5V Input Wireless Power Charging Solution

IDTP9035A-TX-A11 EVM USER GUIDE

Features

- WPC compliant
- Input voltage range – 4.75V~5.25V
- Output power –peak power is up to 5W
- With 5V/1.2A input adapter, peak power delivered at receiver end is greater than 4W
- Peak Efficiency (DC in to DC out) – 72%
- Status indication LEDs and buzzer
- System monitoring function enabled by firmware and GUI software
- Easy firmware update via USB and I²C

Evaluation Kit Contents

- IDTP9035A LV DEMO V1.1
- IDTP9035A-TX-A11 UG Rev1.3 – this document
- JM60 Programming Dongle
- USB type A to micro-USB type B cable
- 5V AC to DC Power Adapter
- WPC "Qi" Compatible RX Energizer Sleeve
- IDTP9035A Product Datasheet
- CD containing:
  - IDTP9035A control software tool
  - PC_USB Driver software
  - Reference layout Gerber Files
  - Reference layout Cadence Allegro board files
  - Electronic copy of IDTP9035A-EVAL manual

  Electronic copy of IDTP9035A Product Datasheet

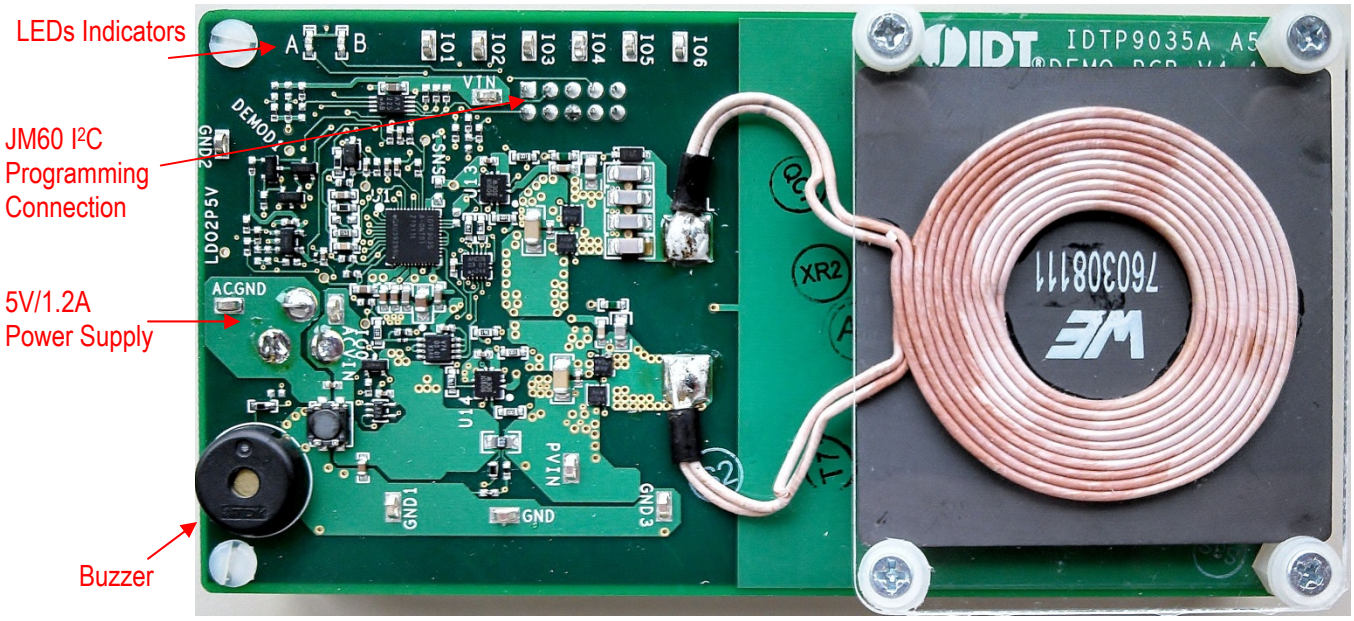
General Description

The IDTP9035A LV DEMO evaluation board serves to demonstrate the features and performance of the IDTP9035A Wireless Power Charging solution for Base Station with 5V input voltage and TX-A11 Coil Transmitter. The design allows in detail signal inspection access to different nodes of the schematic by the existing testing points, in this way the system designer may better understand the particularities and the keys functionality.

