MK3715

LOW COST 3.3 VOLT VCXO

Description

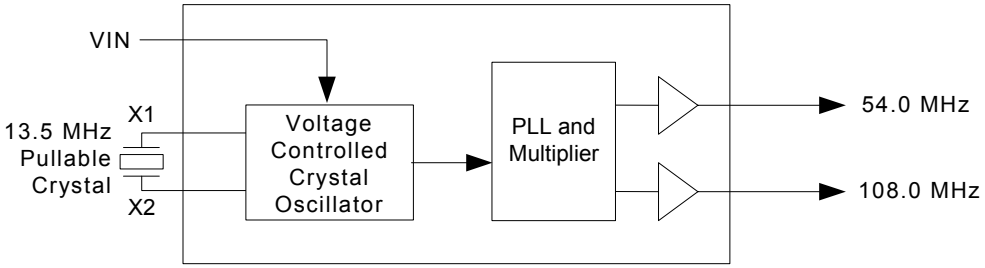
The MK3715 is a low cost, low jitter, high-performance 3.3 volt VCXO designed to replace expensive VCXO modules. The on-chip Voltage Controlled Crystal Oscillator accepts a 0 to 3.3 V input voltage to cause the output clocks to vary by ±100 ppm. Using ICS' patented VCXO techniques, the device uses an inexpensive external 13.5 MHz pullable crystal to produce two fixed clock outputs of 54.0 MHz and 108.0 MHz.

ICS manufactures a large variety of Set-Top Box and multimedia clock synthesizers for all applications. If more clock outputs are needed, see the MK2731 or MK377x family of parts. Consult ICS to eliminate VCXOs, crystals and oscillators from your board.

Features

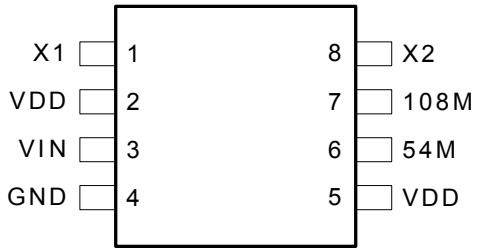
- Packaged in 8 pin SOIC
- 3.3 V only operating voltage
- Provides two fixed clock outputs of 54.0 MHzand 108.0 MHz
- Uses an inexpensive pullable 13.5 MHz externalcrystal
- On-chip VCXO (patented) with pull range of200ppm (minimum)
- VCXO tuning voltage of 0 to 3.3 V
- 12mA output drive capability at TTL levels
- Advanced, low power, sub-micron CMOS process

Block Diagram



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Pin Assignment



8-Pin (150 mil) SOIC

Pin Descriptions

Pin Number	Pin Name	Pin Type	Pin Description
1	XI	Input	Crystal connection. Connect to a pullable 13.5 MHz crystal.
2	VDD	Power	Connect to +3.3 V.
3	VIN	Input	Voltage input to VCXO. Zero to 3.3 V analog input which controls the VCXO frequency.
4	GND	Power	Connect to ground.
5	VDD	Power	Connect to +3.3 V.
6	54M	Output	Fixed clock output of 54.0 MHz.
7	108M	Output	Fixed clock output of 108.0 MHz.
8	X2	Input	Crystal connection. Connect to a pullable 13.5 MHz crystal.

External Component Selection

The MK3715 requires a minimum number of external components for proper operation.

Decoupling Capacitors

A decoupling capacitor of 0.01μF should be connected between VDD and GND on pins 2 and 4 as close to the MK3715 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 and the load is over 1 inch, series termination should be used. To series terminate a 50Ω trace (a commonly used trace impedance), place a 33Ω resistor in series with the clock line, as close to the clock output pin as possible. The nominal impedance of the clock output is 20Ω.

Quartz Crystal

The MK3715 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 oscillation frequency of a quartz crystal is determined by its “cut” and by the load capacitors connected to it. The MK3715 incorporates on-chip variable load capacitors that “pull” (change) the frequency of the crystal. The crystal specified for use with the MK3715 is designed to have zero frequency error when the total of on-chip + stray capacitance is 14 pF.

Recommended Crystal Parameters:

Initial Accuracy at 25°C	±20 ppm
Drift Over Temperature and Aging	±50 ppm
Load Capacitance	14 pf
C0/C1 Ratio	240 Max
Equivalent Series Resistance	35 Ω Max

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 MK3715. 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. See application note MAN05.

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 MK3715. 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

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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		3.15		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		6		mA
Short Circuit Current	I_{OS}			±50		mA
VIN, VCXO Control Voltage	V_{IA}		0		3.3	V

AC Electrical Characteristics

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

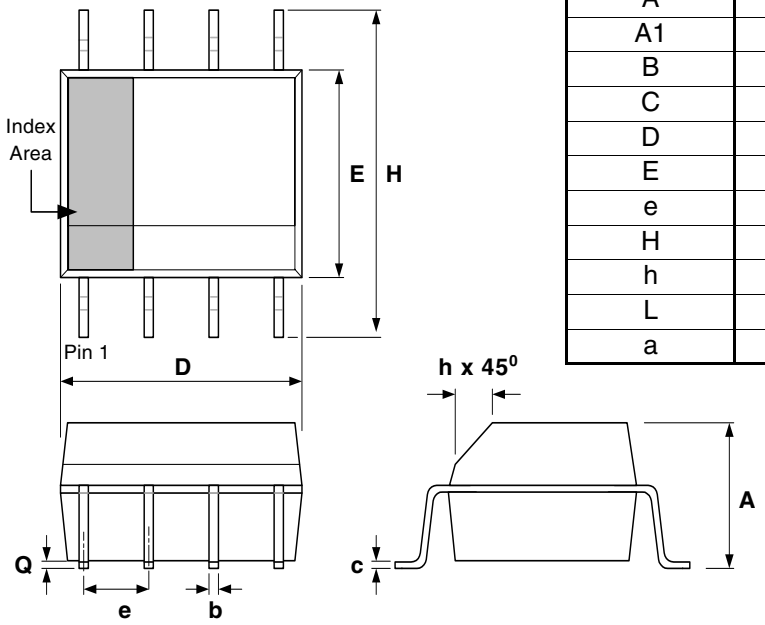
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Crystal Frequency				13.500000		MHz
Input Crystal Accuracy		Note 1				
Output Frequency Pullability	F_P	0V≤ VIN ≤ 3.3 V, Note 1	±100			ppm
Output Clock Rise Time	t_{OR}	0.8 to 2.0 V			1.5	ns
Output Clock Fall Time	t_{OF}	2.0 to 0.8 V			1.5	ns
Output Clock Duty Cycle	t_D	At VDD/2	40	50	60	%
Maximum Absolute Jitter, short term	t_J			110		ps

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

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Package Outline and Package Dimensions (8-pin SOIC)

Package dimensions are kept current with JEDEC Publication No. 95



	Millimeters		Inches	
Symbol	Min	Max	Min	Max
A	1.35	1.75	0.0532	0.0688
A1	0.10	0.25	0.0040	0.0098
B	0.33	0.51	0.013	0.020
C	0.19	0.25	0.0075	0.0098
D	4.80	5.00	.1890	.1968
E	3.80	4.00	0.1497	0.1574
e	1.27 Basic		0.050 Basic	
H	5.80	6.20	0.2284	0.2440
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
a	0°	8°	0°	8°

Ordering Information

Part / Order Number	Marking	Shipping packaging	Package	Temperature
MK3715S	3715S	Tubes	8-pin SOIC	0 to +70° C
MK3715STR	3715S	Tape and Reel	8-pin SOIC	0 to +70° C

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