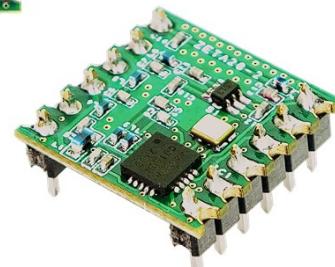




+20dBm RF Transceiver

Features

- TINY form factor: 16mm x 16mm
- 4Km range, optimised RF matching
- Low cost and high performance
- Frequency - 868MHz
- +20dBm TX power
- 1.8V – 3.6V power supply
- Low power consumption
 - 50nA Standby
 - 13mA Rx
 - 85mA Tx @ 20dBm
- EZRadio™ from Silicon Laboratories
- High sensitivity -129Bm (@ 2.4kbps)
- Max data rate 1Mbps
- TX and RX 64 byte FIFO
- Integrated battery voltage sensor
- Integrated Temperature sensor
- Packet handling:
 - Preamble
 - Sync word detection
 - CRC
- Based on Silicon Labs' Si4463 chipset
- 2.54mm pitch for easy prototyping



Intended Use

- Home automation
- Sensor networks
- Telemetry
- IOT
- Mesh networking

Description

The ZETA20 modules are extremely cost effective and high performance radio module based on the Silicon Labs Si4463. Supplied in a miniature surface mount or DIL package this transceiver module can transmit/receive at up to 1Mbps over a range up to 4,000m.

This module including crystal, RF Changeover switch, impedance matching network and track layout provide a simple digital interface and direct antenna connection. This enables a plug in RF solution with maximum efficiency. Programming of the module is via SPI interface.

The module contains a highly efficient Impedance matching network with RF Switch delivering a full +20dBm at the pin of the module (unlike many other modules where the power is lost from the IC to the module output). These modules will suit one-to-one or multi-node wireless links in applications including car and building security, POS and inventory tracking, remote process monitoring.

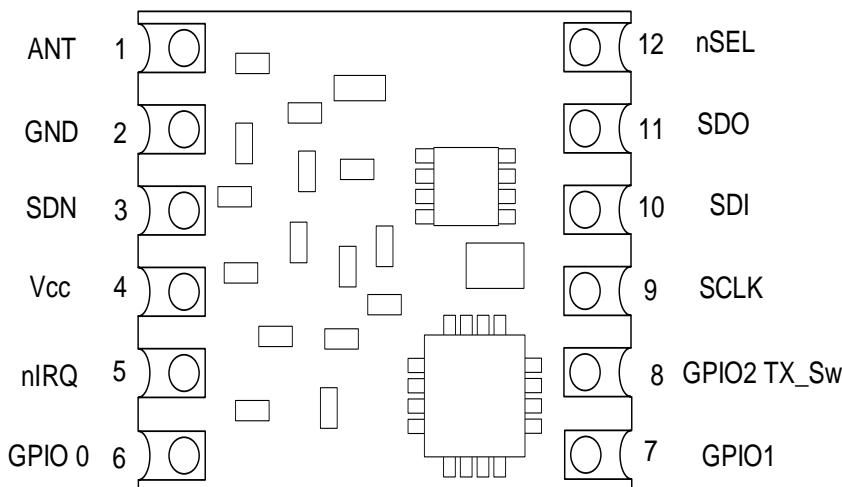
Ordering information

Part Number	Description
ZETA20-8S	FM Transceiver module, optimised for 868MHz
ZETA20-8D	DIP FM Transceiver module, optimised for 868MHz

