



DLP-FR256
LEAD FREE

FERROELECTRIC MEMORY-BASED MICROCONTROLLER MODULE

The DLP-FR256 combines the same USB interface used in the DLP-USB245R module (FTDI FT245R FIFO) with a Texas Instruments microcontroller with 256K of FRAM to form a rapid development tool. The MSP430FR5994 microcontroller is preprogrammed with simple firmware that demonstrates the on-board white noise generator and analog interface, and the DLP-FR256 can be reprogrammed with user firmware via four pins using an MSP-EXP430FR5994 Launchpad (purchased separately).

FEATURES:

- The DLP-FR256 module utilizes a Texas Instruments 16-bit RISC architecture microcontroller with 256K bytes of FRAM, 8K bytes of SRAM and a multi-channel, 12-bit A/D converter:
 - Up to 16MHz operation
 - Ultra-low power FRAM operates as unified memory and is configurable as code, data or storage memory.
 - FRAM fast writes at 125nS per word (64KB in 4mS).
 - FRAM has virtually unlimited write endurance (10^{15} cycles).
 - FRAM is radiation resistant and nonmagnetic.
- The DLP-FR256 has 27 I/O lines available for interfacing to user electronics via a compact, 40-pin standard DIP footprint (two are configured with an onboard analog input interface for measuring voltage up to $\pm 20V$).
- Send/receive data over a full-speed USB 1.1 interface to a host computer at up to 1MByte per second.
- Required 5V power supply can be taken directly from the USB port or supplied by user electronics.
- The FRAM memory can be easily erased and reprogrammed utilizing a user-supplied compatible programmer.
- No in-depth knowledge of USB is required as all USB protocols are handled automatically by the on-board FT245R and its support circuitry:
 - Royalty-free device drivers eliminate the need for USB driver development in most cases.

- USB bulk or isochronous data-transfer modes
- USB 1.1 compatible
- USB VID, PID, serial number and product-description strings are stored in on-board EEPROM memory.

APPLICATION AREAS:

- Prototype Development
- USB ISDN and ADSL Modems
- USB Interface for Digital Cameras
- USB Interface for MP3 Players
- High-Speed USB Instrumentation
- USB Smart-Card Readers
- Set Top Box (STB) PC-USB Interface
- USB Hardware Modems
- USB Wireless Modems
- USB Bar Code Readers

1.0 GENERAL DESCRIPTION

The DLP-FR256 provides a cost-effective, microcontroller-based method of interfacing an electronic peripheral to a host computer via USB.

To send data from the peripheral to the host computer, the microcontroller simply writes data into the FT245R on its 8-bit data bus. Commands and data sent from the host are transferred on the same shared bus.

By using FTDI's Virtual COM Port Drivers, the peripheral looks like a standard COM port to the application software. The USB drivers are available for download from DLP Design's website at www.dlpdesign.com or from FTDI's website at www.ftdichip.com.

2.0 DRIVER SOFTWARE

FTDI's VCP (Virtual COM Port) driver-executable files are provided royalty free on the condition that they are used only with designs incorporating an FTDI device (i.e. the FT245R on the DLP-FR256). The latest versions of the drivers can be downloaded from www.dlpdesign.com or www.ftdichip.com.

The VCP driver download file is a combined set of drivers for all current versions of Windows. Unzip the file to a folder on your PC. (The drivers can coexist in the same folder since the INF files determine which set of drivers to load for each operating system version.) Once loaded, the VCP drivers allow the application software running on your host PC to communicate with the DLP-FR256 as though it were connected to a COM (RS-232) port.

In addition to VCP drivers, FTDI's D2XX direct drivers offer an alternative solution to allow application software to interface with the DLP-FR256 using a DLL instead of a Virtual COM Port. The architecture of the D2XX drivers consists of a Windows WDM driver that communicates with the device via the Windows USB stack and a DLL that interfaces the application software (written in VC++, C++ Builder, Delphi, VB, etc.) to the WDM driver.

The D2XX direct drivers add support for simultaneous access and control of multiple FT245R devices. The Extended Open function (FT_OpenEx) allows the device to be opened by either its product description or serial number, both of which can be programmed to be unique. The List Devices function (FT_ListDevices) allows the application software to determine which devices are currently available for use, again by either product description or by serial number.

Download FTDI Application Notes AN232-03, AN232-05, AN232-06 and AN232-07 for detailed instructions on how to install and remove the drivers.

3.0 EEPROM WRITE UTILITY

The DLP-FR256 has the option of accepting manufacturer-specific information that is written into on-board EEPROM memory. Parameters that can be programmed include the VID and PID identifiers, the manufacturer's product string or a serial number.

MPROG is an EEPROM serializer from FTDI for the FT245R device. MPROG is based on the D2XX drivers, and it will work on all current versions of Windows.

You must install the CDM drivers in order to run this application. (Refer to the MPROG User's Guide for details on the program's use.)

