PHASE-LOCKED LOOP
INTEGRATED CIRCUITS

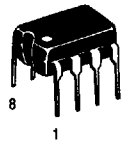
Motorola offers the designer an array of devices to perform phase-locked loop functions, such as prescalers, phase detectors, and oscillators.

Description	Pins	Device	Temp	DIP'S	SM
Control Function					
Counter Control Logic	16	MC12014	0 to +75°C	P,L	
Counter					
Dual Voltage-Controlled Multivibrator	14	MC4024	0 to +75°C	P,L	
Dual Voltage-Controlled Multivibrator	14	MC4324	−55° to +125°C	P,L	
Programmable Modulo-N Counters (N = 0–9)	16	MC4016	0 to +75°C	P,L	
Programmable Modulo-N Counters (N = 0–9)	16	MC4018	0 to +75°C	P,L	
Programmable Modulo-N Counters (N = 0–9)	16	MC4316	−55° to +125°C	P,L	
Detector					
Analog Mixer	14	MC12002	−30° to +85°C	P,L	
Phase-Frequency Detector	14	MC4044	0 to +75°C	P,L	
Phase-Frequency Detector	14	MC4344	−55° to +125°C	P,L	
Phase-Frequency Detector	14	MC12040	0 to +75°C	P,L	FN
Oscillator					
130 MHz Voltage-Controlled Multivibrator	20	MC12101	0 to +75°C	P	FN
200 MHz Voltage-Controlled Multivibrator	20	MC12100	0 to +75°C	P	FN
Crystal Oscillator	16	MC12061	0 to +75°C	P,L	
Low Power Voltage-Controlled Oscillator	8	MC12148	−40° to +85°C		D,SD
Voltage-Controlled Multivibrator	16	MC1658	−30° to +85°C	P,L	D,FN
Voltage-Controlled Oscillator	14	MC1648	−30° to +85°C	P,L	D,FN
Prescaler					
1.1 GHz ÷256 Prescaler	8	MC12074	0 to +70°C	P	D
1.1 GHz ÷32/33, ÷64/65 Dual Modulus Prescaler	8	MC12028A	−40° to +85°C	P	D
1.1 GHz ÷32/33, ÷64/65 Dual Modulus Prescaler	8	MC12028B	−40° to +85°C	P	D
1.1 GHz ÷64 Prescaler	8	MC12073	0 to +70°C	P	D
1.1 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler	8	MC12022A	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler	8	MC12022B	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler	8	MC12022SLA	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler	8	MC12022SLB	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler	8	MC12022TSA	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler	8	MC12022TSB	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler with Stand-By Mode	8	MC12036A	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler with Stand-By Mode	8	MC12036B	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Low Power Dual Modulus Prescaler	8	MC12052A	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Low Power Dual Modulus Prescaler	8	MC12052B	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Low Voltage Dual Modulus Prescaler	8	MC12022LVA	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Low Voltage Dual Modulus Prescaler	8	MC12022LVB	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Low Voltage Dual Modulus Prescaler	8	MC12022TVA	−40° to +85°C	P	D
1.1 GHz ÷64/65, ÷128/129 Low Voltage Dual Modulus Prescaler	8	MC12022TVB	−40° to +85°C	P	D
1.3 GHz ÷256 Prescaler	8	MC12076	0 to +85°C	P	D
1.3 GHz ÷256 Prescaler	8	MC12078	0 to +85°C	P	D
2.0 GHz ÷32/33, ÷64/65, Dual Modulus Prescaler	8	MC12034A	−40° to +85°C	P	D
2.0 GHz ÷32/33, ÷64/65, Dual Modulus Prescaler	8	MC12034B	−40° to +85°C	P	D
2.0 GHz ÷32/33, ÷64/65 Low Voltage Dual Modulus Prescaler	8	MC12033A	−40° to +85°C	P	D
2.0 GHz ÷32/33, ÷64/65 Low Voltage Dual Modulus Prescaler	8	MC12033B	−40° to +85°C	P	D
2.0 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler	8	MC12032A	−40° to +85°C	P	D
2.0 GHz ÷64/65, ÷128/129 Dual Modulus Prescaler	8	MC12032B	−40° to +85°C	P	D
2.0 GHz ÷64/65, ÷128/129 Low Voltage Dual Modulus Prescaler	8	MC12031A	−40° to +85°C	P	D
2.0 GHz ÷64/65, ÷128/129 Low Voltage Dual Modulus Prescaler	8	MC12031B	−40° to +85°C	P	D
225 MHz ÷20/21 Dual Modulus Prescaler	8	MC12019	−40° to +85°C	P,L	D
225 MHz ÷32/33 Dual Modulus Prescaler	8	MC12015	−40° to +85°C	P,L	D
225 MHz ÷40/41 Dual Modulus Prescaler	8	MC12016	−40° to +85°C	P,L	D
225 MHz ÷64 Prescaler	8	MC12023	0 to +70°C	P	D
225 MHz ÷64/65 Dual Modulus Prescaler	8	MC12017	−40° to +85°C	P,L	D
480 MHz ÷5/6 Dual Modulus Prescaler	16	MC12009	−30° to +85°C	P,L	
520 MHz ÷128/129 Dual Modulus Prescaler	8	MC12018	−40° to +85°C	P,L	D
520 MHz ÷64/65 Dual Modulus Prescaler	8	MC12025	−40° to +85°C	P	D
550 MHz ÷10/11 Dual Modulus Prescaler	16	MC12013	−30° to +85°C	P,L	
550 MHz ÷8/9 Dual Modulus Prescaler	16	MC12011	−30° to +85°C	P,L	
750 MHz ÷2 UHF Prescaler	16	MC12090	0 to +75°C	P,L	

