

## QS6K21TR-VB Datasheet

### Dual N-Channel 40 V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
40	0.058 at $V_{GS} = 10$ V	3.6	4.0
	0.072 at $V_{GS} = 4.5$ V	3.0	

#### FEATURES

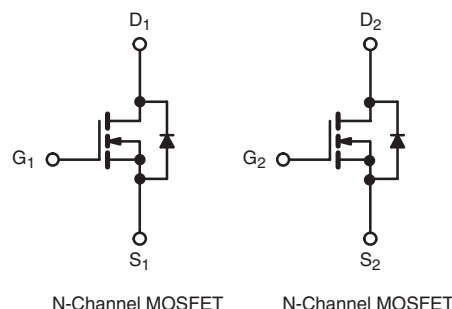
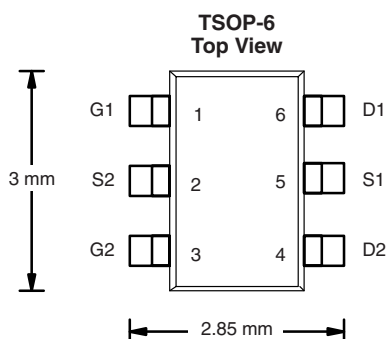
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT

#### APPLICATIONS

- CCFL Inverter
- DC/DC Converter
- HDD



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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	A
		$T_C = 70$ °C	
		$T_A = 25$ °C	
		$T_A = 70$ °C	
Pulsed Drain Current (10 $\mu$ s Pulse Width)	$I_{DM}$	20	
Source-Drain Current Diode Current	$I_S$	$T_C = 25$ °C	
		$T_A = 25$ °C	
Pulsed Source-Drain Current	$I_{SM}$	20	
Single Pulse Avalanche Current	$I_{AS}$	10	
Single Pulse Avalanche Energy	$E_{AS}$	5	
Maximum Power Dissipation	$P_D$	$T_C = 25$ °C	W
		$T_C = 70$ °C	
		$T_A = 25$ °C	
		$T_A = 70$ °C	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C

#### THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typ.	Max.	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	$t \leq 10$ s	$R_{thJA}$	49	62.5	°C/W
Maximum Junction-to-Foot (Drain)	Steady-State	$R_{thJF}$	30	40	

Notes:

a. Based on  $T_C = 25$  °C.

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

c.  $t = 10$  s.

d. Maximum under steady state conditions is 120 °C/W.

SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	40			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA		49		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 5.2		
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.0		2.0	V
Gate-Body 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> = 40 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			10	
On-State Drain Current <sup>b</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V	20			A
Drain-Source On-State Resistance <sup>b</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.0A		0.058		Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 6.0A		0.072		
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 7.0A		35		S
Dynamic <sup>a</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 MHz		280		pF
Output Capacitance	C <sub>oss</sub>			50		
Reverse Transfer Capacitance	C <sub>rss</sub>			22		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.0 A		9.0		nC
		V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 7.0 A		4.5		
Gate-Source Charge	Q <sub>gs</sub>			1.5		
Gate-Drain Charge	Q <sub>gd</sub>			1.5		
Gate Resistance	R <sub>g</sub>	f = 1 MHz	0.6	2.7	5.4	Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 2 Ω I <sub>D</sub> ≅ 7.0 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		7	14	ns
Rise Time	t <sub>r</sub>			9	18	
Turn-Off Delay Time	t <sub>d(off)</sub>			16	32	
Fall Time	t <sub>f</sub>			8	16	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 2 Ω I <sub>D</sub> ≅ 7.0 A, V <sub>GEN</sub> = 4.5 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>			13	26	
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		2.6		A
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>			20		
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 3 A		0.77	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 5 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C		15	30	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			7.5	15	nC
Reverse Recovery Fall Time	t <sub>a</sub>			9		ns
Reverse Recovery Rise Time	t <sub>b</sub>			6		