4.0 QUICK-START GUIDE

This guide requires the use of a Windows PC that is equipped with a USB port.

1. Download the WHQL-certified CDM device drivers from either **www.dlpdesign.com** or **www.ftdichip.com**. Unzip the drivers into a folder on the hard drive.

Note: The DLP-FR256 can be configured to receive its operating power from the USB port or from user electronics. Pins 19 and 20 allow for this configuration. (Refer to the Pinout Description in the next section for details on the DLP-FR256 electrical interface.)

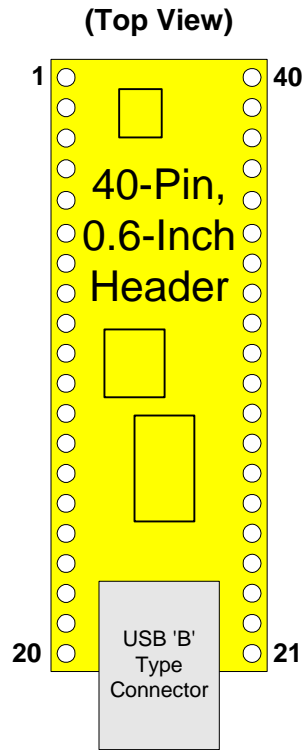
****The board will not operate until a power source has been connected.****

2. Connect the DLP-FR256 board to the PC via a standard A-B, 6-foot USB cable. This action initiates loading of the USB drivers. When prompted, select the folder where the CDM device drivers were stored in Step 1. Windows will then complete installation of the device drivers for the DLP-FR256 board. (The next time the DLP-FR256 board is attached, the host PC will immediately load the correct drivers without any prompting.) Reboot the PC if prompted to do so.

The DLP-FR256 is shipped with default VID, PID, etc. values programmed into the EEPROM memory. You only need to run MPROG if you want to change the default values.

At this point, the DLP-FR256 is ready for use. Note that the DLP-FR256 will appear non-responsive if data sent from the host PC is not read from the FT245R device by the MSP430FR5994 microcontroller. The example firmware with which the DLP-FR256 comes preloaded will read data sent by the host by default. Custom user firmware should also follow this protocol.

TABLE 1: DLP-FR256 PINOUT DESCRIPTION



PIN #	DESCRIPTION
1	GROUND
2	P2.4/A7
3	P2.3/A6
4	GROUND
5	P1.2/A2
6	P1.0/A0
7	P1.1/A1
8	GROUND
9	P1.3/A3
10	P1.4/A4
11	P1.5/A5
12	PJ.1
13	PJ.3
14	PJ.2
15	PJ.0
16	P2.5
17	GROUND
18	SWVCC (Out) - Switched 5V power from the host PC. This output becomes active once enumeration is complete.
19	EXTVCC (In) - Use for applying main power (4.4-5.25 volts) to the module; connect to PORTVCC if the module is to be powered by the USB port (typical configuration).

20	PORTVCC (Out) - USB port power. Connect to EXTVCC if the module is to be powered by the USB port (typical configuration). 500mA is the maximum current available to the DLP-FR256 and target electronics if the USB device is configured for high power.
21	GROUND
22	3V3 (Out) - Power from the 3.3V regulator (active once enumeration is complete).
23	P2.6
24	P2.0
25	P2.1
26	P2.2
27	P3.4
28	P3.6
29	GROUND
30	P3.7
31	P1.6
32	GROUND
33	P1.7
34	P3.5
35	P3.1/A13
36	P3.0/A12
37	GROUND
38	ANA_IN- (In) – Negative analog differential input
39	ANA_IN+ (In) – Positive analog differential input
40	GROUND

