

## PROGRAMMABLE PRECISION REFERENCE

## LTL432ATLT1G

**Description**

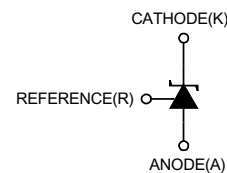
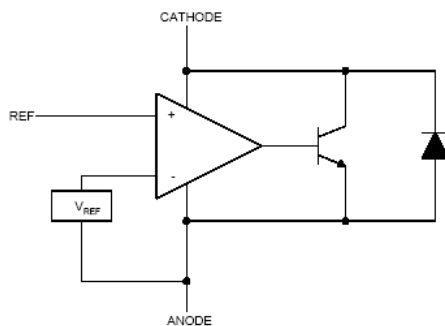
The LTL432ATLT1G is a three-terminal adjustable regulator with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between  $V_{REF}$  (approximately 1.24V) and 18V with two external resistors. It provides very wide applications, including shunt regulator, series regulator, switching regulator, voltage reference and others.



1: Cathode; 2: Ref; 3: Anode

**Features:**

- Precise Reference Voltage to 1.24V
- Guaranteed 0.5% Reference Voltage Tolerance
- Sink Current Capability, 55 $\mu$ A to 100mA
- Quick Turn-on
- Adjustable Output Voltage,  $V_o = V_{REF}$  to 18V
- 0.05 $\Omega$  Typical Output Impedance
- We declare that the material of product is ROHS compliant and does not contain any Br, Cl, and Sb203
- ESD HBM 7000V



### Absolute Maximum Ratings

| Symbol    | Parameter                            | Rating      | Unit |
|-----------|--------------------------------------|-------------|------|
| $V_{KA}$  | Cathode voltage                      | 20          | V    |
| $I_K$     | Continuous cathode current range     | 100         | mA   |
| $I_{REF}$ | Reference current range              | 10          | mA   |
| $T_j$     | Operating Junction Temperature Range | 150         | °C   |
| $T_{opr}$ | Operating Ambient Temperature        | - 20 to 125 | °C   |

### Electrical Characteristics (Typical and limits apply for $T_j=25^\circ\text{C}$ unless otherwise noted.)

| Characteristic   |      | Test Circuit | Symbol                                 | Test conditions   | MIN          | TYP   | MAX   | UNIT          |
|--|------|--------------|--|---|--------------|-------|-------|---------------|
| Reference Voltage  | 0.5% | 3            | $V_{REF}$                              | $V_{KA}=V_{REF}, I_{KA}=10\text{mA}$  | 1.234        | 1.240 | 1.246 | V             |
|  | 1%   |              |  |   | 1.228        | 1.240 | 1.252 |               |
| Deviation of Reference Voltage Over-Temperature            |      | 3            | $\Delta V_{REF}$                       | $V_{KA}=V_{REF}$<br>$I_{KA}=10\text{mA}$  | 0 to 70°C    | 2     | 10    | mV            |
|  |      |              |  |   | -20 to 125°C | 3     | 15    |               |
| Ratio of Change in VREF to the Change in Cathode Voltage   |      | 4            | $\frac{\Delta V_{REF}}{\Delta V_{KA}}$ | $I_{KA}=10\text{mA}$ ,<br>$\Delta V_{KA}: V_{REF}$ to 16V                       |              | -0.5  | -1.5  | mV/V          |
| Reference Input Current                                    |      | 4            | $I_{REF}$                              | $I_{KA}=10\text{mA}$ , $R1=10\text{K}\Omega$ , $R2=\infty$                      |              | 0.15  | 0.4   | $\mu\text{A}$ |
| Deviation of Reference Current Over Full Temperature Range |      | 4            | $\Delta I_{REF}$                       | $I_{KA}=10\text{mA}$ , $R1=10\text{K}\Omega$ , $R2=\infty$<br>$T_A=-20$ to 85°C |              | 0.1   | 0.4   | $\mu\text{A}$ |
| Minimum Cathode Current for Regulation                     |      | 3            | $I_{KA(MIN)}$                          | $V_{KA}=V_{REF}$  |              | 55    | 80    | $\mu\text{A}$ |
| Off-State Cathode Current                                  |      | 5            | $I_{KA(OFF)}$                          | $V_{REF}=0$ , $V_{KA}=18\text{V}$   |              | 0.04  | 0.50  | $\mu\text{A}$ |
|  |      |              |  | $V_{KA}=6\text{V}$ , $V_{REF}=0$  |              | 0.01  | 0.05  |               |
| Dynamic Impedance  |      | 3            | $Z_{KA}$                               | $V_{KA}=V_{REF}$ , $I_{KA}=1$ to 100mA<br>$f \leq 1.0\text{kHz}$                |              | 0.05  | 0.15  | $\Omega$      |

