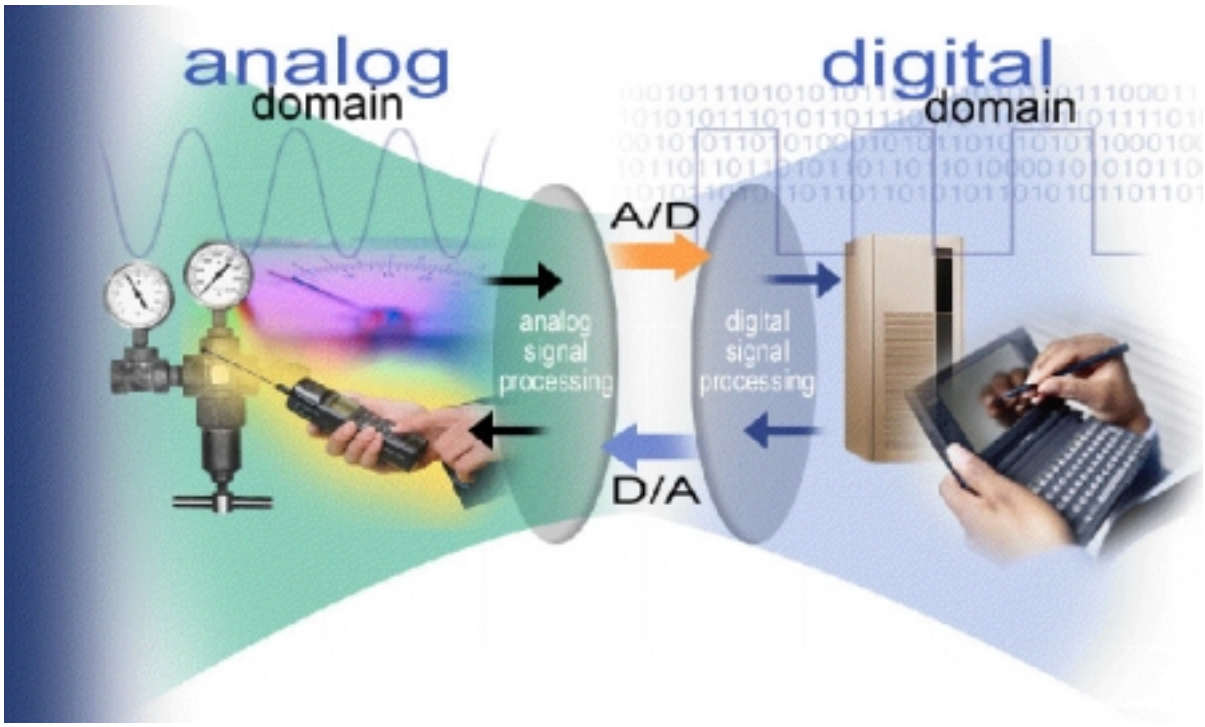
ADuC834 Evaluation Board Reference Guide



MicroConverter® ADuC834

QuickStart™ Development System

CONTENTS:

Evaluation Board Reference Guide:

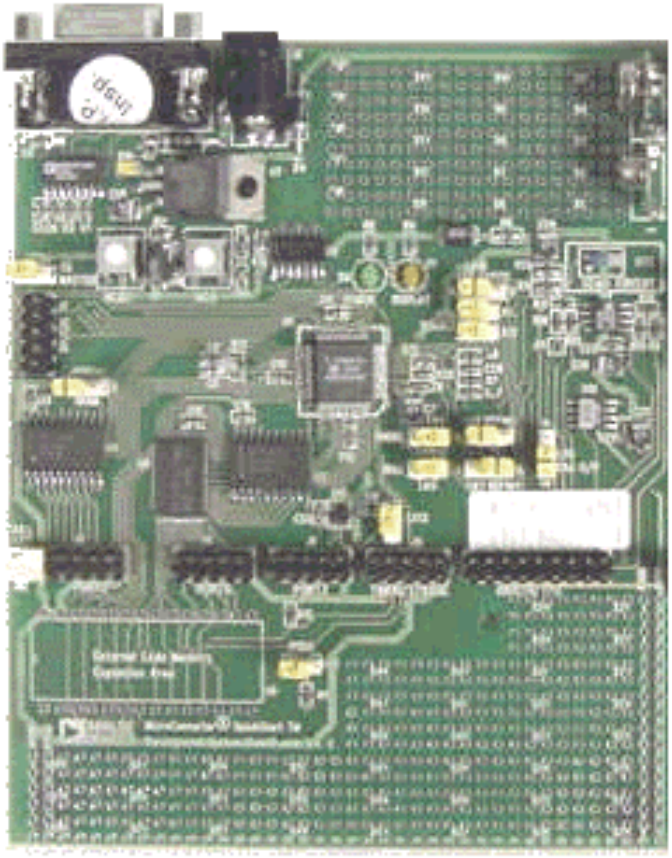


Figure 1: ADuC834 Evaluation Board

(1) EVALUATION BOARD OVERVIEW

The ADuC834 Evaluation board has the following features :

- **2 Layer PCB** (4" X 5" Form Factor)
- **9V power supply**/battery **regulated to 5V** on board (see section 2)
- **RS232 Interface** to ADuC834 via 9-way D-type connector (see section 2)
- Access to all **ADC inputs** from external header. DAC output channel buffered to external header. (see section 2 and section 4)
- All device **Ports and Strobes** are brought out to external header pins (see section 4)
- **General Purpose Prototype Area** (see section 2)
- **32KBytes External memory** (SRAM) (configurable as data or volatile program memory) (see section 2 and section 3)
- **External Program Memory Socket** for NV program memory (see section 2)
- 32.768kHz **Watch Crystal** to drive the PLL clock (see section 2)
- AD780 **2.5V External Reference** Chip (see section 2)
- **Reset/External Interrupt 0** Push Buttons (see section 2)
- Power Indicator/General Purpose **LEDs** (see section 2)
- Example RTD **Temperature Sensor Demonstration** Circuit (see section 5)

NOTES :

1. All references in this document to physical orientation of components on the board are made with respect to a component side view of the board with the battery connections appearing in the top right corner of the board as shown in figure 1.

2. The board is laid out to minimize coupling between the analog and digital sections of the board. To this end, the ground plane is split with the analog section on the right hand side and a digital plane on the left hand side of the board. The regulated 5V power supply is routed directly to the digital section and is filtered before being routed into the analog section of the board.

3. The ADuC834 can be socketed on the board using a QFP carrier adaptor and corresponding surface mount feet available from Ironwood Electronics The part numbers are CA-QFE52SB-L-Z-T-01 and SF-QFE52SB-L-01 respectively.
   WEB: www.ironwoodelectronics.com
   Email: info@ironwoodelectronics.com

(2) EVALUATION BOARD FEATURES

Power Supply:

A 9V supply is fed to the board via the 2.1mm input power socket (J8). The input connector is configured as 'CENTER NEGATIVE' i.e. GND on the center pin and +9V on the outer shield. Alternatively the user can connect a 9V battery via J9(-) and J10(+). The 9V supply is regulated via a linear voltage regulator (U7), the 5V output being used to drive the digital side of the board directly. The 5V supply is also filtered and then used to supply the analog side of the board.

When on, the green LED (D2) indicates that a valid 5V supply is being driven from the regulator circuit.

All analog supplies are decoupled with 10uF and 0.1uF at device supply pins. Digital supplies are decoupled with 0.1uF at the digital supply pins.

RS232 Interface:

The ADuC834 (U1) TXD and RXD (pins 17 and 16 respectively) lines are connected via an RS232 transceiver (U2) to the external 9-way D-Type connector (J1). The transceiver generates the required level shifting to allow direct connection to a PC serial port. This interface will be the main channel of interactive communications on the board. A standard serial port cable is included as part of the QuickStart™ Development System to connect the PC directly to Evaluation Board.