5.0 PROGRAMMING / DEBUGGING

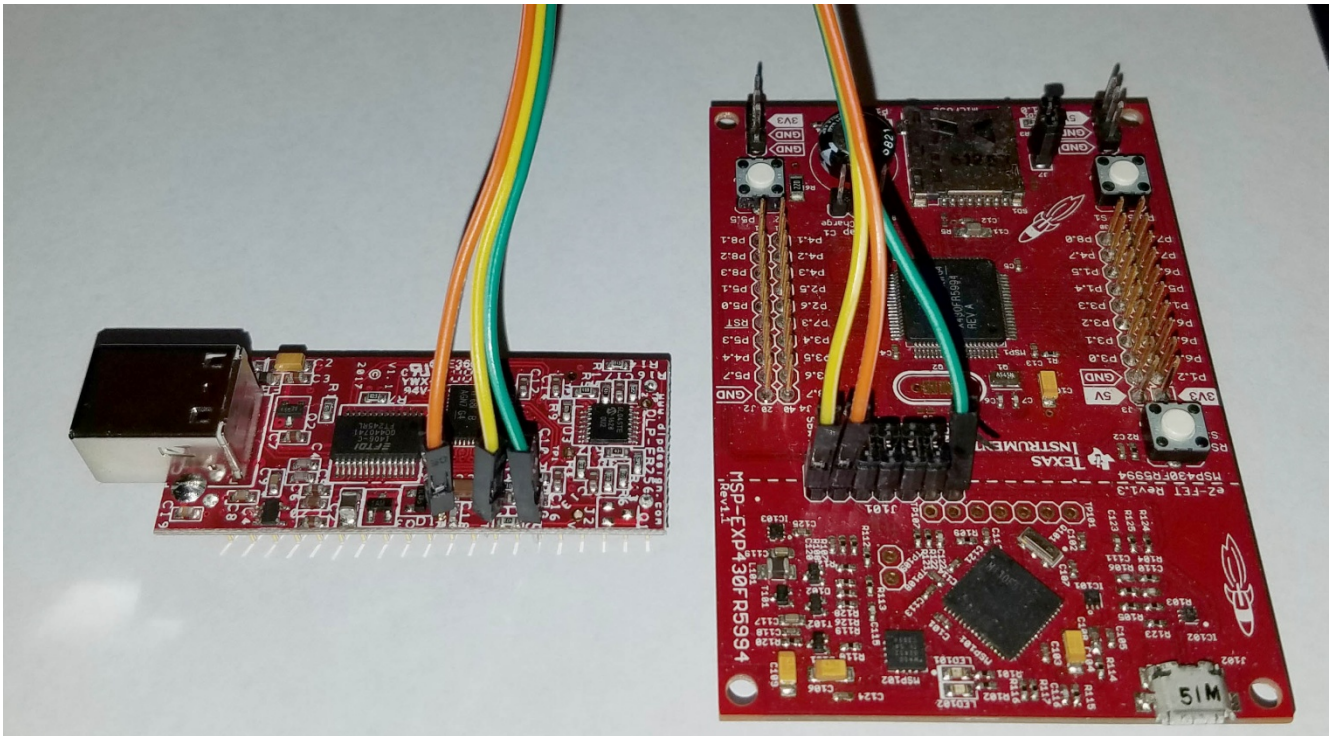
The MSP430FR5994 can be reprogrammed using a Texas Instruments MSP-EXP430FR5994 Launchpad. Before connecting the required three wires to the DLP-FR256, you must first remove three shorting headers from J101 (GND, SBWTCK and SBWTDIO) on the Launchpad.

J2 Spy-By-Wire

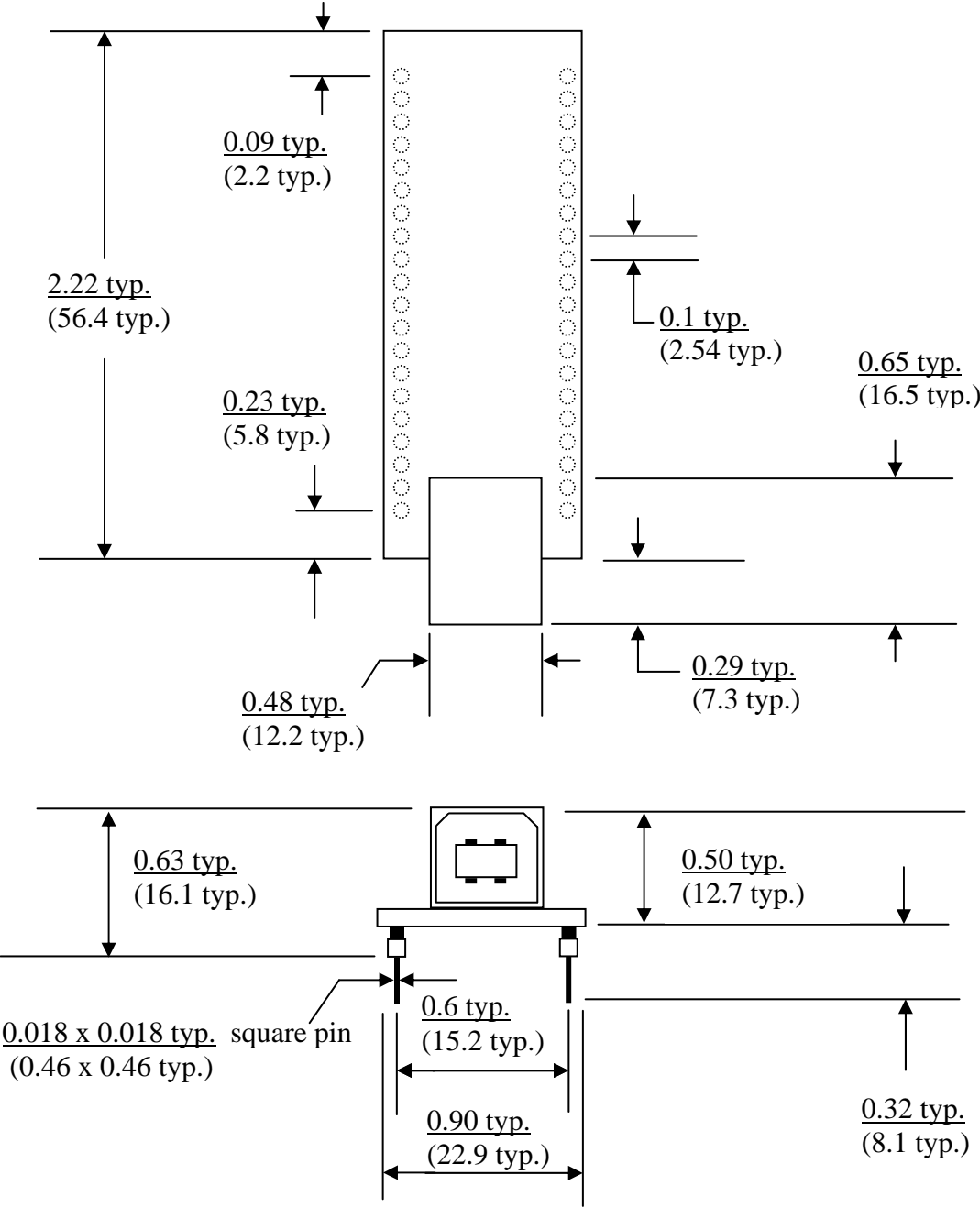
Pin 1 3V3 Power
Pin 2 Ground
Pin 3 SPWTCK
Pin 4 RST

