

DESCRIPTION

Demonstration circuit 1420A from Linear Technology is a convenient platform for testing and evaluation of a PSE Integrated Connector Module (PSE-ICM) that complies with the PoETec specification.

PoETec is a consortium of leading manufacturers of network equipment and components, dedicated to promoting and advancing Power over Ethernet (PoE) technology.

The PSE-ICM is a 12-port Ethernet Jack containing PoE Power Sourcing Equipment (PSE) circuitry, integrated gigabit LAN magnetics, and status indicator LEDs in a compact 2x6 ganged connector assembly. The PoETec PSE-ICM specification also defines 8-port (2x4) and 16-port (2x8) modules, but the DC1420A demo board currently only supports the 12-port PSE-ICM.

Designers of high-power PSE face a variety of technical challenges such as isolation, EMI/EMC, and heat dissipation. These challenges are already met by the PSE-ICM makers, thus the PSE-ICM offers a drop-in solution with the potential to drastically reduce time-to-market.


The PSE-ICM can function autonomously or be controlled by an external host computer via an I²C inter-

face. The PSE-ICM provides isolation on the I²C interface, so no external optocouplers are needed to meet the isolation requirements specified in IEEE Standard 802.3at.

The PSE-ICM register set defined by PoETec is a subset of the registers in the LTC[®]4266 quad PSE controller chip from Linear Technology, therefore the LTC4266 demo software can be used to evaluate the PSE-ICM, and is an excellent tool for learning the register set and developing power management application software.

The DC1420A board is compatible with any 12-port PoETec compliant PSE-ICMs. However, some features of the demo software will work only with PSE-ICMs that utilize the LTC4266 chip.

The LTC4266 demo software and the design files for the DC1420A board are available from Linear Technology. **Contact your local Linear Technology sales person.**

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QUICK START PROCEDURE

Demonstration circuit 1420A can be used stand-alone in auto mode, or can be controlled from a computer. For customers interested in computer control, Linear Technology provides the DC590B board as an interface between a standard USB port and the I²C bus on the DC1420A board. The DC590B board can also provide power to run the circuitry inside the PSE-ICM.

Figure 1 shows the basic setup. The computer and DC590B board shown at the bottom of Figure 1 can be omitted when running the PSE-ICM in auto mode, but an external power supply would then be required to provide 3.3V.

Choose one of the procedures shown below, depending on whether or not computer control is required.

Setup Procedure with Computer Interface

1. Install the QuickEval software available at www.linear.com on the PC.
2. On the DC590B board:
 - a. Set both sides (ISO and SW) of JP5 to ON.
 - b. Set JP6 to 3.3V.
3. Connect the DC590B board to the PC with a standard USB A-B cable.
 - a. Verify the ISO PWR LED on the DC590B board is lit.
4. On the DC1420A board:
 - a. Set JP1 to Internal.
 - b. Set the AUTO pole of the DIP switch (SW1) to OFF. This sets the AUTO pin high, enabling auto mode.
5. Connect the DC590B board to the DC1420A board with the 14-conductor ribbon cable supplied with the DC590B board.

6. Before connecting the main power supply to the DC1420A board verify the voltage is between 51V and 57V, **and that the main supply is turned off.**
7. Connect the main power supply to the DC1420A board with two banana patch cords. **Verify the polarity is correct before turning on the power.**
8. Turn on the main power supply and verify LED1 on the DC1420A board is lit.
9. Connect PDs to any of the ports on the PSE-ICM and verify they turn on.
10. Launch the QuickEval software.

Quick Start without Computer Interface

1. On the DC1420A board:
 - a. Set JP1 to External.
 - b. Set the AUTO pole of the DIP switch (SW1) to OFF. This sets the AUTO pin high, enabling auto mode.
2. Connect a 3.3V power supply to the D3.3V and GND test points as shown in Figure 1.
3. Before connecting the main power supply to the DC1420A board verify the voltage is between 51V and 57V, **and that the main supply is turned off.**
4. Connect the main power supply to the DC1420A board with two banana patch cords. **Verify the polarity is correct before turning on the power.**
5. Turn on the main power supply and verify LED1 on the DC1420A board is lit.
6. Connect PDs to any of the ports on the PSE-ICM and verify they turn on.

