

DESCRIPTION

The LP2950-XX/LP2951-XX is micropower voltage regulators with very low quiescent current (75uA typ.) and very low dropout voltage (typ. 40 mV at light loads and 380mV at 100mA). Careful design of the LP2950-XX/LP2951-XX has minimized all contributions to the error budget. This includes a tight initial tolerance (0.5% typ.), extremely good load and line regulation (0.05% typ.) and a very low output voltage temperature coefficient, making the part useful as a low-power voltage reference. The LP2950-XX/LP2951XX is ideally suited for use in battery powered systems. Furthermore, the quiescent current of the LP2950-XX/LP2951-XX increases only slightly in dropout, prolonging battery life.

Another feature is an error flag output which warns of a low output voltage, often due to falling batteries on the input. It may be used for a power-on reset. A second feature is the logic-compatible shutdown input which enables the regulator to be switched on and off. Also the part may be pin strapped for a 5V, 3V, or 3.3V output (depending on version), or programmed from 1.24V to 29V with an external pair of resistors. The LP2950-XX is offered in 3-pin TO-92 package compatible with other fixed regulator.

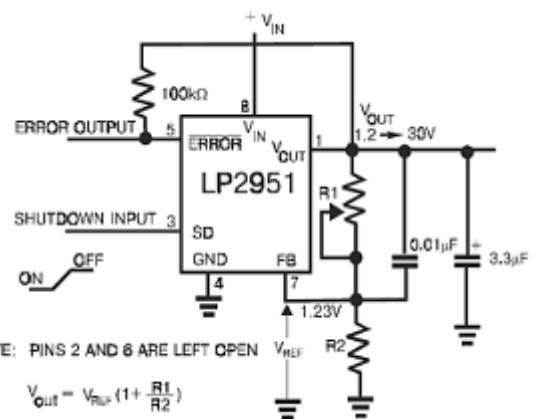
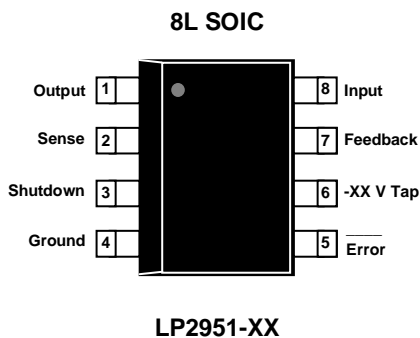
FEATURES

- ◆ High accuracy output voltage
- ◆ Guaranteed 100mA output current voltage
- ◆ Very low quiescent current
- ◆ Low dropout voltage
- ◆ Extremely tight load and line regulation
- ◆ Very low temperature coefficient
- ◆ Needs only 1uF for stability
- ◆ Error Flag warns of output dropout
- ◆ Logic-Controlled electronic shutdown
- ◆ Output programmable from 1.24V to 29V

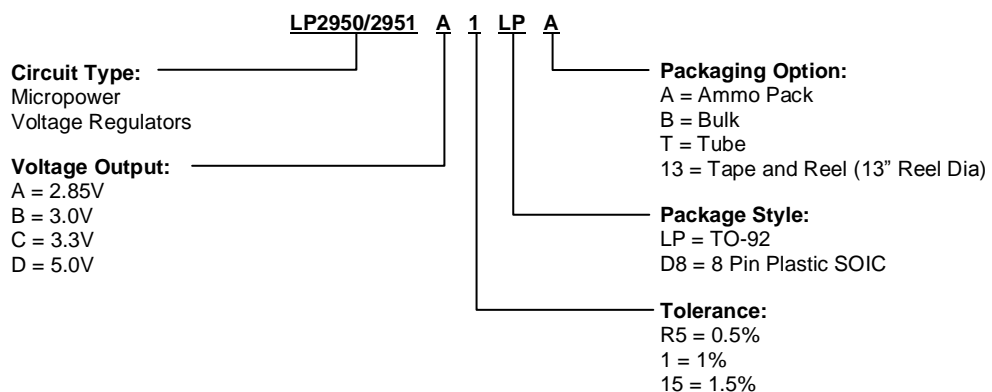
APPLICATIONS

- ◆ Battery Powered Systems
- ◆ Cordless Telephones
- ◆ Radio Control Systems
- ◆ Portable/ Palm Top/ Notebook Computers
- ◆ Portable Consumer Equipment
- ◆ Portable Instrumentation
- ◆ Avionics
- ◆ Automotive Electronics
- ◆ SMPS Post-Regulator
- ◆ Voltage Reference

