

# MC74VHC1G125

## Noninverting 3-State Buffer

The MC74VHC1G125 is an advanced high speed CMOS noninverting 3-state buffer fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

The internal circuit is composed of three stages, including a buffered 3-state output which provides high noise immunity and stable output.

The MC74VHC1G125 input structure provides protection when voltages up to 7.0 V are applied, regardless of the supply voltage. This allows the MC74VHC1G125 to be used to interface 5.0 V circuits to 3.0 V circuits.

- High Speed:  $t_{PD} = 3.5$  ns (Typ) at  $V_{CC} = 5.0$  V
- Low Power Dissipation:  $I_{CC} = 1$   $\mu$ A (Max) at  $T_A = 25^\circ$ C
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Pin and Function Compatible with Other Standard Logic Families
- Chip Complexity: FETs = 58; Equivalent Gates = 15

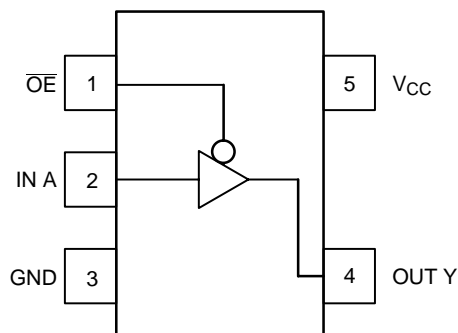


Figure 1. Pinout (Top View)

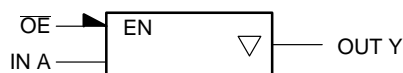


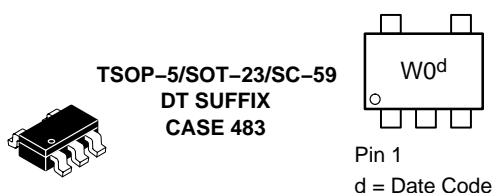
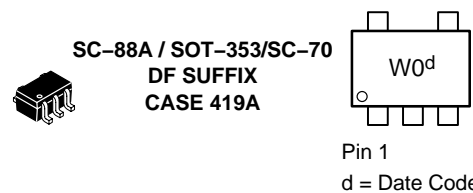
Figure 2. Logic Symbol



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### MARKING DIAGRAMS



PIN ASSIGNMENT	
1	$\overline{OE}$
2	IN A
3	GND
4	OUT Y
5	$V_{CC}$

### FUNCTION TABLE

A Input	$\overline{OE}$ Input	Y Output
L	L	L
H	L	H
X	H	Z

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

# MC74VHC1G125

## MAXIMUM RATINGS (Note 1)

Symbol	Characteristics	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0	V
V <sub>IN</sub>	DC Input Voltage	-0.5 to +7.0	V
V <sub>OUT</sub>	DC Output Voltage V <sub>CC</sub> = 0 High or Low State	-0.5 to 7.0 -0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	Input Diode Current	-20	mA
I <sub>OK</sub>	Output Diode Current V <sub>OUT</sub> < GND; V <sub>OUT</sub> > V <sub>CC</sub>	+20	mA
I <sub>OUT</sub>	DC Output Current, per Pin	+25	mA
I <sub>CC</sub>	DC Supply Current, V <sub>CC</sub> and GND	+50	mA
P <sub>D</sub>	Power Dissipation in Still Air SC-88A, TSOP-5	200	mW
θ <sub>JA</sub>	Thermal resistance SC-88A, TSOP-5	333	°C/W
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 s	260	°C
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C
V <sub>ESD</sub>	ESD Withstand Voltage Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4)	> 2000 > 200 N/A	V
I <sub>Latch-Up</sub>	Latch-Up Performance Above V <sub>CC</sub> and Below GND at 125°C (Note 5)	± 500	mA

1. Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute-maximum-rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

- Tested to EIA/JESD22-A114-A
- Tested to EIA/JESD22-A115-A
- Tested to JESD22-C101-A
- Tested to EIA/JESD78

## RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics	Min	Max	Unit
V <sub>CC</sub>	DC Supply Voltage	2.0	5.5	V
V <sub>IN</sub>	DC Input Voltage	0.0	5.5	V
V <sub>OUT</sub>	DC Output Voltage	0.0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature Range	-55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time V <sub>CC</sub> = 3.3 V ± 0.3 V V <sub>CC</sub> = 5.0 V ± 0.5 V	0	100 20	ns/V

## Device Junction Temperature versus Time to 0.1% Bond Failures

Junction Temperature °C	Time, Hours	Time, Years
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

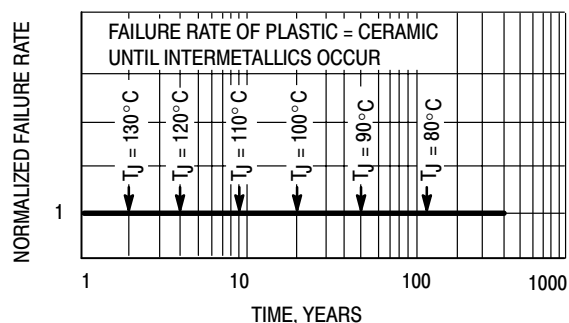


Figure 3. Failure Rate vs. Time Junction Temperature

# MC74VHC1G125

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> ≤ 85°C		-55 ≤ T <sub>A</sub> ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V <sub>IH</sub>	Minimum High-Level Input Voltage		2.0 3.0 4.5 5.5	1.5 2.1 3.15 3.85			1.5 2.1 3.15 3.85		1.5 2.1 3.15 3.85	V	
V <sub>IL</sub>	Maximum Low-Level Input Voltage		2.0 3.0 4.5 5.5			0.5 0.9 1.35 1.65		0.5 0.9 1.35 1.65		0.5 0.9 1.35 1.65	V
V <sub>OH</sub>	Minimum High-Level Output Voltage V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -50 μA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5		1.9 2.9 4.4		1.9 2.9 4.4	V	
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -4 mA I <sub>OH</sub> = -8 mA	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66	V	
V <sub>OL</sub>	Maximum Low-Level Output Voltage V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 50 μA	2.0 3.0 4.5		0.0 0.0 0.0	0.1 0.1 0.1		0.1 0.1 0.1		0.1 0.1 0.1	V
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 4 mA I <sub>OL</sub> = 8 mA	3.0 4.5			0.36 0.36		0.44 0.44		0.52 0.52	V
I <sub>OZ</sub>	Maximum 3-State Leakage Current	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND	5.5			±0.25		±2.5		±2.5	μA
I <sub>IN</sub>	Maximum Input Leakage Current	V <sub>IN</sub> = 5.5 V or GND	0 to 5.5			±0.1		±1.0		±1.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5			1.0		20		40	μA

