RADIO MODULE

MTX-405

ASK/FSK TRANSMITTER MODULE

PRELIMINARY

DATA SHEET

Radios, Inc.

November 19, 2007 Preliminary Data Sheet

MTX-405

ASK/FSK TRANSMITTER MODULE

The MTX-405 is a 290MHz-980MHz RF transmitter IC designed for unlicensed ISM band operations. It's designed to work in the North American 315MHz and 915MHz bands as well as the European 433MHz and 868MHz bands.

The transmitter consists of an FSK/ASK modulator, PLL frequency synthesizer and a power amplifier. The frequency synthesizer consists of a voltage controlled oscillator (VCO), a crystal oscillator, dual modulus prescaler, programmable frequency dividers and a phase-detector. The output power of the power amplifier can be programmed to eight levels. A lock detect circuit detects when the PLL is in lock.

In FSK mode, the user can select between three different modulation types allowing a data rate up to 200kbps. When selecting FSK modulation applied with dividers, the MTX-405 is switching between to sets of register values. The second modulation type is closed loop VCO modulation using the internal modulator that applies the modulated data to the VCO. The third FSK modulation type is Open loop VCO modulation.

In ASK modulation, the user can select between two modulation types, with or without spreading. In both modes the modulation depth is programmable.
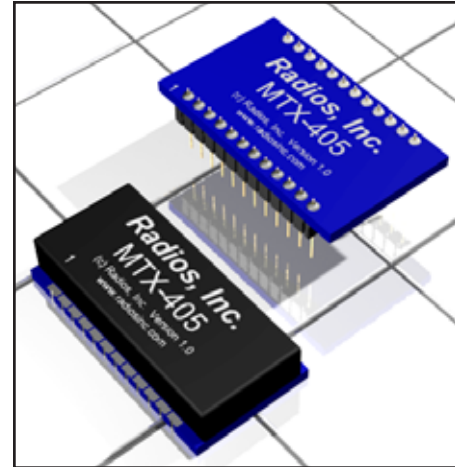
Key Features

- FSK/ASK transmitter
- Low cost
- Commonly employed RKE frequencies
- Wide operating temperature range
- Easily integrated
- Compact surface-mount packages/Small size
- Frequency Programmable
- ASK modulation depth programmable
- Power down pin
- No production tuning
- High efficiency power amplifier
- Programmable output power
- Base band package engine
- TX buffer
- No external tuning circuitry

Typical Applications

- Meter reading
- Automotive
- Smart home
- Remote control systems
- Residential automation
- Wireless security system
- General wire elimination

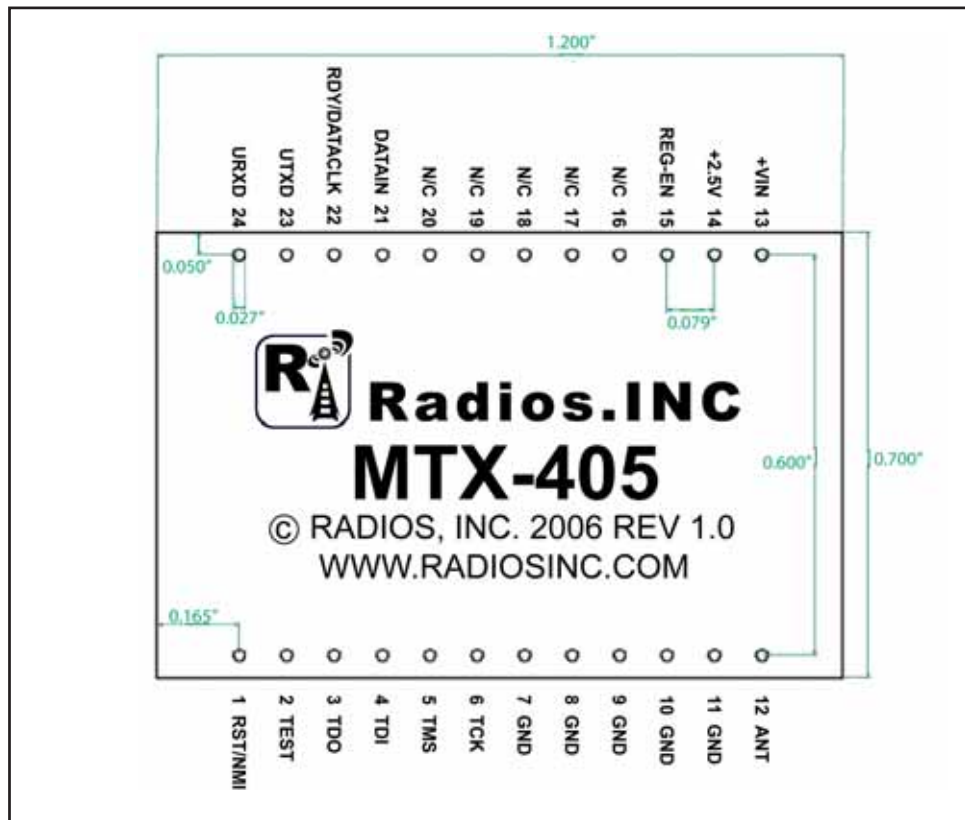| Contact Information	
Radios, Inc. 1408 Center Avenue Oostburg, WI 53070	Phone: 920-564-6622 Fax: 920-564-6630 Email: sales@radiosinc.com