Case Information

8-Pin Packages

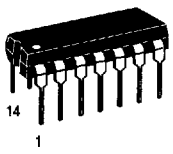
D SUFFIX
SOIC PACKAGE
CASE 751-03



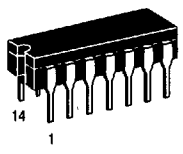
P SUFFIX
PLASTIC PACKAGE
CASE 626-04

SD SUFFIX
SSOP PACKAGE
CASE 941-02

14-Pin Packages

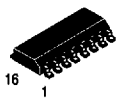


P,N SUFFIX
PLASTIC PACKAGE
CASE 646-06

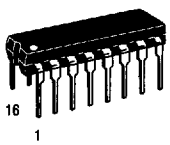


L,J SUFFIX
CERAMIC PACKAGE
CASE 632-08

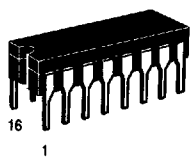
16-Pin Packages



D SUFFIX
SOIC PACKAGE
CASE 751B-03

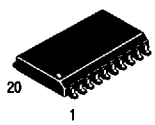


P,N SUFFIX
PLASTIC PACKAGE
CASE 648-08

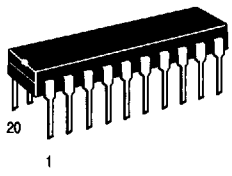


L,J SUFFIX
CERAMIC PACKAGE
CASE 620-09

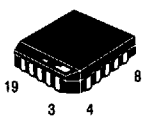
20-Pin Packages



DW SUFFIX
SOIC PACKAGE
CASE 751D-03



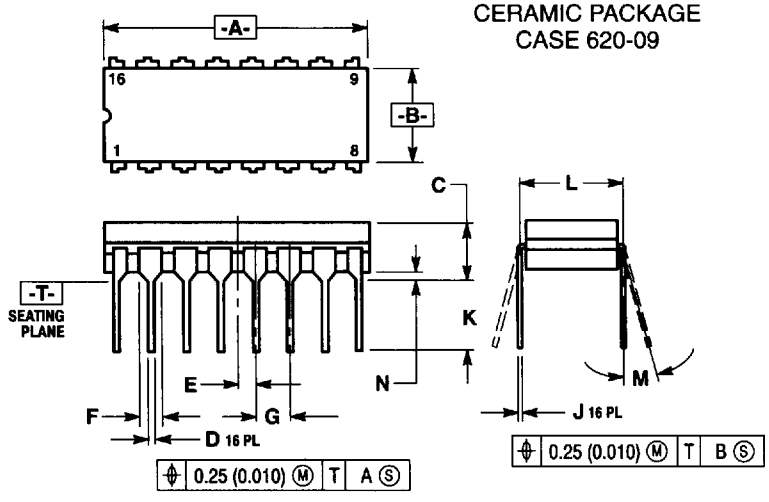
