# Low-Voltage CMOS Octal Buffer Flow Through Pinout
With 5V-Tolerant Inputs and Outputs (3-State, Non-Inverting)

The MC74LCX541 is a high performance, non–inverting octal buffer operating from a 2.7 to 3.6V supply. This device is similar in function to the MC74LCX244, while providing flow through architecture. 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 MC74LCX541 inputs to be safely driven from 5V devices. The MC74LCX541 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

Current drive capability is 24mA at the outputs. The Output Enable (OE1. OE2) inputs, when HIGH, disables the output by placing them in a HIGH Z condition.

- Designed for 2.7 to 3.6V V_{CC} Operation
- 5V Tolerant — Interface Capability With 5V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When $V_{CC} = 0V$
- LVTTL Compatible
- LVCMOS Compatible
- 24mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10µA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500mA
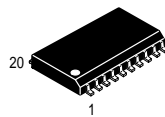- ESD Performance: Human Body Model >2000V; Machine Model >200V
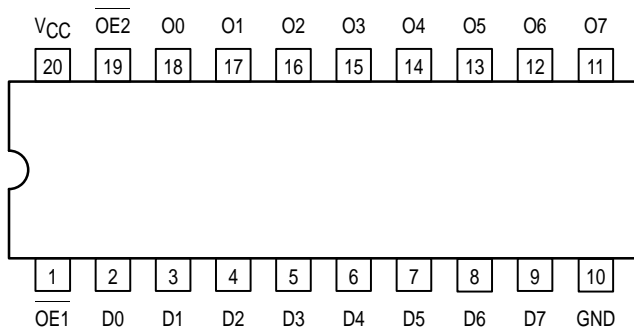
MC74LCX541

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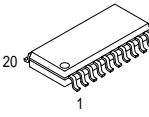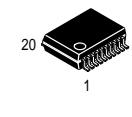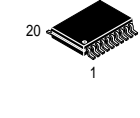**LOW–VOLTAGE CMOS OCTAL BUFFER**

DW SUFFIX
PLASTIC SOIC
CASE 751D–04

M SUFFIX
PLASTIC SOIC EIAJ
CASE 967–01

SD SUFFIX
PLASTIC SSOP
CASE 940C–03

DT SUFFIX
PLASTIC TSSOP
CASE 948E–02

PIN NAMES

Pins	Function
OEn	Output Enable Inputs
Dn	Data Inputs
On	3–State Outputs

Pinout: 20–Lead (Top View)

V_{CC}	OE2	O0	O1	O2	O3	O4	O5	O6	O7
20	19	18	17	16	15	14	13	12	11
1	2	3	4	5	6	7	8	9	10
OE1	D0	D1	D2	D3	D4	D5	D6	D7	GND

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REV 1

MC74LCX541

LOGIC DIAGRAM
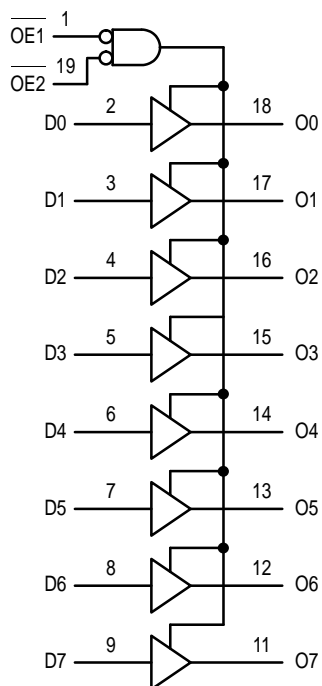
INPUTS			OUTPUTS
OE1	OE2	Dn	On
L	L	L	L
L	L	H	H
X	H	X	Z
H	X	X	Z

H = High Voltage Level; L = Low Voltage Level; Z = High
Impedance State; X = High or Low Voltage Level and Transitions
Are Acceptable, for I_{CC} reasons, DO NOT FLOAT Inputs

