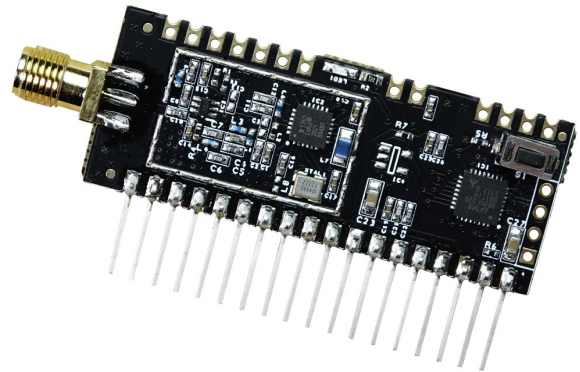
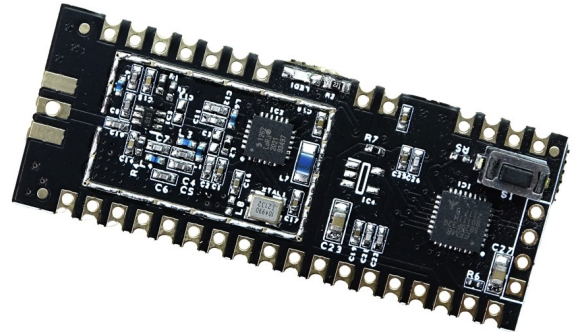




20Km Telemetry Module

Features

- Range 20Km+
- Transmit Power +22dBm
- Receive Sensitivity -148dBm
- 10 “No Volt” Switch inputs
- 10 Digital Switching outputs
- 1 x serial data output
- Map any I/P to any or many O/P's
- FSK / Spread Spectrum technology
- No external components
- Supply Voltage 1.8-3.6V or 3.6-15V
- Operates at 868 or 918MHz
- SIL version with SMAF connector
- 868MHz RED/ CE compliant



Intended Use

- Long Range Telemetry
- Remote Switching
- Embedded Remote Control
- Remote Sensors

Description

GAMMA62T Telemetry Module can be a Transmitter / Receiver / Transceiver based industrial bi-directional remote module. Two or more modules may be combined to provide a simple or complex network of radio telemetry. It can also be used in conjunction with any RF Solutions hand held transmitter operating on the same frequency to create an embedded Remote Control System.

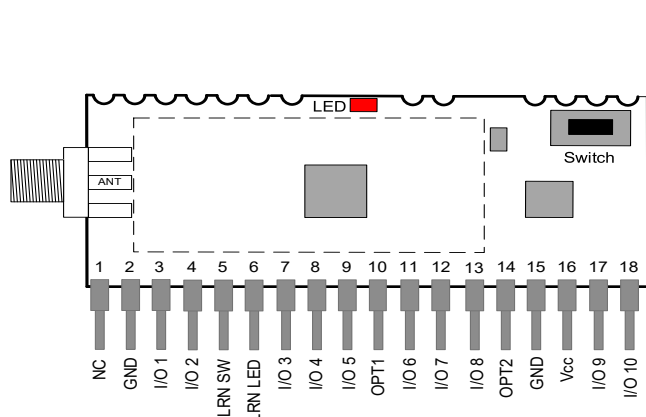
GAMMA62T is easy to use with direct no-volt Switch input and direct Switching outputs. GAMMA62T uses the latest OFDM, spread spectrum technology and extensive algorithm enhancements to achieve an industry leading 20+Km (12+mile) range.

Part Numbering 1.8 - 3.6V Version

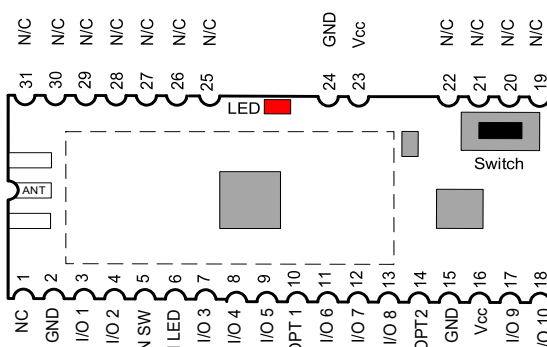
Part No	Description
GAMMA62T-89S	SMT package 868/918MHz
GAMMA62T-89D	SIL package 868/918MHz

Part Numbering 3.6 - 15V Version

Part No	Description
GAMMA62TR-89S	SMT package 868/918 MHz
GAMMA62TR-89D	SIL package 868/918MHz



GAMMA62 SIL version

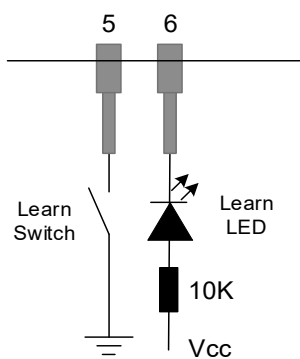


GAMMA62 S (SMT) version

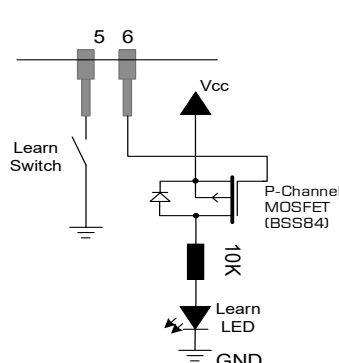
Operating Mode	OPT1 (pin10)	OPT2 (pin14)	Digital Inputs	Digital Outputs	Serial Output
Transmitter All I/O lines are dedicated as "no volt" digital inputs (open/closed contact switch)	NC	NC	10	-	
Receiver All I/O lines are dedicated as digital switching outputs.	NC	GND	-	10	
Transceiver Operates as a combination of 4 x "no volt" digital inputs and 4 x digital switching outputs, and 1 x Serial Data output.	GND	NC	4	4	1
Not Used	GND	GND			

Pin No	Name	Direction	Description
1	NC	-	Do not connect
2, 15, 24*	GND	In	Connect to ground (*SMT version only)
3, 4, 7, 8, 9, 11, 12, 13, 17, 18	I/O 1-10 Or OP1-4 and IP1-4	-	When configured as a transmitter: Pins 3, 4, 7, 8, 9, 11, 12, 13, 17, 18 Inputs are internally pulled high, active low When configured as a receiver: Pins: 3, 4, 7, 8, 9, 11, 12, 13, 17, 18 All outputs are internally pulled low, active high Maximum drive current per output 12.5mA (100mA total). Where configured as a transceiver: Pins: 3,4,7,8 outputs and pins 9, 11-13 inputs Inputs and outputs act as above. Pin:17 Configured as Serial TX Output Pin:18 Do Not Connect NOTE: due to hardware limitations I/O 9 and 10 cannot provide the "Acknowledgment" feature
5	SET SW	In	Internally pulled high, active low switch input. Connect to ground to activate. Operation directly matches the on board SET switch. Leave unconnected if not required.
6	LED	Out	Optional LED drive output which mirrors the on-board LED. See example LED drive circuit.
10, 14	OPT1 OPT2	In	Option links for module Operation Mode setting
16, 23*	Vcc	In	Supply voltage (*SMT version only)

Example External LED Drive



Standard version



Regulated version

Transmit Mode

GAMMA62 module configured as a transmitter

When configured as a transmitter the GAMMA62 module will automatically default to low power sleep mode. A change on any input(s) will cause the GAMMA62 to wake, read all inputs and initiate RF transmission, (multiple input changes may take place simultaneously).

On input assertion the module requires 5mS to wake then monitors the input for 2mSec before accepting Valid input. During the 2mSecs the input is continuously sampled and must remain activated to be read as 'valid assertion'

Maximum switching frequency is dependent on the LORA™ mode in which the GAMMA62 is operating see Configuring a GAMMA62 module for more information on LORA™ modes.

