

# Terminus T2 Products User Manual – Hardware Guide

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**JANUS** REMOTE  
C ● M M U N I C A T I O N S ●

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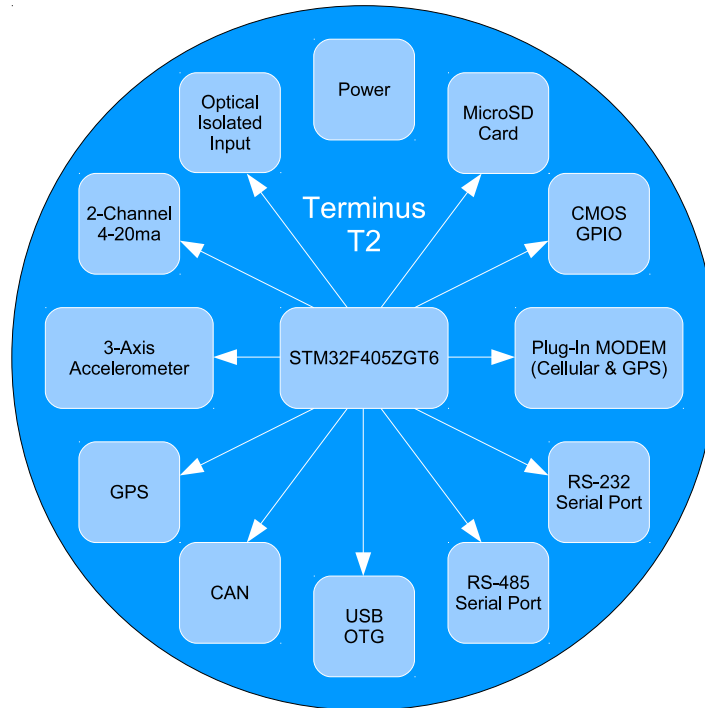
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### Terminus T2 Cellular Platform:

The Terminus T2 provides a complete wireless communication device with integrated ARM Cortex M4™ processor, expanded peripheral set and cellular communication protocols to fit any application. The ARM Cortex M4™ processor has a large support community available to reference while developing applications. Additionally, Janus has hardware/software partners waiting to assist users in quickly getting your product to market.



### Plug-In Terminals:

Cellular communication protocols for the Terminus T2 are powered by Terminus Plug-In terminals. Plug-In Terminus offer easy integration and interchangeability of communication protocols between GSM/GPRS, CDMA/EVDO, HSPA and more by combining full M2M functionality with the flexibility of a standard “plug-in” DIP design. These terminals share the same mechanical footprint and offer users the ability to configure their applications for communications via any cellular protocol. By using these modules to power the cellular technology of the Terminus T2, users can easily change cellular technology without having to change platforms. The Terminus T2 provides one platform that supports current cellular technology with the future in mind.

### Terminus T2 Cortex M4™ Processor:

The Terminus T2 has an internal ARM 32-bit Cortex M4 210DMIPS MCU+FPU with 1MB Flash and 192+4KB RAM. For a complete description of the processor refer to the ST Microelectronics data sheet.

ST Microelectronics Part Number: STM32F405ZGT6

## Terminus T2 Peripherals:

The following section describes the connections of external peripherals.

### Accelerometer:

A digital 3-axis accelerometer is connected to the I2C2 interface of the Cortex M4™ processor. The accelerometer has programmable acceleration range, low pass filter and motion triggered interrupts. For a complete description of the accelerometer refer to the Bosch data sheet.

Bosch data sheet: BMA222

### Accelerometer Interconnects:

BMA222		STM32F405ZGT6	
Pin	Name	Pin Name	Pin Description
2	SDA	PF0	I2C2_SDA
12	SCL	PF1	I2C2_SCL
1	SA0	PE1	GPIO
5	INT1	PE4	GPIO
6	INT2	PE5	GPIO

### SD Memory Card:

A microSD memory card socket is connected to the SDIO Interface of the Cortex M4™ processor. The SDIO interface is compliant with the SD Memory Card Specification V2.0.

### SD Memory Card Interconnects:

SD Card		STM32F405ZGT6	
Pin Name		Pin Name	Pin Description
CLK		PC12	SDIO_CLK
CMD		PD2	SDIO_CMD
D0		PC8	SDIO_D0
D1		PC9	SDIO_D1
D2		PC10	SDIO_D2
D3		PC11	SDIO_D3
CDPC0			GPIO

### USB OTG (FS):

A USB OTG connector is connected to the full-speed device/host/OTG port of the Cortex-M4 processor. The USB OTG FS peripheral is compliant with the USB 2.0 specification and with the OTG 1.0 specification. It has software-configurable endpoint setting and supports suspend/resume. The Terminus T2 does not supply VBUS.

### USB OTG Interconnects:

USB OTG		STM32F405ZGT6	
Pin	Name	Pin Name	Pin Description
1	VBUS	PA9	OTG_FS_VBUS
2	D-	PA11	OTG_FS_DM
3	D+	PA12	OTG_FS_DP
4	ID	PA10	OTG_FS_ID

## Terminus T2 Peripherals continued:

### RS-232 Serial Port:

An RS-232 level serial port is connected to USART3 of the Cortex M4™ processor. This serial port supports RTS/CTS handshaking. An additional RS-232 level serial port is exposed via the 30-pin locking header and is directly connected to the diagnostic port of the Plug-in Terminus. For a complete description of the RS-232 line driver refer to the Intersil data sheet.