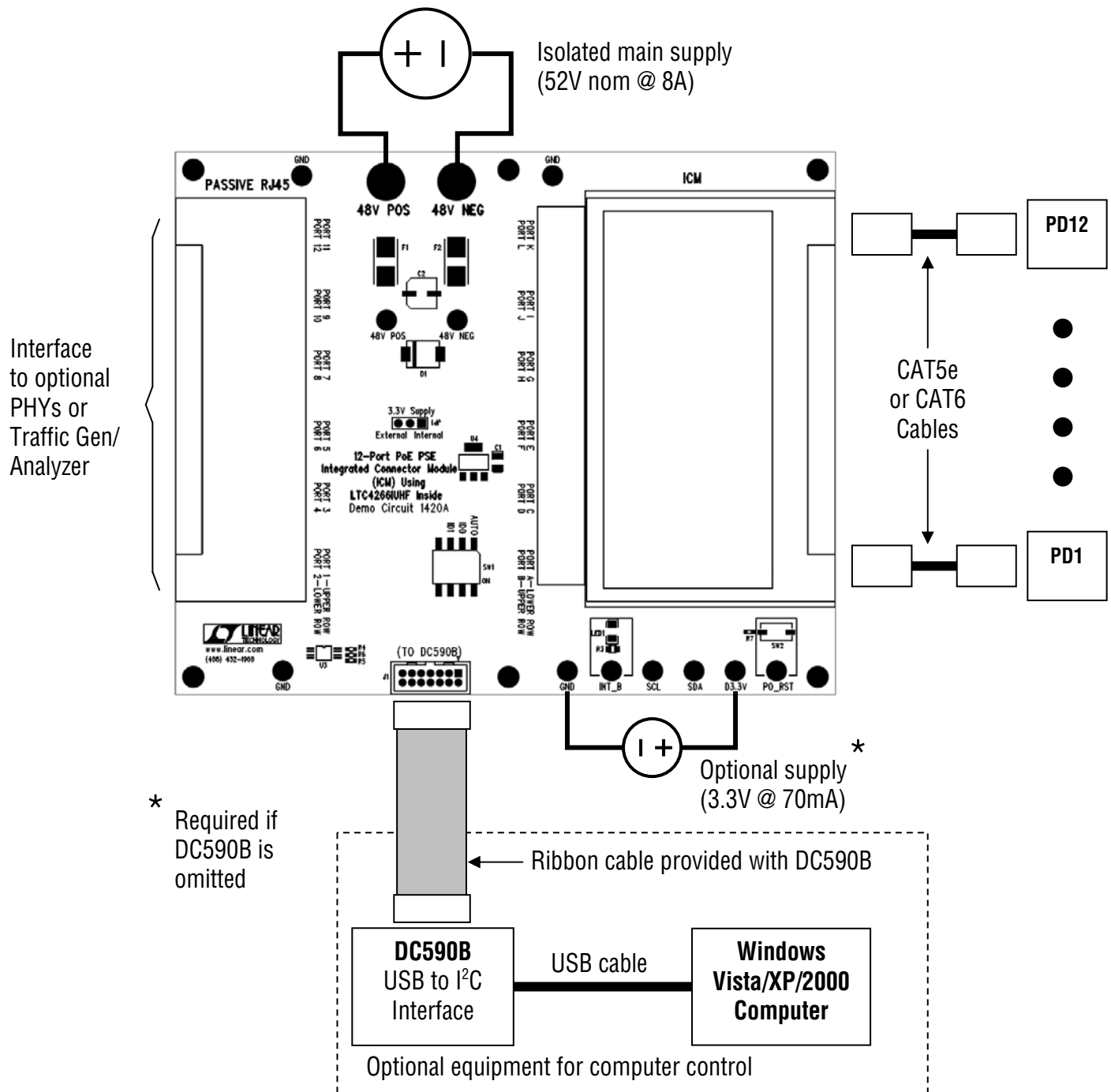


Figure 1. DC1420A Board Setup.

OPERATION

Introduction

The Integrated Connector Module (PSE-ICM) provides a powerful and versatile high-power PSE solution for network equipment makers. The challenges of EMI, isolation, and heat dissipation have already been dealt with by the PSE-ICM maker, thus shortening the time-to-market for a new PoE-enabled system.

Power Supplies

The PSE-ICM requires two power supplies:

- The main supply. Nominally 51V to 57V @ 8A.
- The logic supply. Nominally +3.3V @ 60mA.

The main supply powers the PDs. To comply with the IEEE 802.3at standard the main supply must be isolated and in the range of 51V to 57V. Each PD may draw up to 600mA (class 4) so the total load current for 12 PDs can be as high as 7.2A. Therefore a main supply rated for at least 8A is recommended.

Linear Technology strongly recommends using a main power supply that has foldback to reduce the risk of damage if the polarity is accidentally reversed. If foldback is not available the DC1420A board will still protect the PSE-ICM with two 10A fuses (F1, F2) and a clamp diode (D1). Replacement fuses are available from many distributors; see the bill of materials at the end of this document for the fuse part number.

WARNING: Permanent damage to the PSE-ICM may result if the transient suppressor diode (D1) is removed. D1 protects the PSE-ICM from accidental polarity reversal, and from overvoltage transients that can occur if the main power supply is hot-plugged.