"No Volt" Digital inputs: High impedance inputs, LVCMOS/LVTTL compatible, 5V tolerant. Can be connected directly to CMOS/TTL logic or switch inputs connected to 0V or VCC.

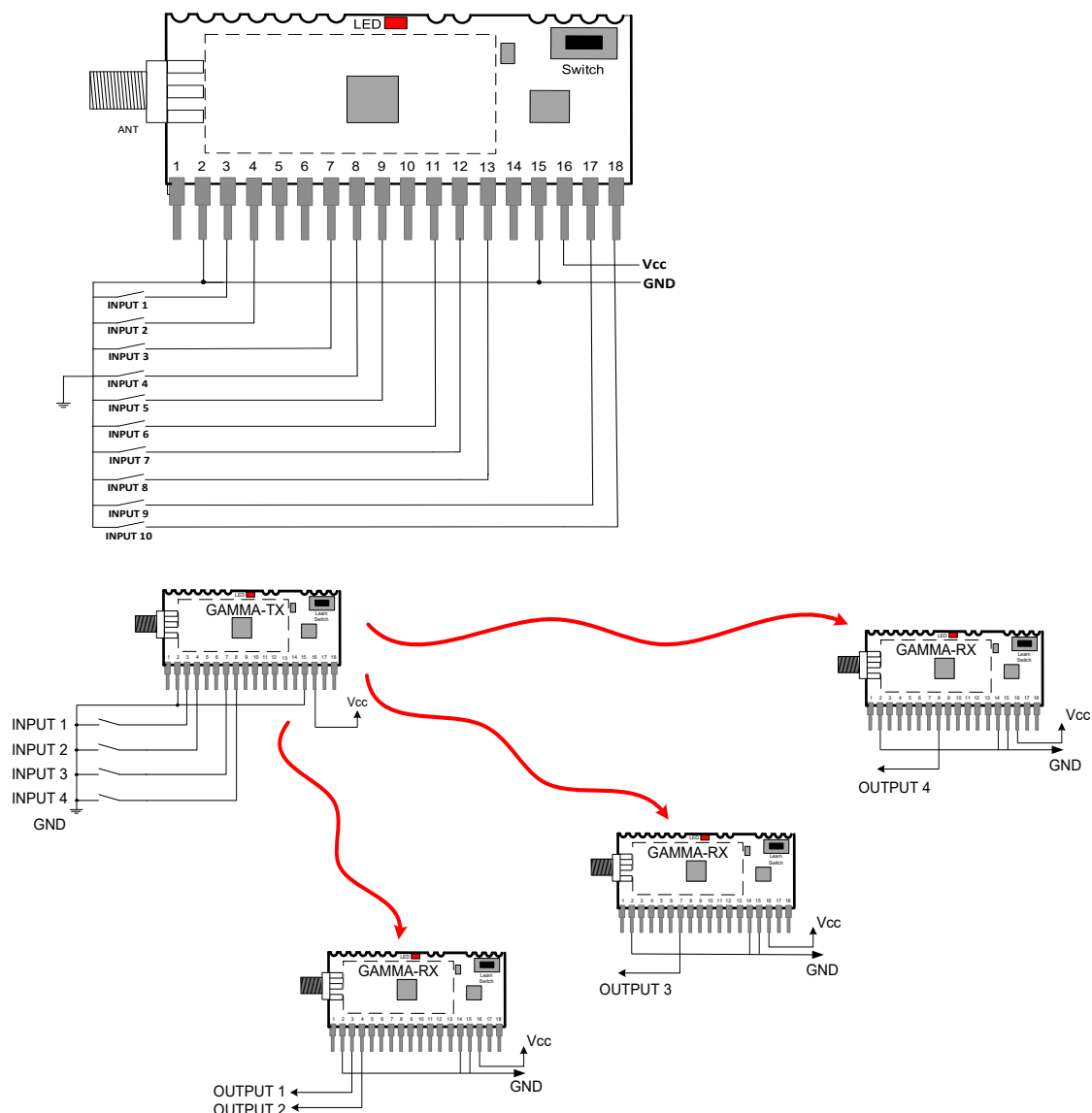
Transmitter application circuit example

Description:

This example shows a GAMMA62 module configured as a transmitter with all 10 inputs connected. Each input to be connected to GND to activate.

Application example:

Example showing 1 transmitter paired to 3 receivers - I/O used is arbitrary.



Receive Mode

GAMMA62 module configured as a receiver

When configured as a receiver the GAMMA62 module will remain in listening mode. When a valid RF Transmission is received it will:

1. Flash the onboard LED.
2. Action output changes. Each output will follow the status of its associated (paired) transmitter input.
3. Send back an RF Acknowledge if requested.

Digital outputs:

Active high LVCMOS/LVTTL compatible outputs. Can be connected directly to CMOS/TTL logic or drive.

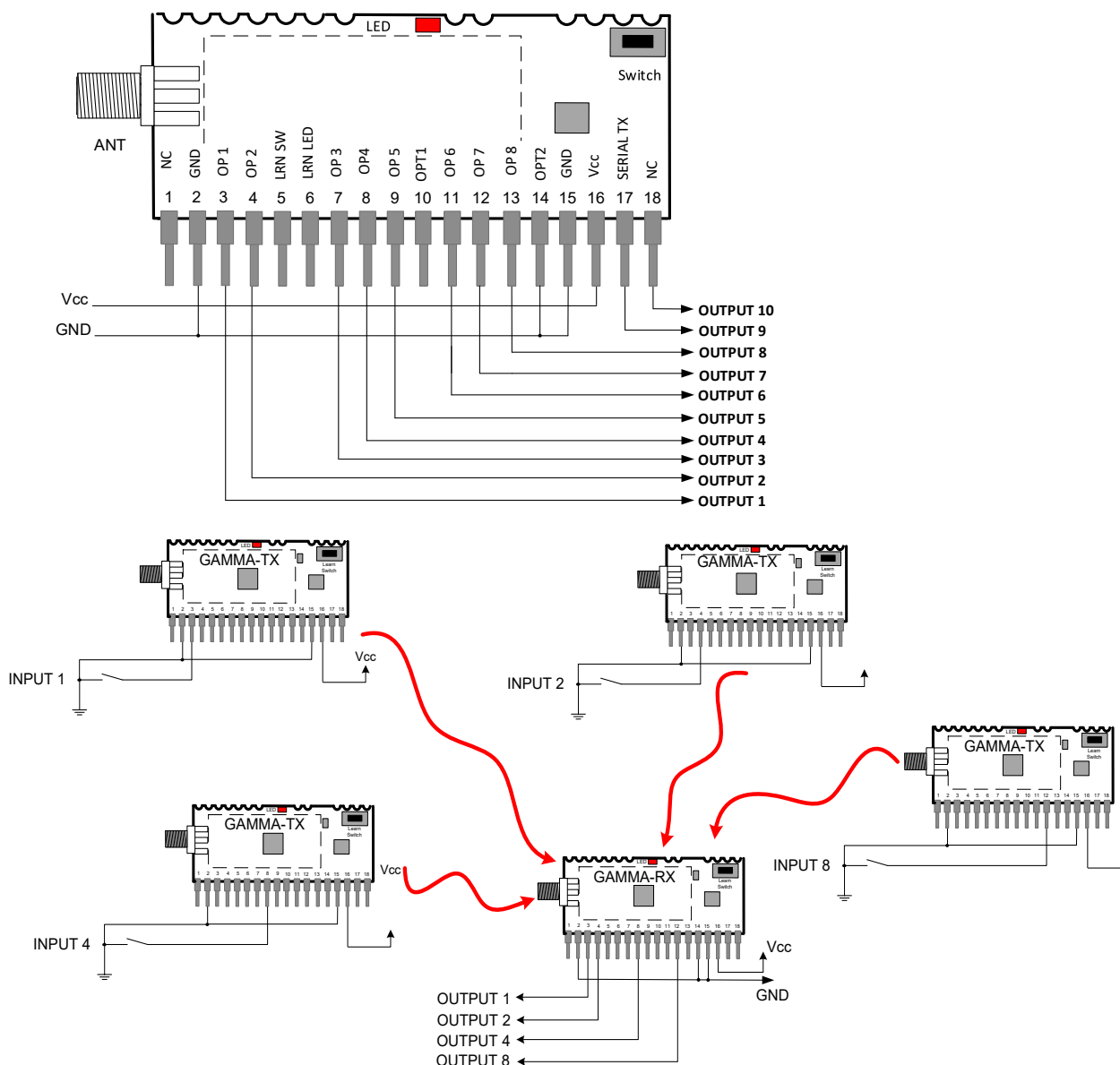
Receiver example application circuit

Description:

This example shows a GAMMA62 module configured as a receiver with all 10 outputs connected. The external learn switch and LED are also not fitted in this example.

