

SQS401EN-T1-GE3-VB Datasheet

P-Channel 40 V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ.)
- 40	0.012 at $V_{GS} = -10$ V	- 45 ^d	43.1 nC
	0.013 at $V_{GS} = -4.5$ V	- 40 ^d	

FEATURES

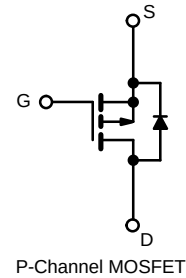
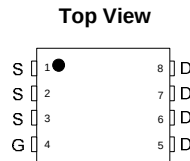
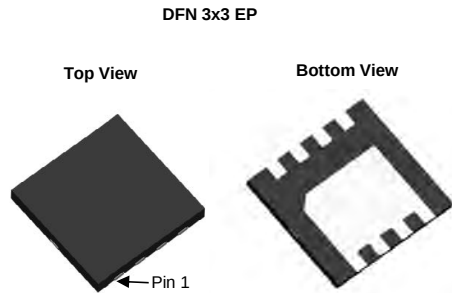
- Trench Power MOSFET
- Low On-Resistance for Low Voltage Drop
- 100 % R_g and UIS Tested

APPLICATIONS

- Battery, Load and Adaptor Switches
 - Notebook Computers
 - Notebook Battery Packs



RoHS
COMPLIANT
HALOGEN
FREE



ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	- 40	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ($T_J = 150^\circ\text{C}$)	$T_C = 25^\circ\text{C}$	- 45 ^d	A
	$T_C = 70^\circ\text{C}$	- 40 ^d	
	$T_A = 25^\circ\text{C}$	- 33.1 ^{a, b}	
	$T_A = 70^\circ\text{C}$	- 28.4 ^{a, b}	
Pulsed Drain Current ($t = 100 \mu\text{s}$)	I_{DM}	- 100	
Continuous Source-Drain Diode Current	$T_C = 25^\circ\text{C}$	- 50 ^d	
	$T_A = 25^\circ\text{C}$	- 4.1 ^{a, b}	
Avalanche Current	I_{AS}	- 25	
Single-Pulse Avalanche Energy	E_{AS}	31.2	mJ
Maximum Power Dissipation	$T_C = 25^\circ\text{C}$	48	W
	$T_C = 70^\circ\text{C}$	31	
	$T_A = 25^\circ\text{C}$	5 ^{a, b}	
	$T_A = 70^\circ\text{C}$	3.2 ^{a, b}	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature) ^{e, f}		260	

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{a, c}	R_{thJA}	21	25	$^\circ\text{C/W}$
Maximum Junction-to-Case	R_{thJC}	2.1	2.6	

Notes:

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

b. $t = 10$ s.

c. Maximum under steady state conditions is 70°C/W .

d. Package limited.

e. The DFN3X3 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.

