# MK3235
# Handheld System Clock Synthesizer

ICS MICROCLOCK

## Description

The MK3235 is the smallest size, lowest power system clock synthesizer available. It is the ideal way to generate clocks for handheld computers, such as PDAs, PICs, and other devices where low power is required. Using analog Phase-Locked Loop (PLL) techniques, the device operates from a single 32.768 kHz crystal to produce the 32.768kHz, 14.318MHz, and serial communications output clocks.

The device has three power down modes for the 14.3MHz, communications, and 32.768kHz clocks.

The MK3235 can save board space and cost even if it only replaces the 32kHz oscillator circuitry and one additional surface mount crystal or oscillator. The extremely low IDD, the ease of surface mounting, and the power down capability are added benefits in using the part.

## Features

- Input crystal frequency of 32.768 kHz
- Lowest power solution available
- Lowest profile clock solution where height is critical
- Three output clocks
- 3.3V or 5.0V operation
- Duty cycle of 45/55
- 14.3MHz or 14.3MHz+Comm clock power downs
- Separate battery supply pin for 32 kHz runs to 2V
- IDD less than 4µA when 32 kHz running
- Packaged in 16 pin narrow SOIC

## Block Diagram
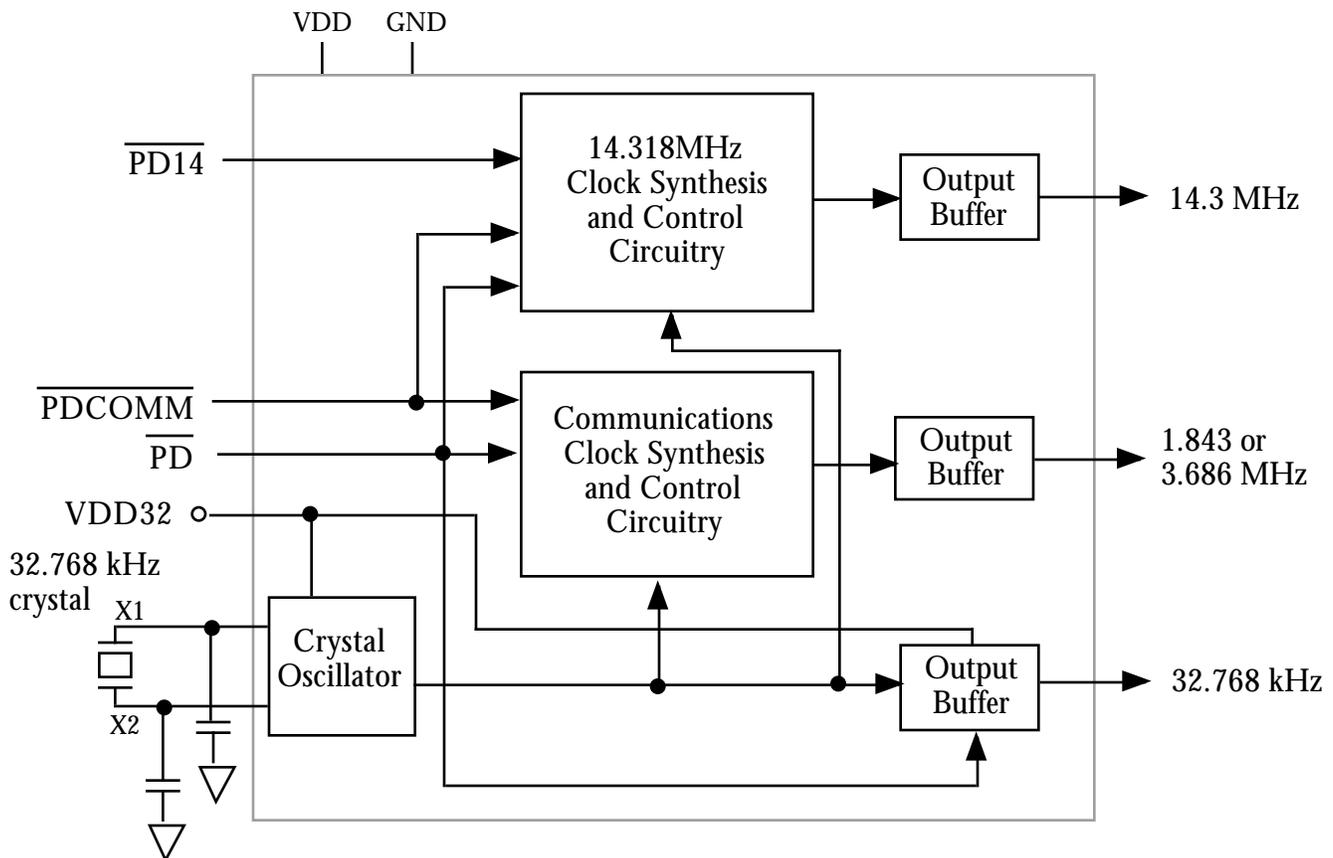
## Pin Assignment

```
          X2 ☐ 1○      16 ☐ GND
          X1 ☐ 2       15 ☐ GND
       VDD32 ☐ 3       14 ☐ VDD
         VDD ☐ 4       13 ☐ PD14
         GND ☐ 5       12 ☐ GND
     COMMCLK ☐ 6       11 ☐ 14.3M
         32K ☐ 7       10 ☐ PD
      PDCOMM ☐ 8        9 ☐ GND
```

