Marking

Because of the limited space available for part marking on some SMT packages, abbreviated marking codes are used to identify the device. These codes, if used, are identified in the individual SMT package data sheets.

Lead Finish and Solderability

Standard lead finish is electroplated PbSn (15% Pb/85% Sn). LTC offers 100% matte tin lead finish upon request. Both are electroplated with < 0.05% carbon content. Solderability meets the requirements of MIL-STD-883C, Method 2003. Recommended minimum solder pad dimensions are given with each package. (Note: Consideration should be given to your process and power requirements.)

Wave and Reflow Soldering

Following are the recommended procedures for soldering surface mount packages to PC boards.

1. Wave Soldering

- Use solder plating boards.
- Dispense adhesive to hold components on board.
- Place components on board.
- Cure adhesive per adhesive manufacturer's specification.
- Preheat package temperature shall be between 100°C and 130°C.
- Foam flux using RMA (Rosin Mildly Activating) flux.
- Wave solder using a dual wave soldering system at 230°C to 250°C for 2 seconds per wave.
- Clean board.
- **Wave soldering is not recommended for SOT-223, QFN and DFN packages.**

2. Reflow Soldering (PbSn and Matte Tin Lead Finish)

Note: LTC offers products with either PbSn or pure matte tin lead finish. Both finishes are compatible with typical PbSn and SnAgCu pastes. See matte tin (Pb free) update at www.linear.com/about/pbfree.html.

- Screen solder paste on board.
- Mount components on board.
- Infrared or forced hot air convection reflow is recommended for best performance. Parameters:
  - Preheat peak temperature 135°C ± 15°C and 2°C to 4°C per second rise
  - Time above reflow temperature:
    PbSn (37/63) Paste 183°C – 140 seconds
    SnAgCu (95.5/4/0.5) Paste 217°C – 140 seconds
  - Peak package body temperature:
    PbSn Paste 220°C to 245°C
    SnAgCu Paste 245°C to 255°C
  - Dwell time at peak temperature 10 to 15 seconds
  - Cooling rate 2°C to 4°C per second
- Clean boards.
- For Vapor Phase Reflow (PbSn), recommended parameter ranges for:
  - Heating rate: 4°C per second max
  - Preheat temperature: 45°C to 80°C
  - Time above 200°C: 50 seconds to 90 seconds
  - Peak package temperature: 212°C to 219°C

3. Hand Soldering

- **Hand soldering of packages is not recommended.**

Dry Pack in Moisture Barrier Bags

In the event of a requirement for Dry Pack, LTC employs as a guideline the methods of IPC-SM-786A, Procedures for Characterization of Moisture/Reflow Sensitive ICs.

Thermal Information

Table 1 shows the range of junction-to-ambient thermal resistance of SO devices mounted on a PCB of FR4 material with copper traces, in still air at 25°C. θ_{JA} with a ceramic substrate is about 70% of the FR4 value. Maximum power dissipation may be calculated by the following formula:

$$P_{DMAX}\left(T_A\right) = \frac{T_{JMAX} - T_A}{\theta_{JA}}$$

where,

T_{JMAX} = Maximum operating junction temperature.
T_A = Desired ambient operating temperature.
θ_{JA} = Junction-to-ambient thermal resistance.

Table 1. Typical Thermal Resistance Values

SO-8	150°C/W to 200°C/W	SO-18	70°C/W to 100°C/W
SO-14	100°C/W to 140°C/W	SO-20	70°C/W to 90°C/W
SO-16 (0.150)	90°C/W to 130°C/W	SO-24	60°C/W to 80°C/W
SO-16 (0.300)	85°C/W to 100°C/W	SO-28	55°C/W to 75°C/W

Conditions: PCB mount on FR4 material, still air at 25°C, copper trace.

Thermal resistance for power packages (DD and SOT-223) depends greatly on the individual device type. Please consult the device data sheets for thermal information.

More current data, by device type, may be obtained by contacting LTC, Marketing Department.

Tape and Reel Packing (See Tape and Reel Section)

