DESCRIPTION

Demonstration Circuit 1214A features the LTC4263-1, a high power, single Power Sourcing Equipment (PSE) controller for use in Power over Ethernet (PoE) systems. The internal current limit and short-circuit protection are designed to provide up to 30W of PSE output power for power hungry PoE applications such as WAPs, security cameras and RFID readers.

The LTC4263-1 includes IEEE 802.3af compliant Powered Device (PD) detection circuitry along with selectable AC and DC disconnect sensing, allowing seamless operation in conventional IEEE 802.3af systems as well as proprietary, high power applications. The LTC4263-1 simplifies PSE implementation, needing only a single supply and a small number of passive support components. Onboard control algorithms provide complete PSE functionality without the need of a microcontroller and built-in foldback and thermal shutdown provide comprehensive fault protection. An LED pin indicates the state of the port and detection backoff timing is configurable for either Endpoint or Midspan operation.

On the DC1214A, two LTC4263-1s are used to show a 4-Pair high power 10/100 Ethernet solution. The first is configured for an Endpoint PSE and controls power applied to the center taps of the high power Ethernet transformers at the data pairs. The second has the Midspan Backoff timer enabled and applies power directly to the spare pairs. Jumpers on the board for each controller configure AC or DC disconnect sensing, legacy detection enable, and controller shutdown. An LED for each device also indicates the state of the power on the respective pair set.

The LTC4263-1 is available in a miniature 14-pin 4mm × 3mm DFN package.

Design files for this circuit board are available. Call the LTC factory.

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Table 1. Typical DC1214A Performance Summary (\(T_A = 25^\circ C\))

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONDITION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage (VDD48 – VSS)</td>
<td>Operation</td>
<td>33V to 66V</td>
</tr>
<tr>
<td></td>
<td>30W Output Power</td>
<td>56V</td>
</tr>
<tr>
<td>Overload Current Threshold</td>
<td>Current at VOUT or VOUT_B</td>
<td>570mA</td>
</tr>
<tr>
<td>Midspan Mode Detection Backoff</td>
<td>Midspan Enabled, Failed Detection</td>
<td>3.2 seconds</td>
</tr>
<tr>
<td>Detection Range</td>
<td>Valid IEEE802.3af PD Detection</td>
<td>17k to 29.7k</td>
</tr>
<tr>
<td>Ethernet Powered Pairs Pinout</td>
<td>Endpoint PSE, Alternative A (MDI)</td>
<td>1/2(+), 3/6(-)</td>
</tr>
<tr>
<td>(See Figure 2)</td>
<td>Midspan PSE, Alternative B</td>
<td>4/5(+), 7/8 (-)</td>
</tr>
</tbody>
</table>

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QUICK START PROCEDURE

Demonstration circuit 1214A is easy to set up to evaluate the performance of the LTC4263-1. Refer to Figure 1 for proper equipment setup and follow the procedure below.

1. Place jumpers in the following positions:
   - /SD EN
   - LEGACY EN
   - ACCOMP AC
   - DISCON AC

2. Apply 56V across VDD48 and VSS.

3. Connect a 4-Pair PD J4 at PSE OUT.
   (Connect a scope probe at VOUT and VOUT_B, both referenced to positive rail VDD48 to observe port operation.)

Figure 1. Basic DC1214A Setup
OPERATING PRINCIPLES

DC1214A provides two implementations of a PSE controlled by the LTC4263-1, a Midspan PSE and an Endpoint PSE. A single supply across VDD48 to VSS is all that is required to power the board. This in turn provides power to the Midspan PSE and Endpoint PSE outputs. On each solution, an LTC4263-1 provides detection of a PD, safe power on of the PD, port current limit, and disconnect detection. Both solutions can be enabled at the same port to make a 4-pair high power solution.

