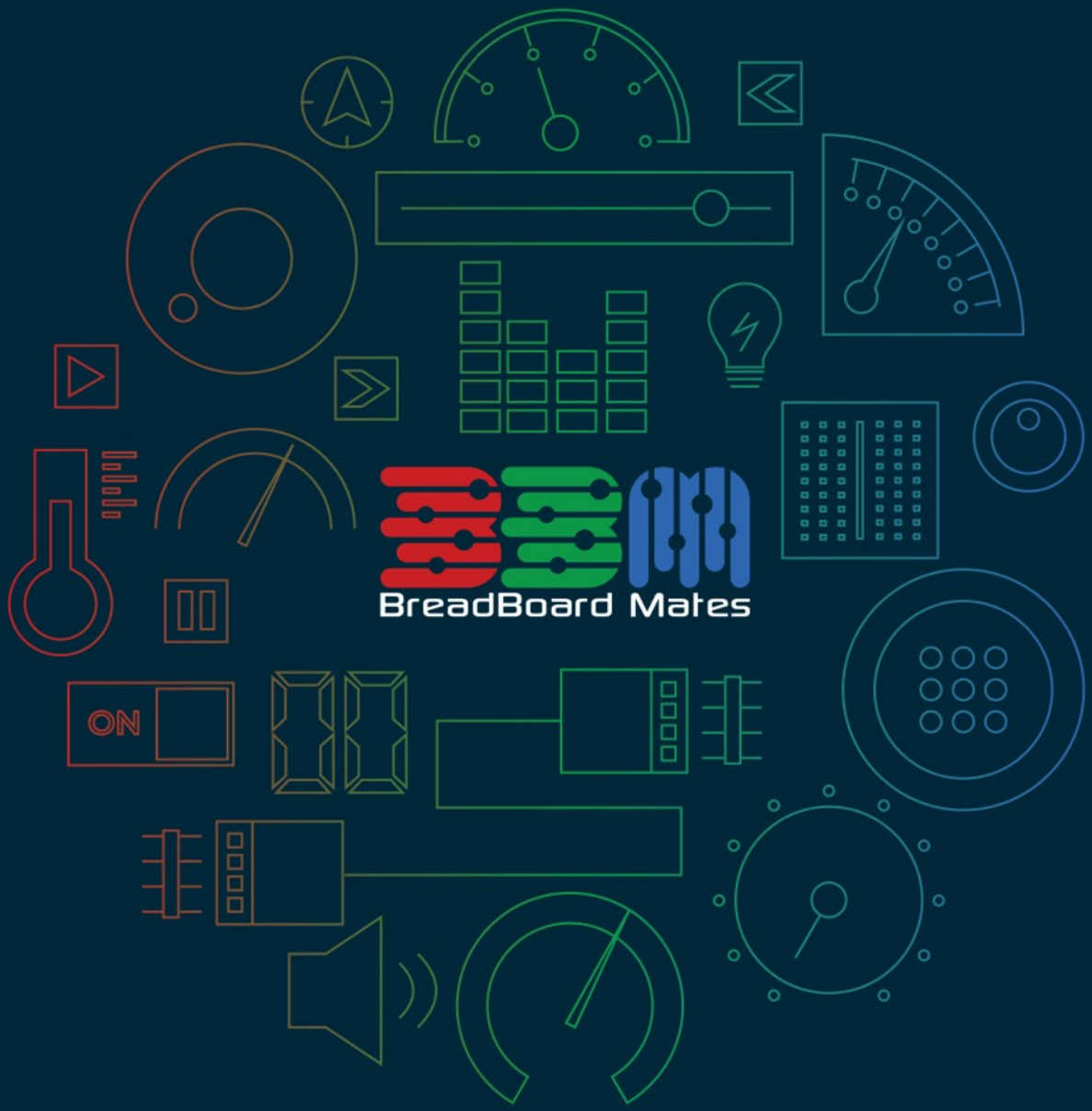
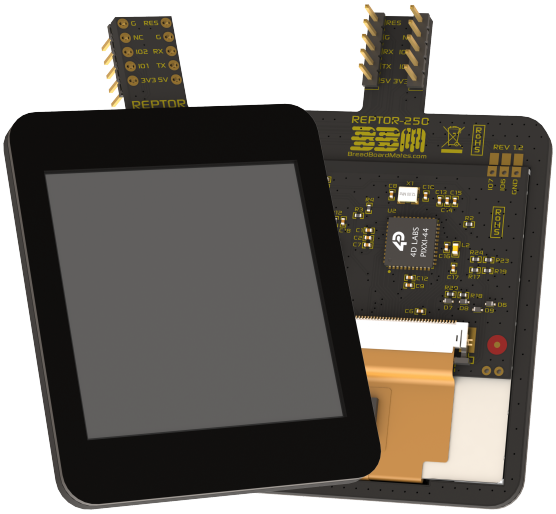


REPTOR-250

DATASHEET

Contents

Introduction



REPTOR-250, is a unique breadboard compatible display development module, aimed to speed up and reinvent the way electronic testing, development and projects are carried out, in either stand alone, host interfaced, PC tethered, or educational settings.

