

# P2010A

## Low Frequency EMI Reduction IC

### Description

The P2010A is a selectable spread spectrum frequency modulator designed specifically for PC peripheral and embedded controller markets. The P2010A reduces electromagnetic interference (EMI) at the clock source which provides system wide reduction of EMI of all clock dependent signals. The P2010A allows significant system cost savings by reducing the number of circuit board layers and shielding that are traditionally required to pass EMI regulations.

The P2010A uses the most efficient and optimized modulation profile approved by the FCC and is implemented in a proprietary all-digital method.

The P2010A modulates the output of a single PLL in order to “spread” the bandwidth of a synthesized clock and, more importantly, decreases the peak amplitudes of its harmonics. This results in significantly lower system EMI compared to the typical narrow band signal produced by oscillators and most frequency generators. Lowering EMI by increasing a signal’s bandwidth is called ‘spread spectrum clock generation.’

### Applications

The P2010A is targeted towards the embedded controller market and PC peripheral markets including scanners, facsimile, MFP’s, printers, PDA, IA, and GPS devices.

### Features

- FCC Approved Method of EMI Attenuation
- Provides up to 20 dB of EMI Suppression
- Generates a Low EMI Spread Spectrum Clock of the Input Frequency
- Optimized for 10 MHz to 35 MHz Input Frequency Range
- Internal Loop Filter Minimizes External Components and Board Space
- 4 Selectable Spread Ranges
- SSON Control Pin for Spread Spectrum Enable and Disable Options
- Low Cycle-to-Cycle Jitter
- Wide Operating Range (3 V to 5 V)
- 16 mA Output Drives
- TTL or CMOS Compatible Outputs
- Low Power CMOS Design
- Available in 8-pin SOIC and TSSOP Packages
- These are Pb-Free Devices



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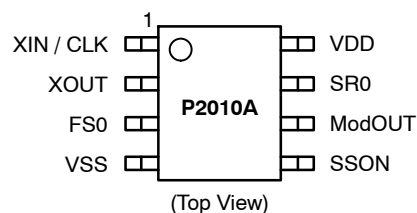


SOIC-8  
S SUFFIX  
CASE 751BD



TSSOP-8  
T SUFFIX  
CASE 948AL

### PIN CONFIGURATION



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

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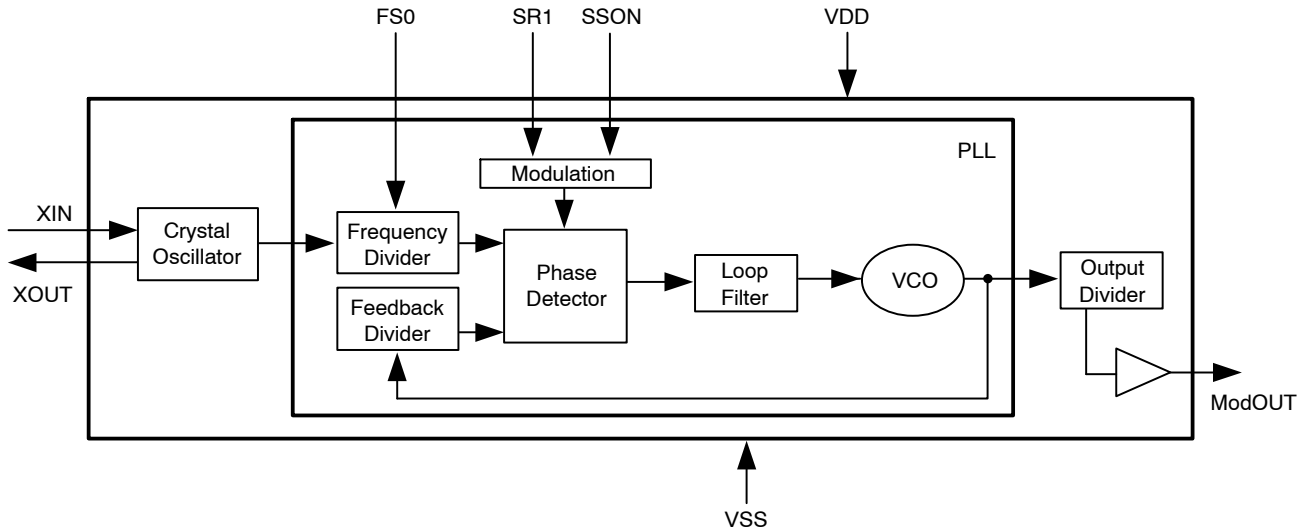


