# Tape and Reel Packaging

## Introduction

The electronics industry is making a tremendous investment in surface-mount technology. The reasons for this investment include cost savings resulting from automated component placement and increased density of PCB layout due to smaller package sizes.

Today's placement machines can pick and place thousands of components per hour with a very high degree of accuracy. To achieve this performance, the component delivery system must be capable of feeding parts at high speeds in a consistent orientation, positively indexed to the demands of the machine. The leads of the components must be protected from damage during shipment, handling, and placement.

The preferred packing material available today for these demands is tape and reel. Analog Devices' tape and reel system is fully compatible with the detaping equipment that is standard in most automated placement equipment.

In the tape and reel format, the components are placed in specifically designed pockets embossed in a plastic carrier tape. The cover tape is sealed to the carrier tape to keep the parts in place in these pockets. A row of sprocket holes is provided along one edge of the embossed tape to facilitate positive indexing. The tape is then wound onto a rigid plastic reel that provides mechanical protection during handling and storage. These reels are dust-free and compatible with a clean environment.

## Specifications

Analog Devices' tape and reel specifications are in conformance with the EIA Standard 481 "Taping of Surface-Mount Components for Automatic Placement."

## ESD Protection

Analog Devices' tape and reel delivery system is designed to offer a very high degree of protection against electrostatic discharge (ESD). All tape and reel materials are static-dissipative. In addition, drypacked reels are shipped in moisture barrier bags; nondrypacked reels are shipped in a box with ESD conductive coating or in a conductive ESD bag. To retain the benefits of this protection, the bags should be opened only at ESD controlled workstations by trained personnel.

## Peel Back Strength

The peel back force will be between 10 *g* and 100 *g* for 8 mm wide tape and 10 *g* to 130 *g* for tapes 12 mm and wider when tested at room temperature and pulled at a 175° to 180° angle with a peel-off speed of 300 ± 10 mm/min.

## Direction of Feed

Direction of feed is defined as the direction in which the end user unreels the tape. The direction of feed for all products is counterclockwise when the reel is held with the round sprocket holes facing the observer.

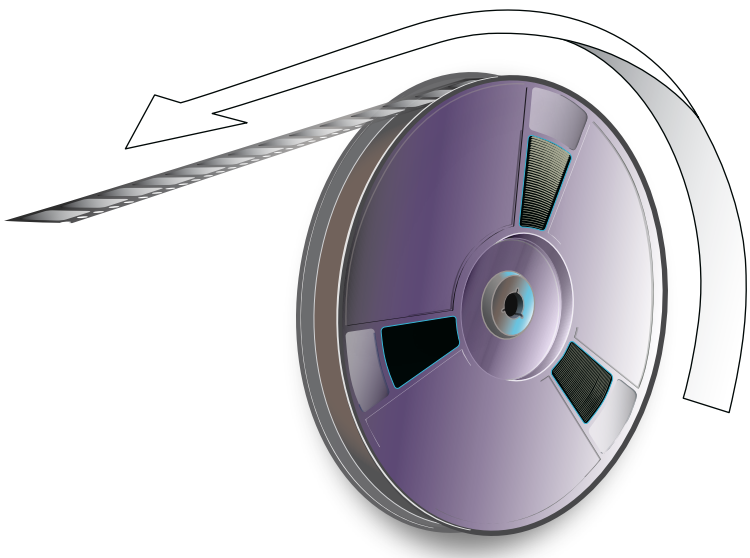


*Figure 1. Direction of feed.*

## Pin 1 Orientation

Devices are reeled so that Pin 1 is oriented properly with the direction of feed and round sprocket holes. Pin 1 orientation is denoted as C1 to C4, or M1, with respect to the direction of feed and round sprocket holes, as illustrated below.