## Pin Descriptions

| Number | Name | Type | Description |
|---|---|---|---|
| 1 | X2 | O | Crystal connection. Connect to 32.768 kHz crystal. |
| 2 | X1 | I | Crystal connection. Connect to 32.768 kHz crystal. |
| 3 | VDD32 | P | Separate power supply connection for 32.768kHz clock. Will operate to 2.0V. |
| 4 | VDD | P | Connect to +3.3V or +5V. Must be the same voltage as pin 14. |
| 5 | GND | P | Connect to ground. |
| 6 | COMMCLK | O | Serial communications (1.84 on -01 version, or 3.68MHz on -02 version) clock output. |
| 7 | 32K | O | 32.768 kHz square wave clock output. |
| 8 | $\overline{\text{PDCOMM}}$ | I | Power Down serial Communications and 14.3M clock outputs (stop low) when low. |
| 9 | GND | P | Connect to ground. |
| 10 | $\overline{\text{PD}}$ | I | Powers Down everything but 32kHz oscillator internally. 32kHz output buffer is off. |
| 11 | 14.3M | O | 14.318 MHz output clock. |
| 12 | GND | P | Connect to ground. |
| 13 | $\overline{\text{PD14}}$ | I | Power Down 14.318MHz clock output (stops low) when low. |
| 14 | VDD | P | Connect to +3.3V or +5V. Must be the same voltage as pin 4. |
| 15 | GND | P | Connect to ground. |
| 16 | GND | P | Connect to ground. |

Type:  I = Input, O = output, P = power supply connection
**Power Down status:**  Output clocks will stop in a low state when powered down

## External Components

The MK3235 requires a minimum number of external components for proper operation. Decoupling capacitors of 0.1µF should be connected between VDD and GND, and VDD32 and GND, as close to the MK3235 as possible. A series resistor should be used on the VDD32 supply. A series termination resistor of 33   may be used for each clock output, except the 32.768 kHz. For tuning the real time clock output, use a 32.768 kHz crystal with a load capacitance of 12.5pF, and connect a 20pF±5% (NPO dielectric) capacitor between each crystal pin and ground. The 32.768 kHz crystal must be connected as close to the chip as possible. Consult MicroClock for a recommended external circuit schematic.

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## 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 |
| Soldering Temperature | Max of 30 seconds | | | 260 | °C |
| Storage Temperature | | -65 | | 150 | °C |
| **DC CHARACTERISTICS (at 5.0V unless otherwise noted)** | | | | | |
| Operating Voltage, VDD | | 3.0 | | 5.5 | V |
| Operating Voltage,VDD32 | | 2.0 | | 5.5 | V |
| Input High Voltage, VIH | VDD=5V | 2.0 | | | V |
| Input Low Voltage, VIL | VDD=5V | | | 0.8 | V |
| Output High Voltage, VOH, 3.3V or 5V | IOH=-4mA | VDD-0.4 | | | V |
| Output High Voltage, VOH | VDD=5V, IOH=-25mA | 2.4 | | | V |
| Output Low Voltage, VOL | VDD=5V, IOL=25mA | | | 0.4 | V |
| Input High Voltage, VIH | VDD=3.3V | 1.9 | | | V |
| Input Low Voltage, VIL | VDD=3.3V | | | 0.4 | 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 |
| IDD Operating Supply Current, 5V | No Load | | 9 | | mA |
| IDD32 with only 32 kHz running, 5V | No Load | | 3.5 | | μA |
| IDD Operating Supply Current, 3.3V | No Load | | 6 | | mA |
| IDD32 with only 32 kHz output running, 3.3V | No Load | | 2.5 | | μA |
| IDD32, only 32 kHz osc. running, 3.3V, note 2 | 32kHz output off. $\overline{PD}$=0 | | 1 | | μA |
| Short Circuit Current, 5V | 32kHz output | | ±30 | | mA |
| Short Circuit Current, 5V | 14, 1.8MHz outputs | | ±80 | | mA |
| Input Capacitance | | | 7 | | pF |
| **AC CHARACTERISTICS (at 5.0V unless otherwise noted)** | | | | | |
| Input Frequency | | | 32.768 | | kHz |
| Output Clock Rise and Fall Time, 0.2 to 0.8VDD | | | | 2 | ns |
| Output Clock Duty Cycle, all MHz clocks | At VDD/2 | 45 | 49 to 51 | 55 | % |
| 32.768 kHz Clock Duty Cycle | At VDD32/2 | | 57 | | % |
| Absolute Clock Period Jitter | 14.318 MHz | -500 | | 500 | ps |
| Power up time, to all clocks stable, 32k running | VDD=3.3 or 5V | | 9 | | ms |
| Power on time,VDD32=0V to all clocks stable | 32.768kHz crystal with ESR 25k | 500 | | 1000 | ms |
| Power on time, all power down pins taken high | 32.768kHz oscillator running | 15 | | | ms |

