

High-Efficiency **MODULE** Carrier Board

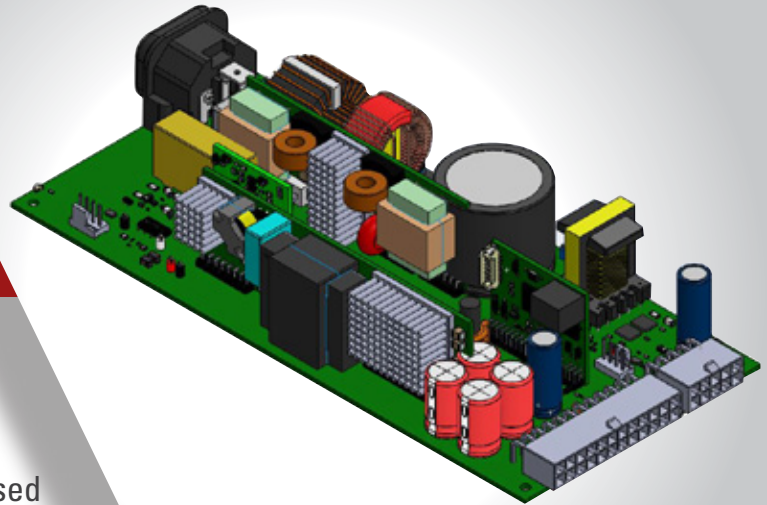
TD-DEV-500-12V Technical Specification

FEATURES

- Low profile 1U, 500W power supply
- High efficiency power supply
- Fully integrated with CPU control
- PMBus interface
- Voltage and current monitoring

PRODUCT OVERVIEW

The Telcodium HEM Module Development board is used to test the TD HEM modules. This board is used to develop a 12V output with a 42Amp power supply with PMBUS interface, input and output current, voltage sense, including monitoring and logging include the schematic, gerber files and BOM for the carrier board.

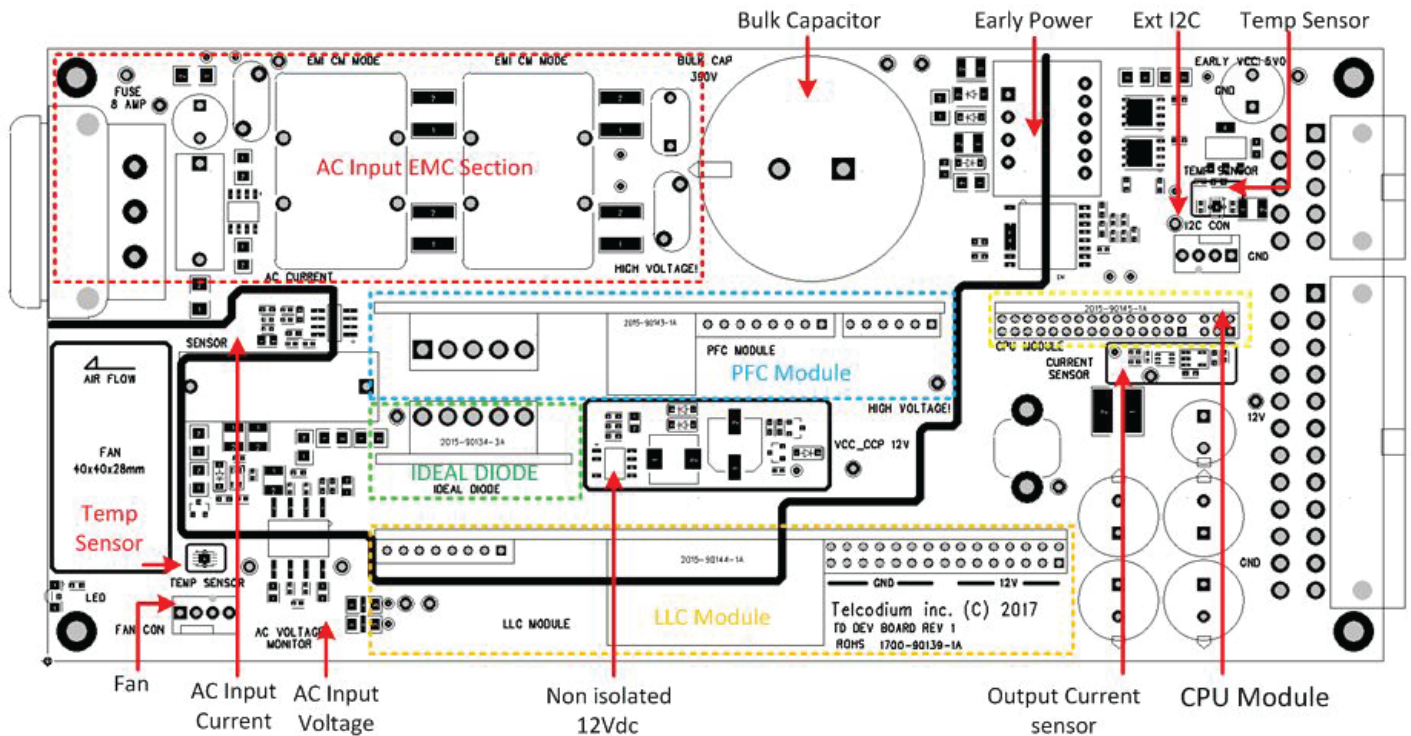


APPLICATIONS

- Power supply design using HEM module from Telcodium
- High efficiency equipment design
- High end power supply with PMBUS interface
- Ready for production power supply design
- 100W - 500W

OVERVIEW

Figure 1.



