



High Speed CMOS Bus Interface 9-Bit and 10-Bit Tranceivers

QS54/74FCT861T
QS54/74FCT862T*
QS54/74FCT863T*
QS54/74FCT864T*

QS54/74FCT2861T*
QS54/74FCT2862T*
QS54/74FCT2863T*
QS54/74FCT2864T*

FEATURES/BENEFITS

- Pin and function compatible to the 74F861/862/863/864 74FCT861/862/863/864 and 74FCT861T/862T/863T/864T
- CMOS power levels: <7.5 mW static
- Available in DIP, SOIC, QSOP, ZIP
- Undershoot clamp diodes on all inputs
- TTL-compatible input and output levels
- Ground bounce controlled outputs
- Reduced output swing of 0-3.5V
- Military product compliant to MIL-STD-883

FCT-T 861T, 862T, 863T, 864T

- JEDEC-FCT spec compatible
- Fastest CMOS logic family available
- A and B speed grades with 6 ns t_{PD} for B
- $I_{OL} = 48$ mA Com., 32 mA Mil.

FCT-T 2861T, 2862T, 2863T, 2864T

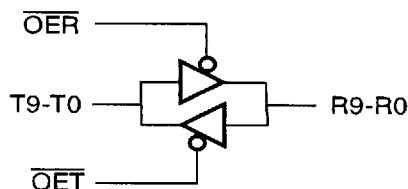
- Built-in 25Ω series resistor outputs reduce reflection and other system noise
- A and B speed grades with 6 ns t_{PD} for B
- $I_{OL} = 12$ mA

DESCRIPTION

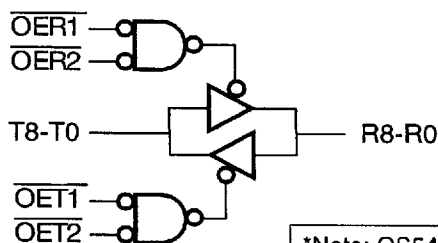
The QSFCT861/2/3/4T and QSFCT2861/2/3/4T are 9-bit and 10-bit inverting and non-inverting bus transceivers. Separate enables for each bus control the direction of data flow. The 2861/2/3/4A/B are 25Ω resistor output versions useful for driving transmission lines and reducing system noise. The 2861 parts can replace the 861 series to reduce noise in an existing design. All inputs have clamp diode for undershoot noise suppression. All outputs have ground bounce suppression (see QSI Application Note AN-001), and outputs will not load an active bus when V_{CC} is removed from the device.

FUNCTIONAL BLOCK DIAGRAMS

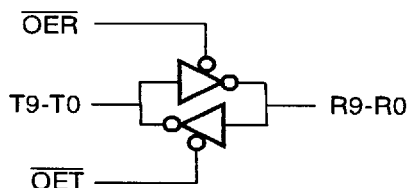
FCT861 — 10-Bit



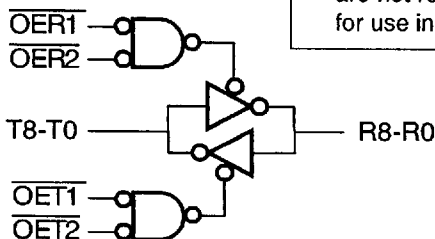
FCT863 — 9-Bit



FCT862 — 10-Bit



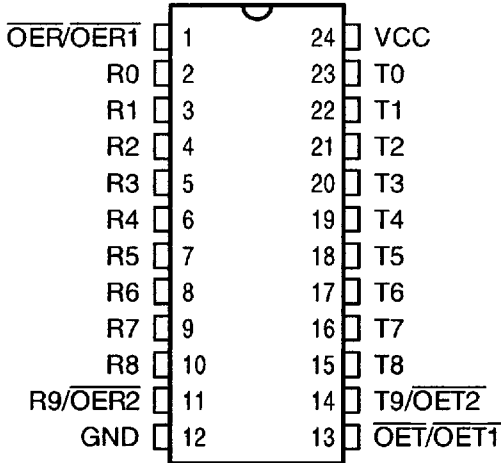
FCT864 — 9-Bit



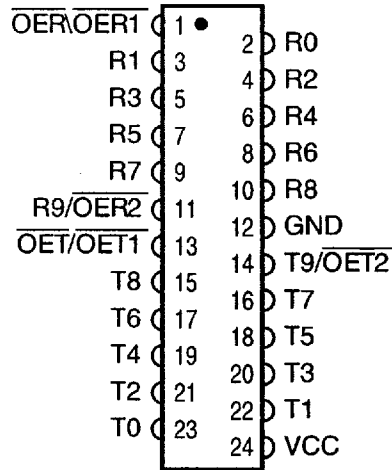
*Note: QS54/74FCT862T, 863T, 864T, 2861T, 2862T, 2863T, 2864T are not recommended for use in new designs

