



DIMITTECH

DTX2-2800C

mSPI GPS Module

DATA SHEET

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1. Overview

DTX2-2800C is a small footprint module from the DTX 2nd generation series. It contains a highly sensitive GPS receiver along with its dedicated power supply and a pre-programmed high-speed microcontroller, running Dimitech's mSPI-to-UART software communication engine.

DTX2-2800C performs as **mSPI slave device**.

Feature Highlights

- Standard PLCC68 style package
- Wide range 4-20V DC power supply
- Fully self-contained – does not need any external components to run
- Built-in patch antenna and support for an optional external active antenna
- High-speed on-board mSPI communications engine
- Built-in GPS status LED
- RoHS compliant

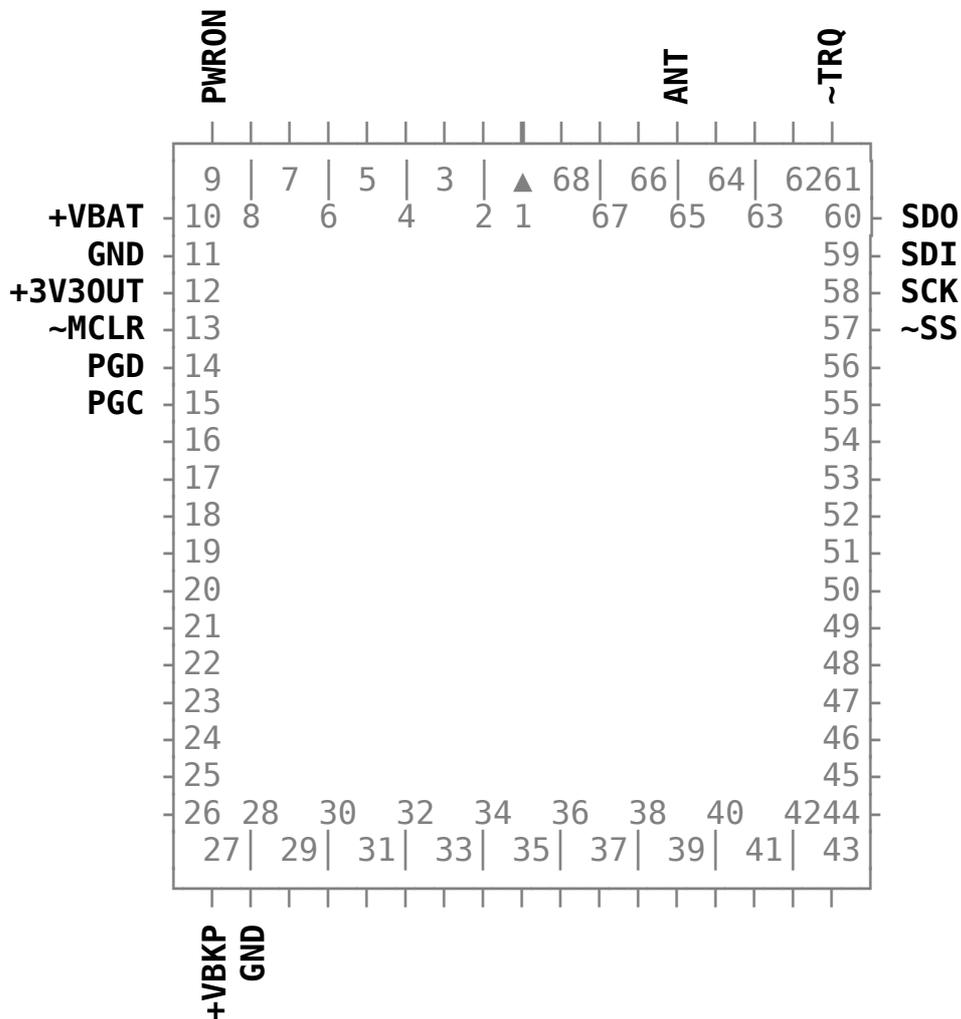
Typical Applications:

- Hobby and academic projects
- Robotics and various toys
- Automotive and industrial automation devices
- Portable electronics
- Data logging

