



**THE DATASHEET OF  
MC74VHC1G66DFT1G**



# MC74VHC1G66

## SPST (NO) Normally Open Analog Switch

The MC74VHC1G66 is a single pole single throw (SPST) analog switch. It achieves high speed propagation delays and low ON resistances while maintaining low power dissipation. This bilateral switch controls analog and digital voltages that may vary across the full power-supply range (from  $V_{CC}$  to GND).

The MC74VHC1G66 is compatible in function to a single gate of the High Speed CMOS MC74VHC4066 and the metal-gate CMOS MC14066. The device has been designed so that the ON resistances ( $R_{ON}$ ) are much lower and more linear over input voltage than  $R_{ON}$  of the metal-gate CMOS or High Speed CMOS analog switches.

The ON/OFF control inputs are compatible with standard CMOS outputs. The ON/OFF control input structure provides protection when voltages between 0 V and 5.5 V are applied, regardless of the supply voltage. This input structure helps prevent device destruction caused by supply voltage – input/output voltage mismatch, battery backup, hot insertion, etc.

### Features

- High Speed:  $t_{PD} = 20$  ns (Typ) at  $V_{CC} = 5.0$  V
- Low Power Dissipation:  $I_{CC} = 1.0$   $\mu$ A (Max) at  $T_A = 25^\circ$ C
- Diode Protection Provided on Inputs and Outputs
- Improved Linearity and Lower ON Resistance over Input Voltage
- Chip Complexity: 11 FETs or 3 Equivalent Gates
- ON/OFF Control Input has OVT
- Chip Complexity: FETs = 11
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



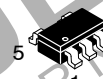
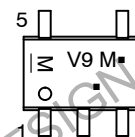
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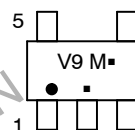
### MARKING DIAGRAMS



