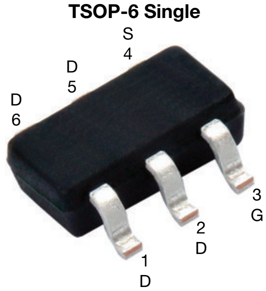
P-Channel 20 V (D-S) MOSFET

TSOP-6 Single



Top View

Marking code: BQ

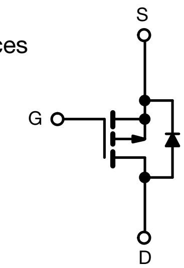
FEATURES

- TrenchFET® Gen III p-channel power MOSFET
- $R_{DS(on)}$ rating at V_{GS} = -1.8 V
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Battery management in mobile devices
- Battery switch
- Load switch
- PA switch



P-Channel MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	-20
$R_{DS(on)}$ max. (Ω) at V_{GS} = -4.5 V	0.0240
$R_{DS(on)}$ max. (Ω) at V_{GS} = -2.5 V	0.0321
$R_{DS(on)}$ max. (Ω) at V_{GS} = -1.8 V	0.0511
Q_g typ. (nC)	19.8
I_D (A) [a, d]	-8
Configuration	Single

ORDERING INFORMATION	
Package	TSOP-6
Lead (Pb)-free and halogen-free	Si3493DDV-T1-GE3

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}	± 8	
Continuous drain current (T_J = 150 °C)	T_C = 25 °C	I_D	-8 [a]	A
	T_C = 70 °C		-8	
	T_A = 25 °C		-7.5 [b, c]	
	T_A = 70 °C		-6 [b, c]	
Pulsed drain current (t = 100 μs)		I_{DM}	-32	
Continuous source-drain diode current	T_C = 25 °C	I_S	-3	
	T_A = 25 °C		-1.67 [b, c]	
Single pulse avalanche current	L = 0.1 mH	I_{AS}	-10	
Single pulse avalanche energy		E_{AS}	5	mJ
Maximum power dissipation	T_C = 25 °C	P_D	3.6	W
	T_C = 70 °C		2.3	
	T_A = 25 °C		2 [b, c]	
	T_A = 70 °C		1.3 [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]	t ≤ 5 s	R_{thJA}	50	62.5	°C/W
Maximum junction-to-case (drain)	Steady state	R_{thJC}	28	35	

Notes
a. Package limited.
b. Surface mounted on 1" x 1" FR4 board.
c. t = 5 s.
d. Maximum under steady state conditions is 110 °C/W.

