

## HDTV CLOCK SYNTHESIZER

**MK2716**

### Description

The MK2716 is a low-cost, low jitter, high-performance PLL clock synthesizer designed to produce the 74.176 MHz and 74.25 MHz clocks necessary for HDTV systems. Using IDT's patented analog Phase-Locked Loop (PLL) techniques, the device accepts a 27 MHz crystal or clock input. The zero ppm synthesis error exactly locks the display to the digital stream.

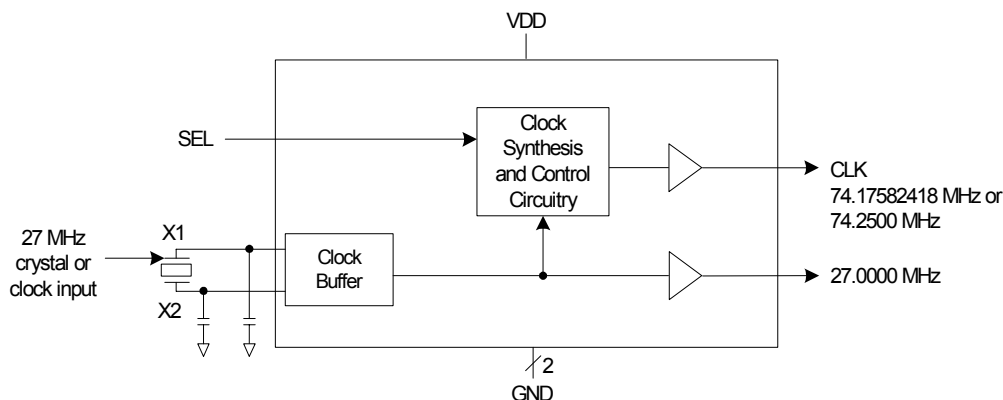
IDT manufactures the largest variety multimedia clock synthesizers for all applications. Consult IDT to eliminate crystals and oscillators from your board.

For applications that require lower jitter, such as SDI and pixel clocks, use the ICS664.

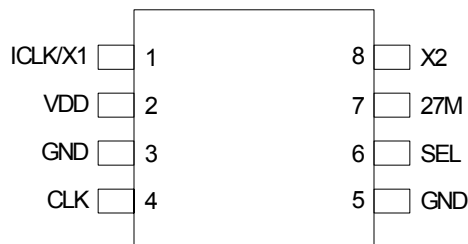
### Features

- Packaged in 8-pin SOIC
- Pb (lead) free package
- Input frequency of 27 MHz
- Zero ppm synthesis error in output clock
- 3.3 V or 5 V  $\pm 10\%$  operating supply
- Ideal for HDTV applications and oscillator manufacturers
- 25 mA output drive capability at TTL levels
- Advanced, low power, sub-micron CMOS process
- Operating voltage of 3.3 V or 5 V

### Block Diagram



## Pin Assignment



## FREQUENCY SELECT TABLE

| SEL | CLK (MHz)   |
|-----|-------------|
| 0   | 74.17582418 |
| 1   | 74.25       |

## Pin Descriptions

| Pin Number | Pin Name | Pin Type | Pin Description                                                                        |
|------------|----------|----------|----------------------------------------------------------------------------------------|
| 1          | ICLK/X1  | XI       | Crystal connection. Connect to a 27 MHz fundamental crystal or clock.                  |
| 2          | VDD      | Power    | Connect to +3.3 V or +5 V.                                                             |
| 3          | GND      | Power    | Connect to ground.                                                                     |
| 4          | 27M      | Output   | 74.17582418 MHz or 74.25 MHz clock output (see table above).                           |
| 5          | GND      | Power    | Connect to ground.                                                                     |
| 6          | SEL      | Input    | Select pin determines value of CLK per table above.                                    |
| 7          | 27M      | Output   | 27 MHz buffered clock or crystal oscillator output.                                    |
| 8          | X2       | XO       | Crystal connection. Connect to a 27 MHz crystal, or leave unconnected for clock input. |

## External Components

### Decoupling Capacitor

As with any high performance mixed-signal IC, the MK2716 must be isolated from system power supply noise to perform optimally.

A decoupling capacitor of 0.01µF must be connected between VDD and GND on pins 2 and 3. It must be connected close to the MK2716 to minimize lead inductance. Pin 5 can be connected to pin 3. No external power supply filtering is required for the MK2716.

### Series Termination Resistor

A 33Ω terminating resistor can be used next to the clock outputs for trace lengths over one inch.

