STAR

STAR STAR Surface Mount Tape-and-Reel Specification

Literature Number: SNOSBW3A

National Semiconductor

PRELIMINARY

STAR™

SEMICONDUCTOR TAPE-AND-REEL SYSTEM

December 1992

STAR™ Surface Mount Tape-and-Reel Specification

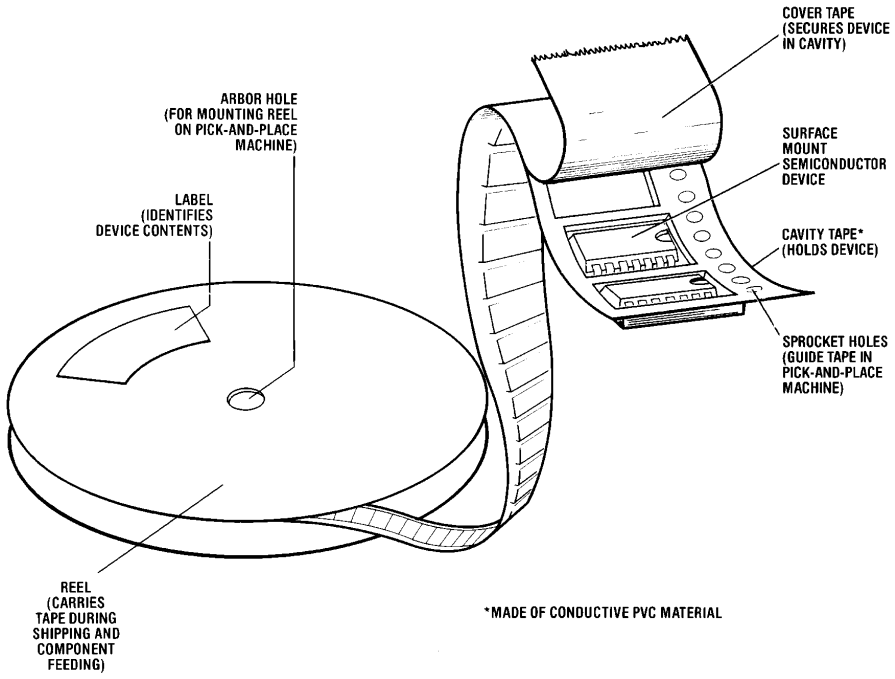
General Description

Tape-and-Reel is a new method for shipment of surface mount devices. This approach simplifies the handling of semiconductors for automated circuit board assembly systems. A Tape-and-Reel holds hundreds-to-thousands of surface mount devices (as compared with less than 100 devices in a rail), so that pick-and-place machines have to be reloaded less frequently. This savings in labor will further reduce manufacturing costs for automated circuit board assembly.

Features

- Conductive PVC material redeuces static charge build-up
- Fully meets proposed EIA standard RS-481A (taping of surface-mounted components for automatic placing)
- Fully compatible with National's surface mount package types
- Variable code density code 39 bar code label for Automated Inventory Management availability
- Mechanical samples of surface mount packages available in Tape-and-Reel for automated assembly process development
- Single Tape-and-Reel holds hundreds-to-thousands of surface mount semiconductors for additional labor savings
- Conductive cover Tape-and-Reel availability
- Reels individually packed

Tape-and-Reel Diagram



TL/HH/8352–1

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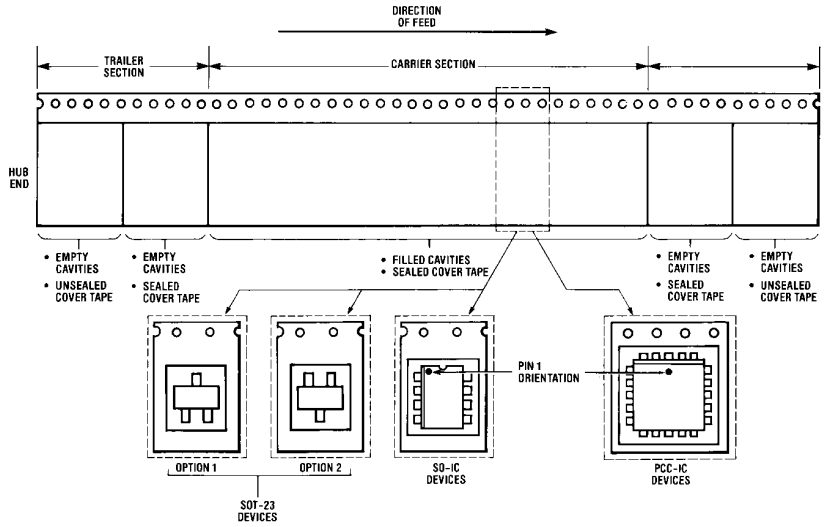
Tape-and-Reel Overview

TAPE FORMAT AND DEVICE ORIENTATION



TL/HH/8352–2

MATERIALS

- Cavity Tape: Conductive PVC (less than 10^5 Ω/Sq)
- Cover Tape: Polyester
  1. Conductive Cover available
- Reel: 1. Solid 80 pt. Fibreboard (standard)
  2. Conductive Fibreboard available
  3. Conductive Plastic (PVC) available

LABEL

Human and machine readable label is provided on reel. A variable (C.P.I.) density code 39 is available. NSC STD Label (7.6 C.P.I.).

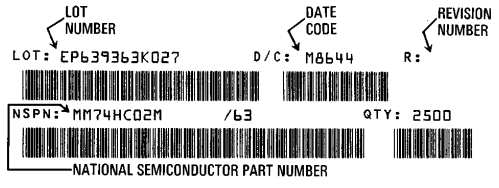
Field

Lot Number
Date Code
Revision Level
National Part No. I.D.
Quantity

Fields are separated by at least one blank space.

Future Tape-and-Reel packs will also include a smaller-size bar code label (high-density code 39) at the beginning of the tape. (This tape label is not available on current production.)

Example:



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National Semiconductor will also offer additional labels containing information per your specific specification.

SOT-23 (High Profile), SOT-23 (Low Profile)

TAPE FORMAT

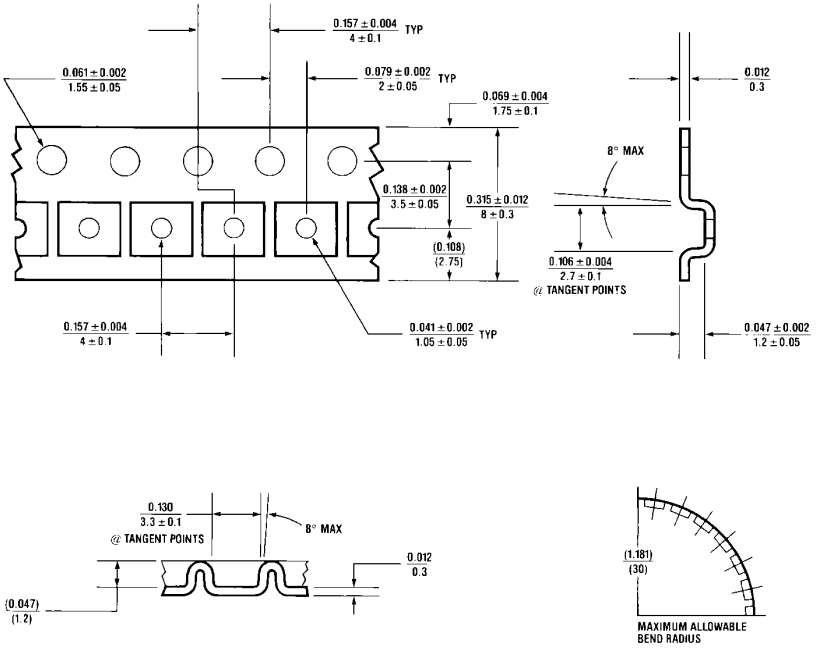
Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	†*2500 (High)	Filled	Sealed
	†*3000 (Low)	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

Direction of Feed ↑

*These quantities represent 7″ Reel Quantity availability.

†10,000 For 13″ Reel.

TAPE DIMENSIONS



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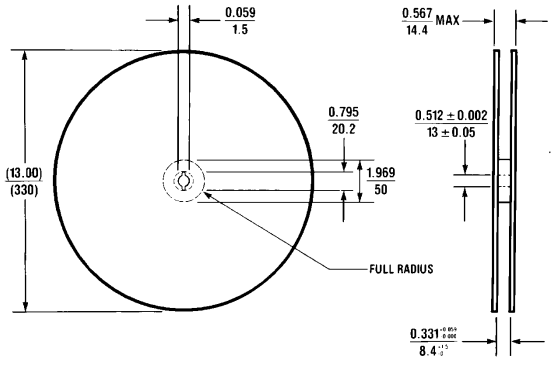
REEL DIMENSIONS



TL/HH/8352–5

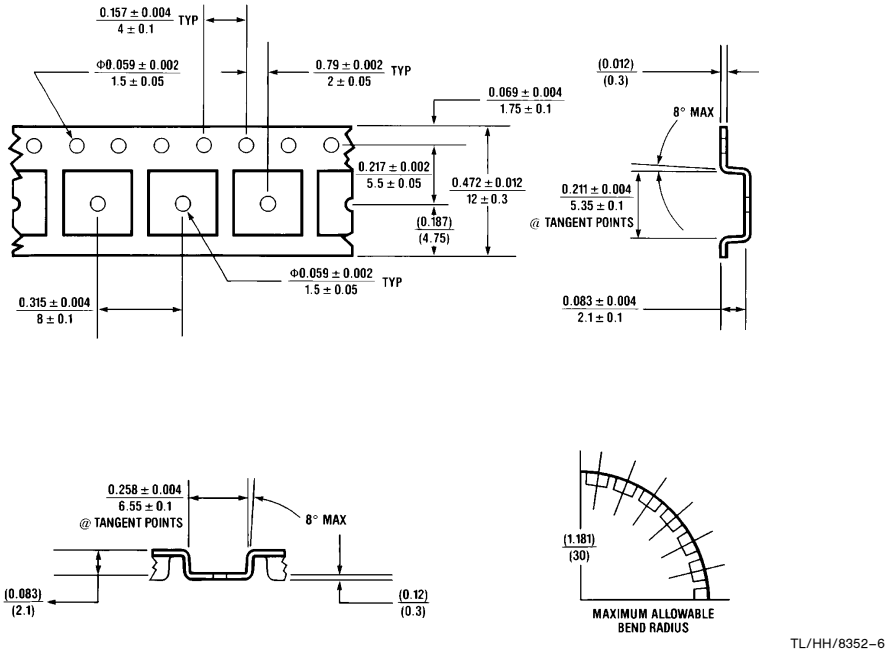
SO-8 (Narrow)

TAPE FORMAT

Direction of Feed ↑

Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	2500	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



