In Development

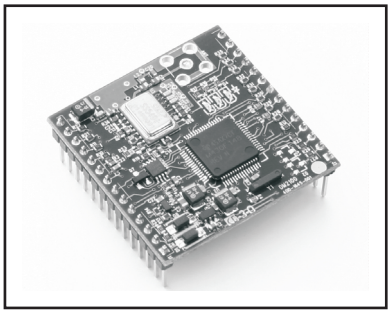
RFM®

DM2100

916.50 MHz Transceiver Module

- ***NOKOTA SOS-OEA V1.5 Multi-mode Mesh Network Protocol***
- ***Network Configurable Analog, Digital and Serial I/O Ports***
- ***3 V, Very Low Current Operation plus Sleep Mode***
- ***FCC 15.249 Certified***

The DM2100 is a 916.5 MHz transceiver module designed for wireless industrial sensor applications. The DM2100 is equipped with seven I/O ports. Each port can be configured as an analog input, a digital input, or a digital output. The DM2100 is also equipped with a serial data port. The communication range of the DM2100 in an "open field" environment is typically 200 meters/hop. The DM2100 combines RFM's low-current ASH radio technology with low-power microprocessor technology to achieve very long battery life. The DM2100 employs NOKOTA's SOS-OEA V1.5 multi-mode mesh network protocol, which provides robust and flexible wireless network routing, a rich application command set, and a powerful and easy-to-use network management utility. The DM2100 is certified under FCC 15.249 regulations.



Absolute Maximum Ratings

Rating	Value	Units
All Input/Output Pins	-0.3 to +4.0	V
Non-Operating Ambient Temperature Range	-50 to +100	°C

Electrical Characteristics

Characteristic	Sym	Notes	Minimum	Typical	Maximum	Units
Operating Frequency	f_O		916.30		916.70	MHz
Modulation Type				OOK		
RF Encoded Data Transmission Rate				4.8		kb/s
Receive Mode:						
Average Input Current, 3 Vdc Supply	I_R			4		mA
Input Signal for 10^{-3} BER, 25 °C				-100		dBm
Transmit Mode:						
Peak Input Current, 3 Vdc Supply	I_{TP}				13.5	mA
Peak Output Power	P_O			1		mW
Sleep Mode Average Input Current, 3 Vdc Supply	I_S			10		µA
Analog Input Measurement Range (10-bit ADC)			0		V_{DD}	V
Analog Input Impedance				2500		ohms
Digital Output Source Current				0.5		mA
Digital Output Sink Current				1		mA
Reference Crystal Accuracy				±200		ppm
Serial Port Data Rate				9.6		kb/s
Internal Power Supply Input Voltage Range			3.1		14.0	Vdc
External Power Supply Voltage Range	V_{DD}		2.85		3.7	Vdc
External Power Supply Voltage Ripple					10	mV_{P-P}
Operating Ambient Temperature Range	T_A		-40		+85	°C