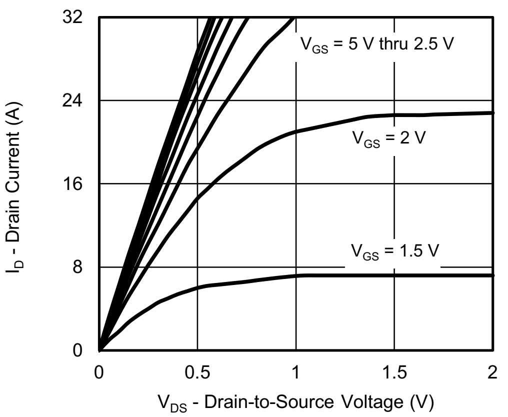
SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-source breakdown voltage	V_{DS}	V_{GS} = 0 V, I_D = -250 μA	-20	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	I_D = -250 μA	-	-12	-	mV/°C
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$		-	2.5	-	
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D =-250 μA	-0.4	-	-1	V
Gate-source leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 8 V	-	-	± 100	nA
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 = 70 °C	-	-	-10	
On-state drain current [a]	$I_{D(on)}$	$V_{DS} \geq$ -10 V, V_{GS} = -4.5 V	-20	-	-	A
Drain-source on-state resistance [a]	$R_{DS(on)}$	V_{GS} = -4.5 V, I_D = -7.5 A	-	0.0200	0.0240	Ω
		V_{GS} = -2.5 V, I_D = -6.4 A	-	0.0257	0.0321	
		V_{GS} = -1.8 V, I_D = -2 A	-	0.0378	0.0511	
Forward transconductance [a]	g_{fs}	V_{DS} = -10 V, I_D = -7.5 A	-	30	-	S
Dynamic [b]						
Input capacitance	C_{iss}	V_{DS} = -10 V, V_{GS} = 0 V, f = 1 MHz	-	1825	-	pF
Output capacitance	C_{oss}		-	210	-	
Reverse transfer capacitance	C_{rss}		-	200	-	
Total gate charge	Q_g	V_{DS} = -10 V, V_{GS} = -8 V, I_D = -7.5 A	-	34.8	52.2	nC
		V_{DS} = -10 V, V_{GS} = -4.5 V, I_D = -7.5 A	-	19.8	30	
Gate-source charge	Q_{gs}		-	2.6	-	
Gate-drain charge	Q_{gd}		-	3	-	
Gate resistance	R_g	f = 1 MHz	2.12	10.6	21.2	Ω
Turn-on delay time	$t_{d(on)}$	V_{DD} = -10 V, R_L = 1.67 Ω, $I_D \cong$ -6 A, V_{GEN} = -4.5 V, R_g = 1 Ω	-	25	38	ns
Rise time	t_r		-	30	45	
Turn-off delay time	$t_{d(off)}$		-	95	145	
Fall time	t_f		-	40	60	
Turn-on delay time	$t_{d(on)}$	V_{DD} = -10 V, R_L = 1.67 Ω, $I_D \cong$ -6 A, V_{GEN} = -8 V, R_g = 1 Ω	-	8	16	
Rise time	t_r		-	20	30	
Turn-off delay time	$t_{d(off)}$		-	115	173	
Fall time	t_f		-	40	60	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	T_C = 25 °C	-	-	-8	A
Pulse diode forward current	I_{SM}		-	-	-32	
Body diode voltage	V_{SD}	I_S = -6 A, V_{GS} = 0 V	-	-0.8	-1.2	V
Body diode reverse recovery time	t_{rr}	I_F = -6 A, dI/dt = 100 A/μs, T_J = 25 °C	-	21	32	ns
Body diode reverse recovery charge	Q_{rr}		-	9	18	nC
Reverse recovery fall time	t_a		-	9	-	ns
Reverse recovery rise time	t_b		-	12	-	

Notes

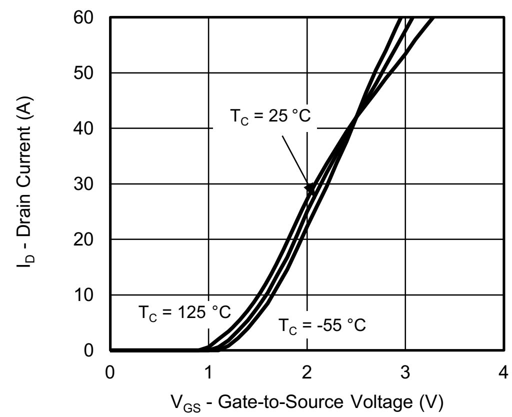
a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

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.

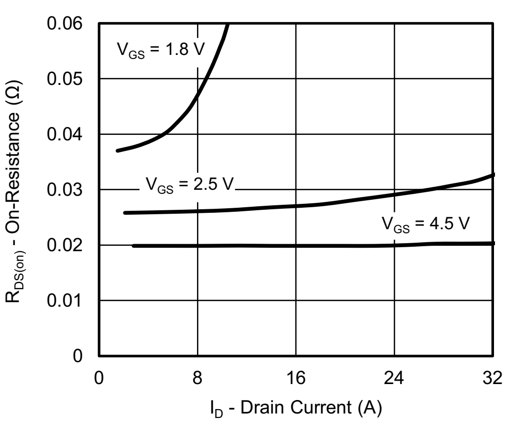
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



