




MK1714-02 Spread Spectrum Multiplier Clock

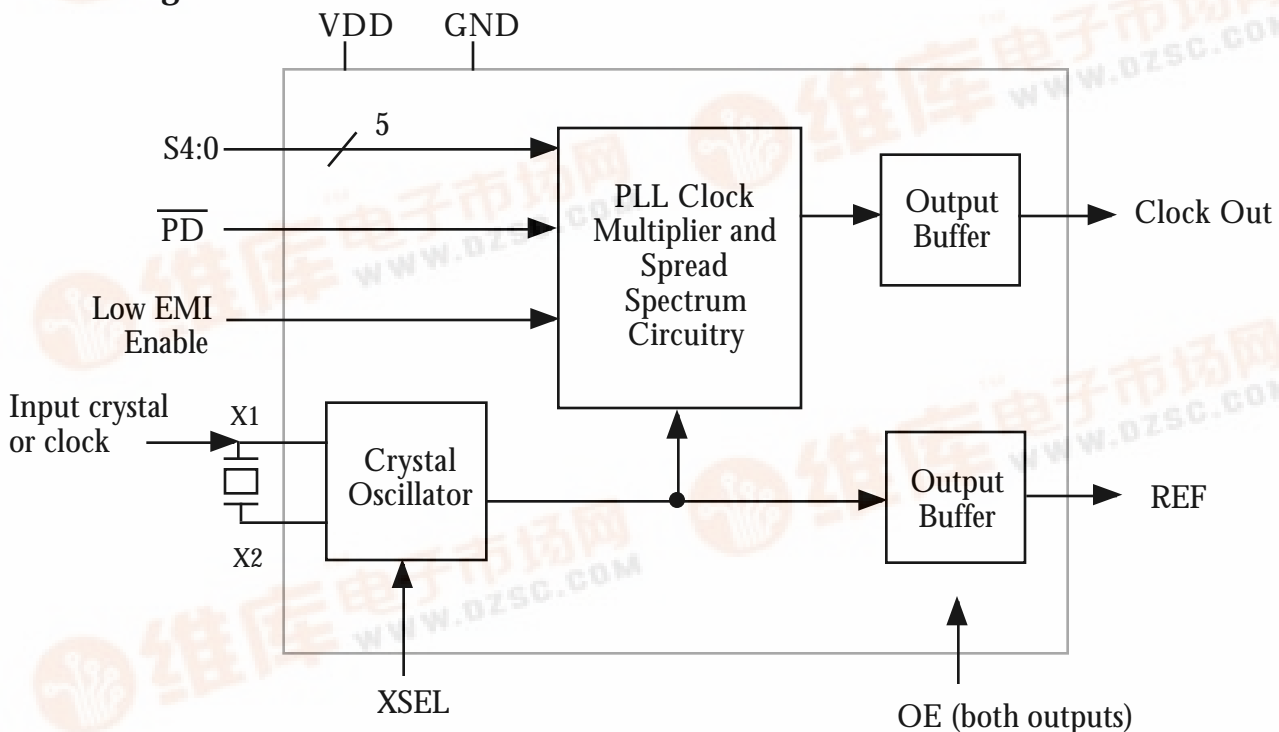
Description

The MK1714-02 is a low cost, high performance clock synthesizer with selectable multipliers and spread amounts (percentages), designed to generate high frequency clocks with low EMI. Using analog/digital Phase-Locked Loop (PLL) techniques, the device accepts an inexpensive, fundamental mode, parallel resonant crystal, or a clock input to produce a spread, or dithered, output, thereby reducing the frequency amplitude peaks by several dB. The OE pin puts both outputs into a high impedance state for board level testing. The PD# pin powers down the entire chip, and the outputs are held low.

Features

- Packaged in 20 pin tiny SSOP (QSOP) 
- Operating VDD of 3.3 V or 5 V
- Multiplier modes of x1, x2, x3, x4, x5, and x6
- Inexpensive 10-25 MHz crystal, or clock input
- OE pin tri-states the outputs for testing
- Power down pin stops the outputs low
- Selectable frequency spread
- Spread can be turned on or off
- Duty cycle of 40/60
- Advanced, low power CMOS process
- Industrial temperature range available

Block Diagram





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Pin Assignment

| | | | |
|---------|----|----|------------------------|
| X2 | 1 | 20 | REF |
| X1/ICLK | 2 | 19 | OE |
| VDD | 3 | 18 | $\overline{\text{PD}}$ |
| VDD | 4 | 17 | GND |
| S4 | 5 | 16 | S0 |
| S3 | 6 | 15 | NC |
| GND | 7 | 14 | S1 |
| GND | 8 | 13 | GND |
| S2 | 9 | 12 | LEE |
| CLK | 10 | 11 | XSEL |

