

T-58-11-23

ORDERING INFORMATION

Device	Alternate	Temperature Range	Package
MC1723CD		0°C to +70°C	SO-14
MC1723CG	LM723CH, μ A723HC	0°C to +70°C	Metal Can
MC1723CL	LM723CJ, μ A723DC	0°C to +70°C	Ceramic DIP
MC1723CP	LM723CN, μ 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**

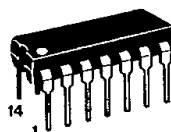
VOLTAGE REGULATOR

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

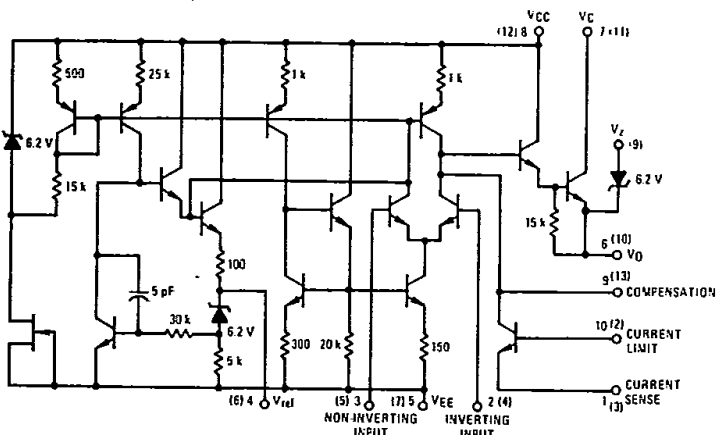
VOLTAGE REGULATOR

**SILICON MONOLITHIC
INTEGRATED CIRCUIT**



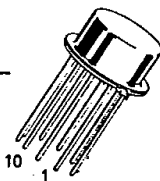
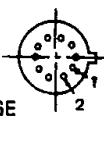
**P SUFFIX
PLASTIC PACKAGE
CASE 646-06**

FIGURE 1 - CIRCUIT SCHEMATIC

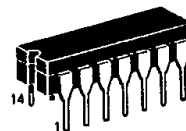


PIN NUMBERS ADJACENT TO TERMINALS ARE FOR THE METAL PACKAGE.
PIN NUMBERS IN PARENTHESIS ARE FOR DUAL IN LINE PACKAGES

(Bottom View)



**G SUFFIX
METAL PACKAGE
CASE 603-04**

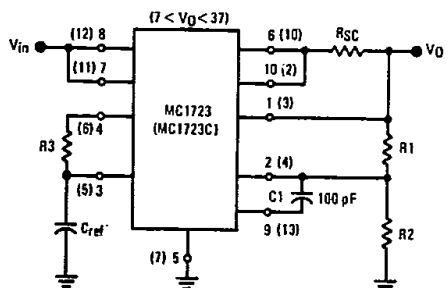


**L SUFFIX
CERAMIC PACKAGE
CASE 632-08**

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



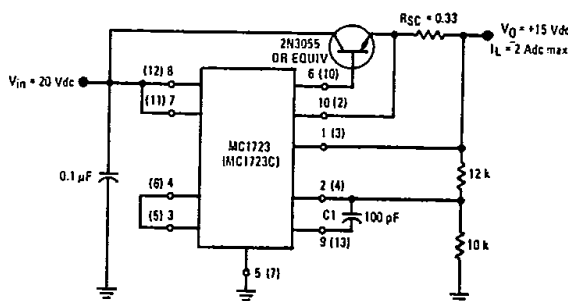
FIGURE 2 - TYPICAL CIRCUIT CONNECTION



$$V_O \approx 7 \left(\frac{R1 + R2}{R2} \right) \quad I_{SC} = \frac{V_{sense}}{R_{SC}} = \frac{0.66}{R_{SC}} \text{ at } T_J = +25^\circ\text{C}$$

For best results $10 \text{ k} < R2 < 100 \text{ k}$
For minimum drift $R3 = R1 \parallel R2$

FIGURE 3 - TYPICAL NPN CURRENT BOOST CONNECTION



MC1723, MC1723C

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

Rating	Symbol	Value	Unit
Pulse Voltage from V_{CC} to V_{EE} (50 ms)	$V_{in(p)}$	50	V_{peak}
Continuous Voltage from V_{CC} to V_{EE}	V_{in}	40	Vdc
Input-Output Voltage Differential	$V_{in} - V_O$	40	Vdc
Maximum Output Current	I_L	150	mAdc
Current from V_{ref}	I_{ref}	15	mAdc
Current from V_Z	I_Z	25	mA
Voltage Between Non-Inverting Input and V_{EE}	V_{ie}	8.0	Vdc
Differential Input Voltage	V_{id}	± 5.0	Vdc
Power Dissipation and Thermal Characteristics			
Plastic Package			
$T_A = +25^\circ\text{C}$	P_D	1.25	W
Derate above $T_A = +25^\circ\text{C}$	$1/\theta_{JA}$	10	$\text{mW}/^\circ\text{C}$
Thermal Resistance, Junction to Air	θ_{JA}	100	$^\circ\text{C}/\text{W}$
Metal Package			
$T_A = +25^\circ\text{C}$	P_D	1.0	Watt
Derate above $T_A = +25^\circ\text{C}$	$1/\theta_{JA}$	6.6	$\text{mW}/^\circ\text{C}$
Thermal Resistance, Junction to Air	θ_{JA}	150	$^\circ\text{C}/\text{W}$
$T_C = +25^\circ\text{C}$	P_D	2.1	Watts
Derate above $T_A = +25^\circ\text{C}$	$1/\theta_{JA}$	14	$\text{mW}/^\circ\text{C}$
Thermal Resistance, Junction to Case	θ_{JC}	35	$^\circ\text{C}/\text{W}$
Dual In-Line Ceramic Package			
Derate above $T_A = +25^\circ\text{C}$	P_D	1.5	Watt
Thermal Resistance, Junction to Air	$1/\theta_{JA}$	10	$\text{mW}/^\circ\text{C}$
	θ_{JA}	100	$^\circ\text{C}/\text{W}$
Operating and Storage Junction Temperature Range			
Metal Package	T_J, T_{stg}	-65 to +150	$^\circ\text{C}$
Dual In-Line Ceramic		-65 to +175	
Operating Ambient Temperature Range			
MC1723C	T_A	0 to +70	$^\circ\text{C}$
MC1723		-55 to +125	

ELECTRICAL CHARACTERISTICS (Unless otherwise noted: $T_A = +25^\circ\text{C}$, $V_{in} = 12\text{ Vdc}$, $V_O = 5.0\text{ Vdc}$, $I_L = 1.0\text{ mAdc}$, $R_{SC} = 0$, $C_1 = 100\text{ pF}$, $C_{ref} = 0$ and divider impedance as seen by the error amplifier $\leq 10\text{ k}\Omega$ connected as shown in Figure 2)

