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Laird Audio Development Kit (ADK)

User Manual

Part # DVK-BTM511
Applicable to the following Bluetooth module part numbers:

- BTM511 – Revision 07 and later

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CONTENTS

Laird Audio Development Kit (ADK) 3

1. Overview 3

Introduction 3

Package Contents 3

2. ADK – Main Development Board 4

3. Getting to know the Development Board 4

4. Power Supply 5

5. USB - RS232 Serial Interface 6

6. Software 7

7. Interface Specification 8

7.1 RS232 Serial signals 8

7.2 PCM / I2S 9

7.3 Differential input – J12 on ADK, labeled DIFF_IN 9

7.4 SPI Interface - J16 on ADK, labeled SPI 9

7.5 Audio Connectors – Labeled LINE_In, MIC_IN and STEREO_OUT 9

7.6 Push Buttons 10

7.7 Board Configuration Jumpers 10

7.8 SW - Switches 12

8. Other Features 12

8.1 Power Consumption Measurement 12

8.2 USB Access 12

9. Additional Documentation 13

LAIRD AUDIO DEVELOPMENT KIT (ADK)

Part # **DVK-BTM511**
Applicable to the following Bluetooth module part numbers:
BTM511 Revision -07 onwards

1. OVERVIEW

Laird's Audio Development Kit (ADK) provides a platform for rapid wireless connectivity prototyping, providing multiple options for the development of Bluetooth stereo and mono audio applications.

This manual is for Rev. 01 of the development PCB and relates to BTM511 DVK-V04 on the PCB itself. The complete functionality of the ADK hardware requires the use of Laird BTM511 firmware revision -07 (firmware v18.1.3.0) or greater.

Introduction

The Laird ADK is designed to support the rapid development of applications and software for the specific Laird Bluetooth module part number BTM511. More information regarding this product including a detailed module User's Manual is available from the following link:
http://www.lairdtech.com/Products/Wireless-M2M-and-Telematics-Solutions/Bluetooth-Module/

Package Contents

All kits contain the following items:

Development Board	The motherboard has the BTM511 module already soldered onto it and exposes all the various hardware interfaces available.
USB cable – Type A to Type B	The USB cable is one option for providing power for the ADK via the on-board connector. The cable also provides serial communications via a FTDI USB – RS232 converter chip.
3.5mm Audio cable	The audio cable is one option for connecting one of the Line in / MIC / Speaker ports to an external media device with 3.5mm audio jack socket.
Web link Card	Provides links to additional information including the BTM511 User Manual, terminal utilities, schematics, quick start guides and firmware release notes.

2. ADK – Main Development Board

The development board allows the Laird Bluetooth module to connect to a PC. The development board provides USB-to-Virtual COM port conversion through a FTDI chip. Any Windows PC (XP or later) auto-installs the necessary drivers; if your PC cannot locate the drivers, you can download them from http://www.ftdichip.com/FTDrivers.htm

