

Product Preview

Unbuffered Inverter

The MC74HC1GU04 is a high speed CMOS unbuffered inverter fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent LSTTL while maintaining CMOS low power dissipation.

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

The MC74HC1GU04 output drive current is 1/2 compared to MC74HC series.

- High Speed: $t_{pD} = 7\text{ns}$ (Typ) at $V_{CC} = 5\text{V}$
- Low Power Dissipation: $I_{CC} = 1\mu\text{A}$ (Max) at $T_A = 25^\circ\text{C}$
- High Noise Immunity
- Balanced Propagation Delays ($t_{pLH} = t_{pHL}$)
- Output Drive Capability: 5 LSTTL
- Symmetrical Output Impedance ($I_{OH} = I_{OL} = 2\text{mA}$)
- ESD Performance: HBM > 2000V; MM > 200V

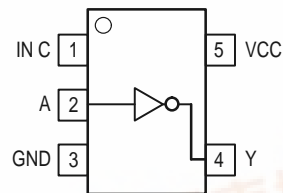
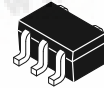


Figure 1. Pinout (Top View)



Figure 2. Logic Symbol

MC74HC1GU04



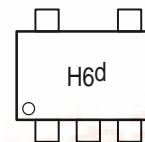
DF SUFFIX
5-LEAD SOT-353 PACKAGE
SC-88A
CASE 419A-01



DT SUFFIX
5-LEAD TSSOP PACKAGE
TSOP5
CASE TBD

FUNCTION TABLE

| Inputs | Outputs |
|--------|---------|
| L | H |
| H | L |



Pin 1
d = Date Code

Marking Diagram

DEVICE ORDERING INFORMATION

| Device Order Number | Device Nomenclature | | | | | | Package Type | Tape and Reel Size |
|---------------------|----------------------------|-----------------------|------------|-----------------|----------------|----------------------|--------------|--------------------|
| | Motorola Circuit Indicator | Temp Range Identifier | Technology | Device Function | Package Suffix | Tape and Reel Suffix | | |
| MC74HC1GU04DFT1 | MC | 74 | HC1G | U04 | DF | T1 | SC-88A | 7-Inch/3000 Unit |
| MC74HC1GU04DTT1 | MC | 74 | HC1G | U04 | DT | T1 | TSOP5 | 7-Inch/3000 Unit |

MC74HC1GU04

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 $V_{CC} + 0.5$ | V |
| DC Output Voltage | V_{OUT} | -0.5 to $V_{CC} + 0.5$ | 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} | ± 12.5 | mA |
| DC Supply Current, V_{CC} and GND | I_{CC} | ± 25 | mA |
| Power dissipation in still air | SC-88A† TSOP5† | 200 450 | 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
 — TSOP5 Package: -6 mW/°C from 65° to 125°C

RECOMMENDED OPERATING CONDITIONS

| Characteristics | Symbol | Min | Max | Unit |
|-----------------------------|-----------------|-----|----------|------|
| DC Supply Voltage | V_{CC} | 2.0 | 6.0 | V |
| DC Input Voltage | V_{IN} | 0.0 | V_{CC} | V |
| DC Output Voltage | V_{OUT} | 0.0 | V_{CC} | V |
| Operating Temperature Range | T_A | -55 | +125 | °C |
| Input Rise and Fall Time | t_r, t_f | 0 | 1000 | ns |
| | $V_{CC} = 2.0V$ | 0 | 600 | |
| | $V_{CC} = 3.0V$ | 0 | 500 | |
| | $V_{CC} = 4.5V$ | 0 | 400 | |
| | $V_{CC} = 6.0V$ | 0 | 400 | |

