General

Crystal clock oscillations are high-frequency devices that supply clock signals to variou electronic circuits. They can be used in lead-electrode and surface mounting applications over frequency ranges from 1.5MHz to 140MHz. Housing crystal units that consist of AT or BT cut fundamental or overtone and their oscillation circuit in the same package, our crystal clock oscillators are designed and manufactured to provide a stable output of signals when the set voltage is applied.

Generally, when customers buy crystal units and use them in thier oscillation circuits, they first need to provide analog settings prior to the installation. These include the settings of load capacitance, oscillation allowance, and variations in characteristics due to temperature changes. With Toyocom's oscillators, these settings are already provided by us, so their output signals can directly control TTL and CMOS ICs. This shortens design processes for customers and contributes to standardizing parts to be used. Our clock oscillators also feature a VCXO function and a Try-state function. The VCXO function enables control of output frequencies with external control voltage, whereas the Try-state feature maintains the output terminals at high impedance levels by outputting signals with control siganls while the power is supplied.

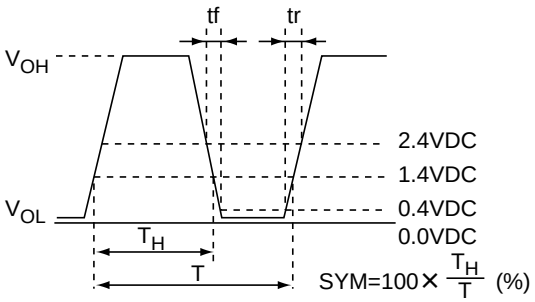
For further details about individual products, please refer to their specification sheets.

1. Definition of symbols and abbreviations

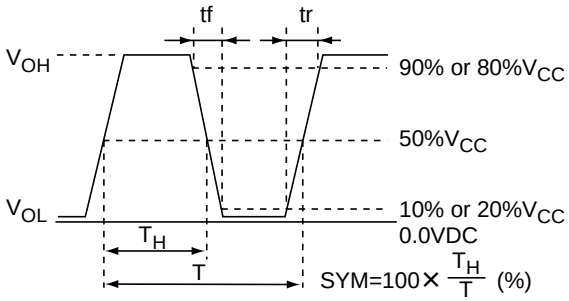
VOLTAGES	All voltages are referenced to ground.
V_{CC} (Opr)	Operating voltage: The range of power supply voltage over which the oscillator is guaranteed to operate within the specified limits.
V_{IH} (Min)	Input HIGH voltage (Mnimum): The minimum value represents the guaranteed input logic HIGH threshold for the oscillator.
V_{IL} (Max)	Input LOW voltage (Maximum): The maximum value represents the guaranteed input logic LOW threshold for the oscillator.
V_{OH} (Min)	Output HIGH voltage (Minimum): The minimum voltage at an output terminal for the specified output current I_{OH} and at the minimum value of V_{CC}.
V_{OL} (Max)	Output LOW voltage (Maximum): The maximum voltage at an output terminal sinking the maximum specified load current I_{OL}.
CURRENTS	Positive current is defined as current flow into an oscillator. Negative current is defined as current flow out of an oscillator.
Icc	Operating current : The current flowing into the V_{CC} supply terminal of an oscillator with the specified input and output conditions.
Topr	Operating temperature.
fo	Output frequency of an oscillator.
Δf/fo	Frequency stability of the output frequency.
SYM	Symmetry of output waveform at the specified level.
tr	Waveform rise time (LOW to HIGH), 0.4V to 2.4V or 10% to 90% or 20% to 80% as specified.
tf	Waveform fall time (HIGH to LOW), 2.4V to 0.4V or 90% to 10% or 80% to 20% as specified.
n	Fanout
C_L	Load capacitance
R_L	Load resistance
tst	Start-up time of the output

2. Output waveform

(TTL)

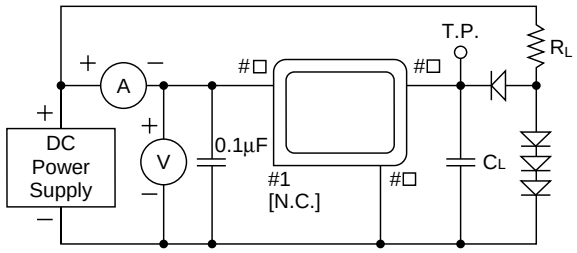


(CMOS)



