MC74VHC1G05

Advance Information
Inverter with Open Drain Output

The MC74VHC1G05 is an advanced high speed CMOS inverter with 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 output switching level. This allows the MC74VHC1G05 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 MC74VHC1G05 input structure provides protection when voltages up to 7V are applied, regardless of the supply voltage.

- High Speed: t_{PD} = 3.8ns (Typ) at V_{CC} = 5V
- Low Internal Power Dissipation: I_{CC} = 2µA (Max) at T_A = 25°C
- Power Down Protection Provided on Inputs
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300mA
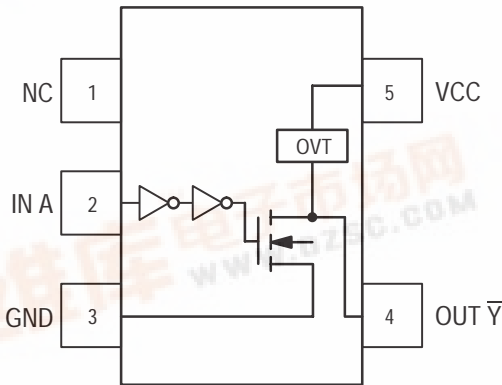- ESD Performance: HBM > 2000V; MM > 200V, CDM > 1500V

ON Semiconductor

http://onsemi.com

SC–88A / SOT–353
DF SUFFIX
CASE 419A

MARKING DIAGRAM

VFd
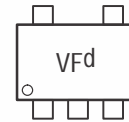
Pin 1
d = Date Code

PIN ASSIGNMENT

1	NC
2	IN A
3	GND
4	OUT $\overline{Y}$
5	VCC

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

LOGIC SYMBOL

ORDERING INFORMATION

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

FUNCTION TABLE

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

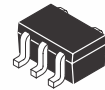This document contains information on a new product. Specifications and information herein are subject to change without notice.

MC74VHC1G05

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}	2.0	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
Input Rise and Fall Time V_{CC} = 3.3V ± 0.3V V_{CC} = 5.0V ± 0.5V	t_r , t_f	0 0	100 20	ns/V

MC74VHC1G05

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V_{CC} (V)	$T_A = 25°C$ Min	Typ	Max	$T_A \leq 85°C$ Min	Max	$T_A \leq 125°C$ Min	Max	Unit
V_{IH}	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_{IL}	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_{OH}	Minimum High–Level Output Voltage $V_{IN} = V_{IH}$ or V_{IL}	$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = -50\mu A$	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
		$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = -4mA$ $I_{OH} = -8mA$	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66		V
V_{OL}	Maximum Low–Level Output Voltage $V_{IN} = V_{IH}$ or V_{IL}	$V_{IN} = V_{IH}$ or V_{IL} $I_{OL} = 50\mu A$	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
		$V_{IN} = V_{IH}$ or V_{IL} $I_{OL} = 4mA$ $I_{OL} = 8mA$	3.0 4.5			0.36 0.36		0.44 0.44		0.52 0.52	V
I_{IN}	Maximum Input Leakage Current	$V_{IN} = 5.5V$ or GND	0 to 5.5			±0.1		±1.0		±1.0	µA
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5			2.0		20		40	µA
I_{OPD}	Maximum Off–state Leakage Current	$V_{OUT} = 5.5V$	0			0.25		2.5		5.0	µA

AC ELECTRICAL CHARACTERISTICS (C_{load} = 50 pF, Input $t_r = t_f$ = 3.0ns)

