



### Description

The MK2704 is a low cost, low jitter, high-performance PLL clock synthesizer designed to replace oscillators and PLL circuits in set-top box and multimedia systems. Using ICS' patented analog Phase Locked Loop (PLL) techniques, the device uses a 27 MHz crystal or clock input to produce a buffered reference clock and a selectable audio clock.

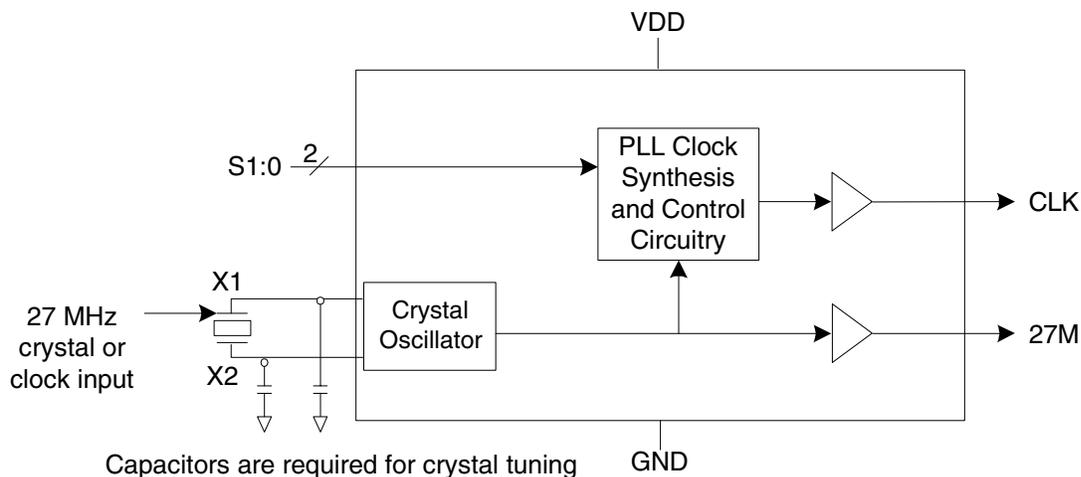
The audio clock is frequency locked to the 27 MHz clock, assuring that the audio with zero ppm error and video will track perfectly.

ICS manufactures the largest variety of Set-Top Box and multimedia clock synthesizers for all applications. Consult ICS to eliminate VCXOs, crystals and oscillators from your board.

### Features

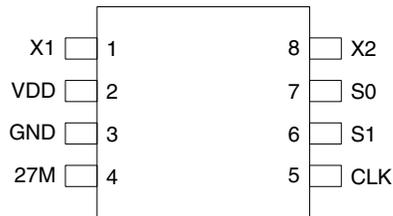
- Packaged in 8-pin SOIC
- Available in Pb-free packaging
- Uses an inexpensive, fundamental crystal or clock
- Selectable audio output clock of 16.9344 MHz, 18.432 MHz, or 36.864 MHz
- Supports MPEG sampling rates of 384x, 44.1 kHz, 48 kHz, and 96 kHz
- Patented zero ppm synthesis error in all clocks
- All frequencies are frequency locked
- 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



8-pin (150 mil) SOIC

## AUDIO CLOCK OUTPUT SELECT TABLE

S1	S0	CLK (MHz)
0	0	36.864
0	1	Test
1	0	16.9344
1	1	18.432

Key: 0 = Connect pin directly to ground

1 = Connect pin directly to VDD

## Pin Descriptions

Pin Number	Pin Name	Pin Type	Pin Description
1	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	27.00 MHz buffered reference clock output.
5	CLK	Output	Audio clock output per table above.
6	S1	Input	Audio clock frequency select input #1. Determines CLK output per table above. Internal pull-up resistor.
7	S0	Input	Audio clock frequency select input #0. Determines CLK output per table above. Internal pull-up resistor.
8	X2	XO	Crystal connection to a 27 MHz crystal, or leave unconnected for clock output.

## External Components

### Decoupling Capacitor

As with any high performance mixed-signal IC, the MK2704 must be isolated from system power supply noise to perform optimally.

A decoupling capacitor of 0.01 $\mu$ F must be connected between VDD and GND on pins 2 and 3. It must be connected close to the MK2704 to minimize lead inductance. No external power supply filtering is required for the MK2704.

### Series Termination Resistor

A 33 $\Omega$  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 16 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 MK2704. These ratings, which are standard values for ICS 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)	+3.13		+5.50	V

## DC Electrical Characteristics

VDD=3.3 V ±5% , Ambient temperature 0 to +70°C, unless stated otherwise

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Operating Voltage	VDD		3.13		5.50	V
Input High Voltage	$V_{IH}$	X1 pin only Note 1	$(VDD/2)+1$	VDD/2		V
Input Low Voltage	$V_{IL}$	X1 pin only Note 1		VDD/2	$(VDD/2)-1$	V
Input High Voltage	$V_{IH}$	S0, S1 pins	2.0			V
Input Low Voltage	$V_{IL}$	S0, S1 pins			0.8	V
Output High Voltage	$V_{OH}$	$I_{OH} = -12 \text{ mA}$	2.4			V



Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Low Voltage	$V_{OL}$	$I_{OL} = 12 \text{ mA}$			0.4	V
Output High Voltage, CMOS level	$V_{OH}$	$I_{OH} = -4 \text{ mA}$	VDD-0.4			V
Operating Supply Current	IDD	No load VDD = 3.3.V		10		mA
		No load VDD = 5 V		18		mA
Short Circuit Current		CLK output		$\pm 50$		mA
Input Capacitance	$C_{IN}$	S0, S1 pins		5		pF
Nominal Output Impedance				20		$\Omega$
Frequency Synthesis Error		All Clocks			0	ppm

Note 1: CMOS level input. Nominal trigger point is VDD/2 for 3.3 V or 5 V operation

## AC Electrical Characteristics

VDD = 3.3 V  $\pm 5\%$ , Ambient Temperature 0 to +70°C, unless stated otherwise

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Crystal or Clock Frequency	$F_{IN}$			27		MHz
Input Crystal Accuracy					$\pm 30$	ppm
Output Clock Rise Time	$t_{OR}$	0.8 to 2.0 V, Note 1			1.5	ns
Output Clock Fall Time	$t_{OF}$	2.0 to 8.0 V, Note 1			1.5	ns
Output Clock Duty Cycle		at VDD/2, Note 1	45		55	%
Maximum Absolute Jitter, short	$t_{ja}$	Deviation from mean		$\pm 225$		ps

Note 1: Measured with 15 pF load.

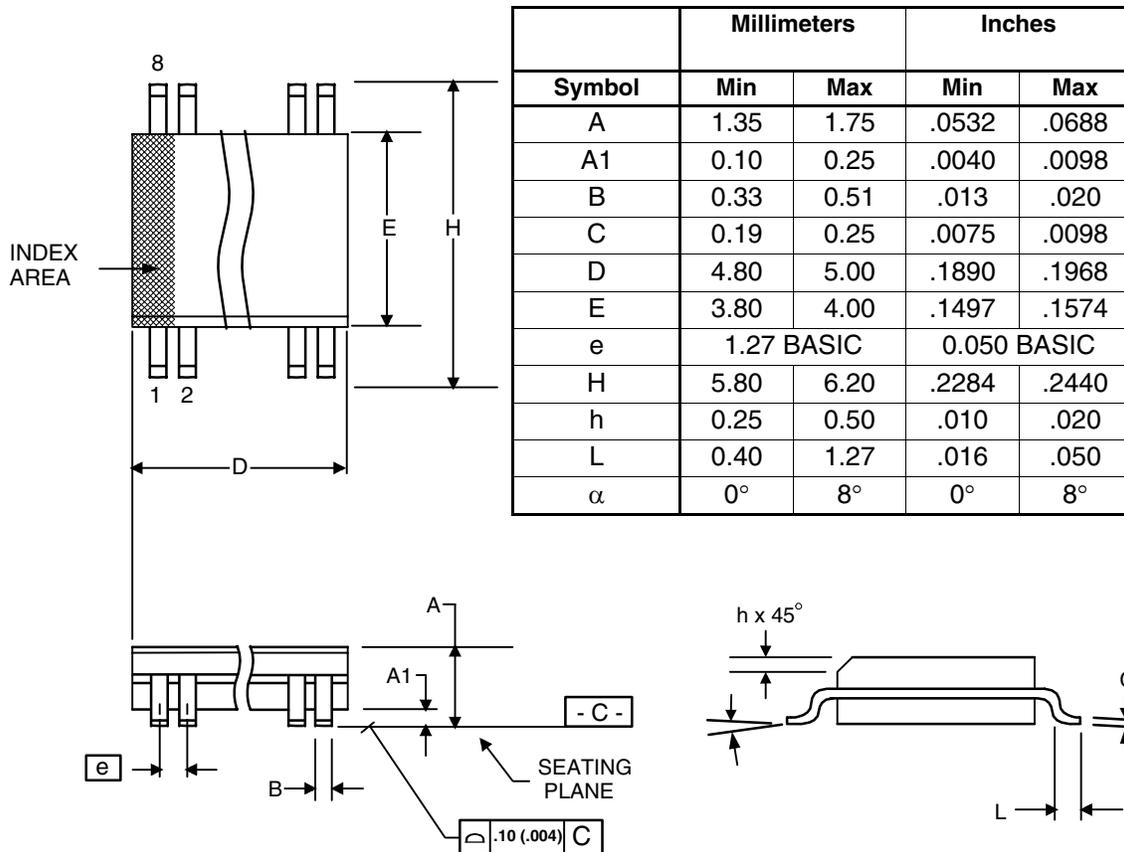
## Thermal Characteristics

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



### 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 (Note 1)	Marking	Shipping packaging	Package	Temperature
MK2704S	2704S	Tubes	8-pin SOIC	0 to +70° C
MK2704STR	2704S	Tape and Reel	8-pin SOIC	0 to +70° C
MK2704SLF	2704SL	Tubes	8-pin SOIC	0 to +70° C
MK2704SLFTR	2704SL	Tape and Reel	8-pin SOIC	0 to +70° C

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