Intersil data sheet: ISL83387

#### DB9 RS-232 Interconnects:

DB9 (MALE)		STM32F405ZGT6	
Pin	Name	Pin Name	Pin Description
2	RXD (Input)	PB11	USART3_RX
3	TXD (Output)	PB10	USART3_TX
7	RTS (Output)	PD12	USART3_RTS
8	CTS (Input)	PD11	USART3_CTS
5	GROUND	N/A	N/A

#### 30-pin Locking Header RS-232 Interconnects:

30-pin Locking Header		Plug-in Terminus	
Pin	Name	Pin Name	Pin Description
7	TRACE_RX (Input)	14	TRACE_RX
8	TRACE_TX (Output)	13	TRACE_TX

#### Line Driver Interconnects:

ISL83387		STM32F405ZGT6	
Pin	Name	Pin Name	Pin Description
9	INVALID (Output)	PE15	GPIO
11	FORCEON (Input)	PF3	GPIO
24	FORCEOFF (Input)	PF4	GPIO

Note: Refer to Intersil data sheet for a complete description of these control I/O.

### RS-485 Serial Port:

An RS-485 level serial port is connected to USART2 of the Cortex M4™ processor. For a complete description of the RS-485 line driver refer to the Intersil data sheet.

Intersil data sheet: ISL8487

#### 30-pin Locking Header RS-485 Interconnects:

30-pin Locking Header		ISL8487	
Pin	Name	Pin	Pin Description
5	RS-485A	6	Non-inverting receiver I/O
6	RS-485B	7	Inverting receiver I/O

#### Line Driver Interconnects:

ISL8487		STM32F405ZGT6	
Pin	Name	Pin Name	Pin Description
1	RO (Output)	PD6	USART2_RX
N/A	DIN (Input)	PD5	USART2_TX

Note: DIN input is inverted and connected to DE pin of the Intersil line driver. DI and RE inputs of the Intersil line driver are pulled-low.

## Terminus T2 Peripherals continued:

### CAN Transceiver:

A CAN transceiver is connected to the CAN1 controller of the Cortex M4™ processor.

The CAN controller is compliant with the 2.0A and B (active) specifications with a bitrate up to 1 Mbit/s. The CAN interface can receive and transmit standard frames with 11-bit identifiers as well as extended frames with 29-bit identifiers. The CAN interface has three transmit mailboxes, two receive FIFOs with 3 stages and 28 scalable filter banks. The 256 bytes of SRAM that is allocated for the CAN interface is not shared with any other Cortex M4™ peripheral. For a complete description of the CAN transceiver refer to the NXP data sheet.

NXP data sheet: TJF1051

### 30-pin Locking Header CAN Interconnects:

30-pin Locking Header		TJF1051	
Pin	Name	Pin	Pin Description
9	CAN_LO	6	LOW-level CAN bus line
10	CAN_HI	7	HIGH-level CAN bus line

### CAN Transceiver Interconnects:

TJF1051		STM32F405ZGT6	
Pin	Name	Pin Name	Pin Description
1	CAN_TX (Input)	PD1	CAN1_TX
4	CAN_RX (Output)	PD0	CAN1_RX
8	S (Input)	PE6	GPIO

### Operating Modes

Mode	Inputs		Outputs	
	Pin S	CAN_TX	CAN Driver	CAN_RX
Normal	LOW	LOW	Dominant	Active <sup>[1]</sup>
Silent	LOW	HIGH	Recessive	Active <sup>[1]</sup>
	HIGH	X <sup>[2]</sup>	Recessive	Active <sup>[1]</sup>

[1] LOW if the CAN bus is dominant, HIGH if the CAN bus is recessive

[2] X = don't care.

## Terminus T2 Peripherals continued:

### GPIO:

The Terminus T2 exposes 14 CMOS level general purpose I/O's. The GPIO can be used as GPIO or alternate functions including SPI, I2C, USART, ADC and DAC. The GPIO's are available via the 30-pin locking header.

30-pin Locking Header		STM32F405ZGT6	
Pin	Description	Pin Name	Alternate Function
14	GPIO1	PA15	SPI1_NSS
16	GPIO2	PB3	SPI1_SCK
18	GPIO3	PB4	SPI1_MISO
20	GPIO4	PB5	SPI1_MOSI
22	GPIO5	PB8	I2C1_SCL
24	GPIO6	PB9	I2C1_SDA
26	GPIO7	PA0	UART4_TX , ADC123_CH0, WKUP
28	GPIO8	PA1	UART4_RX , ADC123_IN1
30	GPIO9	PA2	ADC123_IN2
29	GPIO10	PA3	ADC123_IN3
25	GPIO11	PA4	ADC12_IN4 , DAC1_OUT
23	GPIO12	PA5	ADC12_IN5 , DAC2_OUT
21	GPIO13	PA6	ADC12_IN6
19	GPIO14	PA7	ADC12_IN7

### Optical Isolated Input:

An optical isolated input is available on the Terminus T2. The output of the isocoupler is connected to the Cortex-M4 via GPIO PC13. PC13 can be configured as an RTC Alternate Function that can wake the STM42 from power savings modes.