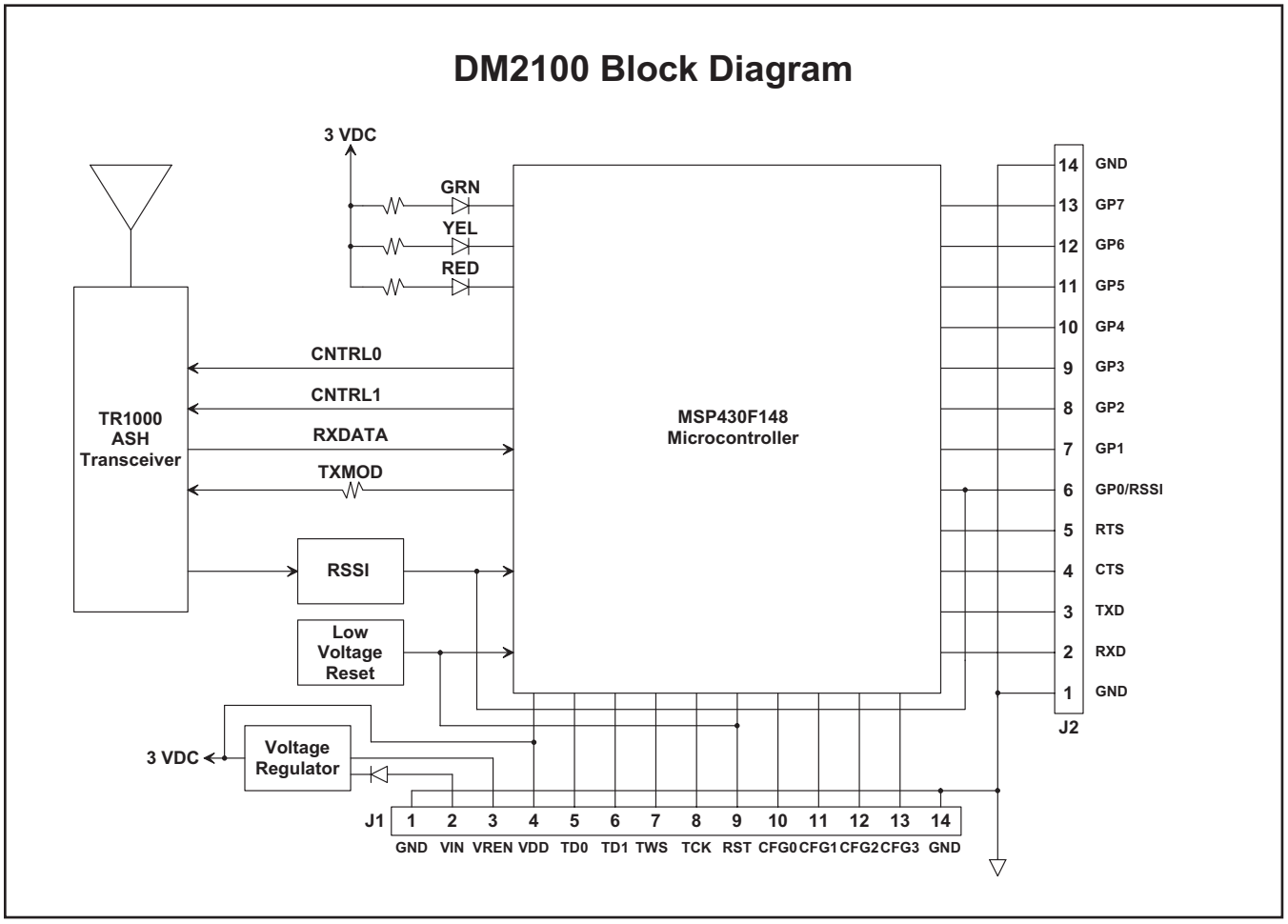


Figure 1

DM2100 Theory of Operation

The major components of the DM2100 include the TR1000 ASH transceiver and the Texas Instruments MSP430F148 microcontroller. The TR1000 operates on 916.5 MHz, with a nominal output power of 1 mW. The MSP430F148 operates from an internal oscillator referenced to an external 32.768 kHz “watch” crystal.

The MSP430F148 UART is used to provide a CMOS serial interface on connector J2. The microcontroller’s general purpose I/O pins are also available on connector J2 for external monitoring or control. Each of these pins can be separately configured through the RF network as a logic input, a logic output, or an analog input. Note that GP0 is dedicated to measuring the value of the received signal strength indicator (RSSI) circuit and should always be set as an analog input. GP1 - GP7 can be used in any configuration needed by the application. The three LEDs on the DM2100 display RF communication activity.

DM2100 operation is based on NOKOTA’s SOS-OEA V1.5 multi-mode mesh network protocol, which supports data and command transfers through both the serial interface and the RF channel. See the *SOS-OEA V1.5 Protocol User’s Guide* for further details.

DM2100 FCC Certification

The DM2100 has been certified for operation under FCC Part 15 Rules, Section 15.249. This certification applies only when the DM2100 is equipped with one of the following RFM antennas:

¼ wave antenna, RFM part number 400-1595-001
helical antenna, RFM part number 500-1141-001
¼ wave antenna-coax assembly, RFM part number 500-1142-001

WARNING: the DM2100 must be re-certified if used with any antennas other than the three listed above. Contact RFM for further information if your application requires a special antenna configuration.

When the DM2100 is run from an off-board power supply (applied to J1-4), the supply voltage must be limited to a maximum of 3.7 Vdc, and the power supply voltage ripple must not exceed 10 mV_{P-P}.