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Test Conditions | V _{CC} (V) | T _A = 25°C | | | T _A ≤ 85°C | | T _A ≤ 125°C | | Unit | | | |
|-----------------|---|--|--|----------------------------------|--|----------|-----------------------|------|------------------------|------|------|------|--|----|
| | | | | Min | Typ | Max | Min | Max | Min | Max | | | | |
| V _{IH} | Minimum High-Level Input Voltage | | 2.0 | 1.7 | | | 1.7 | | 1.7 | | V | | | |
| | | | 3.0 | 2.45 | | | 2.45 | | 2.45 | | | | | |
| | | | 4.5 | 3.60 | | | 3.60 | | 3.60 | | | | | |
| | | | 6.0 | 4.80 | | | 4.80 | | 4.80 | | | | | |
| V _{IL} | Maximum Low-Level Input Voltage | | 2.0 | | | 0.3 | | 0.3 | | 0.3 | V | | | |
| | | | 3.0 | | | 0.5 | | 0.5 | | 0.5 | | | | |
| | | | 4.5 | | | 0.9 | | 0.9 | | 0.9 | | | | |
| | | | 6.0 | | | 1.20 | | 1.20 | | 1.20 | | | | |
| V _{OH} | Minimum High-Level Output Voltage V _{IH} = V _{IH} or V _{IL} | V _{IN} = V _{IH} or V _{IL} I _{OH} = -20μA | 2.0 | 1.8 | 2.0 | | 1.8 | | 1.8 | | V | | | |
| | | | 3.0 | 2.7 | 3.0 | | 2.7 | | 2.7 | | | | | |
| | | | 4.5 | 4.0 | 4.5 | | 4.0 | | 4.0 | | | | | |
| | | | 6.0 | 5.5 | 5.9 | | 5.5 | | 5.5 | | | | | |
| | V _{OL} | Maximum Low-Level Output Voltage V _{IL} = V _{IH} or V _{IL} | V _{IN} = V _{IH} or V _{IL} I _{OL} = 20μA | 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 | | | |
| | | | | 6.0 | | 0.0 | 0.1 | | 0.1 | | 0.1 | | | |
| V _{OL} | Maximum Low-Level Output Voltage V _{IL} = V _{IH} or V _{IL} | V _{IN} = V _{IH} or V _{IL} I _{OL} = 2mA I _{OL} = 2.6mA | 4.5 | | | 0.26 | | 0.33 | | 0.40 | V | | | |
| | | | 6.0 | | | 0.26 | | 0.33 | | 0.40 | | | | |
| | | | I _{IN} | Maximum Input Leakage Current | V _{IN} = 6.0V or GND | 0 to 6.0 | | | ±0.1 | | | ±1.0 | | μA |
| | | | I _{CC} | Maximum Quiescent Supply Current | V _{IN} = V _{CC} or GND | 6.0 | | | 1.0 | | | 10 | | 40 |

AC ELECTRICAL CHARACTERISTICS (C_{load} = 50 pF, Input t_r = t_f = 6.0ns)

| Symbol | Parameter | Test Conditions | T _A = 25°C | | | T _A ≤ 85°C | | T _A ≤ 125°C | | Unit | | |
|--|--|--|--|------------------------|-----|-----------------------|-----|------------------------|-----|------|-----|----|
| | | | Min | Typ | Max | Min | Max | Min | Max | | | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay, Input A to Y | V _{CC} = 5.0V C _L = 15 pF | | 7.0 | 15 | | 20 | | 25 | ns | | |
| | | | V _{CC} = 2.0V C _L = 50 pF | | 48 | 100 | | 125 | | | 155 | |
| | | | | V _{CC} = 3.0V | | 24 | 40 | | 50 | | | 90 |
| | | | | V _{CC} = 4.5V | | 12 | 20 | | 25 | | | 35 |
| | | | | V _{CC} = 6.0V | | 9.0 | 17 | | 21 | | | 26 |
| t _{TLH} , t _{THL} | Output Transition Time | V _{CC} = 5.0V C _L = 15 pF | | 5.0 | 10 | | 15 | | 20 | ns | | |
| | | | V _{CC} = 2.0V C _L = 50 pF | | 50 | 125 | | 155 | | | 200 | |
| | | | | V _{CC} = 3.0V | | 22 | 35 | | 45 | | | 60 |
| | | | | V _{CC} = 4.5V | | 14 | 25 | | 31 | | | 38 |
| | | | | V _{CC} = 6.0V | | 12 | 21 | | 26 | | | 32 |
| C _{IN} | Maximum Input Capacitance | | 5 | 10 | | 10 | | 10 | pF | | | |

| | | | |
|-----------------|---|--|----|
| C _{PD} | Power Dissipation Capacitance (Note 1.) | Typical @ 25°C, V _{CC} = 5.0V | |
| | | 10 | 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} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

MC74HC1GU04

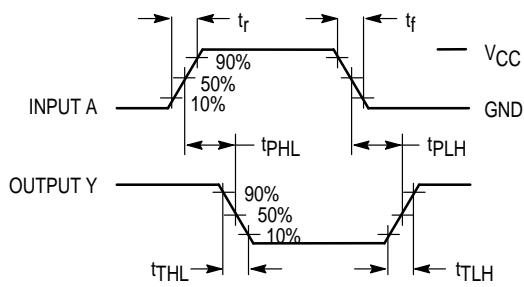
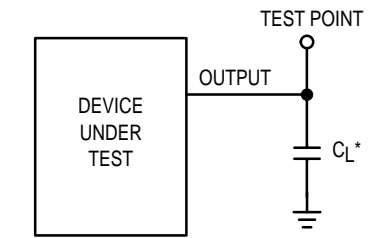