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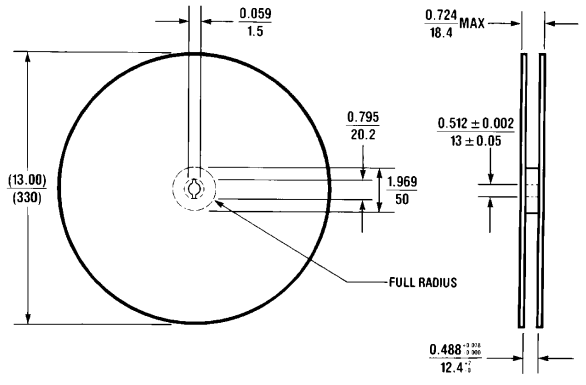
REEL DIMENSIONS



TL/HH/8352–7

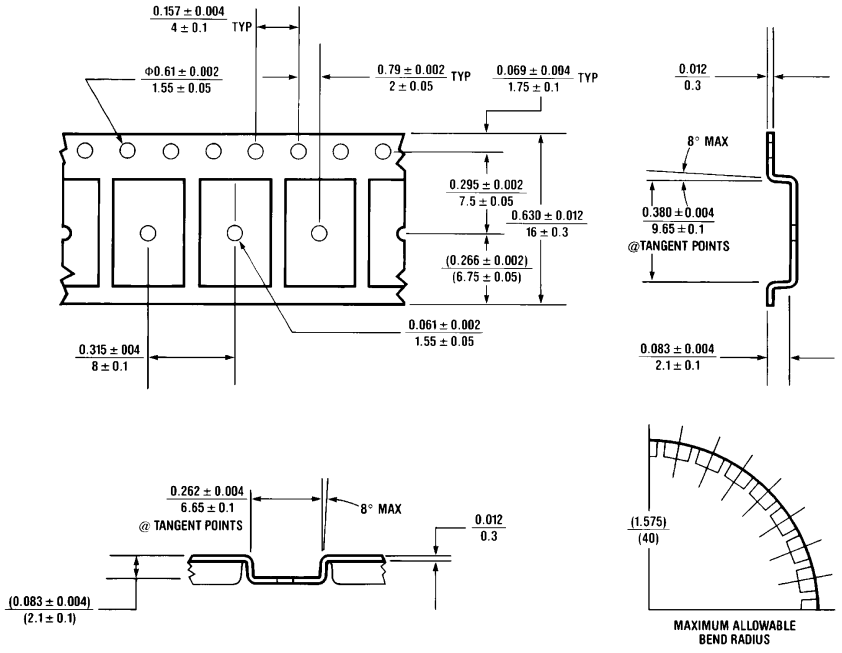
SO-14 (Narrow)

TAPE FORMAT

Direction of Feed ↑

Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	2500	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



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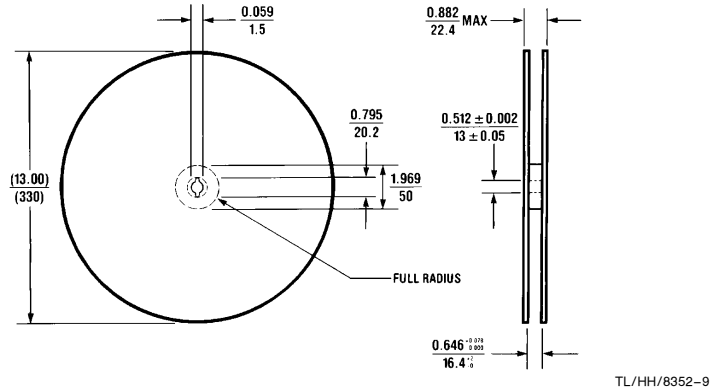
REEL DIMENSIONS



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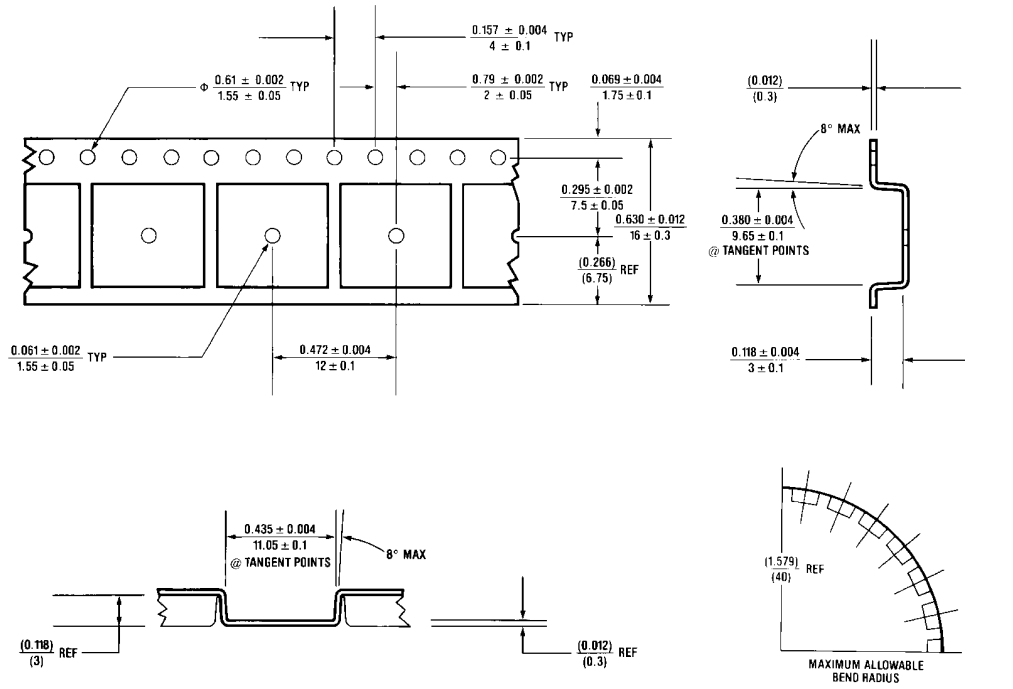
SO-14 (Wide)

TAPE FORMAT

Direction of Feed ↑

Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	1000	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



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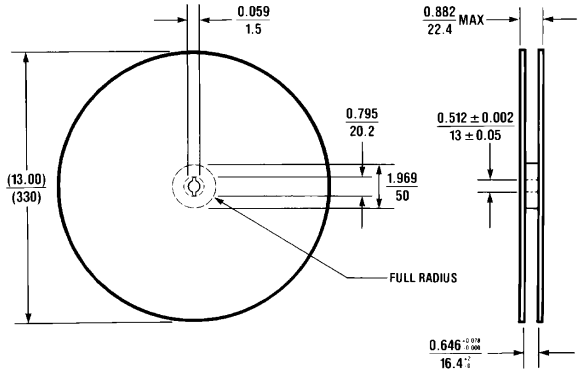
REEL DIMENSIONS



TL/HH/8352–11

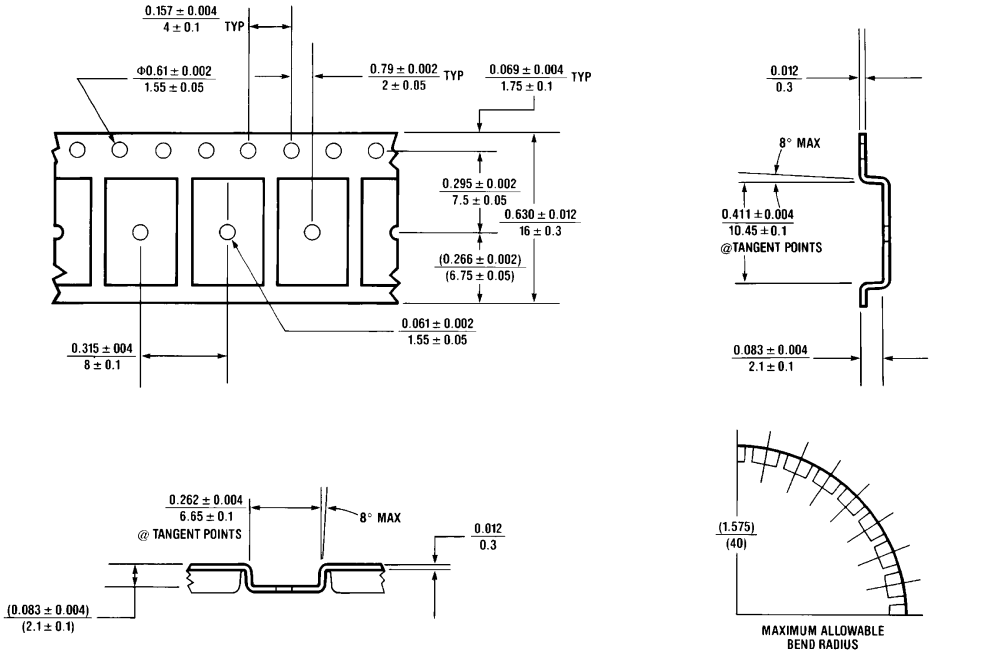
SO-16 (Narrow)

TAPE FORMAT

Direction of Feed ↑

Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	2500	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



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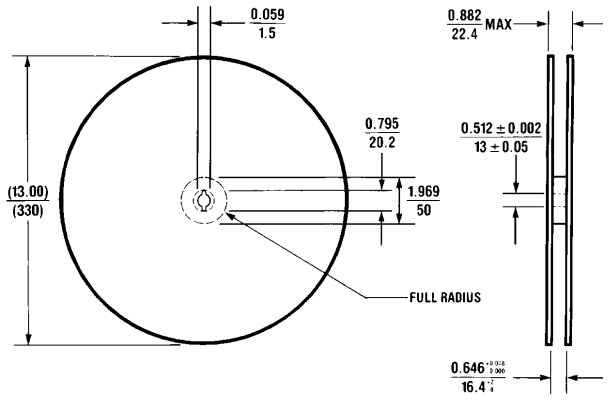
REEL DIMENSIONS



TL/HH/8352–13

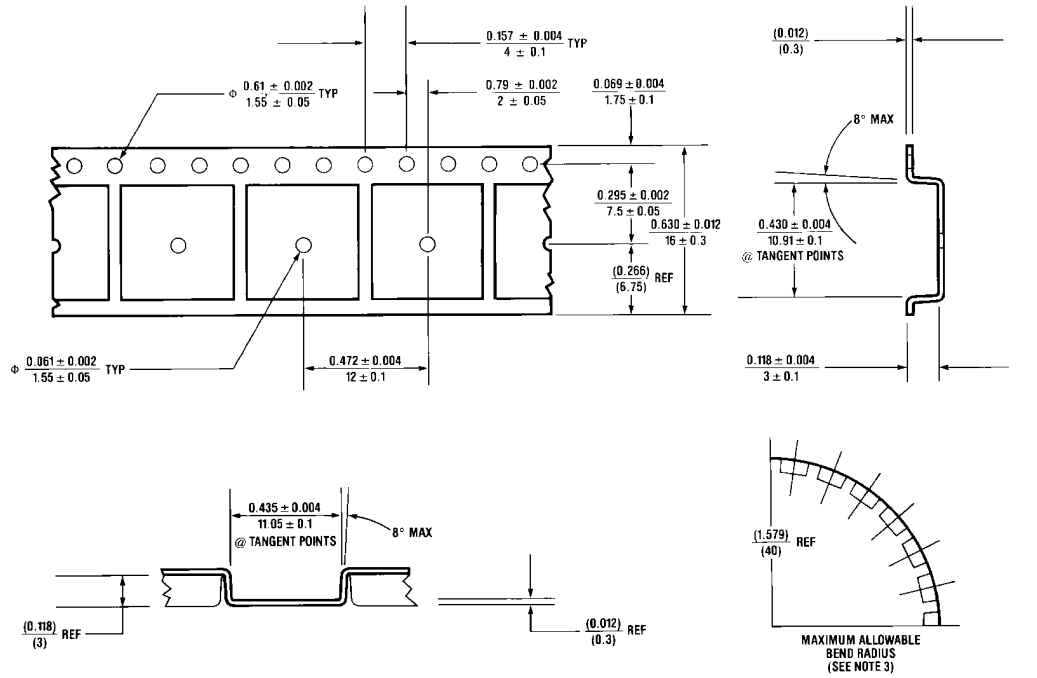
SO-16 (Wide)