Analog I/O Connections:

The inputs to the primary ADC are filtered with a first order (RC) anti-aliasing filter. There is an option (LK5) to bias the AIN2 analog input to 2.5V. There is also an option (LK4) to short both analog input channels (AIN1/AIN2) to allow various noise parameters to be more easily evaluated. (See section 1.2 for Link descriptions). The DAC output is buffered before being driven to an external pin header.
A general purpose buffer configuration is provided at J2-14, J2-16 and J2-17. The buffer configuration allows the user to control the gain and/or offset of a signal.

General Purpose prototype area

General Purpose prototype areas are provided at the top and the bottom or the evaluation board for adding external components as required in the users application. As can be seen from the layout AVDD, AGND, DVDD and DGND tracks are provided in this prototype area.

External Data Memory Interface:

The Evaluation board incorporates 32KBytes SRAM (U5). This external memory can be configured as a data memory or as both code and data memory. Typically the 32Kbytes will be used as external data memory. To configure it as such remove link 13.

The MicroConverter uses a 24-bit address interface to external memory unlike a standard 8051, which only uses 16-bit addresses. This means that the MicroConverter can address up to 16MBytes of XRAM while the 8051 can only address 64kBytes of XRAM. This is done by multiplexing Port2 (high address byte + page address byte) as well as Port0 (low address byte + data byte). See page 62 of the datasheet.

The ADuC834 evaluation board only contains 32kBytes of XRAM. Hence the full 24-bit address interface to the XRAM cannot be used properly. To show this feature off we have configured the memory in two modes using LK9 as discussed in section 1.2. The memory is addressed using 2 external latches (74HC573, U3 and U4). U3 is used to latch the low order address on Port 0 before it multiplexes to a data bus. U4 is used to multiplex Port2.
Note: U4 is unnecessary if the ADuC834 is addressing less than 64kBytes of XRAM.

Configuring the memory as a code memory might be useful in some applications. It is necessary for the Keil Monitor-51 which requires von-Neumann wired code and XData memory. To configure this memory as a data and code memory insert link 13.
Note: If using the external data memory as both external program memory and external data memory make sure that there is no external program memory in the program memory socket provided, (U9). Inserting LK13 with a an external program memory inserted in U9 will cause both U5 and U9 to be enabled together and will cause confliction on the data bus.

External Program Memory Socket:

An external program memory socket is available on the ADuC834 evaluation board. This allows the user to easily connect in an external program memory.
Note: If using an external program meory at U9 make sure that LK13 is removed as described above.

Crystal Circuit:

The board is fitted with a 32.768kHz watch crystal. This crystal is connected between the XTAL1 and XTAL2 pins. There is no need for external caps on the oscillator circuit with the crystal we provide (the ADuC834 has 12pF on each of the XTAL pins internally) although pads are provided (C8 and C9) for external crystals that require larger capacitances.

External Reference (AD780)

An external reference chip for use with the ADC is provided on the evaluation board. This allows the user to get improved ADC results from the ADuC834 ADC. Using the WASP software on the QuickStart Development tools it is possible to compare ADC noise performance using the ADuC834 internal reference and an external reference.

External Power on Reset Chip (ADM809)

The ADuC816 and the ADuC824 require an external power on reset chip to drive the RESET pin of the ADuC816/ADuC824. The ADuC834 however has an internal, robust power on reset circuit and hence an external PoR is not necessary. The ADM809 active low power on reset circuit is provided on the ADuC834 evaluation board however, to allow the one board to be used with all three products.

Reset/*INT0* Push Buttons:

A **RESET push button** is provided to allow the user to manually reset the part. This button is at the input to the ADM809 (Power on Reset chip) so a delay of 240ms approx will be required for the part to be actually released from reset after the button is released.

An ***INT0* push button** switch is provided to allow the user perform external interrupts easily. The *INT0* signal is Schmitt triggered (U6) to prevent noise on the rising edge of *INT0* to cause multiple interrupts as it passes the trip point. This Schmitt trigger also inverts the signal.