Symbol	Parameter	Test Conditions	$T_A = 25°C$ Min	Typ	Max	$T_A \leq 85°C$ Min	Max	$T_A \leq 125°C$ Min	Max	Unit
t_{PZL}	Maximum Output Enable Time, Input A to $\overline{Y}$	$V_{CC} = 3.0 \pm 0.3V$ $C_L = 15$ pF $C_L = 50$ pF		5.0 7.5	7.1 10.6		8.5 12.0		10.0 14.5	ns
		$V_{CC} = 5.0 \pm 0.5V$ $C_L = 15$ pF $C_L = 50$ pF		3.8 5.3	5.5 7.5		6.5 8.5		8.0 10.0	
t_{PLZ}	Maximum Output Disable Time	$V_{CC} = 3.0 \pm 0.3V$, $R_L = 1K\Omega$, $C_L = 50$ pF		7.5	10.6		12.0		14.5	ns
		$V_{CC} = 5.0 \pm 0.5V$, $R_L = 1K\Omega$, $C_L = 50$ pF		5.3	7.5		8.5		10.0	
C_{IN}	Maximum Input Capacitance			4	10		10		10	pF

		Typical @ 25°C, V_{CC} = 5.0V	
C_{PD}	Power Dissipation Capacitance (Note 1.)	18	pF

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

MC74VHC1G05
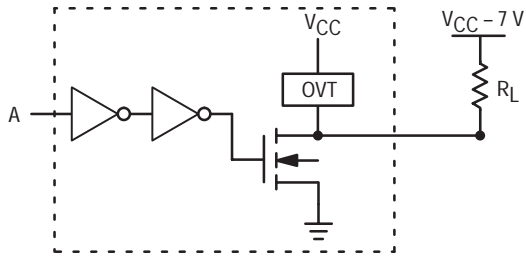

Figure 2. Output Voltage Mismatch Application
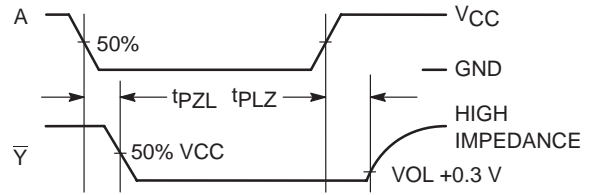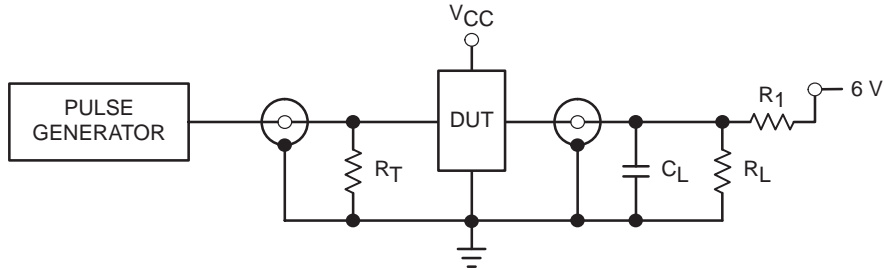

Figure 3. Switching Waveforms

C_L = 50 pF equivalent (Includes jig and probe capacitance)
R_L = R_1 = 500 Ω or equivalent
R_T = Z_{OUT} of pulse generator (typically 50 Ω)

Figure 4. Test Circuit

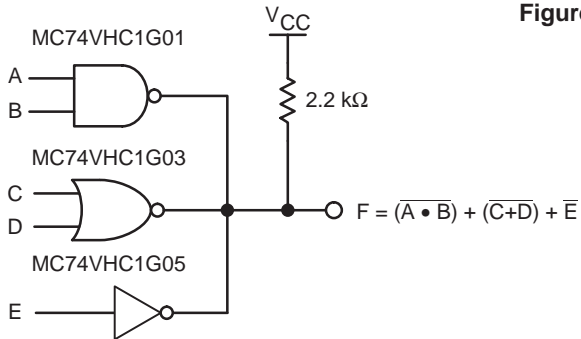$F = \overline{(A \bullet B)} + \overline{(C+D)} + \overline{E}$

Figure 5. Complex Boolean Functions
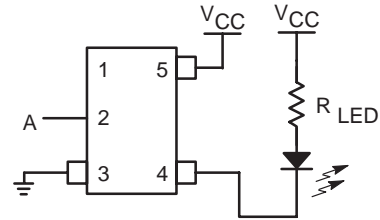
Figure 6. LED Driver
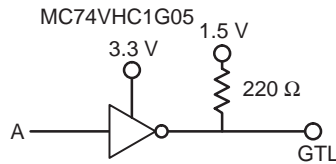
Figure 7. GTL Driver