Ordering Codes

Device	Built-in GPS receiver model
DTX2-2800C	FGPMMOPA6H

2. Pinout



Pinout Summary

Pin	Name	Type	Description
1			No connection
2			No connection
3			No connection
4			No connection
5			No connection
6			No connection
7			No connection
8			No connection
9	PWRON	I	Power enabling input (can be connected directly to +VBAT); active high

10	+VBAT	P	Positive power lead
11	GND	P	Ground
12	+3V3OUT	P	+3.3V output from the internal regulator
13	~MCLR	I	CPU's $\overline{\text{MCLR}}$ line; internally biased to +3.3V; used for programming firmware
14	PGD	I,O	Data line used for programming firmware
15	PGC	I	Clock line used for programming firmware
16			No connection
17			No connection
18			No connection
19			No connection
20			No connection
21			No connection
22			No connection
23			No connection
24			No connection
25			No connection
26			No connection
27	+VBKP	P	RTC backup battery input (typically 3V coin battery); optional
28	GND	P	Ground
29			No connection
30			No connection
31			No connection
32			No connection
33			No connection
34			No connection
35			No connection
36			No connection
37			No connection
38			No connection
39			No connection
40			No connection
41			No connection
42			No connection
43			No connection
44			No connection
45			No connection
46			No connection

47			No connection
48			No connection
49			No connection
50			No connection
51			No connection
52			No connection
53			No connection
54			No connection
55			No connection
56			No connection
57	~SS	I	mSPI Slave Select input; weak biasing to +3.3V; active low
58	SCK	I	mSPI Clock input
59	SDI	I	mSPI Serial Data In
60	SDO	O,Z	mSPI Serial Data Out
61	~TRQ	E	Transaction Request to host; weak biasing to +3.3V; active low Indicates there is at least one CR-terminated (ASCII code 0x0d) text sting in the GPS data buffer
62			No connection
63			No connection
64			No connection
65	ANT	S	Antenna; leave open if unused Optional connection for an external 50-Ohm active or passive antenna
66			No connection
67			No connection
68			No connection

Legend:

I – input with CMOS level
A – analogue signal
S – special functionality

O – digital output
P – power pin

E – open drain/collector output
Z – high impedance

3. Electrical Parameters

ABSOLUTE MAXIMUM RATINGS:

Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

parameter	min	typ	max	units
Power supply voltage range, pin +VBAT with respect to pin GND	3.5	9	20	V
Voltage on pin +VBKP with respect to pin GND	2.5	3	3.7	V
Safe load on +3V3OUT pin			150	mA
Current drain from +VBKP in backup mode			10	µA
Current drain from +VBAT in active mode		24	31	mA
Current drain from +VBAT in off mode			0.1	µA
Parameters of all other functional pins	According to function and IC manufacturer's recommendation			
Operating free-air temperature range	-20		+85	°C
Storage temperature range	-40		+90	°C

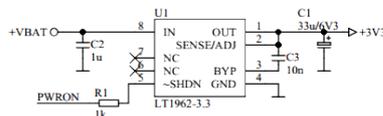
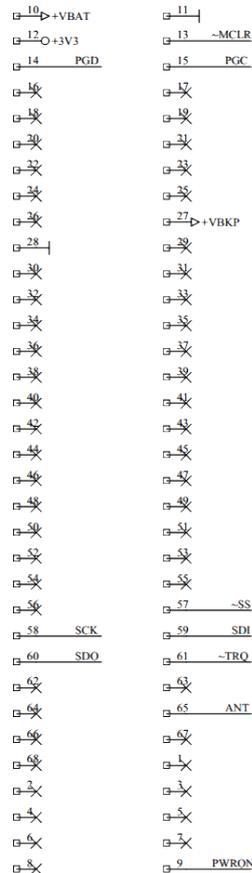
4. Dynamic Parameters

parameter	min	typ	max	units
~RST active low time	5			µS
SCK input clock frequency ¹			4	MHz
T_{SR} Transaction initialisation time			10	µS