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

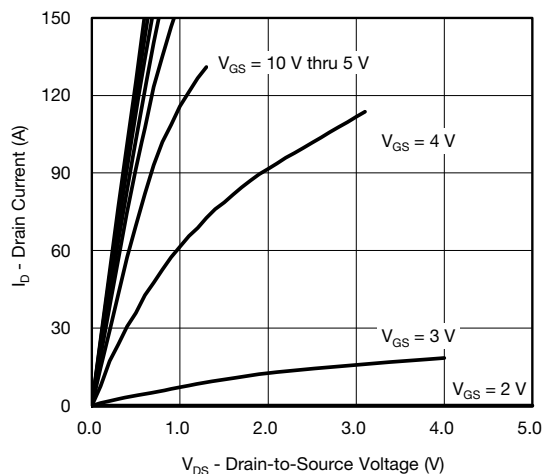
SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0, I _D = - 250 μA	- 40			V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = - 250 μA		- 22		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			4.1		
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = - 250 μA	- 1.2		- 2.5	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = - 30 V, V _{GS} = 0 V			- 1	μA
		V _{DS} = - 30 V, V _{GS} = 0 V, T _J = 55 °C			- 5	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ - 10 V, V _{GS} = - 10 V	- 30			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = - 10 V, I _D = - 15 A		0.012		Ω
		V _{GS} = - 4.5 V, I _D = - 10 A		0.013		
Forward Transconductance ^a	g _{fs}	V _{DS} = - 10 V, I _D = - 15 A		60		S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = - 15 V, V _{GS} = 0 V, f = 1 MHz		5125		pF
Output Capacitance	C _{oss}			615		
Reverse Transfer Capacitance	C _{rss}			554		
Total Gate Charge	Q _g	V _{DS} = - 15 V, V _{GS} = - 10 V, I _D = - 10 A		90	135	nC
Gate-Source Charge	Q _{gs}	V _{DS} = - 15 V, V _{GS} = - 4.5 V, I _D = - 10 A		43.1	65	
Gate-Drain Charge	Q _{gd}			13.6		
Gate Resistance	R _g			28.8		
Turn-On Delay Time	t _{d(on)}	f = 1 MHz	0.5	2.4	4.8	Ω
Rise Time	t _r	V _{DD} = - 15 V, R _L = 1.5 Ω I _D ≡ - 10 A, V _{GEN} = - 10 V, R _g = 1 Ω		15	30	ns
Turn-Off DelayTime	t _{d(off)}			12	24	
Fall Time	t _f			58	110	
Turn-On Delay Time	t _{d(on)}	V _{DD} = - 15 V, R _L = 1.5 Ω I _D ≡ - 10 A, V _{GEN} = - 4.5 V, R _g = 1 Ω		12	24	
Rise Time	t _r			60	120	
Turn-Off DelayTime	t _{d(off)}			60	120	
Fall Time	t _f			52	100	
Fall Time	t _f			26	52	
Drain-Source Body Diode Characteristics						
Continous Source-Drain Diode Current	I _S	T _C = 25 °C			- 50	A
Pulse Diode Forward Current (100 μs)	I _{SM}				- 100	
Body Diode Voltage	V _{SD}	I _S = - 3 A, V _{GS} = 0		- 0.74	- 1.20	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = - 10 A, dI/dt = 100 A/μs, T _J = 25 °C		23	46	ns
Body Diode Reverse Recovery Charge	Q _{rr}			12	24	nC
Reverse Recovery Fall Time	t _a			9		ns
Reverse Recovery Rise Time	t _b			14		

Notes:

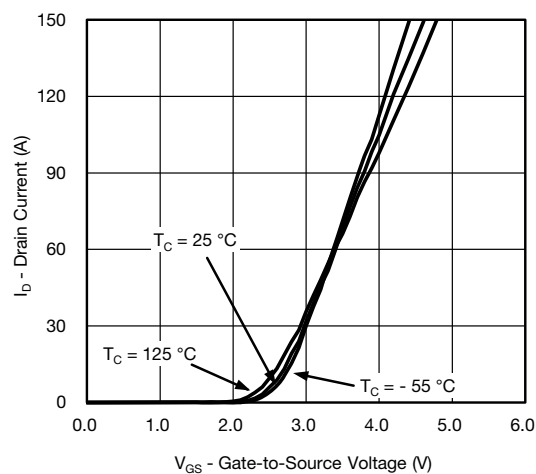
- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

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.

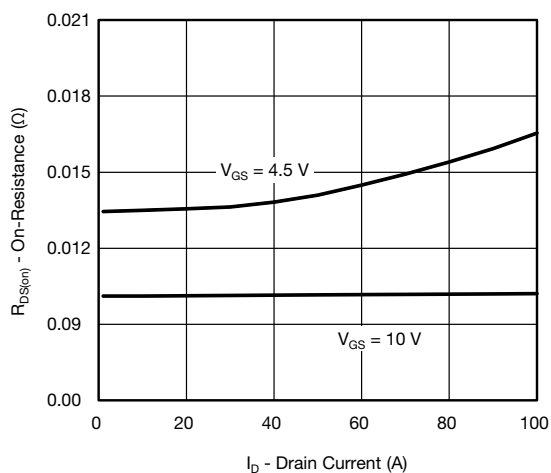
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



