



27 MHz VCXO Clock Generator IC

Applications

Crystal-driven clock source for low cost set top boxes and digital multimedia with MPEG video/audio

General Description

The TLSI T73227 is a single-chip, low-jitter Voltage-Controlled-Crystal-Oscillator. The device accepts a 27 MHz fundamental crystal input and produces a low-jitter output at the same frequency. A 0V to +3.3V control signal is used to fine-tune the output clock frequency in the ± 100 ppm range. The T73227 is an excellent replacement for more expensive canned VCXOs.

Features

- +3.3V operating voltage
- Uses inexpensive pullable crystals
- 12mA drive capability at TTL levels
- Low Cost
- 200 ppm pull range (± 100 ppm)
- 8-pin SOIC and MSOP packages available
- Lead-free packages available

Figure 1. Functional Block Diagram

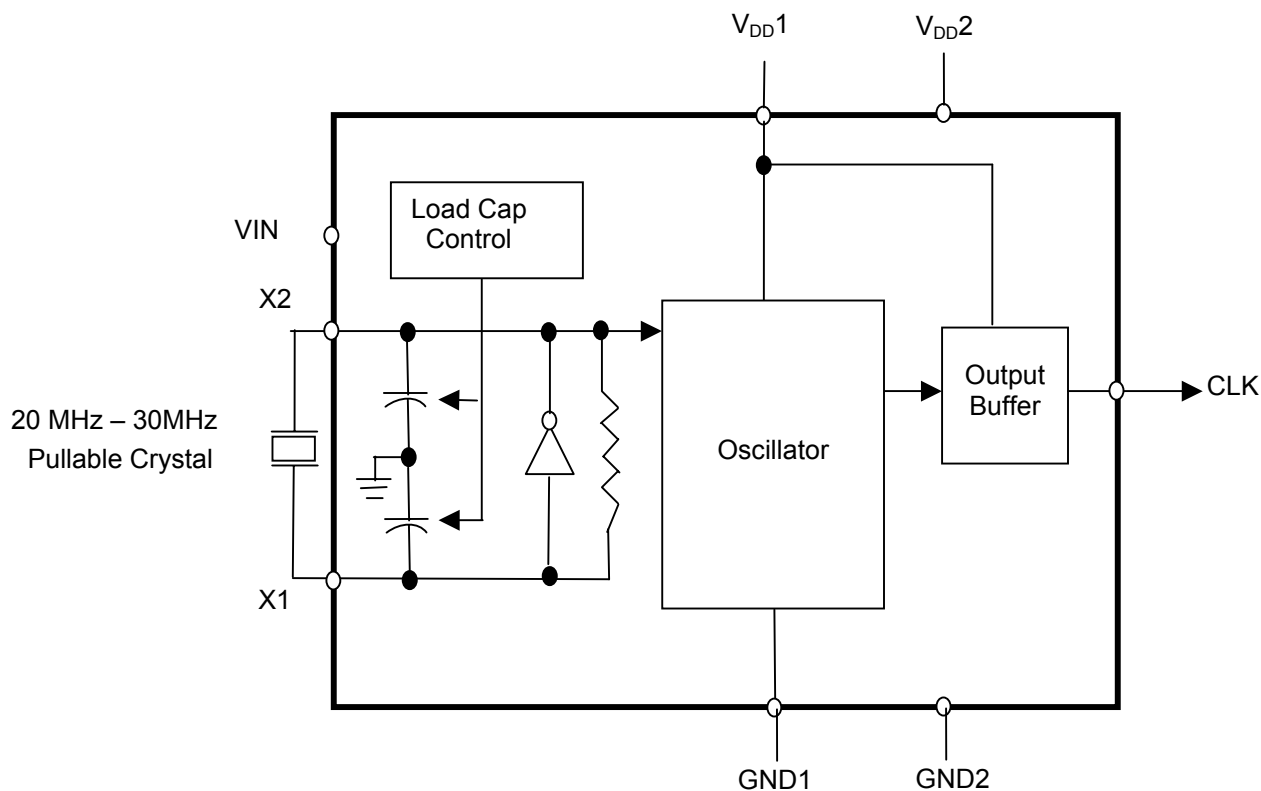


Figure 2. Pin Configuration

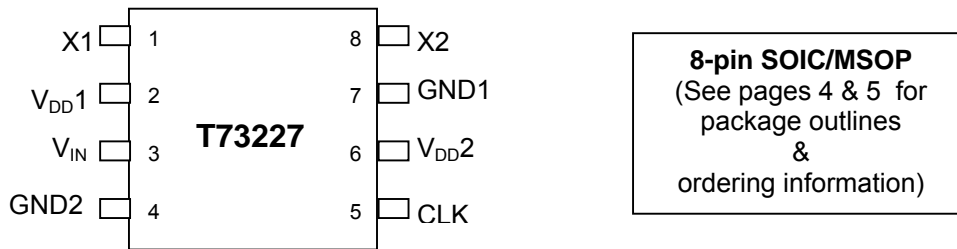


Table 1. Pin Description

Name	Pin No.	Type	Description
X1	1	Xi	Crystal connection. Connect to a 20 MHz – 30 MHz pullable crystal
V _{DD1}	2	P	Connect to +3.3V.
V _{IN}	3	I	Tuning control input. Zero to +3.3V signal controls the frequency of the VCXO.
GND2	4	P	Connect to ground.
CLK	5	O	Clock output
V _{DD2}	6	P	Connect to +3.3V.
GND1	7	P	Connect to ground.
X2	8	Xi	Crystal connection. Connect to a 20 MHz – 30 MHz pullable crystal.

Legend: I = Input
O = Output
P = Power supply connection
Xi = Crystal connections

Functional Block Description

The VCXO provides a tunable, low-jitter frequency reference. Loading capacitance for the crystal is internal to the T73227. No external components (other than the crystal resonator itself) are required for operation of the VCXO. Tuning of the VCXO frequency is accomplished by varying the voltage on Vin (Pin 3). The oscillator operates the crystal resonator in the parallel-resonant mode. Crystal warping, or the “pulling” of the crystal oscillation frequency, is accomplished by altering the effective load capacitance presented to the crystal by the oscillator circuit. The actual amount that changing the load capacitance alters the oscillator frequency will be dependent on the characteristics of the crystal as well as the oscillator circuit itself. Specifically, the motional