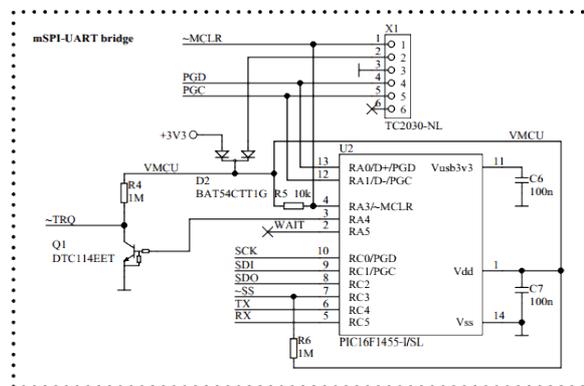
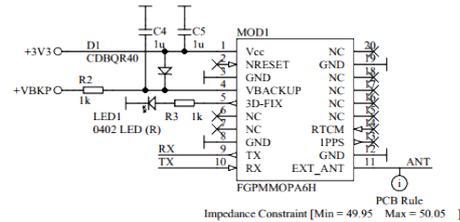
1. Assuming 50% duty cycle

5. Internal Schematic

Note: Dimitech Pty Ltd reserves the rights to make further adjustments in this circuit without prior notifications



DTX2-2800C (mSPI GPS)
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6. Operation

DTX2-2800C conforms with the basic mSPI protocol acting as a **slave device**. For more information about mSPI, please refer to [AN0001](#).

On a hardware level the communication is done via SPI mode 3 with 3.3V signal levels (not 5V-tolerant). All bytes are transferred starting with bit 7 and ending with bit 0. Multi-byte sequences are transferred starting with the most significant byte and ending with the least significant byte.

As per the mSPI specification, the master device is required to address the slave in the bus within the first byte of every new data transaction.

The DTX2-2800C responds to a fixed mSPI address 0x3B:

Byte 0

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	1	1	1	0	1	1

This is the very first byte which DTX2-2800C will be looking for at the start of every data transaction on the bus. If not addressed, the module will remain in standby mode.

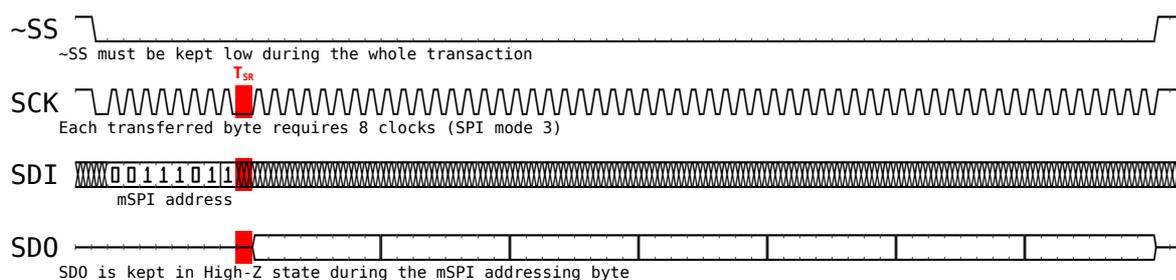
Acting on a valid device address DTX2-2800C will start transmitting back to the master data from its internal data buffer. This data contains raw text information as received from the GPS. Data will be transferred until the master terminates the transaction by pulling the \sim SS line back to high level.

If there is no valid data to be sent to the master from the internal buffer, DTX2-2800C will keep sending bytes with value 0x00.

This is a convenient way to inform the master about it as value 0x00 is the ASCII code NIL, also used as data end indication in null-terminated strings, used in C/C++ and many other programming languages. This code will not be found in the text information sent by the GPS otherwise.

The communication as described is shown in the picture below.

Note the T_{SR} segment, which is important. This is a short delay, which the master is required to make before start clocking the data bytes. This time is needed to let DTX2-2800C initialise its output line and prepare for the transaction. The value of T_{SR} can be found in the table "**Dynamic Parameters**". No dummy clocks are required from the master.