PIN CONFIGURATION – Top View



ORDERING INFORMATION





ABSOLUTE MAXIMUM RATINGS

Power Dissipation	Internally Limited
Lead Temperature (Soldering, 5 seconds)	260°C
Storage Temperature Range	-65°C to +150°C
Operating Junction Temperature Range	-55°C to +125°C
Input Supply Voltage	-0.3 to +30V
Feedback Input Voltage	-1.5 to +30V
Error Comparator Output	-0.3 to +30V

DEVICE SELECTION GUIDE

Vout, Volts	Device
2.85*	LP2950-2.85, LP2951-2.85
3.0	LP2950-3.0, LP2951-3.0
3.3	LP2950-3.3, LP2951-3.3
5.0	LP2950-5.0, LP2951-5.0

ELECTRICAL CHARACTERISTICS (at Ta = 25°C, Vin = 15V: unless otherwise noted)

Parameter	Conditions (Note 2)	Min	Typ	Max	Units	
Output Voltage	at 25°C Full Operating Temperature	0.5%	0.995Vo 0.988Vo	Vo	1.05Vo 1.012Vo	V
	at 25°C Full Operating Temperature	1%	0.990Vo 0.988Vo	Vo	1.010Vo 1.012Vo	
	at 25°C Full Operating Temperature	1.5%	0.985Vo 0.98Vo	Vo	1.015Vo 1.02Vo	
Output Voltage	100µA ≤ IL ≤ 100mA, TJ ≤ TJMAX	0.5%	0.985Vo	Vo	1.015Vo	
		1%	0.985Vo	Vo	1.015Vo	
		1.5%	0.976Vo	Vo	1.024Vo	
Output Voltage Temperature Coefficient	(Note 1)		50	150	ppm/°C	
Line Regulation (Note3)	Vo + 1V ≤ Vin ≤ 30V (Note 4)		0.04	0.4	%	
Load Regulation (Note3)	100µA ≤ IL ≤ 100mA		0.1	0.3	%	
Dropout Voltage (Note 5)	IL=100uA IL=100mA		50 380	80 450	mV	
Ground Current	IL=100uA IL=100mA		75 8	120 12	µA mA	
Dropout Ground Current	Vin=Vo - 0.5V, IL=100 µA		110	170	µA	
Current Limit	Vout=0		160	200	mA	
Thermal Regulation			0.05	0.2	%/W	
Output Noise, 10Hz to 100KHz	CL=1µF CL=200µF CL=3.3µF (Bypass=0.01 µF pins 7 to 1 (LP2951-XX))		430 160 100		µV rms	
8-pin Versions only						
Reference Voltage		1.21	1.235	1.26	V	
Reference Voltage	Over Temperature (Note 6)	1.185		1.285		
Feedback Pin Bias Current			20	40	nA	
Reference Voltage Temperature Coefficient	(Note 7)		50		ppm/°C	
Feedback Pin Bias Current Temperature Coefficient			0.1		nA/°C	



