ZETA Codec RF SPI interface

Features

- RF gateway via SPI interface
- No configuration necessary
- Simple SPI bus comms over RF
- Miniature 3mm^2 package
- Range up to 2km
- RF data rates to 500Kbps
- No external components
- Low voltage 1.8 - 3.6V
- Low BOM cost
- Fast and effective RF development

Applications

- Remote networking
- USB/RS232 cable replacement
- Remote data log
- Meter reading

16mm

Description

The ZETA Codec chipset is an ultra simple way to communicate wirelessly without the hassle research required to configure hundreds of registers and layout an RF matching network.

Combine the ZETA Codec with RF Solutions' low cost ZETA module using your chosen frequency and start sending and receiving data without any the RF knowledge using an SPI interface for simple and robust communication.
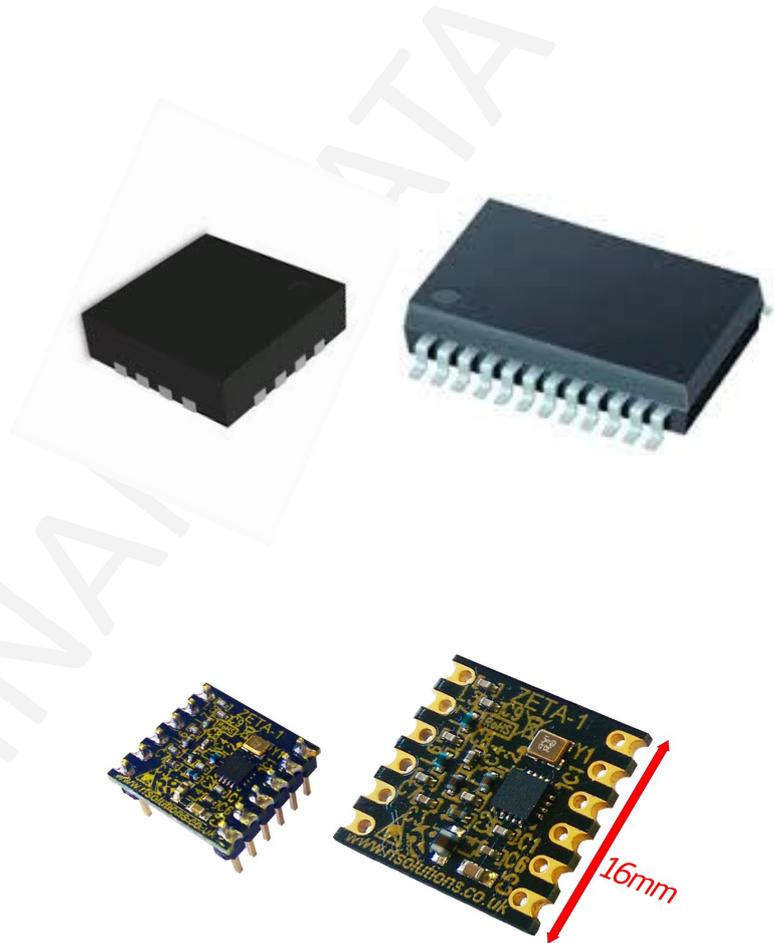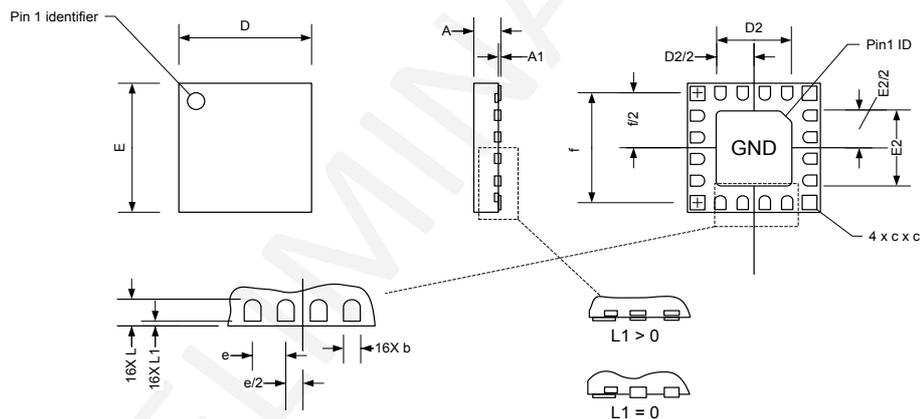
Ordering Information

Part No	Description
IC-ZETA-QFN	Codec IC for ZETA module SMT QFN package
IC-ZETA-QSOP	Codec IC for ZETA module QSOP package