Power Indicator/General Purpose LEDs:

A green power LED (D2) is used to indicate that a sufficient supply is available on the board. A red general purpose LED (D1) is connected to P3.4 of the ADuC834. An inverter is connected between the LED and the port pin so that the SETB instruction turns the LED on and the CLR instruction turns the LED off.

(3) LINK OPTIONS

LK1 (2x1) *SS* Master

Function : Allows P3.5 to drive the *SS* line off-board to a slave SPI device.

Use : ***Slide LK1 into the ON position*** to connect P3.5 to the SPI *SS* line.
Slide LK1 into the OFF position to disconnect P3.5 from the SPI *SS* line.

LK2 (2x1) *EA* Pulldown

Function: Allows the user to force the ADuC834 to execute the first 8kBytes of program memory from the internal or external program memory space.

Use : ***Insert LK2*** to pull *EA* low causing the ADuC834 to run code from external program memory.
Remove LK2 to leave *EA* high so as to run code from the internal Flash/EE program memory.

Note: This link can also be used with the Accutron ACE emulator. The single pin emulator simply connects to this link.

LK3 (2x1) *PSEN* Pulldown for Serial Download/Debug Mode

Function: Allows the user to enter serial download or debug mode.

Use : ***Slide LK3 into the ON position*** to enter serial download mode or debug mode on power-on or after a hardware reset (i.e. pressing reset button).
Slide LK3 into the OFF position for normal device operation.

LK4 (2x1) Analog Input Shorting Link

Function : Allows AIN1 and AIN2 to be shorted externally together.

Use : ***Slide LK4 into the ON position*** to short AIN1 to AIN2 (for ADC noise analysis).
Slide LK4 into the OFF position to disconnect the short.

LK5 (2x1) Analog Input Biasing Link

Function : Allows AIN2 to be biased to a 2.5V common mode voltage.

Use : ***Slide LK5 into the ON position*** to bias AIN2 to 2.5V.
Slide LK5 into the OFF position to remove the external bias voltage from AIN2.

LK6 (3x1) DAC Output Link

Function: The DAC output can be routed out on one of 2 pins. This link routes the selected DAC output pin through an external buffer to the external pin J2-13.

Use : ***Slide LK6 to Position A*** if DAC output is selected on pin 12 (P1.7/AIN4).
Slide LK6 to Position B if DAC output is selected on pin 3 (P1.2/IEXC1).
Slide LK6 to Center Position if DAC output is not being used.

LK7 (3x1) REFIN- Select

Function: Allows the selection of an external reference, i.e. the AD780 or the RTD reference voltage

Use: ***Slide LK7 to Position A*** to connect REFIN- to analog ground (use with AD780).
Slide LK7 to Position B to connect the negative end of the RTD circuit reference voltage (the voltage dropped across R11) to REFIN- (use with RTD temp demo circuit).
Slide LK7 to Center Position to connect an external reference at J2-7 to REFIN+

LK8 (3x1) REFIN+ Select

Function: Allows the selection of an external reference, i.e. the AD780 or the RTD reference voltage

Use: ***Slide LK8 to Position A*** to connect REFIN+ to the 2.5V output of the AD780.
Slide LK8 to Position B to connect the positive end of the RTD circuit reference voltage (the voltage dropped across R11) to REFIN+ (use with RTD temp demo circuit).
Slide LK8 to Center Position to connect an external reference at J2-8 to REFIN-.

LK9 (3x1) External Data Memory

Function: This link is used to configure the external data memory map. Either the bottom 32k Bytes of the external data memory space is mapped or the bottom 256 bytes in the first 128 pages is mapped. (via A16-A23 and U4).

Use : ***Slide LK9 to Position A*** to make U4 transparent. Hence the external data memory (U5) sees address lines A0-A14. Hence the bottom 32K Bytes of the address range are mapped into the external data memory space.
Note: In this mode (using less than 64k Bytes of XRAM) the latch U4 is unnecessary.