3. Getting to know the Development Board

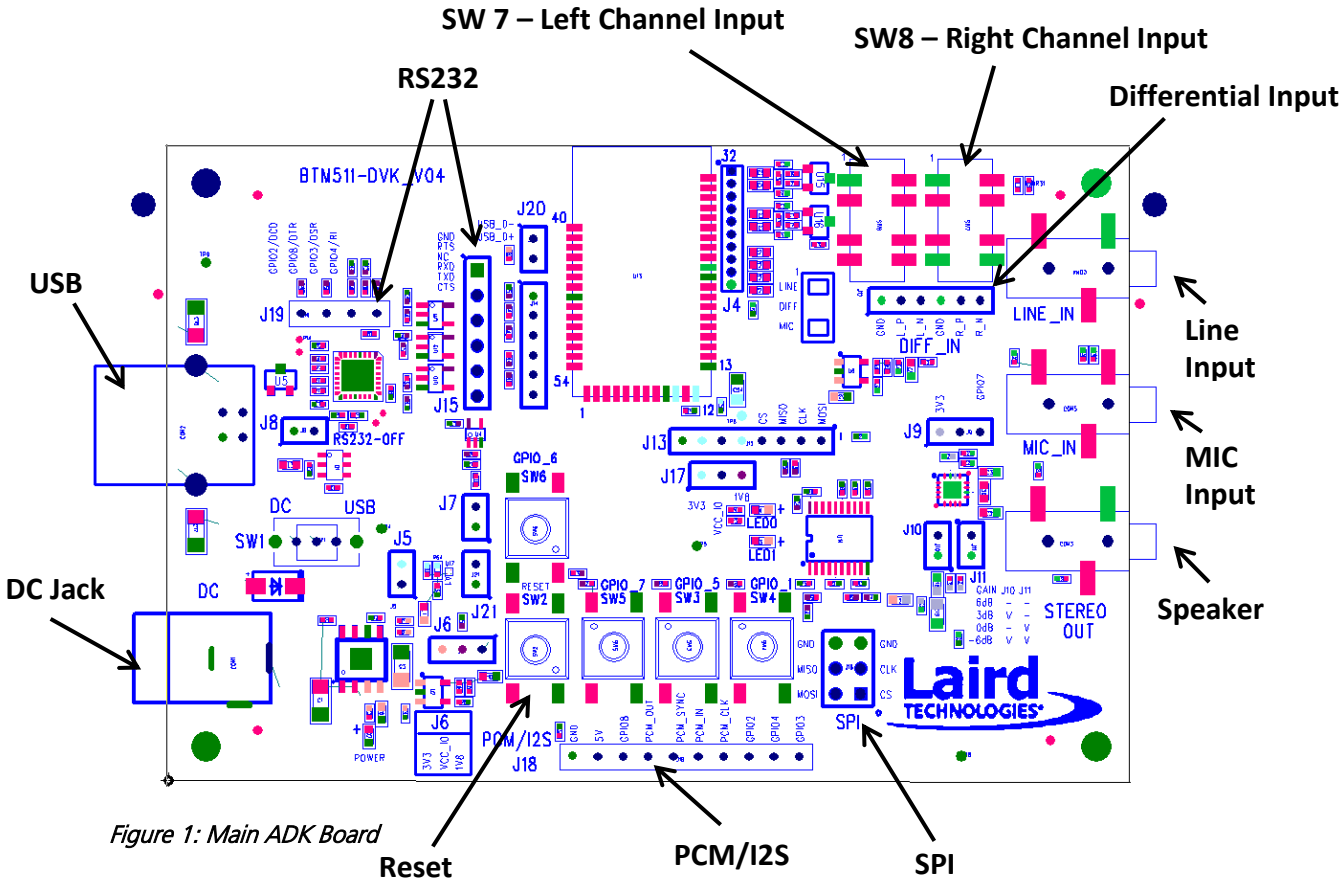


Figure 1: Main ADK Board

4. POWER SUPPLY

	Minimum	Typical	Maximum
Input Voltage	4.5 V	5 V	5.5 V

The development board has two options for providing power to the module:

- 5V power from a USB port
- Power from an external mains power block via a 2.0 mm DC connector

The developer kit includes a USB cable to provide power to the development board. It should be plugged into a PC USB port, a USB hub, or a mains adaptor with a USB output. If a hub is used, it should be a powered USB hub to ensure that sufficient current is available at the port being used. The BTM511 module can be driven by the current available at a standard USB port.

Switch SW1 is used to select between USB or DC jack power source.

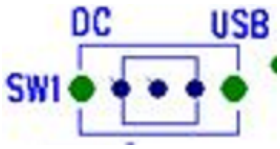


Figure 2: SW1 Settings

SW1 (slide switch) provides the selection of input power for BTM511 module from USB or DC jack. The power for the U3 (FT232R) is always powered by the USB bus.

SW2 (push button TACT switch) provides a reset signal to the BTM511 module.

5. USB - RS232 SERIAL INTERFACE

The ADK provides USB-to-Virtual COM port conversion through a FTDI chip and any Windows PC (XP or later) will auto install the necessary drivers and if your PC cannot locate the drivers, you can download them from http://www.ftdichip.com/FTDrivers.htm

The development board contains a USB to UART interface on the RX, TX, CTS, RTS, DTR, DSR, RI, and DCD signals. In default setting, the FTDI is on by having the J8 open (no jumper), so providing a USB to virtual COM port for evaluation through standard USB cable. See Figure 3.

The UART interface on the BTM511 module can be driven from external microcontroller instead of the on-board FTDI FT232R chip (U3), if the DVK is powered from DC jack and SW1 (Figure 2) is in position 'DC'. At a minimum, RX, TX, RTS, and CTS need to be connected (J15) for this use case. Modem control lines (J19) are optional.