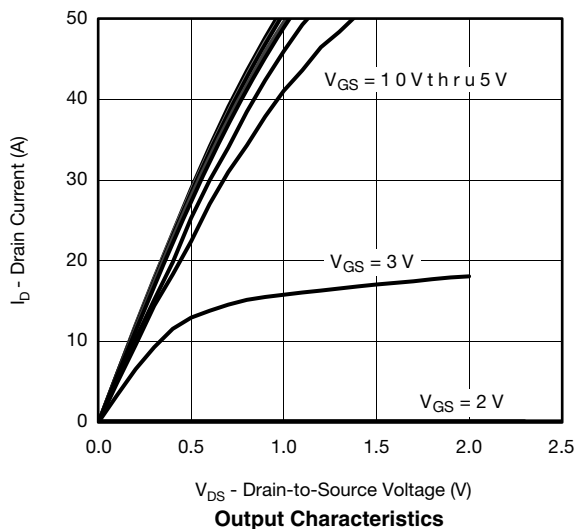
Notes:

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

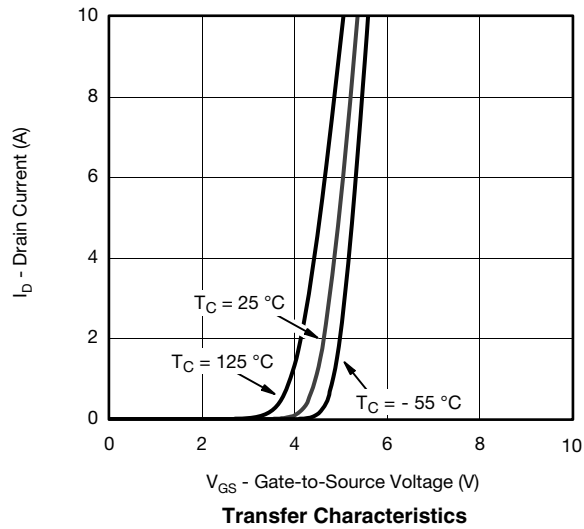
b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

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.

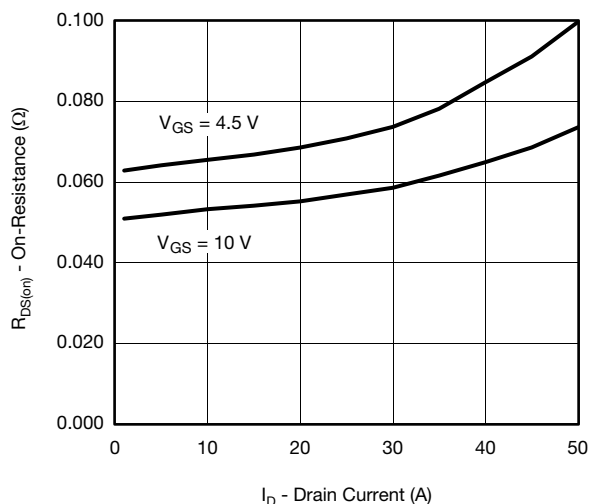
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