The main power supply wires should be kept short and paired; if long wires are used, the parasitic inductance may cause a significant voltage drop in the event of a load transient such as a short circuit. If the main supply voltage at the PSE-ICM inputs drops below the Under-Voltage Lock-Out (UVLO) threshold the LTC4266 chips will be reset, and all ports turned off.

The logic supply powers the internal circuitry of the PSE-ICM. The DC1420A board includes a linear regulator (U4) that uses an unregulated output from the DC590B board to produce well-regulated 3.3V for the PSE-ICM. An external power supply could alternatively be used to provide the 3.3V; see the section below: *Connecting Multiple Boards*.

Modes of Operation

The PSE-ICM has four operating modes. The mode of each port can be configured individually via I²C commands. The operating modes are:

- Auto mode: If the PD has a valid detection signature, the port automatically classifies the PD then turns on power to it.
- Semi-auto mode: The port performs detection and classification autonomously, but waits for a command from the host processor before turning on the PD.
- Manual mode: The port does nothing autonomously. The host computer must issue commands to detect, classify, and turn on the power.
- Shutdown mode: The port is shut down.

The AUTO pin on the PSE-ICM determines the default mode after power-up or reset. If AUTO is left floating (it is pulled high inside the PSE-ICM), then all ports will be in auto mode. If AUTO is tied to JMP_RTN at start-up, all ports will be in shutdown mode.

Resetting the PSE-ICM

The DC1420A board includes a reset button (SW2) that pulls PO_RST low when pressed, resetting the PSE-ICM to its power-up state. A test point is also provided to allow the PSE-ICM to be reset with a pulse generator, or other external equipment.

I²C Bus

The PSE-ICM is an I²C slave device, and does not use clock-stretching. The PSE-ICM will work with clock speeds up to 400kHz.

NOTE: SDA and SCL need pull-up resistors. These are included on the DC590B, but not on the DC1420A. If another I²C master is used instead of the DC590B the user must make sure the new master has pull-up resistors.

I²C Addressing

The first byte of any I²C transaction is the address byte, containing the 7-bit address field and a Read/Write bit as shown in Figure 2. For the PSE-ICM, the upper three bits of the address field (A6, A5, A4) are always "010". Bits A3 and A2 are determined by the ID1 and ID0 pins respectively, which are set by the DIP switch (SW1) on the DC1420A board. The two least significant address bits (A1, A0) select a group of four ports within the PSE-ICM.

In order to reduce cost, PoETec does not require isolation on the ID0 or ID1 pins. Therefore, these inputs go straight into the PSE controller chips on the cable side of the isolation barrier. Some brands of PSE-ICM may have ID0 and ID1 referenced to the high side of the main supply, while other brands may have them referenced to the low side. To make these different brands interoperable, PoETec includes the JMP_RTN pin: An ID pin is shorted to JMP_RTN for '0' or left open for '1'.

WARNING: Permanent damage may occur if ID0, ID1, or JMP_RTN pins are connected to any power supply rails or ground planes. Never connect the ID0 or ID1 to anything other than JMP_RTN. Never connect JMP_RTN to any planes, or the JMP_RTN pin of another PSE-ICM.

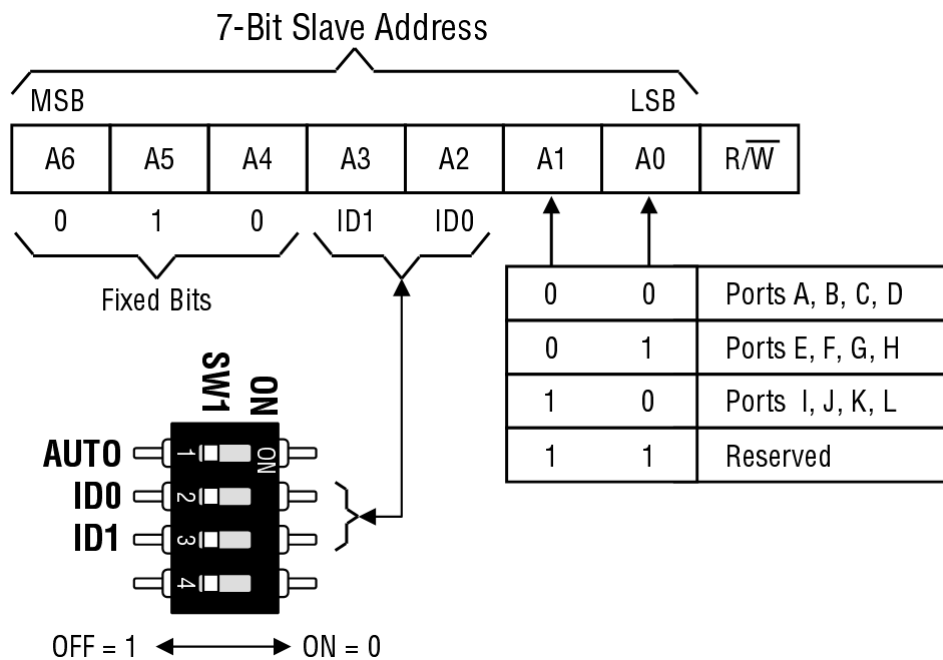


Figure 2. I²C Addressing.