### Classification of Vref and package

| Device        | Marking | RanK | Vref(V) |
|---------------|---------|------|---------|
| LTL432ATLT1G  | 432     | 1.0% | 1.24    |
| LTL432BTLT1G  |         | 0.5% | 1.24    |
| LTL432APTLT1G |         | 1.0% | 1.25    |
| LTL432BPTLT1G |         | 0.5% | 1.25    |

Package: SOT23

### TEST CIRCUIT

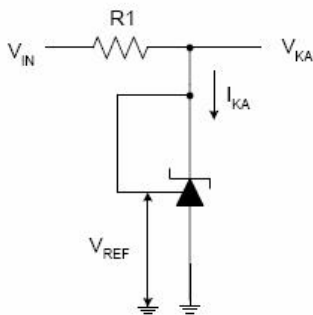


Figure 3 Test Circuit 3 for  $V_{KA}=V_{REF}$

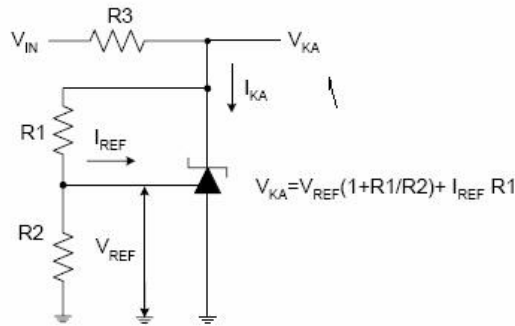