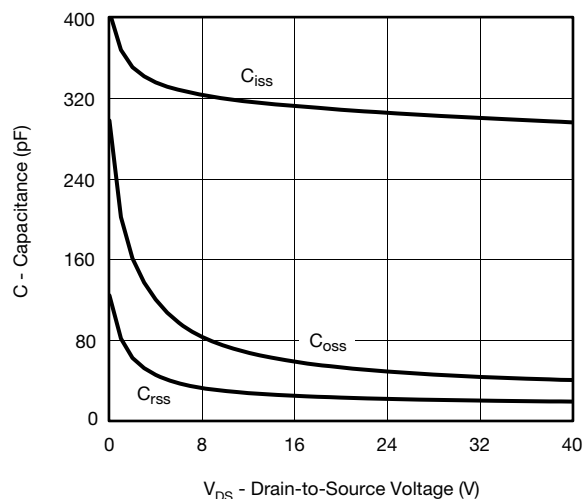
**Output Characteristics**



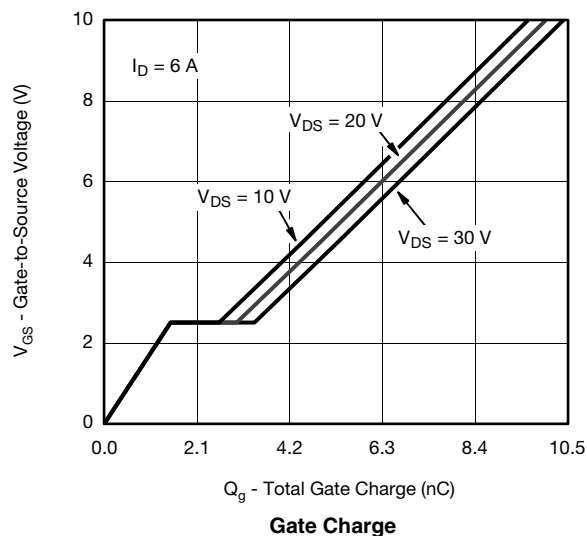
**Transfer Characteristics**



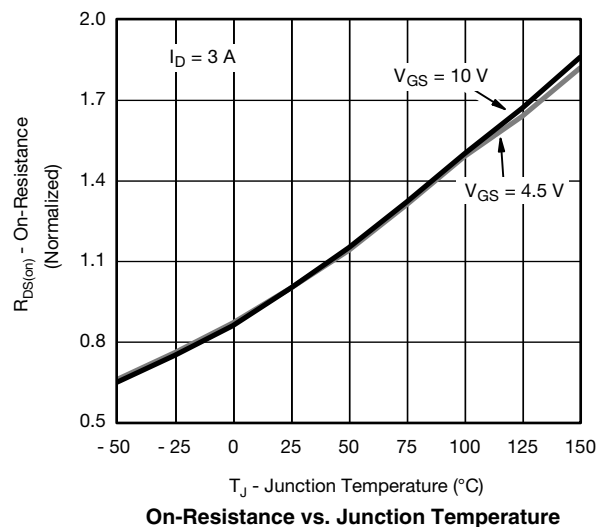
**On-Resistance vs. Drain Current**



**Capacitance**

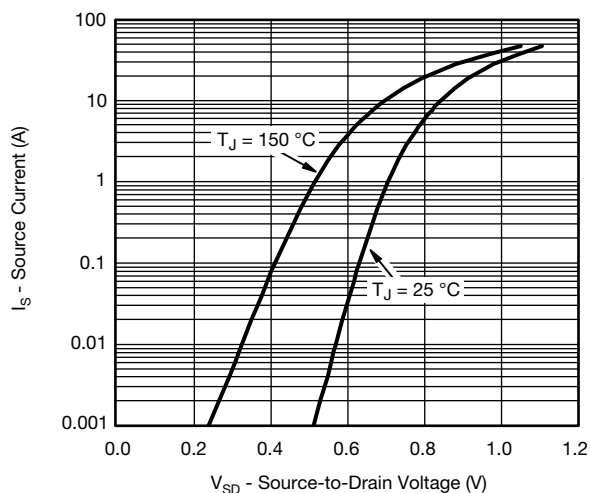


**Gate Charge**

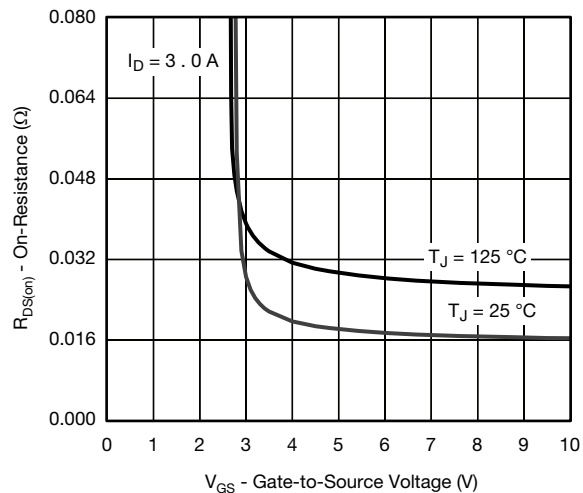