P,N SUFFIX
PLASTIC PACKAGE
CASE 738-03



FN SUFFIX
PLASTIC LEADLESS
CHIP CARRIER (PLCC)
CASE 775-02

Case Outlines

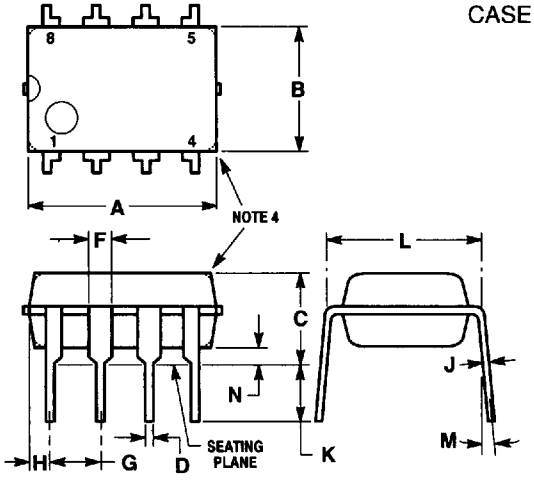
L,J SUFFIX
CERAMIC PACKAGE
CASE 620-09



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.
5. 620-01 THRU -08 OBSOLETE, NEW STANDARD 620-09.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	19.05	19.55	0.750	0.770
B	6.10	7.36	0.240	0.290
C	—	4.19	—	0.165
D	0.39	0.53	0.015	0.021
E	1.27 BSC		0.050 BSC	
F	1.40	1.77	0.055	0.070
G	2.54 BSC		0.100 BSC	
J	0.23	0.27	0.009	0.011
K	—	5.08	—	0.200
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.39	0.88	0.015	0.035

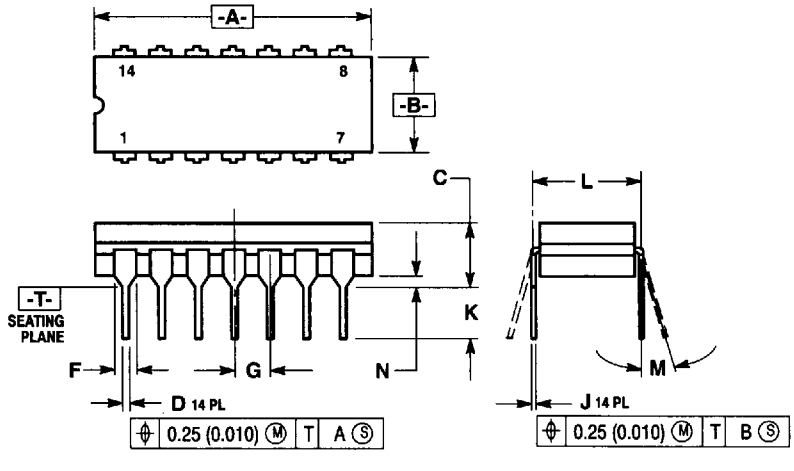
P SUFFIX
PLASTIC PACKAGE
CASE 626-04



NOTES:
1. LEAD POSITIONAL TOLERANCE:
   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.