Characteristic	Symbol	MC1723			MC1723C			Unit
		Min	Typ	Max	Min	Typ	Max	
Input Voltage Range	V_{in}	9.5	—	40	9.5	—	40	Vdc
Output Voltage Range	V_O	2.0	—	37	2.0	—	37	Vdc
Input-Output Voltage Differential	$V_{in} - V_O$	3.0	—	38	3.0	—	38	Vdc
Reference Voltage	V_{ref}	6.95	7.15	7.35	6.80	7.15	7.50	Vdc
Standby Current Drain ($I_L = 0$, $V_{in} = 30\text{ V}$)	I_{IB}	—	2.3	3.5	—	2.3	4.0	mAdc
Output Noise Voltage ($f = 100\text{ Hz}$ to 10 kHz)	V_n	—	20	—	—	20	—	$\mu\text{V(RMS)}$
$C_{ref} = 0$		—	2.5	—	—	2.5	—	
$C_{ref} = 5.0\text{ }\mu\text{F}$		—	—	—	—	—	—	
Average Temperature Coefficient of Output Voltage ($T_{low} \textcircled{1} < T_A < T_{high} \textcircled{2}$)	TCV_O	—	0.002	0.015	—	0.003	0.015	$\%/^\circ\text{C}$
Line Regulation	Regline	—	0.01	0.1	—	0.01	0.1	$\%V_O$
$(T_A = +25^\circ\text{C}) \begin{cases} 12\text{ V} < V_{in} < 15\text{ V} \\ 12\text{ V} < V_{in} < 40\text{ V} \end{cases}$		—	0.02	0.2	—	0.1	0.5	
$(T_{low} \textcircled{1} < T_A < T_{high} \textcircled{2})$		—	—	0.3	—	—	0.3	
$12\text{ V} < V_{in} < 15\text{ V}$		—	—	—	—	—	—	
Load Regulation ($1.0\text{ mA} < I_L < 50\text{ mA}$)	Regload	—	0.03	0.15	—	0.03	0.2	$\%V_O$
$T_A = +25^\circ\text{C}$		—	—	0.6	—	—	0.6	
$T_{low} \textcircled{1} < T_A < T_{high} \textcircled{2}$		—	—	—	—	—	—	
Ripple Rejection ($f = 50\text{ Hz}$ to 10 kHz)	RR	—	74	—	—	74	—	dB
$C_{ref} = 0$		—	86	—	—	86	—	
$C_{ref} = 5.0\text{ }\mu\text{F}$		—	—	—	—	—	—	
Short Circuit Current Limit ($R_{SC} = 10\text{ }\Omega$, $V_O = 0$)	I_{sc}	—	65	—	—	65	—	mAdc
Long Term Stability	$\Delta V_O/\Delta t$	—	0.1	—	—	0.1	—	$\%/1000\text{ Hr}$

$\textcircled{1} T_{low} = 0^\circ\text{C}$ for MC1723C
 $= -55^\circ\text{C}$ for MC1723

$\textcircled{2} T_{high} = +70^\circ\text{C}$ for MC1723C
 $= +125^\circ\text{C}$ for MC1723