J101 on the Launchpad

Connection not needed as the DLP-FR256 will take power from the USB host
GND Pin
SBWTCK
SBWTDIO



**6.0 PRELIMINARY MECHANICAL DRAWINGS - INCHES (MILLIMETERS)
UNLESS OTHERWISE NOTED**



7.0 DISCLAIMER

Neither the whole nor any part of the information contained within or the product described in this datasheet may be adapted or reproduced in any material or electronic form without the prior written consent of the copyright holder.

This product and its documentation are supplied on an as-is basis, and no warranty as to their suitability for any particular purpose is either made or implied. DLP Design will not accept any claim for damages whatsoever arising as a result of the use or failure of this product. Your statutory rights are not affected.

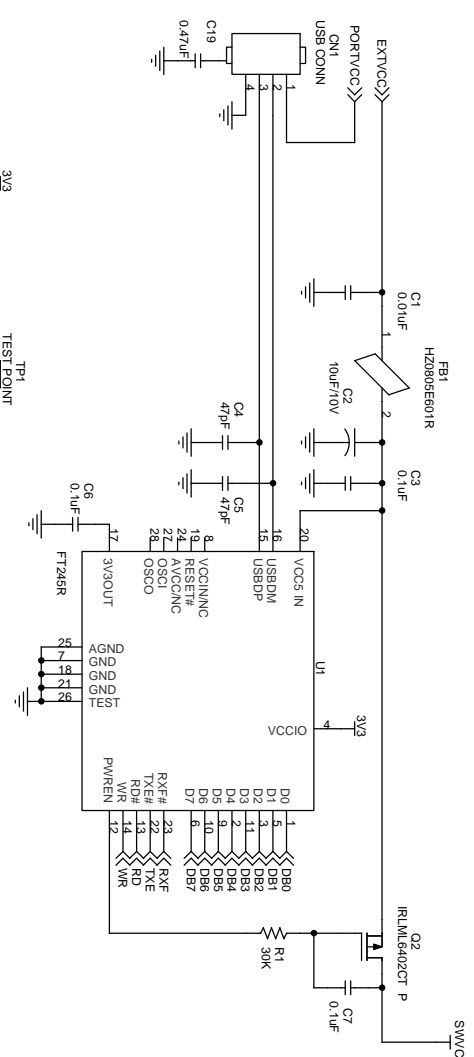
This product or any variant of it is not intended for use in any medical appliance, device or system in which the failure of the product might reasonably be expected to result in personal injury.

This document provides preliminary information that may be subject to change without notice.