REPTOR-250 has a 2.5" TFT IPS LCD display with Capacitive Touch that is driven directly by a Pixxi44 graphics processor from 4D Labs. It features a unique MatesBus interface, which is simple to use in both breadboard applications, as well as on adaptors or directly into developed products.

REPTOR-250 was created as a flexible design aid, primarily to simulate components readouts and meters, along with inputs such as buttons and sliders, which would otherwise be cumbersome or demanding on hardware resources for breadboard or electronic development. Simulating component readouts allows accelerated development and retains the often-limited GPIO hardware associated with many developments.

REPTOR-250 was designed for engineers, hobbyists, and students, from beginner to advanced levels, designed to make breadboarding or project development, easier.

REPTOR-250 is made up of a carrier PCB and a TED-250 module. Refer to REPTOR-250 Configuration for more information regarding this.

Product Features

REPTOR-250's main interface is a 3.3V level Asynchronous Serial UART and features 2 GPIO which can be used as Digital Inputs, Digital Outputs, or Master I2C Communication. These interfaces arm REPTOR-250 with resources to be either a stand-alone controller, a Host driven slave, or a tethered test instrument, while being capable of interfacing and powering external devices itself.

- Powered by 4D Labs Pixxi44 Graphics Processor
- 240(W)x240(H) resolution TFT IPS LCD, Capacitive-Touch
- 3.3V (5V tolerant) Serial UART interface, capable 300 to 2187500 Baud
- Master I2C (3.3V level) interface bus
- 2 GPIO (3.3V level), Digital Inputs, Digital Outputs or Master I2C
- 32MB of External SPI Flash Memory
- 32KB of Processor Flash Memory
- 30KB of Processor SRAM for User Variables
- Single supply 5V power input (*3.3V possible – see System Pins)
- Shared 3.3V power output for User, approximately 300mA available
- Standard 0.1" (2.54mm) pitch male pin headers, breadboard compatible
- RoHS and REACH compliant
- PCB is UL 94V-0 Flammability Rated
- Weight approx. 31.0 grams

Hardware Detail

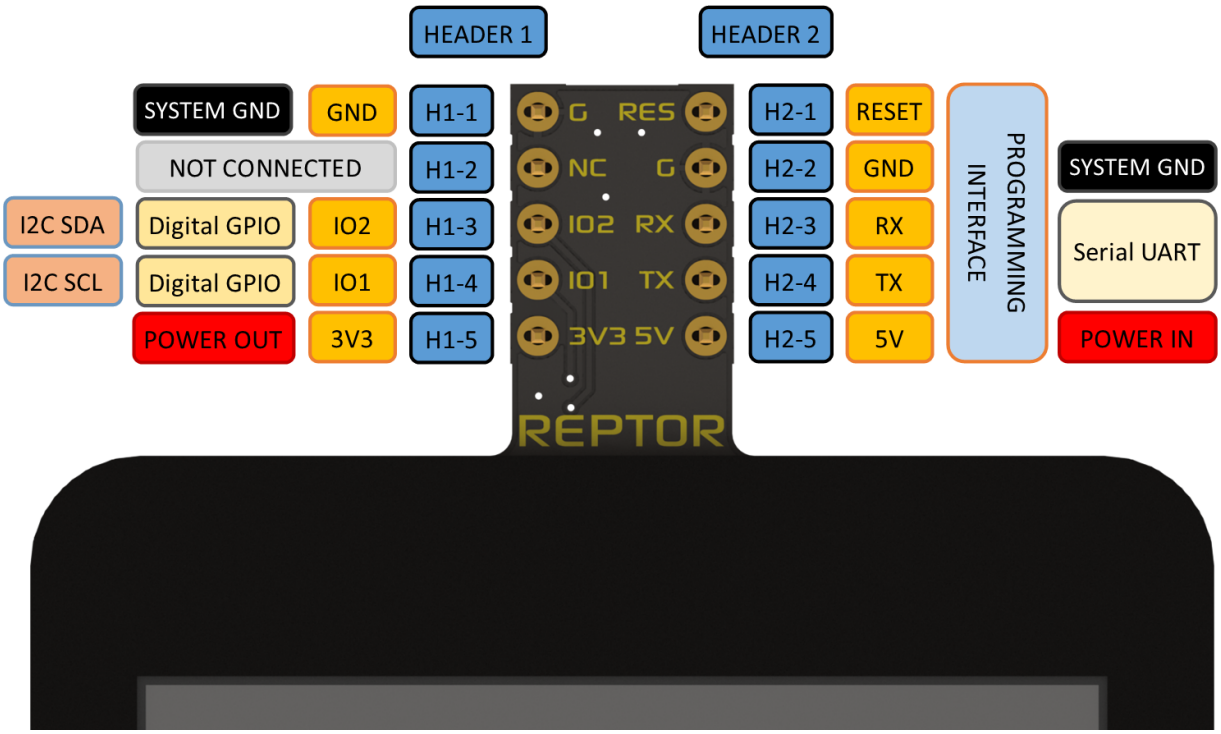
REPTOR-250 utilises the BBM MatesBus, which is a unique interface pinout designed to be simple and easy to use.