TAPE FORMAT

Direction of Feed ↑

Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	1000	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



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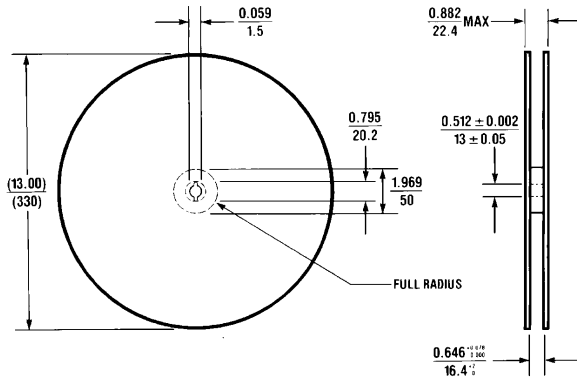
REEL DIMENSIONS



TL/HH/8352–15

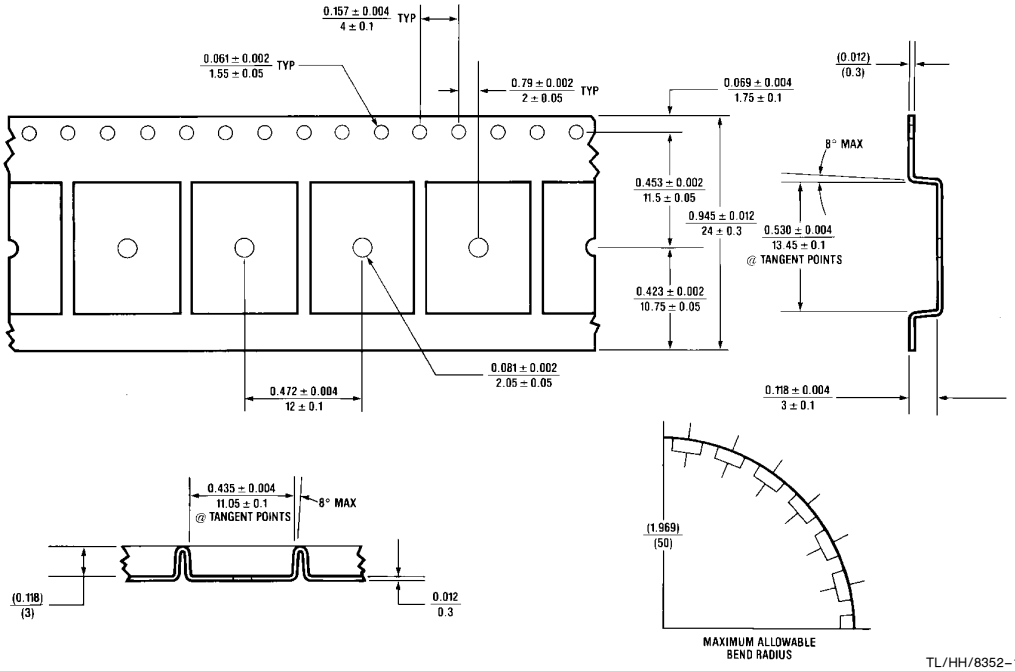
SO-20 (Wide)

TAPE FORMAT

Direction of Feed ↑

Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	1000	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



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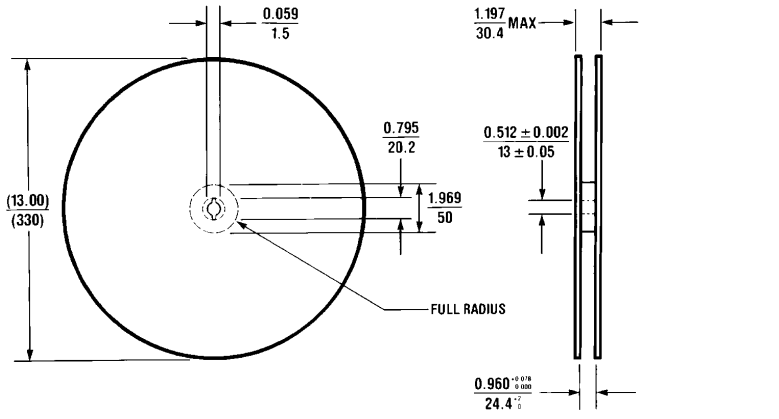
REEL DIMENSIONS



TL/HH/8352–17

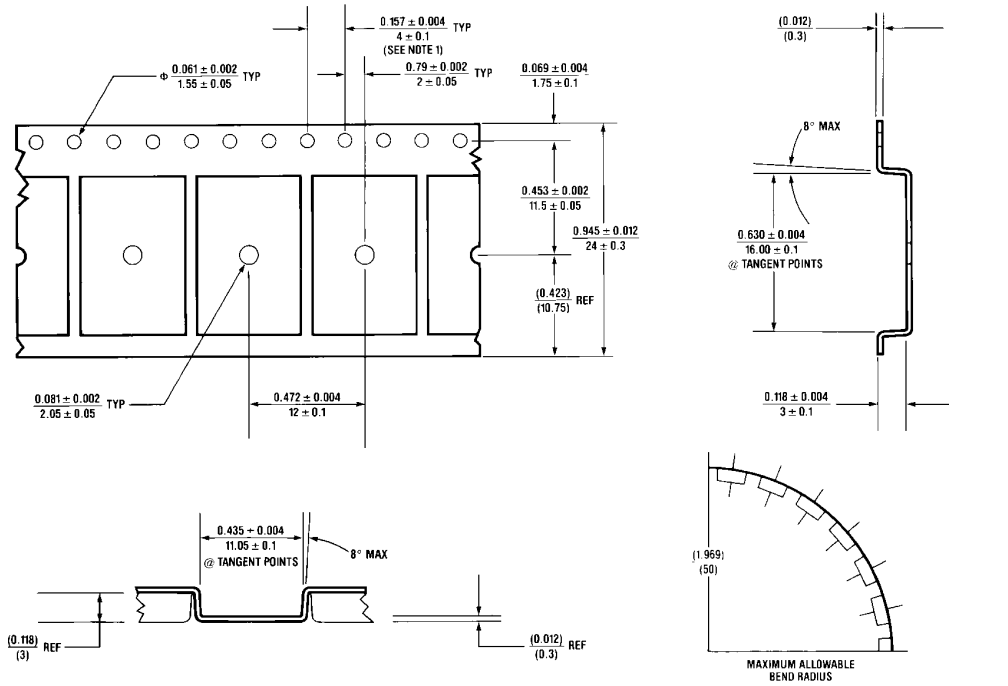
SO-24 (Wide)

TAPE FORMAT

Direction of Feed ↑

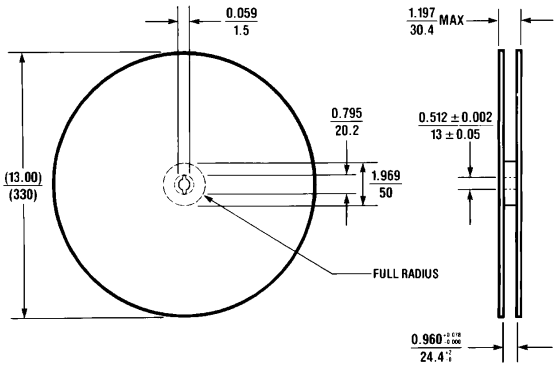
Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	1000	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



TL/HH/8352–18

REEL DIMENSIONS



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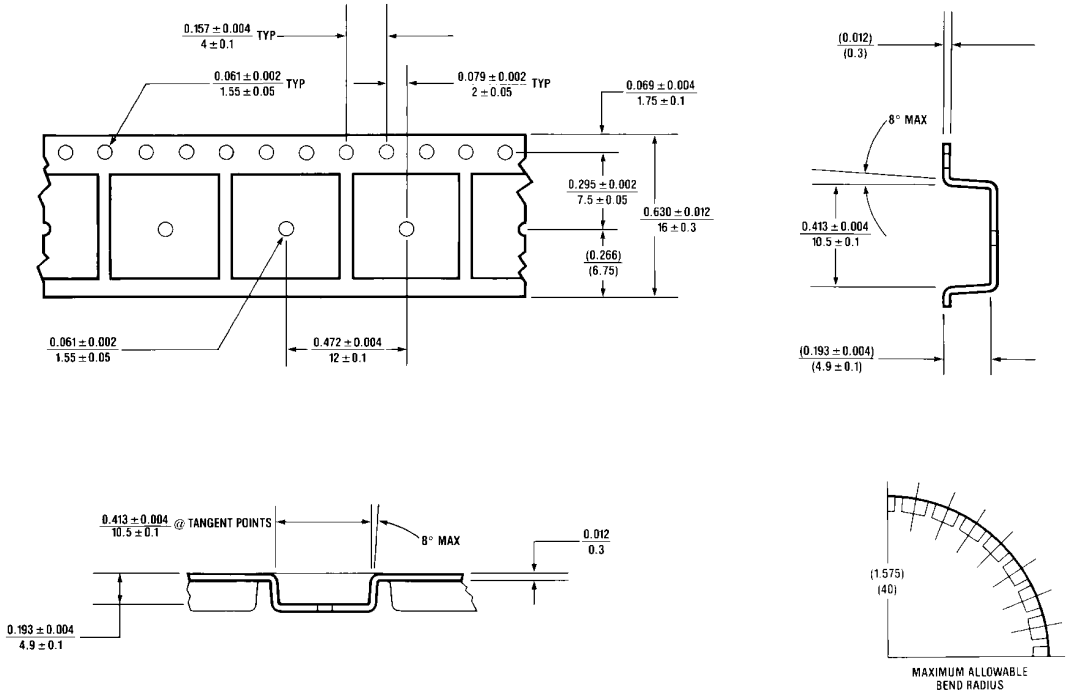
PLCC-20

