

# 74FST3400

## 4-Bit, 4-Port Bus Exchange Switch

The ON Semiconductor 74FST3400 is a 4-bit, 4-port bus exchange switch. The device is CMOS TTL compatible when operating between 4 and 5.5 Volts. The device exhibits extremely low  $R_{ON}$  and adds nearly zero propagation delay. The device adds no noise or ground bounce to the system.

- $R_{ON} < 4 \Omega$  Typical
- Less Than 0.25 ns–Max Delay Through Switch
- Nearly Zero Standby Current
- No Circuit Bounce
- Control Inputs are TTL/CMOS Compatible
- Pin-For-Pin Compatible With QS3400, FST3400, CBT3400
- All Popular Packages: SOIC–24, TSSOP–24, QSOP–24

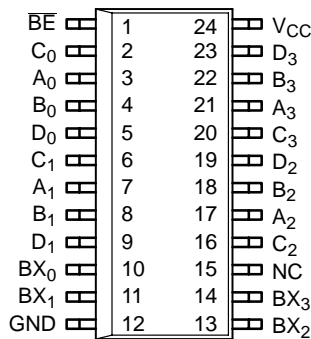


Figure 1. 24-Lead Pinout

### TRUTH TABLE

BE	BX <sub>0</sub>	BX <sub>1</sub>	BX <sub>2</sub>	BX <sub>3</sub>	A0–3	B0–3	Function
H	X	X	X	X	Hi–Z	Hi–Z	Disconnect
L	BX <sub>i</sub> = L				C0–3	D0–3	Connect
L	BX <sub>i</sub> = H				D0–3	C0–3	Exchange

NOTE: H = HIGH Voltage Level, L = LOW Voltage Level, X = Don't Care, Hi–Z = High Impedance, i = 0, 1, 2 or 3

### PIN NAMES

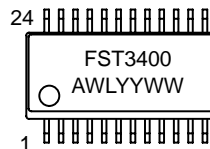
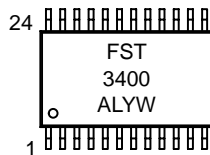
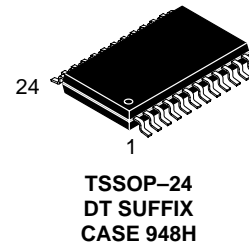
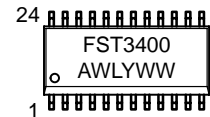
Pin	Description
$\overline{BE}$	Bus Enable Input (Active LOW)
Ax, Bx, Cx, Dx	Bus A, Bus B, Bus C, Bus D
$\overline{OE}_1, \overline{OE}_2$	Bus Exchange (Bit 0)
$\overline{OE}_1, \overline{OE}_2$	Bus Exchange (Bit 1)
$\overline{OE}_1, \overline{OE}_2$	Bus Exchange (Bit 2)
$\overline{OE}_1, \overline{OE}_2$	Bus Exchange (Bit 3)
$\overline{OE}_1, \overline{OE}_2$	No Connect
$\overline{OE}_1, \overline{OE}_2$	Ground
$\overline{OE}_1, \overline{OE}_2$	Power



ON Semiconductor®

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### MARKING DIAGRAMS



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

### ORDERING INFORMATION

Device	Package	Shipping
74FST3400DW	SO–24	48 Units/Rail
74FST3400DWR2	SO–24	2500 Units/Reel
74FST3400DT	TSSOP–24	96 Units/Rail
74FST3400DTR2	TSSOP–24	2500 Units/Reel
74FST3400QS	QSOP–24	96 Units/Rail
74FST3400QSR	QSOP–24	2500 Units/Reel

