

## VS3606AE-VB Datasheet

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

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)	$Q_g$ (Typ.)
30	0.0018 at $V_{GS} = 10$ V	70	22.5 nC
	0.0025 at $V_{GS} = 4.5$ V	60	

#### FEATURES

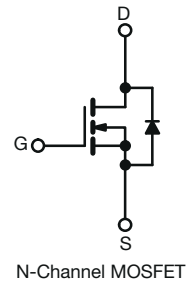
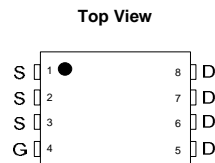
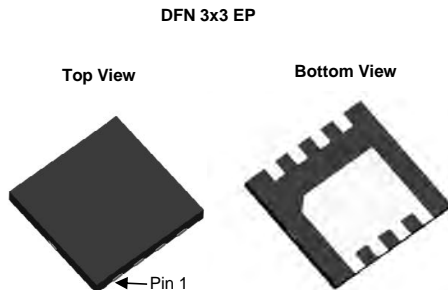
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Gen IV Power MOSFET
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



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

#### APPLICATIONS

- Switch Mode Power Supplies
- Personal Computers and Servers
- Telecom Bricks
- VRM's and POL



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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	30	V
Gate-Source Voltage	$V_{GS}$	+ 20, - 16	
Continuous Drain Current ( $T_J = 150$ °C)	$T_C = 25$ °C	70	A
	$T_C = 70$ °C	50	
	$T_A = 25$ °C	30.9 <sup>a, b</sup>	
	$T_A = 70$ °C	28.3 <sup>a, b</sup>	
Pulsed Drain Current ( $t = 300$ $\mu$ s)	$I_{DM}$	80	
Continuous Source-Drain Diode Current	$T_C = 25$ °C	40 <sup>g</sup>	
	$T_A = 25$ °C	3.3 <sup>a, b</sup>	
Single Pulse Avalanche Current	$I_{AS}$	20	mJ
Single Pulse Avalanche Energy	$E_{AS}$	20	
Maximum Power Dissipation	$T_C = 25$ °C	52	W
	$T_C = 70$ °C	43	
	$T_A = 25$ °C	3.7 <sup>a, b</sup>	
	$T_A = 70$ °C	3.1 <sup>a, b</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C
Soldering Recommendations (Peak Temperature) <sup>c, d</sup>		260	

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a, e</sup>	$R_{thJA}$	24	33	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	1.9	2.4	

Notes:

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

b.  $t = 10$  s.

c. The DFN 3 x 3 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.

d. Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.

e. Maximum under steady state conditions is 81 °C/W.

f. Based on  $T_C = 25$  °C.

g. Package limited.