FM76316

ZETA Codec

Connections - QFN package
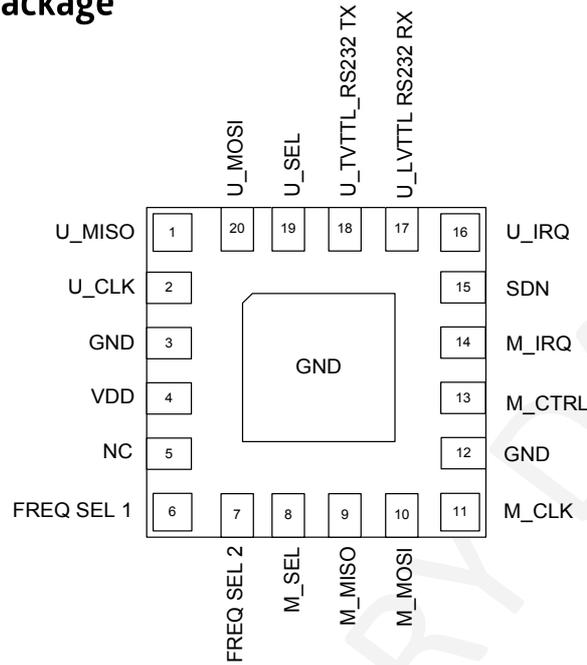
Mechanical dimensions

Dimension	Min.	Typ.	Max.
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
b	0.20	0.25	0.30
c	0.27	0.32	0.37
D		3.00 BSC	
D2	1.60	1.70	1.80
e		0.50 BSC	
E		3.00 BSC	
E2	1.60	1..70	1.80
f		2.53 BSC	
L	0.30	0.40	0.50
L1	0.00	-	0.10

ZETA Codec

Connections - QSOP package

```
U_MOSI    1            24   U_SEL
U_MISO    2            23   U_LVTTL_RS232 TX
U_CLK     3            22   U_LVTTL_RS232 RX
NC        4            21   U_IRQ
GND       5            20   SDN
VDD       6            19   M_IRQ
             24pin QSOP
NC        7            18   M_CTRL
NC        8            17   M_CLK
NC        9            16   M_MOSI
NC       10            15   M_ISO
FREQ SEL 1  11         14   M_SEL
FREQ SEL 2  12         13   NC
```
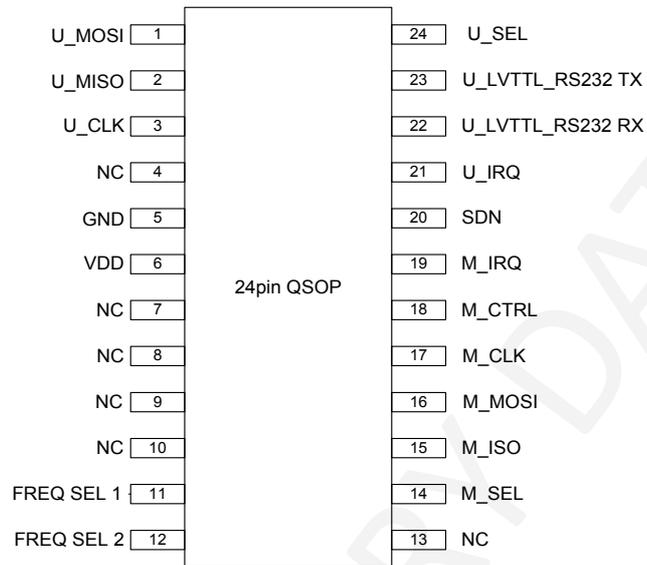
Mechanical dimensions

Dimension	Min.	Typ.	Max.
A	-	-	1.75
A1	0.10	-	0.25
b	0.20	0.25	0.30
c	0.10	-	0.25
D	8.25 BSC		
E	6.00 BSC		
E1	3.90 BSC		
e	0.635 BSC		
L	0.40	-	1.27

ZETA Codec

Pin Description

Pin No		Name	Direction	Description
QFN	QSOP			
1	2	U_MISO	Output	SPI bus - Master Input Slave Output. Output to controlling master IC
2	3	U_CLK	Input	SPI bus - Clock signal from master controlling micro
3,12	5	GND	-	Ground connection(s)
4	6	VDD	Input	Power input 2.2 - 3.6V
5	4, 7-10, 13	NC		Do not connect
6,7	11,12	FREQ SEL 1/2	Input	Frequency Select to allow operation with ZETA 433, 868 and 915MHz variants.
8	14	M_SEL	-	Connect to ZETA module: pin 12 (Codec to ZETA module SPI bus)
9	15	M_MISO	-	Connect to ZETA module: pin 11 (Codec to ZETA module SPI bus)
10	16	M_MOSI	-	Connect to ZETA module: pin 10 (Codec to ZETA module SPI bus)
11	17	M_CLK	-	Connect to ZETA module: pin 9 (Codec to ZETA module SPI bus)
13	18	M_CTRL	-	Connect to ZETA module: pin 7 (Codec to ZETA module SPI bus)
14	19	M_IRQ	-	Connect to ZETA module: pin 5 (Codec to ZETA module SPI bus)
15	20	SDN	-	Shutdown pin for sleep on both ZETA module and ZETA CODEC
16	21	U_IRQ	Output	SPI bus - data ready interrupt Active Low
17	22	U_LVTTL RX	Input	Low Voltage TTL level (3.3V) RS232 data
18	23	U_LVTTL TX	Output	Low Voltage TTL level (3.3V) RS232 data
19	24	U_SEL	Input	SPI bus chip select Active Low
20	1	U_MOSI	Input	SPI bus, Master Output, Slave Input

