

Low Power Crystal Oscillator 32.768 kHz

Description

The EM7604-C7 is a very low power crystal oscillator, which consists of a 32.768 kHz tuning fork crystal and an advanced CMOS oscillator circuit assembled in the same ultra small, cost-effective SMD ceramic package C7. No external components are required.

It combines excellent oscillator stability with a very low power consumption of typ. 300nA, guaranteed over a very wide supply voltage and temperature range.

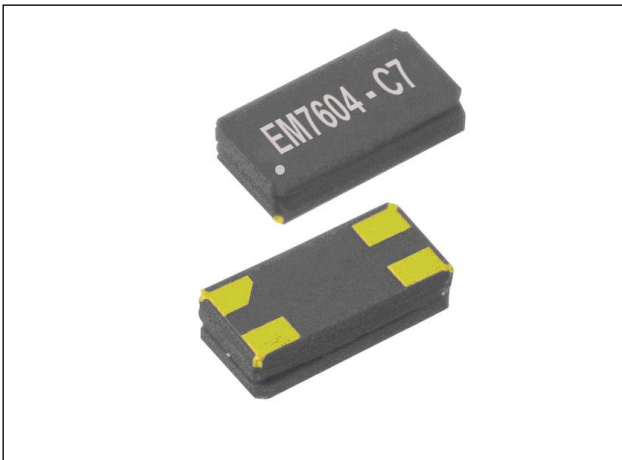
The output frequency is synchronized with signal on input Clock Enable CLKEN. The frequency output CLKOUT is enabled by connecting Clock Enable pin CLKEN to V_{DD}. Connecting CLKEN to V_{SS}, disables the frequency and the output CLKOUT is at Low State.

Typical Applications

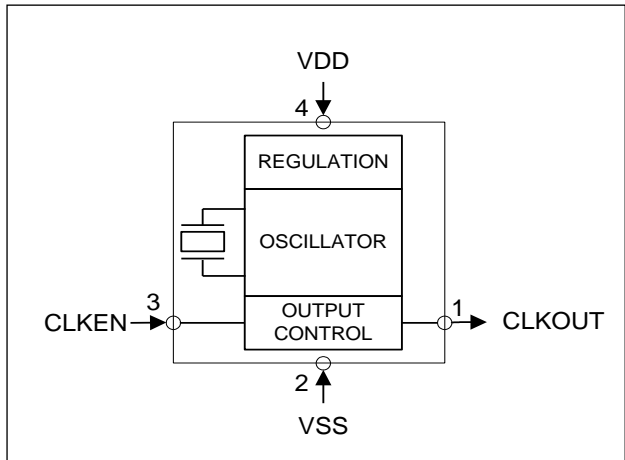
- General purpose clock generator for digital systems
- Clock drivers for Real Time Clocks
- Timekeeping in network servers and computers
- Electricity, gas and water metering
- Portable field communication
- Mobile phone

Features

- Very low power consumption typ. 300nA
- Wide supply voltage range: 1.2V to 5.5V
- Operating temperature range: -10°C to +85°C.
- Very tight frequency tolerances: ± 20ppm
- Excellent oscillator stability: 0.2 ppm/V
- Synchronised output after Enable/Disable
- Low aging
- High shock and vibration resistant
- All-in-one-package solution
- Miniature ceramic package for SMD mounting, package height 1.0mm
- 100% lead free, RoHS - compliant

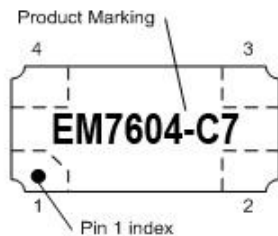


Block Diagram



Pin Connection Top View

Pin	Connection	
1	CLKOUT	Frequency Output
2	V _{SS}	Negative Supply Voltage
3	CLKEN	Output Enable
4	V _{DD}	Positive Supply Voltage



Absolute Maximum Ratings

Parameter	Symbol	Conditions
Voltage at V_{DD} to V_{SS}	V_{DD}	-0.3V to +6V
Minimum voltage	V_{MIN}	$V_{SS} - 0.3V$
Maximum voltage	V_{MAX}	$V_{DD} + 0.3V$
Storage temperature range	T_{STG}	-55°C to +150°C
Maximum soldering	T_{Smax}	260°C x 20s

Stresses above these listed maximum ratings may cause permanent damages to the device. Exposure beyond specified operating conditions may affect device reliability or cause malfunction.

Handling Procedures

This device has built-in protection against high static voltages or electric fields; however, anti-static precautions must be taken as for any other CMOS component. Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the voltage range. Unused inputs must always be tied to a defined logic voltage level.

Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply voltage	V_{DD}	1.2	5.5	V
Operating temperature	T_A	-10	+85	°C

Electrical Characteristics

$V_{DD} = 3.0V$; $V_{SS} = 0V$; $T_A = 25^\circ C$; unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply						
Supply voltage range	V_{DD}		1.2	3.0	5.5	V
Mean current consumption (Note 1)	I_{DD}	$V_{DD} = 5.0V$, CLKEN at V_{SS}		300	550	nA
		$V_{DD} = 3.0V$, CLKEN at V_{SS}		250	500	nA
		$V_{DD} = 5.0V$, CLKEN at V_{SS} , $T_A = -10$ to $+85^\circ C$		750	1000	nA
		$V_{DD} = 3.0V$, CLKEN at V_{SS} , $T_A = -10$ to $+85^\circ C$		650	900	nA
Oscillator + Quartz						
Output frequency	f_O			32.768		kHz
Frequency tolerance (Note 2)					± 20	ppm
Starting voltage	V_{ST}	Within 3 seconds	1.2			V
Start-up time	T_{ST}			0.4	0.8	sec
Voltage coefficient	$\Delta f/f_O * \Delta V_{DD}$	$1.5V \leq V_{DD} \leq 5.5V$		± 0.2	± 2	ppm/V
Aging first year @ 25°C	$\Delta f/f_O$				± 3	ppm
Temperature coefficient	β		-0.039	-0.035	-0.031	ppm/°C ²
Output driver CLKOUT						
Output voltage high	V_{OH}	$I_{OH} = -1.0mA$	$V_{DD} - 0.4$			V
Output voltage low	V_{OL}	$I_{OL} = 1.0mA$			$V_{SS} + 0.4$	V
Output rise time	t_r	$C_L = 15pF$, 10% to 90% V_{DD}		70	100	ns
Output fall time	t_f	$C_L = 15pF$, 10% to 90% V_{DD}		70	100	ns
Duty cycle			40	50	60	%
Output Enable CLKEN						
Input voltage low	V_{IL}		V_{SS}		$0.2 \times V_{DD}$	V
Input voltage high	V_{IH}		$0.8 \times V_{DD}$		V_{DD}	V

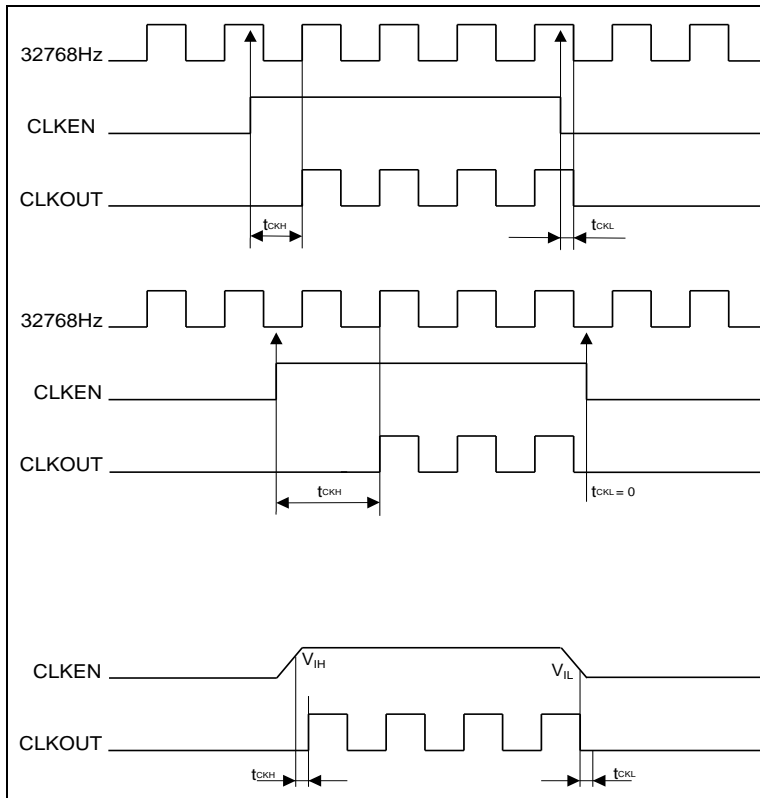
Note 1: The current consumption when the output clock is enabled (CLKEN pin at V_{DD}) is a function of the load capacitance on the CLKOUT pin, the output frequency $f_{OUT} = 32768Hz$ and the supply voltage V_{DD} .

The additional consumption for a given load can be calculated from: $\Delta I_{DD} = C_{LOAD} \times V_{DD} \times f_{OUT}$

Note 2: Tighter tolerance on request.