ZETA20 RF Transceiver



Pin Description

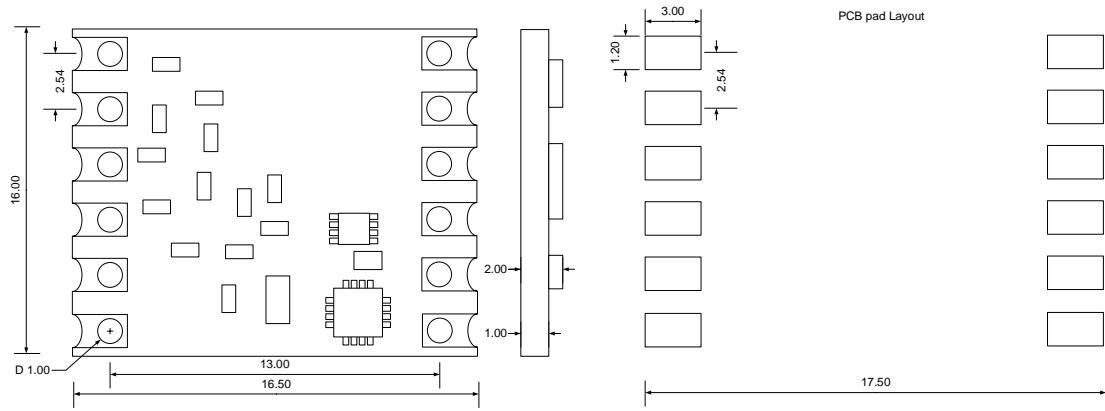


PIN	Definition	Type	Function
1	Antenna connection	In/Out	Antenna pin connection. Keep short and match to 50ohms for best performance
2	GND	In	Ground connection
3	Shutdown	In	The shutdown state is the lowest current consumption state of the device and is entered by driving SDN high. In this state, all register contents are lost and there is no SPI access. Drive low to exit for normal operation
4	Vcc	In	Power Supply connection
5	Interrupt	Output	Active Low Interrupt Status Output – Read interrupt status for event details E.g. The FIFO on the ZETA module contains data
6, 7	GPIO 0, 1	In / Out	General Purpose I/O can be configured by Si4463 to provide additional functions e.g MCU Clock output, FIFO Status, POR, Wake timer, Low Batt Detect, etc
8	GPIO 2	Out	Used with Si4463 GPIO 3 to control the RF Switch to Transmit or Receive. GPIO 2 controls TX GPIO 3 controls RX
9	Serial clock	In	Serial Clock Input (0 – VDD V): Provides serial data clock for 4-line serial data bus Data is clocked on the Positive edge transition
10	Serial data In	In	Serial Data Input (0 – VDD V): Serial data stream input for 4-line serial data bus
11	Serial data Out	Out	Serial Data Output (0 – VDD V)
12	Serial interface select	In	Serial Interface Select Input (0 – VDD V): Provides select/enable function for 4-line serial data bus.

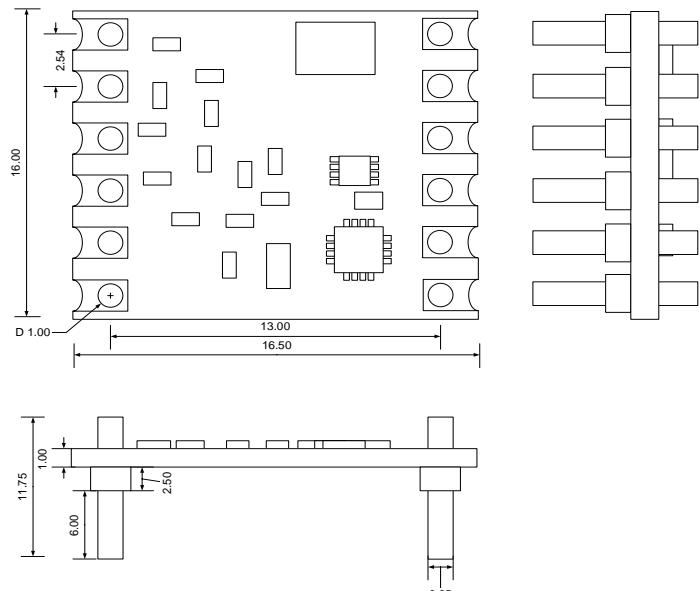
ZETA20 RF Transceiver



SO mechanical dimensions



DIP mechanical dimensions



Electrical parameters

Absolute maximums

Symbol	Parameter	Minimum	Maximum	Unit
V_{dd}	Positive power supply	-0.3	+3.6	V
V_{in}	Voltage on digital inputs	-0.3	$V_{dd}+0.3$	V
V_{in}	Voltage on analogue inputs	-0.3	$V_{dd}+0.3$	V
RX	Max RX input power		+10	dBm
T_{op}	Operating temperature	-40	+85	°C
T_{st}	Storage temperature	-55	125	°C