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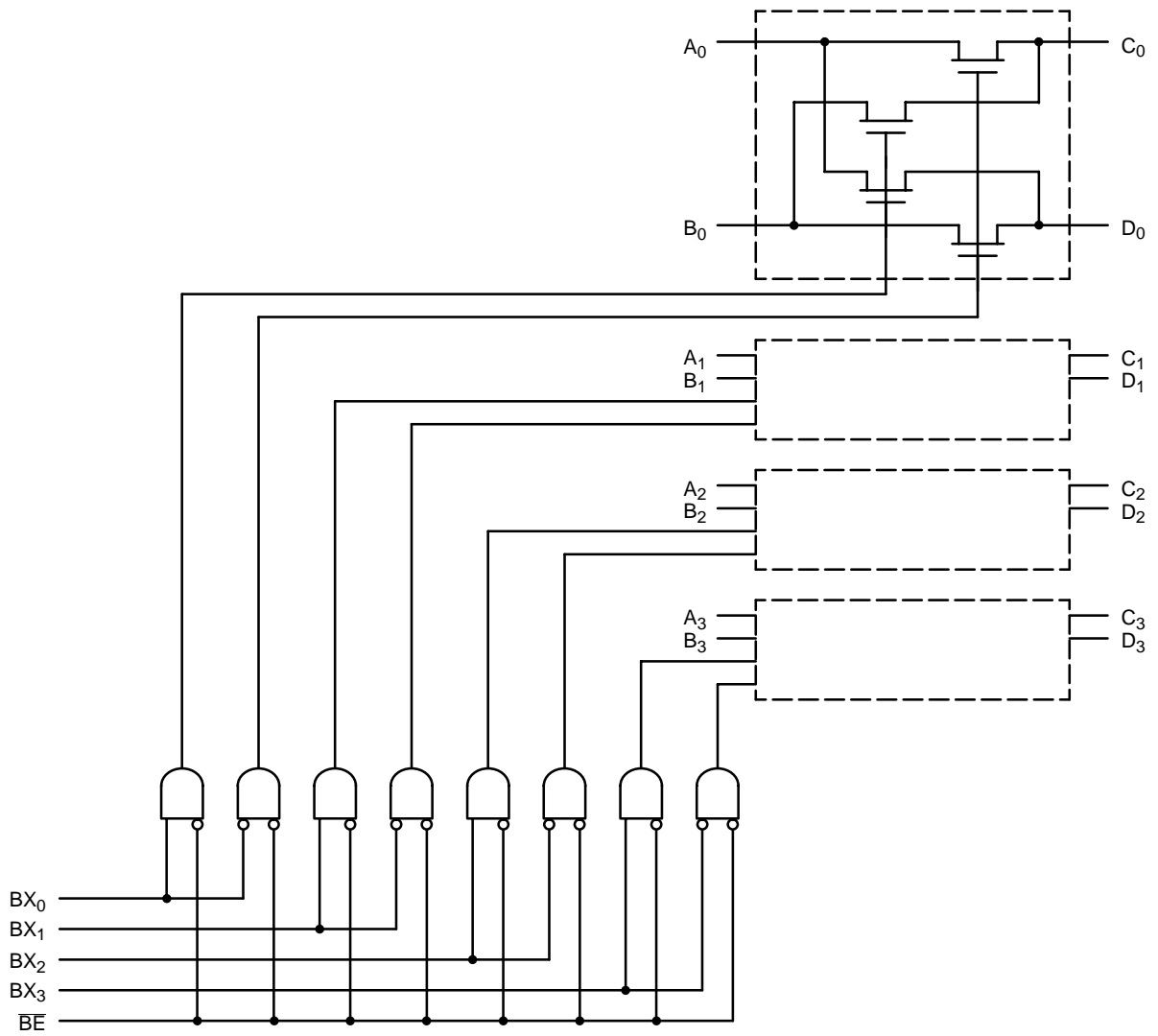