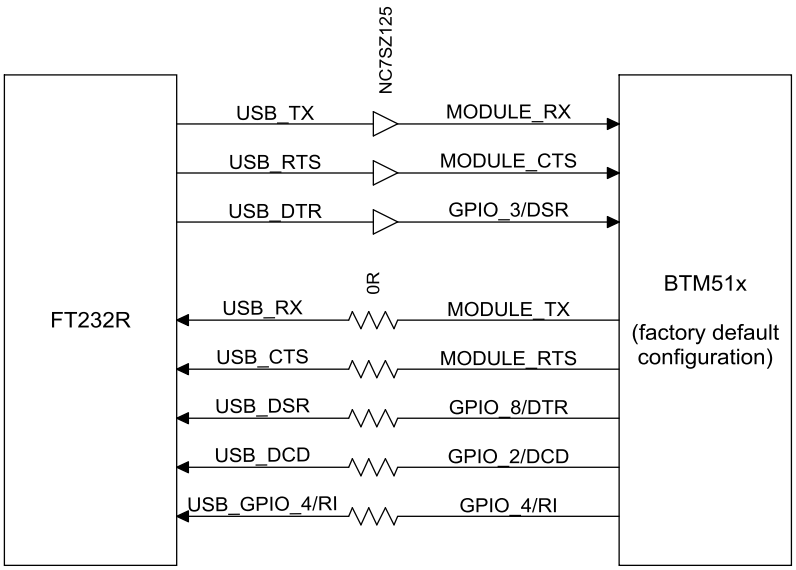


Figure 3: USB to UART Interface

6. SOFTWARE

The development board connects the BTM511 module to a virtual COM port of a PC or other device. From a PC, you can communicate with the module using any Terminal Emulator software, such as HyperTerminal, Procomm, or the supplied EZURiO / Laird Terminal application.

EZURiO / Laird Terminal is a terminal emulation application capable of running on Windows 98, Me, 2000, XP, Windows 7 and Windows 8 operating systems. It was developed specifically to aid development and testing of Laird modules. It allows connection to serial devices using any combination of the communications parameters listed in Table 1.

Table 1: Communication Parameters

COM Port:	1 to 255
Baud rate:	300 to 921600
Parity:	None, Odd, Even
Data Bits:	7 or 8
Stop Bits:	1 or 2
Handshaking:	None or CTS/RTS

The benefits of using EZURiO / Laird Terminal include:

- Continually displayed status of DSR, CTS, DCD, and RI
- Direct control of DTR on the host PC via a check box
- Direct control of RTS
- Sending of BREAK signals
- Scripts can be run to assist
- Additional built-in features accelerate development

Laird includes a "Data Transfer Test" mode allowing data to be sent as fast as the handshaking permits. This feature is useful for testing the bit transfer rate of a Bluetooth connection.

The EZURiO / Laird Terminal application can be downloaded from our website:
http://www.lairdtech.com/Products/Wireless-M2M-and-Telematics-Solutions/Bluetooth-Module/

7. INTERFACE SPECIFICATION

7.1 RS232 Serial signals

The digital RS232 Serial signals are contained in J15/J19 as shown in Table 2.

Note: The direction is from the module's perspective.

Table 2: RS232 Definitions

J15	Signal	J15 Description	Direction	Shared with
Pin-1	GND	Ground	-	-
Pin-2	RTS	Request To Send	Output	-
Pin-3	NC	No Connection	-	-
Pin-4	RXD	Receive Data	Input	-
Pin-5	TXD	Transmit Data	Output	-
Pin-6	CTS	Clear To Send	Input	-

J19	Signal	J19 Description	Direction	Shared with
Pin-1	DCD	Data Carrier Detect	Output	GPIO2
Pin-2	DTR	Data Terminal Ready	Output	GPIO8
Pin-3	DSR	Data Set Ready	Input	GPIO3
Pin-4	RI	Ring Indicator	Output	GPIO4

The format of the holes allows the fitting of your choice of connectors, or can be used for directly soldering test wires to the board. Pins are laid out on a standard 2.54 mm (0.1 inch) pitch.

7.2 PCM / I2S

The development board provides for a PCM / I2S interface for the BTM511. The pins provide the developer with access to the module's I2S or PCM lines, as well as providing power for additional audio hardware to be developed.