ZETA Codec

Connections operational description

The ZETA Codec operates using a Serial Peripheral Interface (SPI) for synchronous, simple industry standard communication between two remote points. ZETA Codec makes designing RF into a circuit simpler and faster than ever before.

Simply pass data to the ZETA Codec using the SPI interface and it seamlessly transmits it to a remote counterpart where the data is made ready and extraction notification is given via an interrupt. No external peripheral components are required, simply connect the ZETA Codec to a ZETA RF module as shown the application circuit, add an antenna and start communicating wirelessly at ranges over 2km.

Additionally the ZETA Codec also contains an RS232 interface, via its LVTTL TX and RX pins, these allow point to point RS232 communication. This may be used instead of the SPI comms, but not as well as.

Pin description operation

SPI Interface to master IC: standard 4-line serial

SPI interface pins				
U_MISO	U_CLK	U_IRQ	U_SEL	U_MOSI

Simple command set to configure packet destination, number of bytes. See page 5 for details.

SPI interface to ZETA module						
M_SEL	M_SEL	M_ISO	M_MOSI	M_CTRL	M_IRQ	M_SDN

The ZETA Codec communicates with the ZETA module via SPI, passing data to the ZETA module in a ready ready to send via RF format. Only connection to the relevant pin on the ZETA module is required for these lines. The interface between the two is completely handled by the ZETA Codec and the ZETA module.

Shutdown / Sleep Mode for module and codec		
U_SDN	M_SDN	

The U_SDN pin is used to send the ZETA Module and the ZETA Codec into low power sleep mode. 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.
The M_SDN pin passes the state of the U_SDN pin to the module.

RS232 Connection and serial data		
U_LVTTL RX	U_LVTTL RX	

The RS232 connections operate in the same way as the SPI comms and use the same command set . The RS232 pins can be used as an alternative form of communication but not as well as the SPI comms.
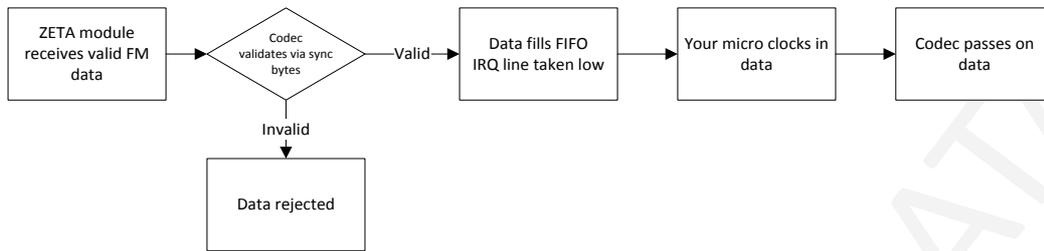For more information see page 8.

FREQUENCY Select pins		
FREQ SEL 1	FREQ SEL 2	

The two frequency selection pins are set such that they tell the CODEC chip which ZETA module it is to work with. Once configured the CODEC will change it's Transmit and Receive mode's altering the available channels to the start points given on pages 6 and 7. The below table defines the settings for each frequency:

	FREQ SEL1	FREQ SEL2
433MHz	NC	NC
868MHz	GND	NC
915MHz	NC	GND

SPI command set and interface

SPI bus flow diagram: receiving a data packet:

```
┌──────────────┐      ╱─────────╲              ┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│ ZETA module  │     ╱  Codec    ╲    Valid    │ Data fills   │      │ Your micro   │      │ Codec passes │
│ receives     │───▶│ validates via │────────▶│ FIFO IRQ line│─────▶│ clocks in    │─────▶│ on data      │
│ valid FM data│     ╲ sync bytes  ╱           │ taken low    │      │ data         │      │              │
└──────────────┘      ╲─────────╱              └──────────────┘      └──────────────┘      └──────────────┘
                          │
                       Invalid
                          ▼
                    ┌──────────────┐
                    │ Data rejected│
                    └──────────────┘
```

Packet structure:

#R	Packet length	RSSI*	Your data

* RSSI (Received Signal Strength Indicator) value is a single 8 bit byte with value 0 -255.
dBm conversion: (RSSI value/2)-130 = dBm

Example: received value 100 => (100/2)-130 = -80dBm

Mode selection:

Command for MODE select: #M 1-3		
Command	Name	Description
1	RX	The command enters RX mode using whichever settings were last configured using the #R command below.
2	Ready	Ready is a low power wake state which can be used for fast entry to RX or switching between TX and RX. Time to RX or TX from READY <1ms
3	Sleep	Low power sleep mode with register retention.