	MILLIMETERS		INCHES	
DIM	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	0.51	0.76	0.020	0.030

J SUFFIX
CERAMIC PACKAGE
CASE 632-08

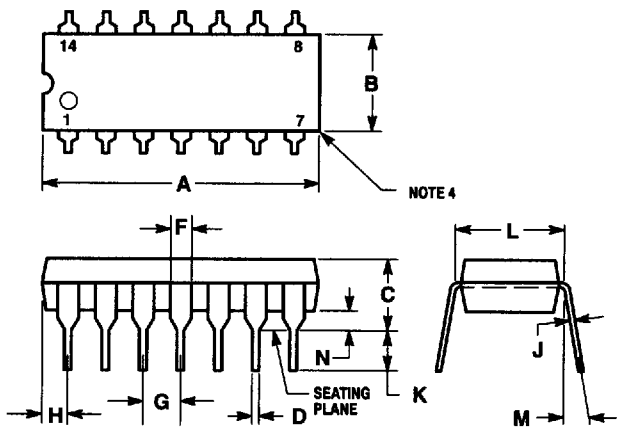


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIM F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.
5. 632-01 THRU -07 OBSOLETE, NEW STANDARD 632-08.

	MILLIMETERS		INCHES	
DIM	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	1.1	0.020	0.040

Case Outlines

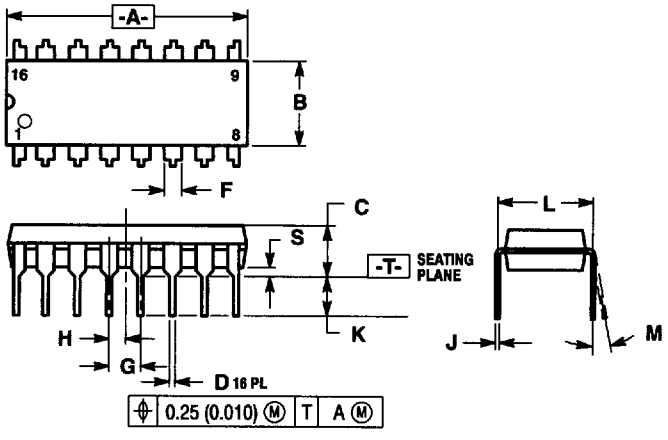
P,N SUFFIX
PLASTIC PACKAGE
CASE 646-06



NOTES:
1. LEADS WITHIN 0.13 mm (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.
5. 646-05 OBSOLETE, NEW STANDARD 646-06.

	MILLIMETERS		INCHES	
DIM	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	0.38	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

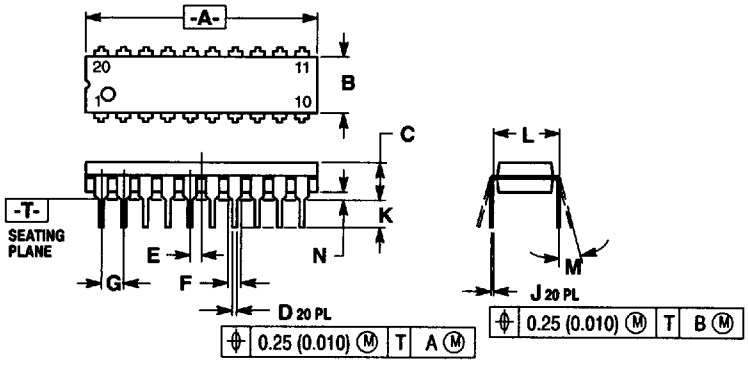
P,N SUFFIX
PLASTIC PACKAGE
CASE 648-08



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.
6. 648-01 THRU -07 OBSOLETE, NEW STANDARD 648-08.