Figure 2. Logic Diagram

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## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0	V
V <sub>I</sub>	DC Input Voltage	-0.5 to +7.0	V
V <sub>O</sub>	DC Output Voltage	-0.5 to +7.0	V
I <sub>IK</sub>	DC Input Diode Current V <sub>I</sub> < GND	-50	mA
I <sub>OK</sub>	DC Output Diode Current V <sub>O</sub> < GND	-50	mA
I <sub>O</sub>	DC Output Sink Current	128	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
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C
θ <sub>JA</sub>	Thermal Resistance SOIC TSSOP QSOP	125 170 200	°C/W
MSL	Moisture Sensitivity	Level 1	
F <sub>R</sub>	Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	
V <sub>ESD</sub>	ESD Withstand Voltage Human Body Model (Note 1) Machine Model (Note 2) Charged Device Model (Note 3)	>2000 >200 N/A	V
I <sub>LATCH-UP</sub>	Latch-Up Performance Above V <sub>CC</sub> and Below GND at 85°C (Note 4)	±500	mA

Maximum 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. Functional operation should be restricted to the Recommended Operating Conditions.

1. Tested to EIA/JESD22-A114-A.
2. Tested to EIA/JESD22-A115-A.
3. Tested to JESD22-C101-A.
4. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage Operating, Data Retention Only	4.0	5.5	V
V <sub>I</sub>	Input Voltage (Note 5)	0	5.5	V
V <sub>O</sub>	Output Voltage (HIGH or LOW State)	0	5.5	V
T <sub>A</sub>	Operating Free-Air Temperature	-40	+85	°C
Δt/ΔV	Input Transition Rise or Fall Rate Switch I/O Switch Control Input V <sub>CC</sub> = 5.0 V ± 0.5 V	0	DC 5	ns/V

5. Unused control inputs may not be left open. All control inputs must be tied to a high or low logic input voltage level.

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## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = -40°C to +85°C			Unit
				Min	Typ*	Max	
V <sub>IK</sub>	Clamp Diode Resistance	I <sub>IN</sub> = -18mA	4.5			-1.2	V
V <sub>IH</sub>	High-Level Input Voltage		4.0 to 5.5	2.0			V
V <sub>IL</sub>	Low-Level Input Voltage		4.0 to 5.5			0.8	V
I <sub>I</sub>	Input Leakage Current	0 ≤ V <sub>IN</sub> ≤ 5.5 V	5.5			±1.0	μA
I <sub>OZ</sub>	OFF-STATE Leakage Current	0 ≤ A, B ≤ V <sub>CC</sub>	5.5			±1.0	μA
R <sub>ON</sub>	Switch On Resistance (Note 6)	V <sub>IN</sub> = 0 V, I <sub>IN</sub> = 64 mA	4.5		4	7	Ω
		V <sub>IN</sub> = 0 V, I <sub>IN</sub> = 30 mA	4.5		4	7	
		V <sub>IN</sub> = 2.4 V, I <sub>IN</sub> = 15 mA	4.5		8	15	
		V <sub>IN</sub> = 2.4 V, I <sub>IN</sub> = 15 mA	4.0		11	20	
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0	5.5			3	μA
ΔI <sub>CC</sub>	Increase In I <sub>CC</sub> per Input	One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND	5.5			2.5	mA

\*Typical values are at V<sub>CC</sub> = 5.0 V and T<sub>A</sub> = 25°C.

6. Measured by the voltage drop between A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A or B) pins.

## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF, R <sub>U</sub> = R <sub>D</sub> = 500 Ω				Unit
			V <sub>CC</sub> = 4.5-5.5 V		V <sub>CC</sub> = 4.0 V		
			Min	Max	Min	Max	
t <sub>PHL</sub> , t <sub>PLH</sub>	Prop Delay Bus to Bus (Note 7)	V <sub>I</sub> = OPEN		0.25		0.25	ns
	Prop Delay, BXn to An, Bn, Cn or Dn		1.0	5.3		6.0	
t <sub>PZH</sub> , t <sub>PZL</sub>	Output Enable Time, BXn to An, Bn, Cn or Dn	V <sub>I</sub> = 7 V for t <sub>PZL</sub>	1.0	5.8		6.5	ns
	Output Enable Time, I <sub>OE</sub> to An, Bn, Cn or Dn	V <sub>I</sub> = OPEN for t <sub>PZH</sub>	1.0	5.8		6.5	
t <sub>PHZ</sub> , t <sub>PLZ</sub>	Output Disable Time, BXn to An, Bn, Cn or Dn	V <sub>I</sub> = 7 V for t <sub>PLZ</sub>	1.0	5.3		6.2	ns
	Output Disable Time, I <sub>OE</sub> to An, Bn, Cn or Dn	V <sub>I</sub> = OPEN for t <sub>PHZ</sub>	1.0	5.3		6.2	