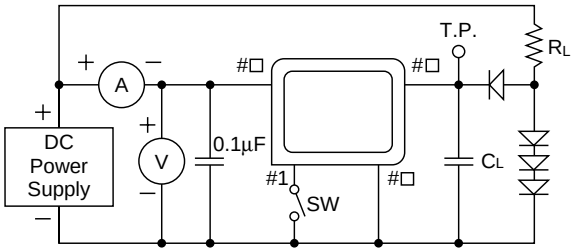
3. Test circuits

●TEST-1 / TTL



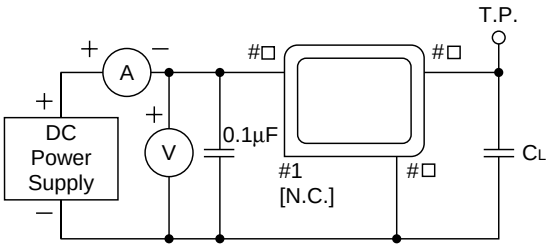
TTL output C_L=15 pF max. (Total fixture and probe capacitance)
R_L : See the specifications

●TEST-2 / TTL（Tri-state）



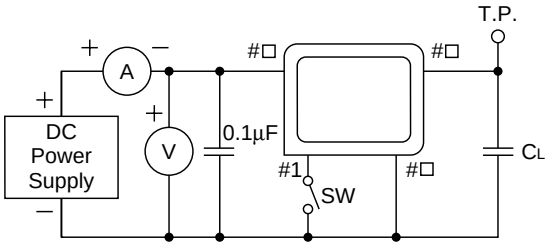
TTL output C_L=15 pF max. (Total fixture and probe capacitance)
R_L : See the specifications

●TEST-3 / CMOS



CMOS output C_L=See the specifications (Total fixture and probe capacitance)

●TEST-4 / CMOS（Tri-state）



CMOS output C_L=See the specifications (Total fixture and probe capacitance)

4. Directions for proper use

- Clock oscillators are high-frquency devices incorporating crystal units and oscillation circuits. In handling these products, it is critical to observe the following directions:

- When designing circuits and printed circuit boards incorporating these products, install a bypass capacitor in the order of 0.01µF at the nearest possible location between the grounding and the oscillator's power terminal.

- These products include semiconductor circuits and very thin crystal blanks. When providing ultrasonic cleaning, we recommend that the user provide assessments prior to the cleaning, as cleaning might damage the crystal blanks depending on how the oscillator is installed and how the cleaning is provided. Also, pay attention to possible impacts on the oscillator both in mechanical and thermal aspects.

- Recomended storage period is 6 months or shorter at 15-35°C, humidity of 75%RH or less.

- Take measures against static electricity during transportation, storage and use.

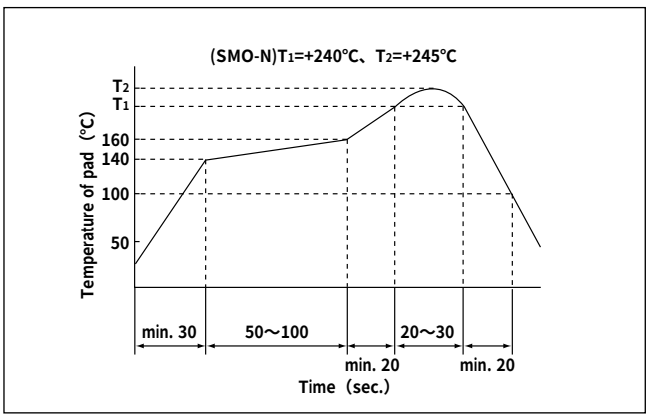
- Clock oscillators use semiconductors in their internal oscillation circuits with the semiconductor terminals directly connected to the oscillators. Therefore, do not apply voltage to other terminals when power is not provided to the power terminal. Also, do not apply power greater than the rated power voltage to terminals other than the power terminal.

5. Soldering heat resistance

- DIP-14P: +260°C max., 10 sec. max. (at leads)
- SMD : +260°C max., 10 sec. max. (Twice max.) or +230°C max., 3 minutes max.

6. Reflow conditions of SMD

[Infrared-reflow]



CRYSTAL CLOCK OSCILLATORS LINE UP

Package	Type	Output	Frequency range	Frequency stability	Operating voltage	Sealing	Page
SMO-N	TCO-787RH3	CMOS	1.5 to 36 MHz	±100 ppm	+3.3/+5 VDC±10 %	Glass sealed	P. 6
	TCO-786RH		1.5 to 70 MHz	±50 ppm	+5 VDC±10 %		
	TCO-787RH		36 to 70 MHz	±100 ppm			
	TCO-786NH	TTL	1.5 to 70 MHz	±50 ppm			P. 7
	TCO-787NH			±100 ppm			
	TCO-786KH	TTL/CMOS	30 to 75 MHz	±50 ppm			P. 8
	TCO-787KH			±100 ppm			
	TCO-786ZH		1.5 to 80 MHz	±50 ppm	+3.3 VDC±10 %		P. 9
	TCO-787ZH			±100 ppm			
	TFG-787RH3	CMOS	70 to 140 MHz	±100 ppm	+3.3/+5 VDC±10 %		P. 10
	TFG-786RH		70 to 112 MHz	±50 ppm	+5 VDC±10 %		
	TFG-786XH				+3.3 VDC±10 %		
SMO-N-K	TCO-787SH3	CMOS	1.5 to 36 MHz	±100 ppm	+3.3/+5 VDC±10 %	Seam welded	P. 11
	TCO-785SH		1.5 to 70 MHz	±25 ppm	+5 VDC±5 %		
	TCO-785YH	TTL/CMOS	1.5 to 80 MHz		+3.3 VDC±5 %		
DIP-14P	TCO-743A7	TTL	1.5 to 60 MHz	±10 ppm	+5 VDC±10 %	DIP-14P	P. 12
	TCO-743HC7	CMOS					
	TCO-743TH7	TTL					

The other frequencies and specifications are available upon your request.