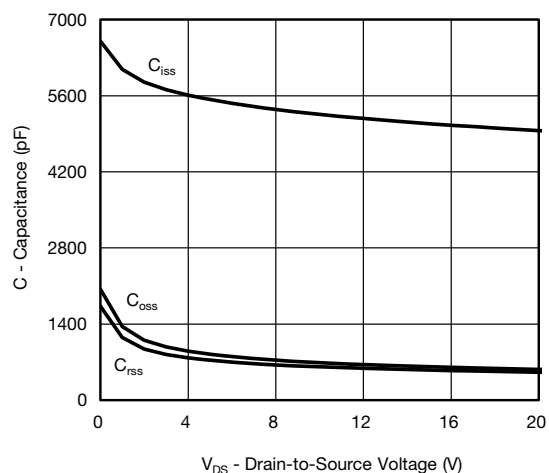
Output Characteristics



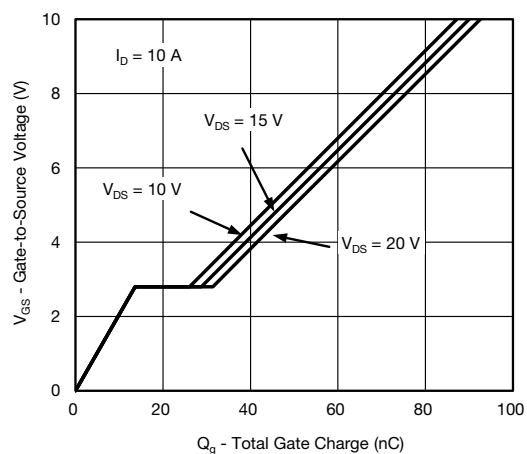
Transfer Characteristics



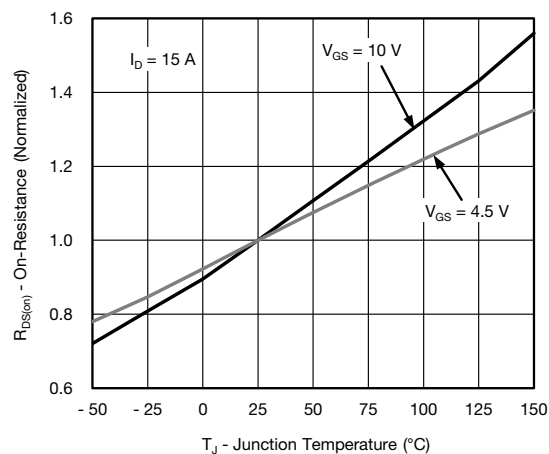
On-Resistance vs. Drain Current



Capacitance

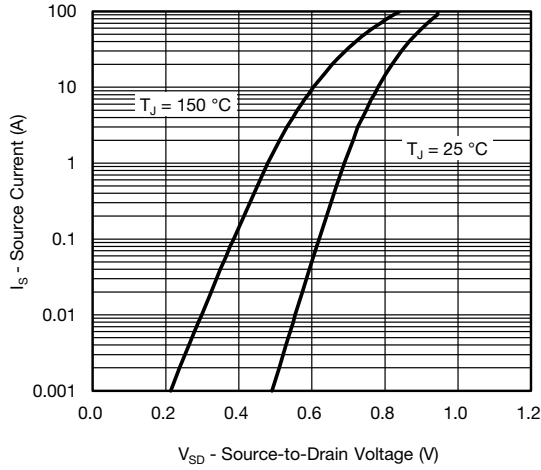


Gate Charge

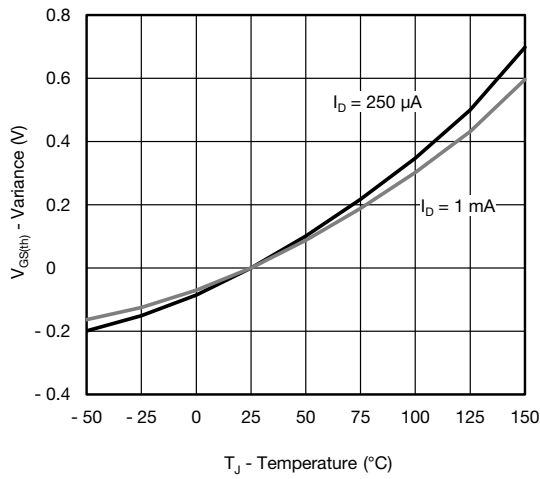


On-Resistance vs. Junction Temperature

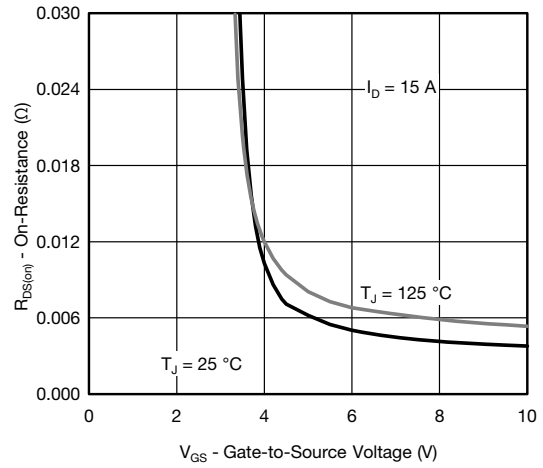
