

T-58-11-23

ORDERING INFORMATION

Device	Alternate	Temperature Range	Package
MC1723CD		0°C to +70°C	SO-14
MC1723CG	LM723CH, $\mu$ A723HC	0°C to +70°C	Metal Can
MC1723CL	LM723CJ, $\mu$ A723DC	0°C to +70°C	Ceramic DIP
MC1723CP	LM723CN, $\mu$ A723PC	0°C to +70°C	Plastic DIP
MC1723G		-55°C to +125°C	Metal Can
MC1723L		-55°C to +125°C	Ceramic DIP

MC1723  
MC1723C

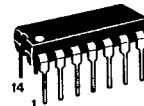
VOLTAGE REGULATOR

The MC1723 is a positive or negative voltage regulator designed to deliver load current to 150 mAdc. Output current capability can be increased to several amperes through use of one or more external pass transistors. MC1723 is specified for operation over the military temperature range (-55°C to +125°C) and the MC1723C over the commercial temperature range (0 to +70°C)

- Output Voltage Adjustable from 2 Vdc to 37 Vdc
- Output Current to 150 mAdc Without External Pass Transistors
- 0.01% Line and 0.03% Load Regulation
- Adjustable Short-Circuit Protection

VOLTAGE REGULATOR

SILICON MONOLITHIC INTEGRATED CIRCUIT

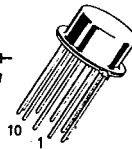


P SUFFIX  
PLASTIC PACKAGE  
CASE 646-06

(Bottom View)



G SUFFIX  
METAL PACKAGE  
CASE 603-04

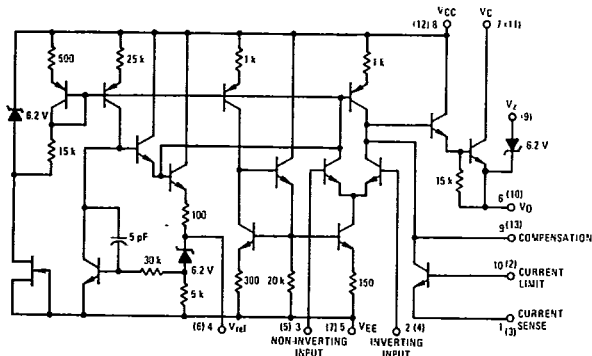


L SUFFIX  
CERAMIC PACKAGE  
CASE 632-08

D SUFFIX  
PLASTIC PACKAGE  
CASE 751A-02  
SO-14

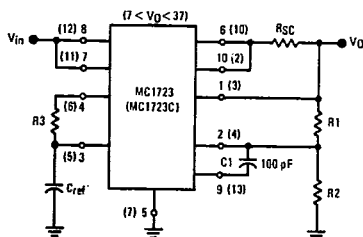


FIGURE 1 - CIRCUIT SCHEMATIC



Pin numbers adjacent to terminals are for the metal package. Pin numbers in parenthesis are for dual in line packages.

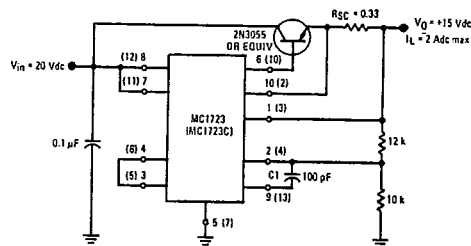
FIGURE 2 - TYPICAL CIRCUIT CONNECTION



$$V_O \approx 7 \left( \frac{R_1 + R_2}{R_2} \right) \quad I_{SC} = \frac{V_{sense}}{R_{SC}} = \frac{0.66}{R_{SC}} \text{ at } T_J = +25^\circ\text{C}$$

For best results  $10\text{ k} < R_2 < 100\text{ k}$   
For minimum drift  $R_3 = R_1:R_2$

FIGURE 3 - TYPICAL NPN CURRENT BOOST CONNECTION



MC1723, MC1723C

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MAXIMUM RATINGS (T<sub>A</sub> = +25°C unless otherwise noted.)

Rating	Symbol	Value	Unit
Pulse Voltage from V <sub>CC</sub> to V <sub>EE</sub> (50 ms)	V <sub>in(p)</sub>	50	V <sub>peak</sub>
Continuous Voltage from V <sub>CC</sub> to V <sub>EE</sub>	V <sub>in</sub>	40	V <sub>dc</sub>
Input-Output Voltage Differential	V <sub>in</sub> - V <sub>O</sub>	40	V <sub>dc</sub>
Maximum Output Current	I <sub>L</sub>	150	mAdc
Current from V <sub>ref</sub>	I <sub>ref</sub>	15	mAdc
Current from V <sub>z</sub>	I <sub>z</sub>	25	mA
Voltage Between Non-Inverting Input and V <sub>EE</sub>	V <sub>ie</sub>	8.0	V <sub>dc</sub>
Differential Input Voltage	V <sub>id</sub>	± 5.0	V <sub>dc</sub>
Power Dissipation and Thermal Characteristics			
Plastic Package			
T <sub>A</sub> = +25°C	P <sub>D</sub>	1.25	W
Derate above T <sub>A</sub> = +25°C	1/θ <sub>JA</sub>	10	mW/°C
Thermal Resistance, Junction to Air	θ <sub>JA</sub>	100	°C/W
Metal Package			
T <sub>A</sub> = +25°C	P <sub>D</sub>	1.0	Watt
Derate above T <sub>A</sub> = +25°C	1/θ <sub>JA</sub>	6.6	mW/°C
Thermal Resistance, Junction to Air	θ <sub>JA</sub>	150	°C/W
T <sub>C</sub> = +25°C	P <sub>D</sub>	2.1	Watts
Derate above T <sub>A</sub> = +25°C	1/θ <sub>JA</sub>	14	mW/°C
Thermal Resistance, Junction to Case	θ <sub>JC</sub>	35	°C/W
Dual In-Line Ceramic Package			
Derate above T <sub>A</sub> = +25°C	P <sub>D</sub>	1.5	Watt
Thermal Resistance, Junction to Air	1/θ <sub>JA</sub>	10	mW/°C
	θ <sub>JA</sub>	100	°C/W
Operating and Storage Junction Temperature Range			
Metal Package	T <sub>J</sub> , T <sub>stg</sub>	-65 to +150	°C
Dual In-Line Ceramic		-65 to +175	
Operating Ambient Temperature Range			
MC1723C	T <sub>A</sub>	0 to +70	°C
MC1723		-55 to +125	

ELECTRICAL CHARACTERISTICS (Unless otherwise noted: T<sub>A</sub> = +25°C, V<sub>in</sub> 12 Vdc, V<sub>O</sub> = 5.0 Vdc, I<sub>L</sub> = 1.0 mAdc, R<sub>SC</sub> = 0, C<sub>1</sub> = 100 pF, C<sub>ref</sub> = 0 and divider impedance as seen by the error amplifier ≤ 10 kΩ connected as shown in Figure 2)