Voltage Input Range: 7 – 28 Vdc  
Input-output isolation Voltage: 3,750 Vrms

### 4 – 20ma Current Loop Outputs:

Two 4-20ma current loop outputs are connected to ADC inputs of the Cortex-M4 processor. Sensor power supply is directly connected to the supply input of the Terminus T2. The sensor supply outputs are available via the 30-pin external locking header. The current loop circuits protect against over current events. If there is an over current event the sensor supply output is latched off and the CL\_ITRIPn output transitions low. To reset the sensor supply the CL\_RESETh input must be held low between 2us to 15us. To put the current loop sensors in shutdown mode hold the CL\_RESETh input low at least 150us.

#### 4-20ma Current Loop-1 Interconnects:

Current Loop 1		STM32F405ZGT6	
Pin Name	Description	Pin Name	Pin Description
VIN	Sensor Supply Input	NC	N/A
CL_ITRIP1	Over Current Output	PD13	GPIO
CL_RESET1	Reset Input	PD14	GPIO
CLV1	Sensor Current Output	PB0	ADC12_IN8

#### 4-20ma Current Loop-2 Interconnects:

Current Loop 2		STM32F405ZGT6	
Pin Name	Description	Pin Name	Pin Description
VIN	Sensor Supply Input	NC	N/A
CL_ITRIP2	Over Current Output	PD15	GPIO
CL_RESET2	Reset Input	PE0	GPIO
CLV2	Sensor Current Output	PB1	ADC12_IN9

## Terminus T2 Peripherals continued: Cellular Plug-In Terminal:

A socket for a Janus Remote Communication Plug-In terminal is available on the Terminus T2. There are GSM, HSPA+, CDMA and EV-DO versions of the Plug-In terminal available. All required I/O to control the Plug-In terminal including USB; USART and GPIO's are described below. For a complete technical description of the Plug-In Terminus, please refer to the Janus Remote Communications User Guide.

Janus Remote Communications Part Numbers: GSM865CF, HSPA910CF, CDMA910CF and EVDO910CF

### Plug-In MODEM Interconnects:

STM32F405ZGT6		Plug-In MODEM		
Pin Name	Function	Pin	Name	Function
PC1	GPIO – OD	3	ENABLE SUPPLY	Plug-In Enable Input
PC2	GPIO – OD	19	ON_OFF	ON OFF Toggle Input
PC3	GPIO – OD	20	RESET	Cellular Reset Input
PG0	GPIO	18	PWRMON	Power Monitor Output
PC4	GPIO	17	SERVICE	Service Input
PG1	GPIO	16	CELLULAR_LED	Status LED
PD10	GPIO – OD	35	GPS_RESET	MS20 GPS Reset Input
PB7	USART1_RX	34	GPS_TX	MS20 NMEA TXD Output
PB6	USART1_TX	33	GPS_RX	MS20 NMEA RXD Input
NC	NC	13	TRACE_TX	Trace Port – TXD Output
NC	NC	14	TRACE_RX	Trace Port – RXD Input
PC6	USART6_TX	9	TXD	DCE Serial Port – TXD Input
PC7	USART6_RX	4	RXD	DCE Serial Port – RXD Output
PG12	USART6_RTS	11	RTS	DCE Serial Port – RTS Input
PG15	USART6_CTS	6	CTS	DCE Serial Port – CTS Output
PD3	GPIO	5	DSR	DCE Serial Port – DSR Output
PD9	GPIO	10	DTR	DCE Serial Port – DTR Input
PD8	GPIO	8	DCD	DCE Serial Port – DCD Output
PD7	GPIO	7	RING	DCE Serial Port – RING Output
PB15	OTG_HS_DP	28	USB_D+	USB D+
PB14	OTG_HS_DM	27	USB_D-	USB D-
PB12	OTG_HS_USBDID	30	USB_ID	UTG USB_ID Analog Input
PG6	GPIO	43	GPIO1	General Purpose IO #1
PG5	GPIO	42	GPIO2	General Purpose IO #2
PG8	GPIO	41	GPIO3	General Purpose IO #3
PG7	GPIO	40	GPIO4	General Purpose IO #4
PG2	GPIO	38	GPIO5	General Purpose IO #5
PG3	GPIO	37	GPIO6	General Purpose IO #6
PG4	GPIO	36	GPIO7	General Purpose IO #7



## Terminus T2 Peripherals - Continued: Cellular Plug-In Terminal - Continued:

### ENABLE SUPPLY Truth Table:

ENABLE SUPPLY (PC1, GPIO – OD)	Function
0	Plug-In terminal power supply is disabled.
High-Z	Plug-In terminal power supply is enabled.

