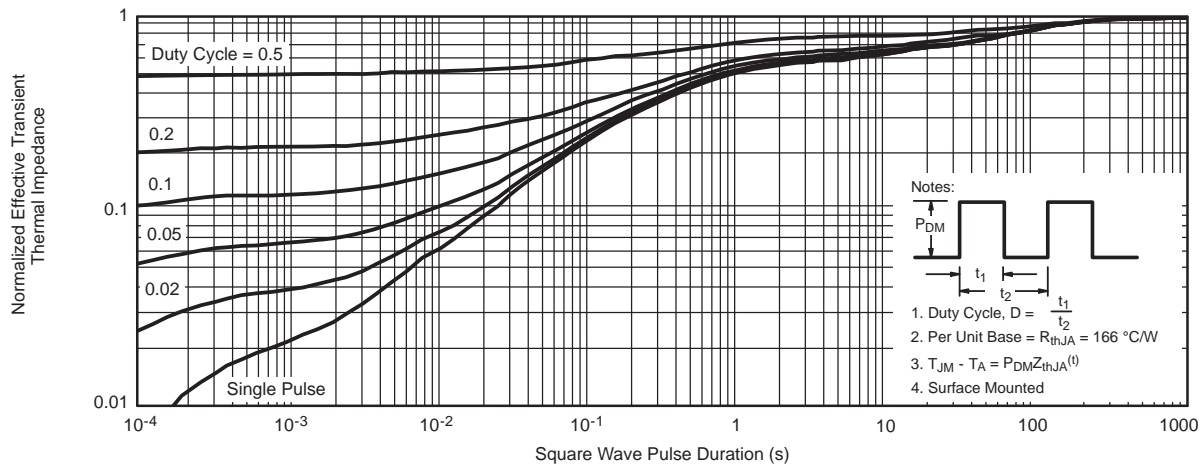
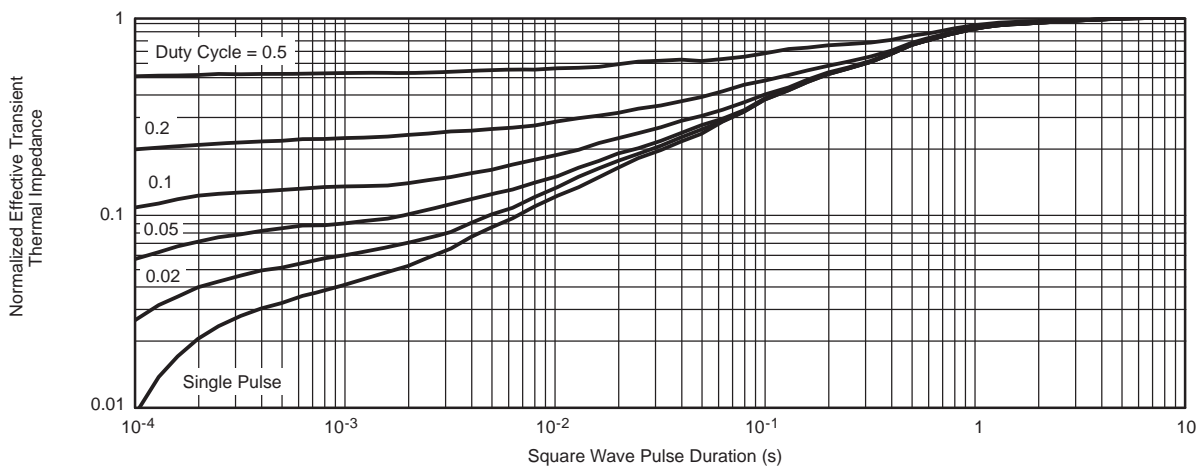
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Source-Drain Diode Forward Voltage**

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

**Threshold Voltage**

**Single Pulse Power**

**Safe Operating Area**

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

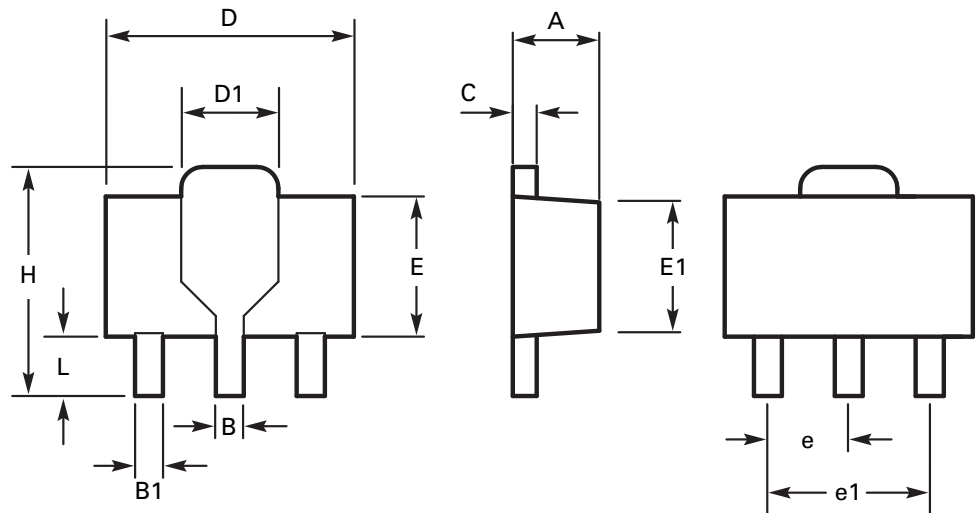
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**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**

Package outline - SOT89



DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
A	1.40	1.60	0.550	0.630	E	2.29	2.60	0.090	0.102
B	0.44	0.56	0.017	0.022	E1	2.13	2.29	0.084	0.090
B1	0.36	0.48	0.014	0.019	e	1.50 BSC		0.059 BSC	
C	0.35	0.44	0.014	0.017	e1	3.00 BSC		0.118 BSC	
D	4.40	4.60	0.173	0.181	H	3.94	4.25	0.155	0.167
D1	1.62	1.83	0.064	0.072	L	0.89	1.20	0.035	0.047

**Note:** Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

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