Slide LK9 to Position B to allow ALE to latch U4. Hence the external data memory (U5) sees the address lines A0-A7 and A16-A22. Hence the bottom 256 Bytes in the first 128 pages of the address range are mapped into the external data memory space.
Note: This mode may not be of particular use to the user but it does show the 24 bit addressing ability of the MicroConverter.

LK10 (3x1) RTD Excite

Function: LK10 connects either the current source at pin 3 or the current source at pin 4 available from the ADuC834, to excite the external RTD.

Use: ***Slide LK10 to Position A*** to connect the current from pin 3 to the RTD.
Slide LK10 to Position B to connect the current from pin 4 to the RTD.
Slide LK10 to Center Position if the RTD temperature demonstration is not being used

LK11 (2x1) Connect AIN1 to RTD

Function: Connects the high end of the external RTD circuit to AIN1.

Use : ***Slide LK11 into the ON position*** to connect the external RTD to AIN1.
Slide LK11 into the OFF position to disconnect the RTD from AIN1.

LK12 (2x1) Connect AIN2 to RTD

Function : Connects the low end of the external RTD circuit to AIN2.

Use : ***Slide LK12 into the ON position*** to connect the external RTD to AIN2.
Slide LK12 into the OFF position to disconnect the RTD from AIN2.

LK13 (2x1) Connect *PSEN* to External Data Memory

Function : Allows the External Data Memory to be used as both an External Program Memory and an External Data Memory.

Use : ***Slide LK13 into the ON position*** to connect the *PSEN* output from the ADuC834 (for use with an external program memory) through an AND gate to the external data memory. This allows the external Data Memory to be used as **both** external program and data memory.
Note: To use this mode make remove any external program memory inserted in the external program memory socket provided (U9) as this will cause confliction on the data bus.
Slide LK13 into the OFF position to disconnect the *PSEN* signal from the data memory, disabling the use of the external data memory as an external program memory.

(4) EXTERNAL JUNCTIONS (CONNECTORS):

J1 Serial Interface Connector

J1 provides a simple connection of the evaluation board to the PC via a PC serial port cable (provided with the ADuC834 QuickStart Development System).

J2 Analog I/O Connector

The analog I/O connector J2 carries all ADC inputs and DAC output channels as well as the external V_{REF} input. The pinout and orientation of this connector is shown below.

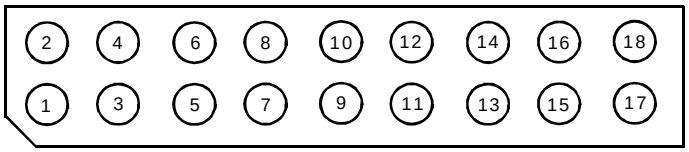


Figure 2: The Analog I/O connector J2

Pin	Function	Pin	Function
1	DGND	10	AIN2
2	DVDD	11	AIN3
3	AGND	12	AIN4/DAC (pin12)
4	AVDD	13	DAC O/P (Buffered)
5	IEXC1/DAC (pin3)	14	O/P OpAmp (Spare)
6	IEXC2/AIN5	15	2.5V AD780 O/P
7	REFIN+	16	In(+) OpAmp (Spare)
8	REFIN-	17	In(-) OpAmp (Spare)
9	AIN1	18	AGND

Table 1: Pin functions for Analog I/O connector J2

J3 (Timer/Strobe)

The timer/strobe control signals on the ADuC834 are all brought out to a 10 way connection port just above the prototyping. The exact pinouts of the ports are shown in table 2 with reference to the connector shown in figure 3 below.

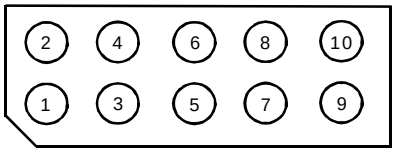


Figure 3: 10 way Connector Port

Pin	Function	Pin	Function
1	T0	6	T2
2	T1	7	T2EX
3	*EA*	8	DGND
4	*PSEN*	9	DVDD
5	ALE	10	DGND

Table 2: Timer/Strobe connector J3

J4/J5/J6 (Port0 / Port2 / Port 3)

3 parallel ports (Port0, Port2 and Port3) are brought out to the connectors J4, J5 and J6. The exact pinout of any of these connectors is shown below with reference to figure 3 above.