Figure 3. Switching Waveforms



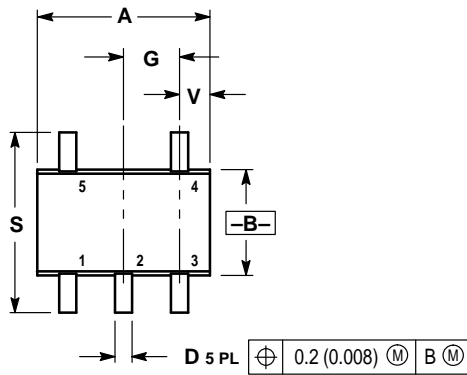
* Includes all probe and jig capacitance

Figure 4. Test Circuit

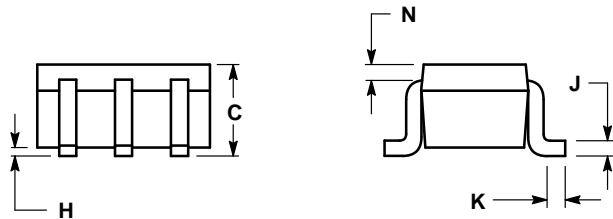
OUTLINE DIMENSIONS

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

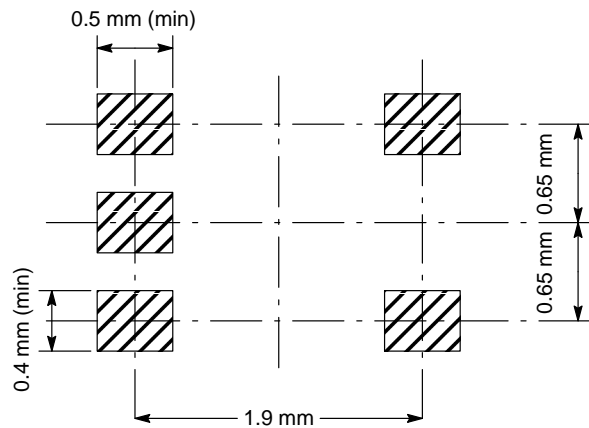
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MM.



| 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 |

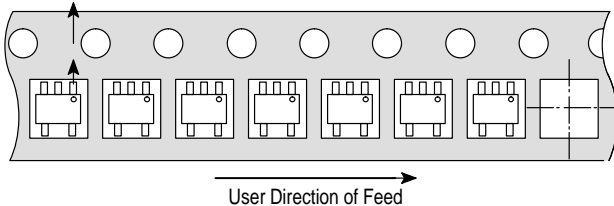


SOT-353

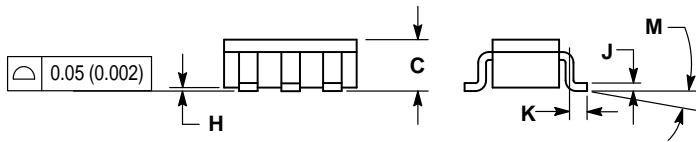
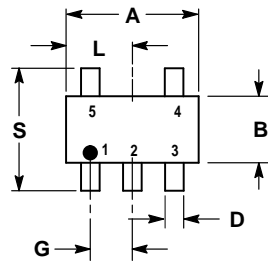


"T1" PIN ONE TOWARDS
SPROCKET HOLE

SOT-353 (5 Pin)
DEVICE



PROPOSED DT SUFFIX
5-LEAD TSSOP PACKAGE
 TSOP5
 CASE TBD
 ISSUE TBD



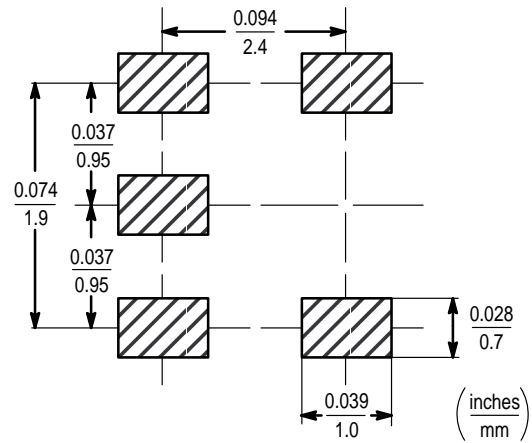
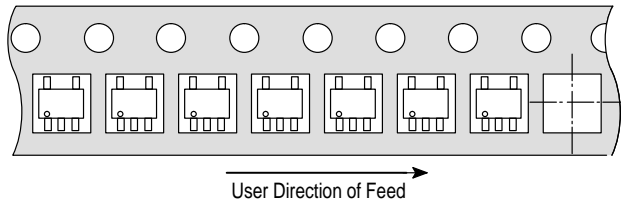
PRELIMINARY
PROPOSED

