RADIO MODULE
MXR-EM20

ZIGBEE TRANSCEIVER MODULE

PRELIMINARY

DATA SHEET

Radios, Inc.

October 14, 2005 Preliminary Data Sheet

MXR-EM20

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The MXR-EM20 is a 2.4 GHz RF transceiver designed for low-power and low-voltage wireless applications. The MXR-EM20 includes a digital direct sequence spread spectrum baseband modem and an effective datarate of 250 kbps. The MXR-EM20 is compatible with a licensed Ember networking stack. The MXR-EM20 is a low-cost, highly integrated solution for robust wireless communication in the 2.4 GHz unlicensed ISM band. It is designed to comply with world-wide regulations covered by EN 300 440 (Europe), CFR47 Part 15 (US) and ARIB STD-T-66 (Japan). The MXR-EM20 provides extensive hardware support for packet handling, data buffering, burst transmissions, data encryption, data authentication, clear channel assessment, link quality indication and packet timing information.
The configuration interface and transmit / receive FIFOs of the MXR-EM20 are accessed via a SPI interface.

Key Features

- Low cost
- RF transceiver with baseband modem, MAC support and networking stack
- Low current consumption
- Low supply voltage with integrated voltage regulator
- Easily integrated
- Low supply voltage with external voltage regulator
- Compact surface-mount packages/small size
- Programmable output power
- DSSS baseband modem w/ 2MChips/s and 250 kbps data rate
- Suitable for both RFD and FFD operation
- No external RF switch/filter needed
- I/Q low-IF receiver
- Digital RRSI/LQI support
- I/Q direct upconversion transmitter
- Can support EN 300 440 and FCC CFR-47 part 15, ARIB STD-T-66
- Hardware MAC encryption

Typical Applications

- 2.4 GHz IEEE 802.15.4 systems
- ZigBee systems
- Consumer Electronics
- Industrial Control
- Home / Building automation
- PC peripherals

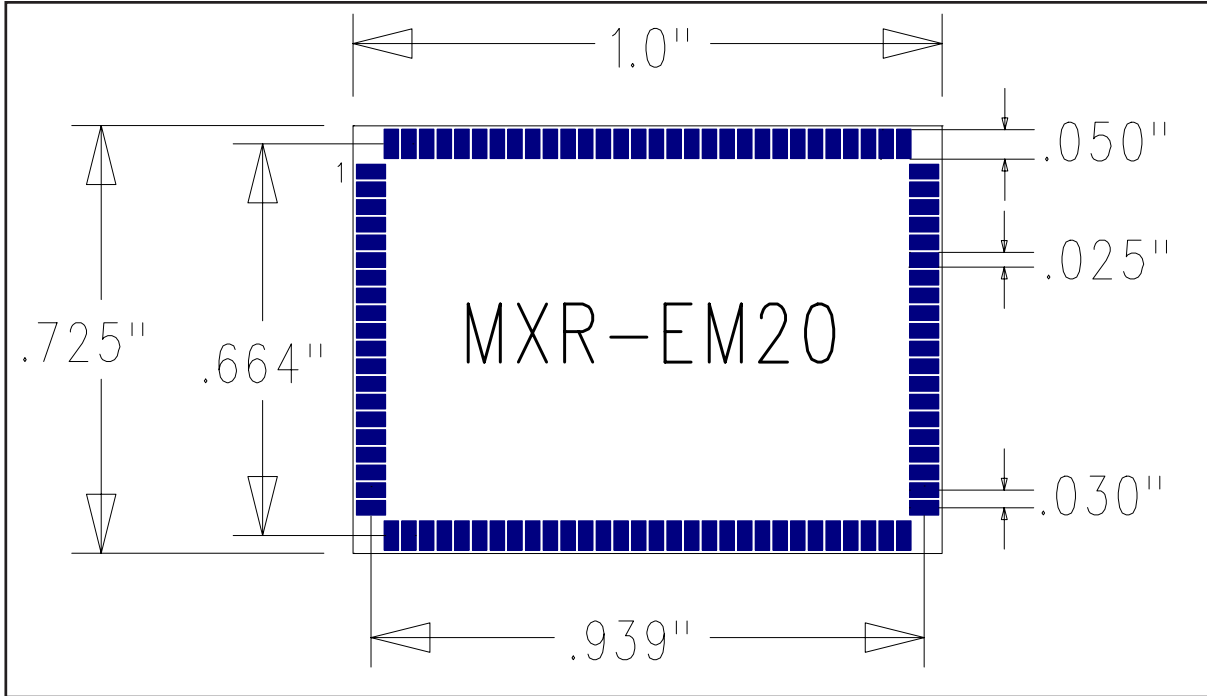| PRODUCT ORDER INFORMATION	
Part Number	Description
MXR-EM20	2.4 GHZ Module Transceiver