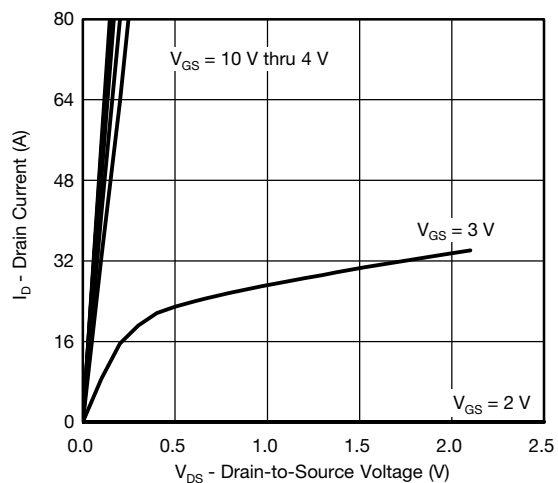
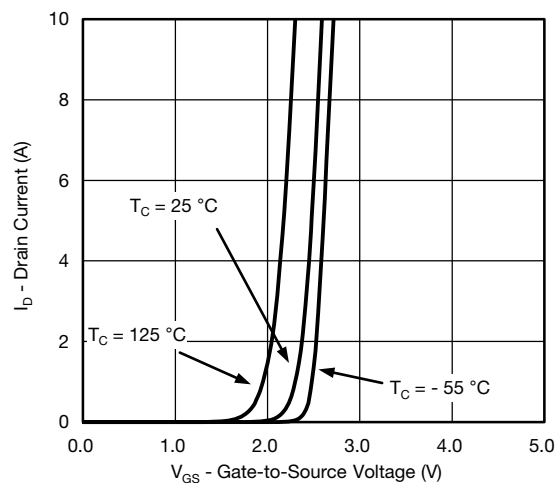
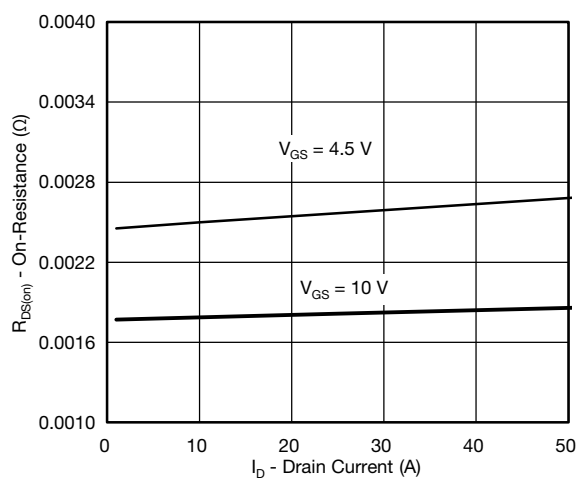
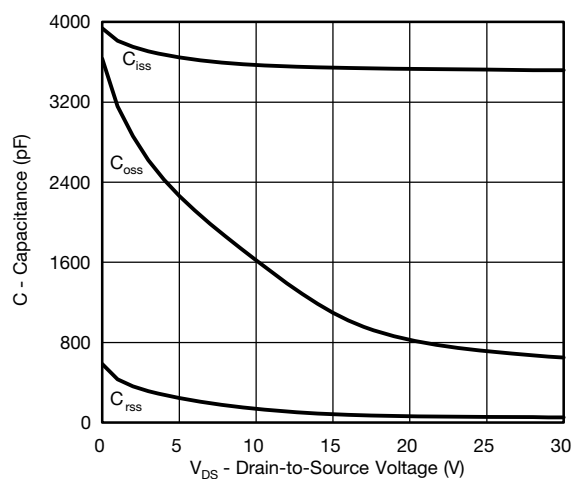
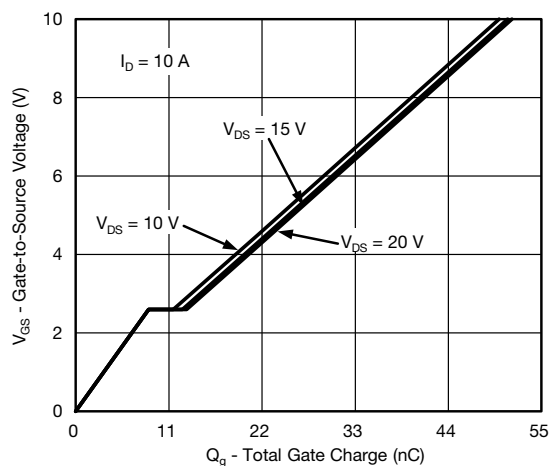
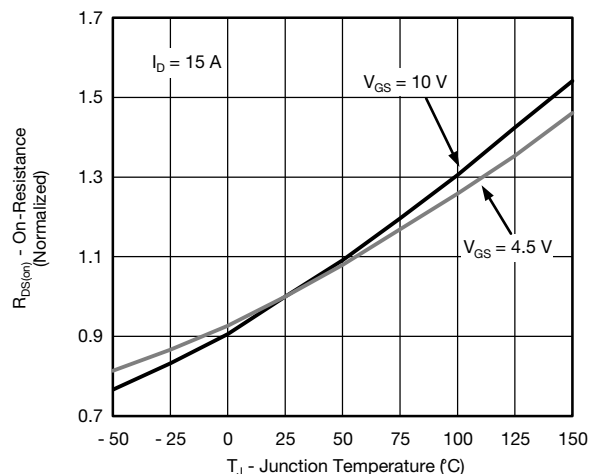
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA		14		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 5.5		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.1		2.2	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = + 20 V, - 16 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 30 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	40			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 15 A		0.0018		Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A		0.0025		
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 15 A		105		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz		3050		pF
Output Capacitance	C <sub>oss</sub>			1040		
Reverse Transfer Capacitance	C <sub>rss</sub>			79		
C <sub>rss</sub> /C <sub>iss</sub> Ratio				0.022	0.044	
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A		51	77	nC
		V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A		22.5	34	
Gate-Source Charge	Q <sub>gs</sub>			8.6		
Gate-Drain Charge	Q <sub>gd</sub>			4		
Output Charge	Q <sub>oss</sub>	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V		30.5		
Gate Resistance	R <sub>g</sub>	f = 1 MHz	0.3	1.25	2.5	Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 15 V, R <sub>L</sub> = 1.5 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω		24	48	ns
Rise Time	t <sub>r</sub>			17	34	
Turn-Off Delay Time	t <sub>d(off)</sub>			25	50	
Fall Time	t <sub>f</sub>			10	20	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 15 V, R <sub>L</sub> = 1.5 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		12	24	
Rise Time	t <sub>r</sub>			10	20	
Turn-Off Delay Time	t <sub>d(off)</sub>			30	60	
Fall Time	t <sub>f</sub>			8	16	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			40	A
Pulse Diode Forward Current	I <sub>SM</sub>				80	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 0 V		0.73	1.1	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 10 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C		36	70	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			24	48	nC
Reverse Recovery Fall Time	t <sub>a</sub>			16		ns
Reverse Recovery Rise Time	t <sub>b</sub>			20		