PIN CONFIGURATIONS (All Pins Top View)

PDIP, SOIC, QSOP



ZIP



PIN DESCRIPTION

| Name | I/O | Description |
|----------------------------------|-----|-------------|
| Ti | I/O | T Bus |
| Ri | I/O | R Bus |
| $\overline{OER}, \overline{OET}$ | I | R, T Enable |

FUNCTION TABLE

| Enables | | 861, 863 | | 862, 864 | | Function |
|------------------|------------------|----------|------|----------|------|---------------|
| \overline{OER} | \overline{OET} | Ti | Ri | Ti | Ri | |
| H | H | Hi-Z | Hi-Z | Hi-Z | Hi-Z | Disable, Hi-Z |
| L | H | L | L | L | H | T → R |
| L | H | H | H | H | L | T → R |
| H | L | L | L | H | L | R → T |
| H | L | H | H | L | H | R → T |

ABSOLUTE MAXIMUM RATINGS

| | |
|---|----------------|
| Supply Voltage to Ground | -0.5V to +7.0V |
| DC Output Voltage V_{OUT} | -0.5V to +7.0V |
| DC Input Voltage V_{IN} | -0.5V to +7.0V |
| AC Input Voltage (for a pulse width ≤ 20 ns) | -3.0V |
| DC Input Diode Current with $V_{IN} < 0$ | -20 mA |
| DC Output Diode Current with $V_{OUT} < 0$ | -50 mA |
| DC Output Current Max. Sink Current/Pin | 120 mA |
| Maximum Power Dissipation | 0.5 watts |
| T_{STG} Storage Temperature | -65° to +150°C |

Note: Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to QSI devices that result in functional or reliability type failures.

CAPACITANCE

$T_A = 25^\circ\text{C}$, $f = 1$ MHz, $V_{IN} = 0\text{V}$, $V_{OUT} = 0\text{V}$

| Pins | SOIC | QSOP | PDIP | ZIP | Unit |
|-------------|------|------|------|-----|------|
| — | 4 | 4 | 5 | 7 | pF |
| — | 6 | 6 | 7 | 9 | pF |
| 1-11, 13-23 | 8 | 8 | 9 | 10 | pF |

Note: Capacitance is characterized but not tested.

POWER SUPPLY CHARACTERISTICS

| Symbol | Parameter | Test Conditions ⁽¹⁾ | Min | Max | Unit |
|-----------------|-------------------------------------|--|-----|------|--------|
| I_{CC} | Quiescent Power Supply Current | $V_{CC} = \text{Max.}$, freq = 0 $0\text{V} \leq V_{IN} \leq 0.2\text{V}$ or $V_{CC}-0.2\text{V} \leq V_{IN} \leq V_{CC}$ | — | 1.5 | mA |
| ΔI_{CC} | Supply Current per Input @ TTL HIGH | $V_{CC} = \text{Max.}$, $V_{IN} = 3.4\text{V}$, freq = 0 ⁽²⁾ | — | 2.0 | mA |
| Q_{CCD} | Supply Current per Input per MHz | $V_{CC} = \text{Max.}$, Outputs open and enabled One bit toggling @ 50% duty cycle Other inputs at GND or V_{CC} ^(3,4) | — | 0.25 | mA/MHz |

Notes:

1. For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
2. Per TTL driven input ($V_{IN} = 3.4\text{V}$).
3. For flip-flops, Q_{CCD} is measured by switching one of the data input pins so that the output changes every clock cycle. This is a measurement of device power consumption only and does not include power to drive load capacitance or tester capacitance. This parameter is guaranteed by design but not tested.
4. I_C can be computed using the above parameters as explained in the Technical Overview section.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Commercial $T_A = 0^\circ\text{C}$ to 70°C , $V_{CC} = 5.0\text{V} \pm 5\%$

