

-40V(D-S) P-Channel Enhancement Mode Power MOS FET

General Features

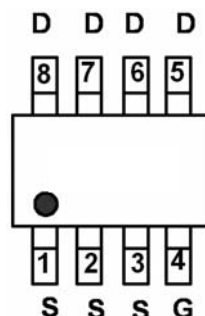
- $V_{DS} = -40V, I_D = -13A$
 $R_{DS(ON)} < 15m\Omega @ V_{GS} = -10V$
 $R_{DS(ON)} < 18m\Omega @ V_{GS} = -4.5V$
- High density cell design for ultra low $R_{DS(on)}$
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation



Lead Free

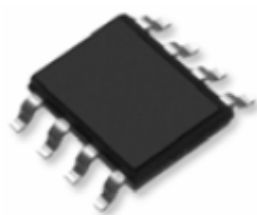
Application

- Power switching application
- Hard switched and high frequency circuits
- DC-DC converter

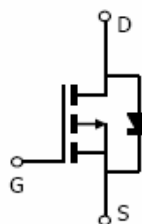


Marking and pin assignment

PIN Configuration



SOP-8 top view



Schematic diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
MSP0413W	MSP0413W	SOP-8	Ø330mm	12mm	2500 units

Absolute Maximum Ratings ($T_A = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	-40	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	-13	A
Drain Current-Continuous($T_C = 100^\circ C$)	$I_D (100^\circ C)$	-9	A
Pulsed Drain Current	I_{DM}	50	A
Maximum Power Dissipation	P_D	2.5	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	$^\circ C$

Thermal Characteristic

Thermal Resistance ,Junction-to-Ambient(Note 2)	$R_{\theta JA}$	50	$^\circ C/W$
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Electrical Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

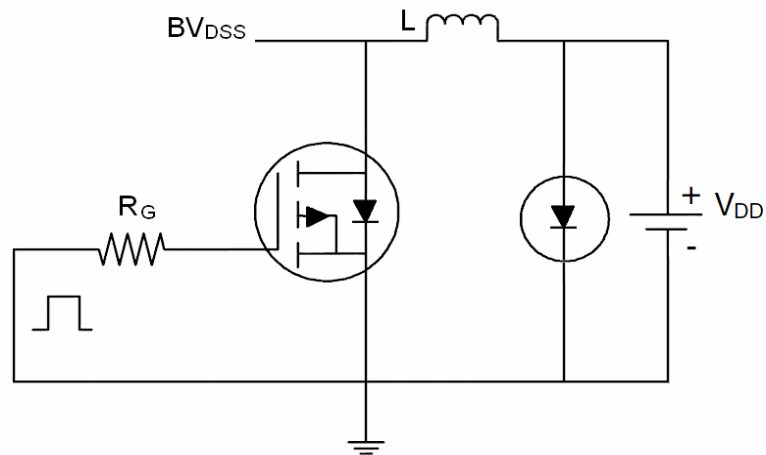
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =-250μA	-40	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-40V,V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V,V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =-250μA	-1.3	-2	-2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-12A	-	12	15	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-15V,I _D =-10A	35	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-20V,V _{GS} =0V, F=1.0MHz	-	2800	-	PF
Output Capacitance	C _{oss}		-	320	-	PF
Reverse Transfer Capacitance	C _{rss}		-	220	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-20V, ,R _L =2Ω V _{GS} =-10V,R _{GEN} =6Ω	-	11	-	nS
Turn-on Rise Time	t _r		-	75	-	nS
Turn-Off Delay Time	t _{d(off)}		-	89	-	nS
Turn-Off Fall Time	t _f		-	35	-	nS
Total Gate Charge	Q _g	V _{DS} =-20V,I _D =-12A, V _{GS} =-10V	-	40	-	nC
Gate-Source Charge	Q _{gs}		-	6	-	nC
Gate-Drain Charge	Q _{gd}		-	12	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V,I _S =-12A	-	-	1.2	V
Diode Forward Current (Note 2)	I _S		-	-	-13	A