### ON\_OFF Truth Table:

ON_OFF (PC2, GPIO – OD)	Function
0	Toggle state. Input should remain in this state for a specified amount of time in order to turn On or Off the Plug-In terminal.  Hold time to turn Plug-In terminal on: $\geq 1s$ Hold time to turn Plug-In terminal off: $\geq 2s$
High-Z	Run state. Input should remain in this state after the Plug-In terminal has been turned on or off.

Note: HSPA910CF Hold time to turn Plug-In terminal on:  $\geq 5s$   
HSPA910CF Hold time to turn Plug-In terminal off:  $\geq 3$

### RESET Truth Table:

RESET (PC3, GPIO – OD)	Function
0	Reset State. Hold time to reset Plug-In terminal: $> 200ms$
High-Z	Run state. Input should remain in this state when Plug-In terminal is operational.

### PWRMON Truth Table:

PWRMON (PC13)	Function
0	Plug-In terminal is in an off state.
1	Plug-In terminal is in an on state.

Note: When turning off the Plug-in Terminus or when in an off state all driving I/O must be set to high-z and pull-ups disabled. If inputs are driven high while the Plug-in Terminus is in an off state, the POWERMON pin might read logic 1 giving a false on state status.

### SERVICE Truth Table:

SERVICE (PC4, GPIO – OD)	Function
0	SERVICE state is enabled.
High-Z	SERVICE state is disabled.

Note: Applies to GSM Terminus T2 models only. The service pin is used to upgrade the cellular module firmware from TRACE RX, TRACE TX that is exposed via the 30-pin locking header.

### GPS\_RESET Truth Table:

GPS_RESET (PD10, GPIO - OD)	Function
0	Run state. Input should remain in this state when MS20 GPS receiver is operational.
1	MS20 GPS Receiver Reset State. Hold time to reset MS20 GPS receiver: $> 1ms$

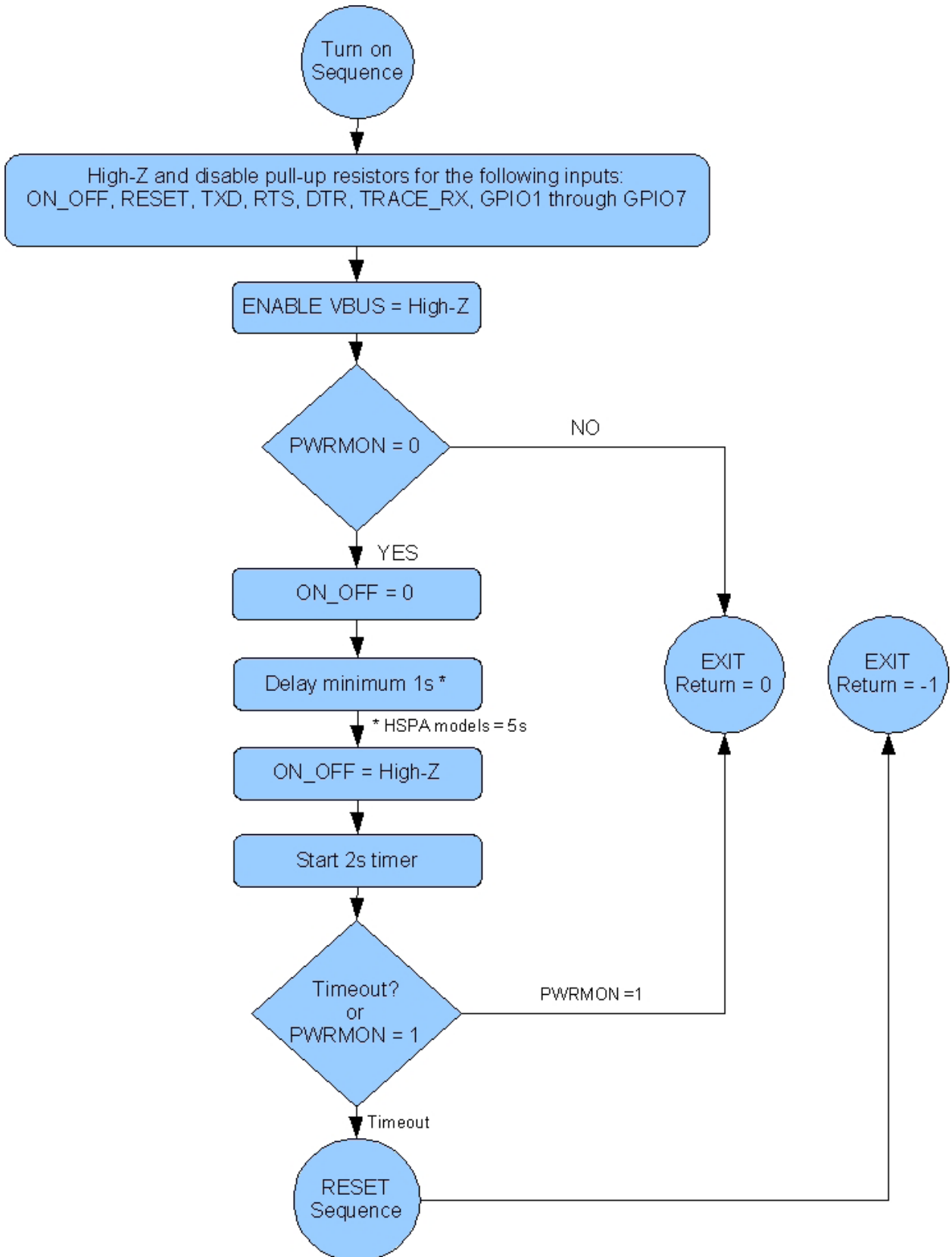
Note: Applies to GSM Terminus T2 with MS20 GPS receiver only.

