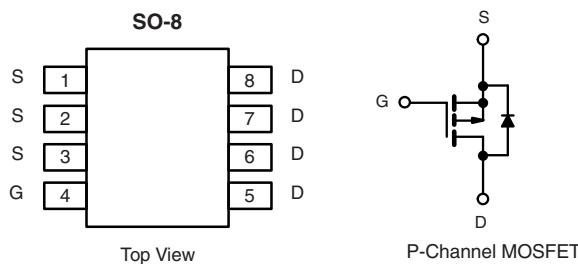


## Automotive P-Channel 60 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V)	- 60
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -10$ V	0.085
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -4.5$ V	0.115
$I_D$ (A)	- 4.6
Configuration	Single

### FEATURES

- Halogen-free According to IEC 61249-2-21  
Definition
- TrenchFET® Power MOSFET
- AEC-Q101 Qualified<sup>c</sup>
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



### ORDERING INFORMATION

Package	SO-8
Lead (Pb)-free and Halogen-free	SQ9407EY-T1-GE3

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	- 60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current	$I_D$	- 4.6	A
		- 2.6	
Continuous Source Current (Diode Conduction)	$I_S$	- 3.4	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	- 18.5	
Single Pulse Avalanche Current	$I_{AS}$	- 20	mJ
Single Pulse Avalanche Energy	$E_{AS}$	20	
Maximum Power Dissipation <sup>a</sup>	$P_D$	3.75	W
		1.25	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 175	°C

### THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient	$R_{thJA}$	100	°C/W
Junction-to-Foot (Drain)	$R_{thJF}$	40	