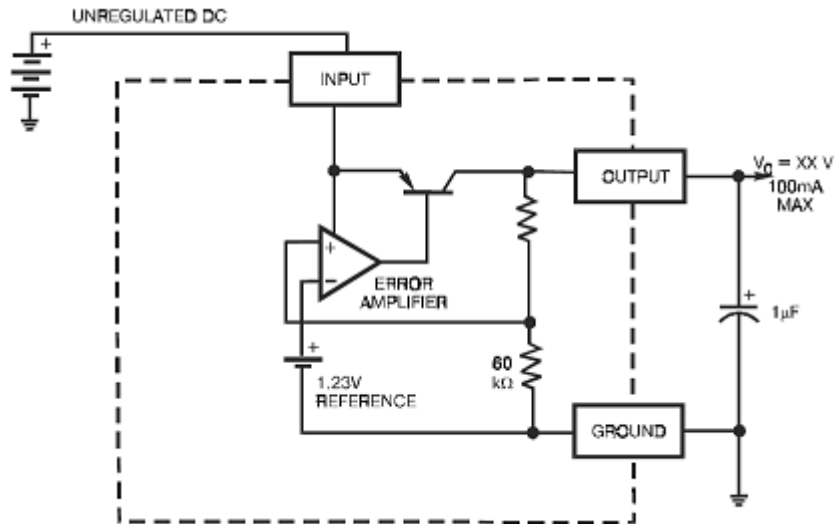
ELECTRICAL CHARACTERISTICS (at Ta = 25°C, Vin = 15V: unless otherwise noted)
(Continued)

Error Comparator					
Output Leakage Current	Voh=30V		0.01	1.0	μA
Output Low Voltage	Vin=4.5V, IOL=400 μA		150	250	mV
Upper Threshold Voltage	(Note 8)	40	60		
Lower Threshold Voltage	(Note 8)		75	95	
Hysterisis	(Note 8)		15		
Shutdown Input					
Input Logic Voltage	Low (Regulator ON) High (Regulator OFF)	2	1.3	0.7	V
Shutdown Pin Input Current	Vs=2.4V Vs=30V		30 450	50 600	μA
Regulator Output Current in Shutdown	(Note 9)				
	VOUT = 5.0 V		3	10	
	3.3V ≤ VOUT < 5.0 V			20	
	2.0V ≤ VOUT < 3.3 V			30	

