DS32KHz
32.768 KHz TCXO

www.dalsemi.com

FEATURES

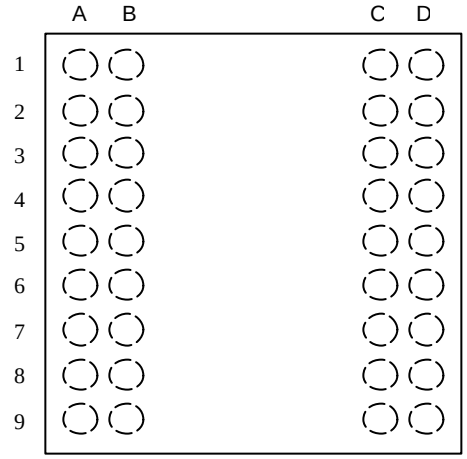
- Accurate to ±4 Min/Yr. (-40°C to +85°C)
- Accurate to ±1 Min/Yr. (0°C to 40°C)
- Battery back up for continuous time keeping
- V_{BAT} operating voltage 2.7 to 5.5 volts with V_{CC} grounded
- V_{CC} operating voltage 4.5 to 5.5 volts
- Operating temperature range:
  COM: 0°C to 70°C
  IND: -40°C to +85°C
- No calibration required
- Low power consumption
- Surface mountable using BGA package

V_{CC}:	C2, C3, D2, D3
V_{BAT}:	A4, A5, B4, B5
32KHz:	C4, C5, D4, D5
GND:	All Remaining Balls

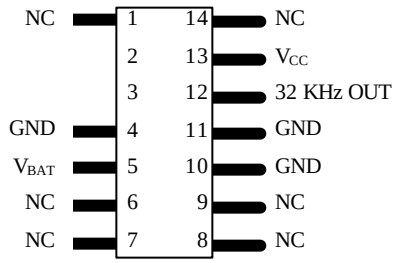
ORDERING INFORMATION

Part Number	Package	Temp. Range
DS32KHZ/BGA	36-pin BGA	Commercial
DS32KHZN/BGA	36-pin BGA	Industrial
DS32KHZ/DIP	14-pin DIP	Commercial
DS32KHZN/DIP	14-pin DIP	Industrial

PIN ASSIGNMENT



DS32KHz 36-Pin SMD
(TOP VIEW)



DS32KHz
14-PIN DIP MODULE
(300 MIL)

DESCRIPTION

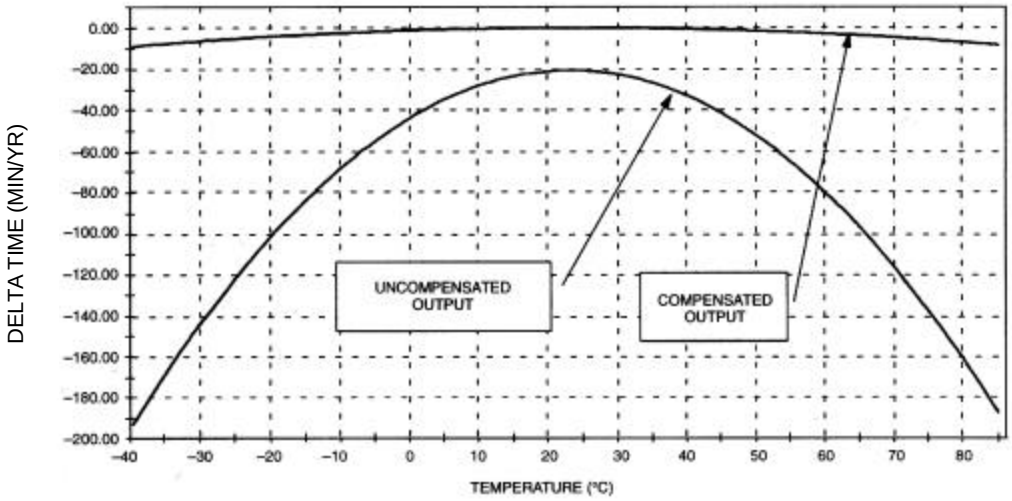
The DS32KHz is a temperature compensated crystal oscillator (TCXO) with an output frequency of 32.768 kHz. This device addresses applications requiring better timekeeping accuracy and may be used to drive the X1 input of most Dallas Semiconductor Real Time Clocks (RTC's), chipsets and other IC's containing RTC's. This device is available in commercial and industrial temperature versions, DS32KHz and DS32KHz–N respectively.