Application example:

Example showing 4 transmitters paired to one single receiver - I/O used is arbitrary.



Transceiver Mode

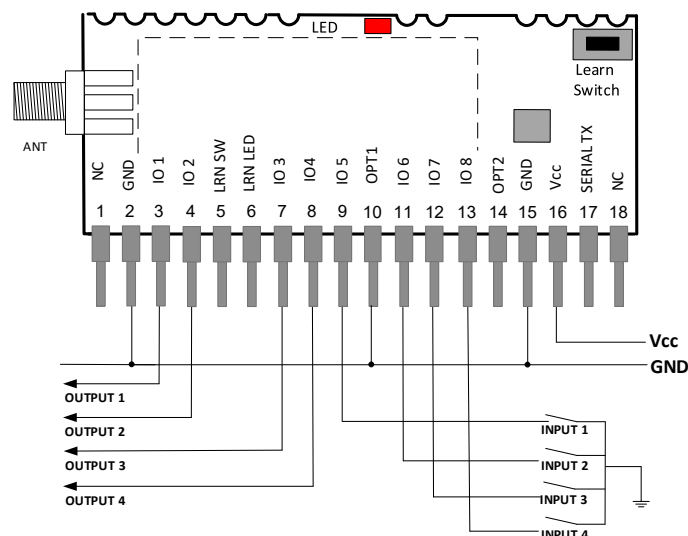
GAMMA62 module configured as a transceiver

When configured as a transceiver the GAMMA62 assigns its I/O lines; 1-4 as outputs and 5-8 as inputs (as shown below).

"no volt" Digital Inputs: High impedance inputs, LVCMOS/LVTTL compatible, 5V tolerant. Can be connected directly to CMOS/TTL logic or switch inputs connected to 0V or VCC.

Outputs are active high LVCMOS/LVTTL compatible and can be connected directly to CMOS/TTL logic or drive. A change on the input will cause the GAMMA to wake, read all inputs and initiate RF transmission.

Transceiver application circuit example

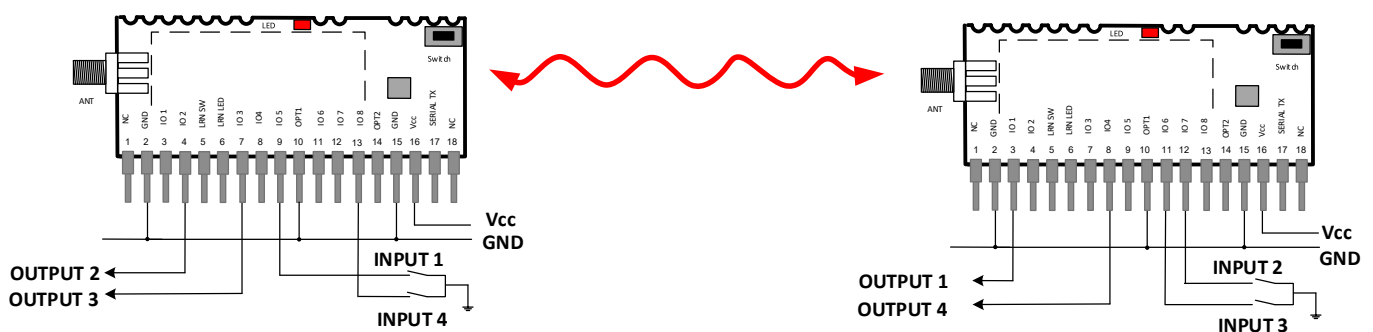


Description:

The example above shows a GAMMA62 module with 4 connected inputs and 4 connected outputs. Pairing modules in transceiver mode auto-maps all inputs on the remote devices to all outputs on the local device. In this way it is possible to connect modules in bi-directionally as in the below example.

Application example:

The below example shows two GAMMA62 modules paired in both directions.



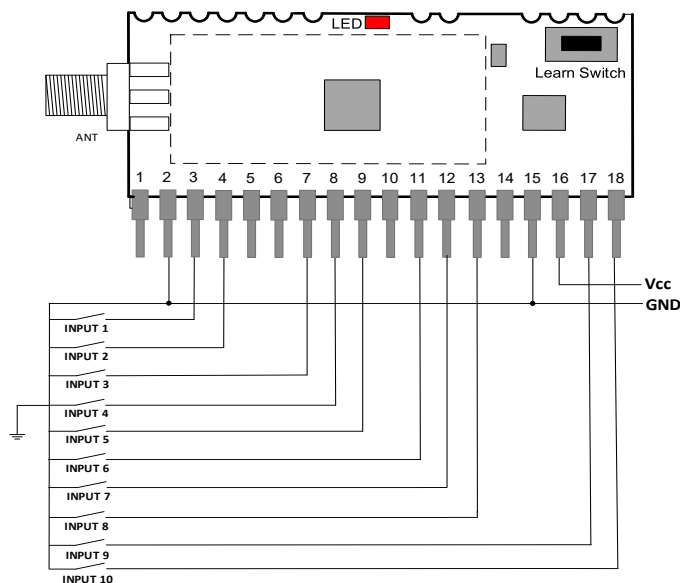
Parallel to Serial Mode

When an input on a GAMMA62 module is activated it will send an RF signal.

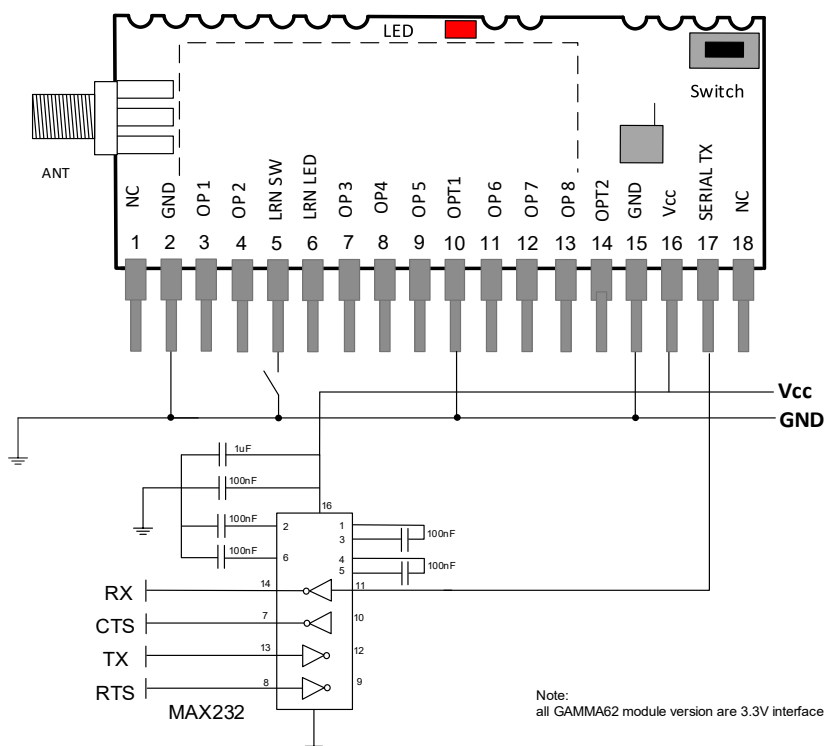
All GAMMA62 modules within range and configured in Receive mode; will output the data via their SERIAL TX pins.