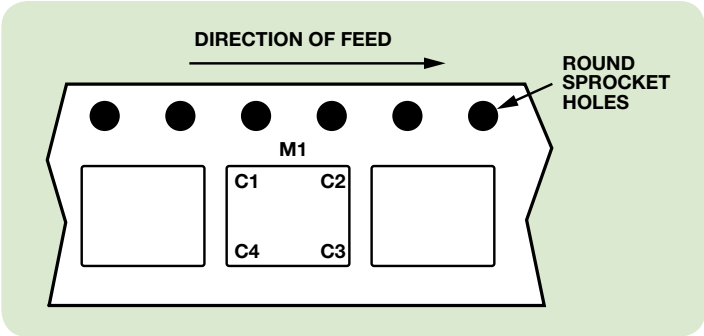



*Figure 2. Pin 1 orientation reference.*

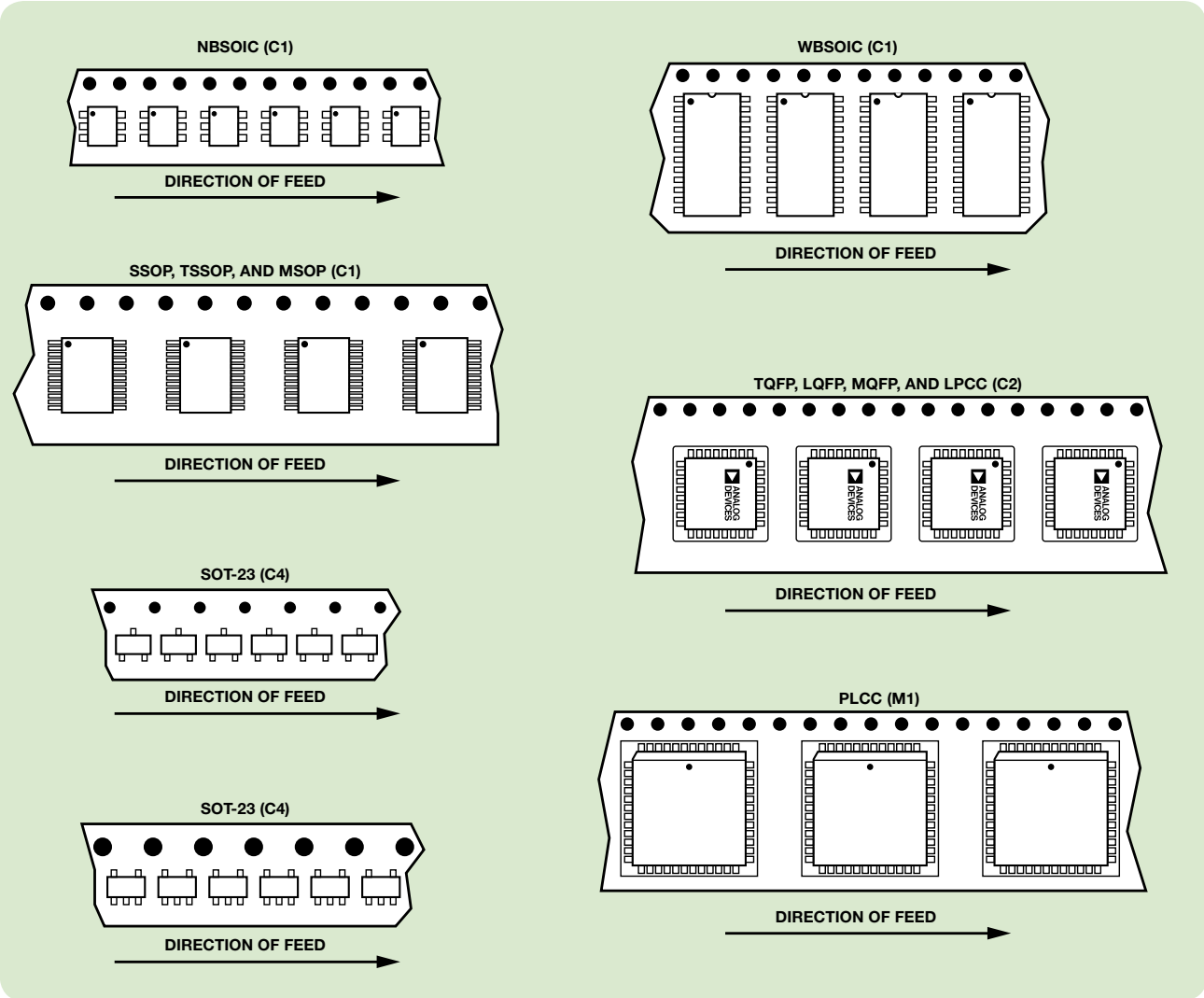



*Figure 3. Examples of standard Pin 1 orientation.*

## Table 1. Standard Package Tape and Reel (See Page 5 for Reel Definitions)

| Device Package Type | Package Designator | Body Size (mm) | Number of Leads | Reel Quantity | | | Tape Width (mm) | Tape Pitch (mm) | Pin 1 Orientation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 7" Reel | 13" Reel (4" Hub) | 13" Reel (6" Hub) | | | |
| PLCC | P | N/A | 20 | 250 | 1000 | N/A | 16 | 12 | M1 |
| PLCC | P | N/A | 28, 32 | Not offered | 750 | N/A | 24 | 16 | M1 |
| PLCC | P | N/A | 44 | Not offered | 500 | N/A | 32 | 24 | M1 |
| PLCC | P | N/A | 68 | Not offered | N/A | 250 | 44 | 32 | M1 |
| PLCC | P | N/A | 84 | Not offered | N/A | 250 | 44 | 36 | M1 |
| JLCC | J | N/A | 28 | Not offered | 250 | N/A | 24 | 16 | M1 |
| JLCC | J | N/A | 44 | Not offered | 500 | N/A | 32 | 24 | M1 |
| LCC | E | N/A | 8 | 250 | 3000 | N/A | 12 | 8 | M1 |
| SOIC_N/SOIC_N_EP | R/RD | N/A | 8 | 1000 | 2500 | N/A | 12 | 8 | C1 |
| SOIC_N/SOIC_N_EP | R/RD | N/A | 14, 16 | 1000 | 2500 | N/A | 16 | 8 | C1 |
| QSOP | RQ/RC | N/A | 16 | 1000 | 2500 | N/A | 12 | 8 | C1 |
| QSOP | RQ | N/A | 20, 24, 28 | 1000 | 2500 | N/A | 16 | 8 | C1 |
| SOIC_W/SOIC_W_BAT | RW/RB | N/A | 14, 16 | 400 | 1000 | N/A | 16 | 12 | C1 |
| SOIC_W/SOIC_W_BAT | RW/RB | N/A | 18 | 400 | 1000 | N/A | 24 | 16 | C1 |
| SOIC_W/SOIC_W_BAT | RW/RB | N/A | 20, 24 | 400 | 1000 | N/A | 24 | 12 | C1 |
| SOIC_W/SOIC_W_BAT | RW/RB | N/A | 28 | 400 | 1000 | N/A | 32 | 12 | C1 |
| SSOP | RS | N/A | 16, 20, 24 | 500 | 1500 | N/A | 16 | 12 | C1 |