Figure 4. Test Circuit 4 for  $V_{KA}>V_{REF}$

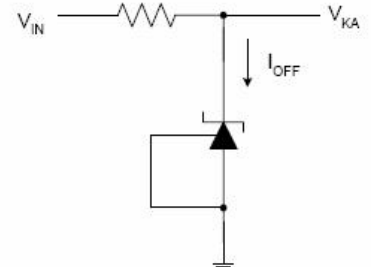


Figure 5. Test Circuit 5 for  $I_{OFF}$

### TYPICAL PERFORMANCE CHARACTERISTICS

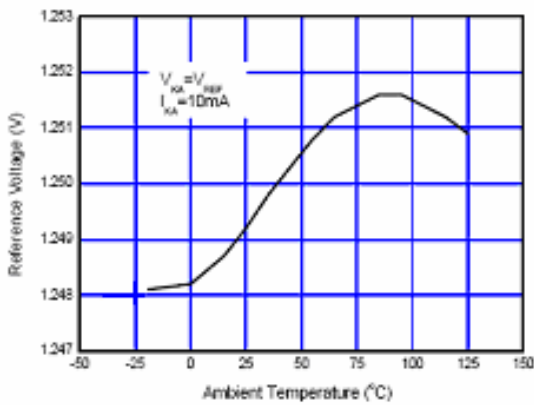


Figure 6. Reference Voltage vs. Ambient Temperature

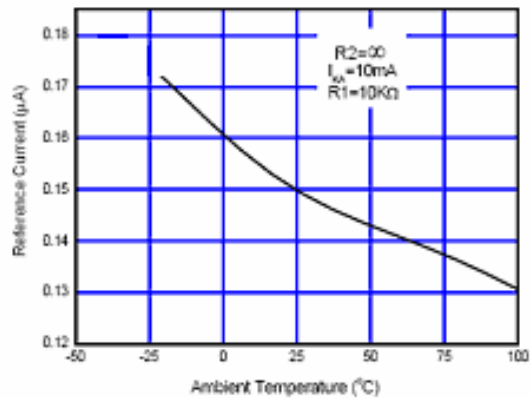


Figure 7. Reference Current vs. Ambient Temperature

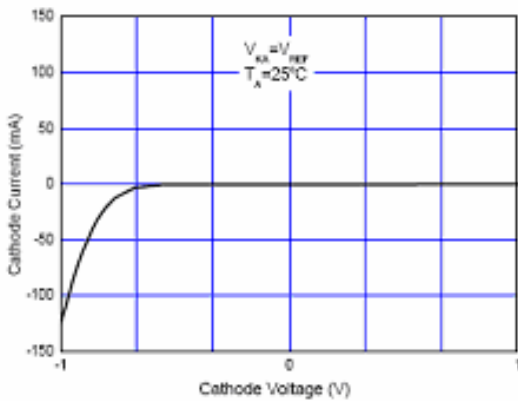


Figure 8. Cathode Current vs. Cathode Voltage

