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# FSA266 • NC7WB66

## Low Voltage Dual SPST

## Normally Open Analog Switch or 2-Bit Bus Switch

### General Description

The FSA266 or NC7WB66 is an ultra high-speed (UHS) dual single-pole/single-throw (SPST) analog switch or 2-bit bus switch. The device is fabricated with advanced sub-micron CMOS technology to achieve high speed enable and disable times and low On Resistance over a broad  $V_{CC}$  range. The device is specified to operate over the 1.65 to 5.5V  $V_{CC}$  operating range. The device is organized as a dual switch with independent CMOS compatible switch enable (OE) controls. When OE is HIGH, the switch is ON and Port A is connected to Port B. When OE is LOW, the switch is OPEN and a high-impedance state exists between the two ports. The enable inputs tolerate voltages up to 5.5V independent of the  $V_{CC}$  operating range.

### Features

- Useful in both analog and digital applications
- Space saving US8 surface mount package
- MicroPak™ Pb-Free leadless package
- Typical  $7\Omega$  On Resistance @ 5V  $V_{CC}$
- Broad  $V_{CC}$  operating range: 1.65V to 5.5V
- Rail-to-Rail signal handling
- Power down high impedance control inputs
- Control inputs are overvoltage tolerant
- Control inputs are CMOS compatible
- >300 MHz -3dB bandwidth

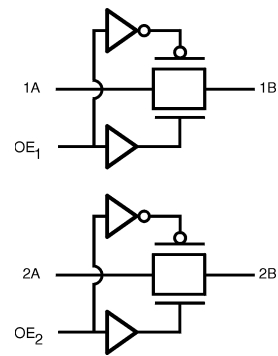
### Ordering Code:

| Order Number | Package Number | Product Code Top Mark | Package Description                               | Supplied As               |
|--------------|----------------|-----------------------|---------------------------------------------------|---------------------------|
| FSA266K8X    | MAB08A         | WB66                  | 8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide | 3K Units on Tape and Reel |
| FSA266L8X    | MAC08A         | P4                    | Pb-Free 8-Lead MicroPak, 1.6 mm Wide              | 5K Units on Tape and Reel |
| NC7WB66K8X   | MAB08A         | WB66                  | 8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide | 3K Units on Tape and Reel |
| NC7WB66L8X   | MAC08A         | P4                    | Pb-Free 8-Lead MicroPak, 1.6 mm Wide              | 5K Units on Tape and Reel |

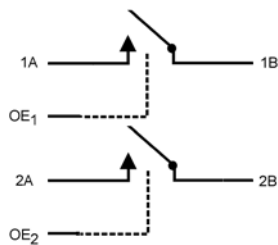
Pb-Free package per JEDEC J-STD-020B.

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Logic Symbol



Analog Symbol



Pin Descriptions

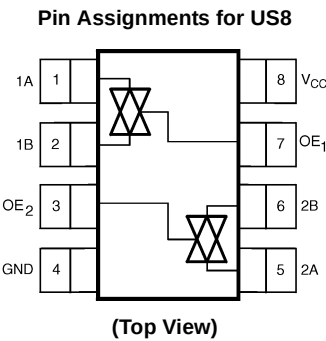
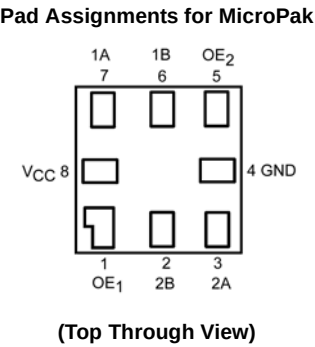
| Pin Names | Description   |
|-----------|---------------|
| A         | Switch Port A |
| B         | Switch Port B |
| OE        | Control Input |

Function Table

| Switch Enable Input (OE) | Function         |
|--------------------------|------------------|
| L                        | Disconnect       |
| H                        | B Connected to A |