The MatesBus is made up of 2 rows of 5 pins, 0.1" (2.54mm) pitch, spaced 0.3" (7.62mm) apart, ideal for direct plug into a breadboard, or compatible adaptor or development board.

While the REPTOR-250 can be orientated in any of its 4 positions, Portrait, Landscape, Portrait Reversed and Landscape Reversed, its natural position forms an upside-down 'T' shape and is designed to interface with the bottom of a breadboard, sitting closest to the User, leaving the top part of the breadboard free for components and wiring.

Pin Configuration

The REPTOR-250 MatesBus has 10 physical pins, 5 on each side of the interface neck, and are spaced apart to easy connect onto a breadboard.



The H2 Header doubles as a programming interface and features Power and Serial UART, while the H1 Header features Power Output and 2 GPIO (General Purpose IO).

Header/Pin	Symbol	I/O Type	Description
Header1-1	GND	Power	Module/System GND
Header1-2	N/C	-	Not Connected
Header1-3	IO2	I/O	GPIO capable of Digital In/Out or I2C SDA (3.3V Level)
Header1-4	IO1	I/O	GPIO capable of Digital In/Out or I2C SCL (3.3V Level)
Header1-5	3V3 OUT	Power	3.3V ~300mA Power Output for User (shared with system)
Header2-1	RESET	I	System Reset, Active Low
Header2-2	GND	Power	Module/System GND
Header2-3	RX	I	Asynchronous Serial UART Receive Pin (3.3V, 5V Tolerant)
Header2-4	TX	O	Asynchronous Serial UART Transmit Pin (3.3V Level)
Header2-5	5V	Power	Module 5V Input, Main Power

Note

IO1 is connected to **IO7**, and **IO2** is connected to **IO6** on the Pixxi44 processor. These are remapped to **IO1** and **IO2** naming conventions to match the MatesBus specification. Mates Studio also uses the **IO1** and **IO2** naming for REPTOR-250.

Hardware Interfaces

The REPTOR-250 has hardware peripherals configured for interfacing with other external devices -- general purpose digital inputs/outputs, UART, and Master I2C.

System Pins

+5V (Device Supply Voltage)

Display supply voltage pin. This pin should be connected to a stable supply voltage in the range of 4.0 Volts to 5.5 Volts DC. Nominal operating voltage is 5.0 Volts for optimal display performance.

> **Note**
>
> If absolutely required, 3.3V can be applied to the +5V input, and the module will operate correctly, but with a lower backlight brightness. For this reason, it is not a recommended configuration, but for systems without 5V it enables compatibility. Note the 3.3V regulators will be passing the input voltage and not regulating themselves, so ensure you are using a clean power supply input. Anything less than about 3.2V the backlight will fail to light up. Over 3.3V is always recommended.

3V3 (Device Output Voltage)

3.3V Output for the User, shared with the system. Capacity of approximately 300mA is available for external use by the User to power circuits/devices. This is an OUTPUT only and is the same regulator as the main system. The regulator is rated for 500mA less system usage.

GND (Module Ground)

Device ground pin. This pin must be connected to system ground.

RESET (Module Master Reset)

Device Master Reset pin. An active low pulse of greater than 2 microseconds will reset the device. Ideally use an open collector type circuit to reset the device if an external reset is required. Alternatively connect it to a GPIO from a host and drive the pin Low to reset and set the pin High (3.3V) to return to run. This pin is not driven low by any internal conditions but is pulled high with a pull up resistor on the REPTOR-250 module itself. The pins primary use is for programming REPTOR-250 and is required by the Mates Programmer for loading Firmware/PmmC and applications.

General Purpose I/O

The REPTOR-250 has two general purpose input/output (GPIO) pins available.

GPIO pins **IO1** & **IO2** can be individually set as a digital input or output. The pin mode of all the pins at power-up or reset is input by default.

When set as digital inputs, the pins are 3.3V tolerant. [These are not 5V tolerant]{.underline} and must not be connected directly to 5V devices outputs or 5V sources. When set as digital outputs, the pins output at 3.3V levels. Digital GPIO pins can source/sink 15 mA.

Serial Ports - TTL Level Serial

The Pixxi44 Processor has a single hardware asynchronous serial port with fixed pins TX/RX. The Pixxi44's serial port can be used to communicate with external serial devices and is also used for programming the Pixxi44 itself.

The primary features are:

- Full-Duplex 8-bit data transmission and reception.
- Data format: 8-bits, No Parity, 1 Stop bit.
- Independent Baud rates from 300 baud up to 2187500 baud.

This serial UART is also the programming interface for User program downloads. Once the compiled application is downloaded and the user code starts executing, the serial port is then available to the user application.

TX pin (Serial Transmit)

Dedicated Asynchronous Serial port transmit pin, TX. Connect this pin to external serial device receive (RX) signal. This pin outputs at 3.3V levels.

RX pin (Serial Receive)

Dedicated Asynchronous Serial port receive pin, RX. Connect this pin to external serial device transmit (TX) signal. This pin is 5.0V tolerant.