Plastic Tube Packing

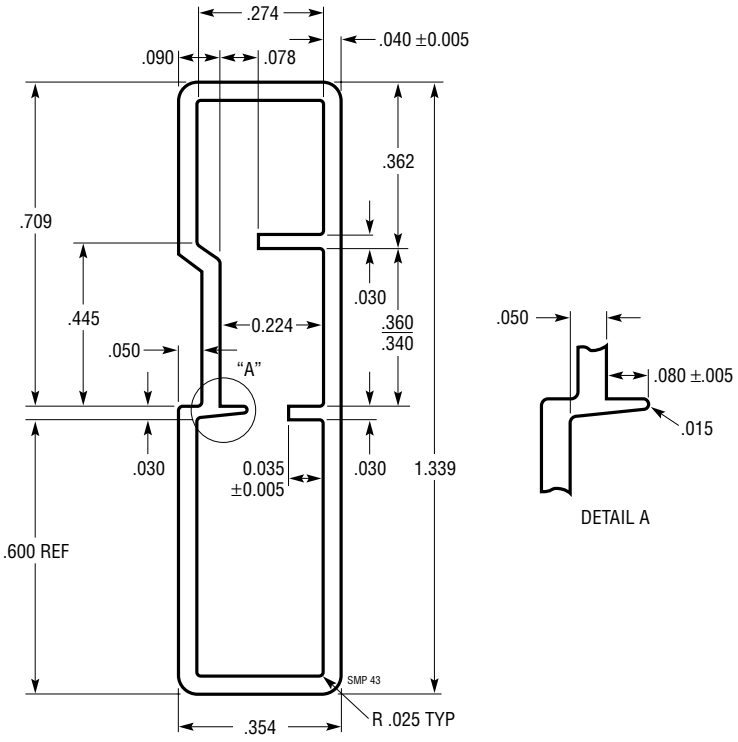
LTC's Surface Mount products are packed in "antistatic" plastic tubes with the tube dimensions indicated in Figure 2. Unit quantities packaged per tube are listed below in Table 2.

Table 2. Devices Per Tube

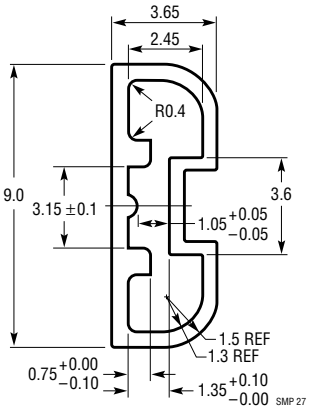
LTC Package Code Designator	LTC Package Type	Actual Lead Count	Number of Units
DD	DFN (3mm × 3mm)	8, 10	121
DE, UE	DFN (4mm × 3mm)	12, 14	91
DH	DFN (5mm × 5mm)	16	73
DHC	DFN (5mm × 3mm)	16	73
DHD	DFN (5mm × 4mm)	16	73
F	TSSOP (4.4mm)	20	74
F, FE	TSSOP (4.4mm)	14/16	94
FW	TSSOP (6.1mm)	48	39
FW	TSSOP (6.1mm)	56	35
G	SSOP (5.3mm)	16	77
G	SSOP (5.3mm)	20	66
G	SSOP (5.3mm)	24	59
G	SSOP (5.3mm)	28	47
G	SSOP (5.3mm)	36	37
GN	SSOP (0.150)	16	100
GN	SSOP (0.150)	20, 24	55
GW	SSOP (7.62mm)	36	32
GW	SSOP (7.62mm)	44	27
MS8, MS8E	MSOP (0.118)	8	50
MS, MSE	MSOP (0.118)	10	50
M, Q, R	DD	3, 5, 7	50
S8	SO (0.150)	8	100
S	SO (0.150)	14	55
S	SO (0.150)	16	50
ST	SOT-223	3	78
SW	SO (0.300)	16	47
SW	SO (0.300)	18	40
SW	SO (0.300)	20	38
SW	SO (0.300)	24	32
SW	SO (0.300)	28	27
UD	QFN (3mm)	16	121
UF	QFN (4mm)	16, 20, 24	91
UH	QFN (5mm)	32	73
UHF	QFN (5mm × 7mm)	38	52
UK	QFN (7mm × 7mm)	48	52
UP	QFN (9mm × 9mm)	64	40

PLASTIC TUBE SPECIFICATIONS

DD Pak
M, Q, R Package Shipping Tube

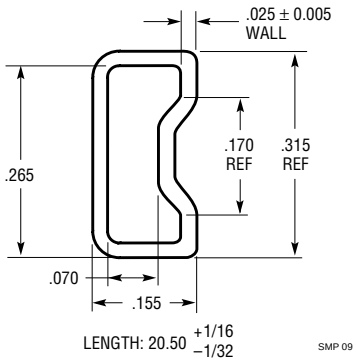


MSOP
MS8 Package Shipping Tube



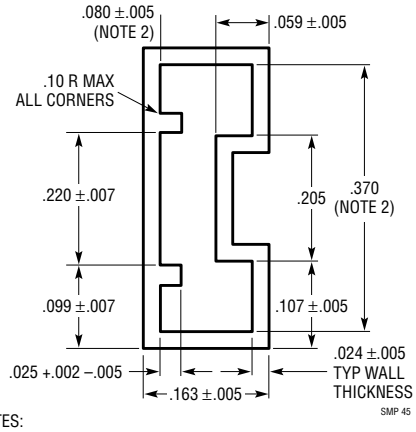
NOTE: ALL DIMENSIONS ARE IN MILLIMETERS
TYP RADIUS: 0.2
MATERIAL THICKNESS: 0.6
MSOP 8LD POLYCARBONATE TUBE TO BE ANTISTATIC COMPLIANT PER LTC SPEC 01-99-0001