	MILLIMETERS		INCHES	
DIM	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

P,N SUFFIX
PLASTIC PACKAGE
CASE 738-03

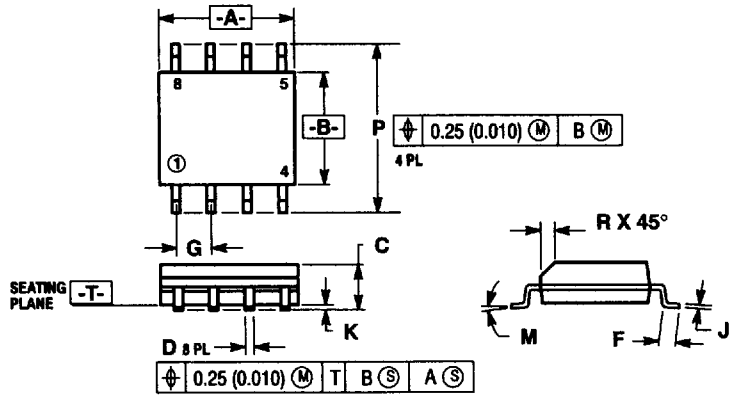


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION "L" TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION "B" DOES NOT INCLUDE MOLD FLASH.
5. 738-02 OBSOLETE, NEW STANDARD 738-03.

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

Case Outlines (continued)

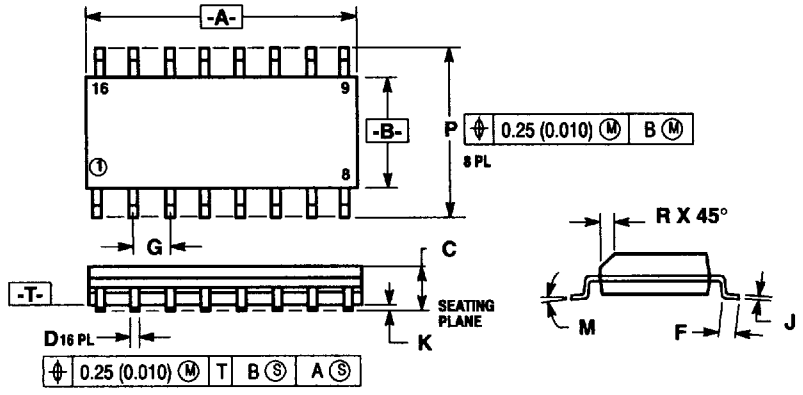
D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751-03



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 DIM: MILLIMETER.
4. DIMENSION "A" AND "B" DO NOT INCLUDE MOLD PROTRUSION.
5. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
6. 751-01 AND -02 OBSOLETE, NEW STANDARD 751-03.

	MILLIMETERS		INCHES	
DIM	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	0.18	0.25	0.007	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

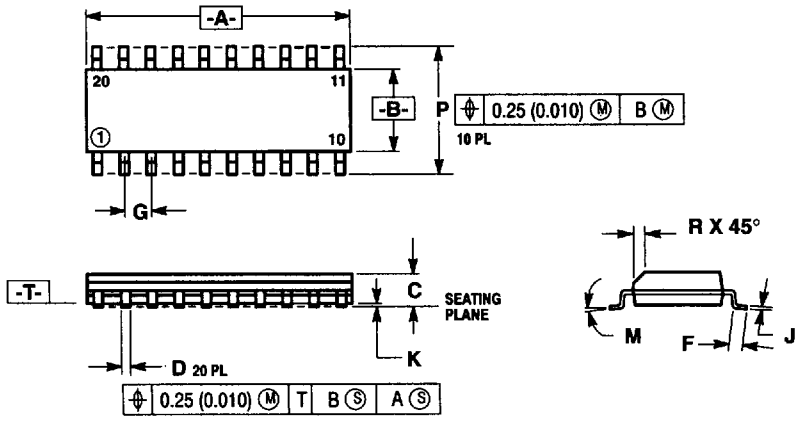
D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751B-03



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. 751B-01 IS OBSOLETE, NEW STANDARD 751B-03.