### ENABLE VBUS Truth Table:

ENABLE VBUS (PC5 GPIO - OD)	Function
0	Plug-In terminal VBUS input is set to ground.
High-Z	Plug-In terminal USB_VBUS input is set to 5Vdc.

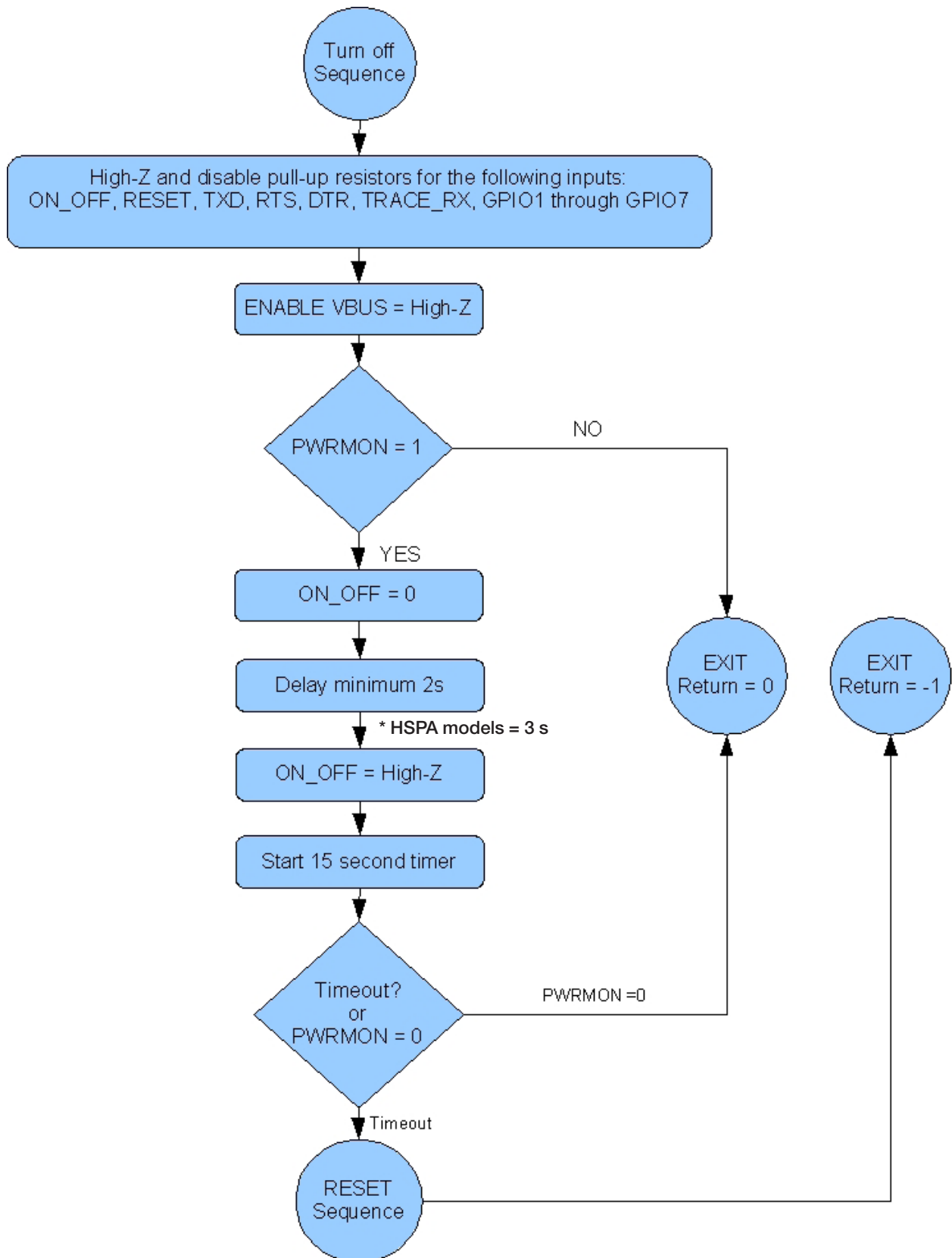
Note: Applies to CDMA and HSPA Terminus T2 models only.