Example: Place the codec in receive mode

Command	#	M	1
ASCII	35	77	1

Receiver mode:

Command for RECEIVER select: #R CHANNEL, PACKET LENGTH		
Command	Name	Description
0-15	CHANNEL	Set in 250KHz increments starting at (FREQ SEL dependent): 433MHz: 868MHz: 915MHz:
1-65	PACKET LENGTH	Length of data packet to be sent in 8 bit bytes

Example: Enter receiver mode on channel 2 with a packet length of 10 (8 bit) bytes.

Command	#	R	2	10
ASCII	35	82	2	10

ZETA Codec

Transmit mode

Command for Transmit Mode: #S CHANNEL, PACKET LENGTH, DATA		
Command	Name	Description
0-15	Channel	Set in 250KHz increments starting at (FREQ SEL dependent): 433MHz: 868MHz: 915MHz:
1-64	Packet length	The length of the data packet to follow. In 8 bit bytes.
	Data	Your data to be transmitted.

Example: send a 13 byte packet on channel 2

Command	#	T	2	13	DATA
ASCII	35	82	2	13	Your 13 bytes

Sync bytes / addressing

Configure module sync bytes: Command: #A SNYC1, SYNC2, SYNC3, SYNC4		
Command	Name	Description
1-4	SYNC1-4	Sent sync bytes 1-4. The sync bytes appear directly after the pre-amble in data packet and can be used as a form of addressing to discriminate between required and spurious data. Set these bytes and the module will then only pass on data which contains the correct sync bytes configuration. Set all to AA if not required. NOTE: Reverse order bytes: ie 2D=B4, D4=2B

Example: Set the sync bytes to 12 34 56 78

Command	#	A	12	34	56	78
ASCII	35	65	12	34	56	78

RF baud rate

Configure the RF baud rate and FSK / GFSK: Command: #B 0-19			
Command	Name	Description	
1-19	Baud rate	FSK baud rates in kbps 0=2.4 FSK 1=4.8 FSK 2=9.6 FSK 3=19.2 FSK 4=38.4 FSK 5=50.0 FSK 6=96.0 FSK 7=128.0 FSK 8=256.0 FSK 9=500.0 FSK	GFSK baud rates in kbps 10=2.4 GFSK 11=4.8 GFSK 12=9.6 GFSK 13=19.2 GFSK 14=38.4 GFSK 15=50.0 GFSK 16=96.0 GFSK 17=128.0 GFSK 18=256.0 GFSK 19=500.0 GFSK

Example: Set the RF baud rate to 500kbps GFSK:

Command	#	B	19
ASCII	35	66	19

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Communication with the ZETA Codec via RS232.

RS232 configuration:
Baud rate: 56K
Data bits: 8
Parity: none
Stop bits: 1

RS232 in
Data is sent to the RX pin on the ZETA codec in standard RS232 format using the correct command set. A 50ms timeout exists to avoid lock-up if not all requested data bytes are sent - in this scenario the packet would be aborted and no data sent.

RS232 out
Data is output from the TX pin on the ZETA codec. At the same time the IRQ line is toggled to provide an interrupt if required.

PCB Layout and wave flow guide - 24pin QSOP
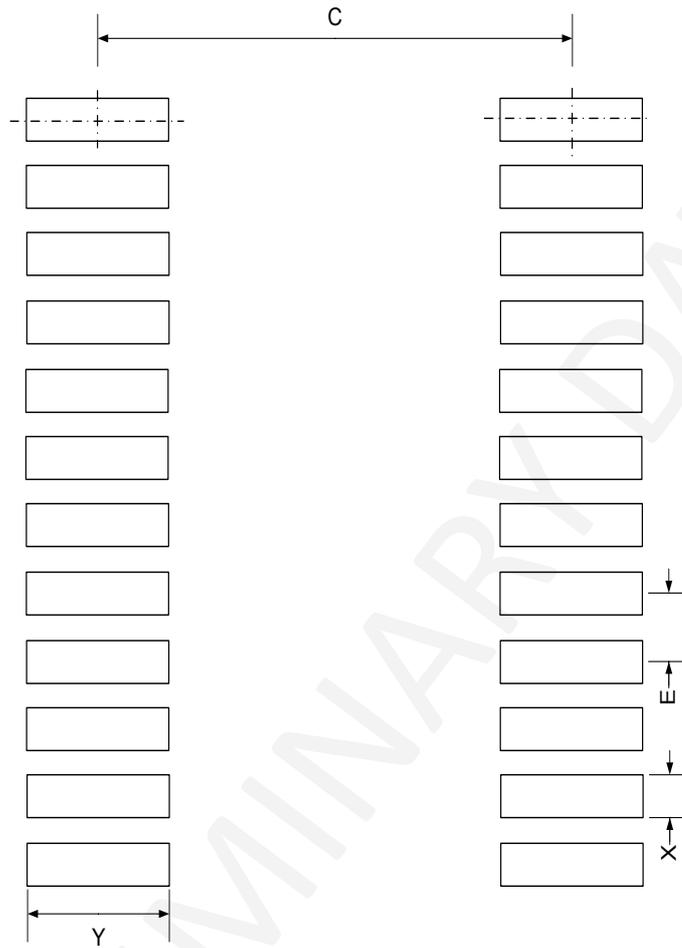
Dimension	Min.	Typ.	Max.
C	5.20	-	5.30
X	0.30	-	0.40
Y	1.50	-	1.60
E	0.635 BSC		