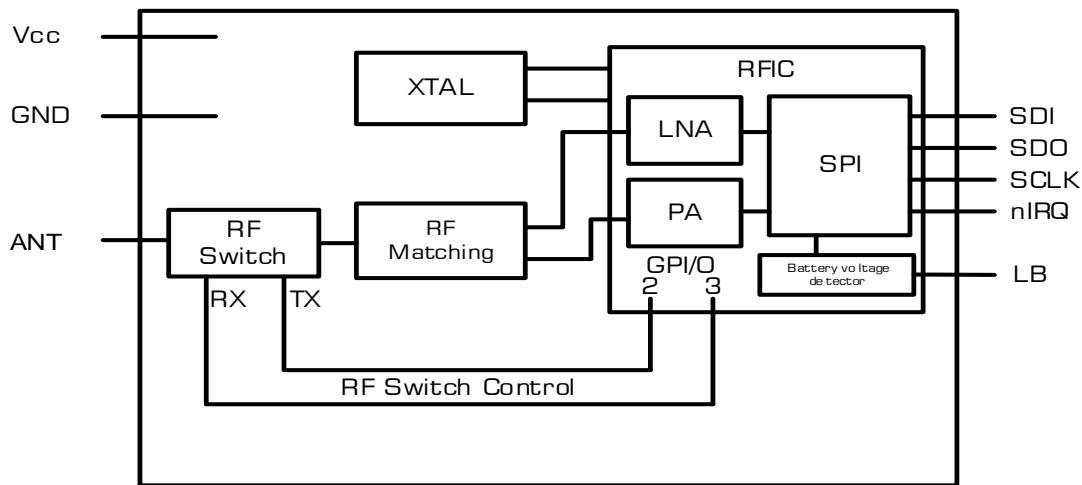
Recommended working range

Symbol	Parameter	Minimum	Maximum	Unit
V_{dd}	Positive power supply	1.8	3.6	V
T_{op}	Working temperature	-40	+85	°C

ZETA20 RF Transceiver



Block diagram

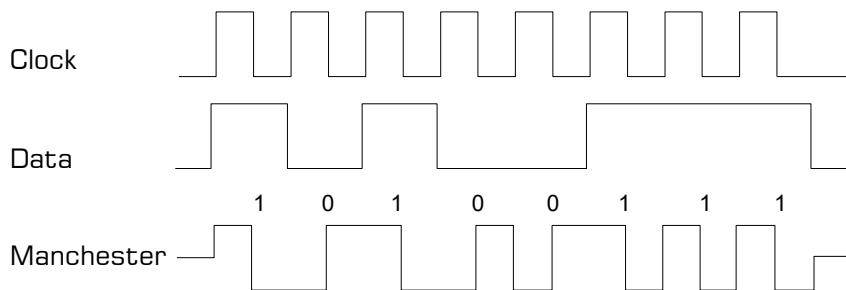


Description

The ZETA20 incorporates a high performance RFIC (Si4463) allowing high data rates and great receive sensitivity. With this powerful RFIC combined with the expert knowledge in RF matching from RF Solutions, ZETA20 is a module with industry leading specifications, such as size and price versus performance.

Additional module features, such as 64-byte TX/RX FIFOs, preamble detection, sync word detector, and CRC, reduce overall current consumption and allow for the use of lower-cost system MCUs.

The ZETA20 comes enabled with Manchester Coding. This method provides a state transition at each bit and so allows for more reliable clock recovery. Manchester Code is used in conjunction with the packet handler option and will be applied to the entire packet (the preamble pattern is set to continuous "1" if therefore, the chip rate of the resulting preamble pattern is the same as for the rest of the packet).



RF Switch Control

The ZETA20 module contains an RF switch to automatically connect the antenna to the TX circuit or the RX Circuit. The RF Switch is controlled by GPIO 2 (TX) and GPIO 3 (RX) Directly from the Si4463.

Operation of the RF switch is autonomous after configuration of the GPI/O control Register. The control Register should be set to XXXXXXXXXXXXXXXXXXXXXXXXX

ZETA20 RF Transceiver



Absolute maximum ratings

Parameter	Value	Unit
V_{DD} to GND	-0.3, +3.6	V
Voltage on digital control inputs	-0.3, $V_{DD} + 0.3$	V
Voltage on analog inputs	-0.3, $V_{DD} + 0.3$	V
RX input power	+10	dBm
Operating ambient temperature range T_A	-0 to +55	°C
Storage temperature range T_{STG}	-40 to +125	°C

Recommended operating conditions

Parameter	Symbol	Test condition	Min	Typ.	Max	Unit
Ambient Temperature	T_A		-40	25	85	°C
Supply Voltage	V_{DD}		1.8		3.6	V
I/O Drive Voltage	V_{GPIO}		1.8		3.6	V

