

BLUETOOTH MODULE

(KBTC01-2020)



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Revision History

Title	KET BLUETOOTH module				
Model No	KBTC01-2020A1				
Document No	BT-DS-C01				
Revision	Date	Description	DESIGN	CHECK	APPR
Ver 1.00	2007.07.08	First release	D.H.RYU		T.Y. SEO
Ver 1.20	2008.02.29	Second release	D.H.RYU		T.Y. SEO

2. Introduction

2.1 Overview

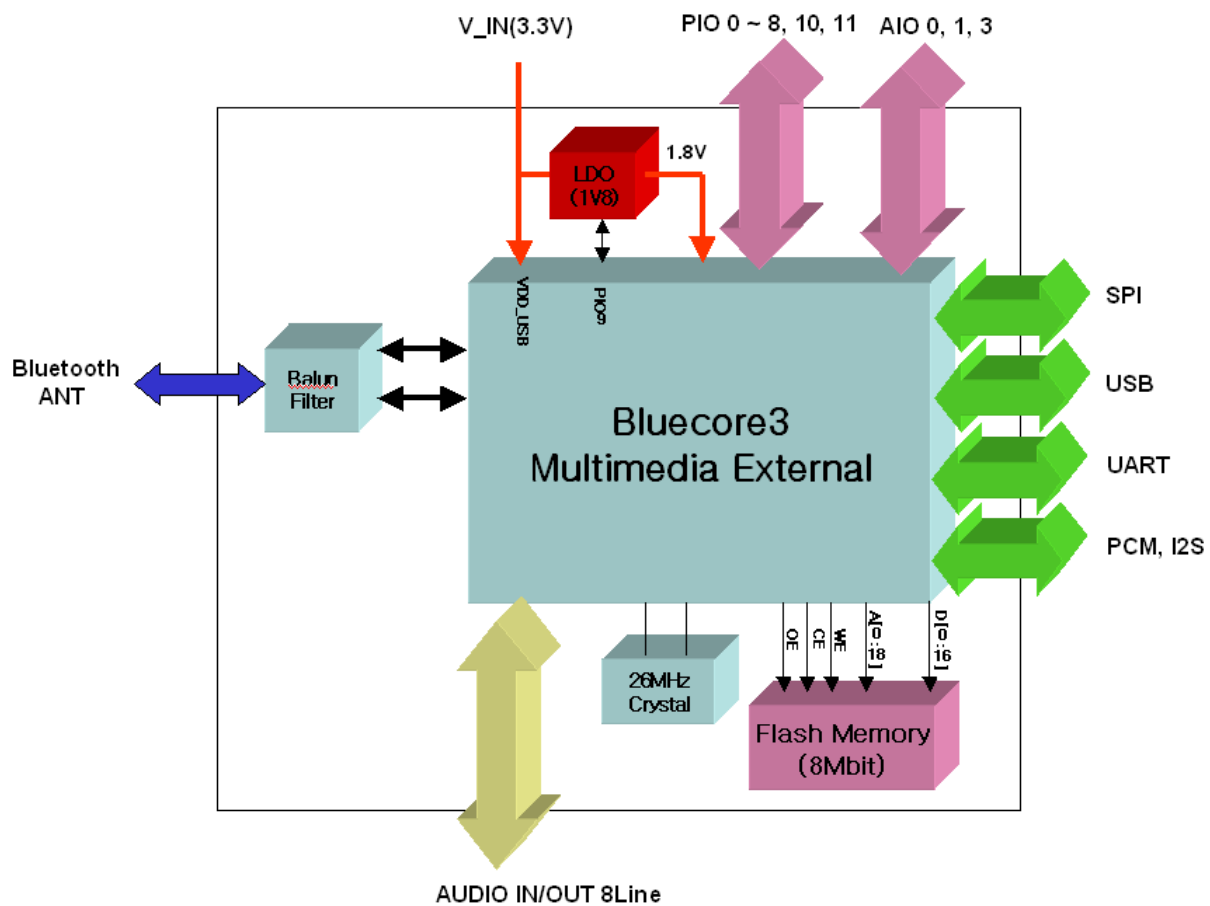
This specification covers Bluetooth module(Class2) which complies with Bluetooth specification version 2.0 and integrates RF & Baseband controller in small package.