Note that if a GAMMA62 Module is paired with another module, when an RF command is received to update the digital outputs. The GAMMA62 module will also output a serial data string showing output status.

Parallel transmitter application circuit example



Serial receiver application circuit example



Configuring the GAMMA62T Module

Using the Onboard Switch The following can be configured

Erase all Pairings (Receiver/Transceiver)

1. Operate the Switch for 5 secs
2. LED will flash slowly 2X to confirm all paired Transmitters are erased from memory

Note: this has no effect on the configuration settings

Reset to Factory Default Settings

1. Apply power with the Switch Operated. Continue to hold the Switch for 5 secs
2. LED will flash slowly 2X to confirm GAMMA62 has Reset all configuration Settings to factory default

Note: This procedure does not erase the Memory of any stored Transmitters

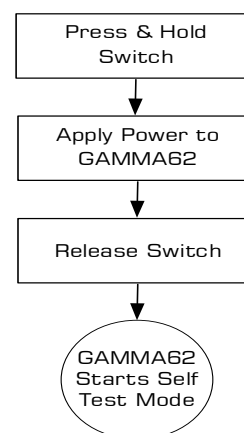
GAMMA62 factory default settings

RF Transmission	FM 868MHz
Acknowledgment	OFF
Learn Mode	PIN

Self Test Mode

GAMMA62 Can perform a self Test which performs the following functions

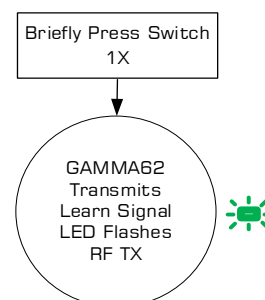
1. Operate all Outputs individually then alternately.
2. Transmit an RF Test Signal on Full power.



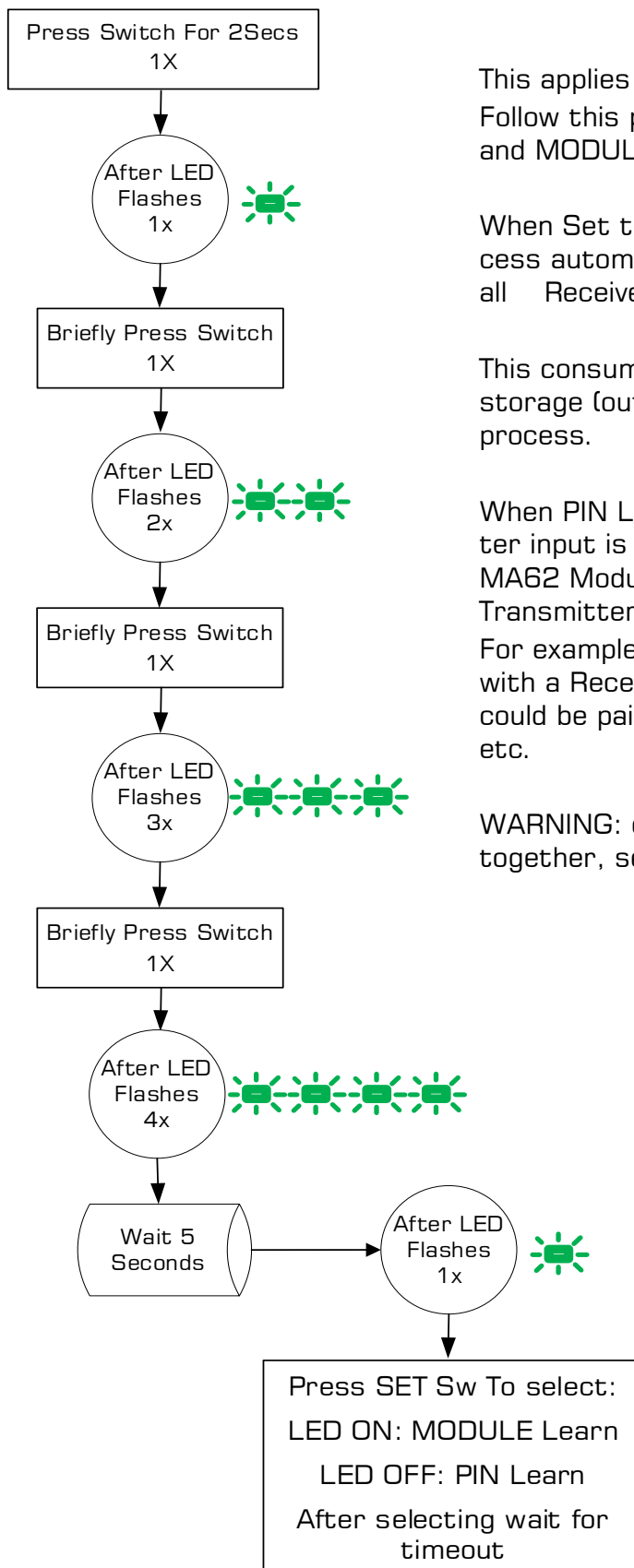
Transmit a RIoT Learn Signal

GAMMA62 has been designed to operate within the RF Solutions RIoT Range of products. This enables the status of a GAMMA62 Transmitter/Transceiver inputs to be monitored in real time on a smartphone or website.

At the time of writing this datasheet this has not yet been implemented.



Set GAMMA62T Transmission to send PIN Learn or MODULE Learn (Applies to GAMMA62T Transmitter/Transceiver)



This applies to a GAMMA62T that is **Transmitting!**
Follow this procedure to switch between PIN Learn and MODULE Learn.

When Set to MODULE Learn. A single pairing process automatically assigns **all** Transmitter inputs to all Receiver outputs, 1-1,2-2, 3-3 etc.

This consumes only one of the Receivers memory storage (out of 32) and provides a quicker pairing process.

When PIN Learn is selected, an Individual Transmitter input is be paired with any one of the GAMMA62 Module Outputs thus creating more complex Transmitter / Receiver relationships
For example Transmitter input 1 could be paired with a Receiver output 4, and Transmitter input 2 could be paired with another Receiver output 4, etc.

WARNING: do not mix PIN and MODULE learning together, select one mode only!

GAMMA62T Receiver Pairing Procedure

A GAMMA62T that is set to Receive (RX or TRX) can “learn” another GAMMA62T that is transmitting (TX or TRX) or any other compatible RF Transmitter, to create a remote Control system.

Each receiving GAMMA62 can learn and store up to 32 Transmitter pairings.