TAPE FORMAT

Direction of Feed ↑

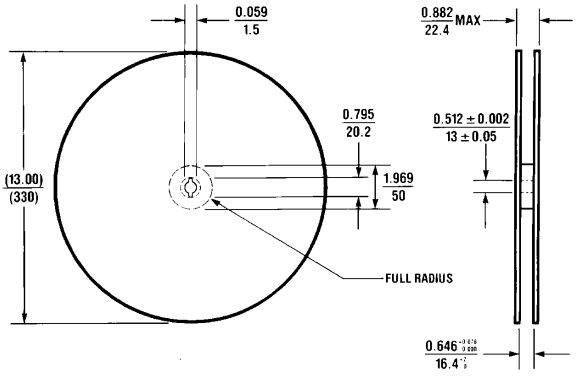
Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	1000	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



TL/HH/8352–20

REEL DIMENSIONS



TL/HH/8352–21

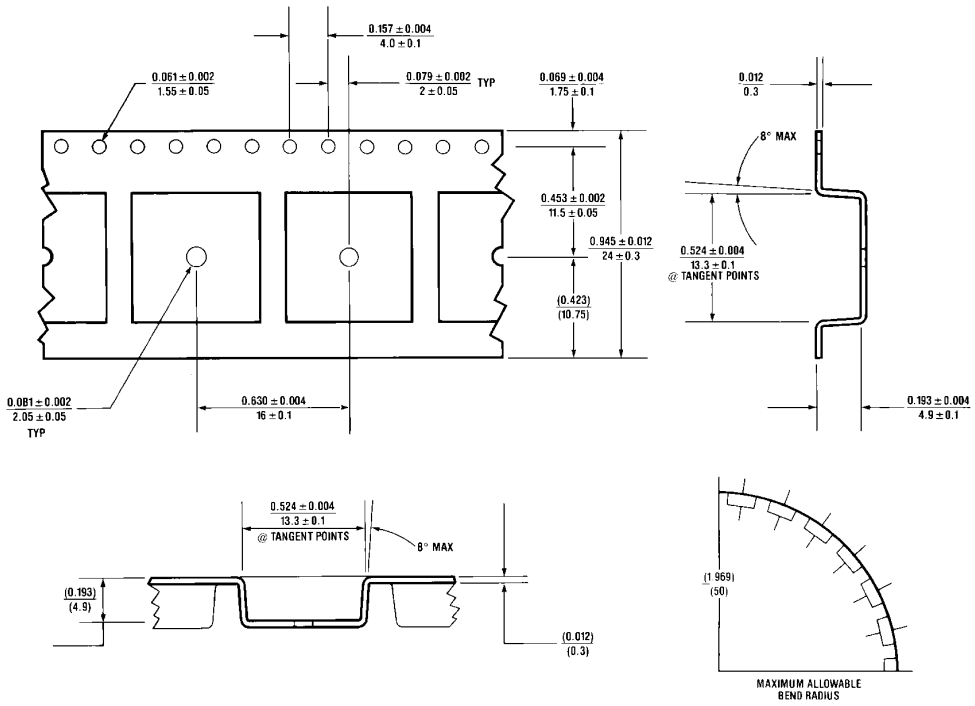
PLCC-28

TAPE FORMAT

Direction of Feed ↑

Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	750	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



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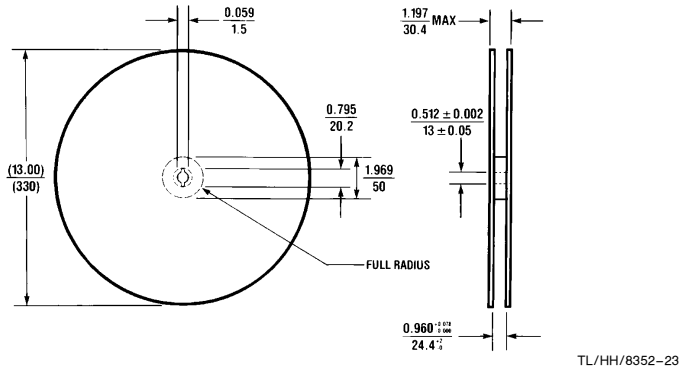
REEL DIMENSIONS



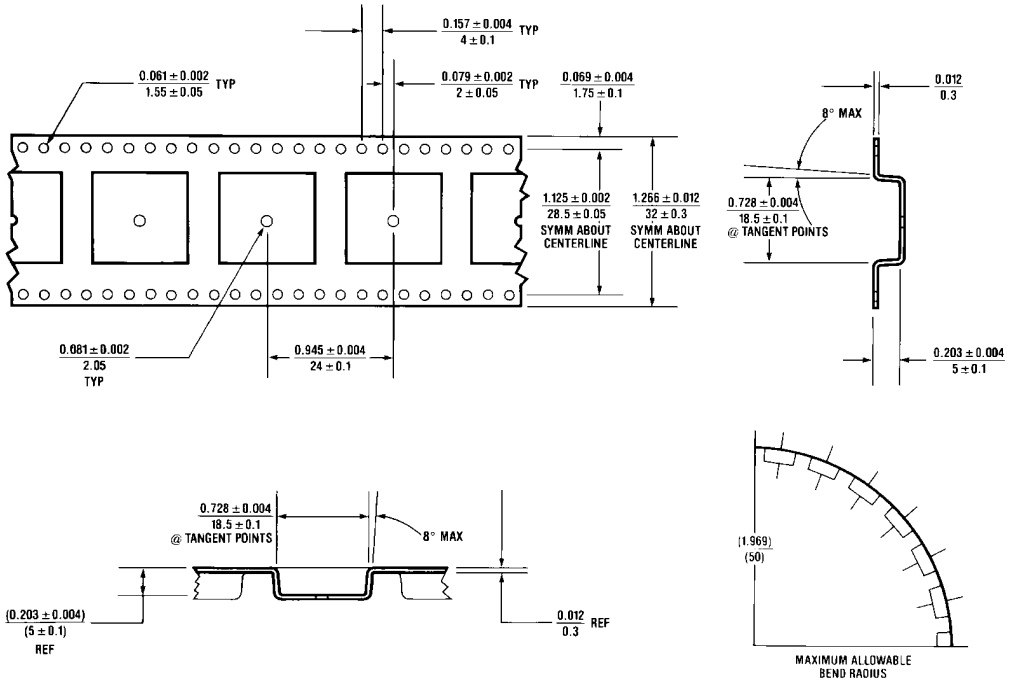
TL/HH/8352–23

PLCC-44

Direction of Feed ↑

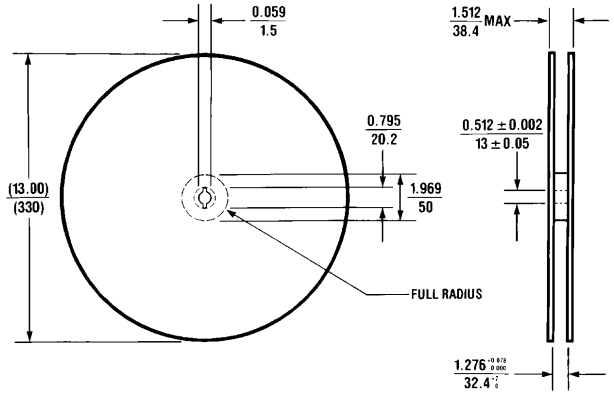
Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	500	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



TL/HH/8352–24

REEL DIMENSIONS



TL/HH/8352–25

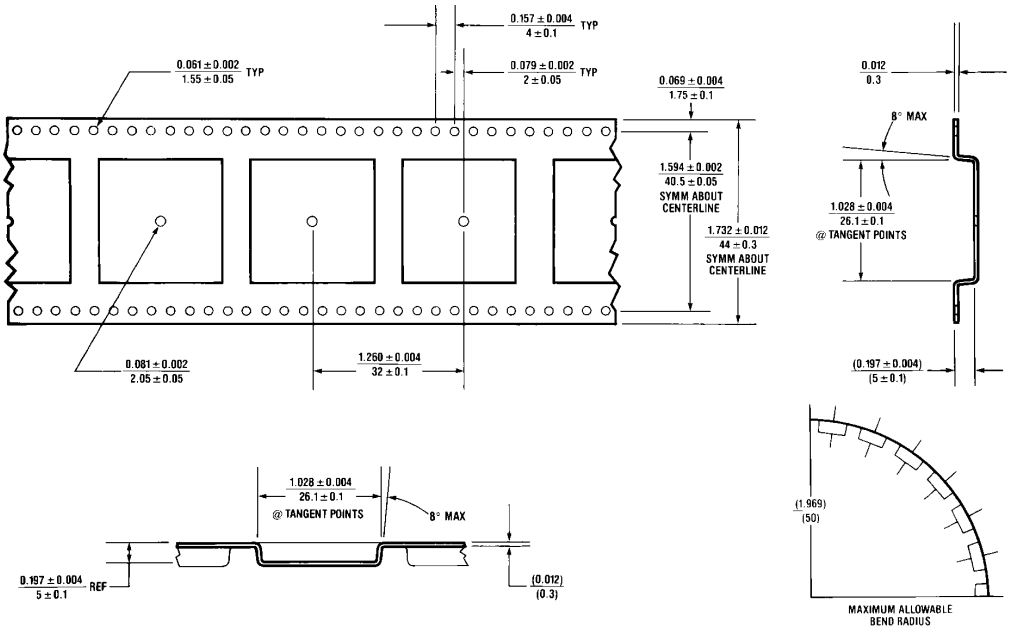
PLCC-68

TAPE FORMAT

Direction of Feed ↑

Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	250	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



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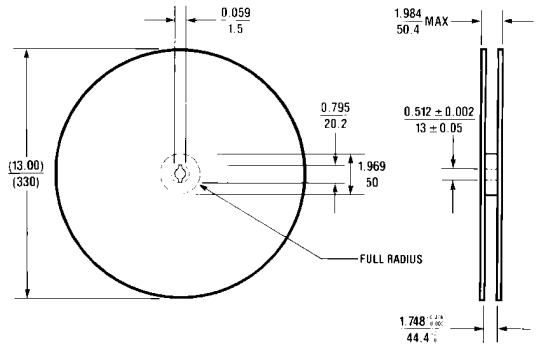
REEL DIMENSIONS