#### Notes

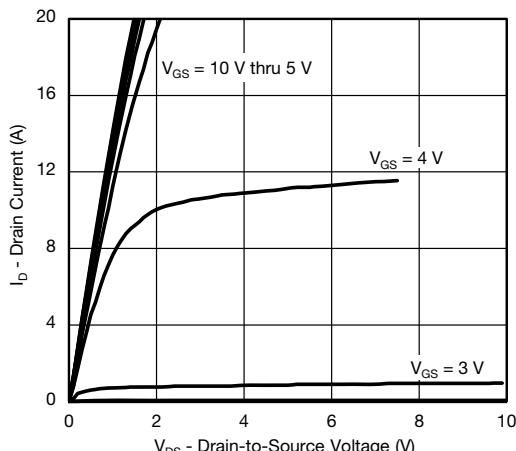
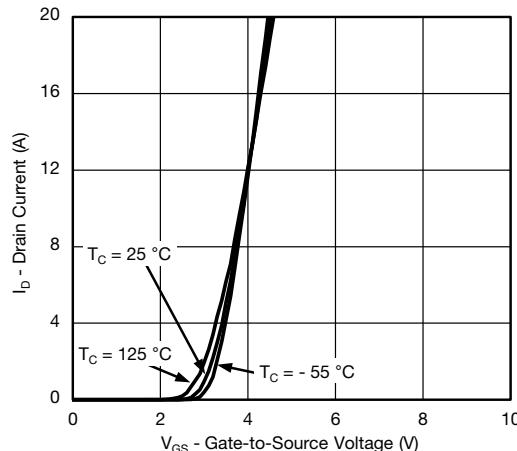
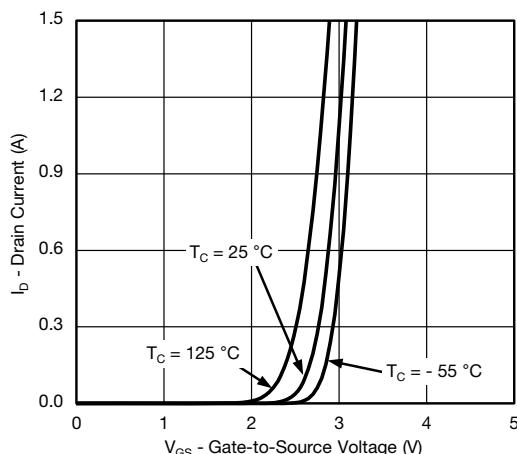
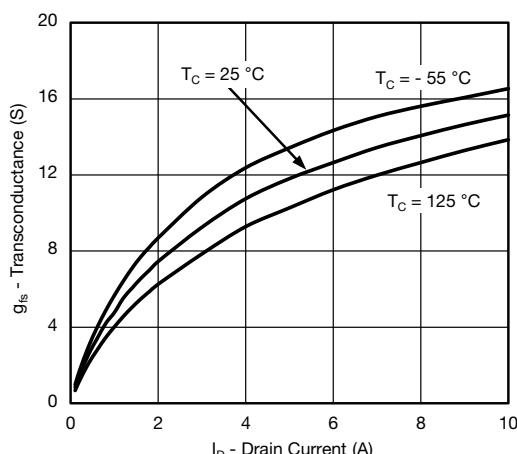
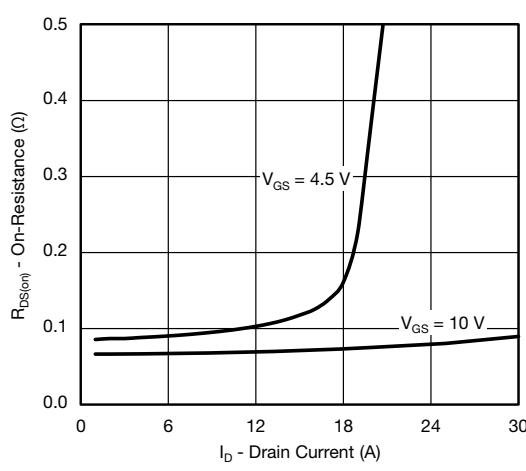
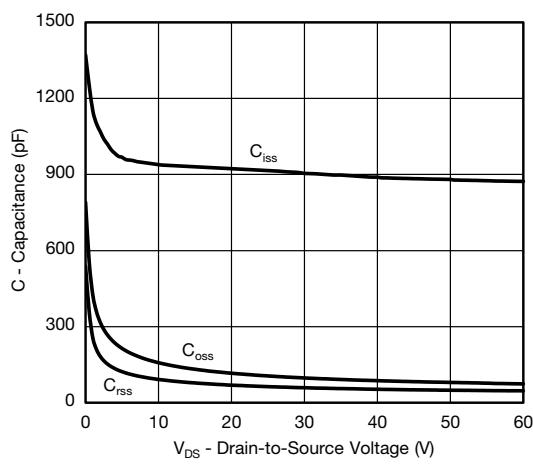
- Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.
- When mounted on 1" square PCB (FR-4 material).
- Parametric verification ongoing.