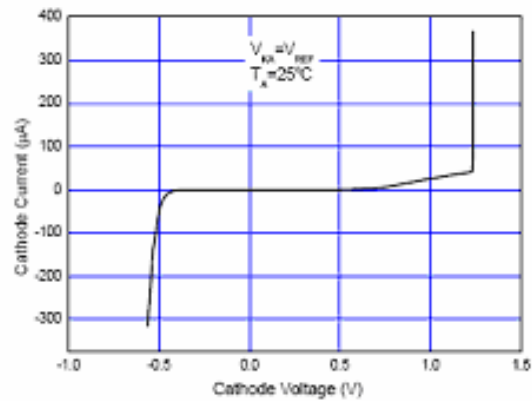


Figure 9. Current vs. cathode Voltage

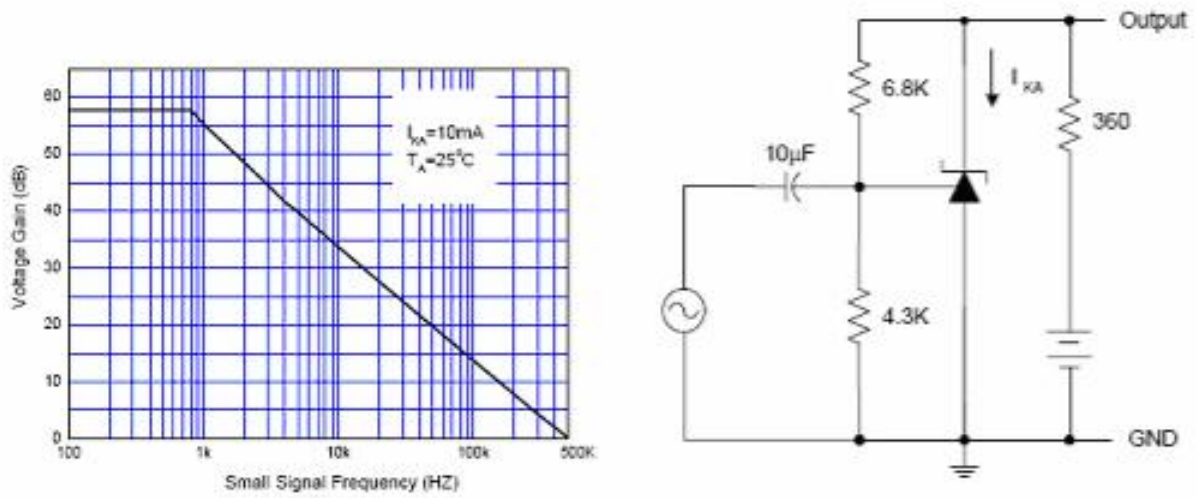


Figure 10. Small Signal Voltage Gain vs. Frequency

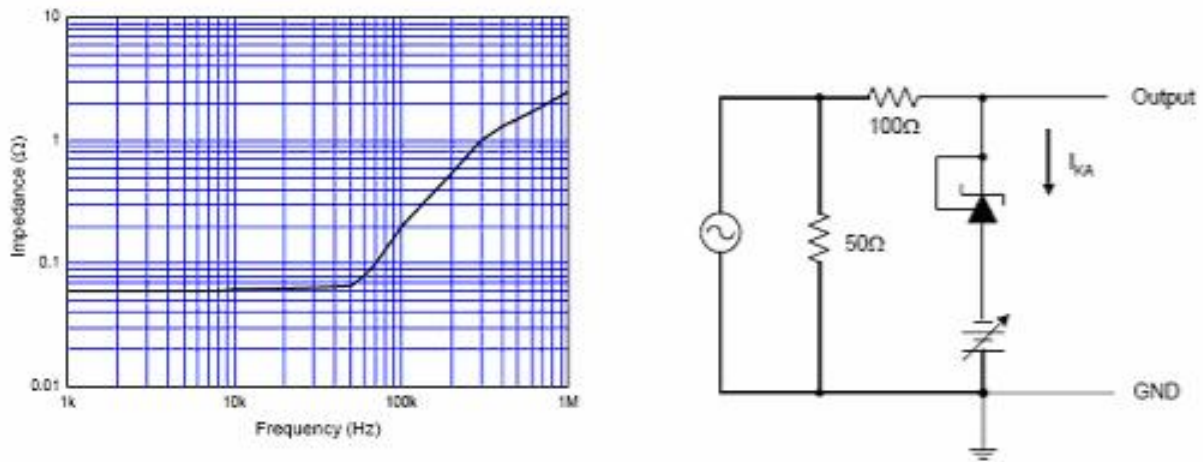


Figure 11. Dynamic Impedance vs. Frequency

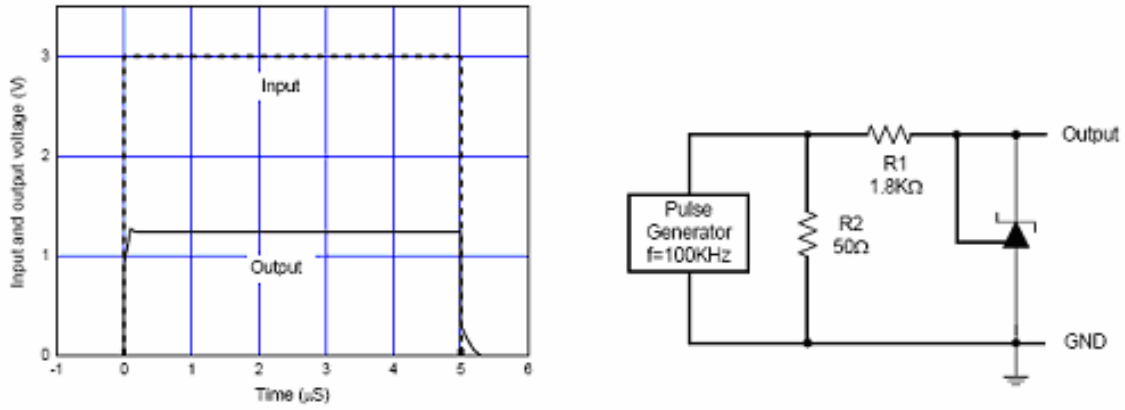


Figure 12. Pulse Response of Input and Output Voltage

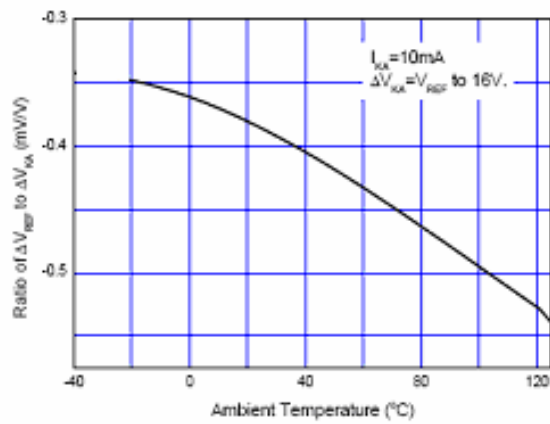


Figure 13. Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage vs. Ambient Temperature