ABSOLUTE MAXIMUM RATINGS*

Symbol	Parameter	Value	Condition	Unit
V_{CC}	DC Supply Voltage	−0.5 to +7.0		V
V_I	DC Input Voltage	$-0.5 \leq V_I \leq +7.0$		V
V_O	DC Output Voltage	$-0.5 \leq V_O \leq +7.0$	Output in 3–State	V
		$-0.5 \leq V_O \leq V_{CC} + 0.5$	Note 1.	V
I_{IK}	DC Input Diode Current	−50	V_I < GND	mA
I_{OK}	DC Output Diode Current	−50	V_O < GND	mA
		+50	V_O > V_{CC}	mA
I_O	DC Output Source/Sink Current	±50		mA
I_{CC}	DC Supply Current Per Supply Pin	±100		mA
I_{GND}	DC Ground Current Per Ground Pin	±100		mA
T_{STG}	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_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating	2.0	3.3	3.6	V
		Data Retention Only	1.5	3.3	3.6	
V_I	Input Voltage		0		5.5	V
V_O	Output Voltage	(HIGH or LOW State)	0		V_{CC}	V
		(3–State)	0		5.5	
I_{OH}	HIGH Level Output Current, V_{CC} = 3.0V – 3.6V				−24	mA
I_{OL}	LOW Level Output Current, V_{CC} = 3.0V – 3.6V				24	mA
I_{OH}	HIGH Level Output Current, V_{CC} = 2.7V – 3.0V				−12	mA
I_{OL}	LOW Level Output Current, V_{CC} = 2.7V – 3.0V				12	mA
T_A	Operating Free–Air Temperature		−40		+85	°C
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate, V_{IN} from 0.8V to 2.0V, V_{CC} = 3.0V		0		10	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = −40°C to +85°C		Unit
			Min	Max	
V_{IH}	HIGH Level Input Voltage (Note 2.)	$2.7V \leq V_{CC} \leq 3.6V$	2.0		V
V_{IL}	LOW Level Input Voltage (Note 2.)	$2.7V \leq V_{CC} \leq 3.6V$		0.8	V
V_{OH}	HIGH Level Output Voltage	$2.7V \leq V_{CC} \leq 3.6V$; I_{OH} = −100μA	V_{CC} − 0.2		V
		V_{CC} = 2.7V; I_{OH} = −12mA	2.2		
		V_{CC} = 3.0V; I_{OH} = −18mA	2.4		
		V_{CC} = 3.0V; I_{OH} = −24mA	2.2		
V_{OL}	LOW Level Output Voltage	$2.7V \leq V_{CC} \leq 3.6V$; I_{OL} = 100μA		0.2	V
		V_{CC} = 2.7V; I_{OL} = 12mA		0.4	
		V_{CC} = 3.0V; I_{OL} = 16mA		0.4	
		V_{CC} = 3.0V; I_{OL} = 24mA		0.55	

2. These values of V_I are used to test DC electrical characteristics only.

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DC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Characteristic	Condition	T_A = −40°C to +85°C Min	T_A = −40°C to +85°C Max	Unit
I_I	Input Leakage Current	$2.7V \leq V_{CC} \leq 3.6V$; $0V \leq V_I \leq 5.5V$		±5.0	µA
I_{OZ}	3–State Output Current	$2.7 \leq V_{CC} \leq 3.6V$; $0V \leq V_O \leq 5.5V$; $V_I = V_{IH}$ or V_{IL}		±5.0	µA
I_{OFF}	Power–Off Leakage Current	$V_{CC} = 0V$; V_I or $V_O = 5.5V$		10	µA
I_{CC}	Quiescent Supply Current	$2.7 \leq V_{CC} \leq 3.6V$; V_I = GND or V_{CC}		10	µA
		$2.7 \leq V_{CC} \leq 3.6V$; $3.6 \leq V_I$ or $V_O \leq 5.5V$		±10	µA
ΔI_{CC}	Increase in I_{CC} per Input	$2.7 \leq V_{CC} \leq 3.6V$; $V_{IH} = V_{CC} - 0.6V$		500	µA

AC CHARACTERISTICS ($t_R = t_F$ = 2.5ns; C_L = 50pF; R_L = 500Ω)

Symbol	Parameter	Waveform	Limits T_A = −40°C to +85°C, V_{CC} = 3.0V to 3.6V Min	V_{CC} = 3.0V to 3.6V Max	V_{CC} = 2.7V Max	Unit
t_{PLH} t_{PHL}	Propagation Delay Input to Output	1	1.5 1.5	6.5 6.5	7.5 7.5	ns
t_{PZH} t_{PZL}	Output Enable Time to High and Low Level	2	1.5 1.5	8.5 8.5	9.5 9.5	ns
t_{PHZ} t_{PLZ}	Output Disable Time From High and Low Level	2	1.5 1.5	7.5 7.5	8.5 8.5	ns
t_{OSHL} t_{OSLH}	Output–to–Output Skew (Note 3.)			1.0 1.0		ns

3. 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_{OSHL}) or LOW–to–HIGH (t_{OSLH}); parameter guaranteed by design.