Product Data (SMO-N)

TCO-787RH3, 786RH, 787RH

Features

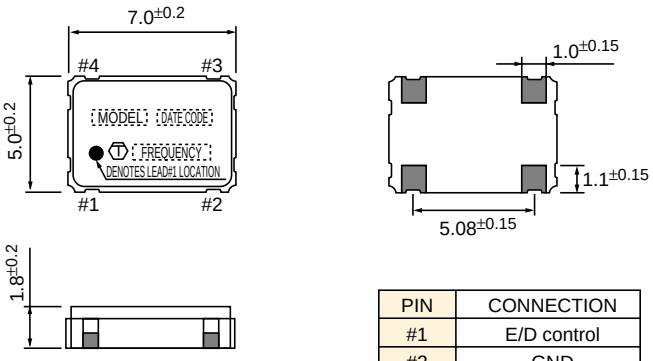
- CMOS output
- Small size：7W×5D×2Hmm
- Enable/Disable control (Oscillation standby function)

Specifications

Type		TCO-787RH3		TCO-786RH	TCO-787RH
Frequency	fo	1.5 to 36 MHz		1.5 to 70 MHz	36 to 70 MHz
Frequency stability*	Δf/fo	±100 ppm		±50 ppm	±100 ppm
Operating temperature	Topr	0 to +70°C			
Supply voltage	Vcc	+5 VDC±10 %	+3.3 VDC±10 %	+5 VDC±10 %	
Supply current	Icc	10 mA Max. (1.5≦fo≦10 MHz) 15 mA Max. (10<fo≦26 MHz) 35 mA Max. (26<fo≦36 MHz)	7 mA Max. (1.5≦fo≦10 MHz) 13 mA Max. (10<fo≦26 MHz) 30 mA Max. (26<fo≦36 MHz)	10 mA Max. (1.5≦fo≦10 MHz) 15 mA Max. (10<fo≦26 MHz) 35 mA Max. (26<fo≦50 MHz) 50 mA Max. (50<fo≦70 MHz)	35 mA Max. (36≦fo≦50 MHz) 50 mA Max. (50<fo≦70 MHz)
Input voltage	V_{IH} V_{IL}	70 % Vcc Min. 20 % Vcc Max.		+3.5 V Min. +1.5 V Max.	
Output voltage	V_{OH} V_{OL}	Vcc-0.4 V Min. +0.4 V Max.			
Symmetry	SYM	45 to 55% (50%Vcc level)	40 to 60% (50%Vcc level)	45 to 55% (50%Vcc level)	
Rise/Fall time	tr/tf	12 nSec. Max. (1.5≦fo≦26MHz) 10 nSec. Max. (26<fo≦36MHz) at 10 to 90 % Vcc	12 nSec. Max. (1.5≦fo≦10MHz) 10 nSec. Max. (10<fo≦26MHz) 8 nSec. Max. (26<fo≦36MHz) at 20 to 80 % Vcc	12 nSec. Max. (1.5≦fo≦26MHz) 10 nSec. Max. (26<fo≦50MHz) 6 nSec. Max. (50<fo≦70MHz) at 10 to 90 % Vcc	10 nSec. Max. (36≦fo≦50MHz) 6 nSec. Max. (50<fo≦70MHz) at 10 to 90 % Vcc
Load capacitance	CL	50 pF Max. (1.5≦fo≦26MHz) 30 pF Max. (26<fo≦36MHz)	15 pF Max. (1.5≦fo≦36 MHz)	50 pF Max. (1.5≦fo≦36 MHz) 30 pF Max. (26<fo≦50 MHz) 15 pF Max. (50<fo≦70 MHz)	30 pF Max. (36≦fo≦50 MHz) 15 pF Max. (50<fo≦70 MHz)
Start-up time	t_{st}	4 mSec. Max. (1.5≦fo≦26 MHz) 10 mSec. Max. (26<fo≦36 MHz)		4 mSec. Max. (1.5≦fo≦26 MHz) 10 mSec. Max. (26<fo≦70 MHz)	10 mSec. Max. (36≦fo≦70 MHz)
Test circuits		TEST-4			
Sealing		Glass sealed			

* Inclusive of calibration tolerance at +25°C, operating temperature, operating voltage range.

