DS32KHz
32.768 kHz TCXO

www.dalsemi.com

FEATURES

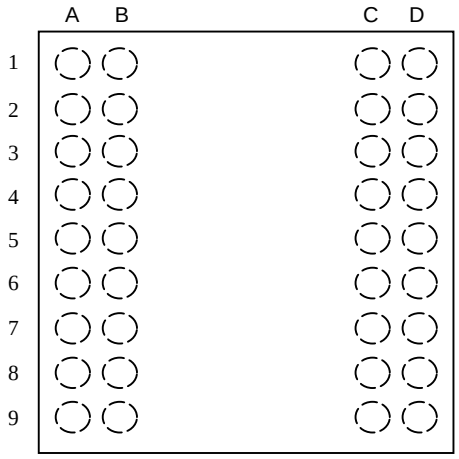
- Accurate to ±4 Min/Yr. (-40°C to +85°C)
- Accurate to ±1 Min/Yr. (0°C to 40°C)
- Battery back up for continuous time keeping
- V_{BAT} operating voltage 2.7 to 5.5V with V_{CC} grounded
- V_{CC} operating voltage 4.5 to 5.5V
- Operating temperature range:
  COM: 0°C to 70°C
  IND: -40°C to +85°C
-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

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

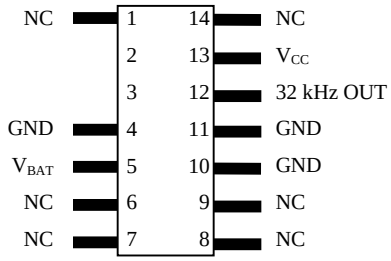
ORDERING INFORMATION

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

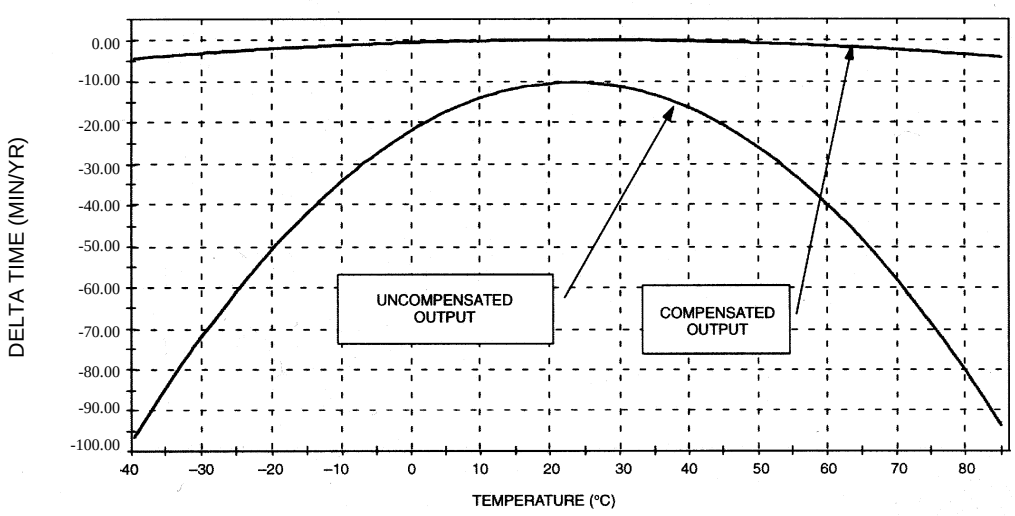
The DS32KHz is a temperature compensated crystal oscillator (TCXO) with an output frequency of 32.768 kHz. This device addresses applications requiring better timekeeping accuracy and may be used to drive the X1 input of most Dallas Semiconductor Real Time Clocks (RTC's), chipsets and other IC's containing 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 32 kHz 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 32 kHz 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.

