DTX1-4000L
'Mirtoo'

Fully Self-Contained Computer-on-Module

DATA SHEET

TO OUR VALUED CUSTOMERS

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1. Overview

Feature Highlights

16-pin device in small LCC 25x25mm package
Wide range 4-20V DC power supply
Fully self-contained – does not need any external components to run
32-bit architecture
Individually programmable eight I/O lines
Analogue inputs capable of measuring up to 16V voltages
Protected digital inputs
Open drain outputs capable of sinking **up to 200mA** each
Glue interface digital port for expansions
Large internal SPI flash memory for program and data storage
Two built-in LEDs for easier indications and debugging
RoHS compliant

Typical Applications

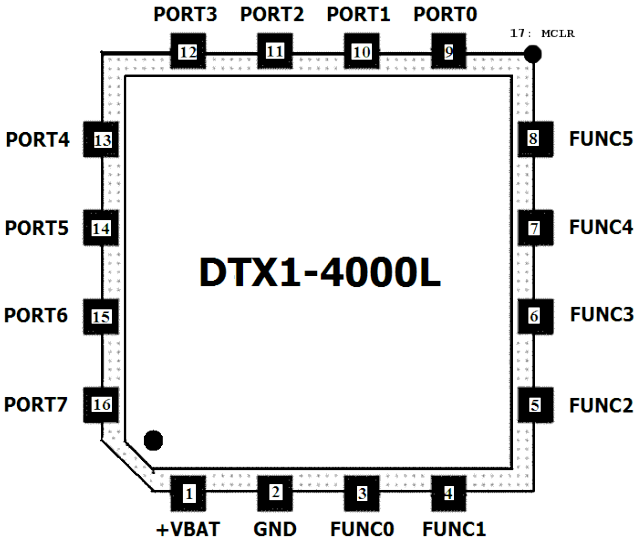
- Hobby and academic projects
- Robotics and various toys
- Automotive and industrial automation devices
- Portable electronics
- Data logging

Ordering Codes

Device	Flash	RAM	Pre-loaded programming shell
DTX1-4000L	**128k**	**32k**	**None**
DTX1-4000L-B	**128k**	**32k**	**Basic***
DTX1-4000L-C	**128k**	**32k**	**C***
DTX1-4000L-F	**128k**	**32k**	**Forth***

** Planned product*

2. Pinout



Pinout Summary

Pin	Name	Type	Description
1	+VBAT	P	DC power supply, positive lead
2	GND	P	Ground
3	FUNC0	I,O,5V	Functional port bit 0
4	FUNC1	I,O,5V	Functional port bit 1
5	FUNC2	I,O,5V	Functional port bit 2
6	FUNC3	I,O,5V	Functional port bit 3
7	FUNC4	I,O,5V	Functional port bit 4
8	FUNC5	I,O,5V	Functional port bit 5
9	PORT0	I,O,OD	Interface port bit 0
10	PORT1	I,O,OD	Interface port bit 1
11	PORT2	I,O,OD	Interface port bit 2
12	PORT3	I,O,OD	Interface port bit 3
13	PORT4	I,O,OD	Interface port bit 4
14	PORT5	I,O,OD	Interface port bit 5
15	PORT6	I,O,OD	Interface port bit 6
16	PORT7	I,O,OD	Interface port bit 7
17	MCLR	I	PIC32's MCLR input (also pad 1 in X1)

Legend:
I – input with CMOS level
O – digital output
5V – 5 volt tolerant pin
OD – open drain output
P – power pin

+VBAT

The module can be powered from any DC power supply with voltage within the range of 4 – 20V. No external capacitors are needed.

FUNC0 - FUNC5

The FUNCn ports are intended for module expansion with other logic. They have such internal connections that would allow them to be used in different modes. The table below shows the recommended uses of each FUNC bit as an interface pin. Of course they can also be used as digital I/O ports or any other purpose as specified by the PIC32MX200's series datasheet, although they are not protected like the PORT lines and further care should be taken to ensure they operate within the specified conditions for the ports of PIC32.

	UART	**SPI**	**I²C**	**USB[1]**	**CPU**
FUNC0	TX2			D+	PGD INT1
FUNC1	RX2			D-	PGC INT3
FUNC2		SDI1	SCL1	Vbus	INT3
FUNC3		SDO1	SDA1	ID	INT3
FUNC4	TX1	~SS1			INT4
FUNC5	RX1	SCK1		VbusON (Host/OTG)	INT2

Note **1.** *Due to internal clock limitations in the current revision of the PIC32MX1xx/2xx series, USB cannot be used in this release of the Mirtoo module.*

PORT0 - PORT7

Eight equivalent interface bits. Each bit can be individually programmed as analogue input, capable of measuring within the range 0 – 16V, buffered digital input or open drain digital output that is able to sink up to 200mA current in voltages up to 30V.