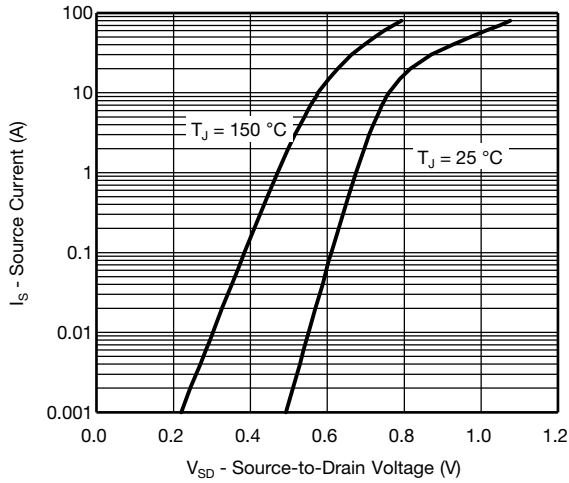
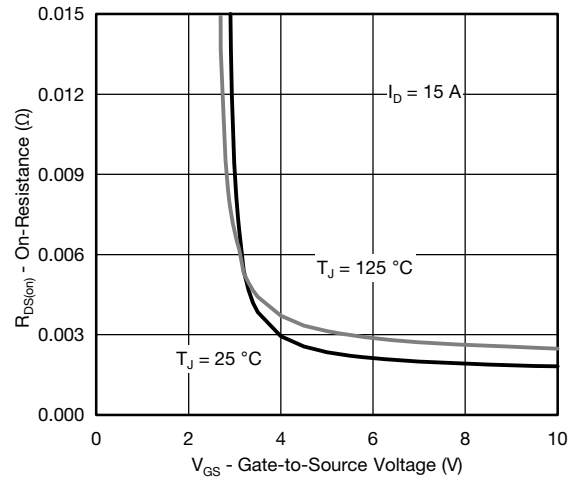
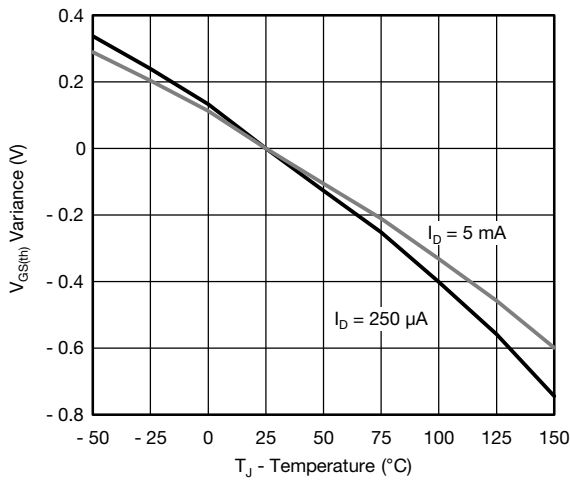
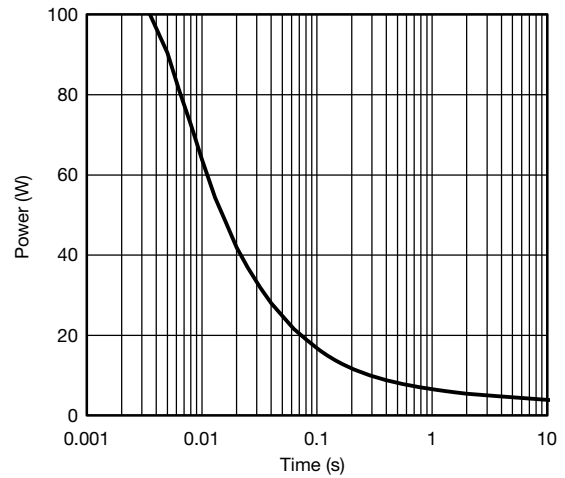
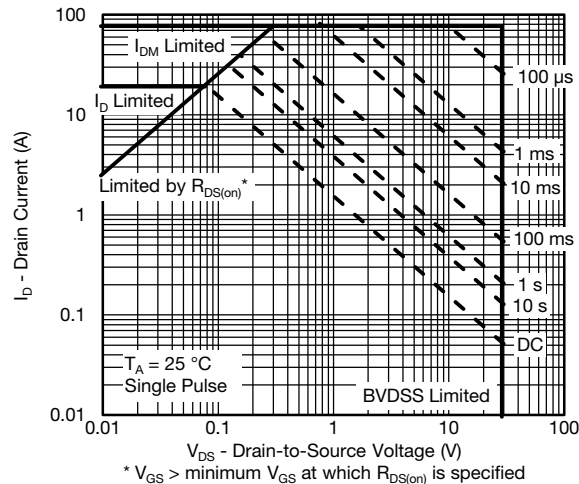
Notes:

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

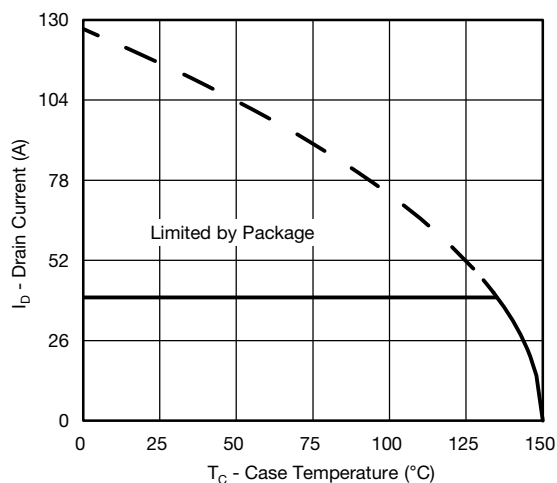
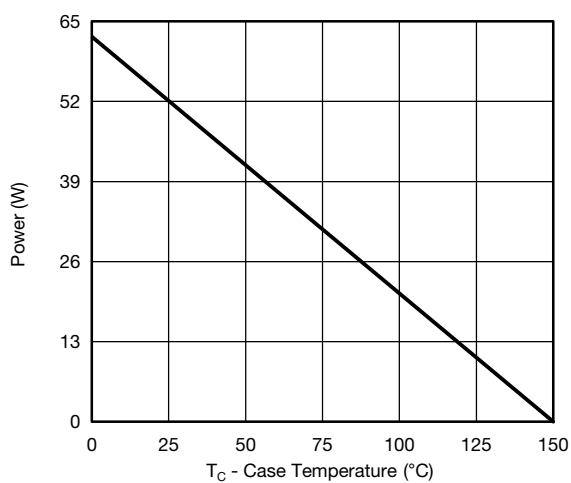
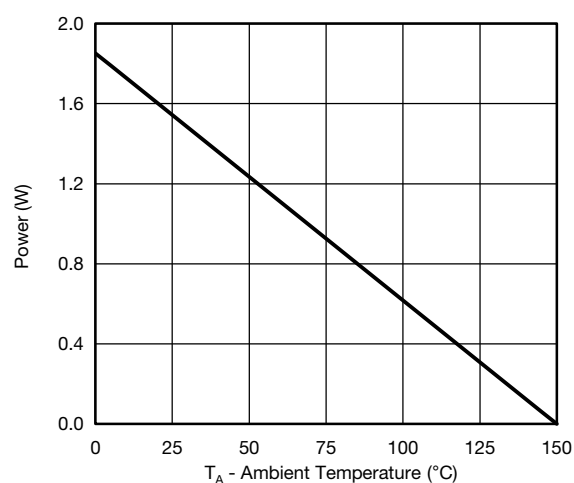
b. Guaranteed by design, not subject to production testing.

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.