The evaluation module is a stand-alone application; all it needs is a 5V/1.2A DC power adapter and a WPC certified power receiver.

Optionally the EVM's activity can be monitored by I²C communication and GUI (graphical user interface) software through a USB cabled JM60 dongle board, which interfaces the EVM to the computer. The MAIN tab of the software tool provides real time plots of Coil Current, PWM Frequency, and Duty Cycle including different states of the microcontroller and FOD (foreign object detection).

The evaluation board utilizes an external EEPROM which contains Tx firmware to enable programmability. The external EEPROM memory chip is pre-programmed with a standard start-up program that is automatically loaded when 5V power is applied. The EEPROM can be reprogrammed to suit the needs of specific applications using the IDTP9035A software tool.



IDTP9035A TX-A11 EVM Overview

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- **JM60 Programming Dongle**
- **USB type A to micro-USB type B cable**
- **IDTP9035-EVAL Evaluation Board Manual**
- **IDTP9035 Product Datasheet**
- **Universal AC to 5V DC Power Adapter**
- **WPC "Qi" Compatible RX Energizer Sleeve**
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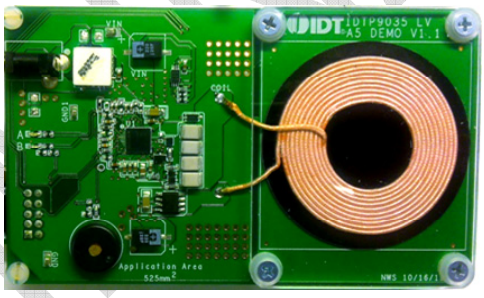
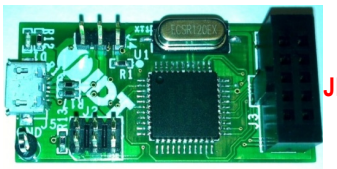


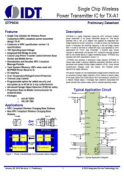
IDTP9035-EVAL

RX WPC Qi Load



JM60

IDTP9035 Datasheet



IDTP9035-EVAL User Manual

Universal AC to 5V DC Adaptor

USB Cable

Usage Guide

This IDTP9035A-EVAL demo board is designed to demonstrate the performance and functionality of the IDTP9035A wireless transmitter in a lab bench test environment. In most cases, this board can be wired into an existing system for evaluation. For complex or electrically sensitive situations, it is recommended to use the reference layout to integrate this design into the final system to eliminate hardware limitations or signal degradation introduced by long leads.

With no computer interface, this evaluation board can function in its pre-programmed mode of operation using a 5V power supply or AC adaptor. To evaluate the full potential of this device, a WinXP/7 PC with integrated USB ports is required. All other necessary items are included in this evaluation kit as shown on the previous page.

Quick-Start Guide

Follow these simple steps to power-up and enable the power management features of the IDTP9035A:

1. Install the Wireless Power Demo Windows GUI software by executing the Setup.exe file in the folder “9035Tool_final” (Figure 2 and 5).
2. Connect the USB cable from a PC to the 1” x 2” JM60 programming board. The JM60 board has already been programmed at the factory.
3. Connect the JM60 to the underside connector of the IDTP9035A QFN DEMO PCB board (J1 Fig 1).
4. Plug the AC adapter into the wall (120 VAC) and connect the other end (19 VDC) into the adapter plug on the IDTP9035A-DEMO board (J3 Figure 1).
5. Click Start >> All Programs >> IDT Wireless Power Solution (Folder) >> Wireless Power Demo (Application Icon) to open the GUI for IDTP9035A Wireless Power Transmitter Demo software Fig 3.
6. Without an RX load on the coil, note LED “A” and “B” are enabled on the eval board.