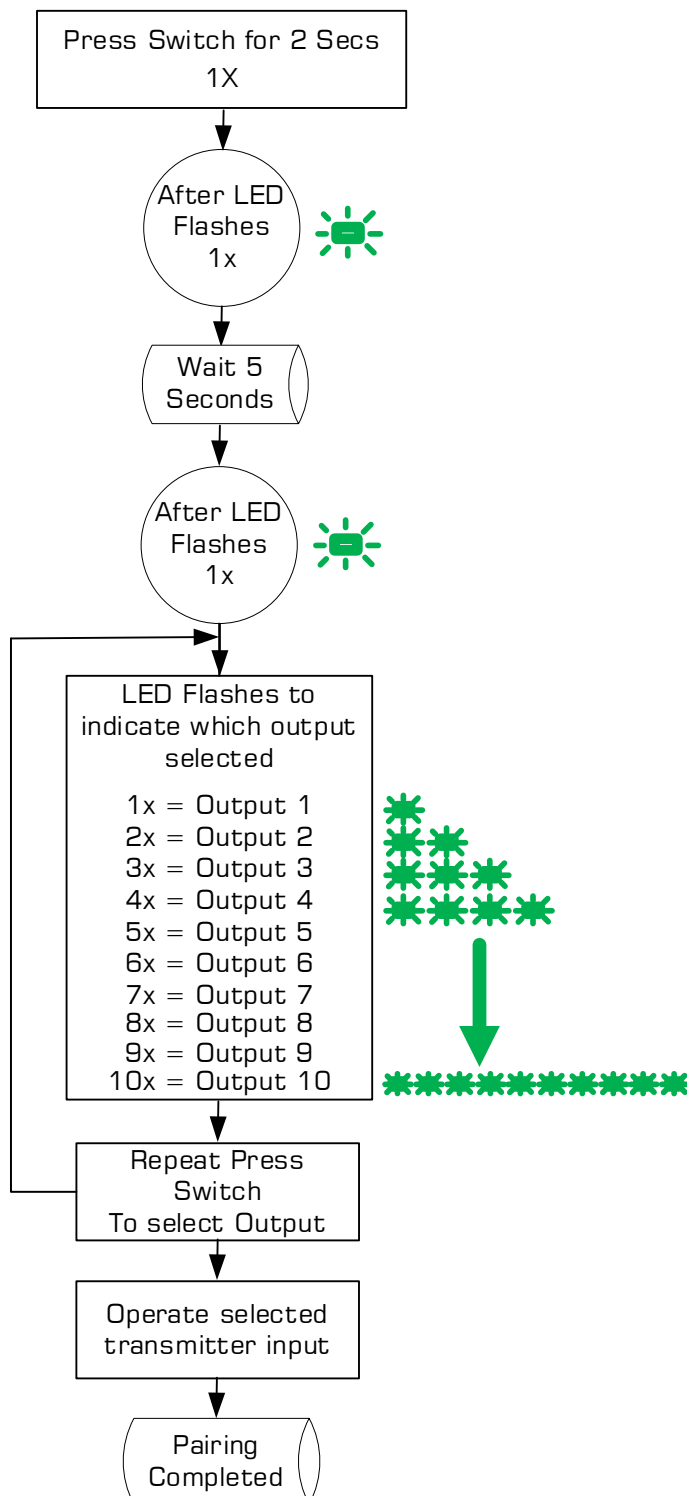
When a PIN signal is learned, up to 32 individual PIN input/outputs can be learnt

When a MODULE signal is learned, up to 32 MODULES can be learnt

Note Serial Data is always output without the need to perform any pairing. (Pairing is required only for the digital Telemetry outputs to be active)

Pairing a PIN Transmitter Signal

User select an individual output Pin to pair with an individual transmitted input.



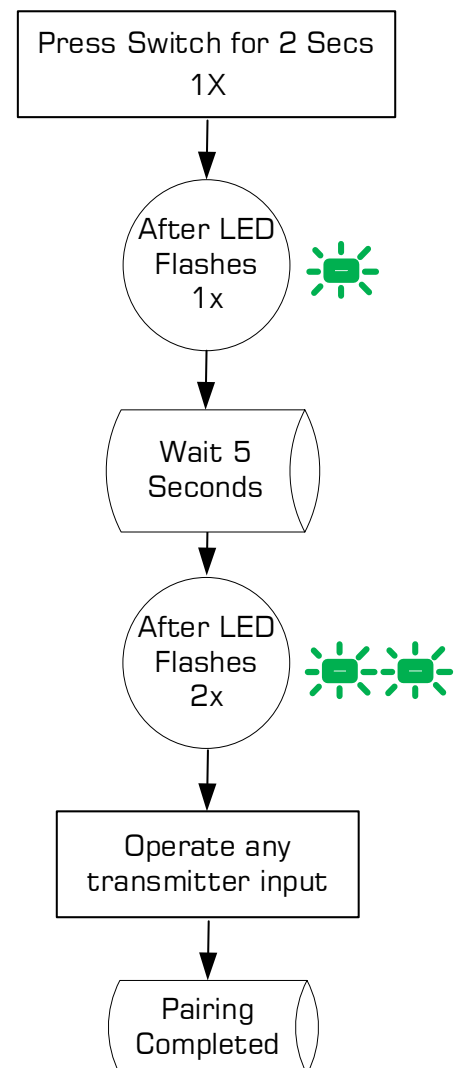
Pairing a Module Transmitter Signal

This procedure automatically assigns all Transmitter inputs to GAMMA62 outputs as follows

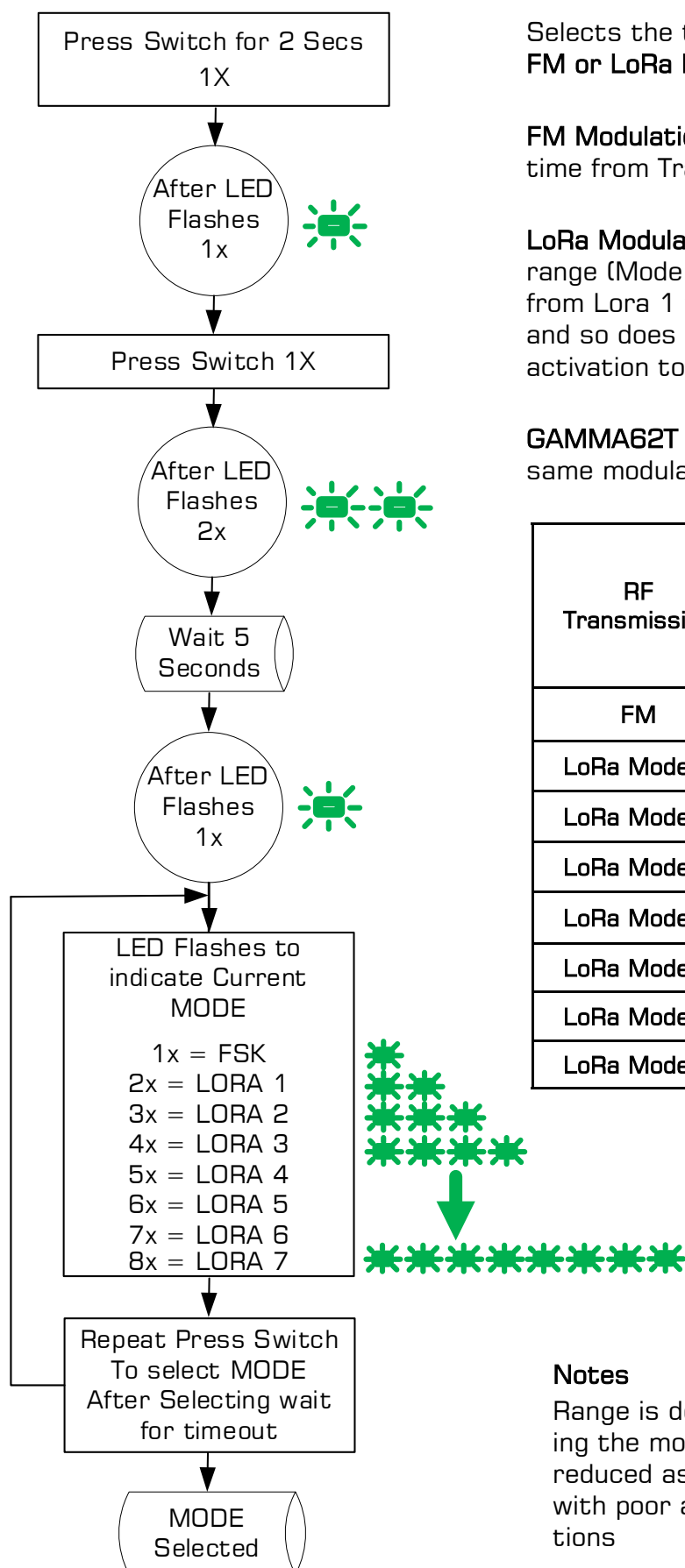
I/P 1 paired with O/P1

I/P 2 paired with O/P2

I/P 3 paired with O/P3etc



Set the RF Modulation



Selects the type of RF Modulation. This can be:
FM or LoRa Modes 1 to 7 (Spread Spectrum)

FM Modulation provides the fastest operation time from Transmit activation to Receiver output.

