

APM9950KC-TRL-VB Datasheet

Dual N-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ.)
60	0.012 at $V_{GS} = 10$ V	10	15 nC
	0.015 at $V_{GS} = 4.5$ V	9.0	

FEATURES

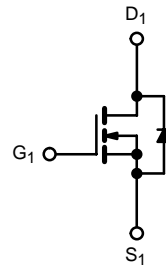
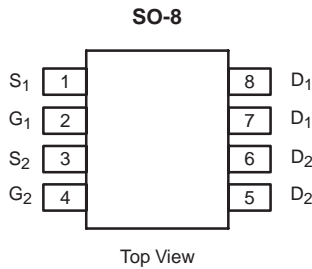
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % UIS Tested
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



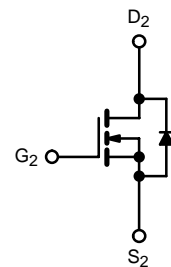
RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Set Top Box
- Low Current DC/DC



N-Channel MOSFET



N-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ($T_J = 150$ °C)	$T_C = 25$ °C	10 ^a	A
	$T_C = 70$ °C	8.2	
	$T_A = 25$ °C	7.2 ^{b, c}	
	$T_A = 70$ °C	6.2 ^{b, c}	
Pulsed Drain Current	I_{DM}	40	A
Continuous Source-Drain Diode Current	$T_C = 25$ °C	2.25	
	$T_A = 25$ °C	1.48 ^{b, c}	
Single Pulse Avalanche Current	I_{AS}	30	mJ
Single Pulse Avalanche Energy	E_{AS}	55	
Maximum Power Dissipation	$T_C = 25$ °C	2.7	W
	$T_C = 70$ °C	4.77	
	$T_A = 25$ °C	2.78 ^{b, c}	
	$T_A = 70$ °C	1.14 ^{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 ^{a, c, d}	$t \leq 10$ s	R_{thJA}	58	70	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	38	45	

Notes:

a. Package limited, $T_C = 25$ °C.

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

c. $t = 10$ 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	60			V	
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA		32		mV/°C	
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			- 5.0			
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1.0		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			10		
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ 5 V, V _{GS} = 10 V	10			A	
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 5 A		0.012		Ω	
		V _{GS} = 4.5 V, I _D = 4 A		0.015			
Forward Transconductance ^a	g _{fs}	V _{DS} = 10 V, I _D = 5 A		16		S	
Dynamic ^b							
Input Capacitance	C _{iss}	V _{DS} = 15 V, V _{GS} = 0 V, f = 1 MHz		586		pF	
Output Capacitance	C _{oss}			217			
Reverse Transfer Capacitance	C _{rss}			155			
Total Gate Charge	Q _g	V _{DS} = 15 V, V _{GS} = 10 V, I _D = 5 A		15	25	nC	
Gate-Source Charge	Q _{gs}	V _{DS} = 15 V, V _{GS} = 4.5 V, I _D = 5 A		6.7	9.6		
Gate-Drain Charge	Q _{gd}			4.4	6.0		
Gate Resistance	R _g			3.05	4.0		
Turn-On Delay Time	t _{d(on)}	f = 1 MHz	0.8	4.3	8.6	Ω	
Rise Time	t _r		V _{DD} = 15 V, R _L = 3 Ω I _D ≅ 5 A, V _{GEN} = 4.5 V, R _g = 1 Ω		12		24
Turn-Off Delay Time	t _{d(off)}				55		100
Fall Time	t _f				11		22
Turn-On Delay Time	t _{d(on)}	V _{DD} = 15 V, R _L = 3 Ω I _D ≅ 5 A, V _{GEN} = 10 V, R _g = 1 Ω			8	16	
Rise Time	t _r			4	8		
Turn-Off Delay Time	t _{d(off)}			9	18		
Fall Time	t _f			10	20		
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			2.25	A	
Pulse Diode Forward Current	I _{SM}				24		
Body Diode Voltage	V _{SD}	I _S = 2 A, V _{GS} = 0 V		0.8	1.2	V	
Body Diode Reverse Recovery Time	t _{rr}	I _F = 5 A, dI/dt = 100 A/μs, T _J = 25 °C		11	20	ns	
Body Diode Reverse Recovery Charge	Q _{rr}			4	8	nC	
Reverse Recovery Fall Time	t _a			7		ns	
Reverse Recovery Rise Time	t _b			4			

Notes:

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

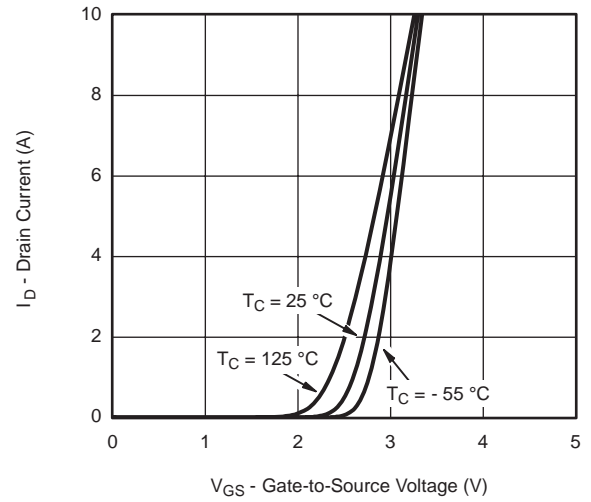
b. Guaranteed by design, not subject to production testing.

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.

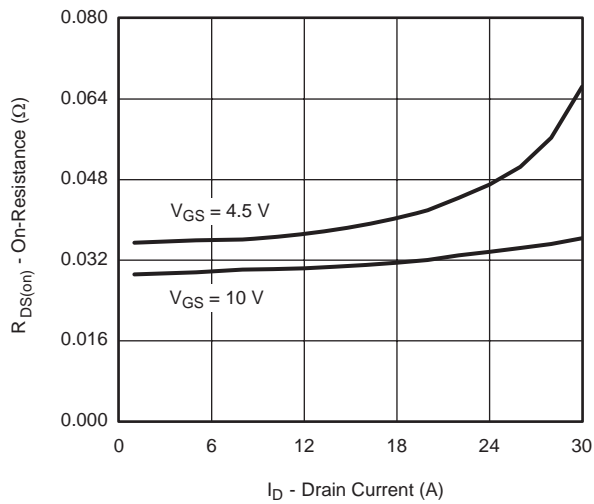
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



