

*Advance Information*  
**Low-Voltage CMOS 16-Bit  
Transceiver/Registered  
Transceiver**  
**With 5V-Tolerant Inputs and Outputs  
(3-State, Non-Inverting)**

The MC74LCX16646 is a high performance, non-inverting 16-bit transceiver/registered transceiver operating from a 2.7 to 3.6V supply. The device is byte controlled. Each byte has separate control inputs which can be tied together for full 16-bit operation. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A  $V_I$  specification of 5.5V allows MC74LCX16646 inputs to be safely driven from 5V devices. The MC74LCX16646 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

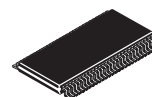
Data on the A or B bus will be clocked into the registers as the appropriate clock pin goes from a LOW-to-HIGH logic level. Output Enable (OEn) and Direction Control (DIRn) pins are provided to control the transceiver outputs. In the transceiver mode, data present at the high impedance port may be stored in either the A or the B register or in both. The select controls (SBAn, SABn) can multiplex stored and real-time (transparent mode) data. The DIR determines which bus will receive data when OE is active LOW. In the isolation mode (OE HIGH), A data may be stored in the B register or B data may be stored in the A register. Only one of the two buses, A or B, may be driven at one time.

- Designed for 2.7 to 3.6V  $V_{CC}$  Operation
- 5.2ns Maximum  $t_{pd}$
- 5V Tolerant — Interface Capability With 5V TTL Logic
- Supports Live Insertion and Withdrawal
- I<sub>OFF</sub> Specification Guarantees High Impedance When  $V_{CC} = 0V$
- LVTTTL Compatible
- LVCMOS Compatible
- 24mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (20 $\mu$ A)  
Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500mA
- ESD Performance: Human Body Model >2000V; Machine Model >200V

**MC74LCX16646**

**LCX**

**LOW-VOLTAGE CMOS  
16-BIT TRANSCEIVER/  
REGISTERED TRANSCEIVER**



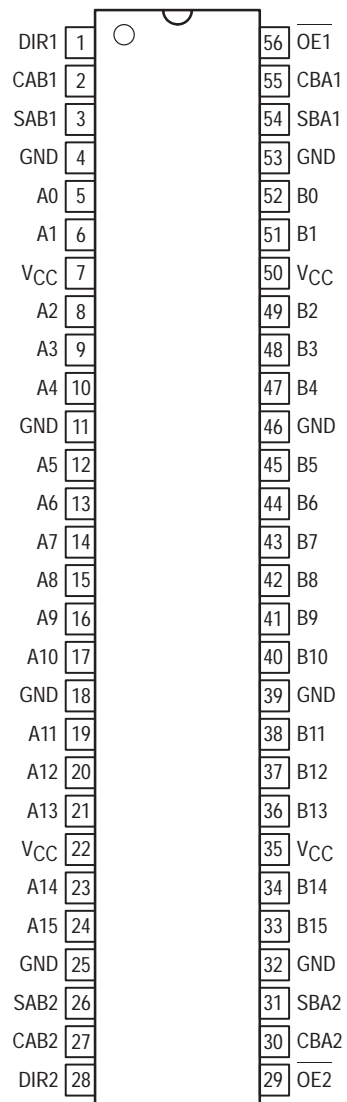
**DT SUFFIX**  
PLASTIC TSSOP PACKAGE  
CASE 1202-01

**PIN NAMES**

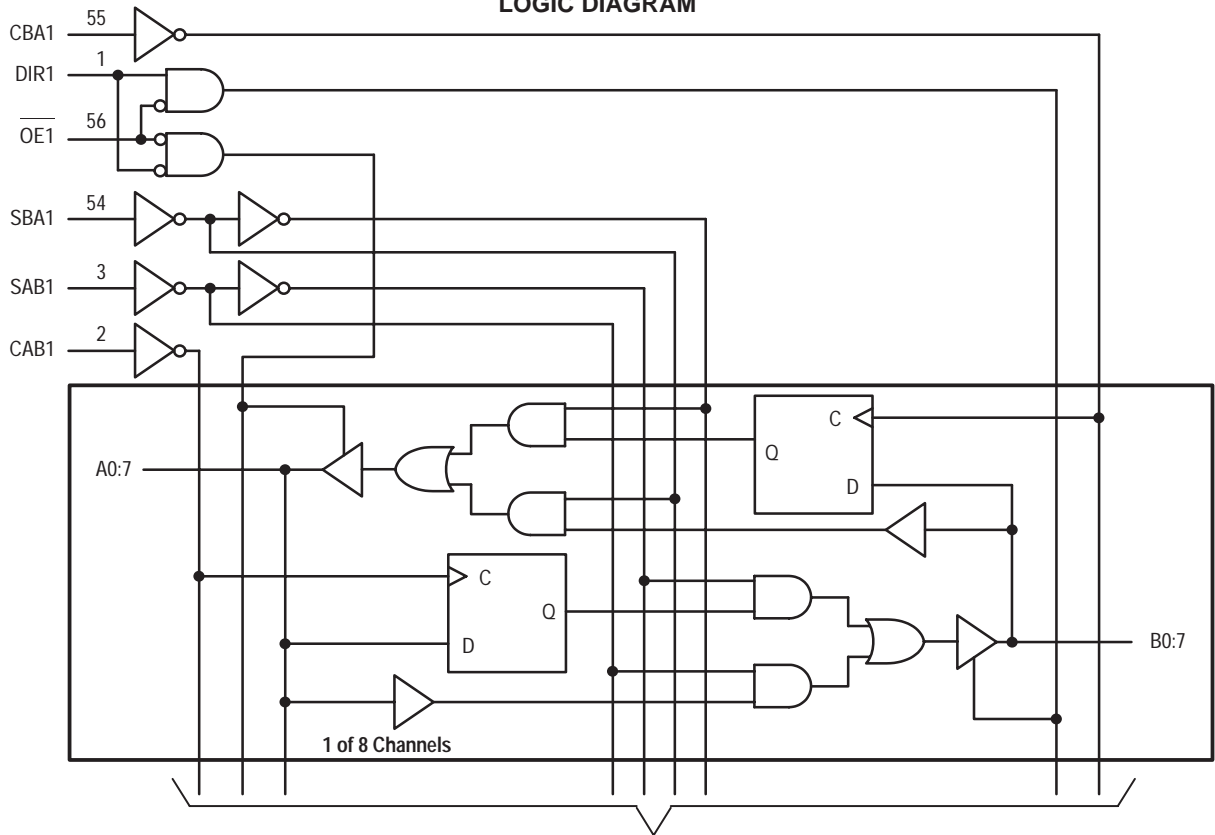
Pins	Function
A0–A15	Side A Inputs/Outputs
B0–B15	Side B Inputs/Outputs
CABn, CBAn	Clock Pulse Inputs
SABn, SBAn	Select Control Inputs
DIRn, OEn	Output Enable Inputs

This document contains information on a new product. Specifications and information herein are subject to change without notice.