S (0.150)
SO Package Shipping Tube



NOTE: ALL DIMENSIONS ARE IN INCHES

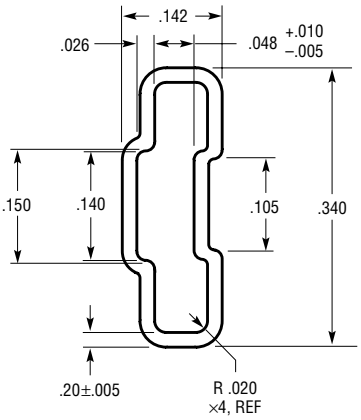
SSOP
G Package Shipping Tube



NOTES:
1. UNITS ARE IN INCHES
2. CRITICAL DIMENSIONS
3. TUBES TO BE TRANSPARENT RIGID PVC
4. TUBE STRAIGHTNESS .030 INCH MAX PER LENGTH OF TUBE
5. FINISH TO BE TREATED WITH ANTISTATIC COATING
6. MARK "ANTISTATIC 5.3mm SSOP" AT LOCATION INDICATED ON DRAWING
7. ITW REFERENCE DRAWING NUMBER: O-GT0651-14
8. PLUG TYPE: BLACK END PLUG #50-3111 (NONTESTED)
   GREEN END PLUG #50-3116 (TESTED)
9. WHEN APPLICABLE, A BIDIRECTIONAL LABEL OF THE RECYCLE DATE AND SYMBOL SHALL BE PRINTED IN GREEN ON THE PRINT SIDE AT THE TUBE RIGHT

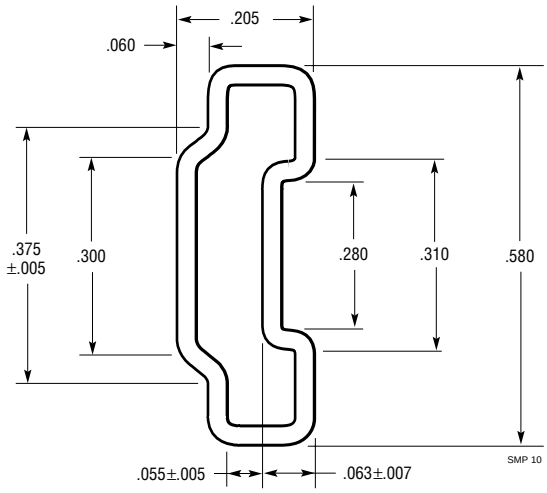
PLASTIC TUBE SPECIFICATIONS

ST
SOT-223 Package Shipping Tube



NOTE: ALL DIMENSIONS ARE IN INCHES

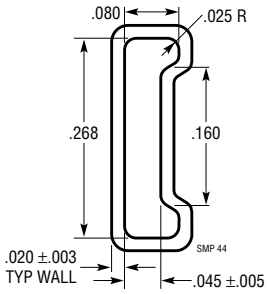
SW (0.300)
SO Package Shipping Tube



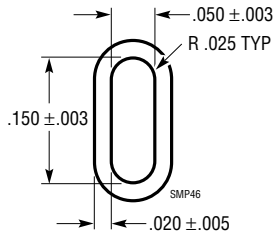
LENGTH: 20.75 +1/32 –1/16

NOTE: ALL DIMENSIONS ARE IN INCHES, ±0.010 UNLESS OTHERWISE SPECIFIED
MATERIAL: ANITSTATIC TREATED RIGID TRANSPARENT PVC OR RIGID BLACK CONDUCTIVE
PRINTING: "LTC LOGO, LINEAR TECHNOLOGY CORP., ANTISTATIC" ON TOPSIDE OF TUBE

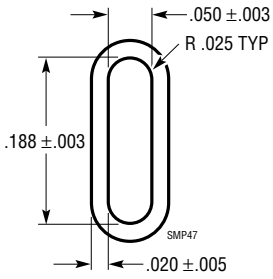
TSSOP
F, FE Package Shipping Tube



DD (4mm × 3mm), DE (4mm × 3mm)
UE (4mm × 3mm), UD (3mm × 3mm)
DFN/QFN Package Shipping Tube



UF (4mm × 4mm)
QFN Package Shipping Tube



UH (5mm × 5mm)
QFN Package Shipping Tube