MC1723, MC1723C

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TYPICAL CHARACTERISTICS

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

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

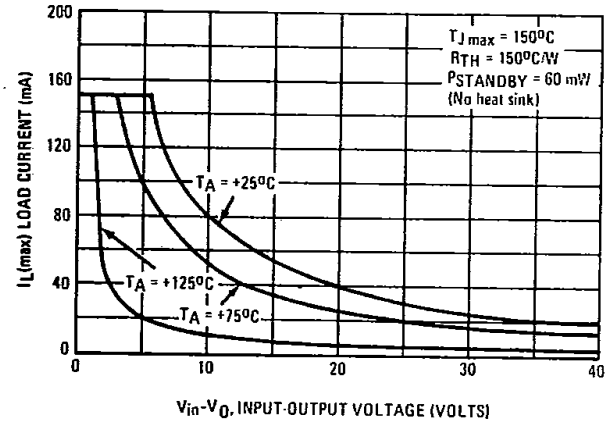


FIGURE 5 – LOAD REGULATION CHARACTERISTICS WITHOUT CURRENT LIMITING

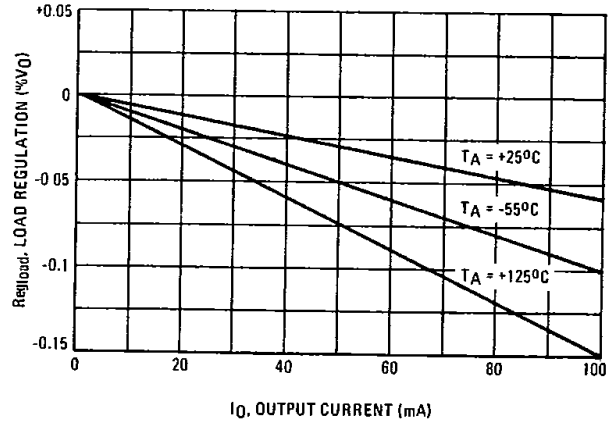


FIGURE 6 – LOAD REGULATION CHARACTERISTICS WITH CURRENT LIMITING

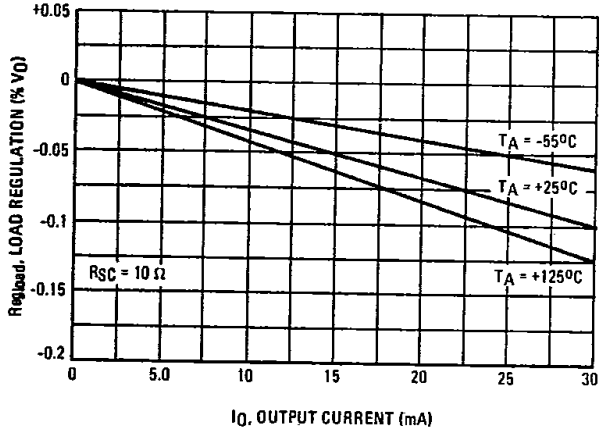


FIGURE 7 – LOAD REGULATION CHARACTERISTICS WITH CURRENT LIMITING

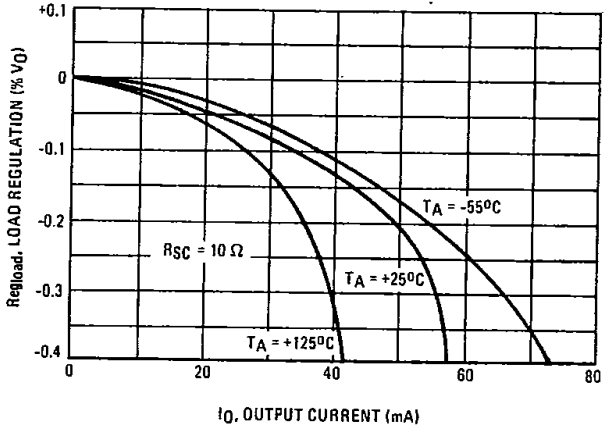


FIGURE 8 – CURRENT LIMITING CHARACTERISTICS

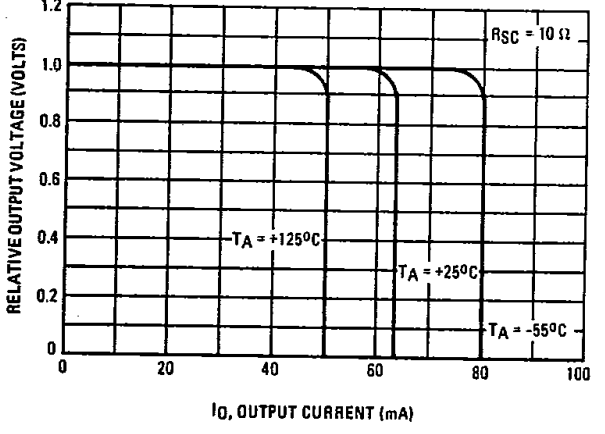
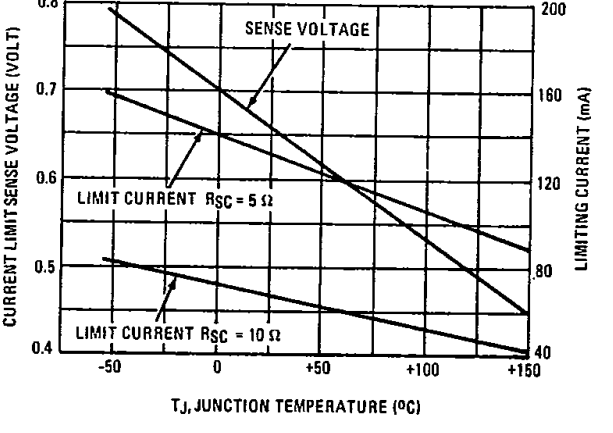


FIGURE 9 – CURRENT LIMITING CHARACTERISTICS AS A FUNCTION OF JUNCTION TEMPERATURE



MC1723, MC1723C

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TYPICAL CHARACTERISTICS (continued)