H = HIGH Logic Level  
L = LOW Logic Level

Connection Diagrams



**Absolute Maximum Ratings**(Note 1)

|                                                                |                          |
|----------------------------------------------------------------|--------------------------|
| Supply Voltage ( $V_{CC}$ )                                    | -0.5V to +7.0V           |
| DC Switch Voltage ( $V_S$ )                                    | -0.5V to $V_{CC} + 0.5V$ |
| DC Input Voltage ( $V_{IN}$ ) (Note 2)                         | -0.5V to +7.0V           |
| DC Input Diode Current<br>@ ( $I_{IK}$ ) $V_{IN} < 0V$         | -50 mA                   |
| DC Switch Output Current ( $I_{OUT}$ )                         | ±128 mA                  |
| DC $V_{CC}$ or Ground Current ( $I_{CC}/I_{GND}$ )             | ±100 mA                  |
| Storage Temperature Range ( $T_{STG}$ )                        | -65°C to +150°C          |
| Junction Lead Temperature<br>under Bias ( $T_J$ )              | +150°C                   |
| Junction Lead Temperature ( $T_L$ )<br>(Soldering, 10 Seconds) | +260°C                   |
| Power Dissipation ( $P_D$ ) @ +85°C<br>SC70-6                  | 250 mW                   |

**Recommended Operating Conditions** (Note 3)

|                                         |                   |
|-----------------------------------------|-------------------|
| Supply Voltage ( $V_{CC}$ )             | 1.65V to 5.5V     |
| Control Input Voltage ( $V_{IN}$ )      | 0V to 5.5V        |
| Switch Input Voltage ( $V_{IN}$ )       | 0V to $V_{CC}$    |
| Switch Output Voltage ( $V_{OUT}$ )     | 0V to $V_{CC}$    |
| Operating Temperature ( $T_A$ )         | -40°C to +85°C    |
| Input Rise and Fall Time ( $t_r, t_f$ ) |                   |
| Control Input $V_{CC} = 1.65V-2.7V$     | 0 ns/V to 20 ns/V |
| Control Input $V_{CC} = 3.0V-3.6V$      | 0 ns/V to 10 ns/V |
| Control Input $V_{CC} = 4.5V-5.5V$      | 0 ns/V to 5 ns/V  |
| Thermal Resistance ( $\theta_{JA}$ )    | 250°C/W           |

**Note 1:** 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 2:** The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