This Module has deployed CSR's BC3MME (BlueCore 03 Multimedia External) Chipset.

2.2 Feature

- Comply with Bluetooth Specification Version 2.0
- Support up to 7 ACL connection and 3 SCO connection
- Support Faster connection, Flush timeout, Synchronization, LMP improvements, AFH, Parameter ranges and LMP SCO Handle.
- Up to 12 PIO/ 3 AIO pin definitions is ideally suited for rapid embedded development any kind of products.
- 13 or 16bit linear, 8bit u-Law or A-Law PCM interface
- UART interface with programmable baud rate
- Compact size (20.0x20.0x 3.0mm) can be fit any type of product
- RF output power -6dBm ~ +4 dBm (class 2).
- High receiving sensitivity (-85 dBm 0.1%BER).
- Dynamic Temperature Range.
 - Operating Range : -20 ~ 70 °C
 - Storage Range : -45 ~ 105 °C
- Dynamic Voltage Range (3.0 ~ 3.6V, Typ 3.3V)
- Crystal Internal 12.0 MHz
- Output interface over USB/UART/PCM/SPI.

2.3 Block Diagram



[BTC01-2020A1 Block Diagram]

2.4 Product Application

- Stereo Headphones
- Automotive Hands-Free Kits
- Echo Cancellation
- High Performance Telephony
- Enhanced Audio Applications
- A/V Profile support

3. Specifications

3.1 General Specifications

Parameter		Unit	Specification	Remark
Supply Voltage		V	3.3	3.0 ~ 3.6
Carrier Frequency		MHz	2402 ~ 2480	
Modulation			GFSK, 1Mbps	0.5BT Gaussian
Maximum Data Rate	kbps		723.7	Asynchronous
			433.9	Synchronous
Transmit Power		dBm	4 (MAX)	Class 2 : -6 ~ 4 dBm
Hopping		Hops/sec	1600	
Sensitivity		dBm	-80	Spec ≤-70 dBm
Channel Spacing		MHz	1	
Reference Clock		MHz	26	
Output Interface			USB, PCM, SPI, UART	
Built In Memory		MBit	8	
Bluetooth Spec			Version 1.2	
Bluetooth Profile			Advanced Audio Distribution Hands-Free Audio/Video Remote Control	
Product Application			Stereo Headphones Automotive Hands-Free Kits Echo Cancellation High Performance Telephony Enhanced Audio Applications A/V Profile support	
Power Consumption		mA	50	VDD 3.3V Tx pwoer 4dBm
Temp	Operating	℃	-20 ~ 70	
	Storage	℃	-40 ~ 105	

3.2 Tx Radio Specification

Parameter		Unit	Specification			Bluetooth Specification
			Min	Typ	Max	
Carrier Frequency		MHz	2402		2480	
Transmit Power		dBm		0	4	Class 2 : -6 ~ 4 dBm
RF Power Control Range		dB		35		≥ 16
Power Control Resolution		dB		0.5		
20dB Bandwidth for Modulation Carrier		kHz		720	1000	≤ 1000
Adjacent Channel Power	F=F0 $\pm$ 2MHz	dBm		-35	-20	≤ -20
	F=F0 $\pm$ 3MHz	dBm		-45	-40	≤ -40
	F=F0 $>\pm$ 2MHz	dBm		-50	-40	≤ -40
Modulation Characteristics	Δf_{1avg}	kHz	140	165	175	$140 < \Delta f_{1avg} < 175$
	Δf_{2max}	kHz	115	140		≥ 115
	$\Delta f_{2avg}/\Delta f_{1avg}$		0.8	0.95		≥ 0.8
Draft Rate	DH1	KHz/50us		9	20	≤ 20
	DH3	kHz/50us		10	25	≤ 25
	DH5	kHz/50us		11	40	≤ 40
2nd Harmonic content		dBm		-45	-30	≤ -30
3rd Harmonic content		dBm		<-50	-30	≤ -30