FCC Labels and Notices

A clearly visible label is required on the outside of the user's (OEM) enclosure stating that this product contains a DM2100 radio module, FCC ID: TE6-DM2100A.

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.

WARNING: This device operates under Part 15 of the FCC rules. Any modification to this device, not expressly authorized by RF Monolithics, Inc., may void the user's authority to operate this device.

DM2100 Applications

There are two ways to use the DM2100 in an application. The DM2100 can be used with a companion application interface board, the IM2100. The IM2100 has provisions for powering the DM2100 from a USB cable, an external unregulated DC supply such as a 5 Vdc "wall" transformer, an external regulated 3 Vdc power supply, or an external battery. The IM2100 also provides the choice of UART, RS232, RS485 (single drop) or USB for a host computer serial interface. In addition, the IM2100 includes captured-screw terminal strips for connecting analog inputs, digital logic inputs, digital logic outputs and form C relay outputs. Refer to the IM2100 data sheet for additional details.

The DM2100 can also be integrated into the user's own application board. The DM2100 pin descriptions are given in the Table on pages 4 and 5. The DM2100 pin-out locations are show in Figure 2, and the PCB layout for the mating connectors is shown in Figure 3.

The operating range of the DM2100 critically depends on the antenna being located properly. When using either the 400-1595-001 or the 500-1141-001 antenna, care should be taken to keep the antenna at least 0.5 inch away from the sides of its enclosure. The enclosure must be made from a plastic with low RF attenuation, such as fiberglass, PVC or ABS. For a metal enclosure, use the 500-1142-001 antenna-coax assembly, with the antenna mounted on the outside of the enclosure. Note that a reverse-pin SMA connector must be installed on the DM2100 to use this assembly.

The DM2100 enclosure should be mounted so the antenna is at least 4 feet off the ground, and ideally 6 or more feet off the ground.

The DM2100 has an on-board regulator input on Pin J1-2. To use the on-board regulator, connect J1-3 to J1-2 and apply a voltage to this connection of at least 3.1 Vdc, but not greater than 14 Vdc, including ripple variations. When running from the on-board regulator, up to 5 mA is available on J1-4 to operate external circuitry. Any external circuitry connected to J1-4 must not induce more that 10 mV_{P-P} ripple on the regulated 3 Vdc at this pin.

The DM2100 can also be run from an off-board regulated supply or a battery. In this case, connect J1-3 to ground, leave J1-2 unconnected, and apply the regulated supply or battery input to J1-4. Note the input voltage range for J1-4 must be in the range of 2.9 to 3.7 Vdc, with no more than 10 mV_{P-P} ripple.

Only pins J1-2 and J1-3 are rated to operate from a supply voltage higher than 3.7 Vdc. *Further, care must be taken so that analog or logic inputs applied to the DM2100 stay within the voltage range of 0 to VDD (voltage at J1-4). Applying a voltage outside of the 0 to VDD voltage range to an analog or logic input can damage the DM2100.*

The DM2100 has current limiting protection resistors on most of the I/O pins. These limit the current that a logic output can source or sink. Any DM2100 pin defined as an output should be used only to drive a high impedance load such as a CMOS logic input or a MOSFET transistor.

