

# Micropower Programmable Operational Amplifier

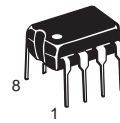
This extremely versatile operational amplifier features low power consumption and high input impedance. In addition, the quiescent currents within the device may be programmed by the choice of an external resistor value or current source applied to the  $I_{set}$  input. This allows the amplifier's characteristics to be optimized for input current and power consumption despite wide variations in operating power supply voltages.

- $\pm 1.2$  V to  $\pm 18$  V Operation
- Wide Programming Range
- Offset Null Capability
- No Frequency Compensation Required
- Low Input Bias Currents
- Short Circuit Protection

## MC1776C

### PROGRAMMABLE OPERATIONAL AMPLIFIER

#### SEMICONDUCTOR TECHNICAL DATA



**P1 SUFFIX**  
PLASTIC PACKAGE  
CASE 626

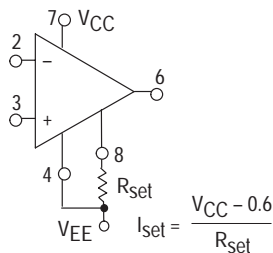


**D SUFFIX**  
PLASTIC PACKAGE  
CASE 751  
(SO-8)

#### Resistive Programming

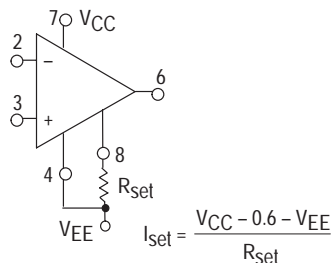
(See Figure 1)

##### R<sub>set</sub> to Ground



##### R<sub>set</sub> to Negative Supply

(Recommended for supply voltage less than  $\pm 6.0$  V)

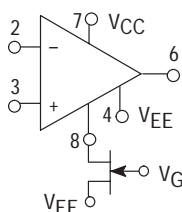


Typical R <sub>set</sub> Values		
V <sub>CC</sub> , V <sub>EE</sub>	I <sub>set</sub> = 1.5 $\mu$ A	I <sub>set</sub> = 15 $\mu$ A
$\pm 6.0$ V	3.6 M $\Omega$	360 k $\Omega$
$\pm 10$ V	6.2 M $\Omega$	620 k $\Omega$
$\pm 12$ V	7.5 M $\Omega$	750 k $\Omega$
$\pm 15$ V	10 M $\Omega$	1.0 M $\Omega$

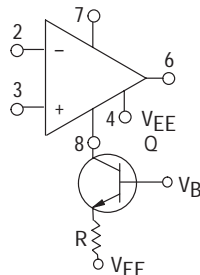
Typical R <sub>set</sub> Values		
V <sub>CC</sub> , V <sub>EE</sub>	I <sub>set</sub> = 1.5 $\mu$ A	I <sub>set</sub> = 15 $\mu$ A
$\pm 1.5$ V	1.6 M $\Omega$	160 k $\Omega$
$\pm 3.0$ V	3.6 M $\Omega$	360 k $\Omega$
$\pm 6.0$ V	7.5 M $\Omega$	750 k $\Omega$
$\pm 15$ V	20 M $\Omega$	2.0 M $\Omega$

#### Active Programming

##### FET Current Source

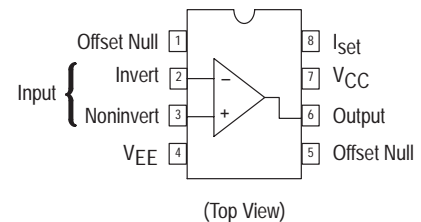


##### Bipolar Current Source



Pins not shown are not connected.

#### PIN CONNECTIONS



#### ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC1776CD	$T_A = 0^\circ$ to $+70^\circ$ C	SO-8
MC1776CP1		Plastic DIP

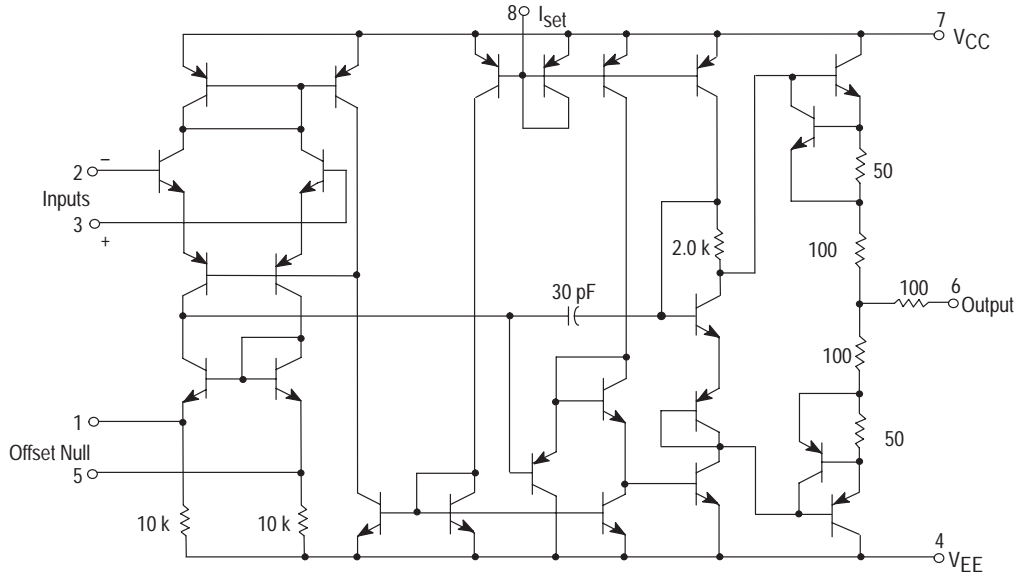
# MC1776C

**MAXIMUM RATINGS** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

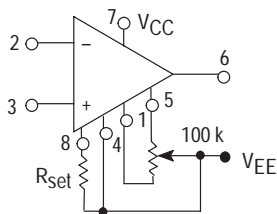
Rating	Symbol	Value	Unit
Power Supply Voltages	$V_{CC}, V_{EE}$	$\pm 18$	Vdc
Differential Input Voltage	$V_{ID}$	$\pm 30$	Vdc
Common Mode Input Voltage $V_{CC}$ and $ V_{EE}  < 15\text{ V}$ $V_{CC}$ and $ V_{EE}  \geq 15\text{ V}$	$V_{ICM}$	$V_{CC}, V_{EE}$ $\pm 15$	Vdc
Offset Null to $V_{EE}$ Voltage	$V_{off-V_{EE}}$	$\pm 0.5$	Vdc
Programming Current	$I_{set}$	500	$\mu\text{A}$
Programming Voltage (Voltage from $I_{set}$ Terminal to Ground)	$V_{set}$	$(V_{CC} - 2.0\text{ V})$ to $V_{CC}$	Vdc
Output Short Circuit Duration (Note 1)	$t_{SC}$	Indefinite	sec
Operating Temperature Range	$T_A$	0 to $+70$	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	$-65$ to $+150$	$^\circ\text{C}$
Junction Temperature	$T_J$	150	$^\circ\text{C}$

NOTE 1. May be to ground or either supply voltage. Rating applies up to a case temperature of  $+125^\circ\text{C}$  or ambient temperature of  $+70^\circ\text{C}$  and  $I_{set} \leq 30\ \mu\text{A}$ .

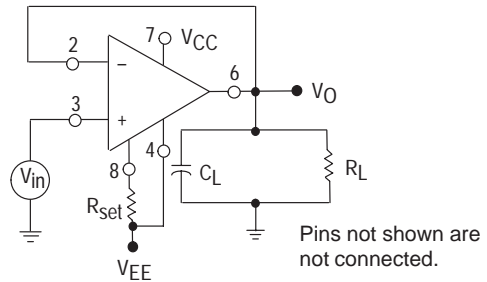
## Representative Schematic Diagram



## Voltage Offset Null Circuit



## Transient Response Test Circuit



# MC1776C

## ELECTRICAL CHARACTERISTICS ( $V_{CC} = +3.0\text{ V}$ , $V_{EE} = -3.0\text{ V}$ , $I_{Set} = 1.5\ \mu\text{A}$ , $T_A = +25^\circ\text{C}$ , unless otherwise noted.\*)

Characteristic	Symbol	Min	Typ	Max	Unit
Input Offset Voltage ( $R_S \leq 10\text{ k}\Omega$ ) $T_A = +25^\circ\text{C}$ $T_{low}^* \leq T_A \leq T_{high}^*$	$V_{IO}$	–	2.0	6.0	mV
		–	–	7.5	
Offset Voltage Adjustment Range	$V_{IOR}$	–	9.0	–	mV
Input Offset Current $T_A = +25^\circ\text{C}$ $T_A = T_{high}$ $T_A = T_{low}$	$I_{IO}$	–	0.7	6.0	nA
		–	–	6.0	
		–	–	10	
Input Bias Current $T_A = +25^\circ\text{C}$ $T_A = T_{high}$ $T_A = T_{low}$	$I_{IB}$	–	2.0	10	nA
		–	–	10	
		–	–	20	
Input Resistance	$r_i$	–	50	–	M $\Omega$
Input Capacitance	$c_i$	–	2.0	–	pF
Input Voltage Range $T_{low} \leq T_A \leq T_{high}$	$V_{ID}$	+1.0	–	–	V
Large Signal Voltage Gain $R_L \geq 75\text{ k}\Omega$ , $V_O = \pm 1.0\text{ V}$ , $T_A = +25^\circ\text{C}$ $R_L \geq 75\text{ k}\Omega$ , $V_O = \pm 1.0\text{ V}$ , $T_{low} \leq T_A \leq T_{high}$	$A_{VOL}$	25 k 25 k	200 k –	– –	V/V
Output Voltage Swing $R_L \geq 75\text{ k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	$V_O$	$\pm 2.0$	$\pm 2.4$	–	V
Output Resistance	$r_o$	–	5.0	–	k $\Omega$
Output Short Circuit Current	$I_{SC}$	–	3.0	–	mA
Common Mode Rejection $R_S \leq 10\text{ k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	CMR	70	86	–	dB
Supply Voltage Rejection Ratio $R_S \leq 10\text{ k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	PSRR	–	25	200	$\mu\text{V/V}$
Supply Current $T_A = +25^\circ\text{C}$ $T_{low} \leq T_A \leq T_{high}$	$I_{CC}$ , $I_{EE}$	–	13	20	$\mu\text{A}$
		–	–	25	
Power Dissipation $T_A = +25^\circ\text{C}$ $T_{low} \leq T_A \leq T_{high}$	$P_D$	–	78	120	$\mu\text{W}$
		–	–	150	
Transient Response (Unity Gain) $V_{in} = 20\text{ mV}$ , $R_L \geq 5.0\text{ k}\Omega$ , $C_L = 100\text{ pF}$ Rise Time Overshoot	$t_{TLH}$ $t_{os}$	–	3.0 0	–	$\mu\text{s}$ %
Slew Rate ( $R_L \geq 5.0\text{ k}\Omega$ )	$S_R$	–	0.03	–	V/ $\mu\text{s}$

\* $T_{low} = 0^\circ\text{C}$      $T_{high} = +70^\circ\text{C}$

# MC1776C

## ELECTRICAL CHARACTERISTICS ( $V_{CC} = +3.0\text{ V}$ , $V_{EE} = -3.0\text{ V}$ , $I_{set} = 15\ \mu\text{A}$ , $T_A = +25^\circ\text{C}$ , unless otherwise noted.)\*

Characteristic	Symbol	Min	Typ	Max	Unit
Input Offset Voltage ( $R_S \leq 10\ \text{k}\Omega$ ) $T_A = +25^\circ\text{C}$ $T_{low}^* \leq T_A \leq T_{high}^*$	$V_{IO}$	–	2.0	6.0	mV
		–	–	7.5	
Offset Voltage Adjustment Range	$V_{IOR}$	–	18	–	mV
Input Offset Current $T_A = +25^\circ\text{C}$ $T_A = T_{high}$ $T_A = T_{low}$	$I_{IO}$	–	2.0	25	nA
		–	–	25	
		–	–	40	
Input Bias Current $T_A = +25^\circ\text{C}$ $T_A = T_{high}$ $T_A = T_{low}$	$I_{IB}$	–	15	50	nA
		–	–	50	
		–	–	100	
Input Resistance	$r_i$	–	5.0	–	M $\Omega$
Input Capacitance	$c_i$	–	2.0	–	pF
Input Voltage Range $T_{low} \leq T_A \leq T_{high}$	$V_{ID}$	$\pm 1.0$	–	–	V
Large Signal Voltage Gain $R_L \geq 5.0\ \text{k}\Omega$ , $V_O = \pm 1.0\ \text{V}$ , $T_A = +25^\circ\text{C}$ $R_L \geq 5.0\ \text{k}\Omega$ , $V_O = \pm 1.0\ \text{V}$ , $T_{low} \leq T_A \leq T_{high}$	$A_{VOL}$	25 k 25 k	200 k –	– –	V/V
Output Voltage Swing $R_L \geq 5.0\ \text{k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	$V_O$	$\pm 2.0$	$\pm 2.1$	–	V
Output Resistance	$r_o$	–	1.0	–	k $\Omega$
Output Short Circuit Current	$I_{SC}$	–	5.0	–	mA
Common Mode Rejection $R_S \leq 10\ \text{k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	CMR	70	86	–	dB
Supply Voltage Rejection Ratio $R_S \leq 10\ \text{k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	PSRR	–	25	200	$\mu\text{V/V}$
Supply Current $T_A = +25^\circ\text{C}$ $T_{low} \leq T_A \leq T_{high}$	$I_{CC}$ , $I_{EE}$	–	130	170	$\mu\text{A}$
		–	–	180	
Power Dissipation $T_A = +25^\circ\text{C}$ $T_{low} \leq T_A \leq T_{high}$	$P_D$	–	780	1020	$\mu\text{W}$
		–	–	1080	
Transient Response (Unity Gain) $V_{in} = 20\ \text{mV}$ , $R_L \geq 5.0\ \text{k}\Omega$ , $C_L = 100\ \text{pF}$ Rise Time Overshoot	$t_{TLH}$ $os$	–	0.6 5.0	– –	$\mu\text{s}$ %
Slew Rate ( $R_L \geq 5.0\ \text{k}\Omega$ )	$S_R$	–	0.35	–	V/ $\mu\text{s}$

\* $T_{low} = 0^\circ\text{C}$      $T_{high} = +70^\circ\text{C}$

# MC1776C

## ELECTRICAL CHARACTERISTICS ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ , $I_{set} = 1.5\text{ }\mu\text{A}$ , $T_A = +25^\circ\text{C}$ , unless otherwise noted.\*)

Characteristic	Symbol	Min	Typ	Max	Unit
Input Offset Voltage ( $R_S \leq 10\text{ k}\Omega$ ) $T_A = +25^\circ\text{C}$ $T_{low}^* \leq T_A \leq T_{high}^*$	$V_{IO}$	–	2.0	6.0	mV
		–	–	7.5	
Offset Voltage Adjustment Range	$V_{IOR}$	–	9.0	–	mV
Input Offset Current $T_A = +25^\circ\text{C}$ $T_A = T_{high}$ $T_A = T_{low}$	$I_{IO}$	–	0.7	6.0	nA
		–	–	6.0	
		–	–	10	
Input Bias Current $T_A = +25^\circ\text{C}$ $T_A = T_{high}$ $T_A = T_{low}$	$I_{IB}$	–	2.0	10	nA
		–	–	10	
		–	–	20	
Input Resistance	$r_i$	–	50	–	$M\Omega$
Input Capacitance	$c_i$	–	2.0	–	pF
Input Voltage Range $T_{low} \leq T_A \leq T_{high}$	$V_{ID}$	$\pm 10$	–	–	V
Large Signal Voltage Gain $R_L \geq 75\text{ k}\Omega$ , $V_O = \pm 10\text{ V}$ , $T_A = +25^\circ\text{C}$ $R_L \geq 75\text{ k}\Omega$ , $V_O = \pm 10\text{ V}$ , $T_{low} \leq T_A \leq T_{high}$	$A_{VOL}$	50 k 50 k	400 k –	– –	V/V
Output Voltage Swing $R_L \geq 75\text{ k}\Omega$ , $T_A = +25^\circ\text{C}$ $R_L \geq 75\text{ k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	$V_O$	$\pm 12$ $\pm 10$	$\pm 14$ –	– –	V
Output Resistance	$r_o$	–	5.0	–	$k\Omega$
Output Short Circuit Current	$I_{SC}$	–	3.0	–	mA
Common Mode Rejection $R_S \leq 10\text{ k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	CMR	70	90	–	dB
Supply Voltage Rejection Ratio $R_S \leq 10\text{ k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	PSRR	–	25	200	$\mu\text{V/V}$
Supply Current $T_A = +25^\circ\text{C}$ $T_{low} \leq T_A \leq T_{high}$	$I_{CC}$ , $I_{EE}$	–	20	30	$\mu\text{A}$
		–	–	35	
Power Dissipation $T_A = +25^\circ\text{C}$ $T_{low} \leq T_A \leq T_{high}$	$P_D$	–	780	0.9	mW
		–	–	1.05	
Transient Response (Unity Gain) $V_{in} = 20\text{ mV}$ , $R_L \geq 5.0\text{ k}\Omega$ , $C_L = 100\text{ pF}$ Rise Time Overshoot	$t_{TLH}$ $t_{os}$	–	1.6 0	– –	$\mu\text{s}$ %
Slew Rate ( $R_L \geq 5.0\text{ k}\Omega$ )	$S_R$	–	0.1	–	$\text{V}/\mu\text{s}$

\* $T_{low} = 0^\circ\text{C}$      $T_{high} = +70^\circ\text{C}$

# MC1776C

## ELECTRICAL CHARACTERISTICS ( $V_{CC} = +15\text{ V}$ , $V_{EE} = -15\text{ V}$ , $I_{set} = 15\text{ }\mu\text{A}$ , $T_A = +25^\circ\text{C}$ , unless otherwise noted.)\*

Characteristic	Symbol	Min	Typ	Max	Unit
Input Offset Voltage ( $R_S \leq 10\text{ k}\Omega$ ) $T_A = +25^\circ\text{C}$ $T_{low}^* \leq T_A \leq T_{high}^*$	$V_{IO}$	–	2.0	6.0	mV
Offset Voltage Adjustment Range	$V_{IOR}$	–	18	–	mV
Input Offset Current $T_A = +25^\circ\text{C}$ $T_A = T_{high}$ $T_A = T_{low}$	$I_{IO}$	–	2.0	25	nA
Input Bias Current $T_A = +25^\circ\text{C}$ $T_A = T_{high}$ $T_A = T_{low}$	$I_{IB}$	–	15	50	nA
Input Resistance	$r_i$	–	5.0	–	M $\Omega$
Input Capacitance	$c_i$	–	2.0	–	pF
Input Voltage Range $T_{low} \leq T_A \leq T_{high}$	$V_{ID}$	$\pm 10$	–	–	V
Large Signal Voltage Gain $R_L \geq 5.0\text{ k}\Omega$ , $V_O = \pm 10\text{ V}$ , $T_A = +25^\circ\text{C}$ $R_L \geq 75\text{ k}\Omega$ , $V_O = \pm 10\text{ V}$ , $T_{low} \leq T_A \leq T_{high}$	$A_{VOL}$	50 k 50 k	400 k –	– –	V/V
Output Voltage Swing $R_L \geq 5.0\text{ k}\Omega$ , $T_A = +25^\circ\text{C}$ $R_L \geq 75\text{ k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	$V_O$	$\pm 10$ $\pm 10$	$\pm 13$ –	– –	V
Output Resistance	$r_o$	–	1.0	–	k $\Omega$
Output Short Circuit Current	$I_{SC}$	–	12	–	mA
Common Mode Rejection $R_S \leq 10\text{ k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	CMR	70	90	–	dB
Supply Voltage Rejection Ratio $R_S \leq 10\text{ k}\Omega$ , $T_{low} \leq T_A \leq T_{high}$	PSRR	–	25	200	$\mu\text{V/V}$
Supply Current $T_A = +25^\circ\text{C}$ $T_{low} \leq T_A \leq T_{high}$	$I_{CC}$ , $I_{EE}$	–	160	190	$\mu\text{A}$
Power Dissipation $T_A = +25^\circ\text{C}$ $T_{low} \leq T_A \leq T_{high}$	$P_D$	–	–	5.7	$\mu\text{W}$
Transient Response (Unity Gain) $V_{in} = 20\text{ mV}$ , $R_L \geq 5.0\text{ k}\Omega$ , $C_L = 100\text{ pF}$ Rise Time Overshoot	$t_{TLH}$ $t_{os}$	–	0.35 10	–	$\mu\text{s}$ %
Slew Rate ( $R_L \geq 5.0\text{ k}\Omega$ )	$S_R$	–	0.8	–	V/ $\mu\text{s}$