**Note 3:** Unused inputs must be held HIGH or LOW. They may not float.

**DC Electrical Characteristics**

| Symbol          | Parameter                                                   | $V_{CC}$<br>(V) | $T_A = +25^\circ C$ |      |      | $T_A = -40^\circ C$ to $+85^\circ C$ |      | Units | Conditions                                     |
|-----------------|-------------------------------------------------------------|-----------------|---------------------|------|------|--------------------------------------|------|-------|------------------------------------------------|
|                 |                                                             |                 | Min                 | Typ  | Max  | Min                                  | Max  |       |                                                |
| $V_{IH}$        | HIGH Level Input Voltage                                    | 1.65 to 1.95    | 0.75 $V_{CC}$       |      |      | 0.75 $V_{CC}$                        |      | V     |                                                |
|                 |                                                             | 2.3 to 5.5      | 0.7 $V_{CC}$        |      |      | 0.7 $V_{CC}$                         |      |       |                                                |
| $V_{IL}$        | LOW Level Input Voltage                                     | 1.65 to 1.95    | 0.25 $V_{CC}$       |      |      | 0.25 $V_{CC}$                        |      | V     |                                                |
|                 |                                                             | 2.3 to 5.5      | 0.3 $V_{CC}$        |      |      | 0.3 $V_{CC}$                         |      |       |                                                |
| $I_{IN}$        | Input Leakage Current                                       | 0 to 5.5        | ±0.1                |      |      | ±1.0                                 |      | μA    | $0 \leq V_{IN} \leq 5.5V$                      |
| $I_{OFF}$       | Switch OFF Leakage Current                                  | 1.65 to 5.5     | ±0.1                |      |      | ±1.0                                 |      | μA    | $0 \leq A, B \leq V_{CC}$                      |
| $R_{ON}$        | Switch On Resistance<br>(Note 4)                            | 4.5             | 6.0                 | 10.0 | 10.0 | 10.0                                 | 10.0 | Ω     | $V_I = 0V, I_O = 30 \text{ mA}$                |
|                 |                                                             |                 | 7.0                 | 13.5 | 13.5 | 13.5                                 | 13.5 |       | $V_I = 2.4V, I_O = -30 \text{ mA}$             |
|                 |                                                             |                 | 6.0                 | 10.0 | 10.0 | 10.0                                 | 10.0 |       | $V_I = 4.5V, I_O = -30 \text{ mA}$             |
|                 |                                                             | 3.0             | 7.5                 | 15.0 | 15.0 | 15.0                                 | 15.0 | Ω     | $V_I = 0V, I_O = 24 \text{ mA}$                |
|                 |                                                             |                 | 8.5                 | 15.0 | 15.0 | 15.0                                 | 15.0 |       | $V_I = 3V, I_O = -24 \text{ mA}$               |
|                 |                                                             | 2.3             | 9.0                 | 20.0 | 20.0 | 20.0                                 | 20.0 | Ω     | $V_I = 0V, I_O = 8 \text{ mA}$                 |
|                 |                                                             |                 | 10.5                | 20.0 | 20.0 | 20.0                                 | 20.0 |       | $V_I = 2.3V, I_O = -8 \text{ mA}$              |
|                 |                                                             | 1.65            | 12.5                | 30.0 | 30.0 | 30.0                                 | 30.0 | Ω     | $V_I = 0V, I_O = 4 \text{ mA}$                 |
|                 |                                                             |                 | 17.0                | 30.0 | 30.0 | 30.0                                 | 30.0 |       | $V_I = 1.65V, I_O = -4 \text{ mA}$             |
| $I_{CC}$        | Quiescent Supply Current<br>All Channels ON or OFF          | 5.5             | 1.0                 |      |      | 10.0                                 |      | μA    | $V_{IN} = V_{CC}$ or GND<br>$I_{OUT} = 0$      |
|                 | Analog Signal Range                                         | $V_{CC}$        | 0                   |      |      | 0                                    |      | V     |                                                |
| $R_{Range}$     | On Resistance Over<br>Signal Range<br>(Note 4)(Note 5)      | 4.5             | 8.0                 | 15.0 | 15.0 | 15.0                                 | 15.0 | Ω     | $I_O = -30 \text{ mA}, 0 \leq V_I \leq V_{CC}$ |
|                 |                                                             | 3.0             | 15.0                | 30.0 | 30.0 | 30.0                                 | 30.0 |       | $I_O = -24 \text{ mA}, 0 \leq V_I \leq V_{CC}$ |
|                 |                                                             | 2.3             | 45.0                | 75.0 | 75.0 | 75.0                                 | 75.0 |       | $I_O = -8 \text{ mA}, 0 \leq V_I \leq V_{CC}$  |
|                 |                                                             | 1.65            | 150                 | 275  | 275  | 275                                  | 275  |       | $I_O = -4 \text{ mA}, 0 \leq V_I \leq V_{CC}$  |
| $\Delta R_{ON}$ | On Resistance Match<br>Between Channels<br>(Note 4)(Note 7) | 4.5             | 0.2                 |      |      |                                      |      | Ω     | $I_O = -30 \text{ mA}, V_I = 3.15$             |
|                 |                                                             | 3.0             | 0.2                 |      |      |                                      |      |       | $I_O = -24 \text{ mA}, V_I = 2.1$              |
|                 |                                                             | 2.3             | 0.5                 |      |      |                                      |      |       | $I_O = -8 \text{ mA}, V_I = 1.6$               |
|                 |                                                             | 1.65            | 0.6                 |      |      |                                      |      |       | $I_O = -4 \text{ mA}, V_I = 1.15$              |
| $R_{flat}$      | On Resistance Flatness<br>(Note 4)(Note 5)(Note 6)          | 4.5             | 2.5                 | 6.0  | 6.0  | 6.0                                  | 6.0  |       | $I_O = -30 \text{ mA}, 0 \leq V_I \leq V_{CC}$ |
|                 |                                                             | 3.0             | 8.0                 | 17.5 | 17.5 | 17.5                                 | 17.5 |       | $I_O = -24 \text{ mA}, 0 \leq V_I \leq V_{CC}$ |
|                 |                                                             | 2.3             | 33.0                | 60.0 | 60.0 | 60.0                                 | 60.0 |       | $I_O = -8 \text{ mA}, 0 \leq V_I \leq V_{CC}$  |
|                 |                                                             | 1.65            | 135                 | 250  | 250  | 250                                  | 250  |       | $I_O = -4 \text{ mA}, 0 \leq V_I \leq V_{CC}$  |