Note

The serial UART output at the level of TTL 3.3V, however is 5V tolerant on the RX pin, so can accept communications from 5V devices.

I2C Interface

The I2C peripheral operates up to 1 MHz, supporting standard mode, full speed, and fast mode.

I2C clock output pin, SCL (**IO1**). Connect this pin to the SCL pin of an external I2C device. This is 3.3V tolerant only and [must not be connected to 5V I2C buses]{.underline}.

I2C data input/output pin, SDA (**IO2**). Connect this pin to the SDA pin of an external I2C device. This is 3.3V tolerant only and [must not be connected to 5V I2C buses]{.underline}.

No pull-up resistors are provided on REPTOR-250, therefore external pull up resistors are required to be added by the User on the Breadboard/Bus. Typical pull up resistors to 3.3V are in the region of 4.7Kohm.

Note

The REPTOR-250 can only function as a Master in an I2C bus, therefore it cannot be an I2C Slave to a Host at this time.

Hardware Requirements

Hardware Overview

REPTOR-250 is designed to be used in several ways, but the most basic configurations can be achieved with a REPTOR-250 module and a Mates Programmer, connected to your PC in a tethered configuration (see Programming Hardware).

The REPTOR-250 can also be used with various Adaptors and Development Boards which feature a MatesBus interface, or simply into a breadboard directly. The hardware and software requirements for these configurations varies and will be described in documentation associated with those adaptors or boards.

What You Will Need

- REPTOR-250 Module
- Mates Programmer
- MicroUSB Cable (Standard Type A USB to microUSB -- Not included)
- Windows PC/Laptop running Windows 7 or higher, x86 or x64. ARM is currently not supported at this time.

The Mates Programmer does not come with the microUSB cable, this can be purchased from virtually any hardware/computer store.

Currently, Microsoft Windows is the only supported Operating System for Mates Studio. Announcements will be made when other OS's will become supported.

Optional Hardware

These items are not required but will assist development in situations requiring components or other electronics modules. These are not required for direct PC interfacing.

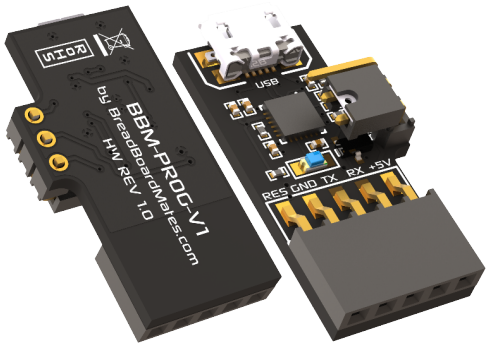
- Standard or Extended Breadboard
- 5-pin Right Angle header (2.54mm pitch), included with the Mates Programmer
- Jumper wires for interfacing to components and sensors

Programming Hardware

REPTOR-250 utilises a USB-to-Serial programmer for application and firmware updates, which programs both the Processor Flash memory, along with the on-board SPI Flash memory.

The programmer, dubbed BBM-PROG, is the official Mates Programmer and can also be used for testing and debugging of REPTOR-250 applications using the Mates Studio IDE.

The Mates Programmer utilises the Silicon Labs CP2104 USB to UART bridge and uses the REPTOR-250's Serial UART to load applications, firmware/PmmC and media content.



REPTOR-250 requires the jumper to be positioned like the image above, closest to the 5-way female header. This makes the programmer compatible with programming the 4D Labs Pixxi44 processor.

Software Requirements

All software development for the TIMI-96 module utilizes the Mates Studio IDE.

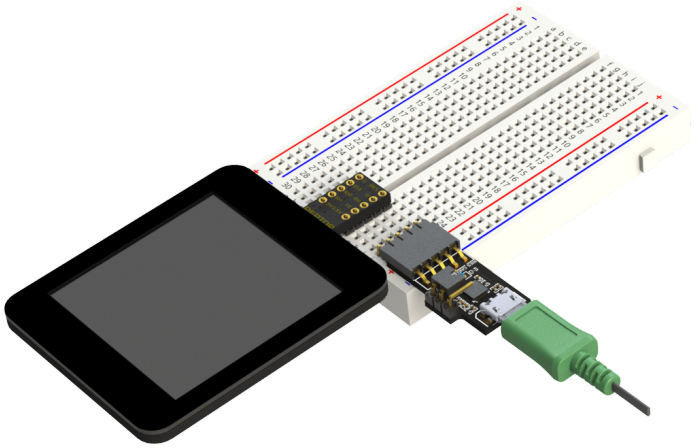
The latest version of Mates Studio can be downloaded from the 4D Systems website or directly from this link here.

Details specific about the Mates Studio IDE can be found in the Mates Studio IDE documentation.