## AC ELECTRICAL CHARACTERISTICS C<sub>load</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 3.0 ns

Symbol	Parameter	Test Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> ≤ 85°C		-55 ≤ T <sub>A</sub> ≤ 125°C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Input A to Y (Figures 3 and 4)	V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 15 pF		4.5	8.0		9.5		12.0	ns
		C <sub>L</sub> = 50 pF		6.4	11.5		13.0		16.0	
		V <sub>CC</sub> = 5.0 ± 0.5 V C <sub>L</sub> = 15 pF		3.5	5.5		6.5		8.5	
		C <sub>L</sub> = 50 pF		4.5	7.5		8.5		10.5	
t <sub>PZL</sub> , t <sub>PZH</sub>	Maximum Output Enable Time, Input OE to Y (Figures 4 and 5)	V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 15 pF		4.5	8.0		9.5		11.5	ns
		R <sub>L</sub> = 1000 Ω C <sub>L</sub> = 50 pF		6.4	11.5		13.0		15.0	
		V <sub>CC</sub> = 5.0 ± 0.5 V C <sub>L</sub> = 15 pF		3.5	5.1		6.0		8.5	
		R <sub>L</sub> = 1000 Ω C <sub>L</sub> = 50 pF		4.5	7.1		8.0		10.5	
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Maximum Output Disable Time, Input OE to Y (Figures 4 and 5)	V <sub>CC</sub> = 3.3 ± 0.3 V C <sub>L</sub> = 15 pF		6.5	9.7		11.5		14.5	ns
		R <sub>L</sub> = 1000 Ω C <sub>L</sub> = 50 pF		8.0	13.2		15.0		18.0	
		V <sub>CC</sub> = 5.0 ± 0.5 V C <sub>L</sub> = 15 pF		4.8	6.8		8.0		10.0	
		R <sub>L</sub> = 1000 Ω C <sub>L</sub> = 50 pF		7.0	8.8		10.0		12.0	
C <sub>IN</sub>	Maximum Input Capacitance			4.0	10		10		10	pF
C <sub>OUT</sub>	Maximum 3-State Output Capacitance (Output in High Impedance State)			6.0						pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 6)	Typical @ 25°C, V <sub>CC</sub> = 5.0 V							pF	
		8.0								

6. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

# MC74VHC1G125

## SWITCHING WAVEFORMS

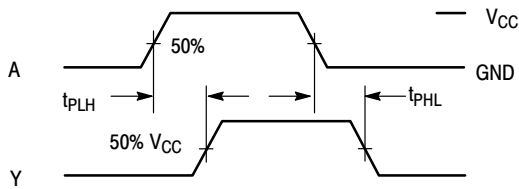


Figure 4. Switching Wave Forms

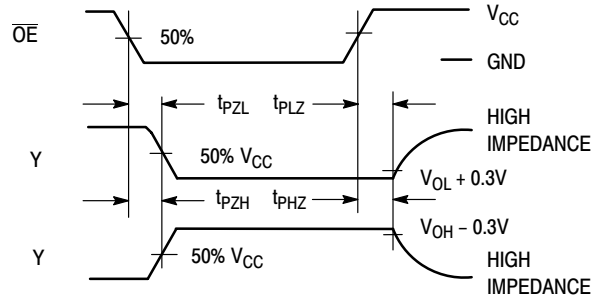
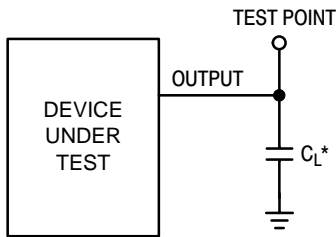
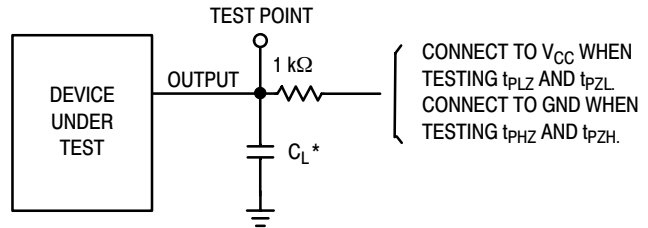


Figure 5.