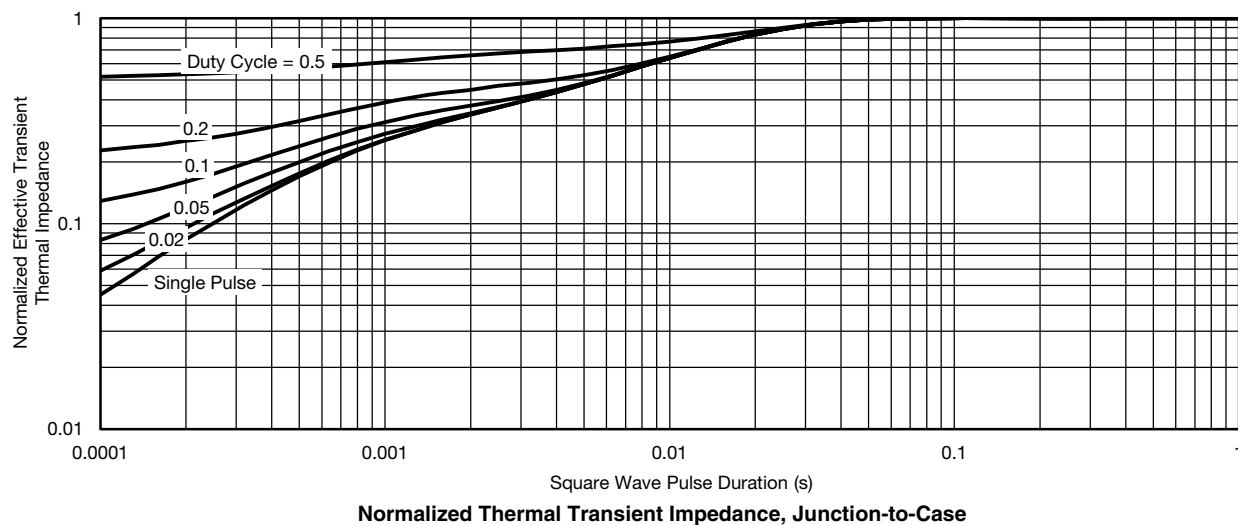
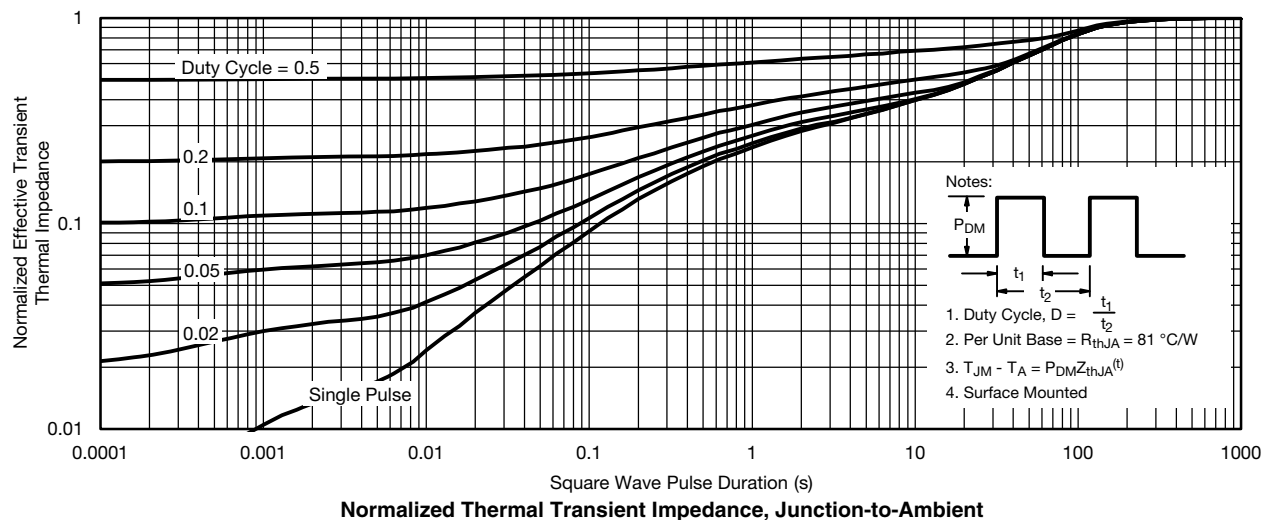
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Output Characteristics**

