

Description

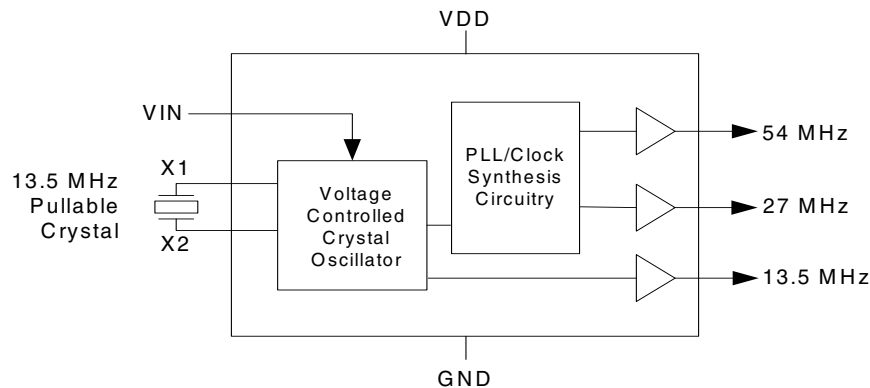
The MK3720D is a drop-in replacement for the MK3720S and MK3720A devices. Compared to these earlier devices the MK3720D offers a wider operating frequency range and improved power supply noise rejection.

The MK3720 is a low-cost, low-jitter, high-performance 3.3 Volt VCXO designed to replace expensive 13.5, 27, or 54 MHz VCXOs. The patented on-chip Voltage Controlled Crystal Oscillator accepts a 0 to 3.3 V input voltage to cause the output clocks to vary by ± 100 ppm. Using ICS' patented VCXO and analog/digital Phase-Locked Loop (PLL) techniques, the device uses an inexpensive external pullable crystal input to produce output clocks of 13.5 MHz, 27 MHz, and 54 MHz.

The MK3720D exhibits a moderate VCXO gain of 120 ppm/V typical, when used with a high-quality external pullable quartz crystal.

The frequency of the on-chip VCXO is adjusted by an external control voltage input into pin VIN. Because VIN is a high impedance input, it can be driven directly from an PWM RC integrator circuit.

Block Diagram

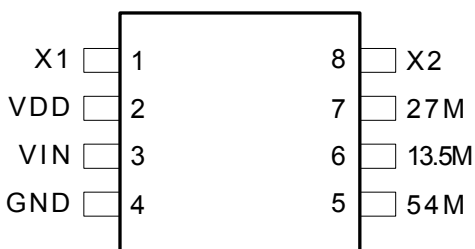


Features

- MK3720D is a drop-in upgrade to the earlier MK3720S and MK3720A devices
- Packaged in 8-pin SOIC
- Available in Pb (lead) free package
- Operating voltage of 3.3 V ($\pm 5\%$)
- Output clocks of 54, 27, and 13.5 MHz
- Uses an inexpensive 13.500 MHz external crystal
- On-chip VCXO (patented) with pull range of 200 ppm (minimum)
- VCXO tuning voltage of 0 to 3.3 V
- 12 mA output drive capability at TTL levels
- Advanced, low-power, sub-micron CMOS process

MK3720D is Recommended for New Designs

Pin Assignment



8-Pin (150 mil) SOIC

Pin Descriptions

Pin Number	Pin Name	Pin Type	Pin Description
1	X1	Input	Crystal connection. Connect to the external pullable crystal.
2	VDD	Power	Connect to +3.3 V (0.01uf decoupling capacitor recommended).
3	VIN	Input	Voltage input to VCXO. Zero to 3.3 V analog input which controls the oscillation frequency of the VCXO.
4	GND	Power	Connect to ground.
5	54M	Output	54 MHz VCXO clock output.
6	13.5	Output	13.5 MHz VCXO clock output.
7	27	Output	27 MHz VCXO clock output.
8	X2	Input	Crystal connection. Connect to the external pullable crystal.

External Component Selection

The MK3720 requires a minimum number of external components for proper operation.

Decoupling Capacitor

A decoupling capacitor of 0.01 μ F must be connected between VDD (pin 2) and GND (pin 4), as close to these pins as possible. For optimum device performance, the decoupling capacitor should be mounted on the component side of the PCB. Avoid the use of vias in the decoupling circuit.

Series Termination Resistor

When the PCB trace between the clock output (CLK, pin 5) and the load is over 1 inch, series termination should be used. To series terminate a 50 Ω trace (a commonly used trace impedance) place a 33 Ω resistor in series with the clock line, as close to the clock output pin as possible. The nominal impedance of the clock output is 20 Ω .

Quartz Crystal

The MK3720 VCXO function consists of the external crystal and the integrated VCXO oscillator circuit. To assure the best system performance (frequency pull range) and reliability, a crystal device with the recommended parameters (shown below) must be used, and the layout guidelines discussed in the following section shown must be followed.

The frequency of oscillation of a quartz crystal is determined by its "cut" and by the load capacitors connected to it. The MK3720 incorporates on-chip variable load capacitors that "pull" (change) the frequency of the crystal. The crystal specified for use with the MK3720 is designed to have zero frequency error when the total of on-chip + stray capacitance is 14 pF.

Recommended Crystal Parameters:

See application note MAN05 for crystal information. MAN05 is available on the internet at www.icst.com/pdf/man05.pdf.

The external crystal must be connected as close to the chip as possible and should be on the same side of the PCB as the MK3720. There should be no via's between the crystal pins and the X1 and X2 device pins. There should be no signal traces underneath or close to the crystal.