\*Includes all probe and jig capacitance

Figure 6. Test Circuit



\*Includes all probe and jig capacitance

Figure 7. Test Circuit

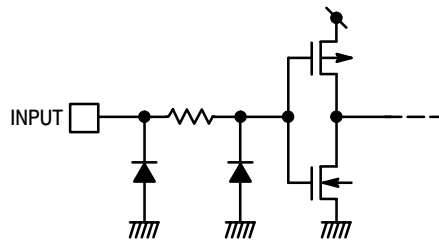


Figure 8. Input Equivalent Circuit

### DEVICE ORDERING INFORMATION

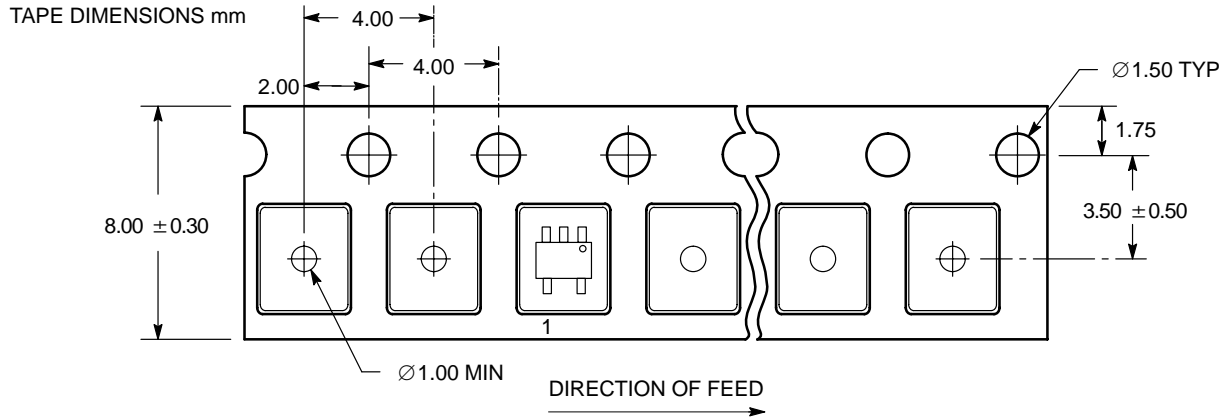
Device Order Number	Device Nomenclature						Package Type (Name/SOT#/ Common Name)	Tape and Reel Size†
	Circuit Indicator	Temp Range Identifier	Technology	Device Function	Package Suffix	Tape & Reel Suffix		
MC74VHC1G125DFT1	MC	74	VHC1G	125	DF	T1	SC-88A / SOT-353 / SC-70	178 mm (7") 3000 Unit
MC74VHC1G125DFT2	MC	74	VHC1G	125	DF	T2	SC-88A / SOT-353 / SC-70	178 mm (7") 3000 Unit
MC74VHC1G125DTT1	MC	74	VHC1G	125	DT	T1	TSOP-5 / SOT-23 / SC-59	178 mm (7") 3000 Unit