SECTION DESCRIPTION

- AC Input EMC Section
 - Ideal diode
 - PFC Module
 - LLC Module
 - CPU Module
 - Non isolated 12V
 - Early Power 5.0V
 - Ext I2C
 - Temp Sensor
 - AC Input current sensor
 - AC Input Voltage
 - DC Output Current
 - Bulk Capacitor
 - FAN
- AC inlet connector type 3 emi filter
 TD-DIODE_1000
 TD-PFC-500
 TD-LLC-500-12V
 TD-CPU-192
 Local 12V DC-DC, none isolated
 External 5.0V at 2.5A, DC output voltage
 External I2C interface, 5.0V
 Two section input and output temperature sensor
 AC isolated current sensor (Need TD CPU Module)
 AC isolated voltage sensor (Need TD CPU Module)
 Output 12V current sensor (Need TD CPU Module)
 330uf, 450V bulk capacitor for 500W, design
 Fan connector with tach and pwm (Need TD CPU Module)

Figure 2.

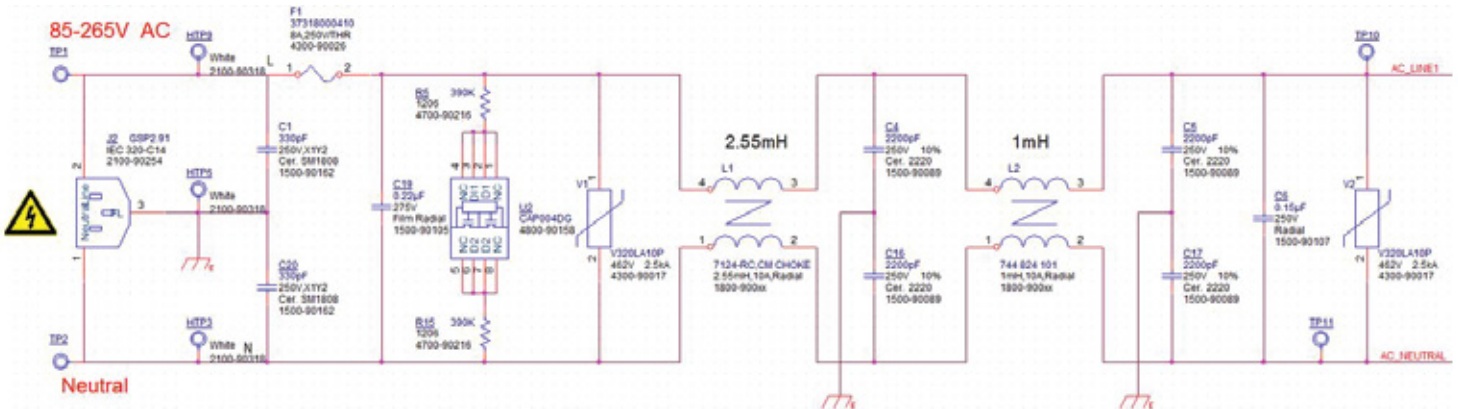


Figure 3.

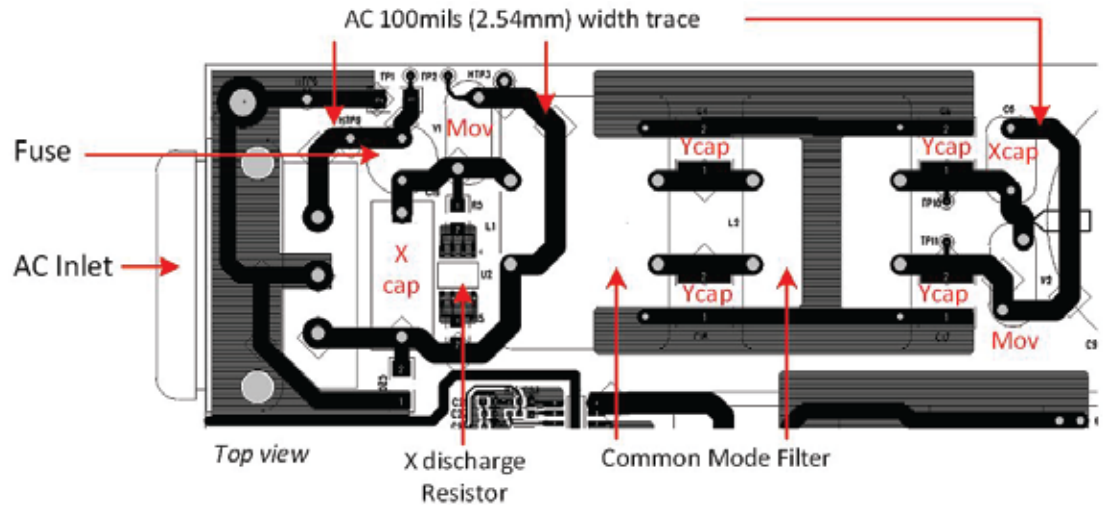


Figure 4.

AC INPUT DESCRIPTION

- Fuse for 500W design min 8A,
- Trace width on AC line, 100mils, (2.54mm), plating 1.5oz (53um) for the top and bottom
- Trace spacing for High voltage trace 125mils (3.175mm)
- X Cap and Y Cap capacitors need to be used
- Inductor needs to have a min current rating of 8A,

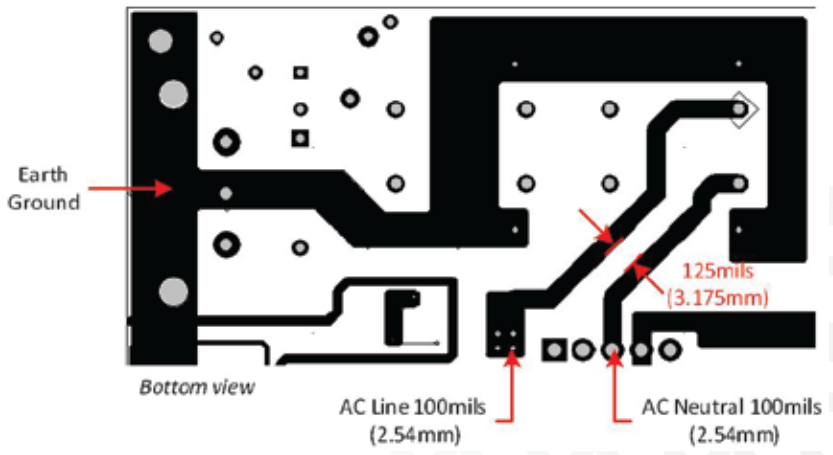


Figure 5.

