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LOW POWER CIRCUIT FOR DEBUG LEDs WITHOUT ANY LIGHT LEAKAGE

HP INC

Low Power Circuit for Debug LEDs Without Any Light Leakage

With this disclosure, we can activate debug LEDs manually when we need them, especially for the service team. Service usually requires debug LEDs on the boards to easily determine whether the board power is normal or not. But with more LEDs, comes more power consumption, and more chances to have light leakage. When a system is power consumption sensitive, or has lots of opening on its chassis, this design can solve the low power and special chassis problems.

Problems

1. Light leakage: Thin Client products are designed with lots of opening on chassis because thin clients are passively cooled and need airflow. Users can easily observe the LED lights from the thermal openings, which is a bad user experience. However, we need to install debug LEDs on the board for the Service team. The Service Team uses the debug LEDs to check the board power status, and to see if there's something wrong with the board power circuits. In order to leave the LEDs without any light leakage, this disclosure can cut off the LED power unless Service or R&D activates them manually by a jumper.

2. Power Consumption: Some debug LEDs may still be on even if the system is off or in standby, the power consumption of the LEDs is very critical for energy certifications such as Energy Star or California Energy Commission. Using this disclosure, LEDs will not consume any power in all user scenarios.

In previous projects, we would make the LEDs very dim so that users could not observe the light leakage from chassis easily. However, the dim LEDs makes checking the board power status even harder, since the Service team needs to dim the office light to see the much dimmer LEDs. With this disclosure, LED brightness can maintain a normal brightness level and make it easy to check the board power status.

Description

The general purpose of the present invention is to have on-board debug LEDs without additional power consumption and possibility of light leakage. The invention generally relates to a logic circuit which includes a header, a MOSFET and few resistors connected. The header is open by default, and in this condition, the gate of MOSFET is pulled down to low, so the MOSFET is off and there is no path to GND for LED, which means the LED will be off.

Once the header is shorted by a jumper, the voltage level at the gate of MOSFET will be high, which will turn on the MOSFET, and make the LED activated. The LED will be on if its power source is in normal condition; acting as a debug LED to show the board power status.

This application can be used on a system requested for multiple debug LEDs, too. And it only requires adding MOSFETs in series with each LED path to GND. Regarding the header, one header is sufficient to control multiple debug LEDs in the system.

Steps of Building the Circuit

1. For any LED driven by a DC power source on a board, add a MOSFET or BJT in series, with G or B gate controlled by another logical circuit.

2. Add a header with a jumper, or a switch in the control circuit to achieve the manual control.

3. Add a resistor to set a default brightness level to the MOSFET/BJT in item1, so that the LED can keep off by default because of the pull-down resistor, but has the default brightness level when the jumper is installed.

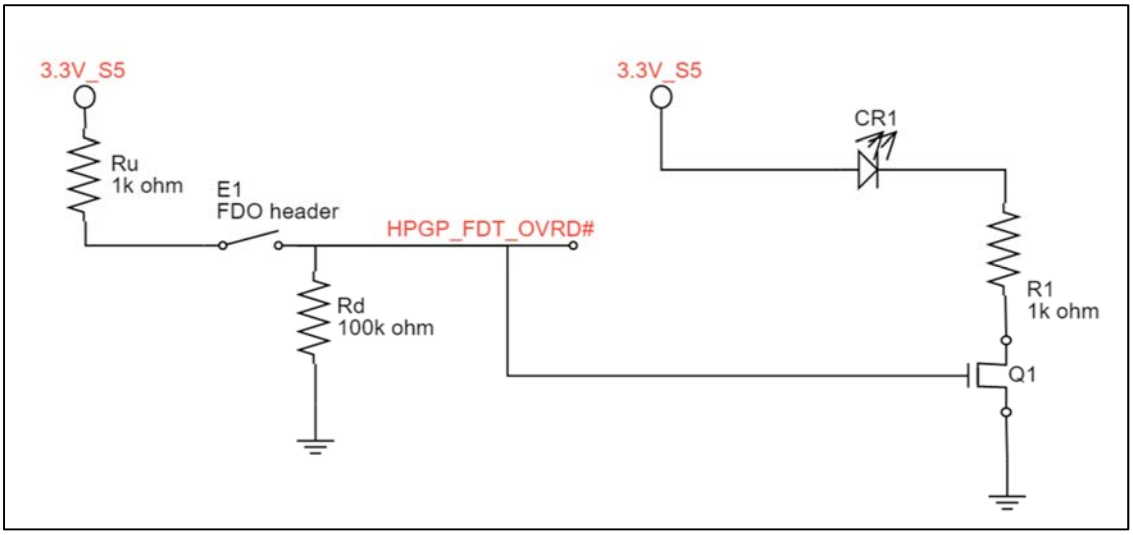

Fig.1 Circuit Drawing using MOSFET

In fig1:

1. Ru is a pull-up resistor, the power source must be AUX power rail.

2. Rd is a pull-down resistor, with the Ru, the divided voltage level must be high to turn on Q1.

3. Q1 is a n-channel MOSFET, its gate has to connect to the divider output, and its source has to connect to GND, its drain has to connect to the original LED path.

4. E1 is a 2-pin header or other switches, opened by default, has to be located between Ru and Rd, and makes the Q1 gate disconnected to Ru in default mode.

Disclosed by Kuang-che (Robert) Teng, Charlie Shaver, HP Inc.