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

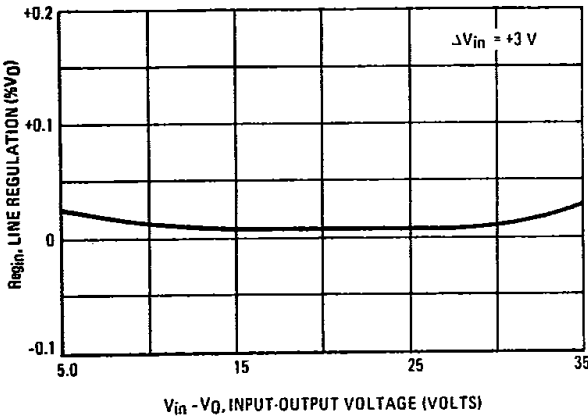


FIGURE 11 – LOAD REGULATION AS A FUNCTION OF INPUT-OUTPUT VOLTAGE DIFFERENTIAL

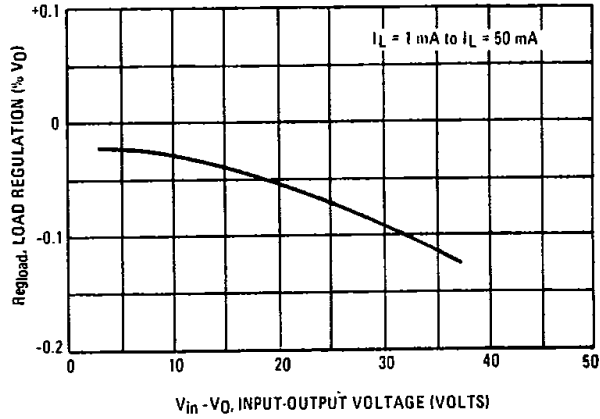


FIGURE 12 – STANDBY CURRENT DRAIN AS A FUNCTION OF INPUT VOLTAGE

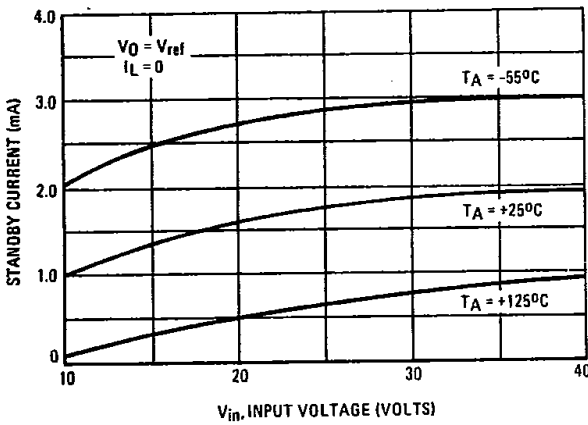


FIGURE 13 – LINE TRANSIENT RESPONSE

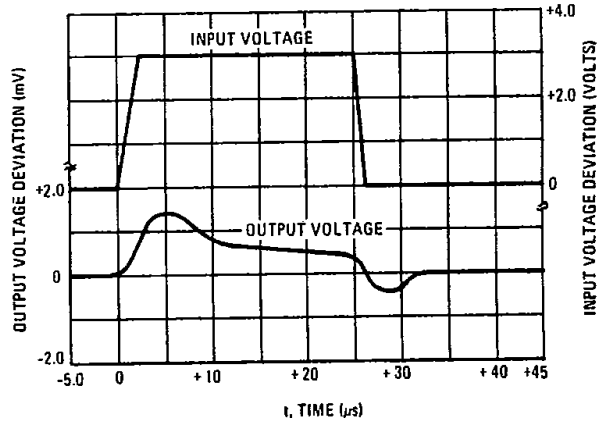


FIGURE 14 – LOAD TRANSIENT RESPONSE

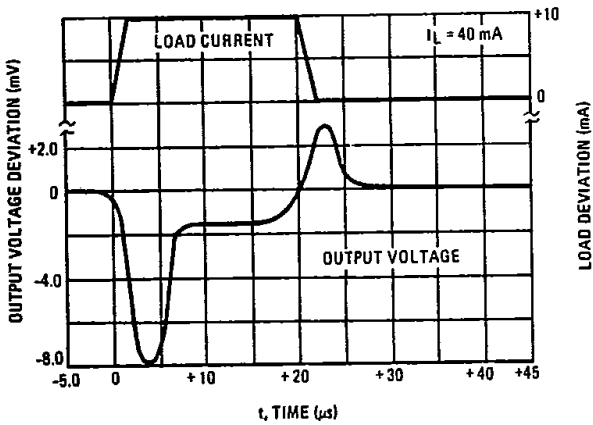
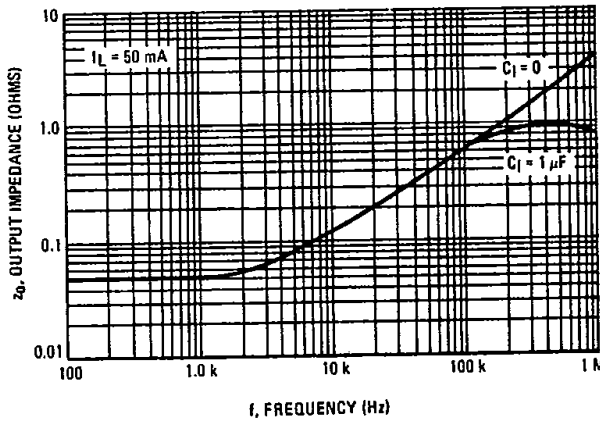


FIGURE 15 – OUTPUT IMPEDANCE AS FUNCTION OF FREQUENCY



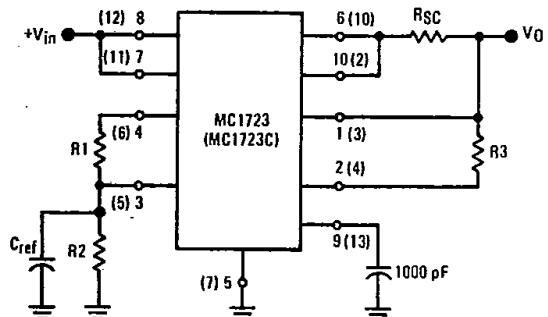
MC1723, MC1723C

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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 $2 < V_O < 7$



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

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

FIGURE 17 - MC1723,C FOLDBACK CONNECTION

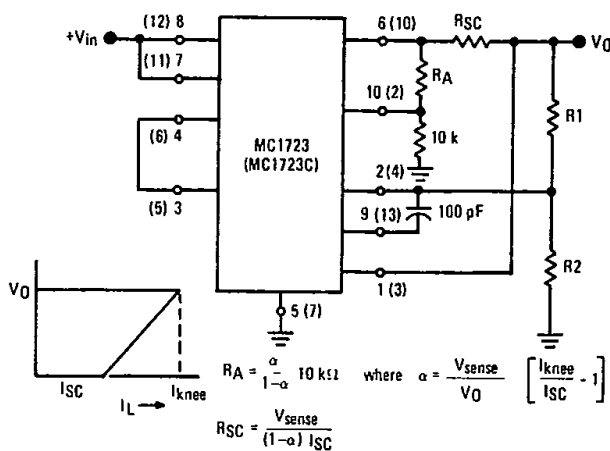


FIGURE 18 - +5 V, 1-AMPERE SWITCHING REGULATOR

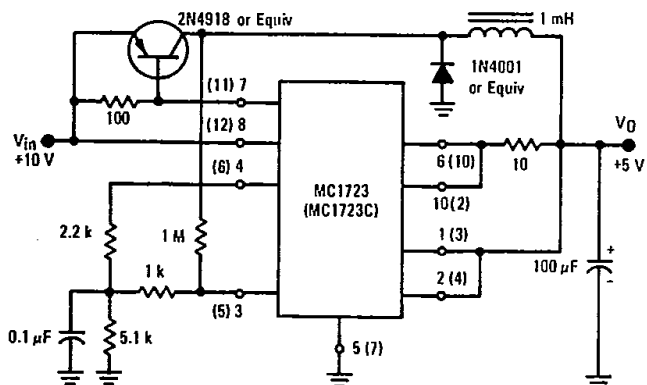


FIGURE 19 - +5 V, 1-AMPERE HIGH EFFICIENCY REGULATOR

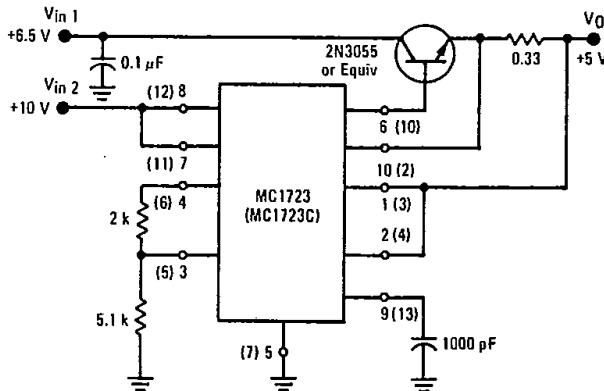


FIGURE 20 - +15 V, 1-AMPERE REGULATOR WITH REMOTE SENSE

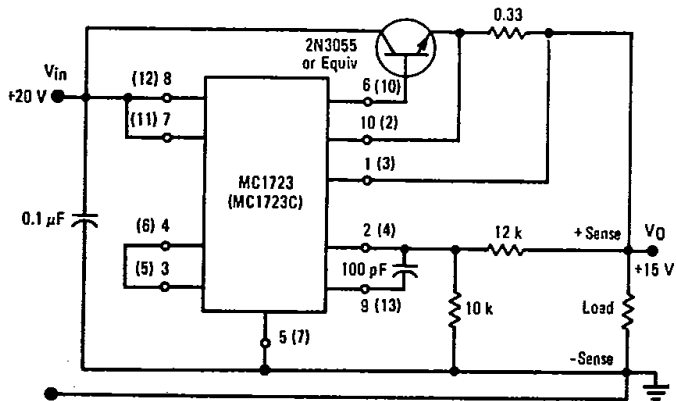
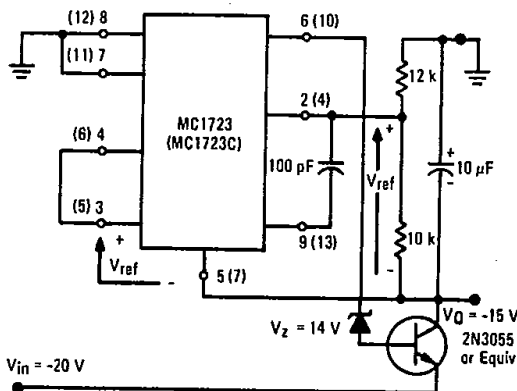