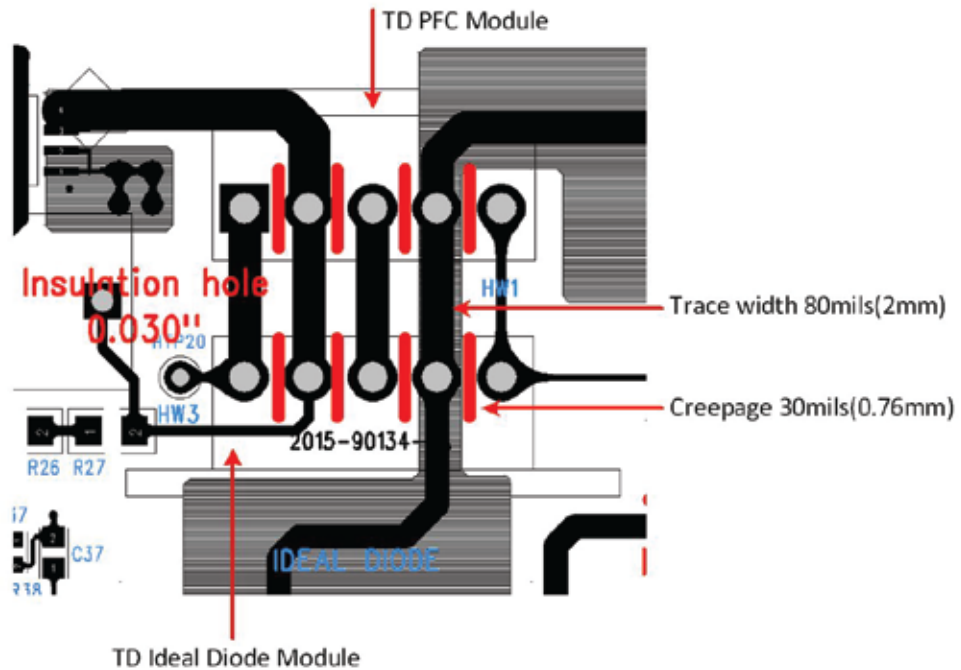
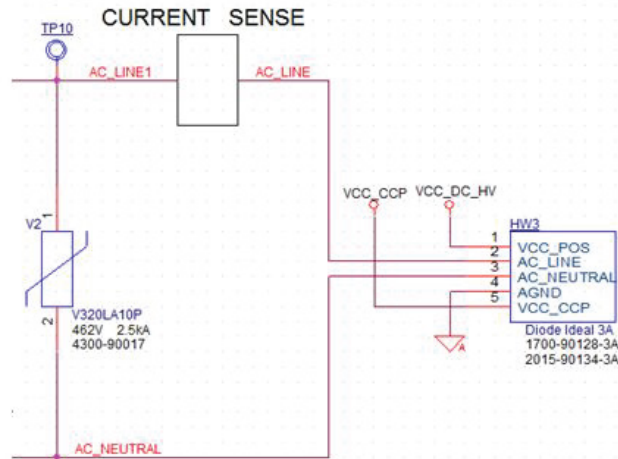


Figure 6.

TD IDEAL DIODE MODULE

- AC_LINE from EMI filter to Pin 2
- AC_NEUTRAL from EMI filter to Pin 3
- VCC_DC_HV rectified DC output
- AGND ground reference for High voltage section
- VCC_CCP, from local DC-DC module (see figure 11)
- Direct connection between TD PFC Module and TD Ideal Diode
- Add creepage of 30mils(0.76mm), cnc cutout between the pad for proper insulation
- AC_LINE,AC_NEUTRAL,VCC_DC_HV, AGND trace width 80mils (2mm)
- VCC_CCP, from PFC module trace width min 15mils (0.038mm) (see figure 11)

Figure 7.

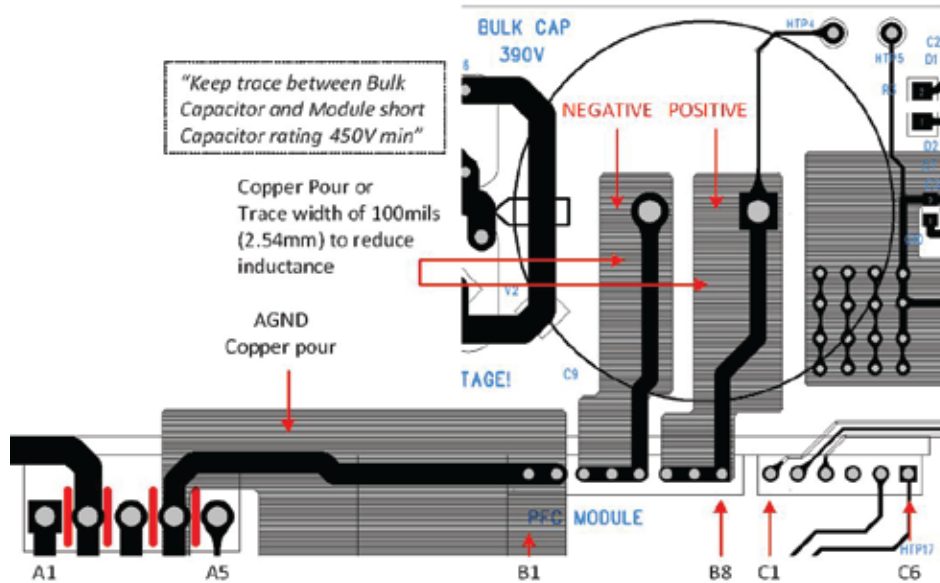
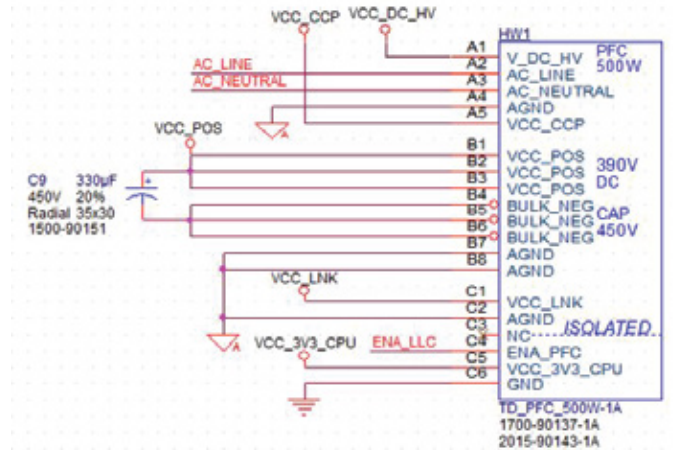


Figure 8.