TL/HH/8352–27

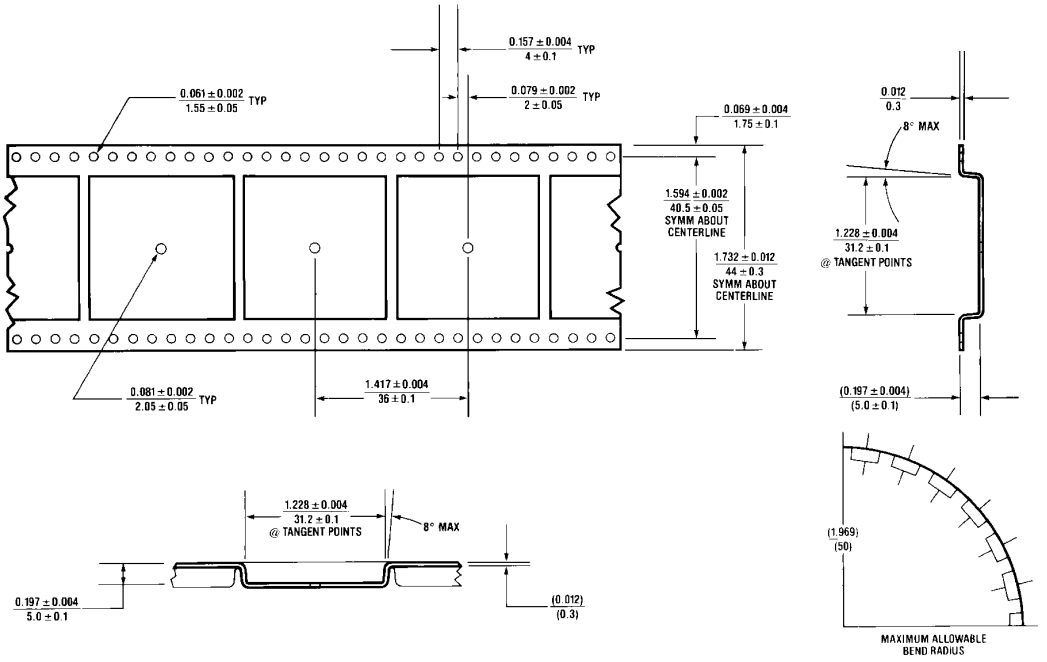
PLCC-84

TAPE FORMAT

Direction of Feed ↑

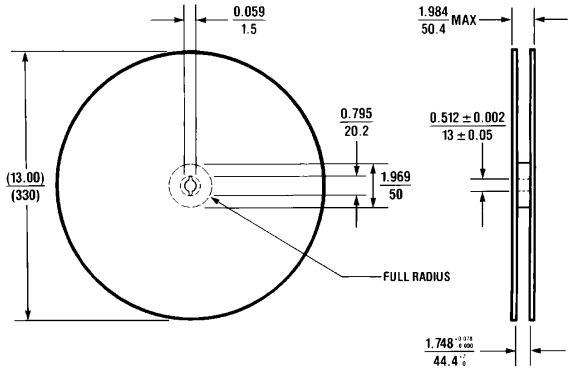
Tape Section	# Cavities	Cavity Status	Cover Tape Status
Leader (Start End)	5 (min)	Empty	Unsealed
	5 (min)	Empty	Sealed
Carrier	250	Filled	Sealed
Trailer (Hub End)	2 (min)	Empty	Sealed
	2 (min)	Empty	Unsealed

TAPE DIMENSIONS



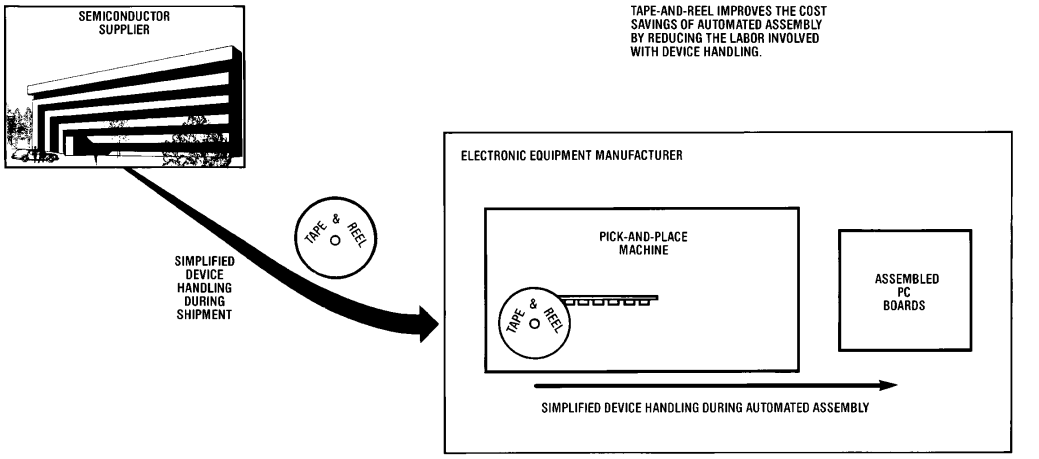
TL/HH/8352–28

REEL DIMENSIONS



TL/HH/8352–29

Application—Total System Saving



TL/HH/8352–32

Cost pressures today are forcing many electronics manufacturers to automate their production lines. Surface mount technology plays a key role in this cost-savings trend because:

1. The mounting of devices on the PC board surface eliminates the expense of drilling holes;
2. The use of pick-and-place machines to assemble the PC boards greatly reduces labor costs;
3. The lighter and more compact assembled products resulting from the smaller dimensions of surface mount packages mean lower material costs.

Production processes now permit both surface mount and insertion mount components to be assembled on the same PC board.

Automated manufacturers can improve their cost savings by using Tape-and-Reel for surface mount devices. Simplified handling results because hundreds-to-thousands of semiconductors are carried on a single Tape-and-Reel pack (see the ''Ordering Information'' section for the exact quantities). With this higher device count per reel (when compared with less than 100 devices per rail), pick-and-place machines have to be re-loaded less frequently and lower labor costs result.

With Tape-and-Reel, manufacturers save twice—once from using surface mount technology for automated PC board assembly and again from less device handling during shipment and machine set-up.

Ordering Information

When you order a surface mount semiconductor, it will be in one of the 15 available surface mount package types (see Appendix II for the physical dimensions of the surface mount packages). Specifying the Tape-and-Reel method of shipment (Note 1) means that you will receive your devices in the following quantities per Tape-and-Reel pack:

		Device Quantity	
Small Outline Transistor	SOT-23 (High Profile) (Note 2)	10000	2500*
	SOT-23 (Low Profile) (Note 2)	10000	3000*
Small Outline IC	SO-8 (Narrow)	2500	
	SO-14 (Narrow)	2500	
	SO-14 (Wide)	1000	
	SO-16 (Narrow)	2500	
	SO-16 (Wide)	1000	
	SO-20 (Wide)	1000	
	SO-24 (Wide)	1000	
Plastic Chip Carrier IC	PLCC-20	1000	
	PLCC-28	750	
	PLCC-44	500	
	PLCC-68	250	
	PLCC-84	250	

*This denotes 7″ reel quantity availability.

Note 1: For small outline transistors, your order will automatically be shipped in Tape-and-Reel unless you indicate otherwise. For surface mount integrated circuits, your order will automatically be shipped in conductive rails unless you indicate ''Tape-and-Reel'' after the device description on your purchase order.

Note 2: Your SOT-23 devices will automatically have Option 1 orientation unless you indicate ''Option 2 Orientation'' after the device description on your purchase order (see ''Tape-and-Reel Overview'' for definition of SOT-23 orientations). In addition, your SOT-23 devices will automatically have the high-profile outline unless you indicate ''Low-Profile Outline'' after the device description on your purchase order (see ''Appendix II—Physical Dimensions of Surface Mount Package'' for definition of SOT-23 outlines).

Example: You order 5,000 LM324M ICs shipped in Tape-and-Reel.

- All 5,000 devices have the same date code
- You receive 2 SO-14 (Narrow) Tape-and-Reel packs, each having 2500 LM324M ICs

Appendix I—Short-Form Procurement Specification

TAPE FORMAT

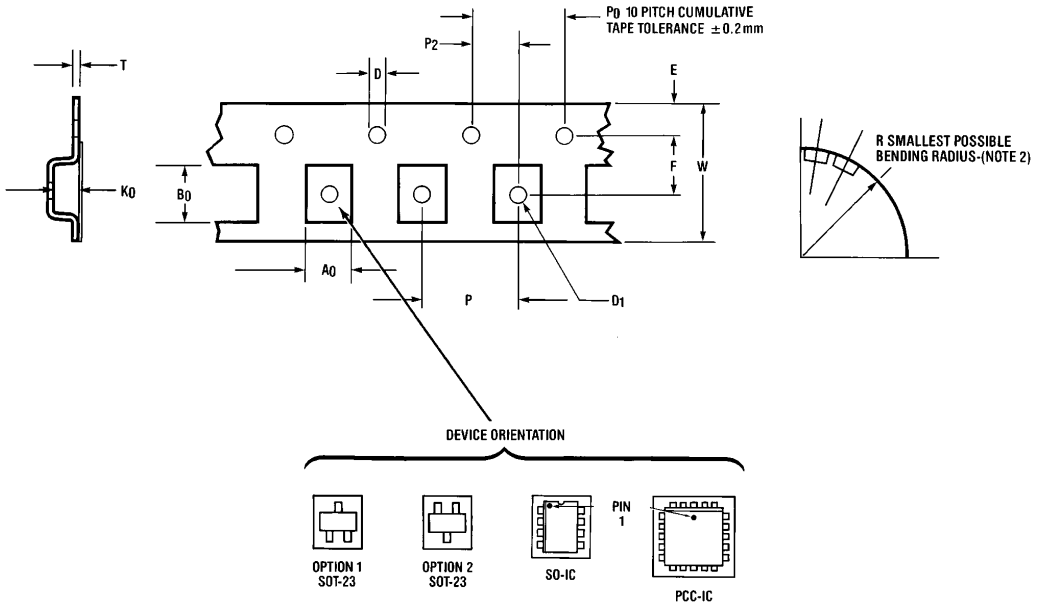
→ Direction of Feed

	Trailer (Hub End)		Carrier		Leader (Start End)	
	Empty Cavities, min (Unsealed Cover Tape)	**Empty Cavities, min (Sealed Cover Tape)**	**Filled Cavities (Sealed Cover Tape)**		**Empty Cavities, min Sealed Cover Tape)**	**Empty Cavities, min (Unsealed Cover Tape)**
SMALL OUTLINE TRANSISTOR						
SOT-23 (High Profile)	2	2	10000	2500*	5	5
SOT-23 (Low Profile)	2	2	10000	3000*	5	5
SMALL OUTLINE IC						
SO-8 (Narrow)	2	2	2500		5	5
SO-14 (Narrow)	2	2	2500		5	5
SO-14 (Wide)	2	2	1000		5	5
SO-16 (Narrow)	2	2	2500		5	5
SO-16 (Wide)	2	2	1000		5	5
SO-20 (Wide)	2	2	1000		5	5
SO-24 (Wide)	2	2	1000		5	5
PLASTIC CHIP CARRIER IC						
PLCC-20	2	2	1000		5	5
PLCC-28	2	2	750		5	5
PLCC-44	2	2	500		5	5
PLCC-68	2	2	250		5	5
PLCC-84	2	2	250		5	5

*This denotes 7″ reel quantity availability.