SC-88A  
DF SUFFIX  
CASE 419A



TSOP-5  
DT SUFFIX  
CASE 483



V9 = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

### PIN ASSIGNMENT

1	IN/OUT $X_A$
2	OUT/IN $Y_A$
3	GND
4	ON/OFF CONTROL
5	$V_{CC}$

### FUNCTION TABLE

On/Off Control Input	State of Analog Switch
L	Off
H	On

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

# MC74VHC1G66

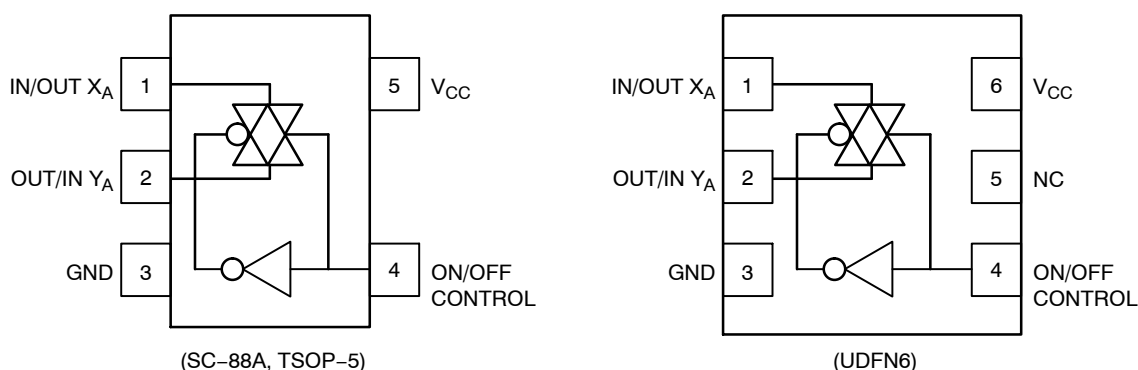


Figure 1. Pinout Diagrams

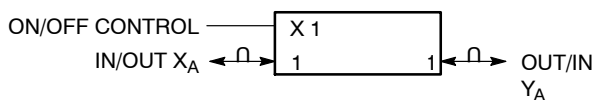


Figure 2. Logic Symbol

## MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit
$V_{CC}$	DC Supply Voltage	-0.5 to +7.0	V
$V_{IN}$	Digital Input Voltage	-0.5 to +7.0	V
$V_{IS}$	Analog Output Voltage	-0.5 to $V_{CC} + 0.5$	V
$I_{IK}$	Digital Input Diode Current	-20	mA
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND	+25	mA
$T_{STG}$	Storage Temperature Range	-65 to +150	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
$T_J$	Junction Temperature Under Bias	+150	°C
$\theta_{JA}$	Thermal Resistance	SC70-5 (Note 1) SOT23-5 350 230	°C/W
$P_D$	Power Dissipation in Still Air at 85°C	SC70-5 SOT23-5 150 200	mW
MSL	Moisture Sensitivity	Level 1	
$F_R$	Flammability Rating	Oxygen Index: 28 to 34 UL 94 V-0 @ 0.125 in	
$V_{ESD}$	ESD Withstand Voltage	Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4) > 2000 > 200 N/A	V
$I_{LATCHUP}$	Latchup Performance	Above $V_{CC}$ and Below GND at 125°C (Note 5) $\pm 500$	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD22-A115-A.
4. Tested to JESD22-C101-A.
5. Tested to EIA/JESD78.

# MC74VHC1G66

## 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	GND	5.5	V
V <sub>IS</sub>	DC Output Voltage	GND	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 ON/OFF Control Input	0	100	ns/V
		0	20	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

## 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

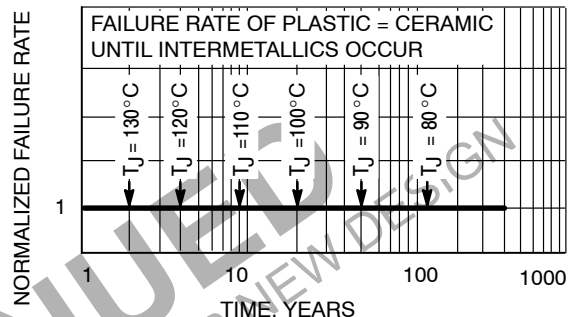


Figure 3. Failure Rate vs. Time Junction Temperature

## 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	Max	Min	Max	Min	Max	
V <sub>IH</sub>	Minimum High-Level Input Voltage ON/OFF Control Input	R <sub>ON</sub> = Per Spec	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 ON/OFF Control Input	R <sub>ON</sub> = Per Spec	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
I <sub>IN</sub>	Maximum Input Leakage Current ON/OFF Control Input	V <sub>IN</sub> = V <sub>CC</sub> 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 V <sub>IO</sub> = 0 V	5.5		1.0		20		40	μA
R <sub>ON</sub>	Maximum "ON" Resistance	V <sub>IN</sub> = V <sub>IH</sub> V <sub>IS</sub> = V <sub>CC</sub> or GND  I <sub>IS</sub>   ≤ 5 mA (Figure 4)	3.0 4.5 5.5		60 45 40		70 50 45		100 60 55	Ω
I <sub>OFF</sub>	Maximum Off-Channel Leakage Current	V <sub>IN</sub> = V <sub>IL</sub> V <sub>IS</sub> = V <sub>CC</sub> or GND Switch Off (Figure 5)	5.5		0.1		0.5		1.0	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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## AC ELECTRICAL CHARACTERISTICS $C_{load} = 50 \text{ pF}$ , Input $t_r/t_f = 3.0 \text{ ns}$