Crystal Tuning Load Capacitors

The crystal traces should include pads for small fixed capacitors, one between X1 and ground, and another between X2 and ground. Stuffing of these capacitors on the PCB is optional. The need for these capacitors is determined at system prototype evaluation, and is influenced by the particular crystal used (manufacture and frequency) and by PCB layout. The typical required capacitor value is 1 to 4 pF.

The procedure for determining the value of these capacitors can be found in application note MAN05.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the MK3720. 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)	+3.15		+3.45	V
Reference crystal parameters	Refer to page 3			

Thermal Characteristics

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

DC Electrical Characteristics

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Operating Voltage	VDD		3.15		3.45	V
Output High Voltage	V _{OH}	I _{OH} = -12 mA	2.4			V
Output Low Voltage	V _{OL}	I _{OL} = 12 mA			0.4	V
Output High Voltage (CMOS Level)	V _{OH}	I _{OH} = -4 mA	VDD-0.4			V
Operating Supply Current	IDD	No load		13		mA
Short Circuit Current	I _{OS}			\pm 50		mA
VIN, VCXO Control Voltage	V _{IA}		0		3.3	V

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
Crystal Pullability	F _P	0V \leq VIN \leq 3.3V, Note 1	\pm 115			ppm
VCXO Gain		VIN = VDD/2 \pm 1 V, Note 1		120		ppm/V
Output Rise Time	t _{OR}	0.8 to 2.0 V, C _L =15 pF			1.5	ns
Output Fall Time	t _{OF}	2.0 to 0.8 V, C _L =15 pF			1.5	ns
Output Clock Duty Cycle	t _D	Measured at 1.4 V, C _L =15 pF	45	50	55	%
Maximum Output Jitter, short term	t _J	C _L =15 pF, 13.5M CLK		80		ps
		C _L =15 pF, 27M and 54M CLK		150		ps

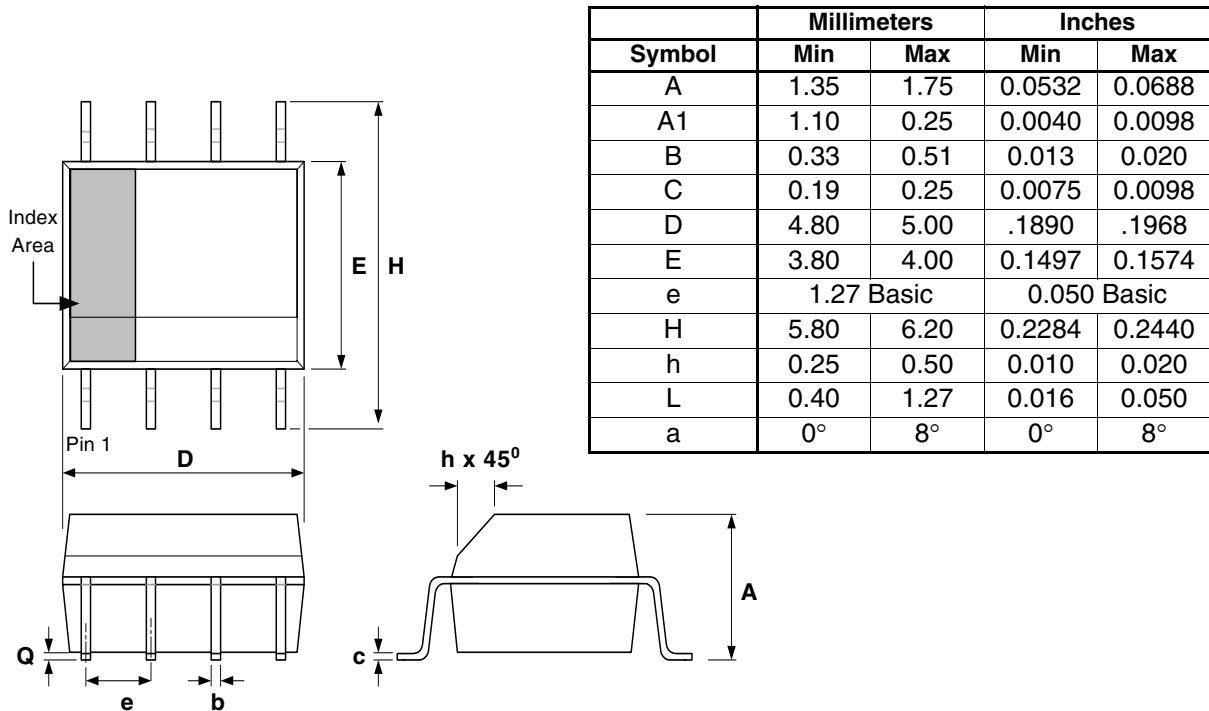
Note 1: External crystal device must conform with Pullable Crystal Specifications listed on page 3.

Note 2: Original MK3720S and MK3720A provided \pm 100 ppm crystal pullability.

Note 3: Original MK3720S and MK3720A provided 100 and 170 ppm/V respectively.

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
MK3720D	MK3720D	Tubes	8-pin SOIC	0 to +70° C
MK3720DTR	MK3720D	Tape and Reel	8-pin SOIC	0 to +70° C
MK3720DLF	MK3720DL	Tubes	8-pin SOIC	0 to +70° C
MK3720DLFTR	MK3720DL	Tape and Reel	8-pin SOIC	0 to +70° C

Note 1: MK3720D is recommended for new designs. Call factory for information on MK3720A and MK3720S.

Parts that are ordered with a "LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.

While the information presented herein has been checked for both accuracy and reliability, Integrated Circuit Systems (ICS) 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 ICS. ICS reserves the right to change any circuitry or specifications without notice. ICS does not authorize or warrant any ICS product for use in life support devices or critical medical instruments.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
 - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
 - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
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/

Trademarks

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