Pin Descriptions

Pin	Name	Description
J1-1	GND	This pin is connected to ground.
J1-2	VIN	This pin is the input to the DM2100 on-board voltage regulator. The minimum input voltage to this pin is 3.1 V, and the maximum input to this pin is 14.0 V.
J1-3	VREN	This pin is the enable input for the DM2100 on-board regulator. To enable the on-board regulator, connect this pin to J1-2. To disable the on-board regulator, connect this pin to ground.
J1-4	VDD	This pin is connected to the DM2100 positive power supply buss. When the DM2100 is powered from the on-board regulator, this pin can provide up to 5 mA of current at 3.0 Vdc. Note this current adds to the receive, transmit and sleep currents listed in the specifications on Page 1. The external load must not impress more than 10 mV peak -peak ripple on the supply buss. If the on-board regulator is disabled, the DM2100 can be powered through this pin by an external 2.85 to 3.7 Vdc source (maximum ripple 10 mV peak-peak).
J1-5	TD0	This pin is only used for factory programming. It must be left unconnected in normal operation.
J1-6	TDI	This pin is only used for factory programming. It must be left unconnected in normal operation.
J1-7	TWS	This pin is only used for factory programming. It must be left unconnected in normal operation.
J1-8	TCK	This pin is only used for factory programming. It must be left unconnected in normal operation.
J1-9	RST	This pin is only used for factory programming. It must be left unconnected in normal operation.
J1-10	CFG0	This pin is a hardware configuration input. When this pin is low, the DM2100 is placed in a low current sleep mode. When this pin is high, the DM2100 operates normally. If this pin is not driven by external logic, connect it to J1-4 (positive supply buss) for normal operation.
J1-11	CFG1	This pin is a hardware configuration input. When this pin is low, the DM2100 is placed in the beacon mode, and transmits beacon packets about once every eight seconds. When this pin is high, the DM2100 operates normally. If this pin is not driven by external logic, connect it to J1-4 (positive supply buss) for normal operation.
J1-12	CFG2	This pin is a hardware configuration input, reserved for future use. Connect it to J1-4 (positive supply buss) for normal operation.
J1-13	CFG3	This pin is a hardware configuration input, reserved for future use. Connect it to J1-4 (positive supply buss) for normal operation.
J1-14	GND	This pin is connected to ground.
J2-1	GND	This pin is connected to ground.
J2-2	RXD	This pin is the serial data input (CMOS).
J2-3	TXD	This pin is the serial data output (CMOS).
J2-4	CTS	This pin is a serial data flow control input (CMOS). Hardware flow control is required.
J2-5	RTS	This pin is a serial data flow control output (CMOS). Hardware flow control is required.
J2-6	GP0/RSSI	This pin is a general purpose I/O pin dedicated to monitoring the RSSI circuit output. It should always be configured as an analog-to-digital converter input. The RSSI signal can also be monitored externally at this pin.
J2-7	GP1	This pin is a general purpose I/O pin. The default configuration of this pin is a logic input. The configuration of this pin can be changed by commands through the RF channel. Other configuration options include a logic output, or an analog-to-digital converter input. If this pin is unused, it may be reconfigured for a logic low output to minimize current. In this case, the pin must be left unconnected.
J2-8	GP2	This pin is a general purpose I/O pin. The default configuration of this pin is a logic input. The configuration of this pin can be changed by commands through the RF channel. Other configuration options include a logic output, or an analog-to-digital converter input. If this pin is unused, it may be reconfigured for a logic low output to minimize current. In this case, the pin must be left unconnected.
J2-9	GP3	This pin is a general purpose I/O pin. The default configuration of this pin is a logic input. The configuration of this pin can be changed by commands through the RF channel. Other configuration options include a logic output, or an analog-to-digital converter input. If this pin is unused, it may be reconfigured for a logic low output to minimize current. In this case, the pin must be left unconnected.

