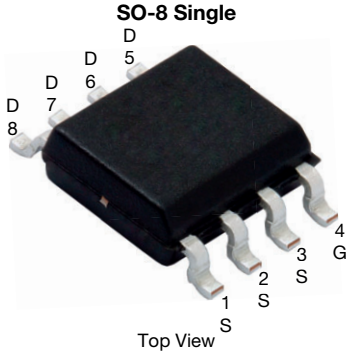
Automotive P-Channel 12 V (D-S) 175 °C MOSFET



Marking Code: Q4005

FEATURES

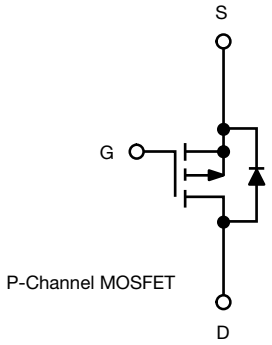
- TrenchFET® power MOSFET
- AEC-Q101 qualified [d]
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

Pb-free

RoHS COMPLIANT

HALOGEN FREE



P-Channel MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	-12
$R_{DS(on)}$ (Ω) at V_{GS} = -4.5 V	0.016
$R_{DS(on)}$ (Ω) at V_{GS} = -2.5 V	0.022
I_D (A)	-15
Configuration	Single

ORDERING INFORMATION	
Package	SO-8
Lead (Pb)-free and halogen-free	SQ4005EY (for detailed order number please see www.vishay.com/doc?79771)

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V_{DS}	-12	V
Gate-source voltage		V_{GS}	± 8	
Continuous drain current [a]	T_C = 25 °C	I_D	-15	A
	T_C = 125 °C		-8.7	
Continuous source current (diode conduction) [a]		I_S	-5.4	
Pulsed drain current [b]		I_{DM}	-60	
Single pulse avalanche current	L = 0.1 mH	I_{AS}	-20	
Single pulse avalanche energy		E_{AS}	20	mJ
Maximum power dissipation [b]	T_C = 25 °C	P_D	6	W
	T_C = 125 °C		2	
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +175	°C
Soldering recommendations (peak temperature)			260	

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-ambient	PCB Mount [c]	R_{thJA}	92	°C/W
Junction-to-foot (drain)		R_{thJF}	25	

Notes

a. Package limited
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %
c. When mounted on 1" square PCB (FR4 material)
d. Parametric verification ongoing

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SPECIFICATIONS (T_C = 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		-12	-	-	V
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = -250 µA		-0.45	-0.6	-1	
Gate-source leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 8 V		-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	V_{GS} = 0 V	V_{DS} = -12 V	-	-	-1	µA
		V_{GS} = 0 V	V_{DS} = -12 V, T_J = 125 °C	-	-	-50	
		V_{GS} = 0 V	V_{DS} = -12 V, T_J = 175 °C	-	-	-150	
On-state drain current [a]	$I_{D(on)}$	V_{GS} = -4.5 V	V_{DS} ≤ -5 V	-20	-	-	A
Drain-source on-state resistance [a]	$R_{DS(on)}$	V_{GS} = -4.5 V	I_D = -13.5 A	-	0.013	0.016	Ω
		V_{GS} = -4.5 V	I_D = -13.5 A	-	-	0.020	
		V_{GS} = -4.5 V	I_D = -13.5 A	-	-	0.022	
		V_{GS} = -2.5 V	I_D = -12 A	-	0.018	0.022	
Forward transconductance [b]	g_{fs}	V_{DS} = -6 V, I_D = -12 A		-	34	-	S
Dynamic [b]							
Input capacitance	C_{iss}	V_{GS} = 0 V	V_{DS} = -6 V, f = 1 MHz	-	2433	3600	pF
Output capacitance	C_{oss}			-	922	1380	
Reverse transfer capacitance	C_{rss}			-	752	1120	
Total gate charge [c]	Q_g	V_{GS} = -4.5 V	V_{DS} = -6 V, I_D = -10 A	-	29	38	nC
Gate-source charge [c]	Q_{gs}			-	4.2	-	
Gate-drain charge [c]	Q_{gd}			-	8.4	-	
Gate resistance	R_g	f = 1 MHz		1.3	2.7	4	Ω
Turn-on delay time [c]	$t_{d(on)}$	V_{DD} = -6 V, R_L = 0.6 Ω I_D ≅ -10 A, V_{GEN} = -4.5 V, R_g = 1 Ω		-	19	26	ns
Rise time [c]	t_r			-	33	44	
Turn-off delay time [c]	$t_{d(off)}$			-	73	97	
Fall time [c]	t_f			-	30	40	
Source-Drain Diode Ratings and Characteristics [b]							
Pulsed current [a]	I_{SM}			-	-	-60	A
Forward voltage	V_{SD}	I_F = -10 A, V_{GS} = 0 V		-	-0.8	-1.1	V