TD PFC MODULE

- AC_LINE from ideal diode Pin A2
- AC_NEUTRAL from ideal diode to Pin A3
- VCC_DC_HV rectified DC input Pin A1
- AGND ground reference for High voltage section A4,B7,B8 and C2
- VCC_CCP, from local DC-DC module (see figure 11)
- VCC_POS, 390Vdc output to ideal diode
- Bulk capacitor B1,2,3 and B5,6,7 (see layout)
- VCC_LNK input (From local DC-DC)
- ENA_LLC (PFC), same enable for LLC and PFC
- VCC_3V3_CPU, local isolated 3.3Vdc
- GND (C6) isolated GND **(DO NOT CONNECT TO AGND)**
- Minimum bulk Capacitor sized for 20ms hold time at 500W are 330uf, 450V,
- Maximum current at 500W, 390Vdc, 1.28A,
- Keep trace length between TD PFC Module and Bulk Capacitor, short to reduce inductance,
- Keep good clearance between trace Pin C1,2,3 and C4,5,6 (min 100mil), (2.54mm)

Figure 9.

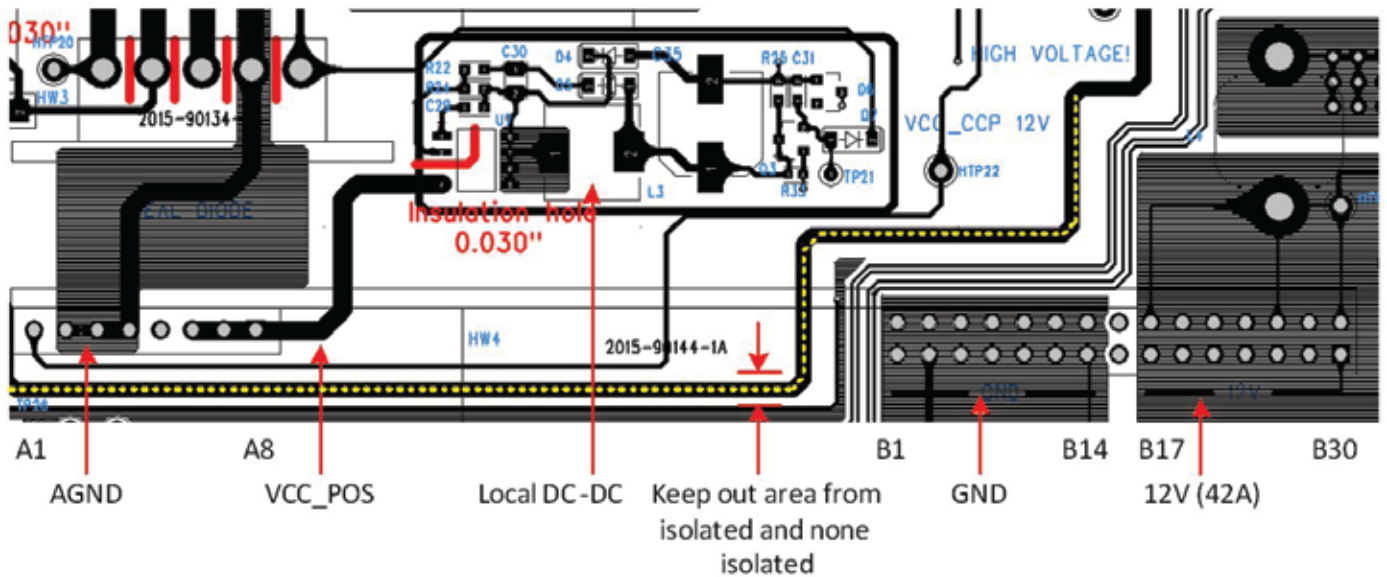
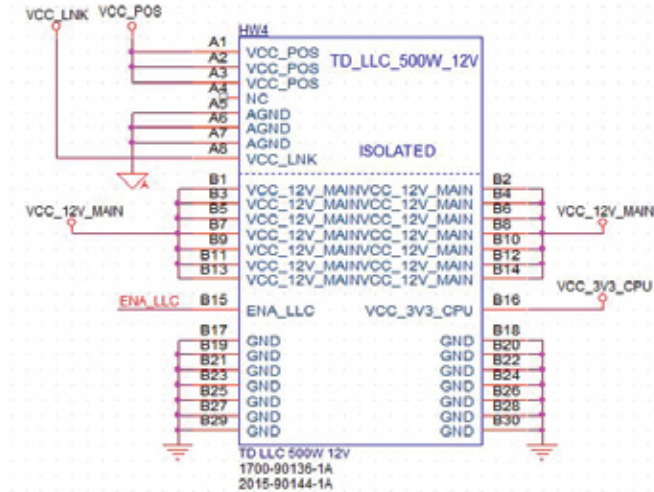


Figure 10.

TD LLC MODULE

- VCC_POS (390Vdc) from TD PFC Pin A1,2,3
- AGND ground reference for High voltage section A5,6,7
- VCC_LNK ,input (From local DC-DC) (see figure 11)
- B15 ENA_LLC (PFC), same enable for LLC and PFC
- B16 VCC_3V3_CPU, local isolated 3.3Vdc
- B1,B14 Main output 12Vdc, isolated
- B17,B30, GND isolated
(DO NOT CONNECT TO AGND)
- Keep out are between high voltage and low voltage min 100mils (2.54mm)
- GND output and 12V need to have enough copper area for 42A
- AGND use copper pour to reduce inductance
- Local DC-DC (see figure 13)

Figure 11.

