4D SYSTEMS
TURNING TECHNOLOGY INTO ART

4DCAPE Range

DATASHEET

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DOCUMENT REVISION: **1.3**

4DCAPE-43 (4.3" Non-Touch)
4DCAPE-43T (4.3" Resistive Touch)

Table of Contents

1. Description

The 4D 4.3" LCD CAPE is a cape specifically designed for the Beagle Bone Black (BBB), and provides a 4.3" primary display for the BBB for direct user interaction and information display.

Available in both touch (4DCAPE-43T) and non-touch (4DCAPE-43).

The 4DCAPE-43 is not compatible with the previous Beagle Bone (Beagle Bone White), and can only be used with the Beagle Bone Black.

The 4D 4.3" LCD CAPE features a 4.3" TFT LCD 480x272 resolution display.

The 4DCAPE-43 utilises the drivers developed for the CircuitCo LCD4, however provides a different form factor and pricing point to the LCD4.

The Beagle Bone Black connects directly to the back of the 4DCAPE-43(T), and provides everything the CAPE requires such as power and display signals.

The 4D 4.3" LCD CAPE features 7 push buttons below the screen, LEFT, RIGHT, UP, DOWN, ENTER, RESET and POWER, along with 2 LED's to indicate Power and User Status (normally heartbeat).

Mounting of the 4DCAPE-43(T) is achieved with the 4x 3.5mm mounting holes present on the CAPE, enabling standard M3 or #6-32 screws to fasten the 4DCAPE-43 as required.

2. Features

- 4.3" TFT LCD CAPE for the Beagle Bone Black
- Available in 2 models, Resistive Touch (4DCAPE-43T) and Non-Touch (43CAPE-43)
- 7 push buttons including LEFT, RIGHT, UP, DOWN, ENTER, RESET and POWER
- 2 LED Lights for Power and User
- 2x2 Jumper with shunts for EEPROM CAPE ID selection
- Module dimensions: 120.4 x 80.0 x 24.8mm
- Module dimensions with Beagle Bone Black connected: Approx 120.4 x 80.0 x 32.0mm
- 4x 3.5mm Mounting holes
- RoHS and CE Compliant.
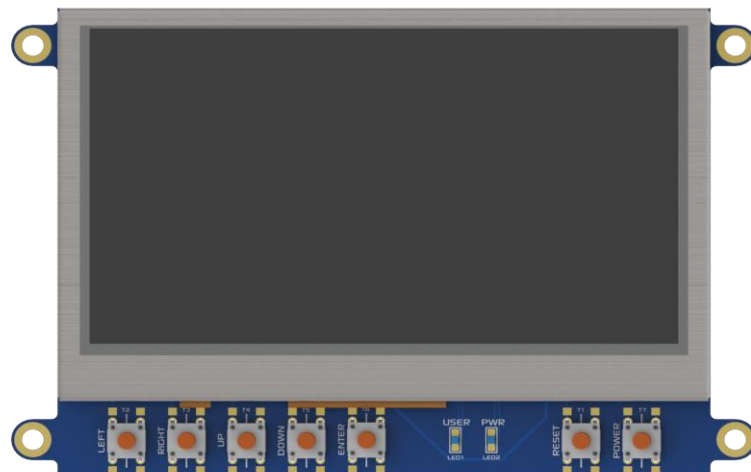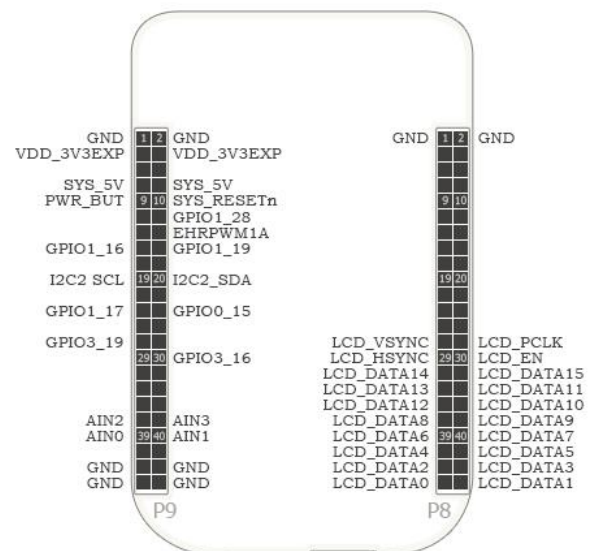
3. Getting Started

3.1. Requirements

The 4D 4.3" LCD CAPE is designed to work with existing software and drivers already developed for the Beagle Bone Black.