Notes

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

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.

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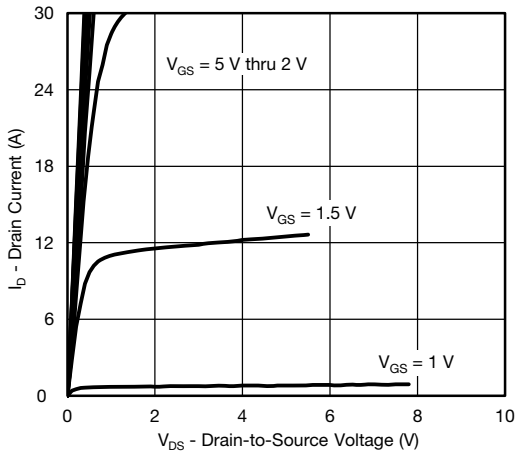
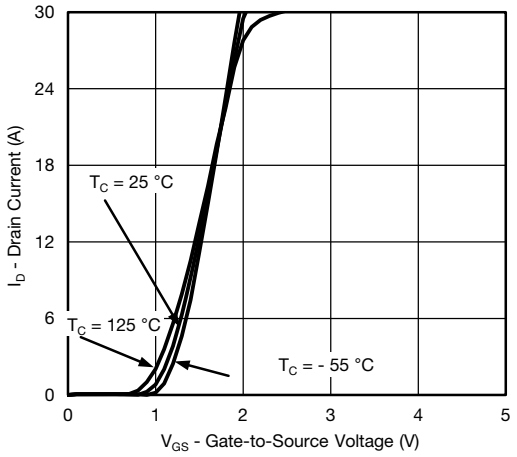
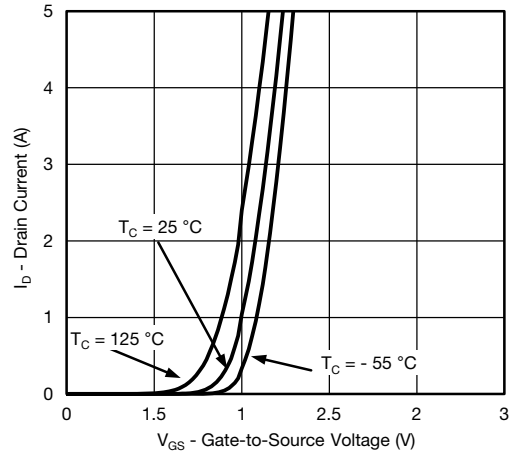
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