	MILLIMETERS		INCHES	
DIM	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 SUFFIX
PLASTIC SOIC PACKAGE
CASE 751D-03

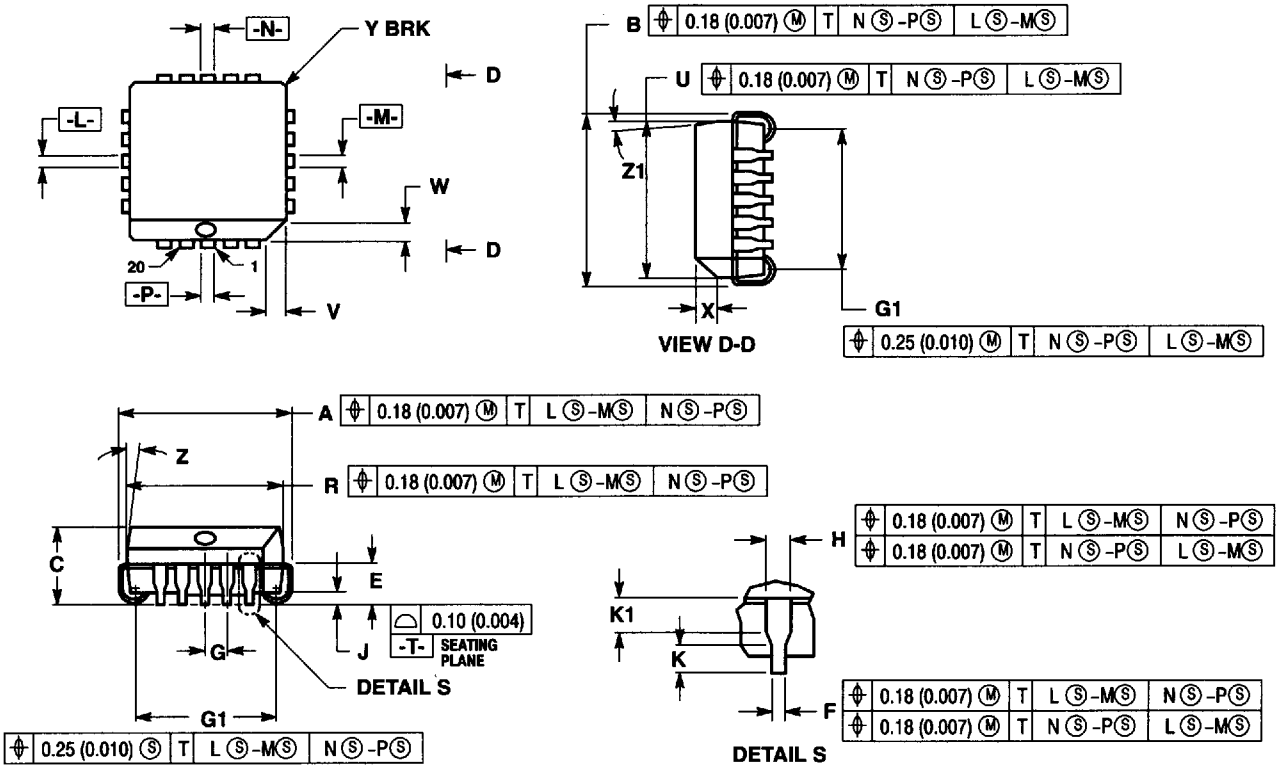


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. 751D-01, AND -02 OBSOLETE, NEW STANDARD 751D-03.

	MILLIMETERS		INCHES	
DIM	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

Case Outlines (continued)