20 pin.150 mil SSOP (QSOP)

Pin Descriptions

| Pin # | Name | Type | Description |
|-------|------------------------|------|--------------------------------------------------------------------------------------------|
| 1 | X2 | XO | Crystal connection. Connect to parallel mode crystal. Leave open for clock. |
| 2 | X1/ICLK | XI | Crystal connection. Connect to parallel mode crystal, or clock. |
| 3 | VDD | P | Connect to VDD. Must be same value as other VDD. |
| 4 | VDD | P | Connect to VDD. Must be same value as other VDD. Decouple with pin 7. |
| 5 | S4 | I(D) | Select pin number 4. Determines multiplier and spread amount per table on following page. |
| 6 | S3 | I | Select pin number 3. Determines multiplier and spread amount per table on following page. |
| 7 | GND | P | Connect to ground. |
| 8 | GND | P | Connect to ground. |
| 9 | S2 | I | Select pin number 2. Determines multiplier and spread amount per table on following page. |
| 10 | CLK | O | Clock output which depends on the input, multiplier and spread amount per table on page 3. |
| 11 | XSEL | I | Connect to VDD for crystal input, or GND for CLK input. |
| 12 | LEE | I | Low EMI Enable. Turns on the Spread spectrum when high. |
| 13 | GND | P | Connect to ground. |
| 14 | S1 | I | Select pin number 1. Determines multiplier and spread amount per table on following page. |
| 15 | NC | - | No Connect. |
| 16 | S0 | I | Select pin number 0. Determines multiplier and spread amount per table on following page. |
| 17 | GND | P | Connect to ground. |
| 18 | $\overline{\text{PD}}$ | I | Power Down. Turns off the chip when low. Outputs stop low. |
| 19 | OE | I | Output Enable. Tri-states all outputs when low. |
| 20 | REF | O | Reference clock output from crystal oscillator. |

Key: I = Input with internal pull-up; I(D) = Input with internal pull-down; XO/XI = crystal connections;
O = output; P = power supply connection



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Clock Output Select Table (in MHz)

| S4 | S3 | S2 | S1 | S0 | Input Range | Multiplier | Output Range | Direction | Amount (%) | 3.3/5V |
|----|----|----|----|----|-------------|------------|--------------|-----------|--------------|--------|
| 0 | 0 | 0 | 0 | 0 | 40-80 | x1 | 40-80 | C | ±0.75 | Both |
| 0 | 0 | 0 | 0 | 1 | 60-120 | x1 | 60-120 | DC | +0.25, -0.75 | Both |
| 0 | 0 | 0 | 1 | 0 | 40-80 | x1 | 40-80 | C | ±1.25 | Both |
| 0 | 0 | 0 | 1 | 1 | 80-150 | x1 | 80-150 | C | ±0.75 | Both |
| 0 | 0 | 1 | 0 | 0 | 10-30 | x2 | 20-60 | C | ±0.75 | Both |
| 0 | 0 | 1 | 0 | 1 | 20-60 | x2 | 40-120 | C | ±0.5 | Both |
| 0 | 0 | 1 | 1 | 0 | 10-25 | x2 | 20-50 | DC | +0.25, -1.5 | Both |
| 0 | 0 | 1 | 1 | 1 | 20-60 | x2 | 40-120 | DC | +0.5, -1.0 | Both |
| 0 | 1 | 0 | 0 | 0 | 20-30 | x3 | 60-90 | C | ±0.5 | Both |
| 0 | 1 | 0 | 0 | 1 | 40-75 | x2 | 80-150 | C | ±0.75 | Both |
| 0 | 1 | 0 | 1 | 0 | 40-100 | x1 | 40-100 | DC | +0.25, -1.5 | Both |
| 0 | 1 | 0 | 1 | 1 | 40-75 | x2 | 80-150 | DC | +0.25, -1.5 | Both |
| 0 | 1 | 1 | 0 | 0 | 20-40 | x1 | 20-40 | DC | +0.5, -2.0 | 3.3 V |
| 0 | 1 | 1 | 0 | 1 | 20-60 | x1 | 20-60 | DC | +0.25, -1.5 | Both |
| 0 | 1 | 1 | 1 | 0 | 10-20 | x1 | 10-20 | DC | +0.5, -2.0 | Both |
| 0 | 1 | 1 | 1 | 1 | 10-30 | x1 | 10-30 | DC | +0.25, -1.5 | Both |
| 1 | 0 | 0 | 0 | 0 | 20-37.5 | x4 | 80-150 | DC | +0.25, -1.25 | Both |
| 1 | 0 | 0 | 0 | 1 | 20-40 | x3 | 60-120 | DC | +0.25, -1.5 | Both |
| 1 | 0 | 0 | 1 | 0 | 10-30 | x1 | 10-30 | C | ±0.75 | Both |
| 1 | 0 | 0 | 1 | 1 | 20-30 | x1 | 20-30 | D | -0.5 | Both |
| 1 | 0 | 1 | 0 | 0 | 5-20 | x2 | 10-40 | DC | +0.25, -2.25 | 3.3 V |
| 1 | 0 | 1 | 0 | 1 | 20-50 | x3 | 60-150 | D | -0.25, -2.25 | Both |
| 1 | 0 | 1 | 1 | 0 | 20-37.5 | x4 | 80-150 | C | ±0.75 | Both |
| 1 | 0 | 1 | 1 | 1 | 80-150 | x1 | 80-150 | DC | +0.25, -1.25 | Both |
| 1 | 1 | 0 | 0 | 0 | 10-25 | x4 | 40-100 | C | ±0.75 | Both |
| 1 | 1 | 0 | 0 | 1 | 10-20 | x5 | 50-100 | C | ±0.75 | Both |
| 1 | 1 | 0 | 1 | 0 | 10-20 | x6 | 60-120 | C | ±0.75 | Both |
| 1 | 1 | 0 | 1 | 1 | 20-50 | x1 | 20-50 | C | ±0.75 | Both |
| 1 | 1 | 1 | 0 | 0 | 10-25 | x4 | 40-100 | DC | +0.25, -1.5 | Both |
| 1 | 1 | 1 | 0 | 1 | 10-20 | x5 | 50-100 | DC | +0.25, -1.25 | Both |
| 1 | 1 | 1 | 1 | 0 | 10-20 | x6 | 60-120 | D | -1.5 | Both |
| 1 | 1 | 1 | 1 | 1 | 10-30 | x1 | 10-30 | C | ±0.75 | Both |