Port Mapping

The ports on and PSE-ICM are designated A through L in accordance with the PoETec specification; Figure 3 shows how the ports are arranged on the front of the PSE-ICM.

The DC1420A includes a 2x6 ganged “passive” – no internal Ethernet magnetics – RJ45 connector where a PHY or traffic generator/analyzer can be connected. The ports on the passive connector are designated 1 through 12.

The ports are connected so Ethernet data can flow through the DC1420A board just like a midspan. Port A connects to port 1, port B connects to port 2, and so on.

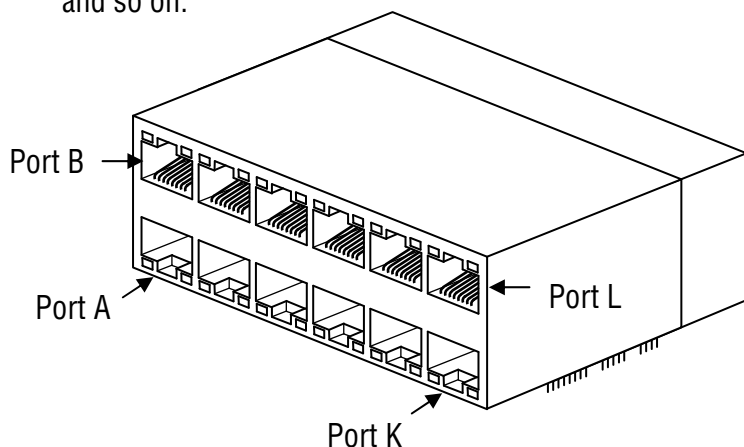


Figure 3. PSE-ICM Port Mapping.

Connecting Multiple DC1420A Boards

Up to four DC1420A boards can be connected to a single DC590B board - for a total of 48 ports - using a 14-conductor ribbon cable as shown in Figure 4. When constructing the ribbon cable it is recommended to leave at least 7 inches between connectors so there is enough service-loop for the cable to jump over the banana plugs. However, the total length of the ribbon cable should not exceed 3 feet; otherwise excessive parasitic capacitance could cause timing problems on the I²C bus.

The DC590B board can supply power for up to two DC1420A boards; if more than two DC1420A boards are connected together then an external power supply must be used, and JP5 on the DC590B board must be set accordingly, as shown in Figure 4. Each DC1420A board contains a 3.3V linear regulator so the external supply can be anywhere from 3.6V to 7V.

WARNING: Standard banana patch cords are typically rated for about 14A. If all 12 ports of an PSE-ICM are at max load (600mA per port) then the total load current per PSE-ICM is 7.2A. Two or more PSE-ICMs can draw a combined current greater than the ampacity of the patch cord. Do not connect the boards in a chain. Connect them in a star configuration using terminal blocks as shown in Figure 5b. Terminal blocks are necessary because if you stack banana plugs at the main PS the plug at the bottom of the stack may carry too much current.

The ID0 and ID1 switch settings must be unique for each DC1420A board; otherwise collisions will occur on the I²C bus.

GUI Software

The GUI application software is a powerful tool for learning the LTC4266 register set and developing power management protocols. Refer to the LTC4266NDASI software interface datasheet for more details.