DTX2-2800C also provides a \sim TRQ output, which is an open-drain type output, internally biased to 3.3V with a weak pull-up resistor and can be used optionally to detect presence of data in the internal buffer. DTX2-2800C has an internal 896-byte data reception buffer which will roll-over when full.

The \sim TRQ output will be set low if there is at least one CR-terminated text string in the internal GPS data buffer. This will inform the master to start a new transaction and retrieve data from DTX2-2800C. Once being set low, \sim TRQ will return back to high only after there is no data left in the internal GPS data buffer and all data has been read out by the mSPI master.

A simple MMBasic program for ICEemite shown below will create dumb terminal output from DTX2-2800C without using the \sim TRQ signal. The program will loop forever until stopped and is for demonstration purpose only.

```
SetPin 4,8 : Pin(4)=1           ' configure ~SS
SetPin 1,2 : SetPin 2,8 : SetPin 3,8 ' configure MISO, MOSI and SCK
Pin(4)=0 : b=SPI(1,2,3,&h3b)    ' select and address the 2800 module
Do
  Print Chr$(SPI(1,2,3,0));      ' receive data from the 2800 module (send 0)
Loop
```

7. Programming Custom Firmware

DTX2-2800C can be programmed with custom user firmware in some specific situations. That can be done either through the on-board TagConnect® (<http://www.tag-connect.com/>) pads, or by connecting a programmer to the dedicated programming pins ~MCLR, PGD and PGC as well as providing power and and ground connections. If the module is programmed when already fit in a system, the on-board programming pads may not be possible to be used due to the increased length of the leading metal rod in the programming header. For such cases only programming through the external pins will be available. If the module is programmed when not fit in a system, its power must come from the programmer.

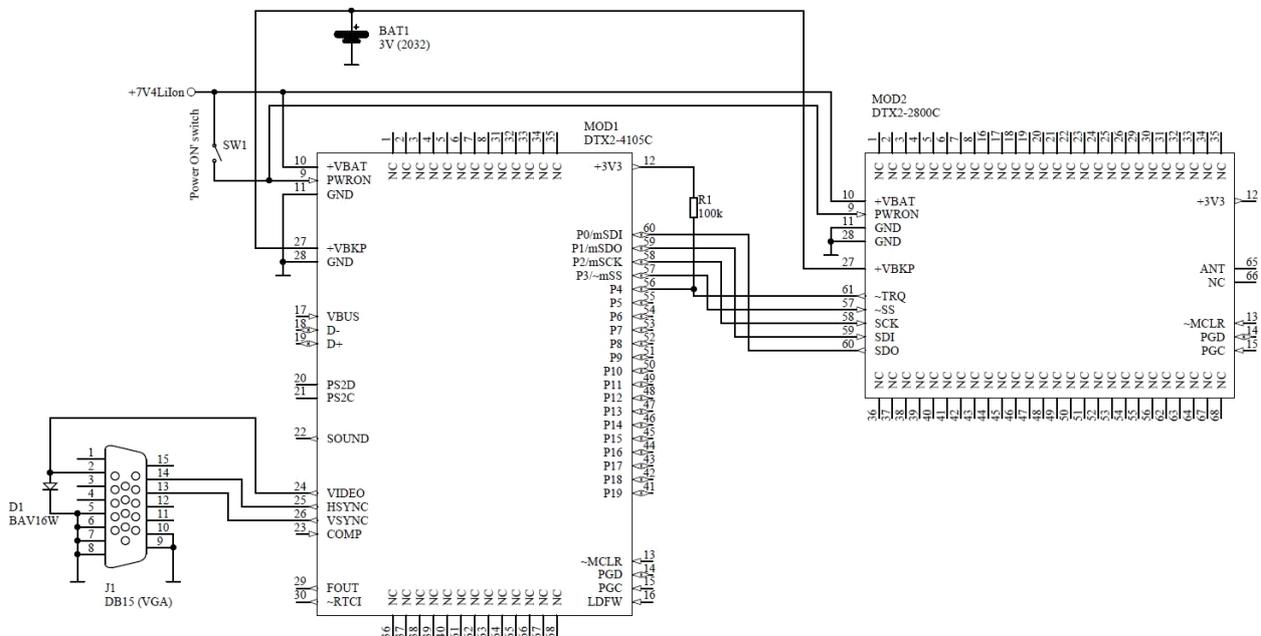
It is important to note that PIC16's LVP (Low-Voltage Programming) option must be enabled in the programmer.