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Mechanical and Pin Diagram
DIP Package

* Note: Pinouts of surface mount and through-hole packages are mirrored

DIP Package

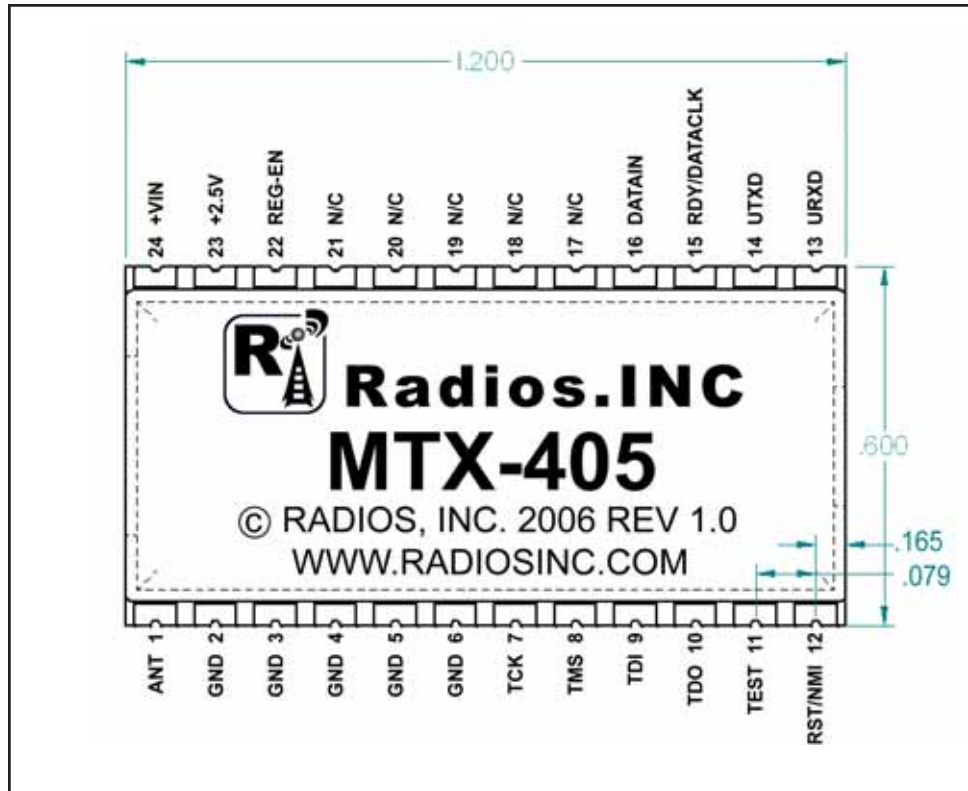| Pin Description					
Pin Num	**Pin Name**	**Description**	**Pin Num**	**Pin Name**	**Description**
Pin 1	RST/NMI	No Connect	Pin 13	+VIN	Positive Supply Pin (2.6-16V)
Pin 2	TEST	No Connect	Pin 14	+2.5V	Regulated Output (2.5V)
Pin 3	TDO	No Connect	Pin 15	REG-EN	Regulator Enable (2-VCC)
Pin 4	TDI	No Connect	Pin 16	N/C	No Connect
Pin 5	TMS	No Connect	Pin 17	N/C	No Connect
Pin 6	TCK	No Connect	Pin 18	N/C	No Connect
Pin 7	Gnd	Ground	Pin 19	N/C	No Connect
Pin 8	Gnd	Ground	Pin 20	N/C	No Connect
Pin 9	Gnd	Ground	Pin 21	DATAIN	Data Input (0-2.5V)
Pin 10	Gnd	Ground	Pin 22	RDY/DATACLK	No Connect
Pin 11	Gnd	Ground	Pin 23	UTXD	No Connect
Pin 12	Ant	RF Output (50 Ohms)	Pin 24	URXD	Receive Data Out—UART mode (0-2.5V)