Military $T_A = -55^\circ\text{C}$ to 125°C , $V_{CC} = 5.0\text{V} \pm 10\%$

| Symbol | Parameter | Test Conditions | Min | Typ ⁽¹⁾ | Max | Unit |
|--------------------------|---|--|------------|--------------------|--------------|---------------|
| V_{IH} | Input HIGH Voltage | Logic HIGH for All Inputs | 2.0 | — | — | V |
| V_{IL} | Input LOW Voltage | Logic LOW for All Inputs | — | — | 0.8 | V |
| ΔV_T | Input Hysteresis | $V_{TLH} - V_{THL}$ for All Inputs | — | 0.2 | — | V |
| $ I_{IH} $ $ I_{IL} $ | Input Current Input HIGH or LOW | $V_{CC} = \text{Max.}, 0 \leq V_{IN} < V_{CC}$ | — | — | 5 | μA |
| $ I_{OZ} $ | Off-State Output Current (Hi-Z) | $V_{CC} = \text{Max.}, 0 \leq V_{IN} \leq V_{CC}$ | — | — | 5 | μA |
| I_{OS} | Short Circuit Current (FCTXXX) | $V_{CC} = \text{Max.}, V_{OUT} = \text{GND}^{(2,3)}$ | -60 | — | — | mA |
| I_{OR} | Current Drive (FCT2XXX - 25 Ω) | $V_{CC} = \text{Min.}, V_{OUT} = 2.0\text{V}^{(3)}$ | 50 | — | — | mA |
| V_{IC} | Input Clamp Voltage | $V_{CC} = \text{Min.}, I_{IN} = -18 \text{ mA}, T_A = 25^\circ\text{C}^{(3)}$ | — | -0.7 | -1.2 | V |
| V_{OH} | Output HIGH Voltage | $V_{CC} = \text{Min.}$ $I_{OH} = -12 \text{ mA (MIL)}$ $I_{OH} = -15 \text{ mA (COM)}$ | 2.4 2.4 | — — | — — | V |
| V_{OL} | Output LOW Voltage (FCTXXX) | $V_{CC} = \text{Min.}$ $I_{OL} = 32 \text{ mA (MIL)}$ $I_{OL} = 48 \text{ mA (COM)}$ | — — | — — | 0.50 0.50 | V |
| V_{OL} | Output LOW Voltage (FCT2XXX - 25 Ω) | $V_{CC} = \text{Min.}$ $I_{OL} = 12 \text{ mA (MIL)}$ $I_{OL} = 12 \text{ mA (COM)}$ | — — | — — | 0.50 0.50 | V |
| R_{OUT} | Output Resistance (FCT2XXX - 25 Ω) | $V_{CC} = \text{Min.}$ $I_{OL} = 12 \text{ mA (MIL)}$ $I_{OL} = 12 \text{ mA (COM)}$ | — 20 | 25 28 | — 40 | Ω |

Notes:

1. Typical values indicate $V_{CC} = 5.0\text{V}$ and $T_A = 25^\circ\text{C}$.
2. Not more than one output should be shorted and the duration is ≤ 1 second.
3. These parameters are guaranteed by design but not tested.

QSFACT861T, 862T, 863T, 864T, 2861T, 2862T 2863T, 2864T

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Commercial TA = 0°C to 70°C, Vcc = 5.0V ± 5%

Military TA = -55°C to 125°C, Vcc = 5.0V ± 10%

CLOAD = 50 pF, RLOAD = 500Ω unless otherwise noted.