For more details about the Microchip PIC16F1455 microcontroller used in DTX2-2800C, refer to its documentation: <http://ww1.microchip.com/downloads/en/DeviceDoc/41639A.pdf>.

Contact Dimitech Pty Ltd for assistance about creation and programming of custom firmware for DTX2-2800C.

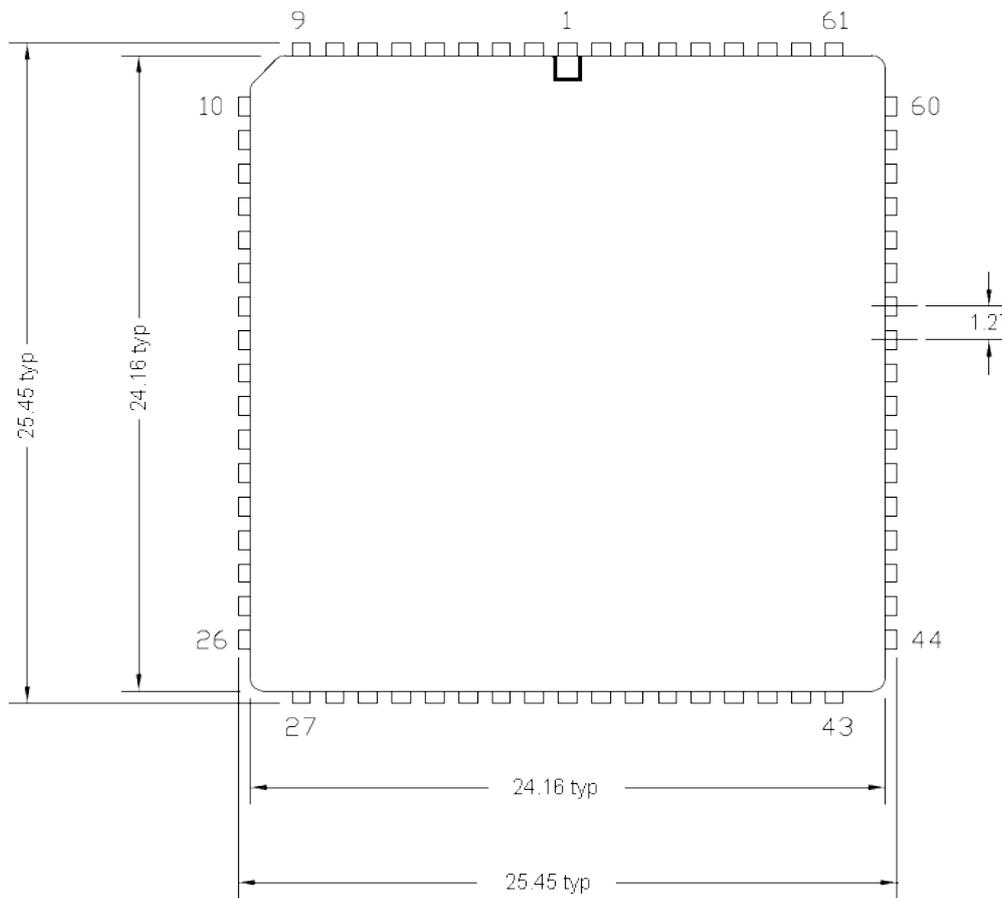
8. Typical Application

The figure below demonstrates a typical simple system with DTX2-2800C for acquisition of GPS data and its visualisation onto a VGA display.



9. Mechanical Parameters

Note: All dimensions are given in millimetres



Dimitech Pty Ltd provides CAD schematic symbols and PCB footprints for the DTX series modules. For more information please visit our website: <http://www.dimitech.com/>.