

Wireless Digital Audio Module OEM Installation & User's Guide

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Wireless Digital Audio Module User Manual

Part number: EA-60026-01

FCC ID: Q3D-WDAM1

IC ID: 10647A-WDAM1

OEM Installation Instructions	1
Regulatory Compliance Requirements	1
FCC Certification Requirements	1
FCC RF Exposure Requirements	2
Fixed or Mobile Device Installation	2
Labeling Requirements	2
Specifications & Operating Characteristics	3
WDAM1 Absolute Maximum Ratings	3
WDAM1 Module Operating Conditions	3
Audio Specifications	4
RF Specifications	5
RF Power Scaling Table	6
Channel Table	6
WDAM1 Pin Diagram	7
WDAM1 Pin Descriptions	7
Module Category Details	9
Power Supply:	9
Digital IO:	9
RF:	9
Audio:	9
WDAM1 Module Block Diagram	10
Mechanical Drawing	11
Document Revision History	12



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OEM Installation Instructions

Regulatory Compliance Requirements

The FCC has established rules governing the installation, usage, and documentation of devices with modular approval status. Conformance to all of the following sections must be adhered to in order to ensure that the WDAM1 module is in compliance when installed in various hosts.

The WDAM1 module is limited to OEM installation only. No instructions are to be provided to end users for the removal, modification, or installation of the module.

To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance of the final configuration, with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational, the host continues to be compliant with the Part 15B unintentional radiator requirements.

Please contact us with specific application details so we can provide guidance to ensure compliance with the FCC requirements.

FCC Certification Requirements

This device complies with Part 15 of the FCC rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

This module has been tested and found to comply with Part 15 of the FCC rules. This equipment may cause harmful interference to radio communications if not installed and used in accordance with this user guide.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



Wireless Digital Audio Module User Manual

Part number: EA-60026-01

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IC ID: 10647A-WDAM1

FCC RF Exposure Requirements

In order to comply with FCC RF Exposure requirements, users of this device must ensure that the module antenna is installed and/or configured to operate with a separation distance of 20cm or more from all persons, and must not transmit simultaneously with any other antenna or transmitter, except in accordance with FCC multi transmitter product procedures.

Fixed or Mobile Device Installation

This module must be installed in a host device intended as either a fixed or mobile installation as defined in Part 2.1091(b) of the FCC rules.

A fixed installation means that the device is physically secured at one location and is not able to be easily moved to another location. A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

Installation of the WDAM1 module in a portable configuration, or with any other antenna configuration, will require separate approvals.

Labeling Requirements

The WDAM1 modules include labels that conform to FCC rules which are located on the top of the module's RF shield. The modules are typically installed in locations that are not accessible by end users. In these cases, an additional permanent label or marking (silkscreen, etc.) is required in a location that is visible or easily accessible by the end user. The label or marking must state:

"Contains FCC ID: Q3D-WDAM1", and if intended for sale in Canada:

"IC ID: 10647A-WDAM1"

The host OEM user manual must also contain clear instructions on how end users can find and/or access the FCC ID.



Wireless Digital Audio Module User Manual

Part number: EA-60026-01

FCC ID: Q3D-WDAM1

IC ID: 10647A-WDAM1

Specifications & Operating Characteristics

WDAM1 Absolute Maximum Ratings

All Min/Max characteristics and specifications are guaranteed over the specified operating conditions. Typical performance characteristics and specifications are derived from measurements taken at typical supply voltages. TA=25°C. GND = 0 V, all voltages with respect to 0 V.

Parameter	Symbol	Value	Unit	Note
Power supply voltage	VCC	8	V	
Digital Input Pin Absolute Maximum Input Voltage		3.63	V	IO Inputs are not 5 V Tolerant.
Digital Reset Voltage	V _{RESET}	3.63	V	
Operating Temperature	TA	60	C	
Storage Temperature	TS	90	C	