**Note 4:** 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.

**Note 5:** Guaranteed by design.

**Note 6:** Flatness is defined as the difference between the minimum and maximum value of ON Resistance over the specified range of conditions.

## DC Electrical Characteristics (Continued)

Note 7:  $\Delta R_{ON} = R_{ON\ max} - R_{ON\ min}$  measured at identical  $V_{CC}$ , temperature and voltage levels.

## AC Electrical Characteristics

| Symbol             | Parameter                                | $V_{CC}$<br>(V) | $T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$ |       |      | Units | Conditions                                                                                                              | Figure Number |
|--------------------|------------------------------------------|-----------------|-----------------------------------------------------|-------|------|-------|-------------------------------------------------------------------------------------------------------------------------|---------------|
|                    |                                          |                 | Min                                                 | Typ   | Max  |       |                                                                                                                         |               |
| $t_{PHL}, t_{PLH}$ | Propagation Delay Bus-to-Bus<br>(Note 8) | 4.5 to 5.5      |                                                     | 0.35  | 1.0  | ns    | $V_I = \text{OPEN}$<br>$C_L = 50\text{ pF}, R_U = R_D = 500\Omega$                                                      | Figures 1, 2  |
|                    |                                          | 3.0 to 3.6      |                                                     | 0.7   | 1.5  |       |                                                                                                                         |               |
|                    |                                          | 2.3 to 2.7      |                                                     | 1.1   | 2.5  |       |                                                                                                                         |               |
|                    |                                          | 1.65 to 1.95    |                                                     | 2.0   | 4.0  |       |                                                                                                                         |               |
| $t_{PZL}, t_{PZH}$ | Output Enable Time<br>Turn on Time       | 4.5 to 5.5      | 0.8                                                 | 2.0   | 3.2  | ns    | $V_I = 0\text{V}$ for $t_{PZH}$<br>$V_I = 2 \times V_{CC}$ for $t_{PZL}$<br>$C_L = 50\text{ pF}, R_U = R_D = 500\Omega$ | Figures 1, 2  |
|                    |                                          | 3.0 to 3.6      | 1.2                                                 | 2.5   | 3.9  |       |                                                                                                                         |               |
|                    |                                          | 2.3 to 2.7      | 1.5                                                 | 3.2   | 5.6  |       |                                                                                                                         |               |
|                    |                                          | 1.65 to 1.95    | 2.5                                                 | 5.7   | 10.0 |       |                                                                                                                         |               |
| $t_{PLZ}, t_{PHZ}$ | Output Disable Time<br>Turn Off Time     | 4.5 to 5.5      | 0.8                                                 | 2.6   | 4.1  | ns    | $V_I = 0\text{V}$ for $t_{PHZ}$<br>$V_I = 2 \times V_{CC}$ for $t_{PLZ}$<br>$C_L = 50\text{ pF}, R_U = R_D = 500\Omega$ | Figures 1, 2  |
|                    |                                          | 3.0 to 3.6      | 1.5                                                 | 3.4   | 5.0  |       |                                                                                                                         |               |
|                    |                                          | 2.3 to 2.7      | 2.0                                                 | 4.2   | 6.9  |       |                                                                                                                         |               |
|                    |                                          | 1.65 to 1.95    | 3.0                                                 | 6.2   | 10.5 |       |                                                                                                                         |               |
| Q                  | Charge Injection (Note 9)                | 1.65 to 5.5     |                                                     |       |      | pC    | $C_L = 0.1\text{ nF}, V_{GEN} = 0\text{V},$<br>$R_{GEN} = 0\Omega, f = 1\text{ MHz}$                                    | Figure 3      |
| OIRR               | Off Isolation (Note 10)                  | 1.65 to 5.5     |                                                     | -55.0 |      | dB    | $R_L = 50\Omega, C_L = 5\text{ pF},$<br>$f = 10\text{ MHz}$                                                             | Figure 4      |
| Xtalk              | Crosstalk                                | 1.65 to 5.5     |                                                     | -70.0 |      | dB    | $R_L = 50\Omega, C_L = 5\text{ pF},$<br>$f = 10\text{ MHz}$                                                             | Figure 5      |
| BW                 | -3dB Bandwidth                           | 1.65 to 5.5     |                                                     | >300  |      | MHz   | $R_L = 50\Omega$                                                                                                        | Figure 8      |
| THD                | Total Harmonic Distortion<br>(Note 9)    | 5               |                                                     | .016  |      | %     | $R_L = 600\Omega$<br>$0.5\text{ V}_{P-P}$<br>$f = 600\text{ Hz to } 20\text{ KHz}$                                      |               |