\* $T_{low} = 0^\circ\text{C}$      $T_{high} = +70^\circ\text{C}$

Figure 1. Set Current versus Set Resistor

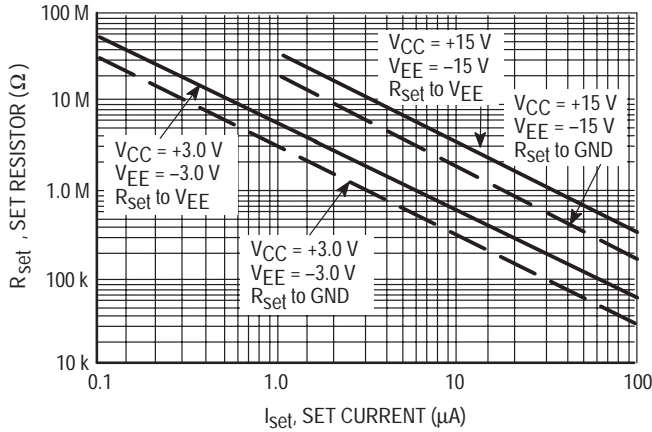


Figure 2. Positive Standby Supply Current versus Set Current

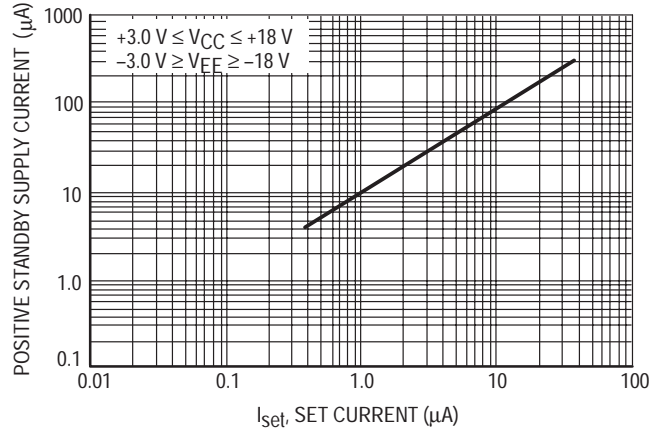


Figure 3. Open Loop Gain versus Set Current

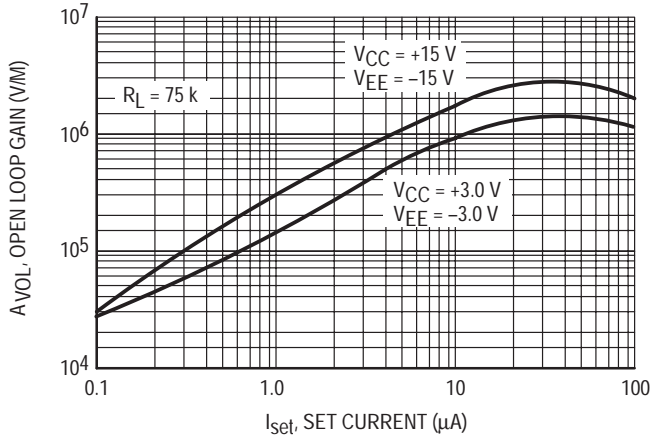


Figure 4. Input Bias Current versus Set Current

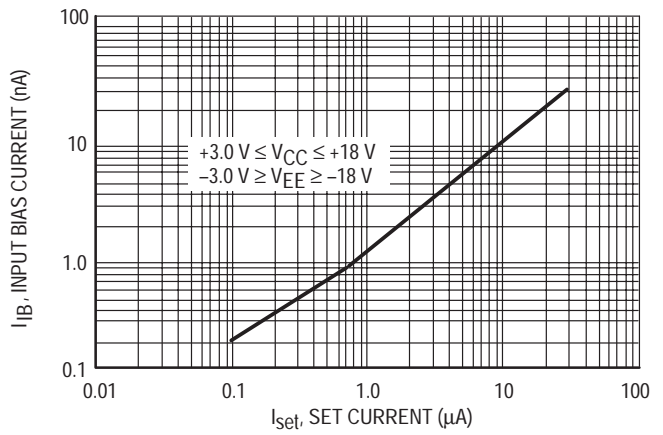


Figure 5. Input Bias Current versus Ambient Temperature

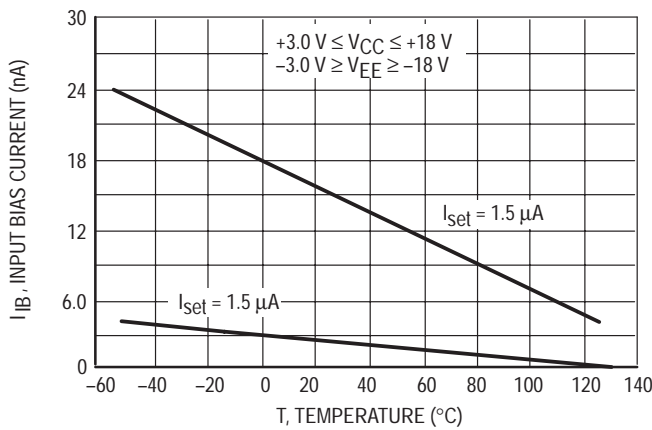


Figure 6. Gain Bandwidth Product versus Set Current

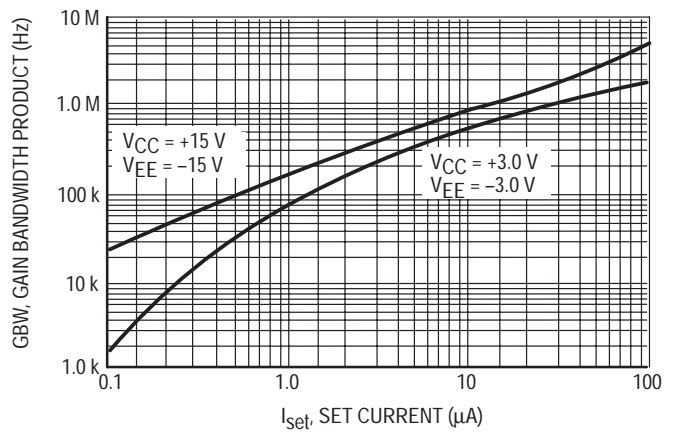


Figure 7. Output Voltage Swing versus Load Resistance

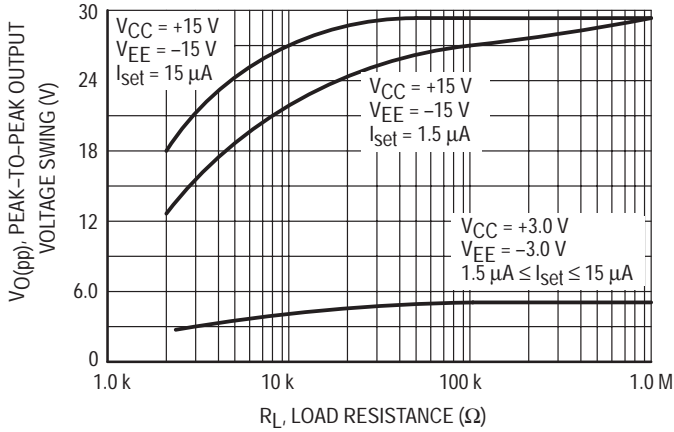


Figure 8. Supply Current versus Ambient Temperature

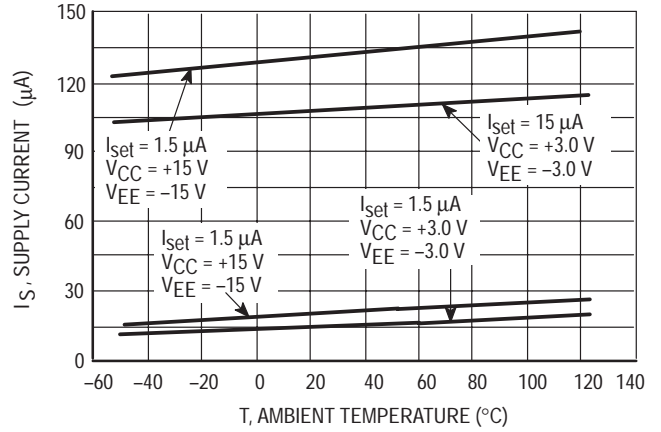


Figure 9. Output Voltage Swing versus Supply Voltage

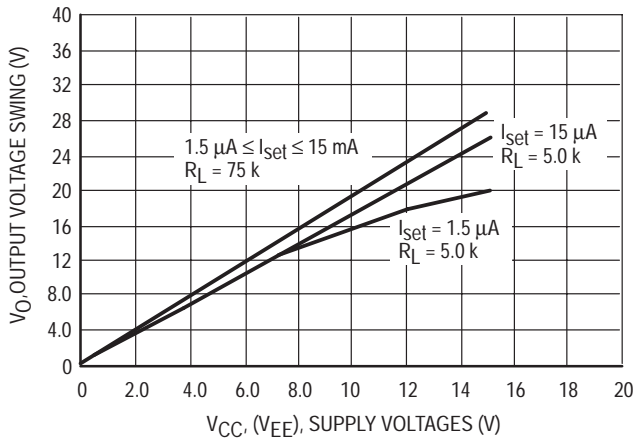


Figure 10. Slew Rate versus Set Current

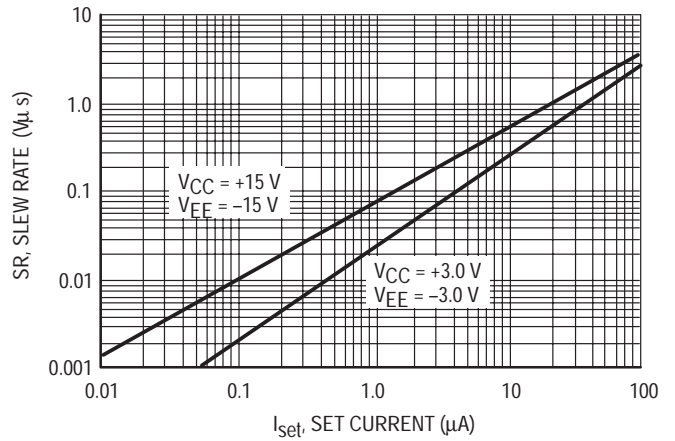


Figure 11. Input Noise Voltage versus Set Current

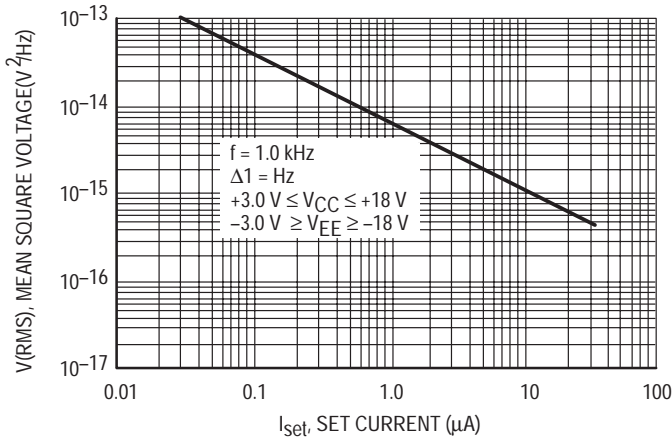


Figure 12. Optimum Source Resistance for Minimum Noise versus Set Current

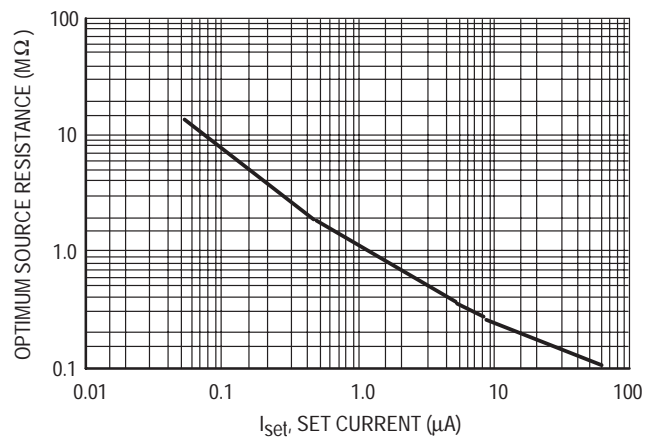
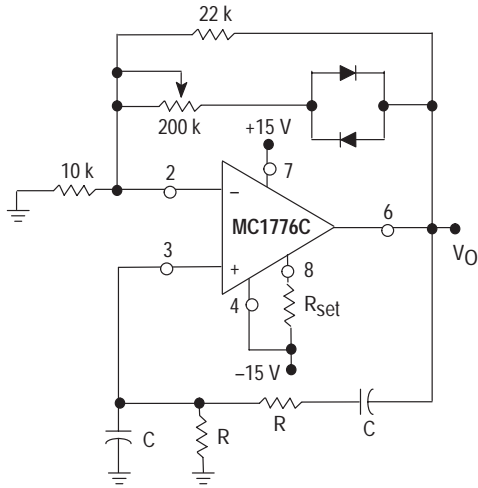




Figure 13. Wien Bridge Oscillator

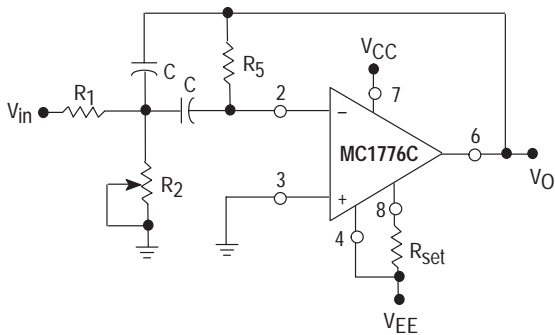


$$f_0 = \frac{1}{2\pi RC} \quad (\text{for } f_0 = 1.0 \text{ kHz})$$

$$R = 16 \text{ k}\Omega$$

$$C = 0.01 \mu\text{F}$$

Figure 14. Multiple Feedback Bandpass Filter



For a given:

$f_0$  = center frequency  
 $A(f_0)$  = Gain at center frequency  
 $Q$  = quality factor

Choose a value for C, then

$$R_5 = \frac{Q}{\pi f_0 C}$$

$$R_1 = \frac{R_5}{2A(f_0)}$$

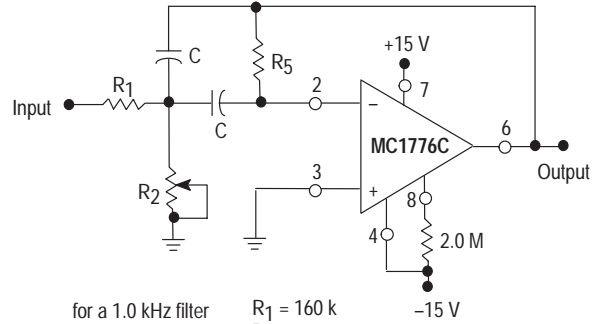
$$R_2 = \frac{R_1 R_5}{4Q^2 R_1 - R_5}$$

To obtain less than 10% error from the operational amplifier:

$$\frac{Q_0 f_0}{\text{GBW}} \leq 0.1$$

where  $f_0$  and GBW are expressed in Hz. GBW is available from Figure 6 as a function of Set Current,  $I_{\text{set}}$ .

Figure 15. Multiple Feedback Bandpass Filter (1.0 kHz)



for a 1.0 kHz filter  
 with  $Q = 10$   
 and  $A(f_0) = 1$

$$R_1 = 160 \text{ k}$$

$$R_2 = 820$$

$$R_5 = 300 \text{ k}$$

$$C = 0.01 \mu\text{F}$$

Figure 16. Gated Amplifier

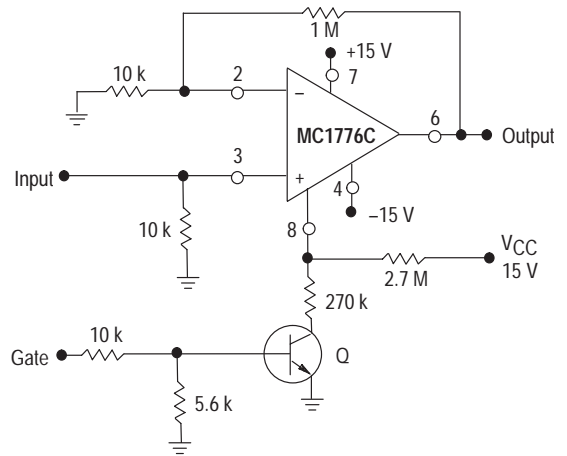
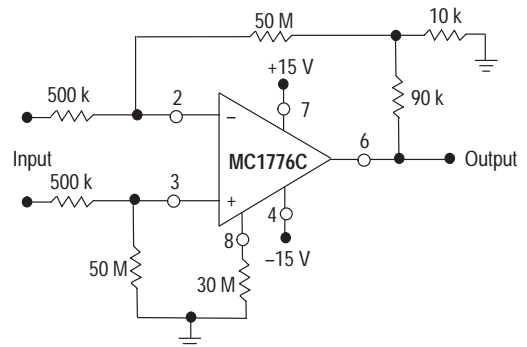


Figure 17. High Input Impedance Amplifier



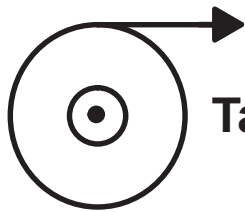
# Tape and Reel Options

---

## In Brief . . .

Motorola offers the convenience of Tape and Reel packaging for our growing family of standard integrated circuit products. Reels are available to support the requirements of both first and second generation pick-and-place equipment. The packaging fully conforms to the latest EIA-481A specification. The antistatic embossed tape provides a secure cavity, sealed with a peel-back cover tape.

	<b>Page</b>
Tape and Reel Configurations . . . . .	12-2
Tape and Reel Information Table . . . . .	12-4
Analog MPQ Table . . . . .	12-5

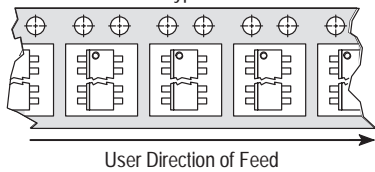


# Tape and Reel Configurations

## Mechanical Polarization

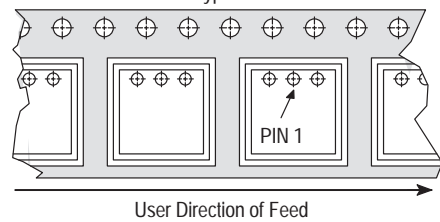
### SOIC and Micro-8 DEVICES

Typical



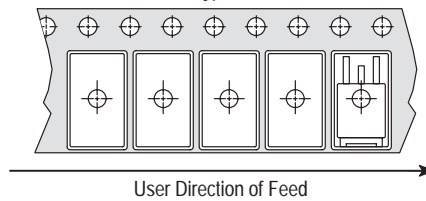
### PLCC DEVICES

Typical



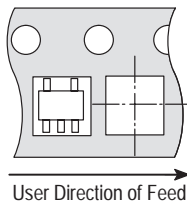
### DPAK and D<sup>2</sup>PAK DEVICES

Typical



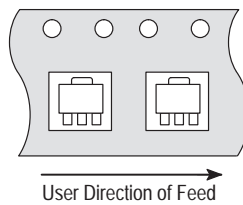
### SOT-23 (5 Pin) DEVICES

Typical



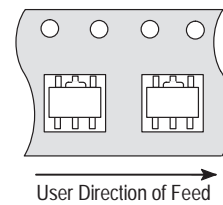
### SOT-89 (3 Pin) DEVICES

Typical



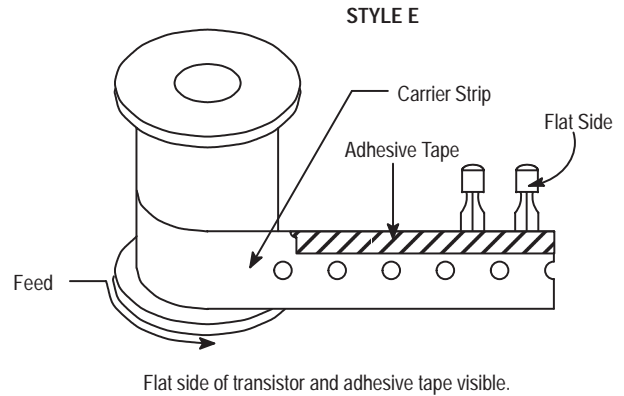
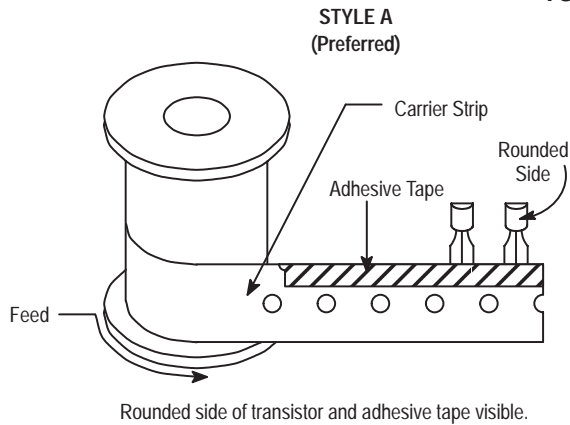
### SOT-89 (5 Pin) DEVICES

Typical

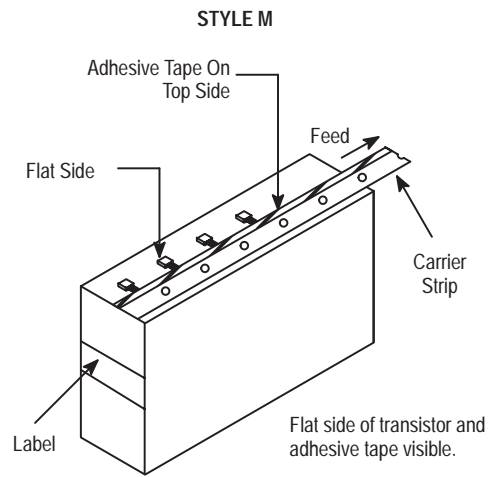
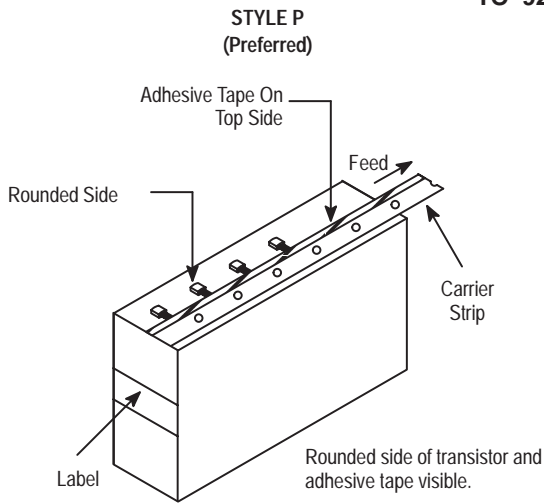


# Tape and Reel Configurations (continued)

## TO-92 Reel Styles



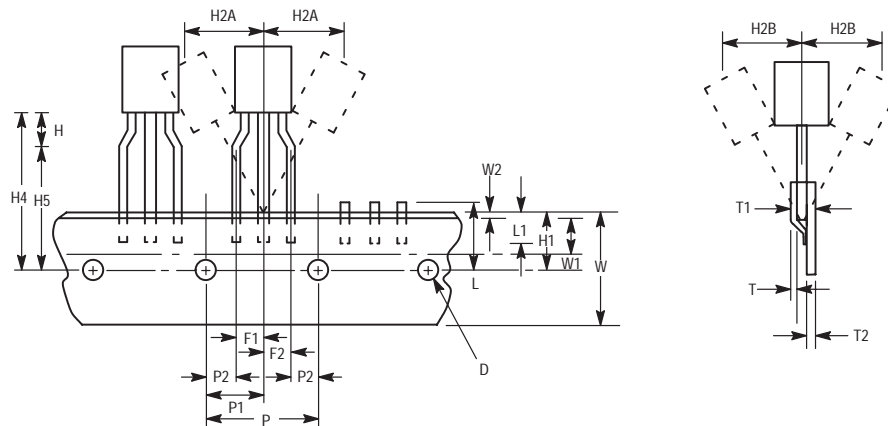
## TO-92 Ammo Pack Styles



Style P ammo pack is equivalent to Styles A and B of reel pack dependent on feed orientation from box.

Style M ammo pack is equivalent to Style E of reel pack dependent on feed orientation from box.

## TO-92 EIA Radial Tape in Fan Fold Box or On Reel



# Tape and Reel Information Table

Package	Tape Width (mm)	Devices <sup>(1)</sup> per Reel	Reel Size (inch)	Device Suffix
SO-8, SOP-8	12	2,500	13	R2
SO-14	16	2,500	13	R2
SO-16	16	2,500	13	R2
SO-16L, SO-8+8L WIDE	16	1,000	13	R2
SO-20L WIDE	24	1,000	13	R2
SO-24L WIDE	24	1,000	13	R2
SO-28L WIDE	24	1,000	13	R2
SO-28L WIDE	32	1,000	13	R3
Micro-8	12	2,500	13	R2
PLCC-20	16	1,000	13	R2
PLCC-28	24	500	13	R2
PLCC-44	32	500	13	R2
PLCC-52	32	500	13	R2
PLCC-68	44	250	13	R2
PLCC-84	44	250	13	R2
TO-226AA (TO-92) <sup>(2)</sup>	18	2,000	13	RA, RE, RP, or RM (Ammo Pack) only
DPAK	16	2,500	13	RK
D <sup>2</sup> PAK	24	800	13	R4
SOT-23 (5 Pin)	8	3,000	7	TR
SOT-89 (3/5 Pin)	12	1,000	7	T1

<sup>(1)</sup> Minimum order quantity is 1 reel. Distributors/OEM customers may break lots or reels at their option, however broken reels may not be returned.

<sup>(2)</sup> Integrated circuits in TO-226AA packages are available in Styes A and E only, with optional "Ammo Pack" (Suffix RP or RM). The RA and RP configurations are preferred. For ordering information please contact your local Motorola Semiconductor Sales Office.