The Requirements for use are:
- 4DCAPE-43 or 4DCAPE-43T Cape
- Beagle Bone Black (BBB) with suitable distribution loaded
- 5V DC Supply suitable for the Beagle Bone Black, recommended 2A @ 5V.
- A Stylus is recommended for accurate touch, however is not required.

3.2. How to use the 4D 4.3" LCD CAPE

The following steps should be all that is required in order to use the 4DCAPE-43(T):

1. Connect the 4DCAPE-43(T) to the Beagle Bone Black while the Beagle Bone Black is not powered. Outline of the BBB is printed on the back of the 4DCAPE-43(T) as a guide for orientation.
2. If using with other capes, ensure the 4DCAPE-43 is not conflicting pin wise to any other cape installed.
3. Ensure the DIP Switch on the CAPE is set to a different EEPROM ID to any other capes.
4. Ensure your Beagle Bone Black is loaded with a suitable Linux distribution which is compatible with 4D Systems 4DCAPE's. Debian is the distribution shipping with current BBB boards now, and can be installed onto older BBB's. If the distribution you wish to use is not supporting 4D Systems 4DCAPE's by default, the supplied source files can be used, please refer to our Product Page.
5. Connect a 5V Supply to the DC Jack of the Beagle Bone Black. It is recommended to use a 2A supply to ensure sufficient supply.
6. Once power is connected, something should be displayed on the 4DCAPE a few moments after it has started to boot. Each distribution will behave differently and require different input from the User. It is recommended to have a keyboard attached while setting the system up, as login details etc may be required. Some distributions may prompt for LCD calibration, while others may prompt for Username/Password.

If there is no output, check the bootloader version of the BBB by running the following in the command terminal:

```
$ sudo
/opt/scripts/tools/version.sh |
grep bootloader
```

The version of the bootloader in the microSD and eMMC should be later than 2018.13 and the microSD's bootloader must be older than what is loaded in the eMMC in order for the CAPE to work properly.

A quick fix is to always remove the version of u-boot from the eMMC, for example this clears out the first 10Mb of the drive:

```
$sudo      dd      if=/dev/zero
of=/dev/mmcblk1 bs=1M count=10
```

For support of the BBB and various distributions, please seek support from the respective websites associated with the BBB itself or the distributions.

A good place to start for information and support regarding the BBB and various distributions available, is www.beagleboard.org

This website details the latest firmware images for the BBB: http://beagleboard.org/latest-images

This website details how to get started with the BBB: http://beagleboard.org/getting-started

For support regarding the 4DCAPE hardware itself, please go to the 4D Systems website and either contact Support directly via a Ticket, or use the 4D Systems Forum. http://forum.4dsystems.com.au

3.3. Changing the brightness (Debian)

It is possible to change the backlight brightness as the backlight is PWM controlled.

Please note, these instructions may become obsolete as new versions of Debian are released, or if different distributions are used.

One method is to SSH into the Beaglebone Black from your PC, and set the backlight value that way. Note this does not persist over restarts, so this would need to be entered into a startup script if the setting is required to be set each startup.

At the command prompt, type the following:
```
# sudo su
# cd /sys/class/backlight/backlight
# echo 50 > brightness
```

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Where 50 represents 50%, this can be changed to any number from 0 to 100 as required.

The exact path may vary with distributions, so check the /sys/class/backlight path to see what backlight file exists.

3.4. Changing the brightness (Android)

Changing the brightness on Android is simple. Navigate to the Settings menu, and to the Display option, and then to Brightness. Slide the slider to the desired position.

3.5. Android Information

The 4DCAPE-43(T) is compatible with Android 4.2.2 and has been tested with an image from TI.