LoRa Modulation provides a longer Operating range (Mode 7 is the longest). With each step from Lora 1 to 7, the operating range increases and so does the propagation time from Transmit activation to Receiver output as Table below

GAMMA62T TX/RX/TRX must all be set to the same modulation to communicate

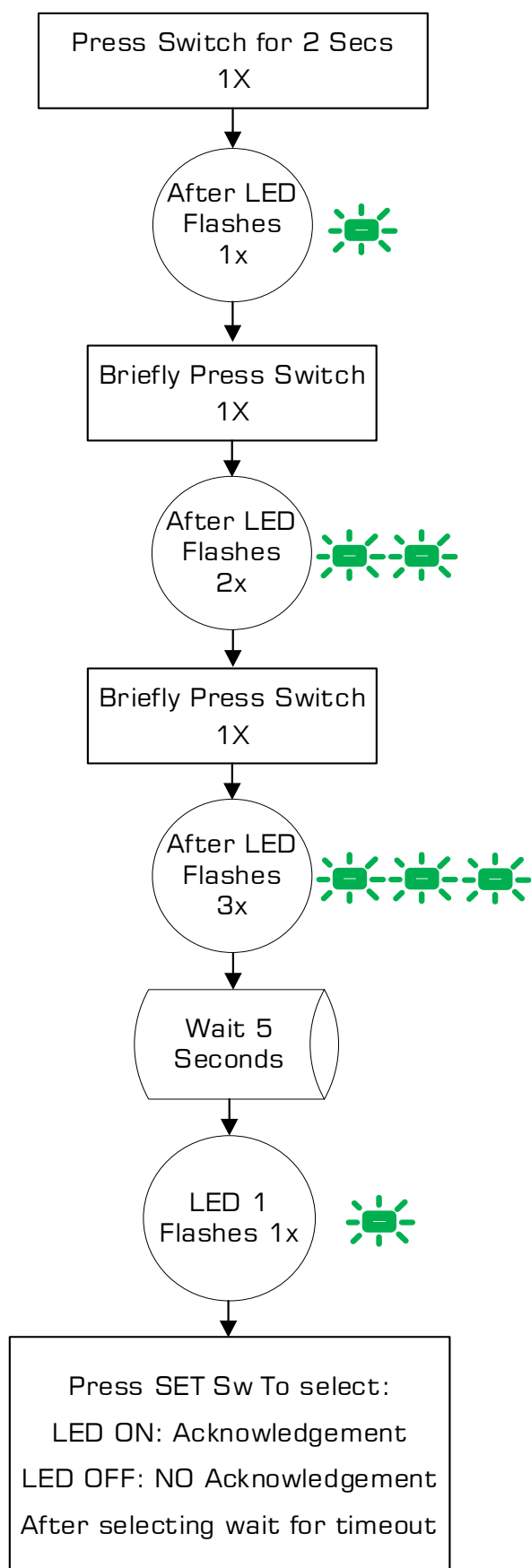
RF Transmission	Mode (No of LED1 Flashes)	Propagation Time from TX to output Activated (approx)
FM	1	45 mS
LoRa Mode 1	2	45 mS
LoRa Mode 2	3	65 mS
LoRa Mode 3	4	80 mS
LoRa Mode 4	5	160 mS
LoRa Mode 5	6	320 mS
LoRa Mode 6	7	640 mS
LoRa Mode 7	8	1.3 Secs

Notes

Range is dependant on many factors including the mode of transmission. Range can be reduced as much as 75% in built up areas with poor antenna, and environmental conditions

Acknowledgement Request

(Applies to GAMMA62T Transmitter/Transceiver)



When Acknowledgment Request is activated, the transmitting GAMMA62 includes an acknowledgement request within each radio transmission.

The receiving GAMMA62 sends an acknowledgement RF signal back.

When the successful acknowledge signal is received back by the transmitting GAMMA62 module, the LED will briefly flash, if no acknowledge is received the LED will flash rapidly 5 times.

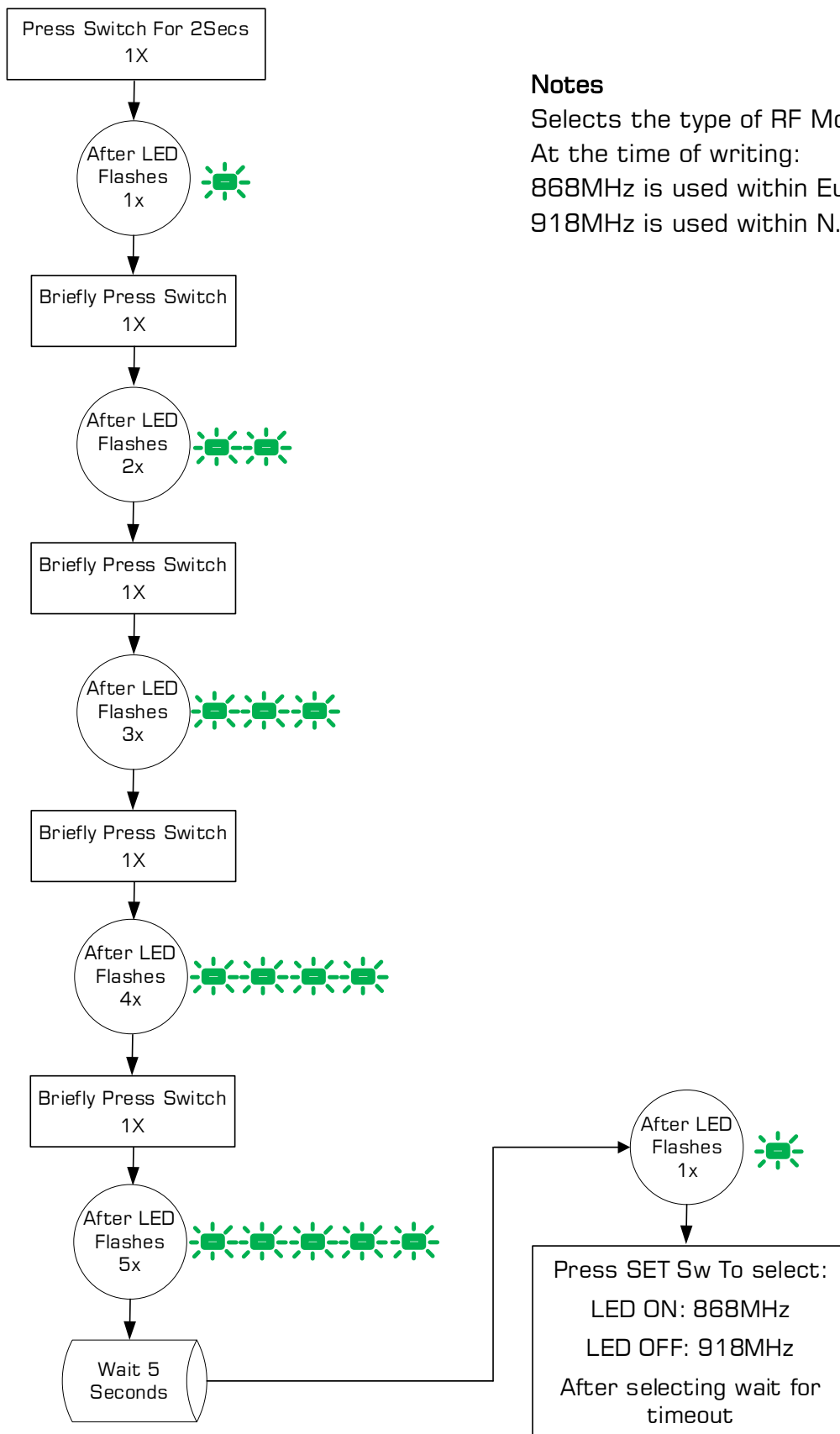
NOTE : This will be after the transmitter has retried four times.