FIGURE 21 - -15 V NEGATIVE REGULATOR



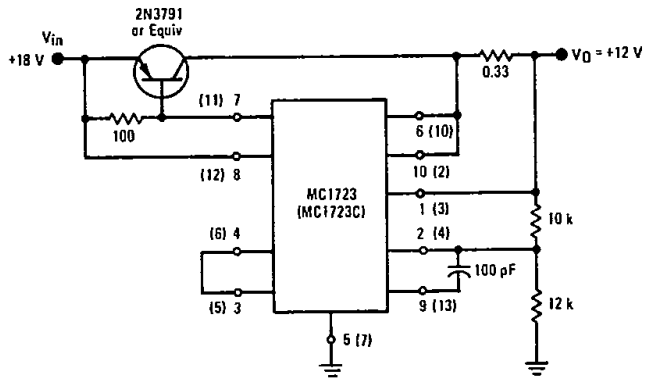
MC1723, MC1723C

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TYPICAL APPLICATIONS (continued)

FIGURE 22 - +12 V, 1-AMPERE REGULATOR

USING PNP CURRENT BOOST



SECTION 19

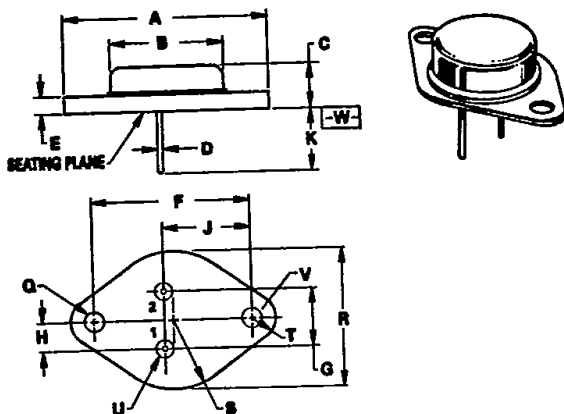
PACKAGE OUTLINE DIMENSIONS

T-90-20

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
B	—	22.23	—	0.875
C	8.35	11.43	0.250	0.450
D	0.97	1.09	0.038	0.043
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	18.89 BSC		0.695 BSC	
R	7.92	—	0.312	—
Q	3.94	4.09	0.151	0.161
S	—	13.94	—	0.525
T	—	4.78	—	0.198
V	3.94	4.09	0.151	0.161

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

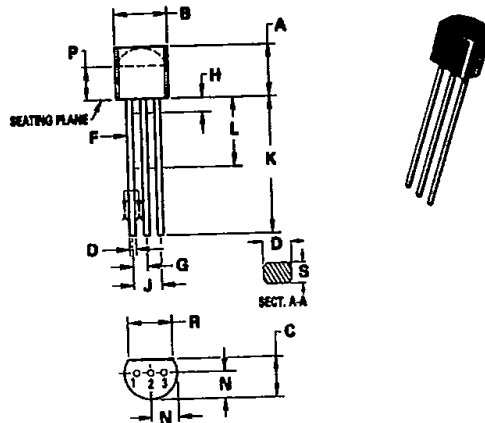
- NOTES:
1. DIAMETER V AND SURFACE W ARE DATUMS.
2. POSITIONAL TOLERANCE FOR HOLE Q:
 $\text{Ⓜ } \phi 0.25 (0.010) \text{ Ⓜ } | \text{W } | \text{V } | \text{Ⓜ}$
3. POSITIONAL TOLERANCE FOR LEADS:
 $\text{Ⓜ } \phi 0.30 (0.012) \text{ Ⓜ } | \text{W } | \text{V } | \text{Ⓜ } | \text{Ⓜ}$



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	3.18	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	2.66	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

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

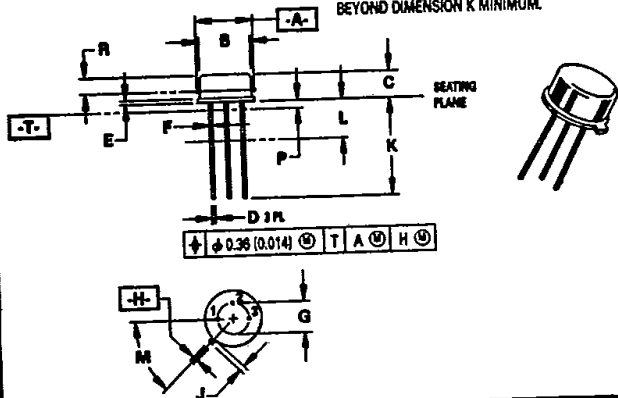
- NOTES:
1. CONTOUR OF PACKAGE BEYOND ZONE "P" IS UNCONTROLLED.
2. DIM "F" APPLIES BETWEEN "H" AND "L". DIM "D" & "S" APPLIES BETWEEN "L" & 12.70mm (0.5") FROM SEATING PLANE. LEAD DIM IS UNCONTROLLED IN "H" & BEYOND 12.70mm (0.5") FROM SEATING PLANE.
3. CONTROLLING DIM: INCH.



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.02	9.29	0.355	0.366
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	0.58	0.017	0.035
F	0.41	0.48	0.016	0.019
G	5.08 BSC		0.200 BSC	
H	0.72	0.86	0.028	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	45° BSC		45° BSC	
P	—	1.27	—	0.050
R	2.54	—	0.100	—

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

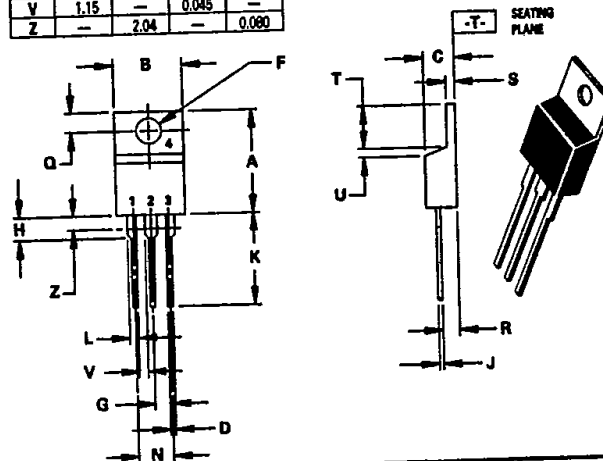
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION J MEASURED FROM DIMENSION A MAXIMUM.
4. DIMENSION B SHALL NOT VARY MORE THAN 0.25 (0.010) IN ZONE R. THIS ZONE CONTROLLED FOR AUTOMATIC HANDLING.
5. DIMENSION F APPLIES BETWEEN DIMENSION P AND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



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	14.48	15.75	0.570	0.620
B	9.68	10.28	0.380	0.405
C	4.07	4.82	0.160	0.190
D	0.64	0.88	0.025	0.035
F	3.81	3.73	0.142	0.147
G	2.42	2.66	0.095	0.105
H	2.80	3.93	0.110	0.155
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	5.97	6.47	0.235	0.255
U	0.00	1.27	0.000	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

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

- 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.