It has been noticed however that the EEPROM Jumpers both need to be connected/closed otherwise the 4DCAPE may not be detected by the Android OS.

3.6. Calibrating resistive touch (Debian)

When a distribution is used for the first time with a 4DCAPE, often a LCD calibration application will start automatically. However depending on the distribution in use, this may or may not happen. Some distributions may not even come with a calibration application loaded.

For ones which do have the calibration program loaded by default, and if the calibration is input incorrectly and it is required to be set again, it can be generally be started from the 'Start' menu.

Note, this may change as newer distributions become available, or if different distributions are used, so these instructions may become obsolete or inaccurate.

4. EEPROM Details

On the 4D 4.3" LCD CAPE there is an EEPROM which is used to configure the Beagle Bone Black with the appropriate configuration in order to use the Cape.

Depending if the board is a 4DCAPE-43 or a 4DCAPE-43T the EEPROM contents will vary slightly.

Please note: some EEPROM content refers to the LCD4* which is made by CircuitCo*. This is the case due to how the BBB identifies the CAPE and what drivers to apply to it. Since the 4DCAPE-43T utilises the LCD4 drivers, this must be the case.

4.1. 4DCAPE-43 EEPROM

EEPROM Support: YES
Board Name: 4D 4.3 LCD CAPE - 4DCAPE-43
Manufacturer: 4D Systems

4.2. 4DCAPE-43T EEPROM

EEPROM Support: YES
Board Name: 4D 4.3 LCD CAPE - 4DCAPE-43T
Manufacturer: 4D Systems

Note (*): The Beaglebone, Beaglebone Black and Beagleboard remains the property of beaglebone.org. All references to the words Beaglebone, Beaglebone Black, Beagleboard are licensed under a Creative Commons Attribution-Share Alike 3.0 license.

All references to CircuitCo and LCD4 remain the property of CircuitCo and beagleboardtoys.org and are not affiliated to 4D Systems in any way.
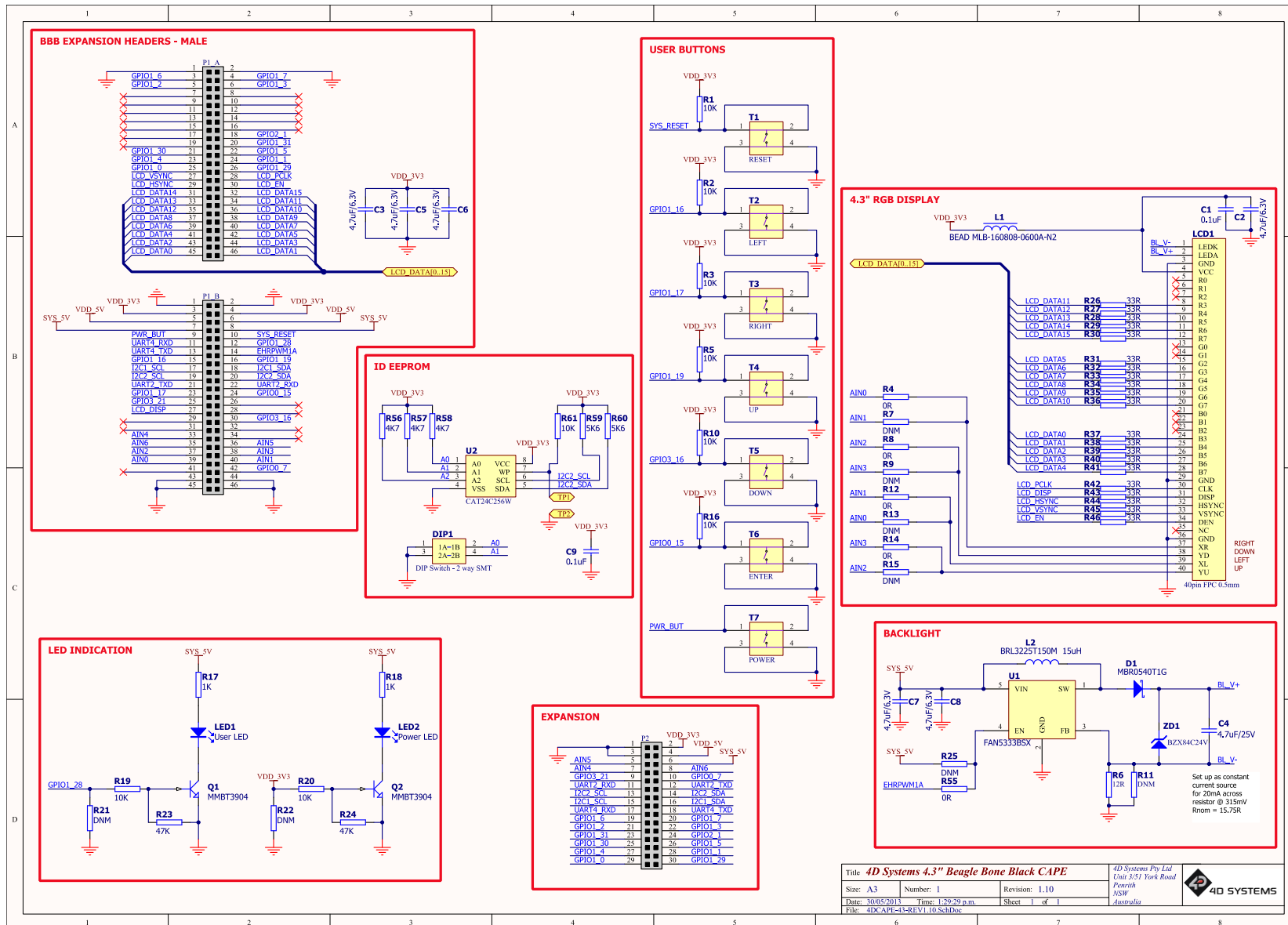
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5. Display Precautions