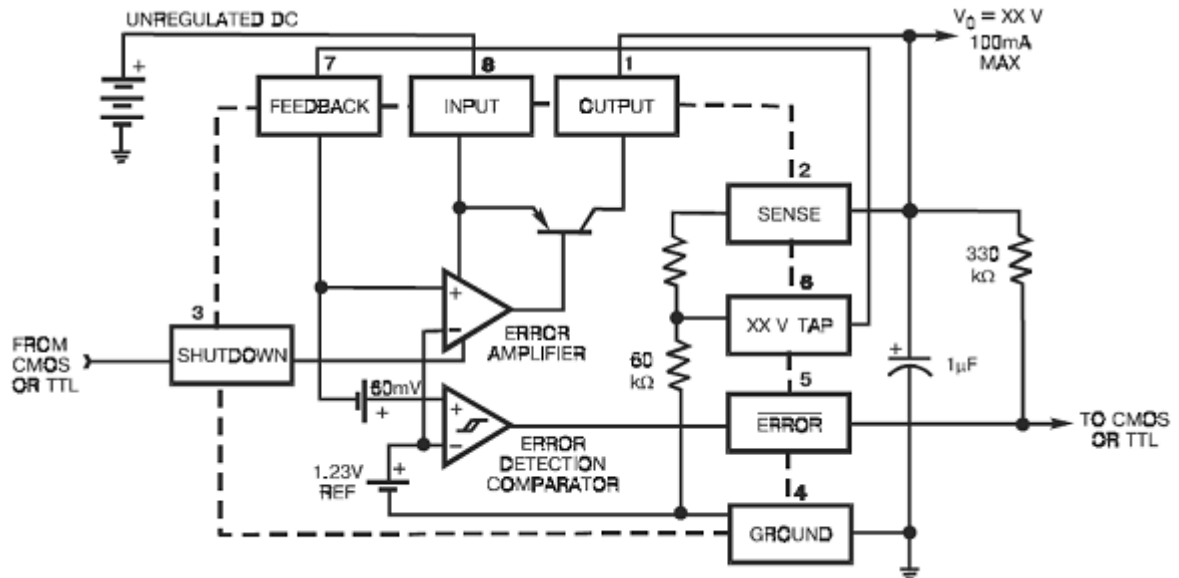
- Note 1:** Absolute Maximum Ratings are limits beyond which damage to the device may occur. For guaranteed performance limits and associated test conditions, see the Electrical Characteristics tables.
- Note 2:** Unless otherwise specified all limits guaranteed for Tj=25°C, Vin=Vo + 1V, IL=100uA and CL=1uF for 5V versions and 2.2uF for 3V and 3.3V versions. Additional conditions for the 8-pin versions are FEEDBACK tied to VTAP, OUTPUT tied to SENSE, and VSHUTDOWN < 0.8V.
- Note 3:** Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle. Changes in output voltage due to heating effects are covered under specification for thermal regulation.
- Note 4:** Line regulation for the LP2951-XX is tested at 150°C for IL=mA. For IL=100uA and Tj=125°C, line regulation is guaranteed by design to 0.2%.
- Note 5:** Dropout voltage is defined as the input to output differential at which the output voltage drops 100mV below its nominal value measured at 1V differential. At very low values of programmed output voltage, the minimum supply voltage of 2V (2.3V over temperature) must be taken into account.
- Note 6:** VREF<=VOUT<=(VIN-1V), 2.3V<=VIN<=30V, 100uA<=IL<=100mA, Tj<=TMAX.
- Note 7:** Output or reference voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.
- Note 8:** Comparator thresholds are expressed in terms of a voltage differential at the feedback terminal below the nominal reference voltage measured at Vo + 1V input. To express these thresholds in terms of output voltage change, multiply by the error amplifier gain = Vout/ Vref = (R1+ R2)/R2. For example, at a programmed output voltage of 5V, the error output is guaranteed to go low when the output drops by 95mV 5V/1.235V = 384mV. Thresholds remain constant as a percent of Vout as Vout is varied, with the dropout warning occurring at typically 5% below nominal, 7.5% guaranteed.
- Note 9:** Vshutdown >=2V, Vin <=30V, Vout=0, Feed-back pin tied to-XX V tap.