Figure 1. Block Diagram

Table 1. ABSOLUTE MAXIMUM RATINGS

| Symbol           | Parameter   | Rating      | Unit |
|------------------|---|-------------|------|
| $V_{DD}, V_{IN}$ | Voltage on any pin with respect to Ground             | -0.5 to +7  | V    |
| $T_{STG}$        | Storage temperature                                   | -65 to +125 | °C   |
| $T_A$            | Operating temperature                                 | -40 to +85  | °C   |
| $T_s$            | Max. Soldering Temperature (10 sec)                   | 260         | °C   |
| $T_J$            | Junction Temperature                                  | 150         | °C   |
| $T_{DV}$         | Static Discharge Voltage (As per JEDEC STD22- A114-B) | 2           | KV   |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Table 2. DC ELECTRICAL CHARACTERISTICS

| Symbol    | Parameter   | Min | Typ  | Max          | Unit |
|-----------|---|-----|------|--------------|------|
| $V_{IL}$  | Input Low Voltage   | GND | -    | 0.8          | V    |
| $V_{IH}$  | Input High Voltage  | 2.0 | -    | $V_{DD}+0.3$ | V    |
| $I_{IL}$  | Input Low Current (pull-up resistor on inputs SR0, FS0)   | -   | -    | -35          | μA   |
| $I_{IH}$  | Input High Current (pull-down resistor on input SSON)     | -   | -    | 35           | μA   |
| $I_{XOL}$ | XOUT Output Low Current (@ 0.4 V, $V_{DD} = 3.3$ V)       | -   | 3    | -            | mA   |
| $I_{XOH}$ | XOUT Output High Current (@ 2.5 V, $V_{DD} = 3.3$ V)      | -   | 3    | -            | mA   |
| $V_{OL}$  | Output Low Voltage ( $V_{DD} = 3.3$ V, $I_{OL} = 20$ mA)  | -   | -    | 0.4          | V    |
| $V_{OH}$  | Output High Voltage ( $V_{DD} = 3.3$ V, $I_{OH} = 20$ mA) | 2.5 | -    | -            | V    |
| $I_{DD}$  | Static Supply Current                                     | -   | 0.6  | -            | mA   |
| $I_{CC}$  | Dynamic Supply Current (3.3 V and 15 pF loading)          | 4   | 6    | 8            | mA   |
| VDD       | Operating Voltage   | 2.7 | 3.3  | 5.5          | V    |
| $t_{ON}$  | Power Up Time (First locked clock cycle after power up)   | -   | 0.18 | -            | mS   |
| $Z_{OUT}$ | Clock Output Impedance                                    | -   | 50   | -            | Ω    |

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**Table 3. AC ELECTRICAL CHARACTERISTICS**

| Symbol            | Parameter                                     | Min | Typ | Max | Unit |
|-------------------|---|-----|-----|-----|------|
| $f_{IN}$          | Input Frequency                               | 10  | 20  | 35  | MHz  |
| $t_{LH}$ (Note 1) | Output rise time (measured at 0.8 V to 2.0 V) | 0.7 | 0.9 | 1.1 | nS   |
| $t_{HL}$ (Note 1) | Output fall time (measured at 2.0 V to 0.8 V) | 0.6 | 0.8 | 1.0 | nS   |
| $t_{JC}$          | Jitter (Cycle-to-cycle)                       | -   | -   | 360 | pS   |
| $t_D$             | Output duty cycle                             | 45  | 50  | 55  | %    |

1.  $t_{LH}$  and  $t_{HL}$  are measured into a capacitive load of 15 pF.