### Crystal Load Capacitors

The total on-chip capacitance is approximately 18 pF. A parallel resonant, fundamental mode, AT cut 27 MHz crystal

should be used. The device crystal connections should include pads for small capacitors from X1 to ground and from X2 to ground. These capacitors are used to adjust the stray capacitance of the board to match the nominally required crystal load capacitance. Because load capacitance can only be increased in this trimming process, it is important to keep stray capacitance to a minimum by using very short PCB traces (and no vias) between the crystal and device. Crystal capacitors, if needed, must be connected from each of the pins X1 and X2 to ground.

The value (in pF) of these crystal caps should equal  $(C_L - 16 \text{ pF}) \times 2$ . In this equation,  $C_L$  = crystal load capacitance in pF. Example: For a crystal with an 18 pF load capacitance, each crystal capacitor would be 4 pF  $[(18 - 16) \times 2] = 4$ .

## Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the MK2716. 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           | 7 V                 |
| All Inputs and Outputs        | -0.5 V to VDD+0.5 V |
| Ambient Operating Temperature | 0 to +70° C         |
| Storage Temperature           | -65 to +150° C      |
| Soldering Temperature         | 260° C              |

## Recommended Operation Conditions

| Parameter                                         | Min. | Typ. | Max. | Units |
|---------------------------------------------------|------|------|------|-------|
| Ambient Operating Temperature                     | 0    |      | +70  | ° C   |
| Power Supply Voltage (measured in respect to GND) | +3.0 |      | +5.5 | V     |

## DC Electrical Characteristics

VDD=5 V unless otherwise noted, Ambient temperature 0 to +70° C

| Parameter                | Symbol          | Conditions              | Min.    | Typ. | Max. | Units |
|--------------------------|-----------------|-------------------------|---------|------|------|-------|
| Operating Voltage        | VDD             |                         | 3.0     | 5    | 5.5  | V     |
| Input High Voltage       | V <sub>IH</sub> |                         | 2.0     |      |      | V     |
| Input Low Voltage        | V <sub>IL</sub> |                         |         |      | 0.8  | V     |
| Output High Voltage      | V <sub>OH</sub> | I <sub>OH</sub> = -4 mA | VDD-0.4 |      |      | V     |
| Output Low Voltage       | V <sub>OL</sub> | I <sub>OL</sub> = 16 mA |         |      | 0.4  | V     |
| Operating Supply Current | IDD             | No load                 |         | 30   |      | mA    |
| Short Circuit Current    |                 | Each output             |         | ±50  |      | mA    |
| Input Capacitance        | C <sub>IN</sub> | S0, S1 pins             |         | 7    |      | pF    |

## AC Electrical Characteristics

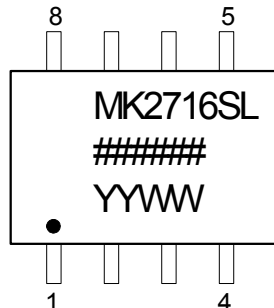
VDD = 5 V unless otherwise noted, Ambient Temperature 0 to +70°C

| Parameter                           | Symbol   | Conditions          | Min. | Typ. | Max. | Units |
|-------------------------------------|----------|---------------------|------|------|------|-------|
| Input Frequency                     | $F_{IN}$ |                     |      | 27   |      | MHz   |
| Frequency Error, Output Clock       |          |                     |      |      | 0    | ppm   |
| Output Clock Rise Time              | $t_{OR}$ | 0.8 to 2.0 V        |      |      | 1.5  | ns    |
| Output Clock Fall Time              | $t_{OF}$ | 2.0 to 8.0 V        |      |      | 1.5  | ns    |
| Output Clock Duty Cycle             |          | at 1.4 V            | 40   | 50   | 60   | %     |
| Maximum Absolute Jitter, short term | $t_{ja}$ | Deviation from mean |      | 200  |      | ps    |

## Thermal Characteristics

| Parameter                              | Symbol        | Conditions     | Min. | Typ. | Max. | Units |
|----------------------------------------|---------------|----------------|------|------|------|-------|
| Thermal Resistance Junction to Ambient | $\theta_{JA}$ | Still air      |      | 150  |      | °C/W  |
|                                        | $\theta_{JA}$ | 1 m/s air flow |      | 140  |      | °C/W  |
|                                        | $\theta_{JA}$ | 3 m/s air flow |      | 120  |      | °C/W  |
| Thermal Resistance Junction to Case    | $\theta_{JC}$ |                |      | 40   |      | °C/W  |

