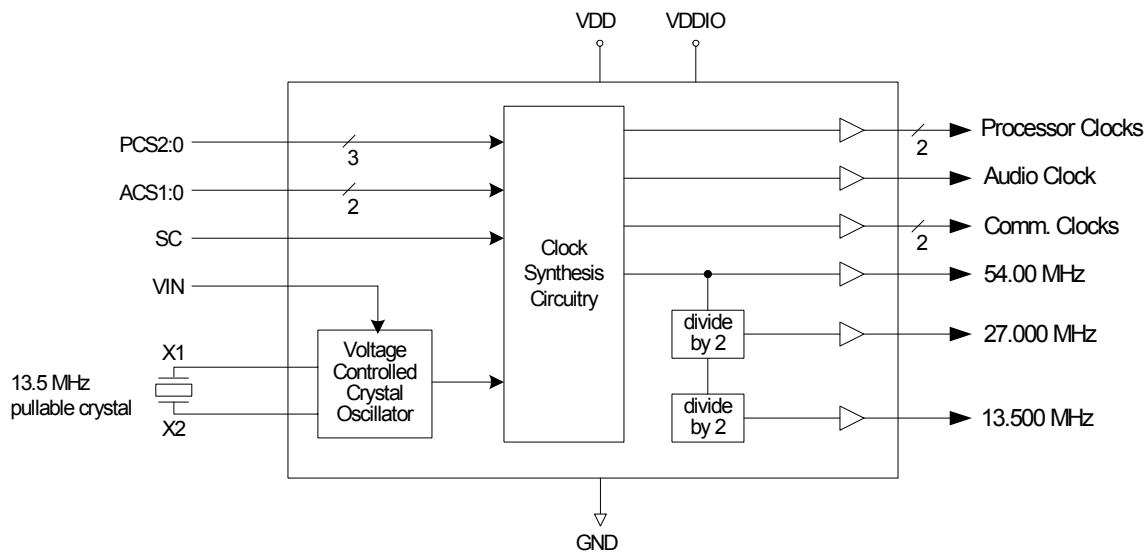


**VCXO AND SET-TOP CLOCK SOURCE**
**MK2771-15**
**Description**

The MK2771-15 is a low-cost, low-jitter, high-performance VCXO and clock synthesizer designed for set-top boxes. The on-chip Voltage Controlled Crystal Oscillator accepts a 0 to 3 V input voltage to cause the output clocks to vary by  $\pm 100$  ppm. Using IDT's patented VCXO and analog Phase-Locked Loop (PLL) techniques, the device uses an inexpensive 13.5 MHz pullable crystal input to produce multiple output clocks including two selectable processor clocks, a selectable audio clock, two communications clocks, and three fixed clocks. All clocks are frequency locked to the 27.00 MHz output (and to each other) with zero ppm error, so any output can be used as the VCXO output.

**Features**

- Packaged in 28 pin SSOP
- Pb-free package
- Ideal for systems using Oak's MPEG decoders
- On-chip patented VCXO with pull range of 200 ppm
- VCXO tuning voltage of 0 to 3 V
- Processor frequencies include 33.3, 40, 50, 66.6, 81, and 100 MHz
- Audio clocks of 8.192 MHz, 11.2896 MHz, 12.288 MHz and 18.432 MHz
- Zero ppm synthesis error in all clocks (all exactly track 27 MHz VCXO)
- Uses an inexpensive 13.5 MHz pullable crystal
- Full CMOS output swings with 25 mA output drive capability at TTL levels
- Advanced, low-power, sub-micron CMOS process
- 5 V operating voltage with 3.3 V capable I/O