DC characteristics

Parameter	Symbol	Test condition	Min	Typ.	Max	Unit
Supply voltage range	V_{DD}		1.8	3.3	3.6	V
Power saving modes	$I_{Shutdown}$	RC oscillator, main digital regulator, and low power digital regulator OFF.	—	30	—	nA
	$I_{Standby}$	Register values maintained.	—	50	—	nA
	I_{Ready}	Crystal oscillator and main digital regulator ON, all other blocks OFF.	—	0.9	—	mA
TUNE mode current	I_{Tune_RX}	RX tune	—	7.2	—	mA
	I_{Tune_TX}	TX tune	—	8.0	—	mA
RX mode current	I_{RX}		—	10	—	mA
TX mode current	I_{TX}	+10 dBm output power, 868 MHz	—	13	—	mA
		+20 dBm output power, 868 MHz	—	85	—	mA

Synthesiser AC electrical characteristics

Parameter	Symbol	Test condition	Min	Typ.	Max	Unit
Synthesizer frequency Range	F_{SYN}		860	—	869	MHz
Synthesizer frequency Resolution	$F_{RES-868}$	850–870 MHz	—	114.4	—	Hz

ZETA20 RF Transceiver



Receiver AC electrical characteristics

Parameter	Symbol	Test condition	Min	Typ.	Max.	Unit
RX frequency range	F_{RX}		850	—	870	MHz
RX sensitivity	P_{RX_5}	(BER < 0.1%) (500bps, GFSK, BT= 0.5, DF = ±250Hz)	—	-126	—	dBm
	P_{RX_40}	(BER < 0.1%) (40Kbps, GFSK, BT= 0.5, DF = ±20KHz)	—	-110	—	dBm
	P_{RX_100}	(BER < 0.1%) (100Kbps, GFSK, BT= 0.5, DF = ±50KHz)	—	-106	—	dBm
	P_{RX_OOK}	(BER < 0.1%, 4.8 kbps, 350kHz Rx BW, OOK, PN15 data)	—	-113	—	dBm
		(BER < 0.1%, 40 kbps, 350kHz Rx BW, OOK, PN15 data)	—	-104	—	dBm
RX channel bandwidth	BW		1.1	—	850	kHz
BER variation vs power Level	P_{RX_RES}	Up to +5 dBm Input Level	—	0	0.1	ppm
RSSI resolution	RES_{RSSI}		—	±0.5	—	dB
±1-Ch offset selectivity	C/I_{1-CH}	Desired Ref Signal 3 dB above sensitivity, BER < 0.1%. Interferer is CW and desired modulated with 1.2 kbps, DF = 5.2 kHz, GFSK with BT= 0.5, RX BW = 58 kHz chan-	—	-60	—	dB
±2-Ch offset selectivity	C/I_{2-CH}		—	-58	—	dB
Blocking 1 MHz offset	$1M_{BLOCK}$	Desired ref signal 3 dB above sensitivity, BER < 0.1%. Interferer is CW and desired modulated with 1.2 kbps DF = 5.2 kHz GFSK with BT = 0.5, RX channel BW = 4.8KHz	—	-75	—	dB
Blocking 8 MHz offset	$8M_{BLOCK}$		—	-84	—	dB
Image rejection	Im_{REJ}	Rejection at the image frequency IF = 468 kHz	—	-35	—	dB

ZETA20 RF Transceiver



Transmitter and General electrical characteristics

Parameter	Symbol	Test condition	Min	Typ	Max	Unit
TX frequency range	f_{TX}		850	—	870	MHz
(G)FSK data rate	DR_{FSK}		0.1	—	500	kbps
OOK data rate	DR_{OOK}		0.2	—	120	kbps
Modulation deviation range	Df_{960}	850–870 MHz	—	—	1500	kHz
Modulation deviation resolution	FRES_{960}	850–870 MHz	—	28.6	—	Hz
Output power range	P_{TX}		-20	—	+20	dBm
TX RF output steps	DP	Using switched current match within 6 dB of max power	—	0.1	—	dB
TX RF output level variation vs. temperature	$\text{DP}_{\text{RF_TEMP}}$	-40 to +85 °C	—	1	—	dB
TX RF output level Variation vs. frequency	$\text{DP}_{\text{RF_FREQ}}$	Measured across 850–870 MHz	—	0.5	—	dB
Transmit modulation filtering	B*T	Gaussian filtering bandwidth time product	—	0.5	—	
Temperature Sensor Sensitivity	TSs			4.5		ADC Codes DegC
Low Battery Resolution	LBDres			50		mV