Midspan PSE and Midspan Mode

In the Midspan solution, a device (router, switch, etc.) that does not have PoE is connected to DATA IN. Data is passed through to PSE OUT on the Ethernet data pairs 1/2 and 3/6. Since power is not on the spare pairs for 10/100 Ethernet, PoE power is applied directly to Ethernet pairs 4/5 and 7/8. In this solution, the Midspan Backoff timer is enabled on the board where a 3.2 second delay occurs after every failed detect cycle unless the result is open circuit. To show the other functions of the LTC4263-1, jumpers allow for the user to select the options of AC or DC disconnect, and legacy detection. A jumper for the /SD pin ties the shutdown pin to VSS to disable the LTC4263-1. An LED that shows the status of the port is driven by a switcher in the LTC4263-1 to improve efficiency when VDD5 is provided internally.

Endpoint PSE

In the Endpoint solution, power is applied to the center taps of high power Ethernet transformers for data pairs 1/2 and 3/6. On the demo circuit, data can be passed from RJ45 connector DATA IN out PSE OUT along with PoE. To show the other functions of the LTC4263-1, jumpers allow for the user to select the options of AC or DC disconnect, and legacy detection. A jumper for the /SD pin ties the shutdown pin to VSS to disable the LTC4263-1. An LED that shows the status of the port is driven by a switcher in the LTC4263-1 to improve efficiency when VDD5 is provided internally.

2-Pair and 4-Pair High Power PSE

The LTC4263-1 controls the power on a 2-Pair set. The current limit has been set higher than IEEE802.3af standard current limits. With a power supply set at 56V, more than 30W of output power is available at the port. To run a 2-Pair PSE, disable the LTC4263-1 controller that will not be used on the DC1214A through its respective shutdown (/SD) jumper.

For increased power, an additional LTC4263-1 controller is used on the remaining pair set. Enable both controllers on the DC1214A through the shutdown (/SD) jumpers. A PD must present a signature resistance on each pair set that it is to receive power on. Figure 2 shows the Ethernet cable wiring diagram for the 4-pairs.
LED Drive
An LED pin indicates the state of the port controlled by the LTC4263-1. When the port is powered, the LED is on; when disconnected or detecting, the LED is off. If an invalid signature is detected or a fault occurs, the LED will flash a pattern that the user or host system can read to indicate the nature of the problem. When running from a single supply at VDD48, the LED pin can operate as a simple switching current source to reduce power dissipation in the LED drive circuitry.

VDD5 Option
The logic 5V power supply can be supplied from the internal LTC4263-1 5V supply or an external 5V supply when above the internal supply. If the internal regulator is used, this pin should only be connected to the bypass capacitor and to any logic pins of the LTC4263-1 that are being held at VDD5.

AC and DC Disconnect
The two methods for detecting if a PD is present and still require power are AC and DC disconnect. Each checks for a particular Maintain Power Signature (MPS) from the PD. DC disconnect senses if a PD is drawing more than 10mA at the port it is to remain on and less than 5mA for power removal. AC disconnect looks for an AC impedance of less than 27k across the port for power to remain on and must remove power for an impedance of up to 1.98M.

AC and DC disconnect are two different methods of detecting whether a valid PD is present and requires power. AC disconnect is the default method for the DC1214A but can be converted to DC disconnect on both controllers through their respective two jumpers. Moving DISCON to DC will short the ACOUT pin of the LTC4263-1 to VSS and configure the controller to DC disconnect. Along with that, moving jumper setting for ACCOMP to DC bypasses the AC blocking diode and removes the RC used for AC disconnect from the circuit.

Legacy Detection
LEGACY and LEGACY_B jumpers control whether legacy detect is enabled. If the LEGACY pin is held at VDD5 (EN selected), legacy detect is enabled and testing for a large capacitor is performed to detect the presence of a legacy PD on the port. If held at VSS (DIS selected), only IEEE 802.3af compliant PDs with a valid 25k signature resistance are detected. If left floating (no jumper), the LTC4263 enters force-power-on mode and any PD that generates between 1V and 10V when biased with 270µA of detection current will be powered as a legacy device. This mode is useful if the system uses a differential detection scheme to detect legacy devices. Warning: Legacy modes are not IEEE 802.3af compliant forms of PD detection.