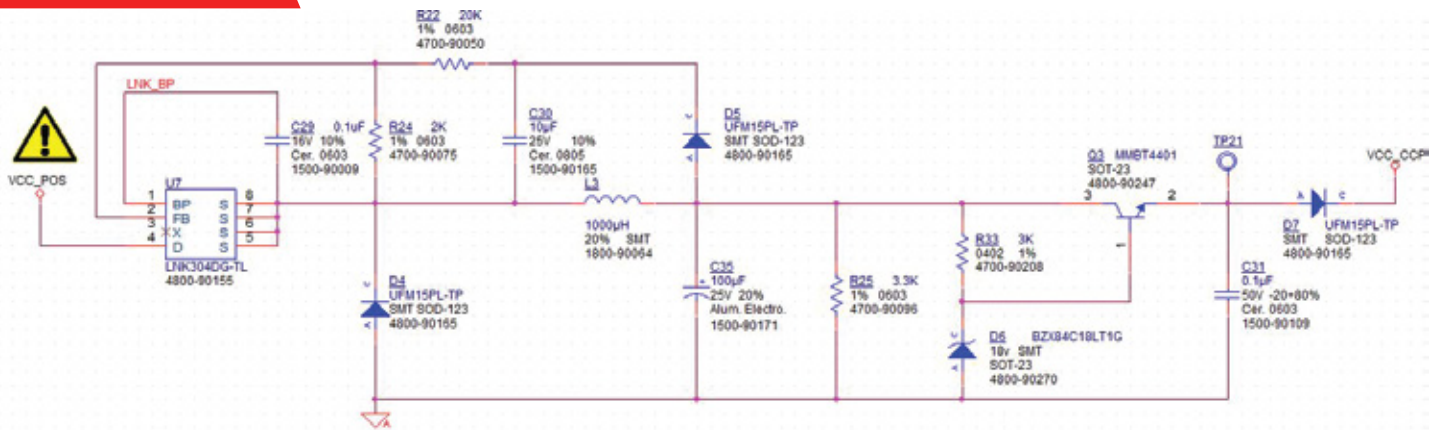


Figure 12.

LOCAL DC-DC

- Add 30mils (0.76mm) creepage
- Add copper pour to reduce inductance on Pin 5 to 8
- Follow the spacing and parts position to avoid noise

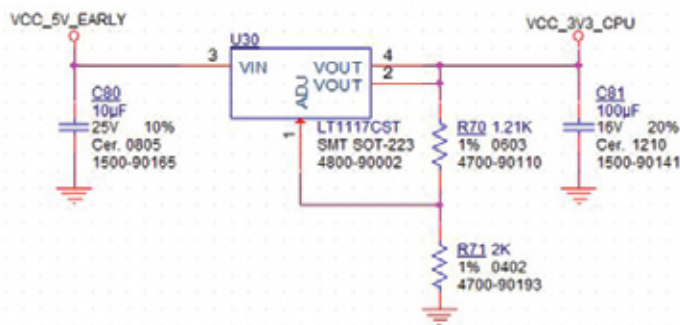
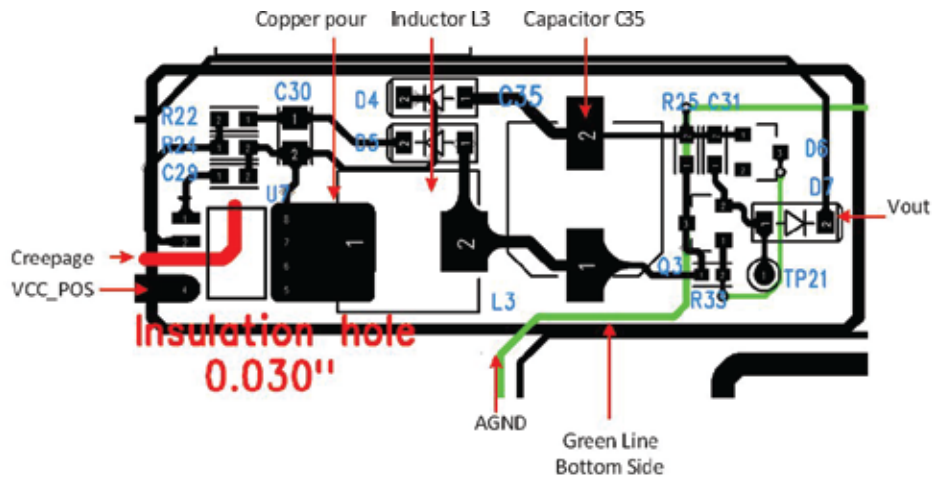


Figure 13.

- Isolated side 5.0V to 3.3V DC-DC

- ✓ Use enough copper pour to reduce heat and loss for TD CPU 200mA (max) at 3.3V

COPPER AREA			THERMAL RESISTANCE (JUNCTION-TO-AMBIENT)
TOPSIDE*	BACKSIDE	BOARD AREA	
2500 Sq. mm	2500 Sq. mm	2500 Sq. mm	45°C/W
1000 Sq. mm	2500 Sq. mm	2500 Sq. mm	45°C/W
225 Sq. mm	2500 Sq. mm	2500 Sq. mm	53°C/W
100 Sq. mm	2500 Sq. mm	2500 Sq. mm	59°C/W
1000 Sq. mm	1000 Sq. mm	1000 Sq. mm	52°C/W
1000 Sq. mm	0	1000 Sq. mm	55°C/W

Figure 14.