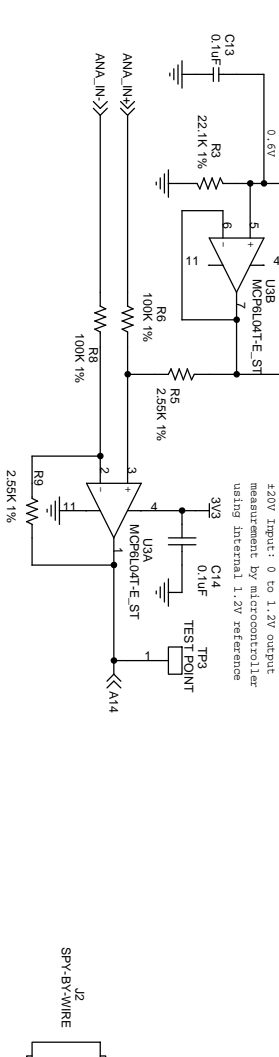
8.0 CONTACT INFORMATION

DLP Design, Inc.
1605 Roma Lane
Allen, TX 75013

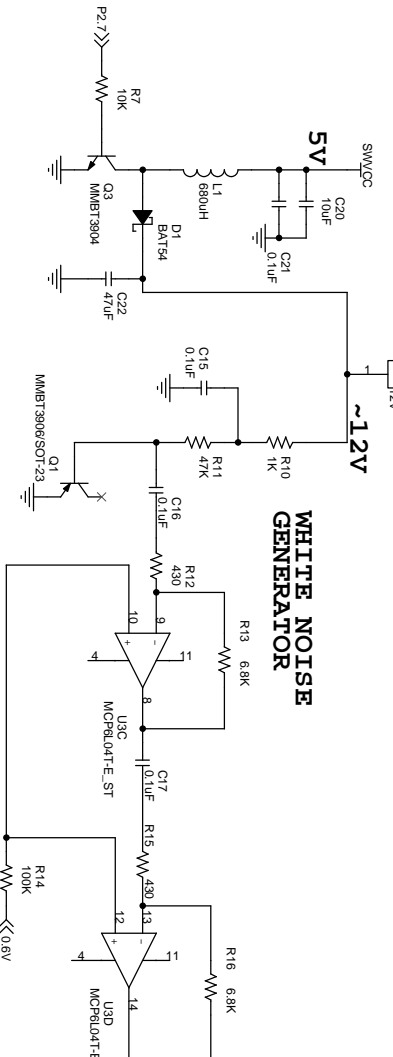
Email: support@dlpdesign.com
Internet: <http://www.dlpdesign.com>