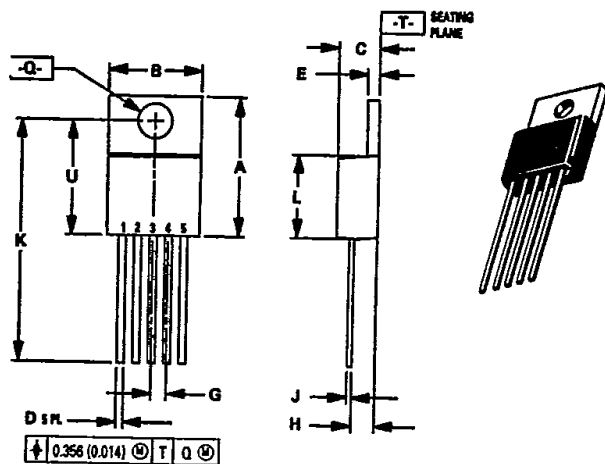


PACKAGE OUTLINE DIMENSIONS (continued)

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	8.062	9.398	0.317	0.370
Q	3.556	3.937	0.140	0.155
U	11.889	12.827	0.468	0.505

T SUFFIX PLASTIC PACKAGE CASE 314D-02

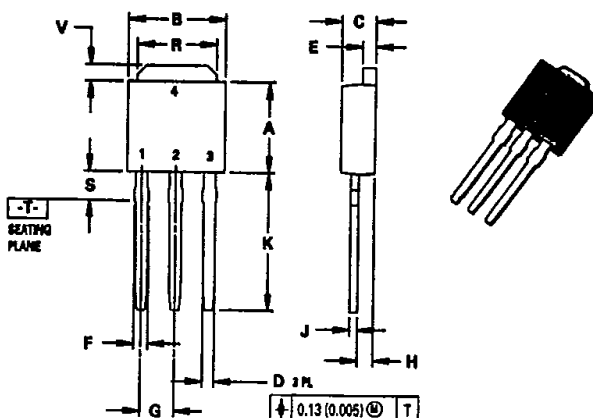
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.



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

DT-1 SUFFIX PLASTIC PACKAGE CASE 369-03

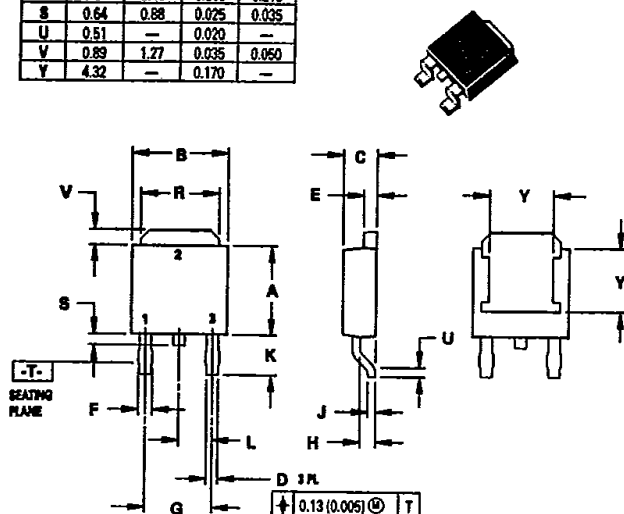
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.



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	—

DT SUFFIX PLASTIC PACKAGE CASE 369A-03 DPAK

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

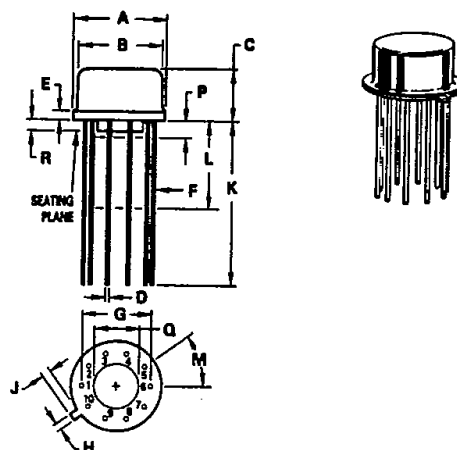


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.51	9.39	0.335	0.370
B	7.75	8.51	0.305	0.335
C	4.19	4.70	0.165	0.185
D	4.07	0.533	0.016	0.021
E	—	1.02	—	0.040
F	0.406	0.483	0.016	0.019
G	5.84 BSC		0.230 BSC	
H	0.712	0.864	0.028	0.034
J	0.737	1.14	0.029	0.045
K	12.70	—	0.500	—
L	6.35	12.70	0.250	0.500
M	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

H, G SUFFIX METAL PACKAGE CASE 603-04 $R_{\theta JA} = 160^{\circ}\text{C/W}$ (TO-100)

- 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.

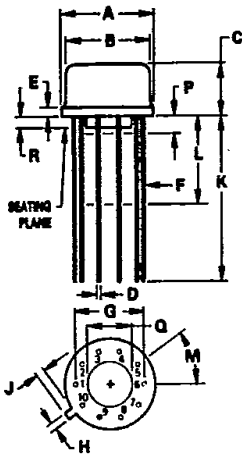


PACKAGE OUTLINE DIMENSIONS (continued)

G SUFFIX METAL PACKAGE CASE 603C-01 $R_{\theta JA} = 150^{\circ}\text{C/W}$ (TYP) (TO-100)

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	0.408	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	4.08	0.140	0.160
R	0.254	1.02	0.010	0.040

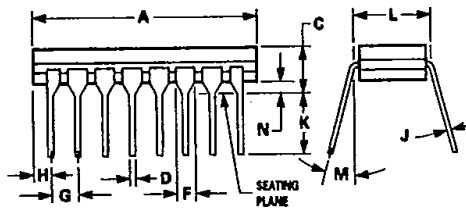
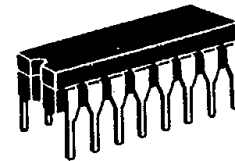
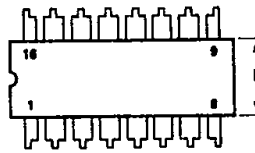
- NOTES:
1. LEADS WITHIN 0.18 mm (0.007) RADIUS OF TRUE POSITION TO DIM. "A" & "H" AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. LEAD DIA UNCONTROLLED BEYOND DIM "K" MIN.