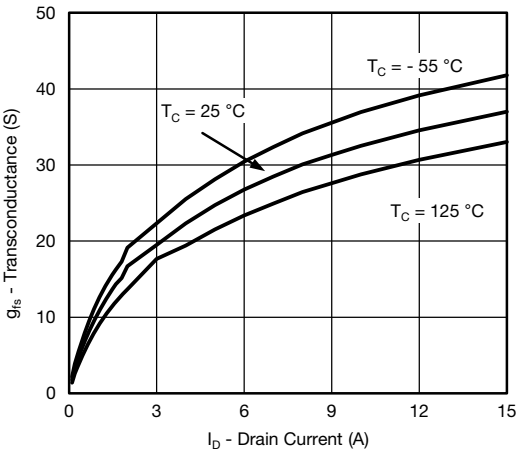
Output Characteristics



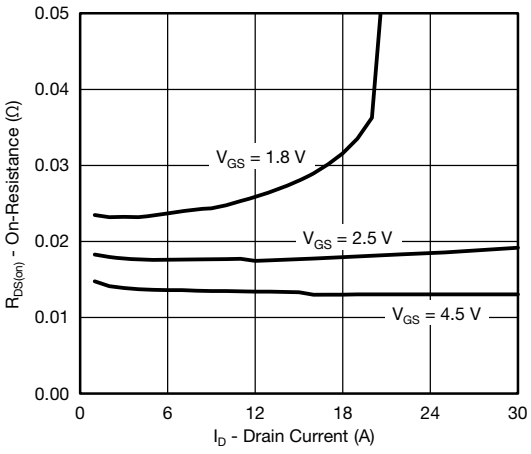
Transfer Characteristics



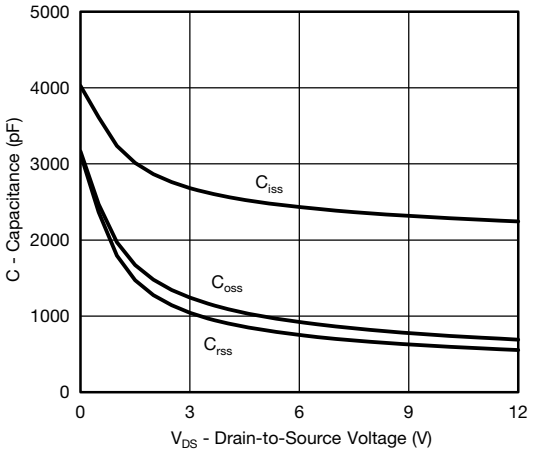
Transfer Characteristics



Transconductance



On-Resistance vs. Drain Current



Capacitance

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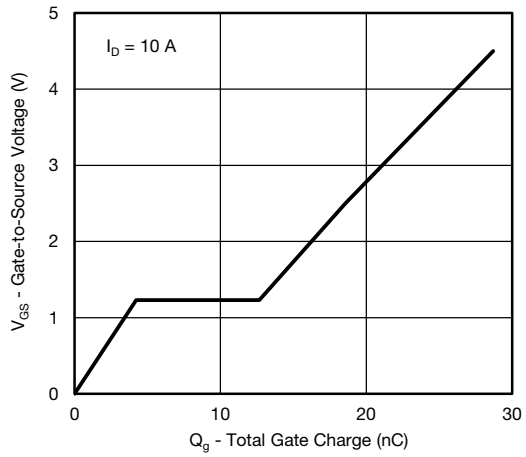
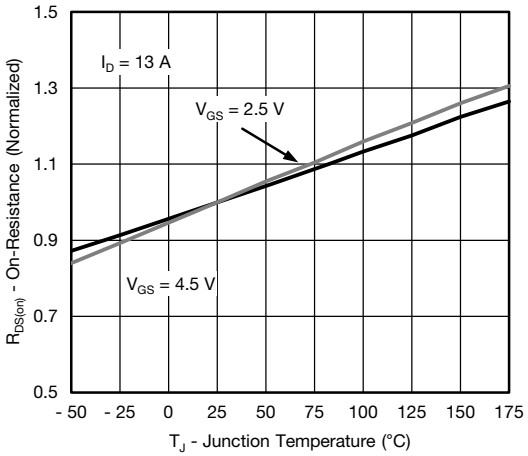
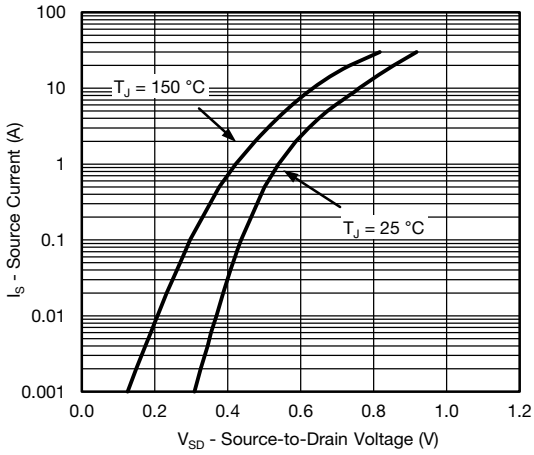