Pin	Function	Pin	Function
1	PortX.0	6	PortX.5
2	PortX.1	7	PortX.6
3	PortX.2	8	PortX.7
4	PortX.3	9	DVDD
5	PortX.4	10	DGND

Table 3: Pin functions for Port0, Port2 and Port3 connectors J4, J5, J6

J7 (SPI Connector)

J7 is situated to the left side of the board and gives access to the SPI and HCOP interfaces. The pin-out is as in fig 3 with the orientation vertical. Look for the pin1 marker on the evaluation board.

Pin	Function	Pin	Function
1	SCLOCK/HCOP0	6	DGND
2	DGND	7	*SS*
3	MOSI/HCOP1	8	DGND
4	DGND	9	NC
5	MISO	10	DGND

Table 4: Pin functions for SPI connector J7

J8/J9/J10 Power Supply Connections

J8 allows for the connection between the evaluation board and the 9V power supply provided in the ADuC834 QuickStart Development System.
J9 and J10 allow for the connection of a typical 9V battery to the evaluation board.

J11 (DAC OpAmp Voltage Bias Input)

J11 is included as an open circuit surface mount pad on the application board. This can be used to bias the voltage output level of the on-board DAC.

(5) RTD TEMPERATURE DEMONSTRATION CIRCUIT

As can be seen from examining the schematic an example RTD circuit is connected in a standard 4-wire configuration as shown in Figure 4 below:

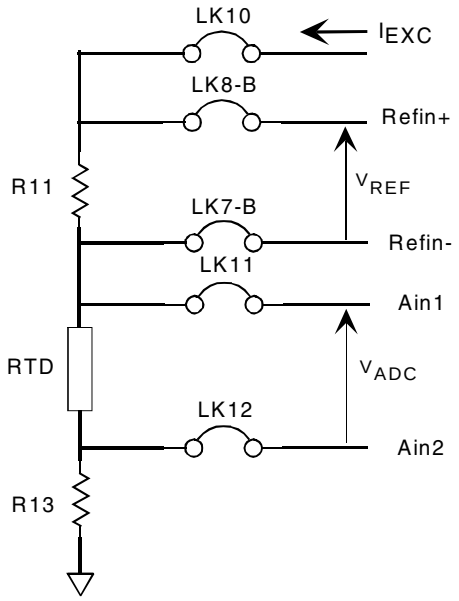


Figure 4: Circuit diagram of the RTD Circuit

To use the RTD circuit the following links should be inserted.

- LK7 Slide to position B
- LK8 Slide to position B
- LK10 Slide to position A [if the current is outputted from pin4 slide to position B]
- LK11 Slide to ON position
- LK12 Slide to ON position
- LK4 Slide to OFF position
- LK5 Slide to OFF position

The RTD is excited by routing the ADuC834 excitation current sources through LK10. This DC excitation current generates a reference voltage across R11. This reference voltage is routed back to the Refin(+)/ Refin(-) inputs via LK7 and LK8. As described on page 35 of the ADuC834 datasheet the 0.1uF capacitors at REFIN+ and REFIN- will cause some dc error. Hence for optimum performance the two capacitors C13 and C29 should be removed while using the RTD demonstration.

The RTD differential voltage output is measured through AIN1/AIN2 via LK11 and LK12.

A series resisitor R13 is included to bias the AIN2 input above AGND (the min voltage input for AIN2 is AGND+100mV).

