

MC14014B, MC14021B

8-Bit Static Shift Register

The MC14014B and MC14021B 8-bit static shift registers are constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. These shift registers find primary use in parallel-to-serial data conversion, synchronous and asynchronous parallel input, serial output data queueing; and other general purpose register applications requiring low power and/or high noise immunity.

- Synchronous Parallel Input/Serial Output (MC14014B)
- Asynchronous Parallel Input/Serial Output (MC14021B)
- Synchronous Serial Input/Serial Output
- Full Static Operation
- “Q” Outputs from Sixth, Seventh, and Eighth Stages
- Double Diode Input Protection
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Capable of Driving Two Low-power TTL Loads or One Low-power Schottky TTL Load Over the Rated Temperature Range
- MC14014B Pin-for-Pin Replacement for CD4014B
- MC14021B Pin-for-Pin Replacement for CD4021B

MAXIMUM RATINGS (Voltages Referenced to V_{SS}) (Note 2.)

Symbol	Parameter	Value	Unit
V_{DD}	DC Supply Voltage Range	-0.5 to +18.0	V
V_{in}, V_{out}	Input or Output Voltage Range (DC or Transient)	-0.5 to $V_{DD} + 0.5$	V
I_{in}, I_{out}	Input or Output Current (DC or Transient) per Pin	± 10	mA
P_D	Power Dissipation, per Package (Note 3.)	500	mW
T_A	Ambient Temperature Range	-55 to +125	$^{\circ}C$
T_{stg}	Storage Temperature Range	-65 to +150	$^{\circ}C$
T_L	Lead Temperature (8-Second Soldering)	260	$^{\circ}C$

2. Maximum Ratings are those values beyond which damage to the device may occur.

3. Temperature Derating:
Plastic “P and D/DW” Packages: - 7.0 mW/ $^{\circ}C$ From 65 $^{\circ}C$ To 125 $^{\circ}C$

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$.

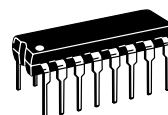
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}). Unused outputs must be left open.



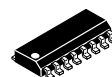
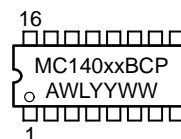
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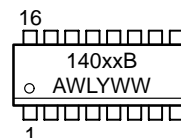
MARKING DIAGRAMS



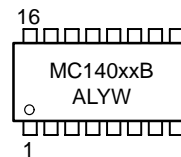
PDIP-16
P SUFFIX
CASE 648



SOIC-16
D SUFFIX
CASE 751B



SOEIAJ-16
F SUFFIX
CASE 966



xx = Specific Device Code
A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MC14014BCP	PDIP-16	2000/Box
MC14014BD	SOIC-16	48/Rail
MC14014BDR2	SOIC-16	2500/Tape & Reel
MC14014BF	SOEIAJ-16	See Note 1.
MC14014BFEL	SOEIAJ-16	See Note 1.
MC14021BCP	PDIP-16	2000/Box
MC14021BD	SOIC-16	48/Rail
MC14021BDR2	SOIC-16	2500/Tape & Reel
MC14021BF	SOEIAJ-16	See Note 1.
MC14021BFEL	SOEIAJ-16	See Note 1.

1. For ordering information on the EIAJ version of the SOIC packages, please contact your local ON Semiconductor representative.

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TRUTH TABLE

SERIAL OPERATION:

t	Clock	D _S	P/S	Q6 t=n+6	Q7 t=n+7	Q8 t=n+8
n	↗	0	0	0	?	?
n+1	↗	1	0	1	0	?
n+2	↗	0	0	0	1	0
n+3	↗	1	0	1	0	1
	↘	X	0	Q6	Q7	Q8

PARALLEL OPERATION:

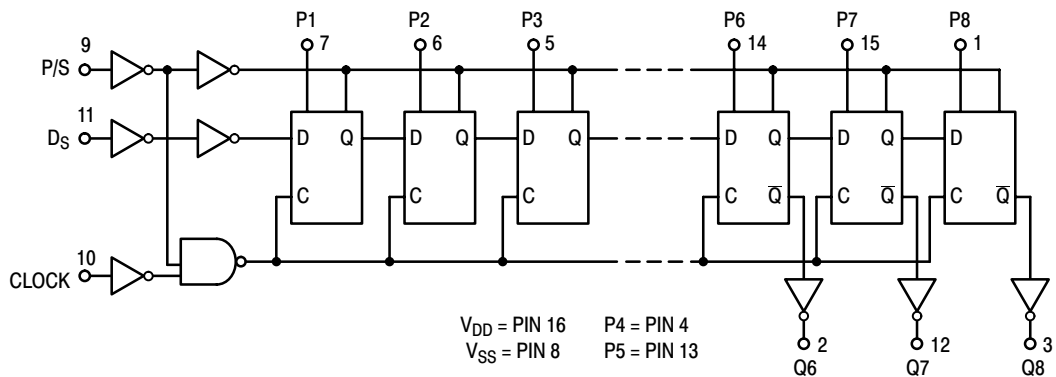
Clock		D _S	P/S	P _n	*Q _n
MC14014B	MC14021B				
↗		X	1	0	0
↗		X	1	1	1

*Q6, Q7, & Q8 are available externally
X = Don't Care

PIN ASSIGNMENT

P8	1 ●	16	V _{DD}
Q6	2	15	P7
Q8	3	14	P6
P4	4	13	P5
P3	5	12	Q7
P2	6	11	D _S
P1	7	10	C
V _{SS}	8	9	P/S

LOGIC DIAGRAM



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ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

Characteristic	Symbol	V_{DD} Vdc	- 55°C		25°C			125°C		Unit									
			Min	Max	Min	Typ (4.)	Max	Min	Max										
Output Voltage $V_{in} = V_{DD}$ or 0 $V_{in} = 0$ or V_{DD}	"0" Level "1" Level	V_{OL}	5.0	—	0.05	—	0	0.05	—	0.05	Vdc								
			10	—	0.05	—	0	0.05	—	0.05									
15			—	0.05	—	0	0.05	—	0.05	—									
V_{OH}	5.0	4.95	—	4.95	5.0	—	4.95	—	4.95	—	Vdc								
												10	9.95	—	9.95	10	—	9.95	—
												15	14.95	—	14.95	15	—	14.95	—
Input Voltage ($V_O = 4.5$ or 0.5 Vdc) ($V_O = 9.0$ or 1.0 Vdc) ($V_O = 13.5$ or 1.5 Vdc)	"0" Level	V_{IL}	5.0	—	1.5	—	2.25	1.5	—	1.5	Vdc								
			10	—	3.0	—	4.50	3.0	—	3.0									
15			—	4.0	—	6.75	4.0	—	4.0	—									
($V_O = 0.5$ or 4.5 Vdc) ($V_O = 1.0$ or 9.0 Vdc) ($V_O = 1.5$ or 13.5 Vdc)	"1" Level	V_{IH}	5.0	3.5	—	3.5	2.75	—	3.5	—	Vdc								
			10	7.0	—	7.0	5.50	—	7.0	—									
			15	11	—	11	8.25	—	11	—									
Output Drive Current ($V_{OH} = 2.5$ Vdc) ($V_{OH} = 4.6$ Vdc) ($V_{OH} = 9.5$ Vdc) ($V_{OH} = 13.5$ Vdc)	Source	I_{OH}	5.0	- 3.0	—	- 2.4	- 4.2	—	- 1.7	—	mAdc								
			5.0	- 0.64	—	- 0.51	- 0.88	—	- 0.36	—									
10			- 1.6	—	- 1.3	- 2.25	—	- 0.9	—										
15			- 4.2	—	- 3.4	- 8.8	—	- 2.4	—										
($V_{OL} = 0.4$ Vdc) ($V_{OL} = 0.5$ Vdc) ($V_{OL} = 1.5$ Vdc)	Sink	I_{OL}	5.0	0.64	—	0.51	0.88	—	0.36	—	mAdc								
			10	1.6	—	1.3	2.25	—	0.9	—									
			15	4.2	—	3.4	8.8	—	2.4	—									
Input Current	I_{in}	15	—	± 0.1	—	± 0.00001	± 0.1	—	± 1.0	μ Adc									
Input Capacitance ($V_{in} = 0$)	C_{in}	—	—	—	—	5.0	7.5	—	—	pF									
Quiescent Current (Per Package)	I_{DD}	5.0	—	5.0	—	0.005	5.0	—	150	μ Adc									
		10	—	10	—	0.010	10	—	300										
		15	—	15	—	0.015	15	—	600										
Total Supply Current (5.) (6.) (Dynamic plus Quiescent, Per Package) ($C_L = 50$ pF on all outputs, all buffers switching)	I_T	5.0	$I_T = (0.75 \mu\text{A/kHz}) f + I_{DD}$							μ Adc									
		10	$I_T = (1.50 \mu\text{A/kHz}) f + I_{DD}$																
		15	$I_T = (2.25 \mu\text{A/kHz}) f + I_{DD}$																

4. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

5. The formulas given are for the typical characteristics only at 25°C.

6. To calculate total supply current at loads other than 50 pF:

$$I_T(C_L) = I_T(50 \text{ pF}) + (C_L - 50) Vfk$$

where: I_T is in μA (per package), C_L in pF, $V = (V_{DD} - V_{SS})$ in volts, f in kHz is input frequency, and $k = 0.0015$.

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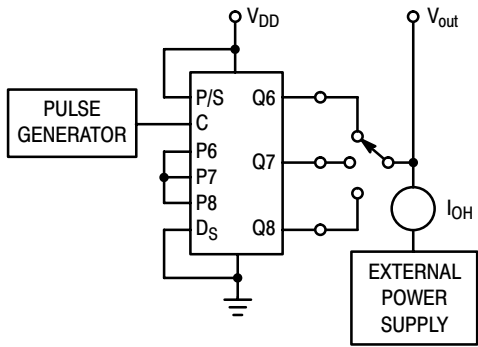
SWITCHING CHARACTERISTICS ^(7.) ($C_L = 50 \text{ pF}$, $T_A = 25^\circ\text{C}$)

Characteristic	Symbol	V _{DD} Vdc	Min	Typ ^(8.)	Max	Unit
Output Rise and Fall Time $t_{TLH}, t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$ $t_{TLH}, t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$ $t_{TLH}, t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$	$t_{TLH},$ t_{THL}	5.0 10 15	— — —	100 50 40	200 100 80	ns
Propagation Delay Time (Clock to Q, P/S to Q) $t_{PHL}, t_{PLH} = (1.7 \text{ ns/pF}) C_L + 315 \text{ ns}$ $t_{PHL}, t_{PLH} = (0.66 \text{ ns/pF}) C_L + 137 \text{ ns}$ $t_{PHL}, t_{PLH} = (0.5 \text{ ns/pF}) C_L + 90 \text{ ns}$	$t_{PLH},$ t_{PHL}	5.0 10 15	— — —	400 170 115	800 340 230	ns
Clock Pulse Width	t_{WH}	5.0 10 15	400 175 135	150 75 40	— — —	ns
Clock Frequency	f_{cl}	5.0 10 15	— — —	3.0 6.0 8.0	1.5 3.0 4.0	MHz
Parallel/Serial Control Pulse Width	t_{WH}	5.0 10 15	400 175 135	150 75 40	— — —	ns
Setup Time P/S to Clock	t_{su}	5.0 10 15	200 100 80	100 50 40	— — —	ns
Hold Time Clock to P/S	t_h	5.0 10 15	20 20 25	-2.5 -10 0	— — —	ns
Setup Time Data (Parallel or Serial) to Clock or P/S	t_{su}	5.0 10 15	350 80 60	150 50 30	— — —	ns
Hold Time Clock to D _s	t_h	5.0 10 15	45 35 35	0 0 5	— — —	ns
Hold Time Clock to P _n	t_h	5.0 10 15	50 45 45	25 20 20	— — —	ns
Input Clock Rise Time	$t_{r(cl)}$	5.0 10 15	— — —	— — —	15 5 4	μs

7. The formulas given are for the typical characteristics only at 25°C.

8. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

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Preset output under test to a logic "1" level.