Note 8: This parameter is guaranteed by design. The switch contributes no propagation delay other than the RC delay of the On Resistance of the switch and the 50 pF load capacitance.

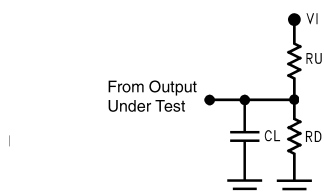
Note 9: Guaranteed by design.

Note 10: Off Isolation =  $20 \log_{10} [V_A/V_{Bn}]$

## Capacitance

| Symbol                  | Parameter                                      | Typ  | Max | Units | Conditions             | Figures  |
|-------------------------|------------------------------------------------|------|-----|-------|------------------------|----------|
| $C_{IN}$                | Control Pin Input Capacitance                  | 2.5  |     | pF    | $V_{CC} = 0\text{V}$   |          |
| $C_{I/O} \text{ (OFF)}$ | Switch Port Off Capacitance                    | 5.0  |     | pF    | $V_{CC} = 5.0\text{V}$ | Figure 6 |
| $C_{I/O} \text{ (ON)}$  | Switch Port Capacitance when Switch is Enabled | 10.0 |     | pF    | $V_{CC} = 5.0\text{V}$ | Figure 7 |

## AC Loading and Waveforms



Input driven by  $50\Omega$  source terminated in  $50\Omega$

$C_L$  includes load and stray capacitance.