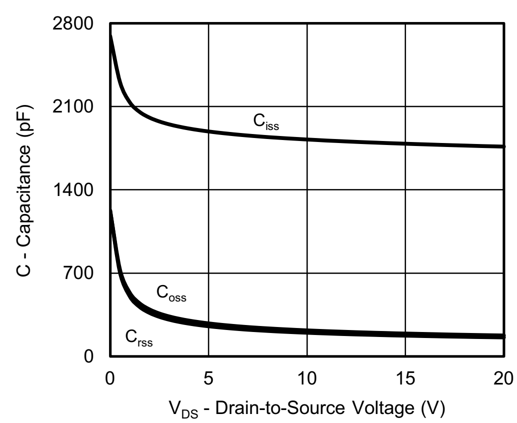
Output Characteristics



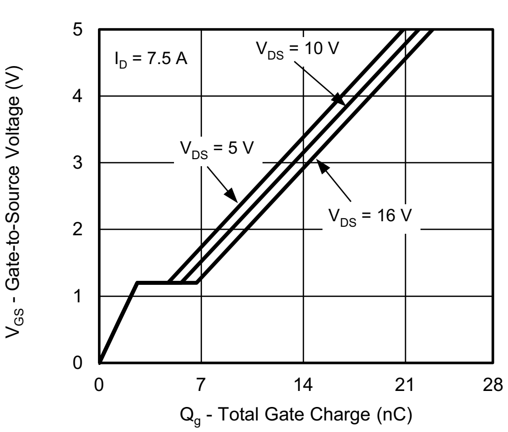
Transfer Characteristics



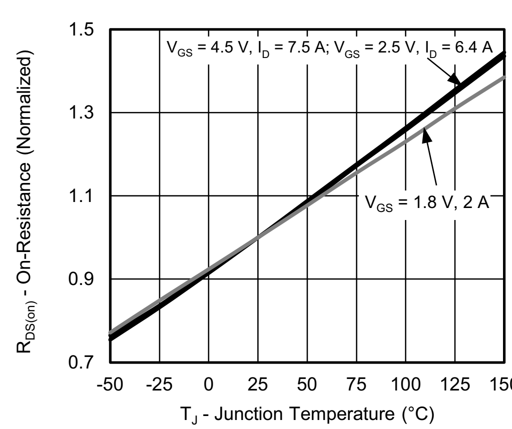
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

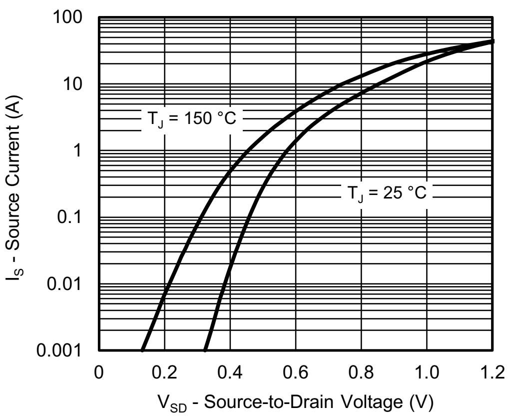


Gate Charge

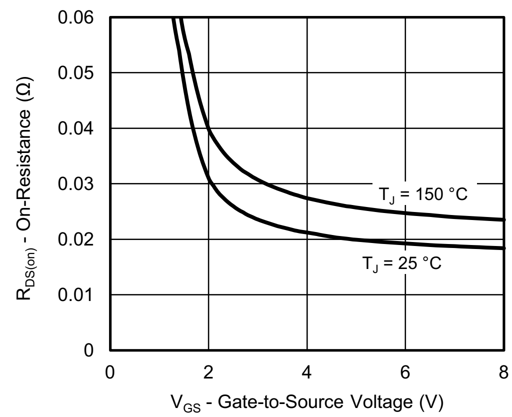


On-Resistance vs. Junction Temperature

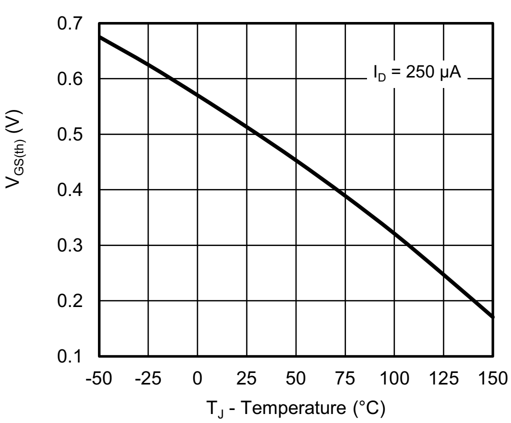
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