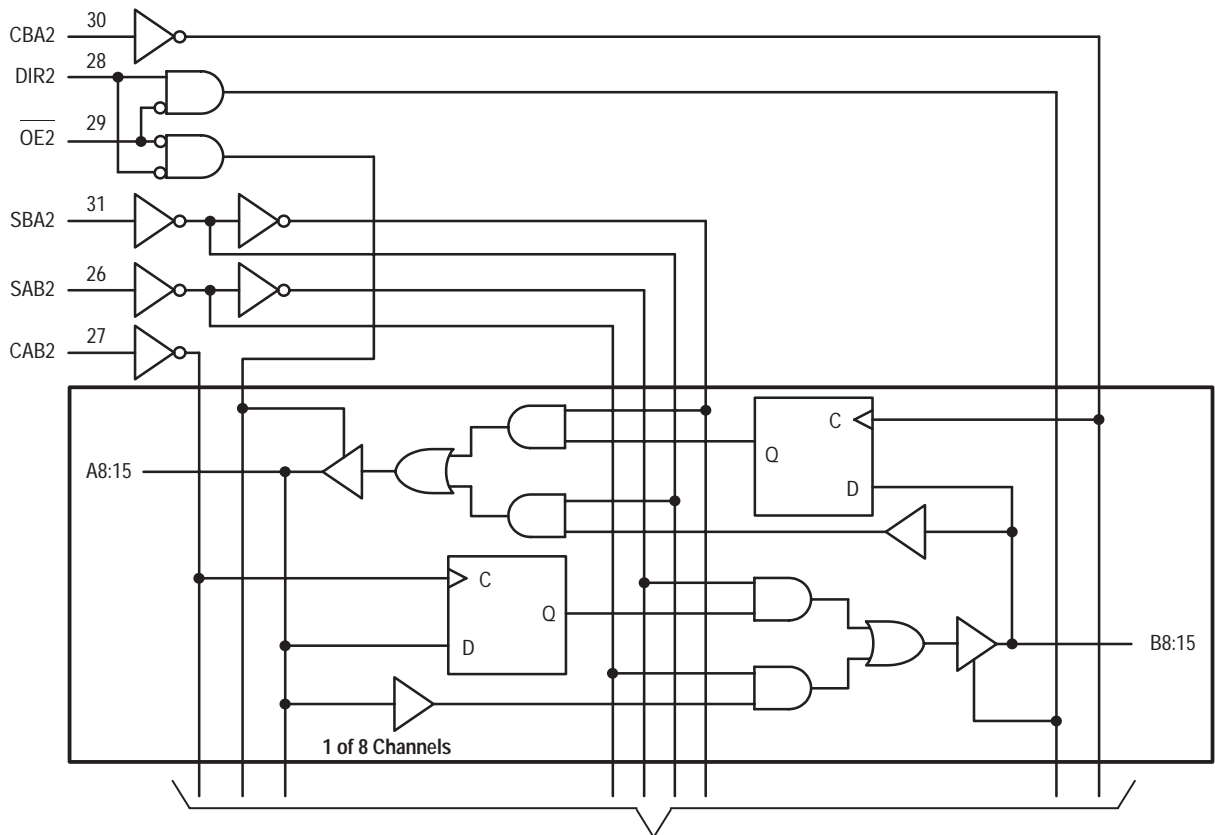




LOGIC DIAGRAM



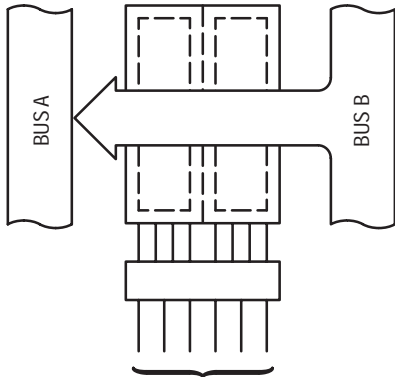
To 7 Other Channels



To 7 Other Channels

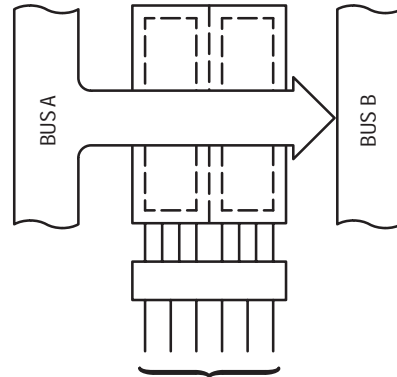
BUS APPLICATIONS

Real Time Transfer – Bus B to Bus A



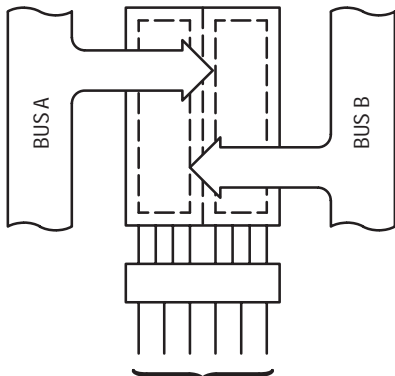
OE	DIR	CAB	CBA	SAB	SBA
L	L	X	X	X	L

Real Time Transfer – Bus A to Bus B



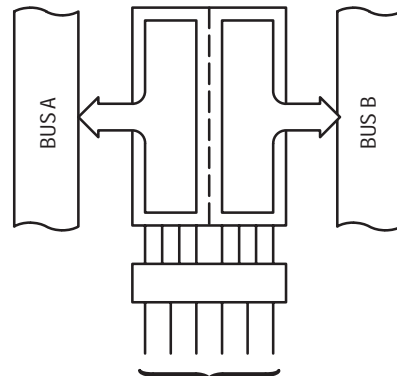
OE	DIR	CAB	CBA	SAB	SBA
L	H	X	X	L	X

Store Data from Bus A, Bus B or Busses A and B



OE	DIR	CAB	CBA	SAB	SBA
X	X	↑	X	X	X
X	X	X	↑	X	X
H	X	↑	↑	X	X

Transfer Storage Data to Bus A or Bus B



OE	DIR	CAB	CBA	SAB	SBA
L	L	X	H or L	X	H
L	H	H or L	X	H	X

FUNCTION TABLE

Inputs						Data Ports		Operating Mode
OEn	DIRn	CABn	CBA n	SABn	SBA n	An	Bn	
H	X					Input	Input	
		↑	↑	X	X	X	X	Isolation, Hold Storage
		↑	↑	X	X	l h X X	X X l h	Store A and/or B Data
L	H					Input	Output	
		↑	X*	L	X	L H	L H	Real Time A Data to B Bus
				H	X	X	QA	Stored A Data to B Bus
		↑	X*	L	X	l h	L H	Real Time A Data to B Bus; Store A Data
				H	X	L H	QA QA	Clock A Data to B Bus; Store A Data
L	L					Output	Input	
		X*	↑	X	L	L H	L H	Real Time B Data to A Bus
				X	H	QB	X	Stored B Data to A Bus
		X*	↑	X	L	L H	l h	Real Time B Data to A Bus; Store B Data
				X	H	QB QB	L H	Clock B Data to A Bus; Store B Data

H = High Voltage Level; h = High Voltage Level One Setup Time Prior to the Low-to-High Clock Transition; L = Low Voltage Level; l = Low Voltage Level One Setup Time Prior to the Low-to-High Clock Transition; X = Don't Care; ↑ = Low-to-High Clock Transition; ↑ = NOT Low-to-High Clock Transition; QA = A input storage register; QB = B input storage register; \* = The clocks are not internally gated with either the Output Enables or the Source Inputs. Therefore, data at the A or B ports may be clocked into the storage registers, at any time. For I<sub>CC</sub> reasons, Do Not Float Inputs.

ABSOLUTE MAXIMUM RATINGS\*

Symbol	Parameter	Value	Condition	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0		V
V <sub>I</sub>	DC Input Voltage	-0.5 ≤ V <sub>I</sub> ≤ +7.0		V
V <sub>O</sub>	DC Output Voltage	-0.5 ≤ V <sub>O</sub> ≤ +7.0	Output in 3-State	V
		-0.5 ≤ V <sub>O</sub> ≤ V <sub>CC</sub> + 0.5	Note 1.	V
I <sub>IK</sub>	DC Input Diode Current	-50	V <sub>I</sub> < GND	mA
I <sub>OK</sub>	DC Output Diode Current	-50	V <sub>O</sub> < GND	mA
		+50	V <sub>O</sub> > V <sub>CC</sub>	mA
I <sub>O</sub>	DC Output Source/Sink Current	±50		mA
I <sub>CC</sub>	DC Supply Current Per Supply Pin	±100		mA
I <sub>GND</sub>	DC Ground Current Per Ground Pin	±100		mA
T <sub>STG</sub>	Storage Temperature Range	-65 to +150		°C

\* Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute-maximum-rated conditions is not implied.

1. Output in HIGH or LOW State. I<sub>O</sub> absolute maximum rating must be observed.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit	
V <sub>CC</sub>	Supply Voltage	Operating	2.0	3.3	3.6	V
		Data Retention Only	1.5	3.3	3.6	
V <sub>I</sub>	Input Voltage	0		5.5	V	
V <sub>O</sub>	Output Voltage (HIGH or LOW State) (3-State)			V <sub>CC</sub>	V	
			0	5.5		
I <sub>OH</sub>	HIGH Level Output Current, V <sub>CC</sub> = 3.0V – 3.6V			–24	mA	
I <sub>OL</sub>	LOW Level Output Current, V <sub>CC</sub> = 3.0V – 3.6V			24	mA	
I <sub>OH</sub>	HIGH Level Output Current, V <sub>CC</sub> = 2.7V – 3.0V			–12	mA	
I <sub>OL</sub>	LOW Level Output Current, V <sub>CC</sub> = 2.7V – 3.0V			12	mA	
T <sub>A</sub>	Operating Free–Air Temperature	–40		+85	°C	
Δt/ΔV	Input Transition Rise or Fall Rate, V <sub>IN</sub> from 0.8V to 2.0V, V <sub>CC</sub> = 3.0V	0		10	ns/V	

## DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T <sub>A</sub> = –40°C to +85°C		Unit
			Min	Max	
V <sub>IH</sub>	HIGH Level Input Voltage (Note 2.)	2.7V ≤ V <sub>CC</sub> ≤ 3.6V	2.0		V
V <sub>IL</sub>	LOW Level Input Voltage (Note 2.)	2.7V ≤ V <sub>CC</sub> ≤ 3.6V		0.8	V
V <sub>OH</sub>	HIGH Level Output Voltage	2.7V ≤ V <sub>CC</sub> ≤ 3.6V; I <sub>OH</sub> = –100μA	V <sub>CC</sub> – 0.2		V
		V <sub>CC</sub> = 2.7V; I <sub>OH</sub> = –12mA	2.2		
		V <sub>CC</sub> = 3.0V; I <sub>OH</sub> = –18mA	2.4		
		V <sub>CC</sub> = 3.0V; I <sub>OH</sub> = –24mA	2.2		
V <sub>OL</sub>	LOW Level Output Voltage	2.7V ≤ V <sub>CC</sub> ≤ 3.6V; I <sub>OL</sub> = 100μA		0.2	V
		V <sub>CC</sub> = 2.7V; I <sub>OL</sub> = 12mA		0.4	
		V <sub>CC</sub> = 3.0V; I <sub>OL</sub> = 16mA		0.4	
		V <sub>CC</sub> = 3.0V; I <sub>OL</sub> = 24mA		0.55	
I <sub>I</sub>	Input Leakage Current	2.7V ≤ V <sub>CC</sub> ≤ 3.6V; 0V ≤ V <sub>I</sub> ≤ 5.5V		±5.0	μA
I <sub>OZ</sub>	3–State Output Current	2.7 ≤ V <sub>CC</sub> ≤ 3.6V; 0V ≤ V <sub>O</sub> ≤ 5.5V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>		±5.0	μA
I <sub>OFF</sub>	Power–Off Leakage Current	V <sub>CC</sub> = 0V; V <sub>I</sub> or V <sub>O</sub> = 5.5V		10	μA
I <sub>CC</sub>	Quiescent Supply Current	2.7 ≤ V <sub>CC</sub> ≤ 3.6V; V <sub>I</sub> = GND or V <sub>CC</sub>		20	μA
		2.7 ≤ V <sub>CC</sub> ≤ 3.6V; 3.6 ≤ V <sub>I</sub> or V <sub>O</sub> ≤ 5.5V		±20	μA
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	2.7 ≤ V <sub>CC</sub> ≤ 3.6V; V <sub>IH</sub> = V <sub>CC</sub> – 0.6V		500	μA

2. These values of V<sub>I</sub> are used to test DC electrical characteristics only.

**AC CHARACTERISTICS** (Note 3.;  $t_R = t_F = 2.5\text{ns}$ ;  $C_L = 50\text{pF}$ ;  $R_L = 500\Omega$ )

Symbol	Parameter	Waveform	Limits				Unit
			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$				
			$V_{CC} = 3.0\text{V to } 3.6\text{V}$		$V_{CC} = 2.7\text{V}$		
			Min	Max	Min	Max	
$f_{\text{max}}$	Clock Pulse Frequency	3	170				MHz
$t_{\text{PLH}}$ $t_{\text{PHL}}$	Propagation Delay Input to Output	1	1.5 1.5	5.2 5.2	1.5 1.5	6.0 6.0	ns
$t_{\text{PLH}}$ $t_{\text{PHL}}$	Propagation Delay Clock to Output	3	1.5 1.5	6.0 6.0	1.5 1.5	7.0 7.0	ns
$t_{\text{PLH}}$ $t_{\text{PHL}}$	Propagation Delay Select to Output	1	1.5 1.5	6.0 6.0	1.5 1.5	7.0 7.0	ns
$t_{\text{PZH}}$ $t_{\text{PZL}}$	Output Enable Time to High and Low Level	2	1.5 1.5	7.5 7.5	1.5 1.5	8.5 8.5	ns
$t_{\text{PHZ}}$ $t_{\text{PLZ}}$	Output Disable Time From High and Low Level	2	1.5 1.5	6.5 6.5	1.5 1.5	7.5 7.5	ns
$t_s$	Setup Time, HIGH or LOW Data to Clock	3	2.5		2.5		ns
$t_h$	Hold Time, HIGH or LOW Data to Clock	3	1.5		1.5		ns
$t_w$	Clock Pulse Width, HIGH or LOW	3	3.0		3.0		ns
$t_{\text{OSHL}}$ $t_{\text{OSLH}}$	Output-to-Output Skew (Note 4.)			1.0 1.0			ns

- 3. These AC parameters are preliminary and may be modified prior to release.
- 4. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW ( $t_{\text{OSHL}}$ ) or LOW-to-HIGH ( $t_{\text{OSLH}}$ ); parameter guaranteed by design.

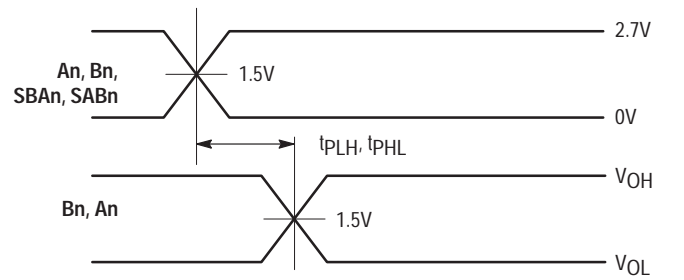
**DYNAMIC SWITCHING CHARACTERISTICS**

Symbol	Characteristic	Condition	$T_A = +25^\circ\text{C}$			Unit
			Min	Typ	Max	
$V_{\text{OLP}}$	Dynamic LOW Peak Voltage (Note 5.)	$V_{CC} = 3.3\text{V}, C_L = 50\text{pF}, V_{\text{IH}} = 3.3\text{V}, V_{\text{IL}} = 0\text{V}$		0.8		V
$V_{\text{OLV}}$	Dynamic LOW Valley Voltage (Note 5.)	$V_{CC} = 3.3\text{V}, C_L = 50\text{pF}, V_{\text{IH}} = 3.3\text{V}, V_{\text{IL}} = 0\text{V}$		0.8		V

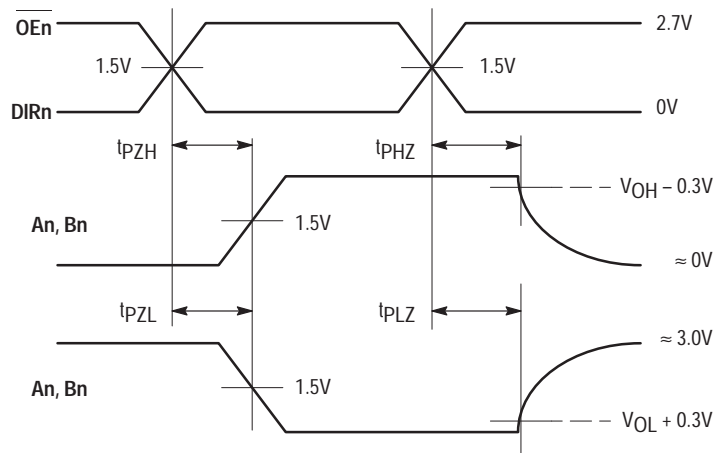
- 5. Number of outputs defined as “n”. Measured with “n-1” outputs switching from HIGH-to-LOW or LOW-to-HIGH. The remaining output is measured in the LOW state.