Typical Connections

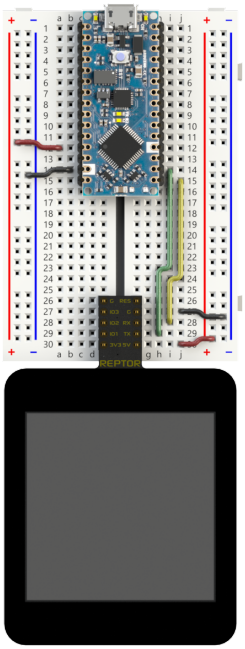
Programming Connection

One of the simplest interfaces for REPTOR-250 is connecting REPTOR-250 to the bottom of a breadboard, connecting the 5-way right angle header into the breadboard next to the H2 header side of REPTOR-250, and attaching the Mates Programmer to the 5-way header.

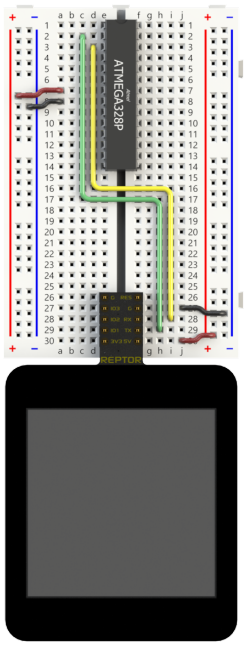


Interfacing with a Host

REPTOR-250 can interface to virtually any microcontroller or Host, using a Serial UART interface. Simple wire connections can be achieved directly to REPTOR-250 or via a breadboard. If the microcontroller or Host utilises 3.3V or 5.0V UART, then REPTOR-250 can easily be connected.



Interfacing with Arduino Board



Interfacing with ATmega328P

> **Note**
>
> Wiring simplified showing main wires only.

Interface Notes

REPTOR-250 has a single Serial UART, which is shared for the programming of REPTOR-250 from the Mates Studio IDE, but it can also be used to interface to a Host or other device.

When programming the REPTOR-250, it needs to be isolated from any other circuit that might be connected to the UART. Unplug any UART connections from the RX and TX, and program the REPTOR-250 module directly with the Programmer. When programming is complete, connect the UART RX/TX back up to allow communication to the host/device to resume.

On some Adaptors/Development boards, a switch or jumper may be offered to isolate the RX pin, allowing only Programming TX signals to reach the REPTOR-250's RX pin, until the switch is changed. This is useful as it means unplugging or unwiring the UART is no longer required when programming REPTOR-250.

The same situation applies for Hosts/Development boards which also only have a single UART, as programming them often uses the UART too so they would need to be disconnected from REPTOR-250 to program them.

REPTOR-250 Configuration

REPTOR-250 is a carrier board for the TED-250 module. All references to REPTOR-250 are the combination of both the REPTOR-250 PCB and the TED-250 PCB, mated together.

It is the TED-250 module which has the Pixxi44 graphics processor and related circuitry on it, and this board is mated with the REPTOR-250 to provide the MatesBUS interface.

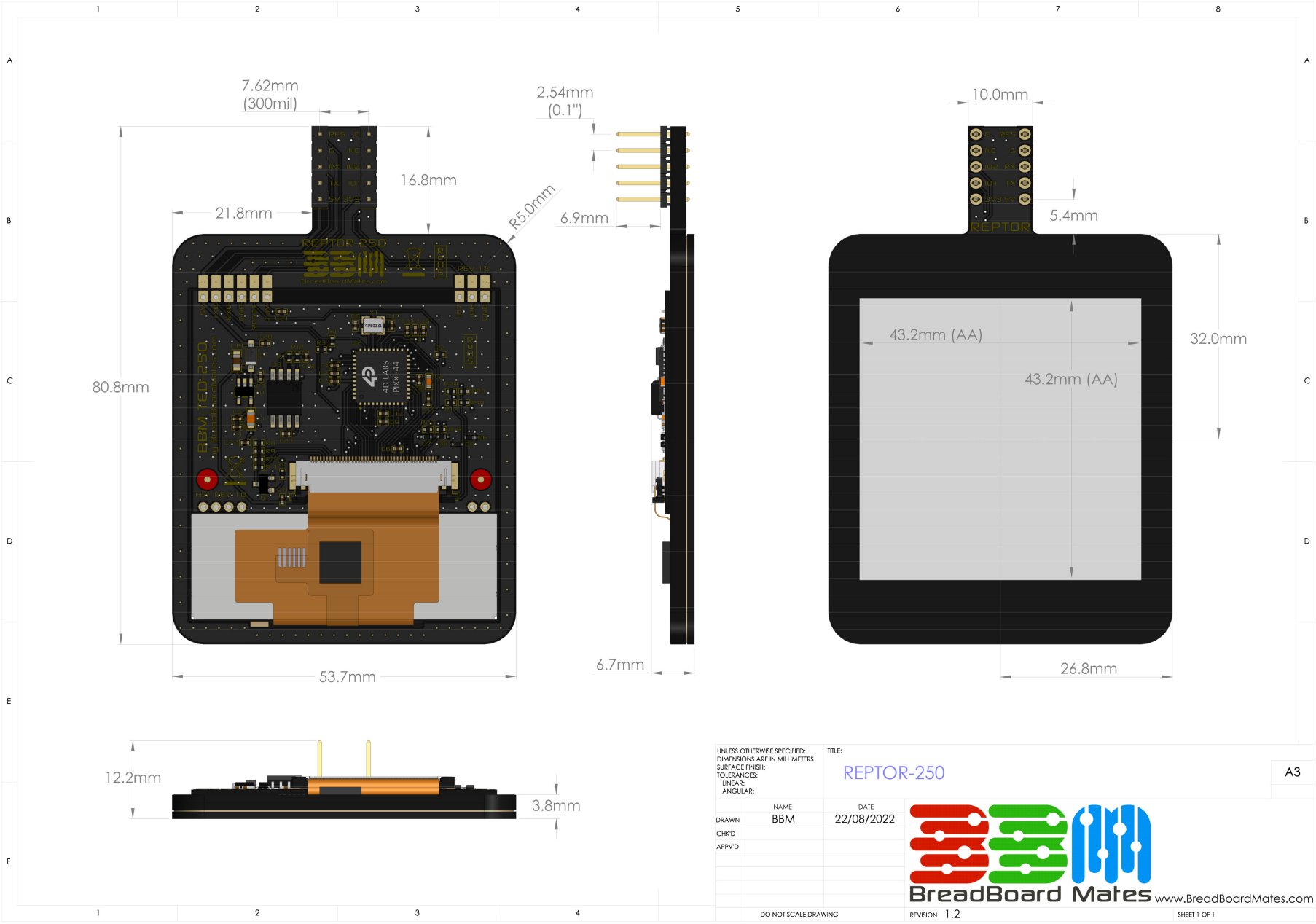
TED-250 was designed to provide a solution to potential OEM customers, where the REPTOR-250 formfactor might not be suitable for end product applications. The TED-250 PCB is small and fits on the back of the display itself, allowing for easy integration if required. Headers can be mounted to TED to provide the User Interface.