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		
MC74VHC1G05DFT1	MC	74	VHC1G	05	DF	T1	SC–88A / SOT–353	7–Inch/3000 Unit

MC74VHC1G05

PACKAGE DIMENSIONS

SC–88A / SOT–353
DF SUFFIX
5–LEAD PACKAGE
CASE 419A–01
ISSUE B
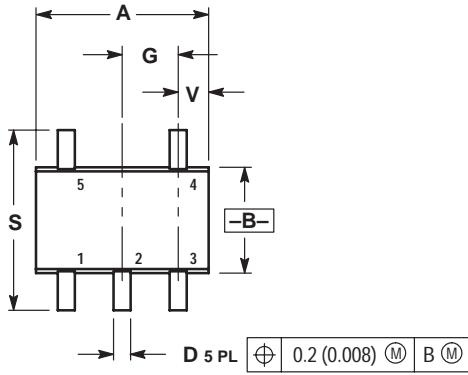
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MM.

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

D 5 PL ⊕ 0.2 (0.008) Ⓜ B Ⓜ

0.5 mm (min)

0.65 mm

0.65 mm

0.4 mm (min)

1.9 mm
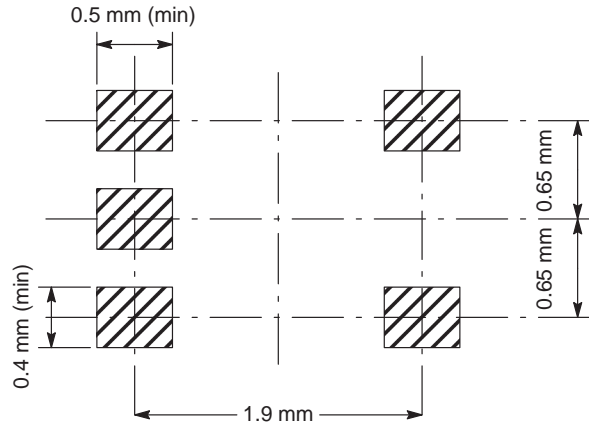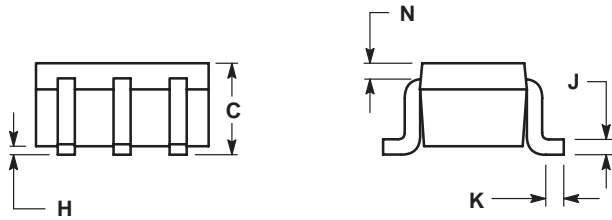
MC74VHC1G05
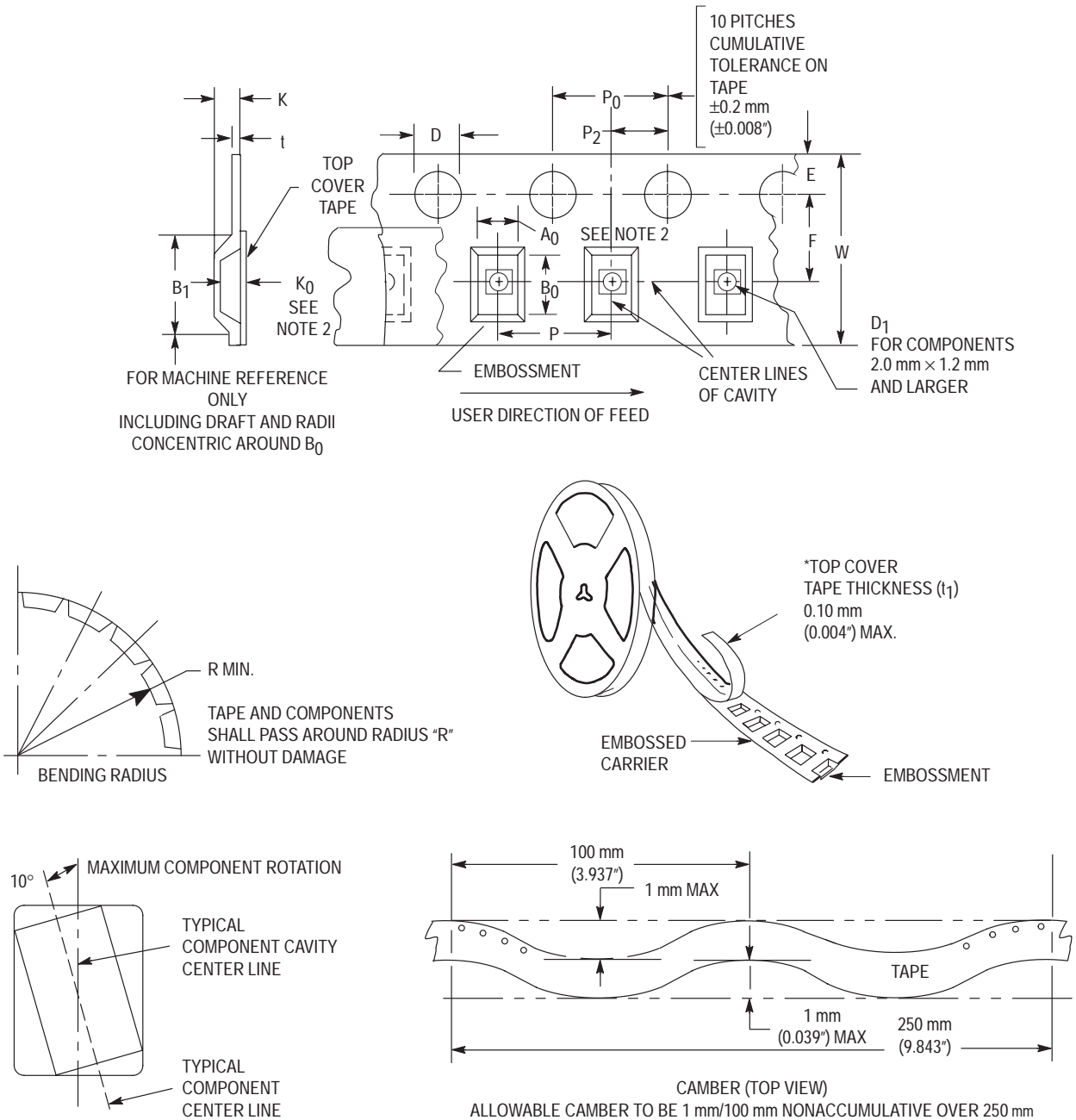
Figure 8. Carrier Tape Specifications