ZETA Codec

PCB Layout - 20pin QFN
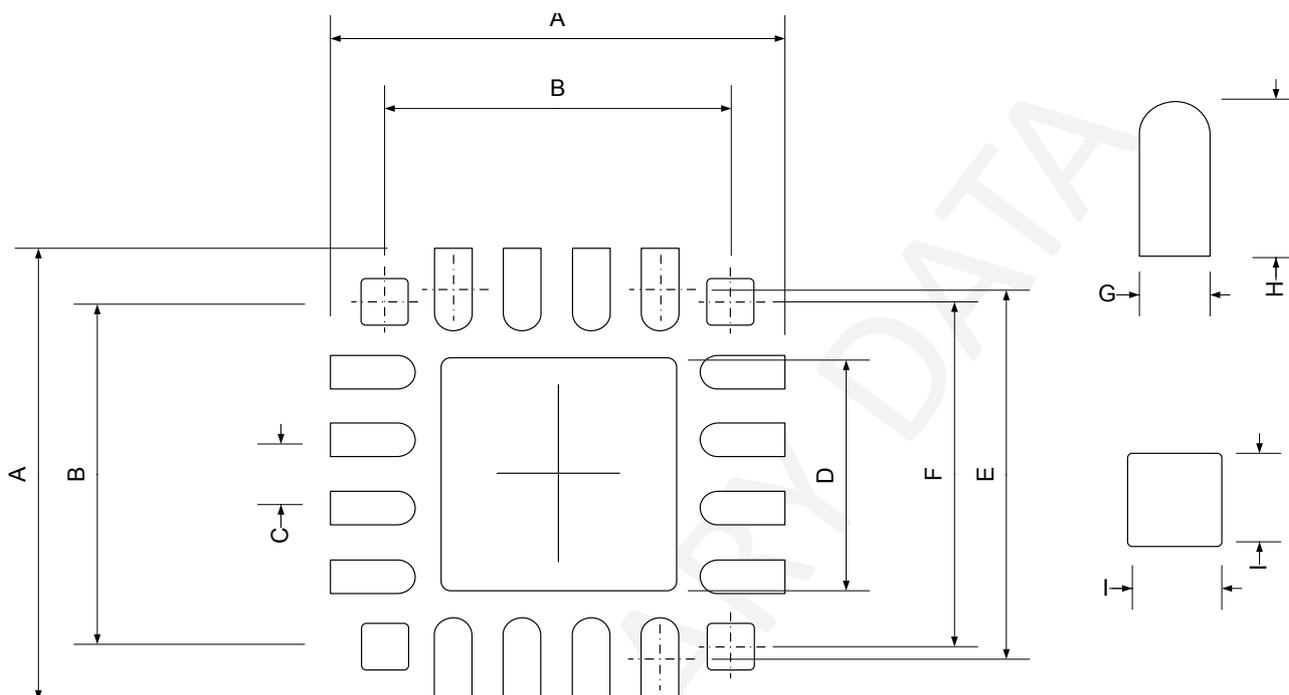
Dimension	Min.	Typ.	Max.
A	-	-	3.31
B		2.53 BSC	
C		0.50 BSC	
D	1.60	-	1.80
E		2.71 BSC	
F		2.53 BSC	
G		-	0.28
H		-	0.61
I		-	0.34

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ZETA Codec

Technical Specifications

Absolute Maximums:
Storage temperature range: −50 to +125°C.
Weight: XX

Parameter		Min	Max	Units
Voltage on any Input	Vcc > 2.2		5.8	V
	Vcc < 2.2		Vcc + 3.6	V
Max Input power (thro Antenna)			+10	dBm

DC Characteristics

Parameter	Min	Typical	Max	Units
Supply voltage	2.4	3	3.6	V
Operating temperature	-10		+55	°C
ZETA Codec TX supply current: When transmitting (At max power)				
ZETA Codec RX supply current: Receiving Sleeping Standby				