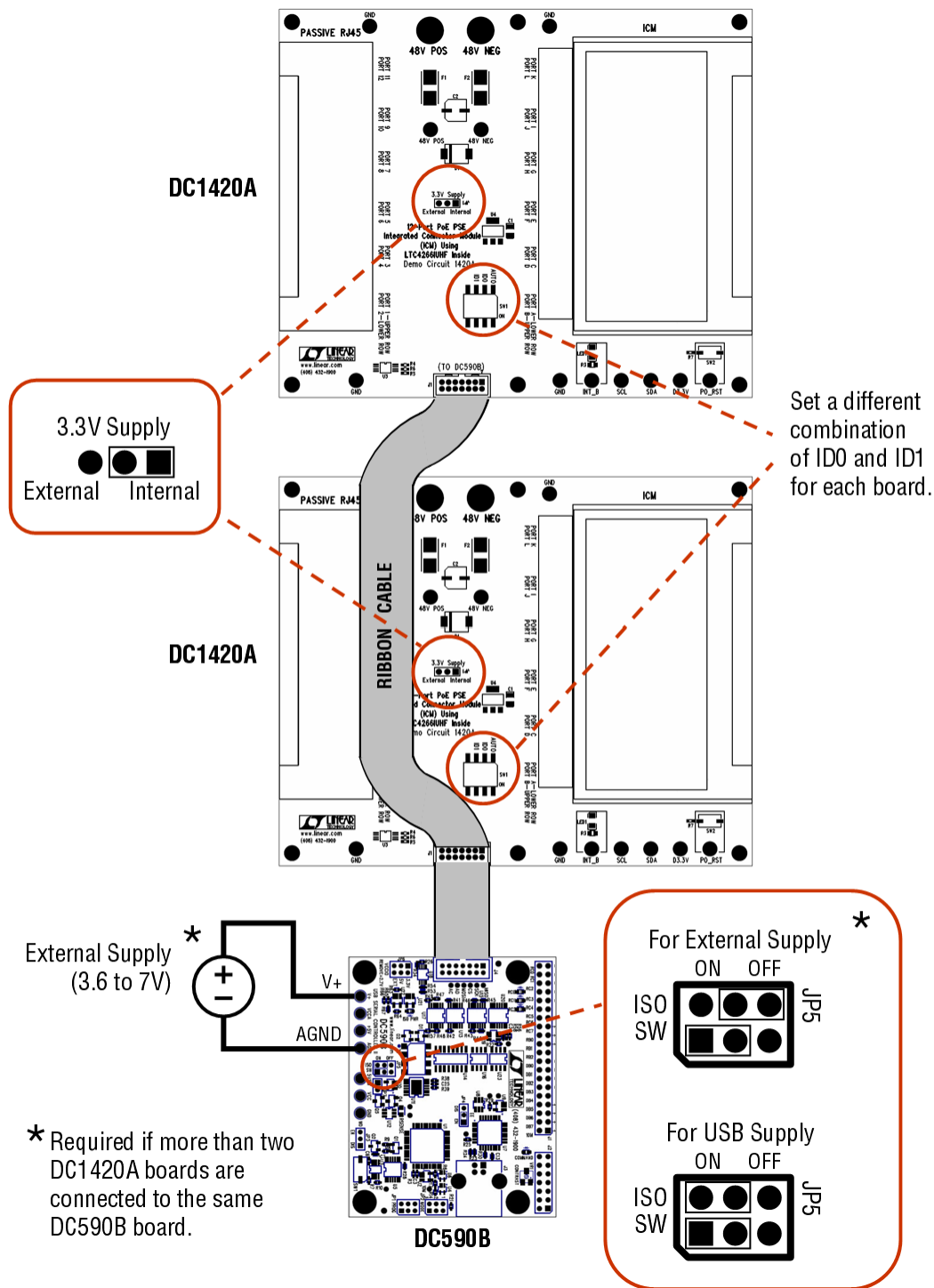


Figure 4. Connecting two or more DC1420A boards to a single DC590B board.

QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 1420A

12-PORT IEEE 802.3AT PSE INTEGRATED CONNECTOR MODULE (PSE-ICM)

LTC4266

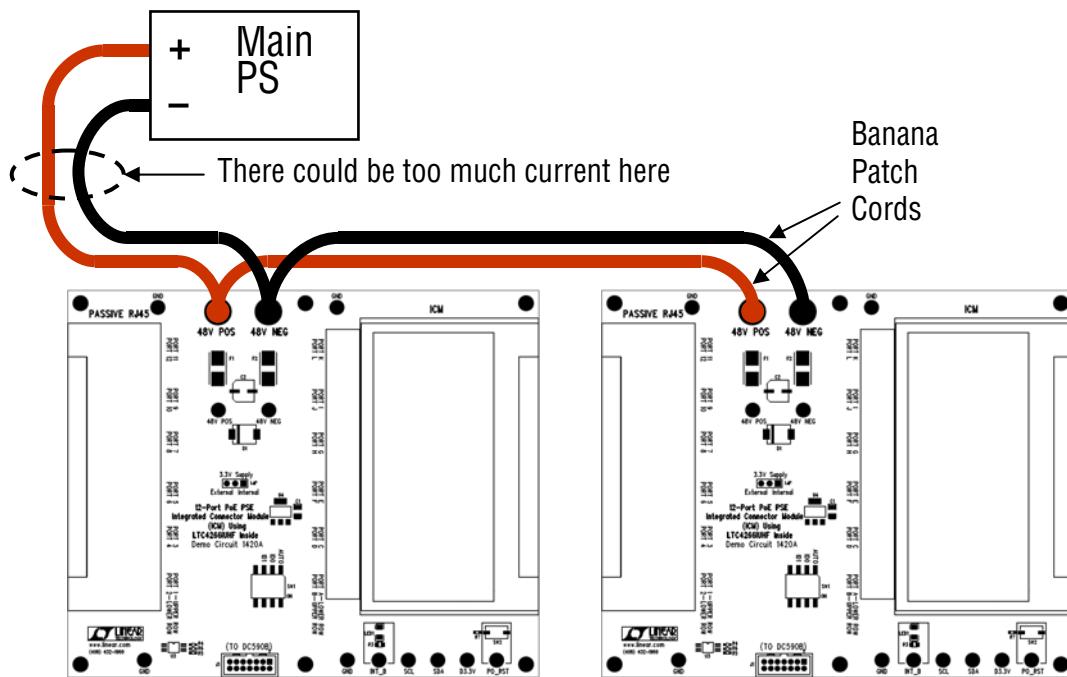


Figure 5a. A risky way to connect multiple boards.