Characteristic	Symbol	MC1723			MC1723C			Unit
		Min	Typ	Max	Min	Typ	Max	
Input Voltage Range	V <sub>in</sub>	9.5	-	40	9.5	-	40	V <sub>dc</sub>
Output Voltage Range	V <sub>O</sub>	2.0	-	37	2.0	-	37	V <sub>dc</sub>
Input-Output Voltage Differential	V <sub>in</sub> - V <sub>O</sub>	3.0	-	38	3.0	-	38	V <sub>dc</sub>
Reference Voltage	V <sub>ref</sub>	6.95	7.15	7.35	6.80	7.15	7.50	V <sub>dc</sub>
Standby Current Drain (I <sub>L</sub> = 0, V <sub>in</sub> = 30 V)	I <sub>IB</sub>	-	2.3	3.5	-	2.3	4.0	mAdc
Output Noise Voltage (f = 100 Hz to 10 kHz)	V <sub>n</sub>	-	20	-	-	20	-	μV(RMS)
C <sub>ref</sub> = 0		-	2.5	-	-	2.5	-	
C <sub>ref</sub> = 5.0 μF		-	-	-	-	-	-	
Average Temperature Coefficient of Output Voltage (T <sub>low</sub> ① < T <sub>A</sub> < T <sub>high</sub> ②)	TCV <sub>O</sub>	-	0.002	0.015	-	0.003	0.015	%/°C
Line Regulation	Reg <sub>line</sub>	-	0.01	0.1	-	0.01	0.1	%V <sub>O</sub>
(T <sub>A</sub> = +25°C) { 12 V < V <sub>in</sub> < 15 V		-	0.02	0.2	-	0.1	0.5	
(T <sub>low</sub> ① < T <sub>A</sub> < T <sub>high</sub> ②)		-	-	0.3	-	-	0.3	
12 V < V <sub>in</sub> < 15 V		-	-	-	-	-	-	
Load Regulation (1.0 mA < I <sub>L</sub> < 50 mA)	Reg <sub>load</sub>	-	0.03	0.15	-	0.03	0.2	%V <sub>O</sub>
T <sub>A</sub> = +25°C		-	-	0.6	-	-	0.6	
T <sub>low</sub> ① < T <sub>A</sub> < T <sub>high</sub> ②		-	-	-	-	-	-	
Ripple Rejection (f = 50 Hz to 10 kHz)	RR	-	74	-	-	74	-	dB
C <sub>ref</sub> = 0		-	86	-	-	86	-	
C <sub>ref</sub> = 5.0 μF		-	-	-	-	-	-	
Short Circuit Current Limit (R <sub>SC</sub> = 10 Ω, V <sub>O</sub> = 0)	I <sub>sc</sub>	-	65	-	-	65	-	mAdc
Long Term Stability	ΔV <sub>O</sub> /Δt	-	0.1	-	-	0.1	-	%/1000 Hr

① T<sub>low</sub> = 0°C for MC1723C  
= -55°C for MC1723

② T<sub>high</sub> = +70°C for MC1723C  
= +125°C for MC1723

MC1723, MC1723C

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TYPICAL CHARACTERISTICS

( $V_{in} = 12 \text{ Vdc}$ ,  $V_O = 5.0 \text{ Vdc}$ ,  $I_L = 1.0 \text{ mA}$ ,  $R_{SC} = 0$ ,  $T_A = +25^\circ\text{C}$  unless otherwise noted.)

FIGURE 4 - MAXIMUM LOAD CURRENT AS A FUNCTION OF INPUT-OUTPUT VOLTAGE DIFFERENTIAL

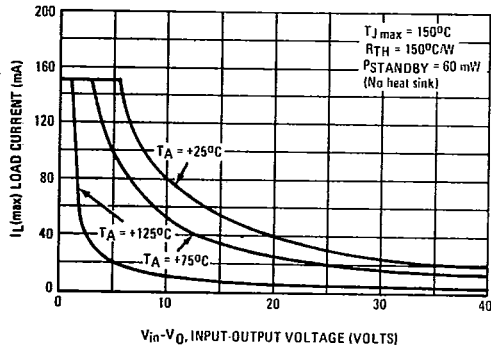


FIGURE 5 - LOAD REGULATION CHARACTERISTICS WITHOUT CURRENT LIMITING

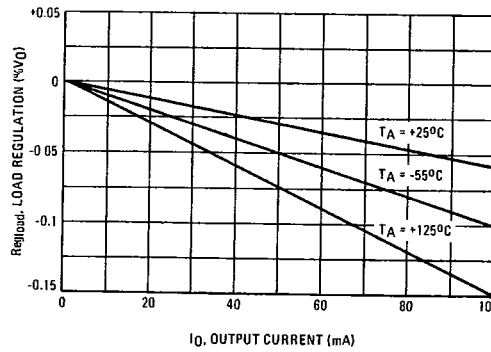


FIGURE 6 - LOAD REGULATION CHARACTERISTICS WITH CURRENT LIMITING

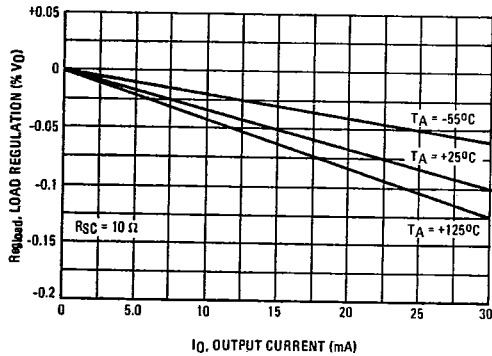


FIGURE 7 - LOAD REGULATION CHARACTERISTICS WITH CURRENT LIMITING

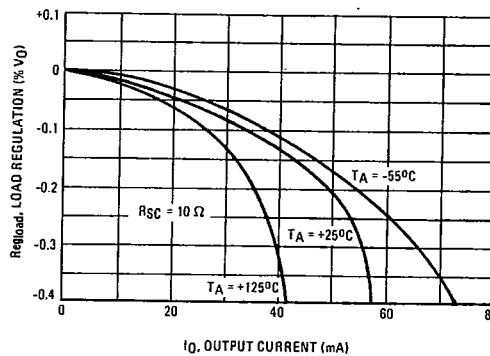


FIGURE 8 - CURRENT LIMITING CHARACTERISTICS

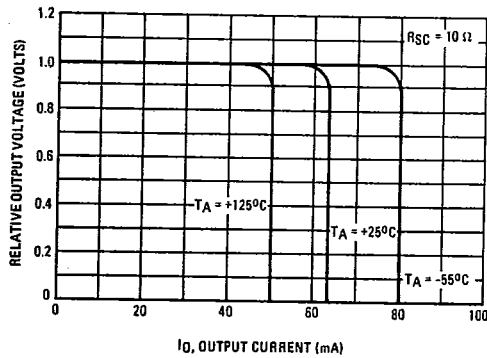
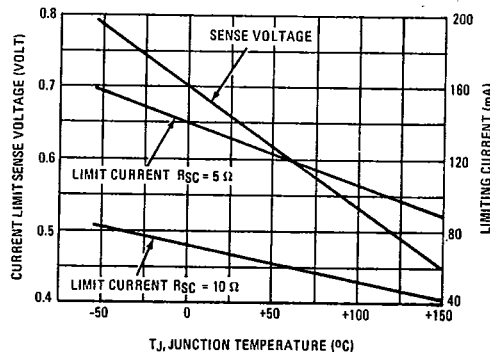