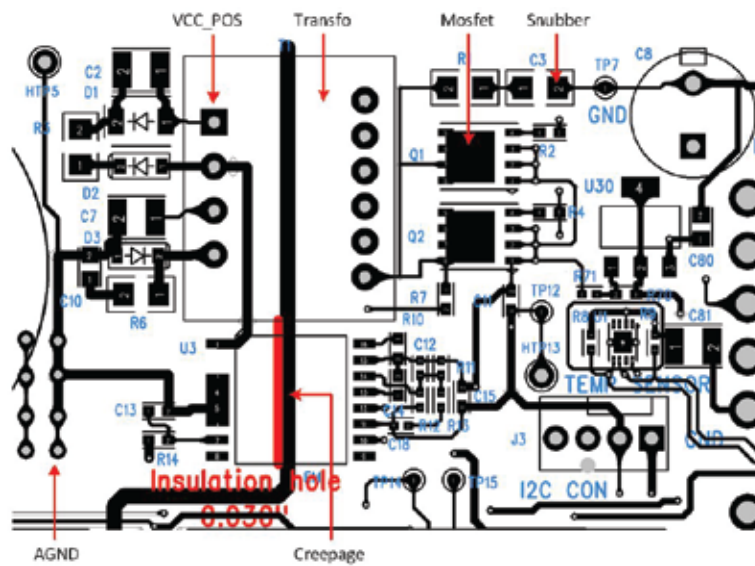
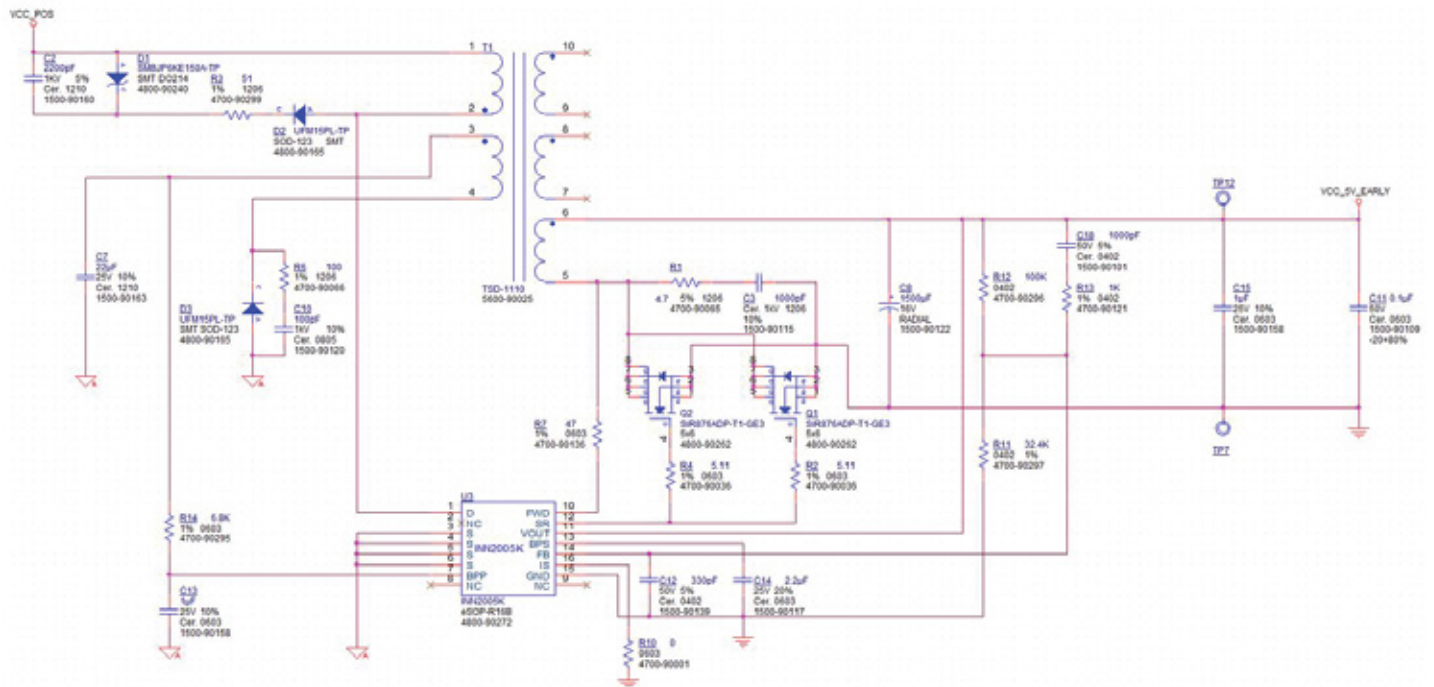


Figure 15.

EARLY POWER 5.0V

- ✓ To avoid any noise issue follow this placement or refer to Power Integration InnoSwitch INN2005K

Figure 16.