The DS32KHz requires four pins for operation: V_{CC}, GND, V_{BAT} and 32KHz OUT. See Figures 1, 2 and 3 for connection schemes. Power is applied via V_{CC} and GND, while V_{BAT} is used to maintain the 32KHz output in the absence of power. The output is accurate to ±7.5 ppm (±4 min/yr) from –40°C to +85°C and ±2 ppm (±1 min/yr) from 0°C to 40°C.

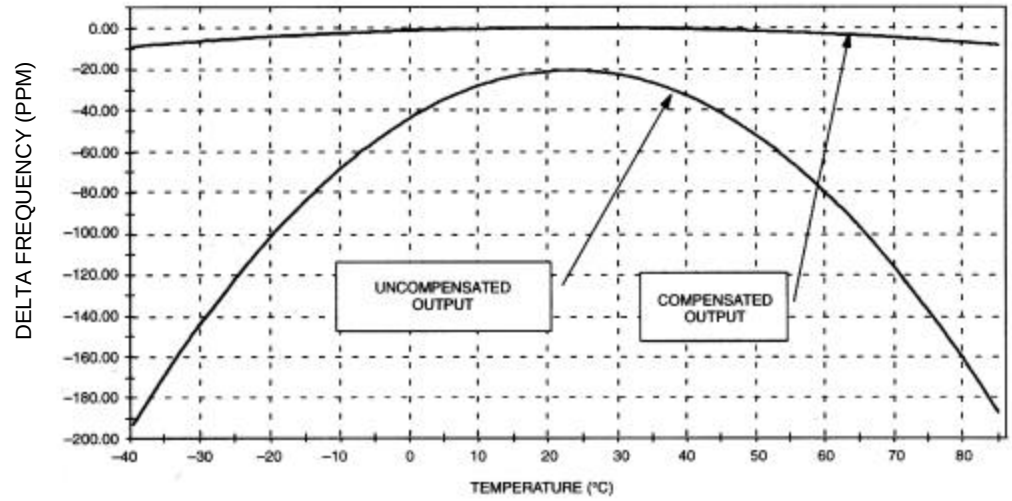
The DS32KHz is packaged in a small 36–pin SMD, utilizing Ball Grid Array (BGA) technology, with dimensions 0.400 inches wide, 0.450 inches long, and 0.180 inches high. Also availabe in a 14–pin DIP module.

The additional board space required is negligible in most applications and therefore the recommended land pattern layout should be implemented on all new designs and future board revisions to satisfy applications requiring better timekeeping accuracy.

DELTA TIME vs TEMPERATURE



DELTA FREQUENCY vs TEMPERATURE



POWER SUPPLY CONNECTIONS

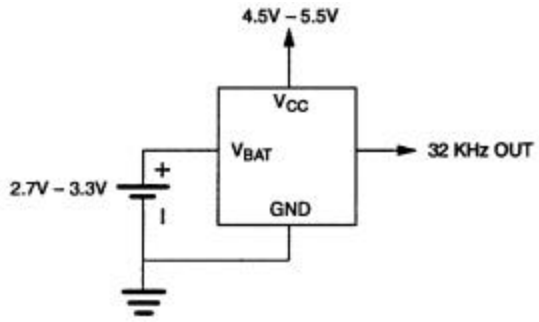


Figure 1.0

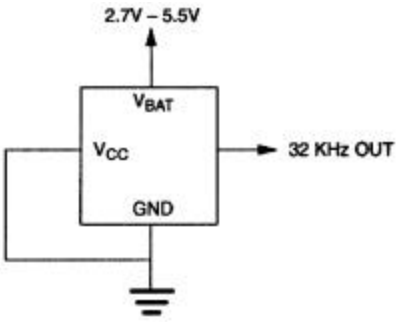


Figure 2.0

Figure 1.0 shows how the DS32KHz should be connected when using two power supplies. V_{CC} should be between 4.5 and 5.5 volts while V_{BAT} should be between 2.7 and 3.3 volts. Figure 2.0 shows how the DS32KHz can be used when only a single supply system is available. V_{CC} should be grounded and V_{BAT} should then be held between 2.7 and 5.5 volts. The V_{BAT} pin should be connected directly to a battery using no external components.