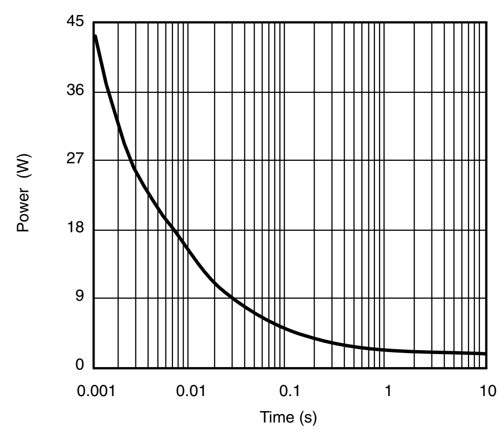
Source-Drain Diode Forward Voltage



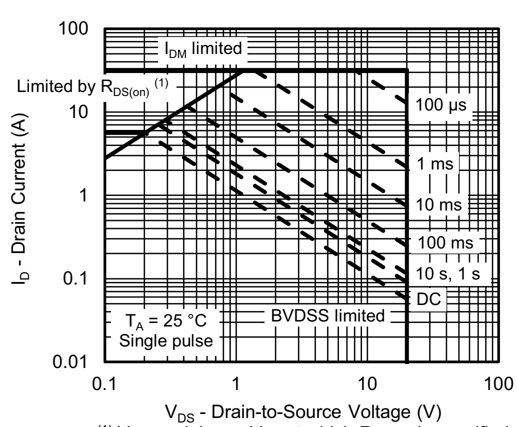
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



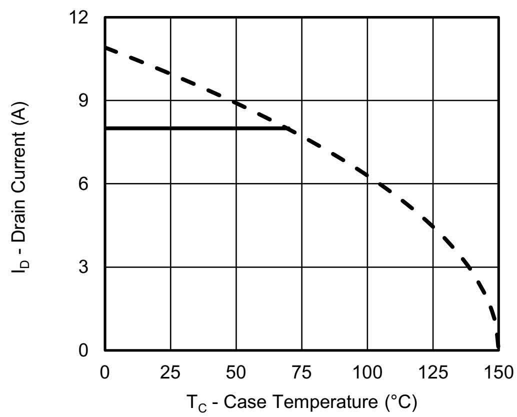
Single Pulse Power, Junction-to-Ambient



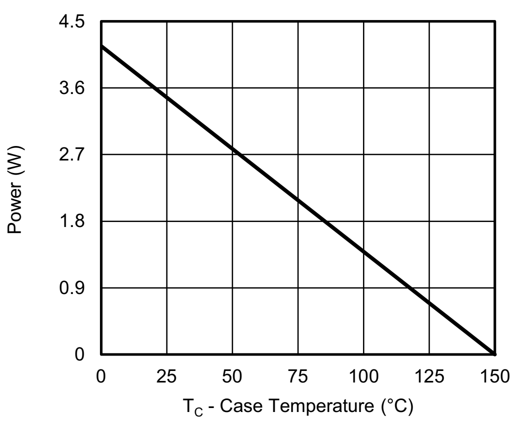
(1) V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

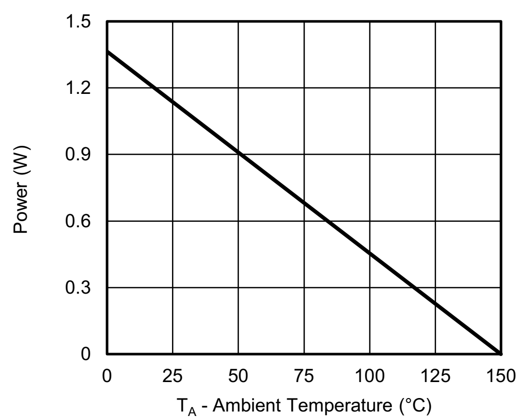
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating [a]