Outline Drawing [mm]



PIN	CONNECTION
#1	E/D control
#2	GND
#3	Output
#4	Vcc (DC)

Product Data (SMO-N)

TCO-786NH, 787NH

Features

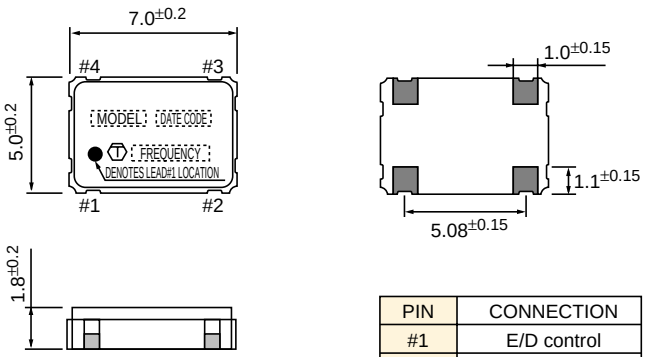
- TTL output
- Small size：7W×5D×2Hmm
- Enable/Disable control (Oscillation standby function)

Specifications

Type		TCO-786NH	TCO-787NH
Frequency	fo	1.5 to 70 MHz	
Frequency stability*	Δf/fo	±50 ppm	±100 ppm
Operating temperature	Topr	0 to +70°C	
Supply voltage	Vcc	+5 VDC±10 %	
Supply current	Icc	10 mA Max. (1.5≦fo≦10 MHz) 15 mA Max. (10<fo≦26 MHz) 35 mA Max. (26<fo≦50 MHz) 50 mA Max. (50<fo≦70 MHz)	
Input voltage	V_{IH} V_{IL}	+3.5 V Min. +1.5 V Max.	
Output voltage	V_{OH} V_{OL}	+4 V Min. +0.4 V Max.	
Symmetry	SYM	45 to 55% (+1.4 V level)	
Rise/Fall time	tr/tf	5 nSec. Max. (1.5≦fo≦70 MHz) at +0.4 to +2.4 V	
Fanout	n	10 Max. (1.5≦fo≦60 MHz) 5 Max. (60<fo≦70 MHz)	
Start-up time	t_{st}	4 mSec. Max. (1.5≦fo≦26 MHz) 10 mSec. Max. (26<fo≦70 MHz)	
Test circuits		TEST-2	
Sealing		Glass sealed	

* Inclusive of calibration tolerance at +25°C, operating temperature, operating voltage range.

Outline Drawing [mm]



PIN	CONNECTION
#1	E/D control
#2	GND
#3	Output
#4	Vcc (DC)

Product Data (SMO-N)

TCO-786KH, 787KH

Features

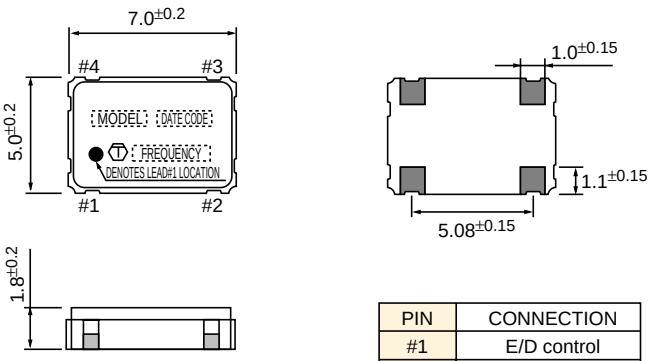
- CMOS/TTL output
- Small size：7W×5D×2Hmm
- Enable/Disable control (Oscillation standby function)

Specifications

Type		TCO-786KH	TCO-787KH
Frequency	fo	30 to 75 MHz	
Frequency stability*	Δf/fo	±50 ppm	±100 ppm
Operating temperature	Topr	0 to +70°C	
Supply voltage	Vcc	+5 VDC±10 %	
Supply current	Icc	40 mA Max. (30≦fo≦50 MHz) 60 mA Max. (50<fo≦75 MHz)	
Input voltage	V_{IH} V_{IL}	+2 V Min. +0.8 V Max.	
Output voltage	V_{OH} V_{OL}	Vcc-0.4 V Min. +0.4 V Max.	
Symmetry	SYM	40 to 60% (50% Vcc level, +1.4 V level)	
Rise/Fall time	tr/tf	7 nSec. Max. (30≦fo≦75 MHz) at 10 to 90% Vcc (CMOS) at +0.4 to +2.4 V (TTL)	
Load capacitance	CL	50 pF Max.	
Fanout	n	10 Max.	
Start-up time	t_{st}	10 mSec. Max. (30≦fo≦75 MHz)	
Test circuits		TEST-2, 4	
Sealing		Glass sealed	

* Inclusive of calibration tolerance at +25°C, operating temperature, operating voltage range.