Appendix I—Short-Form Procurement Specification (Continued)

TAPE DIMENSIONS (24 Millimeter Tape or Less)



TL/HH/8352–33

	W	P	F	E	P_2	P_0	D	T	A_0	B_0	K_0	D_1	R
SMALL OUTLINE TRANSISTOR													
SOT-23 (High Profile)	8 ± .30	4.0 ± .10	3.5 ± .05	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	3.15 ± .05	2.55 ± .05	1.20 ± .05	1.05 ± .05	25
SOT-23 (Low Profile)	8 ± .30	4.0 ± .10	3.5 ± .05	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	3.15 ± .05	2.55 ± .05	1.20 ± .05	1.05 ± .05	25
SMALL OUTLINE IC													
SO-8 (Narrow)	12 ± .30	8.0 ± .10	5.5 ± .05	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	6.4 ± .10	5.2 ± .10	2.1 ± .10	1.55 ± .05	30
SO-14 (Narrow)	16 ± .30	8.0 ± .10	7.5 ± .10	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	6.5 ± .10	9.0 ± .10	2.1 ± .10	1.55 ± .05	40
SO-14 (Wide)	16 ± .30	12.0 ± .10	7.5 ± .10	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	10.9 ± .10	9.5 ± .10	3.0 ± .10	1.55 ± .05	40
SO-16 (Narrow)	16 ± .30	8.0 ± .10	7.5 ± .10	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	6.5 ± .10	10.3 ± .10	2.1 ± .10	1.55 ± .05	40
SO-16 (Wide)	16 ± .30	12.0 ± .10	5.5 ± .10	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	10.9 ± .10	10.76 ± .10	3.0 ± .10	1.55 ± .05	40
SO-20 (Wide)	24 ± .30	12.0 ± .10	11.5 ± .10	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	10.9 ± .10	13.3 ± .10	3.0 ± .10	2.05 ± .05	50
SO-24 (Wide)	24 ± .30	12.0 ± .10	11.5 ± .10	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	10.9 ± .10	15.85 ± .10	3.0 ± .10	2.05 ± .05	50
PLASTIC CHIP CARRIER IC													
PLCC-20	16 ± .30	12.0 ± .10	7.5 ± .10	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	9.3 ± .10	9.3 ± .10	4.9 ± .10	1.55 ± .05	40
PLCC-28	24 ± .30	16.0 ± .10	11.5 ± .10	1.75 ± .10	2.0 ± .05	4.0 ± .10	1.55 ± .05	.30 ± .10	13.0 ± .10	13.0 ± .10	4.9 ± .10	2.05 ± .05	50

Note 1: A_0, B_0 and K_0 dimensions are measured 0.3 mm above the inside wall of the cavity bottom.

Note 2: Tape with components shall pass around a mandril radius R without damage.

Note 3: Cavity tape material shall be PVC conductive (less than 10^5 Ω/Sq).

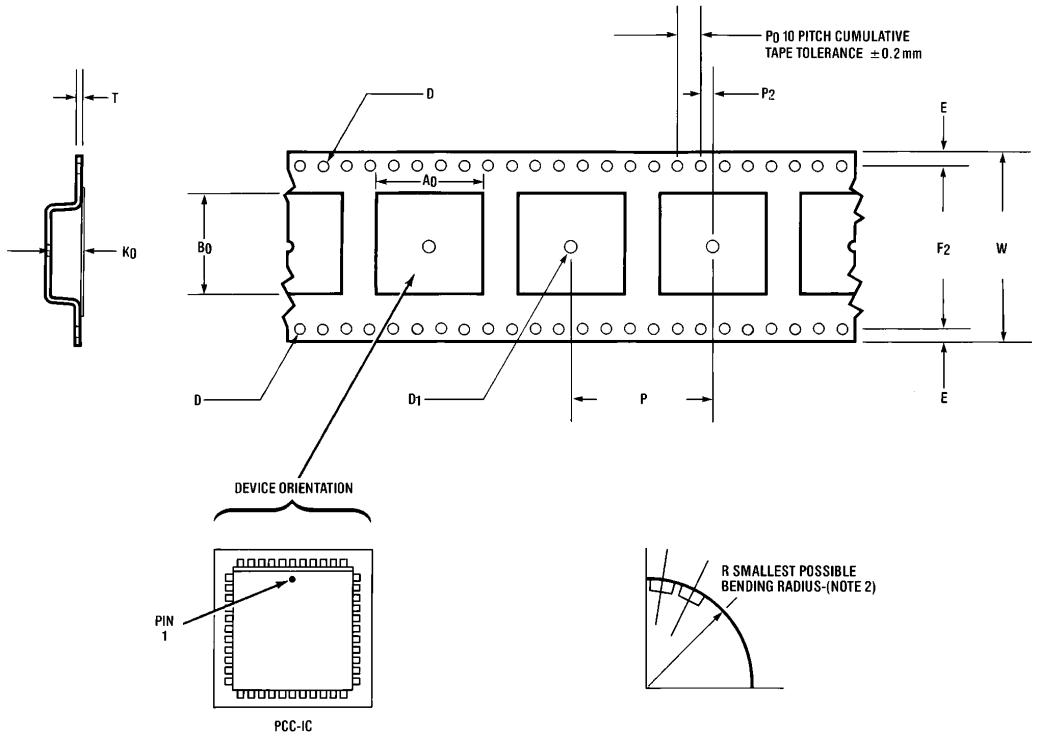
Note 4: Cover tape material shall be polyester (30–65 grams peel-back force).

Note 5: D_1 Dimension is centered within cavity.

Note 6: All dimensions are in millimeters.

Appendix I—Short-Form Procurement Specification (Continued)

TAPE DIMENSIONS (32 Millimeter Tape or Greater)



TL/HH/8352–34

	W	P	F_2	E	P_2	P_0	D	T	A_0	B_0	K_0	D_1	R
PLASTIC CHIP CARRIER IC													
PLCC-44	32 ± .3	24.0 ± .1	14.25 ± .1	1.75 ± .1	2.0 ± .05	4.0 ± .1	1.55 ± .05	.30 ± .1	18.0 ± .1	18.0 ± .1	5.0 ± .1	2.05 ± .05	50
PLCC-68	44.3 ± .3	32.0 ± .1	20.25 ± .1	1.75 ± .1	2.0 ± .05	4.0 ± .1	1.55 ± .05	.30 ± .1	25.6 ± .1	25.6 ± .1	5.0 ± .1	2.05 ± .05	50
PLCC-84	44.3 ± .3	36.0 ± .1	20.25 ± .1	1.75 ± .1	2.0 ± .05	4.0 ± .1	1.55 ± .05	.30 ± .1	30.7 ± .1	30.7 ± .1	5.0 ± .1	2.05 ± .05	50

Note 1: A_0, B_0 and K_0 dimensions are measured 0.3 mm above the inside wall of the cavity bottom.

Note 2: Tape with components shall pass around a mandril radius R without damage.

Note 3: Cavity tape material shall be PVC conductive (less than 10^5 Ω/Sq).

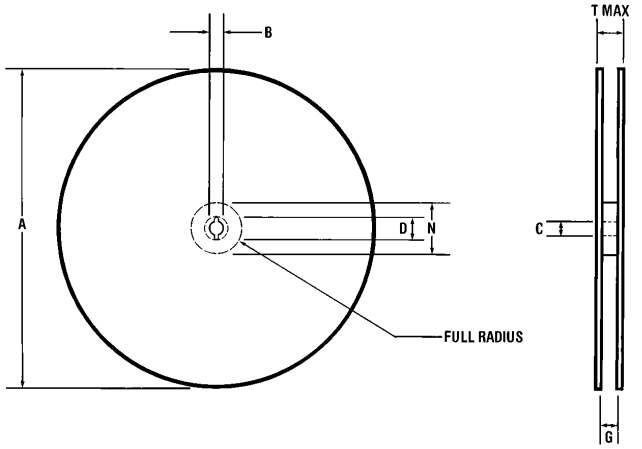
Note 4: Cover tape material shall be polyester (30–65 grams peel-back force).

Note 5: D_1 Dimension is centered within cavity.

Note 6: All dimensions are in millimeters.

Appendix I—Short-Form Procurement Specification (Continued)

REEL DIMENSIONS



TL/HH/8352–35

		A (Max)	B (Min)	C	D (Min)	N (Min)	G	T (Max)
8 mm Tape	SOT-23 (High Profile) SOT-23 (Low Profile)	(13.00) (330)	0.059 1.5	0.512 ± 0.002 13 ± 0.05	0.795 20.2	1.969 50	$0.331^{+0.059}_{-0.000}$ $8.4^{+1.5}_{-0}$	0.567 14.4
12 mm Tape	SO-8 (Narrow)	(13.00) (330)	0.059 1.5	0.512 ± 0.002 13 ± 0.05	0.795 20.2	1.969 50	$0.488^{+0.078}_{-0.000}$ 12.4^{+2}_{-0}	0.724 18.4
16 mm Tape	SO-14 (Narrow) SO-14 (Wide) SO-16 (Narrow) SO-16 (Wide) PLCC-20	(13.00) (330)	0.059 1.5	0.512 ± 0.002 13 ± 0.05	0.795 20.2	1.969 50	$0.646^{+0.078}_{-0.000}$ 16.4^{+2}_{-0}	0.882 22.4
24 mm Tape	SO-20 (Wide) SO-24 (Wide) PLCC-28	(13.00) (330)	0.059 1.5	0.512 ± 0.002 13 ± 0.05	0.795 20.2	1.969 50	$0.960^{+0.078}_{-0.000}$ 24.4^{+2}_{-0}	1.197 30.4
32 mm Tape	PLCC-44	(13.00) (330)	0.059 1.5	0.512 ± 0.002 13 ± 0.05	0.795 20.2	1.969 50	$1.276^{+0.078}_{-0.000}$ 32.4^{+2}_{-0}	1.512 38.4
44 mm Tape	PLCC-68 PLCC-84	(13.00) (330)	0.059 1.5	0.512 ± 0.002 13 ± 0.05	0.795 20.2	1.969 50	$1.748^{+0.078}_{-0.000}$ 44.4^{+2}_{-0}	1.984 50.4

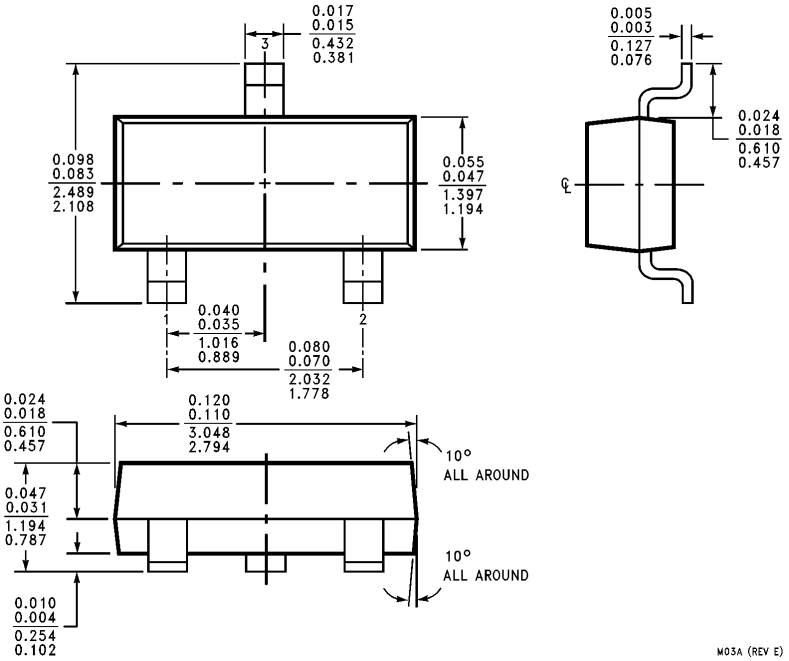
Units: Inches / Millimeters

Material: Paperboard (Non-Flaking)