capacitance of the crystal (usually referred to by crystal manufacturers as C₁), the static capacitance of the crystal (C₀), and the load capacitance (C_L) of the oscillator determine the “warping” or “pulling” capability of the crystal in the oscillator circuit. A simple formula to obtain the warping capability of a crystal oscillator is:

$$\Delta f (ppm) = \frac{C_1 \times (C_{L2} - C_{L1}) \times 10^6}{2 \times (C_0 + C_{L2}) \times (C_0 + C_{L1})}$$

where C_{L1} and C_{L2} are the two extremes of the applied load capacitance.

EXAMPLE: A crystal with the following parameters is used. With C₁ = 0.025pF, C₀ = 6pF, C_{L1} = 10pF, and C_{L2} = 20pF, the tuning range is:

$$\Delta f = \frac{0.025 \times (20 - 10) \times 10^6}{2 \times (6 + 20) \times (6 + 10)} = 300 ppm.$$

Table 2. Absolute Maximum Ratings

Parameter	Conditions	Min	Typ	Max	Units
Supply voltage, V_{DD}	Referenced to GND			5	V
Inputs and Clock Outputs	Referenced to GND	-0.5		$V_{DD}+0.5$	V
Soldering Temperature	Max of 10 seconds			+260	°C
Storage temperature		-65		+150	°C
Input Static Discharge Voltage Protection		2			KV

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. These ratings are stress specifications only and correct functional operation of the device at these or any other conditions above those listed in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

Table 3. Operating Conditions

Parameter	Conditions	Min	Typ	Max	Units
Operating Voltage, V_{DD}		+3.135	+3.3	+3.465	V
Ambient Operating Temperature		0		+70	°C
VCXO control voltage, V_{IN}		0		V_{DD}	V

Table 4. DC Electrical Characteristics

$T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$, $V_{DD} = +3.135\text{ V}$ to $+3.465\text{ V}$ unless otherwise specified

Parameter	Condition	Min	Typ ⁽¹⁾	Max	Units
Output High Voltage, V_{OH}	$I_{OH} = -12\text{mA}$	2.4			V
Output Low Voltage, V_{OL}	$I_{OL} = 12\text{mA}$			0.4	V
Operating Supply Current, I_{DD}	No Load, 27 MHz		25	35	mA
Short Circuit Current	CLK output		± 50		mA

Note:

1. Typical values are at $V_{DD} = +3.3\text{V}$ and $+25^\circ\text{C}$

Table 5. AC Electrical Characteristics

$T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$, $V_{DD} = +3.135\text{ V}$ to $+3.465\text{ V}$ unless otherwise specified