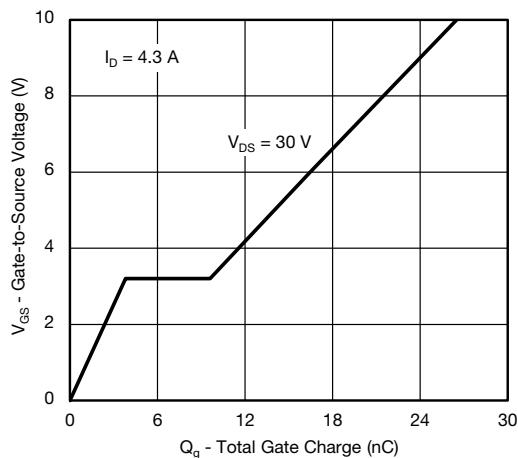
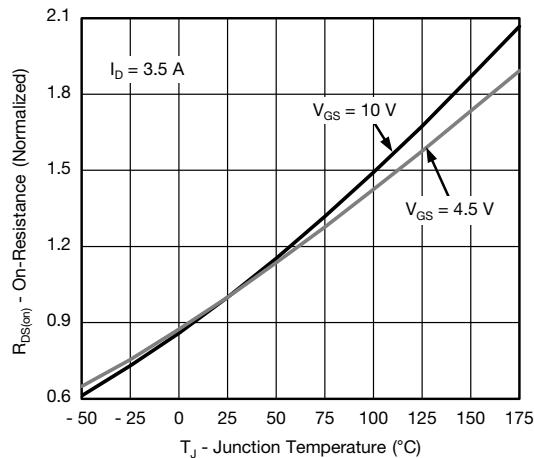
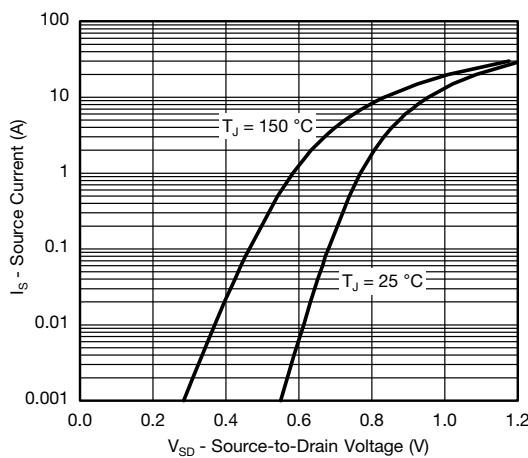
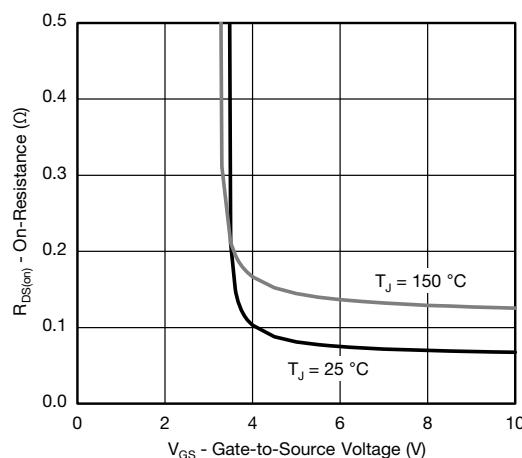
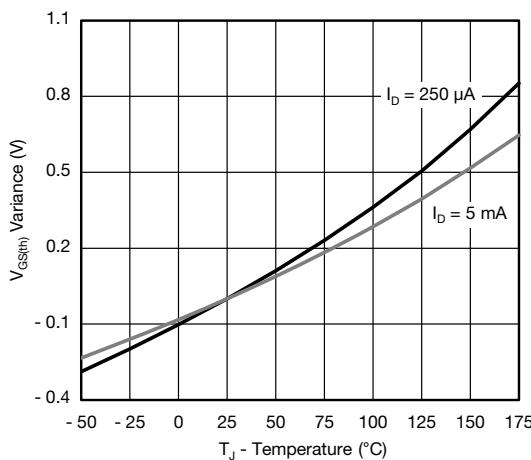
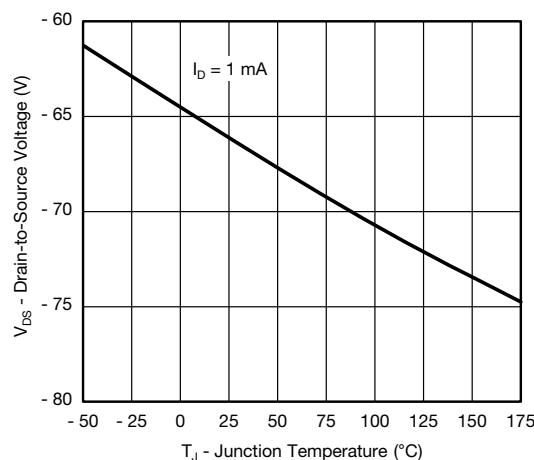
<b>SPECIFICATIONS</b> ( $T_C = 25^\circ\text{C}$ , unless otherwise noted)								
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT	
<b>Static</b>								
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$		- 60	-	-	V	
Gate-Source Threshold Voltage	$V_{GS(\text{th})}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$		- 1.5	- 2.0	- 2.5		
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = -60\text{ V}$	-	-	- 1	$\mu\text{A}$	
		$V_{GS} = 0\text{ V}$	$V_{DS} = -60\text{ V}$ , $T_J = 125^\circ\text{C}$	-	-	- 50		
		$V_{GS} = 0\text{ V}$	$V_{DS} = -60\text{ V}$ , $T_J = 175^\circ\text{C}$	-	-	- 150		
On-State Drain Current <sup>a</sup>	$I_{D(\text{on})}$	$V_{GS} = -10\text{ V}$	$V_{DS} \leq -5\text{ V}$	- 12	-	-	A	
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(\text{on})}$	$V_{GS} = -4.5\text{ V}$	$I_D = -2.5\text{ A}$	-	0.087	0.115	$\Omega$	
		$V_{GS} = -10\text{ V}$	$I_D = -3.5\text{ A}$	-	0.067	0.085		
		$V_{GS} = -10\text{ V}$	$I_D = -3.5\text{ A}$ , $T_J = 125^\circ\text{C}$	-	-	0.143		
		$V_{GS} = -10\text{ V}$	$I_D = -3.5\text{ A}$ , $T_J = 175^\circ\text{C}$	-	-	0.176		
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}$ , $I_D = -3.5\text{ A}$		-	10	-	S	
<b>Dynamic<sup>b</sup></b>								
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$	$V_{DS} = -30\text{ V}$ , $f = 1\text{ MHz}$	-	912	1140	pF	
Output Capacitance	$C_{oss}$			-	100	125		
Reverse Transfer Capacitance	$C_{rss}$			-	60	75		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{GS} = -10\text{ V}$	$V_{DS} = -30\text{ V}$ , $I_D = -4.3\text{ A}$	-	26.5	40	nC	
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			-	3.8	-		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			-	5.8	-		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		3.5	7.1	10.7	$\Omega$	
Turn-On Delay Time <sup>c</sup>	$t_{d(\text{on})}$	$V_{DD} = -30\text{ V}$ , $R_L = 8.8\text{ }\Omega$ $I_D \equiv -3.4\text{ A}$ , $V_{GEN} = -10\text{ V}$ , $R_g = 1\text{ }\Omega$	$I_D = -3.4\text{ A}$ , $V_{GEN} = -10\text{ V}$ , $R_g = 1\text{ }\Omega$	-	11	17	ns	
Rise Time <sup>c</sup>	$t_r$			-	13	20		
Turn-Off Delay Time <sup>c</sup>	$t_{d(\text{off})}$			-	36	54		
Fall Time <sup>c</sup>	$t_f$			-	8	12		
<b>Source-Drain Diode Ratings and Characteristics<sup>b</sup></b>								
Pulsed Current <sup>a</sup>	$I_{SM}$			-	-	- 18.5	A	
Forward Voltage	$V_{SD}$	$I_F = -3\text{ A}$ , $V_{GS} = 0\text{ V}$		-	- 0.84	- 1.1	V	