7. This parameter is guaranteed by design but is not tested. The bus switch contributes no propagation delay other than the RC delay of the typical On resistance of the switch and the 50 pF load capacitance, when driven by an ideal voltage source (zero output impedance).

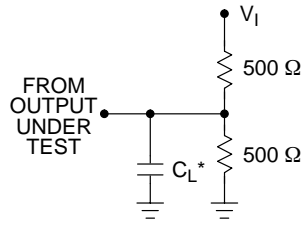
## CAPACITANCE (Note 8)

Symbol	Parameter	Conditions	Typ	Max	Unit
C <sub>IN</sub>	Control Pin Input Capacitance	V <sub>CC</sub> = 5.0 V	6		pF
C <sub>I/O</sub>	Port Input/Output Capacitance	V <sub>CC</sub> , $\overline{OE}$ = 5.0 V	13		pF

8. T<sub>A</sub> = +25°C, f = 1 MHz, Capacitance is characterized but not tested.

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## AC Loading and Waveforms



### NOTES:

1. Input driven by 50  $\Omega$  source terminated in 50  $\Omega$ .
2.  $C_L$  includes load and stray capacitance.  
\* $C_L = 50$  pF

Figure 3. AC Test Circuit

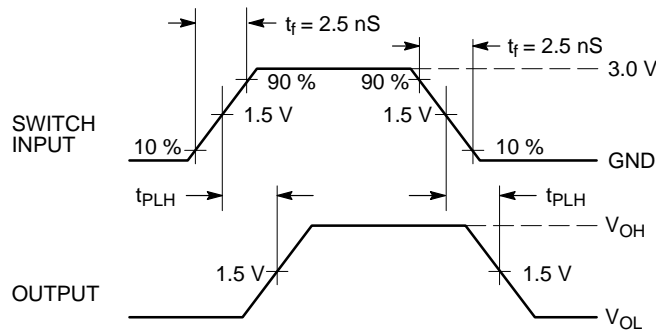


Figure 4. Propagation Delays

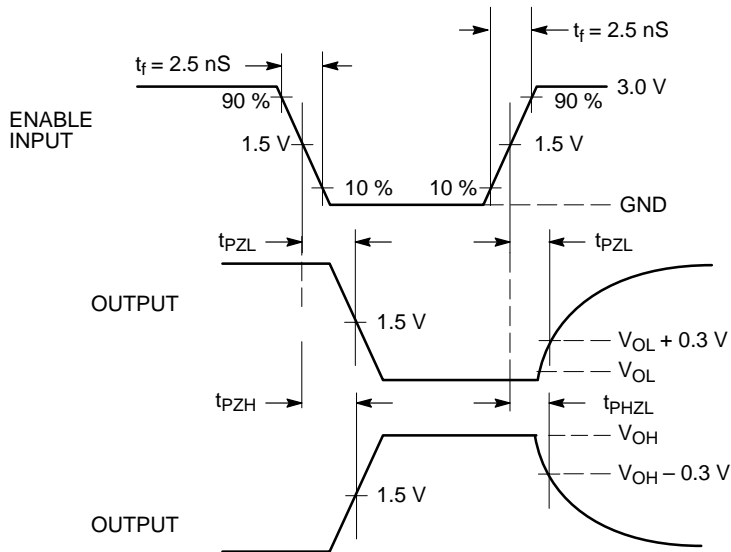
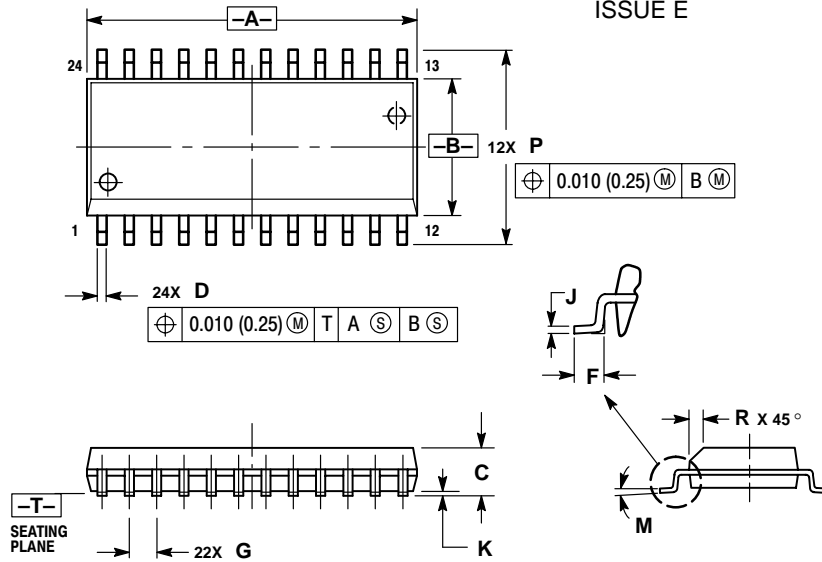


Figure 5. Enable/Disable Delays

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## PACKAGE DIMENSIONS

SO-24  
D SUFFIX  
CASE 751E-04  
ISSUE E



NOTES:

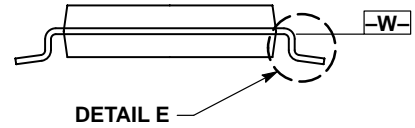
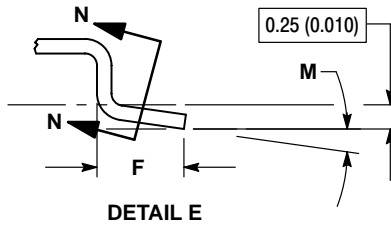
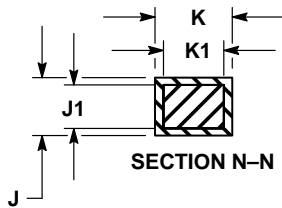
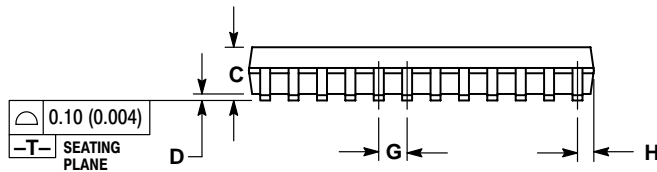
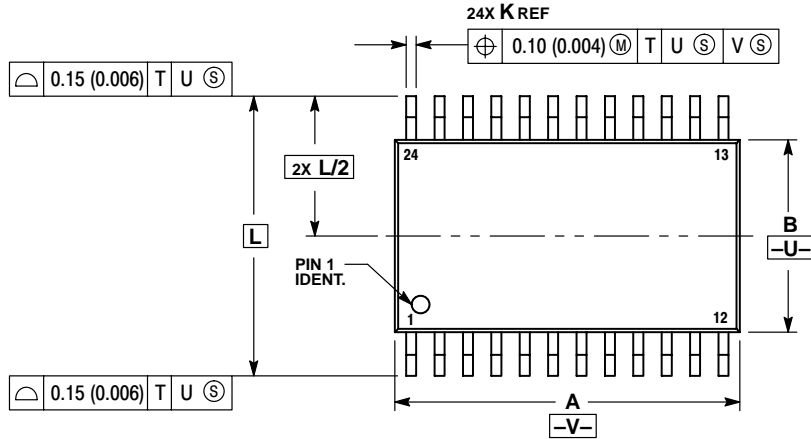
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	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