**CAPACITIVE CHARACTERISTICS**

Symbol	Parameter	Condition	Typical	Unit
$C_{\text{IN}}$	Input Capacitance	$V_{CC} = 3.3\text{V}, V_I = 0\text{V or } V_{CC}$	7	pF
$C_{\text{I/O}}$	Input/Output Capacitance	$V_{CC} = 3.3\text{V}, V_I = 0\text{V or } V_{CC}$	8	pF
$C_{\text{PD}}$	Power Dissipation Capacitance	10MHz, $V_{CC} = 3.3\text{V}, V_I = 0\text{V or } V_{CC}$	20	pF



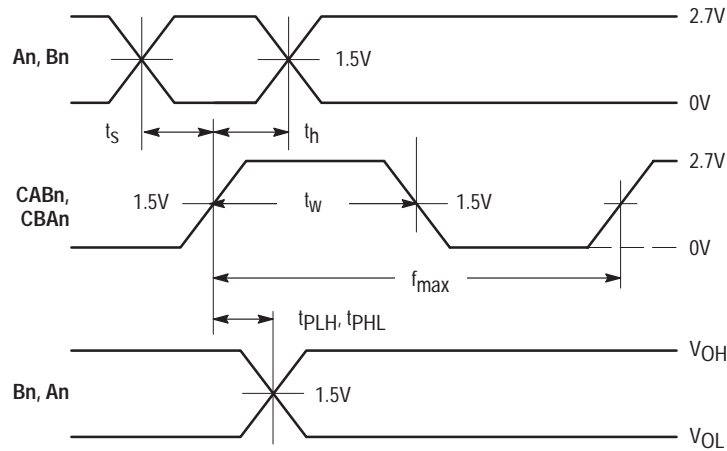
**WAVEFORM 1 – SAB to B and SBA to A, An to Bn PROPAGATION DELAYS**  
 $t_R = t_F = 2.5\text{ns}$ , 10% to 90%;  $f = 1\text{MHz}$ ;  $t_W = 500\text{ns}$



**WAVEFORM 2 –  $\overline{\text{OE}}/\text{DIR}$  to An/Bn OUTPUT ENABLE AND DISABLE TIMES**  
 $t_R = t_F = 2.5\text{ns}$ , 10% to 90%;  $f = 1\text{MHz}$ ;  $t_W = 500\text{ns}$

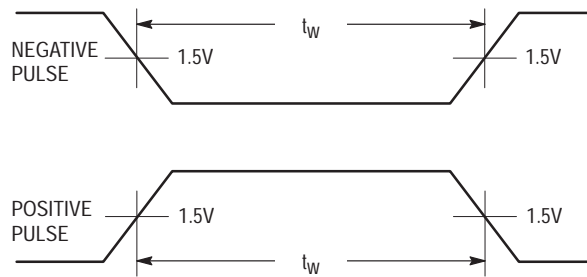
**Figure 1. AC Waveforms**





**WAVEFORM 3 – CLOCK to Bn/An PROPAGATION DELAYS, CLOCK MINIMUM PULSE WIDTH, An/Bn to CLOCK SETUP AND HOLD TIMES**

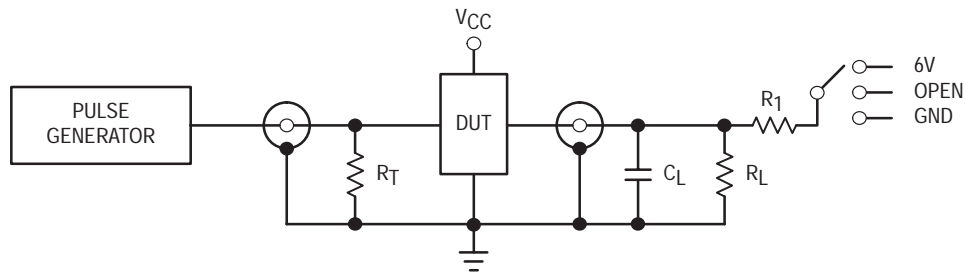
$t_R = t_F = 2.5ns$ , 10% to 90%;  $f = 1MHz$ ;  $t_W = 500ns$  except when noted



**WAVEFORM 4 – INPUT PULSE DEFINITION**

$t_R = t_F = 2.5ns$ , 10% to 90% of 0V to 2.7V

**Figure 1. AC Waveforms (continued)**



TEST	SWITCH
$t_{PLH}$ , $t_{PHL}$	Open
$t_{PZL}$ , $t_{PLZ}$	6V
Open Collector/Drain $t_{PLH}$ and $t_{PHL}$	6V
$t_{PZH}$ , $t_{PHZ}$	GND

$C_L = 50pF$  or equivalent (Includes jig and probe capacitance)

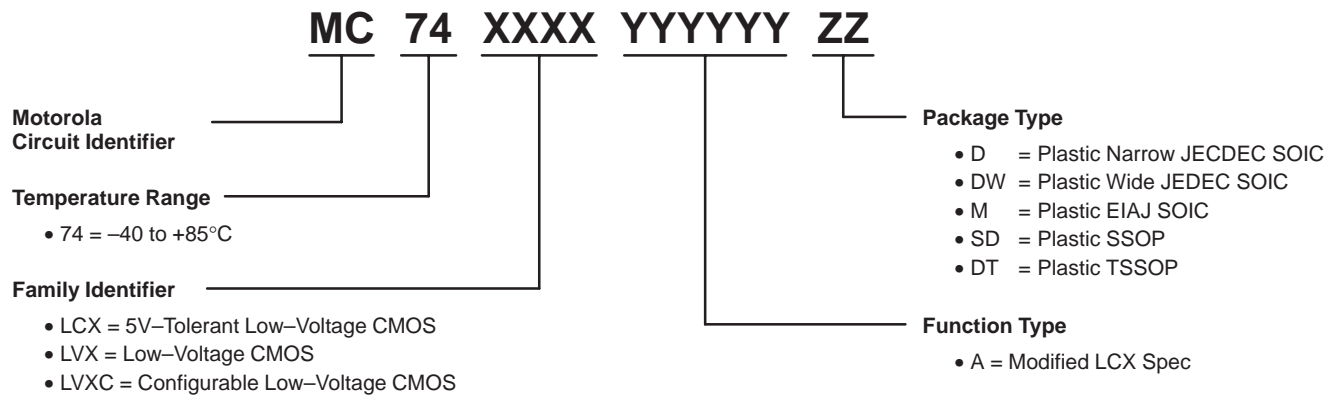
$R_L = R_1 = 500\Omega$  or equivalent

$R_T = Z_{OUT}$  of pulse generator (typically 50 $\Omega$ )

**Figure 2. Test Circuit**

## Ordering Information

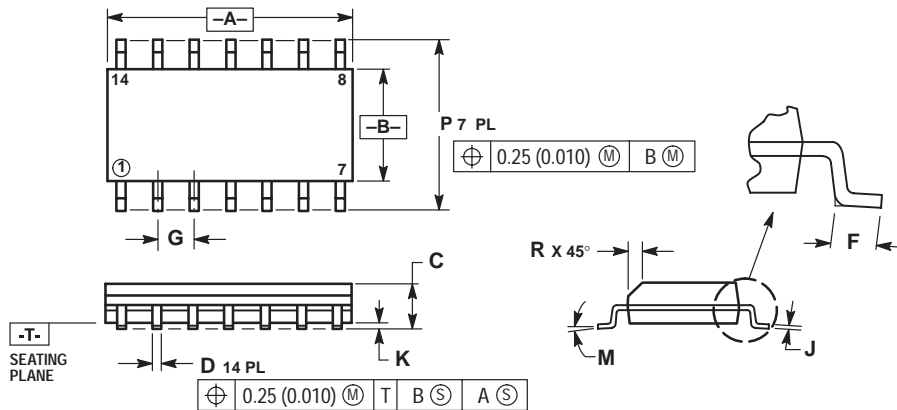
### Device Nomenclature



# Case Outlines

## 14-Pin Packages

### D SUFFIX PLASTIC SOIC PACKAGE CASE 751A-03 ISSUE F

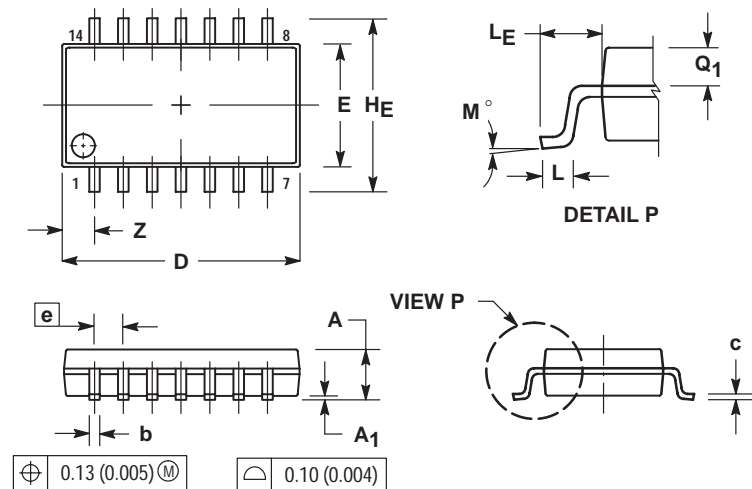


NOTES:

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

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

### M SUFFIX PLASTIC SOIC EIAJ PACKAGE CASE 965-01 ISSUE O



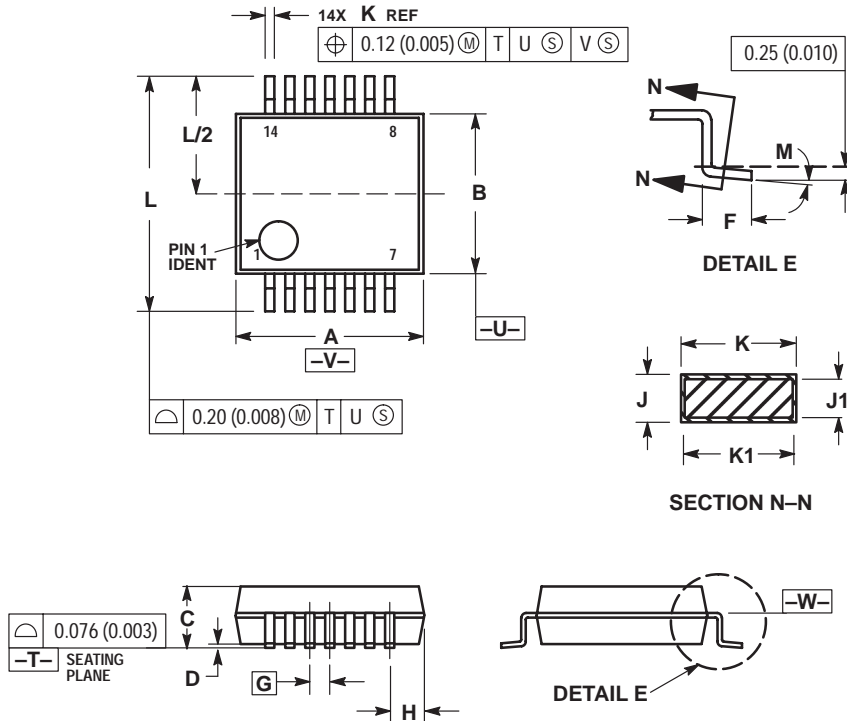
NOTES:

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 <sub>1</sub>	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	
H <sub>F</sub>	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
L <sub>F</sub>	1.10	1.50	0.043	0.059
M	0°	10°	0°	10°
Q <sub>1</sub>	0.70	0.90	0.028	0.035
Z	---	1.42	---	0.056

# 14-Pin Packages (continued)

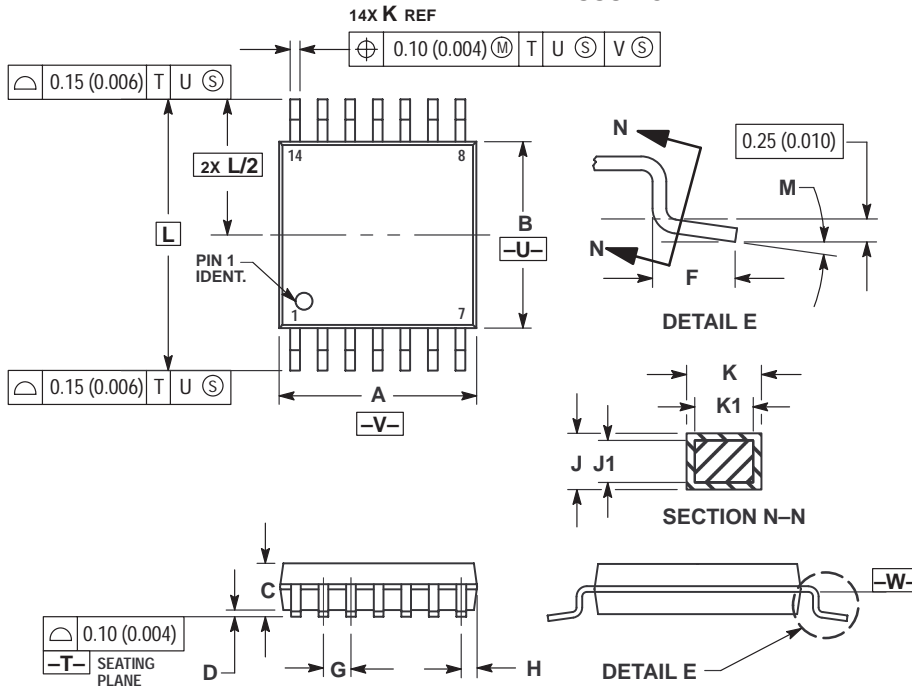
## SD SUFFIX PLASTIC SSOP PACKAGE CASE 940A-03 ISSUE B



- NOTES:
- 6 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - 7 CONTROLLING DIMENSION: MILLIMETER.
  - 8 DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  - 9 DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  - 10 DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF K DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR INTRUSION SHALL NOT REDUCE DIMENSION K BY MORE THAN 0.07 (0.002) AT LEAST MATERIAL CONDITION.
  - 11 TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
  - 12 DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -U-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.07	6.33	0.238	0.249
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	0.63	0.95	0.024	0.037
G	0.65 BSC		0.026 BSC	
H	1.08	1.22	0.042	0.048
J	0.09	0.20	0.003	0.008
J1	0.09	0.16	0.003	0.006
K	0.25	0.38	0.010	0.015
K1	0.25	0.33	0.010	0.013
L	7.65	7.90	0.301	0.311
M	0°	8°	0°	8°

## DT SUFFIX PLASTIC TSSOP PACKAGE CASE 948G-01 ISSUE O

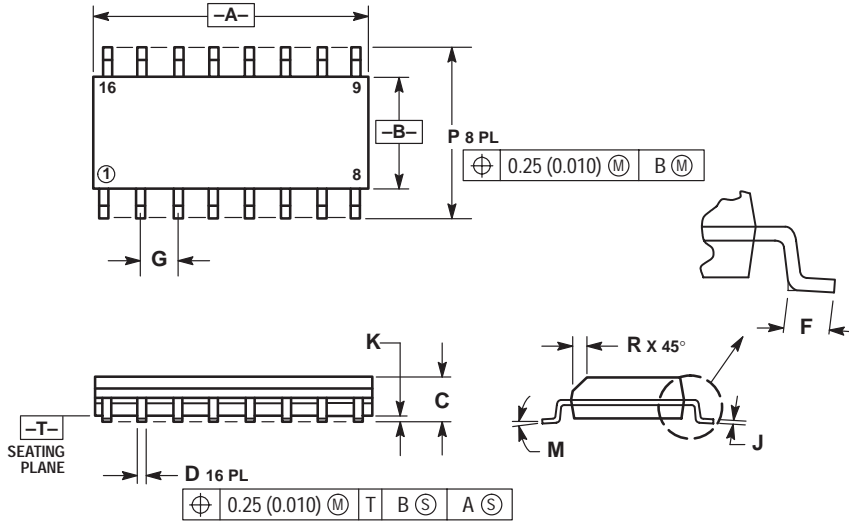


- NOTES:
- 1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - 2 CONTROLLING DIMENSION: MILLIMETER.
  - 3 DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  - 4 DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.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

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

# 16-Pin Packages

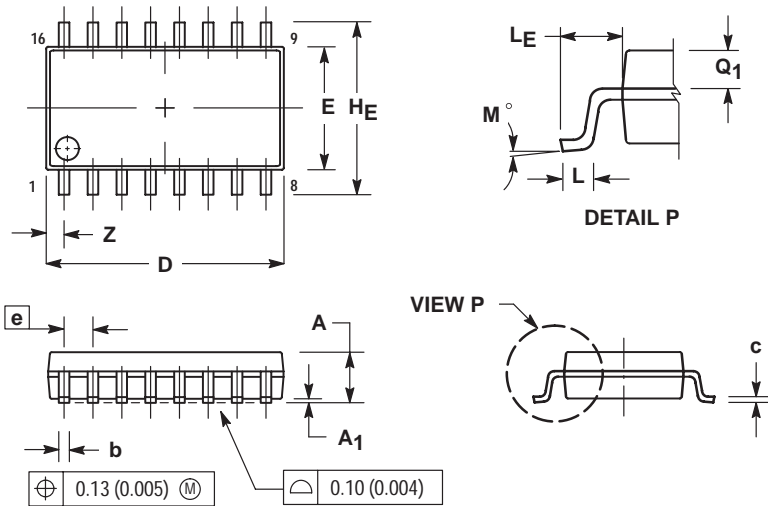
## D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