MCLR

Provides direct access to PIC32's MCLR pin, typically for programming purposes only. If not used, it can be left unconnected.

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**	**max**	**units**
VCC, Supply voltage range, pin +VBAT with respect to pin GND	-0.5	+20	V
Voltage on pins PORT[7..0] with respect to pin GND	-0.5	+30	V
Voltage on pins FUNC[5..0] with respect to pin GND - with +4V < VCC < +20V - with -0.5V < VCC < +4V	 -0.3 -0.3	 +5.5 +3.6	 V V
Output current sunk by pins PORT[7..0] **:NOTE:** This parameter is a function of duty cycle and number of pins conducting simultaneously, see Figure 1 for details.		200	mA
Output current sunk/sourced by pins FUNC[5..0]		15	mA
Operating free-air temperature range	-40	+85	°C
Storage temperature range	-65	+150	°C

RECOMMENDED OPERATING CONDITIONS:

Parameter	**min**	**max**	**units**
VCC, Supply voltage range, pin +VBAT with respect to pin GND	+3	+16	V
Voltage on pins PORT[7..0] with respect to pin GND - configured as analogue input; - configured as digital input; - configured as digital output(open drain);	 0 -0.5 -0.5	 16 30 30	 V V V
Voltage on pins FUNC[5..0] with respect to pin GND **:NOTE:** A valid supply voltage should be present on pin +VBAT.	-0.3	+3.6	V
Output current sunk by pins PORT[7..0]	see Figure 1 for details		
Output current sunk/sourced by pins FUNC[5..0]		15	mA
Operating free-air temperature range	-40	+85	°C

ELECTRICAL CHARACTERISTICS:

Over recommended operating free-air temperature range –40°C to 85°C (unless otherwise noted).

Parameter	**min**	**max**	**units**
HIGH Level Input Voltage, pins PORT[7..0] configured as digital inputs	2.1		V
LOW Level Input Voltage, pins PORT[7..0] configured as digital inputs		0.9	V
ON-state resistance pins PORT[7..0] configured as digital outputs - **Isunk** = 100 mA		3.5	Ohm
HIGH Level Input Voltage, pins FUNC[5..0] configured as digital inputs – FUNC5, FUNC3, FUNC2, FUNC1, FUNC0 – FUNC4	 2.14 1.62		 V V

LOW Level Input Voltage, pins FUNC[5..0] configured as digital inputs – FUNC5, FUNC4 – FUNC3, FUNC2 – FUNC1, FUNC0		 0.49 0.99 0.66	 V V V
HIGH Level Output Voltage, pins FUNC[5..0] configured as digital outputs – Iout ≥ -14 mA – Iout ≥ -12 mA – Iout ≥ -10 mA – Iout ≥ -7 mA	 1.5 2.0 2.4 3.0		 V V V V
LOW Level Output Voltage, pins FUNC[5..0] configured as digital outputs		0.4	V
Icc, Supply Current		TBD	V