• Avoid having to display the same image/object on the screen for lengthy periods of time. This will cause a burn-in which is a common problem with all types of display technologies. Blank the screen after a while or dim it very low by adjusting the contrast. Better still; implement a screen saver feature.

• Moisture and water can damage the display. Moisture on the surface of a powered display will cause the electrodes to corrode. Wipe off any moisture gently or let the display dry before usage.

• Dirt from fingerprint oil and fat can easily stain the surface of the display. Gently wipe off any stains with a soft lint-free cloth.

• The performance of the display will degrade under high temperature and humidity. Avoid such conditions when storing.

• Do not tamper with the display flex cable that is connected to the control board. This may affect the connection between the display and the driving circuitry and cause failure. Under no circumstances should the display flex be disconnected from the PCB and power applied to the PCB, as this could result in instant failure of the CAPE.

• Displays are susceptible to mechanical shock and any force exerted on the module may result in deformed zebra stripes, a cracked display cell and broken backlight

• Always use the mounting holes on the module to mount the display.

• Remove the BBB from the 4DCAPE carefully when required to remove the BBB, as the headers on the 4DCAPE are SMT and excessive force or rough removal could break solder joints and connections. Carefully wiggle the BBB off the 4DCAPE if you require to remove the BBB from the cape once installed.

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6. Software / Driver Disclaimer

4D Systems has developed this 4DCAPE for the Beaglebone Black. 4D Systems does NOT support any software associated with the BBB itself, as 4D Systems is not involved with the development or support of the BBB Operating Systems. It is up to the user to determine which distributions are used on the BBB, and therefore which are compatible with this CAPE. 4D Systems will supply the source code for the 4DCAPE, which is installed on the Debian Distribution for the BBB by default, however the source can be used if Users wish to use another operating system. It will however be up to the User to get this operational. Assistance can be provided on our Forum. http://forum.4dsystems.com.au

4D Systems is not responsible for issues regarding software or drivers associated with the BBB and the compatibility with this product. Community software support is available via resources at www.beaglebone.org/discuss

7. Schematic Diagram – HW Rev 1.1

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BBB EXPANSION HEADERS - MALE

USER BUTTONS

4.3" RGB DISPLAY

ID EEPROM

LED INDICATION

EXPANSION

BACKLIGHT

Set up as constant current source for 20mA across resistor @ 315mV Rnom = 15.75R

Title	4D Systems 4.3" Beagle Bone Black CAPE	4D Systems Pty Ltd Unit 3/51 York Road Penrith NSW Australia
Size: A3	Number: 1	Revision: 1.10
Date: 30/05/2013	Time: 1:29:29 p.m.	Sheet 1 of 1
File: 4DCAPE-43-REV1.10.SchDoc		