FIGURE 9 - CURRENT LIMITING CHARACTERISTICS AS A FUNCTION OF JUNCTION TEMPERATURE



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TYPICAL CHARACTERISTICS (continued)

FIGURE 10 - LINE REGULATION AS A FUNCTION OF INPUT-OUTPUT VOLTAGE DIFFERENTIAL

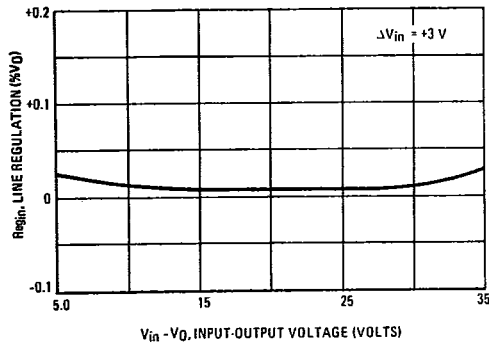


FIGURE 11 - LOAD REGULATION AS A FUNCTION OF INPUT-OUTPUT VOLTAGE DIFFERENTIAL

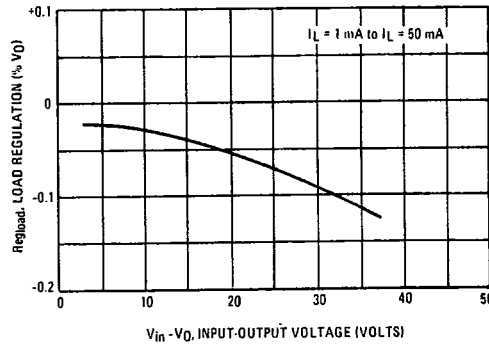


FIGURE 12 - STANDBY CURRENT DRAIN AS A FUNCTION OF INPUT VOLTAGE

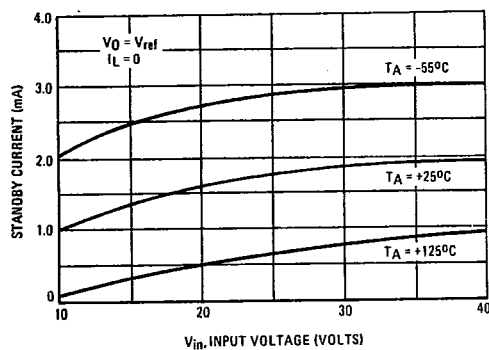


FIGURE 13 - LINE TRANSIENT RESPONSE

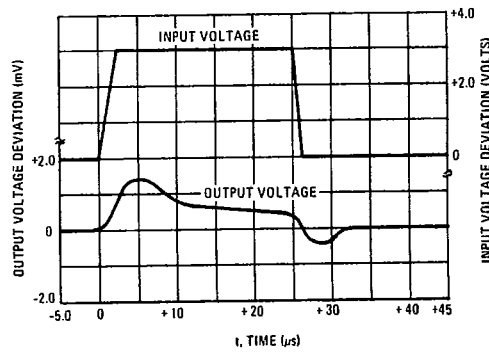


FIGURE 14 - LOAD TRANSIENT RESPONSE

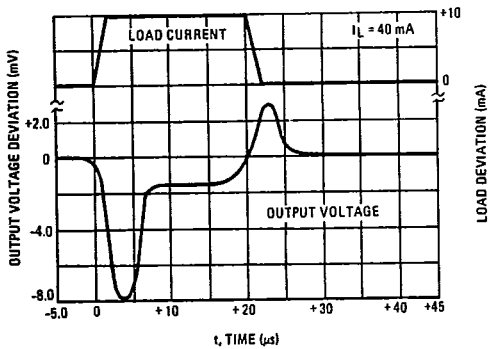
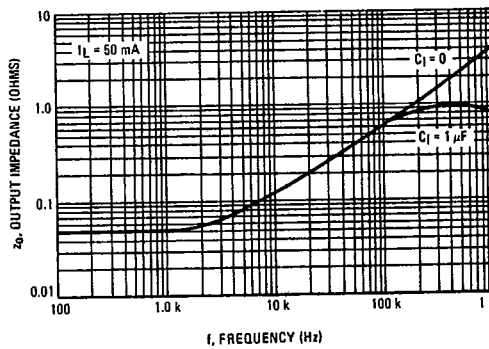


FIGURE 15 - OUTPUT IMPEDANCE AS FUNCTION OF FREQUENCY



MC1723, MC1723C

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TYPICAL APPLICATIONS

Pin numbers adjacent to terminals are for the metal package; pin numbers in parenthesis are for the dual in-line packages.