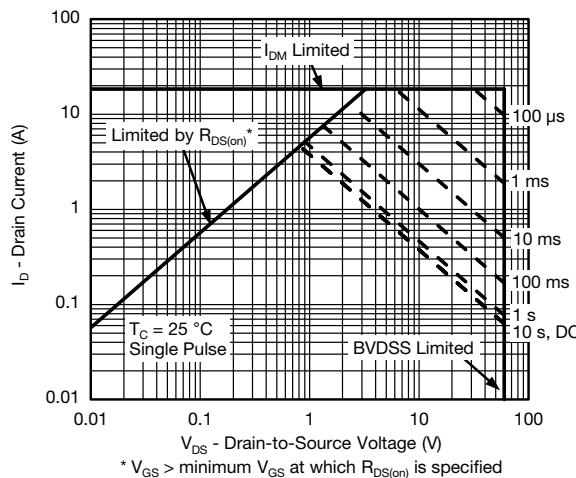
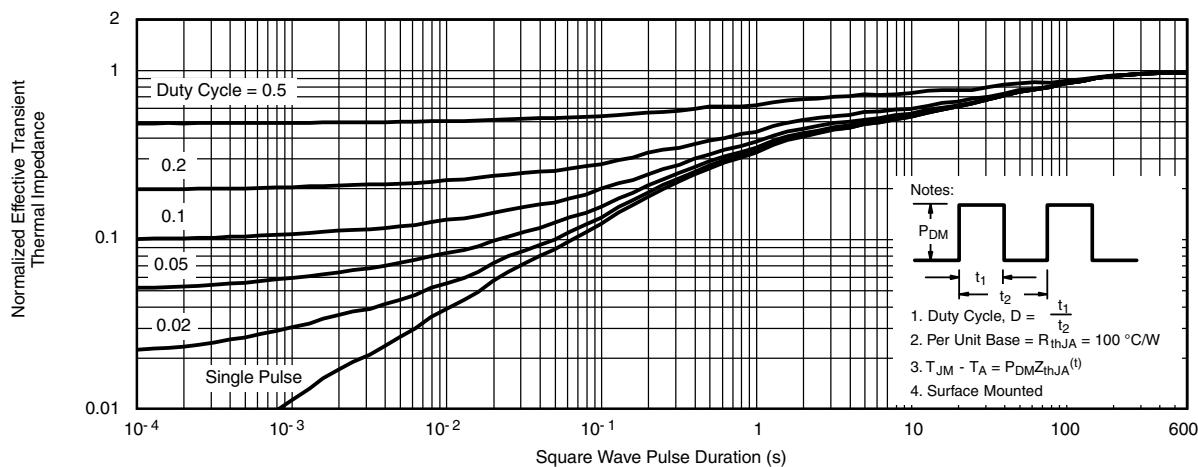
**Notes**