Symbol	Parameter	Condition	Min	Typ ⁽¹⁾	Max	Units
fosc	Input Crystal Frequency	Fundamental	20	27	30	MHz
tr	Output Clock Rise Time	+0.8 to +2.0V, $C_L = 10\text{ pF}$			1.5	ns
tf	Output Clock Fall Time	+2.0 to +0.8V, $C_L = 10\text{ pF}$			1.5	ns
t_{od}	Output Clock Duty Cycle	At $V_{DD}/2$	40		60	%
t_{jit} (pk – pk)	Period Jitter (Peak to Peak)	$C_L = 10\text{ pF}$			150	ps
f_{PULL}	Output frequency pullability	$0\text{V} \leq V_{IN} \leq +3.3\text{V}$	± 100			ppm

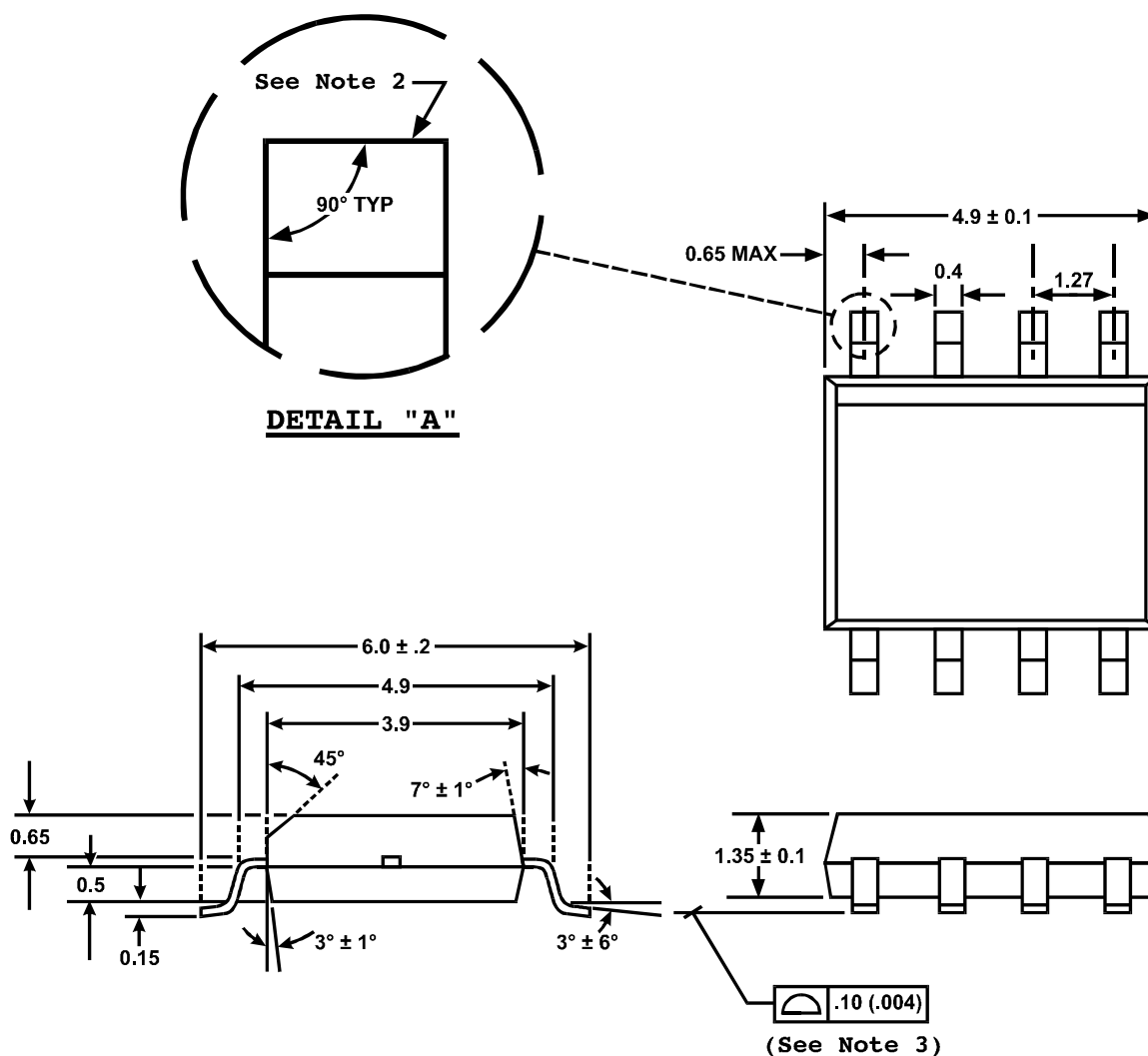
Note:

1. Typical values are at $V_{DD} = +3.3\text{V}$ and $+25^\circ\text{C}$
2. Mil-PRF-55310D 4.8.31.5 Deviation Linearity

Table 6. Pullable Crystal Specifications

Parameter	Symbol	Value
Crystal Resonator Frequency	f_{xtal}	27 MHz (typ)
Crystal Loading Capacitance (AT Cut)	C_L	20 pF (typ)
Capacitance Ratio (crystal gamma)	C_0/C_1	240 max
Equivalent Series Resistance	ESR	50 Ω max

Figure 3. Package Outline (8-pin SOIC)



- Note: 1) All dimensions are in mm.
 2) All leads must be blunt cut. (See DETAIL "A")
 3) Lead coplanarity not to exceed 0.004" maximum.