DYNAMIC SWITCHING CHARACTERISTICS

| Symbol	Characteristic	Condition	T_A = +25°C Min	Typ	Max	Unit
V_{OLP}	Dynamic LOW Peak Voltage (Note 4.)	V_{CC} = 3.3V, C_L = 50pF, V_{IH} = 3.3V, V_{IL} = 0V		0.8		V
V_{OLV}	Dynamic LOW Valley Voltage (Note 4.)	V_{CC} = 3.3V, C_L = 50pF, V_{IH} = 3.3V, V_{IL} = 0V		0.8		V

4. 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_{IN}	Input Capacitance	V_{CC} = 3.3V, V_I = 0V or V_{CC}	7	pF
C_{OUT}	Output Capacitance	V_{CC} = 3.3V, V_I = 0V or V_{CC}	8	pF
C_{PD}	Power Dissipation Capacitance	10MHz, V_{CC} = 3.3V, V_I = 0V or V_{CC}	25	pF
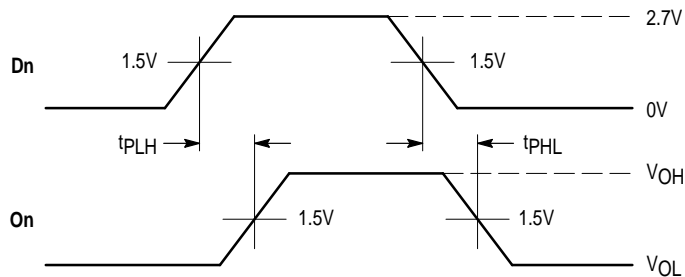
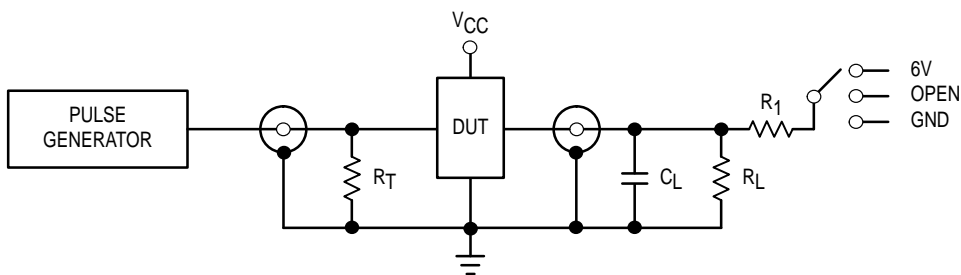**WAVEFORM 1 – PROPAGATION DELAYS**
$t_R = t_F = 2.5ns$, 10% to 90%; $f = 1MHz$; $t_W = 500ns$
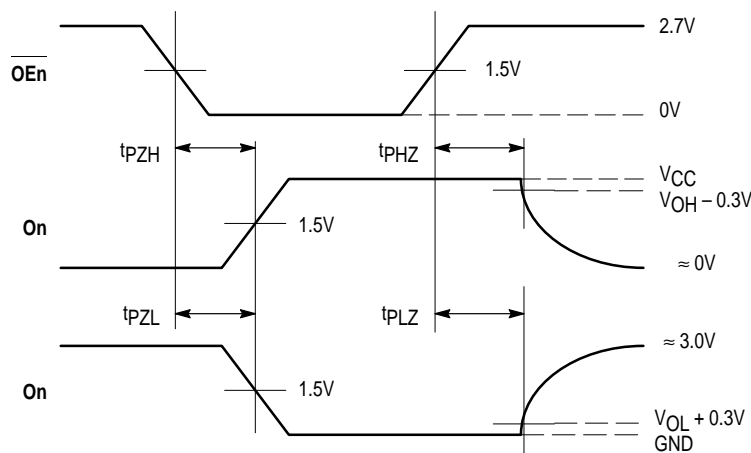
WAVEFORM 2 – OUTPUT ENABLE AND DISABLE TIMES
$t_R = t_F = 2.5ns$, 10% to 90%; $f = 1MHz$; $t_W = 500ns$