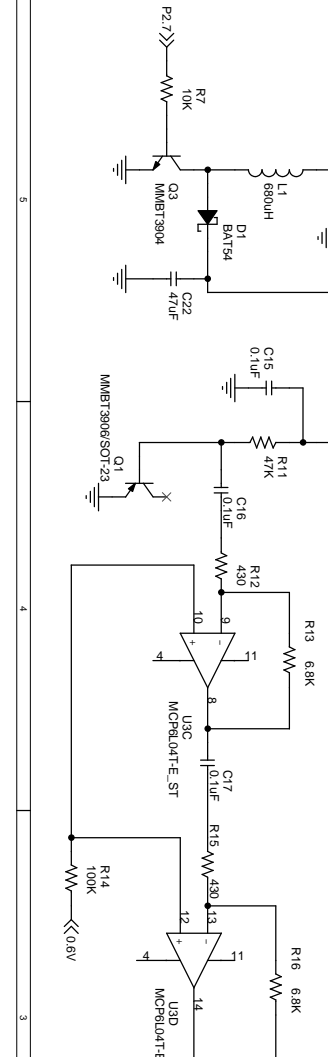
BIPOLAR ANALOG INPUT BUFFER



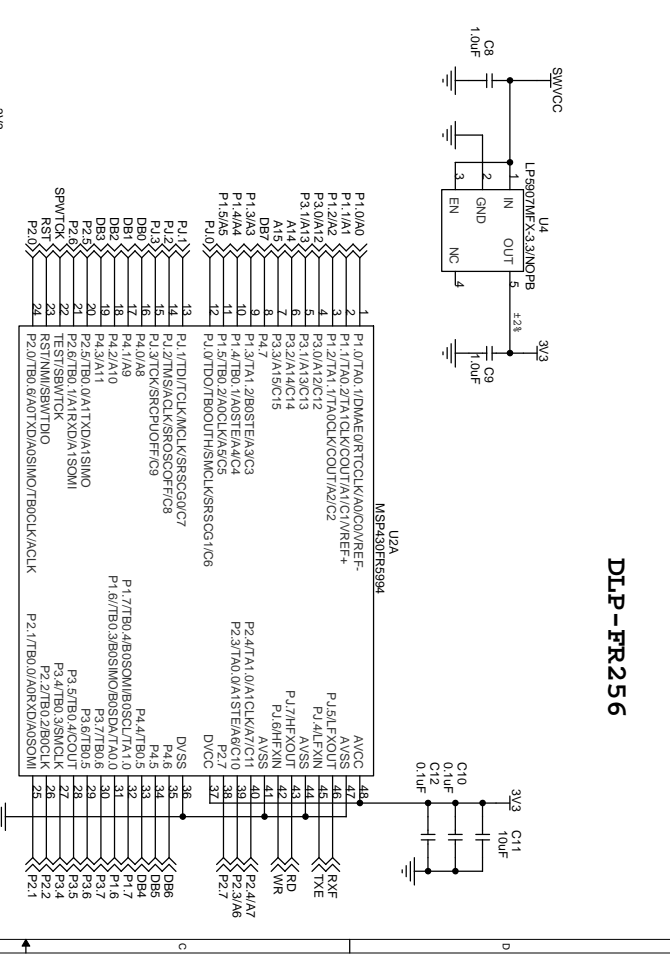
BOOST CONVERTER



WHITE NOISE GENERATOR



Output swings
above and below
0.6V



Pin	Signal	Function
1	P1.0/A0	P1.0/A0
2	P1.1/A1	P1.1/A1
3	P1.2/A2	P1.2/A2
4	P1.3/A3	P1.3/A3
5	P1.4/A4	P1.4/A4
6	P1.5/A5	P1.5/A5
7	P1.6/A6	P1.6/A6
8	P1.7/A7	P1.7/A7
9	P1.8/A8	P1.8/A8
10	P1.9/A9	P1.9/A9
11	P1.10/A10	P1.10/A10
12	P1.11/A11	P1.11/A11
13	P1.12/A12	P1.12/A12
14	P1.13/A13	P1.13/A13
15	P1.14/A14	P1.14/A14
16	P1.15/A15	P1.15/A15
17	P1.16/A16	P1.16/A16
18	P1.17/A17	P1.17/A17
19	P1.18/A18	P1.18/A18
20	P1.19/A19	P1.19/A19
21	P1.20/A20	P1.20/A20
22	P1.21/A21	P1.21/A21
23	P1.22/A22	P1.22/A22
24	P1.23/A23	P1.23/A23
25	P1.24/A24	P1.24/A24
26	P1.25/A25	P1.25/A25
27	P1.26/A26	P1.26/A26
28	P1.27/A27	P1.27/A27
29	P1.28/A28	P1.28/A28
30	P1.29/A29	P1.29/A29
31	P1.30/A30	P1.30/A30
32	P1.31/A31	P1.31/A31
33	P1.32/A32	P1.32/A32
34	P1.33/A33	P1.33/A33
35	P1.34/A34	P1.34/A34
36	P1.35/A35	P1.35/A35
37	P1.36/A36	P1.36/A36
38	P1.37/A37	P1.37/A37
39	P1.38/A38	P1.38/A38
40	P1.39/A39	P1.39/A39
41	P1.40/A40	P1.40/A40
42	P1.41/A41	P1.41/A41
43	P1.42/A42	P1.42/A42
44	P1.43/A43	P1.43/A43
45	P1.44/A44	P1.44/A44
46	P1.45/A45	P1.45/A45
47	P1.46/A46	P1.46/A46
48	P1.47/A47	P1.47/A47
49	P1.48/A48	P1.48/A48
50	P1.49/A49	P1.49/A49
51	P1.50/A50	P1.50/A50
52	P1.51/A51	P1.51/A51
53	P1.52/A52	P1.52/A52
54	P1.53/A53	P1.53/A53
55	P1.54/A54	P1.54/A54
56	P1.55/A55	P1.55/A55
57	P1.56/A56	P1.56/A56
58	P1.57/A57	P1.57/A57
59	P1.58/A58	P1.58/A58
60	P1.59/A59	P1.59/A59
61	P1.60/A60	P1.60/A60
62	P1.61/A61	P1.61/A61
63	P1.62/A62	P1.62/A62
64	P1.63/A63	P1.63/A63
65	P1.64/A64	P1.64/A64
66	P1.65/A65	P1.65/A65
67	P1.66/A66	P1.66/A66
68	P1.67/A67	P1.67/A67
69	P1.68/A68	P1.68/A68
70	P1.69/A69	P1.69/A69
71	P1.70/A70	P1.70/A70
72	P1.71/A71	P1.71/A71
73	P1.72/A72	P1.72/A72
74	P1.73/A73	P1.73/A73
75	P1.74/A74	P1.74/A74
76	P1.75/A75	P1.75/A75
77	P1.76/A76	P1.76/A76
78	P1.77/A77	P1.77/A77
79	P1.78/A78	P1.78/A78
80	P1.79/A79	P1.79/A79
81	P1.80/A80	P1.80/A80
82	P1.81/A81	P1.81/A81
83	P1.82/A82	P1.82/A82
84	P1.83/A83	P1.83/A83
85	P1.84/A84	P1.84/A84
86	P1.85/A85	P1.85/A85
87	P1.86/A86	P1.86/A86
88	P1.87/A87	P1.87/A87
89	P1.88/A88	P1.88/A88
90	P1.89/A89	P1.89/A89
91	P1.90/A90	P1.90/A90
92	P1.91/A91	P1.91/A91
93	P1.92/A92	P1.92/A92
94	P1.93/A93	P1.93/A93
95	P1.94/A94	P1.94/A94
96	P1.95/A95	P1.95/A95
97	P1.96/A96	P1.96/A96
98	P1.97/A97	P1.97/A97
99	P1.98/A98	P1.98/A98
100	P1.99/A99	P1.99/A99
101	P1.100/A100	P1.100/A100