| SSOP | RS | N/A | 28 | 500 | 1500 | N/A | 24 | 12 | C1 |
| PSOP2 | RP | N/A | 20, 28 | 200 | 1000 | N/A | 24 | 12 | C1 |
| PSOP3 | RR | N/A | 20 | Not offered | 750 | N/A | 24 | 20 | C1 |
| SOT_23_3 | RT | N/A | 3 | 3000 | 10,000 | N/A | 8 | 4 | C4 |
| SOT_23[1] | RJ/RT | N/A | 5, 6, 8 | 3000 | 10,000 | N/A | 8 | 4 | C4 |
| SOT-143 | RA | N/A | 4 | 3000 | 10,000 | N/A | 8 | 4 | C4 |
| TSOT | UJ | N/A | 5, 6, 8 | 3000 | 10,000 | N/A | 8 | 4 | C4 |
| SOT-223 | KC | N/A | 3 | 500 | 2500 | N/A | 16 | 12 | C4 |
| SC70 | KS | N/A | 3, 4, 5, 6 | 3000 | 10,000 | N/A | 8 | 4 | C4 |
| TSSOP_4.4 | RU/RE | N/A | 8, 14, 16, 20, 24, 28, 38 | 1000 | 2500 | N/A | 16 | 8 | C1 |
| TSSOP_6.1 | RV | N/A | 28, 48 | Not offered | 2500 | N/A | 24 | 12 | C1 |
| MSOP | RM/RH | N/A | 8, 10 | 1000 | 3000 | N/A | 12 | 8 | C1 |
| CERPAK | QC | N/A | 14 | Not offered | 750 | N/A | 24 | 16 | C1 |
| TQFP | SU/SV | 7 × 7 × 1.0 | All counts | 500 | 2000 | Not offered | 16 | 12 | C2 |
| TQFP | SU/SV | 10 × 10 × 1.0 | All counts | Not offered | 1500 | Not offered | 24 | 16 | C2 |
| TQFP | SU/SV | 12 × 12 × 1.0 | All counts | Not offered | 1000 | Not offered | 24 | 24 | C2 |
| TQFP | SU/SV | 14 × 14 × 1.0 | All counts | Not offered | 1000 | Not offered | 32 | 24 | C2 |
| LQFP | ST | 7 × 7 × 1.4 | All counts | 500 | 2000 | Not offered | 16 | 12 | C2 |
| LQFP | ST | 10 × 10 × 1.4 | All counts | Not offered | 1500 | Not offered | 24 | 16 | C2 |
| LQFP | ST | 12 × 12 × 1.4 | All counts | Not offered | 1000 | Not offered | 24 | 24 | C2 |
| LQFP | ST | 14 × 14 × 1.4 | All counts | Not offered | 1000 | Not offered | 32 | 24 | C2 |
| LQFP | ST | 14 × 20 × 1.4 | All counts | Not offered | 1000 | Not offered | 44 | 24 | C1 |