** Verify pin configurations are correct before connecting power or resulting damage may occur.

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Mechanical and Pin Diagram
Surface Mount Package

* Note: Pinouts of surface mount and through-hole packages are mirrored

Surface Mount Package

Pin Description

Pin Num	Pin Name	Description	Pin Num	Pin Name	Description
Pin 1	Ant	RF Output (50 Ohms)	Pin 13	URXD	Receive Data Out—UART mode (0-2.5V)
Pin 2	Gnd	Ground	Pin 14	UTXD	No Connect
Pin 3	Gnd	Ground	Pin 15	RDY/DATACLK	No Connect
Pin 4	Gnd	Ground	Pin 16	DATAIN	Data Input (0-2.5V)
Pin 5	Gnd	Ground	Pin 17	N/C	No Connect
Pin 6	Gnd	Ground	Pin 18	N/C	No Connect
Pin 7	TCK	No Connect	Pin 19	N/C	No Connect
Pin 8	TMS	No Connect	Pin 20	N/C	No Connect
Pin 9	TDI	No Connect	Pin 21	N/C	No Connect
Pin 10	TDO	No Connect	Pin 22	REG-EN	Regulator Enable (2-VCC)
Pin 11	TEST	No Connect	Pin 23	+2.5V	Regulated Output (2.5V)
Pin 12	RST/NMI	No Connect	Pin 24	+VIN	Positive Supply Pin (2.6-16V)

** Verify pin configurations are correct before connecting power or resulting damage may occur.

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MXR-405 Communication

Communication with the MTX-405 is accomplished through a universal asynchronous receive/transmit (UART) peripheral interface. The UART uses 8-bit, non-parity, LSB, 1200bps baud format. The maximum number of data bytes that can be transmitted in one packet is 50. The user will transmit data through the UART on the MTX-405 via pin 24, URXD. The MTX-405 will packetize and wirelessly transmit the data. The data being sent through the UART should follow a specific protocol.

The communication protocol is outlined below:

Byte #1   **Number of Bytes** – The number of bytes is one byte containing the total number of data bytes. This byte should not be included in the number of bytes. Therefore, the number of bytes should be one less than the total number of bytes being sent. The maximum number of data bytes that can be transmitted is 50; therefore, the number of bytes should not exceed 50.

Bytes #2-51   **Data Bytes** – The data bytes are the actual data byte values being transmitted by the MTX-405. The MTX-405 can send a maximum of 50 data bytes per packet. The first two bytes are used as preamble bytes by Radios, Inc. to differentiate the detection of data from noise. They can be set to any value, but to work with the HHDS-ML they must be set to 0xFF and 0x00, respectively.

When the first byte is received through the UART on the MTX-405, the user will have one second to send the remaining data bytes to the MTX-405. If the MTX-405 does not receive all of the data bytes within that second, the data the MTX-405 did receive will be dumped. For example, if the user sends a 10 for the number of bytes and then only sends five more bytes within one second, the MTX-405 assumes this is corrupted data and does not transmit the packet. The five bytes the MTX-405 did receive will be discarded and the MTX-405 will wait for a new packet of data to be received.

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Pin Number		Pin Name	Description
DIP	**Surface Mount**		
12	1	Ant	This is the transmit RF output, internally ac-coupled. Connect this pin to the transmit antenna.
7,8,9,10,11	2,3,4,5,6	Gnd	Ground
16,17,18, 19,20	17,18,19,20,21	N/C	No Connect
1,2,3,4,5,6	7,8,9,10,11,12	N/C	No Connect. Programming use only.
24	13	URXD	Receive data in—USART0/UART mode
23	14	UTXD	Transmit data out—USART0/UART mode
22	15	RDY/ DATACLK	Transmit buffer Ready / Alternative Data clock
21	16	DATAIN	Data input pin.
15	22	REG-EN	In a regulated module, this pin powers on the module with a 2-16V supply input. Pulling this pin low disables module. In a non-regulated module, this is a no connect.
14	23	+2.5V	In a regulated module, this is a 2.5V output from the onboard regulator when REG-EN is high (2-16V). In a non-regulated module, this is the 2.2V to 3.6V power supply input.
13	24	+VIN	In a regulated module, this is the power supply pin of the module. Input 2.5-16V to power a regulated module. In a non-regulated module, this is a no connect.