Figure 1. AC Waveforms

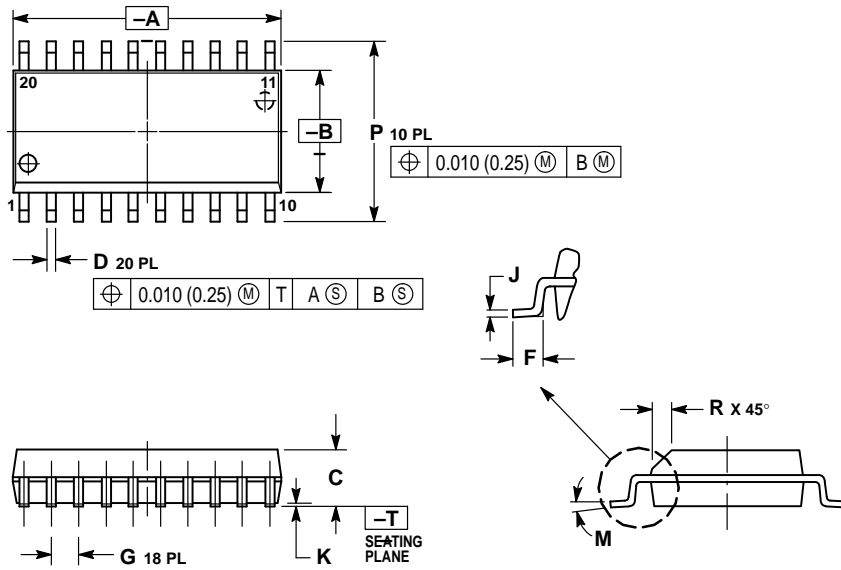| TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6V
Open Collector/Drain t_{PLH} and t_{PHL}	6V
t_{PZH}, t_{PHZ}	GND

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 50Ω)

Figure 2. Test Circuit

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MC74LCX541

OUTLINE DIMENSIONS

DW SUFFIX
PLASTIC SOIC PACKAGE
CASE 751D–04
ISSUE E
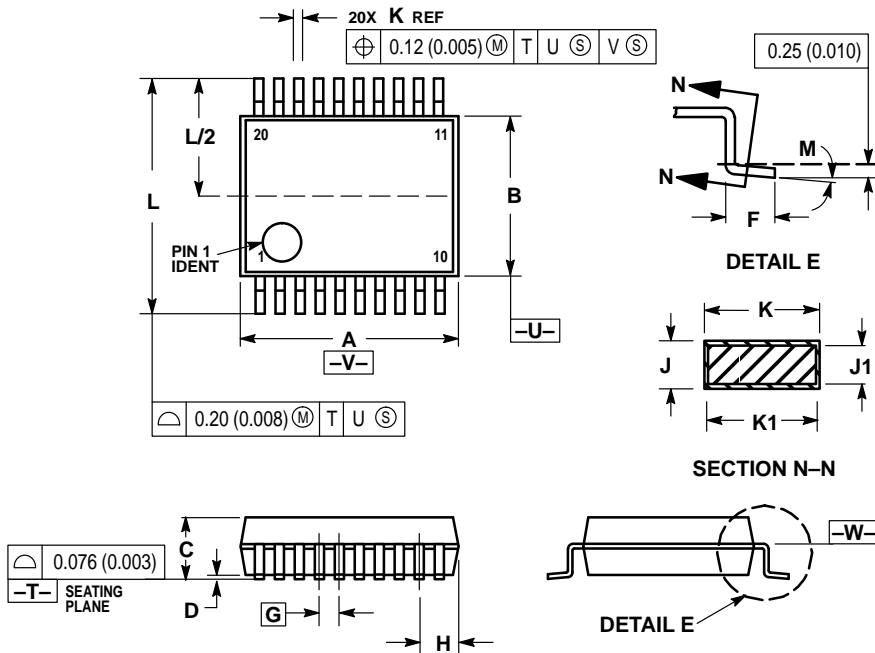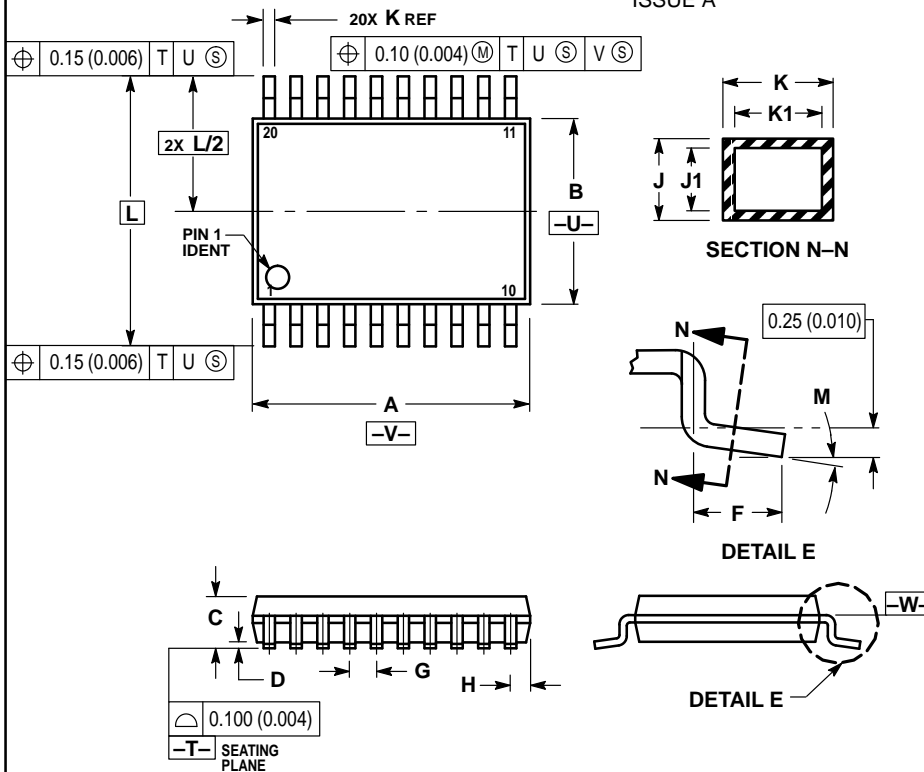