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



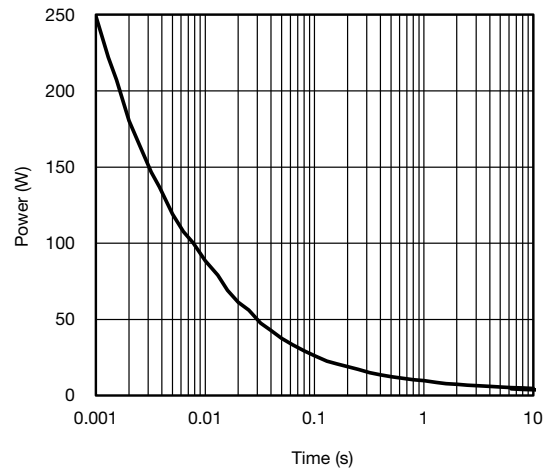
Source-Drain Diode Forward Voltage



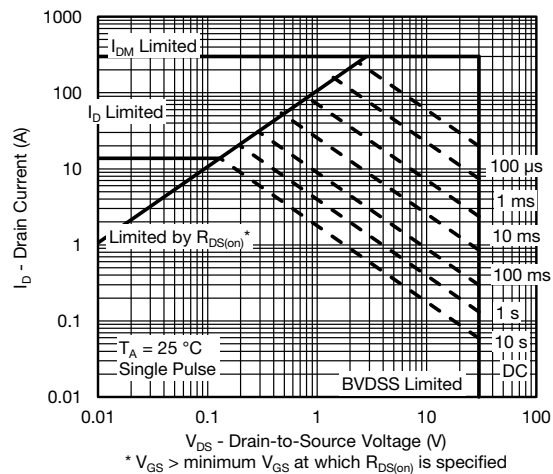
Threshold Voltage



On-Resistance vs. Gate-to-Source Voltage



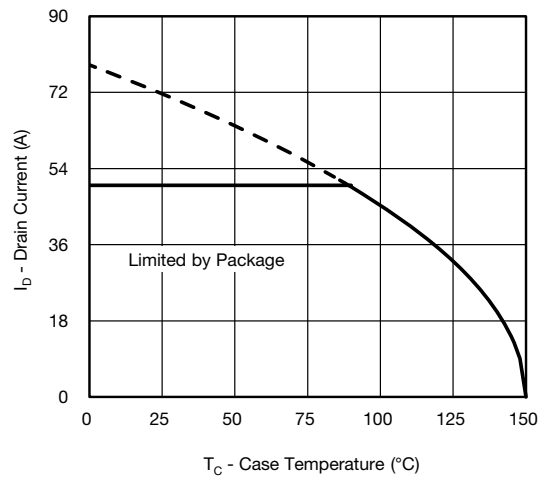
Single Pulse Power, Junction-to-Ambient



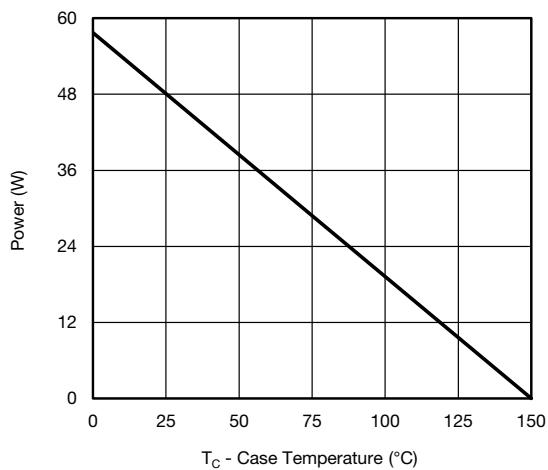
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area