**Table 4. PIN DESCRIPTION**

| Pin# | Pin Name  | Type | Description   |
|------|-----------|------|---|
| 1    | XIN / CLK | I    | Connect to crystal or externally generated clock signal.  |
| 2    | XOUT      | I    | Connect to crystal. No connect if externally generated clock signal is used.  |
| 3    | FS0       | I    | Digital logic input used to select Input Frequency Range (see Table 5). This pin has an internal pull-up resistor.  |
| 4    | VSS       | P    | Ground Connection. Connect to system ground.  |
| 5    | SSON      | I    | Digital logic input used to enable Spread Spectrum function (Active Low). Spread Spectrum function enable when low. This pin has an internal pull-low resistor. |
| 6    | ModOUT    | O    | Spread Spectrum Clock Output.   |
| 7    | SR0       | I    | Digital logic input used to select Spreading Range (see Table 5). This pin has an internal pull-up resistor.  |
| 8    | VDD       | P    | Connect to +3.3 V or +5.0 V.  |

**Table 5. SPREAD RANGE SELECTION**

| FS0 | SR0 | Spreading Range | Input Frequency  | Modulation Rate           |
|-----|-----|-----------------|------------------|---------------------------|
| 1   | 0   | $\pm 1.50\%$    | 10 MHz to 20 MHz | $(F_{in}/10) * 20.83$ KHz |
| 1   | 1   | $\pm 2.50\%$    | 10 MHz to 20 MHz | $(F_{in}/10) * 20.83$ KHz |
| 0   | 0   | $\pm 1.25\%$    | 20 MHz to 35 MHz | $(F_{in}/10) * 20.83$ KHz |
| 0   | 1   | $\pm 2.00\%$    | 20 MHz to 35 MHz | $(F_{in}/10) * 20.83$ KHz |

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## Spread Spectrum Selection

Table 5 illustrates the possible spread spectrum options. The optimal setting should minimize system EMI to the fullest without affecting system performance. The spreading is described as a percentage deviation of the center frequency.

(Note: The center frequency is the frequency of the external reference input on XIN / CLK, Pin 1).

## Example of a Typical Printer or Scanner Application that Operates on a Clock Frequency of 16 MHz:

A spreading selection of FS0=1 and SR0=1 provides a percentage deviation of  $\pm 2.50\%$ \* (see Table 5) of Center Frequency. This results in the frequency on ModOUT being swept from 16.40 MHz to 15.60 MHz at a modulation rate of 33.33 KHz (see Table 5). This particular example (see Figure 2 below) given here is a common EMI reduction method for scanner, printer or embedded applications and has already been adopted by most of the leading manufacturers.

NOTE: Spreading range selection varies from different system manufacturers and their designs.