# Analog MPQ Table

## Tape/Reel and Ammo Pack

Package Type	Package Code	MPQ
<b>PLCC</b>		
Case 775	0802	1000/reel
Case 776	0804	500/reel
Case 777	0801	500/reel
<b>SOIC</b>		
Case 751	0095	2500/reel
Case 751A	0096	2500/reel
Case 751B	0097	2500/reel
Case 751G	2003	1000/reel
Case 751D	2005	1000/reel
Case 751E	2008	1000/reel
Case 751F	2009	1000/reel
<b>Micro-8</b>		
Case 846A	-	2500/reel
<b>TO-92</b>		
Case 29	0031	2000/reel
Case 29	0031	2000/Ammo Pack
<b>DPAK</b>		
Case 369A	-	2500/reel
<b>D2PAK</b>		
Case 936	-	800/reel
<b>SOT-23 (5 Pin)</b>		
Case 1212	-	3000/reel
<b>SOT-89 (3 Pin)</b>		
Case 1213	-	1000/reel
<b>SOT-89 (5 Pin)</b>		
Case 1214	-	1000/reel



# Packaging Information

---

## In Brief . . .

*The packaging availability for each device type is indicated on the individual data sheets and the Selector Guide. All of the outline dimensions for the packages are given in this section.*

*The maximum power consumption an integrated circuit can tolerate at a given operating ambient temperature can be found from the equation:*

$$P_{D(TA)} = \frac{T_{J(max)} - T_A}{R_{\theta JA(Typ)}}$$

*where:*

$P_{D(TA)}$  = *Power Dissipation allowable at a given operating ambient temperature. This must be greater than the sum of the products of the supply voltages and supply currents at the worst case operating condition.*

$T_{J(max)}$  = *Maximum operating Junction Temperature as listed in the Maximum Ratings Section. See individual data sheets for  $T_{J(max)}$  information.*

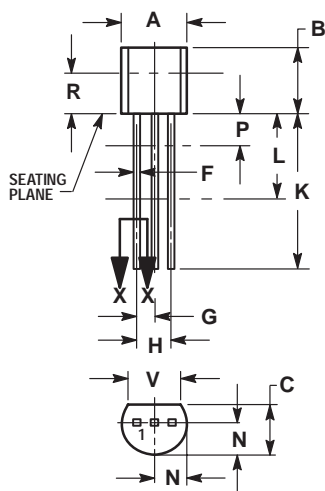
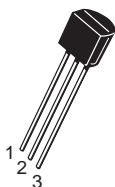
$T_A$  = *Maximum desired operating Ambient Temperature*

$R_{\theta JA(Typ)}$  = *Typical Thermal Resistance Junction-to-Ambient*



# Case Outline Dimensions

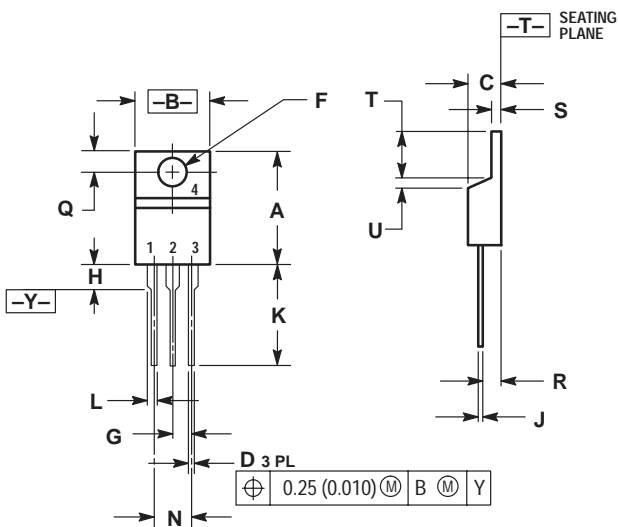
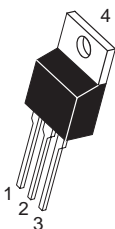
**LP, P, Z SUFFIX**  
**CASE 29-04**  
 Plastic Package  
 (TO-226AA/TO-92)  
 ISSUE AD



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
  4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K MINIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.022	0.41	0.55
F	0.016	0.019	0.41	0.48
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---

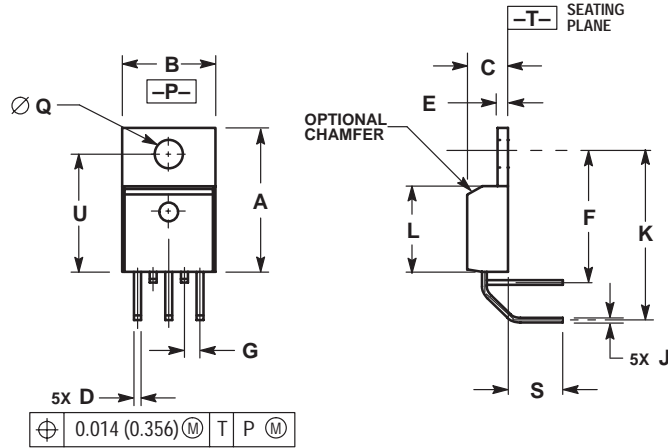
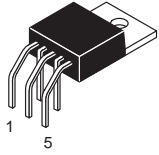
**KC, T SUFFIX**  
**CASE 221A-06**  
 Plastic Package  
 ISSUE Y



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.560	0.625	14.23	15.87
B	0.380	0.420	9.66	10.66
C	0.140	0.190	3.56	4.82
D	0.020	0.045	0.51	1.14
F	0.139	0.155	3.53	3.93
G	0.100 BSC	---	2.54 BSC	---
H	---	0.280	---	7.11
J	0.012	0.045	0.31	1.14
K	0.500	0.580	12.70	14.73
L	0.045	0.070	1.15	1.77
N	0.200 BSC	---	5.08 BSC	---
Q	0.100	0.135	2.54	3.42
R	0.080	0.115	2.04	2.92
S	0.020	0.055	0.51	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27

**TH SUFFIX**  
**CASE 314A-03**  
 Plastic Package  
 ISSUE D

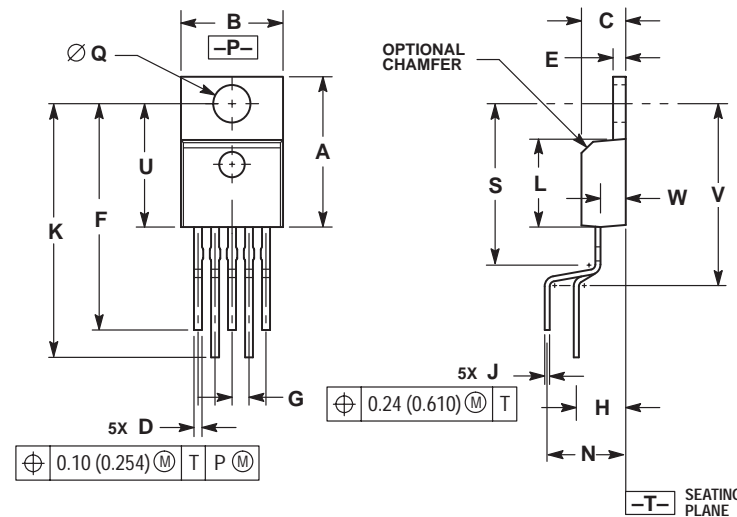
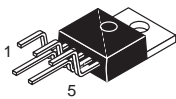


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION D DOES NOT INCLUDE INTERCONNECT BAR (DAMBAR) PROTRUSION. DIMENSION D INCLUDING PROTRUSION SHALL NOT EXCEED 0.043 (1.092) MAXIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.572	0.613	14.529	15.570
B	0.390	0.415	9.906	10.541
C	0.170	0.180	4.318	4.572
D	0.025	0.038	0.635	0.965
E	0.048	0.055	1.219	1.397
F	0.570	0.585	14.478	14.859
G	0.067 BSC		1.702 BSC	
J	0.015	0.025	0.381	0.635
K	0.730	0.745	18.542	18.923
L	0.320	0.365	8.128	9.271
Q	0.140	0.153	3.556	3.886
S	0.210	0.260	5.334	6.604
U	0.468	0.505	11.888	12.827

**T, TV SUFFIX**  
**CASE 314B-05**  
 Plastic Package  
 ISSUE J

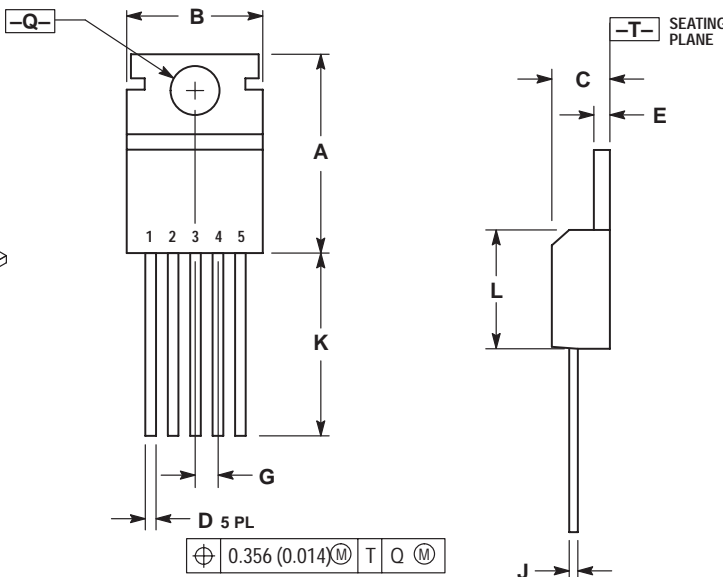
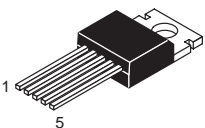


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION D DOES NOT INCLUDE INTERCONNECT BAR (DAMBAR) PROTRUSION. DIMENSION D INCLUDING PROTRUSION SHALL NOT EXCEED 0.043 (1.092) MAXIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.572	0.613	14.529	15.570
B	0.390	0.415	9.906	10.541
C	0.170	0.180	4.318	4.572
D	0.025	0.038	0.635	0.965
E	0.048	0.055	1.219	1.397
F	0.850	0.935	21.590	23.749
G	0.067 BSC		1.702 BSC	
H	0.166 BSC		4.216 BSC	
J	0.015	0.025	0.381	0.635
K	0.900	1.100	22.860	27.940
L	0.320	0.365	8.128	9.271
N	0.320 BSC		8.128 BSC	
Q	0.140	0.153	3.556	3.886
S	---	0.620	---	15.748
U	0.468	0.505	11.888	12.827
V	---	0.735	---	18.669
W	0.090	0.110	2.286	2.794

**T SUFFIX**  
**CASE 314C-01**  
 Plastic Package  
 ISSUE A

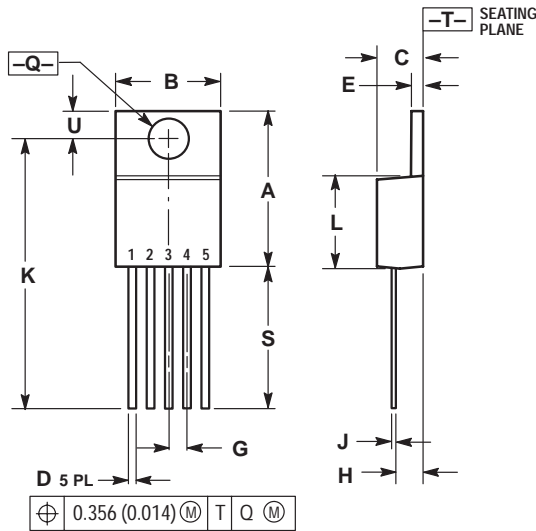
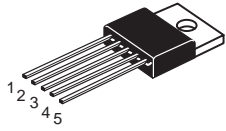


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION D DOES NOT INCLUDE INTERCONNECT BAR (DAMBAR) PROTRUSION. DIMENSION D INCLUDING PROTRUSION SHALL NOT EXCEED 10.92 (0.043) MAXIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.610	0.625	15.59	15.88
B	0.380	0.420	9.65	10.67
C	0.160	0.190	4.06	4.83
D	0.020	0.040	0.51	1.02
E	0.035	0.055	0.89	1.40
G	0.067 BSC		1.702 BSC	
J	0.015	0.025	0.38	0.64
K	0.500	---	12.70	---
L	0.355	0.370	9.02	9.40
Q	0.139	0.147	3.53	3.73

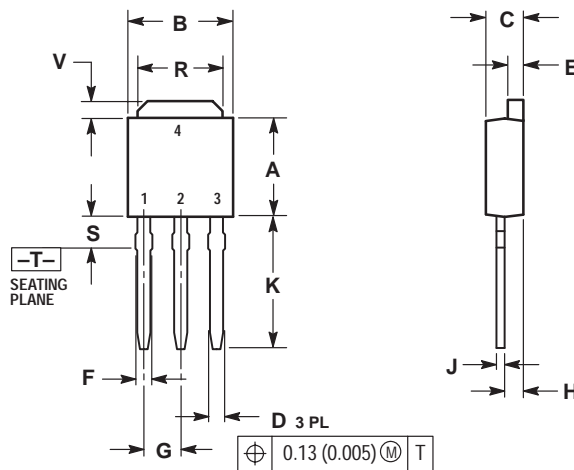
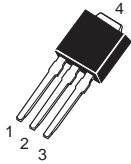
**T, T1 SUFFIX**  
**CASE 314D-03**  
 Plastic Package  
 ISSUE D



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION D DOES NOT INCLUDE INTERCONNECT BAR (DAMBAR) PROTRUSION. DIMENSION D INCLUDING PROTRUSION SHALL NOT EXCEED 10.92 (0.043) MAXIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.572	0.613	14.529	15.570
B	0.390	0.415	9.906	10.541
C	0.170	0.180	4.318	4.572
D	0.025	0.038	0.635	0.965
E	0.048	0.055	1.219	1.397
G	0.067 BSC		1.702 BSC	
H	0.087	0.112	2.210	2.845
J	0.015	0.025	0.381	0.635
K	1.020	1.065	25.908	27.051
L	0.320	0.365	8.128	9.271
Q	0.140	0.153	3.556	3.886
U	0.105	0.117	2.667	2.972
S	0.543	0.582	13.792	14.783

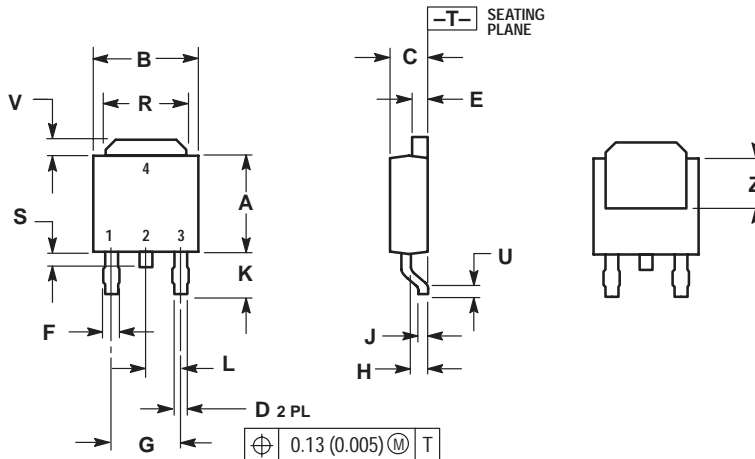
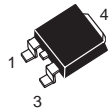
**DT-1 SUFFIX**  
**CASE 369-07**  
 Plastic Package (DPAK)  
 ISSUE K



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.250	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.090 BSC		2.29 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.350	0.380	8.89	9.65
R	0.175	0.215	4.45	5.46
S	0.050	0.090	1.27	2.28
V	0.030	0.050	0.77	1.27

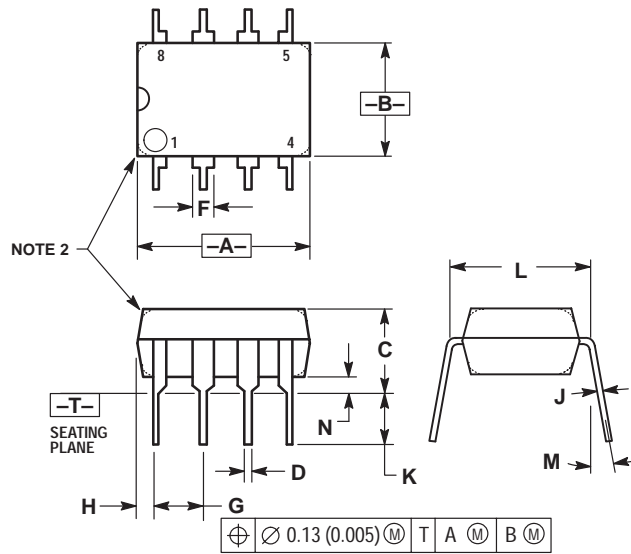
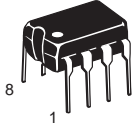
**DT SUFFIX**  
**CASE 369A-13**  
 Plastic Package (DPAK)  
 ISSUE Y



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.250	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.175	0.215	4.45	5.46
S	0.020	0.050	0.51	1.27
U	0.020	---	0.51	---
V	0.030	0.050	0.77	1.27
Z	0.138	---	3.51	---

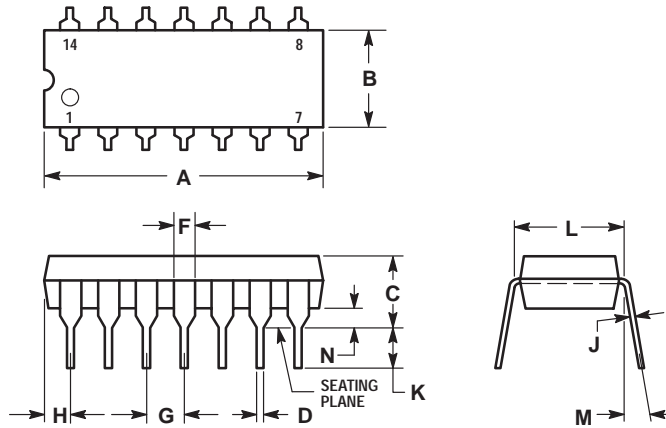
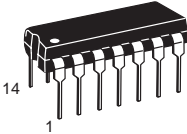
**DP1, N, P, P1 SUFFIX**  
**CASE 626-05**  
 Plastic Package  
 ISSUE K



- NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
  2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
  3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	— 10°		— 10°	
N	0.76	1.01	0.030	0.040

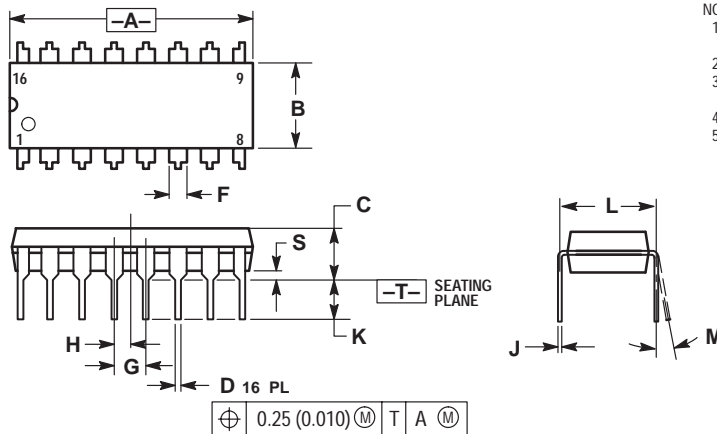
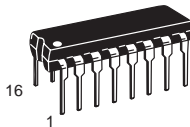
**N, P, N-14, P2 SUFFIX**  
**CASE 646-06**  
 Plastic Package  
 ISSUE L



- NOTES:
1. LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
  2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
  4. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	19.56
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.300 BSC		7.62 BSC	
M	0° 10°		0° 10°	
N	0.015	0.039	0.39	1.01

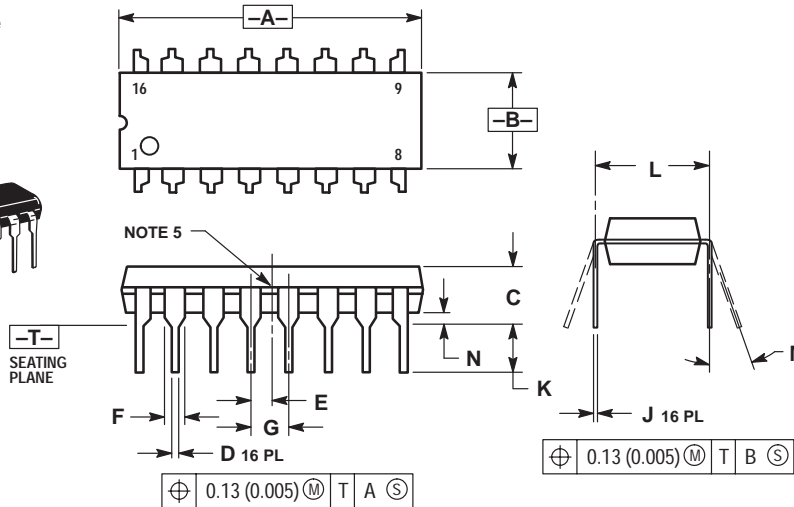
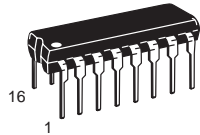
**DP2, N, P, PC SUFFIX**  
**CASE 648-08**  
 Plastic Package  
 ISSUE R



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
  5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0° 10°		0° 10°	
S	0.020	0.040	0.51	1.01

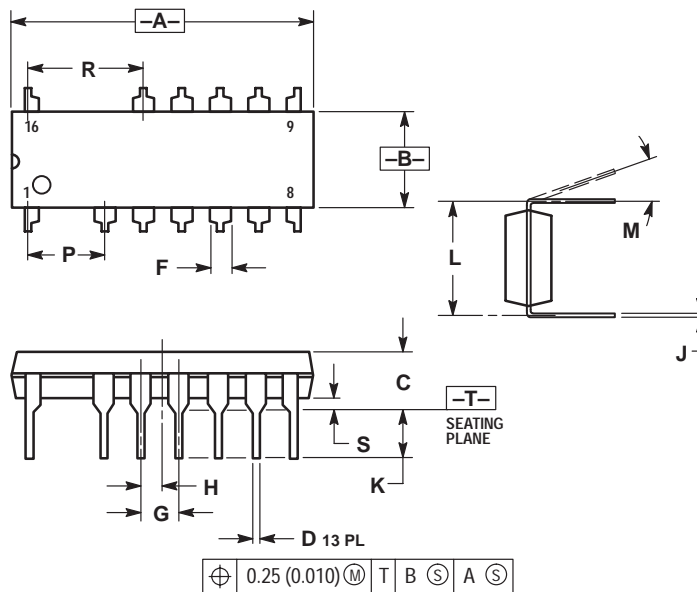
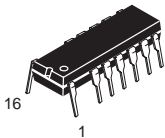
**B, P, P2, V SUFFIX**  
**CASE 648C-03**  
 Plastic Package  
 (DIP-16)  
 ISSUE C



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
  5. INTERNAL LEAD CONNECTION BETWEEN 4 AND 5, 12 AND 13.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.840	18.80	21.34
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
E	0.050 BSC			
F	0.040	0.70	1.02	1.78
G	0.100 BSC			
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.300 BSC			
M	0°	10°	0°	10°
N	0.015	0.040	0.39	1.01

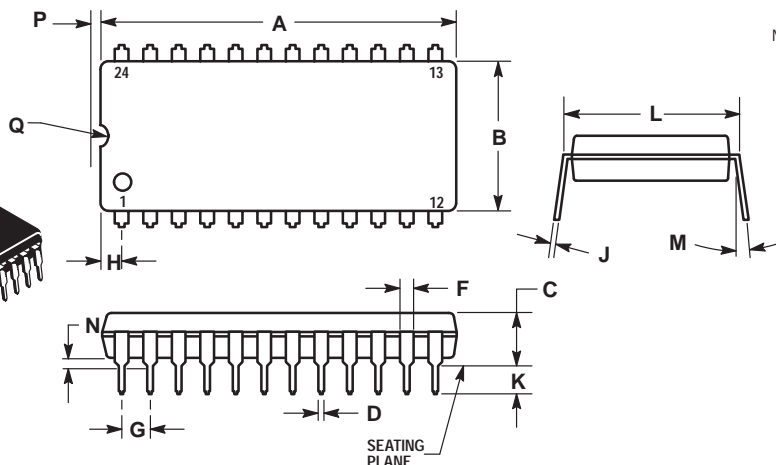
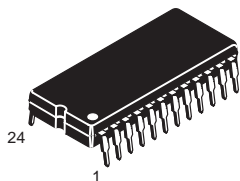
**P SUFFIX**  
**CASE 648E-01**  
 Plastic Package  
 (DIP-16)  
 ISSUE O



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  4. DIMENSION A AND B DOES NOT INCLUDE MOLD PROTRUSION.
  5. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.25 (0.010).
  6. ROUNDED CORNER OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.760	18.80	19.30
B	0.245	0.260	6.23	6.60
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.050	0.070	1.27	1.77
G	0.100 BSC			
H	0.050 BSC			
J	0.008	0.015	0.21	0.38
K	0.120	0.140	3.05	3.55
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
P	0.200 BSC			
R	0.300 BSC			
S	0.015	0.035	0.39	0.88

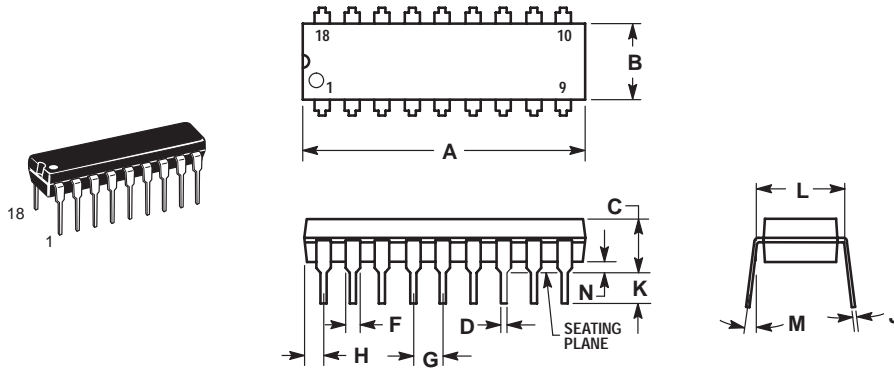
**P SUFFIX**  
**CASE 649-03**  
 Plastic Package  
 ISSUE D



- NOTES:
1. LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
  2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	31.50	32.13	1.240	1.265
B	13.21	13.72	0.520	0.540
C	4.70	5.21	0.185	0.205
D	0.38	0.51	0.015	0.020
F	1.02	1.52	0.040	0.060
G	2.54 BSC		0.100 BSC	
H	1.65	2.16	0.065	0.085
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	14.99	15.49	0.590	0.610
M	---	10	---	10°
N	0.51	1.02	0.020	0.040
P	0.13	0.38	0.005	0.015
Q	0.51	0.76	0.020	0.030