I2S signals are mapped to the PCM pins of BTM51x as outlined in this table:

Table 3: BTM51x pins and I2S Signals

I2S Signal Name	BTM51x Signal Name	BTM51x Module Pin Number	ADK Header (J18)	Comment
SD_IN	PCM_IN	3	5	I2S Serial data in
SD_OUT	PCM_OUT	4	7	I2S Serial data out
WS	PCM_SYNC	5	6	I2S Word select (right/left ch)
SCK	PCM_CLK	6	4	I2S clock
	GND1/2/3/4	[9,22,13,47]	10	GND

Note: For backward compatibility reasons, remaining pins of J18 are connected to signals that are not directly related to PCM/I2S functions.

7.3 Differential input – J12 on ADK, labeled DIFF_IN

If the audio input should be driven by a differential audio source rather than a single-ended signal, J12 allows connecting non-inverted ('P') and inverted ('N') signal of the source to BTM511, as well as AGND (analogue GND) for left and for right channel. In addition, SW7 and SW8 must be set to middle position "DIFF".

Differential signals provide better audio quality due to better noise immunity.

7.4 SPI Interface - J16 on ADK, labeled SPI

This interface is only utilized for Laird's internal use and production testing. We do not recommend that the OEM use these pins.

Note: J14, J13 (labelled SPI/VCC) and J4 are similarly only used for Laird internal use in manufacturing test.

7.5 Audio Connectors – Labeled LINE_In, MIC_IN and STEREO_OUT

These 3.5 mm audio connectors on the right side of the ADK allow OEMs to connect standard speakers, microphones and headphones.

7.6 Push Buttons

Table 4: Push buttons

Push Button	Label on ADK PCB	Description
SW2	RESET	Button to reset the BTM511 module
SW3	GPIO 5	Push button for use of associated GPIO line for a range of configurable functionality
SW4	GPIO 1	Push button for use of associated GPIO line for a range of configurable functionality
SW5	GPIO 7	Push button for use of associated GPIO line for a range of configurable functionality **Note:** Contrary to remaining push buttons, the pull-up resistor (R29) for GPIO 7 is not fitted per default. In future use, GPIO7 may function as an output to control the audio amplifier (U7), see J9.
SW6	GPIO 6	Push button for use of associated GPIO line for a range of configurable functionality

7.7 Board Configuration Jumpers

Table 5: Jumpers

Jumper	Label on ADK PCB	Description
J1 – J3	N/A	Unused on the development board.
J4	J4	INTERNAL USE ONLY.
J5	J5	Provides provide voltage drop on 3.3 V across 0.25 ohm to measure the current for the BTM511 module when open.
J6	J6	Place a jumper on the middle and left side pins for 3.3 V operation. Place a jumper on the middle and right side pins for 1.8 V operation.
J7	J7	INTERNAL USE ONLY.
J8	J8 RS232-OFF	Default state is J8 open (no jumper) for use with USB power and on board FTDI. Alternatively, the UART interface on the BTM511 module can be driven from external microcontroller instead of the on-board FTDI FT232R chip (U3) by powering the DVK via DC jack and setting SW1 (Figure 2) to 'DC'. At a minimum RX, TX, RTS, CTS and GND need to be connected (J15) for this use case.
J9	J9 3.3V GPIO7	Place a jumper on the middle and left side pins to set audio amplifier enabled pin to 3.3 V. Place a jumper on the middle and right side pins to set audio amplifier to be controlled by GPIO-7. **Note:** This second option is not implemented in current firmware version 18.1.3.0.
J10	J10	Place jumper across J10 / J11 (closed) to select audio amplifier gain as listed on silkscreen table below J11.
J11	J11	Place jumper across J10 / J11 (closed) to select audio amplifier gain as listed on silkscreen table below J11.
J12	DIFF_IN	Differential stereo audio input.