Notes:

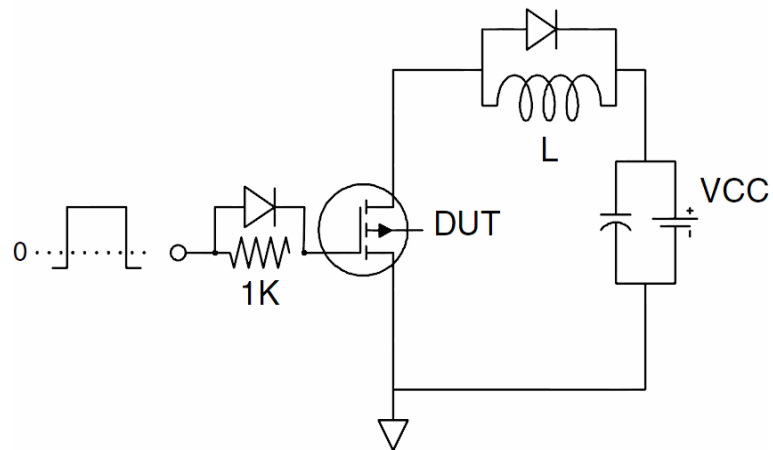
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production

Test Circuit

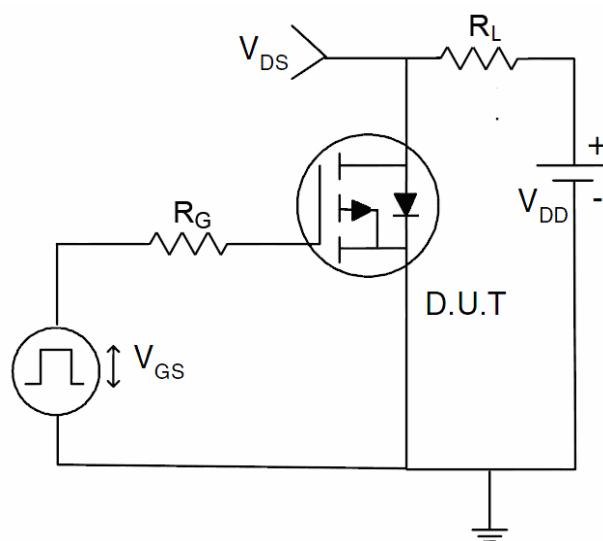
1) E_{AS} Test Circuit



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