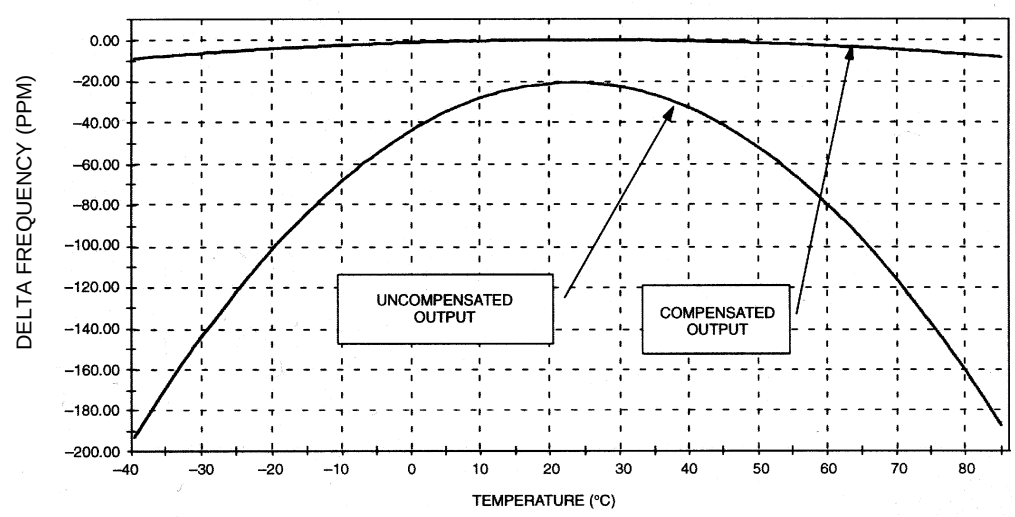
The DS32KHz is packaged in a small 36–pin SMD, utilizing Ball Grid Array (BGA) technology, with dimensions 0.400 inches wide, 0.450 inches long, and 0.180 inches high. Also available in a 14–pin DIP module.