Due to hardware limitation I/O 9 & 10 cannot provide the "Acknowledgment" feature

RF Acknowledgment from Receiver - Warning!

Whilst in theory if an RF signal can be transmitted one way then it can be returned, in practice occasionally the received acknowledgement may not penetrate as well as the GAMMA62 transmitted signal.

To Set the RF Carrier Frequency (868/918MHz)



Notes

Selects the type of RF Modulation.

At the time of writing:

868MHz is used within Europe

918MHz is used within N.America and Australia

Receiver Serial Data Output

GAMMA62 in RX and TRX mode automatically outputs the serial number, button and battery status of any received compatible RF transmitter. This data may be fed directly to a microcontroller or RS232 type driver circuit which may then be fed directly to a PC serial port. Serial data is output on every packet receipt regardless of whether the Transmitter has been learnt or not. The serial data packet contains a learn bit to show if an encoder input is learnt.

Serial data configuration

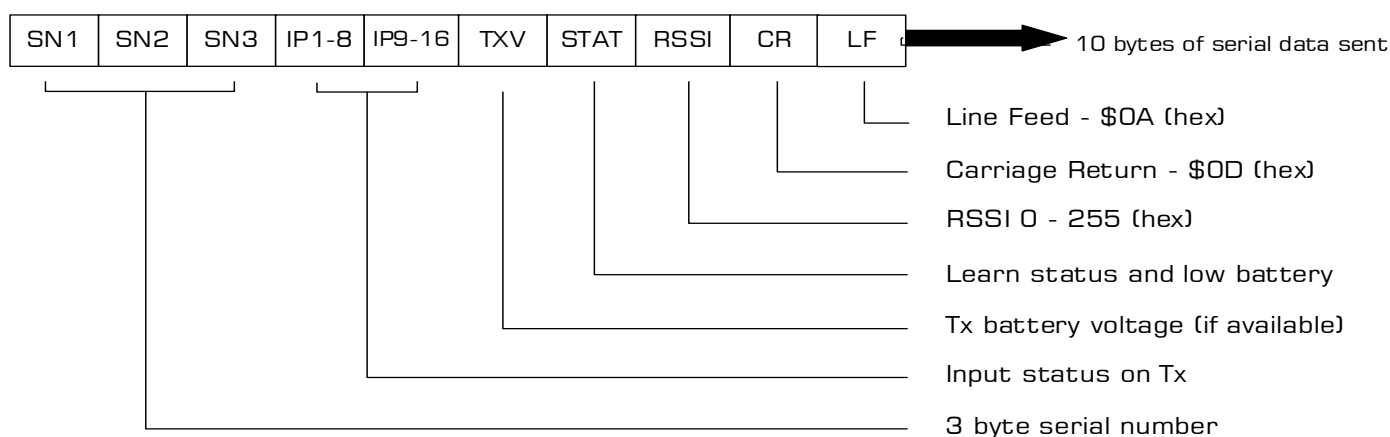
Baud Rate:	19,200
Data bits:	8
Parity:	none
Stop bits:	1
Handshaking:	none

Serial data format:

Serial number [SN1 SN2 SN3]:

Made up of three 8-bit bytes where the most significant byte is transmitted first.

Example: 12ABAA (hexadecimal) or 0001 0010 1010 1011 1010 1010 (binary).



Tx inputs [IP1-8 IP9-16]: made up of two 8-bit bytes.

The low order byte is sent first representing inputs 8 down to 1 where the MSB is input 8 and the LSB is input 1. The high order byte is sent next representing inputs 16 down to 9 where the MSB is input 16 and the LSB is input 9.

A bit at state 1 represents an encoder input as active.

Using this method inputs can be multiplexed giving maximum versatility.

Example: 00000000 00010000 Shows input 13 active.
 10000000 00000000 Shows input 8 active
 10000001 10000000 Shows inputs 16, 8 and 1 active

Learn status and low battery:

One 8 bit byte:

Bit0 shows low battery on Tx - where 1 = Low battery

Bit1 shows learn status of Tx - where 1 = Learnt

TXV

The TXV byte ranges from 0x1F – 0x00 (3.3v – 1.8v) in increments of 0.05v

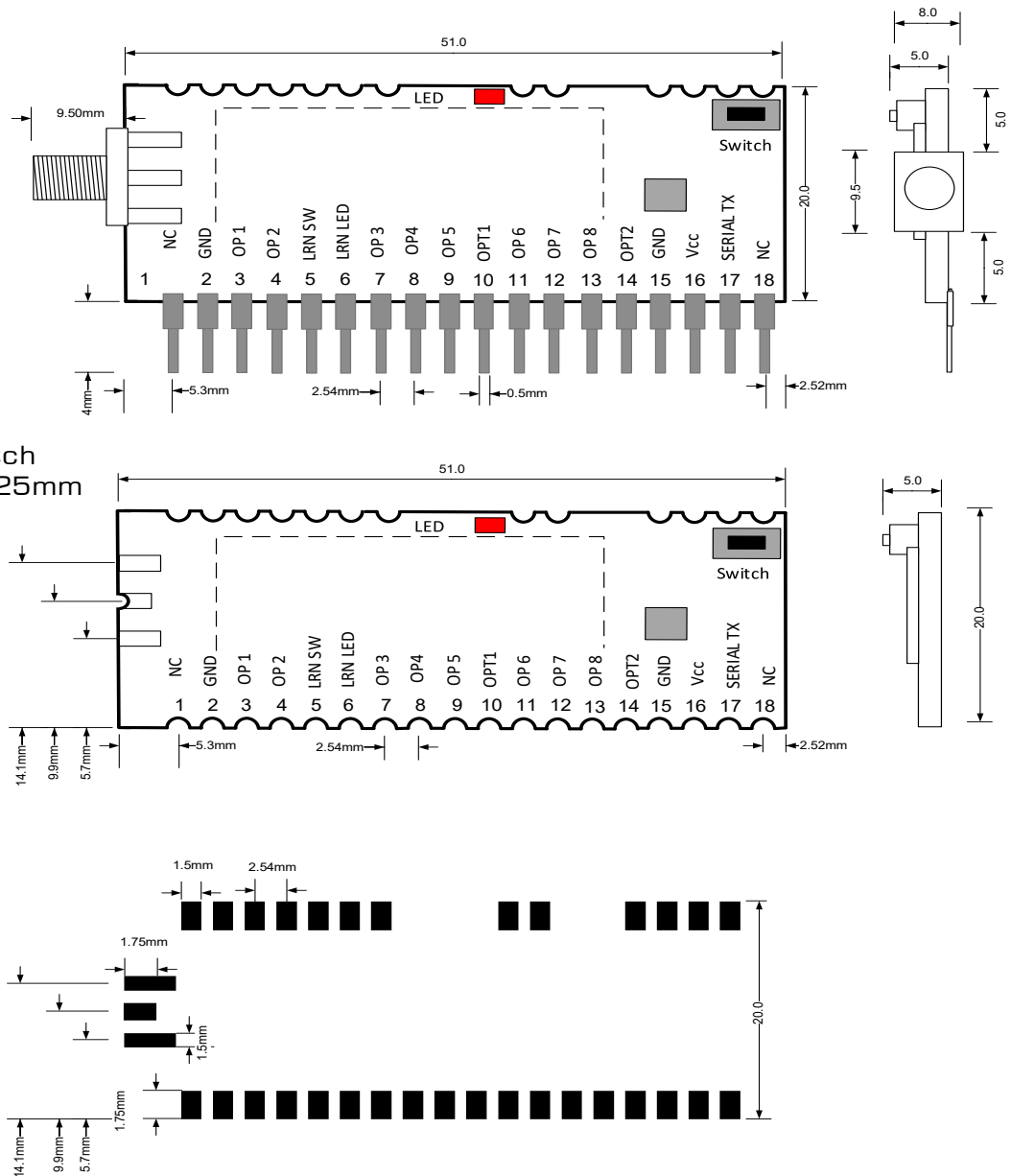
Voltage = 1.8 + (TXV*0.05)