## Table 1. Standard Package Tape and Reel (Continued) (See Page 5 for Reel Definitions)

| Device Package Type | Package Designator | Body Size (mm) | Number of Leads | Reel Quantity | | | Tape Width (mm) | Tape Pitch (mm) | Pin 1 Orientation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 7" Reel | 13" Reel (4" Hub) | 13" Reel (6" Hub) | | | |
| MQFP | S | 10 × 10 × 2.0 | All counts | Not offered | 800 | Not offered | 24 | 24 | C2 |
| MQFP | S | 14 × 14 × 2.0 | All counts | Not offered | 600 | Not offered | 32 | 24 | C2 |
| MQFP[2] | S | 14 × 14 × 2.7 | All counts | Not offered | 500[2] | Not offered | 12 | 8 | C2 |
| CSP_BGA | BC | 5 × 5 | All counts | Not offered | 4000 | Not offered | 12 | 8 | C2 |
| CSP_BGA | BC | 6 × 6 | All counts | Not offered | 2500 | Not offered | 12 | 8 | C2 |
| CSP_BGA | BC | 7 × 7 | All counts | Not offered | 2000 | Not offered | 16 | 12 | C2 |
| CSP_BGA | BC | 8 × 8 | All counts | Not offered | 2000 | Not offered | 16 | 12 | C2 |
| CSP_BGA | BC | 9 × 9 | All counts | 500 | 2000 | Not offered | 16 | 12 | C2 |
| CSP_BGA | BC | 10 × 10 | All counts | 400 | 1500 | Not offered | 24 | 16 | C2 |
| CSP_BGA | BC | 12 × 12 | All counts | Not offered | 1500 | Not offered | 24 | 16 | C2 |
| CSP_BGA | BC | 13 × 13 | All counts | Not offered | 1000 | Not offered | 24 | 24 | C2 |
| CSP_BGA | BC | 17 × 17 | All counts | Not offered | 1000 | Not offered | 24 | 24 | C2 |
| BGA | B | 19 × 19 | All counts | Not offered | Not offered | 700 | 32 | 24 | C2 |
| BGA | B | 23 × 23 | All counts | Not offered | Not offered | 450 | 44 | 32 | C2 |
| BGA | B | 27 × 27 | All counts | Not offered | Not offered | 450 | 44 | 32 | C2 |
| BGA | B | 35 × 35 | All counts | Not offered | Not offered | 300 | 56 | 40 | C2 |
| CBGA | BG | 7 × 7 | 32 balls | Not offered | 500 | Not offered | 16 | 12 | C2 |
| LGA | CC | 3.5 × 4.5 | 24 | 1500 | 5000 | Not offered | 12 | 8 | C1 |
| LGA | CC | 6 × 8 | All counts | 1000 | 4000 | Not offered | 16 | 8 | C1 |
| LGA | CC | 8 × 10 | All counts | Not offered | 2000 | Not offered | 24 | 12 | C1 |
| LGA | CC | 10 × 10 | All counts | Not offered | 2000 | Not offered | 24 | 12 | C2 |
| LFCSP[4] | CP | 3 × 2 | All counts | 3000 | 10,000 | Not offered | 12 | 4 | C1 |
| LFCSP | CP | 3 × 3 | All counts | 1500 | 5000 | Not offered | 12 | 8 | C2 |
| LFCSP | CP | 4 × 4 | All counts | 1500 | 5000 | Not offered | 12 | 8 | C2 |
| LFCSP | CP | 4 × 5 | All counts | 1500 | 5000 | Not offered | 12 | 8 | C1 |
| LFCSP | CP | 5 × 5 | All counts | 1500 | 5000 | Not offered | 12 | 8 | C2 |
| LFCSP | CP | 6 × 6 | All counts | 750 | 2500 | Not offered | 16 | 12 | C2 |
| LFCSP | CP | 7 × 7 | All counts | 750 | 2500 | Not offered | 16 | 12 | C2 |
| LFCSP | CP | 8 × 8 | All counts | 750 | 2500 | Not offered | 16 | 12 | C2 |
| LFCSP | CP | 9 × 9 | All counts | 750 | 2500 | Not offered | 16 | 12 | C2 |
| LFCSP | CP | 10 × 10 | All counts | Not offered | 2000 | Not offered | 24 | 16 | C2 |
| LFCSP | CP | 5 × 5 × 1.45 | All counts | Not offered | 4000 | Not offered | 12 | 8 | C2 |
| LFCSP | CP | 4 × 4 × 1.45 | All counts | Not offered | 4000 | Not offered | 12 | 8 | C2 |
| LFCSP | CP | 3 × 5 × 1.45 | All counts | 1000 | 4000 | Not offered | 12 | 8 | C1 |
| LFCSP | CP | 2 × 3 × 0.75 | All counts | 3000 | 10,000 | Not offered | 12 | 4 | C2 |
| LFCSP | CP | 1.6×1.3×0.55 | All counts | 3000 | 10,000 | Not offered | 8 | 4 | C1 |
| LFCSP | CP | 2.1×2.1×0.55 | All counts | 3000 | 10,000 | Not offered | 8 | 4 | C1 |
| LFCSP | CP | 3 × 3 × 0.75 | All counts | 1500 | 5000 | Not offered | 12 | 8 | C2 |