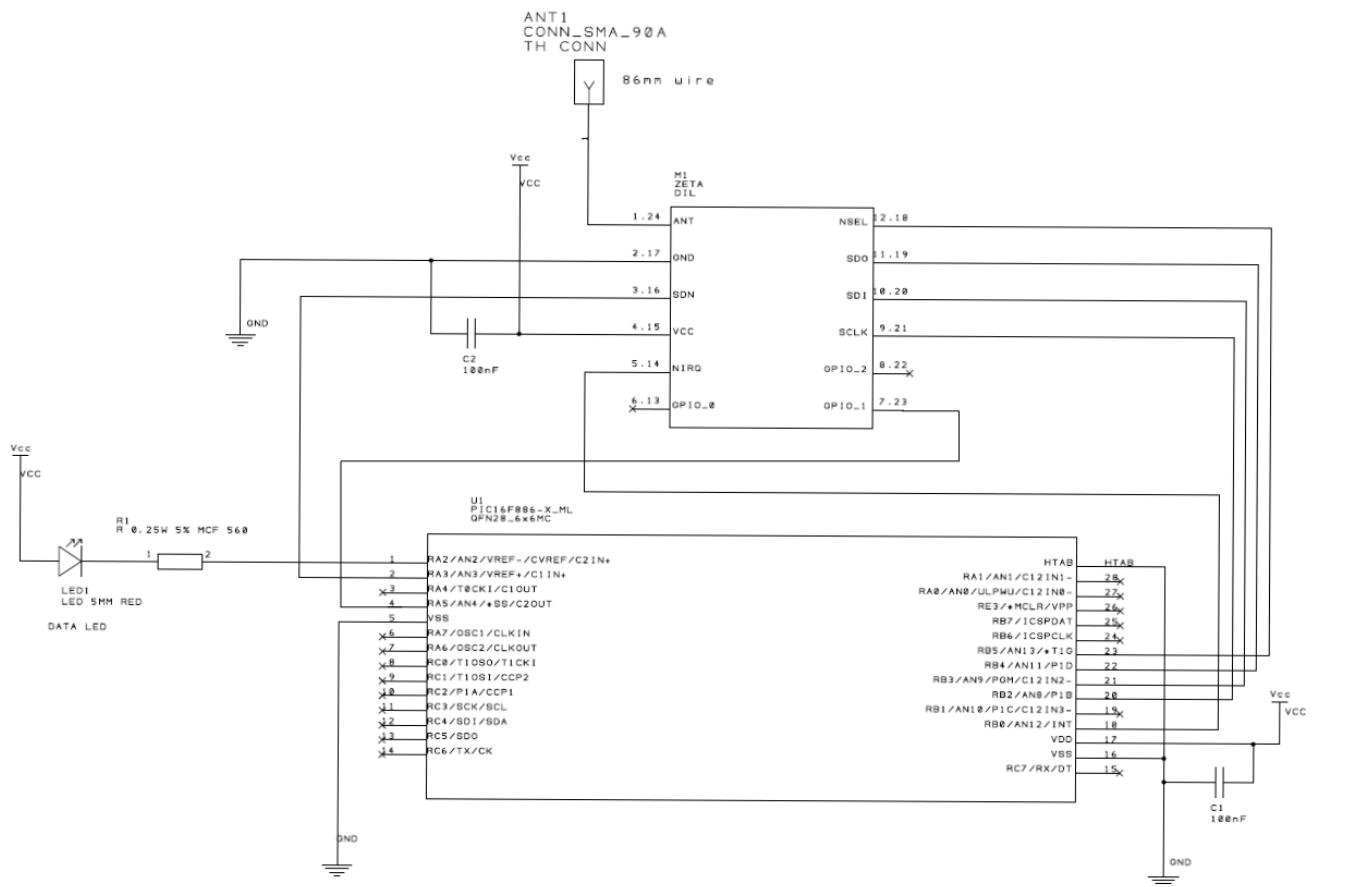
Auxiliary block specifications

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
POR Reset Time	t_{POR}		—	—	5	ms
Crystal frequency tuning	Hex			52		
Tolerance	PPM			+/- 10		

ZETA20 RF Transceiver



Generic application schematic - PIC16F886 micro controller



We have created some base level code to show the basic settings and register values required to get the ZETA module working: This code is created for a Microchip™ PIC 16F886 (as configured in the application schematic below) but the values should be extractable for other devices.