Example schematic for connection to ZETA Module (QFN Version)

LL RS232 to host

SPI to host

FREQUENCY BAND SELECT

ZETA Codec
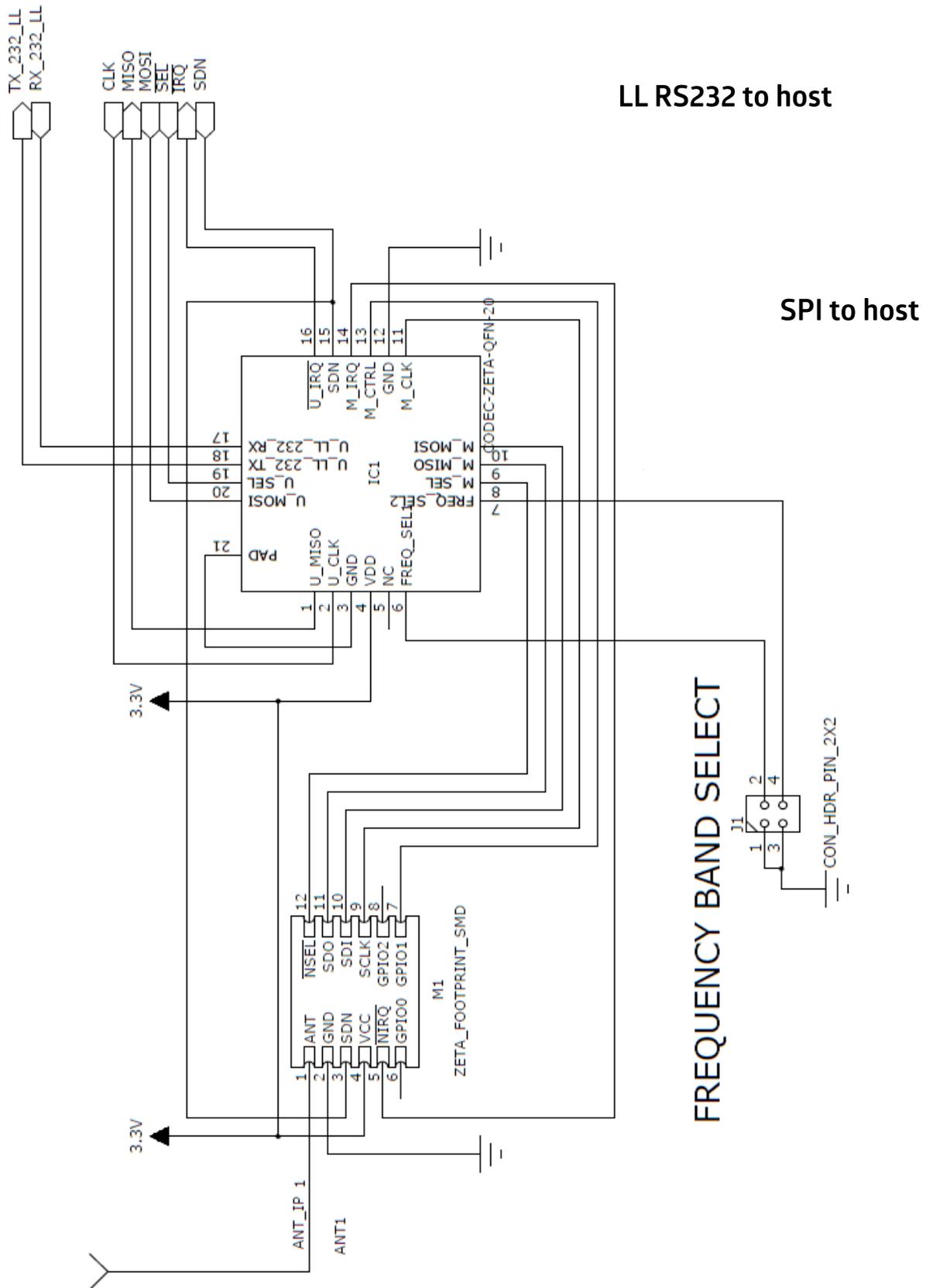
Example schematic for connection to ZETA Module (SSOP Version)