| Symbol | Description | | 861A, 2861A 861A, 2861A 863A, 2863A 864A, 2864A | | 861B, 2861B 861B, 2861B 863B, 2863B 864B, 2864B | | Unit |
|--------|--|----------------------|--|-----|--|-----|------|
| | | | Min | Max | Min | Max | |
| tPHL | Propagation Delay | COM | | 8 | | 6 | ns |
| tPLH | Ti to/from Ri, 861/863 | MIL | | 9 | | 6.5 | |
| tPHL | Propagation Delay | COM ^(1,2) | | 15 | | 13 | ns |
| tPLH | Ti to/from Ri, 861/863 | MIL ^(1,2) | | 17 | | 14 | |
| tPHL | Propagation Delay | COM | | 8 | | 6 | ns |
| tPLH | Ti to/from Ri, 2861/2863 | MIL | | 9 | | 6.5 | |
| tPHL | Propagation Delay | COM ^(1,2) | | 17 | | — | ns |
| tPLH | Ti to/from Ri, 2861/2863 | MIL ^(1,2) | | 18 | | — | |
| tPHL | Propagation Delay | COM | | 7.5 | | 5.5 | n |
| tPLH | Ti to/from Ri, 862/864 | MIL | | 9 | | 6.5 | |
| tPHL | Propagation Delay | COM ^(1,2) | | 14 | | 13 | ns |
| tPLH | Ti to/from Ri, 862/864 | MIL ^(1,2) | | 16 | | 14 | |
| tPHL | Propagation Delay | COM | | 9 | | 5.5 | n |
| tPLH | Ti to/from Ri, 2862/2864 | MIL | | 10 | | 6.5 | |
| tPHL | Propagation Delay | COM ^(1,2) | | 17 | | — | ns |
| tPLH | Ti to/from Ri, 2862/2864 | MIL ^(1,2) | | 18 | | — | |
| tPZH | Output Enable Time | COM | | 11 | | 8 | ns |
| tPZL | \overline{OE} to Ti or Ri, 861/2/3/4 | MIL | | 13 | | 9 | |
| tPZH | Output Enable Time | COM ^(1,2) | | 10 | | 15 | ns |
| tPZL | \overline{OE} to Ti or Ri, 861/2/3/4 | MIL ^(1,2) | | 11 | | 16 | |
| tPZH | Output Enable Time | COM | | 11 | | 8 | n |
| tPZL | \overline{OE} to Ti or Ri, 861/2/3/4 | MIL | | 13 | | 9 | |
| tPZH | Output Enable Time | COM ^(1,2) | | 10 | | — | ns |
| tPZL | \overline{OE} to Ti or Ri, 861/2/3/4 | MIL ^(1,2) | | 11 | | — | |
| tPHZ | Output Disable Time | COM ^(1,3) | | 9 | | 6 | ns |
| tPLZ | \overline{OE} to Ti or Ri | MIL ^(1,3) | | 9 | | 7 | |
| tPHZ | Output Disable Time | COM ⁽¹⁾ | | 10 | | 7 | ns |
| tPLZ | \overline{OE} to Ti or Ri | MIL ⁽¹⁾ | | 10 | | 8 | |

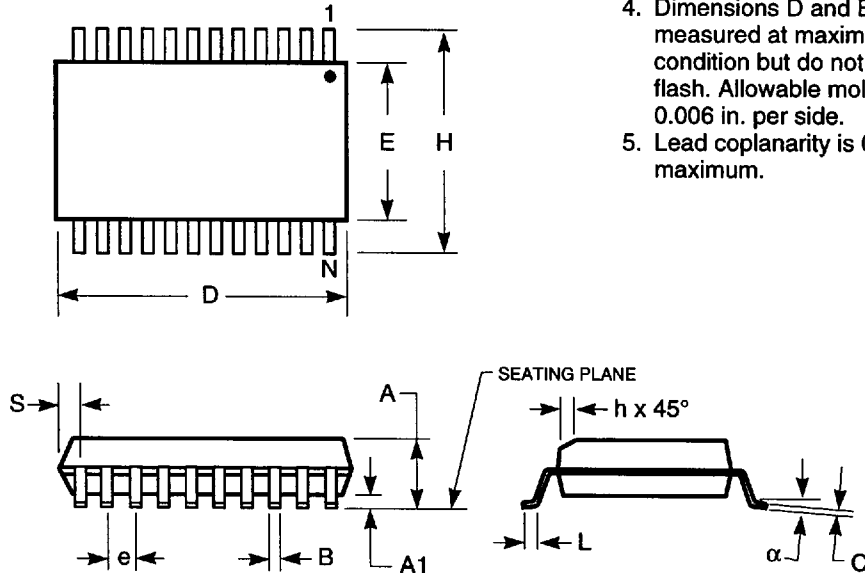
Notes:

1. These parameters are guaranteed by design but not tested in final production.
2. CLOAD = 300 pF.
3. CLOAD = 5 pF.

PACKAGING INFORMATION

150-MIL QSOP - Package Code Q

Quarter-Size Outline Package
Plastic Small Outline Gull-Wing



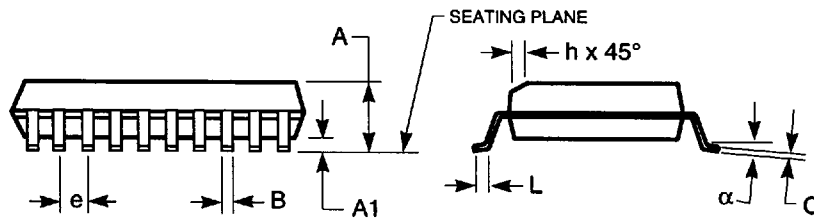
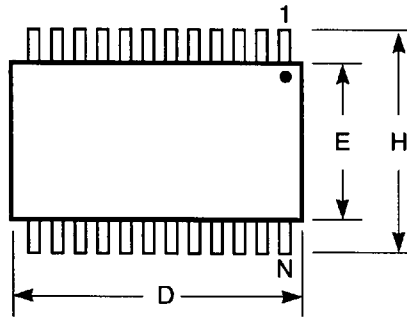
Notes:

1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006 in. per side.
5. Lead coplanarity is 0.004 in. maximum.

| JEDEC# | MO-137AB | | | MO-137AD | | | MO-137AE | | | MO-137AF | | |
|--------|-----------|-------|-------|-----------|-------|-------|-----------|-------|-------|-----------|-------|-------|
| DWG# | PSS-16A | | | PSS-20A | | | PSS-24A | | | PSS-28A | | |
| Symbol | Min | Nom | Max | Min | Nom | Max | Min | Nom | Max | Min | Nom | Max |
| A | 0.060 | 0.064 | 0.068 | 0.060 | 0.064 | 0.068 | 0.060 | 0.064 | 0.068 | 0.060 | 0.064 | 0.068 |
| A1 | 0.004 | 0.006 | 0.008 | 0.004 | 0.006 | 0.008 | 0.004 | 0.006 | 0.008 | 0.004 | 0.006 | 0.008 |
| B | 0.009 | 0.010 | 0.012 | 0.009 | 0.010 | 0.012 | 0.009 | 0.010 | 0.012 | 0.009 | 0.010 | 0.012 |
| C | 0.007 | 0.008 | 0.010 | 0.007 | 0.008 | 0.010 | 0.007 | 0.008 | 0.010 | 0.007 | 0.008 | 0.010 |
| D | 0.189 | 0.193 | 0.197 | 0.337 | 0.341 | 0.344 | 0.337 | 0.341 | 0.344 | 0.386 | 0.390 | 0.394 |
| E | 0.150 | 0.154 | 0.157 | 0.150 | 0.154 | 0.157 | 0.150 | 0.154 | 0.157 | 0.150 | 0.154 | 0.157 |
| e | 0.025 BSC | | | 0.025 BSC | | | 0.025 BSC | | | 0.025 BSC | | |
| H | 0.230 | 0.236 | 0.244 | 0.230 | 0.236 | 0.244 | 0.230 | 0.236 | 0.244 | 0.230 | 0.236 | 0.244 |
| h | 0.010 | 0.013 | 0.016 | 0.010 | 0.013 | 0.016 | 0.010 | 0.013 | 0.016 | 0.010 | 0.013 | 0.016 |
| L | 0.016 | 0.025 | 0.035 | 0.016 | 0.025 | 0.035 | 0.016 | 0.025 | 0.035 | 0.016 | 0.025 | 0.035 |
| N | 16 | | | 20 | | | 24 | | | 28 | | |
| α | 0° | 5° | 8° | 0° | 5° | 8° | 0° | 5° | 8° | 0° | 5° | 8° |
| S | 0.006 | 0.009 | 0.010 | 0.056 | 0.058 | 0.060 | 0.031 | 0.033 | 0.035 | 0.031 | 0.033 | 0.035 |

PACKAGING INFORMATION

300-MIL SOIC - Package Code SO Plastic Small Outline Gull-Wing



Notes:

1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006 in. per side.
5. Lead coplanarity is 0.004 in. maximum.