Typical Application Schematic
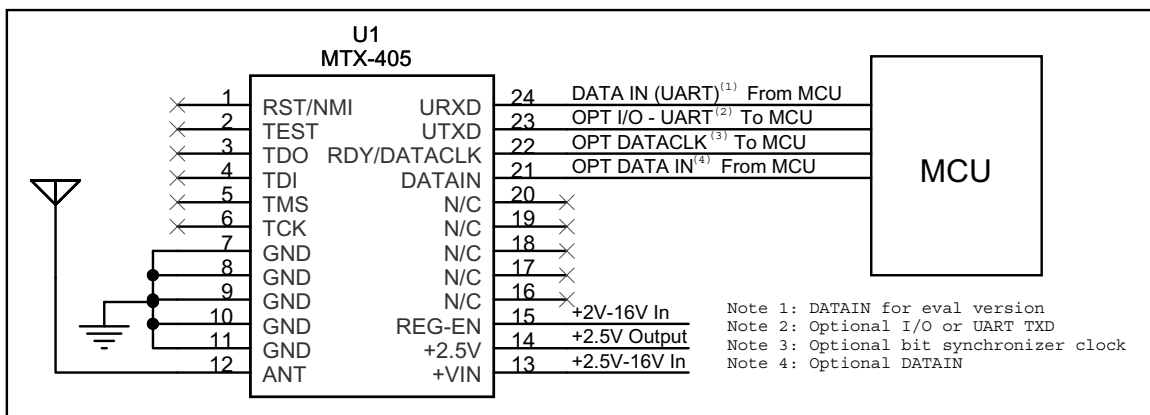
MTX-405, 433.92 MHz

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ASK/FSK TRANSMITTER MODULE

Electrical Limits

Sym	Parameters	Min	Typ	Max	Unit	Notes
	Absolute Maximum Ratings					
VCC	Supply Voltage - Regulated	2.6		16	V	
	Supply Voltage - Not Regulated	2.2		3.6	V	
	Voltage on I/O Pins	-0.3		3.7	V	
	Storage Temperature Range	0		70	°C	
	Lead Temperature		260		°C	
V_{EN}	Enable Input Voltage	0		16	V	
	Operating Ratings					
V_{EN}	Enable Input Voltage	0		VCC	V	
TA	Ambient operating temperature	0		70	°C	

Electrical Characteristics

This device is ESD sensitive. Do not operate or store near strong electrostatic fields. Use appropriate ESD precautions. All voltages are with respect to Ground.

Parameters	Test Conditions	Min	Typ	Max	Unit
Power Supply					
Power Down Current			0.3		µA
Standby Current			200		µA
PLL Mode Current	PA off		5.6		mA
Quiescent Current	REG-EN </= 0.4V (shutdown)		0.01		µA
Operating Voltage	Regulated	2.6		16	V
	Not Regulated	2.2		3.6	V
Transmit Section					
Output Power Level	Pa2-0=111		10		dBm
	Pa2-0=001		-7		dBm
Output Power Tolerance	Over temperature range		1.5		dB
	Over power supply range		3.0		dB
RF Frequency Operating Range	Freq_band=0	290		325	MHz
	Freq_band=1	430		490	MHz
	Freq_band=2-3	860		980	MHz
Tx Current Consumption	Pa2-0=111		18		mA
	Pa2-0=001		9.6		mA
	Pa2-0=000		5.6		mA
Modulation Depth ASK/OOK	ASK=7 (OOK)		60		dB
	ASK=6		20		dB
Binary FSK Frequency Deviation	Bitrate = 200kbps			300	kHz
Data Rate	VCO modulation	20		200	kbps
	Divider modulation			20	kbps
	ASK			50	kbps
Occupied Bandwidth	FSK 38.4kbps, RBW=10kHz		130		kHz
	FSK 125kbps, RBW=30kHz		425		kHz
	FSK 200kbps, RBW=100kHz		750		kHz
	ASK (OOK) 38.4kbps, RBW=10kHz		200		kHz
	ASK 20db modulation depth, 38.4kbps, RBW=10kHz		120		kHz

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Electrical Characteristics - CONT.