Power, Junction-to-Case

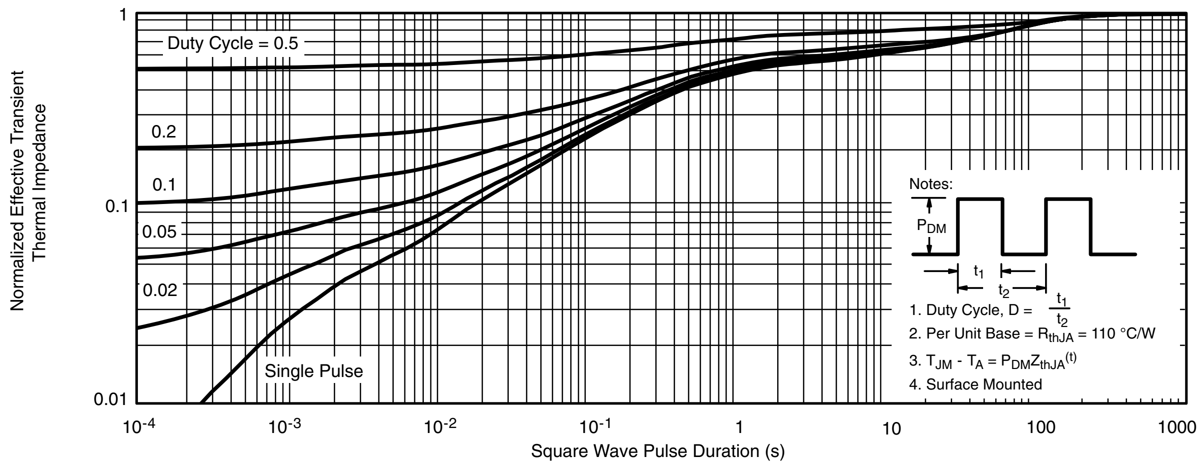


Power, Junction-to-Ambient

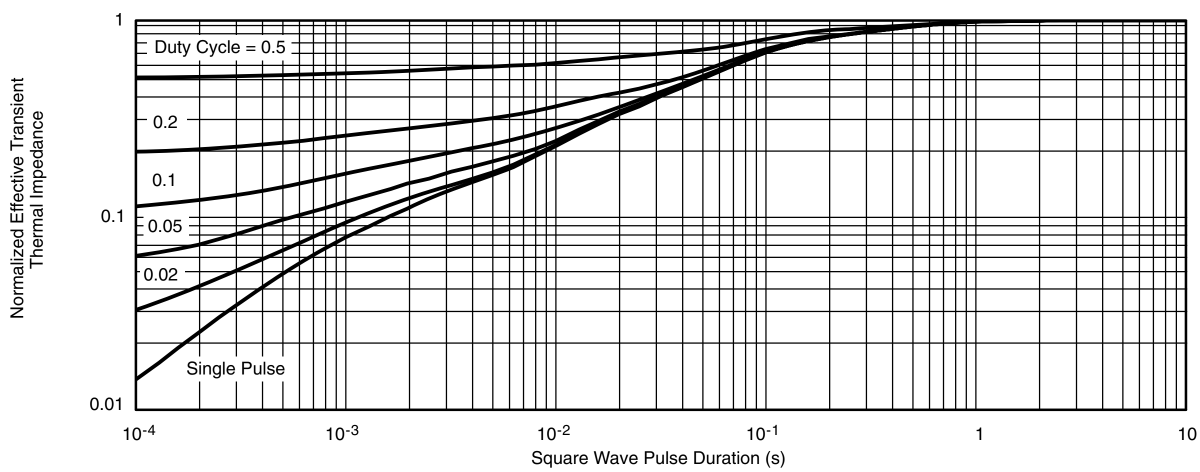
Note

a. 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

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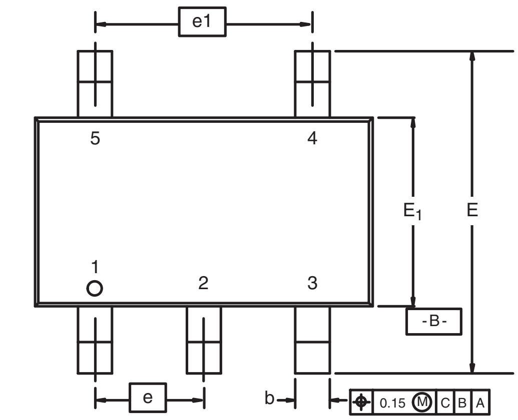
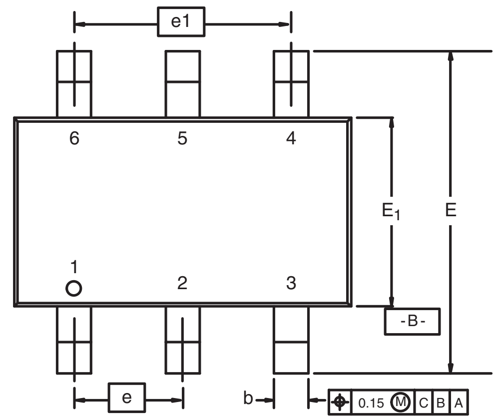
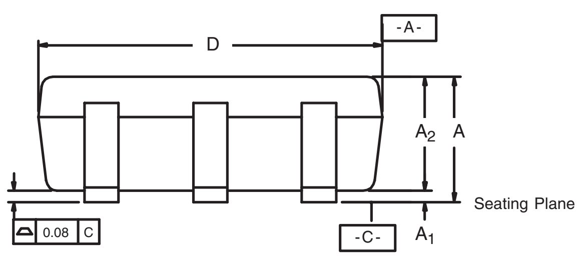
TSOP: 5/6–LEAD
JEDEC Part Number: MO-193C