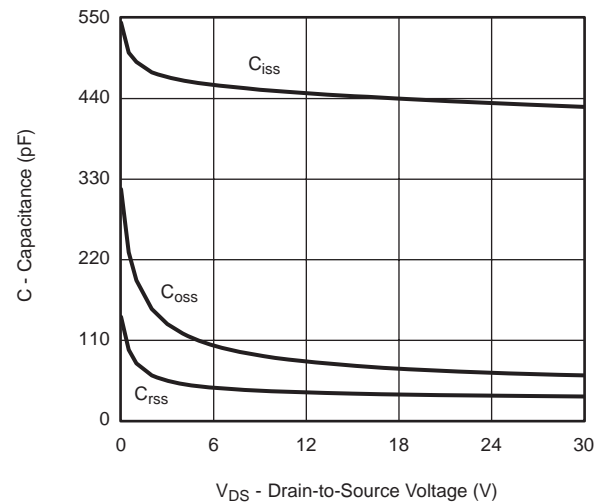
Output Characteristics



Transfer Characteristics



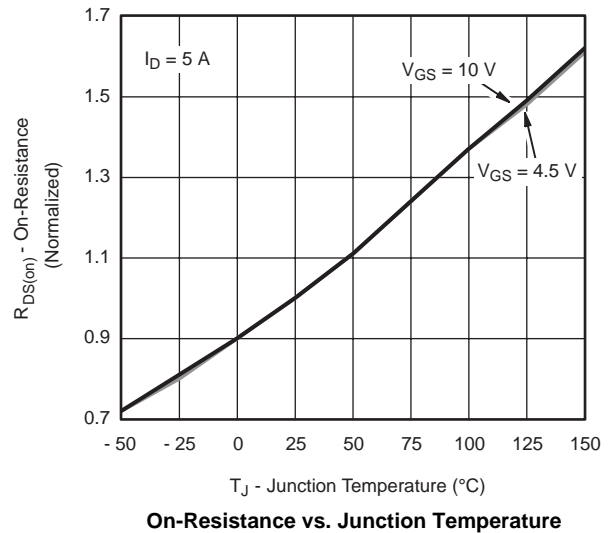
On-Resistance vs. Drain Current



Capacitance

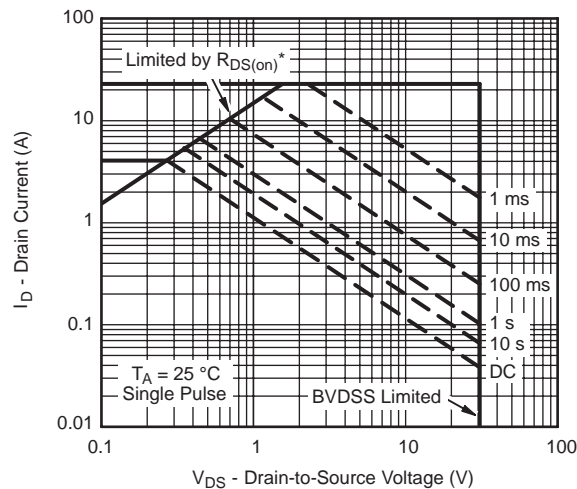
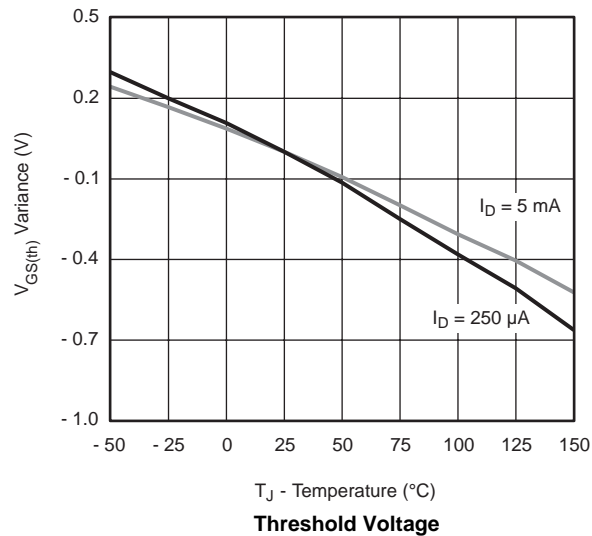
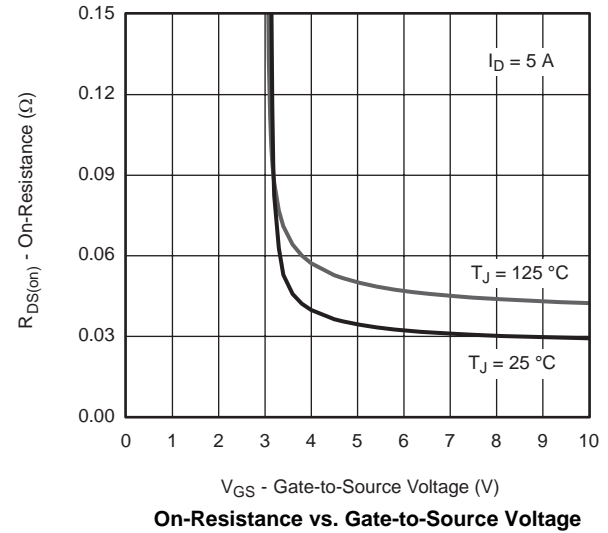
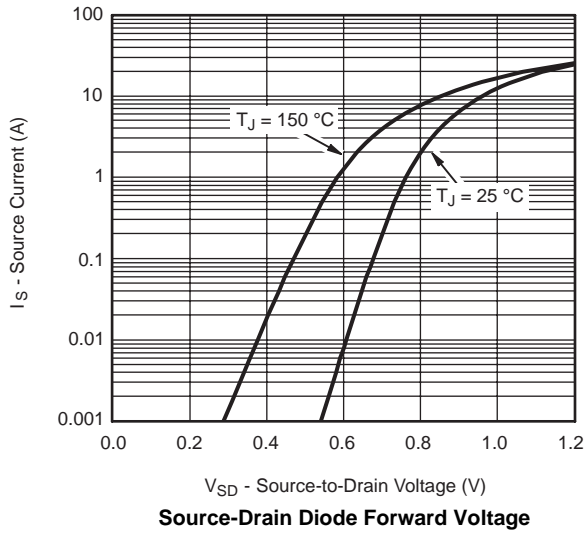


Gate Charge



On-Resistance vs. Junction Temperature

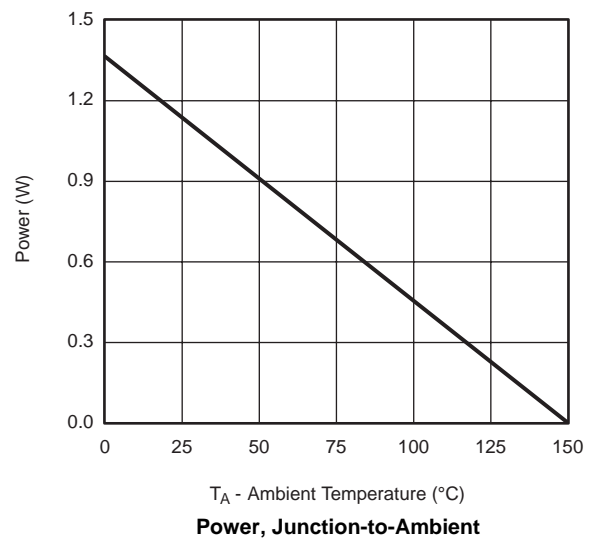
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