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8. Schematic Diagram – HW Rev 1.3

BBB EXPANSION HEADERS - MALE

USER BUTTONS

4.3" RGB DISPLAY

LED INDICATION

ID EEPROM

BACKLIGHT SUPPLY

Backlight Current FET off = (5uA x R38) / R11
= (5uA x 20K) / 2R
= 50mA

Backlight Current FET on = (5uA x R38)(R37) / R11
= (5uA x 20K)(10R) / 2R
= (5uA x 9.99R) / 2R
= 25uA

Title	4D Systems 4.3" Beagle Bone Black CAPE		4D Systems Pty Ltd Unit 3/51 York Road Penrith NSW Australia	Cannot open file C:\Users\James\Dropbox\James\ 4d systems logo-1.jpg
Size: A3	Number: 1	Revision: 1.3		
Date: 21/08/2018	Time: 4:39:29 PM	Sheet 1 of 1		
File: 4DCAPE-43-REV1.30.SchDoc				

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9. Mechanical Details

4DCAPE - BBB
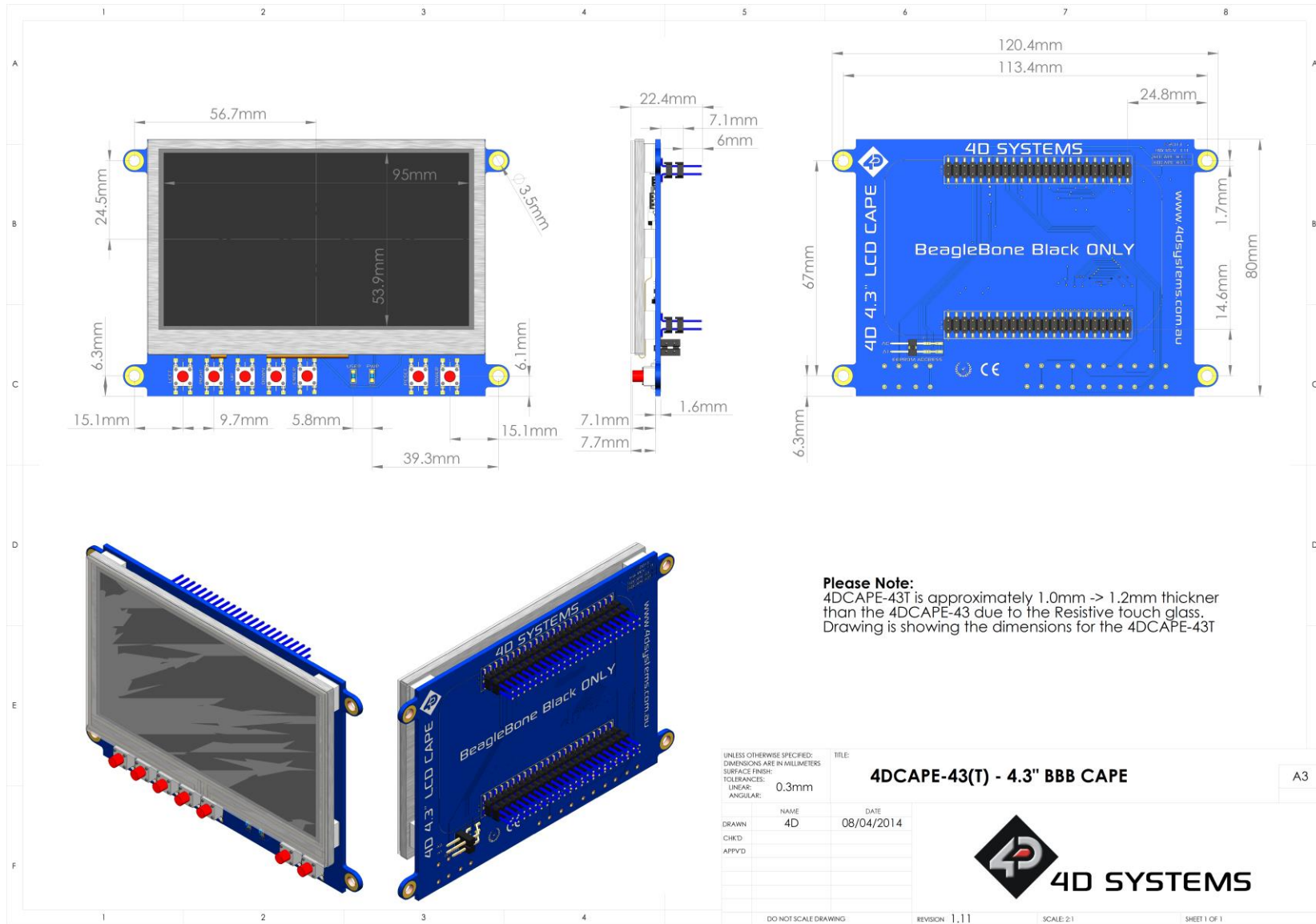
10. Specifications

ABSOLUTE MAXIMUM RATINGS
Operating ambient temperature .... -20°C to +70°C
Storage temperature .... -30°C +80°C

NOTE: Stresses above those listed here may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the recommended operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

GLOBAL CHARACTERISTICS BASED ON OPERATING CONDITIONS					
Parameter	Conditions	Min	Typ	Max	Units
Supply Current (5V bus of BBB) (**INCLUDES POWER BBB USES ALSO** – NOTE)	4DCAPE-43 (Max Brightness)	--	590	--	mA
	4DCAPE-43T (Max Brightness)	--	600	--	mA
Display Endurance	Hours of operation, measured to when display is 50% original brightness	30000	--	--	H
Touch Screen Endurance (Resistive Touch)	Number of touches/hits with a 12.5mm tip at a rate of 2x per second with 250gf force	--	1M	--	Touches
	Slide stylus on screen, 100gf force, 60mm/s speed with a 0.8mm polyacetal tip stylus pen	--	100K	--	Slides