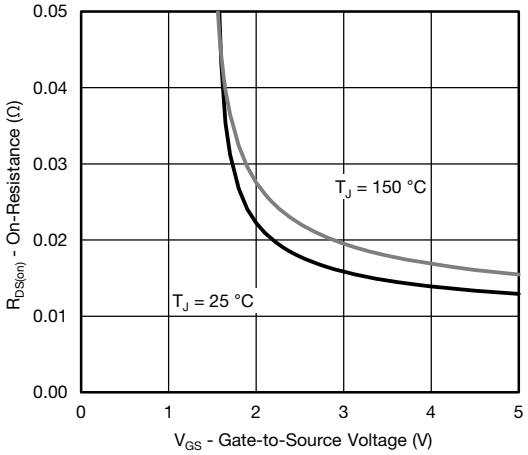
Gate Charge



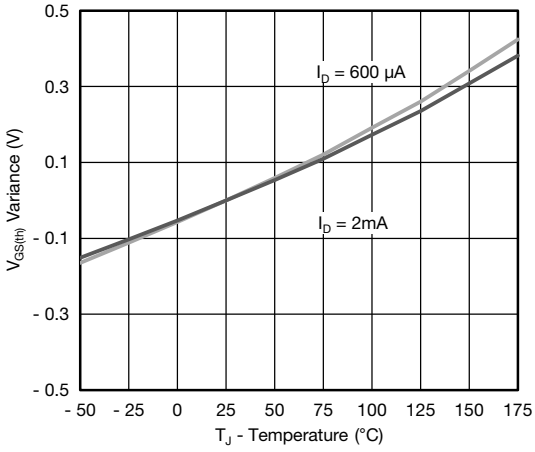
On-Resistance vs. Junction Temperature



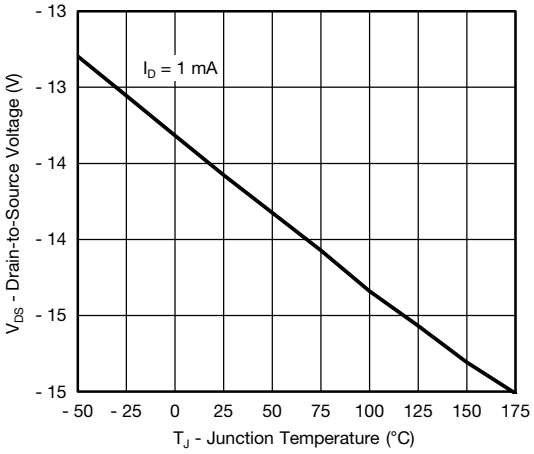
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Breakdown Voltage vs. Junction Temperature

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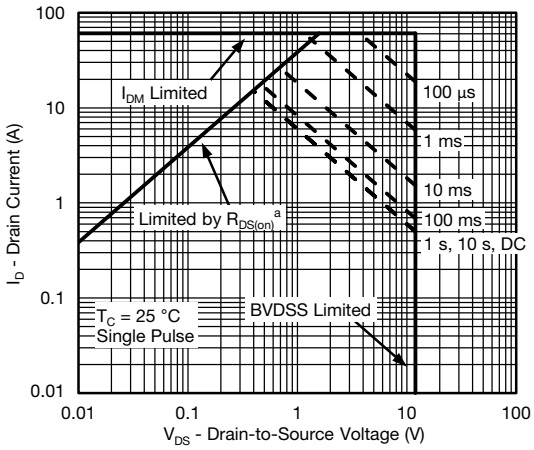