DS32KHz CONNECTIONS

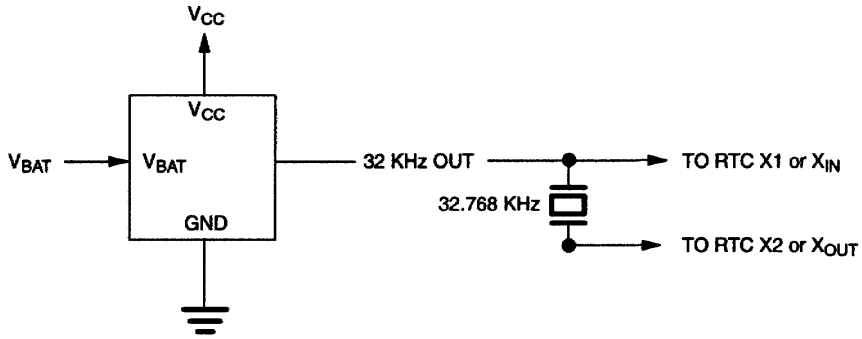


Figure 3.0

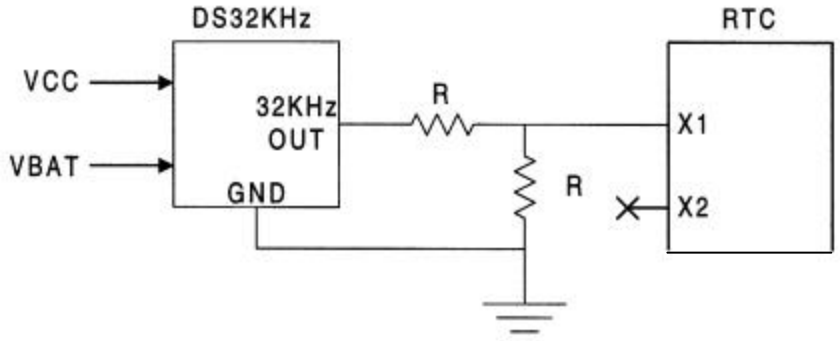


Figure 4.0

Figure 3.0 illustrates how a standard 32.768 kHz crystal and the DS32KHz should be connected to address the interchangeable option. Using this connection scheme and the recommended layout provides a solution which requires no hardware modifications. Only one device should be used at a time and both layouts should be located very close together if the recommended layout is not used.

Oscillators in general are designed using various topologies and most are intended to be used with either a quartz crystal or resonator. With this in mind, some oscillators may consume more power when driven by another oscillator instead of a quartz crystal or resonator. There are various circuits that can be used to reduce this increased power. Figure 4.0 shows one recommended circuit that can be used to reduce the total current consumption of a DS32KHz and an RTC. The value of resistance, R, will vary depending on the RTC used. However, a value of 1.0 MΩ is recommended as a starting point.

ABSOLUTE MAXIMUM RATINGS*

Voltage on Any Pin Relative to Ground	-3.0V to +7.0V
Operating Temperature	0°C to 70°C - Commercial
	-40°C to +85°C - Industrial
Storage Temperature	-40°C to +85°C
Soldering Temperature	+260°C for 10 seconds (2 times max.)

* This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

The Dallas Semiconductor DS32KHz is built to the highest quality standards and manufactured for long term reliability. All Dallas Semiconductor devices are made using the same quality materials and manufacturing methods. However, the DS32KHz is not exposed to environmental stresses, such as burn-in, that some industrial applications require. For specific reliability information on this product, please contact the factory in Dallas at (972) 371-4448.