For S4:S0, 0 = connect to GND, 1 = connect to VDD.

Direction: C=Center spread, D=Down spread, DC=Down+Center spread.

Amount equals the spread amount. So for a 40 MHz output clock spread down 1%, the lowest frequency is 39.60 MHz.

Contact ICS with your exact output frequency for details on spread direction and amount.



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Spread Spectrum Multiplier Clock

Electrical Specifications

| Parameter | Conditions | Minimum | Typical | Maximum | Units |
|-----------------------------------------------------------|-------------------------------------------|-----------|---------|-----------|-------|
| ABSOLUTE MAXIMUM RATINGS (note 1) | | | | | |
| Supply voltage, VDD | Referenced to GND | | | 7 | V |
| Inputs and Clock Outputs | Referenced to GND | -0.5 | | VDD+0.5 | V |
| Ambient Operating Temperature | | 0 | | 70 | °C |
| | MK1714-02RI only | -40 | | 85 | °C |
| Soldering Temperature | Max of 10 seconds | | | 260 | °C |
| Storage temperature | | -65 | | 150 | °C |
| DC CHARACTERISTICS (VDD = 3.3V or 5V unless noted) | | | | | |
| Operating Voltage, VDD | | 3.0 | | 5.5 | V |
| Input High Voltage, VIH, X1/ICLK only | Clock input | VDD/2 + 1 | VDD/2 | | V |
| Input Low Voltage, VIL, X1/ICLK only | Clock input | | VDD/2 | VDD/2 - 1 | V |
| Input High Voltage, VIH | Select inputs, OE, $\overline{\text{PD}}$ | 2 | | | V |
| Input Low Voltage, VIL | Select inputs, OE, $\overline{\text{PD}}$ | | | 0.8 | V |
| Output High Voltage, VOH | VDD=3.3V, IOH=-8mA | 2.4 | | | V |
| Output Low Voltage, VOL | VDD=3.3V, IOL=8mA | | | 0.4 | V |
| Output High Voltage, VOH, VDD = 3.3 or 5V | IOH=-8mA | VDD-0.4 | | | V |
| Operating Supply Current, IDD, at 5V | No Load, note 2 | | 40 | | mA |
| Operating Supply Current, IDD, at 3.3V | No Load, note 2 | | 26 | | mA |
| Short Circuit Current, VDD = 3.3 | Each output | | ±50 | | mA |
| Input Capacitance | Except X1, X2 | | 7 | | pF |
| Internal Pull-up or Pull-down Resistor | Except X1 | | 500 | | k |
| AC CHARACTERISTICS (VDD = 3.3V or 5V unless noted) | | | | | |
| Input Crystal Frequency | | 10 | | 25 | MHz |
| Input Clock Frequency | See page 3 | 10 | | 150 | MHz |
| Output Clock Rise Time | 0.8 to 2.0V, no load | | | 1.5 | ns |
| Output Clock Fall Time | 2.0 to 0.8V, no load | | | 1.5 | ns |
| Output Clock Duty Cycle | At VDD/2 | 40 | 50 | 60 | % |
| One Sigma Jitter, CLK | | | 40 | | ps |
| Absolute Jitter, CLK | | | ±160 | | ps |

Notes: 1. Stresses beyond those listed under Absolute Maximum Ratings could cause permanent damage to the device. Prolonged exposure to levels above the operating limits but below the Absolute Maximums may affect device reliability.
2. Multiplier of x1, all clocks at highest frequencies.