FN SUFFIX
PLASTIC PACKAGE
CASE 775-02

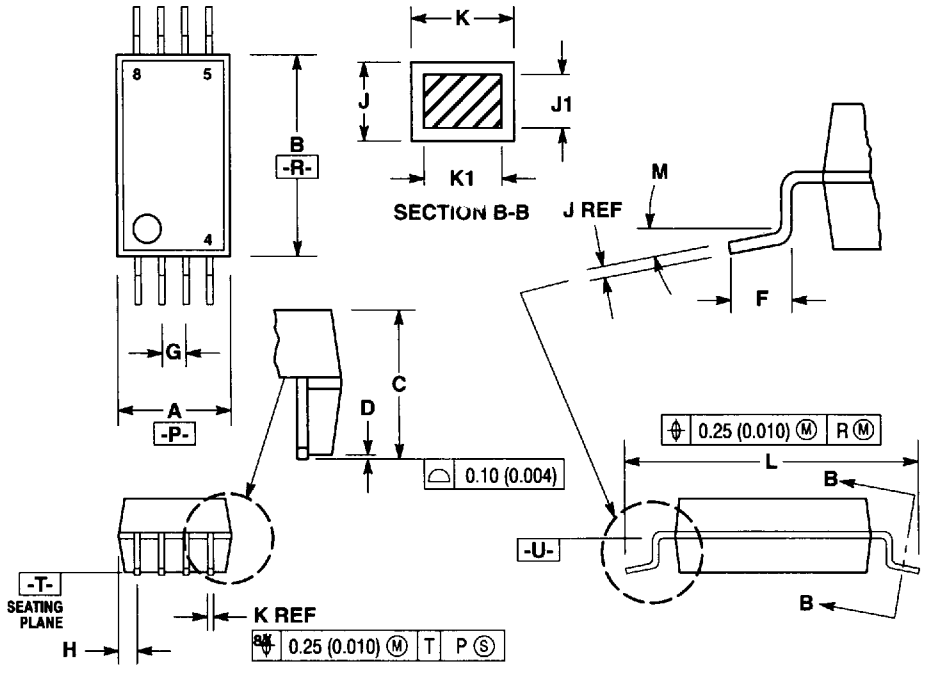


DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.78	10.03	0.385	0.395
B	9.78	10.03	0.385	0.395
C	4.20	4.57	0.165	0.180
E	2.29	2.79	0.090	0.110
F	0.33	0.48	0.013	0.019
G	1.27 BSC		0.050 BSC	
H	0.66	0.81	0.026	0.032
J	0.51	—	0.020	—
K	0.64	—	0.025	—
R	8.89	9.04	0.350	0.356
U	8.89	9.04	0.350	0.356
V	1.07	1.21	0.042	0.048
W	1.07	1.21	0.042	0.048
X	1.07	1.42	0.042	0.056
Y	—	0.50	—	0.020
Z	2°	10°	2°	10°
G1	7.88	8.38	0.310	0.330
K1	1.02	—	0.040	—
Z1	2°	10°	2°	10°

NOTES:
1. DATUMS -L-, -M-, -N-, AND -P- DETERMINED WHERE TOP OF LEAD SHOULDER EXIT PLASTIC BODY AT MOLD PARTING LINE.
2. DIM GI, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
3. DIM R AND U DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.25 (0.010) PER SIDE.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: INCH.
6. 775-01 IS OBSOLETE, NEW STANDARD 775-02.

Case Outlines (continued)

SD SUFFIX
PLASTIC SSOP PACKAGE
CASE 940-02



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 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 (.006) PER SIDE.
4. DIMENSION "B" DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (.010) PER SIDE.
5. DIMENSION "K" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (.003) TOTAL IN EXCESS OF THE "K" DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DATUMS -P- AND -R- ARE TO BE DETERMINED AT DATUM PLANE -U-.
8. DIMENSION "A" AND "B" ARE TO BE DETERMINED AT DATUM PLANE -U-
9. CROSS SECTION B-B TO BE DETERMINED AT 0.10 (.004) TO 0.25 (.010) FROM THE LEADTIP.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.87	3.13	0.113	0.123
B	5.20	5.38	0.205	0.212
C	1.73	1.99	0.068	0.078
D	0.05	0.21	0.002	0.008
F	0.55	0.95	0.022	0.037
G	0.65 BSC		0.026 BSC	
H	0.50	—	0.020	—
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.22	0.38	0.009	0.015
K1	0.22	0.33	0.009	0.013
L	7.65	7.90	0.301	0.311
M	0°	8°	0°	8°