

FSA2257

Low R_{ON} Low Voltage Dual SPDT Bi-Directional Analog Switch

General Description

The FSA2257 is a high performance bi-directional dual Single Pole Double Throw (SPDT) analog switch. This switch can be configured as either a multiplexer or a demultiplexer by select pins. The device features ultra low R_{ON} of 1.3Ω maximum at 4.5V V_{CC} and will operate over the wide V_{CC} range of 1.65V to 5.5V. The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation. The select input is TTL level compatible.

Features

- Maximum 1.15Ω ON Resistance (R_{ON}) for 4.5V supply
- 0.3Ω max R_{ON} flatness for +5V supply
- Space saving Pb-Free MicroPak™ packaging
- Broad V_{CC} operating range: 1.65V to 5.5V
- Fast turn-on and turn-off time
- Break-before-make enable circuitry
- Over-voltage tolerant TTL compatible control input

Applications

- Cell Phone
- PDA
- Ultra-Portable

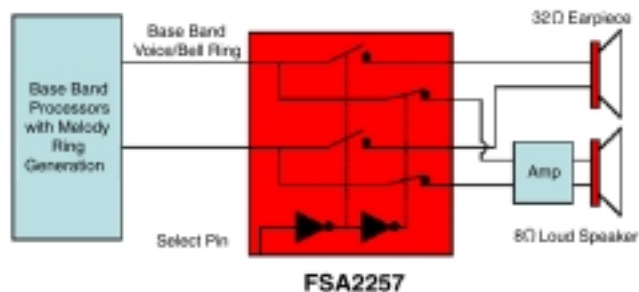
Ordering Code:

| Order Number | Package Number | Product Code Top Mark | Package Description | Supplied As |
|----------------------------|----------------|-----------------------|---|-----------------------------|
| FSA2257L10X | MAC010A | EP | Pb-Free 10-Lead MicroPak, 1.6 mm x 2.1mm | 5K Units on Tape and Reel |
| FSA2257MTCX | MTC14 | FSA2257 | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide | 2500 Units on Tape and Reel |
| FSA2257MTCX_NL (Note 1) | MTC14 | FSA2257 | Pb-Free 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide | 2500 Units on Tape and Reel |

Pb-Free package per JEDEC J-STD-020B.

Note 1: "_NL" indicates Pb-Free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

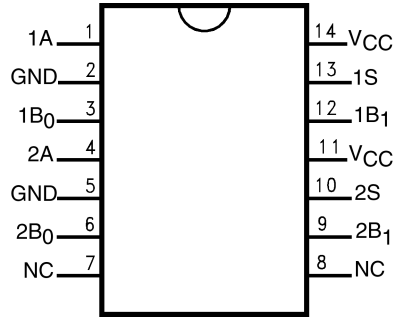
Block Diagram



MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

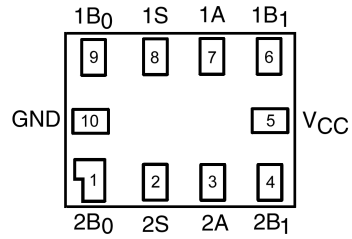
Connection Diagrams

Pin Assignments for TSSOP



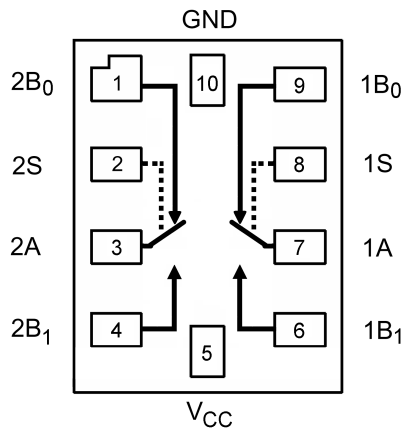
(Top View)

Pad Assignments for MicroPak



(Top View)

Analog Symbols



(Top Through View)

Truth Table

| Control Input(s) | Function |
|------------------|-------------------------------|
| L | B ₀ Connected to A |
| H | B ₁ Connected to A |