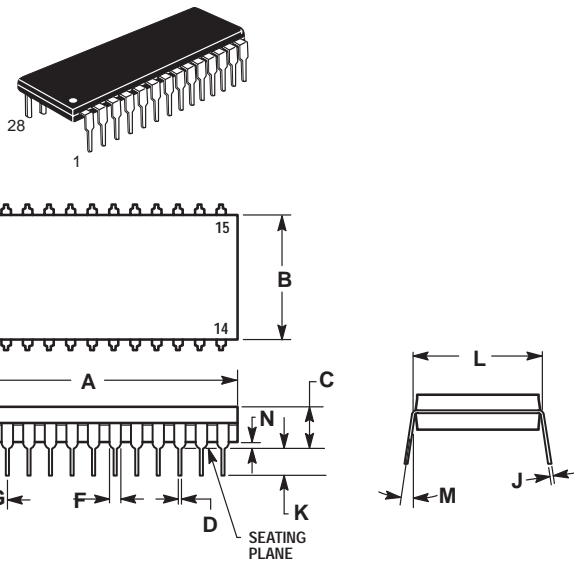
**A, B, N, P SUFFIX**  
**CASE 707-02**  
 Plastic Package  
 ISSUE C



- NOTES:
1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25 (0.010) AT MAXIMUM MATERIAL CONDITION, IN RELATION TO SEATING PLANE AND EACH OTHER.
  2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	22.22	23.24	0.875	0.915
B	6.10	6.60	0.240	0.260
C	3.56	4.57	0.140	0.180
D	0.36	0.56	0.014	0.022
F	1.27	1.78	0.050	0.070
G	2.54 BSC		0.100 BSC	
H	1.02	1.52	0.040	0.060
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040

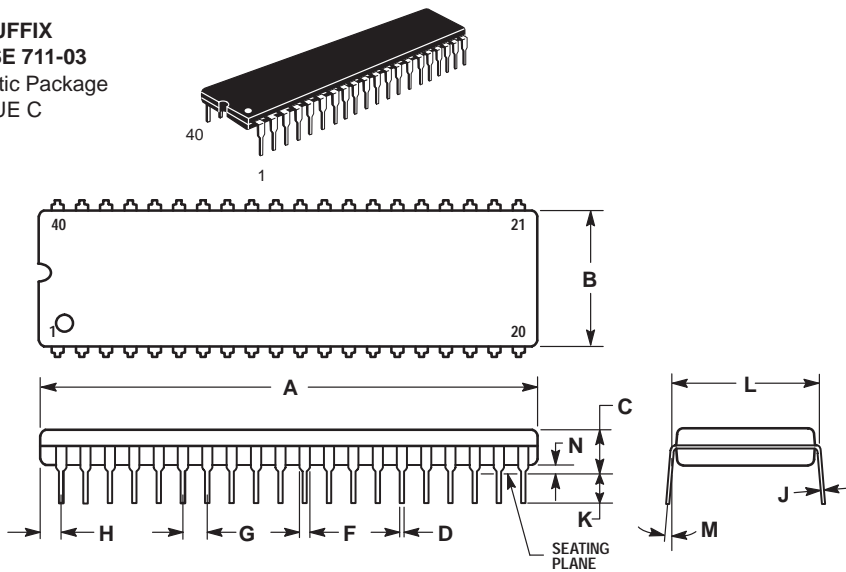
**P SUFFIX**  
**CASE 710-02**  
 Plastic Package  
 ISSUE B



- NOTES:
1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25 (0.010) AT MAXIMUM MATERIAL CONDITION, IN RELATION TO SEATING PLANE AND EACH OTHER.
  2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	36.45	37.21	1.435	1.465
B	13.72	14.22	0.540	0.560
C	3.94	5.08	0.155	0.200
D	0.36	0.56	0.014	0.022
F	1.02	1.52	0.040	0.060
G	2.54 BSC		0.100 BSC	
H	1.65	2.16	0.065	0.085
J	0.20	0.38	0.008	0.015
K	2.92	3.43	0.115	0.135
L	15.24 BSC		0.600 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040

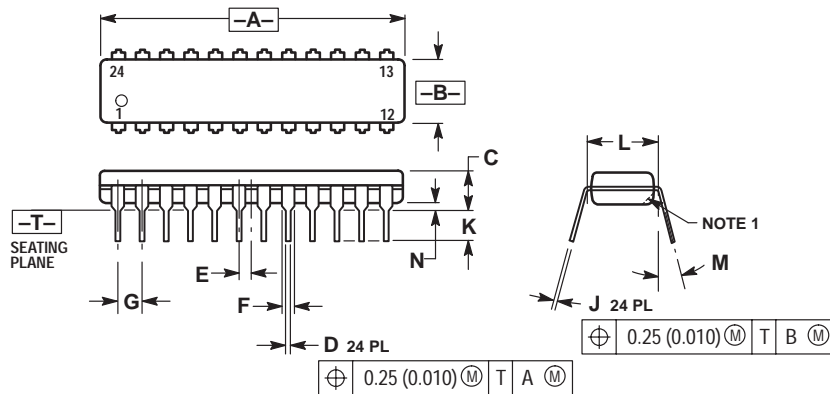
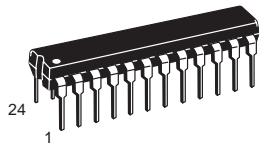
**P SUFFIX**  
**CASE 711-03**  
 Plastic Package  
 ISSUE C



- NOTES:
1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25 (0.010) AT MAXIMUM MATERIAL CONDITION, IN RELATION TO SEATING PLANE AND EACH OTHER.
  2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	51.69	52.45	2.035	2.065
B	13.72	14.22	0.540	0.560
C	3.94	5.08	0.155	0.200
D	0.36	0.56	0.014	0.022
F	1.02	1.52	0.040	0.060
G	2.54 BSC		0.100 BSC	
H	1.65	2.16	0.065	0.085
J	0.20	0.38	0.008	0.015
K	2.92	3.43	0.115	0.135
L	15.24 BSC		0.600 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040

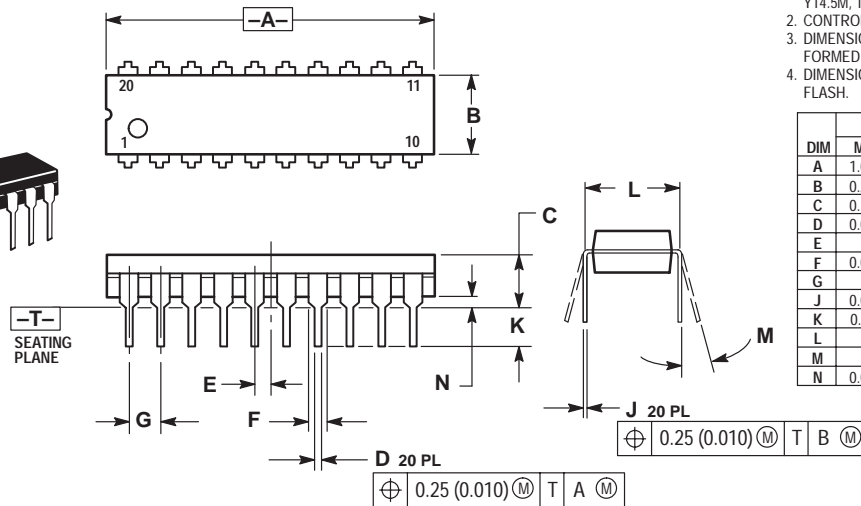
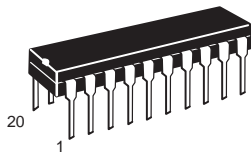
**F, P, P-3 SUFFIX**  
**CASE 724-03**  
 Plastic Package  
 (NDIP-24)  
 ISSUE D



- NOTES:
1. CHAMFERED CONTOUR OPTIONAL.
  2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  4. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.230	1.265	31.25	32.13
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.020	0.38	0.51
E	0.050 BSC		1.27 BSC	
F	0.040	0.060	1.02	1.52
G	0.100 BSC		2.54 BSC	
J	0.007	0.012	0.18	0.30
K	0.110	0.140	2.80	3.55
L	0.300 BSC		7.62 BSC	
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.01

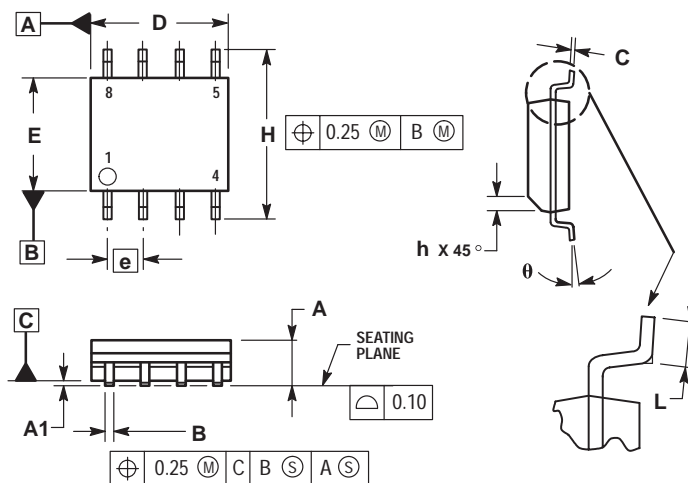
**H, P, DP SUFFIX**  
**CASE 738-03**  
 Plastic Package  
 ISSUE E



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
  4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.010	1.070	25.66	27.17
B	0.240	0.260	6.10	6.60
C	0.150	0.180	3.81	4.57
D	0.015	0.022	0.39	0.55
E	0.050 BSC		1.27 BSC	
F	0.050	0.070	1.27	1.77
G	0.100 BSC		2.54 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.140	2.80	3.55
L	0.300 BSC		7.62 BSC	
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.01

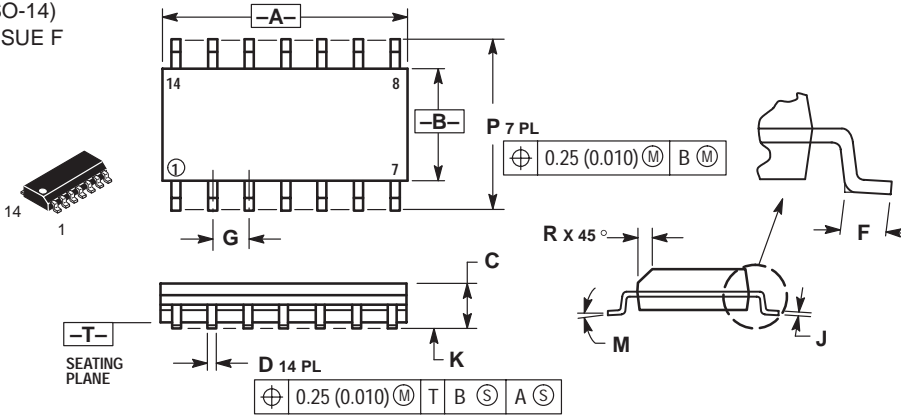
**D, D1, D2 SUFFIX**  
**CASE 751-05**  
 Plastic Package  
 (SO-8, SOP-8)  
 ISSUE R



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. DIMENSIONS ARE IN MILLIMETERS.
  3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
  5. DIMENSION B DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.18	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0°	7°

**D SUFFIX**  
**CASE 751A-03**  
 Plastic Package  
 (SO-14)  
 ISSUE F

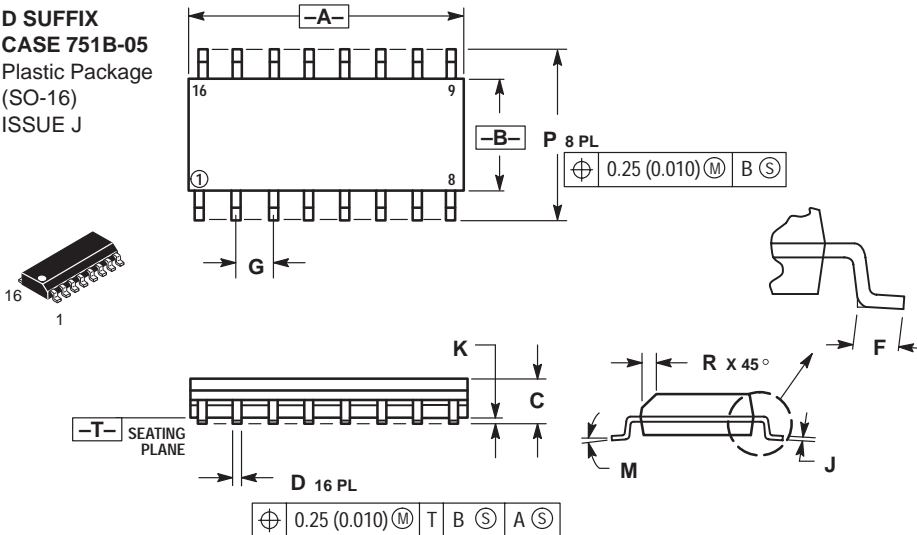


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

**D SUFFIX**  
**CASE 751B-05**  
 Plastic Package  
 (SO-16)  
 ISSUE J

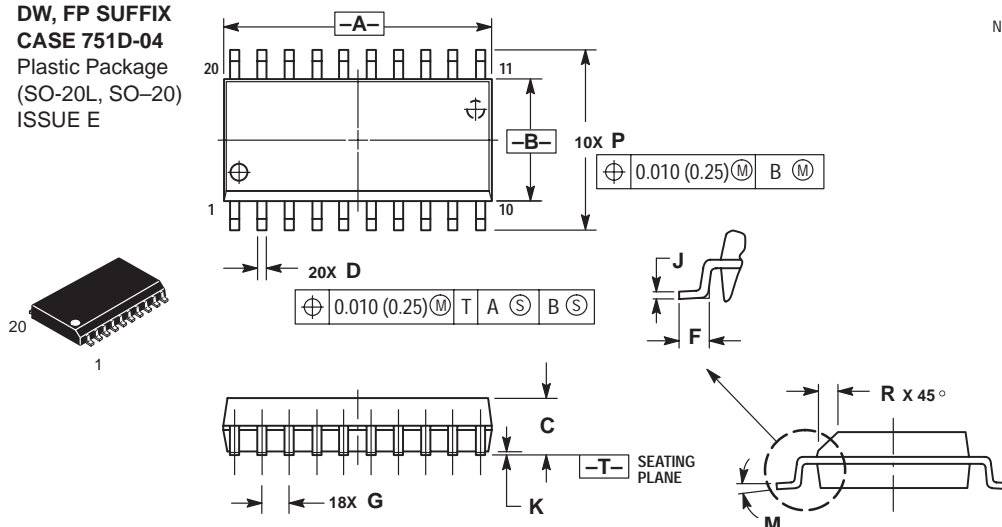


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

**DW, FP SUFFIX**  
**CASE 751D-04**  
 Plastic Package  
 (SO-20L, SO-20)  
 ISSUE E



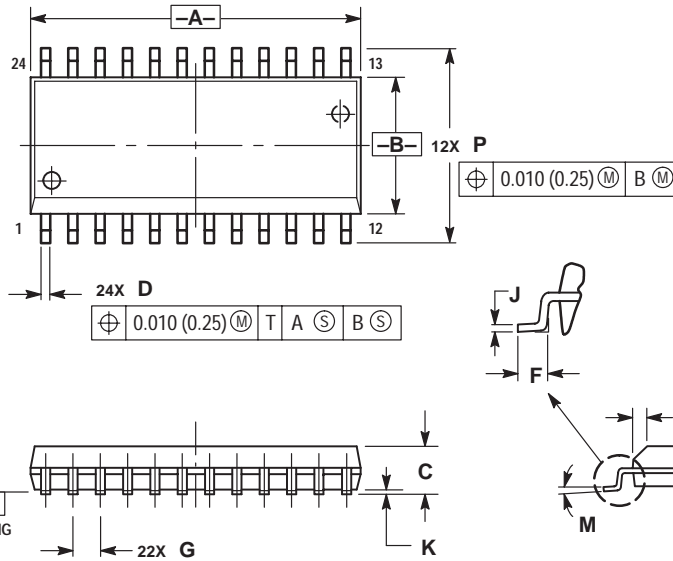
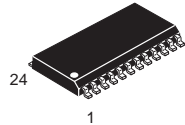
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.150 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	12.65	12.95	0.499	0.510
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029



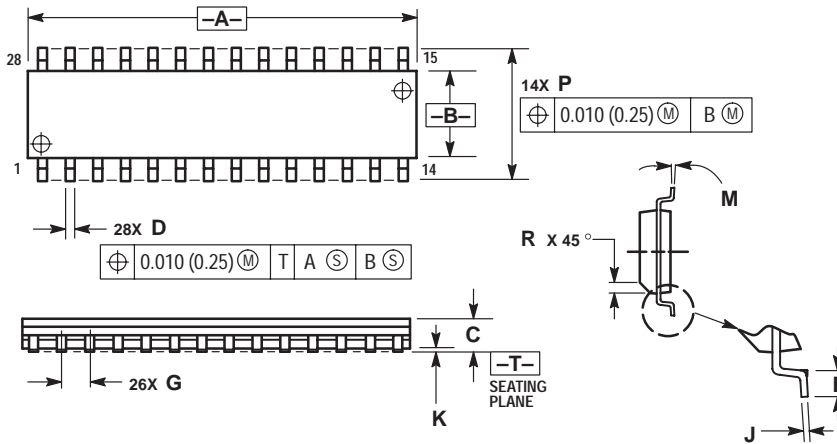
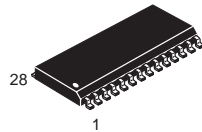
**DW SUFFIX**  
**CASE 751E-04**  
 Plastic Package  
 (SO-24L,  
 SOP (16+4+4)L)  
 ISSUE E



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	15.25	15.54	0.601	0.612
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.41	0.90	0.016	0.035
G	1.27 BSC		0.050 BSC	
J	0.23	0.32	0.009	0.013
K	0.13	0.29	0.005	0.011
M	0°	8°	0°	8°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

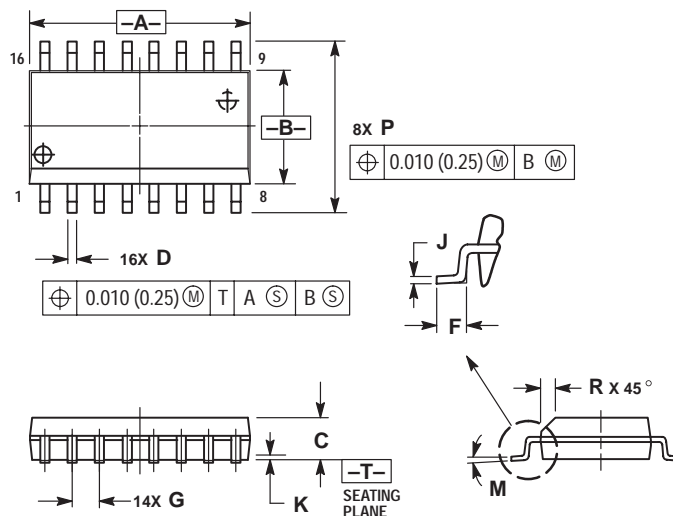
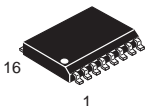
**DW SUFFIX**  
**CASE 751F-04**  
 Plastic Package  
 (SO-28L, SOIC-28)  
 ISSUE E



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	17.80	18.05	0.701	0.711
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.41	0.90	0.016	0.035
G	1.27 BSC		0.050 BSC	
J	0.23	0.32	0.009	0.013
K	0.13	0.29	0.005	0.011
M	0°	8°	0°	8°
P	10.01	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

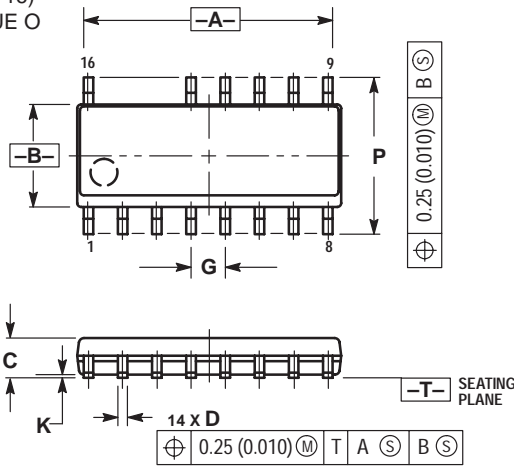
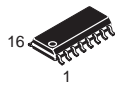
**DW SUFFIX**  
**CASE 751G-02**  
 Plastic Package  
 (SO-16L, SOP-16L,  
 SOP-8+8L)  
 ISSUE A



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.15	10.45	0.400	0.411
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

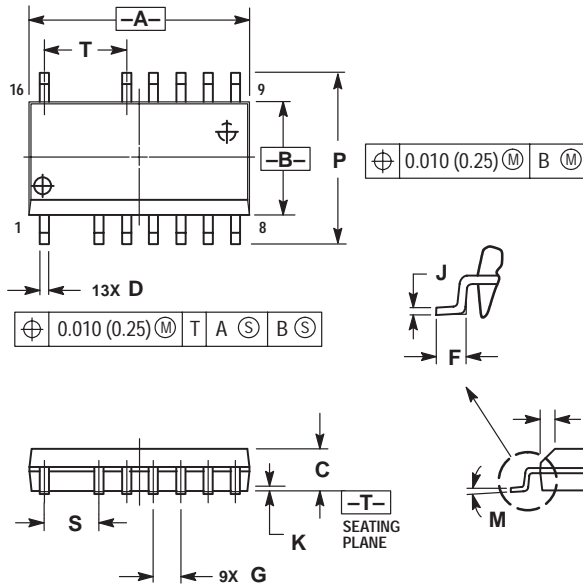
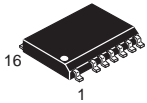
**D SUFFIX**  
**CASE 751K-01**  
 Plastic Package  
 (SO-16)  
 ISSUE O



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.368	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

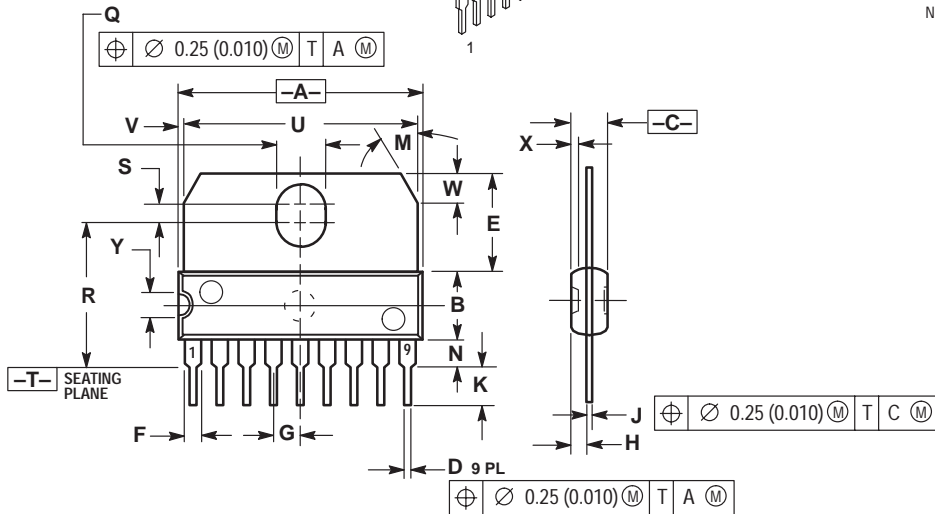
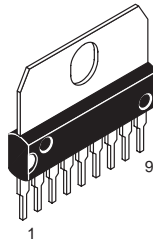
**DW SUFFIX**  
**CASE 751N-01**  
 Plastic Package  
 (SOP-16L)  
 ISSUE O



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.15	10.45	0.400	0.411
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029
S	2.54 BSC		0.100 BSC	
T	3.81 BSC		0.150 BSC	