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

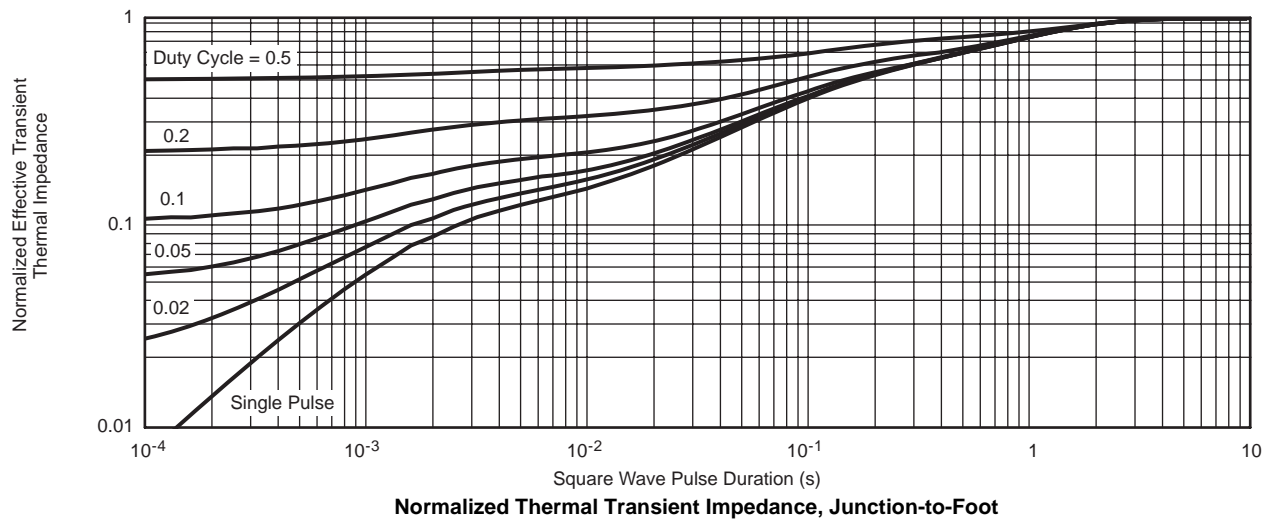
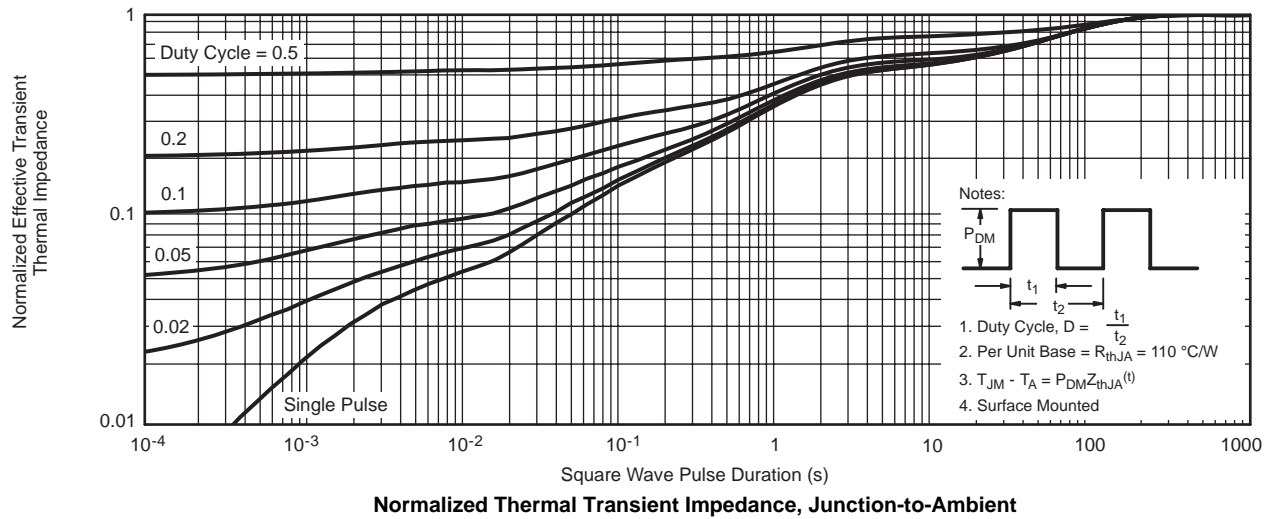
Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