H = HIGH Logic Level
L = LOW Logic Level

Pin Descriptions

| Pin Names | Function |
|------------------------------------|---------------|
| A, B ₀ , B ₁ | Data Ports |
| S | Control Input |

| Absolute Maximum Ratings ^(Note 2) | | Recommended Operating Conditions | |
|---|--------------------------|---|----------------|
| Supply Voltage (V_{CC}) | -0.5V to +6.0V | Supply Voltage (V_{CC}) | 1.65V to 5.5V |
| Switch Voltage (V_S) (Note 3) | -0.5V to $V_{CC} + 0.5V$ | Control Input Voltage (V_{IN}) (Note 4) | 0V to V_{CC} |
| Input Voltage (V_{IN}) (Note 3) | -0.5V to +6.0V | Switch Input Voltage (V_{IN}) | 0V to V_{CC} |
| Input Diode Current | -50 mA | Operating Temperature (T_A) | -40°C to +85°C |
| Switch Current | 200 mA | | |
| Peak Switch Current (Pulsed at 1 ms duration, <10% Duty Cycle) | 400 mA | | |
| Storage Temperature Range (T_{STG}) | -65°C to +150°C | | |
| Maximum Junction Temperature (T_J) | +150°C | | |
| Lead Temperature (T_L) | | | |
| Soldering, 10 seconds | +260°C | | |
| ESD | | | |
| Human Body Model | 8000V | | |

Note 2: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 3: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

Note 4: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics (All typical values are @ 25°C unless otherwise specified)

| Symbol | Parameter | V_{CC} (V) | $T_A = +25^\circ\text{C}$ | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | Units | Conditions |
|----------------------------|---|-----------------|---------------------------|------|-------|---|---------------|---|---|
| | | | Min | Typ | Max | Min | Max | | |
| V_{IH} | Input Voltage High | 2.7 to 3.6 | | | | 2.0 | V | | |
| | | 4.5 to 5.5 | | | | 2.4 | | | |
| V_{IL} | Input Voltage Low | 2.7 to 3.6 | | | | 0.6 | V | | |
| | | 4.5 to 5.5 | | | | 0.8 | | | |
| I_{IN} | Control Input Leakage | 2.7 to 3.6 | | | | -1.0 | μA | $V_{IN} = 0V \text{ to } V_{CC}$ | |
| | | 4.5 to 5.5 | | | | -1.0 | | | |
| $I_{NO(OFF)}, I_{NC(OFF)}$ | OFF-Leakage Current of Port B ₀ and B ₁ | 5.5 | -2.0 | 2.0 | -20.0 | 20.0 | nA | A = 1V, 4.5V B ₀ or B ₁ = 1V, 4.5V | |
| $I_{A(ON)}$ | ON Leakage Current of Port A | 5.5 | -4.0 | 4.0 | -40.0 | 40.0 | nA | A = 1V, 4.5V B ₀ or B ₁ = 1V, 4.5V or Floating | |
| R_{ON} | Switch ON Resistance | 2.7 | | 2.6 | 4.0 | | 4.3 | Ω | $I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 1.5V$ |
| | MicroPak (Note 5) | 4.5 | | 0.95 | 1.15 | | 1.3 | | $I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 3.5V$ |
| | Switch ON Resistance | 2.7 | | 2.8 | | | 4.5 | | $I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 1.5V$ |
| | TSSOP (Note 5) | 4.5 | | 1.5 | | | 3.0 | | $I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 3.5V$ |
| ΔR_{ON} | ON Resistance Matching Between Channels (Note 6) MicroPak | 4.5 | | 0.06 | 0.12 | | 0.15 | Ω | $I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 3.5V$ |
| | ON Resistance Matching Between Channels (Note 6) TSSOP | 4.5 | | 0.7 | | | 0.3 | | $I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 3.5V$ |
| $R_{FLAT(ON)}$ | ON Resistance Flatness (Note 7) | 2.7 | | 1.4 | | | | Ω | $I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 0V, 0.75V, 1.5V$ |
| | | 4.5 | | 0.2 | 0.3 | | 0.4 | | $I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 0V, 1V, 2V$ |
| I_{CC} | Quiescent Supply Current | 3.6 | | 0.1 | 0.5 | | 1.0 | μA | $V_{IN} = 0V \text{ or } V_{CC}, I_{OUT} = 0V$ |
| | | 5.5 | | 0.1 | 0.5 | | 1.0 | | |

Note 5: ON Resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.

