

# MC74VHC1G135

## Product Preview

# 2-Input NAND Schmitt-Trigger with Open Drain Output

The MC74VHC1G135 is a single gate CMOS Schmitt NAND trigger with an open drain output 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 an open drain output which provides the capability to set the output switching level. This allows the MC74VHC1G135 to be used to interface 5V circuits to circuits of any voltage between  $V_{CC}$  and 7V using an external resistor and power supply.

The MC74VHC1G135 input structure provides protection when voltages up to 7V are applied, regardless of the supply voltage.

The MC74VHC1G135 can be used to enhance noise immunity or to square up slowly changing waveforms.

- High Speed:  $t_{PD} = 4.9\text{ns}$  (Typ) at  $V_{CC} = 5\text{V}$
- Low Internal Power Dissipation:  $I_{CC} = 2\mu\text{A}$  (Max) at  $T_A = 25^\circ\text{C}$
- Power Down Protection Provided on Inputs
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300mA
- ESD Performance: HBM > 2000V; MM > 200V, CDM > 1500V

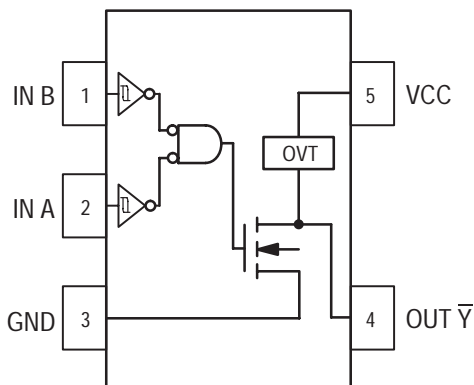
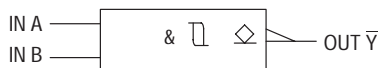


Figure 1. 5-Lead SOT-353 Pinout (Top View)

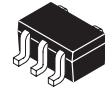
### LOGIC SYMBOL



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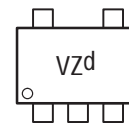


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SC-88A / SOT-353  
DF SUFFIX  
CASE 419A

### MARKING DIAGRAM



Pin 1  
d = Date Code

### PIN ASSIGNMENT

Pin	Function
1	IN B
2	IN A
3	GND
4	OUT $\bar{Y}$
5	VCC

### ORDERING INFORMATION

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

### FUNCTION TABLE

Inputs		Output
A	B	$\bar{Y}$
L	L	Z
L	H	Z
H	L	Z
H	H	L

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## MAXIMUM RATINGS\*

Characteristics	Symbol	Value	Unit
DC Supply Voltage	$V_{CC}$	-0.5 to +7.0	V
DC Input Voltage	$V_{IN}$	-0.5 to +7.0	V
DC Output Voltage	$V_{OUT}$	-0.5 to 7.0	V
Input Diode Current	$I_{IK}$	-20	mA
Output Diode Current ( $V_{OUT} < GND$ ; $V_{OUT} > V_{CC}$ )	$I_{OK}$	+20	mA
DC Output Current, per Pin	$I_{OUT}$	+25	mA
DC Supply Current, $V_{CC}$ and GND	$I_{CC}$	+50	mA
Power dissipation in still air, SC-88A †	$P_D$	200	mW
Lead temperature, 1 mm from case for 10 s	$T_L$	260	°C
Storage temperature	$T_{stg}$	-65 to +150	°C

\* 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.

† Derating — SC-88A Package: -3 mW/°C from 65° to 125°C

## RECOMMENDED OPERATING CONDITIONS

Characteristics	Symbol	Min	Max	Unit
DC Supply Voltage	$V_{CC}$	4.5	5.5	V
DC Input Voltage	$V_{IN}$	0.0	5.5	V
DC Output Voltage	$V_{OUT}$	0.0	7.0	V
Operating Temperature Range	$T_A$	-55	+85	°C