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

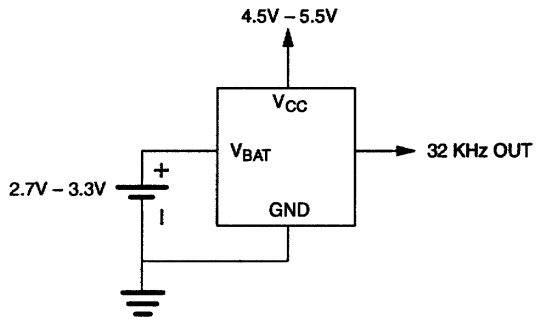


Figure 1.0

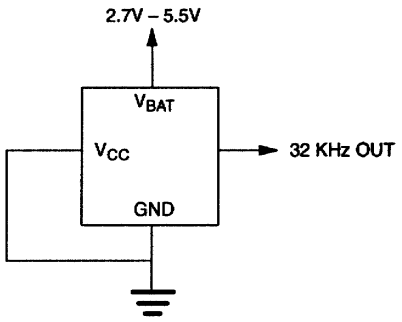


Figure 2.0

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

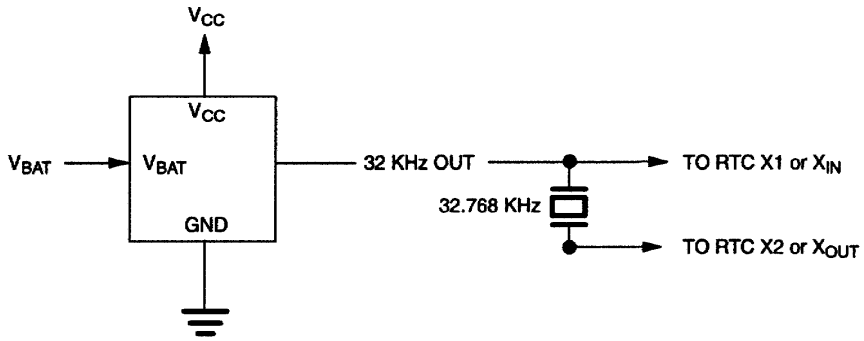


Figure 3.0

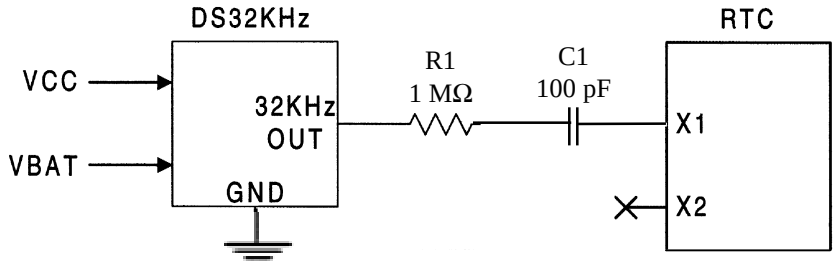


Figure 4.0

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.

The DS32KHz I_{CC} and I_{BAT} currents are specified with no output loads. Many RTC oscillator circuits are designed to be used with a quartz crystal or resonator. Driving the oscillator circuit with the rail-to-rail output of the DS32KHz may increase the I_{CC} and I_{BAT} currents significantly, and increase the current consumption of the RTC as well. Figure 4 shows one recommended circuit that can be used to reduce the current consumption of a DS32KHz and an RTC. The values of R1 and C1 will vary depending on the RTC used. However, values of 1.0 MΩ and 100 pF are recommended as a starting point.

RELATED APPLICATION NOTES:

Application Note 58 – Crystal Considerations with Dallas Real Time Clocks
Application Note 701 – Using the DS32KHz with Dallas RTC's

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	

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	See J-STD-020A specification (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.

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)	$\Delta f/f_O$	-3.0	+1	+2.0	ppm	
(-40°C to +85°C)		-7.5		+7.5		
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	
Crystal Aging	$\Delta f/f_O$		±1.0		ppm/yr	8

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.

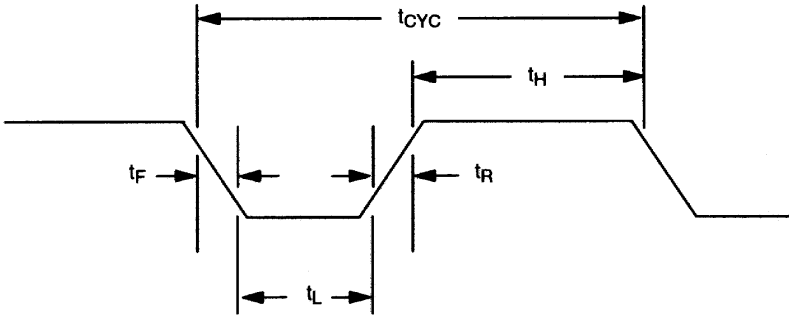
5. These parameters are measured with V_{CC} on under nominal operating conditions.

6. When V_{CC} is grounded V_{BAT} can operate from 2.7V to 5.5V. Freq. stability will be affected in this operation, typically 1 ppm/volt above or below 3.0V.

7. These parameters are measured under no load conditions. The difference between I_{CC} and I_{BAT} is due to power switching circuitry.

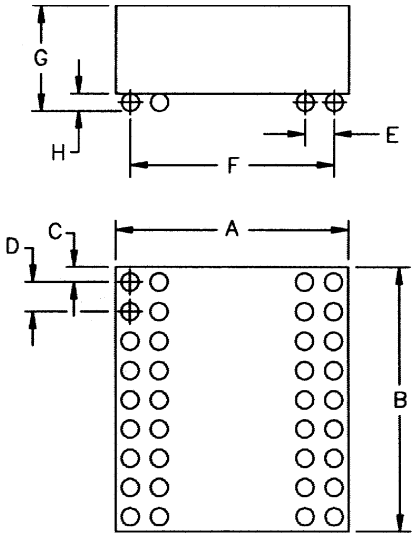
8. After reflow.