Jumper	Label on ADK PCB	Description
J13	J13	INTERNAL USE ONLY.
J14	N/A	INTERNAL USE ONLY.
J15	J15	Through hole plated UART interface for use when direct access to the UART pins from an external microcontroller. UART pins supported on J15 are GND, RTS, NC, RXD, TXD, CTS. Additional UART lines on J19. Please see notes on J8.
J16	SPI	INTERNAL USE ONLY.
J17	J17 3V3 1V8	Place a jumper on left hand side and middle pins to set VDDIO to 3.3 V. Place a jumper on middle and right hand side pins to set VDDIO to 1.8 V.
J18	PCM / I2S	Please see the PCM / I2S section.
J19	J19	Through hole plated UART interface (modem control lines) for use when direct access to the UART pins from an external microcontroller is required. UART pins supported on J19 are DCD, DTR, DSR and RI. Additional UART lines on J15. Please see notes on J8.
J20	USB_D+ USB_D-	USB access can be provided to allow a direct USB connection to a Bluetooth HCI module. **Note:** If this is done and the unit is connected to a USB host port, it will be powered from that same port. Do not attempt to use any other power source for the development kit when operating in this mode. This is not relevant for modules with a UART interface.
J21	J21	Do not close J21 by placing a jumper. J21 is not fitted by default to prevent a short circuit caused by accidentally closing the headers with a jumper. Full details are available in Section 8.1

7.8 SW - Switches

Switch	Label on ADK PCB	Description
SW1	DC USB	Switch to select power input from DC jack or USB connector.
SW7 - Left SW 8 - Right	LINE DIFF MIC	Control the input source from Line input /Differential input /MIC input. SW7/SW8 should be placed at the same position for each input setting. For example, if you require Line Input then both SW7 and SW8 need to be placed in the TOP position.

8. OTHER FEATURES

8.1 Power Consumption Measurement

J21, pin 2 provides the output voltage of current sensing amplifier U17 (INA216A4). Current is measured by voltage drop over the parallel resistors R64, R65 (0.51 Ohm each). R64 and R65 can be seen as one 0.255 Ohm resistor. With the gain of U17, which is 200, the following formula results:

I = ((voltage_J21 / 200) / 0.255) A

Or simplified:

I = (voltage_J21 / 51) A

Note 1 : The parameters of this DVK are optimised for measuring average low currents. If the intention is to measure current patterns (e.g. for sniff mode investigation, higher currents), the bandwidth of this design (response to fast changing currents) is insufficient. In that case, a current-sensing amplifier with less gain but higher bandwidth should be utilised (see INA216A data sheet). J5 allows to do this externally.

Note 2: This only measures the current consumption of the module, and not of the level shifter or other peripheral circuitry.

8.2 USB Access

USB access can be provided to allow a direct USB connection to a Bluetooth HCI module. To enable this operation, close J8 by placing a jumper on the pins.

If this is done and the unit is connected to a USB host port, it will be powered from that same port. Do not attempt to use any other power source for the development kit when operating in this mode.

Note: This is not relevant for modules with a UART interface.

9. ADDITIONAL DOCUMENTATION

Laird offers a variety of documentation and ancillary information to support our customers through the initial evaluation process and ultimately into mass production. Additional documentation includes:

- BTM511 – Class 2 Audio Multimedia Module – Datasheet
- BTM510 / 511 – User Manual
- Firmware Release Notes – BTM510 / 511 to v18.1.x.x
- ADK – Audio Development Kit - Schematics
- BTM511 – ADK – Quick Start Guide – A2DP & AVRCP
- BTM511 – ADK – Quick Start Guide – HFP
- BTM511 – ADK – Quick Start Guide – SPP

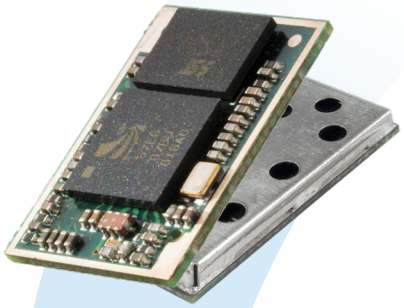
For any additional question or queries or to receive local technical support for the ADK or BTM511 module, please contact wirelessinfo@lairdtech.com.

APN_06008_1_v2_ADK
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Laird TECHNOLOGIES

Innovative **Technology** for a **Connected** World

Bluetooth® Audio Modules
BTM510/511



The BTM510 and BTM 511 are low-power Bluetooth® modules designed for adding robust audio and voice capabilities. Based on the market-leading Cambridge Silicon Radio BC05 chipset, these modules provide exceptionally low power consumption with outstanding range. Supporting the latest Bluetooth Version 2.1+EDR specification, these modules provide the important advantage of secure simple pairing that improves security and enhances easy use.