DP2, D, J, L, N SUFFIX CERAMIC PACKAGE CASE 620-10 $R_{\theta JA} = 100^{\circ}\text{C/W}$ (TYP)

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

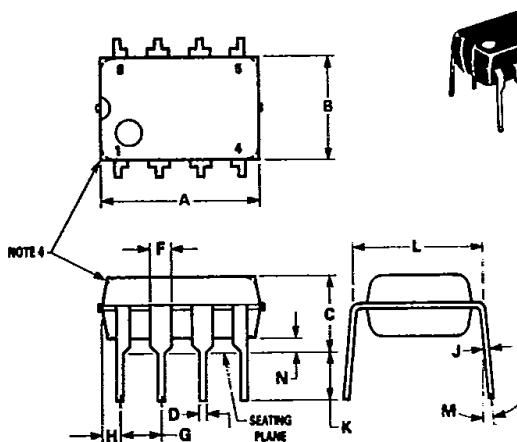
- NOTES:
1. LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. PACKAGE INDEX: NOTCH IN LEAD NOTCH IN CERAMIC OR INK DOT.
3. DIM "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIM "A" AND "B" DO NOT INCLUDE GLASS RUN-OUT.
5. DIM "F" MAY NARROW TO 0.76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



N, P1 SUFFIX PLASTIC PACKAGE CASE 626-05 $R_{\theta JA} = 100^{\circ}\text{C/W}$ (TYP)

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

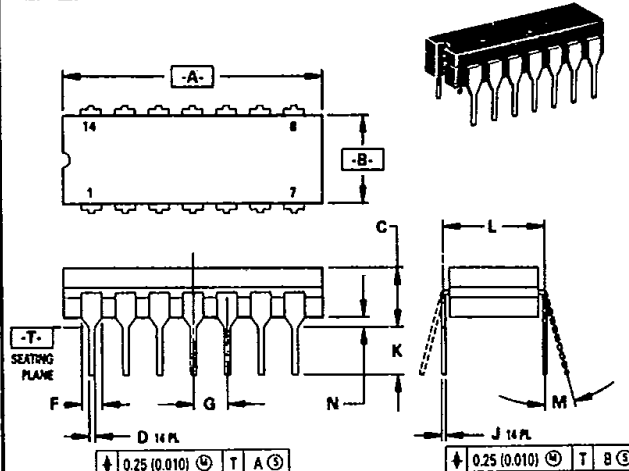
- NOTES:
1. LEAD POSITIONAL TOLERANCE:
 $\pm \phi 0.13$ (0.005) M T A M B M
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
4. DIMENSIONS A AND B ARE DATUMS.
5. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.



L SUFFIX CERAMIC PACKAGE CASE 632-08 $R_{\theta JA} = 100^{\circ}\text{C/W}$ (TYP) (TO-116)

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

- 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.

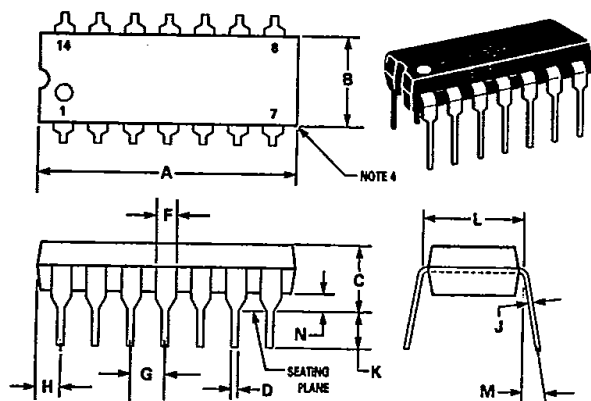


PACKAGE OUTLINE DIMENSIONS (continued)

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	19.58	0.715	0.770
B	6.10	6.60	0.240	0.260
C	3.69	4.69	0.145	0.185
D	0.38	0.53	0.015	0.021
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	1.32	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

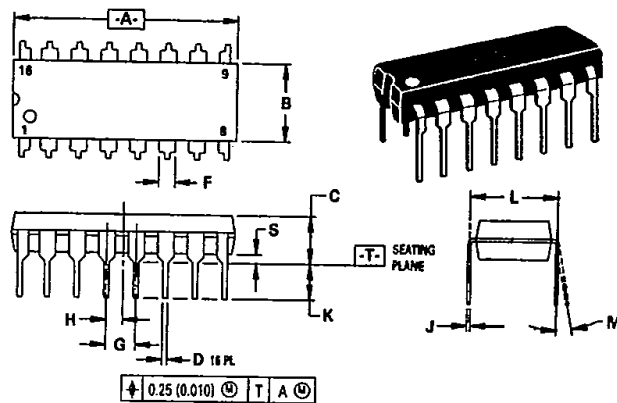
- NOTES:
- LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
 - DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
 - DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
 - ROUNDED CORNERS OPTIONAL.



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	19.56	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

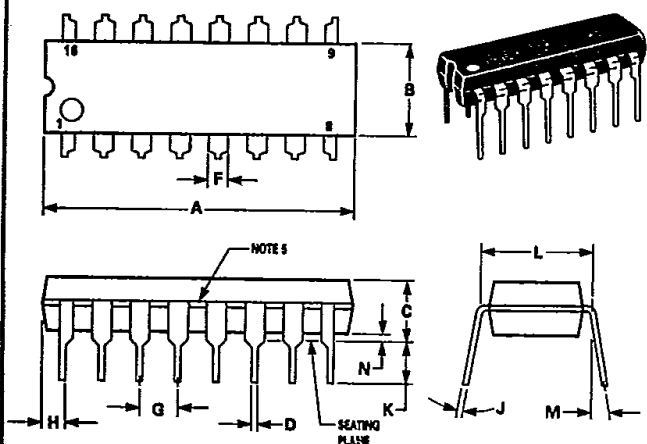
- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 - CONTROLLING DIMENSION: INCH.
 - DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
 - DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
 - ROUNDED CORNERS OPTIONAL.