Figure 1. Output Source Current Test Circuit

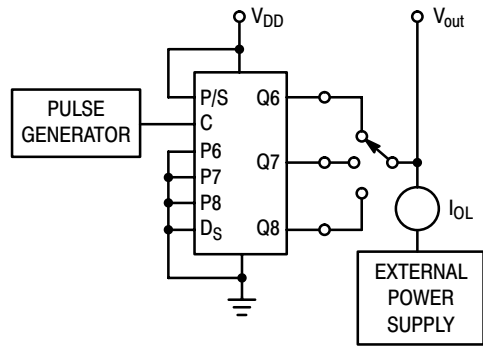


Figure 2. Output Sink Current Test Circuit

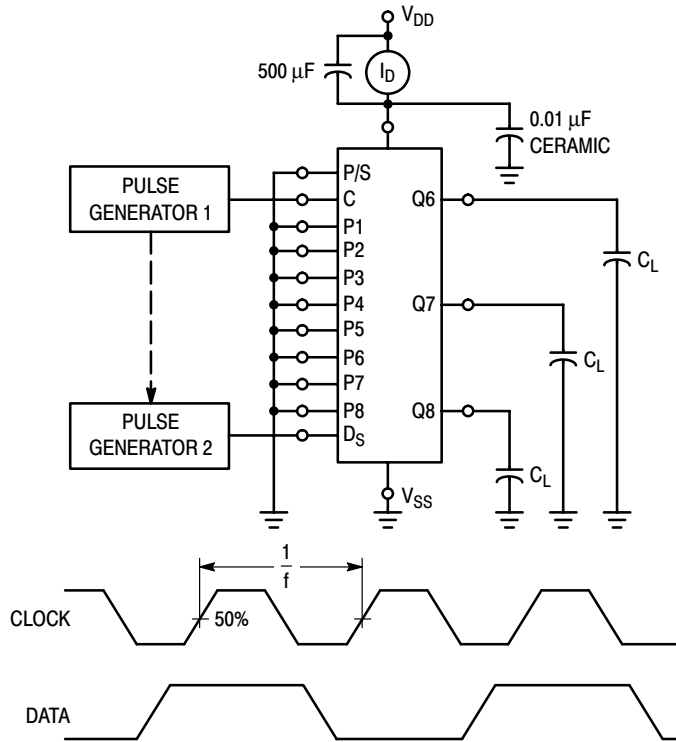


Figure 3. Power Dissipation Test Circuit and Waveform

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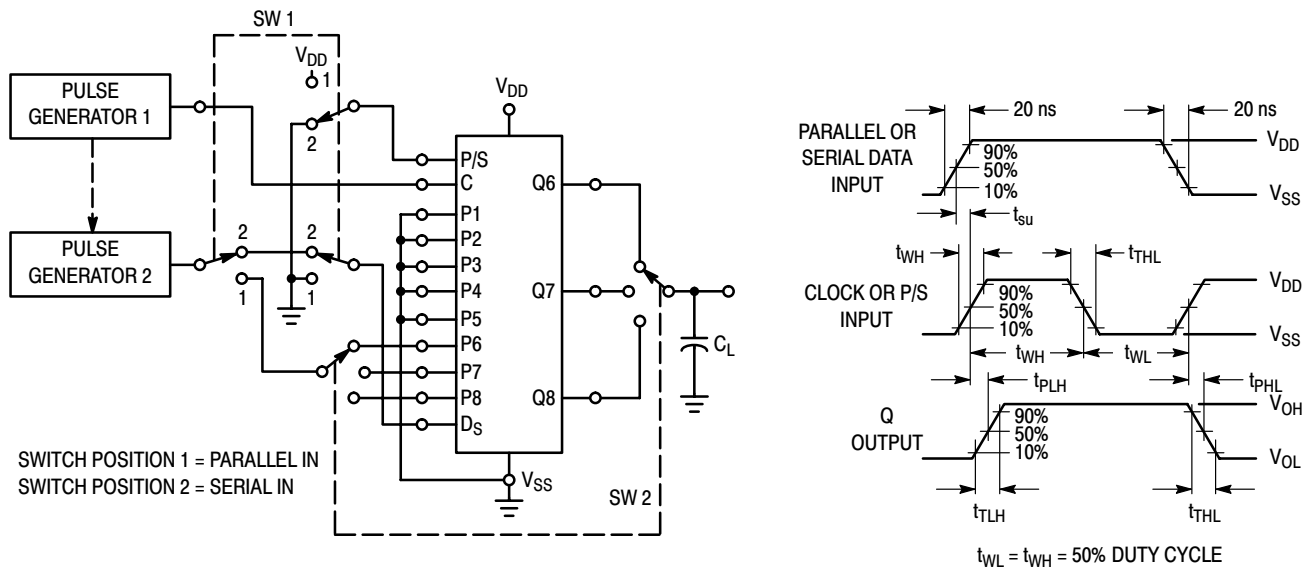
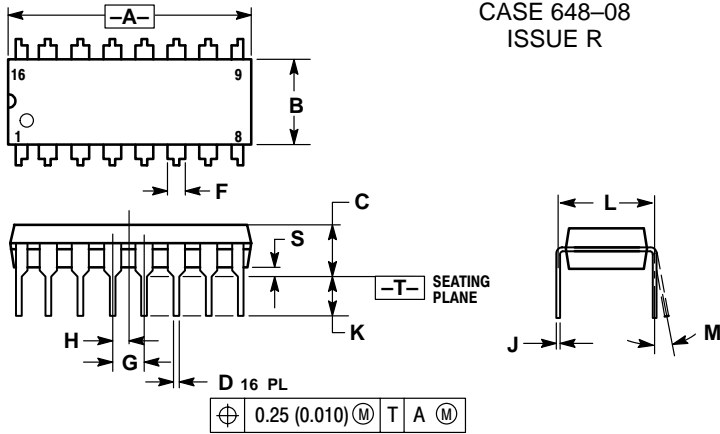