Outline Drawing [mm]



PIN	CONNECTION
#1	E/D control
#2	GND
#3	Output
#4	Vcc (DC)

Product Data (SMO-N)

TCO-786ZH, 787ZH

Features

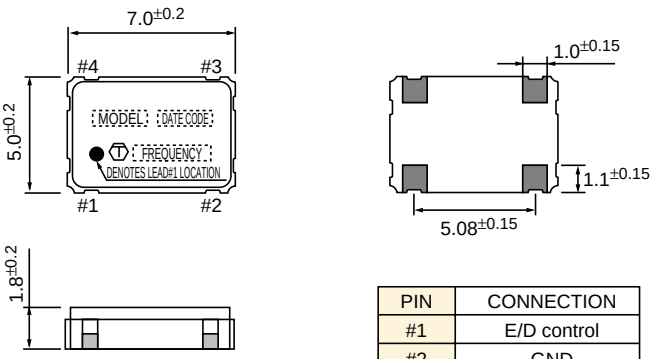
- CMOS/TTL output
- Small size：7W×5D×2Hmm
- Enable/Disable control (Oscillation standby function)
- Low operating voltage (+3.3V)

Specifications

Type		TCO-786ZH	TCO-787ZH
Frequency	fo	1.5 to 80 MHz	
Frequency stability*	Δf/fo	±50 ppm	±100 ppm
Operating temperature	Topr	0 to +70°C	
Supply voltage	Vcc	+3.3 VDC±10 %	
Supply current	Icc	6 mA Max. (1.5≦fo≦12 MHz) 25 mA Max. (28<fo≦40 MHz) 10 mA Max. (12<fo≦26 MHz) 35 mA Max. (40<fo≦70 MHz) 15 mA Max. (26<fo≦28 MHz) 45 mA Max. (70<fo≦80 MHz)	
Input voltage	V_{IH} V_{IL}	70% Vcc Min. 30% Vcc Max.	
Output voltage	V_{OH} V_{OL}	90% Vcc Min. 10% Vcc Max.	
Symmetry	SYM	45 to 55% (50% Vcc level) 40 to 60% (+1.4 V level)	
Rise/Fall time	tr/tf	6 nSec. Max. (1.5≦fo≦36 MHz) 4 nSec. Max. (36<fo≦80 MHz) at 20 to 80% Vcc (CMOS) at +0.4 to +2.4 V (TTL)	
Load capacitance	CL	30 pF Max.	
Fanout	n	5 Max.	
Start-up time	t_{st}	10 mSec. Max. (1.5≦fo≦80 MHz)	
Test circuits		TEST-2, 4	
Sealing		Glass sealed	

* Inclusive of calibration tolerance at +25°C, operating temperature, operating voltage range.

Outline Drawing [mm]



PIN	CONNECTION
#1	E/D control
#2	GND
#3	Output
#4	Vcc (DC)

Product Data (SMO-N)

TFG-787RH3, 786RH, 786XH

Features

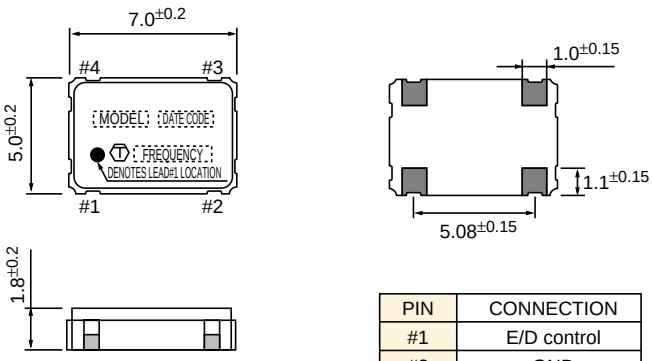
- CMOS output
- Small size：7W×5D×2Hmm
- One chip PLL with VCO

Specifications

Type		TFG-787RH3		TFG-786RH	TFG-786XH
Frequency	fo	70 to 140 MHz		70 to 112 MHz	
Frequency stability*	Δf/fo	±100 ppm		±50 ppm	
Operating temperature	Topr	0 to +70°C			
Supply voltage	Vcc	+5 VDC±10 %	+3.3 VDC±10 %	+5 VDC±10 %	+3.3 VDC±10 %
Supply current	Icc	60 mA Max. (70≦fo≦96 MHz) 70 mA Max. (96<fo≦120 MHz) 60 mA Max. (120<fo≦140 MHz)	40 mA Max. (70≦fo≦96 MHz) 50 mA Max. (96<fo≦140 MHz)	60 mA Max. (70≦fo≦96 MHz) 70 mA Max. (96<fo≦112 MHz)	40 mA Max. (70≦fo≦96 MHz) 50 mA Max. (96<fo≦112 MHz)
Input voltage	V_{IH} V_{IL}	70% Vcc Min. 20% Vcc Max.			
Output voltage	V_{OH} V_{OL}	90% Vcc Min. 10% Vcc Max.			
Symmetry	SYM	45 to 55% (50% Vcc level)			
Rise/Fall time	tr/tf	3 nSec. Max. (70≦fo≦140 MHz) at 20 to 80% Vcc		3 nSec. Max. (70≦fo≦112 MHz) at 20 to 80% Vcc	
Load capacitance	CL	30 pF Max. (70≦fo≦120 MHz) 15 pF Max. (120<fo≦140 MHz)		30 pF Max. (70≦fo≦112 MHz)	
Start-up time	t_{st}	2 mSec. Max.			
Test circuits		TEST- 4			
Sealing		Glass sealed			

* Inclusive of calibration tolerance at +25°C, operating temperature, operating voltage range.