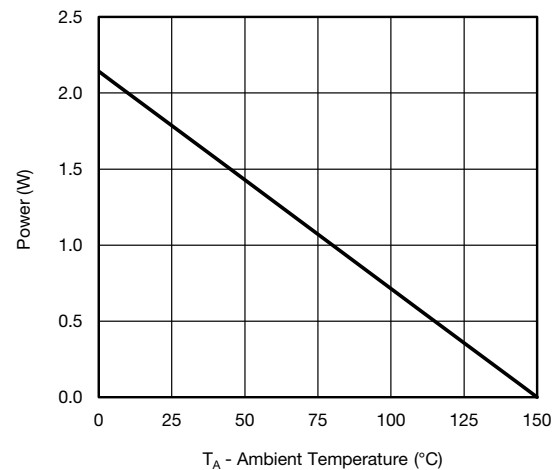
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating*



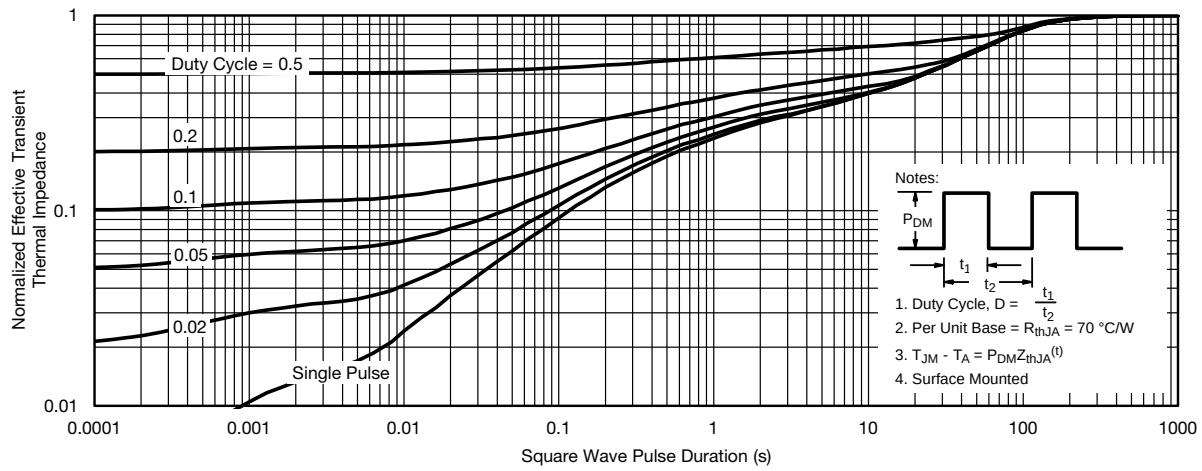
Power, Junction-to-Case



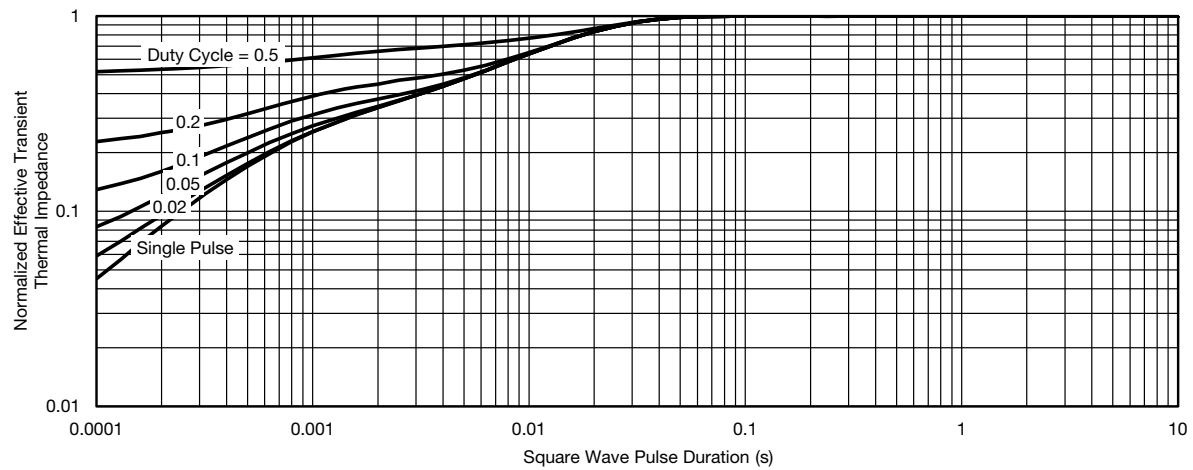
Power Derating, Junction-to-Ambient

* 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.