- 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.

| 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 |

DO NOT DESIGN WITH THESE DIMENSIONS - PRELIMINARY

TSOP5 (5 Pin) DEVICE



MC74HC1GU04

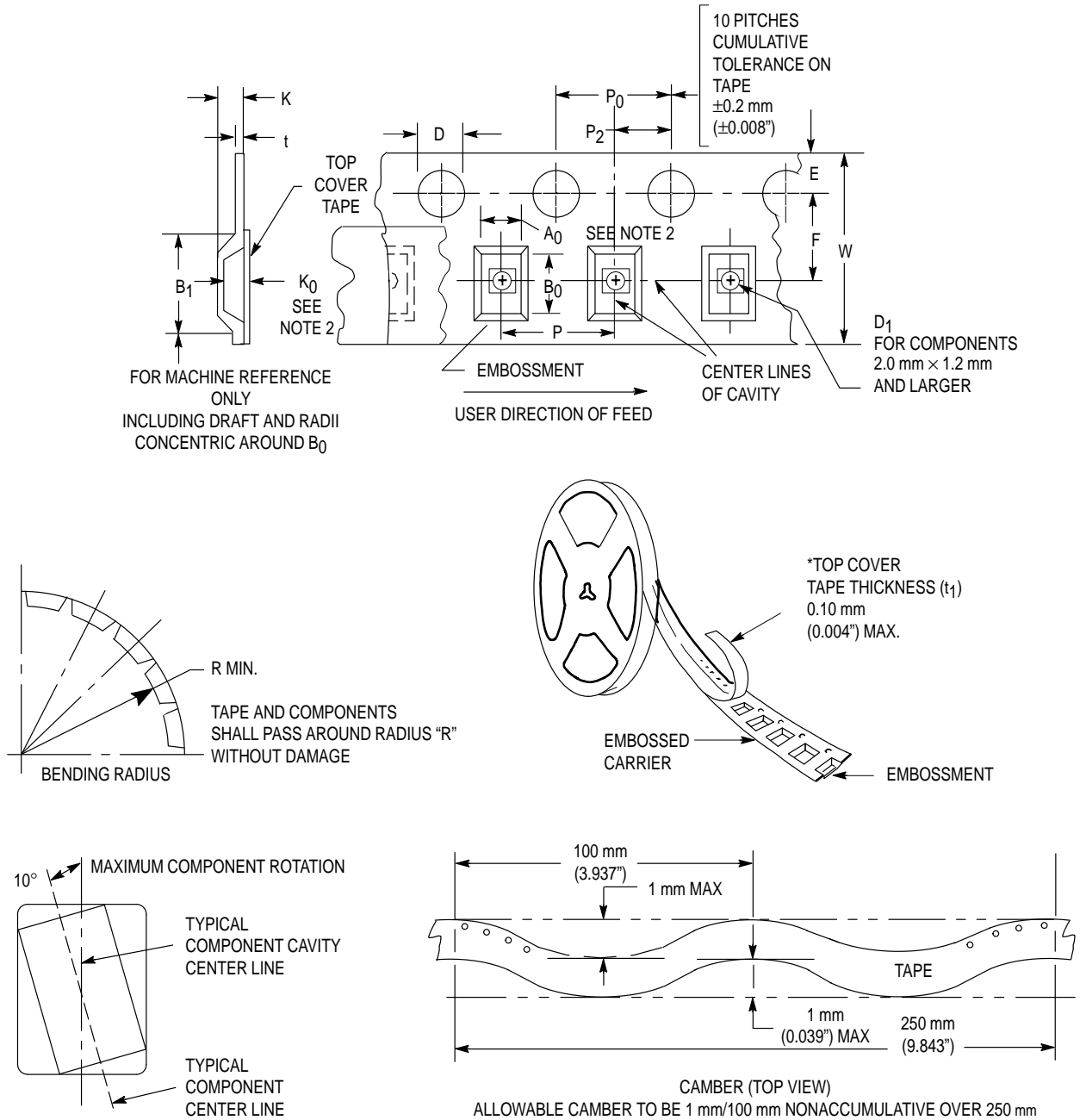


Figure 5. Carrier Tape Specifications

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. A₀, B₀, and K₀ 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