2nd Harmonic			-36		dBm
3rd Harmonic			-54		dBm
Spurious Emission<1GHz				-54	dBm
Spurious Emission>1GHz				-41	dBm
LO Leakage				-80	dBm
VCO and PLL Section					
Reference Frequency		4		40	MHz
PLL Startup	1kHz loop filter bandwidth, Fphd=200kHz		7.0		ms
	3kHz loop filter bandwidth, Fphd=500kHz		1.8		ms
	30kHz loop filter bandwidth, Fphd=1000kHz		140		μs
Standby-TX (PA on) 30kHz Bandwidth			200		μs
Crystal Oscillator Start-Up Time			300		μs
Charge Pump Current	CP_CUR=3		100		μA
Regulator Enable Input					
Input Low Voltage	Regulator OFF			0.6	V
Input High Voltage	Regulator ON	2.0			V
Enable Input Current	REG-EN = 0.6V; Regulator OFF		0.01		μA

Note 1. Exceeding the absolute maximum rating may damage the device.

Note 2. The device is not guaranteed to function outside its operating rating.

Note 3. Devices are ESD sensitive. Handling precautions recommended. Human body model, 1.5k in series with 100pF.

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Technical Support:

Radios, Inc. is committed to providing its customers with excellent technical support and the resources necessary to assist them with their product development. All technical support is provided free of charge. Customers have several options to obtain assistance. First, any questions or concerns can be e-mailed to Radios, Inc. at information@radiosinc.com. We monitor our e-mail daily, and will respond to all questions promptly. Additionally, to speak directly to a technical support representative, customers can call Radios, Inc. at 920-564-6622.

Compliance:

Embedded wireless modules are intended for use as component devices which require peripheral elements to operate. Radios, Inc.'s modules are intended to be used in products requiring compliance. They are, however, not pre-approved by the FCC or any other agency worldwide unless so stated. The user or customer understands that regulatory compliance may be required prior to the sale or operation of the module or development system, and agrees to abide by all laws governing the module's or development system's use in the country of operation.

The approval process of embedded wireless modules in the United States is relatively uncomplicated. The Federal Communications Commission (FCC) is the governing body in the US that specifies its requirements in the Code of Federal Regulations (CFR), Title 47. Title 47 consists of several volumes and it is necessary to first identify the correct section that applies to your application. These rules require that a device which intentionally creates RF emissions be FCC compliant; i.e., pre-tested for compliance and assigned an identification number. Radios, Inc. offers pre-screening at one of our affiliate test sites. Final certification is then accomplished by an independent test laboratory. After passing compliance testing, you will be issued a unique ID number which must be placed on each product manufactured.

Any questions dealing with interpretations of the rules relating to testing or compliance should be addressed to:

<div align="center">

FCC
Equipment Authorization Division
Customer Service Branch, MN 1300F2
7435 Oakland Mills Road
Columbia, MD 21046

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Returns:

Products may be returned directly to Radios, Inc. for evaluation. Returns, without exception, must have a valid RMA number attached. RMA numbers can be obtained by calling a customer service representative at Radios, Inc. If a product is found to be defective and is returned within 90 days of purchase, Radios, Inc. may repair or replace, at its option, said defective product. The warranty does not apply to any products which have been disassembled, modified or subjected to conditions exceeding the application specifications. Under no circumstances will Radios, Inc. be responsible for losses, financial or other, arising from the use or failure of a device in an application or for losses arising from failure to meet delivery requirements, other than the repair, replacement, or refund limited to the original product purchase price. No other warranties, express, implied, or statutory, including warranty of fitness for a particular purpose, apply.

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Editorial Information:

(Date)

Last Updated   November 19, 2007 PRELIMINARY

Product Ordering Information:

MTX-405 - 433 D 4800 R A -B

Packaging:	B - Bulk
	TB - Tube
	TR - Tape and Reel
Antenna:	A - Antenna
	- No Antenna
Voltage Regulation:	R - Regulated
	- Not Regulated
Baud Rate:	600 = 600 bps
	= 1200 bps
	2400 = 2400 bps
	4800 = 4800 bps
	9600 = 9600 bps
	14400 = 14,400 bps
	28800 = 28,800 bps
Footprint:	D - Through-hole
	S - Surface Mount
	SC - Surface Mount Capped
Frequency: (based on module's frequency range)	310 = 310 MHz
	315 = 315 MHz
	390 = 390 MHz
	418 = 418 MHz
	433 = 433.92 MHz
	915 = 915 MHz
	XXX = Custom Frequency