Table 1 – WDAM1 Absolute Maximum Ratings

WDAM1 Module Operating Conditions

Parameter	Conditions	Min	Typical	Max	Unit
POWER SUPPLY VOLTAGES					
Digital Power Supply		4.75	5.0	8	V
CURRENT DRAW (Values are firmware dependent)					
Active Mode -- Average RMS	VCC = 5.0 V	Tx: 78 Rx: 58	Rx: 59	Tx: 83 Rx: 59.3	mA
Hunt Mode*	VCC = 5.0 V	Tx: 10	Rx: 51.5	Tx: 59.6	mA
Standby Mode	VCC = 5.0 V		Rx: 51.3		mA
Sleep Mode*	VCC = 5.0 V	Rx: 29.5		Rx: 49	mA
LOGIC THRESHOLDS					
Input Low Voltage Threshold	VCC = 3.3 V			0.8	V
Input High Voltage Threshold	VCC = 3.3 V	2.0			V
Output Low Voltage Threshold	VCC = 3.3 V			0.4	V
Output High Voltage Threshold	VCC = 3.3 V	2.4			V
Input Leakage Current	VCC = 3.3 V	-10	± 1	10	µA
TEMPERATURE					
Operating Temperature	All power ranges	0		60	C
Storage Temperature		-20		90	C

Table 2 – Operating Conditions

* In the Tx Hunt Mode and Rx Sleep Mode the current jumps between the min and max values



Wireless Digital Audio Module User Manual

Part number: EA-60026-01

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IC ID: 10647A-WDAM1

Audio Specifications

Parameter	Transmitter: Audio Input Format with Internal Firmware SRC	
Data format	Slave I2S	
Supported Sample Rates	44.1, 48, 88.2, 96 kHz	
Resolution	16 bit	
LRCLK	44.1, 48, 88.2, 96 kHz	
BCLK	2.822, 3.072, 5.644, 6.144 MHz	
	Transmitter: Audio Input Format without Internal Firmware SRC	
Data format	Master I2S	
Supported Sample Rates	48 kHz	
Resolution	16 bit	
LRCLK	48 kHz	
BCLK	3.072 MHz	
	Receiver: Audio Output Format	
Data format	Master or Slave I2S	
Supported Sample Rates	48 kHz	
Resolution	16 bit	
LRCLK	48 kHz	
BCLK	3.072 MHz	
	Full Range Channels	Low Frequency Channels
Audio Input Pre-processing	Not required	Max. frequency range must be limited to 800 Hz
Compression Protocol	HPX™	Uncompressed
SNR (Left / Right)	> 95 dB	
THD+N (I2S in/out)	Better than 0.01% across band	
Audio Frequency Response	20 Hz to 20 kHz	10 to 800 Hz

Table 3 – Audio Characteristics



Wireless Digital Audio Module User Manual

Part number: EA-60026-01

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IC ID: 10647A-WDAM1

RF Specifications

The WDAM1 audio module RF characteristics are described below with special attention to information pertinent to FCC and ETSI regulations.

Parameter	Conditions	Min	Typical	Max	
RF CHARACTERISTICS					
Modulation Type		FSK			
Raw Data Rate			2.048	Mbps	
Channel Spacing		1.537		MHz	
Channel Width	-20 dBC	2.225	2.250	2.275	MHz
Number of Channels		49			
Frequency Range (Total)	FCC Test Method	2.40355		2.4773	GHz
Expected Antenna Impedance	Z _{Ant}		50		Ω
Receiver Sensitivity	at 3% PER		-80		dBm
Max RF Input Level (BER)	at 0.1% BER		+3		dBm
Max RF Input Level (PER)	at 1% PER		+12		dBm
OUTPUT POWER					
Tx Output Power (Low-Power)	Conducted		-24		dBm
Tx Output Power (Mid-Power)	Conducted		0		dBm
Tx Output Power (High-Power)	Conducted	14.5	17	18.5	dBm
LOCAL OSCILLATOR					
Rx Output Power (Low-Channel) 2.40355 GHz	Conducted		-82.84		dBm
Rx Output Power (Mid-Channel) 2.4404 GHz	Conducted		-81.0		dBm
Rx Output Power (High-Channel) 2.47725 GHz	Conducted		-82.6		dBm

Table 4 – RF Specifications



Wireless Digital Audio Module User Manual

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FCC ID: Q3D-WDAM1

IC ID: 10647A-WDAM1

RF Power Scaling Table

RF power scaling is accomplished by scaling the RF output power both for current consumption and coexistence constraints. WDAM1 has the ability to adjust RF output by adjusting two parameters: transceiver output and PA bias circuitry. Different combinations will yield different power levels. In total, there are 16 different power levels available. Deviating outside of the recommended settings may cause a decrease in performance and, as such, should be avoided.