Symbol	Parameter	Test Conditions	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$			$T_A \leq 85^\circ\text{C}$		$-55 \leq T_A \leq 125^\circ\text{C}$		Unit
				Min	Typ	Max	Min	Max	Min	Max	
$t_{PLH}$ , $t_{PHL}$	Maximum Propagation Delay, Input X to Y	$Y_A = \text{Open}$ (Figure 14)	2.0		1	5		6		7	ns
			3.0		0.6	2		3		4	
			4.5		0.6	1		1		2	
			5.5		0.6	1		1		1	
$t_{PLZ}$ , $t_{PHZ}$	Maximum Propagation Delay, ON/OFF Control to Analog Output	$R_L = 1000 \Omega$ (Figure 15)	2.0		32	40		45		50	ns
			3.0		28	35		40		45	
			4.5		24	30		35		40	
			5.5		20	25		30		35	
$t_{PZL}$ , $t_{PZH}$	Maximum Propagation Delay, ON/OFF Control to Analog Output	$R_L = 1000 \Omega$ (Figure 15)	2.0		32	40		45		50	ns
			3.0		28	35		40		45	
			4.5		24	30		35		40	
			5.5		20	25		30		35	
$C_{IN}$	Maximum Input Capacitance	ON/OFF Control Input	0.0		3	10		10		10	pF
		Control Input = GND Analog I/O Feedthrough	5.0		4	10		10		10	
				Typical @ $25^\circ\text{C}$ , $V_{CC} = 5.0 \text{ V}$							
$C_{PD}$	Power Dissipation Capacitance (Note 6)			18						pF	

6.  $C_{PD}$  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:  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

## ADDITIONAL APPLICATION CHARACTERISTICS (Voltages Referenced to GND Unless Noted)

Symbol	Parameter	Test Conditions	$V_{CC}$	Limit $25^\circ\text{C}$	Unit
BW	Maximum On-Channel Bandwidth or Minimum Frequency Response (Figure 10)	$f_{in} = 1 \text{ MHz}$ Sine Wave Adjust $f_{in}$ voltage to obtain 0 dBm at $V_{OS}$ Increase $f_{in}$ = frequency until dB meter reads -3 dB $R_L = 50 \Omega$	3.0	150	MHz
			4.5	175	
			5.5	180	
ISO <sub>off</sub>	Off-Channel Feedthrough Isolation (Figure 11)	$f_{in} = \text{Sine Wave}$ Adjust $f_{in}$ voltage to obtain 0 dBm at $V_{IS}$ $f_{in} = 10 \text{ kHz}$ , $R_L = 600 \Omega$	3.0	-80	dB
			4.5	-80	
			5.5	-80	
NOISE <sub>feed</sub>	Feedthrough Noise Control to Switch (Figure 12)	$V_{in} \leq 1 \text{ MHz}$ Square Wave ( $t_r = t_f = 2 \text{ ns}$ )  $R_L = 600 \Omega$	3.0	45	mV <sub>PP</sub>
			4.5	60	
			5.5	130	
THD	Total Harmonic Distortion (Figure 13)	$f_{in} = 1 \text{ kHz}$ , $R_L = 10 \text{ k}\Omega$ THD = THD <sub>Measured</sub> - THD <sub>Source</sub> $V_{IS} = 3.0 \text{ V}_{PP}$ sine wave $V_{IS} = 5.0 \text{ V}_{PP}$ sine wave	3.3	0.30	%
			5.5	0.15	