At only 14mm x 20mm for the BTM510 and 14mm x 25mm for the BTM511, the compact size of the modules makes them ideal for battery-powered or headset form factor audio and voice devices. With a 16-bit stereo codec and microphone inputs to support both stereo and mono applications, these modules also contain a full, integrated Bluetooth-qualified stack along with SPP, HFP 1.5, HSP, AVRCP, and A2DP profiles. (Customers using these modules may list and promote their products free of charge on the Bluetooth website.)

The BTM510/511 modules include an embedded 32-bit, 64-MIPS DSP core within the BC05. This allows designers to add significant product enhancements including features such as echo cancellation, noise reduction, and audio enhancement using additional soft codecs. The availability of the 16MB of flash memory in the module allows complex functionality to be included. DSP routines can be licensed through a number of specialist partners.

To speed product development and integration, Laird Technologies has developed a comprehensive AT command interface that simplifies application development, including support for audio and headset functionality. Combined with a low-cost development kit, Laird Technologies' Bluetooth modules provide faster time to market.

FEATURES

- Fully featured Bluetooth multimedia chipset
- Bluetooth v2.1+EDR
- Supports mono and stereo headset applications
- Adaptive frequency hopping to cope with interference from other wireless devices
- 32bit Kalimba DSP for enhanced audio applications
- Support for secure simple pairing
- External or internal antenna options
- HSP, HFP, A2DP, and AVRCP audio profiles
- 16-bit stereo codec and microphone input
- Integrated audio amplifiers for driving stereo speaker
- Comprehensive AT interface for simple programming
- Bluetooth End product qualified
- Compact size
- Class 2 output – 4dBm
- Low power operation
- Wi-Fi co-existence hardware support

APPLICATION AREAS

- High-quality stereo headsets
- Mono voice headsets
- Hands-free devices
- Wireless audio cable replacement
- MP3 and music players
- Phone accessories
- VoIP products
- Cordless headsets
- Aftermarket automotive applications

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Laird TECHNOLOGIES

Innovative **Technology** for a **Connected** World

Bluetooth® Audio Modules
BTM510/511

CATEGORIES	FEATURE	IMPLEMENTATION
Wireless Specification	Bluetooth®	Version 2.1+EDR
	Frequency	2.402 – 2.480 GHz
	Max Transmit Power	Class 2 4dBm (at antenna pad – BTM510) 4dBmi (from integrated antenna – BTM511)
	Receive Sensitivity	Better than -86dBm
	Range	30 meters
	Data Rates	Up to 3Mbps (over the air)
	UART Data Transfer Rate	Greater than 300 Kbps
Host Interface	UART	Supports DTR, DSR, DCD and RI, multiplexed with other functionality.
Audio Interfaces	Codec	Internal 16 bit Stereo Codec Integrated Amplifiers for driving Stereo Speaker
	Microphone	Stereo microphone input
DSP	Integrated Kalimba DSP	32bit, 64MIPS
Profiles		SPP – Serial Port Profile HSP HFP – Audio Gateway and Handset A2DP – Source and Sink AVRCP – Target and Controller
Supply Voltage	Supply	3.0V – 3.6V DC
	I/O	1.7V – 3.6V DC
Power Consumption	Current Consumption	Operational - Less than 70 mA (including speaker amplifiers) Idle (sleep) < 1.0mA
Coexistence / Compatibility	802.11 (Wi-Fi)	2 wire and 3 wire schemes supported
Connections	External Antenna	Connection via SMT pad – BTM510
	Internal Antenna	Multilayer ceramic antenna – BTM511
Programming API		AT Command Set (extended for audio and headset functions)
Physical	Dimensions	14.0mm x 20.0mm x 3.4mm (integrated antenna – BTM510) 14.0mm x 25.0mm x 3.4mm (integrated antenna – BTM511)
Environmental	Operating Temperature	-30°C to +70°C
	Storage Temperature	-40°C to +85°C
Miscellaneous	Lead free	Lead-free and RoHS compliant
	Warranty	1 Year
Development Tools	Development Kit	Development board and software tools
Approvals	Bluetooth	End Product Approved
	FCC/IC & CE	BTM510 - Limited Modular Approval BTM511 - Full Modular Approval

ORDERING INFORMATION

BTM510	Bluetooth Multimedia Module (external antenna)
BTM511	Bluetooth Multimedia Module (with integrated antenna)
DVK- BTM510	Development Kit (external antenna)
DVK- BTM511	Development Kit (with integrated antenna)

The details contained within the document are subject to change. Download the product specification from www.lairdtech.com/wireless for the most current specification.

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