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

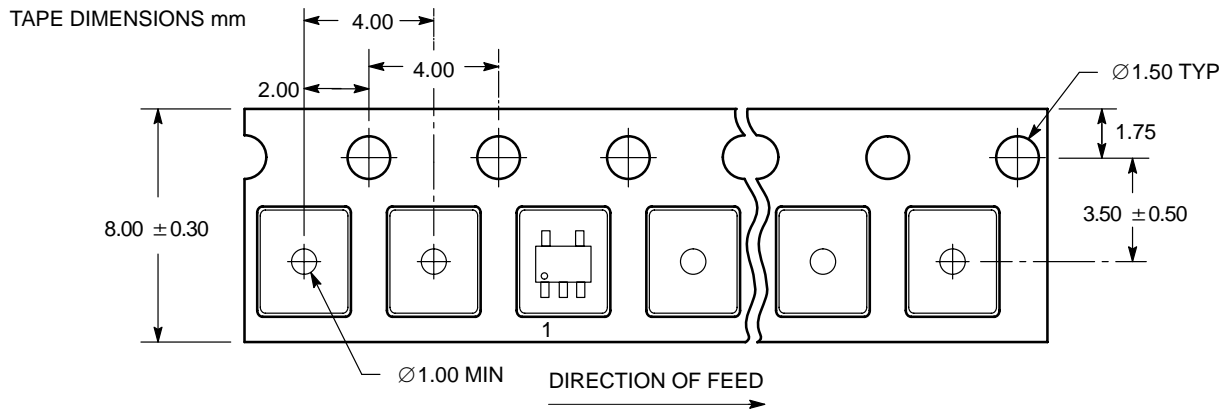
# MC74VHC1G125



**Figure 9. Tape Ends for Finished Goods**



**Figure 10. SC-70-5/SC-88A/SOT-353 DFT1 Reel Configuration/Orientation**



**Figure 11. SC-70/SC-88A/SOT-353 DFT2 and SOT23-5/TSOP-5/SC59-5 DTT1 Reel Configuration/Orientation**

# MC74VHC1G125

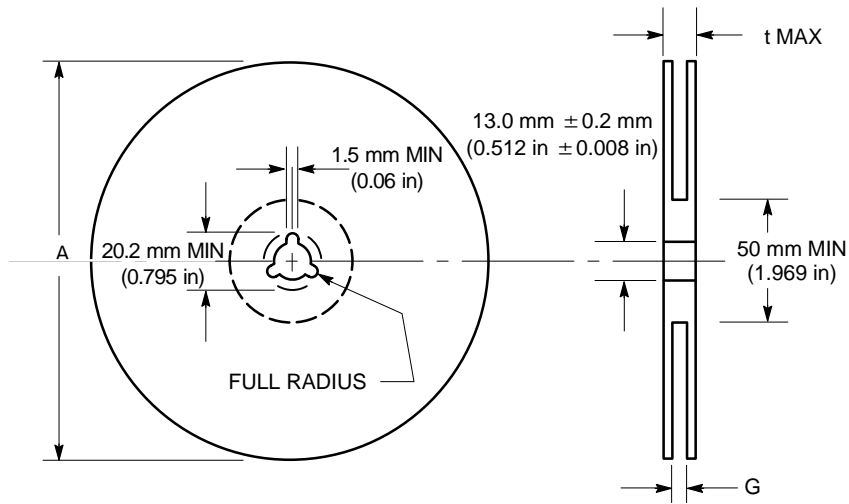


Figure 12. Reel Dimensions

## REEL DIMENSIONS

Tape Size	T and R Suffix	A Max	G	t Max
8 mm	T1, T2	178 mm (7 in)	8.4 mm, + 1.5 mm, -0.0 (0.33 in + 0.059 in, -0.00)	14.4 mm (0.56 in)

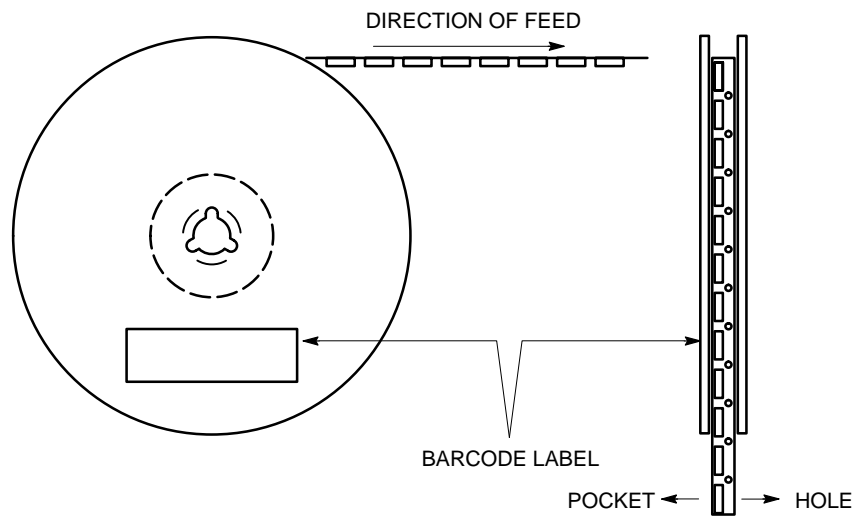
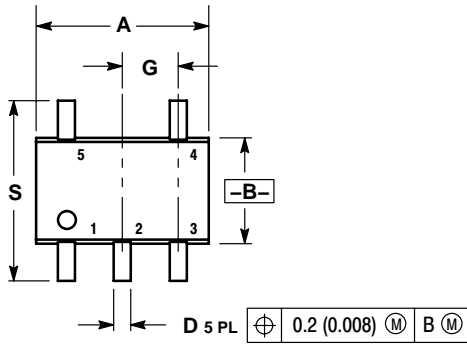