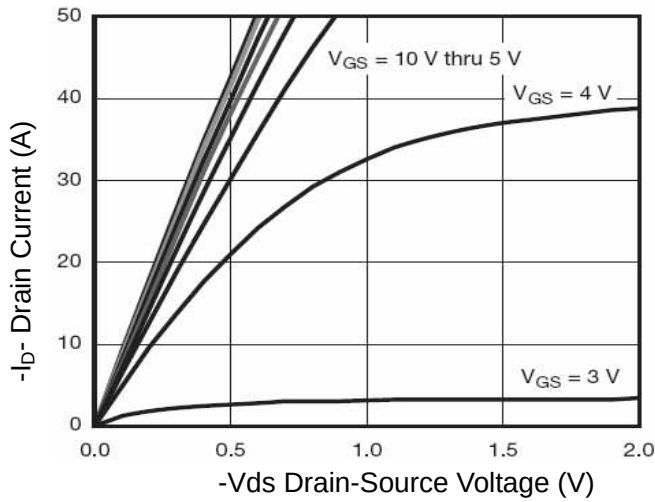


Figure 1 Output Characteristics

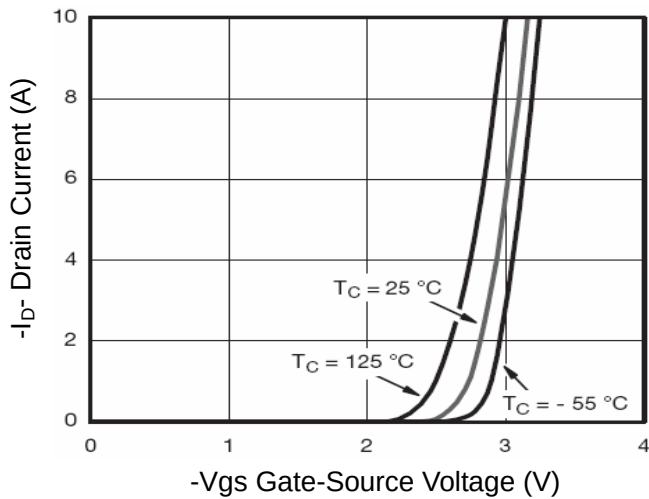


Figure 2 Transfer Characteristics

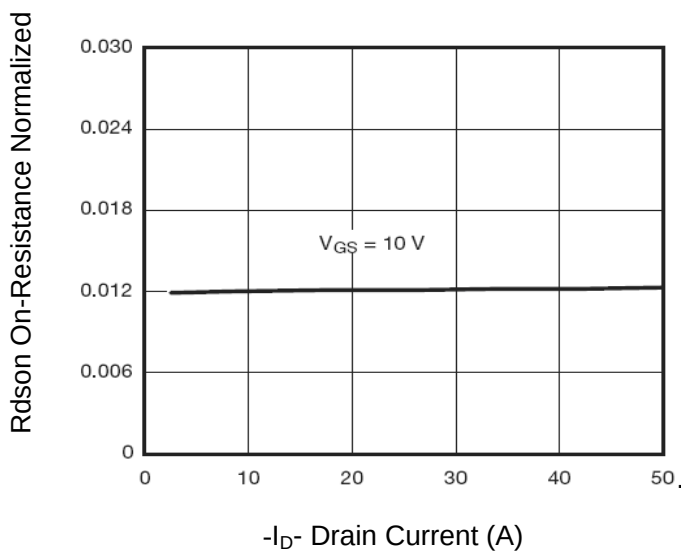


Figure 3 Rdson- Drain Current