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## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> ≤ 85°C		T <sub>A</sub> ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V <sub>T+</sub>	Positive Threshold Voltage		3.0	1.50	1.88	2.25	1.50	2.25	1.50	2.25	V
			4.5	2.35	2.66	3.10	2.35	3.10	2.35	3.10	
			5.5	2.80	3.21	3.70	2.80	3.70	2.80	3.70	
V <sub>T-</sub>	Negative Threshold Voltage		3.0	0.65	1.03	1.40	0.65	1.40	0.65	1.40	V
			4.5	1.10	1.62	2.10	1.10	2.10	1.10	2.10	
			5.5	1.45	2.02	2.60	1.45	2.60	1.45	2.60	
V <sub>H</sub>	Hysteresis Voltage		3.0	0.30	0.85	1.60	0.30	1.60	0.30	1.60	V
			4.5	0.40	1.05	2.00	0.40	2.00	0.40	2.00	
			5.5	0.50	1.20	2.25	0.50	2.25	0.50	2.25	
V <sub>OH</sub>	Minimum High-Level Output Voltage I <sub>OH</sub> = -50μA	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -50μA	2.0	1.9	2.0		1.9		1.9		V
			3.0	2.9	3.0		2.9		2.9		
		4.5	4.4	4.5		4.4		4.4			
		I <sub>OH</sub> = -4mA I <sub>OH</sub> = -8mA	3.0	2.58			2.48		2.34		V
4.5	3.94			3.80		3.66					
V <sub>OL</sub>	Maximum Low-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 50μA	2.0		0.0	0.1		0.1		0.1	V
			3.0		0.0	0.1		0.1		0.1	
		4.5		0.0	0.1		0.1		0.1		
		I <sub>OL</sub> = 4mA I <sub>OL</sub> = 8mA	3.0			0.36		0.44		0.52	V
4.5			0.36		0.44		0.52				
I <sub>IN</sub>	Maximum Input Leakage Current	V <sub>IN</sub> = 5.5V or GND	0 to 5.5			±0.1		±1.0		μA	
I <sub>CC</sub>	Maximum Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5			2.0		20		40	μA
I <sub>OPD</sub>	Maximum Off-state Leakage Current	V <sub>OUT</sub> = 5.5V	0			0.25		2.5		5.0	μA

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

Symbol	Parameter	Test Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> ≤ 85°C		T <sub>A</sub> ≤ 125°C		Unit	
			Min	Typ	Max	Min	Max	Min	Max		
t <sub>PZL</sub>	Maximum Output Enable Time, A or B to $\bar{Y}$	V <sub>CC</sub> = 3.3 ± 0.3V R <sub>L</sub> = 1KΩ	C <sub>L</sub> = 15 pF		7.6	11.9	1.0	14.0	1.0	16.1	ns
			C <sub>L</sub> = 50 pF		10.1	15.4	1.0	17.5	1.0	19.6	
		V <sub>CC</sub> = 5.0 ± 0.5V R <sub>L</sub> = 1KΩ	C <sub>L</sub> = 15 pF		4.9	7.7	1.0	9.0	1.0	10.3	
			C <sub>L</sub> = 50 pF		6.4	9.7	1.0	11.0	1.0	12.3	
t <sub>PLZ</sub>	Maximum Output Disable Time	V <sub>CC</sub> = 3.0 ± 0.3V, R <sub>L</sub> = 1KΩ, C <sub>L</sub> = 50 pF			10.1	15.4		17.5		19.6	ns
		V <sub>CC</sub> = 5.0 ± 0.5V, R <sub>L</sub> = 1KΩ, C <sub>L</sub> = 50 pF			6.4	9.7		11.0		12.3	
C <sub>IN</sub>	Maximum Input Capacitance			5.0	10		10		10	pF	

C <sub>PD</sub>	Power Dissipation Capacitance (Note 1.)	Typical @ 25°C, V <sub>CC</sub> = 5.0V		pF
		16		

1. 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>.

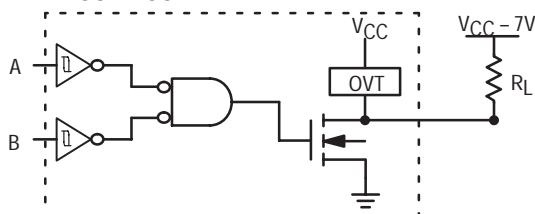


Figure 2. Output Voltage Mismatch Application

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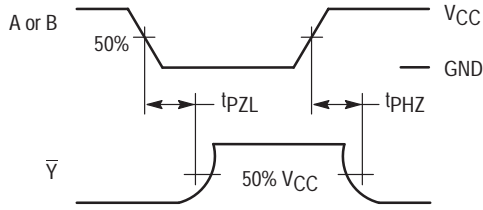
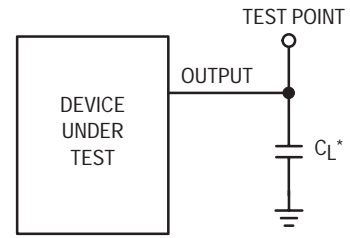