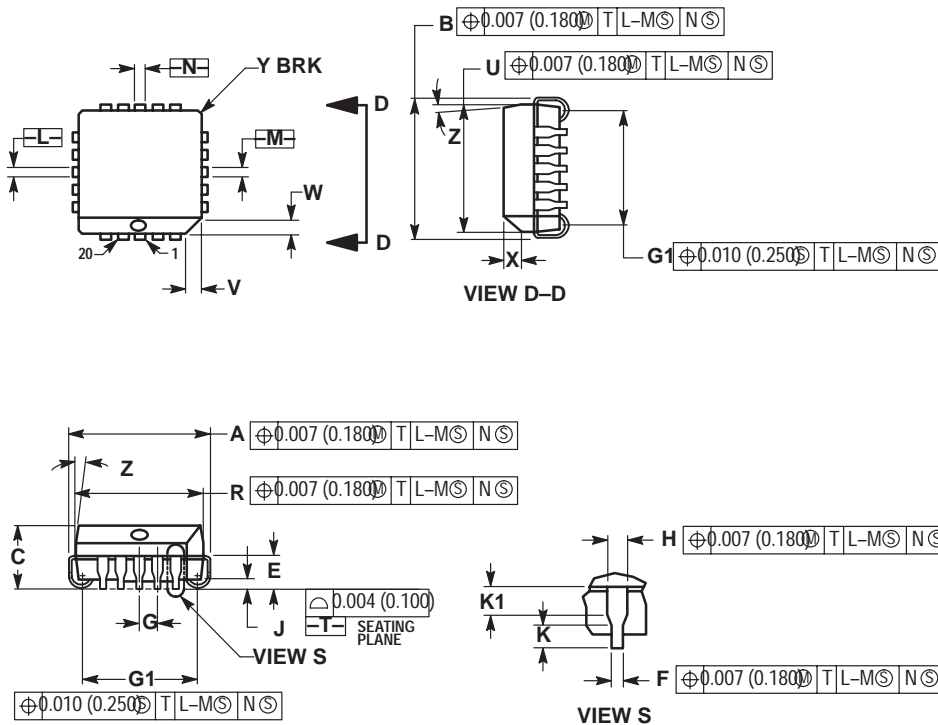
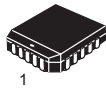
**CASE 762-01**  
 Plastic Medium Power Package  
 (SIP-9)  
 ISSUE C



- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1982.  
 2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	22.40	23.00	0.873	0.897
B	6.40	6.60	0.252	0.260
C	3.45	3.65	0.135	1.143
D	0.40	0.55	0.015	0.021
E	9.35	9.60	0.368	0.377
F	1.40	1.60	0.055	0.062
G	2.54 BSC		0.100 BSC	
H	1.51	1.71	0.059	0.067
J	0.360	0.400	0.014	0.015
K	3.95	4.20	0.155	0.165
M	30° BSC		30° BSC	
N	2.50	2.70	0.099	0.106
Q	3.15	3.45	0.124	0.135
R	13.60	13.90	0.535	0.547
S	1.65	1.95	0.064	0.076
U	22.00	22.20	0.866	0.874
V	0.55	0.75	0.021	0.029
W	2.89 BSC		0.113 BSC	
X	0.65	0.75	0.025	0.029
Y	2.70	2.80	0.106	0.110

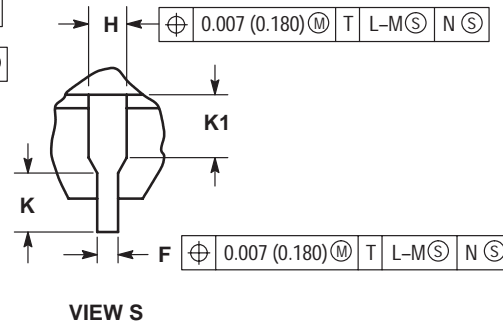
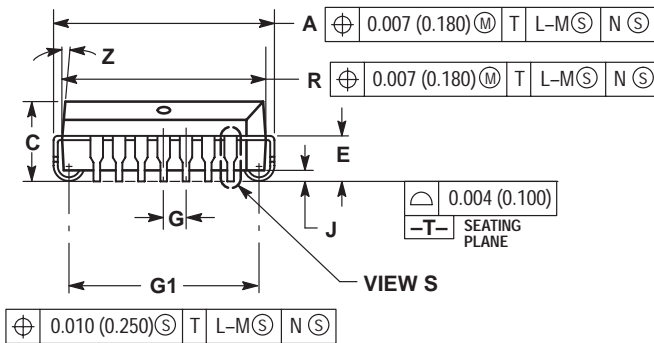
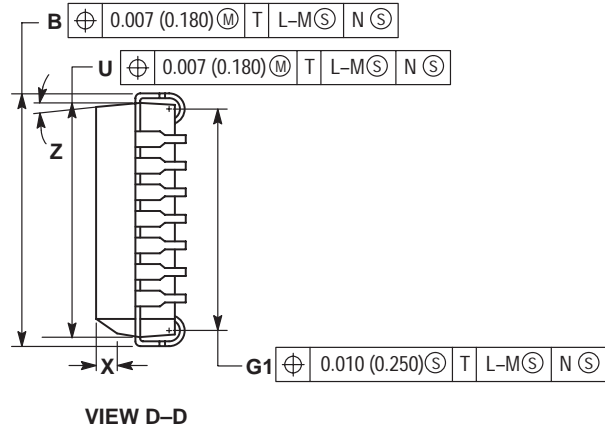
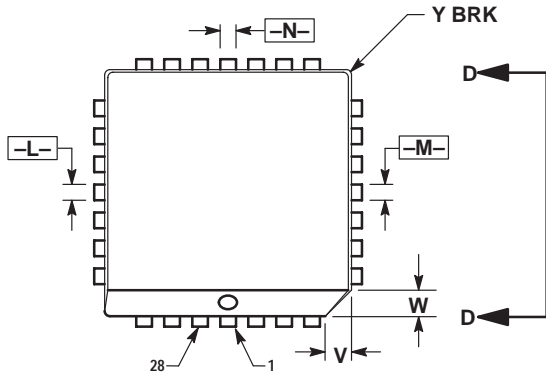
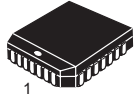
**FN SUFFIX**  
**CASE 775-02**  
 Plastic Package  
 (PLCC-20)  
 ISSUE C



- NOTES:  
 1. DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.  
 2. DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.  
 3. DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.  
 4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 5. CONTROLLING DIMENSION: INCH.  
 6. THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM BY UP TO 0.012 (0.300). DIMENSIONS R AND U ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.  
 7. DIMENSION H DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE GREATER THAN 0.037 (0.940). THE DAMBAR INTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE SMALLER THAN 0.025 (0.635).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.385	0.395	9.78	10.03
B	0.385	0.395	9.78	10.03
C	0.165	0.180	4.20	4.57
E	0.090	0.110	2.29	2.79
F	0.013	0.019	0.33	0.48
G	0.050 BSC		1.27 BSC	
H	0.026	0.032	0.66	0.81
J	0.020	---	0.51	---
K	0.025	---	0.64	---
R	0.350	0.356	8.89	9.04
U	0.350	0.356	8.89	9.04
V	0.042	0.048	1.07	1.21
W	0.042	0.048	1.07	1.21
X	0.042	0.056	1.07	1.42
Y	---	0.020	---	0.50
Z	2°	10°	---	10°
G1	0.310	0.330	7.88	8.38
K1	0.040	---	1.02	---

**FN SUFFIX**  
**CASE 776-02**  
 Plastic Package  
 (PLCC-28)  
 ISSUE D

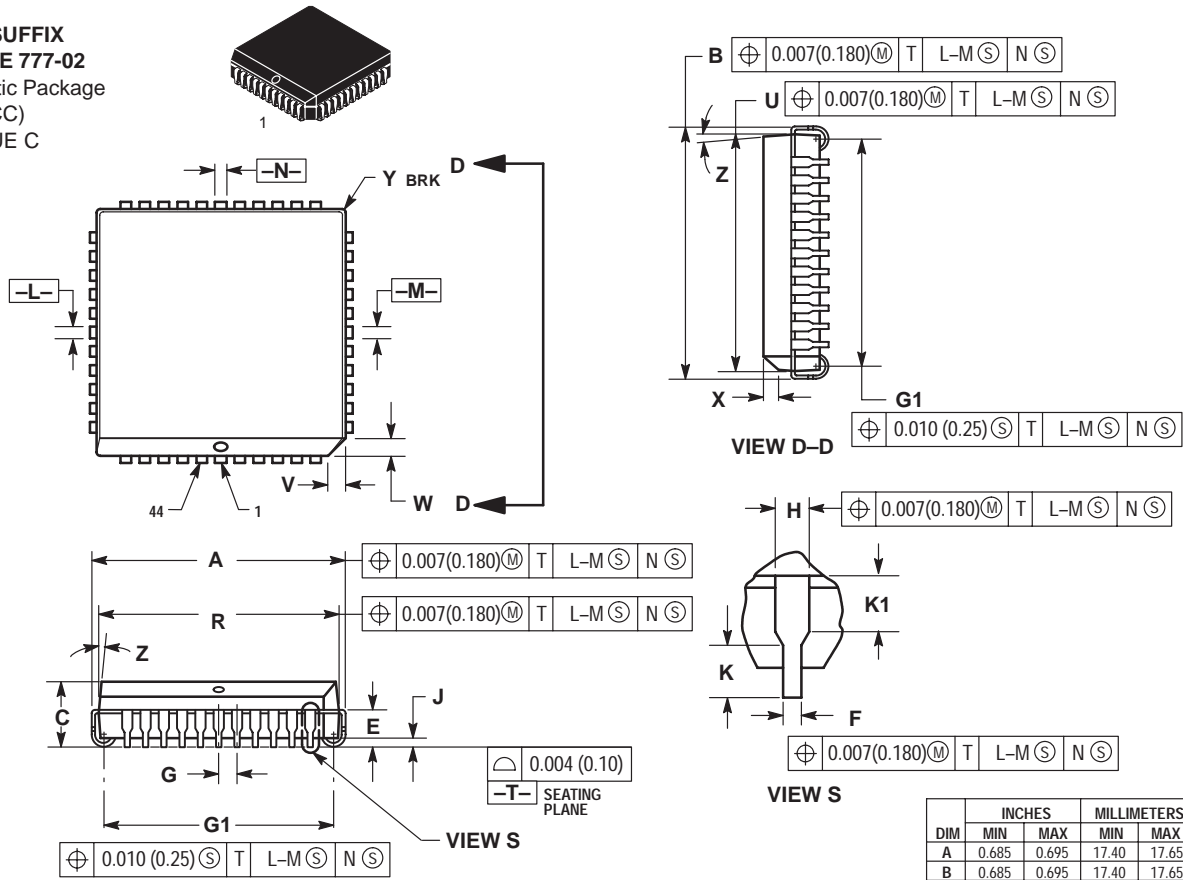


**NOTES:**

- DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
- DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
- DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM BY UP TO 0.012 (0.300). DIMENSIONS R AND U ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
- DIMENSION H DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE GREATER THAN 0.037 (0.940). THE DAMBAR INTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE SMALLER THAN 0.025 (0.635).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.485	0.495	12.32	12.57
B	0.485	0.495	12.32	12.57
C	0.165	0.180	4.20	4.57
E	0.090	0.110	2.29	2.79
F	0.013	0.019	0.33	0.48
G	0.050 BSC		1.27 BSC	
H	0.026	0.032	0.66	0.81
J	0.020	---	0.51	---
K	0.025	---	0.64	---
R	0.450	0.456	11.43	11.58
U	0.450	0.456	11.43	11.58
V	0.042	0.048	1.07	1.21
W	0.042	0.048	1.07	1.21
X	0.042	0.056	1.07	1.42
Y	---	0.020	---	0.50
Z	2°	10°	2°	10°
G1	0.410	0.430	10.42	10.92
K1	0.040	---	1.02	---

**FN SUFFIX**  
**CASE 777-02**  
 Plastic Package  
 (PLCC)  
 ISSUE C

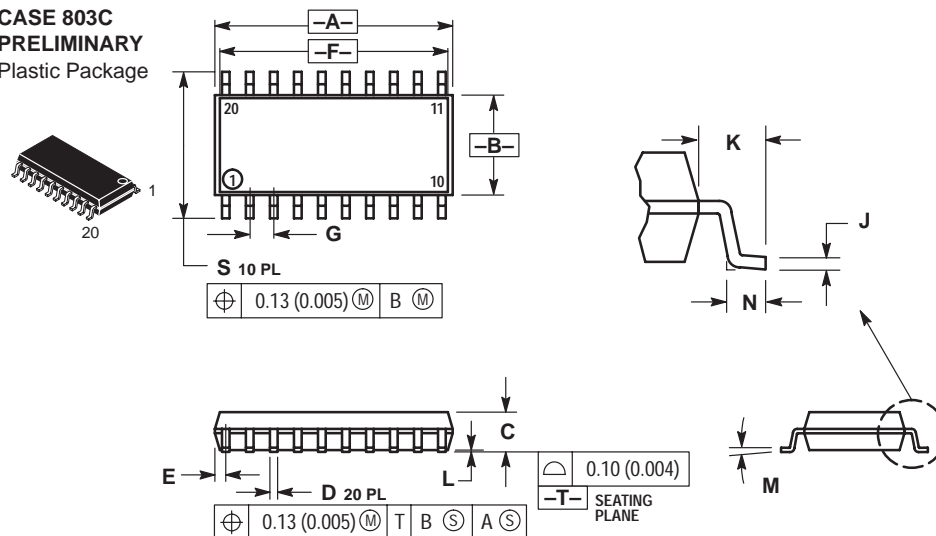


- NOTES:
- DATUMS -L-, -M-, AND -N- ARE DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
  - DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
  - DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.25) PER SIDE.
  - DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - CONTROLLING DIMENSION: INCH.

- THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM BY UP TO 0.012 (0.300). DIMENSIONS R AND U ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
- DIMENSION H DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE GREATER THAN 0.037 (0.940). THE DAMBAR INTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE SMALLER THAN 0.025 (0.635).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.685	0.695	17.40	17.65
B	0.685	0.695	17.40	17.65
C	0.165	0.180	4.20	4.57
E	0.090	0.110	2.29	2.79
F	0.013	0.019	0.33	0.48
G	0.050 BSC		1.27 BSC	
H	0.026	0.032	0.66	0.81
J	0.020	---	0.51	---
K	0.025	---	0.64	---
R	0.650	0.656	16.51	16.66
U	0.650	0.656	16.51	16.66
V	0.042	0.048	1.07	1.21
W	0.042	0.048	1.07	1.21
X	0.042	0.056	1.07	1.42
Y	---	0.020	---	0.50
Z	2°	10°	2°	10°
G1	0.610	0.630	15.50	16.00
K1	0.040	---	1.02	---

**M SUFFIX**  
**CASE 803C**  
**PRELIMINARY**  
 Plastic Package

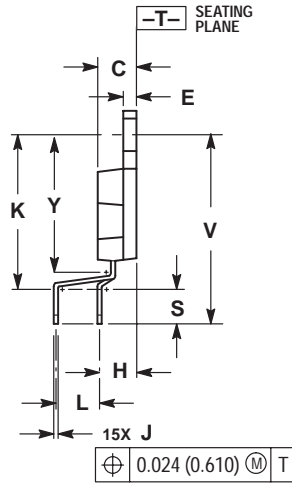
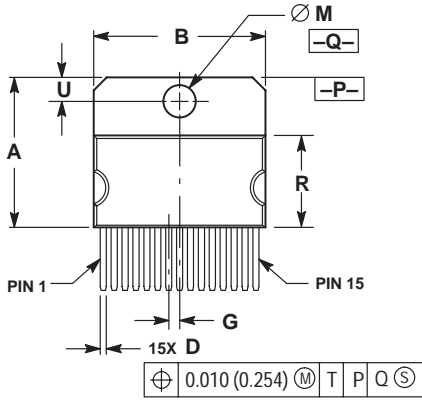
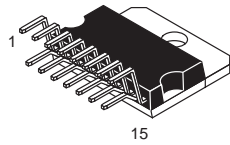


- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - CONTROLLING DIMENSION: MILLIMETER.
  - DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  - MAXIMUM MOLD PROTRUSION 0.15 (0.008) PER SIDE.
  - DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.006) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	12.35	12.80	0.486	0.504
B	5.10	5.45	0.201	0.215
C	1.95	2.05	0.077	0.081
D	0.35	0.50	0.014	0.020
E	---	0.81	---	0.032
F	12.40*		0.488*	
G	1.15	1.39	0.045	0.055
H	0.59	0.81	0.023	0.032
J	0.18	0.27	0.007	0.011
K	1.10	1.50	0.043	0.059
L	0.05	0.20	0.001	0.008
M	0°	10°	0°	10°
N	0.50	0.85	0.020	0.033
S	7.40	8.20	0.291	0.323

\*APPROXIMATE

**TV SUFFIX**  
**CASE 821C-04**  
 Plastic Package  
 (15-Pin ZIP)  
 ISSUE D

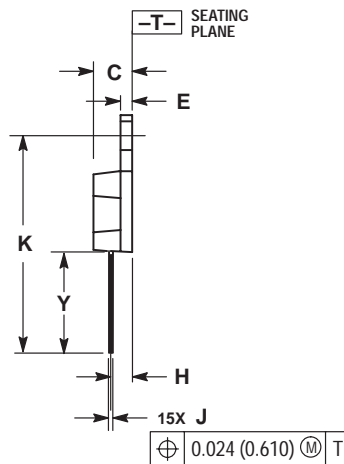
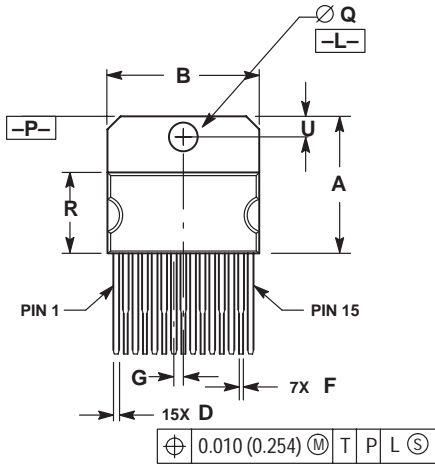
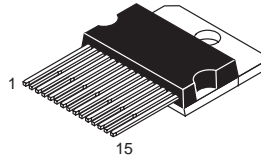


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION R DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
5. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 (0.250).
6. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.003 (0.076) TOTAL IN EXCESS OF THE D DIMENSION, AT MAXIMUM MATERIAL CONDITION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.684	0.694	17.374	17.627
B	0.784	0.792	19.914	20.116
C	0.173	0.181	4.395	4.597
D	0.024	0.031	0.610	0.787
E	0.058	0.062	1.473	1.574
G	0.050 BSC		1.270 BSC	
H	0.169 BSC		4.293 BSC	
J	0.018	0.024	0.458	0.609
K	0.700	0.710	17.780	18.034
L	0.200 BSC		5.080 BSC	
M	0.148	0.151	3.760	3.835
R	0.416	0.426	10.567	10.820
S	0.157	0.167	3.988	4.242
U	0.105	0.115	2.667	2.921
V	0.868 REF		22.047 REF	
Y	0.625	0.639	15.875	16.231

**T SUFFIX**  
**CASE 821D-03**  
 Plastic Package  
 ISSUE C

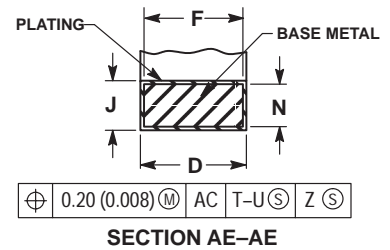
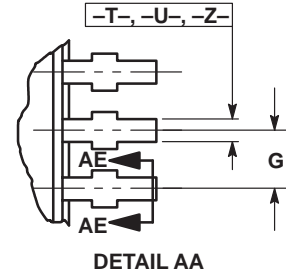
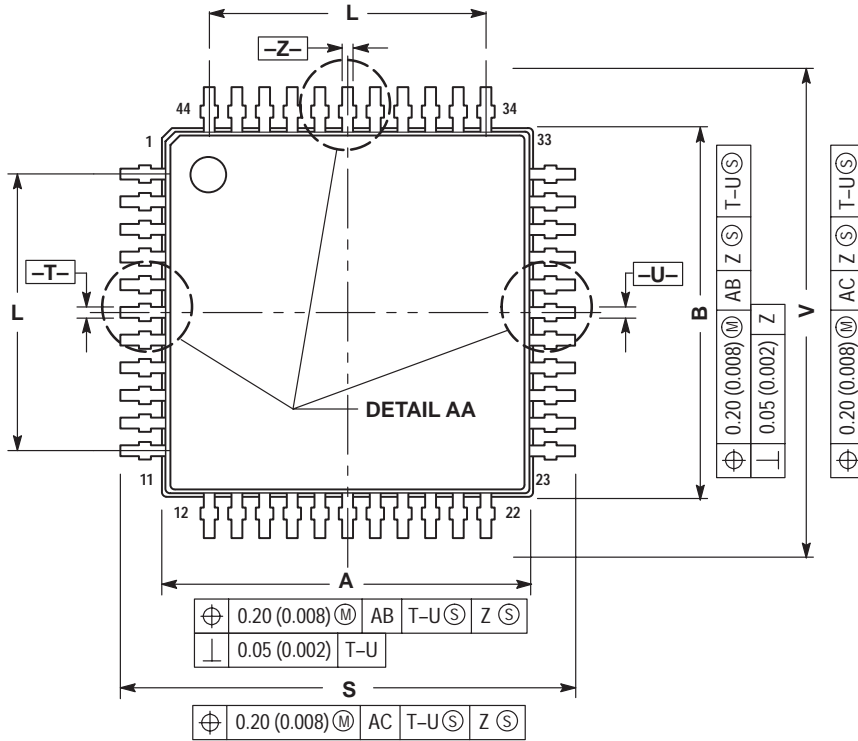
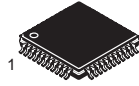


**NOTES:**

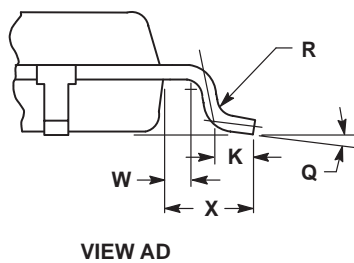
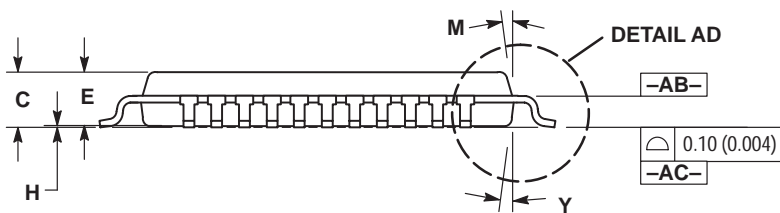
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION R DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
5. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 (0.250).
6. DELETED
7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.003 (0.076) TOTAL IN EXCESS OF THE D DIMENSION, AT MAXIMUM MATERIAL CONDITION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.681	0.694	17.298	17.627
B	0.784	0.792	19.914	20.116
C	0.173	0.181	4.395	4.597
D	0.024	0.031	0.610	0.787
E	0.058	0.062	1.473	1.574
F	0.016	0.023	0.407	0.584
G	0.050 BSC		1.270 BSC	
H	0.110 BSC		2.794 BSC	
J	0.018	0.024	0.458	0.609
K	1.078	1.086	27.382	27.584
Q	0.148	0.151	3.760	3.835
R	0.416	0.426	10.567	10.820
U	0.110 BSC		2.794 BSC	
Y	0.503 REF		12.776 REF	

**FTB SUFFIX**  
**CASE 824D-01**  
 Plastic Package  
 (TQFP-44)  
 ISSUE O

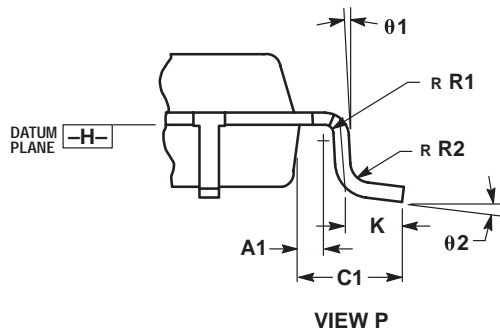
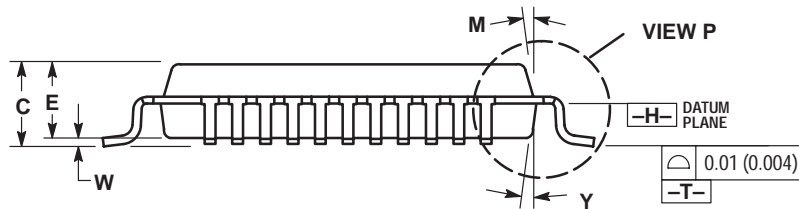
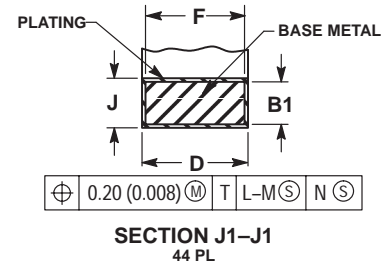
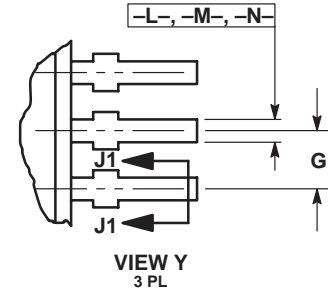
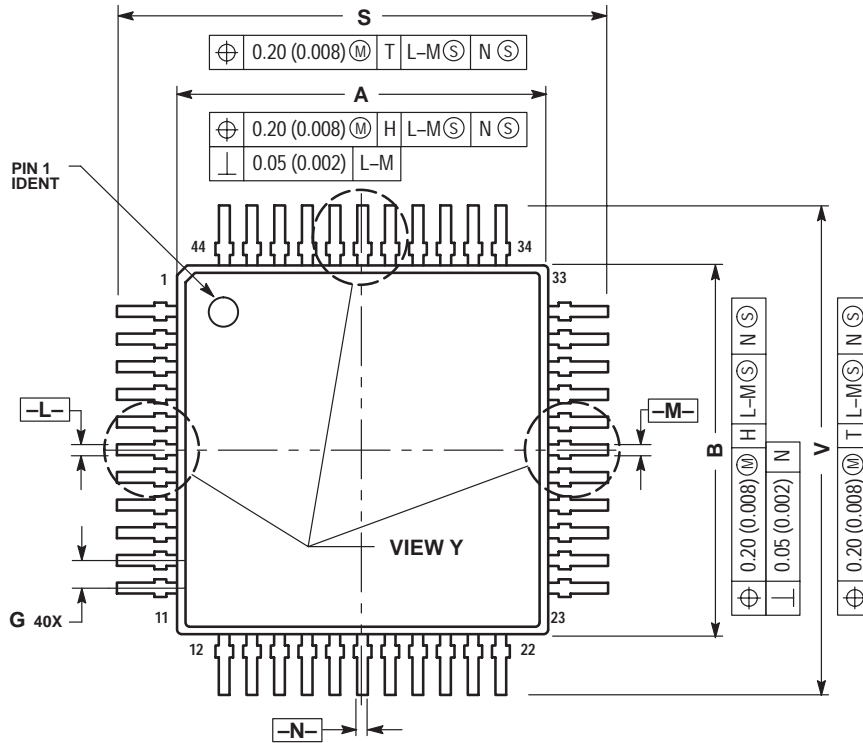
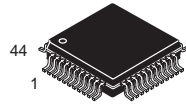


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DATUM PLANE -AB- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
  4. DATUMS -T-, -U- AND -Z- TO BE DETERMINED AT DATUM PLANE -AB-.
  5. DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE -AC-.
  6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -AB-.
  7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.530 (0.021).