EMBOSSED CARRIER DIMENSIONS (See Notes 1 and 2)

Tape Size	B_1 Max	D	D_1	E	F	K	P	P_0	P_2	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_0, B_0, and K_0 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

MC74VHC1G05

1.5 mm MIN
(0.06″)

20.2 mm MIN
(0.795″)

A

13.0 mm ±0.2 mm
(0.512″ ±0.008″)

t MAX

50 mm MIN
(1.969″)

G

FULL RADIUS
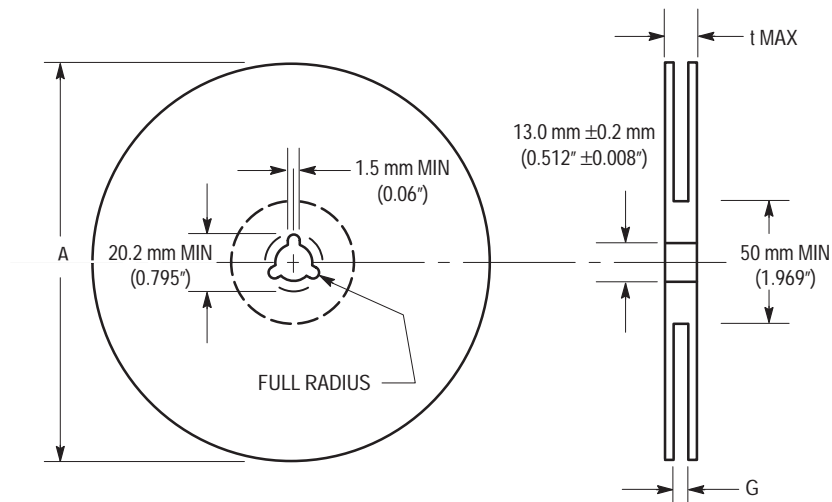
Figure 9. Reel Dimensions

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″)