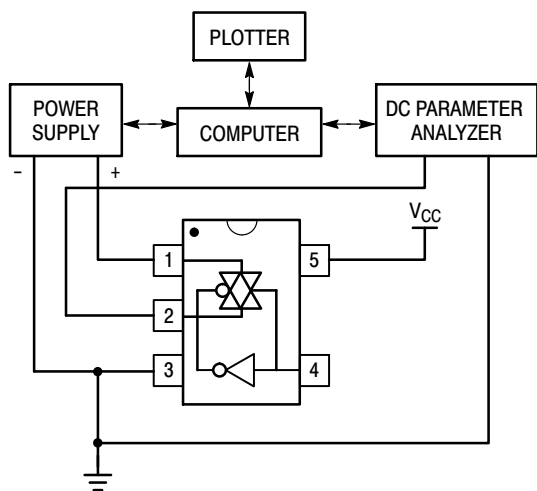


Figure 4. On Resistance Test Set-Up

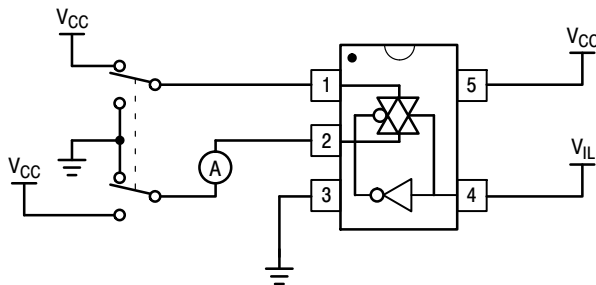


Figure 5. Maximum Off-Channel Leakage Current Test Set-Up

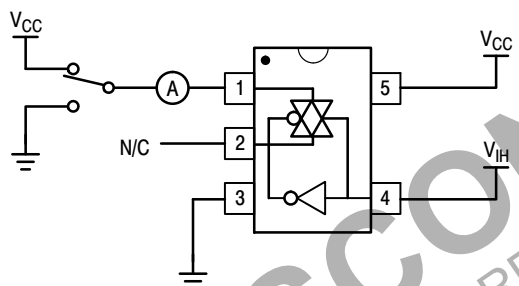


Figure 6. Maximum On-Channel Leakage Current Test Set-Up

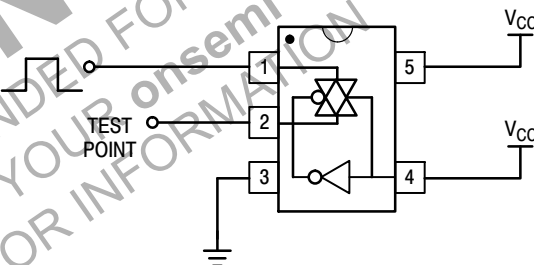
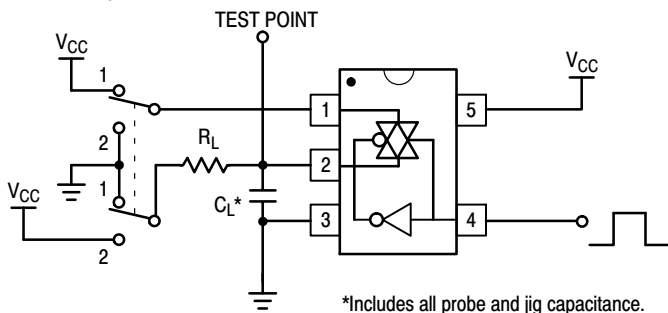


Figure 7. Propagation Delay Test Set-Up

Switch to Position 2 when testing  $t_{PLZ}$  and  $t_{PZL}$   
 Switch to Position 1 when testing  $t_{PHZ}$  and  $t_{PZH}$



\*Includes all probe and jig capacitance.

Figure 8. Propagation Delay Output Enable/Disable Test Set-Up

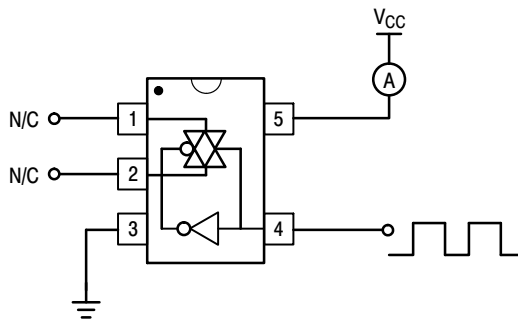
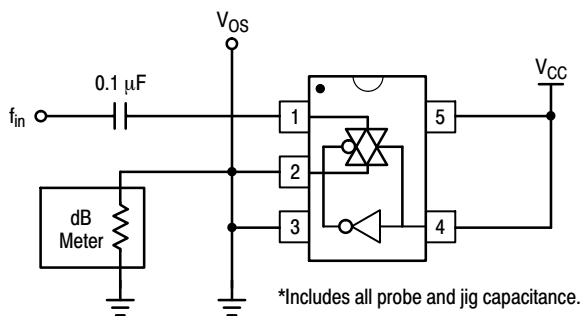
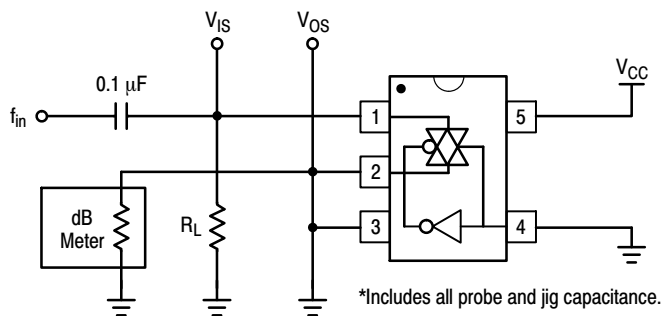