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.950	10.050	0.392	0.396
B	9.950	10.050	0.392	0.396
C	1.400	1.600	0.055	0.063
D	0.300	0.450	0.012	0.018
E	1.350	1.450	0.053	0.057
F	0.300	0.400	0.012	0.016
G	0.800 BSC		0.031 BSC	
H	0.050	0.150	0.002	0.006
J	0.090	0.200	0.004	0.008
K	0.450	0.550	0.018	0.022
L	8.000 BSC		0.315 BSC	
M	12° REF		12° REF	
N	0.090	0.160	0.004	0.006
Q	1°	5°	1°	5°
R	0.100	0.200	0.004	0.008
S	11.900	12.100	0.469	0.476
V	11.900	12.100	0.469	0.476
W	0.200 REF		0.008 REF	
X	1.000 REF		0.039 REF	
Y	12° REF		12° REF	

**FB SUFFIX**  
**CASE 824E-02**  
 Plastic Package  
 (QFP)  
 ISSUE A



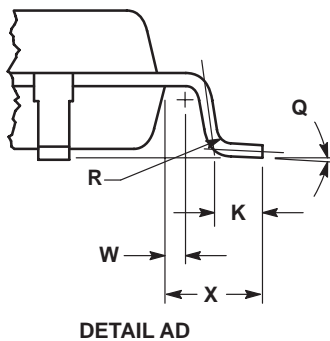
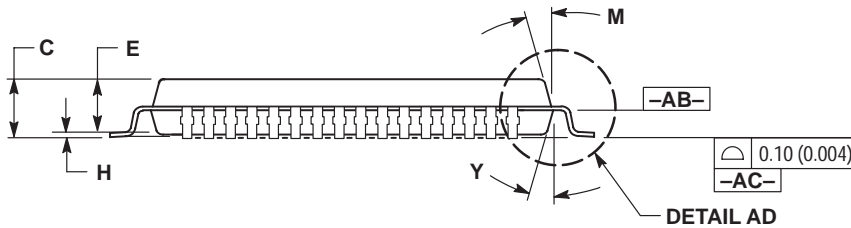
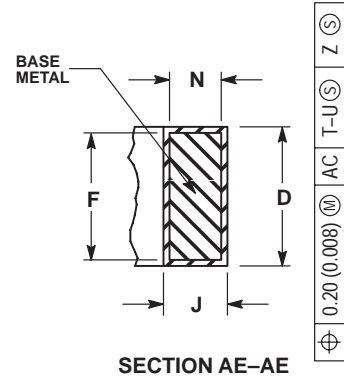
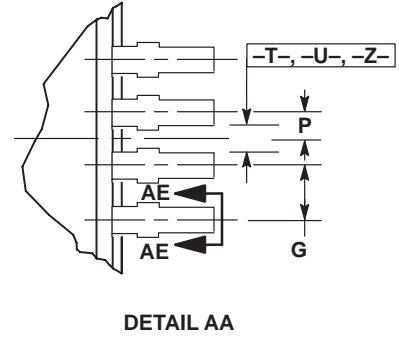
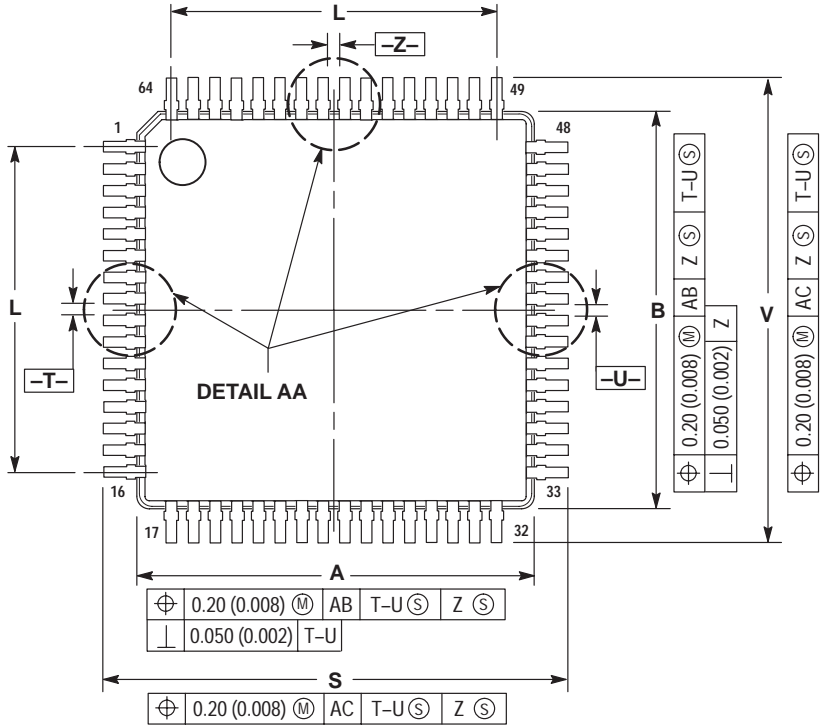
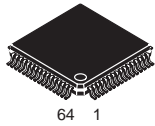
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DATUM PLANE -H- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
4. DATUMS -L-, -M- AND -N- TO BE DETERMINED AT DATUM PLANE -H-.
5. DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE -T-.
6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.530 (0.021).

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.90	10.10	0.390	0.398
B	9.90	10.10	0.390	0.398
C	2.00	2.21	0.079	0.087
D	0.30	0.45	0.0118	0.0177
E	2.00	2.10	0.079	0.083
F	0.30	0.40	0.012	0.016
G	0.80 BSC		0.031 BSC	
J	0.13	0.23	0.005	0.009
K	0.65	0.95	0.026	0.037
M	5° 10°		5° 10°	
S	12.95	13.45	0.510	0.530
V	12.95	13.45	0.510	0.530
W	0.000	0.210	0.000	0.008
Y	5° 10°		5° 10°	
A1	0.450 REF		0.018 REF	
B1	0.130	0.170	0.005	0.007
C1	1.600 REF		0.063 REF	
R1	0.130	0.300	0.005	0.012
R2	0.130	0.300	0.005	0.012
$\theta 1$	5° 10°		5° 10°	
$\theta 2$	0° 7°		0° 7°	



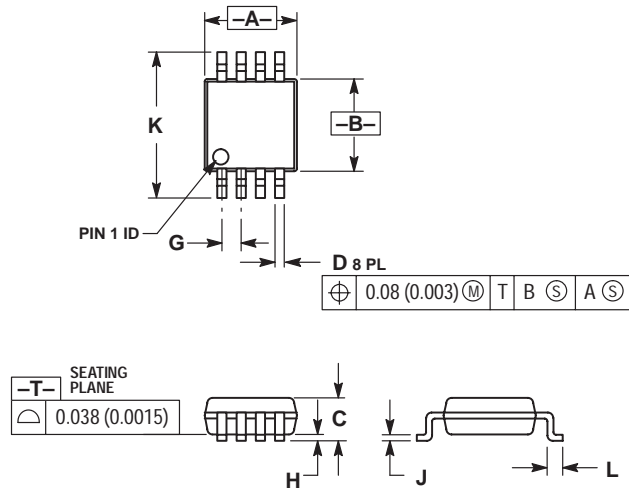
**FB SUFFIX**  
**CASE 840F-01**  
 Plastic Package  
 ISSUE O



- NOTES:**
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DATUM PLANE -AB- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
  4. DATUMS -T-, -U- AND -Z- TO BE DETERMINED AT DATUM PLANE -AC-.
  5. DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE -AC-.
  6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -AB-.
  7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.350 (0.014).

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.950	10.050	0.392	0.396
B	9.950	10.050	0.392	0.396
C	1.400	1.600	0.055	0.063
D	0.170	0.270	0.007	0.011
E	1.350	1.450	0.053	0.057
F	0.170	0.230	0.007	0.009
G	0.500 BSC		0.020 BSC	
H	0.050	0.150	0.002	0.006
J	0.090	0.200	0.004	0.008
K	0.450	0.550	0.018	0.022
L	7.500 BSC		0.295 BSC	
M	12° REF		12° REF	
N	0.090	0.160	0.004	0.006
P	0.250 BSC		0.010 BSC	
Q	1°	5°	1°	5°
R	0.100	0.200	0.004	0.008
S	11.900	12.100	0.469	0.476
V	11.900	12.100	0.469	0.476
W	0.200 REF		0.008 REF	
X	1.000 REF		0.039 REF	
Y	12° REF		12° REF	

**DM SUFFIX**  
**CASE 846A-02**  
 Plastic Package  
 (Micro-8)  
 ISSUE C

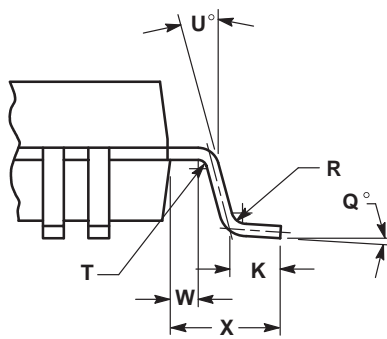
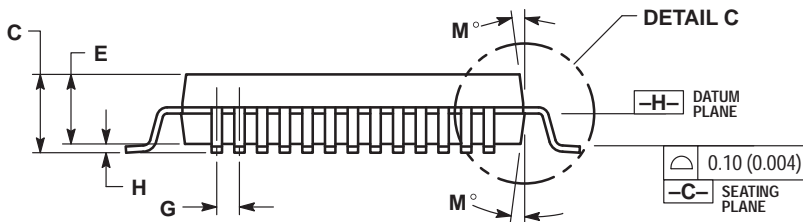
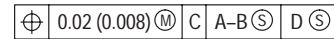
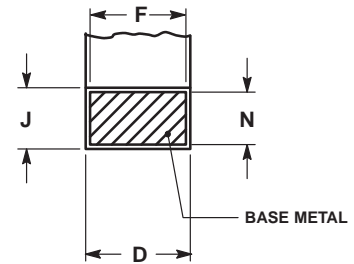
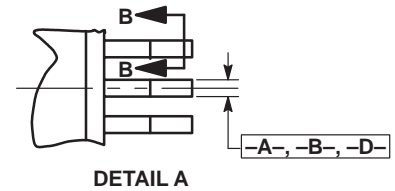
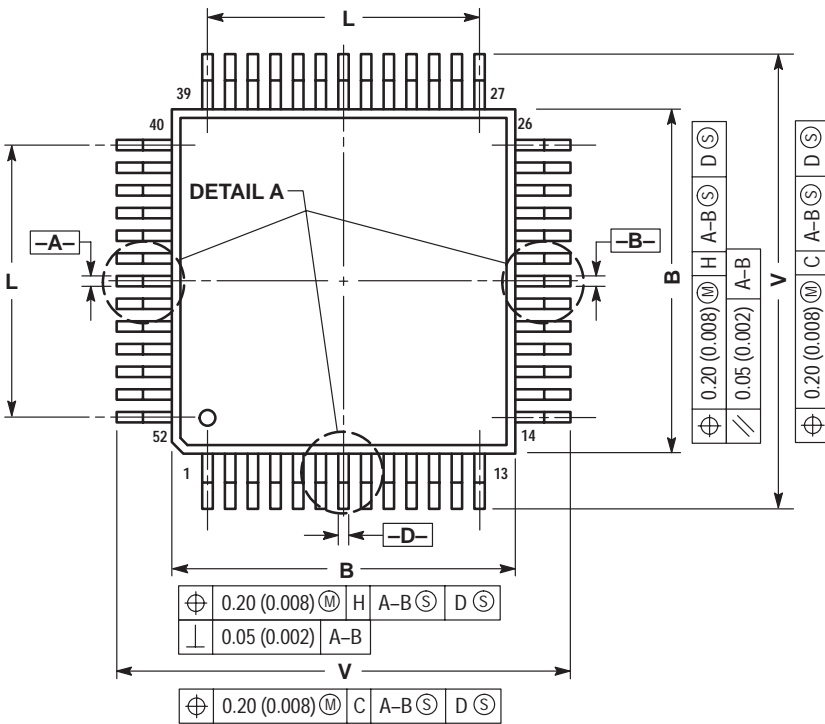
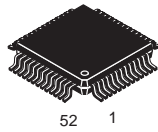


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	---	1.10	---	0.043
D	0.25	0.40	0.010	0.016
G	0.65 BSC		0.026 BSC	
H	0.05	0.15	0.002	0.006
J	0.13	0.23	0.005	0.009
K	4.75	5.05	0.187	0.199
L	0.40	0.70	0.016	0.028

**FB SUFFIX**  
**CASE 848B-04**  
 Plastic Package  
 (TQFP-52)  
 ISSUE C

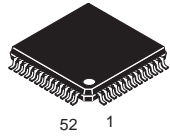


**NOTES:**

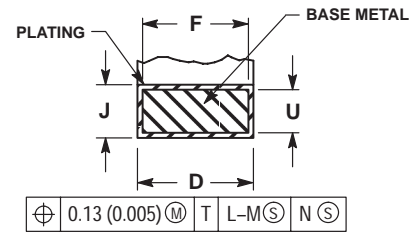
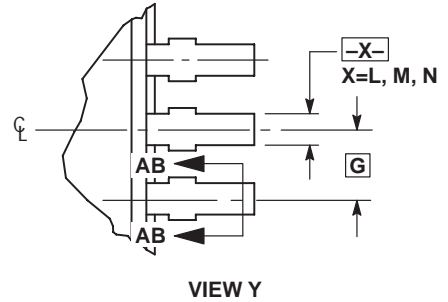
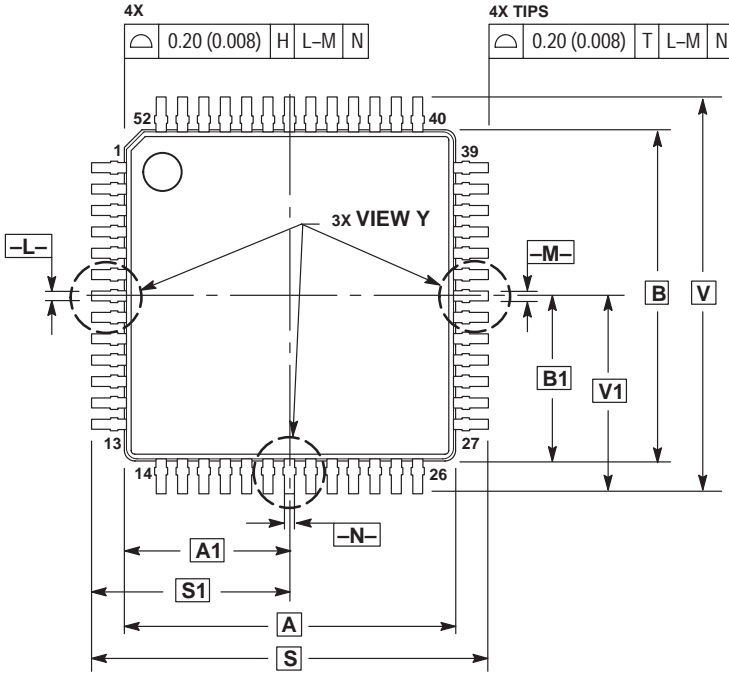
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DATUM PLANE -H- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
- DATUMS -A-, -B- AND -D- TO BE DETERMINED AT DATUM PLANE -H-.
- DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE -C-.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.90	10.10	0.390	0.398
B	9.90	10.10	0.390	0.398
C	2.10	2.45	0.083	0.096
D	0.22	0.38	0.009	0.015
E	2.00	2.10	0.079	0.083
F	0.22	0.33	0.009	0.013
G	0.65 BSC		0.026 BSC	
H	---	0.25	---	0.010
J	0.13	0.23	0.005	0.009
K	0.65	0.95	0.026	0.037
L	7.80 REF		0.307 REF	
M	5°	10°	5°	10°
N	0.13	0.17	0.005	0.007
Q	0°	7°	0°	7°
R	0.13	0.30	0.005	0.012
S	12.95	13.45	0.510	0.530
T	0.13	---	0.005	---
U	0°	---	0°	---
V	12.95	13.45	0.510	0.530
W	0.35	0.45	0.014	0.018
X	1.6 REF		0.063 REF	

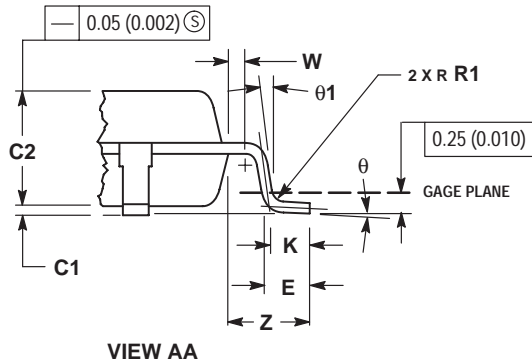
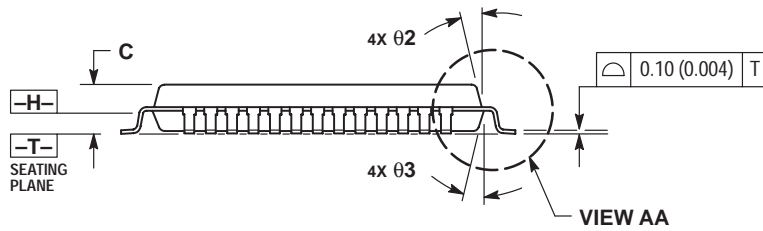
**FB SUFFIX**  
**CASE 848D-03**  
 Plastic Package  
 ISSUE C



52 1



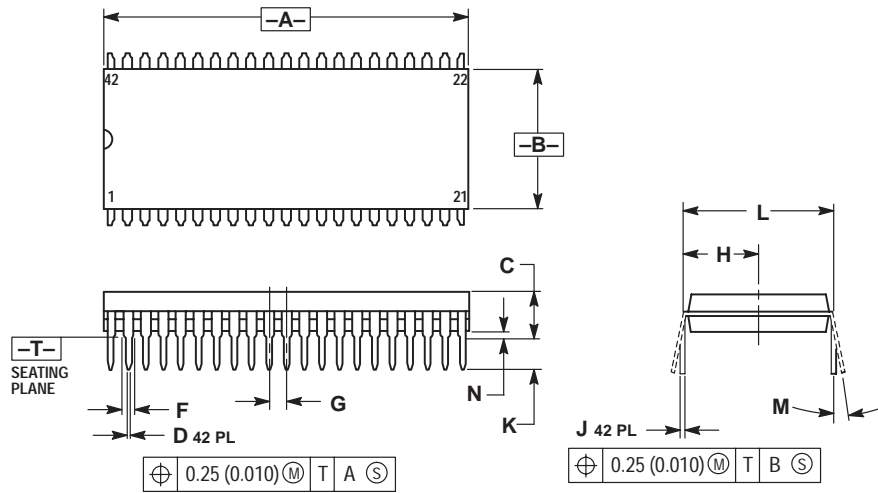
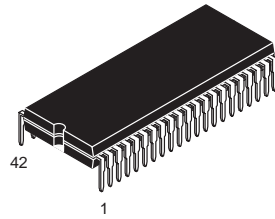
**SECTION AB-AB**  
 ROTATED 90° CLOCKWISE



- NOTES:**
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DATUM PLANE -H- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
  4. DATUMS -L-, -M- AND -N- TO BE DETERMINED AT DATUM PLANE -H-.
  5. DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE -T-.
  6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 (0.010) PER SIDE. DIMENSIONS A AND B DO NOT INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
  7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED 0.46 (0.018). MINIMUM SPACE BETWEEN PROTRUSION AND ADJACENT LEAD OR PROTRUSION 0.07 (0.003).