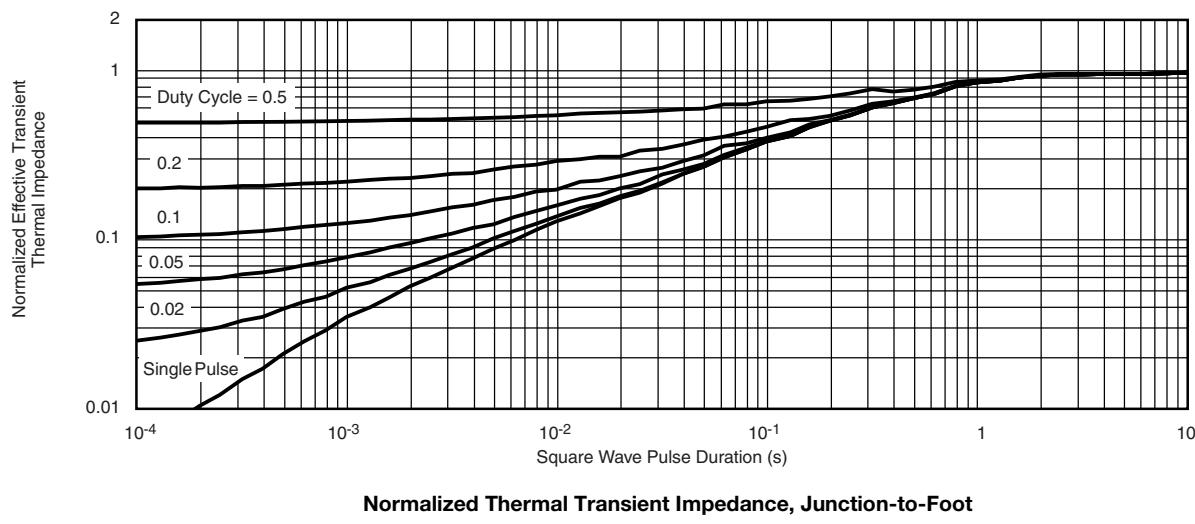
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\text{ \%}$ .
- b. Guaranteed by design, not subject to production testing.
- c. Independent of operating temperature.