DIRECTION OF FEED

BARCODE LABEL

POCKET

HOLE
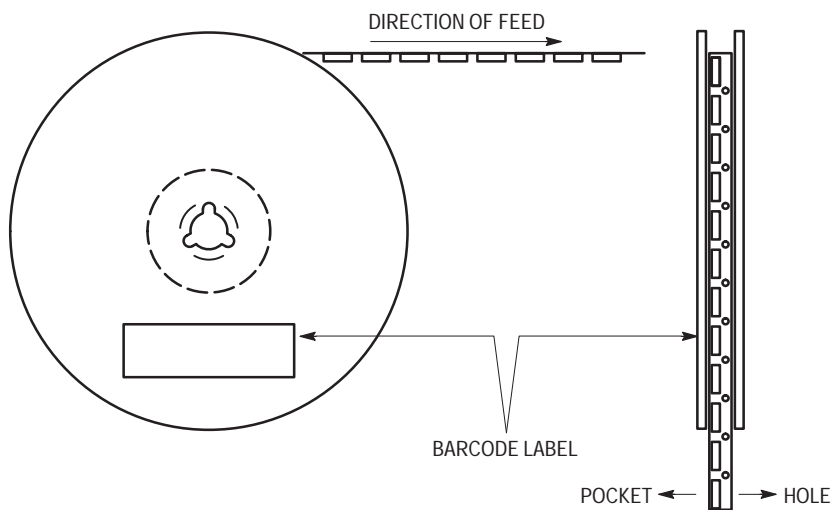
Figure 10. Reel Winding Direction

MC74VHC1G05
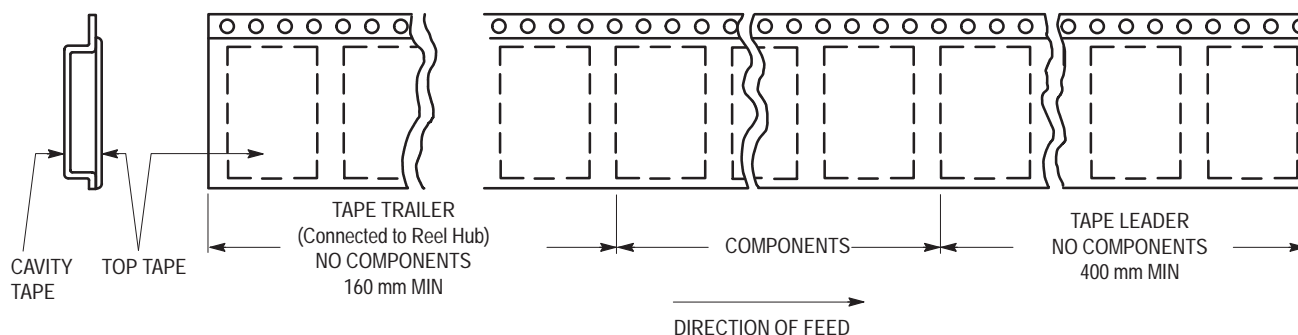
Figure 11. Tape Ends for Finished Goods
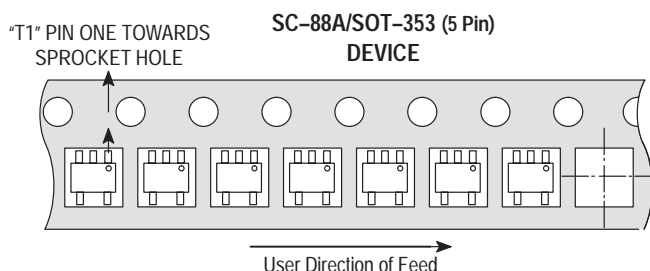
Figure 12. Reel Configuration