Outline Drawing [mm]



PIN	CONNECTION
#1	E/D control
#2	GND
#3	Output
#4	Vcc (DC)

Product Data (SMO-N-K)

TCO-787SH3, 785SH, 785YH

Features

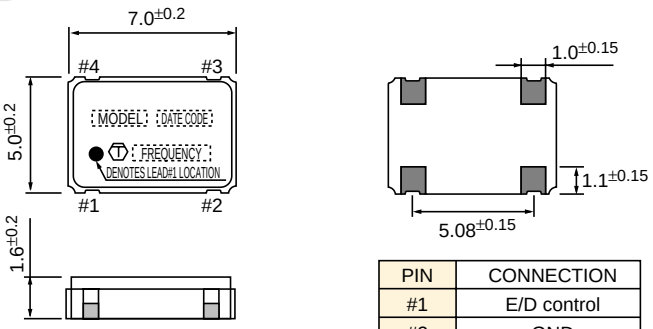
- Small size：7W×5D×1.8Hmm
- Enable/Disable control (Oscillation standby function)

Specifications

Type		TCO-787SH3		TCO-785SH	TCO-785YH
Frequency	fo	1.5 to 36 MHz		1.5 to 70 MHz	1.5 to 80 MHz
Frequency stability*	Δf/fo	±100 ppm		±25 ppm	
Operating temperature	Topr	0 to +70°C			
Supply voltage	Vcc	+5 VDC±10 %	+3.3 VDC±10 %	+5 VDC±5 %	+3.3 VDC±5 %
Supply current	Icc	10 mA Max. (1.5≦fo≦10 MHz) 15 mA Max. (10<fo≦26 MHz) 35 mA Max. (26<fo≦36 MHz)	7 mA Max. (1.5≦fo≦10 MHz) 13 mA Max. (10<fo≦26 MHz) 30 mA Max. (26<fo≦36 MHz)	10 mA Max. (1.5≦fo≦10 MHz) 15 mA Max. (10<fo≦26 MHz) 35 mA Max. (26<fo≦50 MHz) 50 mA Max. (50<fo≦70 MHz)	6 mA Max. (1.5≦fo≦12 MHz) 10 mA Max. (12<fo≦26 MHz) 15 mA Max. (26<fo≦28 MHz) 25 mA Max. (28<fo≦40 MHz) 35 mA Max. (40<fo≦70 MHz) 45 mA Max. (70<fo≦80 MHz)
Input voltage	V_{IH} V_{IL}	70% Vcc Min. 20% Vcc Max.		+3.5 V Min. +1.5 V Max.	70% Vcc Min. 30% Vcc Max.
Output voltage	V_{OH} V_{OL}	Vcc-0.4 V Min. +0.4 V Max.		Vcc-0.4 V Min. +0.4 V Max.	90% Vcc Min. 10% Vcc Max.
Symmetry	SYM	45 to 55% (50% Vcc level)	40 to 60% (50% Vcc level)	45 to 55% (50% Vcc level)	45 to 55% (50% Vcc level) 40 to 60% (+1.4 V level)
Rise/Fall time	tr/tf	12 nSec. Max. (1.5≦fo≦26 MHz) 10 nSec. Max. (26<fo≦36 MHz) at 10 to 90% Vcc	12 nSec. Max. (1.5≦fo≦10 MHz) 10 nSec. Max (10<fo≦26 MHz) 8 nSec. Max. (26<fo≦36 MHz) at 20 to 80% Vcc	12 nSec. Max. (1.5≦fo≦26 MHz) 10 nSec. Max (26<fo≦50 MHz) 6 nSec. Max. (50<fo≦70 MHz) at 10 to 90 % Vcc	6 nSec. Max. (1.5≦fo≦36 MHz) 4 nSec. Max. (36<fo≦80 MHz) at 20 to 80 % Vcc (CMOS) at +0.4 to +2.4V (TTL)
Load capacitance	CL	50 pF Max. (1.5≦fo≦26 MHz) 30 pF Max. (26<fo≦36 MHz)	15 pF Max. (1.5≦fo≦36 MHz)	50 pF Max. (1.5≦fo≦26 MHz) 30 pF Max. (26<fo≦50 MHz) 15 pF Max. (50<fo≦70 MHz)	30 pF Max.
Fanout	n	—			5 Max. (TTL)
Start-up time	t_{st}	4 mSec. Max. (1.5≦fo≦26 MHz) 10 mSec. Max. (26<fo≦36 MHz)		4 mSec. Max. (1.5≦fo≦26 MHz) 10 mSec. Max. (26<fo≦70 MHz)	10 mSec. Max. (1.5≦fo≦80 MHz)
Test circuits		TEST-4			TEST-2, 4
Sealing		Seam welded			

* Inclusive of calibration tolerance at +25°C, operating temperature, operating voltage range.