**Terminus T2 Peripherals - Continued:**  
**Cellular Plug-In Terminal - Continued:**



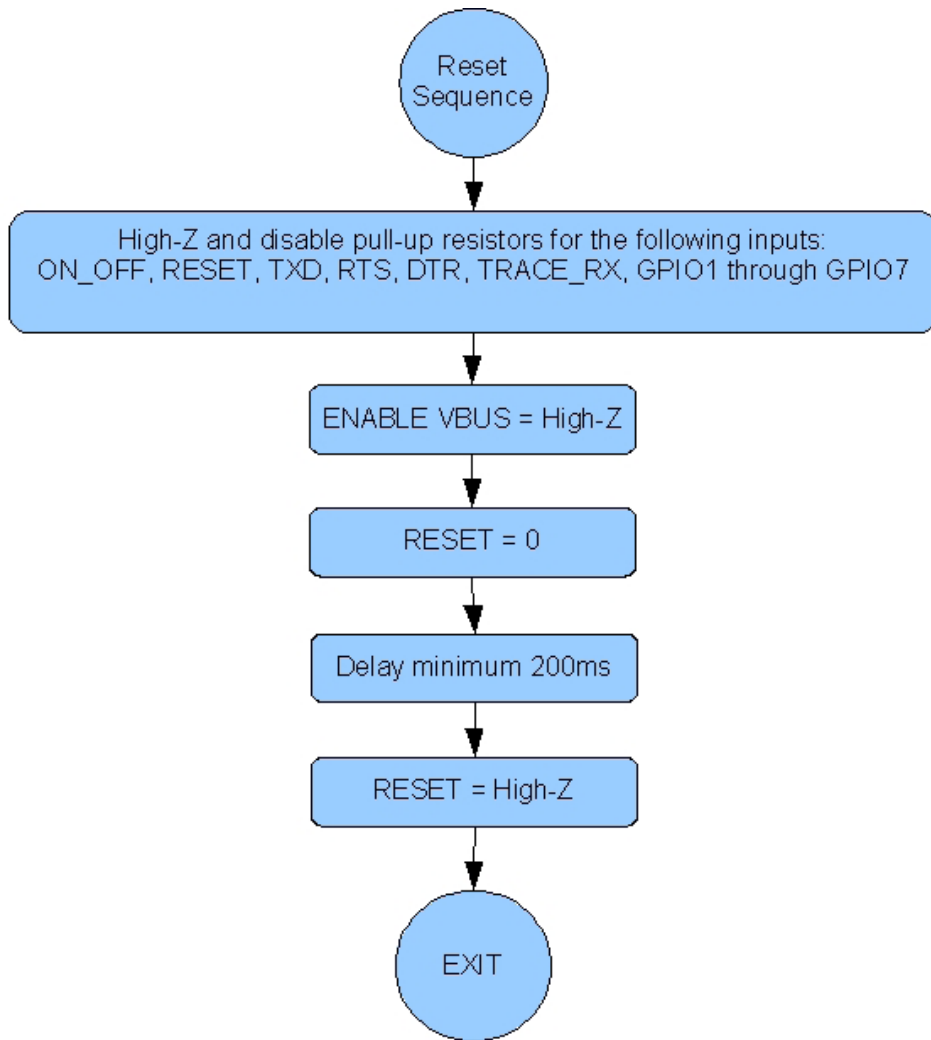
Cellular Plug-In Terminal: Turn on Sequence

**Terminus T2 Peripherals - Continued:**  
**Cellular Plug-In Terminal - Continued:**



Cellular Plug-In Terminal: Turn off Sequence

Terminus T2 Peripherals - Continued:  
Cellular Plug-In Terminal - Continued:



Cellular Plug-In Terminal: Reset Sequence

## External Interfaces:

### Reset Button:

The Reset button is connected to the reset input of the Cortex M4™ processor.

### LEDs:

The Terminus T2 has three LEDs available. Each LED is controllable via a GPIO of the Cortex M4™ processor.

LED	STM32F405ZGT6	
Color	Pin Name	Function
RED	PE12	GPIO
YELLOW	PE13	GPIO
GREEN	PE14	GPIO

### Cellular RF Port:

#### SMA - FEMALE

Pin	Description
Center Pin	Cellular Signal
Outer Conductor	SIGNAL Ground

For Cellular RF Port details, view the Plug-In Terminus Manual as reference.

### GPS RF Port:

#### MCX - FEMALE

Pin	Description
Center Pin	GPS Signal, 3.7 Vdc nominal supplied from Terminus to power active antenna.
Outer Conductor	Signal ground

For GPS RF Port details, view Plug-In Terminus User Manual as reference

### SIM Card:

Standard locking SIM card connector available on bottom of enclosure.

### Power Supply:

The Terminus T2 power supply jack accepts input voltages from 7 to 28 VDC and requires a nominal current sourcing capacity of 5W (maximum 10W). This jack accepts a barrel type plug with a receptacle for a 2.1mm center conductor. Power supply connection is also available via the 30-pin locking header.