TYPICAL APPLICATIONS

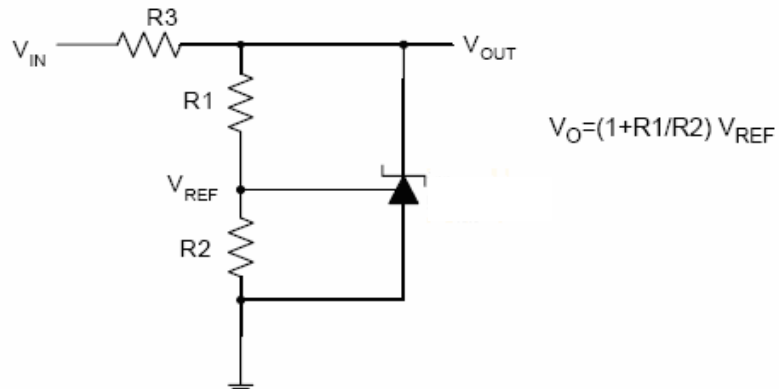


Figure 14: Shunt Regulator

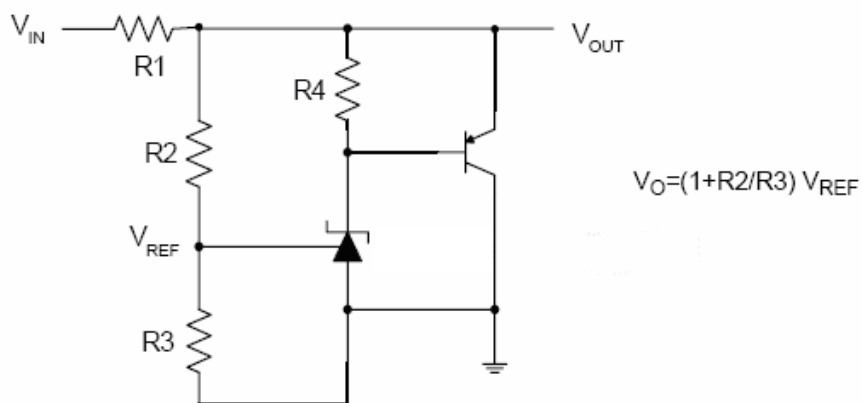


Figure 15: High Current Shunt Regulator

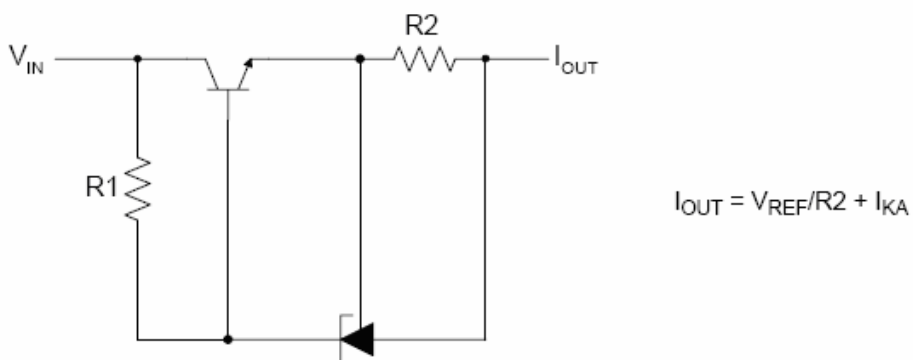


Figure 16: Current Source or Current Limit

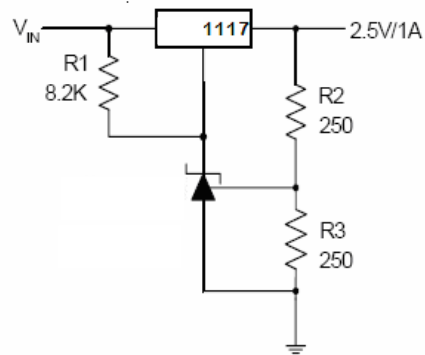


Figure 17 Precision 2.5V/1A Regulator

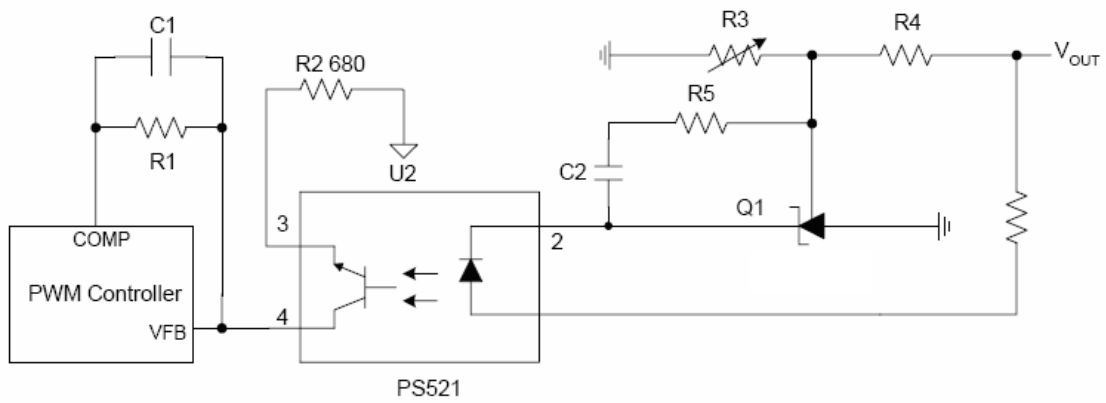
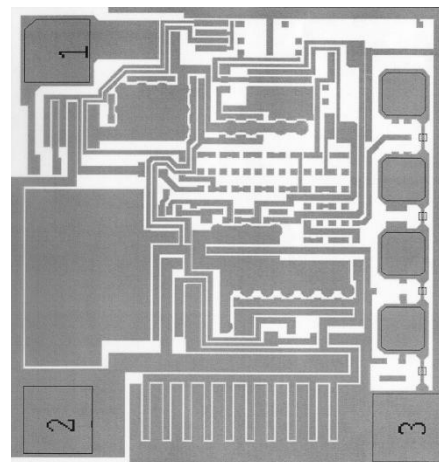
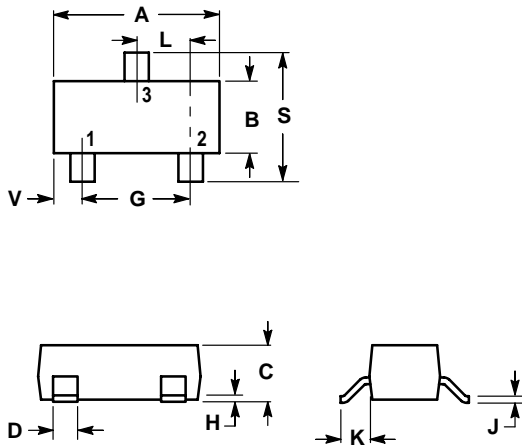