**On-Resistance vs. Junction Temperature**

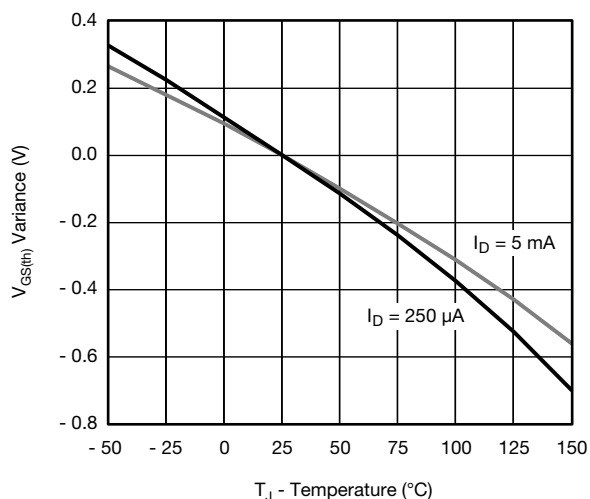
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



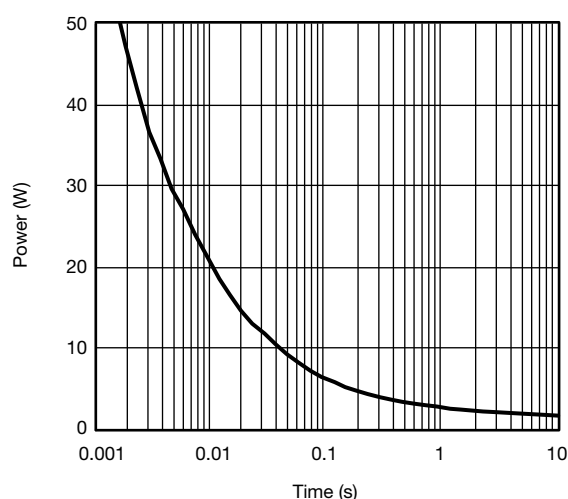
Source-Drain Diode Forward Voltage



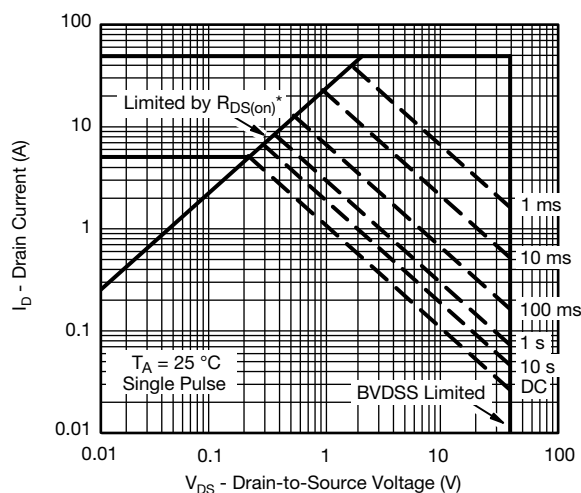
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