Pin	Description
Center Pin	Supply (+)
Outer Conductor	Supply (-)

### SD Card:

Standard microSD card (15 mm × 11 mm × 1.0 mm)

## External Interfaces continued:

### DB9 Connector:

Standard DB9 male connector

PIN	Description	
2	RXD	Input
3	TXD	Output
5	Ground	Supply
7	RTS	Output
8	CTS	Input

### USB Connector:

Standard mini AB USB connector

PIN	Description	
1	VBUS	Supply Input
2	D+	Bi-Dir
3	D-	Bi-Dir
4	USB_ID	Input
5		Ground
Shield		Ground

### 30-Pin Locking Header:

PIN	Description	Direction	Level
1	Supply Enable	Input	Supply
2	Power Supply Input	N/A	Supply
3	Optical Isolated Input	Input	Supply
5	RS485_A	Bi-Directional	RS-485
6	RS485_B	Bi-Directional	RS-485
7	TRACE Port Receive	Input	RS-232
8	TRACE Port Transmit	Output	RS-232
9	CAN_LO	Bi-Directional	CAN
10	CAN_HI	Bi-Directional	CAN
13	Current Loop Supply Channel 1	Output	Supply
14	GPIO1	Bi-Directional	2.8V CMOS
15	Current Loop Supply Channel 2	Output	Supply
16	GPIO2	Bi-Directional	2.8V CMOS
18	GPIO3	Bi-Directional	2.8V CMOS
19	GPIO14	Bi-Directional	2.8V CMOS/ANALOG
20	GPIO4	Bi-Directional	2.8V CMOS
21	GPIO13	Bi-Directional	2.8V CMOS/ANALOG
22	GPIO5	Bi-Directional	2.8V CMOS
23	GPIO12	Bi-Directional	2.8V CMOS/ANALOG
24	GPIO6	Bi-Directional	2.8V CMOS
25	GPIO11	Bi-Directional	2.8V CMOS/ANALOG
26	GPIO7	Bi-Directional	2.8V CMOS/ANALOG
28	GPIO8	Bi-Directional	2.8V CMOS/ANALOG
29	GPIO10	Bi-Directional	2.8V CMOS/ANALOG
30	GPIO9	Bi-Directional	2.8V CMOS/ANALOG
4,11,12,17,27	Supply Ground	N/A	Ground

Samtec Part Number:

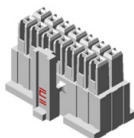
Housing: IPD1-15-D-K

Contacts: CC79L-2024-01-L

Janus Store Part Number:

Housing: XT-507-G

Contacts: XT-479-G



## Electrical Specifications:

### Absolute Maximum Ratings:

Parameter	Minimum	Nominal	Maximum	Unit	Note
Storage Temperature	-40	-	85	°C	1
Supply (Supply & Enable Input)	-40	-	60	Volt	1,2
VIN (Digital Inputs 2.8V CMOS)	-0.3	-	3.6	Volt	1
VIN (RS-232 Inputs)	-25	-	25	Volt	1
VIN (RS-485 Inputs)	-8	-	12.5	Volt	1
VIN (CAN Inputs)	-58	-	58	Volt	1

#### Notes:

- 1) Operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions is not implied. Exposure to Absolute Maximum Rating conditions for extended periods of time may affect device reliability.
- 2) The supply inputs are protected from reverse voltage and transients beyond the Recommended Operating Conditions. If transients persist the supply will be latched in a disable state. Once disabled the supply will need to be cycled off and on to reset.

### Recommended Operating Conditions:

Parameter	Minimum	Nominal	Maximum	Unit	Note
Operational Temperature:					
GSM865T2	-40	-	50	°C	3
CDMA864T2	-30	-	50	°C	3, 4
HSPA910T2	-40	-	50	°C	3
EVDO910T2 (Verizon)	-40	-	50	°C	3
Supply (Supply & Enable Input)	7	-	28	Volt	
Peak Supply Current	1.5	-	-	Amp	1
Average Supply Current	-	-	917	mA	2
Vsupply = 12 Vdc Ambient Temp = 85°C					
Average Supply Current	-	-	319	mA	2
Vsupply = 24 Vdc Ambient Temp = 85°C					

#### Notes:

- 1) Peak Supply Current specification is stated as the minimum amount of current the external power supply must supply during the TX burst of the embedded cellular radio. Please refer to the Plug-In User Manual for power supply characteristics of the embedded Plug-In Module embedded in the Terminus T2. Plug-In User Manual can be downloaded at <http://www.janus-rc.com/terminuscf.html>
- 2) Average Supply Current specification is stated as the maximum average current the Terminus T2 terminal can draw while maintaining junction temperatures within the internal power supply IC's specifications. It is the applications responsibility to maintain operation within this limit to maintain reliable operation over the life of this terminal product.
- 3) Maximum temperature range is limited by the ABS plastic enclosure.
- 4) CDMA864T2 models are EOL.

### I/O Levels (2.8V CMOS)

Parameter	Minimum	Nominal	Maximum	Unit	Note
Input Voltage Low - Vil	-0.3	-	0.84	Volt	
Input Voltage High - Vih	1.96	-	3.1	Volt	
Output Voltage Low - Vol	-	-	0.4	Volt	1
Output Voltage High - Voh	2.4	-	-	Volt	1
Output Current - Io	-	-	8	mA	
Pull-up Resistance - RPULLUP	30	40	50	kOhm	

#### Notes:

- 1) Test conditions: Max Io.

### I/O Levels (RS-232 Transceiver)

Please refer to Intersil's data sheet for a complete listing of specifications for the RS-232 transceiver used in the Terminus T2.