FIGURE 16 - TYPICAL CONNECTION FOR  $2 < V_O < 7$

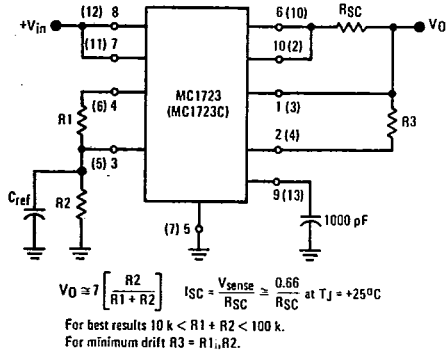


FIGURE 17 - MC1723,C FOLDBACK CONNECTION

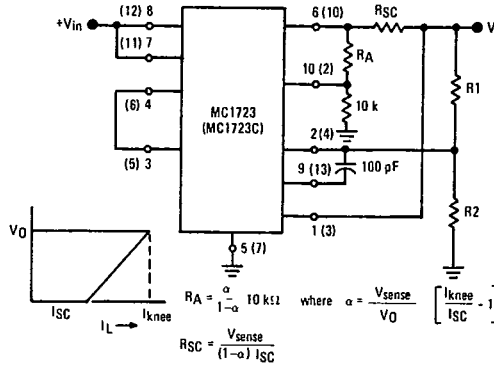


FIGURE 18 - +5 V, 1-AMPERE SWITCHING REGULATOR

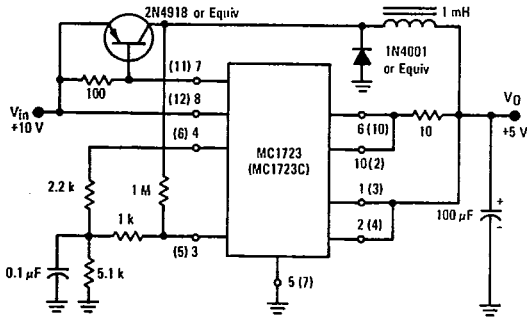


FIGURE 19 - +5 V, 1-AMPERE HIGH EFFICIENCY REGULATOR

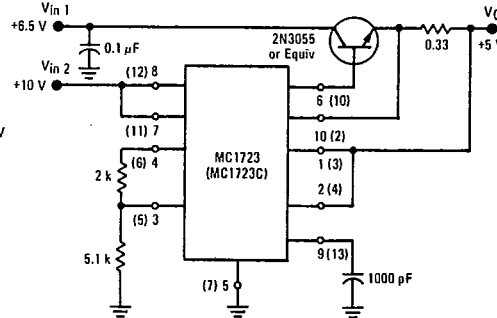


FIGURE 20 - +15 V, 1-AMPERE REGULATOR WITH REMOTE SENSE

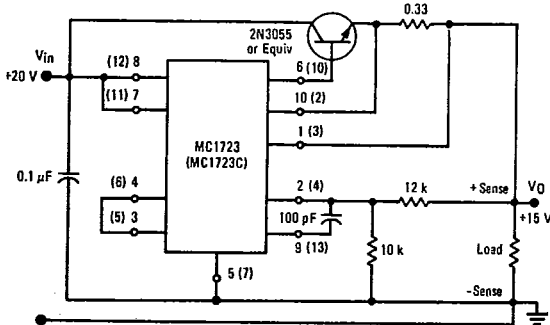
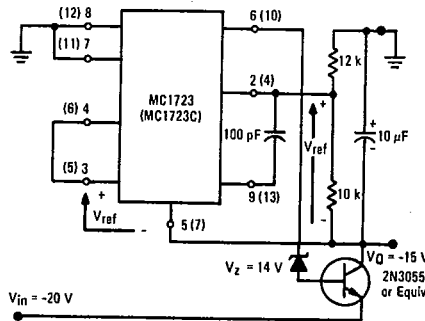


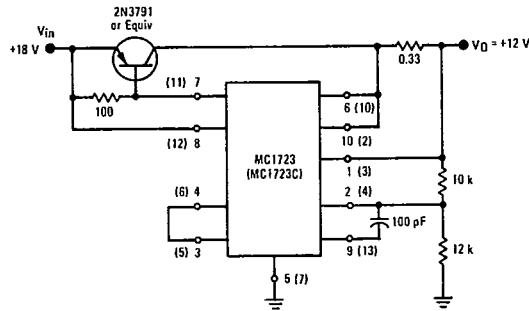
FIGURE 21 - -15 V NEGATIVE REGULATOR



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TYPICAL APPLICATIONS (continued)  
FIGURE 22 - +12 V, 1-AMPERE REGULATOR  
USING PNP CURRENT BOOST



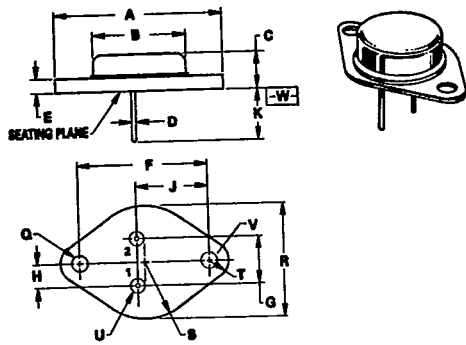
# SECTION 19 PACKAGE OUTLINE DIMENSIONS

T-90-20

## K SUFFIX METAL PACKAGE CASE 1-03 $R\theta_{JA} = 45^{\circ}\text{C/W (TYP)}$ (TO-3)

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
B	—	22.23	—	0.875
C	8.25	11.43	0.325	0.453
D	0.97	1.09	0.038	0.042
E	—	3.43	—	0.135
F	30.15 BSC 1.187 BSC			
G	10.92 BSC 0.430 BSC			
H	5.46 BSC 0.215 BSC			
J	16.89 BSC 0.665 BSC			
K	7.92	—	0.312	—
Q	3.94	4.09	0.151	0.161
S	—	13.34	—	0.525
T	—	4.78	—	0.188
V	3.94	4.09	0.151	0.161

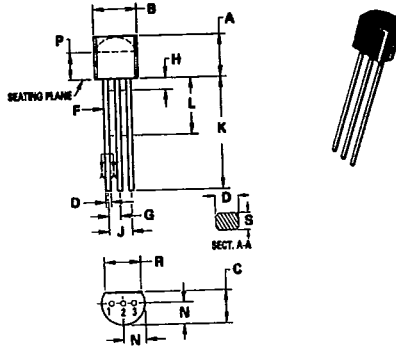
- NOTES:  
 1. DIAMETER V AND SURFACE W ARE DATUMS.  
 2. POSITIONAL TOLERANCE FOR HOLE Q:  
 $\pm 0.25 (0.010) \text{ (M) | W | V | Q |}$   
 3. POSITIONAL TOLERANCE FOR LEADS:  
 $\pm 0.30 (0.012) \text{ (M) | W | V | Q | Q |}$



## LP, P, Z SUFFIX PLASTIC PACKAGE CASE 29-04 $R\theta_{JA} = 200^{\circ}\text{C/W (TYP)}$ (TO-226AA/TO-92)

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.32	5.33	0.170	0.210
B	4.45	5.20	0.175	0.205
C	3.19	4.19	0.125	0.165
D	0.41	0.55	0.016	0.022
F	0.41	0.48	0.016	0.019
G	1.15	1.39	0.045	0.055
H	—	2.54	—	0.100
J	2.42	2.68	0.095	0.105
K	12.70	—	0.500	—
L	6.35	—	0.250	—
N	2.04	2.68	0.080	0.105
P	2.93	—	0.115	—
R	3.43	—	0.135	—
S	0.39	0.50	0.015	0.020

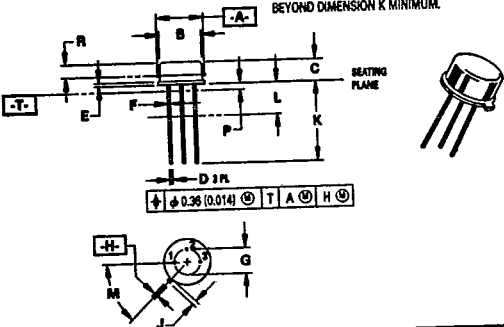
- NOTES:  
 1. CONTOUR OF PACKAGE BEYOND ZONE "P" IS UNCONTROLLED.  
 2. DIM "F" APPLIES BETWEEN "H" AND "L". DIM "D" & "S" APPLIES BETWEEN "L" & 12.70mm (0.5") FROM SEATING PLANE. LEAD DIM IS UNCONTROLLED IN "H" & BEYOND 12.70mm (0.5") FROM SEATING PLANE.  
 3. CONTROLLING DIM: INCH.