LP2950-XX



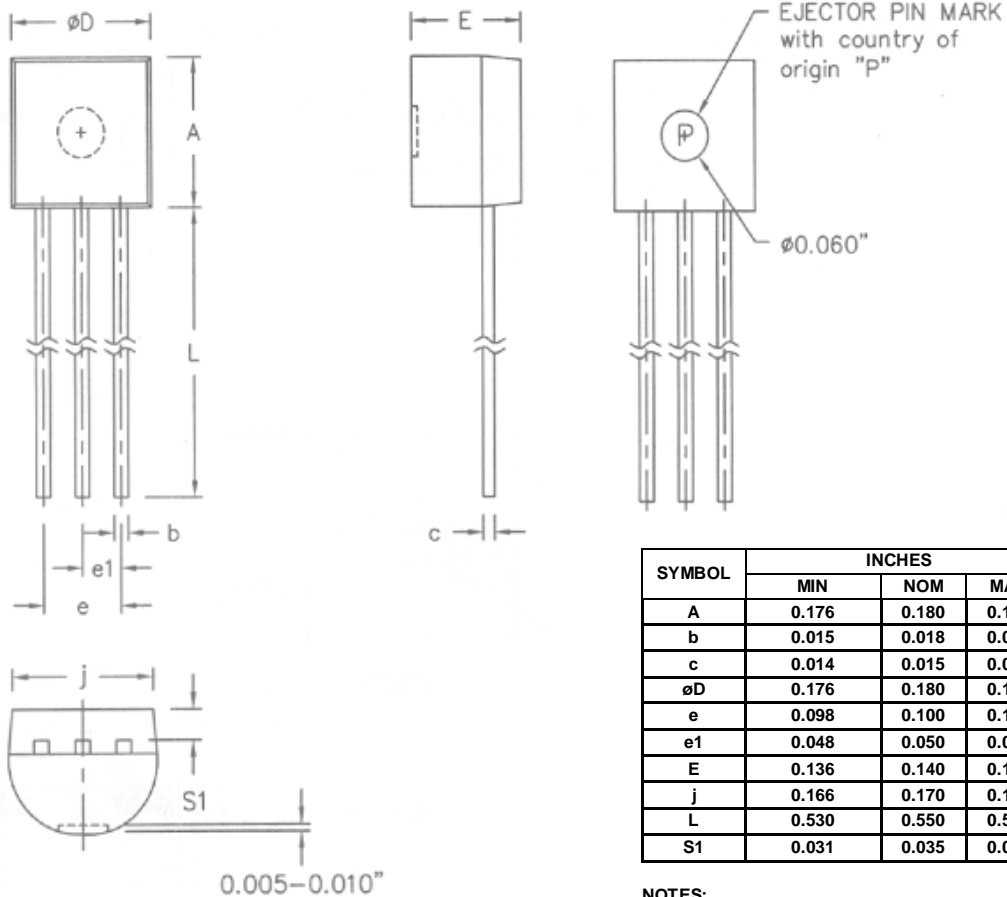
LP2951-XX





TO-92 PACKAGE DIMENSION

3-Lead TO-92 Plastic Package
SLI Package Code: LP



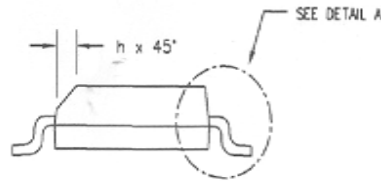
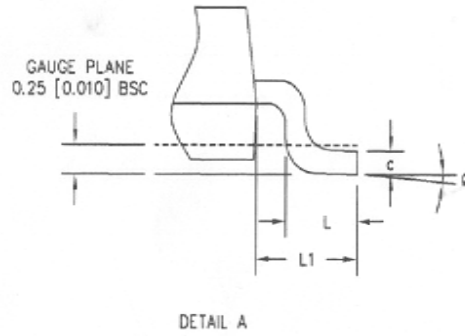
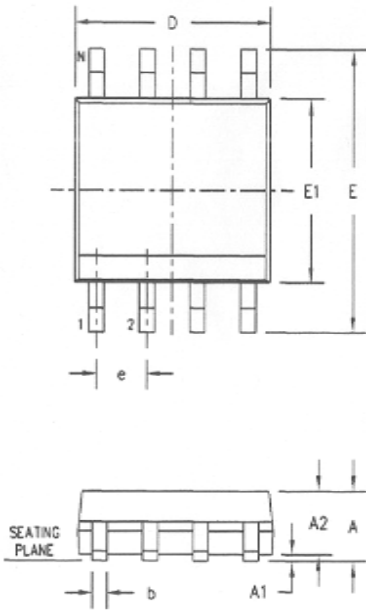
SYMBOL	INCHES		
	MIN	NOM	MAX
A	0.176	0.180	0.184
b	0.015	0.018	0.022
c	0.014	0.015	0.020
ϕD	0.176	0.180	0.184
e	0.098	0.100	0.102
e1	0.048	0.050	0.052
E	0.136	0.140	0.144
j	0.166	0.170	0.174
L	0.530	0.550	0.570
S1	0.031	0.035	0.039

- NOTES:
1. ALL DIMENSIONS IN INCHES.
 2. A MECHANICAL TOLERANCE OF ± 0.002 " APPLIES TO ALL DIMENSIONS WHERE NO TOLERANCE IS EXPLICITLY GIVEN.
 3. BASED FROM JEDEC T0-226 VARIATION AA OUTLINE.