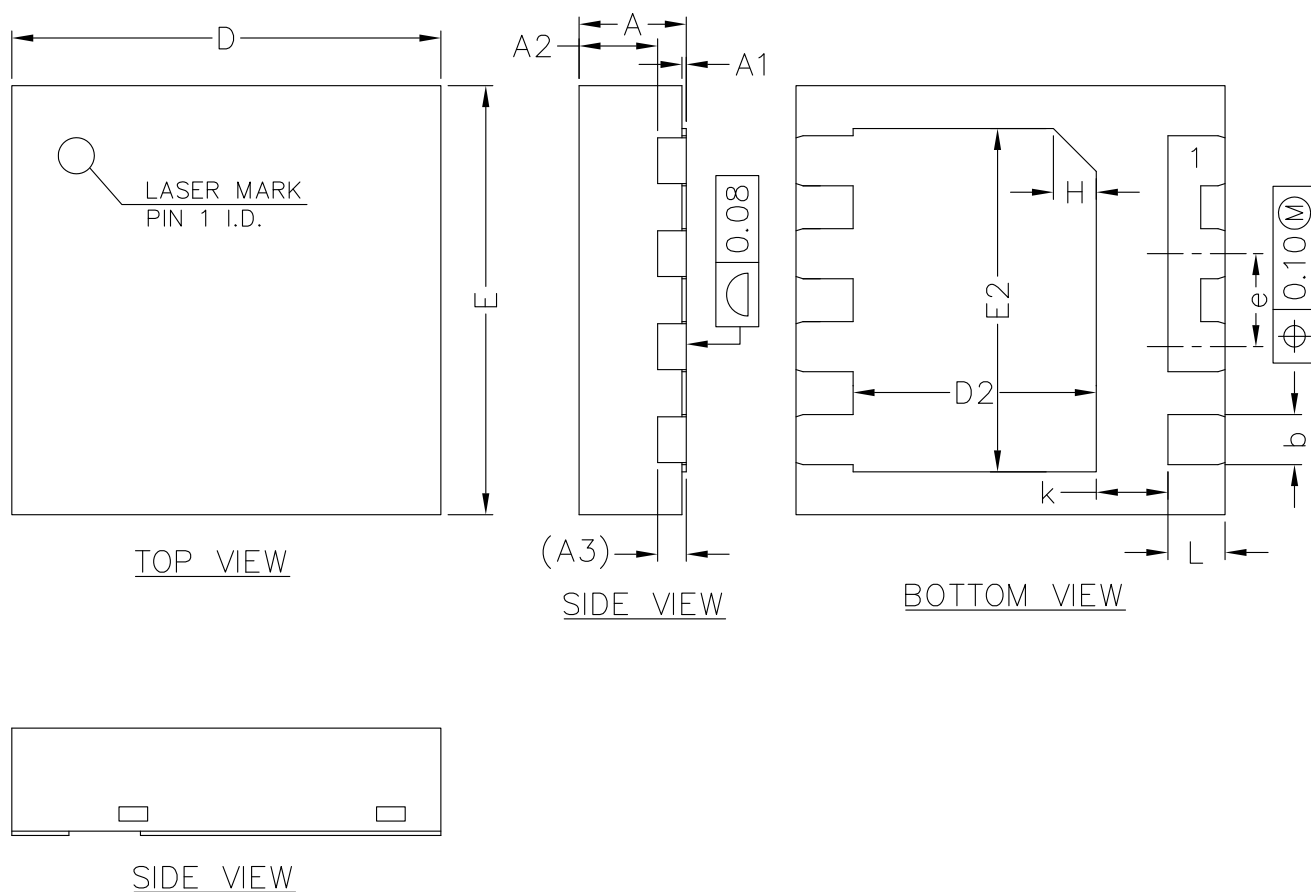
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case



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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