RECOMMENDED DC OPERATING CONDITIONS (-40°C to +85°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Power Supply Voltage	V_{CC}	4.5	5.0	5.5	V	1
Battery Voltage	V_{BAT}	2.7	3.0	3.3, 5.5	V	1, 7

DC ELECTRICAL CHARACTERISTICS (V_{CC} =4.5V to 5.5V; -40°C to +85°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Active Supply Current	I_{CC}		150	180	µA	2, 8
Active Battery Current (V_{CC}=0V, V_{BAT}=3.3V)	I_{BAT}		1	4	µA	3, 8
High Output Voltage (I_{OH}=-1.0 mA)	V_{OH}	2.4			V	6
Low Output Voltage (I_{OL}=2.1 mA)	V_{OL}			0.4	V	6
Battery Switch Voltage	V_{SW}		V_{BAT}		V	

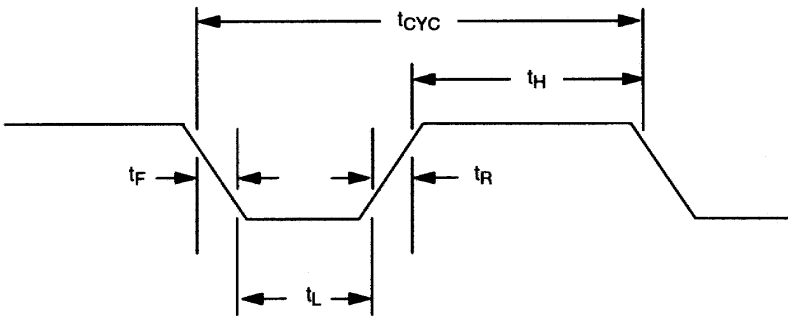
AC TIMING CHARACTERISTICS (V_{CC}=4.5V to 5.5V; -40°C to +85°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Output Frequency	f_{OUT}		32.768		kHz	
Frequency Stability vs Temp (0°C to 40°C) (-40°C to +85°C)	$\Delta f/f_O$		±2.0 ±7.5	±7.5	PPM	
Duty Cycle	T_W/T	45	50	55	%	
Cycle Time	t_{CYC}		30.518		µs	4
High/Low Time	t_H/t_L		15.06		µs	4
Rise Time	t_R		200		ns	4
Fall Time	t_F		60		ns	4
Oscillator Start-Up Time	t_{OSC}		150		ms	4
Frequency Stability vs Operating Voltage	$\Delta f/_V$		±1.0		PPM/$_V$	

NOTES:

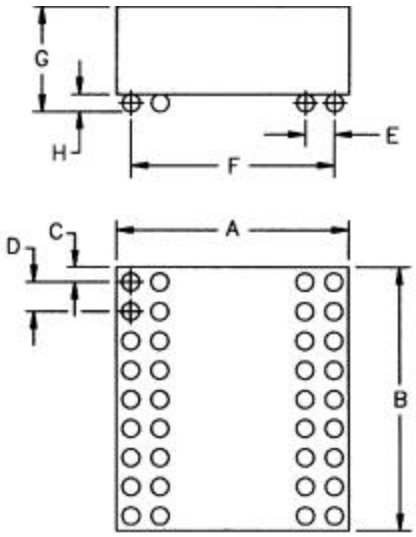
1. All voltages are referenced to ground.
2. Typical values are at +25°C and nominal supplies.
3. This current is the active mode current sourced from the backup supply/battery.
4. These parameters are measured using a 15 pF load.
5. DS32KHz-N is tested over the industrial temperature range to meet the specifications above.
6. These parameters are measured with V_{CC} on under nominal operating conditions.
7. When V_{CC} is grounded V_{BAT} can operate from 2.7V to 5.5V. Freq. stability will be affected in this operation, typically 1PPM/Volt above or below 3.0V.
8. These parameters are measured under no load conditions. The difference between I_{CC} and I_{BAT} is due to power switching circuitry.
9. Typical crystal aging is ±1 ppm/yr after reflow.