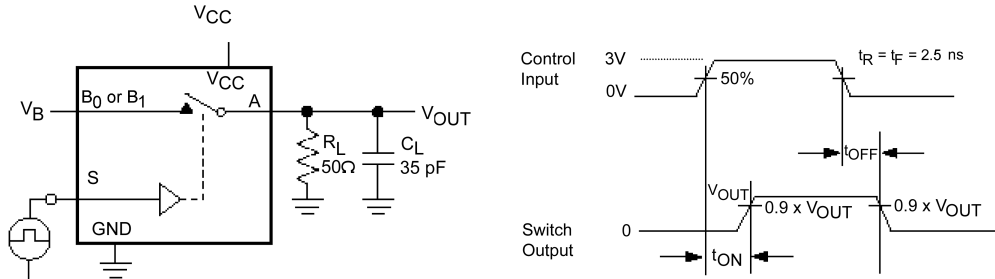
Note 6: $\Delta R_{ON} = R_{ONmax} - R_{ONmin}$ measured at identical V_{CC} , temperature, and voltage.

Note 7: Flatness is defined as the difference between the maximum and minimum value of ON Resistance over the specified range of conditions.

| AC Electrical Characteristics (All typical value are @ 25°C unless otherwise specified) | | | | | | | | | | |
|---|---------------------------|------------------------|------------------------|-------|-----|---------------------------------|-----|---|------------|---------------|
| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | T _A = -40°C to +85°C | | Units | Conditions | Figure Number |
| | | | Min | Typ | Max | Min | Max | | | |
| t _{ON} | Turn ON Time | 2.7 to 3.6 | | 50.0 | | 60.0 | ns | B ₀ or B ₁ = 1.5V, R _L = 50Ω, C _L = 35 pF | Figure 1 | |
| | | 4.5 to 5.5 | | 35.0 | | 40.0 | | B ₀ or B ₁ = 3.0V, R _L = 50Ω, C _L = 35 pF | | |
| t _{OFF} | Turn OFF Time | 2.7 to 3.6 | | 20.0 | | 30.0 | ns | B ₀ or B ₁ = 1.5V, R _L = 50Ω, C _L = 35 pF | Figure 1 | |
| | | 4.5 to 5.5 | | 15.0 | | 20.0 | | B ₀ or B ₁ = 3.0V, R _L = 50Ω, C _L = 35 pF | | |
| t _{B-M} | Break-Before-Make Time | 2.7 to 3.6 | | | 1.0 | | ns | B ₀ or B ₁ = 1.5V, R _L = 50Ω, C _L = 35 pF | Figure 2 | |
| | | 4.5 to 5.5 | 20.0 | | 1.0 | | | B ₀ or B ₁ = 3.0V, R _L = 50Ω, C _L = 35 pF | | |
| Q | Charge Injection | 2.7 to 3.6 | | 20.0 | | | pC | C _L = 1.0 nF, V _{GEN} = 0V, R _{GEN} = 0Ω | Figure 4 | |
| | | 4.5 to 5.5 | | 10.0 | | | | | | |
| OIRR | OFF-Isolation | 2.7 to 3.6 | | -70.0 | | | dB | f = 1MHz, R _L = 50Ω | Figure 3 | |
| | | 4.5 to 5.5 | | -70.0 | | | | | | |
| Xtalk | Crosstalk | 2.7 to 3.6 | | -75.0 | | | dB | f = 1MHz, R _L = 50Ω | Figure 3 | |
| | | 4.5 to 5.5 | | -75.0 | | | | | | |
| BW | -3db Bandwidth | 2.7 to 3.6 | | 350 | | | MHz | R _L = 50Ω | Figure 6 | |
| | | 4.5 to 5.5 | | 350 | | | | | | |
| THD | Total Harmonic Distortion | 2.7 to 3.6 | | 0.002 | | | % | R _L = 600Ω, V _{IN} = 0.5V P.P, f = 20Hz to 20kHz | Figure 7 | |
| | | 4.5 to 5.5 | | 0.002 | | | | | | |

| Capacitance | | | | | | | | | | |
|------------------|-------------------------------|------------------------|------------------------|------|-----|--------------------------------|-----|-------|-------------------------|--|
| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | T _A = 40°C to +85°C | | Units | Conditions | |
| | | | Min | Typ | Max | Min | Max | | | |
| C _{IN} | Control Pin Input Capacitance | 0.0 | | 3.5 | | | | pF | f = 1MHz (see Figure 5) | |
| C _{OFF} | B Port OFF Capacitance | 4.5 | | 12.0 | | | | pF | f = 1MHz (see Figure 5) | |
| C _{ON} | A Port ON Capacitance | 4.5 | | 40.0 | | | | pF | f = 1MHz (see Figure 5) | |