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.00 BSC	0.394 BSC		
A1	5.00 BSC	0.197 BSC		
B	10.00 BSC	0.394 BSC		
B1	5.00 BSC	0.197 BSC		
C	---	1.70	---	0.067
C1	0.05	0.20	0.002	0.008
C2	1.30	1.50	0.051	0.059
D	0.20	0.40	0.008	0.016
E	0.45	0.75	0.018	0.030
F	0.22	0.35	0.009	0.014
G	0.65 BSC	0.026 BSC		
J	0.07	0.20	0.003	0.008
K	0.50 REF	0.020 REF		
R1	0.08	0.20	0.003	0.008
S	12.00 BSC	0.472 BSC		
S1	6.00 BSC	0.236 BSC		
U	0.09	0.16	0.004	0.006
V	12.00 BSC	0.472 BSC		
V1	6.00 BSC	0.236 BSC		
W	0.20 REF	0.008 REF		
Z	1.00 REF	0.039 REF		
theta	0°	7°	0°	7°
theta 1	0°	---	0°	---
theta 2	12° REF	---	12° REF	---
theta 3	5°	13°	5°	13°

**B SUFFIX**  
**CASE 858-01**  
 Plastic Package  
 ISSUE O

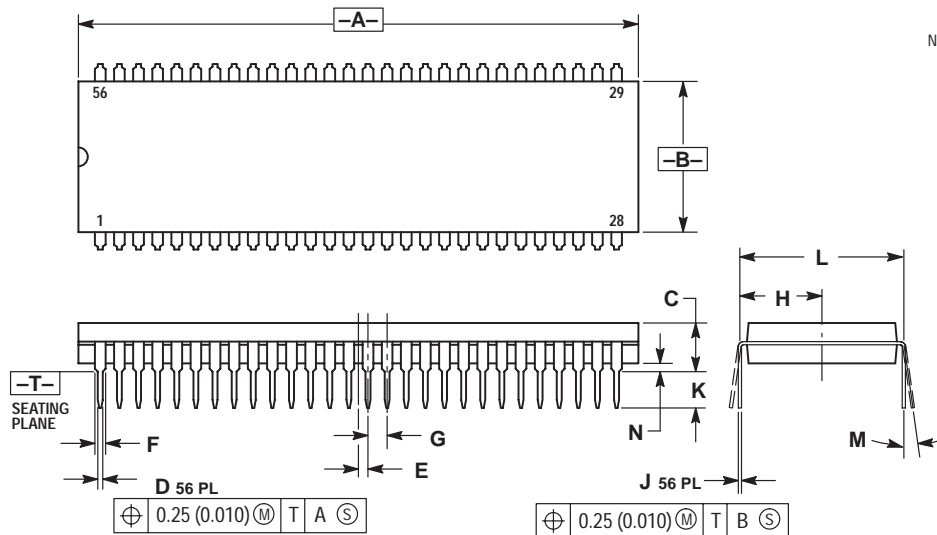
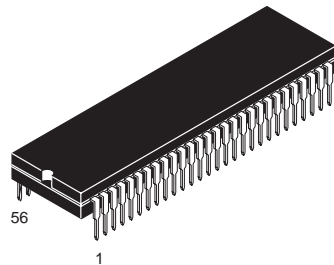


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH. MAXIMUM MOLD FLASH 0.25 (0.010).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.435	1.465	36.45	37.21
B	0.540	0.560	13.72	14.22
C	0.155	0.200	3.94	5.08
D	0.014	0.022	0.36	0.56
F	0.032	0.046	0.81	1.17
G	0.070 BSC		1.778 BSC	
H	0.300 BSC		7.62 BSC	
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.600 BSC		15.24 BSC	
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.02

**B SUFFIX**  
**CASE 859-01**  
 Plastic Package  
 (SDIP)  
 ISSUE O

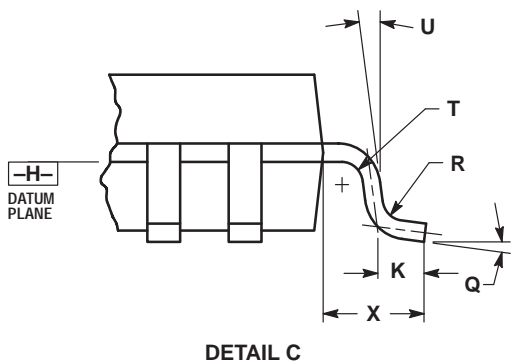
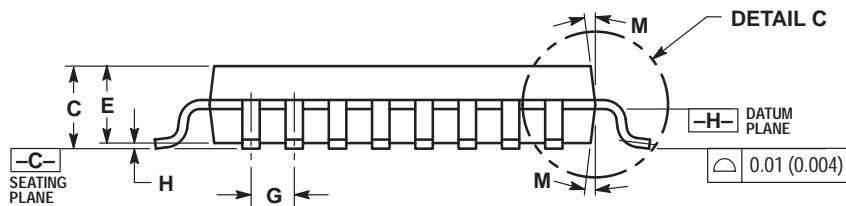
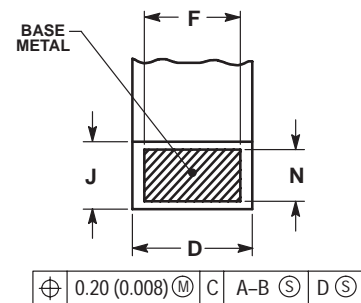
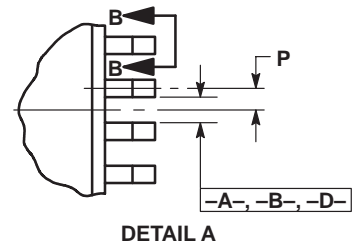
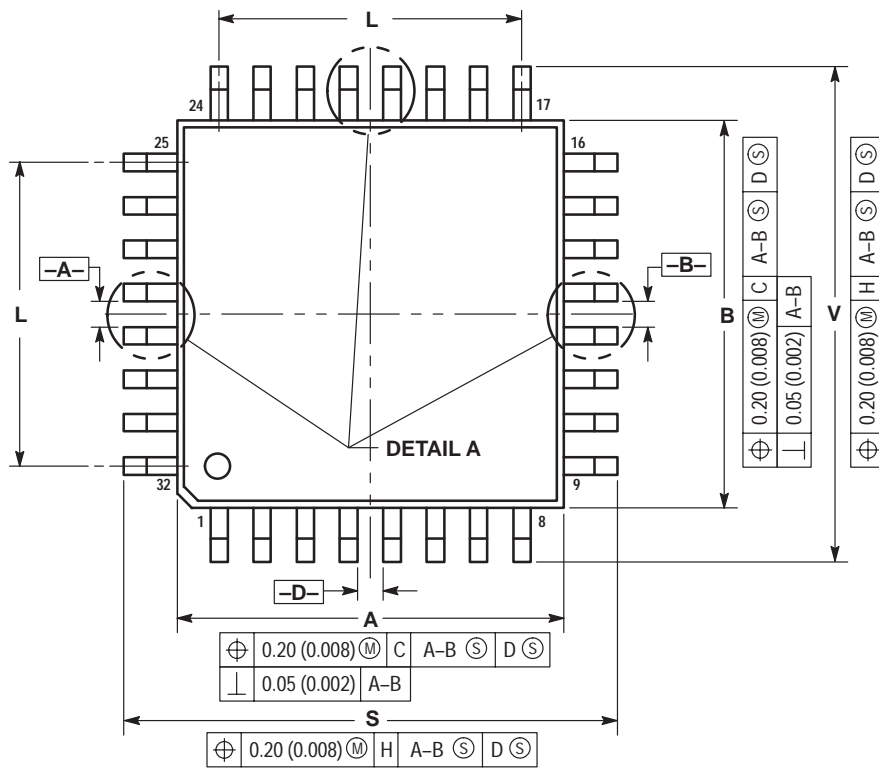
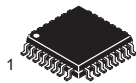


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH. MAXIMUM MOLD FLASH 0.25 (0.010)

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	2.035	2.065	51.69	52.45
B	0.540	0.560	13.72	14.22
C	0.155	0.200	3.94	5.08
D	0.014	0.022	0.36	0.56
E	0.035 BSC		0.89 BSC	
F	0.032	0.046	0.81	1.17
G	0.070 BSC		1.778 BSC	
H	0.300 BSC		7.62 BSC	
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.600 BSC		15.24 BSC	
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.02

**FB, FTB SUFFIX**  
**CASE 873-01**  
 Plastic Package  
 (TQFP-32)  
 ISSUE A

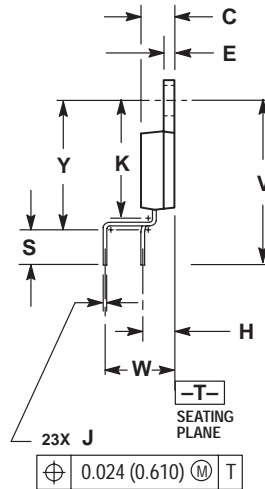
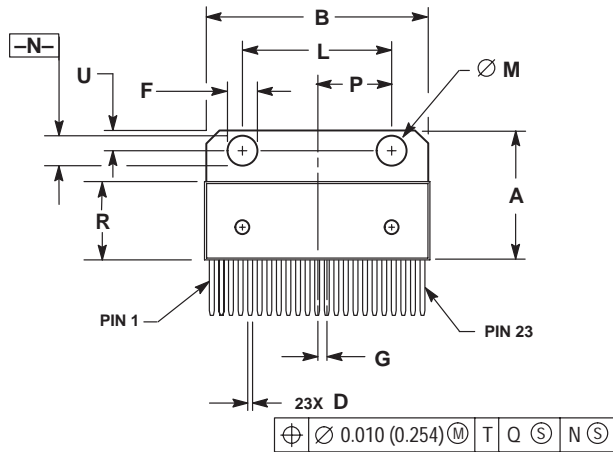
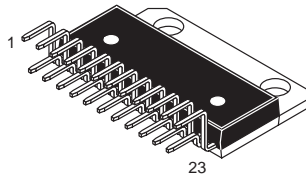


**NOTES:**

- DIMENSION AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DATUM PLANE -H- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
- DATUMS -A-, -B- AND -D- TO BE DETERMINED AT DATUM PLANE -H-.
- DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE -C-.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.95	7.10	0.274	0.280
B	6.95	7.10	0.274	0.280
C	1.40	1.60	0.055	0.063
D	0.273	0.373	0.010	0.015
E	1.30	1.50	0.051	0.059
F	0.273	---	0.010	---
G	0.80	BSC	0.031	BSC
H	---	0.20	---	0.008
J	0.119	0.197	0.005	0.008
K	0.33	0.57	0.013	0.022
L	5.6	REF	0.220	REF
M	6°	8°	6°	8°
N	0.119	0.135	0.005	0.005
P	0.40	BSC	0.016	BSC
Q	5°	10°	5°	10°
R	0.15	0.25	0.006	0.010
S	8.85	9.15	0.348	0.360
T	0.15	0.25	0.006	0.010
U	5°	11°	5°	11°
V	8.85	9.15	0.348	0.360
X	1.00	REF	0.039	REF

**T SUFFIX**  
**CASE 894-03**  
 Plastic Package  
 (23-Pin SZIP)  
 ISSUE B

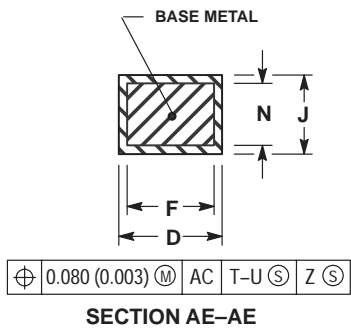
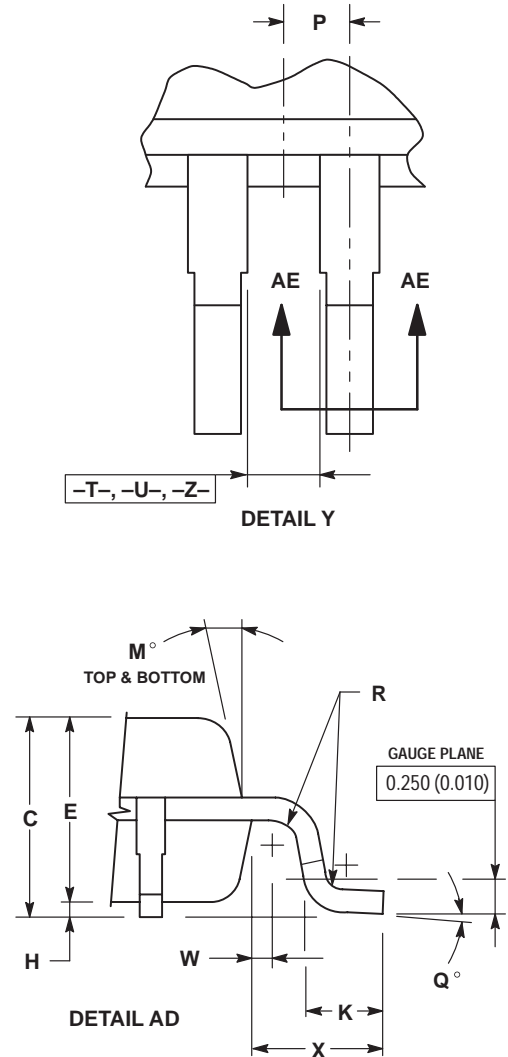
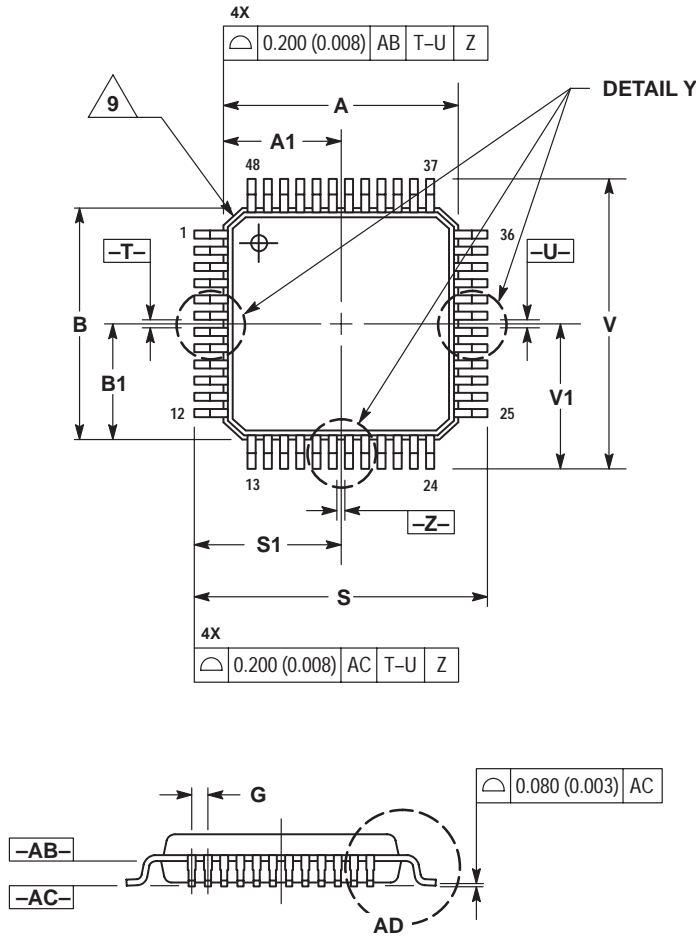
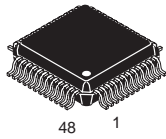


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION R DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
5. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 (0.250).
6. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.003 (0.076) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.684	0.694	17.374	17.627
B	1.183	1.193	30.048	30.302
C	0.175	0.179	4.445	4.547
D	0.026	0.031	0.660	0.787
E	0.058	0.062	1.473	1.574
F	0.165	0.175	4.191	4.445
G	0.050 BSC		1.270 BSC	
H	0.169 BSC		4.293 BSC	
J	0.014	0.020	0.356	0.508
K	0.625	0.639	15.875	16.231
L	0.770	0.790	19.558	20.066
M	0.148	0.152	3.760	3.861
N	0.148	0.152	3.760	3.861
P	0.390 BSC		9.906 BSC	
R	0.416	0.424	10.566	10.770
S	0.157	0.167	3.988	4.242
U	0.105	0.115	2.667	2.921
V	0.868 REF		22.047 REF	
W	0.200 BSC		5.080 BSC	
Y	0.700	0.710	17.780	18.034

**FTA SUFFIX**  
**CASE 932-02**  
 Plastic Package  
 (TQFP-48)  
 ISSUE D

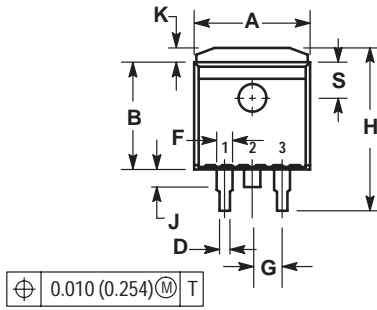
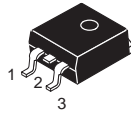


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DATUM PLANE -AB- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
  4. DATUMS -T-, -U-, AND -Z- TO BE DETERMINED AT DATUM PLANE -AB-.
  5. DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE -AC-.
  6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -AB-.
  7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.350 (0.014).
  8. MINIMUM SOLDER PLATE THICKNESS SHALL BE 0.0076 (0.0003).
  9. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

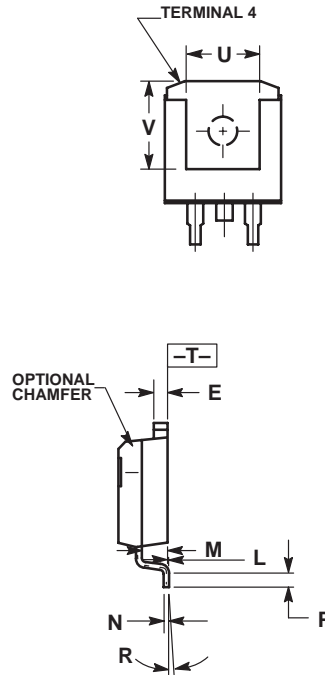
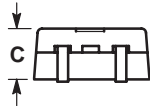
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.000 BSC		0.276 BSC	
A1	3.500 BSC		0.138 BSC	
B	7.000 BSC		0.276 BSC	
B1	3.500 BSC		0.138 BSC	
C	1.400	1.600	0.055	0.063
D	0.170	0.270	0.007	0.011
E	1.350	1.450	0.053	0.057
F	0.170	0.230	0.007	0.009
G	0.500 BASIC		0.020 BASIC	
H	0.050	0.150	0.002	0.006
J	0.090	0.200	0.004	0.008
K	0.500	0.700	0.020	0.028
M	12° REF		12° REF	
N	0.090	0.160	0.004	0.006
P	0.250 BASIC		0.010 BASIC	
Q	1°	5°	1°	5°
R	0.150	0.250	0.006	0.010
S	9.000 BSC		0.354 BSC	
S1	4.500 BSC		0.177 BSC	
V	9.000 BSC		0.354 BSC	
V1	4.500 BSC		0.177 BSC	
W	0.200 REF		0.008 REF	
X	1.000 REF		0.039 REF	



**D2T SUFFIX**  
**CASE 936-03**  
 Plastic Package  
 ISSUE B



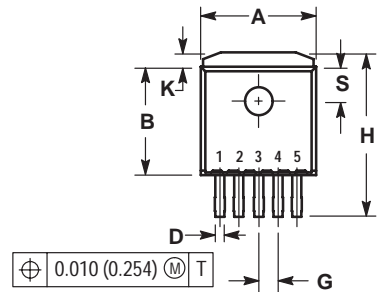
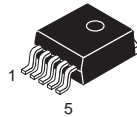
$\oplus$	0.010 (0.254)	$\textcircled{M}$	T
----------	---------------	-------------------	---



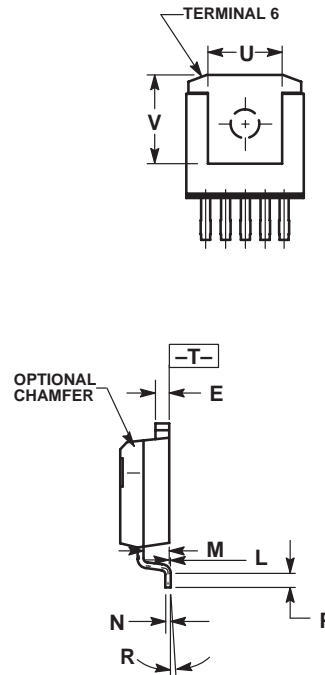
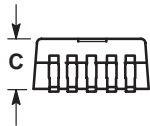
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. TAB CONTOUR OPTIONAL WITHIN DIMENSIONS A AND K.
  4. DIMENSIONS U AND V ESTABLISH A MINIMUM MOUNTING SURFACE FOR TERMINAL 4.
  5. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.025 (0.635) MAXIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.386	0.403	9.804	10.236
B	0.356	0.368	9.042	9.347
C	0.170	0.180	4.318	4.572
D	0.026	0.036	0.660	0.914
E	0.045	0.055	1.143	1.397
F	0.051 REF		1.295 REF	
G	0.100 BSC		2.540 BSC	
H	0.539	0.579	13.691	14.707
J	0.125 MAX		3.175 MAX	
K	0.050 REF		1.270 REF	
L	0.000	0.010	0.000	0.254
M	0.088	0.102	2.235	2.591
N	0.018	0.026	0.457	0.660
P	0.058	0.078	1.473	1.981
R	5° REF		5° REF	
S	0.116 REF		2.946 REF	
U	0.200 MIN		5.080 MIN	
V	0.250 MIN		6.350 MIN	

**D2T SUFFIX**  
**CASE 936A-02**  
 Plastic Package  
 (D<sup>2</sup>PAK)  
 ISSUE A



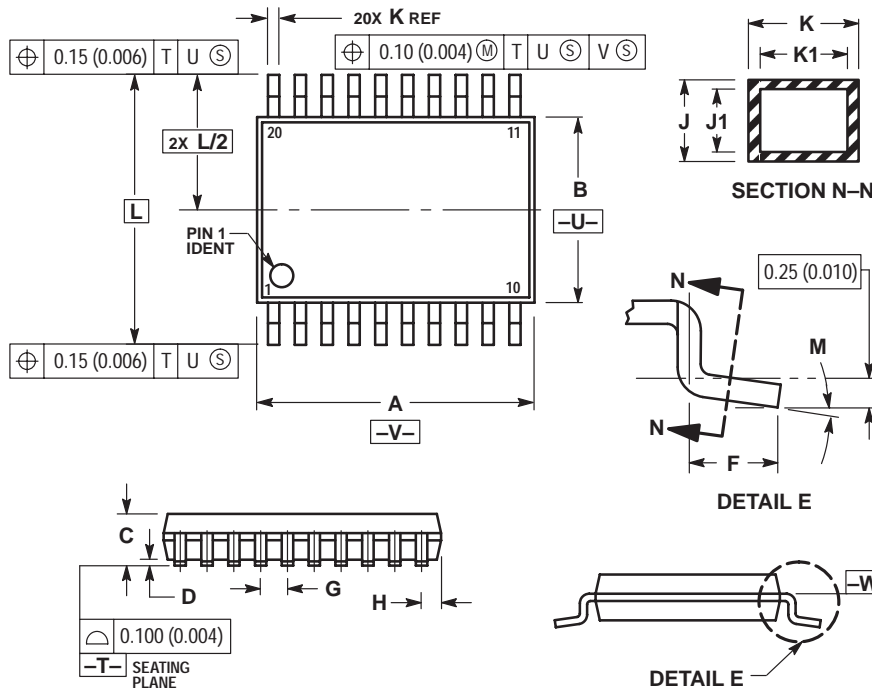
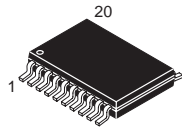
$\oplus$	0.010 (0.254)	$\textcircled{M}$	T
----------	---------------	-------------------	---



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. TAB CONTOUR OPTIONAL WITHIN DIMENSIONS A AND K.
  4. DIMENSIONS U AND V ESTABLISH A MINIMUM MOUNTING SURFACE FOR TERMINAL 6.
  5. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.025 (0.635) MAXIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.386	0.403	9.804	10.236
B	0.356	0.368	9.042	9.347
C	0.170	0.180	4.318	4.572
D	0.026	0.036	0.660	0.914
E	0.045	0.055	1.143	1.397
G	0.067 BSC		1.702 BSC	
H	0.539	0.579	13.691	14.707
K	0.050 REF		1.270 REF	
L	0.000	0.010	0.000	0.254
M	0.088	0.102	2.235	2.591
N	0.018	0.026	0.457	0.660
P	0.058	0.078	1.473	1.981
R	5° REF		5° REF	
S	0.116 REF		2.946 REF	
U	0.200 MIN		5.080 MIN	
V	0.250 MIN		6.350 MIN	

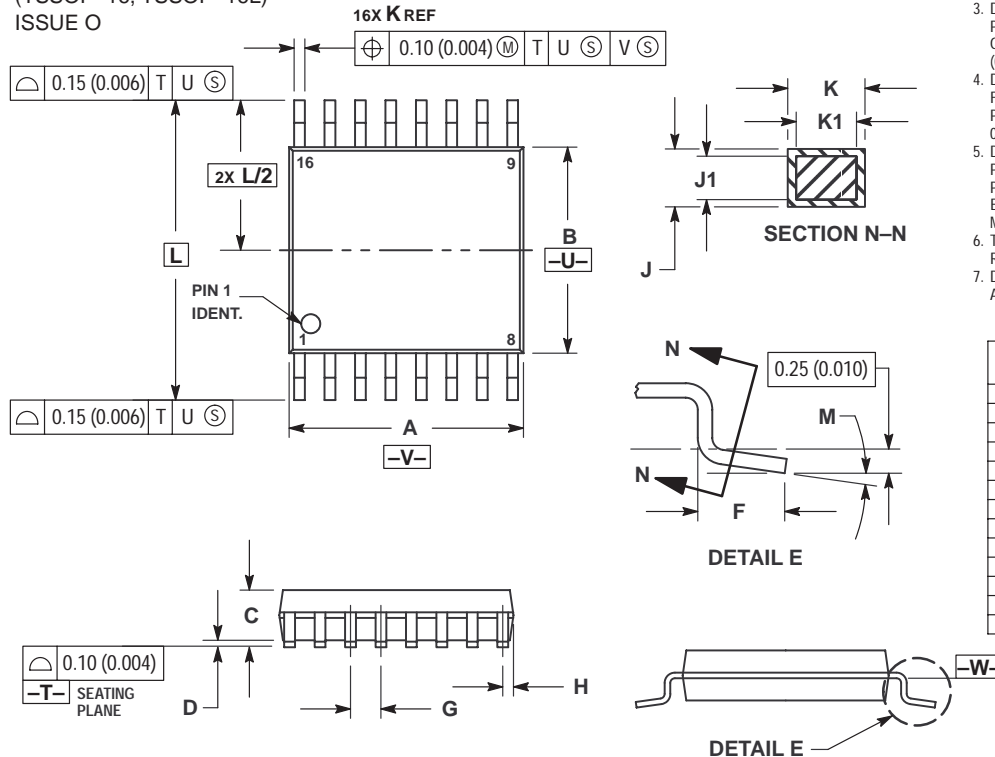
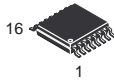
**DT, DTB SUFFIX**  
**CASE 948E-02**  
 Plastic Package  
 (TSSOP-20)  
 ISSUE A