Note 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.
Note 2: When $\overline{PD}$=0 (low) and VDD32 is greater than 2.0V, then the 32kHz oscillator will continue to run on the chip, but the output is turned off. This allows for a quick power-up (<20ms), while the chip is only consuming approximately 1μA.

## Package Outline and Package Dimensions

**16 pin SOIC narrow**
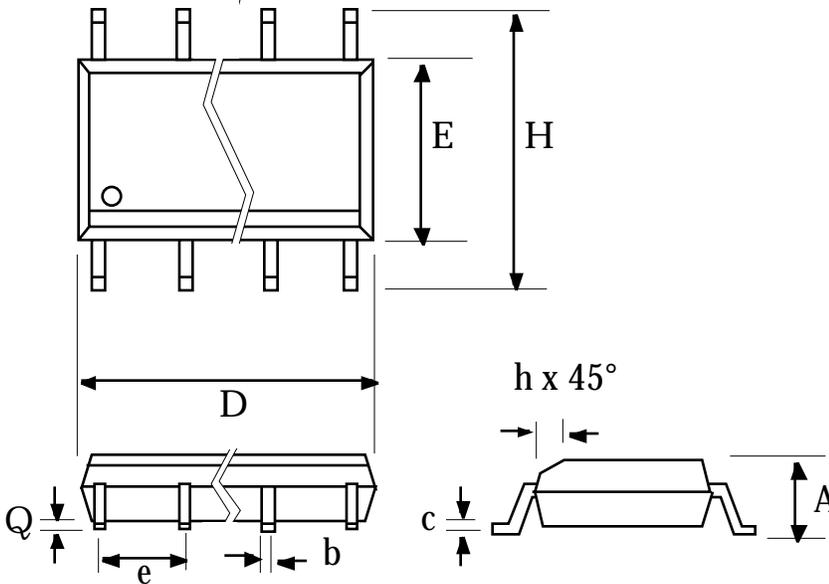


| Symbol | Inches Min | Inches Max | Millimeters Min | Millimeters Max |
|--------|------|------|------|------|
| A | 0.055 | 0.068 | 1.397 | 1.7272 |
| b | 0.013 | 0.019 | 0.330 | 0.483 |
| c | 0.007 | 0.010 | 0.191 | 0.254 |
| D | 0.385 | 0.400 | 9.779 | 10.160 |
| E | 0.150 | 0.160 | 3.810 | 4.064 |
| H | 0.225 | 0.245 | 5.715 | 6.223 |
| e | .050 BSC | | 1.27 BSC | |
| h | | 0.016 | | 0.406 |
| Q | 0.004 | 0.01 | 0.102 | 0.254 |

## Ordering Information

| Part/Order Number | Marking | Communications Clock | Package | Temperature |
|-------------------|---------|----------------------|---------|-------------|
| MK3235-01S | MK3235-01S | 1.843 MHz | 16 pin SOIC | 0-70°C |
| MK3235-02S | MK3235-02S | 3.686 MHz | 16 pin SOIC | 0-70°C |
| MK3235-01STR | MK3235-01S | 1.843 MHz | Add Tape & Reel | 0-70°C |
| MK3235-02STR | MK3235-02S | 3.686 MHz | Add Tape & Reel | 0-70°C |