Outline Drawing [mm]



PIN	CONNECTION
#1	E/D control
#2	GND
#3	Output
#4	Vcc (DC)

Product Data (DIP-14P)

TCO-743A7, 743HC7, 743TH7

Features

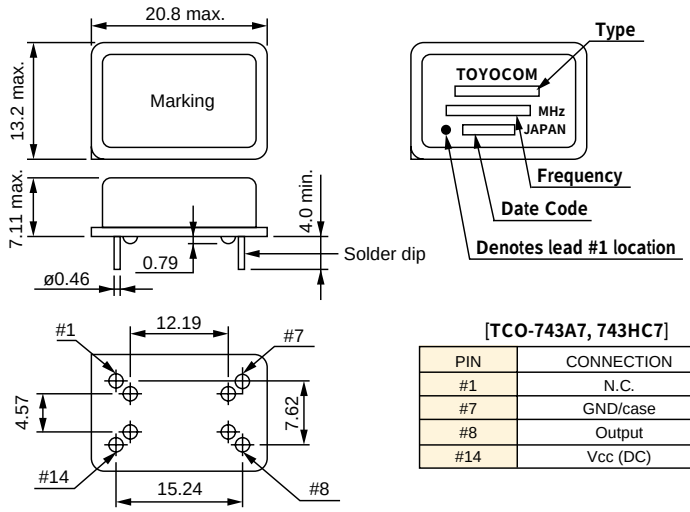
- DIP-14 pin IC package compatible
- Tight stability (±10 ppm)
- Hermetically double-sealed metal package and high reliability

Specifications

Type		TCO-743A7	TCO-743HC7	TCO-743TH7
Frequency	fo	1.5 to 60 MHz		
Frequency stability*	Δf/fo	±10 ppm		
Operating temperature	Topr	0 to +70°C		
Supply voltage	Vcc	+5 VDC±10 %		
Supply current	Icc	15 mA Max. (1.5≦fo≦10 MHz) 20 mA Max. (10<fo≦26 MHz) 40 mA Max. (26<fo≦60 MHz)	10 mA Max. (1.5≦fo≦10 MHz) 15 mA Max. (10<fo≦26 MHz) 35 mA Max. (26<fo≦50 MHz) 50 mA Max. (50<fo≦60 MHz)	15 mA Max. (1.5≦fo≦10 MHz) 20 mA Max. (10<fo≦26 MHz) 40 mA Max. (26<fo≦60 MHz)
Input voltage	V_{IH} V_{IL}	—	—	+3.5 V Min. +1.5 V Max.
Output voltage	V_{OH} V_{OL}	+4 V Min. +0.4 V Max.	Vcc-0.4 V Min. +0.4 V Max.	+4 V Min. +0.4 V Max.
Symmetry	SYM	45 to 55% (+1.4 V level)	45 to 55% (50% Vcc level)	45 to 55% (+1.4 V level)
Rise/Fall time	tr/tf	5 nSec. Max. (1.5≦fo≦60 MHz) at +0.4 to +2.4 V	12 nSec. Max. (1.5≦fo≦26 MHz) 10 nSec. Max. (26<fo≦50 MHz) 6 nSec. Max. (50<fo≦60 MHz) at 10 to 90% Vcc	5 nSec. Max. (1.5≦fo≦60 MHz) at +0.4 to +2.4 V
Load capacitance	CL	—	50 pF Max. (1.5≦fo≦26 MHz) 30 pF Max. (26<fo≦50 MHz) 15 pF Max. (50<fo≦60 MHz)	—
Fanout	n	10 Max.		
Start-up time	t_{st}	4 mSec. Max. (1.5≦fo≦26 MHz) 10 mSec. Max. (26<fo≦60 MHz)		
Test circuits		TEST-1	TEST-3	TEST-2

* Inclusive of calibration tolerance at +25°C, operating temperature.