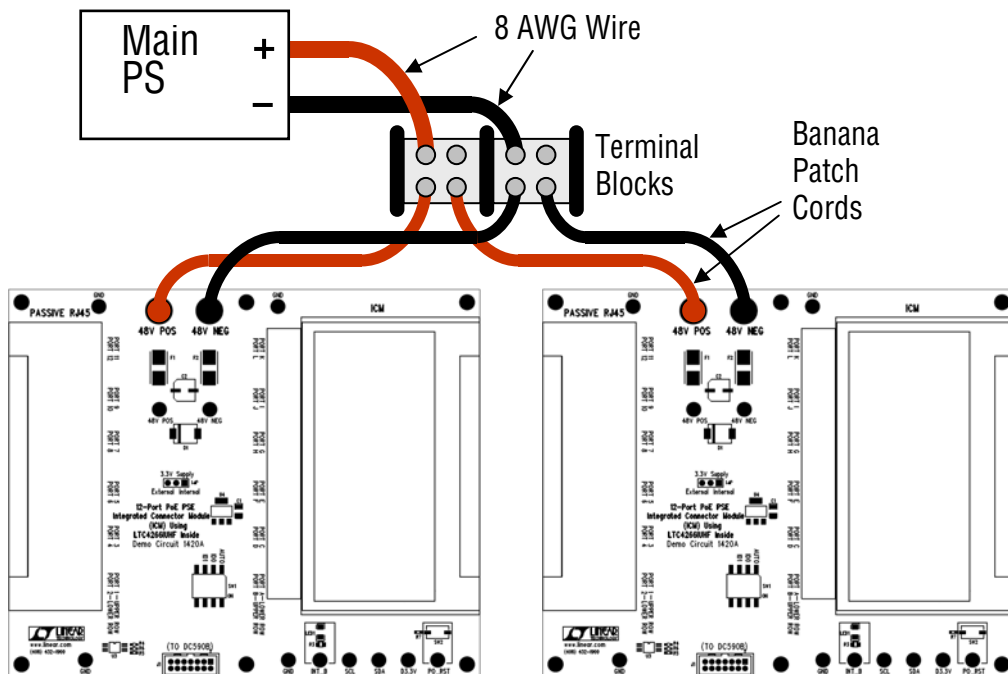
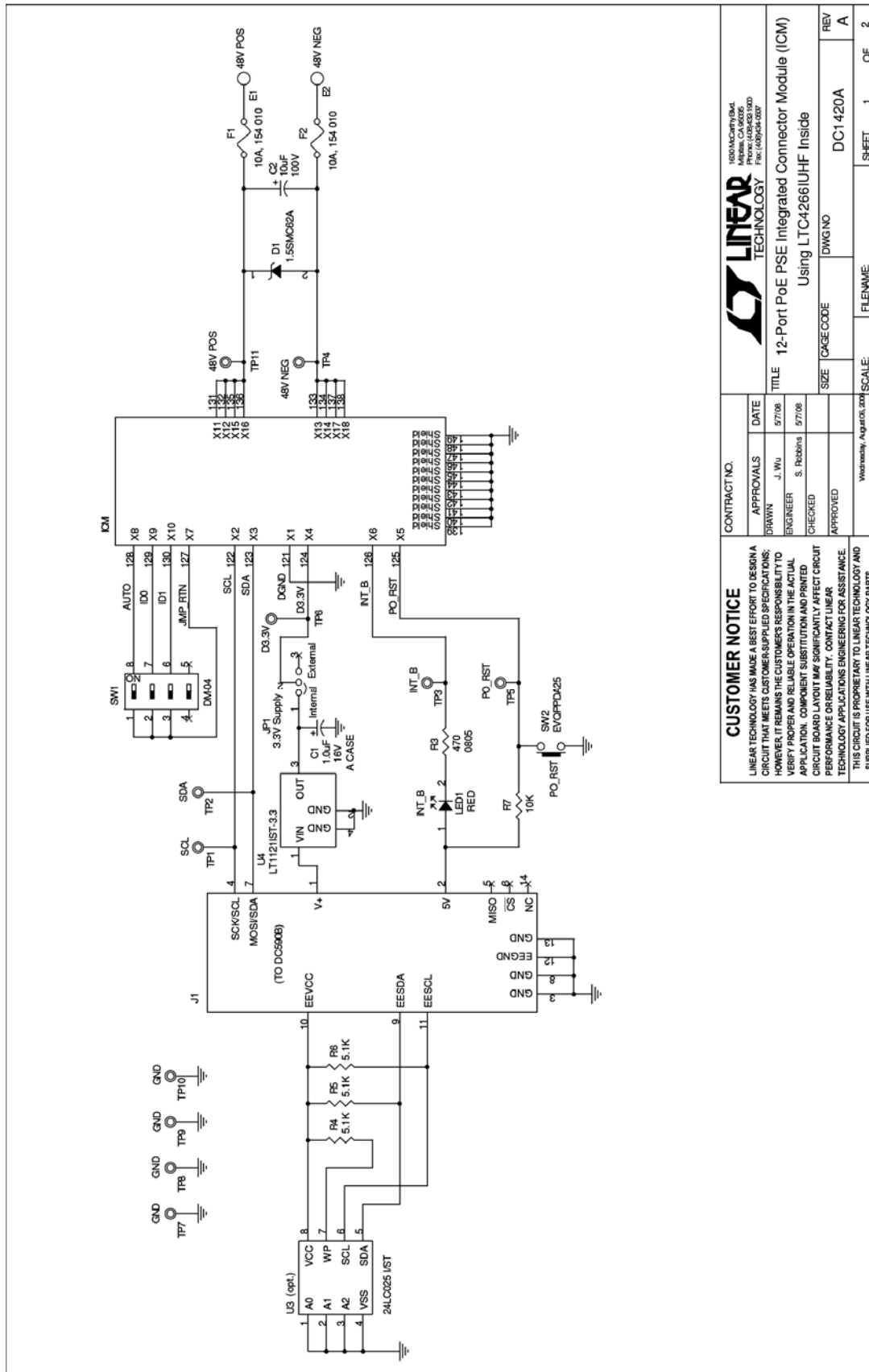