Schematics of both the TED-250 and the REPTOR-250 are available at the end of this document. All references to REPTOR-250 in this document are about the entire assembly, of REPTOR-250 and TED-250 together.

TED-250 is available to purchase as a module without the REPTOR-250 carrier.

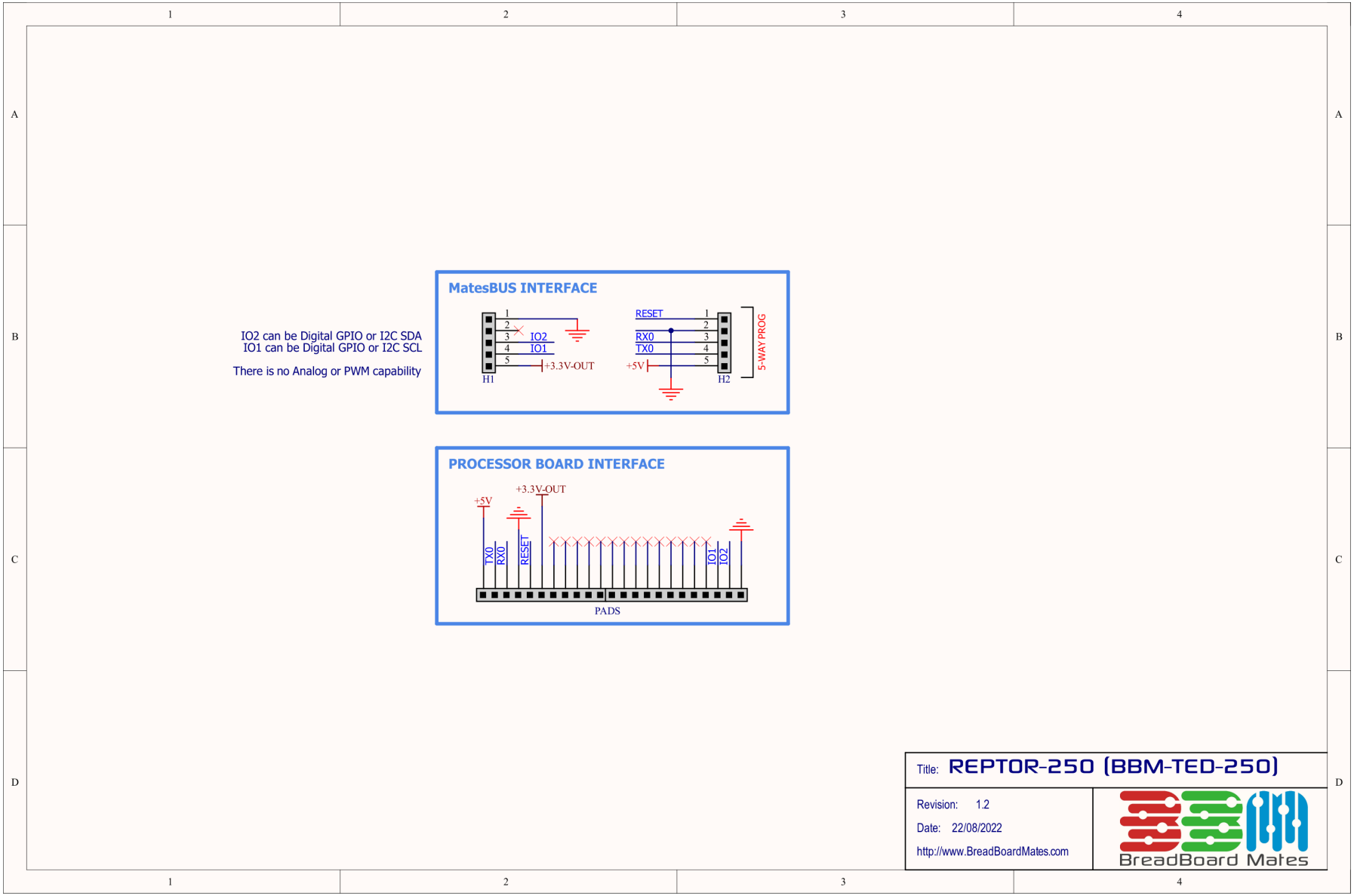
In the future, REPTOR-250 might become available with other processors, hence why the IO3 marking is currently shown on the interface. This also is due to the MatesBUS interface and retaining the same markings. Currently the IO3 is not connected as Pixxi44 has no extra GPIO available, however in the future this might become available.