**Transfer Characteristics**

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

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

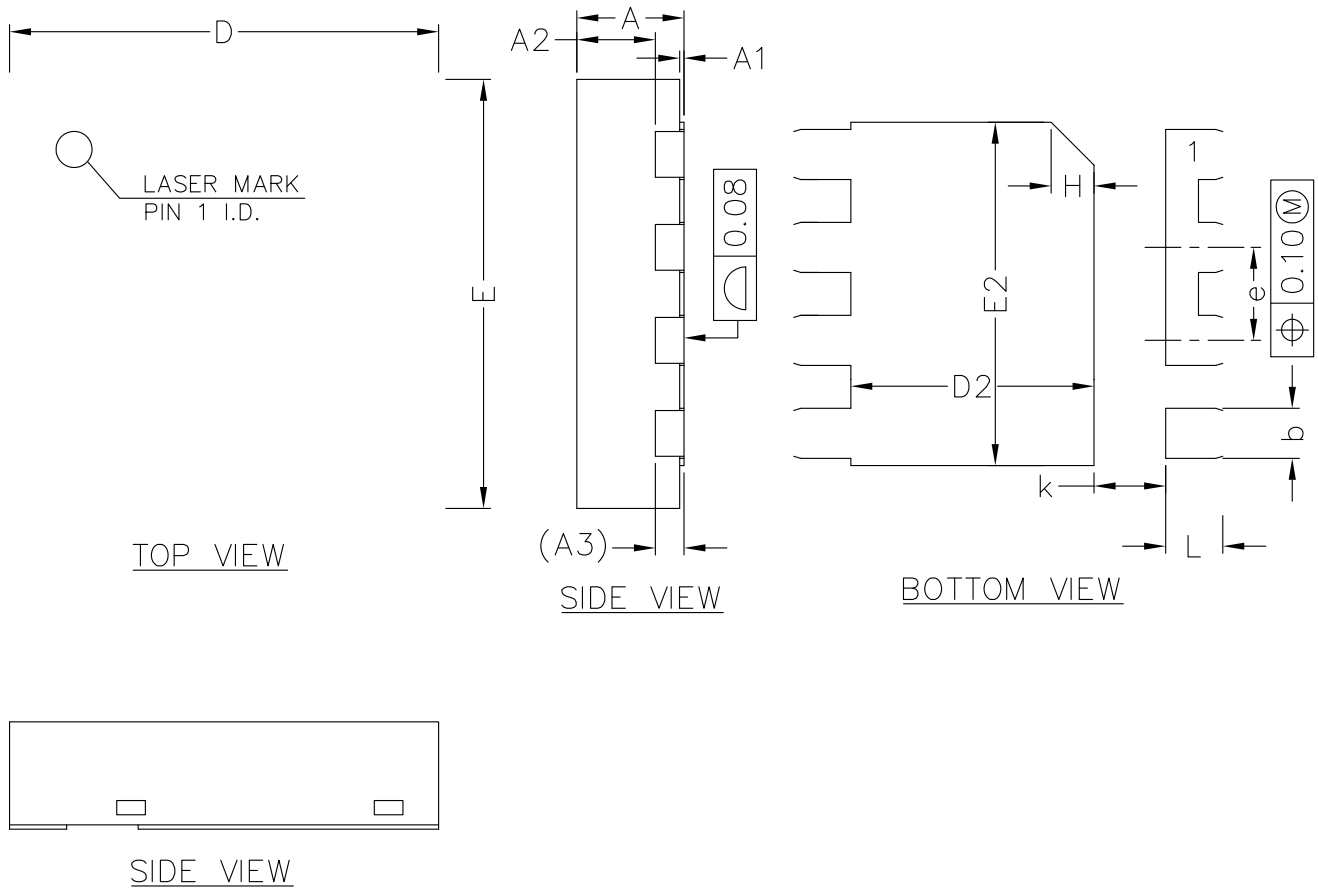
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**Source-Drain Diode Forward Voltage**

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

**Threshold Voltage**

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

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

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

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

**Current Derating\***

**Power, Junction-to-Case**

**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)




COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A2	0.50	0.55	0.60
A3	0.20REF		
b	0.30	0.35	0.40
D	2.90	3.00	3.10
E	2.90	3.00	3.10
D2	1.60	1.70	1.80
E2	2.30	2.40	2.50
e	0.55	0.65	0.75
K	0.40	0.50	0.60
L	0.35	0.40	0.45

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