Safe Operating Area

Note

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

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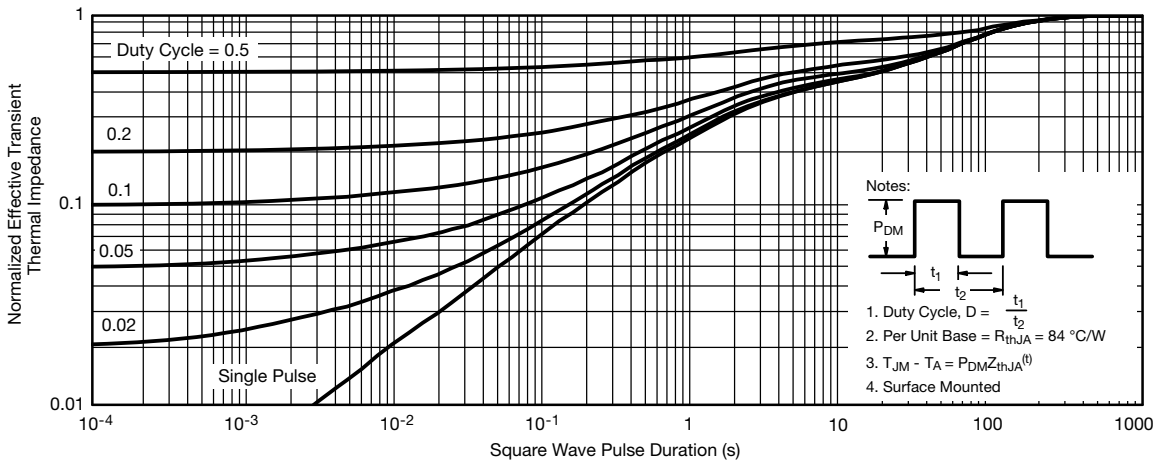
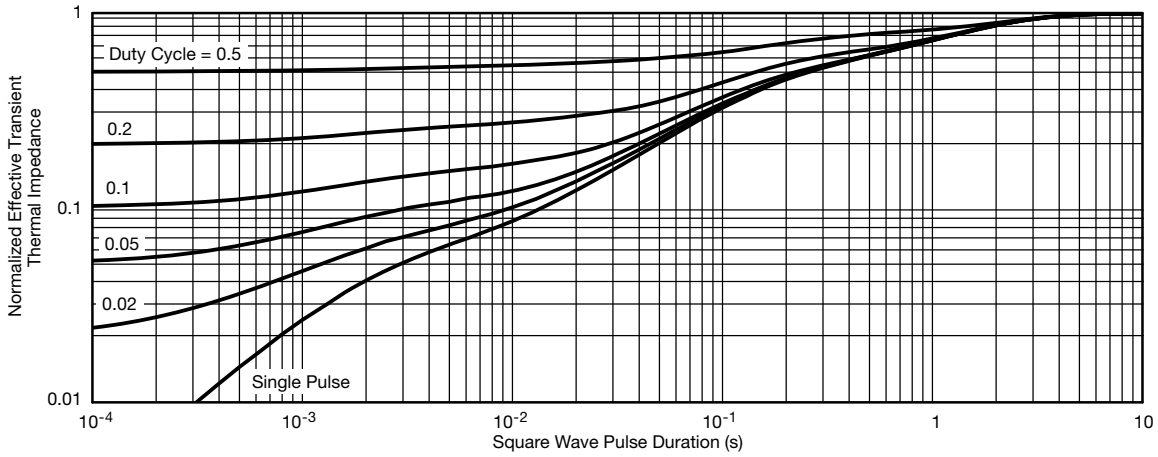


Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

Note

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Foot (25 °C)

  are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions

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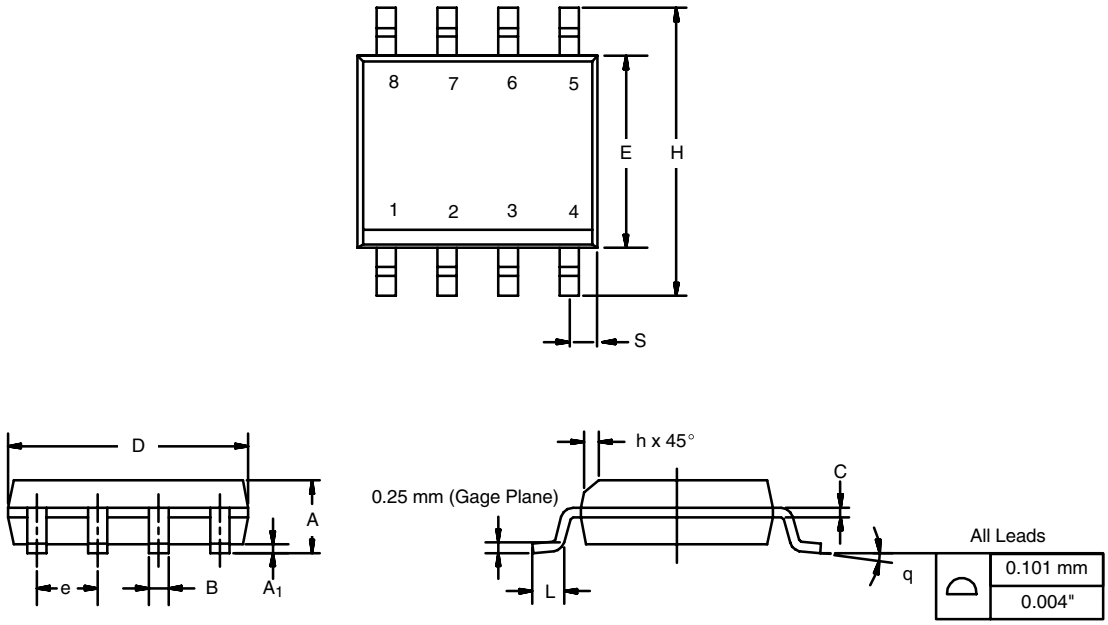
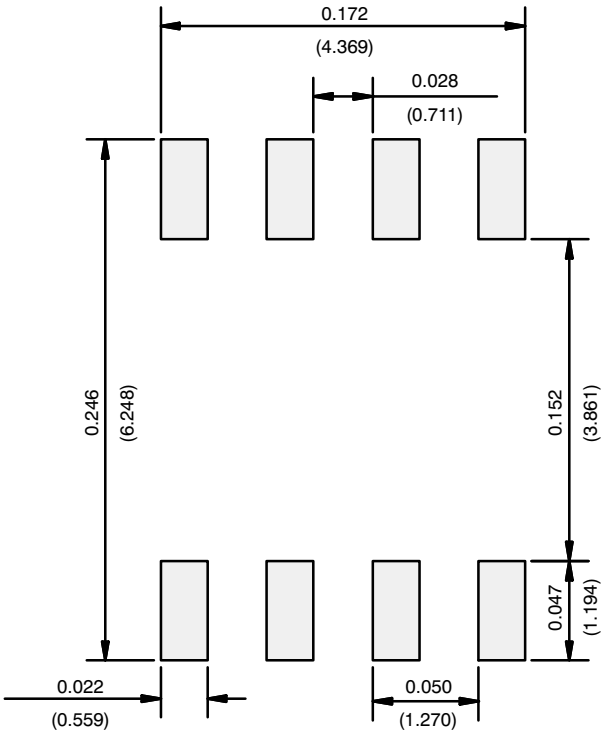
SOIC (NARROW): 8-LEAD
JEDEC Part Number: MS-012



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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