<http://www.rfsolutions.co.uk/downloads/zeta.php>

ZETA20 RF Transceiver



Antenna Control Via RF Switch

The ZETA20 module contains an RF switch to automatically connect the antenna to the TX / RX Circuit. The RF Switch is controlled by GPI/O2 and GPI/O3 of the Si4463.

The RF Switch configuration can be set using the WDS program located in the example folder, which also includes a preset configuration file used in the example code.

This gives a bit more detail on how the RF GPIO Pins are configured:

Radio Configuration Application

1. Select project

Name	B	C	D	G
Empty framework	+	-	-	+
Unmodulated carrier	+	-	-	+
PN9	+	-	-	+
Standard packet TX	+	-	-	+
Standard packet RX	+	-	-	+

Description:
The main purpose of this Project is to generate a source code that contains the radio_config.h file with all the necessary API and property settings for the desired radio and packet related settings. It does not contain... [more](#)

2. Configure project

Frequency and power | RF parameters | Packet | Interrupts | **GPIO and FRR**

GPIO
Enable pullup

GPIO 0: DONOTHING - Behavior of this pin is not modified.

GPIO 1: CTS - Clear To Send signal. This output goes high when the command I

GPIO 2: TX_STATE - This output is set high while in TX state and is low otherwise.

GPIO 3: RX_STATE - This output is set high while in RX state and is low otherwise.

NIRQ: DONOTHING - Do not modify the behavior of this pin.

SDO: DONOTHING - Do not modify the behavior of this pin.

Drive strength: GPIOs configured as outputs will have highest drive strength.

Fast Response Registers

Fast Response Register A: Disabled. Will always read back 0

Fast Response Register B: Disabled. Will always read back 0

Fast Response Register C: Disabled. Will always read back 0

Fast Response Register D: Disabled. Will always read back 0

3. Deploy project

Create batch | Configure&evaluate | Download project | **Generate source**

Device: Si4463 Simulation | Chip Revision: C2 | Ready for deployment

This configuration creates the following string of bytes which can be seen by clicking generate source:

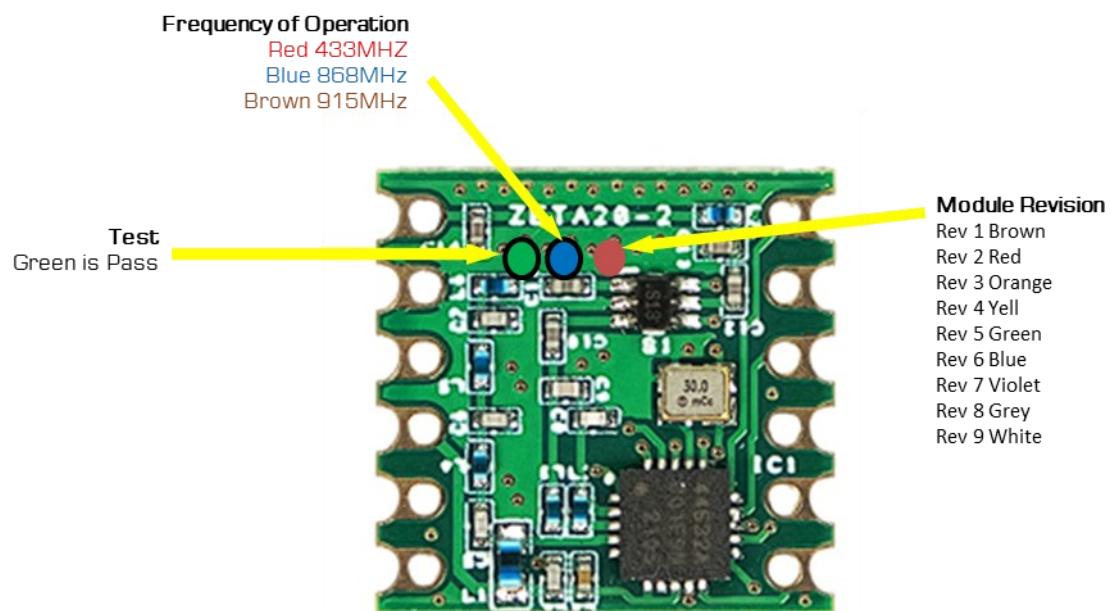
```
/*
// Command:      RF_GPIO_PIN_CFG
// Description:  Configures the GPIO pins.
*/
#define RF_GPIO_PIN_CFG 0x13, 0x00, 0x08, 0x20, 0x21, 0x00, 0x00, 0x00
/*
```

Once configured, when placed into transmit mode or receive mode the switch will automatically be changed without the need for further commands to be sent, or require external control of the switch.