8L-SOIC PACKAGE DIMENSION

8-Lead SOIC Plastic
Surface Mounted Package
SLI Package Code: D8



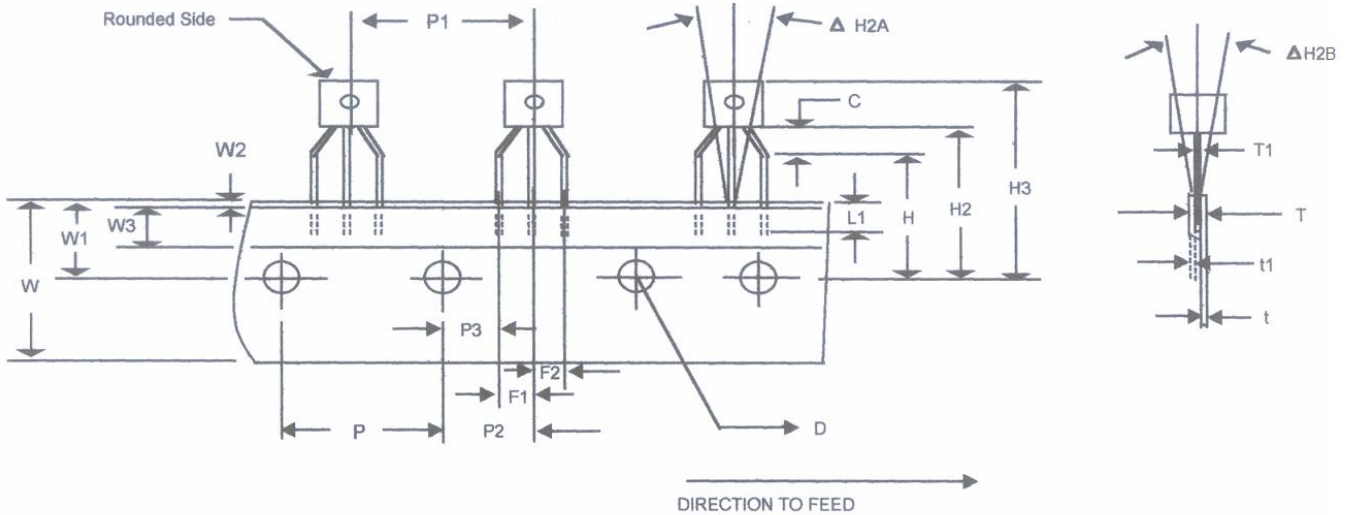
SYM	DIMENSION IN INCHES			DIMENSION IN MM		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.059	0.062	0.065	1.50	1.57	1.65
A1	0.004	0.008	0.010	0.10	0.20	0.25
A2	0.051	0.054	0.057	1.30	1.37	1.45
b	0.013	0.016	0.020	0.33	0.41	0.51
c	0.007	0.008	0.010	0.18	0.20	0.25
D	0.191	0.193	0.195	4.85	4.90	4.95
E1	0.151	0.153	0.155	3.84	3.89	3.94
E	0.228	0.234	0.240	5.79	5.94	6.10
e	0.050			1.27		
L	0.020	0.024	0.032	0.51	0.61	0.81
L1	0.039	0.041	0.043	0.99	1.04	1.09
Ø	0*	-	B*	0*	-	B*
h	0.011	0.015	0.019	0.28	0.38	0.48

NOTES:

1. DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
2. COPLANARITY APPLIES TO THE TERMINALS. COPLANARITY SHALL NOT EXCEED 0.003" [0.08 mm].
3. BASED FROM JEDEC NS-012 VARIATION AA.