2.3 Rx Radio Specification

Parameter		Unit	Specification			Bluetooth Specification
			Min	Typ	Max	
Carrier Frequency		MHz	2402		2480	
Sensitivity		dBm		-80		≤ -70
Maximum received signal at 0.1% BER		dBm		>10		≤ -20
C/I performance	Co-Ch	dB		8	11	≤ 11
	F=F0+1MHz	DB	0	-3		≤ 0
	F=F0-1MHz	dB	0	-3		≤ 0
	F=F0+2MHz	dB		-37	-30	≤ -30
	F=F0-2MHz	dB		-22	-20	≤ -20
	F $\geq$ F0+3MHz	dB		-44	-40	≤ -40
	F $\leq$ F0-5MHz	dB		-43	-40	≤ -40
	F=Fimage	dB		-23	-9	≥ -9
Intermodulation Interferers		dBm		-30	-39	≥ -39
Out of Band Blocking	30MHz ~ 2GHz	dBm	-10			
	2GHz ~ 2.4GHz	dBm	-27			
	2.5GHz ~ 3GHz	dBm	-27			
	3GHz ~ 12.75GHz	dBm	-10			

4. Pin Description

PIN No.	Name	I/O	Description
1	UART_CTS	I	UART clear to send active low
2	UART_RTS	O	UART request to send active low
3	UART_TX	O	UART data output
4	UART_RX	I	UART data input
5	PCM_IN	I	Synchronous data input
6	PCM_SYNC	I/O	Synchronous data sync
7	PCM_CLK	I/O	Synchronous data clock
8	PCM_OUT	O	Synchronous data output
9	PIO[4]/USB_ON/ UART_TX	I/O	PIO or USB on (input senses when VBUS is high, wakes BlueCore3-Multimedia External)
10	PIO[5]/USB_DETACH/ UART_RTS	I/O	PIO line or chip detaches from USB when this input is high
11	PIO[6]/CLK_REQ/ UART_CTS	I/O	PIO line or clock request output to enable external clock for external clock line
12	PIO[7]/UART_RX/ CLK_OUT	I/O	Programmable input/output line or programmable frequency clock output
13	RESET	I	Reset if high. Input debounced so must be high for >5ms to cause a reset
14	GND		Ground
15	SPI_CSB	I	Chip select for Synchronous Serial Interface active low
16	SPI_MOSI	I	Serial Peripheral Interface data input
17	SPI_MISO	O	Serial Peripheral Interface data output
18	SPI_CLK	I	Serial Peripheral Interface clock
19	PIO[8]	I/O	Programmable input/output line
20	V_IN		DC 3.3 V
21	GND		Ground
22	GND		Ground
23	PIO[10]	I/O	Programmable input/output line
24	PIO[11]	I/O	Programmable input/output line
25	GND		Ground

4. Pin Description (*Continued*)

PIN No.	Name	I/O	Description
26	PIO[0]/RXEN	I/O	Control output for external Tx/Rx switch (if fitted)
27	PIO[1]/TXEN	I/O	Control output for external PA (if fitted)
28	PIO[2]	I/O	Programmable input/output line
29	PIO[3]	I/O	Programmable input/output line
30	GND		Ground
31	GND		Ground
32	ANT		BLUETOOTH ANT
33	GND		Ground
34	GND		Ground
35	AUDIO_IN_P_LEFT	AI	Microphone input positive (left side)
36	AUDIO_IN_N_LEFT	AI	Microphone input negative (left side)
37	AUDIO_IN_P_RIGHT	AI	Microphone input positive (right side)
38	AUDIO_IN_N_RIGHT	AI	Microphone input negative (right side)
39	GND		Ground
40	AUDIO_OUT_P_RIGHT	AO	Speaker output positive (right side)
41	AUDIO_OUT_N_RIGHT	AO	Speaker output negative (right side)
42	AUDIO_OUT_P_LEFT	AO	Speaker output positive (left side)
43	AUDIO_OUT_N_LEFT	AO	Speaker output negative (left side)
44	GND		Ground
45	AIO[0]	I/O	Programmable input/output line
46	AIO[1]	I/O	Programmable input/output line
47	AIO[3]	I/O	Programmable input/output line
48	USB_DP	I/O	USB data plus
49	USB_DN	I/O	USB data minus
50	GND		Ground