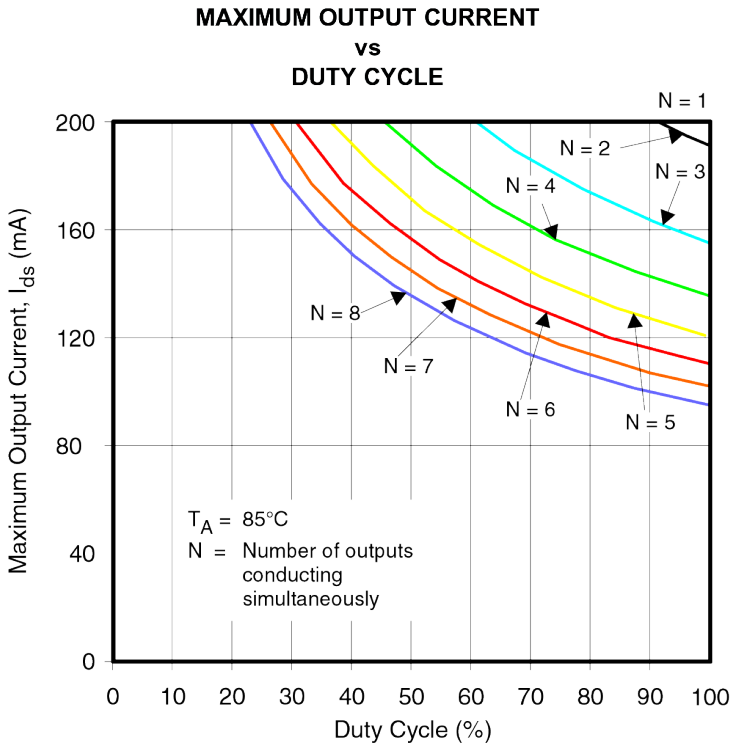
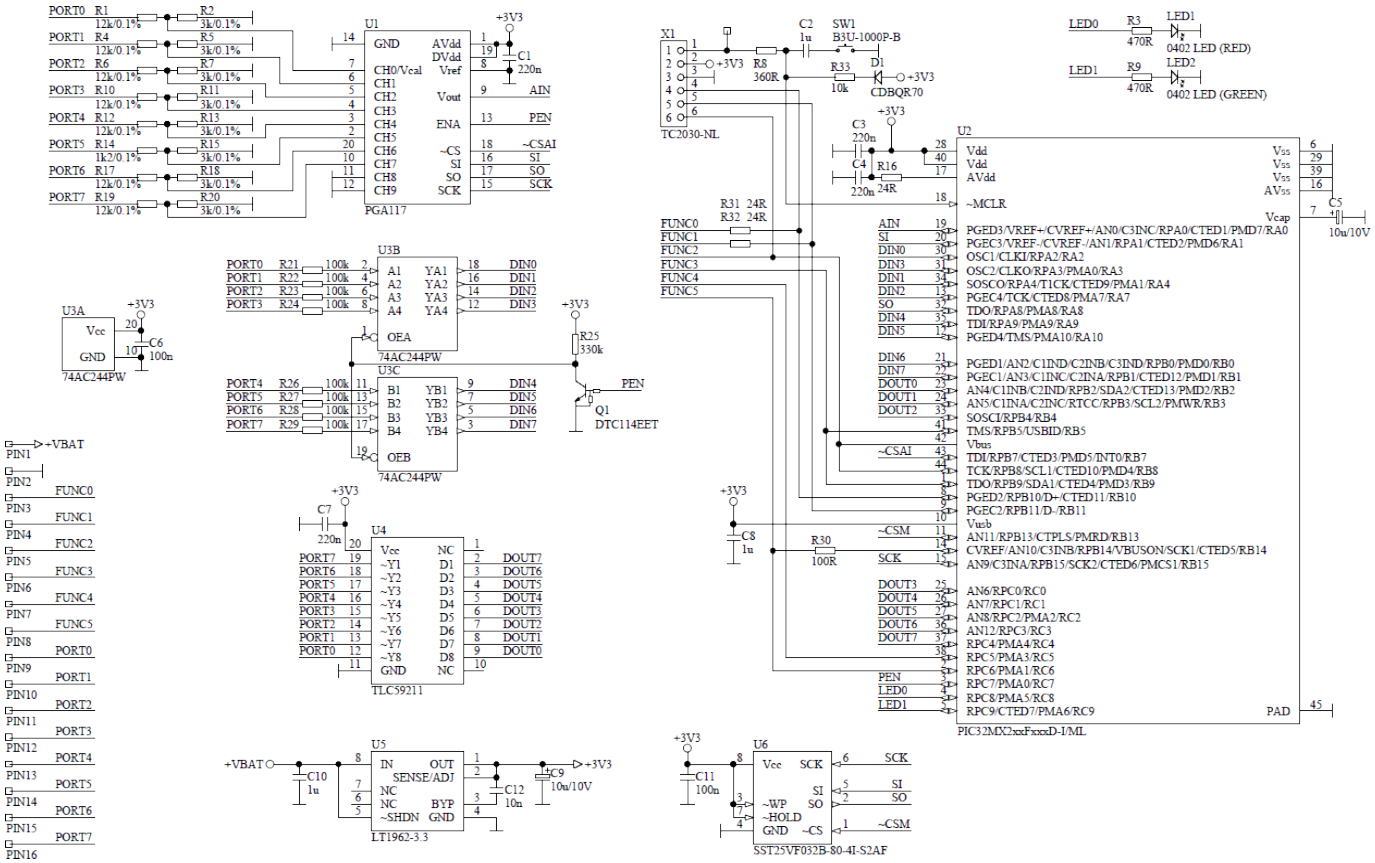


Figure 1

4. Internal Schematic

Note: *Dimitech Pty Ltd reserves the right to make further adjustments into this circuit without prior notifications*

The internal circuit of DTX1-4000L is shown below:



Notes:

1. A prototype "R1" version of the circuit exists with some slight differences. The table below outlines the different connections between the "R1" version and the current "R2" release:

U2 pin	Function in "R1"	Function in "R2"
30	SO	DIN0
31	DIN0	DIN3
32	DIN3	SO

The "R2" version also differs from "R1" in the resistor values of the input voltage dividers before U1. Whilst they are 12k and 3k in "R2", their values were 1k2 and 300R in "R1".