TD CPU MODULE

- ✓ Use 10 mils (0.0254mm) min for routing signal trace

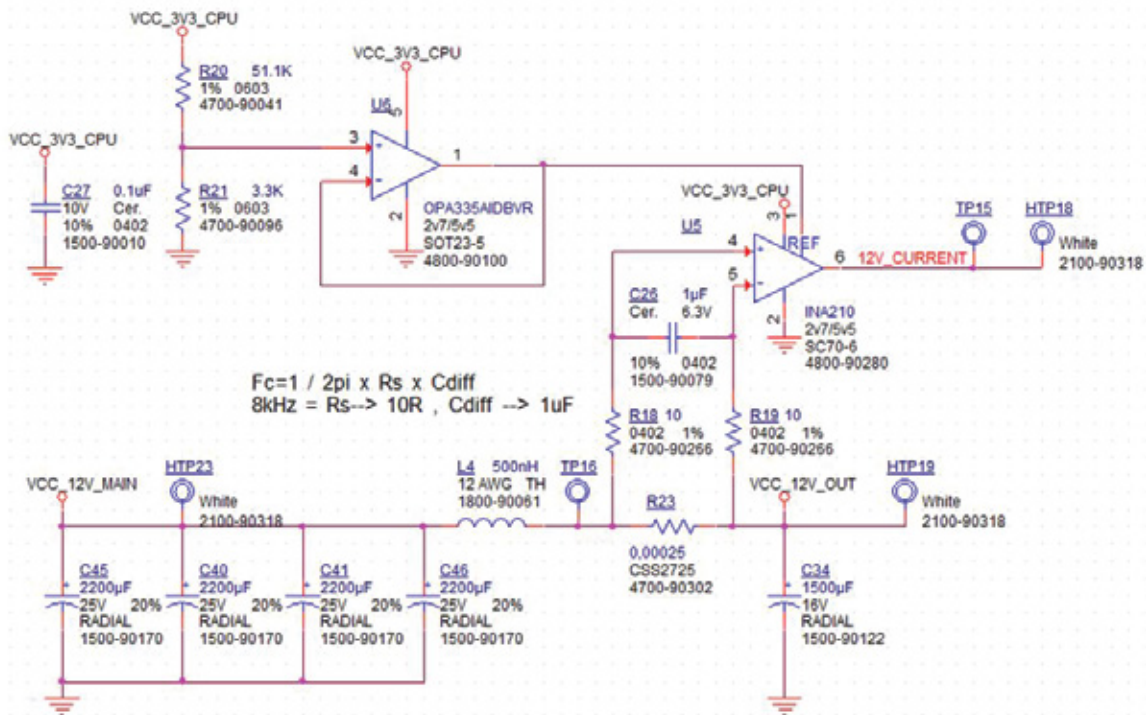
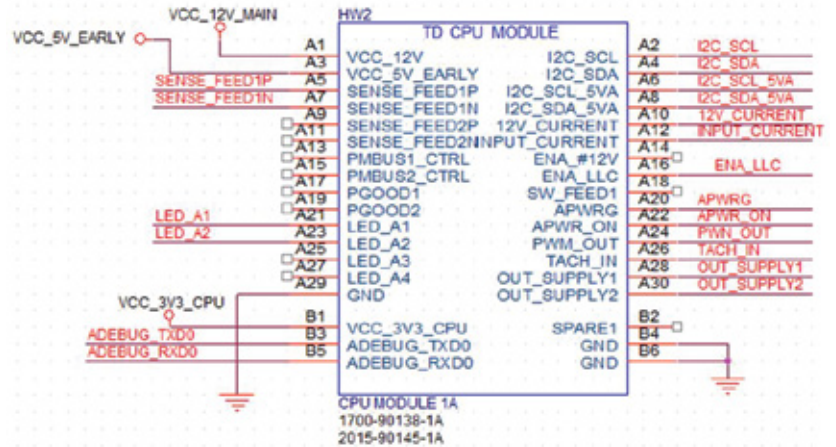


Figure 17.

CURRENT SENSE AND 12V MAIN OUTPUT FILTERING

- Output filter for the Main 12V use C40,41,45 and 46 with Choke inductor L4
- Current sense use R23 at 0.00025ohms and U5 for the voltage sense
- Routing of R18 and R19 are critical for noise see layout figure 17

Figure 18.

OUTPUT CURRENT SENSE LAYOUT

- Current sense layout keep all the parts on the same layer
- Reduce signal trace length at min to avoid noise
- Route in differential the sense signal from the resistor R23
- Route without any via the current sense output signal U5 pin 6

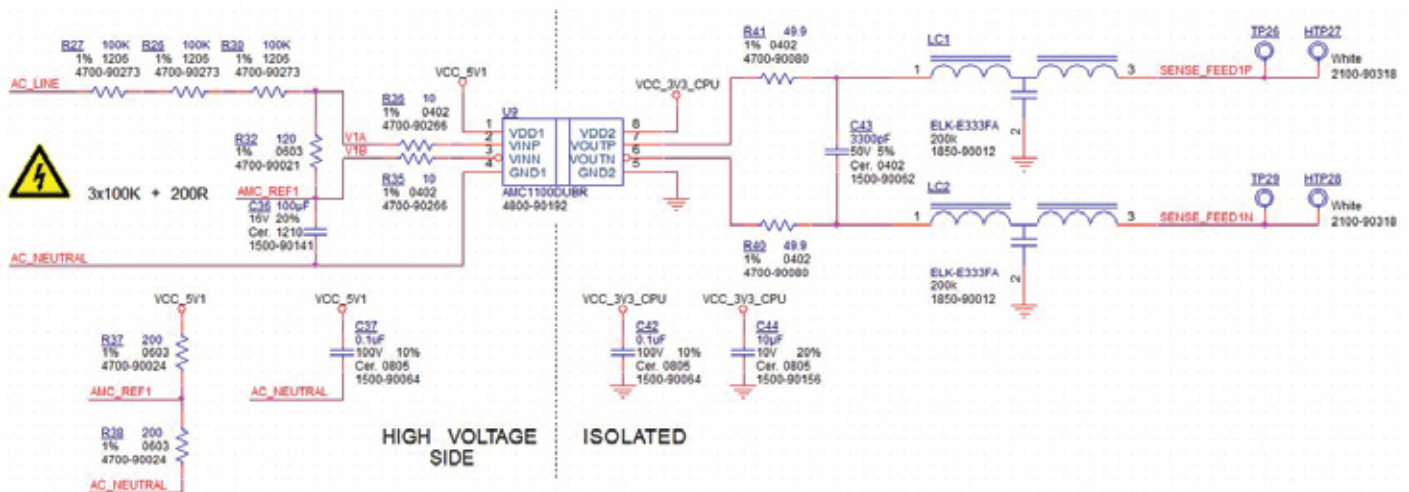
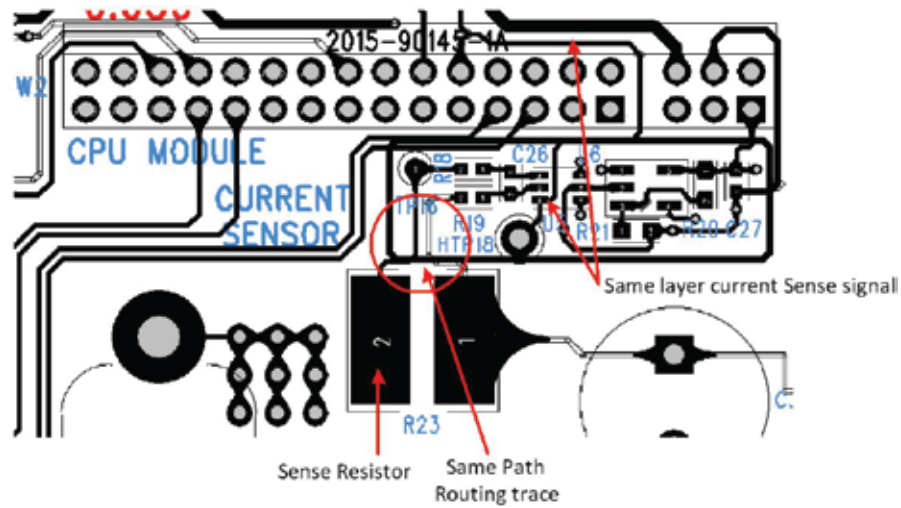