- 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

## M SUFFIX PLASTIC SOIC EIAJ PACKAGE CASE 966-01 ISSUE O

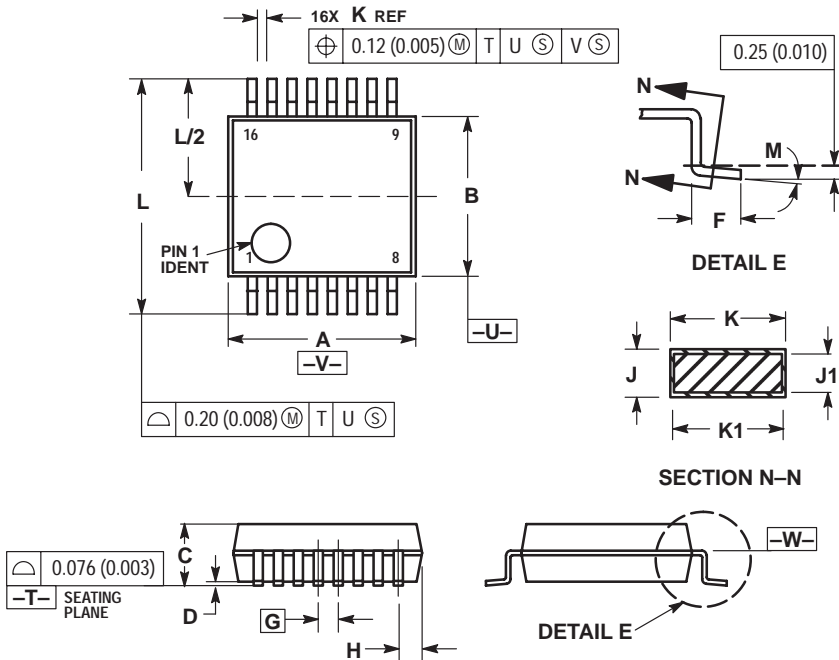


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. TERMINAL NUMBERS ARE SHOWN 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
A1	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
c	0.18	0.27	0.007	0.011
D	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°
Q1	0.70	0.90	0.028	0.035
Z	---	0.78	---	0.031

# 16-Pin Packages (continued)

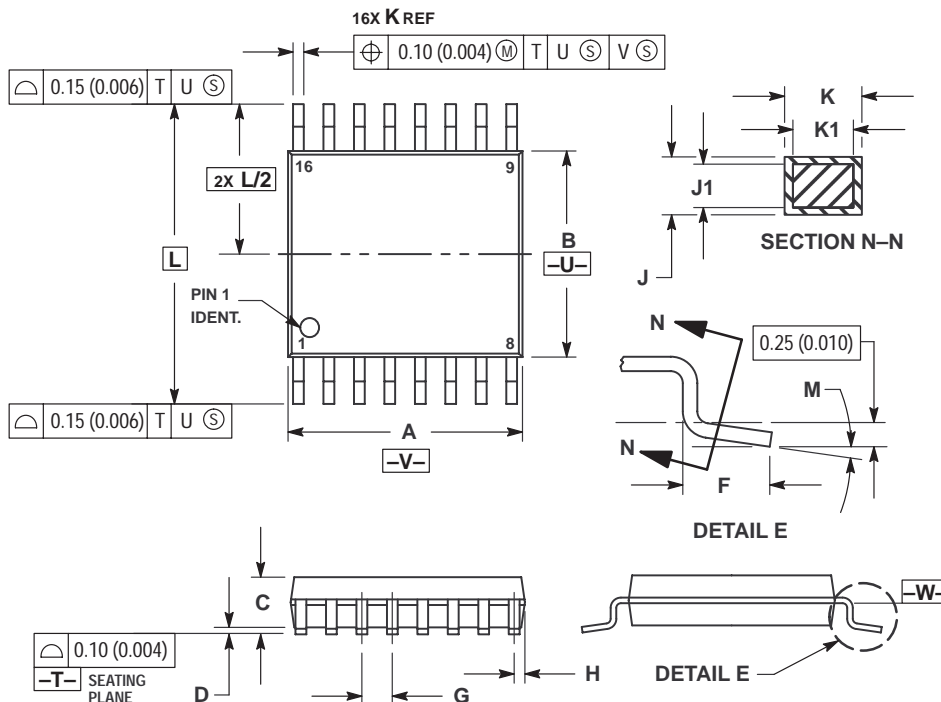
## SD SUFFIX PLASTIC SSOP PACKAGE CASE 940B-03 ISSUE B



- NOTES:
- 6 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - 7 CONTROLLING DIMENSION: MILLIMETER.
  - 8 DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  - 9 DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  - 10 DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF K DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR INTRUSION SHALL NOT REDUCE DIMENSION K BY MORE THAN 0.07 (0.002) AT LEAST MATERIAL CONDITION.
  - 11 TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
  - 12 DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.07	6.33	0.238	0.249
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	0.63	0.95	0.024	0.037
G	0.65 BSC		0.026 BSC	
H	0.73	0.90	0.028	0.035
J	0.09	0.20	0.003	0.008
J1	0.09	0.16	0.003	0.006
K	0.25	0.38	0.010	0.015
K1	0.25	0.33	0.010	0.013
L	7.65	7.90	0.301	0.311
M	0°	8°	0°	8°

## DT SUFFIX PLASTIC TSSOP PACKAGE CASE 948F-01 ISSUE O

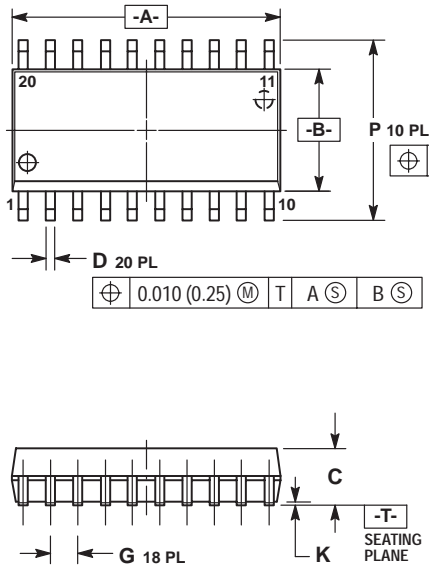


- NOTES:
- 1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - 2 CONTROLLING DIMENSION: MILLIMETER.
  - 3 DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  - 4 DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.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

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

## 20-Pin Packages

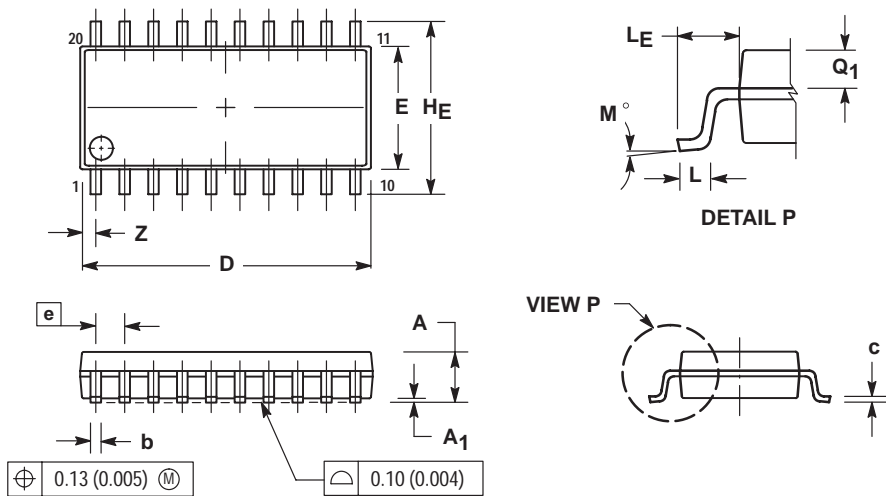
### DW SUFFIX PLASTIC SOIC PACKAGE CASE 751D-04 ISSUE E