Intersil Part Number: ISL83387

### I/O Levels (RS-485 Transceiver)

Please refer to Intersil's data sheet for a complete listing of specifications for the RS-485 transceiver used in the Terminus T2.

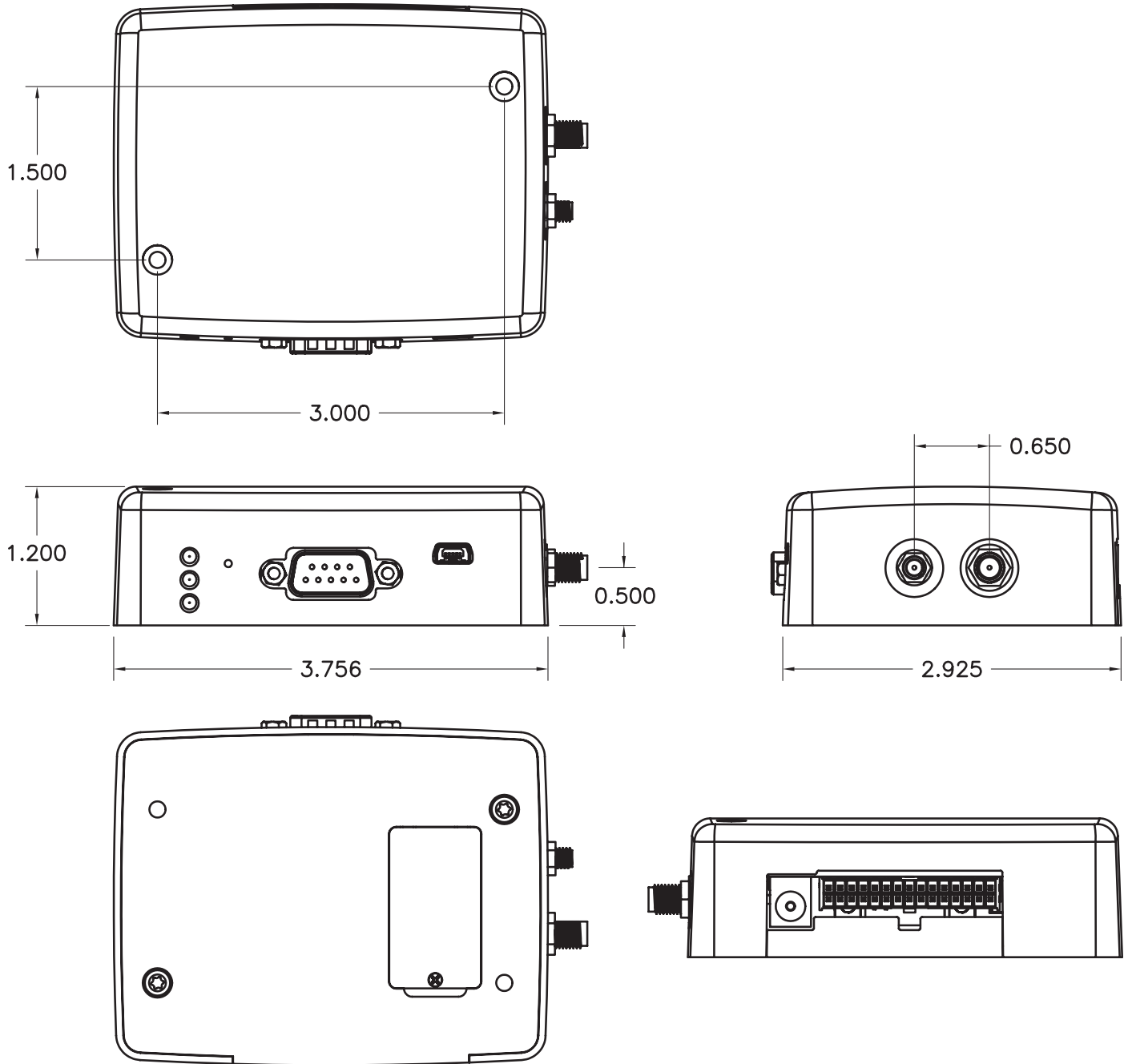
Intersil Part Number: ISL8487

### I/O Levels (CAN Transceiver)

Please refer to NXP's data sheet for a complete listing of specifications for the CAN transceiver used in the Terminus T2.

NXP Part Number: TJF1051T

## Mechanical Specifications:





# Terminus T2 Products User Manual – Hardware Guide



## Ordering Information

Ordering Information	Description
CDMA864T2 v2.0	CDMA-1xRTT (Sprint)
CDMA864T2 v3.0	CDMA-1xRTT (Verizon)
CDMA864T2 v4.0	CDMA-1xRTT (Aeris)
HSPA910T2 v1.0	HSPA+/UMTS/EDGE/GPRS/GSM
EVDO910T2 v3.0	EV-DO (Verizon) (coming soon)
WiFi1500T2 v1.0	Wi-Fi GPS Enabled (coming soon)
WiFi1500T2 v2.0	Wi-Fi without GPS (coming soon)

## Revision History

Revision	Revision Date	Note
A00	09/25/14	Advanced Release - T2-F4 User Manual
P00	10/28/14	Updates and Release to Preliminary

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