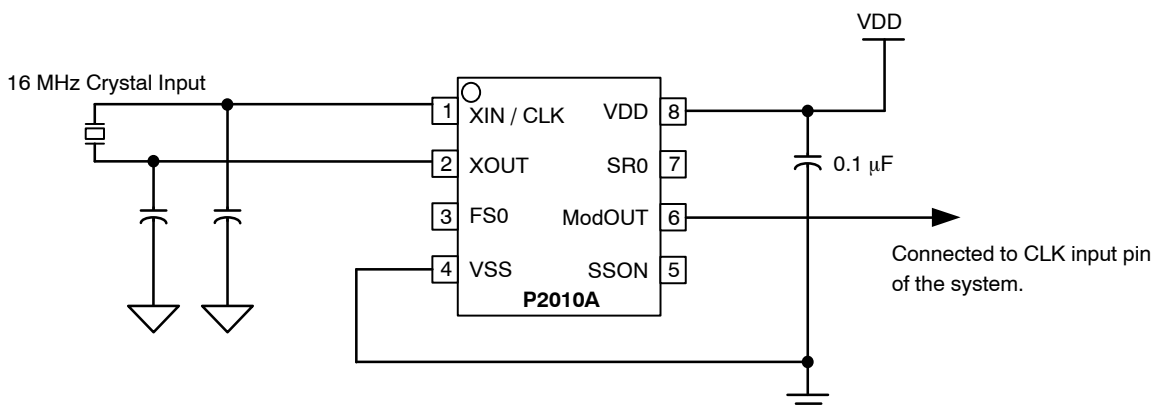
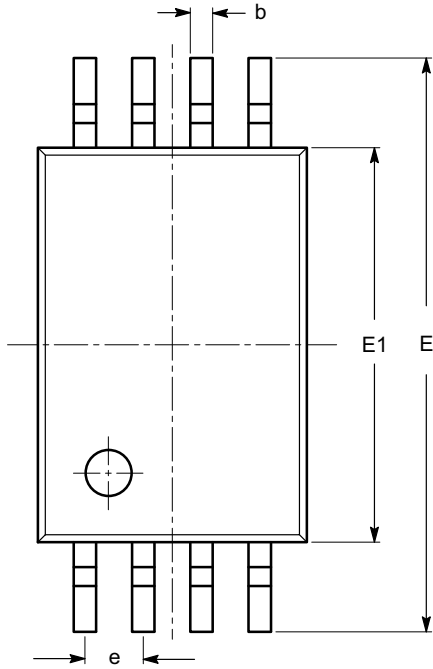


Figure 2. P2010A Application Schematic for Flat-Bed Scanner

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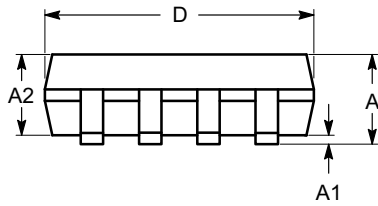
## PACKAGE DIMENSIONS

TSSOP8, 4.4x3  
CASE 948AL-01  
ISSUE O

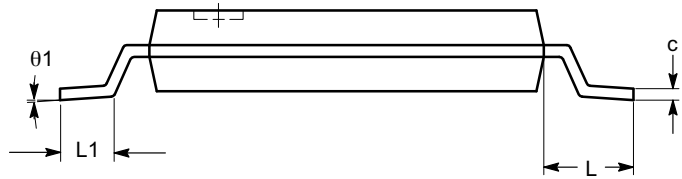


| SYMBOL   | MIN      | NOM  | MAX  |
|----------|----------|------|------|
| A        |          |      | 1.20 |
| A1       | 0.05     |      | 0.15 |
| A2       | 0.80     | 0.90 | 1.05 |
| b        | 0.19     |      | 0.30 |
| c        | 0.09     |      | 0.20 |
| D        | 2.90     | 3.00 | 3.10 |
| E        | 6.30     | 6.40 | 6.50 |
| E1       | 4.30     | 4.40 | 4.50 |
| e        | 0.65 BSC |      |      |
| L        | 1.00 REF |      |      |
| L1       | 0.50     | 0.60 | 0.75 |
| $\theta$ | 0°       |      | 8°   |

TOP VIEW



SIDE VIEW



END VIEW

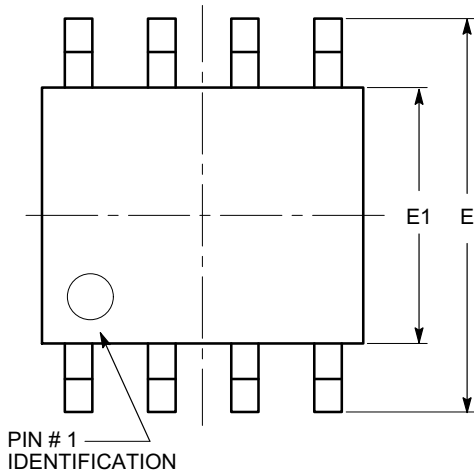
**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-153.