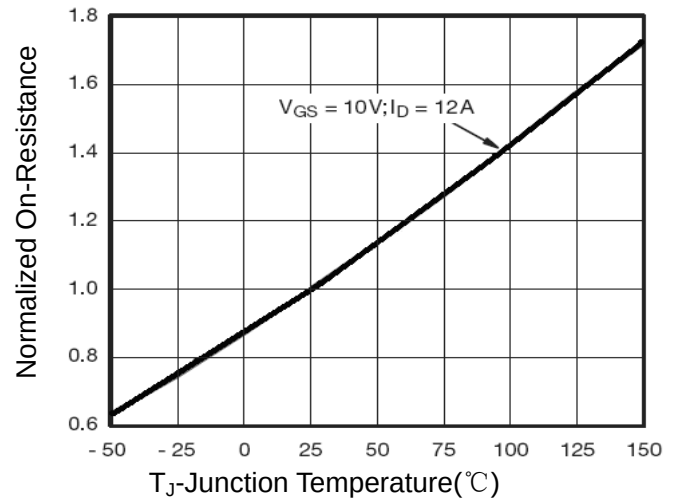


Figure 4 Rdson-Junction Temperature

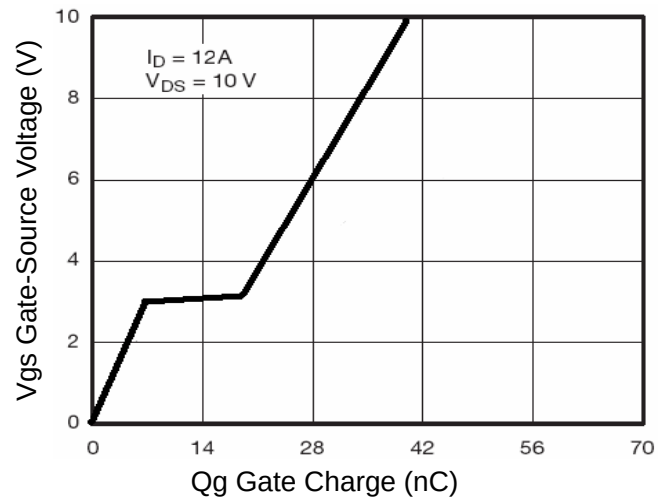


Figure 5 Gate Charge

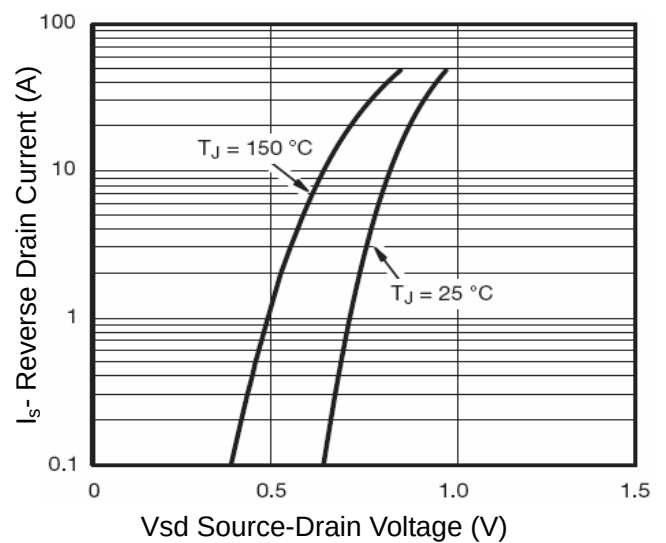


Figure 6 Source- Drain Diode Forward

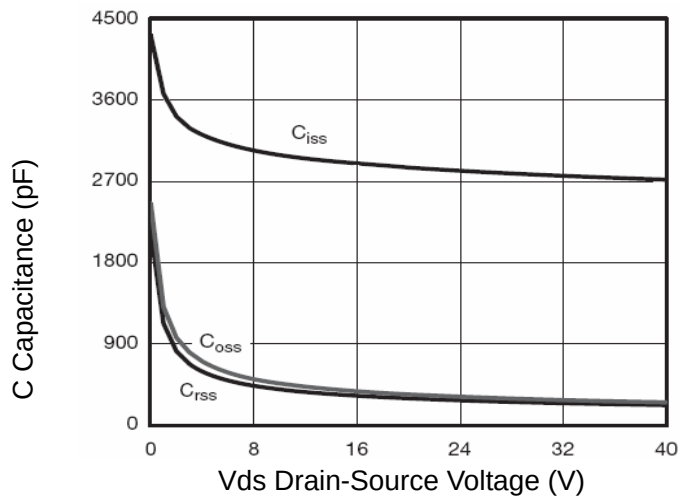