Touch Screen Transparency	Resistive Touch	82	--	--	%
	Capacitive Touch	90	--	--	%
Touch Screen Operational Force (Resistive Touch)	Only use Finger or Stylus, do not use anything sharp or metal	20	--	100	Gf
CLB Hardness (Capacitive Touch)	Cover Lens Bezel Glass Hardness	--	6	--	H

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LCD INFORMATION		
Parameter	**Conditions**	**Specification**
Display Type		TFT Transmissive LCD
Display Sizes		4.3", 5.0" or 7.0" Diagonal
Display Resolution		480 x 272 (Landscape Viewing) – 4.3" 800 x 480 (Landscape Viewing) – 5" & 7"
Display Brightness	4DCAPE-43 (Max Brightness)	500 cd/m2
	4DCAPE-43T (Max Brightness)	400 cd/m2
Display Contrast Ratio	Typical	500:1
Display Viewing Angles	Above Centre	70 Degrees
	Below Centre	60 Degrees
	Left of Centre	70 Degrees
	Right of Centre	70 Degrees
Display Viewing Direction		12 o'clock Display (Optimal viewing is from above when in Landscape/Wide mode)
Display Backlighting	4DCAPE-43xx Models	2x5 Parallel LED's
Pixel Pitch	4.3"	0.198 x 0.198mm (Square pixels)
Pixel Density	4.3"	128 DPI/PPI

11. Ordering Information

ORDERING INFORMATION
Order Code:
4DCAPE-43 (Non Touch) 4DCAPE-43T (Resistive Touch) **Packaging:** Module sealed in antistatic foam padded 4D Systems Box

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12. Hardware Revision History

Revision Number	Date	Description
1.11	6/11/2013	Initial Public Release Version
1.20	17/12/2015	Simplified LED indication circuit Changed Backlight Driver IC and circuit

13. Datasheet Revision History

Revision Number	Date	Description
1.2	8/03/2017	Initial Public Release
1.3	14/03/2019	Cosmetic Changes to 4DCAPE Datasheet

14. Legal Notice

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