Pin	Signal	Function
1	CONN.FSB.2N2	CONN.FSB.2N2
2	P2.4/A7	P2.4/A7
3	P2.3/A6	P2.3/A6
4	P2.2/A5	P2.2/A5
5	P1.0/A0	P1.0/A0
6	P1.1/A1	P1.1/A1
7	P1.2/A2	P1.2/A2
8	P1.3/A3	P1.3/A3
9	P1.4/A4	P1.4/A4
10	P1.5/A5	P1.5/A5
11	P1.6/A6	P1.6/A6
12	P1.7/A7	P1.7/A7
13	P1.8/A8	P1.8/A8
14	P1.9/A9	P1.9/A9
15	P1.10/A10	P1.10/A10
16	P1.11/A11	P1.11/A11
17	P1.12/A12	P1.12/A12
18	P1.13/A13	P1.13/A13
19	P1.14/A14	P1.14/A14
20	P1.15/A15	P1.15/A15
21	P1.16/A16	P1.16/A16
22	P1.17/A17	P1.17/A17
23	P1.18/A18	P1.18/A18
24	P1.19/A19	P1.19/A19
25	P1.20/A20	P1.20/A20
26	P1.21/A21	P1.21/A21
27	P1.22/A22	P1.22/A22
28	P1.23/A23	P1.23/A23
29	P1.24/A24	P1.24/A24
30	P1.25/A25	P1.25/A25
31	P1.26/A26	P1.26/A26
32	P1.27/A27	P1.27/A27
33	P1.28/A28	P1.28/A28
34	P1.29/A29	P1.29/A29
35	P1.30/A30	P1.30/A30
36	P1.31/A31	P1.31/A31
37	P1.32/A32	P1.32/A32
38	P1.33/A33	P1.33/A33
39	P1.34/A34	P1.34/A34
40	P1.35/A35	P1.35/A35
41	P1.36/A36	P1.36/A36
42	P1.37/A37	P1.37/A37
43	P1.38/A38	P1.38/A38
44	P1.39/A39	P1.39/A39
45	P1.40/A40	P1.40/A40
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47	P1.42/A42	P1.42/A42
48	P1.43/A43	P1.43/A43
49	P1.44/A44	P1.44/A44
50	P1.45/A45	P1.45/A45
51	P1.46/A46	P1.46/A46
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56	P1.51/A51	P1.51/A51
57	P1.52/A52	P1.52/A52
58	P1.53/A53	P1.53/A53
59	P1.54/A54	P1.54/A54
60	P1.55/A55	P1.55/A55
61	P1.56/A56	P1.56/A56
62	P1.57/A57	P1.57/A57
63	P1.58/A58	P1.58/A58
64	P1.59/A59	P1.59/A59
65	P1.60/A60	P1.60/A60
66	P1.61/A61	P1.61/A61
67	P1.62/A62	P1.62/A62
68	P1.63/A63	P1.63/A63
69	P1.64/A64	P1.64/A64
70	P1.65/A65	P1.65/A65
71	P1.66/A66	P1.66/A66
72	P1.67/A67	P1.67/A67
73	P1.68/A68	P1.68/A68
74	P1.69/A69	P1.69/A69
75	P1.70/A70	P1.70/A70
76	P1.71/A71	P1.71/A71
77	P1.72/A72	P1.72/A72
78	P1.73/A73	P1.73/A73
79	P1.74/A74	P1.74/A74
80	P1.75/A75	P1.75/A75
81	P1.76/A76	P1.76/A76
82	P1.77/A77	P1.77/A77
83	P1.78/A78	P1.78/A78
84	P1.79/A79	P1.79/A79
85	P1.80/A80	P1.80/A80
86	P1.81/A81	P1.81/A81
87	P1.82/A82	P1.82/A82
88	P1.83/A83	P1.83/A83
89	P1.84/A84	P1.84/A84
90	P1.85/A85	P1.85/A85
91	P1.86/A86	P1.86/A86
92	P1.87/A87	P1.87/A87
93	P1.88/A88	P1.88/A88
94	P1.89/A89	P1.89/A89
95	P1.90/A90	P1.90/A90
96	P1.91/A91	P1.91/A91
97	P1.92/A92	P1.92/A92
98	P1.93/A93	P1.93/A93
99	P1.94/A94	P1.94/A94
100	P1.95/A95	P1.95/A95