Figure 3. Switching Waveforms



\*Includes all probe and jig capacitance

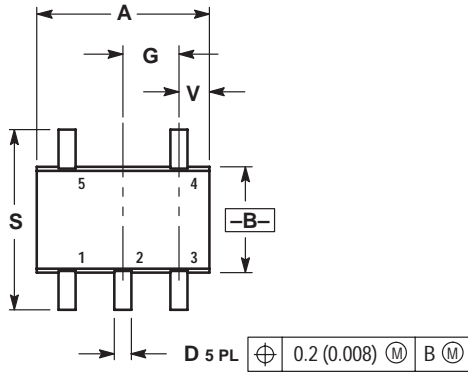
Figure 4. Test Circuit

## DEVICE ORDERING INFORMATION

Device Order Number	Device Nomenclature						Package Type	Tape and Reel Size
	Circuit Indicator	Temp Range Identifier	Technology	Device Function	Package Suffix	Tape & Reel Suffix		
MC74VHC1G135DFT1	MC	74	VHC1G	135	DF	T1	SC-88A / SOT-353	7-Inch/3000 Unit

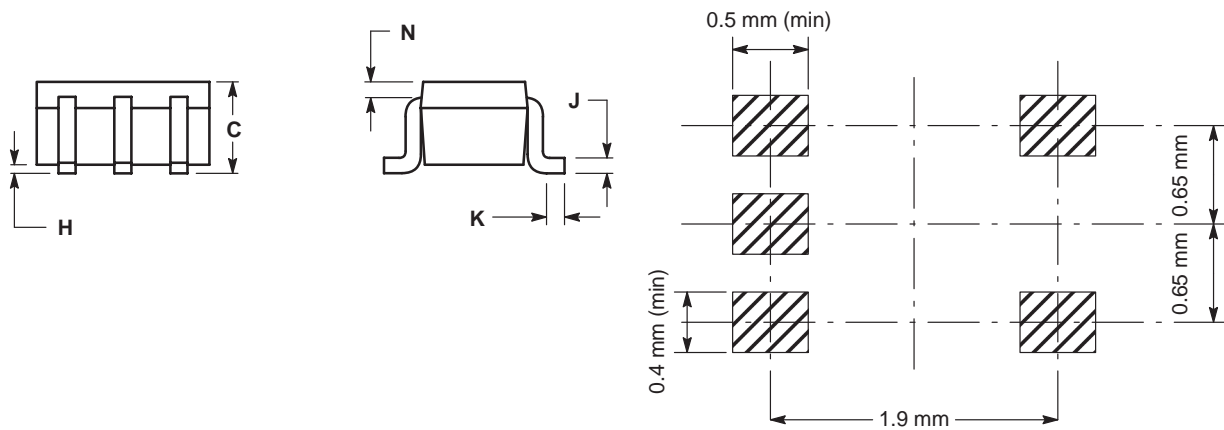
## PACKAGE DIMENSIONS

SC-88A / SOT-353  
DF SUFFIX  
5-LEAD SOT-353 PACKAGE  
CASE 419A-01  
ISSUE B

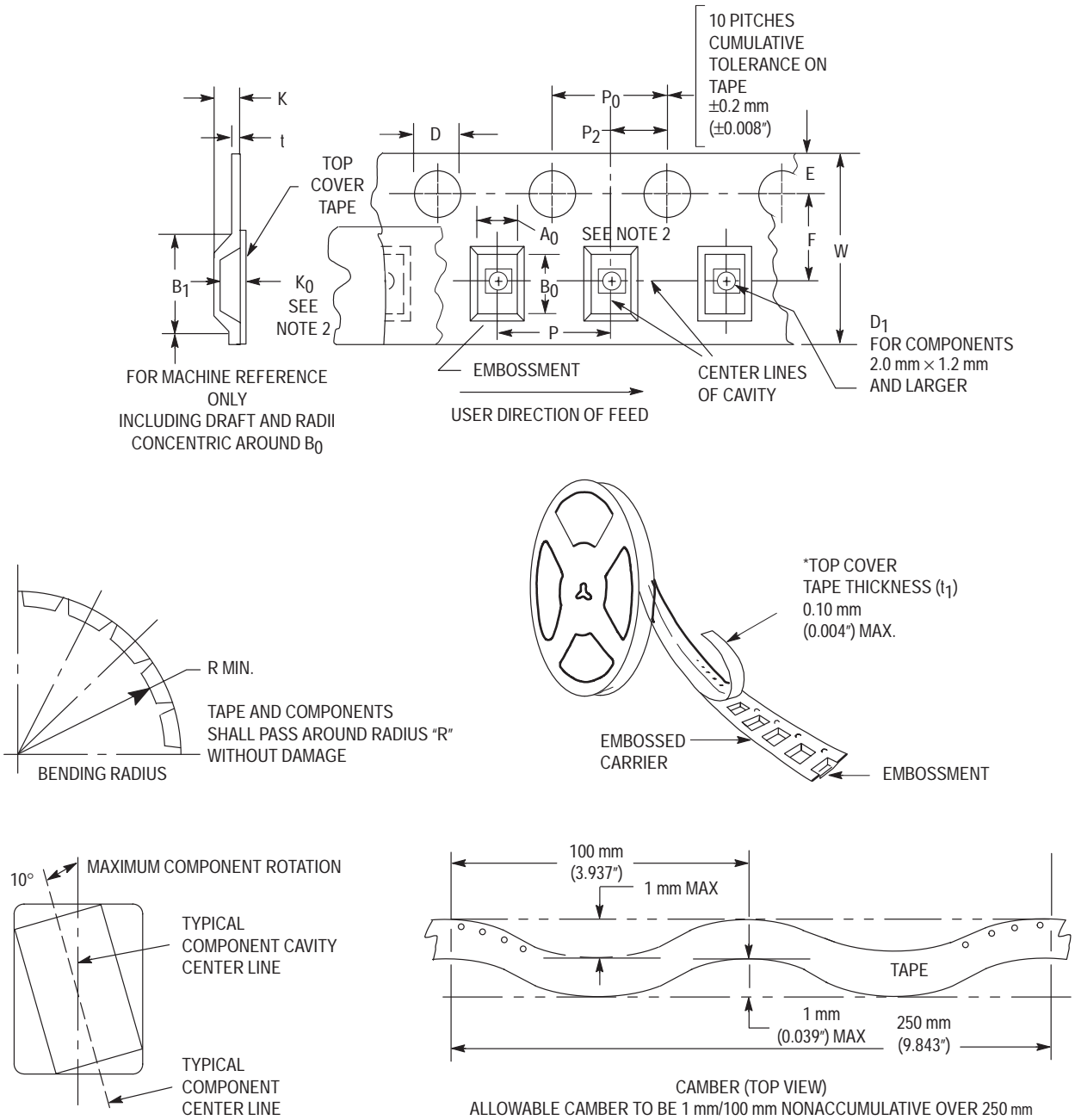


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: MM.

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
V	0.012	0.016	0.30	0.40



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**Figure 5. Carrier Tape Specifications**