Input PRR = 1.0 MHz;  $t_W = 500$  ns

FIGURE 1. AC Test Circuit

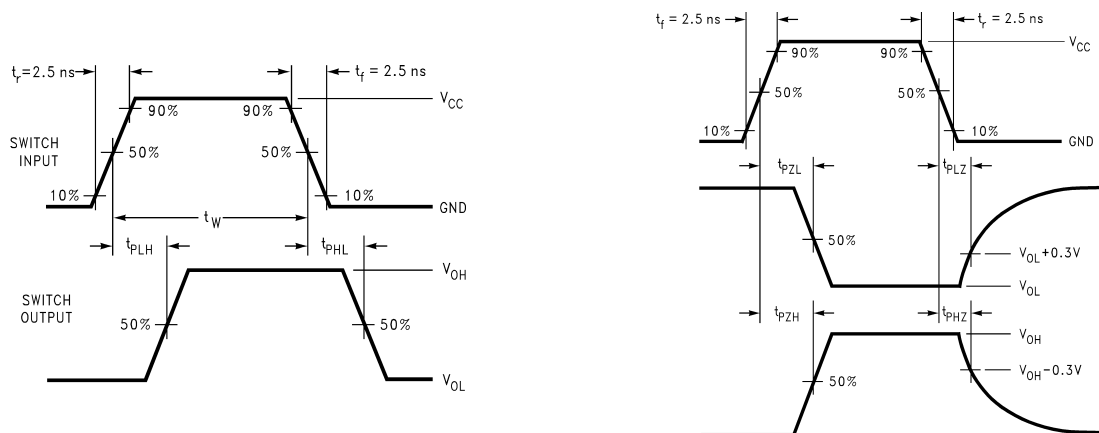


FIGURE 2. AC Waveforms

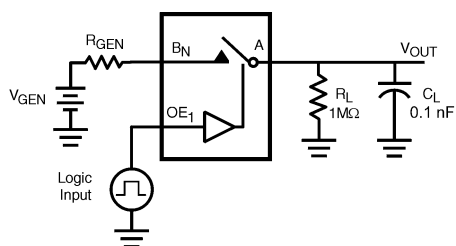
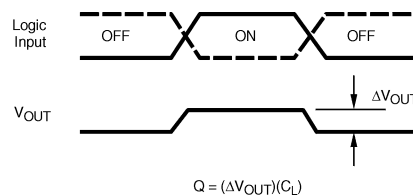


FIGURE 3. Charge Injection Test

## AC Loading and Waveforms (Continued)

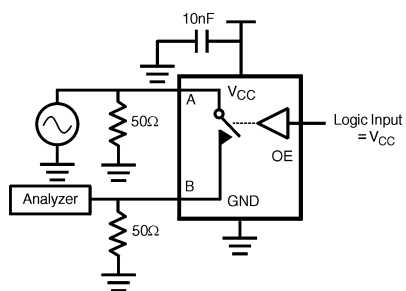


FIGURE 4. Off Isolation

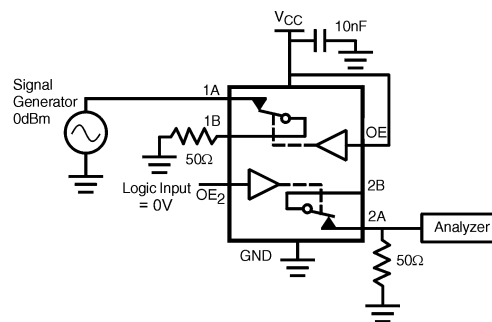


FIGURE 5. Crosstalk

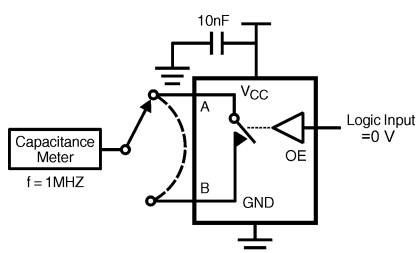


FIGURE 6. Channel Off Capacitance

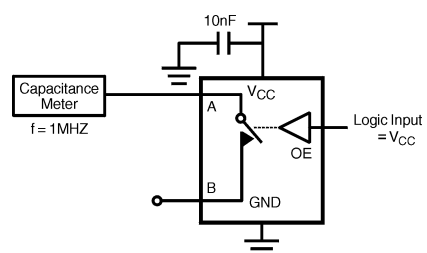


FIGURE 7. Channel On Capacitance

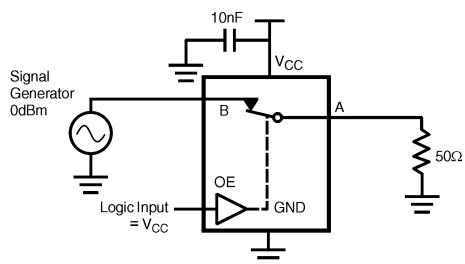
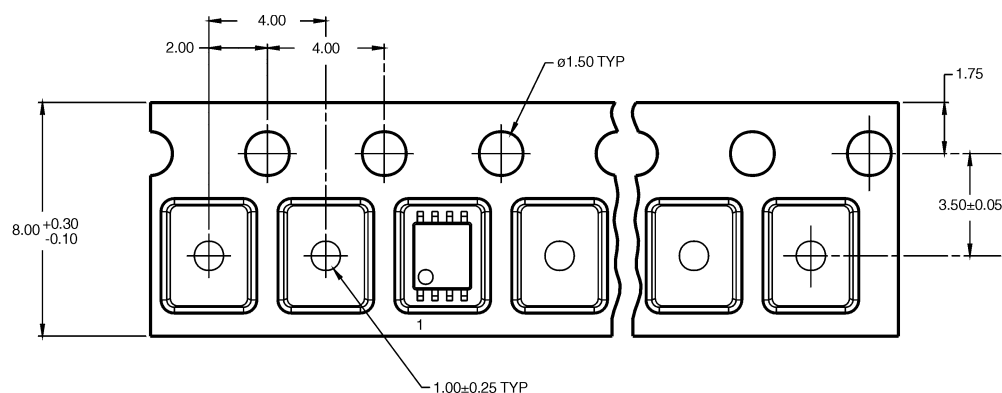