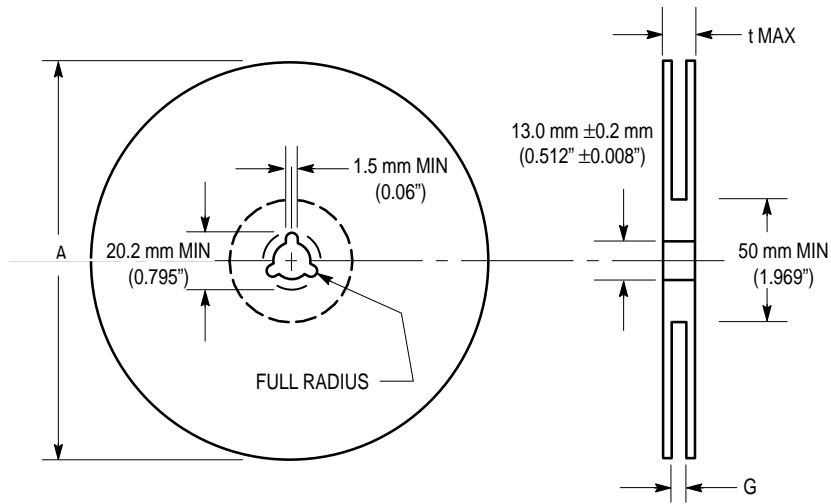


Figure 6. Reel Dimensions

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") |

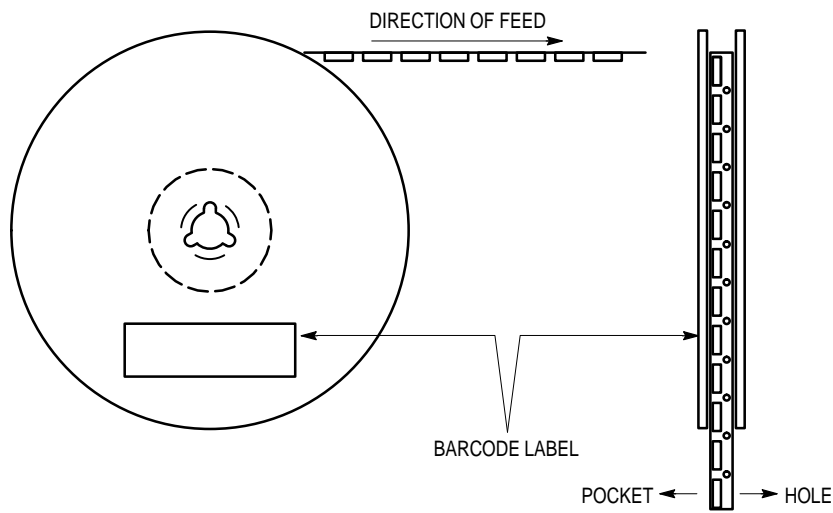


Figure 7. Reel Winding Direction

MC74HC1GU04

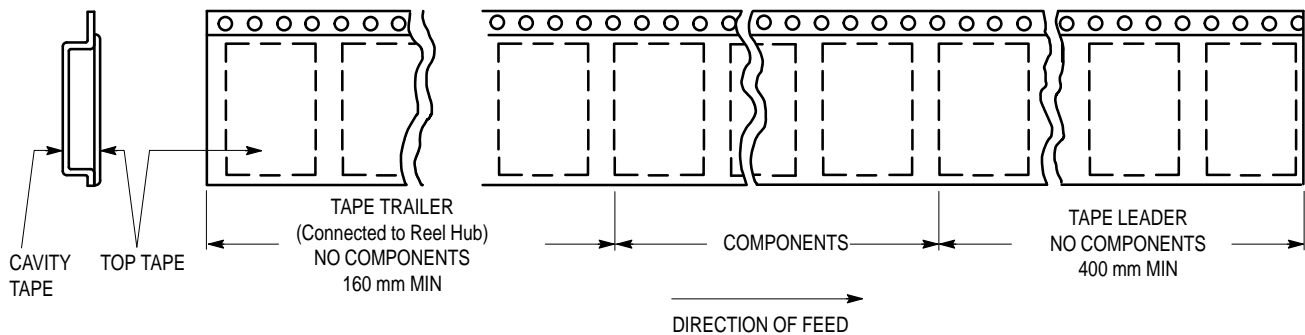



Figure 8. Tape Ends for Finished Goods

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