ZETA20 RF Transceiver



ZETA20 module Version Identification

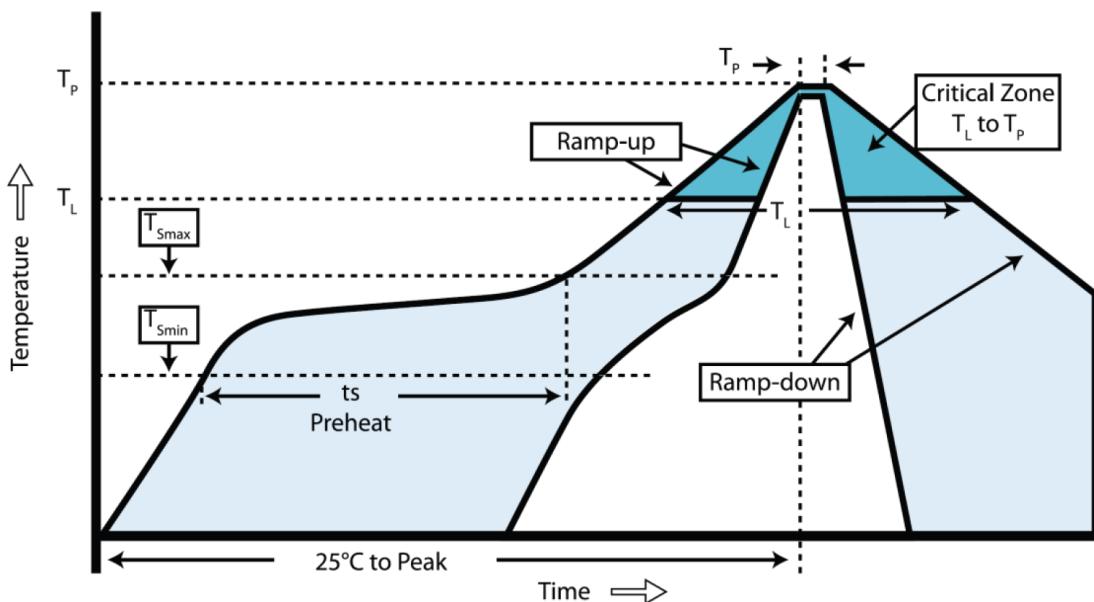


ZETA20 Revision Change History			
Part	New Revision	Date	Change / Fix
ZETA20-8S	1	1/5/22	Product Launch

ZETA20 RF Transceiver



ZETA20 module re-flow guide



ZETA20 is a 2 layer PCB, re-flow is based on IPC/JEDEC JSTD020C July 2004

Profile feature	Value (lead free)
Ramp up rate	3°C /s
Pre-heat temperature	
- Temperature Min (T_{Smin})	150°C
- Temperature Max (T_{Smax})	200°C
- Pre-heat time	60-100s
Peak temperature (T_p)	240°C
Time at T_p	10-20sec
Ramp down rate	6°C/s
Time from 25°C to peak	8 mins max.

Important European compliance information

This RF Solutions radio module meets the essential requirements of the European Radio Equipment Directive 2014/53/EU and has been tested to European Harmonised Standards and CE marked where space allows. A copy of the EU Declaration of Conformity can be located on the RF Solutions Website,

www.rfsolutions.co.uk/certification-i59.

When using the module in an end product, continued compliance can only be assured by incorporating the module in accordance with RF Solutions specific installation instructions and in accordance with the published information on the RF Solutions product data sheet.

Article 3.1a and 3.1b of the EU Radio Equipment Directive 2014/53/EU should be assessed in the final product.

Failure to follow this guidance may result in a non-compliant product being placed on the European Market, for which RF Solutions cannot accept any responsibility.

Further guidance may be obtained from RF Solutions Technical Support.

ZETA20 RF Transceiver



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