## G, H SUFFIX METAL PACKAGE CASE 79-05 $R\theta_{JA} = 185^{\circ}\text{C/W (TYP)}$ (TO-39)

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.02	9.29	0.355	0.369
B	8.01	8.50	0.315	0.335
C	4.20	4.57	0.165	0.180
D	0.44	0.53	0.017	0.021
E	0.44	0.68	0.017	0.036
F	0.41	0.48	0.016	0.019
G	5.08 BSC 0.200 BSC			
H	0.72	0.86	0.029	0.034
J	0.74	1.01	0.029	0.040
K	12.70	19.05	0.500	0.750
L	6.35	—	0.250	—
M	85° BSC 45° BSC			
P	—	1.27	—	0.050
R	2.34	—	0.100	—

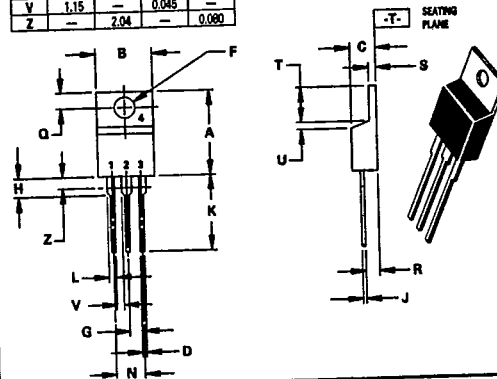
- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 2. CONTROLLING DIMENSION: INCH.  
 3. DIMENSION J MEASURED FROM DIMENSION A MAXIMUM.  
 4. DIMENSION B SHALL NOT VARY MORE THAN 0.25 (0.010) IN ZONE R. THIS ZONE CONTROLLED FOR AUTOMATIC HANDLING.  
 5. DIMENSION F APPLIES BETWEEN DIMENSION P AND L. DIMENSION D APPLIES BETWEEN DIMENSION L AND K MINIMUM. LEAD DIAMETER IS UNCONTROLLED IN DIMENSION P AND BEYOND DIMENSION K MINIMUM.



## KC, T SUFFIX PLASTIC PACKAGE CASE 221A-04 $R\theta_{JA} = 65^{\circ}\text{C/W (TYP)}$ (TO-220AB)

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	14.48	15.75	0.570	0.620
B	9.68	10.29	0.380	0.405
C	4.07	4.82	0.160	0.190
D	0.64	0.88	0.025	0.035
F	3.61	3.73	0.142	0.147
G	2.42	2.68	0.095	0.105
H	2.90	3.33	0.110	0.135
J	0.36	0.55	0.014	0.022
K	12.70	14.27	0.500	0.562
L	1.15	1.39	0.045	0.055
N	4.83	5.33	0.190	0.210
Q	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.15	1.39	0.045	0.055
T	6.97	8.47	0.235	0.335
U	0.09	1.27	0.004	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 2. CONTROLLING DIMENSION: INCH.  
 3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

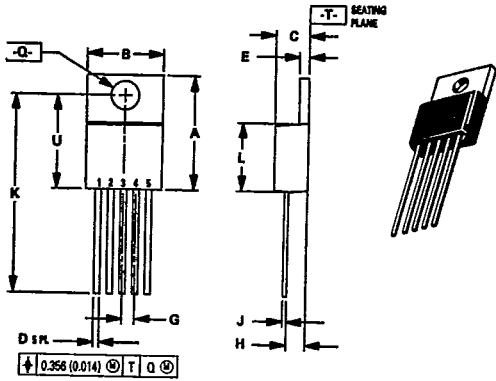


PACKAGE OUTLINE DIMENSIONS (continued)

**T SUFFIX  
PLASTIC PACKAGE  
CASE 314D-02**

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	14.529	15.570	0.572	0.613
B	9.908	10.541	0.390	0.415
C	4.318	4.572	0.170	0.180
D	0.635	0.965	0.025	0.038
E	1.169	1.397	0.046	0.055
G	1.702 BSC		0.067 BSC	
H	2.109	2.717	0.083	0.107
J	0.381	0.635	0.015	0.025
K	25.907	26.670	1.016	1.050
L	8.052	9.398	0.317	0.370
Q	3.556	3.937	0.140	0.155
U	11.893	12.827	0.468	0.505

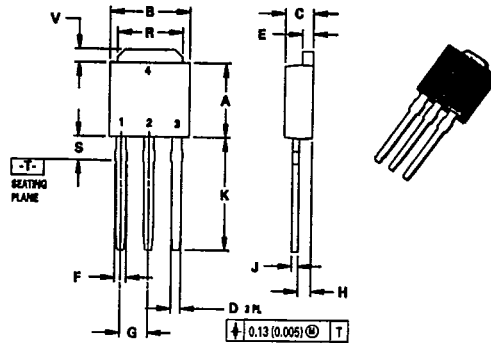
NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.



**DT-1 SUFFIX  
PLASTIC PACKAGE  
CASE 369-03**

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	5.97	6.22	0.235	0.245
B	6.35	6.73	0.250	0.265
C	2.19	2.38	0.086	0.094
D	0.69	0.88	0.027	0.035
E	0.84	0.94	0.033	0.037
F	0.77	1.14	0.030	0.045
G	2.29 BSC		0.090 BSC	
H	0.97	1.06	0.038	0.042
J	0.46	0.58	0.018	0.023
K	8.89	9.65	0.350	0.380
R	5.21	5.46	0.205	0.215
S	1.91	2.28	0.075	0.090
V	0.89	1.27	0.035	0.050

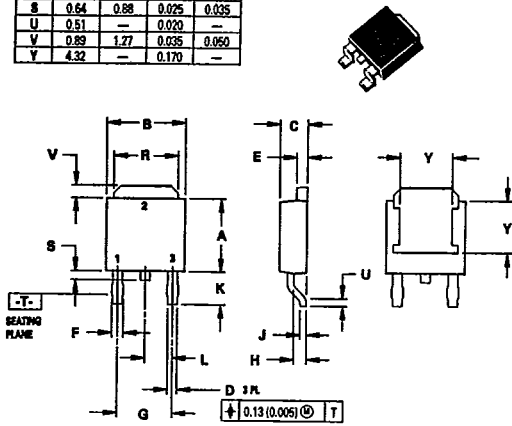
NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.