Power Level	Mid-band Output [dBm]	Power Level	Mid-band Output [dBm]
1	17	9	6
2	16	10	4
3	15	11	1
4	14	12	0
5	12	13	-2
6	10	14	-7
7	9	15	-15
8	7	16	-25

Table 5 – WDAM1 RF Power Scaling

Channel Table

Channel #	Center Frequency (GHz)	Channel #	Center Frequency (GHz)	Channel #	Center Frequency (GHz)
1	2.4035	18	2.4297	35	2.4558
2	2.4051	19	2.4312	36	2.4573
3	2.4066	20	2.4327	37	2.4589
4	2.4081	21	2.4343	38	2.4604
5	2.4097	22	2.4358	39	2.4619
6	2.4112	23	2.4374	40	2.4635
7	2.4128	24	2.4389	41	2.465
8	2.4143	25	2.4404	42	2.4666
9	2.4158	26	2.442	43	2.4681
10	2.4174	27	2.4435	44	2.4696
11	2.4189	28	2.445	45	2.4712
12	2.4204	29	2.4466	46	2.4727
13	2.422	30	2.4481	47	2.4742
14	2.4235	31	2.4496	48	2.4758
15	2.4251	32	2.4512	49	2.4773
16	2.4266	33	2.4527		
17	2.4281	34	2.4543		

Table 6– RF Center Frequencies



Wireless Digital Audio Module User Manual

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FCC ID: Q3D-WDAM1

IC ID: 10647A-WDAM1

WDAM1 Pinout Diagram

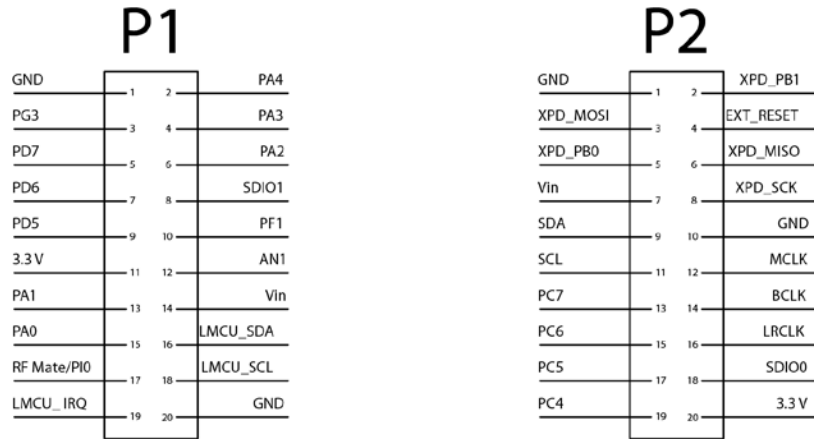


Figure 1 – WDAM1 Pinout Diagram
(as viewed from top of module)

WDAM1 Pin Descriptions

Pin #	Tx/Rx Pin Name	Category	Tx/Rx Description
P1			
1	GND	Power	Ground
2	PA4	IO	General Purpose
3	PG3	IO	General Purpose
4	PA3	IO	General Purpose
5	PD7	IO	General Purpose
6	PA2	IO	General Purpose
7	PD6	IO	General Purpose
8	SDIO1	Audio	LFE I2S Data (Subwoofer 0.1 channel)
9	PD5	IO	General Purpose
10	PF1	IO	General Purpose
11	3.3V	Power	Regulated 3.3V output
12	AN1	Analog Input	General Purpose Analog Input
13	PA1	IO	General Purpose
14	VIN	Power	Supply voltage. Supply 5V to this pin or pin 7 on header P2.
15	PA0	IO	General Purpose
16	LMCU_SDA	2-wire	2 Wire Slave Data Interface. Serial Data. External pullup with 4.7k to 3.3V.
17	RF_MATE/ PIO	IO	RF mate button. Active low, connect to a momentary push button with a 10k pull up to 3.3v. / General Purpose IO
18	LMCU_SCL	2-wire	2 Wire Slave Data Interface. Serial Clock. External pullup with 4.7k to 3.3V.
19	LMCU_IRQ	2-wire	2 Wire Slave Data Interface. Interrupt output pin to indicate new data.
20	GND	Power	Ground