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
  5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
  6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
  7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.40	6.60	0.252	0.260
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

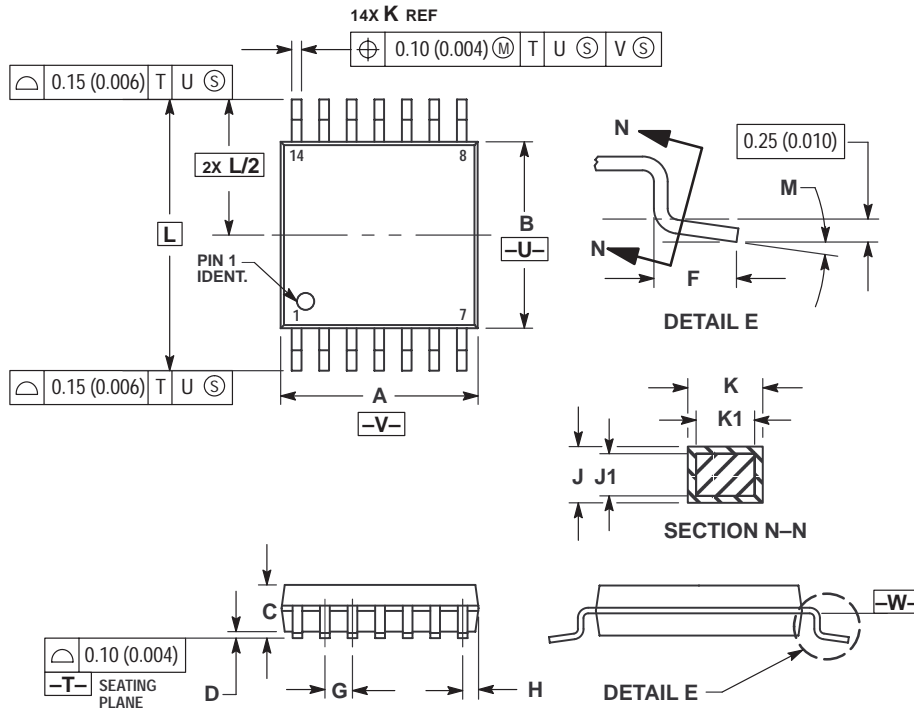
**DTB SUFFIX**  
**CASE 948F-01**  
 Plastic Package  
 (TSSOP-16, TSSOP-16L)  
 ISSUE O



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
  5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
  6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
  7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.18	0.28	0.007	0.011
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

**DTB SUFFIX**  
**CASE 948G-01**  
 Plastic Package  
 (TSSOP-14)  
 ISSUE O

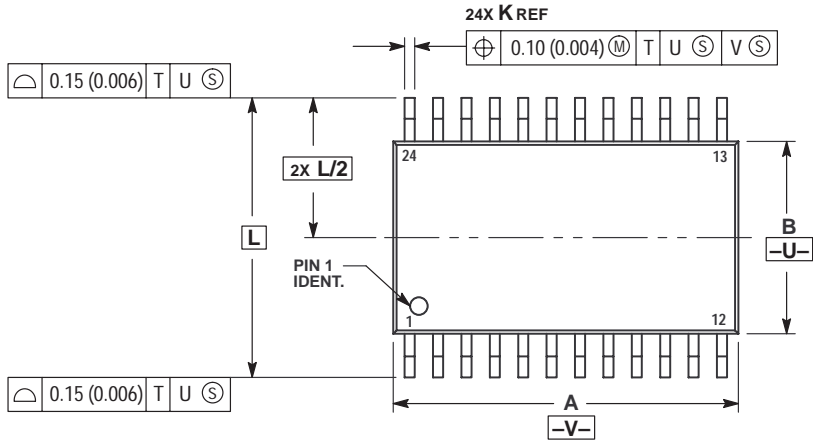
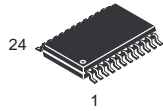


**NOTES:**

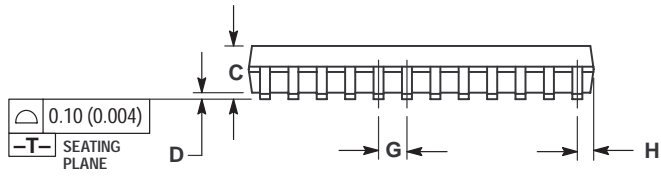
- 1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION: MILLIMETER.
- 3 DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- 4 DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
- 5 DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
- 6 TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- 7 DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

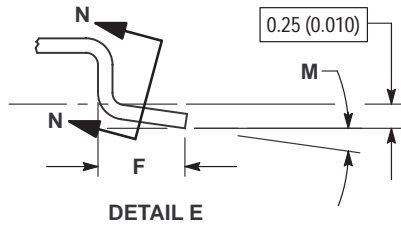
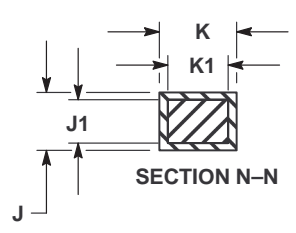
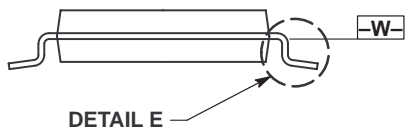
**DTB SUFFIX**  
**CASE 948H-01**  
 Plastic Package  
 ISSUE O



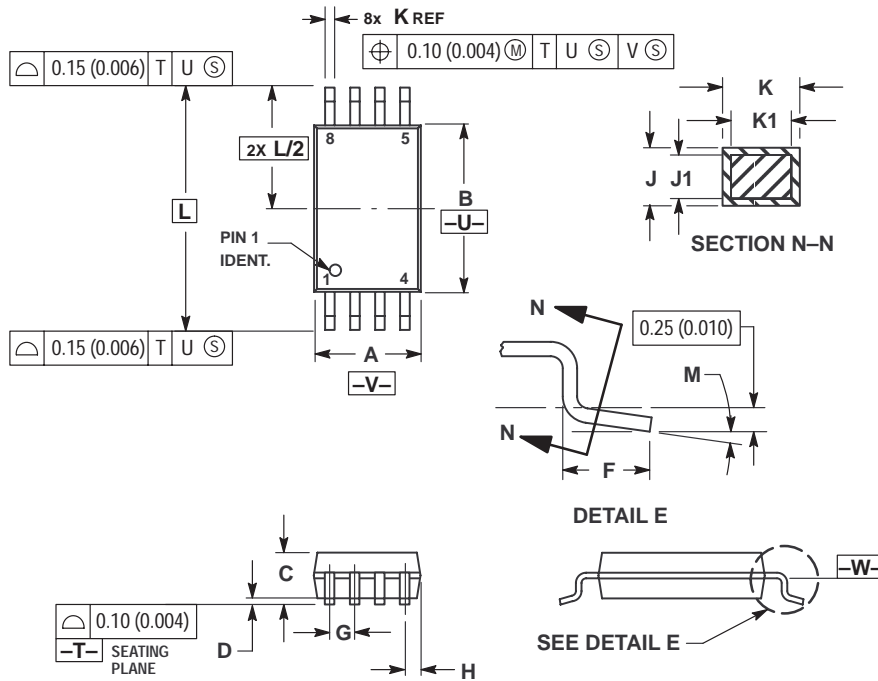
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
  5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
  6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
  7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.70	7.90	0.303	0.311
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°



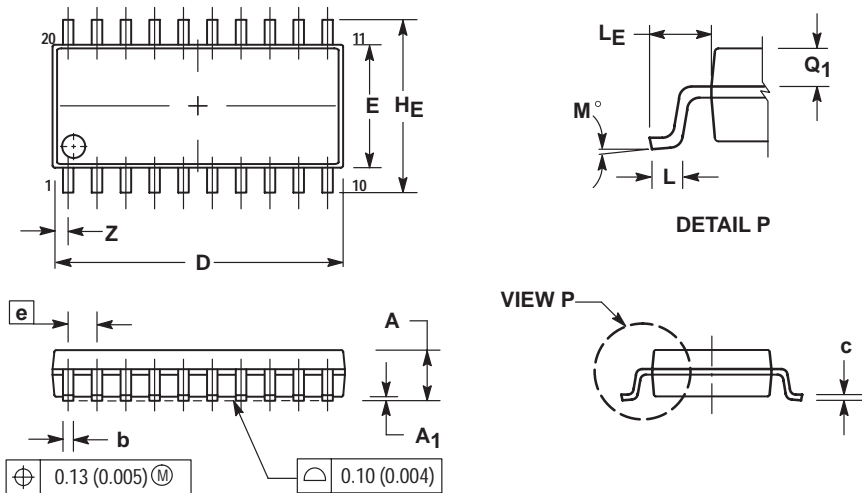
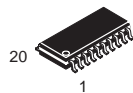
**DTB SUFFIX**  
**CASE 948J-01**  
 Plastic Package  
 (TSSOP-8)  
 ISSUE O



- NOTES:
- 1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - 2 CONTROLLING DIMENSION: MILLIMETER.
  - 3 DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  - 4 DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
  - 5 DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
  - 6 TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
  - 7 DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

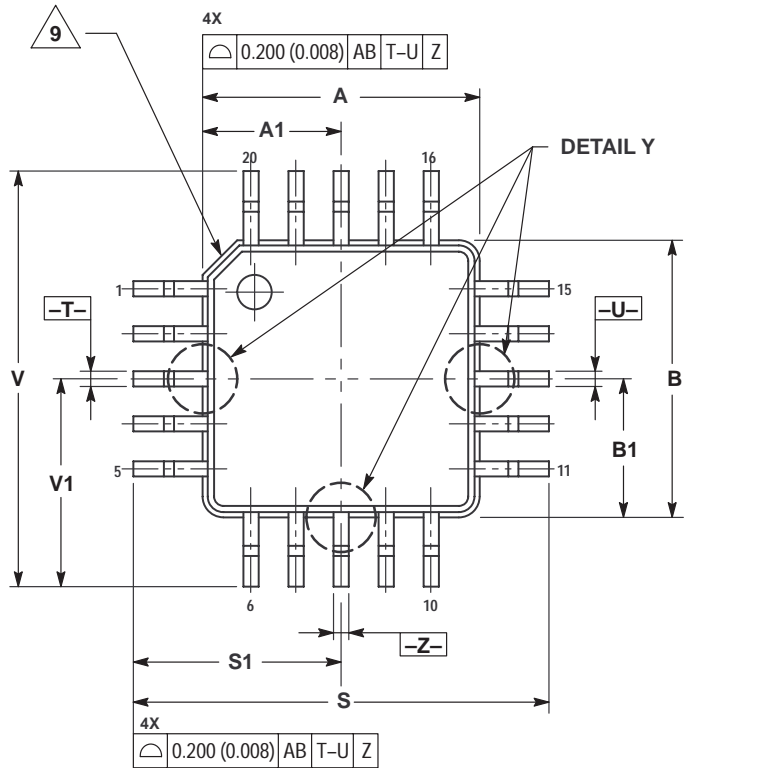
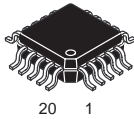
**M SUFFIX**  
**CASE 967-01**  
 Plastic Package  
 (EIAJ-20)  
 ISSUE O



- NOTES:
- 1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - 2 CONTROLLING DIMENSION: MILLIMETER.
  - 3 DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  - 4 TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
  - 5 THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

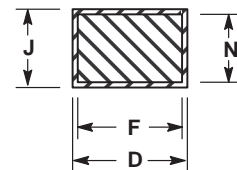
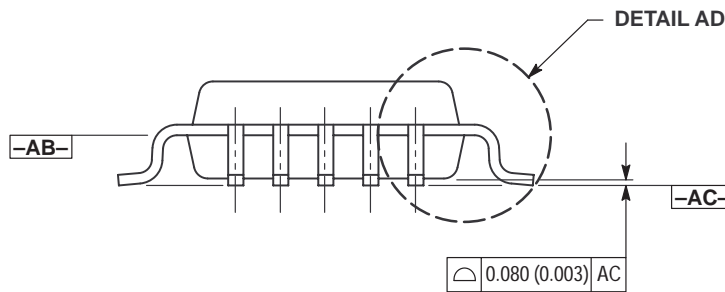
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	---	2.05	---	0.081
A1	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
c	0.18	0.27	0.007	0.011
D	12.35	12.80	0.486	0.504
E	5.10	5.45	0.201	0.215
e	1.27 BSC		0.050 BSC	
H <sub>F</sub>	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
L <sub>F</sub>	1.10	1.50	0.043	0.059
M	0°	10°	0°	10°
Q <sub>1</sub>	0.70	0.90	0.028	0.035
Z	---	0.81	---	0.032

FTB SUFFIX  
CASE 976-01  
Plastic Package  
(TQFP-20)  
ISSUE O



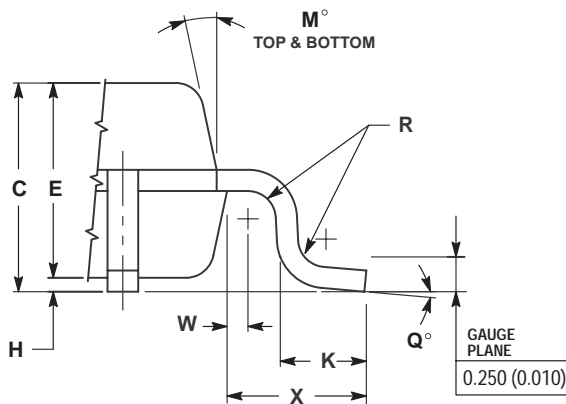
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DATUM PLANE -AB- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
  4. DATUMS -T-, -U-, AND -Z- TO BE DETERMINED AT DATUM PLANE -AB-.
  5. DIMENSIONS S AND V TO BE DETERMINED AT DATUM PLANE -AC-.
  6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -AB-.
  7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.350 (0.014).
  8. MINIMUM SOLDER PLATE THICKNESS SHALL BE 0.0076 (0.0003).
  9. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.000 BSC		0.157 BSC	
A1	2.000 BSC		0.079 BSC	
B	4.000 BSC		0.157 BSC	
B1	2.000 BSC		0.079 BSC	
C	1.400	1.600	0.055	0.063
D	0.170	0.270	0.007	0.011
E	1.350	1.450	0.053	0.057
F	0.170	0.230	0.007	0.009
G	0.650 BSC		0.026 BSC	
H	0.050	0.150	0.002	0.006
J	0.090	0.200	0.004	0.008
K	0.500	0.700	0.020	0.028
M	12° REF		12° REF	
N	0.090	0.160	0.004	0.006
P	0.250 BSC		0.010 BSC	
Q	1°	5°	1°	5°
R	0.150	0.250	0.006	0.010
S	6.000 BSC		0.236 BSC	
S1	3.000 BSC		0.118 BSC	
V	6.000 BSC		0.236 BSC	
V1	3.000 BSC		0.118 BSC	
W	0.200 REF		0.008 REF	
X	1.000 REF		0.039 REF	

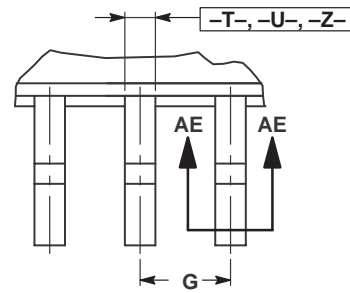


$\oplus 0.080 (0.003) \text{ } \textcircled{S} \text{ } AC \text{ } T-U \text{ } \textcircled{S} \text{ } Z \text{ } \textcircled{S}$

SECTION AE-AE

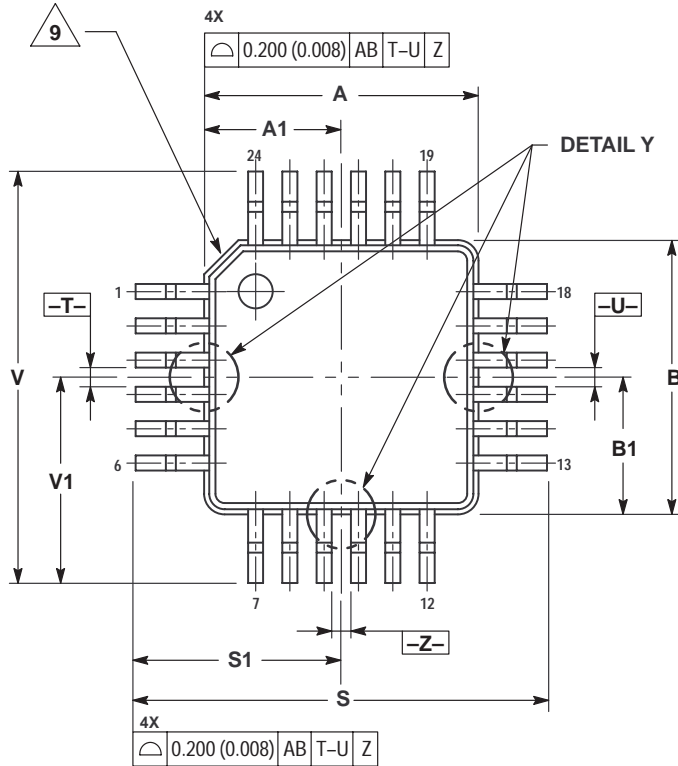
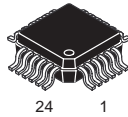


DETAIL AD



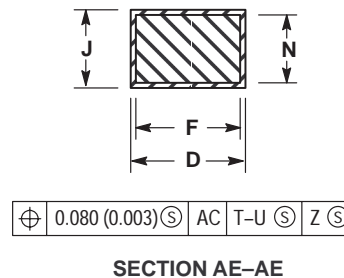
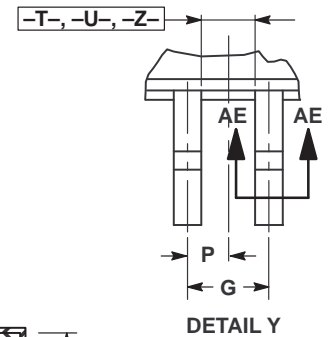
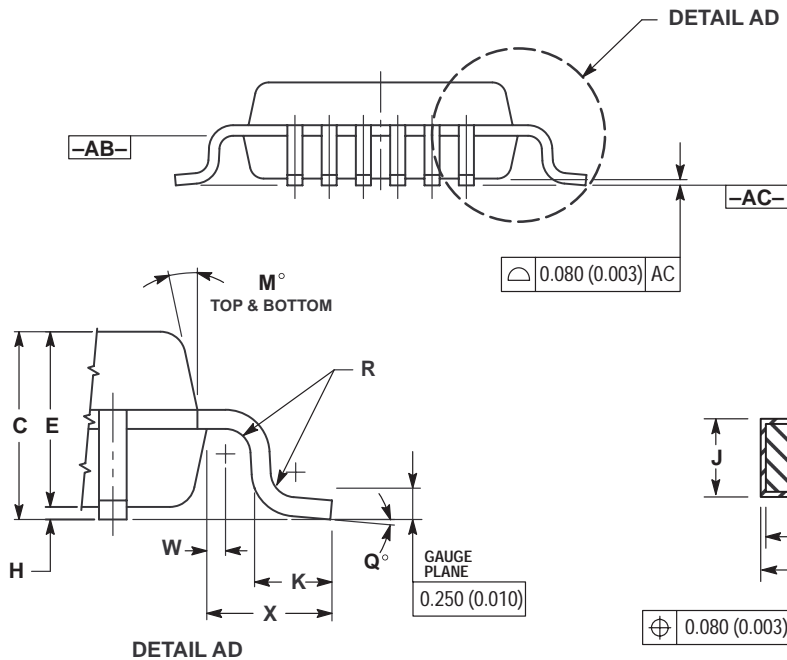
DETAIL Y

FTA SUFFIX  
CASE 977-01  
Plastic Package  
ISSUE O

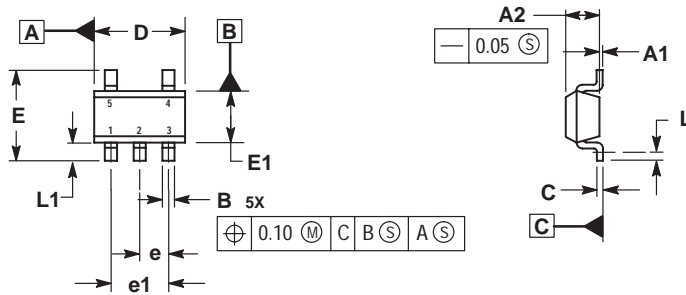


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DATUM PLANE -AB- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
  4. DATUMS -T-, -U-, AND -Z- TO BE DETERMINED AT DATUM PLANE -AB-.
  5. DIMENSIONS S AND V TO BE DETERMINED AT DATUM PLANE -AC-.
  6. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -AB-.
  7. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.350 (0.014).
  8. MINIMUM SOLDER PLATE THICKNESS SHALL BE 0.0076 (0.0003).
  9. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.000 BSC		0.157 BSC	
A1	2.000 BSC		0.079 BSC	
B	4.000 BSC		0.157 BSC	
B1	2.000 BSC		0.079 BSC	
C	1.400	1.600	0.055	0.063
D	0.170	0.270	0.007	0.011
E	1.350	1.450	0.053	0.057
F	0.170	0.230	0.007	0.009
G	0.500 BSC		0.020 BSC	
H	0.050	0.150	0.002	0.006
J	0.090	0.200	0.004	0.008
K	0.500	0.700	0.020	0.028
M	12° REF		12° REF	
N	0.090	0.160	0.004	0.006
P	0.250 BSC		0.010 BSC	
Q	1°	5°	1°	5°
R	0.150	0.250	0.006	0.010
S	6.000 BSC		0.236 BSC	
S1	3.000 BSC		0.118 BSC	
V	6.000 BSC		0.236 BSC	
V1	3.000 BSC		0.118 BSC	
W	0.200 REF		0.008 REF	
X	1.000 REF		0.039 REF	



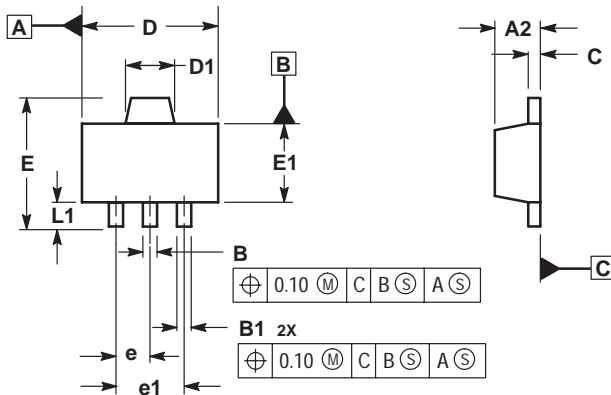
**N SUFFIX**  
**CASE 1212-01**  
 Plastic Package  
 (SOT-23)  
 ISSUE O



- NOTES:  
 1. DIMENSIONS ARE IN MILLIMETERS.  
 2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.  
 3. DATUM C IS A SEATING PLANE.

MILLIMETERS		
DIM	MIN	MAX
A1	0.00	0.10
A2	1.00	1.30
B	0.30	0.50
C	0.10	0.25
D	2.80	3.00
E	2.50	3.10
E1	1.50	1.80
e	0.95 BSC	
e1	1.90 BSC	
L	0.20	----
L1	0.45	0.75

**H SUFFIX**  
**CASE 1213-01**  
 Plastic Package  
 (SOT-89)  
 ISSUE O



- NOTES:  
 1. DIMENSIONS ARE IN MILLIMETERS.  
 2. INTERPRET DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.  
 3. DATUM C IS A SEATING PLANE.

MILLIMETERS		
DIM	MIN	MAX
A2	1.40	1.60
B	0.37	0.57
B1	0.32	0.52
C	0.30	0.50
D	4.40	4.60
D1	1.50	1.70
E	----	4.25
E1	2.40	2.60
e	1.50 BSC	
e1	3.00 BSC	
L1	0.80	----