DM2100 Pin Out

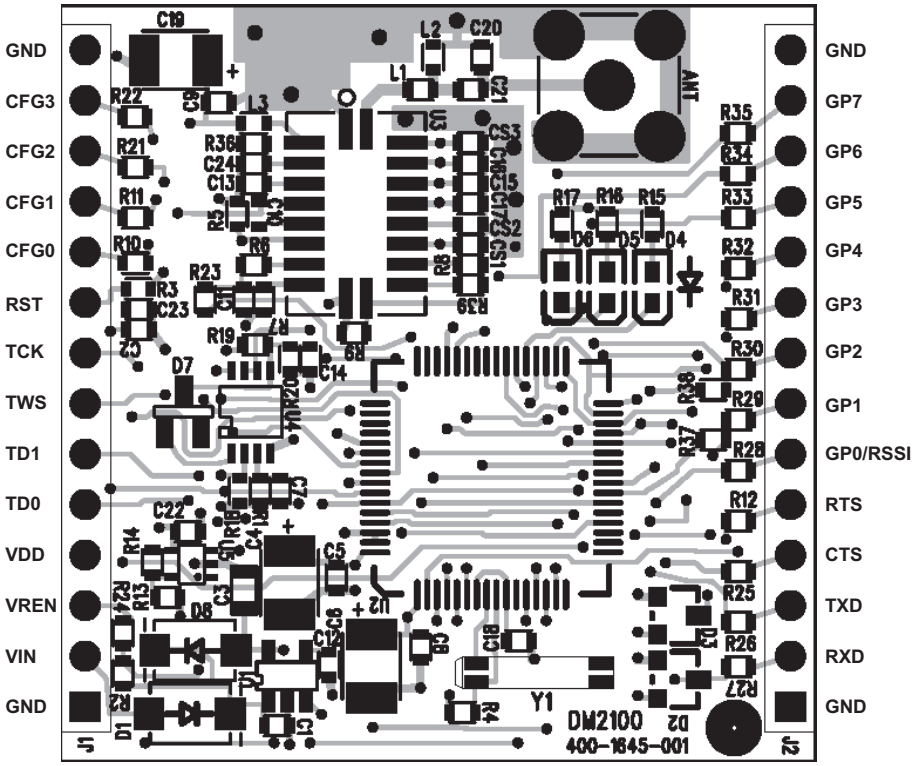
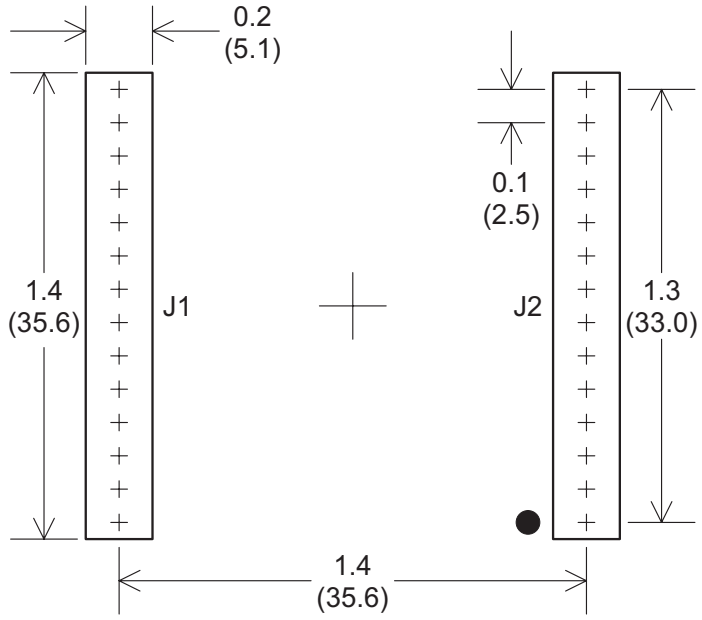


Figure 2

Pin	Name	Description
J2-10	GP4	This pin is a general purpose I/O pin. The default configuration of this pin is a logic input. The configuration of this pin can be changed by commands through the RF channel. Other configuration options include a logic output, or an analog-to-digital converter input. If this pin is unused, it may be reconfigured for a logic low output to minimize current. In this case, the pin must be left unconnected.
J2-11	GP5	This pin is a general purpose I/O pin. The default configuration of this pin is a logic input. The configuration of this pin can be changed by commands through the RF channel. Other configuration options include a logic output, or an analog-to-digital converter input. If this pin is unused, it may be reconfigured for a logic low output to minimize current. In this case, the pin must be left unconnected.
J2-12	GP6	This pin is a general purpose I/O pin. The default configuration of this pin is a logic input. The configuration of this pin can be changed by commands through the RF channel. Other configuration options include a logic output, or an analog-to-digital converter input. If this pin is unused, it may be reconfigured for a logic low output to minimize current. In this case, the pin must be left unconnected.
J2-13	GP7	This pin is a general purpose I/O pin. The default configuration of this pin is a logic input. The configuration of this pin can be changed by commands through the RF channel. Other configuration options include a logic output, or an analog-to-digital converter input. If this pin is unused, it may be reconfigured for a logic low output to minimize current. In this case, the pin must be left unconnected.
J2-14	GND	This pin is connected to ground.

DM2100 Interface Connector
PCB Layout Detail



Connectors are FCI Electronics 66951-Y13 or equivalent
Dimensions in inches and (mm)

Figure 3

Note: Specifications subject to change without notice.

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