Figure 18: PWM Converter with Reference

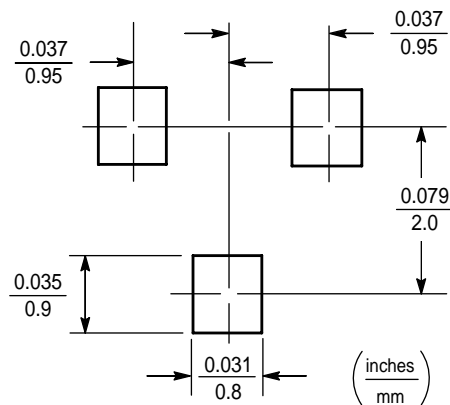

 Chip Size(before saw) : 0.72 \* 0.68 (mm)<sup>2</sup>

**SOT-23**
**NOTES:**

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



| DIM | INCHES |        | MILLIMETERS |       |
|-----|--------|--------|-------------|-------|
|     | MIN    | MAX    | MIN         | MAX   |
| A   | 0.1102 | 0.1197 | 2.80        | 3.04  |
| B   | 0.0472 | 0.0551 | 1.20        | 1.40  |
| C   | 0.0350 | 0.0440 | 0.89        | 1.11  |
| D   | 0.0150 | 0.0200 | 0.37        | 0.50  |
| G   | 0.0701 | 0.0807 | 1.78        | 2.04  |
| H   | 0.0005 | 0.0040 | 0.013       | 0.100 |
| J   | 0.0034 | 0.0070 | 0.085       | 0.177 |
| K   | 0.0140 | 0.0285 | 0.35        | 0.69  |
| L   | 0.0350 | 0.0401 | 0.89        | 1.02  |
| S   | 0.0830 | 0.1039 | 2.10        | 2.64  |
| V   | 0.0177 | 0.0236 | 0.45        | 0.60  |



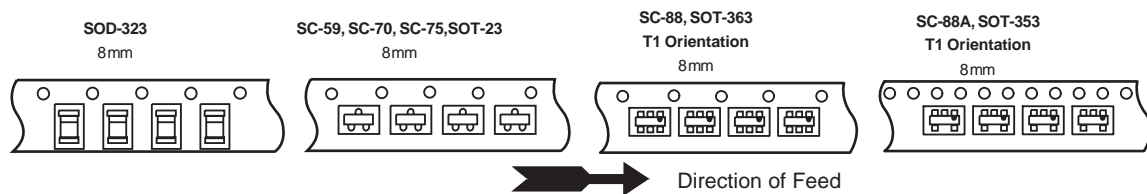


## Tape & Reel and Packaging Specifications

Embossed Tape and Reel is used to facilitate automatic pick and place equipment feed requirements. The tape is used as the shipping container for various products and requires a minimum of handling. The antistatic/conductive tape provides a secure cavity for the product when sealed with the “peel-back” cover tape.

- Two Reel Sizes Available (7"and 13",)
- Used for Automatic Pick and Place Feed Systems
- Minimizes Product Handling
- EIA 481, -1, -2
- SOT-23, SC-70/SOT-323,
- SC-89, SC-88/SOT-363, SC-88A/SOT-353,
- SOD-323, SOD-523 in 8 mm Tape

Use the standard device title and add the required suffix as listed in the option table below (Table 1). Note that the individual reels have a finite number of devices depending on the type of product contained in the tape. Also note the minimum lot size is one full reel for each line item, and orders are required to be in increments of the single reel quantity.