Figure 5b. Recommended way to connect multiple boards.

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12-PORT IEEE 802.3AT PSE INTEGRATED CONNECTOR MODULE (PSE-ICM)

LTC4266

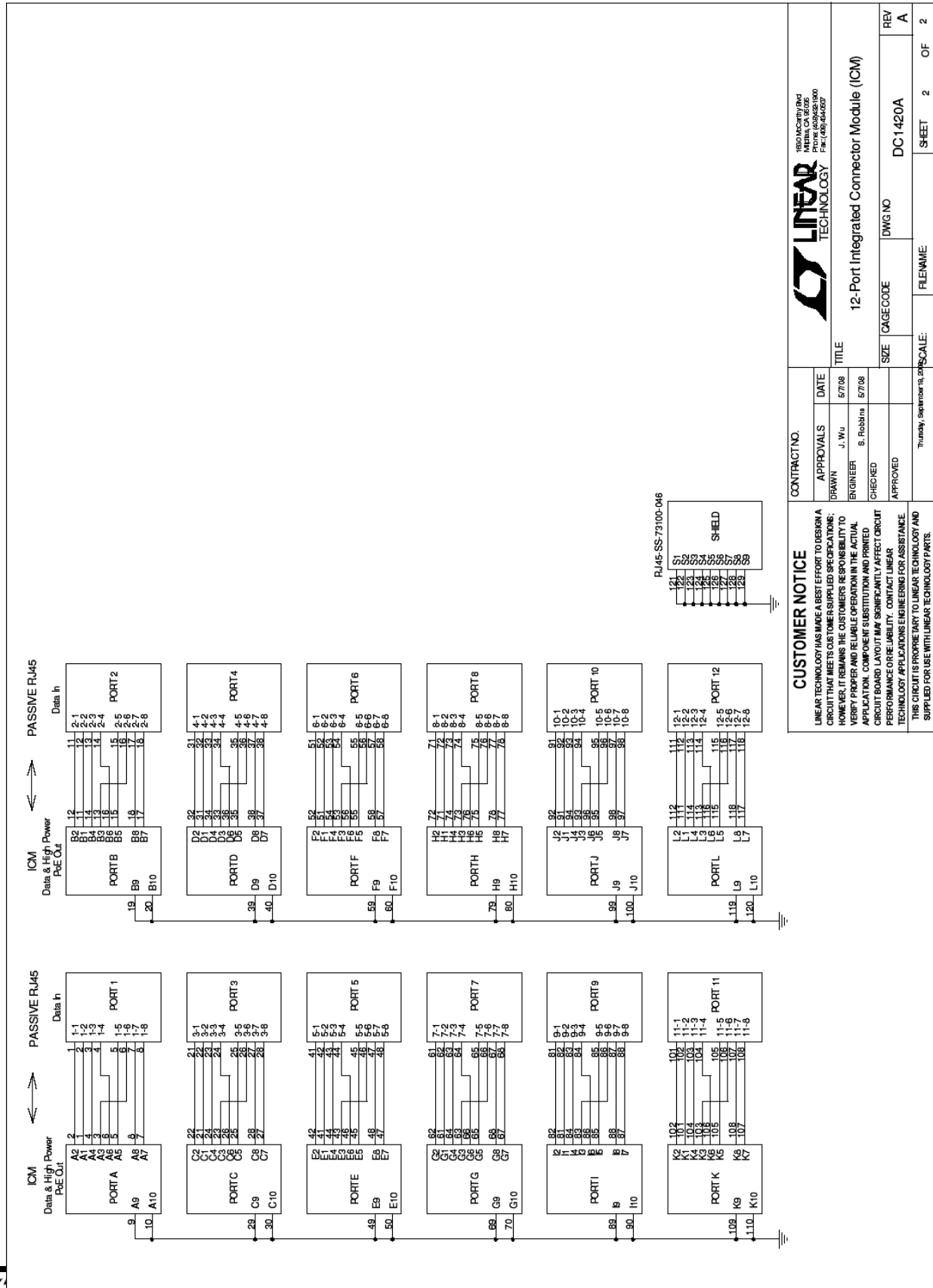


CUSTOMER NOTICE LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS. HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE. CONTACT LINEAR TECHNOLOGY FOR ASSISTANCE.	CONTRACT NO.		1650 KNOFFLY BLVD MILPITAS, CA 95035 TEL: (408) 261-2000 FAX: (408) 264-4507	
	DRAWN	APPROVALS	DATE	 LINEAR TECHNOLOGY
	ENGINEER	J. Wu	5/7/08	
	CHECKED	S. Robbins	5/7/08	
	APPROVED			
	TITLE		12-Port PoE PSE Integrated Connector Module (ICM) Using LTC4266/UHF Inside	
	SIZE	QAGE CODE	DWG NO	REV
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Wednesday, August 6, 2008				

QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 1420A

12-PORT IEEE 802.3AT PSE INTEGRATED CONNECTOR MODULE (PSE-ICM)

LTC4266



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THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND IS SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.		DRAWN	DATE
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		S. Robbins	5/7/08
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12-Port Integrated Connector Module (ICM)		TITLE	
LINEAR TECHNOLOGY		REV	
		SIZE	CODE
		DWG NO	REV
		DC1420A	A



QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 1420A