Hardware Drawing

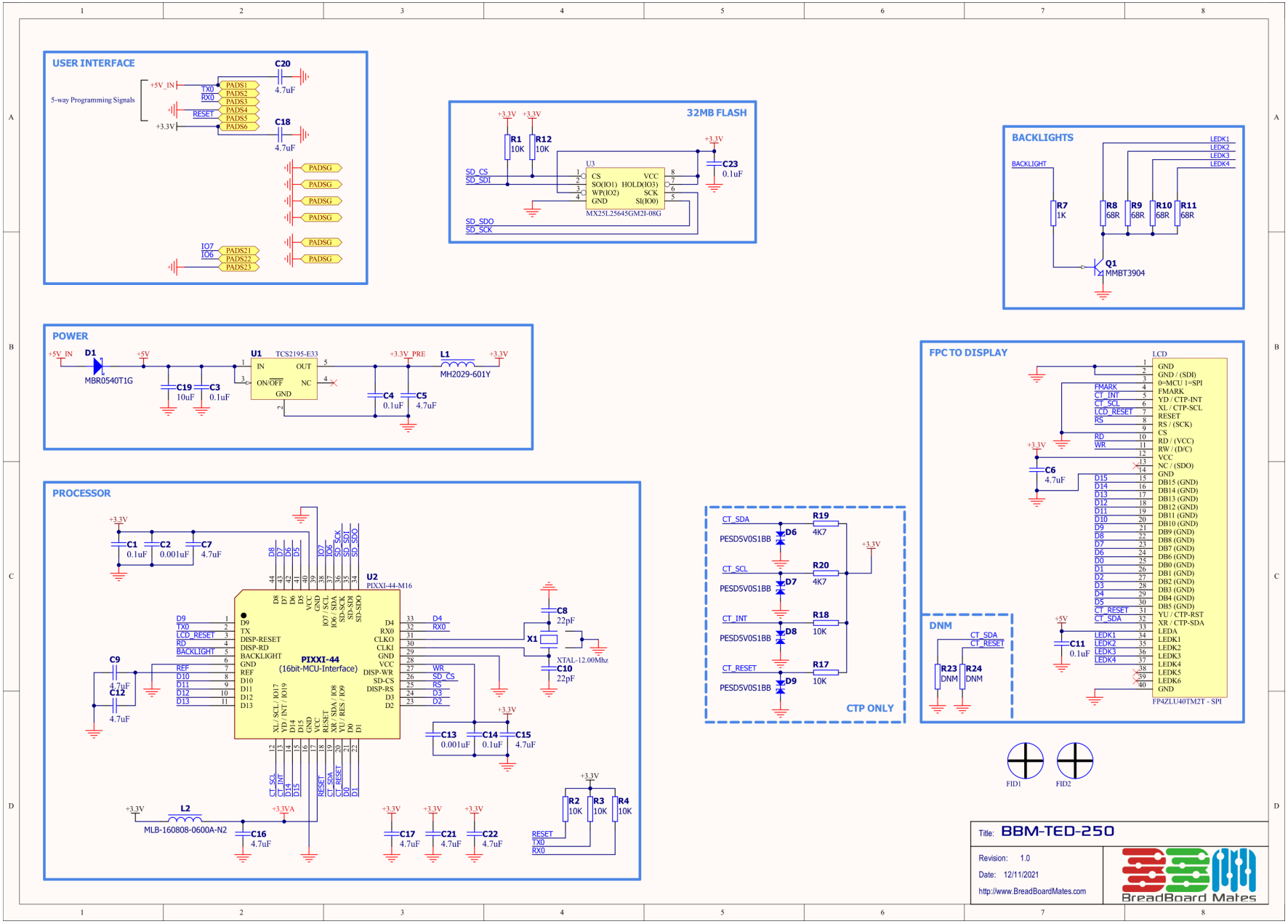


Hardware Schematic

REPTOR-250 Carrier



TED-250


USER INTERFACE
5-way Programming Signals
+5V_IN
TX0
RX0
RESET
+3.3V
PADS1
PADS2
PADS3
PADS4
PADS5
PADS6
PADSG
IO7
IO6
PADS21
PADS22
PADS23
C20
4.7uF
C18
4.7uF
32MB FLASH
R1
10K
R12
10K
SD_CS
SD_SDI
SD_SDO
SD_SCK
U3
CS
SO(IO1)
WP(IO2)
GND
VCC
HOLD(IO3)
SCK
SI(IO0)
MX25L25645GM2I-08G
C23
0.1uF
BACKLIGHTS
BACKLIGHT
LEDK1
LEDK2
LEDK3
LEDK4
R7
1K
R8
68R
R9
68R
R10
68R
R11
68R
Q1
MMBT3904
POWER
+5V_IN
D1
MBR0540T1G
+5V
U1
TCS2195-E33
IN
OUT
ON/OFF
NC
GND
+3.3V_PRE
L1
MH2029-601Y
+3.3V
C19
10uF
C3
0.1uF
C4
0.1uF
C5
4.7uF
FPC TO DISPLAY
LCD
GND
GND / (SDI)
0=MCU 1=SPI
FMARK
YD / CTP-INT
XL / CTP-SCL
RESET
RS / (SCK)
CS
RD / (VCC)
RW / (D/C)
VCC
NC / (SDO)
GND
DB15 (GND)
DB14 (GND)
DB13 (GND)
DB12 (GND)
DB11 (GND)
DB10 (GND)
DB9 (GND)
DB8 (GND)
DB7 (GND)
DB6 (GND)
DB0 (GND)
DB1 (GND)
DB2 (GND)
DB3 (GND)
DB4 (GND)
DB5 (GND)
YU / CTP-RST
XR / CTP-SDA
LEDA
LEDK1
LEDK2
LEDK3
LEDK4
LEDK5
LEDK6
GND
FP4ZLU40TM2T - SPI
C6
4.7uF
C11
0.1uF
DNM
CT_SDA
CT_RESET
R23
DNM
R24
DNM
PROCESSOR
U2
PIXXI-44-M16
PIXXI-44
(16bit-MCU-Interface)
C1
0.1uF
C2
0.001uF
C7
4.7uF
C8
22pF
C10
22pF
X1
XTAL-12.00Mhz
C9
4.7uF
C12
4.7uF
C13
0.001uF
C14
0.1uF
C15
4.7uF
L2
MLB-160808-0600A-N2
C16
4.7uF
C17
4.7uF
C21
4.7uF
C22
4.7uF
+3.3VA
R2
10K
R3
10K
R4
10K
CTP ONLY
CT_SDA
CT_SCL
CT_INT
CT_RESET
PESD5V0S1BB
D6
D7
D8
D9
R19
4K7
R20
4K7
R18
10K
R17
10K
FID1
FID2
Title: BBM-TED-250
Revision: 1.0
Date: 12/11/2021
http://www.BreadBoardMates.com
BreadBoard Mates

Specifications & Ratings

Recommended Operating Conditions