Figure 7 Capacitance vs Vds

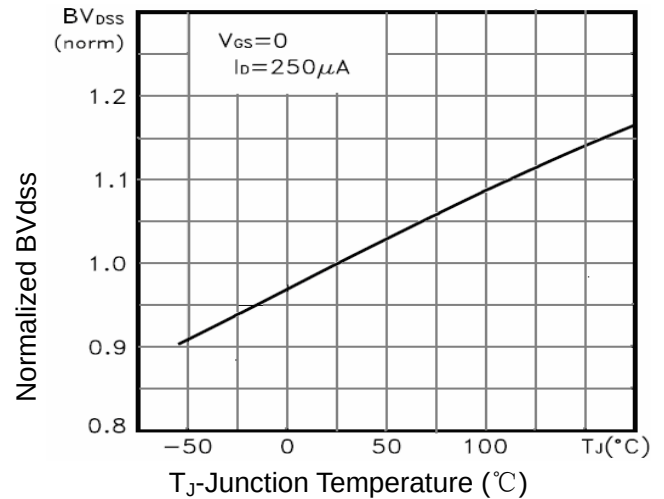


Figure 9 BV_{DSS} vs Junction Temperature

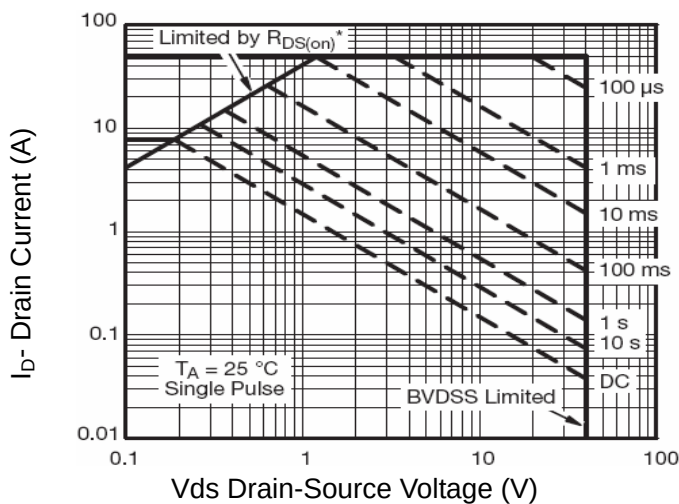


Figure 8 Safe Operation Area

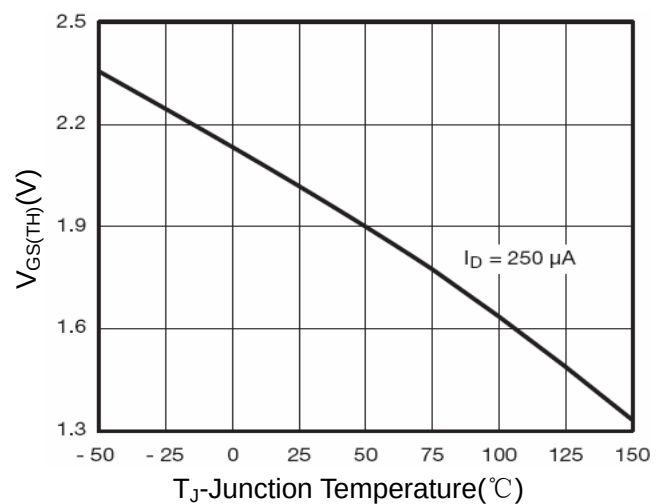