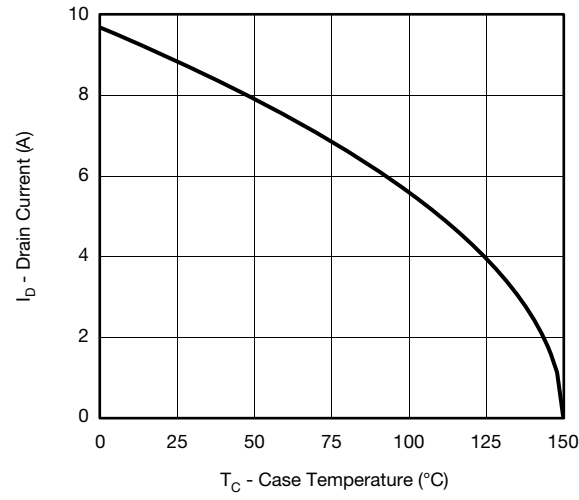
Single Pulse Power, Junction-to-Ambient



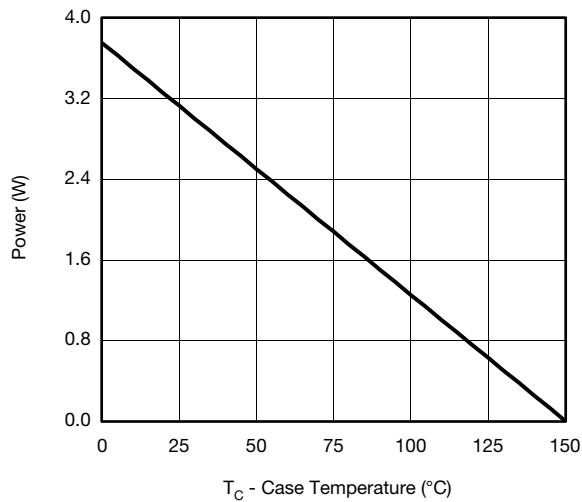
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area

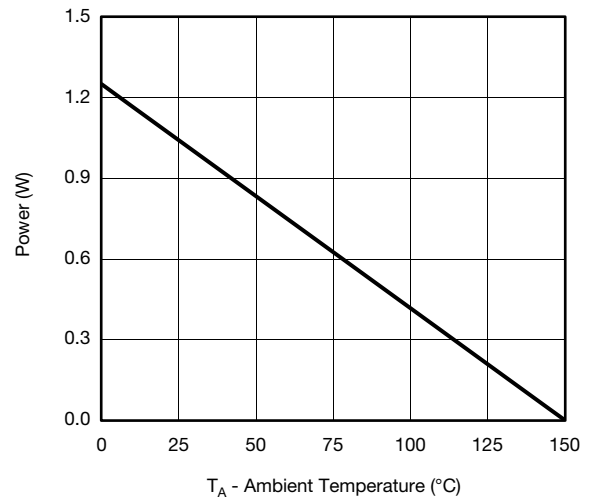
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Current Derating\***