**Block Diagram**


## Pin Assignment

|       |                          |    |    |                          |       |
|-------|--------------------------|----|----|--------------------------|-------|
| PCS0  | <input type="checkbox"/> | 1  | 28 | <input type="checkbox"/> | ACS1  |
| X2    | <input type="checkbox"/> | 2  | 27 | <input type="checkbox"/> | ACS0  |
| X1    | <input type="checkbox"/> | 3  | 26 | <input type="checkbox"/> | 54M   |
| VDD   | <input type="checkbox"/> | 4  | 25 | <input type="checkbox"/> | 27M   |
| VDD   | <input type="checkbox"/> | 5  | 24 | <input type="checkbox"/> | GND   |
| VIN   | <input type="checkbox"/> | 6  | 23 | <input type="checkbox"/> | CCLK1 |
| VDDIO | <input type="checkbox"/> | 7  | 22 | <input type="checkbox"/> | VDD   |
| VDD   | <input type="checkbox"/> | 8  | 21 | <input type="checkbox"/> | VDD   |
| SC    | <input type="checkbox"/> | 9  | 20 | <input type="checkbox"/> | PCS2  |
| GND   | <input type="checkbox"/> | 10 | 19 | <input type="checkbox"/> | GND   |
| PCLK1 | <input type="checkbox"/> | 11 | 18 | <input type="checkbox"/> | GND   |
| PCLK2 | <input type="checkbox"/> | 12 | 17 | <input type="checkbox"/> | CCLK2 |
| PCS1  | <input type="checkbox"/> | 13 | 16 | <input type="checkbox"/> | 13.5M |
| ACLK  | <input type="checkbox"/> | 14 | 15 | <input type="checkbox"/> | DC    |

## Processor Clock Select Table (MHz)

| PCS2 | PCS1 | PCS0 | PCLK1  | PCLK2   |
|------|------|------|--------|---------|
| 0    | 0    | 0    | 27.500 | OFF     |
| 0    | 0    | 1    | 33.333 | 66.666  |
| 0    | 1    | 0    | 33.326 | 83.314  |
| 0    | 1    | 1    | 50.000 | 100.000 |
| 1    | 0    | 0    | 32.400 | 81.000  |
| 1    | 0    | 1    | 40.000 | 33.333  |
| 1    | 1    | 0    | TEST   | TEST    |
| 1    | 1    | 1    | TEST   | TEST    |

## Audio Clock Table

| ACS1 | ACS0 | ACLK (MHz) |
|------|------|------------|
| 0    | 0    | 8.192      |
| 0    | 1    | 11.2896    |
| 1    | 0    | 12.288     |
| 1    | 1    | 18.432     |

## Comm Clock Table (MHz)

| SC | CCLK1   | CCLK2  |
|----|---------|--------|
| 0  | 18.432  | 24.576 |
| M  | 11.0592 | 18.432 |
| 1  | 11.0592 | 24.576 |

0 = connect directly to ground

1 = connect directly to VDDIO

M = leave floating or unconnected

## Pin Descriptions

| Pin Number     | Pin Name | Pin Type        | Pin Description  |
|----------------|----------|-----------------|--|
| 1              | PCS0     | Input           | Processor clock select 0. Selects PCLKs on pins 11 and 12. See table above. Internal pull-up resistor. |
| 2              | X2       | XO              | Crystal connection. Connect to a pullable 13.5 MHz crystal.  |
| 3              | X1       | XI              | Crystal connection. Connect to a pullable 13.5 MHz crystal.  |
| 4, 5, 8        | VDD      | Power           | Connect to +5 V.   |
| 6              | VIN      | Input           | Voltage input to VCXO. Zero to 3 V signal which controls the frequency of the VCXO.                    |
| 7              | VDDIO    | Power           | Connect to +3.3 V or +5 V. Amplitude of inputs must, and outputs will, match this.                     |
| 9              | SC       | Tri-level input | Communications clock select pin. Biased to M level if floating   |
| 10, 18, 19, 24 | GND      | Power           | Connect to ground.   |
| 11             | PCLK1    | Output          | Processor clock output number 1. Determined by status of PCS2:0.                                       |
| 12             | PCLK2    | Output          | Processor clock output number 2. Determined by status of PCS2:0.                                       |
| 13             | PCS1     | Input           | Processor clock select 1. Selects PCLKs on pins 11 and 12. See table above. Internal pull-up resistor. |
| 14             | ACLK     | Output          | Audio clock output. Determined by status of ACS1, ACS0 per table above.                                |
| 15             | DC       | —               | Don't Connect anything to this pin.  |
| 16             | 13.5M    | Output          | 13.50 MHz VCXO clock output.   |
| 17             | CCLK2    | Output          | Communications clock output 2 determined by status of SC per table above.                              |
| 20             | PCS2     | Input           | Processor clock select 2. Selects PCLKs on pins 11 and 12. See table above. Internal pull-up resistor. |
| 21, 22         | VDD      | Power           | Connect to +5 V.   |
| 23             | CCLK1    | Output          | Communications clock output 1 determined by status of SC per table above.                              |
| 25             | 27M      | Output          | 27.00 MHz VCXO clock output.   |
| 26             | 54M      | Output          | 54.00 MHz VCXO clock output.   |
| 27             | ACS0     | Input           | Audio clock select 0. Selects ACLK on pin 14. See table above. Internal pull-up resistor.              |
| 28             | ACS1     | Input           | Audio clock select 1. Selects ACLK on pin 14. See table above. Internal pull-up resistor.              |

## Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the MK2771-15. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

| Item   | Rating              |
|--|---------------------|
| Supply Voltage, VDD (referenced to GND)      | 7 V                 |
| Inputs and Clock Outputs (referenced to GND) | -0.5 V to VDD+0.5 V |
| Ambient Operating Temperature                | 0 to +70° C         |
| Storage Temperature                          | -65 to +150° C      |
| Junction Temperature                         | 125° C              |
| Soldering Temperature                        | 260° C              |

## DC Electrical Characteristics

Unless stated otherwise, **VDD = 5 V**, Ambient Temperature 0 to +70° C

| Parameter                              | Symbol   | Conditions               | Min.      | Typ.  | Max. | Units |
|--|--|--------------------------|-----------|-------|------|-------|
| Operating Voltage                      | VDD  |                          | 4.75      |       | 5.25 | V     |
| Operating Voltage                      | VDDIO  | All inputs/outputs       | 3.15      |       | 5.25 | V     |
| Input High Voltage, X1 pin only        | V <sub>IH</sub>                                |                          | 3.5       | 2.5   |      | V     |
| Input Low Voltage, X1 pin only         | V <sub>IL</sub>                                |                          |           | 2.5   | 1.5  | V     |
| Input High Voltage, except SC and PCS2 | V <sub>IH</sub>                                |                          | 2         |       |      | V     |
| Input Low Voltage, except SC and PCS2  | V <sub>IL</sub>                                |                          |           |       | 0.8  | V     |
| Input High Voltage, SC and PCS2 only   | V <sub>IH</sub>                                |                          | VDDIO-0.5 |       |      | V     |
| Input Low Voltage, SC and PCS2 only    | V <sub>IL</sub>                                |                          |           |       | 0.5  | V     |
| Output High Voltage                    | V <sub>OH</sub>                                | I <sub>OH</sub> = -25 mA | 2.4       |       |      | V     |
| Output Low Voltage                     | V <sub>OL</sub>                                | I <sub>OL</sub> = 25 mA  | –         | –     | 0.4  | V     |
| Output High Voltage, CMOS Level        | V <sub>OH</sub>                                | I <sub>OH</sub> = -8 mA  | VDDIO-0.4 |       |      | V     |
| Operating Supply Current               | I <sub>DD</sub> + I <sub>DDIO</sub><br>(3.3 V) | No load, Note 1          |           | 46+27 |      | mA    |
| Short Circuit Current                  | I <sub>OS</sub>                                | Each output              |           | ±100  |      | mA    |
| Input Capacitance, except X1           | C <sub>IN</sub>                                | Except X1, X2            |           | 7     |      | pF    |
| Frequency Synthesis Error              |  | All clocks               |           |       | 0    | ppm   |
| VIN, VCXO Control Voltage              |  |                          | 0         |       | 3    | V     |

## AC Electrical Characteristics

Unless stated otherwise, **VDD = 5 V**, Ambient Temperature 0 to +70° C

| Parameter                           | Symbol   | Conditions            | Min.      | Typ. | Max. | Units |
|-------------------------------------|----------|-----------------------|-----------|------|------|-------|
| Input Frequency                     |          |                       | 13.500000 |      |      | MHz   |
| Output Clock Rise Time              | $t_{OR}$ | 0.8 to 2.0 V, no load |           | 1.5  |      | ns    |
| Output Clock Fall Time              | $t_{OF}$ | 2.0 to 0.8 V, no load |           | 1.5  |      | ns    |
| Output Clock Duty Cycle             | $t_{OD}$ | At VDDIO/2            | 40        | 50   | 60   | %     |
| Maximum Absolute Jitter, short term | $t_{ja}$ |                       |           | 300  |      | ps    |
| VCXO Pullability                    | $t_{ja}$ | Note 2                | -100      |      | 100  | ppm   |

Note 1: With PCLK at 100 MHz.