Appendix II—Physical Dimensions of Surface Mount Packages

SOT-23 (High Profile)

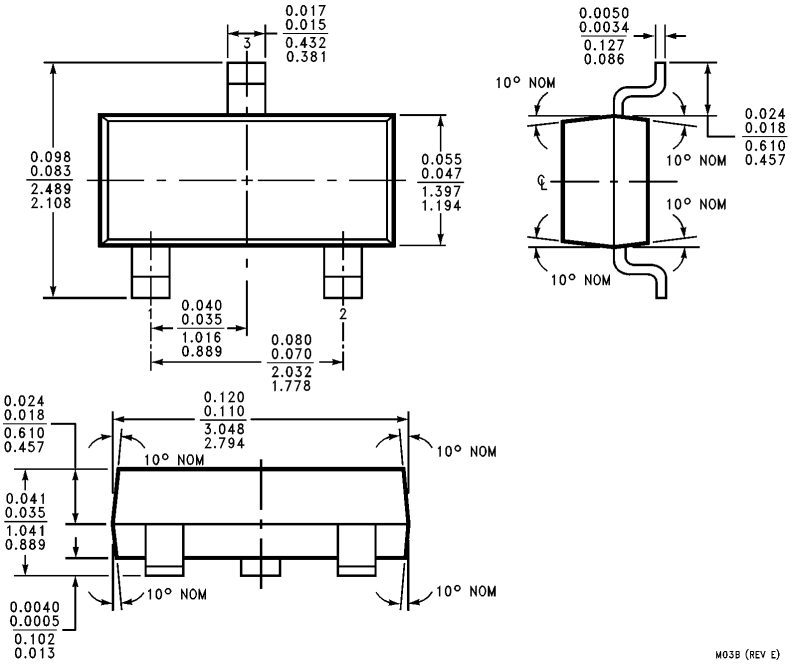
(Generally used for Top-of-Board Mounting)



M03A (REV E)

SOT-23 (Low Profile)

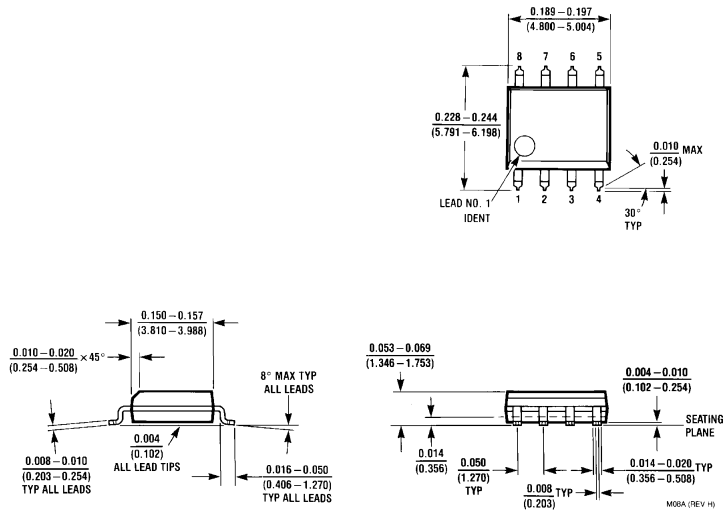
(Generally used for Underside-of-Board Mounting)



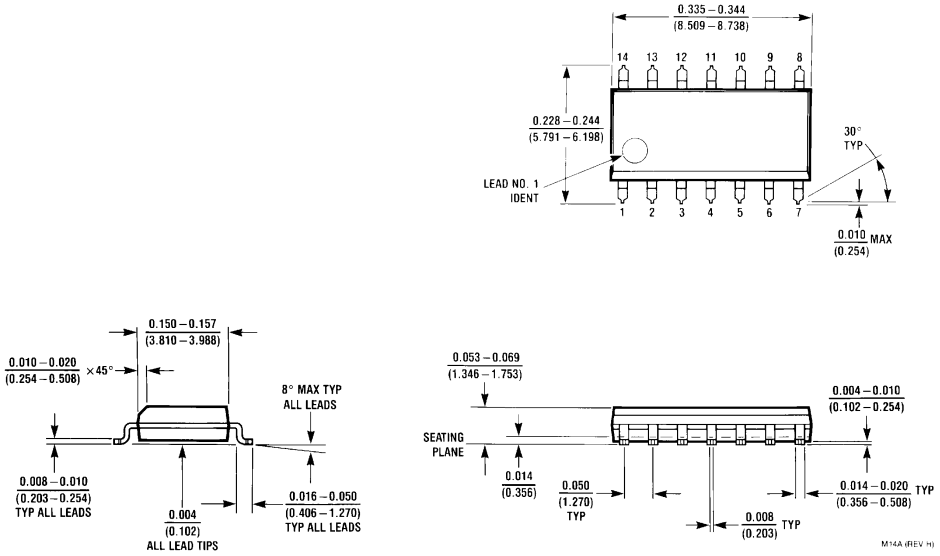
M03B (REV E)

Appendix II—Physical Dimensions of Surface Mount Packages (Continued)

SO-8 (Narrow)

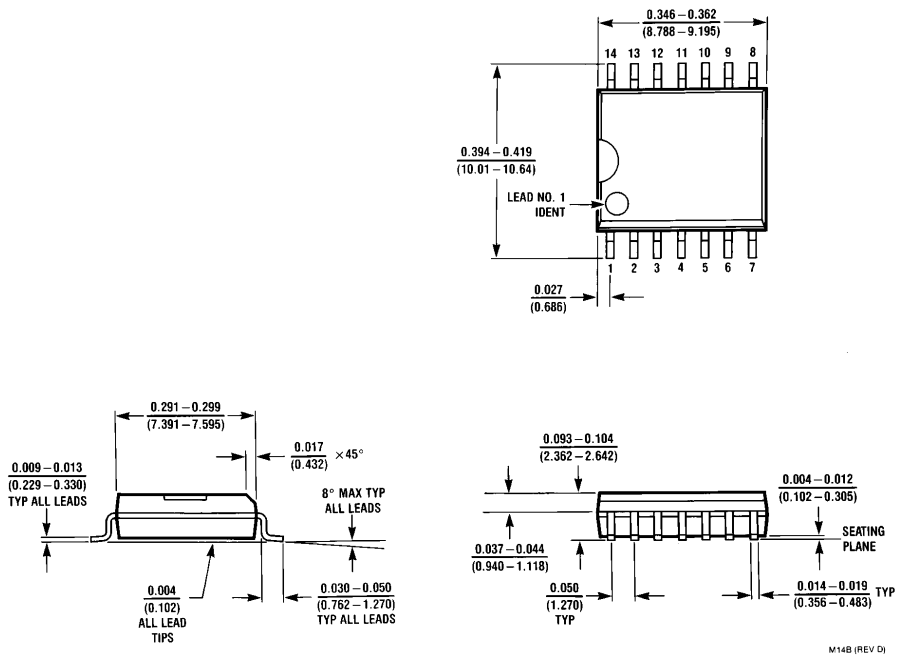


SO-14 (Narrow)

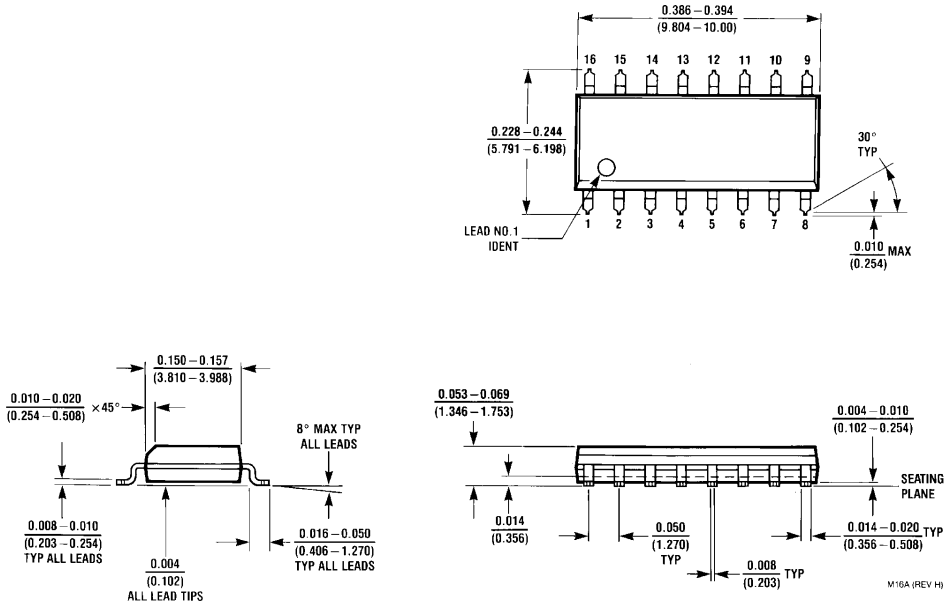


Appendix II—Physical Dimensions of Surface Mount Packages (Continued)

SO-14 (Wide)

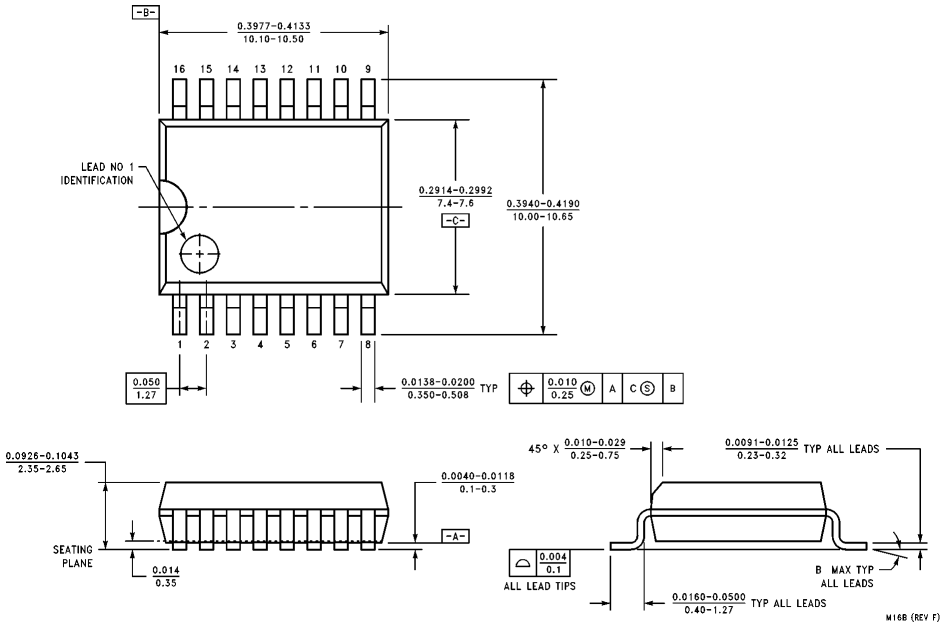


SO-16 (Narrow)