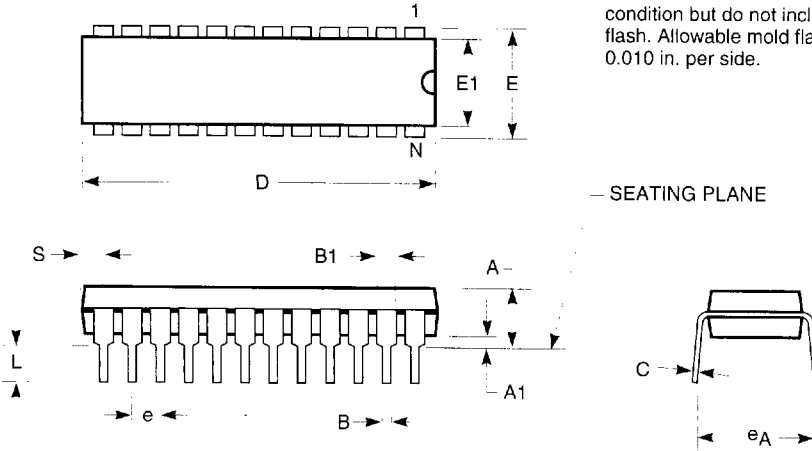
| JEDEC# | MS-013AA | | MS-013AC | | MS-013AD | | MS-013AE | |
|----------|----------|-------|----------|-------|----------|-------|----------|-------|
| DWG# | PS16A | | PS20A | | PS24A | | PS28A | |
| Symbol | Min | Max | Min | Max | Min | Max | Min | Max |
| A | 0.096 | 0.104 | 0.096 | 0.104 | 0.096 | 0.104 | 0.096 | 0.104 |
| A1 | 0.005 | 0.011 | 0.005 | 0.011 | 0.005 | 0.011 | 0.005 | 0.011 |
| B | 0.014 | 0.019 | 0.014 | 0.019 | 0.014 | 0.019 | 0.014 | 0.019 |
| C | 0.009 | 0.012 | 0.009 | 0.012 | 0.009 | 0.012 | 0.009 | 0.012 |
| D | 0.402 | 0.412 | 0.500 | 0.510 | 0.602 | 0.612 | 0.701 | 0.711 |
| E | 0.292 | 0.299 | 0.292 | 0.299 | 0.292 | 0.299 | 0.292 | 0.299 |
| e | 0.044 | 0.056 | 0.044 | 0.056 | 0.044 | 0.056 | 0.044 | 0.056 |
| H | 0.396 | 0.416 | 0.396 | 0.416 | 0.396 | 0.416 | 0.396 | 0.416 |
| h | 0.010 | 0.016 | 0.010 | 0.016 | 0.010 | 0.016 | 0.010 | 0.016 |
| L | 0.020 | 0.040 | 0.020 | 0.040 | 0.020 | 0.040 | 0.020 | 0.040 |
| N | 16 | | 20 | | 24 | | 28 | |
| α | 0° | 8° | 0° | 8° | 0° | 8° | 0° | 8° |

PACKAGING INFORMATION

300-MIL PDIP - Package Code P Plastic Dual In-line Package

Notes:

1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.010 in. per side.