**EMBOSSED CARRIER DIMENSIONS** (See Notes 1 and 2)

Tape Size	B <sub>1</sub> Max	D	D <sub>1</sub>	E	F	K	P	P <sub>0</sub>	P <sub>2</sub>	R	T	W
8 mm	4.35 mm (0.171")	1.5 +0.1/-0.0 mm (0.059 +0.004/-0.0")	1.0 mm Min (0.039")	1.75 ±0.1 mm (0.069 ±0.004")	3.5 ±0.5 mm (1.38 ±0.002")	2.4 mm (0.094")	4.0 ±0.10 mm (0.157 ±0.004")	4.0 ±0.1 mm (0.156 ±0.004")	2.0 ±0.1 mm (0.079 ±0.002")	25 mm (0.98")	0.3 ±0.05 mm (0.01 +0.0038/-0.0002")	8.0 ±0.3 mm (0.315 ±0.012")

1. Metric Dimensions Govern—English are in parentheses for reference only.
2. A<sub>0</sub>, B<sub>0</sub>, and K<sub>0</sub> are determined by component size. The clearance between the components and the cavity must be within 0.05 mm min to 0.50 mm max. The component cannot rotate more than 10° within the determined cavity

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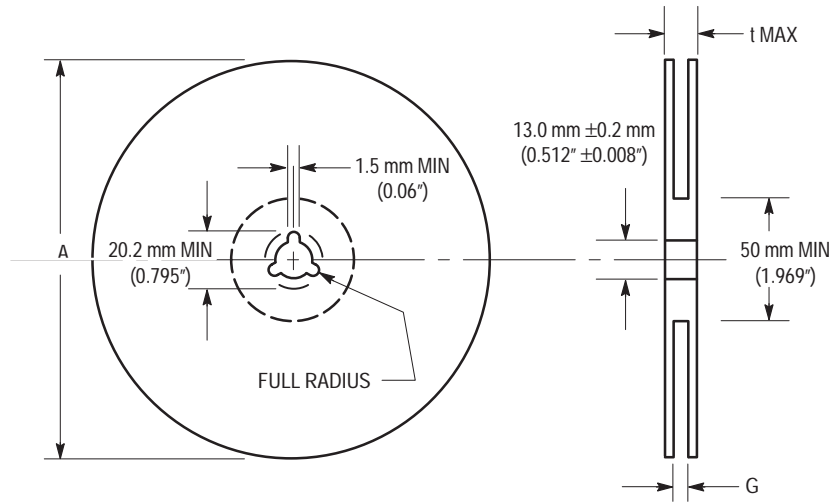