Parameter	Conditions / Information	Min	Typ	Max	Un
Operating Temperature		-20	—	+70	°(
Storage Temperature		-30	—	+80	°(
Humidity (RH)	Max 60°C	—	—	90%	R
Supply Voltage (VCC)	Stable external supply required	4.0	5.0	5.5	V
Processor voltage (VP)		—	3.3	—	V
Input Low Voltage (VIL)	all pins	GND	—	0.2VP	V
Input High Voltage (VIH)	non 5V tolerant pins	0.8VP	—	3.3	V
Input High Voltage (VIH)	5V Tolerant Pins, (RX pin)	0.8VP	—	VCC	V
Reset Pulse	External Open Collector (RESET pin)	1.3	—	—	µ
Operational Delay	Power-Up or External Reset	500	—	3000	m
Output Voltage (3V3)	Output Voltage for User	—	3.3	—	V
Output Current	Output Current capability for User	—	-	300	m
GPIO Current	Source / Sink	—	—	15	m

Operating Characteristics

Parameter	Conditions / Information	Min	Typ	Max	Ur
Supply Current (ICC)	5V Supply – Normal Operation	—	130	—	m
Supply Current (ICC)	5V Supply – Sleep Mode	—	4	—	m
Supply Current (ICC)	5V Supply – Deep Sleep Mode	—	2	—	m
Display Endurance	Hours of operation, measured to when display is 50% original brightness	30000	—	—	H

LCD Display Information

Parameter	Conditions / Information	Specification
Display Type		TFT IPS LCD
Display Size		2.5” Diagonal
Display Resolution		240x240 pixels
Display Brightness	5V Supply	280 cd/m2 (typical)
Display Contrast Ratio		800:1 (typical)
Display Viewing Angles	Above, Below, Left and Right of Center	80 Degrees
Display Viewing Direction		ALL (IPS Display)
Display Backlighting	White LED Backlighting	1x4 Parallel LEDs
Pixel Pitch		0.18 x 0.18mm (Square pixels)
Pixel Density	Number of pixels in 1 row in 25.4mm	141 DPI/PPI