Pin	Signal	Function
1	CONN.FSB.2N2	CONN.FSB.2N2
2	P2.4/A7	P2.4/A7
3	P2.3/A6	P2.3/A6
4	P2.2/A5	P2.2/A5
5	P1.0/A0	P1.0/A0
6	P1.1/A1	P1.1/A1
7	P1.2/A2	P1.2/A2
8	P1.3/A3	P1.3/A3
9	P1.4/A4	P1.4/A4
10	P1.5/A5	P1.5/A5
11	P1.6/A6	P1.6/A6
12	P1.7/A7	P1.7/A7
13	P1.8/A8	P1.8/A8
14	P1.9/A9	P1.9/A9
15	P1.10/A10	P1.10/A10
16	P1.11/A11	P1.11/A11
17	P1.12/A12	P1.12/A12
18	P1.13/A13	P1.13/A13
19	P1.14/A14	P1.14/A14
20	P1.15/A15	P1.15/A15
21	P1.16/A16	P1.16/A16
22	P1.17/A17	P1.17/A17
23	P1.18/A18	P1.18/A18
24	P1.19/A19	P1.19/A19
25	P1.20/A20	P1.20/A20
26	P1.21/A21	P1.21/A21
27	P1.22/A22	P1.22/A22
28	P1.23/A23	P1.23/A23
29	P1.24/A24	P1.24/A24
30	P1.25/A25	P1.25/A25
31	P1.26/A26	P1.26/A26
32	P1.27/A27	P1.27/A27
33	P1.28/A28	P1.28/A28
34	P1.29/A29	P1.29/A29
35	P1.30/A30	P1.30/A30
36	P1.31/A31	P1.31/A31
37	P1.32/A32	P1.32/A32
38	P1.33/A33	P1.33/A33
39	P1.34/A34	P1.34/A34
40	P1.35/A35	P1.35/A35
41	P1.36/A36	P1.36/A36
42	P1.37/A37	P1.37/A37
43	P1.38/A38	P1.38/A38
44	P1.39/A39	P1.39/A39
45	P1.40/A40	P1.40/A40
46	P1.41/A41	P1.41/A41
47	P1.42/A42	P1.42/A42
48	P1.43/A43	P1.43/A43
49	P1.44/A44	P1.44/A44
50	P1.45/A45	P1.45/A45
51	P1.46/A46	P1.46/A46
52	P1.47/A47	P1.47/A47
53	P1.48/A48	P1.48/A48
54	P1.49/A49	P1.49/A49
55	P1.50/A50	P1.50/A50
56	P1.51/A51	P1.51/A51
57	P1.52/A52	P1.52/A52
58	P1.53/A53	P1.53/A53
59	P1.54/A54	P1.54/A54
60	P1.55/A55	P1.55/A55
61	P1.56/A56	P1.56/A56
62	P1.57/A57	P1.57/A57
63	P1.58/A58	P1.58/A58
64	P1.59/A59	P1.59/A59
65	P1.60/A60	P1.60/A60
66	P1.61/A61	P1.61/A61
67	P1.62/A62	P1.62/A62
68	P1.63/A63	P1.63/A63
69	P1.64/A64	P1.64/A64
70	P1.65/A65	P1.65/A65
71	P1.66/A66	P1.66/A66
72	P1.67/A67	P1.67/A67
73	P1.68/A68	P1.68/A68
74	P1.69/A69	P1.69/A69
75	P1.70/A70	P1.70/A70
76	P1.71/A71	P1.71/A71
77	P1.72/A72	P1.72/A72
78	P1.73/A73	P1.73/A73
79	P1.74/A74	P1.74/A74
80	P1.75/A75	P1.75/A75
81	P1.76/A76	P1.76/A76
82	P1.77/A77	P1.77/A77
83	P1.78/A78	P1.78/A78
84	P1.79/A79	P1.79/A79
85	P1.80/A80	P1.80/A80
86	P1.81/A81	P1.81/A81
87	P1.82/A82	P1.82/A82
88	P1.83/A83	P1.83/A83
89	P1.84/A84	P1.84/A84
90	P1.85/A85	P1.85/A85
91	P1.86/A86	P1.86/A86
92	P1.87/A87	P1.87/A87
93	P1.88/A88	P1.88/A88
94	P1.89/A89	P1.89/A89
95	P1.90/A90	P1.90/A90
96	P1.91/A91	P1.91/A91
97	P1.92/A92	P1.92/A92
98	P1.93/A93	P1.93/A93
99	P1.94/A94	P1.94/A94
100	P1.95/A95	P1.95/A95

Pin	Signal	Function
1	CONN.FSB.2N2	CONN.FSB.2N2
2	P2.4/A7	P2.4/A7
3	P2.3/A6	P2.3/A6
4	P2.2/A5	P2.2/A5
5	P1.0/A0	P1.0/A0
6	P1.1/A1	P1.1/A1
7	P1.2/A2	P1.2/A2
8	P1.3/A3	P1.3/A3
9	P1.4/A4	P1.4/A4
10	P1.5/A5	P1.5/A5
11	P1.6/A6	P1.6/A6
12	P1.7/A7	P1.7/A7
13		