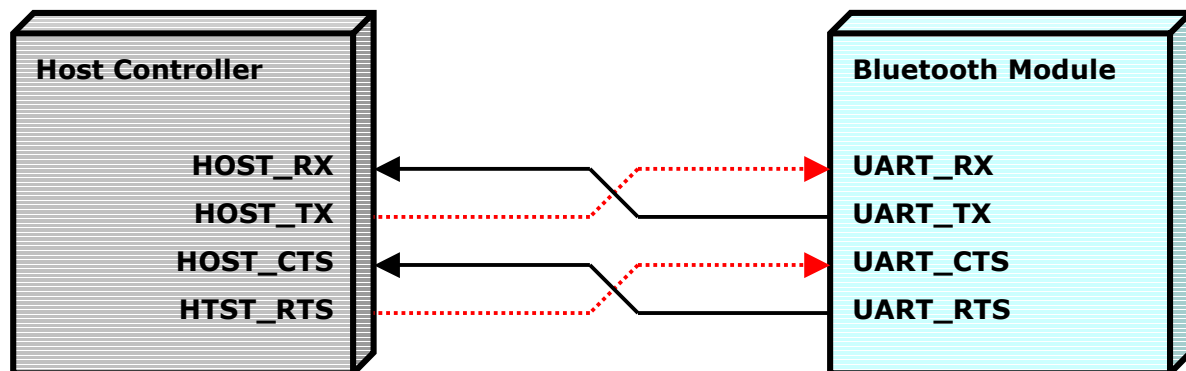
5. Interface

5.1 UART Interface

KBTC01 Module Universal Asynchronous Receiver Transmitter (UART) interface provides a simple mechanism for communicating with other serial devices using the RS232 protocol.

Four signals are used to implement the UART function.

Signal Name	Driving Source	Description
UART_TX	KBTC01 Module	Data from KBTC01 Module
UART_RX	Host	Data from Host
UART_RTS	KBTC01 Module	Request to send output of KBTC01 Module
UART_CTS	Host	Clear to send of KBTC01 Module



5.1.1 Possible UART Settings

UART configuration parameters, such as Baud rate and packet format, are set using KBTC01 Module software.

Parameter		Possible Value	Remark
Baud Rate	Min	1200 Baud (≤ 2 % Error)	
		1200 Baud (≤ 1 % Error)	
	Max	1.5 MBaud (≤ 1 % Error)	
Flow Control		RTS/CTS or None	
Parity		None, Odd or Even	
Number of Stop Bits		1 or 2	
Bits per channel		8	

5.1.2 UART Bypass Mode

For devices that do not tri-state the UART bus, the UART bypass mode on KBTC01 can be used.