Table 7– P1 Pin Descriptions



Wireless Digital Audio Module User Manual

Part number: EA-60026-01

FCC ID: Q3D-WDAM1

IC ID: 10647A-WDAM1

Pin #	Tx/Rx Pin Name	Category	Tx/Rx Description
P2			
1	GND	Power	Ground
2	XPD_PB1	XPD	XPD -- Module Chip Select
3	XPD_MOSI	XPD	XPD -- Master In Slave Out
4	XPD_RESET	Power	XPD -- Active Low Reset (1.8V Max)
5	XPD_PB0	XPD	XPD -- Chip Select (PROM)
6	XPD_MISO	XPD	XPD -- Master Out Slave In
7	VIN	Power	Supply voltage. Supply 5V to this pin or pin 14 on header P1.
8	XPD_SCK	XPD	XPD -- Clock
9	SDA	2-wire	Master 2 Wire Audio Device Control Interface. Serial Data. Pulled up with 4.7k to 3.3V on WDAM1 module. and default Test Mode Pin.
10	GND	Power	Ground
11	SCL	2-wire	Master 2 Wire Audio Device Control Interface. Serial Clock. Pulled up with 4.7k to 3.3V on WDAM1 module.
12	MCLK	Output	Master Clock Output
13	PC7	IO	General Purpose IO
14	I2S_BCLK	Audio	I2S Bit Clock Input/Output
15	PC6	IO	General Purpose IO
16	I2S_LRCK	Audio	I2S Frame Clock Input/Output. NC if unused.
17	PC5	IO	General Purpose IO
18	I2S_SDIO0	Audio	I2S Data (Full range 2.0 channel)
19	PC4	IO	General Purpose IO
20	3_3V	Power	Regulated 3.3V output

Table 8– P2 Pin Descriptions



Wireless Digital Audio Module User Manual

Part number: EA-60026-01

FCC ID: Q3D-WDAM1

IC ID: 10647A-WDAM1

Module Category Details

Power Supply:

The WDAM1 module has a 3.3V (800mA max current) voltage regulator located onboard. It has a maximum dropout voltage of 1.3V. Each header has Vin and 3.3V pins. The Vin pins are internally connected and functionally equivalent. The 3.3V pins are both outputs and are also internally connected. Having the same power pins on each header allows for more motherboard layout options. When using the internal regulator: Supply a minimum of 4.75V to either header's Vin pin. The 3.3V pins can be used to power external devices such as a SRC or DAC/ADC.

Digital IO:

WDAM1 has general purpose digital IO ("GPIO") pins available that are configured in the application firmware. GPIO pins use the 3.3V logic voltage and have the following software configurable features: IO direction, drive strength (for output only), Schmitt Trigger (for input only), pull up (input only), pull down (input only), slew rate (output only). WDAM1 is also capable of active-high and active-low configuration of LEDs.

RF:

WDAM1 modules utilize a PCB trace antenna in an inverted F configuration. This provides a typical indoor range of 20 meters or more (dependent on the number and construction of walls and/or ceilings).

Audio:

WDAM1 is capable of streaming digital audio using the I2S protocol. GPIO can be allocated for configurable Digital-Audio pins (e.g. for AMP / DAC enable, Mute, etc.) and also as I2S protocol pins (e.g. Bit Clock, LR Clock, Master Clock and Data).



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WDAM1 Module Block Diagram

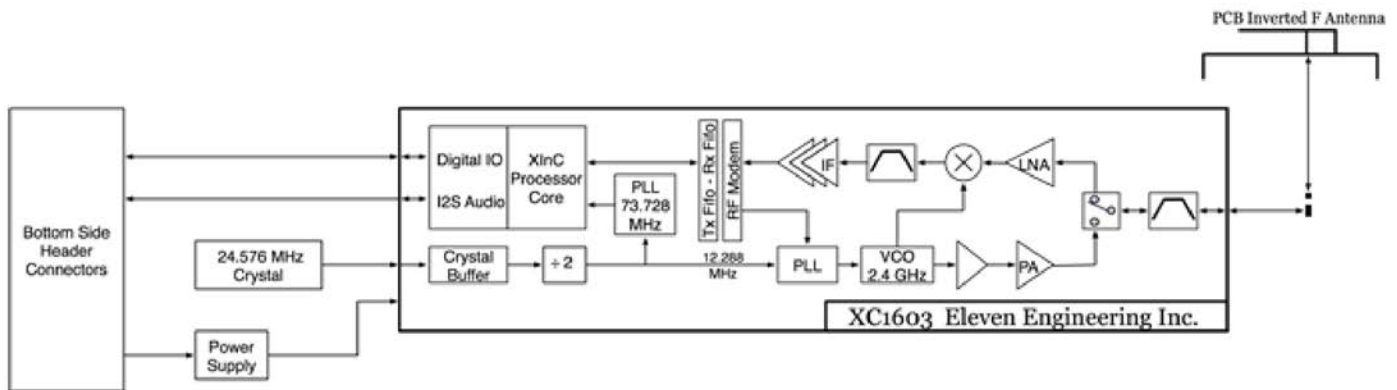


Figure 2 – WDAM1 Module Block Diagram

Component	Description
PLL	Phase Loop Lock
PA	Power Amplifier
VCO	Voltage Controlled Oscillator
LNA	Low Noise Amplifier
IF	Intermediate Frequency