TO-92 AMMO PACK SPECIFICATIONS



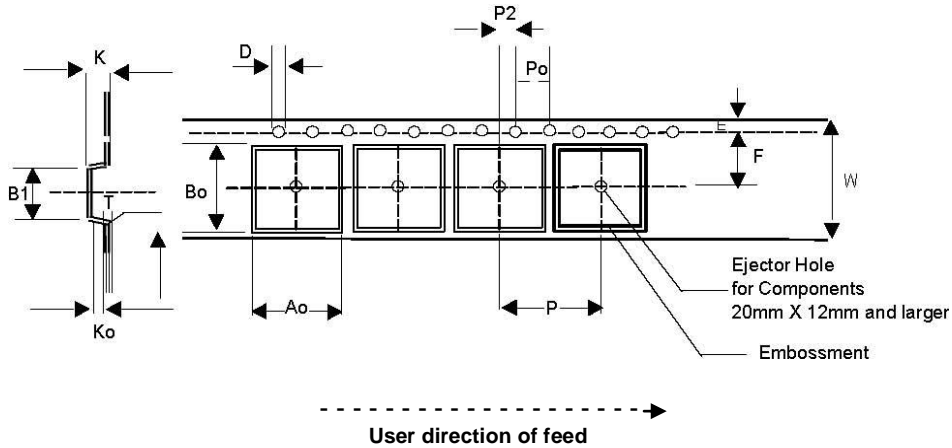
SYMBOL	DESCRIPTION	NOMINAL VALUE		TOLERANCES			
		mm	inch	min		max	
D	Feed Hole Diameter	4.0	0.157	3.8	0.150	4.2	0.165
T1 (POD)	Component Lead Thickness	0.405	0.016	0.36	0.014	0.45	0.018
F1/F2	Lead Pitch (Left / Right)	2.54	0.100	2.4	0.094	2.8	0.110
C	Bottom of Component to Seating Plane	2.50	0.098	1.50	0.059	4.00	0.157
W1	Edge to Sprocket Hole Center	9.0	0.354	8.50	0.335	9.50	0.374
H2A	Deflection (Left or Right)	0.50	0.020	0	0	0.50	0.020
H2B	Deflection (Front or Rear)	1.0	0.039	0	0	1.0	0.039
H2 (H + C)	Feed Hole to Bottom of Component	18.5	0.728	17.00	0.669	20.50	0.087
H	Height of Seating Plane	16	0.630	15.5	0.610	16.5	0.650
H3	Feed Hole Center to Overall Transistor Height	27.75	1.092	23.5	0.925	32.0	1.260
L	Defective Unit Clipped Dimension	-	-	-	-	11.0	0.433
L1	Leadwire Enclosure	2.50	0.098	2.50	0.098	-	-
P	Feed Hole Pitch	12.7	0.500	12.40	0.488	13.0	0.512
P2	Center of Feed Hole to Center Lead	6.35	0.250	6.0	0.234	6.75	0.266
P3 (P2-F1)	First Lead Spacing Dimension	3.75	0.148	3.6	0.142	3.95	0.156
P1	Center Lead to Center Lead	12.7	0.500	12.2	0.500	13.2	0.520
t1	Adhesive Tape Thickness	0.18	0.007	0.16	0.006	0.20	0.008
T (t+t1+T1)	Overall Taped Package Thickness	-	-	-	-	1.55	0.061
T	Carrier Strip Thickness	0.37	0.015	0.27	0.011	0.47	0.018
W	Carrier Strip Width (18mm)	18.00	0.709	17.5	0.689	19.0	0.748
W3	Adhesive Tape Width (6mm)	6.00	0.236	5.5	0.217	6.3	0.248
W2	Adhesive Tape Position	0.25	0.010	0	0	0.50	0.020

TO-92 Ammo Pack Requirement			
Components		Tape Width (W) mm	Fan Fold Box
TO92	3L	18	2000



PACKAGE MECHANICAL DRAWING

Surface Mountable Tape & Reel Specifications in mm (inch)
(SOIC)