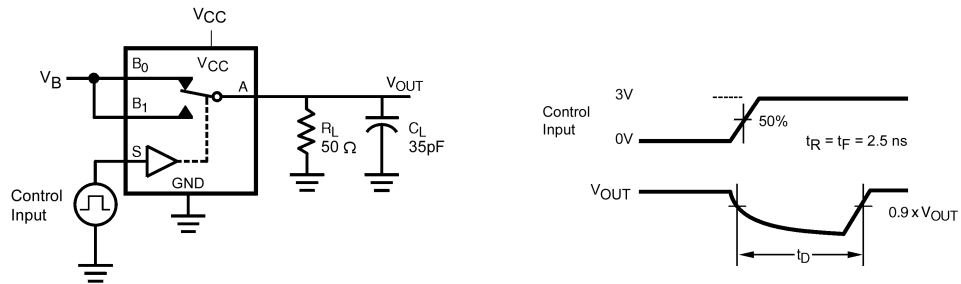
AC Loading and Waveforms



C_L includes Fixture and Stray Capacitance

Logic Input Waveforms Inverted for Switches that have the Opposite Logic Sense

FIGURE 1. Turn-On/Turn-Off Timing



C_L Includes Fixture and Stray Capacitance

FIGURE 2. Break-Before-Make Timing

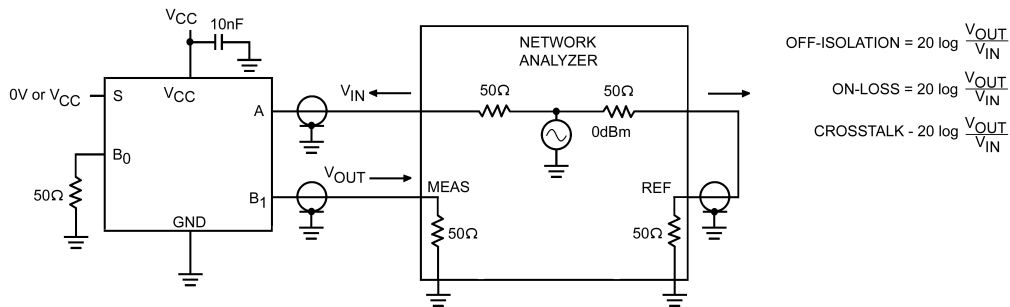


FIGURE 3. OFF Isolation and Crosstalk

AC Loading and Waveforms (Continued)