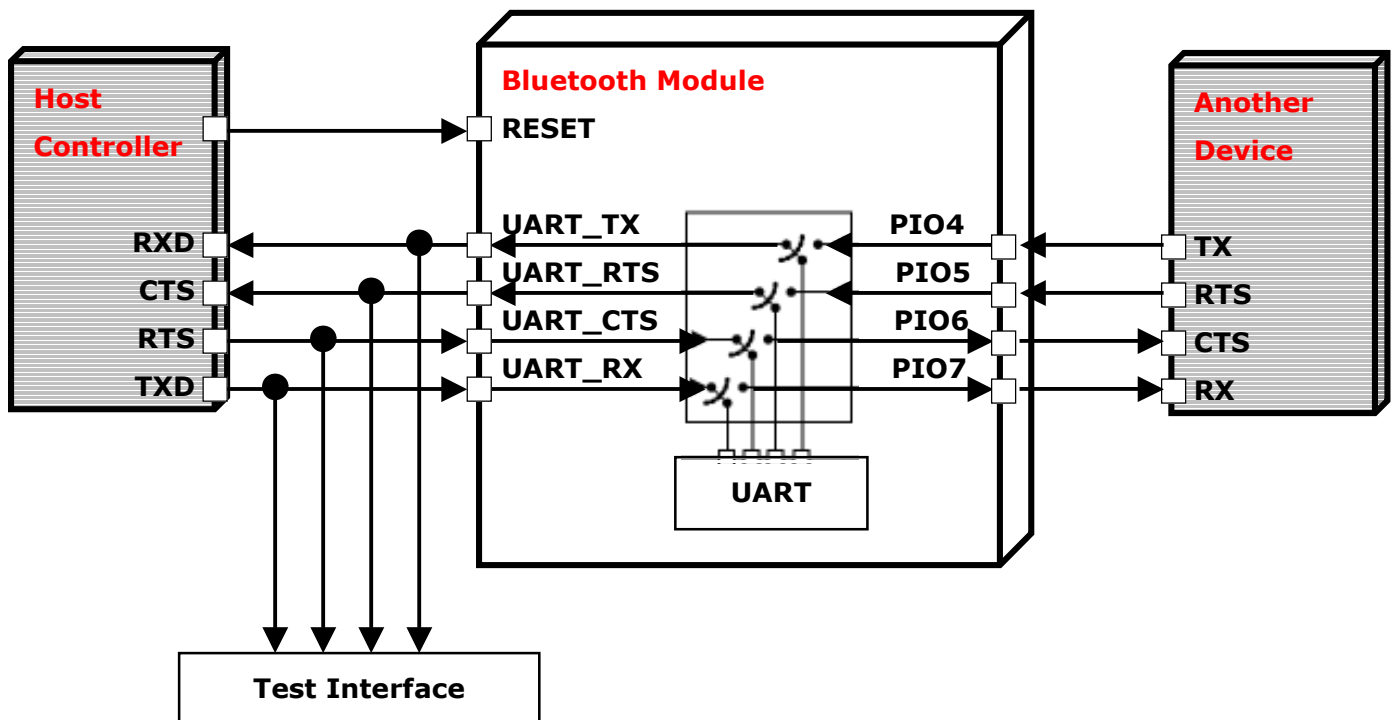
The default state of KBTC01 after reset is de-asserted, this is for the host UART bus to be connected to the KBTC01 UART, thereby allowing communication to KBTC01 via the UART.

In order to apply the UART bypass mode, a BCCMD command will be issued to KBTC01 upon this, it will switch the bypass to PIO[7:4].

Once the bypass mode has been invoked, KBTC01 will enter the deep sleep state indefinitely.

In order to re-establish communication with KBTC01, the chip must be reset so that the default configuration takes affect.

It is important for the host to ensure a clean Bluetooth disconnection of any active links before the bypass mode is invoked. Therefore it is not possible to have active Bluetooth links while operating the bypass mode.



5.2 USB Interface

KBTC01 devices contain a full speed (12Mbps/s) USB interface that is capable of driving a USB cable directly.

No external USB transceiver is required.

The device operates as a USB peripheral, responding to requests from a master host controller such as a PC. Both the OHCI and the UHCI standards are supported. The set of USB endpoints implemented can behave as specified in the USB section of the Bluetooth specification v2.0 or alternatively can appear as a set of endpoints appropriate to USB audio devices such as speakers.

Since USB is a Master/Slave oriented system (in common with other USB peripherals), KBTC01 only supports USB Slave operation.