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	6.60	0.240	0.260
C	3.69	4.69	0.145	0.185
D	0.38	0.53	0.015	0.021
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.38	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

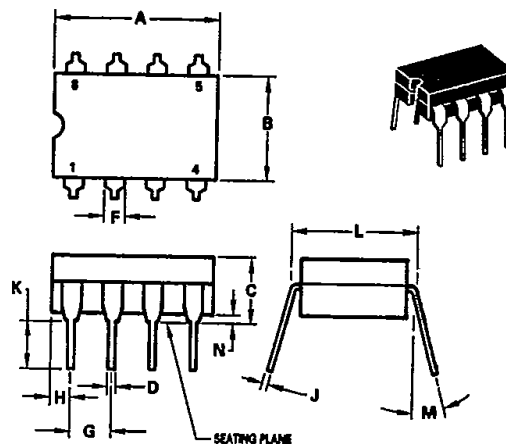
- NOTES:
- LEADS WITHIN 0.13 mm (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
 - DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.
 - DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
 - ROUNDED CORNERS OPTIONAL.
 - EXTERNAL LEAD CONNECTION, BETWEEN 4 AND 5, 12 AND 13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

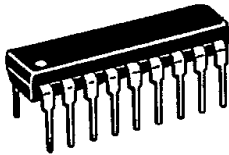
- NOTES:
- LEADS WITHIN 0.13 mm (0.005) RAD OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
 - DIMENSION "L" TO CENTER OF LEADS WHEN FORMED PARALLEL.



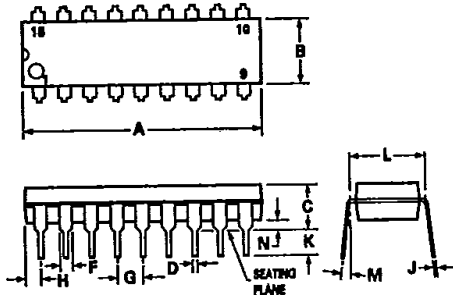
PACKAGE OUTLINE DIMENSIONS (continued)

A, B, N, P SUFFIX PLASTIC PACKAGE CASE 707-02 $R_{\theta JA} = 100^{\circ}\text{C/W (TYP)}$

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	3.56	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	0.136
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040



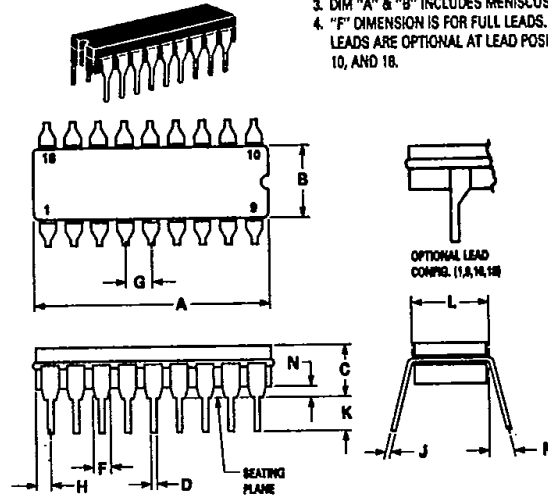
- NOTES:
1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25mm(0.010) AT MAXIMUM MATERIAL CONDITION, IN RELATION TO SEATING PLANE AND EACH OTHER.
 2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
 3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.



J, L SUFFIX CERAMIC PACKAGE CASE 726-04 $R_{\theta JA} = 100^{\circ}\text{C/W (TYP)}$

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	22.35	23.11	0.880	0.910
B	6.10	7.49	0.240	0.296
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 16.

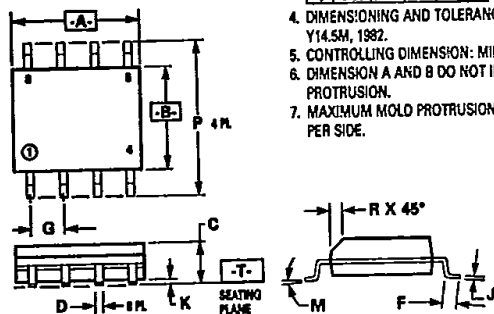


D SUFFIX PLASTIC PACKAGE CASE 751-03 SO-8, SOP-8 $R_{\theta JA} = 190^{\circ}\text{C/W (SO-8)}$ $R_{\theta JA} = 160^{\circ}\text{C/W (SOP-8)}$

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.198
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



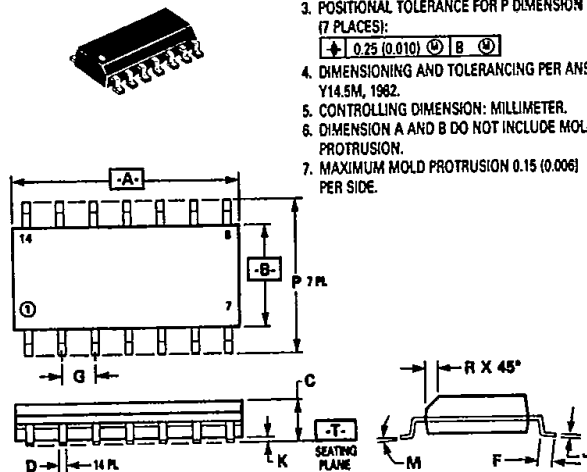
- NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
 2. POSITIONAL TOLERANCE FOR D DIMENSION (8 PLACES):
 $\pm 0.25 (0.010) \text{ (M) T B (A)}$
 3. POSITIONAL TOLERANCE FOR P DIMENSION (4 PLACES):
 $\pm 0.25 (0.010) \text{ (M) B (A)}$
 4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 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 $R_{\theta JA} = 145^{\circ}\text{C/W (TYP)}$

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

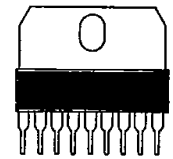
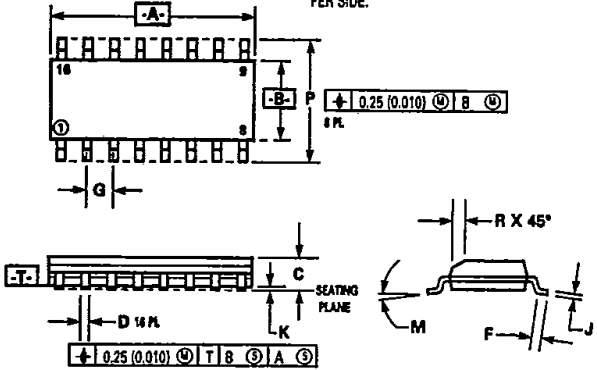
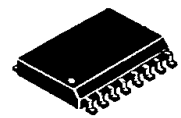
- NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
 2. POSITIONAL TOLERANCE FOR D DIMENSION (14 PLACES):
 $\pm 0.25 (0.010) \text{ (M) T B (A)}$
 3. POSITIONAL TOLERANCE FOR P DIMENSION (7 PLACES):
 $\pm 0.25 (0.010) \text{ (M) B (A)}$
 4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 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	0.43	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
	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	0.897
B	6.40	6.60	0.252	0.260
C	3.45	3.65	0.136	0.143
D	0.40	0.55	0.016	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	0.30	0.40	0.012	0.016
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	0.136
R	13.80	13.90	0.543	0.547
S	1.65	1.95	0.065	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

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