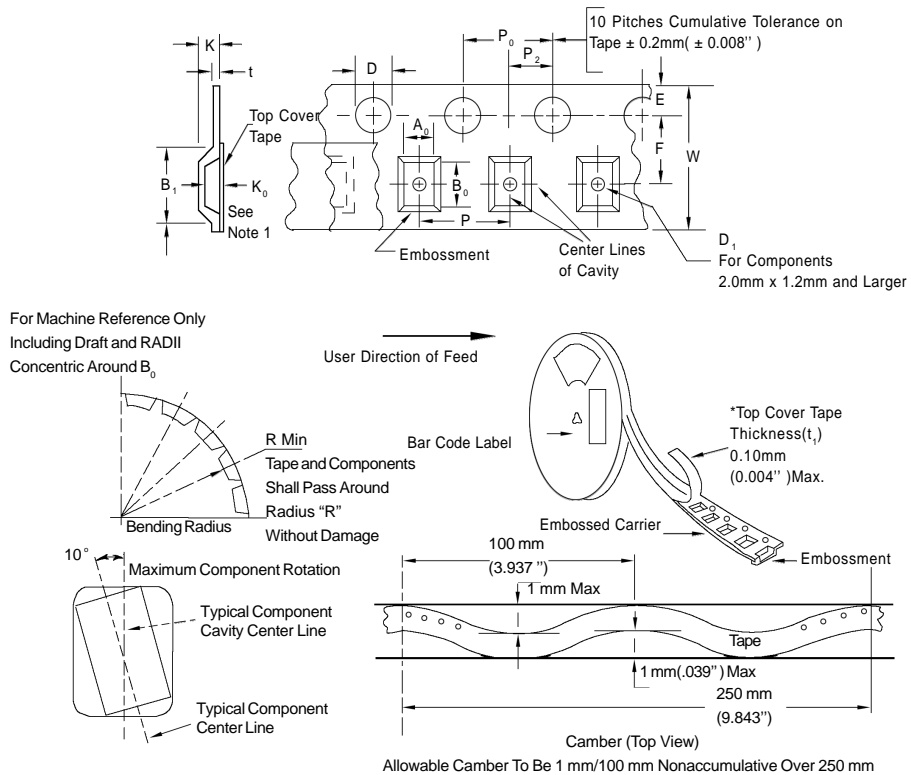


Typical Reel Orientations

Table 1. EMBOSSED TAPE AND REEL ORDERING INFORMATION

| Package        | Tape Width (mm) | Pitch mm | Reel Size mm(inch) | Devices Per Reel and Minimum Order Quantity | Device Suffix |
|----------------|-----------------|----------|--------------------|---|---------------|
| SOT-23         | 8               | 4        | 178                | (7)   | 3,000 T1      |
|                | 8               |          | 330                | (13)  | 10,000 T3     |
| SC-70/SOT-323  | 8               | 4        | 178                | (7)   | 3,000 T1      |
|                | 8               |          | 330                | (13)  | 10,000 T3     |
| SC-89          | 8               | 4        | 178                | (7)   | 3,000 T1      |
|                | 8               |          | 330                | (13)  | 10,000 T3     |
| SC-88/SOT-363  | 8               | 4        | 178                | (7)   | 3,000 T1      |
|                | 8               |          | 330                | (13)  | 10,000 T3     |
| SC-88A/SOT-353 | 8               | 4        | 178                | (7)   | 3,000 T1      |
|                | 8               |          | 330                | (13)  | 10,000 T3     |
| SOD-323        | 8               | 4        | 178                | (7)   | 3,000 T1      |
|                | 8               |          | 330                | (13)  | 10,000 T3     |
| SOD-523        | 8               | 4        | 178                | (7)   | 3,000 T1      |
|                | 8               |          | 330                | (13)  | 10,000 T3     |

## EMBOSSED TAPE AND REEL DATA FOR DISCRETES CARRIER TAPE SPECIFICATIONS



### DIMENSIONS

| Tape Size | $B_1$ Max         | D                     | $D_1$               | E                         | F                          | K                    | $P_0$                     | $P_2$                     | RMin            | TMax             | WMax                     |
|-----------|-------------------|-----------------------|---------------------|---------------------------|----------------------------|----------------------|---------------------------|---------------------------|-----------------|------------------|--------------------------|
| 8mm       | 4.55mm<br>(.179") | 1.5±0.1mm<br>- 0.0    | 1.0Min<br>(.039")   | 1.75±0.1mm<br>(.069±.004) | 3.5±0.05mm<br>(.138±.002") | 2.4mmMax<br>(.094")  | 4.0±0.1mm<br>(.157±.004") | 2.0±0.1mm<br>(.079±.002") | 25mm<br>(.98")  | 0.6mm<br>(.024") | 8.3mm<br>(.327")         |
| 12mm      | 8.2mm<br>(.323")  | (.059±.004")<br>- 0.0 | 1.5mmMin<br>(.060") |                           | 5.5±0.05mm<br>(.217±.002") | 6.4mmMax<br>(.252")  |                           |                           | 30mm<br>(1.18") |                  | 12±.30mm<br>(.470±.012") |
| 16mm      | 12.1mm<br>(.476") |                       |                     |                           | 7.5±0.10mm<br>(.295±.004") | 7.9mmMax<br>(.311")  |                           |                           |                 |                  | 16.3mm<br>(.642")        |
| 24mm      | 20.1mm<br>(.791") |                       |                     |                           | 11.5±0.1mm<br>(.453±.004") | 11.9mmMax<br>(.468") |                           |                           |                 |                  | 24.3mm<br>(.957")        |