Contact Information	
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Mechanical and Pin Diagram

1.0"

.050"

.025"

.030"

.725"

.664"

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.939"

Pin Description

Num	Name	Description	Num	Name	Description	Num	Name	Description	Num	Name	Description
Pin 1	TXD	UART1 Transmit Pin	Pin 26	PF7	ADC Channel 7	Pin 51	N/C	No Connect	Pin 76	N/C	No Connect
Pin 2	PD6	I/O	Pin 27	PF6	ADC Channel 6	Pin 52	N/C	No Connect	Pin 77	N/C	No Connect
Pin 3	PD5	USART Ext Clk I/O	Pin 28	PF5	ADC Channel 5	Pin 53	N/C	No Connect	Pin 78	N/C	No Connect
Pin 4	PC2	I	Pin 29	PF4	ADC Channel 4	Pin 54	REG-EN	Regulator Enable	Pin 79	V1.8	+1.8 Volt Supply Input
Pin 5	PG0	I/O	Pin 30	PF3	ADC Channel 3	Pin 55	N/C	No Connect	Pin 80	PB3	SPI MISO
Pin 6	PD7	Tmr/Cntr2 Clk Input	Pin 31	PF2	ADC Channel 2	Pin 56	N/C	No Connect	Pin 81	PE5	Ext Int5 Output Capture/PWM
Pin 7	PG1	I/O	Pin 32	PF1	ADC Channel 1	Pin 57	N/C	No Connect	Pin 82	PD7	Tmr/Cntr2 Clk Input
Pin 8	PC3	I	Pin 33	PF0	ADC Channel 0	Pin 58	N/C	No Connect	Pin 83	GND	Ground
Pin 9	PC0	I	Pin 34	NPEN	Programming Enable	Pin 59	GND	Ground	Pin 84	PD4	Tmr/Cntr1 Input Capture Pin
Pin 10	PC4	I	Pin 35	GND	Ground	Pin 60	GND	Ground	Pin 85	GND	Ground
Pin 11	GND	Ground	Pin 36	GND	Ground	Pin 61	N/C	No Connect	Pin 86	GND	Ground
Pin 12	GND	Ground	Pin 37	PDI	PDI/UART Receive Pin	Pin 62	N/C	No Connect	Pin 87	N/C	No Connect
Pin 13	PC5	I	Pin 38	PDO	PDO/UART Transmit Pin	Pin 63	N/C	No Connect	Pin 88	PB6	Output Compare/PWM
Pin 14	PC6	I	Pin 39	PE2	Analog Comparator Pos In Output Compare/PWM	Pin 64	N/C	No Connect	Pin 89	PB7	Output Compare/PWM
Pin 15	PC7	I	Pin 40	PE3	Analog Comparator Neg In Output Compare/PWM	Pin 65	ANT	RF Input	Pin 90	N/C	No Connect
Pin 16	PG2	I/O	Pin 41	PE4	Ext Int4 Output Compare/PWM	Pin 66	N/C	No Connect	Pin 91	RESET	External Reset Pin
Pin 17	PA7	I/O	Pin 42	PE7	Ext Int7 Tmr/Cntr3 Input Capture Pin	Pin 67	N/C	No Connect	Pin 92	N/C	No Connect
Pin 18	PA6	I/O	Pin 43	PE6	Ext Int6 Tmr/Cntr3 Input Capture Pin	Pin 68	N/C	No Connect	Pin 93	PD0	Ext Int0/TWI Serial Data
Pin 19	PA5	I/O	Pin 44	PB0	SPI Slave Select	Pin 69	N/C	No Connect	Pin 94	PD1	Ext Int1/TWI Serial Data
Pin 20	PA4	I/O	Pin 45	SCK	SPI Serial Clock	Pin 70	N/C	No Connect	Pin 95	RXD	UART1 Receive Pin
Pin 21	GND	Ground	Pin 46	PB2	SPI MOSI	Pin 71	GND	Ground	Pin 96	PC1	I
Pin 22	PA3	I/O	Pin 47	+VIN	Positive Voltage Input	Pin 72	N/C	No Connect	Pin 97	PD4	Tmr/Cntr1 Input Capture Pin
Pin 23	PA2	I/O	Pin 48	PB4	Output Compare/PWM	Pin 73	N/C	No Connect	Pin 98	V3.3	+3.3 Volt Supply Input
Pin 24	PA1	I/O	Pin 49	N/C	No Connect	Pin 74	N/C	No Connect	Pin 99	N/C	No Connect
Pin 25	PA0	I/O	Pin 50	GND	Ground	Pin 75	N/C	No Connect	Pin 100	GND	Ground