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Figure 4. Package Outline (8-pin MSOP)

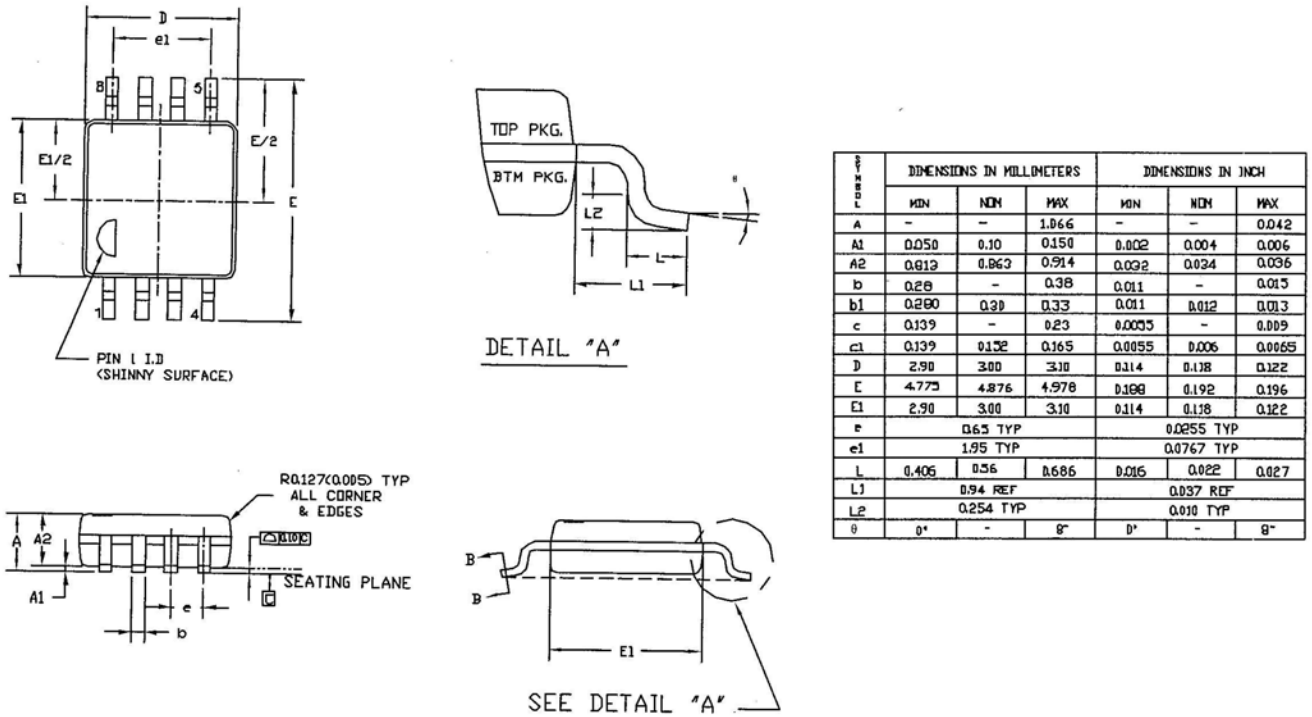


Table 7. Ordering Information

Part Number	Marking	Shipping/Packaging	No. of Pins	Package	Temperature
T73227-SO8	T73227	Tubes	8	SOIC	0°C to +70°C
T73227-SO8-TNR	T73227	Tape & Reel	8	SOIC	0°C to +70°C
T73227-SO8-LF	T73227●	Tubes	8	SOIC (Pb-Free)	0°C to +70°C
T73227-SO8-LF-TNR	T73227●	Tape & Reel	8	SOIC (Pb-Free)	0°C to +70°C
T73227-MO8	T73227	Tubes	8	MSOP	0°C to +70°C
T73227-MO8-TNR	T73227	Tape & Reel	8	MSOP	0°C to +70°C
T73227-DIE	N/A	Die in Waffle Pack	8	N/A	0°C to +70°C
T73227-DPW	N/A	Die in Probed Wafer	8	N/A	0°C to +70°C