Figure 13. Reel Winding Direction

# MC74VHC1G125

## PACKAGE DIMENSIONS

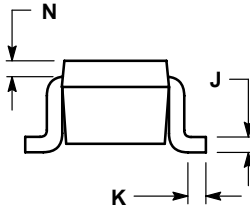
**SC70-5/SC-88A/SOT-353**  
**DF SUFFIX**  
**5-LEAD PACKAGE**  
**CASE 419A-02**  
**ISSUE G**



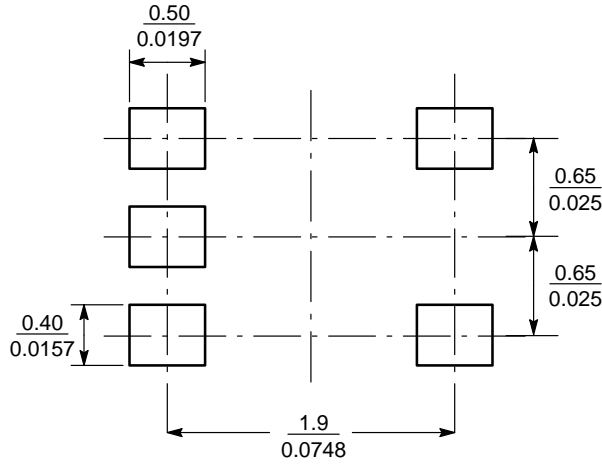
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20



### SOLDERING FOOTPRINT\*



**Figure 14. SC-88A/SC70-5/SOT-353**

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MC74VHC1G125

## PACKAGE DIMENSIONS

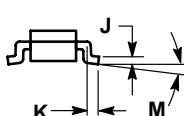
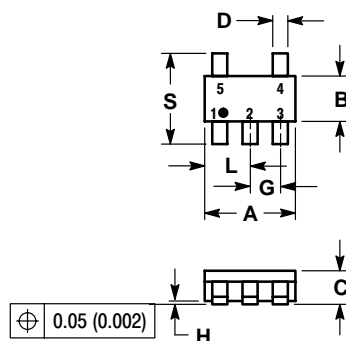
SOT23-5/TSOP-5/SC59-5

DT SUFFIX

5-LEAD PACKAGE

CASE 483-01

ISSUE C



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. A AND B DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.1142	0.1220
B	1.30	1.70	0.0512	0.0669
C	0.90	1.10	0.0354	0.0433
D	0.25	0.50	0.0098	0.0197
G	0.85	1.05	0.0335	0.0413
H	0.013	0.100	0.0005	0.0040
J	0.10	0.26	0.0040	0.0102
K	0.20	0.60	0.0079	0.0236
L	1.25	1.55	0.0493	0.0610
M	0	10	0	10
S	2.50	3.00	0.0985	0.1181

### SOLDERING FOOTPRINT\*

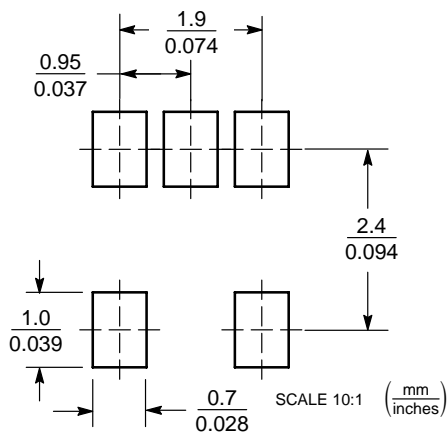



Figure 15. THIN SOT23-5/TSOP-5/SC59-5

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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