Figure 9. Power Dissipation Capacitance Test Set-Up

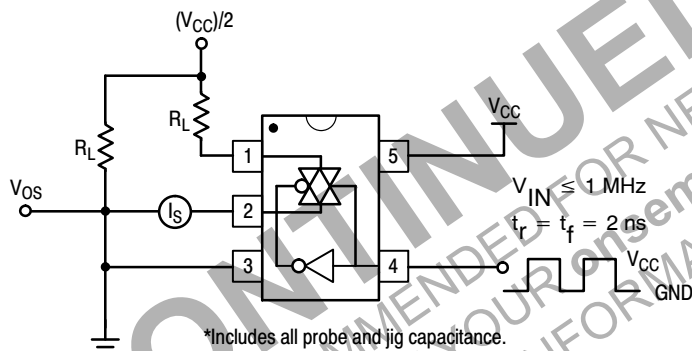
# MC74VHC1G66



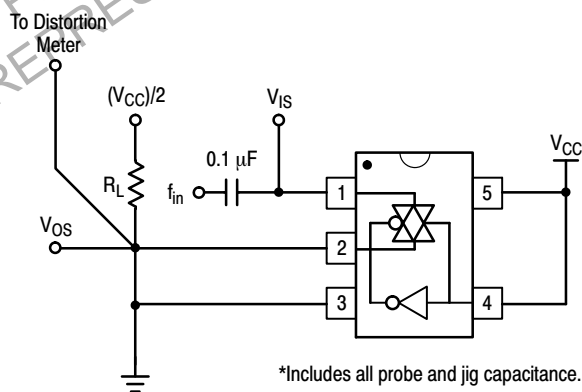
**Figure 10. Maximum On-Channel Bandwidth Test Set-Up**



**Figure 11. Off-Channel Feedthrough Isolation Test Set-Up**



**Figure 12. Feedthrough Noise, ON/OFF Control to Analog Out, Test Set-Up**



**Figure 13. Total Harmonic Distortion Test Set-Up**

# MC74VHC1G66

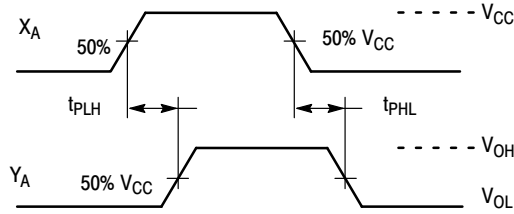


Figure 14. Propagation Delay, Analog In to Analog Out Waveforms

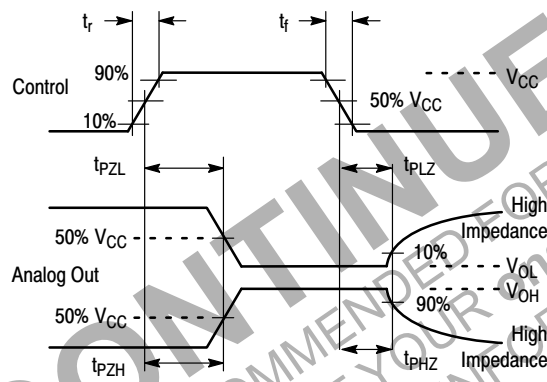


Figure 15. Propagation Delay, ON/OFF Control

## ORDERING INFORMATION

Device	Package	Shipping†
MC74VHC1G66DFT1G	SC-88A (Pb-Free)	3000 / Tape & Reel
NLVVHC1G66DFT1G*		
MC74VHC1G66DFT2G		
NLVVHC1G66DFT2G*		
MC74VHC1G66DTT1G	TSOP-5 (Pb-Free)	3000 / Tape & Reel
NLVVHC1G66DTT1G*		

†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.