Outline Drawing [mm]



[TCO-743A7, 743HC7]

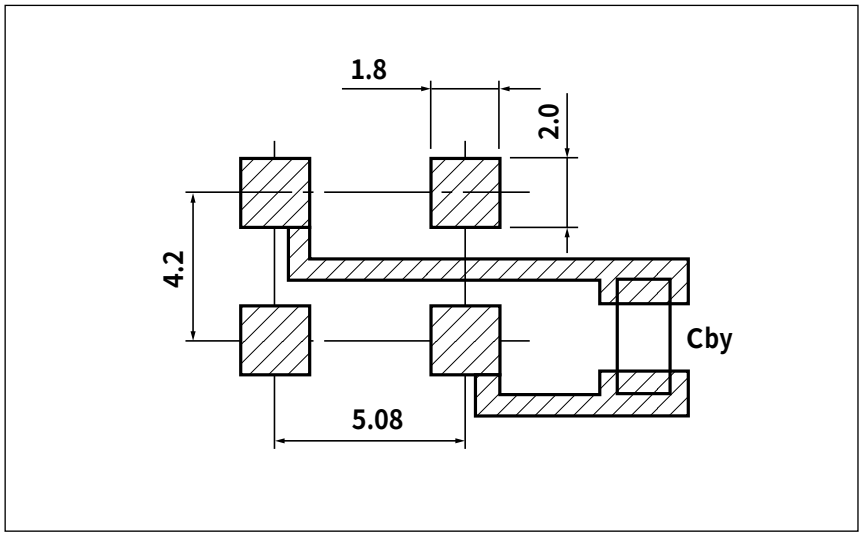
PIN	CONNECTION
#1	N.C.
#7	GND/case
#8	Output
#14	Vcc (DC)

[TCO-743TH7]

PIN	CONNECTION
#1	E/D control
#7	GND/case
#8	Output
#14	Vcc (DC)

Reference Footprint [mm]

[SMO-N & SMO-N-K]



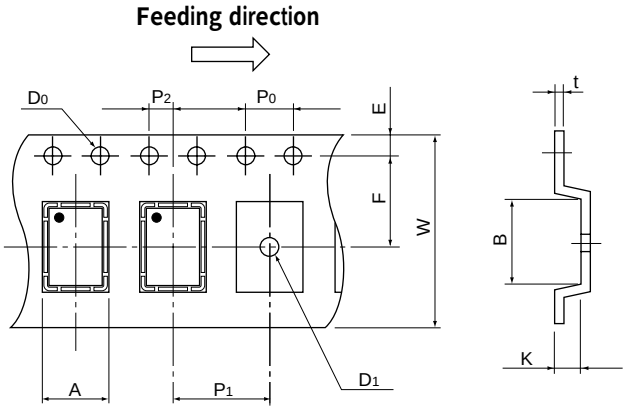
- **The figure shows oscillator arrangements close to the ideal.**
- **The bypass capacitor Cby must be a ceramic type with 0.1µF or greater.**
- **The E/D control terminal (oscillation standby function) should be used for control purposes only. When not in use, this terminal must never be connected to the mains nor grounded.**

PACKAGING (Tape and Reel) [mm]

SMO-N & SMO-N-K

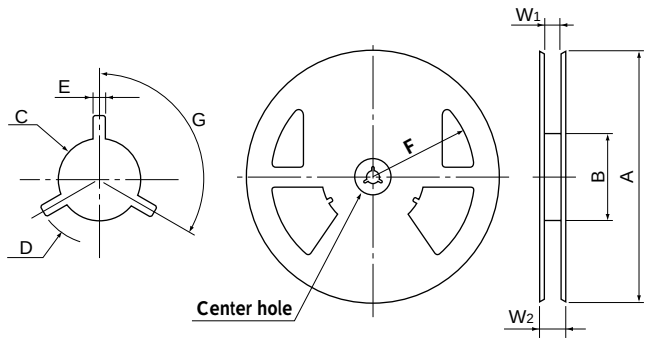
●Tape (Embossed carrier)

Packing unit：1,000pcs./reel



A	B	D0	D1	E	F	K	P0	P1	P2	t	W
5.4	7.4	ϕ1.5	ϕ1.5	1.75	7.5	2.1	4.0	8.0	2.0	0.3	16.0

●Reel



A	B	C	D	E	F	G	W1	W2
ϕ254	ϕ100	ϕ13	ϕ21	2.0	102	120 °	17.5	21.5

Inquiry and Ordering Information

1. Type : _____

2. Package : SMO-N, DIP-14P

3. Frequency : _____ MHz

4. Frequency stability : ±100ppm, ±50ppm, ±25ppm, ±10ppm

5. Operating temperature range : 0 to +70°C, –40 to +85°C or _____

6. Supply voltage : Vcc=+5V±10% or _____ V± _____ %

7. Output :
   - Logic : TTL (Fanout 10, 5 Max.)
     CMOS (C_L=15pF, 30pF, 50pF)
   - Symmetry : 40/60%, 45/55% or _____ %
   - tr, tf : TOYOCOM standard or _____ ns

8. Function : Normal output
   Tri-state output
   or _____

9. Marking : TOYOCOM standard or _____

10. Other requirements, if any : _____

11. Sample :
    - Engineering : _____ pcs. Delivery needed by _____
    - Qualification : _____ pcs. Delivery needed by _____

12. Project
    - Total usage : _____ pcs.
    - Schedule : _____