Table 9 – WDAM1 Module Block Diagram Description



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FCC ID: Q3D-WDAM1
IC ID: 10647A-WDAM1

Mechanical Drawing

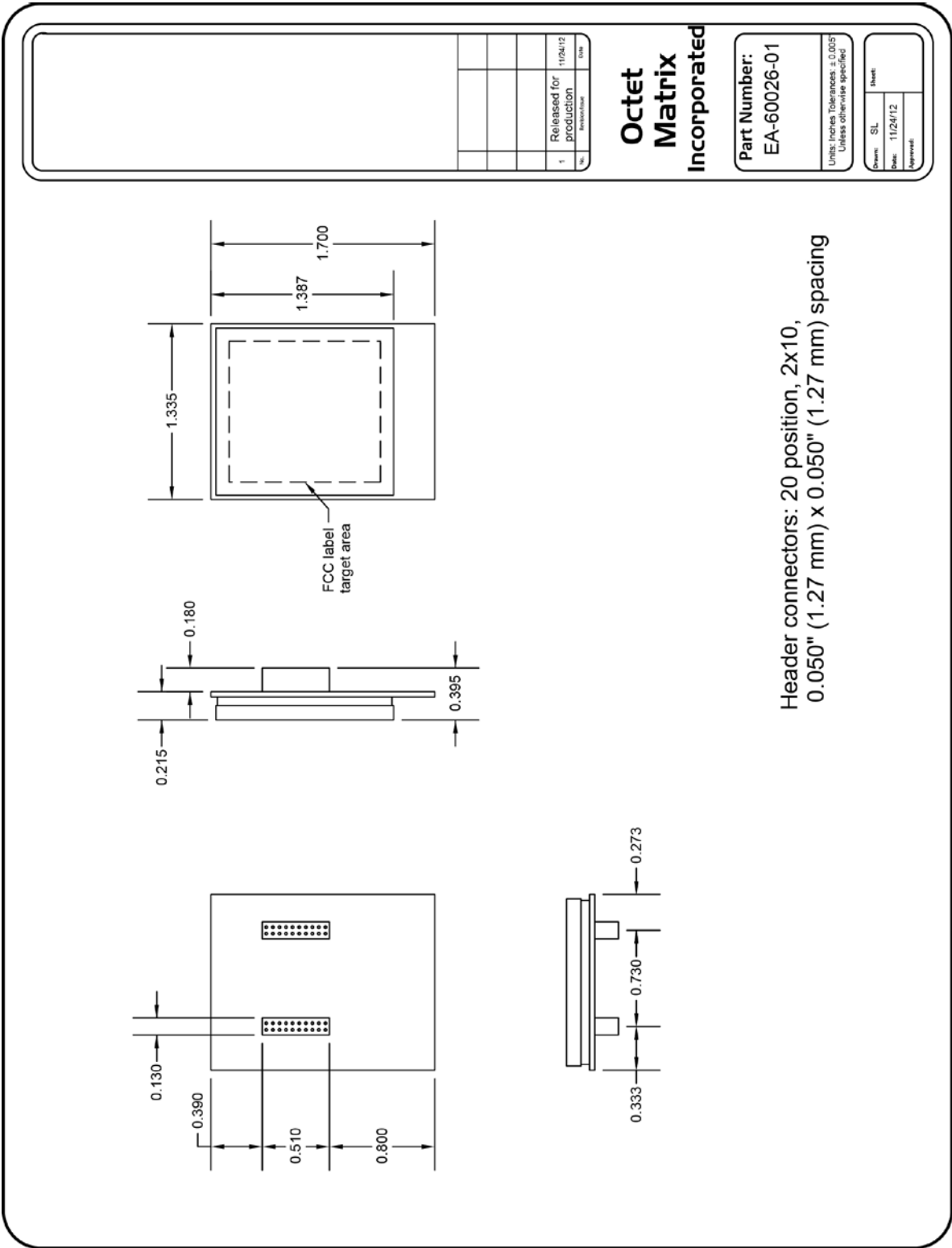


Figure 3 – WDAM1 Mechanical Drawing



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Document Revision History

Revision #	Release Date	Details
1.0	11/26/2012	Initial document release

Table 9 – Document Revision History