32 kHz OUTPUT WAVEFORM

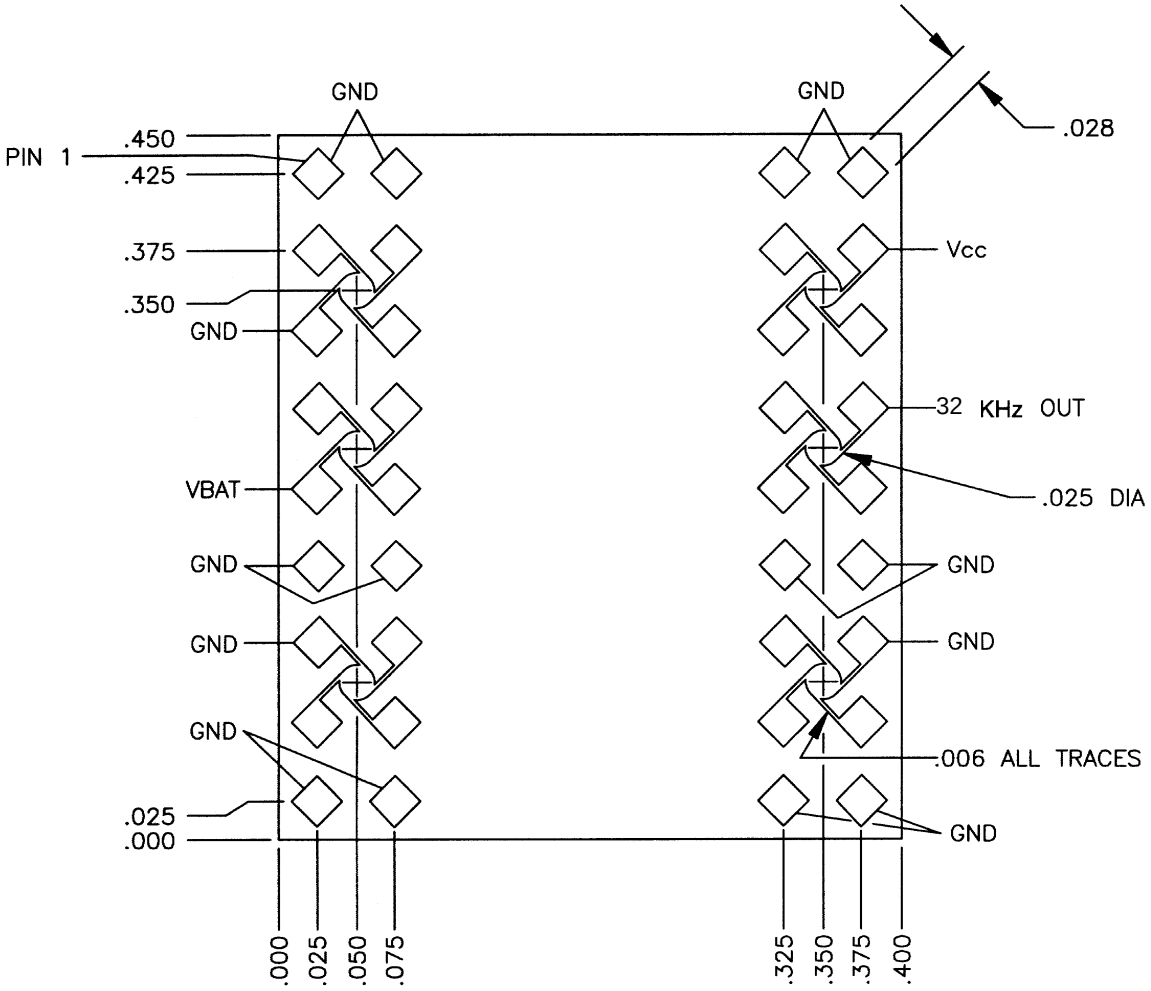


MECHANICAL DIMENSIONS

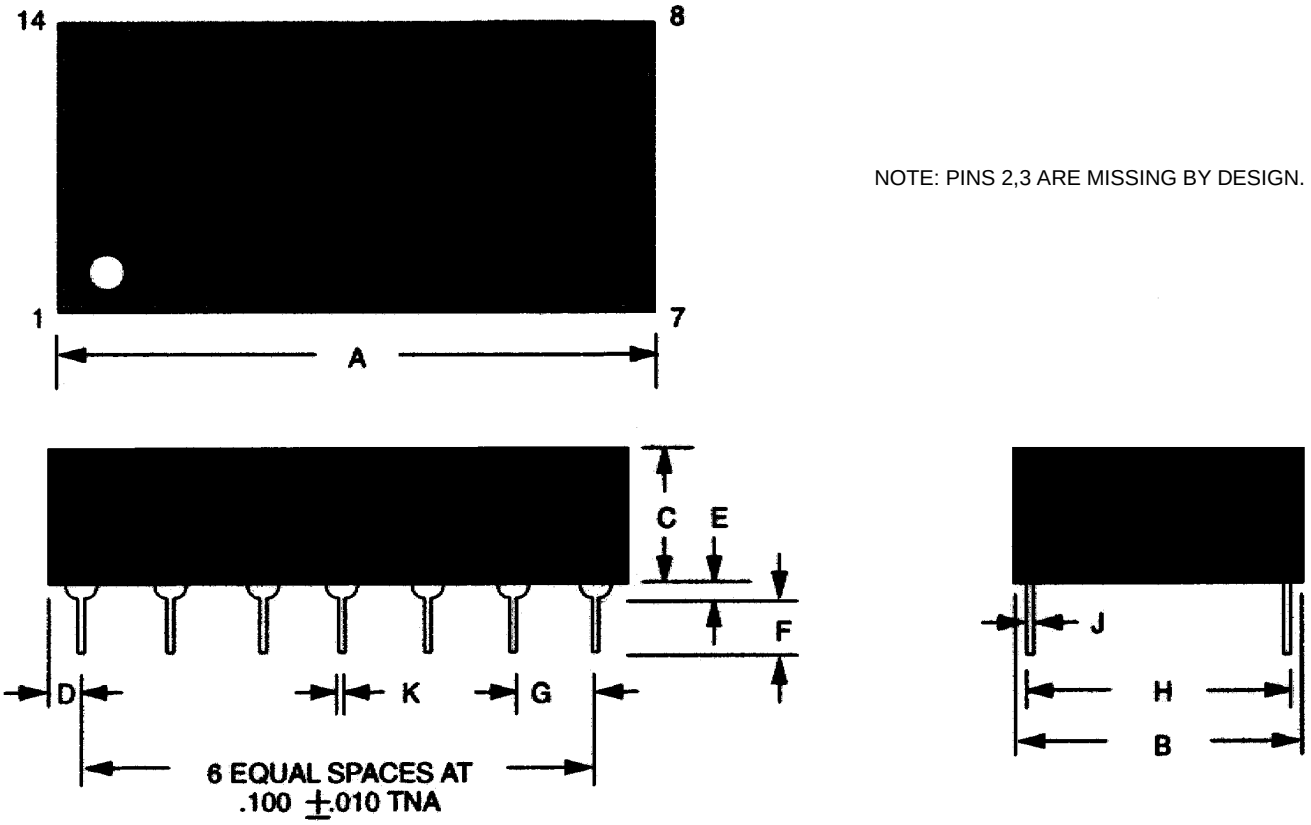
PKG	36–PIN BALL GRID	
DIM	MIN	MAX
A (in)	.395	.405
B (in)	.445	.455
C (in)	.022	.028
D (in)	.047	.053
E (in)	.047	.053
F (in)	.347	.353
G (in)	.170	.190
H (in)	.020	.030



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