[1]For SOT-23 packages with greater than three leads, use the RJ designator.
[2]Advantek part number Q14X14-HHX52.OP2 is the only approved carrier tape for this package. When boxing this reel, dunnage (crumpled kraft paper) shall be used between the reel.
[3]For bumped die or WLCSP packages, see Table 2. Orientation for these devices is as per EIA783 (bumps facing bottom of carrier cavity; Pin 1 towards sprocket holes).
[4]Standard thickness for LFCSP is 0.85 mm, except when noted.

## Table 2. WLCSP/Bumped Die Sales Tape and Reel

| Part Number | Device Package Type | Package Designator | Die Size X (µm) | Die Size Y (µm) | Die Size Z (µm) | Reel Quantity | | | Tape Width (mm) | Tape Pitch (mm) | Pin 1 Orientation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 7" Reel | 13" Reel (4" Hub) | 13" Reel (6" Hub) | | | |
| ADG3304 | WLCSP | CB | 1610 | 2010 | 655 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| ADG787 | WLCSP | CB | 1500 | 2000 | 655 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| ADG819 | WLCSP | CB | 1140 | 2180 | 605 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| ADG884 | WLCSP | CB | 1500 | 2000 | 655 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| ADG888 | WLCSP | CB | 2000 | 2000 | 655 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| ADL5500[1] | WLCSP | CB | 1000 | 1000 | 596 | 250 | 3000 | 10,000 | 8 | 4 | C1 |
| ADM8834 | WLCSP | CB | 2000 | 2000 | 605 | N/A | 4000 | 15,000 | 8 | 4 | C1 |
| AD6548 | Bumped chip | CD | 3240 | 3140 | 350 | N/A | N/A | 3000 | 12 | 8 | C2 |
| AD7877 | WLCSP | CB | 2765 | 2545 | 600 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| AD8205 | CHIP | C | 1650 | 1650 | 710 | N/A | 4000 | 10,000 | 8 | 4 | C1 |
| AD8311/AD8312 | WLCSP | CB | 1000 | 1500 | 596 | 250 | 3000 | N/A | 8 | 4 | C1 |
| AD8605 | WLCSP | CB | 940 | 1330 | 496 | N/A | 4000 | 15,000 | 8 | 4 | C1 |
| AD9938 | Bumped chip | CD | 2675 | 4290 | 501 | N/A | 3000 | N/A | 12 | 4 | C1 |
| AD5801 | WLCSP | CB | 3270 | 3170 | 655 | N/A | 1500 | 5000 | 12 | 8 | C4 |
| AD5801[2] | WLCSP | CB | 3270 | 3170 | 555 | N/A | 1500 | 5000 | 12 | 8 | C4 |
| AD5398 | WLCSP | CB | 1515 | 1690 | 655 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| AD9948/AD9949 | WLCSP | CB | 2710 | 3360 | 563 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| ADG3308 | WLCSP | CB | 1960 | 2460 | 600 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| ADG790 | WLCSP | CB | 2500 | 3000 | 656 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| AD5806 | WLCSP | CB | 2500 | 2500 | 656 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| ADAU1301 | Bumped chip | CD | 1275 | 875 | 350 | N/A | 5000 | 10,000 | 8 | 4 | C1 |
| AD5820 | WLCSP | CB | 1035 | 1500 | 656 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| AD5820[2] | WLCSP | CB | 1035 | 1500 | 555 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| AD5805 | WLCSP | CB | 1170 | 1890 | 505 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| AD15/AD416 | WLCSP | CB | 1960 | 2460 | 600 | N/A | 3000 | 10,000 | 8 | 4 | C2 |
| AD5821 | WLCSP | CB | 1515 | 1690 | 655 | N/A | 3000 | 10,000 | 8 | 4 | C1 |
| ADV7521 | WLCSP | CB | 3500 | 3500 | 605 | N/A | 1500 | 5000 | 12 | 8 | C1 |