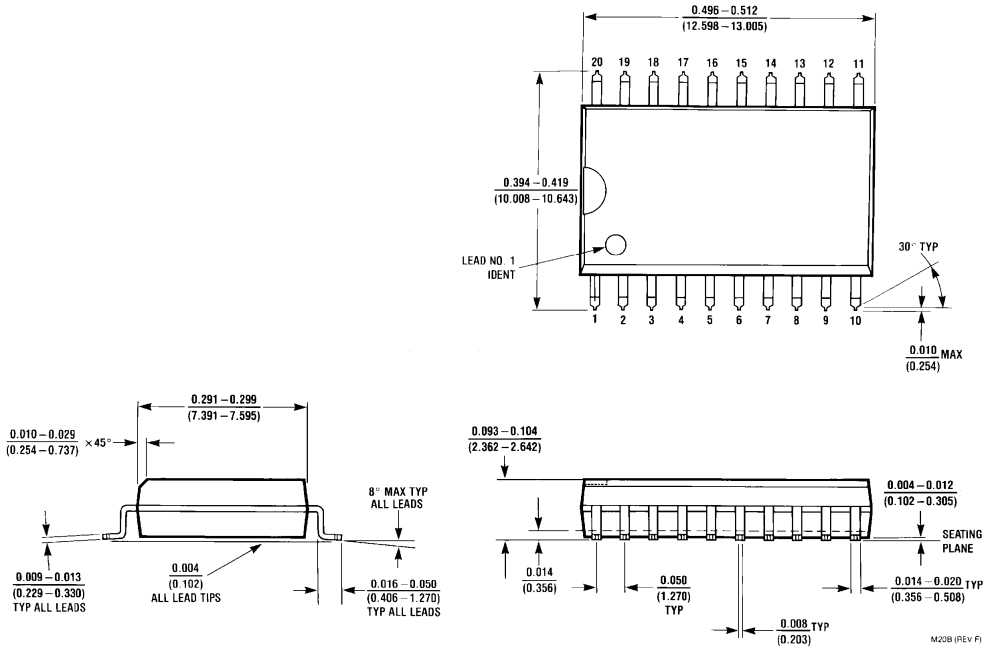


Appendix II—Physical Dimensions of Surface Mount Packages (Continued)

SO-16 (Wide)

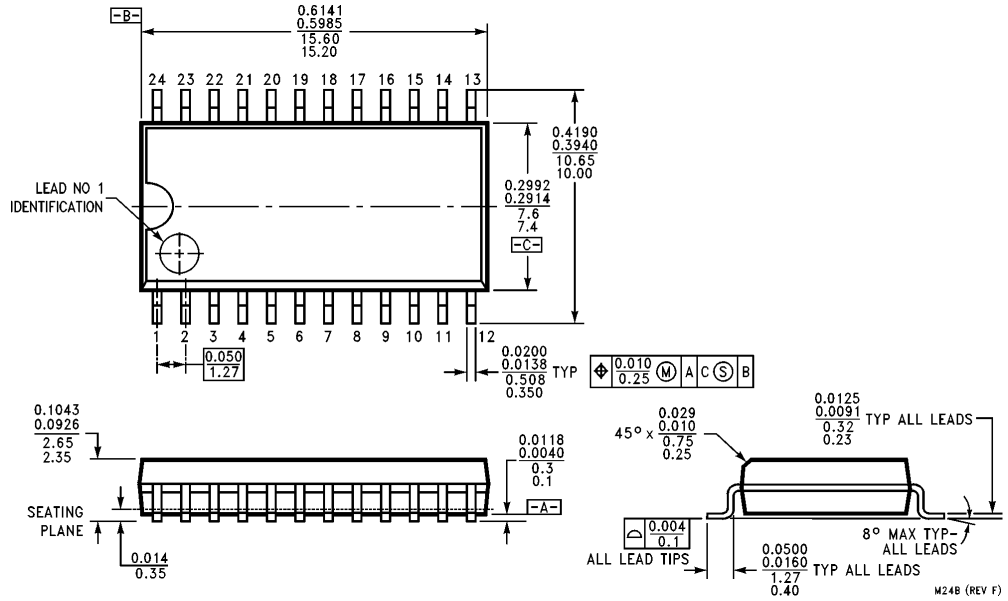


SO-20 (Wide)

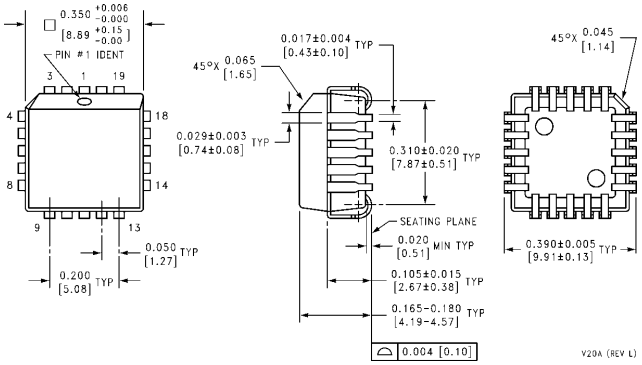


Appendix II—Physical Dimensions of Surface Mount Packages (Continued)

SO-24 (Wide)

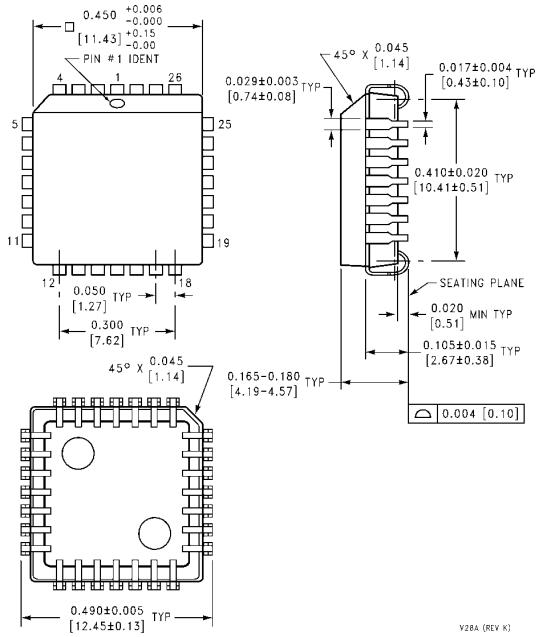


PLCC-20

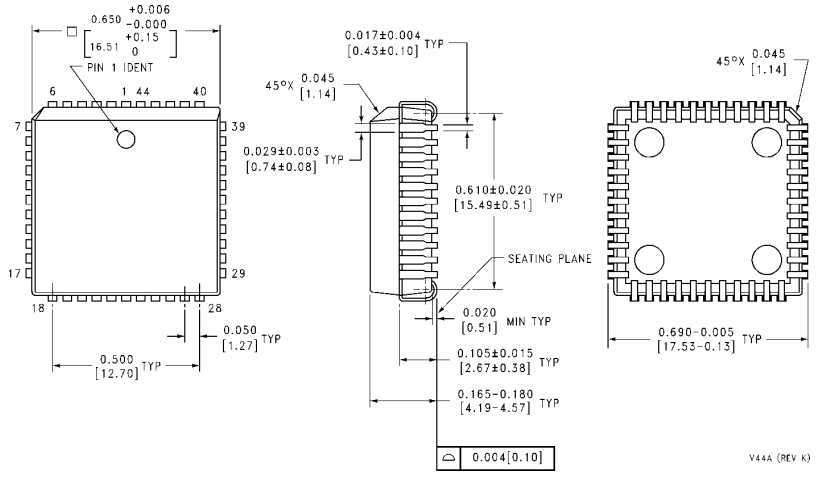


Appendix II—Physical Dimensions of Surface Mount Packages (Continued)

PLCC-28

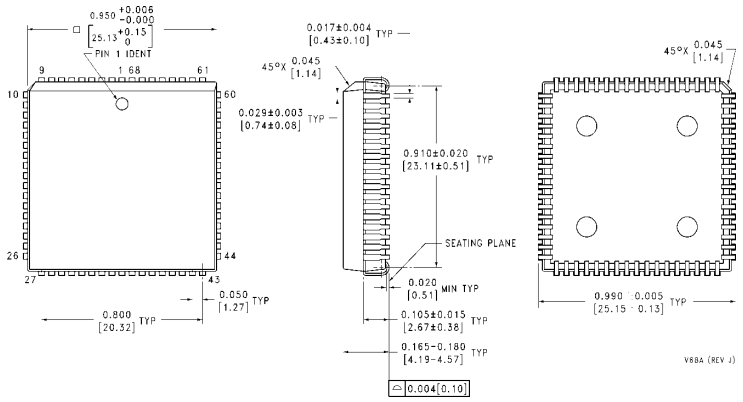


PLCC-44

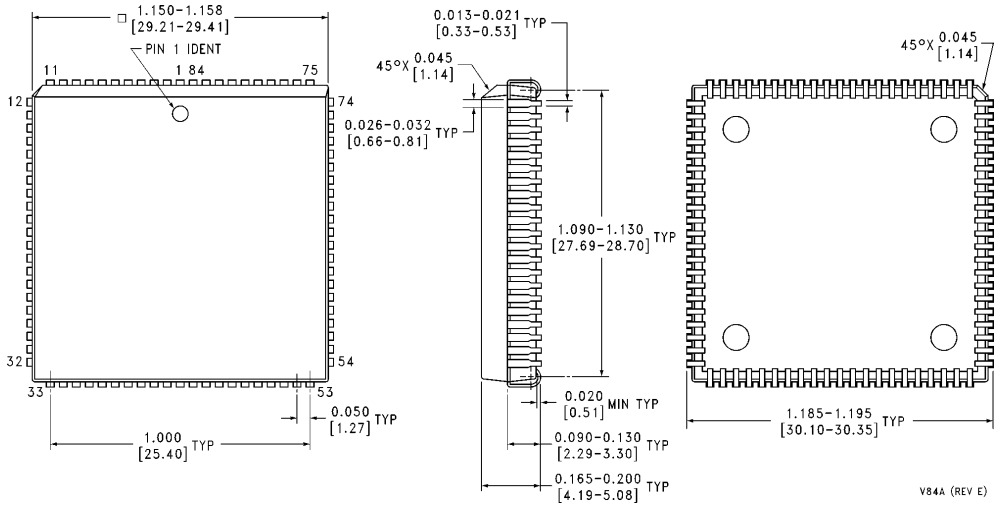


Appendix II—Physical Dimensions of Surface Mount Packages (Continued)

PLCC-68



PLCC-84



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