RSSI

The RSSI is calculated by:

RSSI (dBm) = - RSSI / 2

Mechanical Dimensions



Notes

1. Pins 2.54mm pitch
2. Pin Dims 0.5x0.25mm
3. All dims in mm

Range Considerations

The antenna choice and position directly affects the system range, keep it clear of any large metal parts. The best position is protruding vertically from the top of the product. This is often not desirable for practical reasons and thus a compromise may be needed. Note that the space around the antenna is as important as the antenna itself, all radio systems are dependent on a radio signal being received through airspace.

The range quoted is the optimal in direct line of sight, without obstacles and in good atmospheric conditions.

Range is affected by many things, for example local environmental conditions, atmospheric conditions, interference from other radio transmitters. For evaluating the local environment please see our RF meter (DS006)

In very worse case applications the range quoted may be reduced dramatically below the optimal range stated.

Technical Specifications

Absolute Maximums see note 1:

Temperature range: **Storage:** -50 to +125°C. **Operating:** -25 to +80°C

Parameter	Min	Typical	Max	Units
Operating frequency		869.500 918.000		MHz
GAMMA- TX output power			+22	dBm
GAMMA- RX Sensitivity	-121		-137	dBm
Max input power (through RX antenna)			+10	dBm
Supply voltage Standard version	1.8		3.6 *	V
Supply voltage high Voltage version "R"	3.6		16 *	V
Voltage on any input—see note 2	-0.3		5.8	V
GAMMA- TX supply current:				
When transmitting	-	118		mA
Low Voltage version when sleeping		1		uA
High Voltage version when sleeping		75		uA
GAMMA- RX supply current:				
When receiving	19	20	23	mA
Max current sourced / sunk (Per I/O)			5 / 12.5	mA
Max current sourced / sunk (Total)			100	mA
TX Input asserted to be recognised as Valid by TX (debounce) - see note 3	7			mSecs
Time from TX input asserted to Rx output Activated In FSK see note 4		45		mSecs

1. Absolute Maximum Supply do not exceed this value
2. I/O pins are 5V tolerant when operating at 3V supply
3. Input must be activated constantly for Min time before module recognises as "asserted"
4. Assuming Listen Before Talk does not inhibit transmission

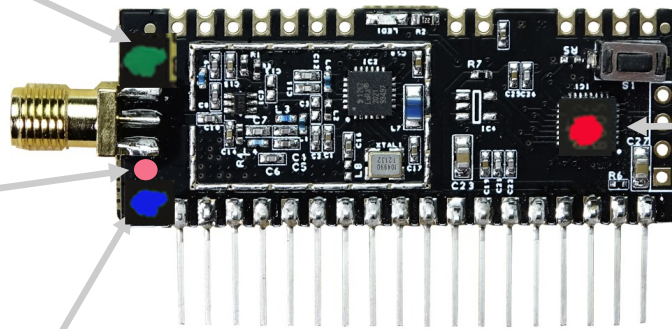
Module Identification

On Power on the onboard LED will flash once to indicate the module type as a Telemetry module

Test Confirmation
Green has passed Test

GAMMA62T
has Pink dot

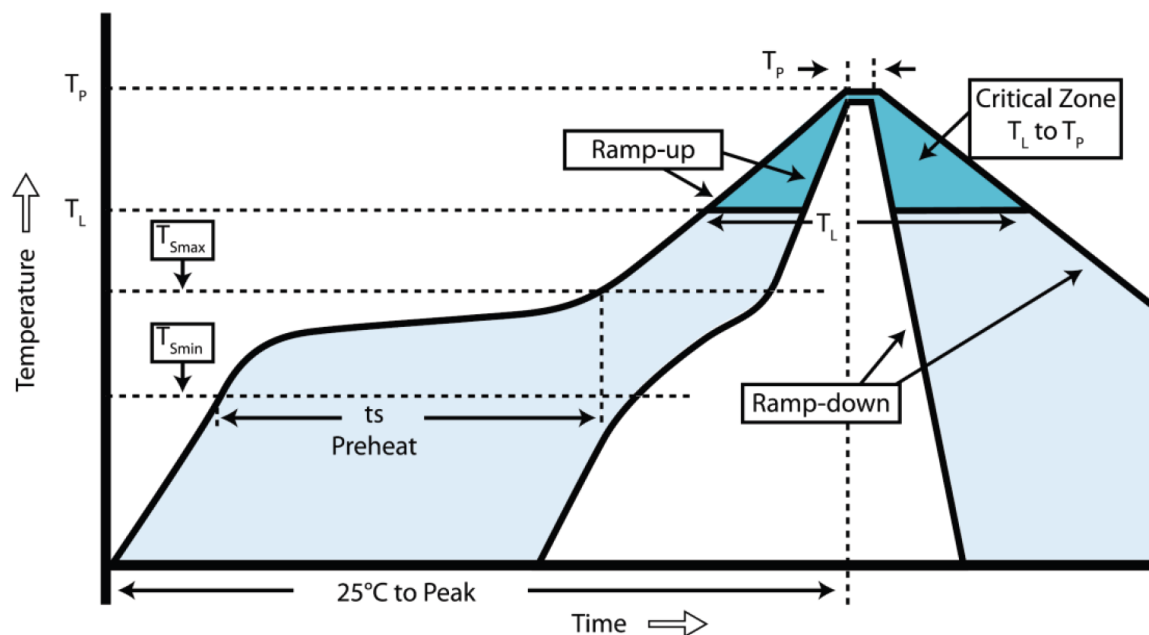
BLUE Dot here if part is Low voltage
RED Dot here if part is High voltage



Revision Number:
Rev 1 Brown
Rev 2 Red
Rev 3 Orange
Rev 4 Yellow
Rev 5 Green
Rev 6 Blue
Rev 7 Violet
Rev 8 Grey
Rev 9 White

Product Revision Change History			
Part	ECN / Date	Rev	Change / Fix
GAMMA62T-89 GAMMA62TR-89	386 23/11/22	2	Bug fix: 1. When exiting Transceiver Pairing, defaulted to Rx mode instead of remaining in Transceiver mode 2. Learn capacity increased to 32 pairings Enhancement: Digital Input assertion min time reduced to 7mSecs

Module re-flow guide



The GAMMA62 MODULE is a 4 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}) - Temperature Max (T_{Smax}) - Pre-heat time	150°C 200°C 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.

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DO NOT

Discard with normal waste, please recycle.

ROHS Directive 2011/65/EU as amendment by 2015/863/EU

Specifies certain limits for hazardous substances.

WEEE Directive 2012/19/EU

Waste electrical & electronic equipment. This product must be disposed of through a licensed WEEE collection point.

RF Solutions Ltd., fulfils its WEEE obligations by membership of an approved compliance scheme.

Environment Agency Registration Number **WEE/JB0104WV**.



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