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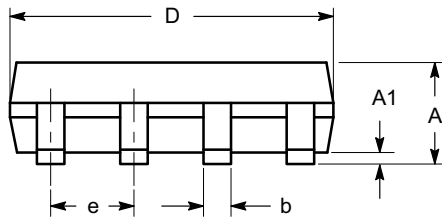
## PACKAGE DIMENSIONS

SOIC 8, 150 mils  
CASE 751BD-01  
ISSUE O

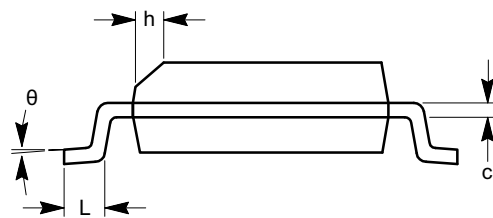


TOP VIEW

| SYMBOL   | MIN      | NOM | MAX  |
|----------|----------|-----|------|
| A        | 1.35     |     | 1.75 |
| A1       | 0.10     |     | 0.25 |
| b        | 0.33     |     | 0.51 |
| c        | 0.19     |     | 0.25 |
| D        | 4.80     |     | 5.00 |
| E        | 5.80     |     | 6.20 |
| E1       | 3.80     |     | 4.00 |
| e        | 1.27 BSC |     |      |
| h        | 0.25     |     | 0.50 |
| L        | 0.40     |     | 1.27 |
| $\theta$ | 0°       |     | 8°   |



SIDE VIEW



END VIEW


**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MS-012.

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**Table 6. ORDERING INFORMATION**

| Part Number  | Marking | Package Type                        | Temperature |
|--------------|---------|-------------------------------------|-------------|
| P2010AF-08ST | P2010AF | 8-Pin SOIC, Tube, Pb Free           | Commercial  |
| P2010AF-08SR | P2010AF | 8-Pin SOIC, Tape and Reel, Pb Free  | Commercial  |
| P2010AG-08ST | P2010AG | 8-Pin SOIC, Tube, Green             | Commercial  |
| P2010AG-08SR | P2010AG | 8-Pin SOIC, Tape and Reel, Green    | Commercial  |
| I2010AF-08ST | I2010AF | 8-Pin SOIC, Tube, Pb Free           | Industrial  |
| I2010AF-08SR | I2010AF | 8-Pin SOIC, Tape and Reel, Pb Free  | Industrial  |
| I2010AG-08ST | I2010AG | 8-Pin SOIC, Tube, Green             | Industrial  |
| I2010AG-08SR | I2010AG | 8-Pin SOIC, Tape and Reel, Green    | Industrial  |
| P2010AF-08TT | P2010AF | 8-Pin TSSOP, Tube, Pb Free          | Commercial  |
| P2010AF-08TR | P2010AF | 8-Pin TSSOP, Tape and Reel, Pb Free | Commercial  |
| P2010AG-08TT | P2010AG | 8-Pin TSSOP, Tube, Green            | Commercial  |
| P2010AG-08TR | P2010AG | 8-Pin TSSOP, Tape and Reel, Green   | Commercial  |
| I2010AF-08TT | I2010AF | 8-Pin TSSOP, Tube, Pb Free          | Industrial  |
| I2010AF-08TR | I2010AF | 8-Pin TSSOP, Tape and Reel, Pb Free | Industrial  |
| I2010AG-08TT | I2010AG | 8-Pin TSSOP, Tube, Green            | Industrial  |
| I2010AG-08TR | I2010AG | 8-Pin TSSOP, Tape and Reel, Green   | Industrial  |

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