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

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

### M SUFFIX PLASTIC SOIC EIAJ PACKAGE CASE 967-01 ISSUE O

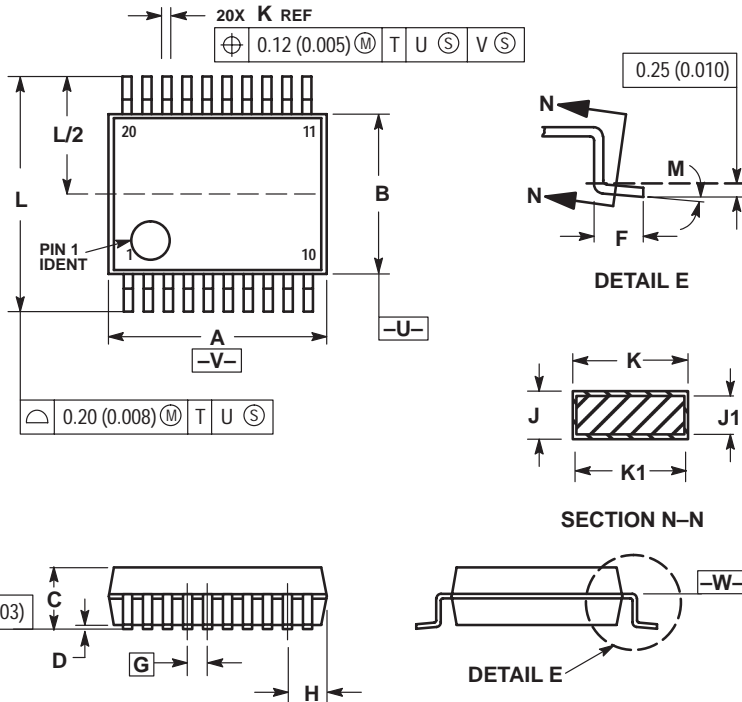


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. TERMINAL NUMBERS ARE SHOWN 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 <sub>1</sub>	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
c	0.18	0.27	0.007	0.011
D	12.35	12.80	0.486	0.504
E	5.10	5.45	0.201	0.215
e	1.27 BSC	0.050 BSC		
H <sub>F</sub>	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
L <sub>F</sub>	1.10	1.50	0.043	0.059
M	0°	10°	0°	10°
Q <sub>1</sub>	0.70	0.90	0.028	0.035
Z	---	0.81	---	0.032

20-Pin Packages (continued)

SD SUFFIX  
PLASTIC SSOP PACKAGE  
CASE 940C-03  
ISSUE B



NOTES:

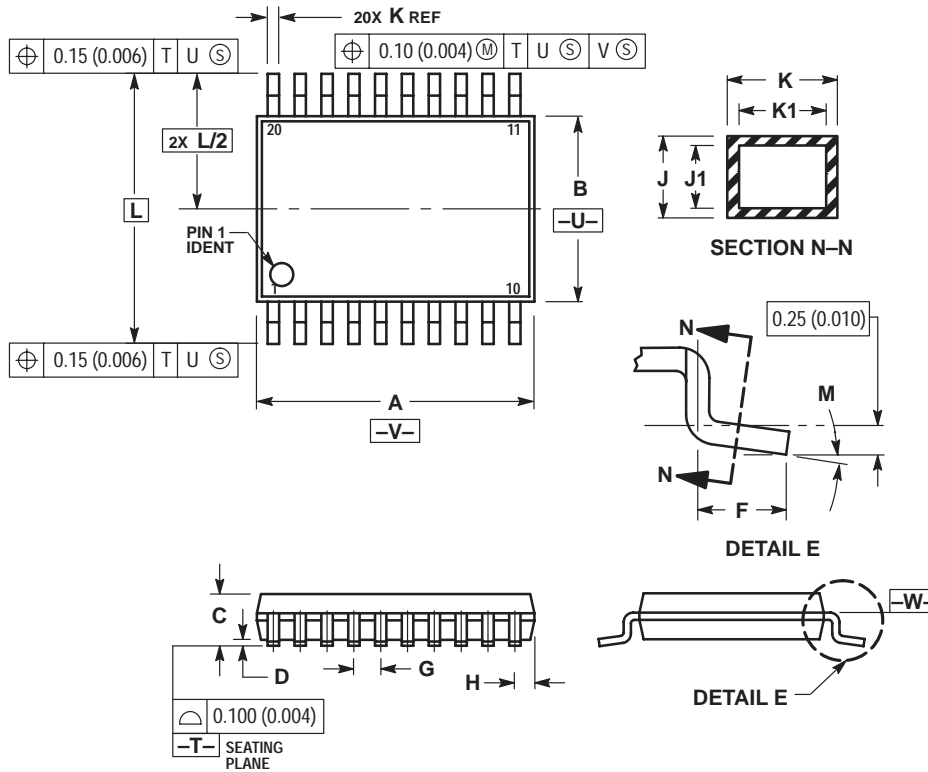
- 6 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- 7 CONTROLLING DIMENSION: MILLIMETER.
- 8 DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- 9 DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- 10 DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF K DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR INTRUSION SHALL NOT REDUCE DIMENSION K BY MORE THAN 0.07 (0.002) AT LEAST MATERIAL CONDITION.
- 11 TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- 12 DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.07	7.33	0.278	0.288
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	0.63	0.95	0.024	0.037
G	0.65 BSC		0.026 BSC	
H	0.59	0.75	0.023	0.030
J	0.09	0.20	0.003	0.008
J1	0.09	0.16	0.003	0.006
K	0.25	0.38	0.010	0.015
K1	0.25	0.33	0.010	0.013
L	7.65	7.90	0.301	0.311
M	0°	8°	0°	8°



## 20-Pin Packages (continued)

**DT SUFFIX**  
**PLASTIC TSSOP PACKAGE**  
 CASE 948E-02  
 ISSUE A



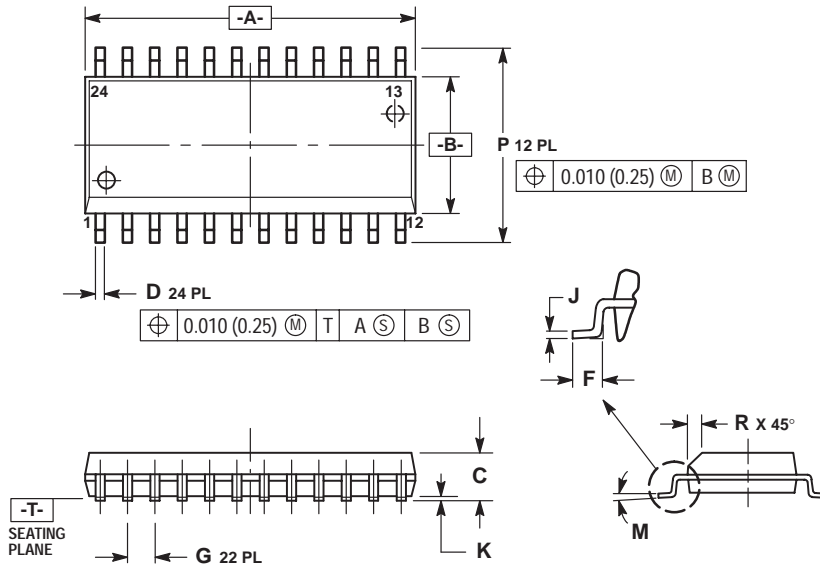
**NOTES:**

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

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

# 24-Pin Packages

## DW SUFFIX PLASTIC SOIC PACKAGE CASE 751E-04 ISSUE E

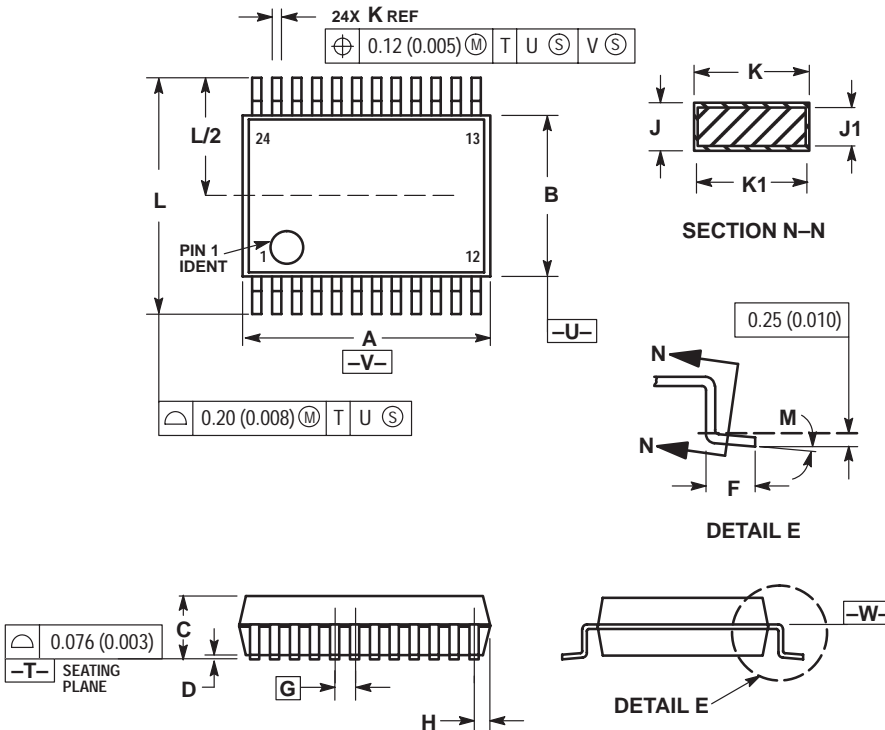


NOTES:

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

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

## SD SUFFIX PLASTIC SSOP PACKAGE CASE 940D-03 ISSUE B



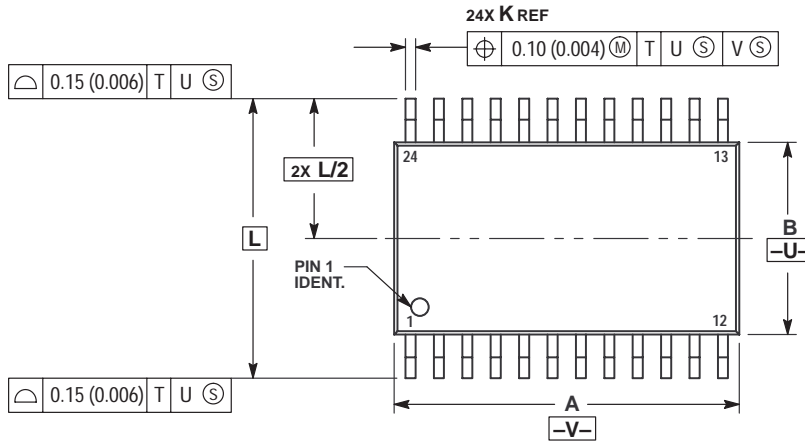
NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF K DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR INTRUSION SHALL NOT REDUCE DIMENSION K BY MORE THAN 0.07 (0.002) AT LEAST MATERIAL CONDITION.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

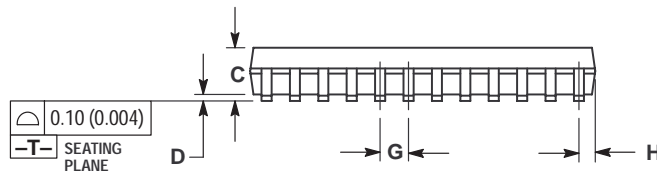
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.07	8.33	0.317	0.328
B	5.20	5.38	0.205	0.212
C	1.73	1.99	0.068	0.078
D	0.05	0.21	0.002	0.008
F	0.63	0.95	0.024	0.037
G	0.65 BSC		0.026 BSC	
H	0.44	0.60	0.017	0.024
J	0.09	0.20	0.003	0.008
J1	0.09	0.16	0.003	0.006
K	0.25	0.38	0.010	0.015
K1	0.25	0.33	0.010	0.013
L	7.65	7.90	0.301	0.311
M	0°	8°	0°	8°

## 24-Pin Packages (continued)

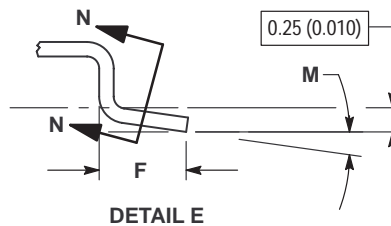
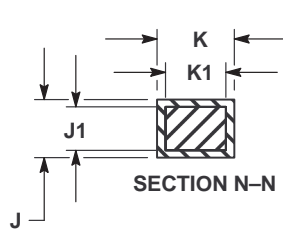
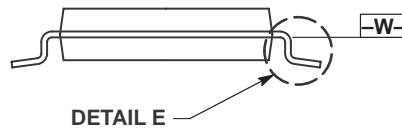
**DT SUFFIX**  
**PLASTIC TSSOP PACKAGE**  
 CASE 948H-01  
 ISSUE O



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

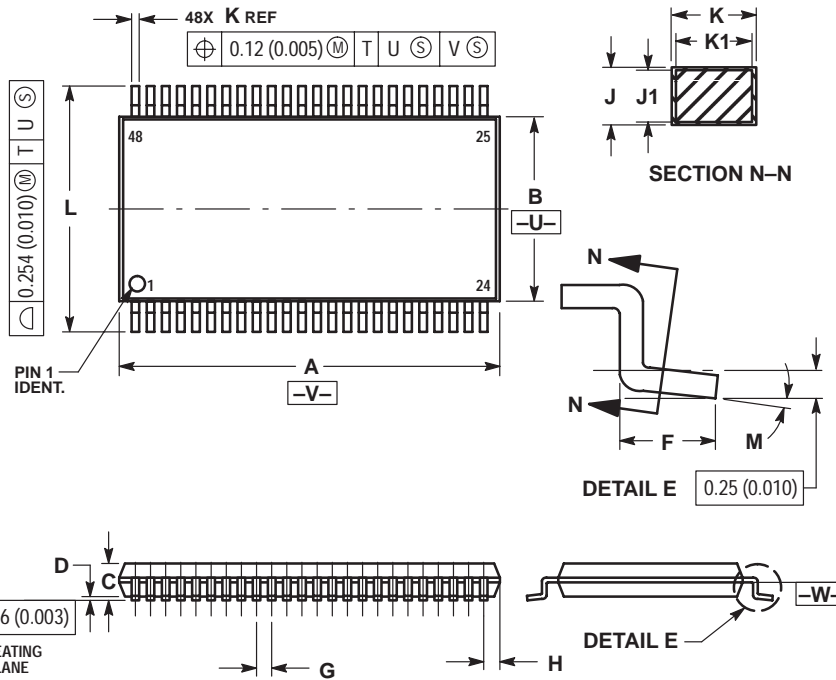


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.70	7.90	0.303	0.311
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010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



# 48-Pin Package

**DT SUFFIX**  
**PLASTIC TSSOP PACKAGE**  
**CASE 1201-01**  
**ISSUE A**

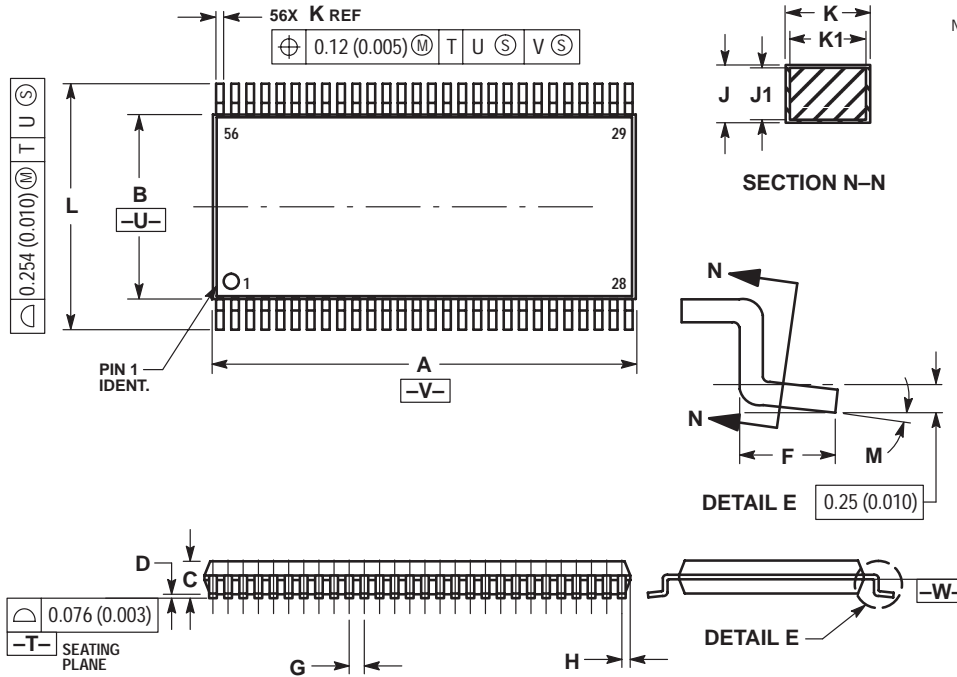


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	12.40	12.60	0.488	0.496
B	6.00	6.20	0.236	0.244
C	---	1.10	---	0.043
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.50 BSC		0.0197 BSC	
H	0.37	---	0.015	---
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.17	0.27	0.007	0.011
K1	0.17	0.23	0.007	0.009
L	7.95	8.25	0.313	0.325
M	0°	8°	0°	8°

# 56-Pin Package

**DT SUFFIX**  
**PLASTIC TSSOP PACKAGE**  
**CASE 1202-01**  
**ISSUE A**



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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	13.90	14.10	0.547	0.555
B	6.00	6.20	0.236	0.244
C	---	1.10	---	0.043
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.50 BSC		0.0197 BSC	
H	0.12	---	0.005	---
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.17	0.27	0.007	0.011
K1	0.17	0.23	0.007	0.009
L	7.95	8.25	0.313	0.325
M	0°	8°	0°	8°