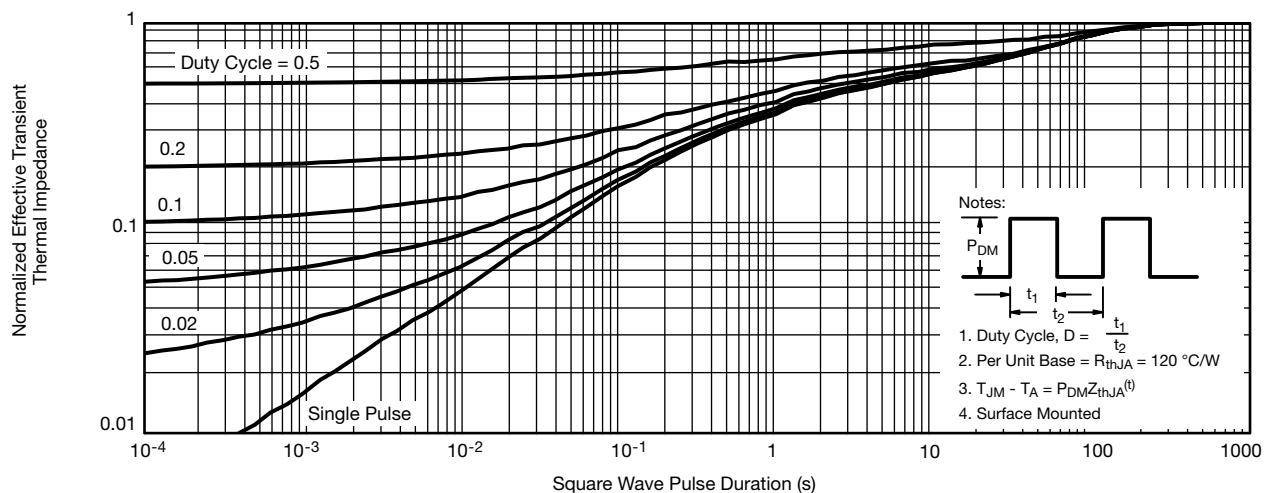
**Power Derating, Junction-to-Foot**



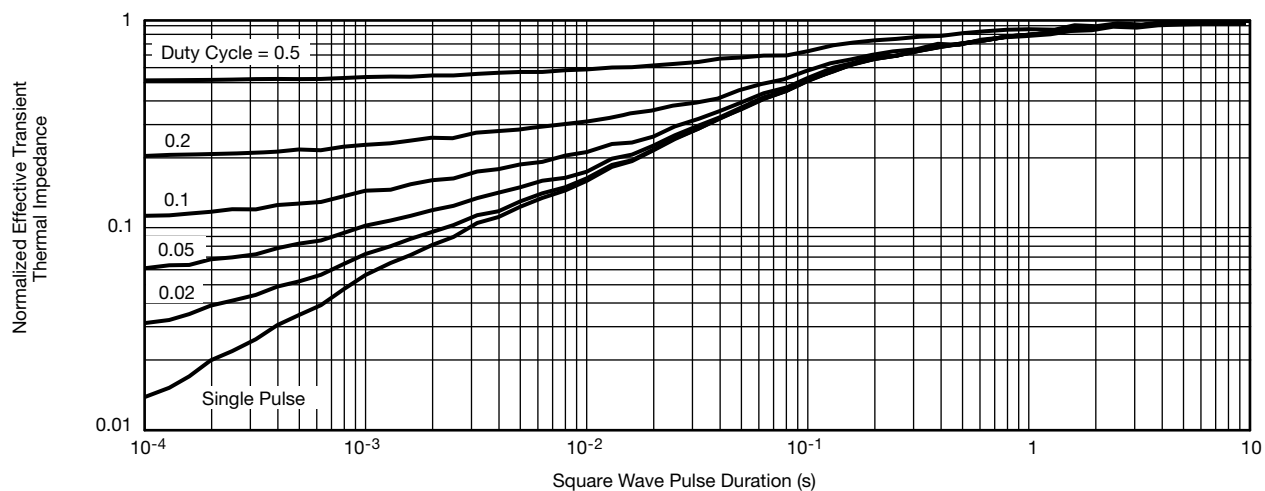
**Power Derating, Junction-to-Ambient**

\* 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)



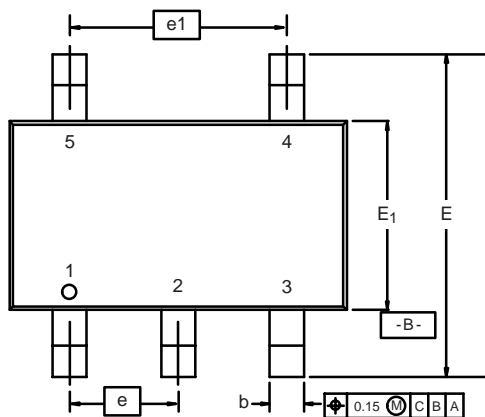
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



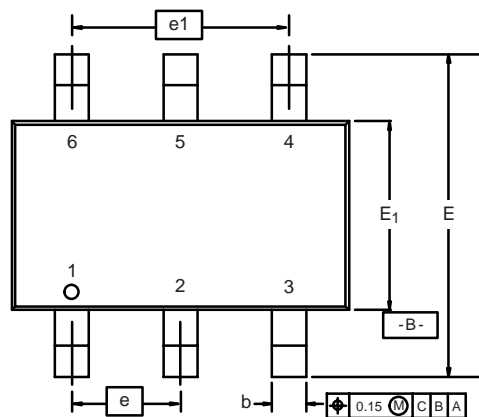
**Normalized Thermal Transient Impedance, Junction-to-Foot**