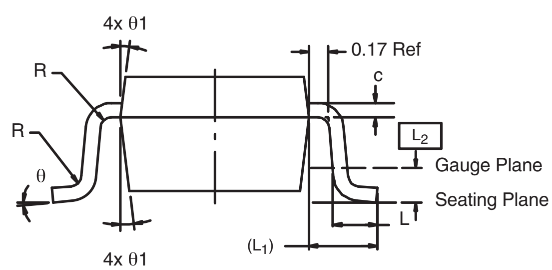


5-LEAD TSOP



6-LEAD TSOP

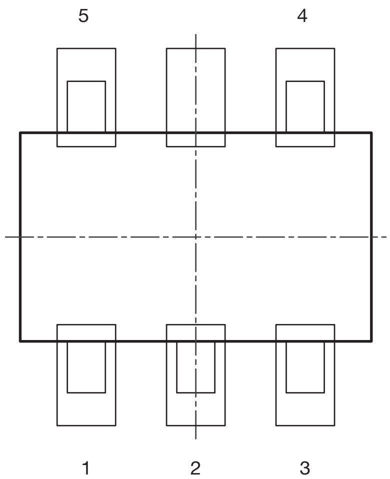


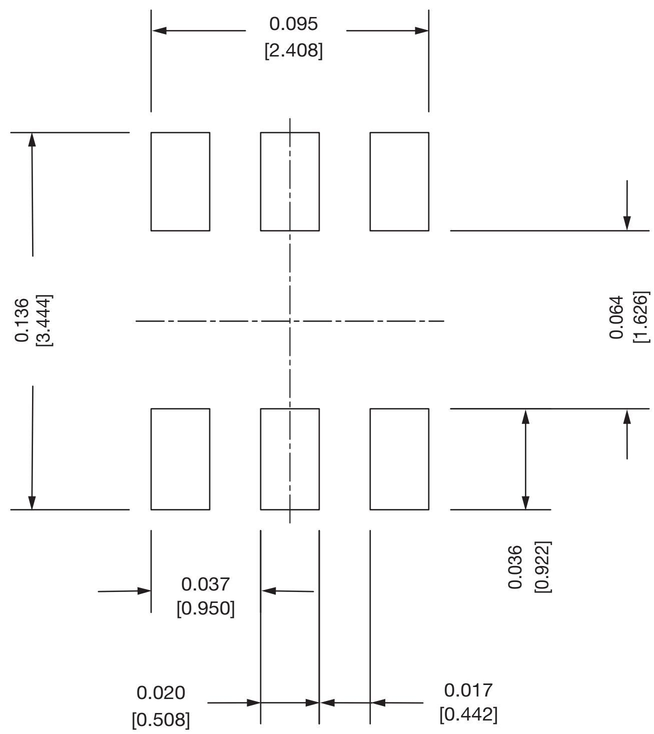


Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	-	1.10	0.036	-	0.043
A_1	0.01	-	0.10	0.0004	-	0.004
A_2	0.90	-	1.00	0.035	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E_1	1.55	1.65	1.70	0.061	0.065	0.067
e	0.95 BSC			0.0374 BSC		
e_1	1.80	1.90	2.00	0.071	0.075	0.079
L	0.32	-	0.50	0.012	-	0.020
L_1	0.60 Ref			0.024 Ref		
L_2	0.25 BSC			0.010 BSC		
R	0.10	-	-	0.004	-	-
θ	0°	4°	8°	0°	4°	8°
θ_1	7° Nom			7° Nom		

ECN: C-06593-Rev. I, 18-Dec-06
DWG: 5540

Recommended Land Pattern For TSOP-5L / TSOP-6L





Note

- All dimensions are in inches (millimeter)

ECN: C22-0860-Rev. B, 24-Oct-2022 DWG: 3010

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