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Electrical Limits

Sym	Parameters	Min	Typ	Max	Unit	Notes
	Absolute Maximum Ratings					
VDD	Supply Voltage	-20		38	V	
	Voltage on any Pins	-0.5		6.0	V	
	Storage Temperature Range	-50		150	°C	
	Lead Temperature		260		°C	
V$_{EN}$	Enable Input Voltage				V	
	ESD Rating				kV	
	Operating Ratings					
	Package Thermal Resistance				°C/W	
V$_{EN}$	Enable Input Voltage	2.1		3.6	V	
TA	Ambient operating temperature	-40		85	°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					
RF Frequency Operating Range		2400		2483.5	MHz
Power Supply					V
Power Down Current					µA
Standby current					µA
Quiescent Current		13	20	29	µA
VCO and PLL Section					
Reference Frequency					MHz
PLL Lock Time	915MHz to 915.5MHz				ms
3kHz bandwidth	902MHz to 927MHz				ms
	20kHz bandwidth				ms
Switch Time	Rx – Tx				ms
3kHz loop bandwidth	Tx – Rx				ms
	Standby Rx				ms
	Standby Tx				ms
Crystal Oscillator Start-Up Time	16 pF load		0.86		ms
Charge Pump Current	VCPOUT = 1.1V, CP_HI = 0				µA
	VCPOUT = 1.1V, CP_HI = 1				µA
Charge Pump Tolerance					%
Transmit Section					
Output Power	Delivered to a single ended 50 ohm load through a balun	-3	0		dBm
Output Power Tolerance	Over temperature range				dB
	Over power supply range				dB
Tx Current Consumption	P = -25 dBm		8.5		mA
	P = -15 dBm		9.9		mA
	P = -10 dBm		11		mA
	P = -5 dBm		14		mA
	P = 0 dBm		17.4		mA

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Electrical Characteristics - CONT.

Tx Current Consumption Variation	10dBm				mA
Binary FSK Frequency Separation	bitrate = 200kbps				kHz
Data Rate		250		250	kbps
Occupied bandwidth	20kbps, b = 2, 20dBc				kHz
	125kbps, b = 2, 20dBc				kHz
	200kbps, b = 2, 20dBc				kHz
2nd Harmonic			-34		dBc
3rd Harmonic			-60		dBc
Spurious Emission	30-1000 MHz			-36	dBm
	1-12.75 GHz			-30	dBm
	1.8-1.9 GHz			-47	dBm
	5.15-5.3 GHz			-47	dBm
Receive Section					
Rx Current Consumption			19.7		mA
Rx Current Consumption Variation	Over temperature				mA
Receiver Sensitivity		-90	-94		dBm
Receiver Maximum Input Power	125kbps, 125kHz deviation				dBm
	20kbps, 20kHz deviation				dBm
Receiver Sensitivity Tolerance	Over temperature				dB
	Over power supply range				dB
Receiver Bandwidth					kHz
Co-Channel Rejection					dB
Adjacent Channel Rejection	+5 MHz spacing		39		dB
	-5 MHz spacing		46		dB
Blocking	30-2000 MHz		TBD		dBm
	2000-2399 MHz		TBD		dBm
	2498-3000 MHz		TBD		dBm
	3-12.75 MHz		TBD		dBm
Noise Figure, Cascade					dB
1dB Compression					dB
Input IP3	2 tones with 1MHz separation				dBm
Input IP2					dBm
LO Leakage				-47	dBm
Spurious Emission	30-1 GHz			-57	dBm
	1-12.75 GHz			-47	dBm
Input Impedance					Ohms
Input Reflection (s11)					dB
RSSI Dynamic Range			100		dB
RSSI Output Voltage	Pin = 100dBm				V
	Pin = 60dBm				V

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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Editorial Information:

                                    (Date)
Last Updated   October 14, 2005PRELIMINARY