**DT SUFFIX  
PLASTIC PACKAGE  
CASE 369A-03  
DPAK**

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	5.97	6.22	0.235	0.245
B	6.35	6.73	0.250	0.265
C	2.19	2.38	0.086	0.094
D	0.69	0.88	0.027	0.035
E	0.84	0.94	0.033	0.037
F	0.77	1.14	0.030	0.045
G	4.58 BSC		0.180 BSC	
H	0.97	1.06	0.038	0.042
J	0.46	0.58	0.018	0.023
K	2.60	2.89	0.102	0.114
L	2.29 BSC		0.090 BSC	
R	5.21	5.46	0.205	0.215
S	0.64	0.88	0.025	0.035
U	0.51	—	0.020	—
V	0.89	1.27	0.035	0.050
Y	4.32	—	0.170	—

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

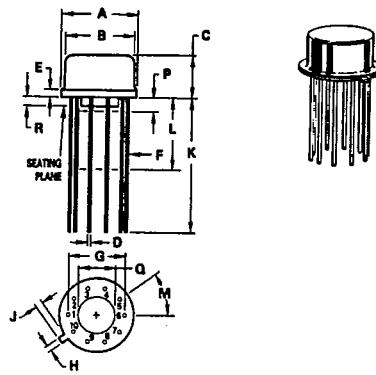


**H, G SUFFIX  
METAL PACKAGE  
CASE 603-04  
R<sub>θJA</sub> = 160°C/W  
(TO-100)**

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.51	9.29	0.335	0.370
B	7.25	8.51	0.285	0.335
C	4.19	4.70	0.165	0.185
D	0.407	0.533	0.016	0.021
E	—	1.02	—	0.040
F	0.406	0.483	0.016	0.019
G	5.84 BSC		0.230 BSC	
H	0.712	0.864	0.028	0.034
J	0.737	1.14	0.029	0.045
K	12.70	—	0.500	—
L	6.35	12.70	0.250	0.500
M	—	—	36° BSC	36° BSC
P	—	1.27	—	0.050
Q	3.56	4.06	0.140	0.160
R	0.254	1.02	0.010	0.040

NOTE:  
LEADS WITHIN 0.18 mm (0.007) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.

All JEDEC Dimensions and Notes Apply.



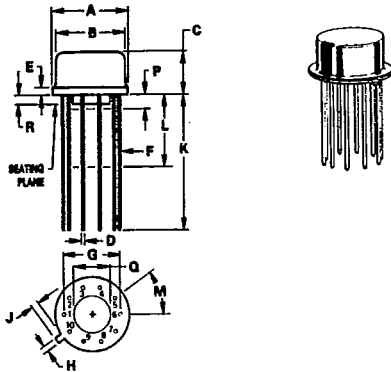


PACKAGE OUTLINE DIMENSIONS (continued)

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.51	9.39	0.335	0.370
B	7.75	8.51	0.305	0.335
C	4.19	6.73	0.165	0.265
D	0.407	0.533	0.016	0.021
E	—	1.02	—	0.040
F	0.406	0.483	0.016	0.019
G	5.84 BSC		0.230 BSC	
H	0.712	0.864	0.028	0.034
J	0.737	1.14	0.029	0.045
K	12.70	—	0.500	—
L	6.35	12.70	0.250	0.500
M	36° BSC		36° BSC	
P	—	1.27	—	0.050
Q	3.56	4.06	0.140	0.160
R	0.254	1.02	0.010	0.040

**G SUFFIX  
METAL PACKAGE  
CASE 603C-01**  
R $\theta$ JA = 150°C/W (TYP)  
(TO-100)

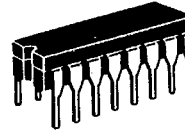
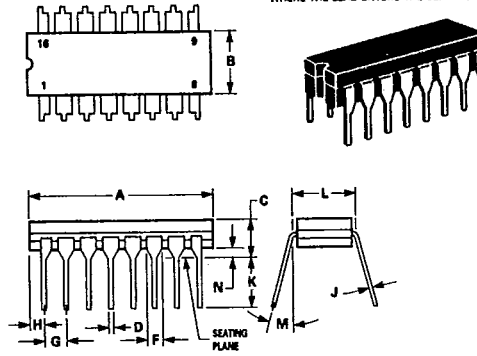
- NOTES:  
1. LEADS WITHIN 0.18 mm (0.007) RADIUS OF TRUE POSITION TO DIM. "A" & "H" AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.  
2. LEAD DIA UNCONTROLLED BEYOND DIM "K" MIN.



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	19.05	19.94	0.750	0.785
B	6.10	7.49	0.240	0.295
C	—	5.08	—	0.200
D	0.38	0.53	0.015	0.021
F	1.40	1.78	0.055	0.070
G	2.54 BSC		0.100 BSC	
H	0.51	1.14	0.020	0.045
J	0.20	0.30	0.008	0.012
K	3.18	4.32	0.125	0.170
L	7.62 BSC		0.300 BSC	
M	—	15°	—	15°
N	0.51	1.02	0.020	0.040

**DP2, D, J, L, N SUFFIX  
CERAMIC PACKAGE  
CASE 620-10**  
R $\theta$ JA = 100°C/W (TYP)

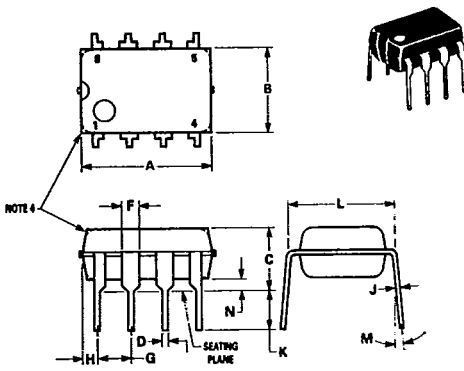
- NOTES:  
1. LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.  
2. PACKAGE INDEX: NOTCH IN LEAD NOTCH IN CERAMIC OR INK DOT.  
3. DIM "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.  
4. DIM "A" AND "B" DO NOT INCLUDE GLASS RUN-OUT.  
5. DIM "F" MAY NARROW TO 0.76 mm (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.