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.150 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005)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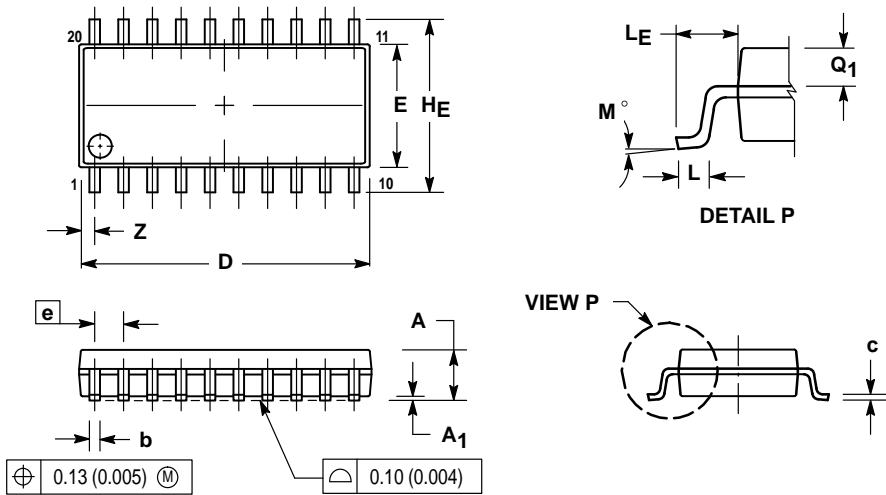
DETAIL P

VIEW P

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	12.35	12.80	0.486	0.504
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	---	0.81	---	0.032

OUTLINE DIMENSIONS

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

20X **K** REF

| ⊕ | 0.12 (0.005) Ⓜ | T | U Ⓢ | V Ⓢ |

0.25 (0.010)

DETAIL E

SECTION N–N

| ⌒ | 0.20 (0.008) Ⓜ | T | U Ⓢ |

| ⌒ | 0.076 (0.003) |
–T– SEATING PLANE

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 0.15 (0.006) PER SIDE.
17 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.
18 TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
19 DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE –W–.

| | MILLIMETERS | | INCHES | |
DIM	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 °

DT SUFFIX
PLASTIC TSSOP PACKAGE
CASE 948E–02
ISSUE A

| ⊕ | 0.15 (0.006) | T | U Ⓢ |

20X **K** REF

| ⊕ | 0.10 (0.004) Ⓜ | T | U Ⓢ | V Ⓢ |

2X **L/2**

| ⊕ | 0.15 (0.006) | T | U Ⓢ |

SECTION N–N

0.25 (0.010)

DETAIL E

| ⌒ | 0.100 (0.004) |
–T– SEATING PLANE

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 0.25 (0.010) PER SIDE.
10 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.
11 TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
12 DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE –W–.

| | MILLIMETERS | | INCHES | |
DIM	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°

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