Description

The Si4710/11 is the industry's first 100% CMOS FM transmitter single chip IC. The device leverages Silicon Labs' highly successful and proven Si4700/01 FM receiver, and offers unmatched integration and performance allowing FM transmit to be added to any portable device by using a single chip. As with the Si4700/01, the Si4710/11 offers industry leading size, performance, low power consumption, and ease of use.

The Si4710/11's digital integration reduces the required external components of traditional offerings, resulting in a solution requiring only an external inductor and bypass capacitor, and PCB space of approximately 15 mm². High reliability in device manufacturing, improved quality, easy design-in, and software programmability are key advantages of the Si4710/11.

The Si4711 supports the European Radio Data System (RDS) and the US Radio Broadcast Data System (RBDS) including all the symbol encoding, block synchronization, and error correction functions. Using this feature, the Si4711 enables data such as artist name and song title to be transmitted to an RDS/RBDS receiver.

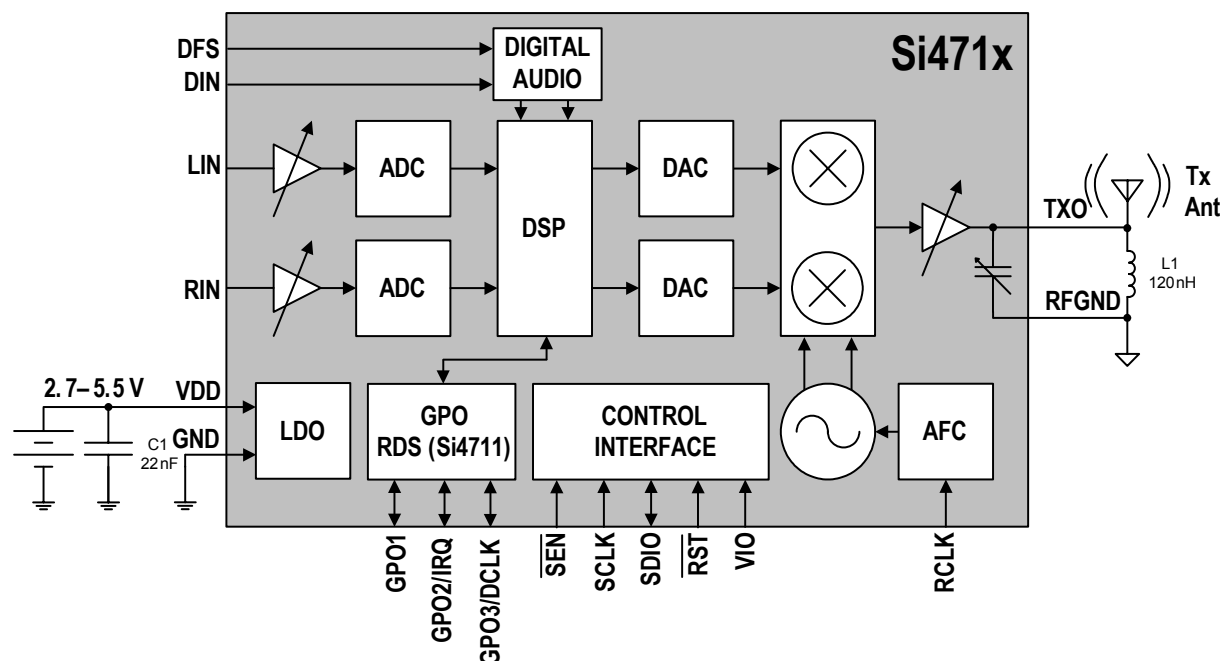
Users are responsible to adjust their system's radiated power levels to comply with local regulations on RF transmission (FCC, ETSI, ARIB, etc.).