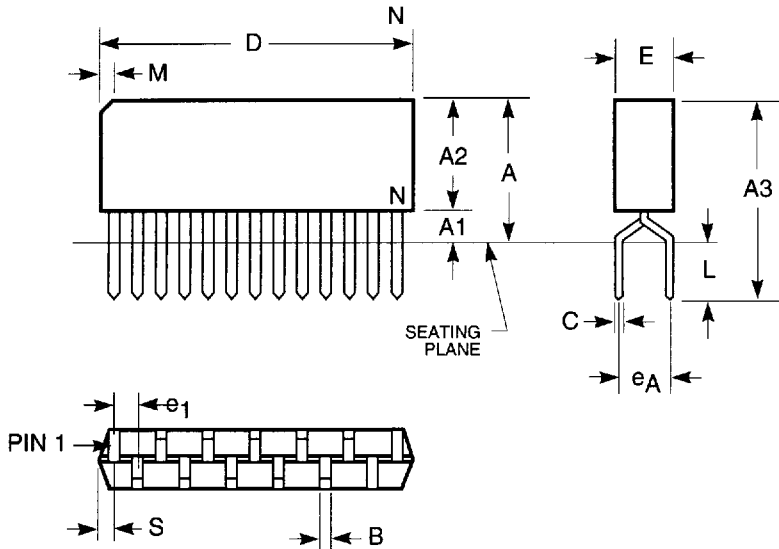
| JEDEC# | MS-001AC | | MS001AA | | MS-001AE | | N/A | | MS-001AF | | MO-095AH | |
|----------------|----------|-------|---------|-------|----------|-------|-------|-------|----------|-------|----------|-------|
| DWG# | PD14A | | PD16A | | PD20A | | PT22B | | PT24A | | PT28A | |
| Symbol | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| A | 0.130 | 0.170 | 0.130 | 0.170 | 0.130 | 0.170 | 0.130 | 0.170 | 0.130 | 0.170 | 0.130 | 0.180 |
| A1 | 0.015 | 0.040 | 0.015 | 0.040 | 0.015 | 0.040 | 0.015 | 0.040 | 0.015 | 0.040 | 0.015 | 0.040 |
| B | 0.016 | 0.020 | 0.016 | 0.020 | 0.016 | 0.020 | 0.016 | 0.020 | 0.016 | 0.020 | 0.016 | 0.020 |
| B1 | 0.045 | 0.070 | 0.045 | 0.070 | 0.045 | 0.070 | 0.045 | 0.070 | 0.045 | 0.070 | 0.045 | 0.060 |
| C | 0.009 | 0.012 | 0.009 | 0.012 | 0.009 | 0.012 | 0.009 | 0.012 | 0.009 | 0.012 | 0.009 | 0.012 |
| D | 0.745 | 0.765 | 0.745 | 0.765 | 1.020 | 1.040 | 1.020 | 1.040 | 1.150 | 1.260 | 1.345 | 1.385 |
| E | 0.300 | 0.325 | 0.300 | 0.325 | 0.300 | 0.325 | 0.300 | 0.325 | 0.300 | 0.325 | 0.300 | 0.325 |
| E1 | 0.240 | 0.270 | 0.240 | 0.270 | 0.240 | 0.270 | 0.240 | 0.270 | 0.250 | 0.280 | 0.275 | 0.295 |
| e | 0.090 | 0.110 | 0.090 | 0.110 | 0.090 | 0.110 | 0.090 | 0.110 | 0.090 | 0.110 | 0.090 | 0.110 |
| e _A | 0.310 | 0.380 | 0.310 | 0.380 | 0.310 | 0.380 | 0.310 | 0.380 | 0.310 | 0.380 | 0.310 | 0.380 |
| L | 0.120 | 0.140 | 0.120 | 0.140 | 0.120 | 0.140 | 0.120 | 0.140 | 0.120 | 0.140 | 0.120 | 0.140 |
| S | 0.070 | 0.080 | 0.020 | 0.035 | 0.060 | 0.070 | 0.010 | 0.020 | 0.025 | 0.080 | 0.020 | 0.040 |
| N | 14 | | 16 | | 20 | | 22 | | 24 | | 28 | |

7466803 0003416 711

PACKAGING INFORMATION

300-MIL ZIP - Package Code Z

Zig-zag In-line Packages



| JEDEC# | MO-072AB | | MO-072AC | | MO-072AD | |
|--------|-----------|-------|-----------|-------|-----------|-------|
| DWG# | PZ20A | | PZ24A | | PZ28A | |
| Symbol | Min | Max | Min | Max | Min | Max |
| A | 0.350 | 0.400 | 0.350 | 0.400 | 0.350 | 0.400 |
| A1 | 0.030 | 0.070 | 0.030 | 0.070 | 0.032 | 0.055 |
| A2 | 0.280 | 0.340 | 0.320 | 0.350 | 0.335 | 0.345 |
| A3 | 0.450 | 0.550 | 0.450 | 0.550 | 0.460 | 0.550 |
| B | 0.015 | 0.024 | 0.015 | 0.024 | 0.015 | 0.024 |
| C | 0.008 | 0.012 | 0.008 | 0.012 | 0.008 | 0.012 |
| D | 1.008 | 1.030 | 1.200 | 1.250 | 1.409 | 1.424 |
| E | 0.100 | 0.120 | 0.100 | 0.120 | 0.110 | 0.120 |
| e1 | 0.050 BSC | | 0.050 BSC | | 0.050 BSC | |
| eA | 0.100 BSC | | 0.100 BSC | | 0.100 BSC | |
| L | 0.100 | 0.150 | 0.100 | 0.150 | 0.110 | 0.150 |
| M | 0.035 | 0.085 | 0.035 | 0.085 | 0.035 | 0.085 |
| N | 20 | | 24 | | 28 | |
| S | 0.018 | 0.032 | 0.018 | 0.032 | 0.025 | 0.038 |

Notes:

1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.010 in. per side.

7466803 0003427 5T7