Figure 6. Reel Dimensions

## REEL DIMENSIONS

Tape Size	A Max	G	t Max
8 mm	330 mm (13")	8,400 mm, +1.5 mm, -0.0 (0.33", +0.059", -0.00)	14.4 mm (0.56")

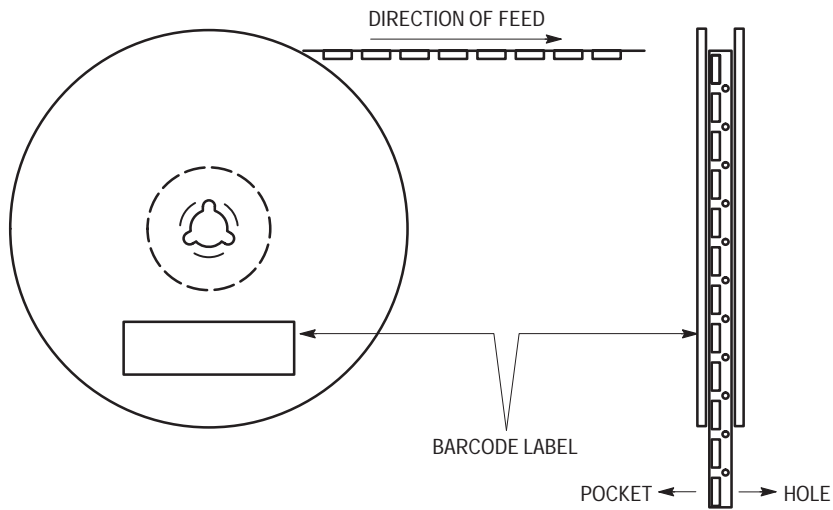
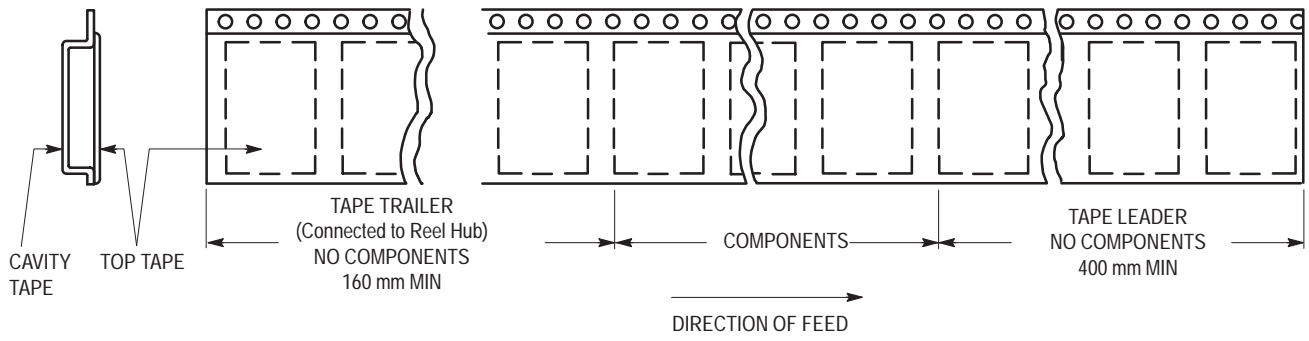
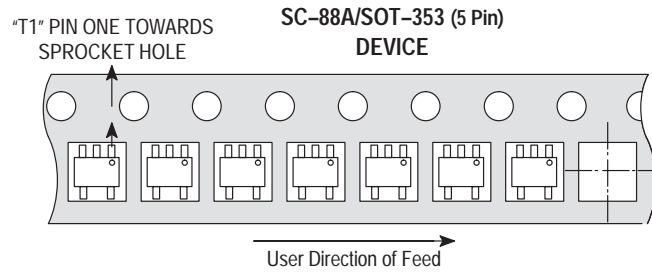


Figure 7. Reel Winding Direction

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**Figure 8. Tape Ends for Finished Goods**



**Figure 9. Reel Configuration**

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