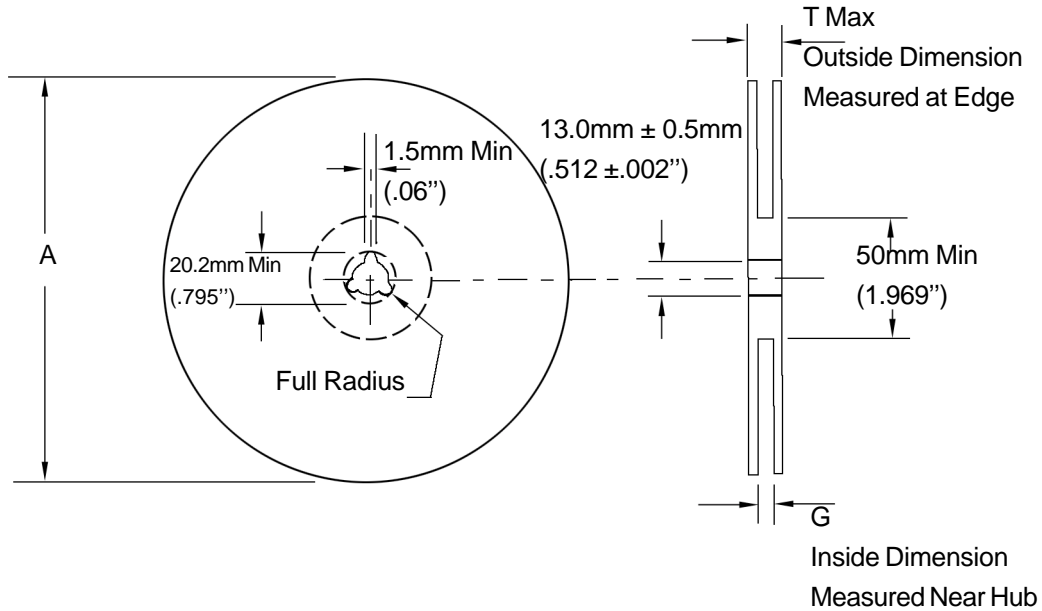
Metric dimensions govern - English are in parentheses for reference only.

NOTE 1:  $A_0$ ,  $B_0$ , and  $K_0$  are determined by component size. The clearance between the components and the cavity must be within .05 mm min. to .50 mm max.,

NOTE 2: the component cannot rotate more than 10° within the determined cavity.

NOTE 3: If  $B_1$  exceeds 4.2 mm (.165") for 8 mm embossed tape, the tape may not feed through all tape feeders.

## EMBOSSED TAPE AND REEL DATA FOR DISCRETES



| Size  | A Max              | G  | T Max              |
|-------|--------------------|--|--------------------|
| 8 mm  | 330mm<br>(12.992") | 8.4mm+1.5mm, -0.0<br>(.33"+.059", -0.00)   | 14.4mm<br>(.56")   |
| 12mm  | 330mm<br>(12.992") | 12.4mm+2.0mm, -0.0<br>(.49"+.079", -0.00)  | 18.4mm<br>(.72")   |
| 16mm  | 360mm<br>(14.173") | 16.4mm+2.0mm, -0.0<br>(.646"+.078", -0.00) | 22.4mm<br>(.882")  |
| 24 mm | 360mm<br>(14.173") | 24.4mm+2.0mm, -0.0<br>(.961"+.070", -0.00) | 30.4mm<br>(1.197") |

### Reel Dimensions

Metric Dimensions Govern — English are in parentheses for reference only

#### Storage Conditions

Temperature: 5 to 40 Deg.C (20 to 30 Deg. C is preferred)

Humidity: 30 to 80 RH (40 to 60 is preferred)

Recommended Period: One year after manufacturing

(This recommended period is for the soldering condition only. The characteristics and reliabilities of the products are not restricted to this limitation)