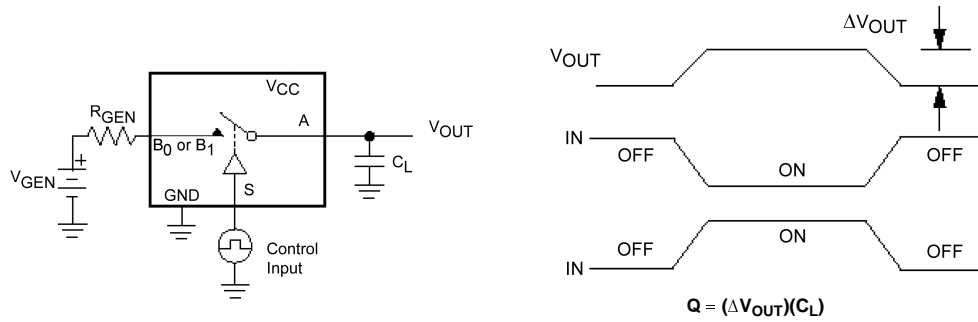


FIGURE 4. Charge Injection

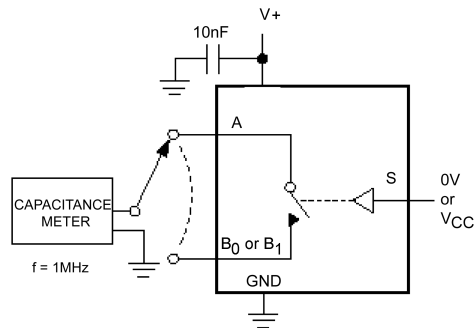


FIGURE 5. ON/OFF Capacitance Measurement Setup

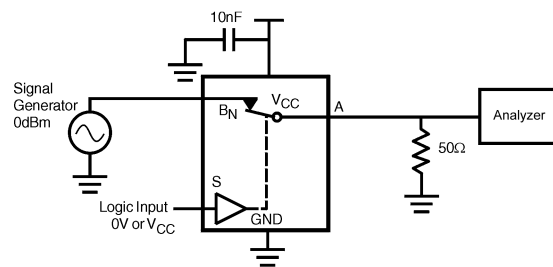


FIGURE 6. Bandwidth

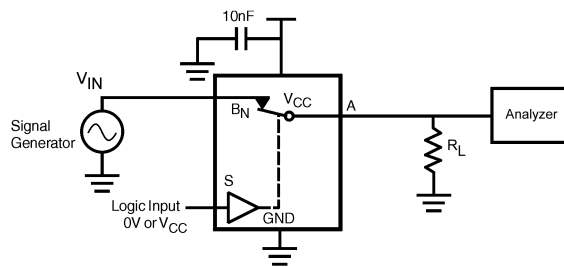
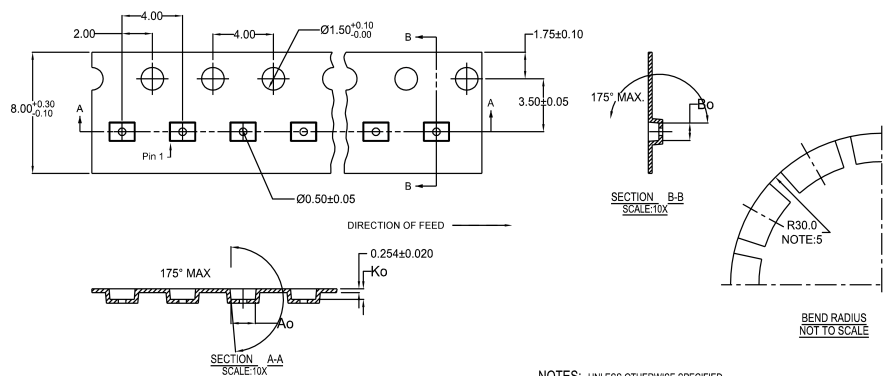


FIGURE 7. Harmonic Distortion

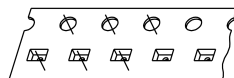
Tape and Reel Specification

Tape Format For Micropak 10

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| L10X | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 5000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |



| | | | | |
|----|--------|-------------|-------------|-------------|
| 10 | 300056 | 2.30 ± 0.05 | 1.78 ± 0.05 | 0.68 ± 0.05 |
| 8 | 300038 | 1.78 ± 0.05 | 1.78 ± 0.05 | 0.68 ± 0.05 |
| 6 | 300033 | 1.60 ± 0.05 | 1.15 ± 0.05 | 0.70 ± 0.05 |