LL RS232 to host

SPI to host

FREQUENCY BAND SELECT

ZETA Codec
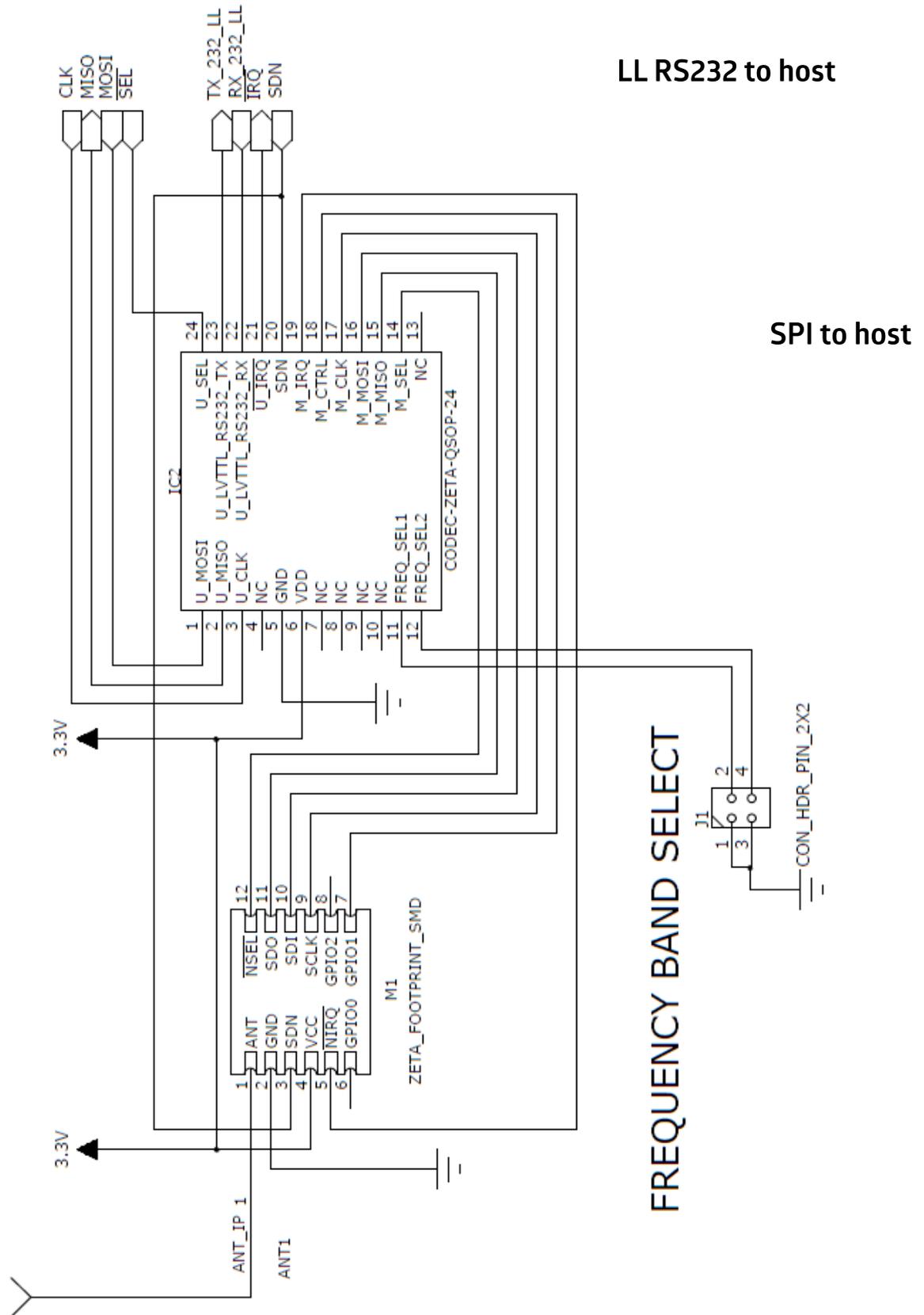
ZETA module and CODEC re-flow guide
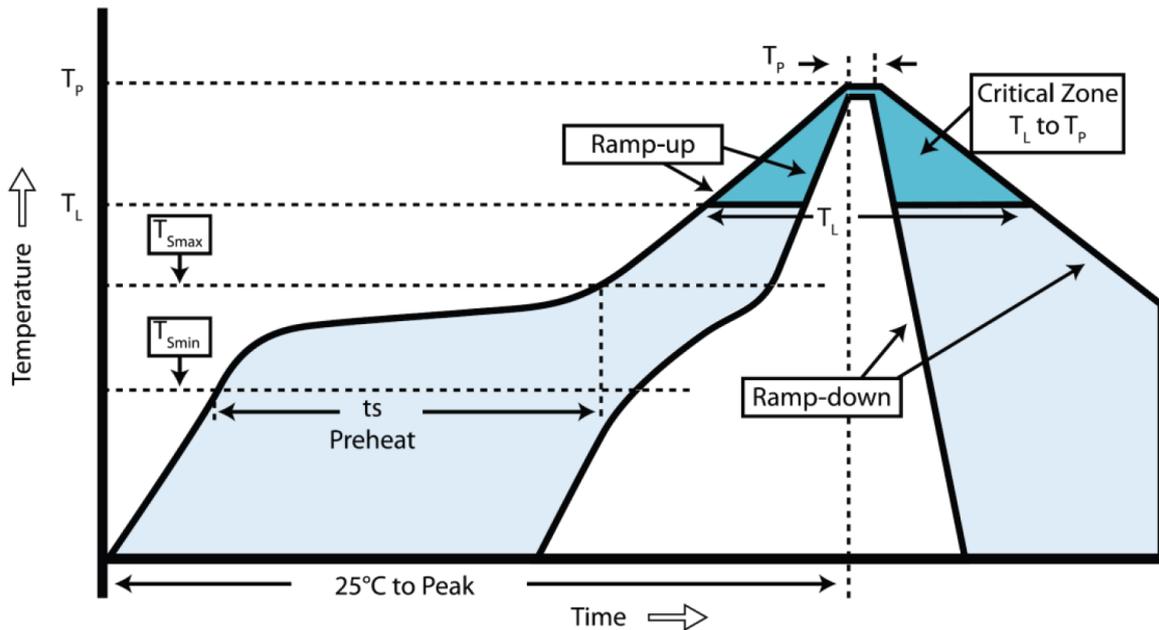
ZETA MODULE is a 2 layer PCB, re-flow is based on IPC/JEDEC JSTD020C July 2004