(6) ADuC834 Evaluation Board Parts List

Component	Qty	Part	Description	Order No	Order From
EVAL- ADuC834QS QuickStart PCB	1	PCB-1	2 sided surface mount PCB		
PCB Stand-off	4	Stand-off	Stick on mounting feet	148-922	Farnell pg 611
U1	1	ADuC834	MicroConverter (52PQFP)		ADI
U2	1	ADM3202ARN	RS232 transceiver, (16 pin SOIC)		ADI
U3, U4	2	MM74HC573WM	OCTAL D-TYPE TRANSPARENT LATCH	379-580	Farnell
U5	1	UM62256EV	32K X 8 CMOS SRAM, (28 pin TSOP)		Farnell
U6	1	MM74HC14M	HEX SCHMITT-TRIGGER INV, (14 pin SOIC)	379-268	Farnell
U7	1	MC7805CT	Fixed 5V Linear Voltage Regulator	701-853	Farnell
U8	1	OP284ES	Dual Op-Amp, (8 pin SOIC)		ADI
U10	1	AD780	Bandgap reference		ADI
U11	1	ADM809RART	Power on Reset Supervisory Circuit		ADI
U12	1	NC7S08M5	Single AND gate	685-925	Farnell
SW1, SW2	2	Push button Switch	PCB mounted push button switch	176-432	Farnell
D1	1	Red Led	1.8mm miniature red led	657-025	Farnell
D2	1	Green Led	1.8mm miniature green led	657-037	Farnell
D3 D4	2	1N4001	Diode	365-117	Farnell
C14	1	0.01uF SM Cap	Surface Mount Ceramic Cap, 0603 Case	499-146	Farnell
C19	1	0.33uF SM Cap	Surface Mount Tantalum Cap, Taj-A Case	498-919	Farnell
C7, C20, C21, C24, C26	5	10uF SM Cap	Surface Mount Tantalum Cap, Taj-B Case	498-737	Farnell
C1-C6, C10-C13, C15-C18, C22-C23, C25, C27-C29	20	0.1uF	Surface Mount Ceramic Cap, 0603 Case	499-675	Farnell
C8-C9	2		Unused XTAL caps 0603 case		

R1, R2, R7-R10, R12, R14-R17	11	1K	Surface Mount Resistor, 0603 Case	612-480	Farnell
R3, R18	2	100K	Surface Mount Resistor, 0603 Case	612-728	Farnell
R4,R5	2	270R	Surface Mount Resistor, 0603 Case	612-418	Farnell
R6	1	1R5	Surface Mount Resistor, 0805 Case	758-310	Farnell
R11	1	5K62 (0.1%)	Surface Mount Resistor, 0805 Case	554-728	Farnell
R13	1	562R (0.1%)	Surface Mount Resistor, 0805 Case	553-761	Farnell
R19	1	2K2	Surface Mount Resistor, 0603 Case	612-522	Farnell
Q1	1	BC856	PNP general purpose transistor	506266	Farnell
L	1	Ferrite Bead	Surface Mount Inductor, 1206 Case	557-330	Farnell
LK1, LK3-LK5, LK11-LK13	7	SPST Switch Header	2x1 SPST Switch Header	986-501	Farnell
LK6-LK10	5	SP Changeover Header	SP3T Changeover Header	JsC4-16-GO	Futora Electronics
LK2	1	2x1 (with friction lock)	Square Pin Header with friction lock	143-139	Farnell
J1	1	9 way socket	RA D Type PCB mounted Socket	150-820	Farnell
J2	1	9 X 2 Pin Header	Double Row Link Header	148-535	Farnell
J3,J4,J5,J6,J7	5	5X2 Pin Header	Double Row Link Header	148-535	Farnell
J8	1	PCB Mounted Socket	PCB Mounted Socket (2.1mm Pin Diameter)	224-959	Farnell
J9	1	9V Snap on	Battery connector Male (-)	723-988	Farnell
J10	1	9V Snap n	Battery connector Female (+)	723-988	Farnell
XTAL1	1	32.768kHz	Watch Crystal	492-980	Farnell
RTD	1	RTD	Sensor	721-8850	Farnell
	3		Shorting links (black)	312-307	Farnell