"R2" modules have the relevant text written next to pin 1, while the "R1" modules have no text in that area.

2. The on-board connector X1 consists of surface pads, intended for use along with TC2030-NL programming header (see http://www.tag-connect.com for more details).

The pinout strictly follows the recommended by Microchip one:

1 (*MCLR*), 2 (*Vdd*), 3 (*GND*), 4 (*PGD*), 5 (*PGC*), 6 (*NC*)

A great care should be taken when using the programming connector to supply power to DTX1-4000L. The voltage on the ***Vdd*** pin should never be higher than 3.6V.

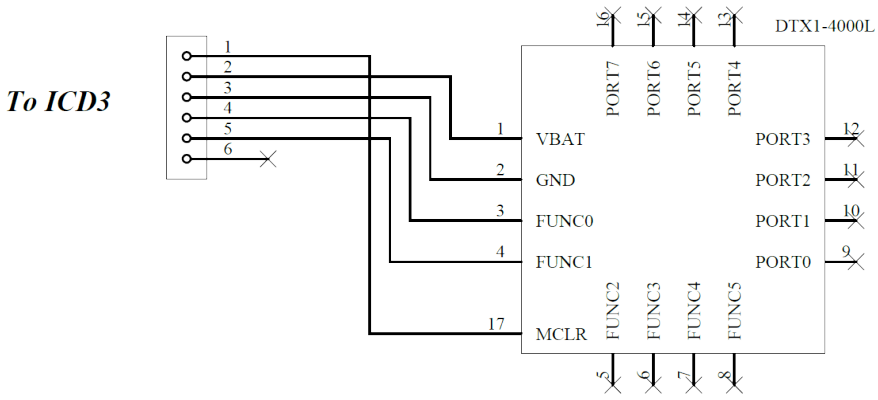
Using Microchip's ICD3 for programming is recommended.

Please be aware, that loading custom firmware into the module will destroy the pre-loaded programming shell (applicable for DTX1-4000L modules with pre-loaded software only).

3. Programming with an external connector should be done via the appropriate pins: FUNC0 (programming data), FUNC1 (programming clock), MCLR (master clear), +VBAT (Vdd) and GND.

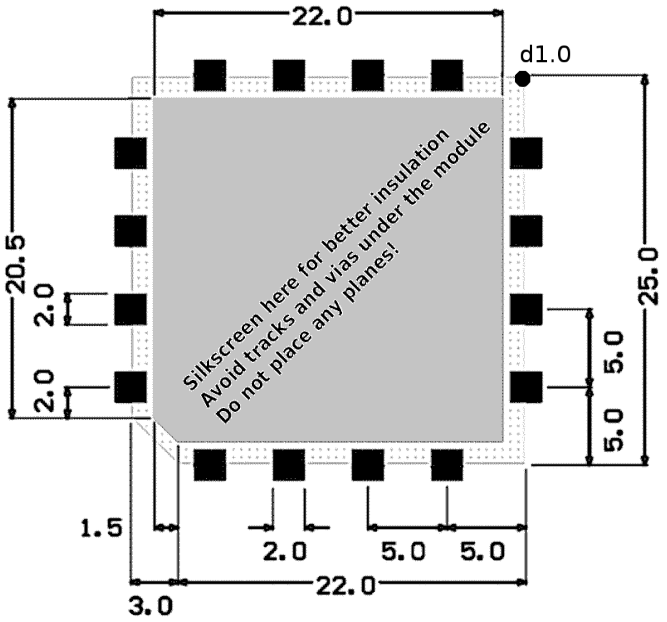
The connection on +VBAT is optional and if not used, the module should be externally powered during the programming process. If not used however, ICD3 still has to be set to provide power to the external target (which won't matter in this case), because ICD3's internal firmware always checks for voltage present on the Vdd line before starting the process.

In case the module is receiving power from ICD3 via the +VBAT line, the programming voltage, provided by ICD3 should be set no lower than 4.5V.



5. Dimensions and Recommended Footprint

Note: *All dimensions are given in millimetres*



Dimitech Pty Ltd provides CAD schematic symbols and PCB footprints for DTX1 series.
For more information please visit our website: http://www.dimitech.com/.