Figure 4. Switching Time Test Circuit and Waveforms

MC14014B, MC14021B

PACKAGE DIMENSIONS

PDIP-16 P SUFFIX PLASTIC DIP PACKAGE CASE 648-08 ISSUE R

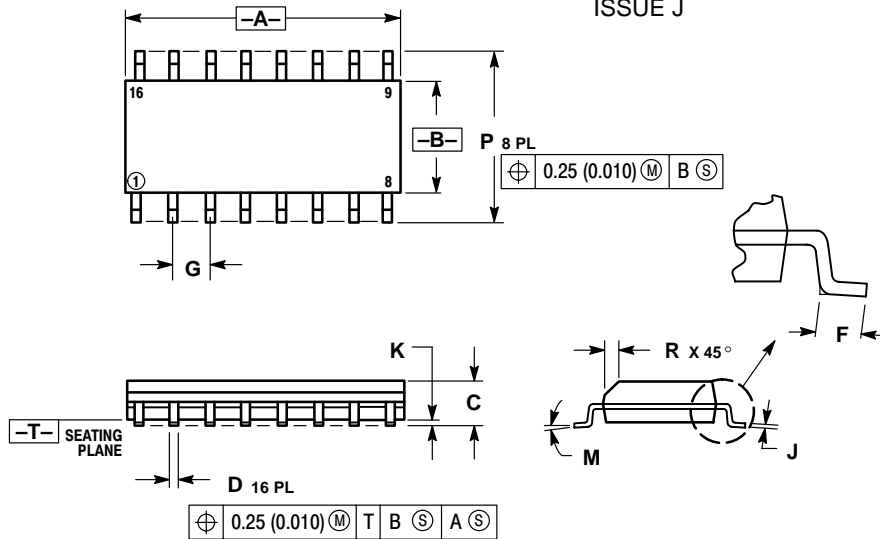


NOTES:

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

SOIC-16 D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



NOTES:

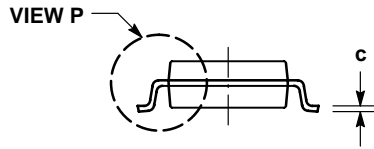
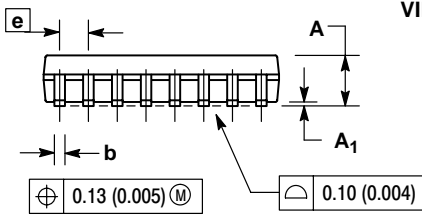
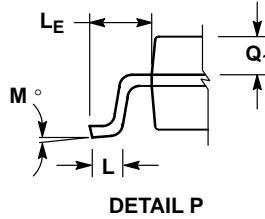
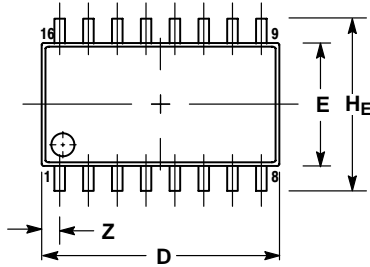
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL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

MC14014B, MC14021B

PACKAGE DIMENSIONS


SOEIAJ-16 F SUFFIX PLASTIC EIAJ SOIC PACKAGE CASE 966-01 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
A ₁	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	9.90	10.50	0.390	0.413
E	5.10	5.45	0.201	0.215
e	1.27 BSC		0.050 BSC	
HE	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
LE	1.10	1.50	0.043	0.059
M	0°	10°	0°	10°
Q ₁	0.70	0.90	0.028	0.035
Z	---	0.78	---	0.031

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