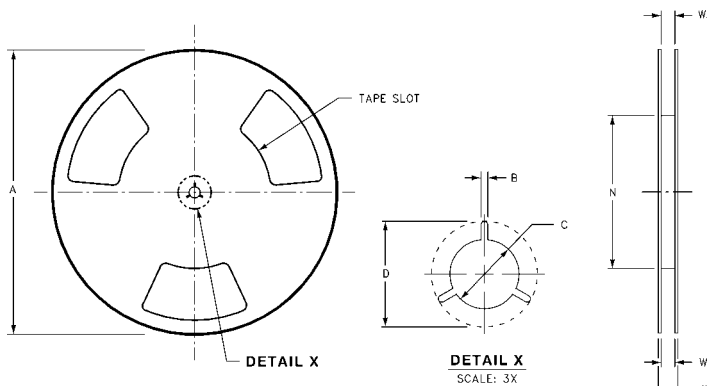


SCALE: 6X

NOTES: UNLESS OTHERWISE SPECIFIED

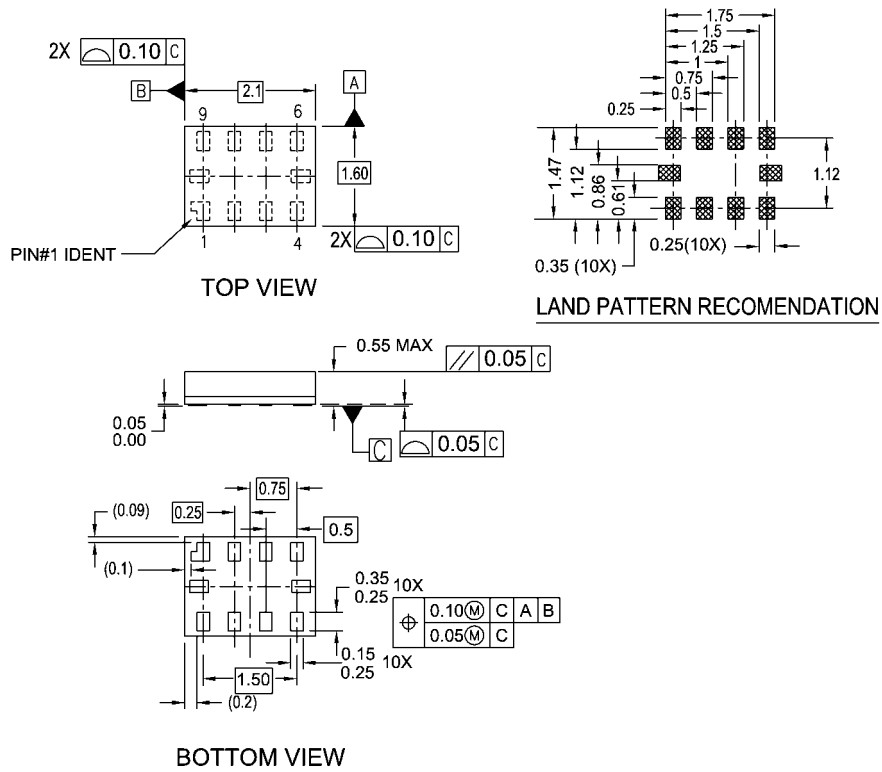
1. ACCUMULATED 50 SPROCKETS, SPROCKET HOLE PITCH IS 200.00 ± 0.30MM
2. NO INDICATED CORNER RADIUS IS 0.127MM
3. CAMBER NOT TO EXCEED 1MM IN 100MM
4. SMALLEST ALLOWABLE BENDING RADIUS
5. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE

REEL DIMENSIONS inches (millimeters)



| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | 0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00) | 0.567 (14.40) | W1 + 0.078/-0.039 (W1 + 2.00/-1.00) |

Physical Dimensions inches (millimeters) unless otherwise noted



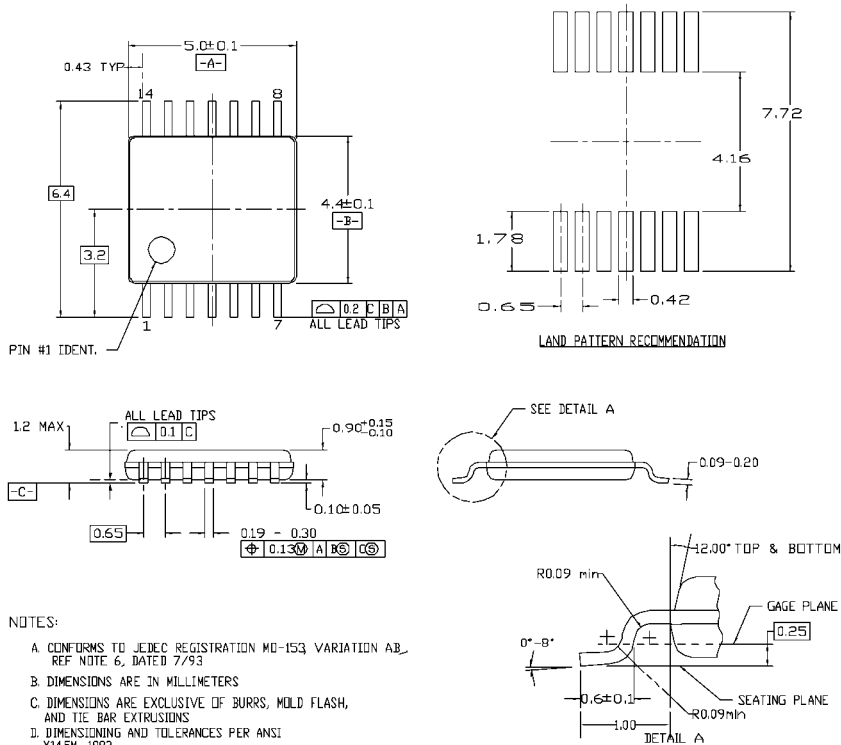
NOTES:

- A. PACKAGE CONFORMS TO JEDEC MO255, VARIATION UABD
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES CONFORMS TO ASME Y14.5M, 1994.

MAC010ARevB

Pb-Free 10-Lead MicroPak, 1.6 mm x 2.1mm
Package Number MAC010A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



- NOTES:
- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATED 7/93
 - B. DIMENSIONS ARE IN MILLIMETERS
 - C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
 - D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982

MTC14revD

14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC14

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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