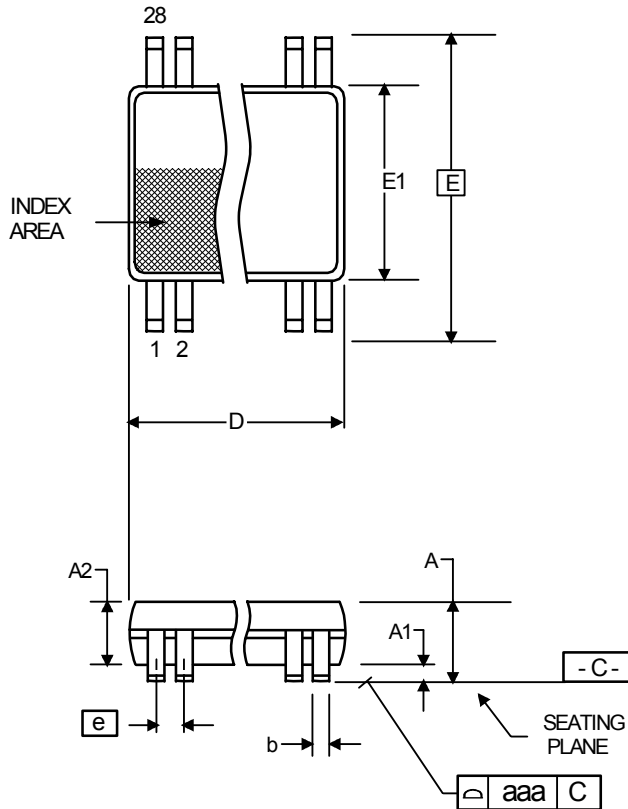
Note 2: With a pullable crystal that conforms to IDT's specifications.

## Pullable Crystal Specifications

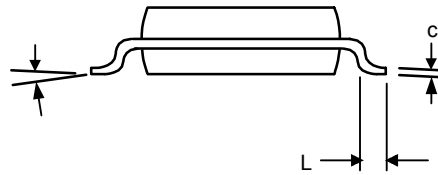
|                                  |                  |
|----------------------------------|------------------|
| Frequency                        | 13.500000 MHz    |
| Correlation (load) Capacitance   | 14 pF            |
| CO/C1                            | 240 max.         |
| ESR                              | 35 $\Omega$ max. |
| Operating Temperature            | 0 to 70°C        |
| Initial Accuracy                 | $\pm 20$ ppm     |
| Temperature plus Aging Stability | $\pm 50$ ppm     |

## Package Outline and Package Dimensions (28-pin SSOP)

Package dimensions are kept current with JEDEC Publication No. 95



| Symbol | Millimeters |        | Inches     |       |
|--------|-------------|--------|------------|-------|
|        | Min         | Max    | Min        | Max   |
| A      | 1.35        | 1.75   | 0.053      | 0.069 |
| A1     | 0.102       | 0.254  | 0.004      | 0.010 |
| A2     | --          | 1.50   | --         | .059  |
| b      | 0.203       | 0.305  | 0.008      | 0.012 |
| c      | 0.191       | 0.254  | 0.007      | 0.010 |
| D      | 9.804       | 10.008 | 0.386      | 0.394 |
| E      | 5.791       | 6.198  | 0.228      | 0.244 |
| E1     | 3.810       | 3.988  | 0.150      | 0.157 |
| e      | .635 Basic  |        | .025 Basic |       |
| L      | 0.406       | 1.270  | 0.016      | 0.050 |
| α      | 0°          | 8°     | 0°         | 8°    |



## Ordering Information

| Part / Order Number | Marking     | Shipping packaging | Package     | Temperature |
|---------------------|-------------|--------------------|-------------|-------------|
| MK2771-15RLF        | MK2771-15LF | Tubes              | 28-pin SSOP | 0 to +70° C |
| MK2771-15RLFTR      | MK2771-15LF | Tape and Reel      | 28-pin SSOP | 0 to +70° C |

Note: "LF" denotes Pb (lead) free package.

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