**TSOP: 5/6-LEAD**

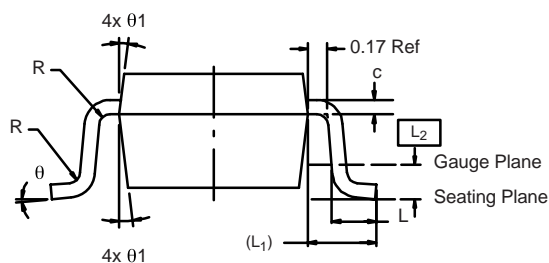
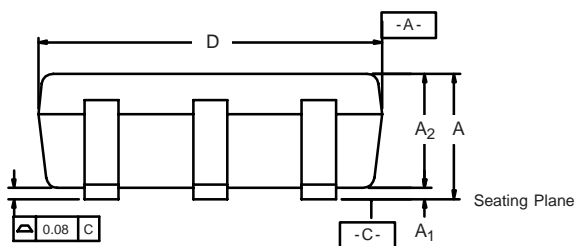
JEDEC Part Number: MO-193C



**5-LEAD TSOP**

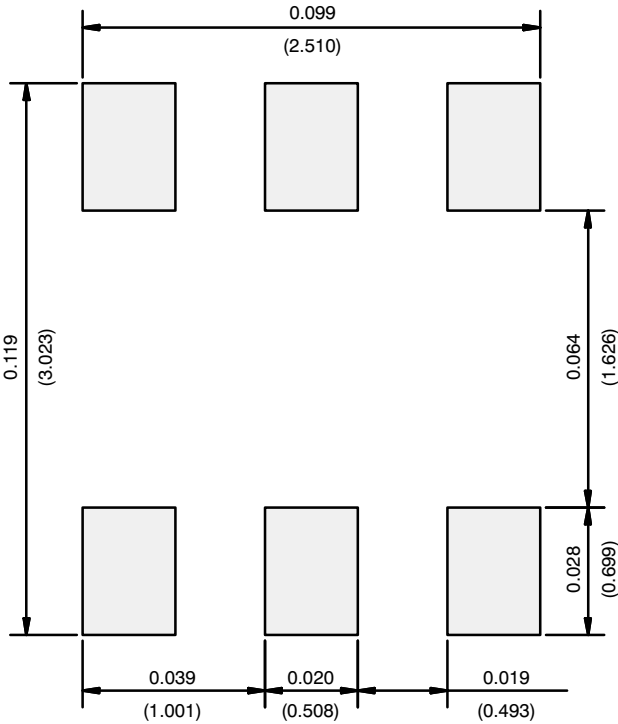


**6-LEAD TSOP**



	MILLIMETERS			INCHES		
Dim	Min	Nom	Max	Min	Nom	Max
A	0.91	-	1.10	0.036	-	0.043
A <sub>1</sub>	0.01	-	0.10	0.0004	-	0.004
A <sub>2</sub>	0.90	-	1.00	0.035	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E <sub>1</sub>	1.55	1.65	1.70	0.061	0.065	0.067
e	0.95 BSC			0.0374 BSC		
e <sub>1</sub>	1.80	1.90	2.00	0.071	0.075	0.079
L	0.32	-	0.50	0.012	-	0.020
L <sub>1</sub>	0.60 Ref			0.024 Ref		
L <sub>2</sub>	0.25 BSC			0.010 BSC		
R	0.10	-	-	0.004	-	-
θ	0°	4°	8°	0°	4°	8°
θ <sub>1</sub>	7° Nom			7° Nom		
ECN: C-06593-Rev. I, 18-Dec-06 DWG: 5540						

RECOMMENDED MINIMUM PADS FOR TSOP-6



Recommended Minimum Pads  
Dimensions in Inches/(mm)



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