[1]C-Pak part number 4205418-2/A (BD0090X0090) is the only approved carrier tape for the ADL5500 WLCSP.
[2]Special carrier tapes exist for these products, where the required wafer thickness is 12 mil and the required spheres are 250 µm.

## Table 3. Small Quantity Reel

| Device Package Type | Package Designator | Body Size (mm) | Number of Leads | Reel Quantity | Tape Width (mm) | Tape Pitch (mm) | Pin 1 Orientation |
|---|---|---|---|---|---|---|---|
| | | | | 7" Reel | | | |
| SOT-23 | RT | N/A | 3 | 250 | 8 | 4 | C4 |
| SOT-23[1] | RJ/RT | N/A | 5, 6, 8 | 250 | 8 | 4 | C4 |
| SOT-143 | RT | N/A | 4 | 250 | 8 | 4 | C4 |
| SC70 | KS | N/A | 3, 4, 5, 6 | 250 | 8 | 4 | C4 |
| MSOP | RM | N/A | 8, 10 | 250 | 12 | 8 | C1 |
| WLCSP[2] | CB | N/A | All counts | 250 | See Table 2 | See Table 2 | See Table 2 |
| LFCSP | CP | 3 × 2 | All counts | 250 | 12 | 4 | C1 |
| LFCSP | CP | 3 × 3 | All counts | 250 | 12 | 8 | C2 |
| LFCSP | CP | 4 × 4 | All counts | 250 | 12 | 8 | C2 |
| LFCSP | CP | 5 × 5 | All counts | 250 | 12 | 8 | C2 |

[1]For SOT-23 packages prior to Rev. W, all products and lead counts use RT. For SOT-23 packages from Rev. W, all new products with greater than three leads use the RJ designator.
[2]For actual WLCSP products available in small quantity reels, please cross reference with "7" reel (small quantity)" column of Table 2.

## Glossary

**REEL7 (aka R7 or RL7)**

This is a 7" reel. Quantities vary based on package size.

**Reel (aka RL or R)**

This is a 13" reel. Quantities vary based on package size.

**Waffle Pack**

A small 2" × 2" tray designed to contain a small quantity of product in small packages, such as LFCSP, and in die forms like bare die, bumped chip, and WLCSPs.

**Analog Devices, Inc.**
**Worldwide Headquarters**
Analog Devices, Inc.
One Technology Way
P.O. Box 9106
Norwood, MA 02062-9106
U.S.A.
Tel: 781.329.4700
(800.262.5643,
U.S.A. only)
Fax: 781.461.3113

**Analog Devices, Inc.**
**Europe Headquarters**
Analog Devices, Inc.
Wilhelm-Wagenfeld-Str. 6
80807 Munich
Germany
Tel: 49.89.76903.0
Fax: 49.89.76903.157

**Analog Devices, Inc.**
**Japan Headquarters**
Analog Devices, KK
New Pier Takeshiba
South Tower Building
1-16-1 Kaigan, Minato-ku,
Tokyo, 105-6891
Japan
Tel: 813.5402.8200
Fax: 813.5402.1064

**Analog Devices, Inc.**
**Southeast Asia**
**Headquarters**
Analog Devices
22/F One Corporate Avenue
222 Hu Bin Road
Shanghai, 200021
China
Tel: 86.21.2320.8000
Fax: 86.21.2320.8222

©2013 Analog Devices, Inc. All rights reserved.
Trademarks and registered trademarks are the
property of their respective owners.

T03762-0-1/13(J)

**www.analog.com**

ANALOG DEVICES