32KHz OUTPUT WAVEFORM

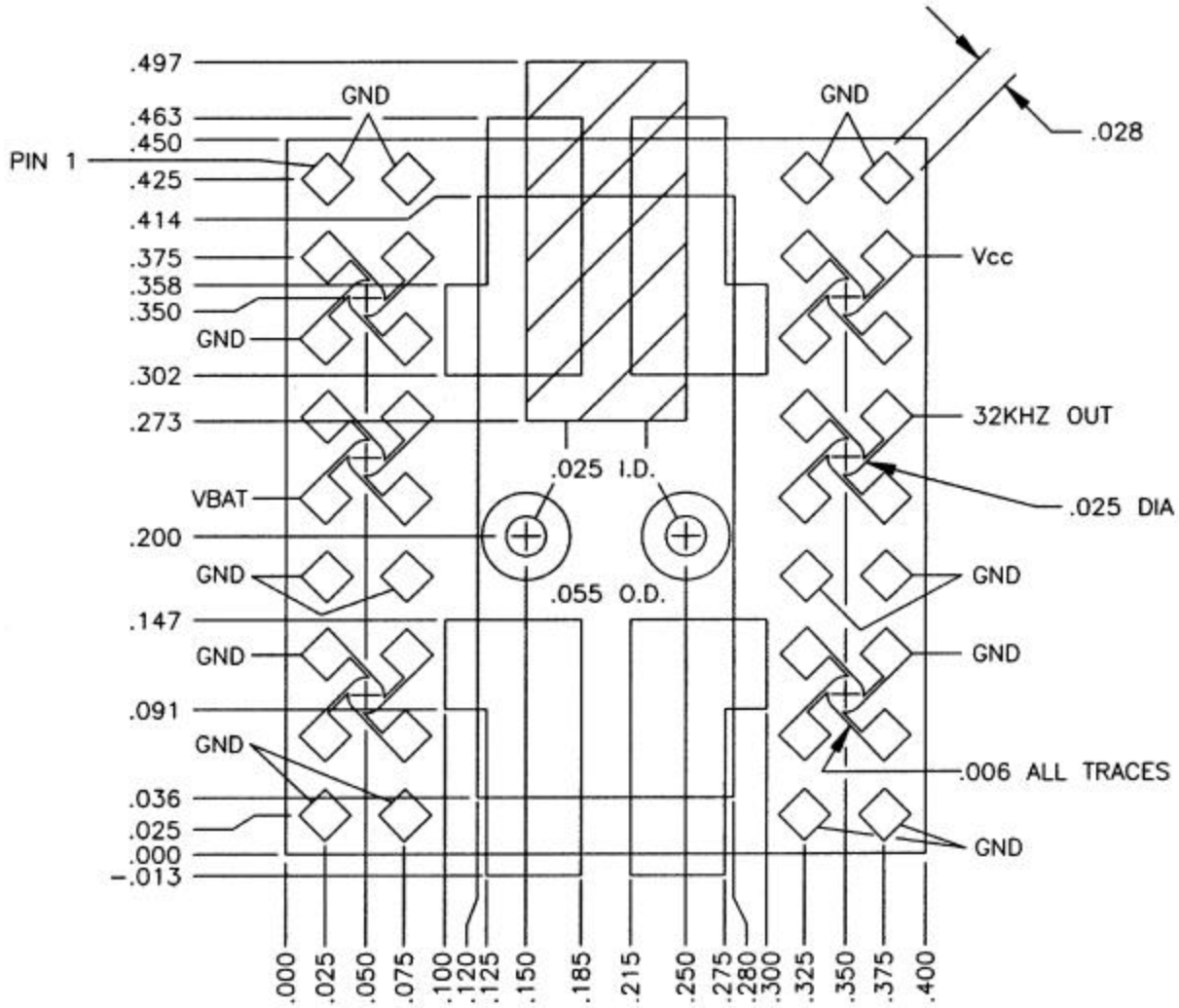


MECHANICAL DIMENSIONS

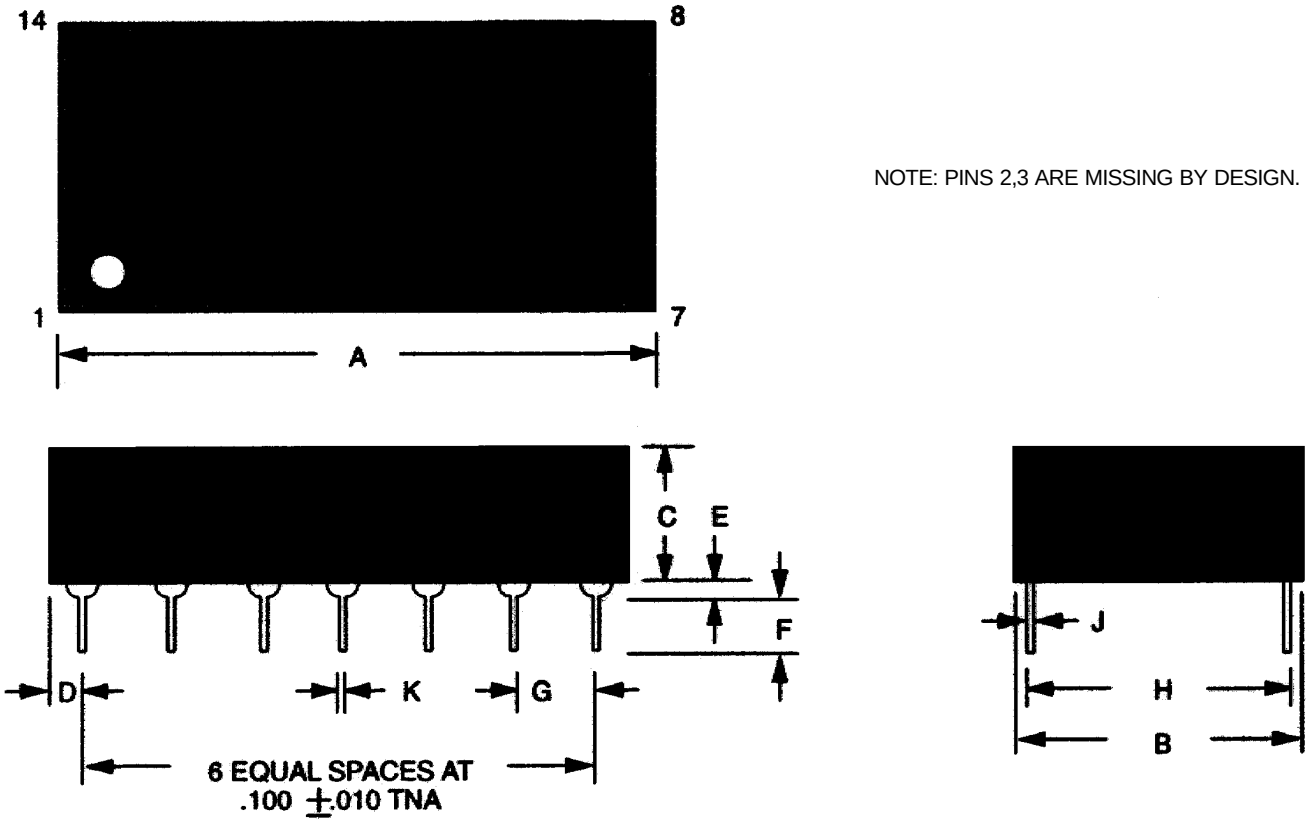
PKG	36–PIN BALL GRID	
DIM	MIN	MAX
A (in)	.395	.405
B (in)	.445	.455
C (in)	.022	.028
D (in)	.047	.053
E (in)	.047	.053
F (in)	.347	.353
G (in)	.170	.190
H (in)	.025	.030



RECOMMENDED LAND PATTERN LAYOUT (36-Pin BGA)



14-PIN DIP MODULE



NOTE: PINS 2,3 ARE MISSING BY DESIGN.

PKG DIM	14-PIN DIP	
	MIN	MAX
A IN.	0.825	0.840
B IN.	0.420	0.440
C IN.	0.235	0.260
D IN.	0.100	0.130
E IN.	0.015	0.030
F IN.	0.110	0.140
G IN.	0.090	0.110
H IN.	0.290	0.330
J IN.	0.008	0.012
K IN.	0.015	0.021