## Marking Diagram (Pb free)

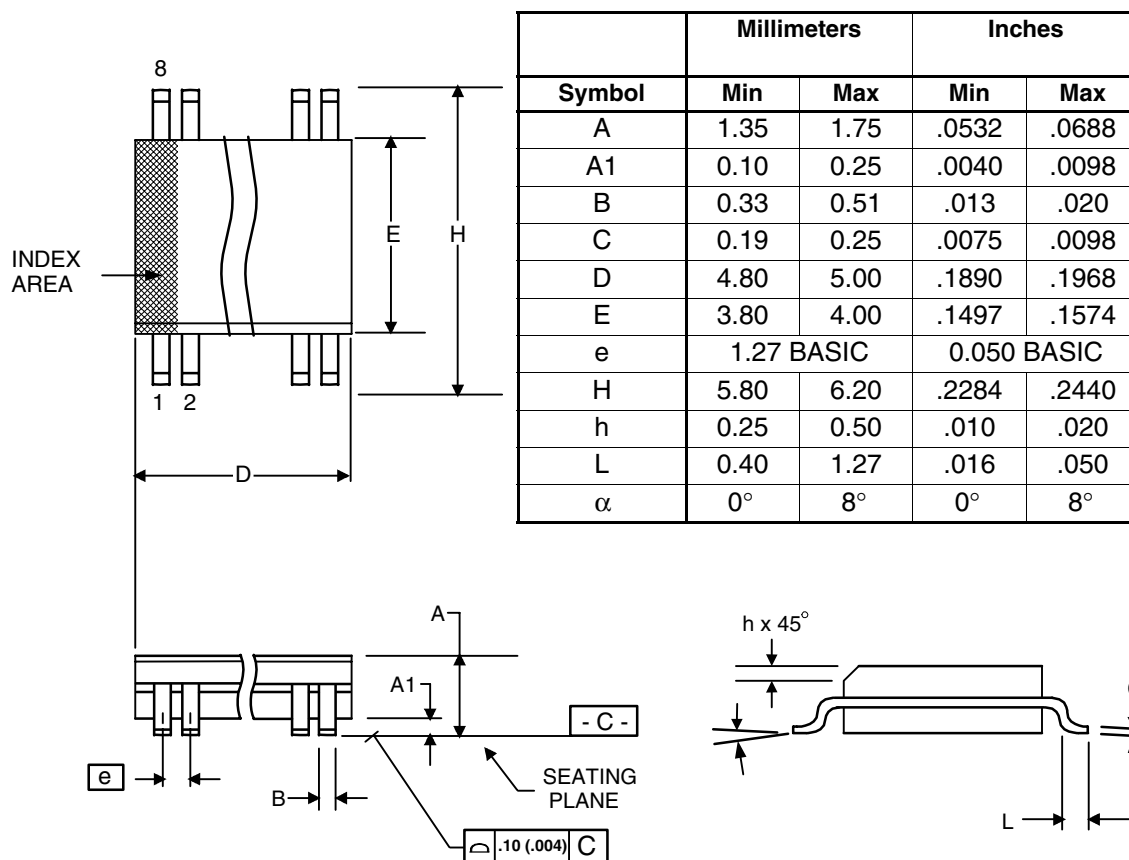


Notes:

1. ##### is the lot number.
2. YYWW is the last two digits of the year and week that the part was assembled.
3. "LF" or "L" denotes Pb (lead) free package.
4. Bottom marking: (origin)  
Origin = country of origin if not USA

## Package Outline and Package Dimensions (8-pin SOIC, 150 Mil. Narrow Body)

Package dimensions are kept current with JEDEC Publication No. 95



## Ordering Information

| Part / Order Number | Marking  | Shipping Packaging | Package    | Temperature |
|---------------------|----------|--------------------|------------|-------------|
| MK2716SLF           | MK2716SL | Tubes              | 8-pin SOIC | 0 to +70° C |
| MK2716SLFTR         | MK2716SL | Tape and Reel      | 8-pin SOIC | 0 to +70° C |

While the information presented herein has been checked for both accuracy and reliability, Integrated Device Technology (IDT) assumes no responsibility for either its use or for the infringement of any patents or other rights of third parties, which would result from its use. No other circuits, patents, or licenses are implied. This product is intended for use in normal commercial applications. Any other applications such as those requiring extended temperature range, high reliability, or other extraordinary environmental requirements are not recommended without additional processing by IDT. IDT reserves the right to change any circuitry or specifications without notice. IDT does not authorize or warrant any IDT product for use in life support devices or critical medical instruments.

MK2716

HDTV CLOCK SYNTHESIZER

CLOCK SYNTHESIZER

## IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES ("RENESAS") PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Rev.1.0 Mar 2020)

### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:  
[www.renesas.com/contact/](http://www.renesas.com/contact/)

### Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.