External Components

The MK1714 requires a minimum number of external components for proper operation. Decoupling capacitors of 0.01µF should be connected between VDD and GND (on pins 4 and 7), as close to the chip as possible. A series termination resistor of 33Ω may be used for each clock output. The crystal must be connected as close to the chip as possible. The crystal should be a fundamental mode and parallel resonant. If accurate tuning is required, crystal capacitors should be connected from pins X1 to ground and X2 to ground. The value of these capacitors is given by the following equation, where C_L is the crystal load capacitance: Crystal caps (pF) = $(C_L - 6) \times 2$. So for a crystal with 20pF load capacitance, two 28 pF caps should be used. If a clock input is used, drive it into X1 and leave X2 unconnected.



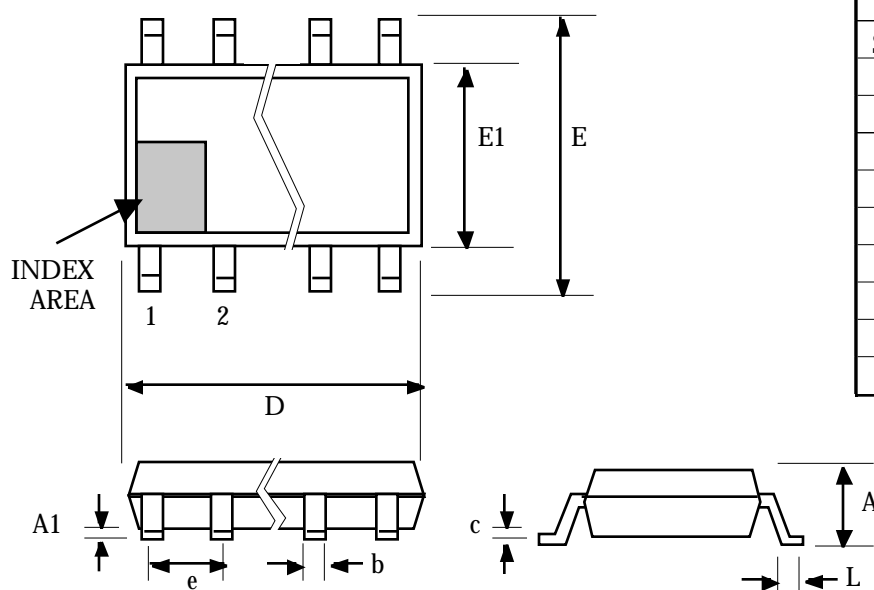
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Spread Spectrum Multiplier Clock

Package Outline and Package Dimensions

(For current dimensional specifications, see JEDEC Publication No. 95.)

20 pin SSOP



| Symbol | Inches | | Millimeters | |
|--------|----------|-------|-------------|------|
| | Min | Max | Min | Max |
| A | 0.053 | 0.069 | 1.35 | 1.75 |
| A1 | 0.004 | 0.010 | 0.10 | 0.25 |
| b | 0.008 | 0.012 | 0.20 | 0.30 |
| c | 0.007 | 0.010 | 0.19 | 0.25 |
| D | 0.337 | 0.344 | 8.56 | 8.74 |
| e | .025 BSC | | 0.65 BSC | |
| E | 0.228 | 0.244 | 5.79 | 6.20 |
| E1 | 0.150 | 0.157 | 3.81 | 3.99 |
| L | 0.016 | 0.050 | 0.41 | 1.27 |

Ordering Information

| Part/Order Number | Marking | Package | Shipping | Temperature |
|-------------------|-------------|-------------|---------------|--------------|
| MK1714-02R | MK1714-02R | 20 pin SSOP | Tubes | 0 to 70 °C |
| MK1714-02RTR | MK1714-02R | 20 pin SSOP | Tape and Reel | 0 to 70 °C |
| MK1714-02RI | MK1714-02RI | 20 pin SSOP | Tubes | -40 to 85 °C |
| MK1714-02RITR | MK1714-02RI | 20 pin SSOP | Tape and Reel | -40 to 85 °C |

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