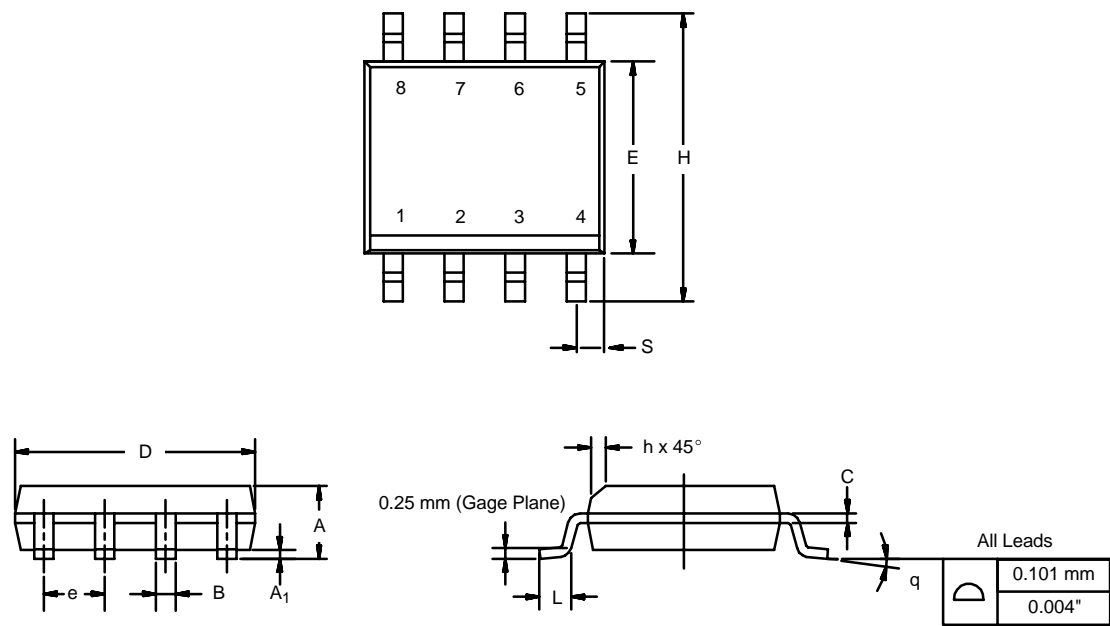


* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



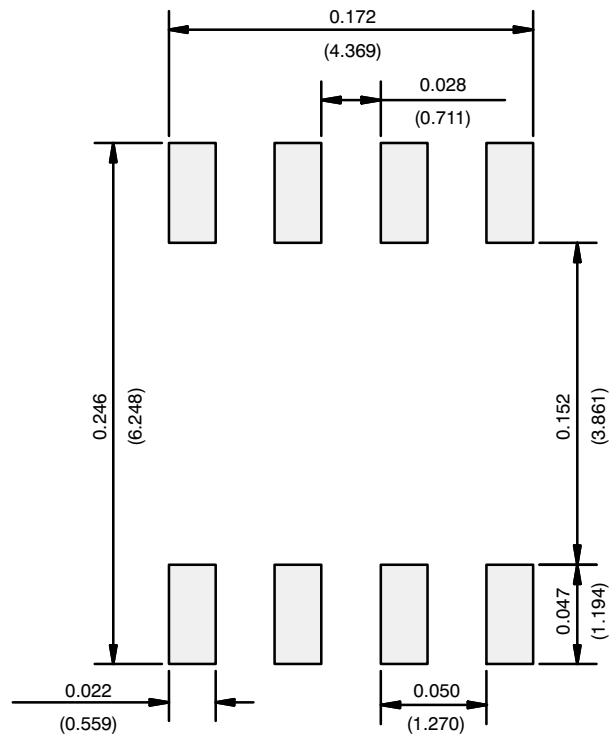
SOIC (NARROW): 8-LEAD
 JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A ₁	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026

ECN: C-06527-Rev. I, 11-Sep-06
 DWG: 5498

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads
Dimensions in Inches/(mm)

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