Figure 19.

AC INPUT CURRENT SENSE

Figure 20.

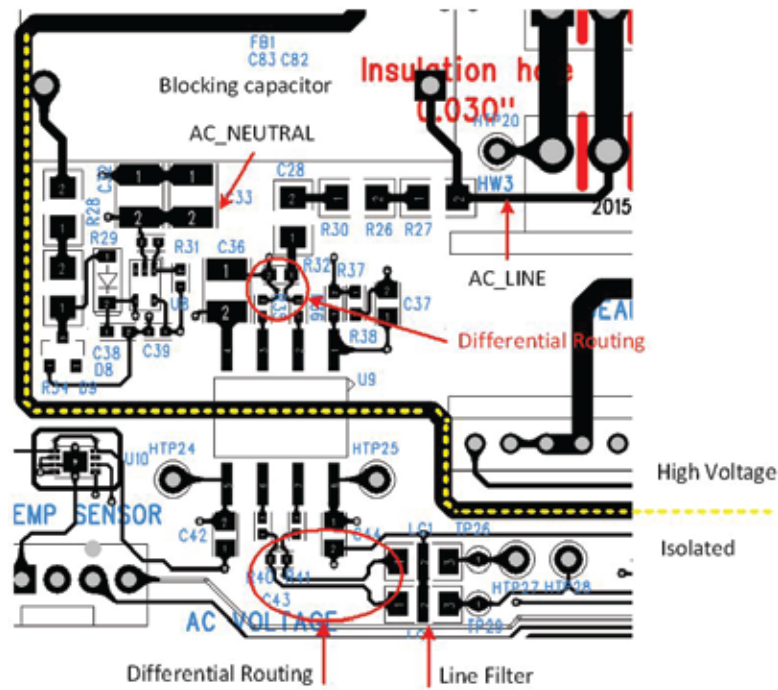
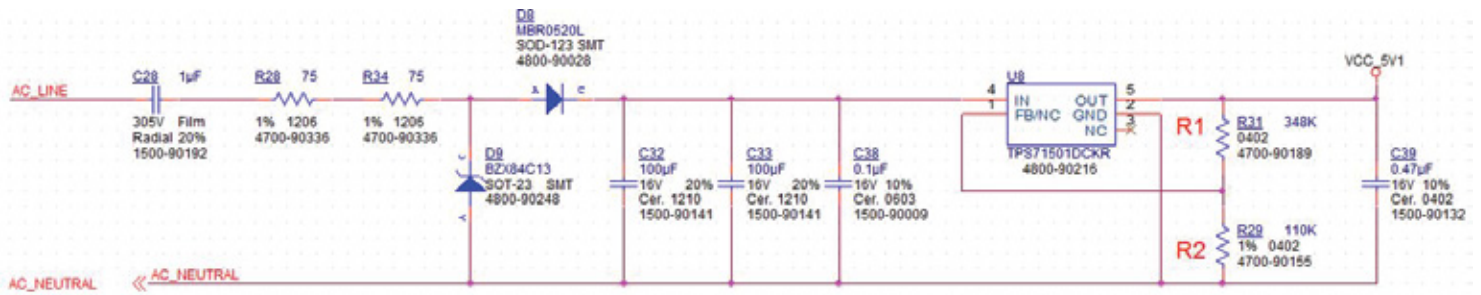


Figure 21.

AC INPUT CURRENT SENSE POWER SUPPLY *Cap drop design*

- Blocking capacitor C28 needs to be X rated
- Keep clearance at 100mils (2.54mm)
- Signal input and output of U9 needs to be routed in differential mode
- Keep insulation at min 100mils (2.54mm)
- Minimal trace routing 10mils (0.0254mm)

PCB SPECIFICATION

- Plating 1.5oz (53um) final "0.5oz (18um)+ 1oz (35um) plating"
- Total copper Thickness 2.1mils (53um)
- TD DEV board, 2 layers
- Thickness: 62 mils
- Material: FR4
- Solder mask: Green
- Silkscreen: White
- Plating: Emersion gold
- Minimal drill size: 10-24
- Trace width minimal: 10mils (0.0254mm) for 1.5 oz plating

PCB TRACE TEMPERATURE RISE AND CURRENT CAPACITY *(For reference)*

- 100mils (2.54mm) trace width, 39.6F (22C) Ambient, 200kHz Freq
 - Power dissipation: 0.13W
 - Conductor DC resistance: 0.00361ohms
 - Conductor Current: 6.04A
 - Voltage Drop: 0.0218V / 1000mils (25.4mm)
 - Max temperature rise 111F (44C)
- IPC-2152 (no plane)

POWER SUPPLY DESIGN SERVICES AVAILABLE

If you would prefer us to design your next power supply using Telcodium High-Efficiency modules please contact us: info@telcodium.com

HEADQUARTERS

TELCODIUM INC.
91 De la Barre,
Boucherville, Quebec
Canada J4B 2X6

Telephone: 1 450-274-6170
info@telcodium.com
www.telcodium.com

High-Efficiency Power Modules
AC Power Supplies
DC Power Supplies