Features

- Worldwide FM band support (88–107.9 MHz) for transmit
- Requires only two external components
- Frequency synthesizer with integrated VCO
- Digital stereo modulator
- Programmable pre-emphasis (50/75 μ s)
- Analog/digital audio interface
- Programmable reference clock
- RDS/RBDS transmit encoder (Si4711 only)
- PCB loop antenna support with self calibrated capacitor tuning
- Programmable transmit level
- Programmable modulation
- 2.7 to 5.5 V supply voltage
- Digital gain compression
- Integrated LDO regulator
- 3 x 3 x 0.55 mm 20-pin QFN
 - Pb-free and RoHS Compliant

Applications

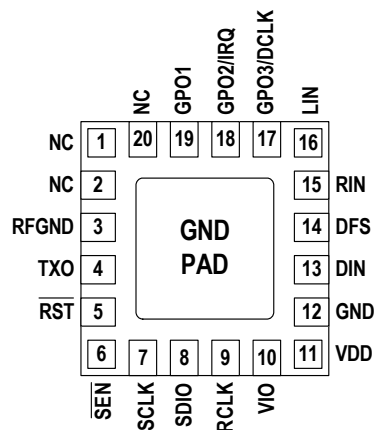
- Cellular handsets/hands-free
- MP3 players
- Portable audio/video players
- Wireless speakers/microphone
- Satellite digital audio radios
- Personal computers/notebooks



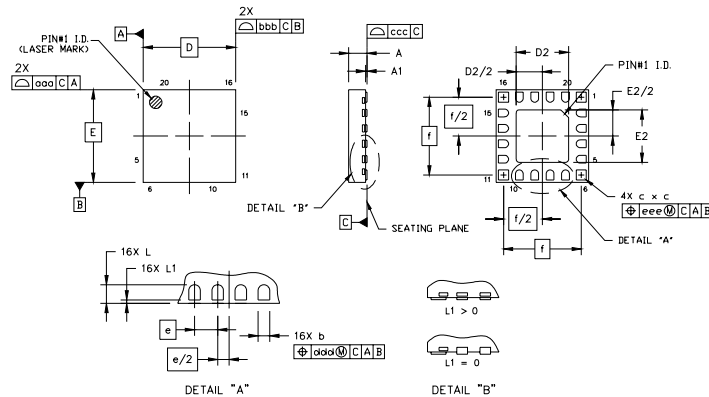
Selected Electrical Specifications

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Transmit Frequency Range	f_{RF}		88.1	—	107.9	MHz
Programmable Transmit Output Voltage, TXO (Maximum Voltage)			—	115	—	dB μ V
Programmable Transmit Output Voltage, TXO (Minimum Voltage)			—	83	—	dB μ V
Transmit Voltage Stability			-1	—	1	dB
Transmit Voltage Step			—	1	2	dB
Transmit Channel Edge Power			—	—	-20	dBc
Transmit Adjacent Channel Power			—	-30	-26	dBc
Pre-emphasis Time Constant		FMPE[1:0] = 00	70	75	80	us
		FMPE[1:0] = 01	45	50	54	us
Audio SNR			—	63	—	dB
Audio THD			—	0.1	0.5	%
Audio Stereo Separation			30	35	—	dB
Sub Carrier Rejection Ratio	SCR		—	-50	-40	dB
Input Signal Level (0 dB)	V_{AI}	0.6 V_{RMS} input, $V_{IO} = 1.8$ V	—	—	0.636	V_{pk}
Audio Bandwidth (3 dB)			20	—	15 K	Hz
Audio Imbalance			-1	—	1	dB
Powerup Settling Time		From powerdown	—	110	—	ms

Pin Assignments



Package Information



Symbol	Millimeters		
	Min	Nom	Max
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
b	0.20	0.25	0.30
c	0.27	0.32	0.37
D	3.00 BSC		
D2	1.65	1.70	1.75
e	0.50 BSC		
E	3.00 BSC		
E2	1.65	1.70	1.75

Symbol	Millimeters		
	Min	Nom	Max
f	2.53 BSC		
L	0.35	0.40	0.45
L1	0.00	—	0.10
aaa	—	—	0.05
bbb	—	—	0.05
ccc	—	—	0.08
ddd	—	—	0.10
eee	—	—	0.10