FIGURE 8. Bandwidth

## Tape and Reel Specification

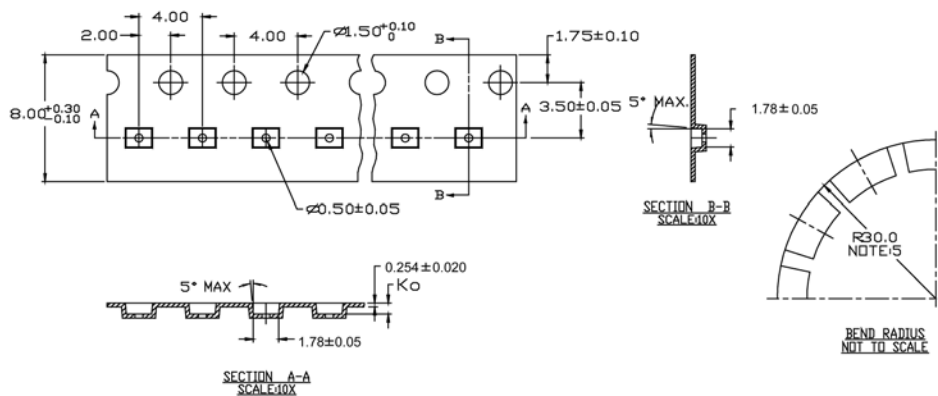
## TAPE FORMAT for US8

| Package Designator | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| K8X                | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|                    | Carrier            | 250             | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |

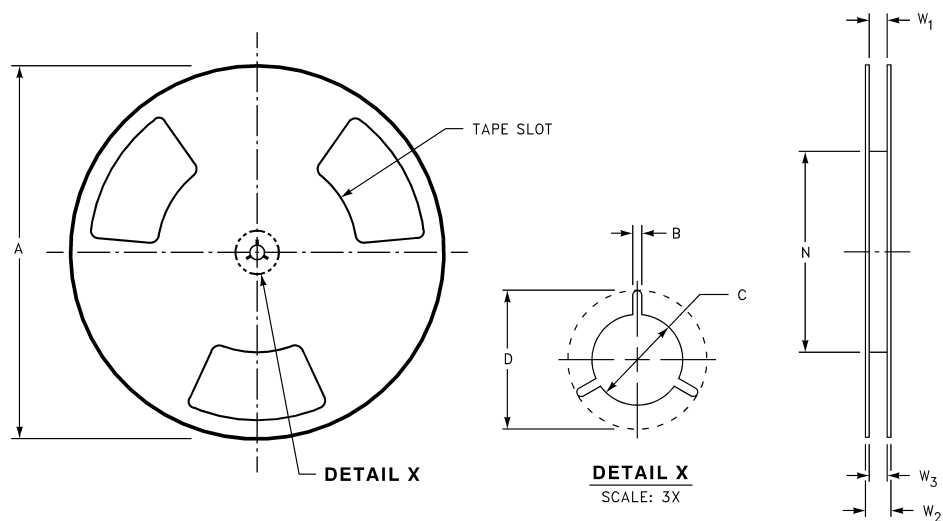
**TAPE DIMENSIONS** inches (millimeters)

## TAPE FORMAT for MicroPak

| Package Designator | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| L8X                | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|                    | Carrier            | 250             | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |

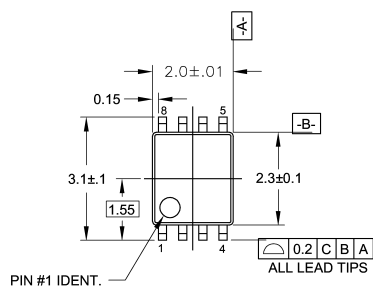
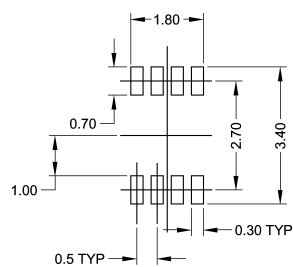
**TAPE DIMENSIONS** inches (millimeters)

## REEL DIMENSIONS inches (millimeters)

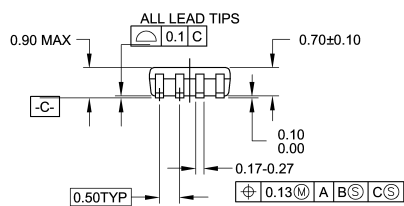
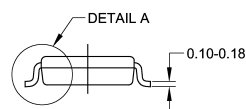
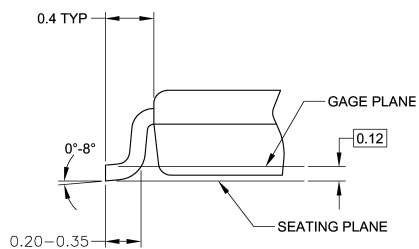


| Tape Size | A              | B               | C                | D                | N                | W1                                          | W2               | W3                                     |
|-----------|----------------|-----------------|------------------|------------------|------------------|---------------------------------------------|-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

# Physical Dimensions inches (millimeters) unless otherwise noted



## LAND PATTERN RECOMMENDATION



## DETAIL A

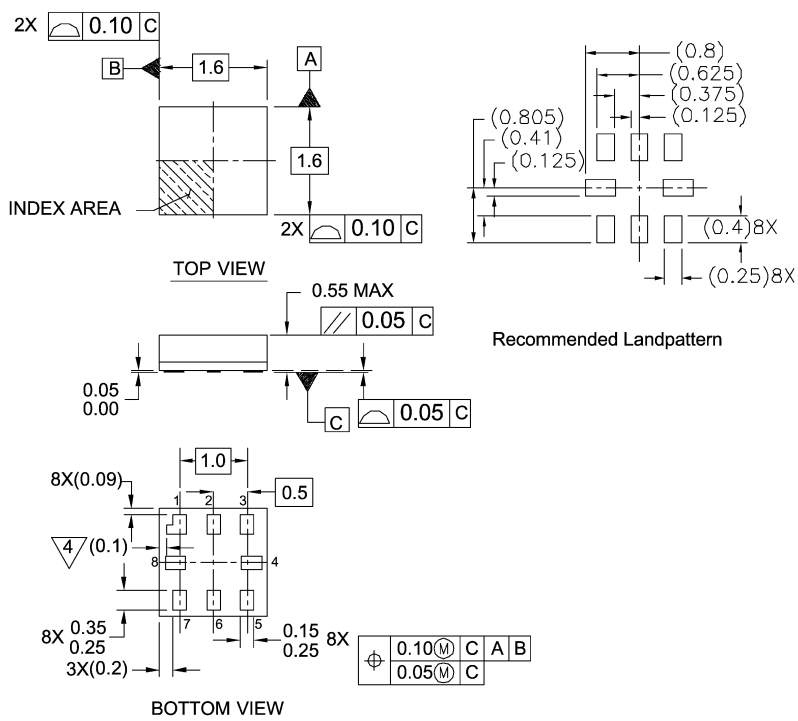
## NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-187
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MAB08AREVC

8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide  
Package Number MAB08A

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



## Notes:

1. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y.14M-1994
4. PIN 1 FLAG, END OF PACKAGE OFFSET.

MAC08AREVC

**Pb-Free 8-Lead MicroPak, 1.6 mm Wide**  
**Package Number MAC08A**

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provided in the labeling, can be reasonably expected to result in significant injury to the user.

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|--------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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