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## PACKAGE DIMENSIONS

TSSOP-24  
DT SUFFIX  
CASE 948H-01  
ISSUE A



### NOTES:

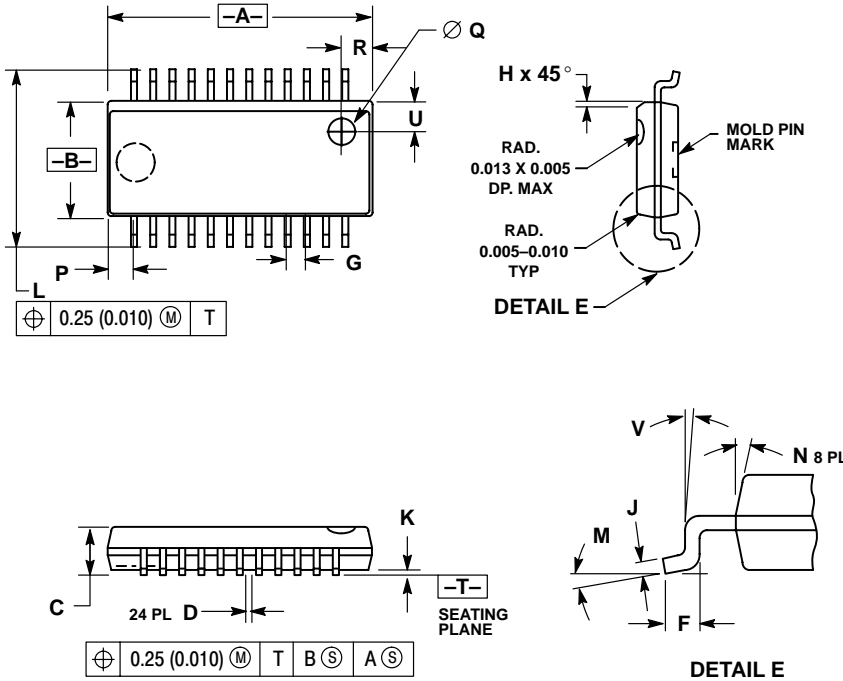
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD 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°

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## PACKAGE DIMENSIONS

QSOP-24  
 QS SUFFIX  
 CASE 492B-01  
 ISSUE O



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. THE BOTTOM PACKAGE SHALL BE BIGGER THAN THE TOP PACKAGE BY 4 MILS (NOTE: LEAD SIDE ONLY). BOTTOM PACKAGE DIMENSION SHALL FOLLOW THE DIMENSION STATED IN THIS DRAWING.
  4. PLASTIC DIMENSIONS DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 6 MILS PER SIDE.
  5. BOTTOM EJECTOR PIN WILL INCLUDE THE COUNTRY OF ORIGIN (COO) AND MOLD CAVITY I.D.

DIM	INCHES		MILLIMETERS	
	MAX	MIN	MAX	MIN
A	0.337	0.344	8.56	8.74
B	0.150	0.157	3.81	3.99
C	0.061	0.068	1.55	1.73
D	0.008	0.012	0.20	0.31
F	0.016	0.035	0.41	0.89
G	0.025 BSC		0.64 BSC	
H	0.008	0.018	0.20	0.46
J	0.0098	0.0075	0.249	0.191
K	0.004	0.010	0.10	0.25
L	0.230	0.244	5.84	6.20
M	0°	8°	0°	8°
N	0°	7°	0°	7°
P	0.027	0.037	0.69	0.94
Q	0.035 DIA		0.89 DIA	
R	0.035	0.045	0.89	1.14
U	0.035	0.045	0.89	1.14
V	0°	8°	0°	8°

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