Figure 10 $V_{GS(th)}$ vs Junction Temperature

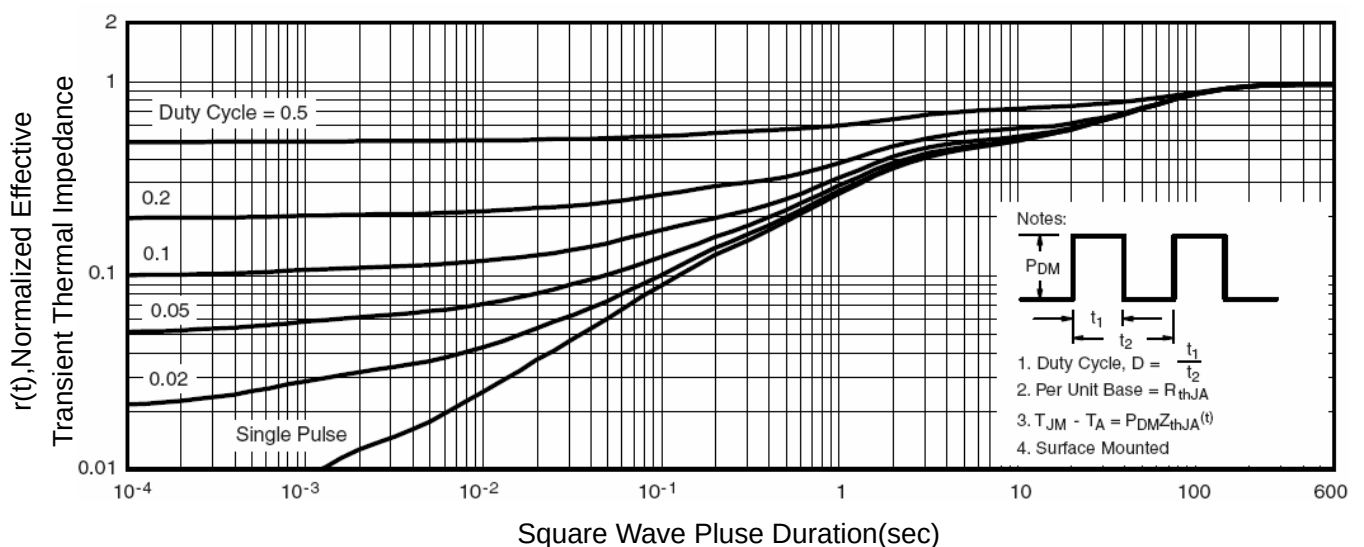
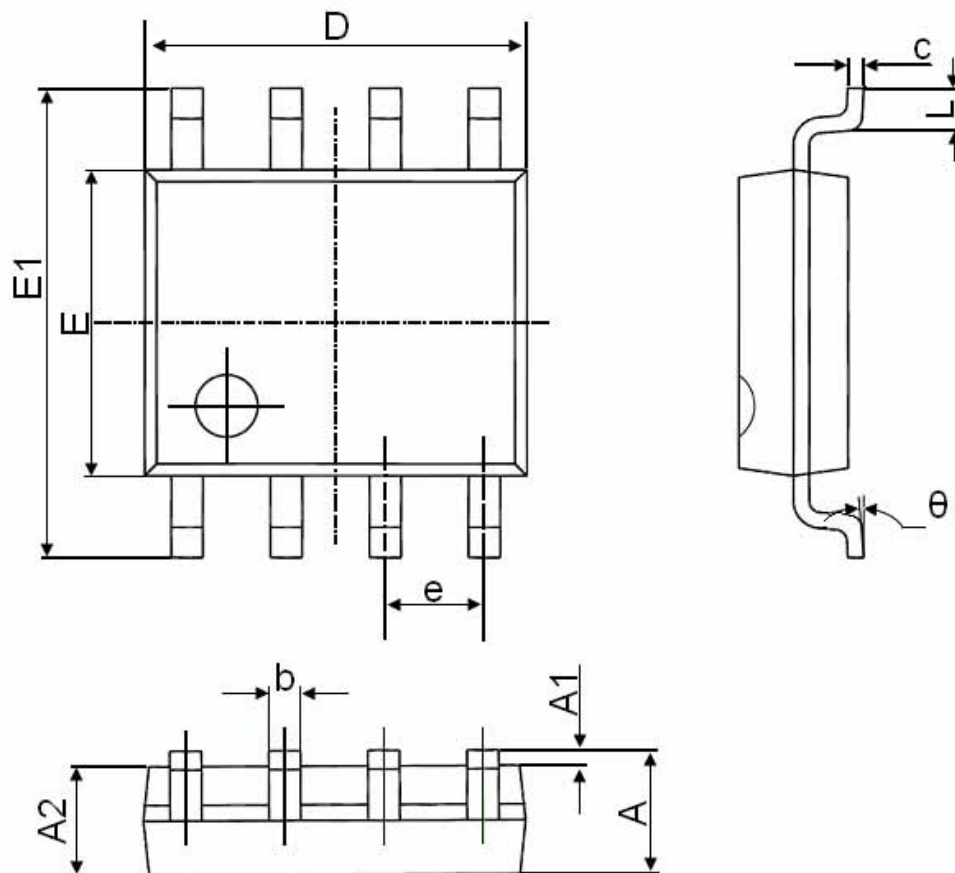


Figure 11 Normalized Maximum Transient Thermal Impedance

SOP-8 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°