\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 2:1

## SC-88A (SC-70-5/SOT-353) CASE 419A-02 ISSUE M

DATE 11 APR 2023



### RECOMMENDED MOUNTING FOOTPRINT

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

### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.1016MM PER SIDE.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.80	0.95	1.10
A1	---	---	0.10
A3	0.20 REF		
b	0.10	0.20	0.30
c	0.10	---	0.25
D	1.80	2.00	2.20
E	2.00	2.10	2.20
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.10	0.15	0.30

### GENERIC MARKING DIAGRAM\*



\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

XXX = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### STYLE 1:

1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

#### STYLE 2:

1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

#### STYLE 3:

1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

#### STYLE 4:

1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

#### STYLE 5:

1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

#### STYLE 6:

1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

#### STYLE 7:

1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

#### STYLE 8:

1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

#### STYLE 9:

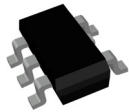
1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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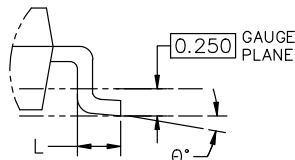
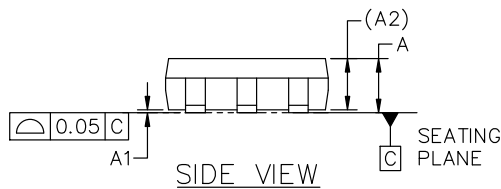
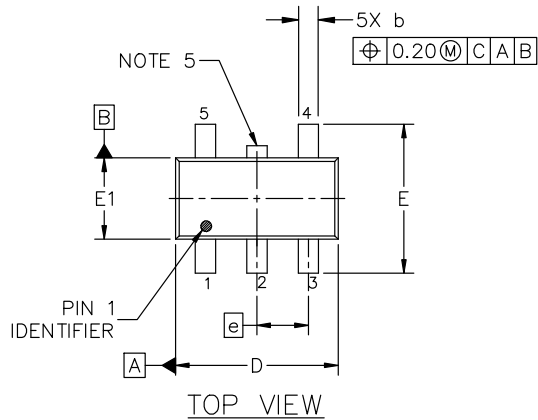
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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



## TSOP-5 3.00x1.50x0.95, 0.95P CASE 483 ISSUE P

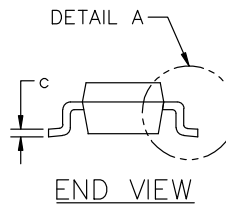
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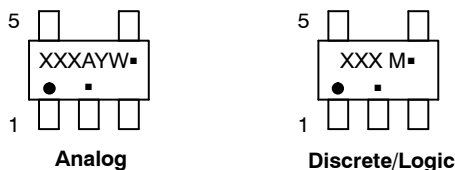
### NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS (ANGLES IN DEGREES).
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OF GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION D.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.900	1.000	1.100
A1	0.010	0.055	0.100
A2	0.950 REF.		
b	0.250	0.375	0.500
c	0.100	0.180	0.260
D	2.850	3.000	3.150
E	2.500	2.750	3.000
E1	1.350	1.500	1.650
e	0.950 BSC		
L	0.200	0.400	0.600
θ	0°	5°	10°



### GENERIC MARKING DIAGRAM\*

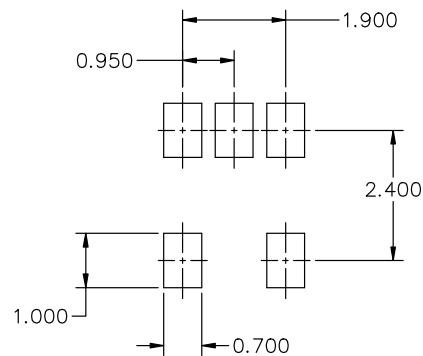


- XXX = Specific Device Code    XXX = Specific Device Code  
 A = Assembly Location        M = Date Code  
 Y = Year                        ▪ = Pb-Free Package  
 W = Work Week

▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



\* FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.

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