Environmental Characteristics

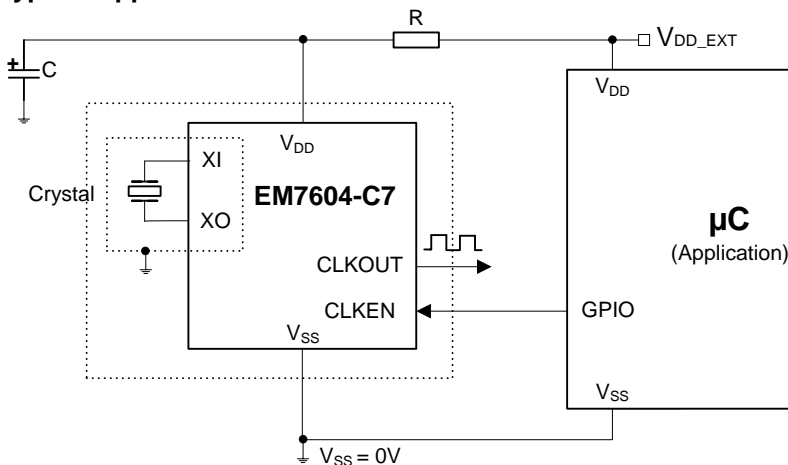
Parameter	Symbol	Conditions	Maximum Deviation	Unit
Shock resistance	$\Delta f/f_O$	5000 g, 0.3 ms, 1/2 sine	± 5	ppm
Vibration resistance	$\Delta f/f_O$	20 g / 10 – 2000Hz	± 5	ppm

Timing Waveforms

Application Note

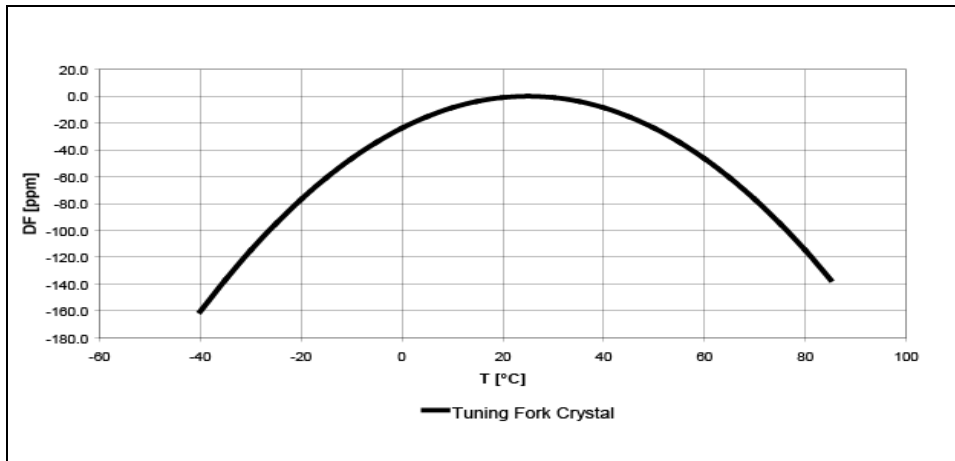
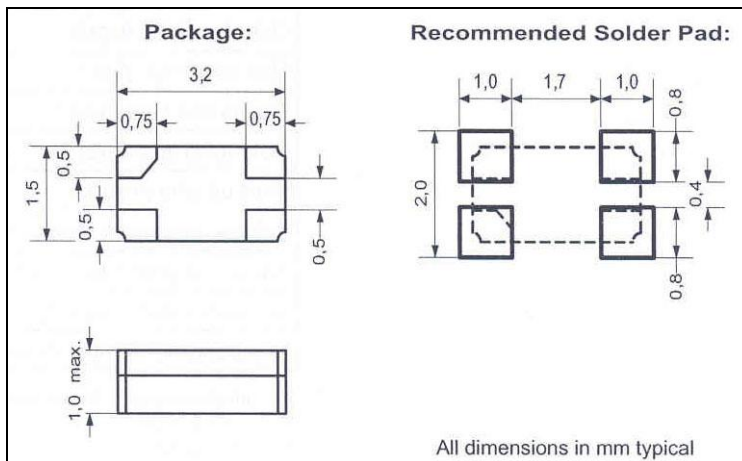
Using EM7604 with disturbed Supply Voltage on V_{DD}

If the power supply of the EM7604 (V_{DD}) is disturbed, the circuit must be protected against V_{DD} fast transients. As the oscillator has a very low power consumption, the clock generation is sensitive to fast supply changes and clock pulses could be lost.

If in the application, positive or negative V_{DD} fast slopes may occur, an RC low pass filter in the V_{DD} supply connection of the EM7604 must be used, according to the following figure:

Typical Application Schematic


The RC filter is composed of a capacitor (C) and resistor (R) implemented per example by a 1k Ω resistor and a 10 μF capacitor. The resistor and the capacitor can be adapted if needed.

Frequency Temperature Characteristics

Package Information:


The termination is with Au flashed pads for SMD mounting.

Ordering Information

Please make sure to quote the exact Part Number when ordering.

Part Number	Version	Frequency Tolerance	Package Type	Marking	Delivery Form
EM7604V20SCP4B+	V20	± 20 ppm	SCP – 4 pin	OV-7604-C7	12mm tape, 7" reel with 3'000 packages

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