**N, P1 SUFFIX  
PLASTIC PACKAGE  
CASE 626-05**  
R $\theta$ JA = 100°C/W (TYP)

- NOTES:  
1. LEAD POSITIONAL TOLERANCE:  
 $\pm 0.13$  (0.005)  $\text{M}$  T A  $\text{M}$  B  $\text{M}$   
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.  
3. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).  
4. DIMENSIONS A AND B ARE DATUMS.  
5. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

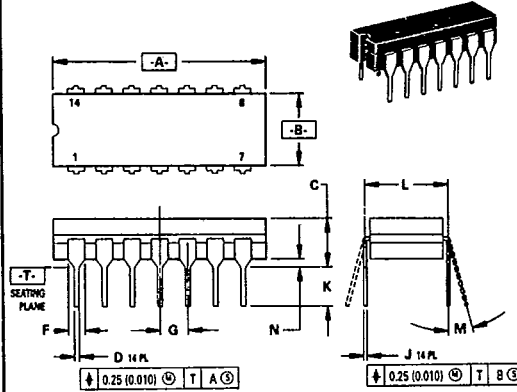
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.52	0.040	0.060
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10°	—	10°
N	0.76	1.01	0.030	0.040



**L SUFFIX  
CERAMIC PACKAGE  
CASE 632-08**  
R $\theta$ JA = 100°C/W (TYP)  
(TO-116)

- 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. DIM F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	19.05	19.94	0.750	0.785
B	6.23	7.11	0.245	0.280
C	3.94	5.08	0.155	0.200
D	0.39	0.50	0.015	0.020
F	1.40	1.65	0.055	0.065
G	2.54 BSC		0.100 BSC	
J	0.21	0.38	0.008	0.015
K	3.18	4.31	0.125	0.170
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	1.01	0.020	0.040

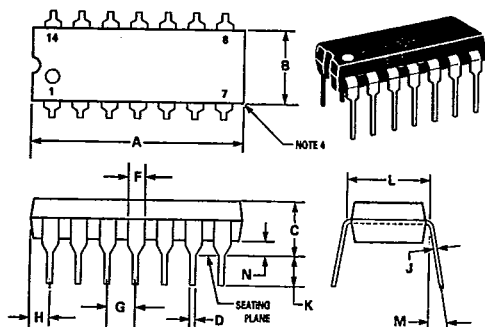


PACKAGE OUTLINE DIMENSIONS (continued)

**N, P, N-14, P2 SUFFIX  
PLASTIC PACKAGE  
CASE 646-06**  
 $R_{\theta JA} = 100^{\circ}\text{C/W (TYP)}$

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	18.16	19.56	0.715	0.770
B	6.10	6.60	0.240	0.260
C	3.69	4.69	0.145	0.185
D	0.39	0.53	0.015	0.021
F	1.02	1.79	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	1.22	2.41	0.052	0.095
J	0.20	0.38	0.008	0.015
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	0°	10°	0°	10°
N	0.39	1.01	0.015	0.039

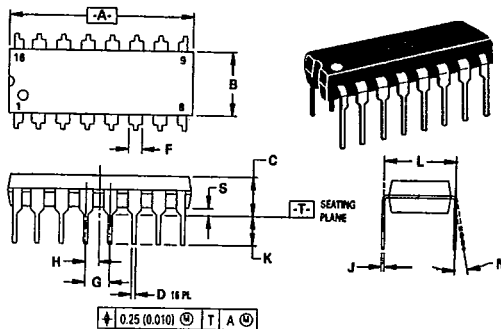
- NOTES:
- LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
  - DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
  - DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
  - ROUNDED CORNERS OPTIONAL.



**N, P SUFFIX  
PLASTIC PACKAGE  
CASE 648-08**  
 $R_{\theta JA} = 100^{\circ}\text{C/W (TYP)}$

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	18.80	19.55	0.740	0.770
B	6.35	6.85	0.250	0.270
C	3.69	4.44	0.145	0.175
D	0.39	0.53	0.015	0.021
F	1.02	1.77	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	1.27 BSC		0.050 BSC	
J	0.21	0.38	0.008	0.015
K	2.80	3.30	0.110	0.130
L	7.50	7.74	0.295	0.305
M	0°	10°	0°	10°
S	0.51	1.01	0.020	0.040

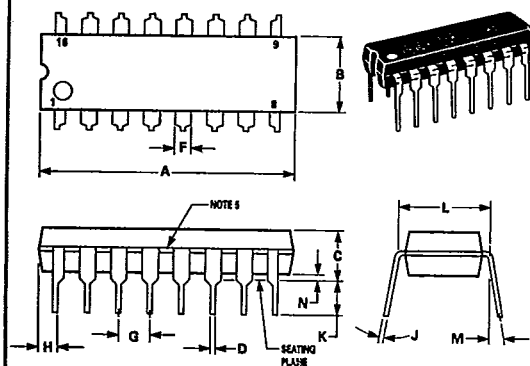
- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - CONTROLLING DIMENSION: INCH.
  - DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
  - DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
  - ROUNDED CORNERS OPTIONAL.



**P SUFFIX  
PLASTIC PACKAGE  
CASE 648C-02**

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	18.80	21.34	0.740	0.840
B	6.10	6.50	0.240	0.260
C	3.69	4.69	0.145	0.185
D	0.39	0.53	0.015	0.021
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.39	2.41	0.015	0.095
J	0.20	0.38	0.008	0.015
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	0°	10°	0°	10°
N	0.39	1.01	0.015	0.040

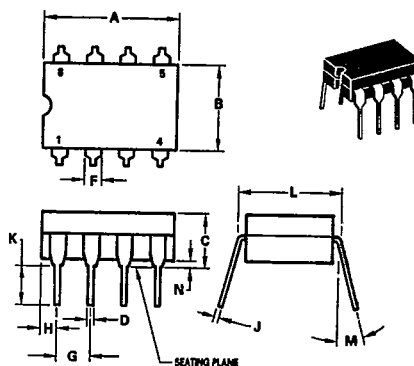
- NOTES:
- LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
  - DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
  - DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
  - ROUNDED CORNERS OPTIONAL.
  - EXTERNAL LEAD CONNECTION, BETWEEN 4 AND 5, 12 AND 13 AS SHOWN.



**J-8, J, JG, U, Z SUFFIX  
CERAMIC PACKAGE  
CASE 693-02**  
 $R_{\theta JA} = 100^{\circ}\text{C/W (TYP)}$

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.91	10.92	0.390	0.430
B	6.22	6.99	0.245	0.275
C	4.32	5.08	0.170	0.200
D	0.41	0.51	0.016	0.020
F	1.40	1.65	0.055	0.065
G	2.54 BSC		0.100 BSC	
H	1.14	1.65	0.045	0.065
J	0.20	0.30	0.008	0.012
K	3.18	4.06	0.125	0.160
L	7.37	7.87	0.290	0.310
M	—	15°	—	15°
N	0.51	1.02	0.020	0.040

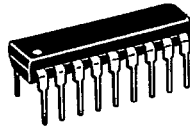
- NOTES:
- LEADS WITHIN 0.13 mm (0.005) RAD OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
  - DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.