Profile feature	Value (lead free)
Ramp up rate	3^oC /s

Pre-heat temperature
   - Temperature Min (T_{Smin})
   - Temperature Max (T_{smax})
   - Pre-heat time
	150^oC
	200^oC
	60-100s

Peak temperature (T_P)	240^oC
Time at T_P	10-20sec
Ramp down rate	6^oC/s
Time from 25^oC to peak	8 mins max.

ZETA Codec

Range Testing

RF Solutions range tested the ZETA module using the CODEC chipset 2 range tests were carried out in different locations to prove the range consistently

Range test 1
Location: Ditchling Beacon, Sussex UK
Conditions: Light wind, overcast, dry.
Result: 2.2km (this is more than, would be expect in an urban environment).
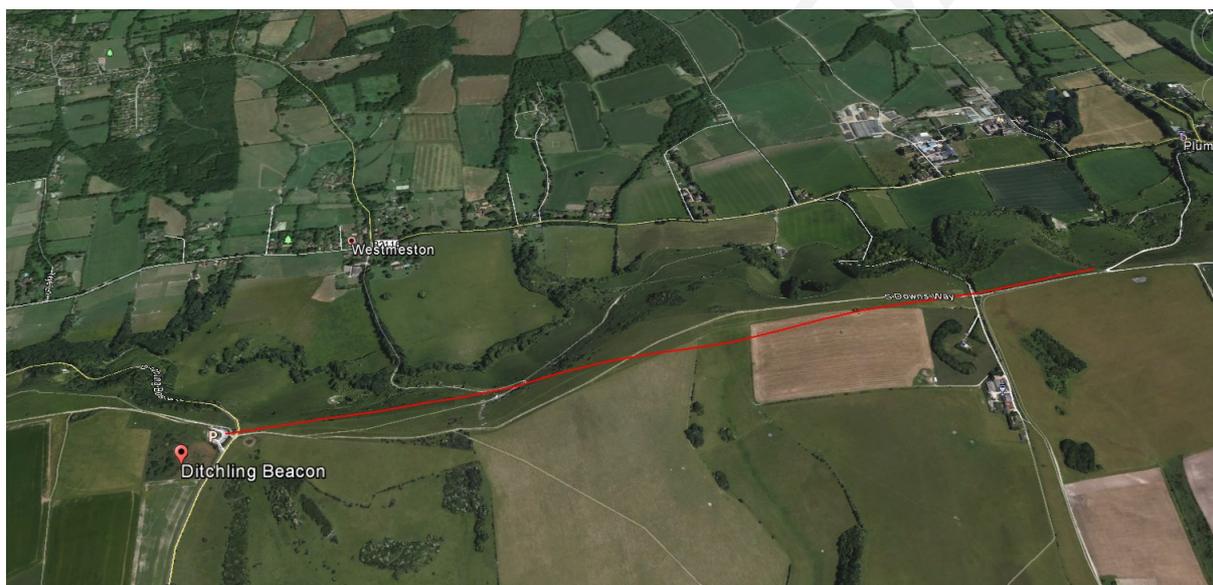
Range test 2
Location: Hove, Sussex, UK
Conditions: Light wind, overcast, dry.

ZETA Codec

Reader Response

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If you wish to provide your comments on organization, clarity, subject matter, and ways in which our documentation can better serve you, please email us your comments to the Technical Publications Manager

Application:
Would you like a reply? Y / N
Datasheet: DS-ZETA-CODEC-1

Questions:

1. What are the best features of this document?

2. How does this document meet your hardware and software development needs?

3. Do you find the organization of this document easy to follow? If not, why?

4. What additions to the document do you think would enhance the structure and subject?

5. What deletions from the document could be made without affecting the usefulness?

6. Is there any incorrect or misleading information (what and where)?

7. How would you improve this document?

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