12-PORT IEEE 802.3AT PSE INTEGRATED CONNECTOR MODULE (PSE-ICM)

LTC4266

Linear Technology Corporation

Bill Of Material
DC1420A
9/18/2008

Item	Qty	Reference	Part Description	Manufacturer / Part #
1	1	C1	CAP., TANT., 1.0uF 16V, A CASE	AVX, TAJA105K016R (in stock)
2	1	C2	CAP., ALUM., 10uF 100V	SANYO, 100CE10BS
3	1	D1	SUPPRESSOR, 1.5SMC62A SMC	CENTRAL SEMI., 1.5SMC62A
4	2	E2,E1	JACK BANANA	KEYSTONE, 575-4 (in stock)
5	2	F2,F1	FUSE, 10A, 154 010,	LITTLE FUSE., 154010
6	1	JP1	0.100 SINGLE ROW HEADER	COM COMM., 3801S-03G2 (in stock)
7	1	XJP1	SHUNT, 0.1" CENTER	SAMTEC, SNT-100-BK-G
8	1	J1	HEADER, 2X7PIN, 0.079CC	MOLEX, 87831-1420 (in stock)
9	1	LED1	LED, RED	PANASONIC, LN1251C-(TR) (in stock)
10	1	R3	RES., CHIP, 470, 1/8W, 5%, 0805	VISHAY, CRCW0805470RJNEA(in stock)
11	3	R4,R5,R6	RES., CHIP, 5.1K, 1/16W, 5%, 0603	VISHAY, CRCW06035K10JNEA(in stock)
12	1	R7	RES., CHIP, 10K, 1/16W, 5%, 0603	VISHAY, CRCW060310KJNEA(in stock)
13	1	SW1	SWITCH, DM-04 SERIES 4-POS. SPST	APEM, DM04(IN STOCK)
14	1	SW2	SWITCH, EVQPPDA25	PANASONIC, EVQPPDA25(From DC1151A)
15	11	TP1-TP11	TESTPOINT, TURRET, .094" pbf	MILL-MAX, 2501-2-00-80-00-07-0
16	1	U1	12-Port Integrated Connector Module	(IN STOCK, ENGINEER PROVIDE)
17	1	U2	CONNECTOR, SS-73100-046 RJ45	Bel Stewart Connector, SS-73100-046
18	0	U3(OPT)	I.C., 24LC025, TSSOP-8	
19	1	U4	I.C., LT1121IST-3.3 SOT-223	Linear Tech., LT1121IST-3.3
20	6	(STAND-OFF)	STAND-OFF, NYLON 0.25"	KEYSTONE, 8831(SNAP ON)