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.

**TYPICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

**Output Characteristics**

**Transfer Characteristics**

**Transfer Characteristics**

**Transconductance**

**On-Resistance vs. Drain Current**

**Capacitance**

**TYPICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**Source Drain Diode Forward Voltage**

**On-Resistance vs. Gate-to-Source Voltage**

**Threshold Voltage**

**Drain Source Breakdown vs. Junction Temperature**

**THERMAL RATINGS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

**Safe Operating Area**

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

**THERMAL RATINGS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient ( $25^\circ\text{C}$ )
  - Normalized Transient Thermal Impedance Junction-to-Foot ( $25^\circ\text{C}$ )

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.

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?67582](http://www.vishay.com/ppg?67582).

### SO-8

Ordering codes for the SQ rugged series power MOSFETs in the SO-8 package:

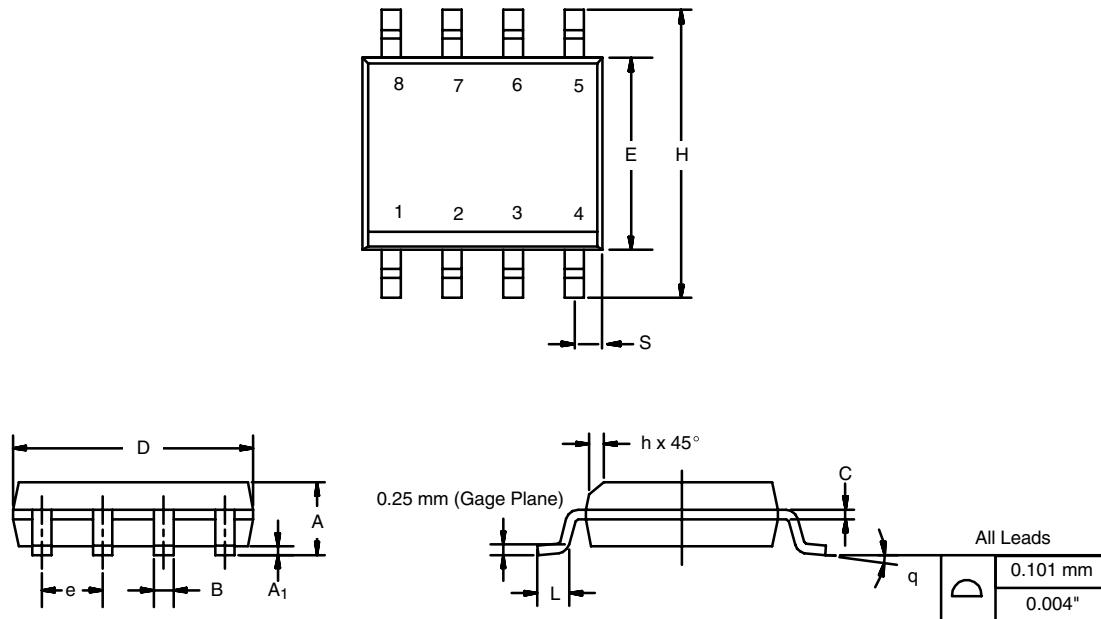
DATASHEET PART NUMBER	OLD ORDERING CODE <sup>a</sup>	NEW ORDERING CODE
SQ4005EY	-	<b>SQ4005EY-T1_GE3</b>
SQ4050EY	SQ4050EY-T1-GE3	<b>SQ4050EY-T1_GE3</b>
SQ4182EY	SQ4182EY-T1-GE3	<b>SQ4182EY-T1_GE3</b>
SQ4184EY	SQ4184EY-T1-GE3	<b>SQ4184EY-T1_GE3</b>
SQ4282EY	SQ4282EY-T1-GE3	<b>SQ4282EY-T1_GE3</b>
SQ4284EY	SQ4284EY-T1-GE3	<b>SQ4284EY-T1_GE3</b>
SQ4401EY	SQ4401EY-T1-GE3	<b>SQ4401EY-T1_GE3</b>
SQ4410EY	SQ4410EY-T1-GE3	<b>SQ4410EY-T1_GE3</b>
SQ4425EY	SQ4425EY-T1-GE3	<b>SQ4425EY-T1_GE3</b>
SQ4431EY	SQ4431EY-T1-GE3	<b>SQ4431EY-T1_GE3</b>
SQ4435EY	SQ4435EY-T1-GE3	<b>SQ4435EY-T1_GE3</b>
SQ4470EY	SQ4470EY-T1-GE3	<b>SQ4470EY-T1_GE3</b>
SQ4483BEEY	SQ4483BEEY-T1-GE3	<b>SQ4483BEEY-T1_GE3</b>
SQ4483EY	-	<b>SQ4483EY-T1_GE3</b>
SQ4532AEY	-	<b>SQ4532AEY-T1_GE3</b>
SQ4840EY	SQ4840EY-T1-GE3	<b>SQ4840EY-T1_GE3</b>
SQ4850EY	SQ4850EY-T1-GE3	<b>SQ4850EY-T1_GE3</b>
SQ4917EY	SQ4917EY-T1-GE3	<b>SQ4917EY-T1_GE3</b>
SQ4920EY	SQ4920EY-T1-GE3	<b>SQ4920EY-T1_GE3</b>
SQ4937EY	SQ4937EY-T1-GE3	<b>SQ4937EY-T1_GE3</b>
SQ4940AEY	SQ4940AEY-T1-GE3	<b>SQ4940AEY-T1_GE3</b>
SQ4946AEY	SQ4946AEY-T1-GE3	<b>SQ4946AEY-T1_GE3</b>
SQ4949EY	SQ4949EY-T1-GE3	<b>SQ4949EY-T1_GE3</b>
SQ4961EY	SQ4961EY-T1-GE3	<b>SQ4961EY-T1_GE3</b>
SQ9407EY	SQ9407EY-T1-GE3	<b>SQ9407EY-T1_GE3</b>
SQ9945BEY	SQ9945BEY-T1-GE3	<b>SQ9945BEY-T1_GE3</b>