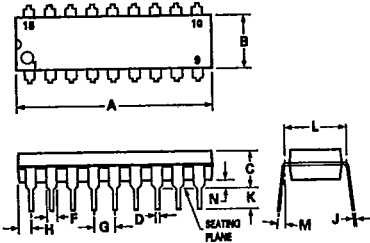
PACKAGE OUTLINE DIMENSIONS (continued)

**A, B, N, P SUFFIX  
PLASTIC PACKAGE  
CASE 707-02**  
R<sub>θJA</sub> = 100°C/W (TYP)

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	3.58	4.57	0.140	0.180
D	0.26	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



- NOTES:
1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25mm(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.

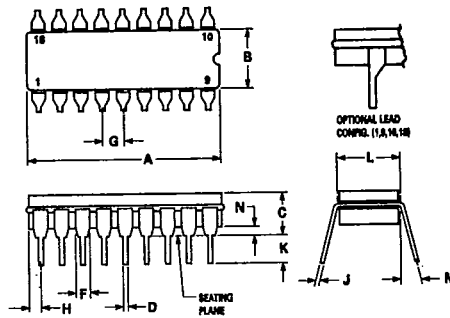


**J, L SUFFIX  
CERAMIC PACKAGE  
CASE 726-04**  
R<sub>θJA</sub> = 100°C/W (TYP)

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	22.35	23.11	0.880	0.910
B	6.10	7.49	0.240	0.295
C	5.08		0.200	
D	0.38	0.53	0.015	0.021
F	1.40	1.78	0.055	0.070
G	2.54 BSC		0.100 BSC	
H	0.51	1.14	0.020	0.045
J	0.20	0.30	0.008	0.012
K	3.18	4.32	0.125	0.170
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040



- NOTES:
1. LEADS, TRUE POSITIONED WITHIN 0.25 mm (0.010) DIA. AT SEATING PLANE, AT MAXIMUM MATERIAL CONDITION.
  2. DIM "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
  3. DIM "A" & "B" INCLUDES MENISCUS.
  4. "F" DIMENSION IS FOR FULL LEADS. "HALF" LEADS ARE OPTIONAL AT LEAD POSITIONS 1, 9, 10, AND 18.

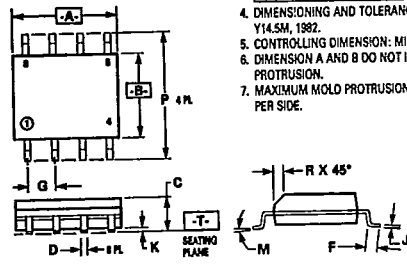


**D SUFFIX  
CASE 751-03  
PLASTIC PACKAGE  
SO-8, SOP-8**  
R<sub>θJA</sub> = 190°C/W (SO-8)  
R<sub>θJA</sub> = 160°C/W (SOP-8)

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
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

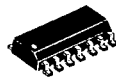


- NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
  2. POSITIONAL TOLERANCE FOR D DIMENSION (8 PLACES):  
±0.25 (0.010) (M) T B (L) A (M)
  3. POSITIONAL TOLERANCE FOR P DIMENSION (4 PLACES):  
±0.25 (0.010) (M) B (M)
  4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  5. CONTROLLING DIMENSION: MILLIMETER.
  6. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
  7. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.

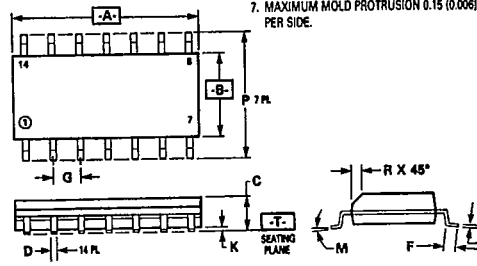


**D SUFFIX  
PLASTIC PACKAGE  
CASE 751A-02  
SO-14**  
R<sub>θJA</sub> = 145°C/W (TYP)

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	0.229	0.244
R	0.25	0.50	0.010	0.019



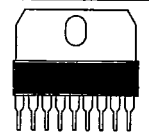
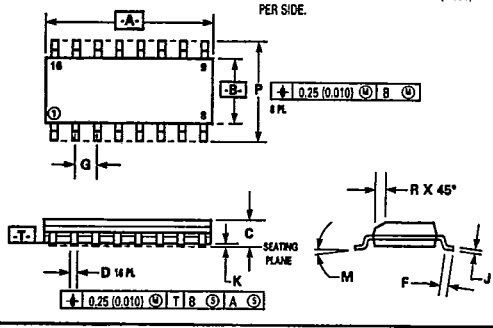
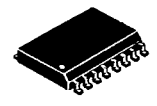
- NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
  2. POSITIONAL TOLERANCE FOR D DIMENSION (14 PLACES):  
±0.25 (0.010) (M) T B (L) A (M)
  3. POSITIONAL TOLERANCE FOR P DIMENSION (7 PLACES):  
±0.25 (0.010) (M) B (M)
  4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  5. CONTROLLING DIMENSION: MILLIMETER.
  6. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
  7. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.



**DW SUFFIX  
PLASTIC PACKAGE  
CASE 751G-01  
SO-16L**

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	10.65	0.395	0.415
	0.25	0.75	0.010	0.029

- NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
  2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  3. CONTROLLING DIMENSION: MILLIMETER.
  4. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
  5. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.



**CASE 762-01  
PLASTIC MEDIUM  
POWER PACKAGE  
SIP-9**

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	22.40	23.00	0.873	0.907
B	6.40	6.80	0.252	0.269
C	3.45	3.65	0.135	0.143
D	0.40	0.55	0.015	0.021
E	0.35	0.60	0.009	0.024
F	1.40	1.60	0.055	0.062
G	2.54 BSC		0.100 BSC	
H	1.81	1.71	0.069	0.067
J	0.380	0.400	0.014	0.015
K	3.30	4.20	0.130	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	13.80	13.90	0.539	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	0.85	0.75	0.033	0.029
Y	2.70	2.90	0.106	0.110

- NOTES:
1. DIMENSIONS A, AND C ARE DATUMS. AND -T- IS A DATUM PLANE.
  2. POSITIONAL TOLERANCE FOR LEAD DIMENSION D:  $\pm 0.25 (0.010) \text{ (M) } | \text{ T } | \text{ A } \text{ (M)}$
  3. POSITIONAL TOLERANCE FOR LEAD DIMENSION J:  $\pm 0.25 (0.010) \text{ (M) } | \text{ T } | \text{ C } \text{ (M)}$
  4. POSITIONAL TOLERANCE FOR LEAD DIMENSION Q:  $\pm 0.25 (0.010) \text{ (M) } | \text{ T } | \text{ A } \text{ (M)}$
  5. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1982.
  6. CONTROLLING DIMENSION: MILLIMETER.