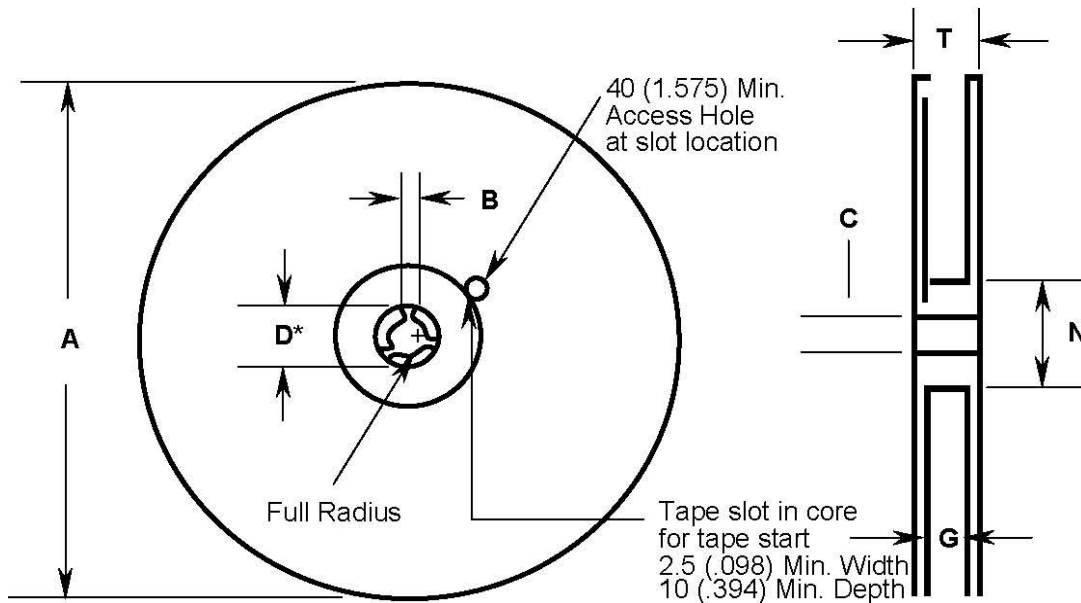


Tape Size (W)	D	E	P0	T (Max)	A0, B0, K0	T1 (Max)	Constant Dimensions
8, 12, 16, 24mm	1.55±0.05 (.061±.002)	1.75±0.10 (.069±.004)	4.0±0.10 (.157±.004)	0.400 (.016)	See Note	0.100 (.004)	

Tape Size (W)	B1 Max.	D1 Min.	F	K Max.	P2	
8 mm	4.2 (.165)	1.0 (.039)	3.5±0.05 (.138±.002)	2.4 (.094)	2.0±.05	
12 mm	8.2 (.323)	1.5 (.059)	5.5±0.05 (.217±.002)	4.5 (.177)	.079±.002	Variable Dimensions

Per Package Requirement					
Components	Tape Width (W) mm	Cavity Pitch (P) mm	Devices per Reel		
			7" Reel	13" Reel	
SOIC 8L	12	8		2500	

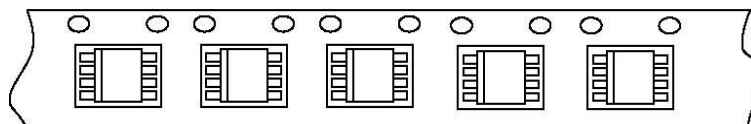
Note: A0 B0 K0 are determined by component size. The clearance between the component and the cavity must be within 0.05 [.002] min. to 0.50 [.020] max. for 8mm tape, 0.05 [.002] min to 0.65 [.026] max for 12mm tape.



REEL DIMENSIONS							
Tape Size	A Max.	B Min.	C	D* Min.	N Min.	G	T Max.
8mm	330 (12.992)	1.5 (.059)	13.0±0.20 (.152±.008)	20.2 (.795)	50 (1.973)	8.4±1.5 0.0 (.331±.059) 0.0	14.4 (.567)
12mm	330 (12.992)	1.5 (.059)	13.0±0.20 (.152±.008)	20.2 (.795)	50 (1.973)	12.4±2.0 0.0 (.488±.078) 0.0	14.4 (.567)

MECHANICAL POLARIZATION

SOIC DEVICE



User direction of feed ----->