**Note**

a. Old ordering code is obsolete and no longer valid for new orders

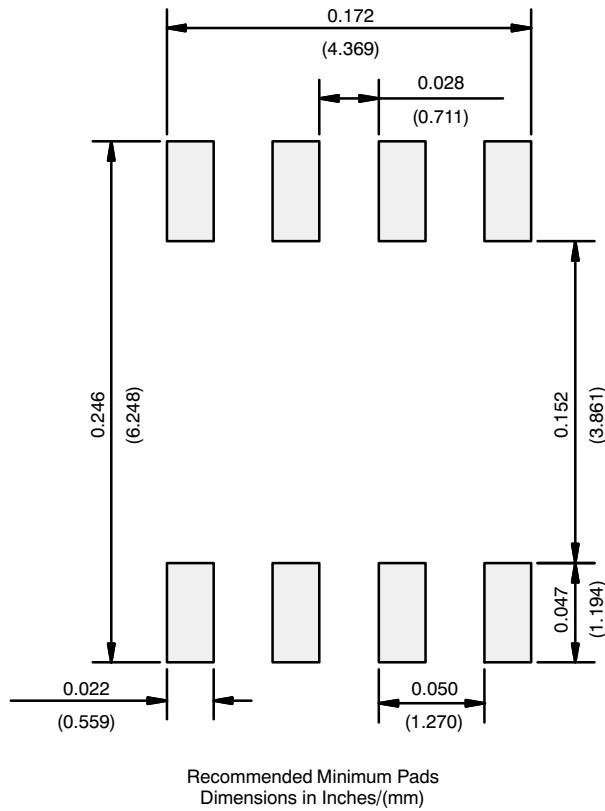
### SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	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



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