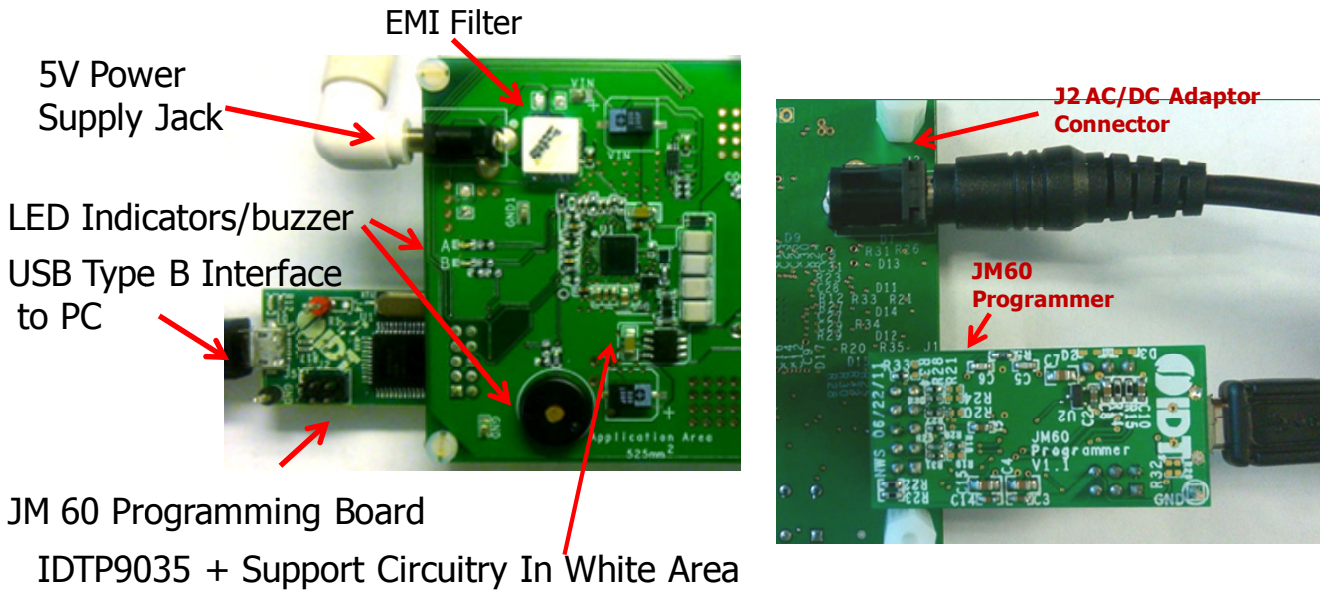


Figure 1. IDTP9035A-EVAL JM60, AC Adaptor connections. The AC/DC Adaptor plug and JM60 connectors are on the backside of the board. The AC Adaptor must be set to 5V for proper operation.

Quick-Start Guide (continued)

7. Place an RX load such as an existing "Qi" compliant device or the IDTP9020 RX demo board onto the TX coil surface and notice the power transfer LED "B" is slowly flashing on/off. The LEDs are defined on page 8, Figure 8 and Table 1. Also, the buzzer will beep (see page 10).
8. Observe the different real time signals propagating on the "MAIN" tab of the GUI (Figure 4).
9. Add a 5W load to the to the RX device or IDTP9020 RX demo board and observe the current increasing and frequency change (Figure 4)
10. Place 4 to 5 coins on the TX coil plastic cover surface and observe the FOD 3 indicator, the LED "A" flashes on/off and the buzzer beeps.
11. Any problems see Troubleshooting page 8.

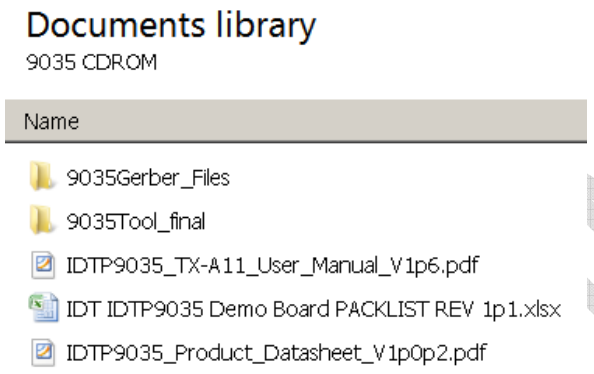


Figure 2. File folder structure on the CDROM.

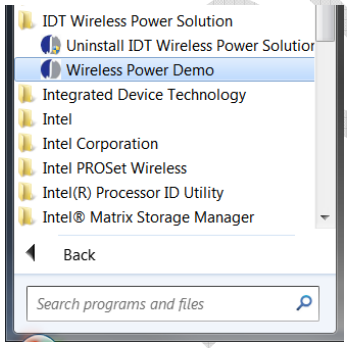


Figure 3. Starting the Graphical User Interface

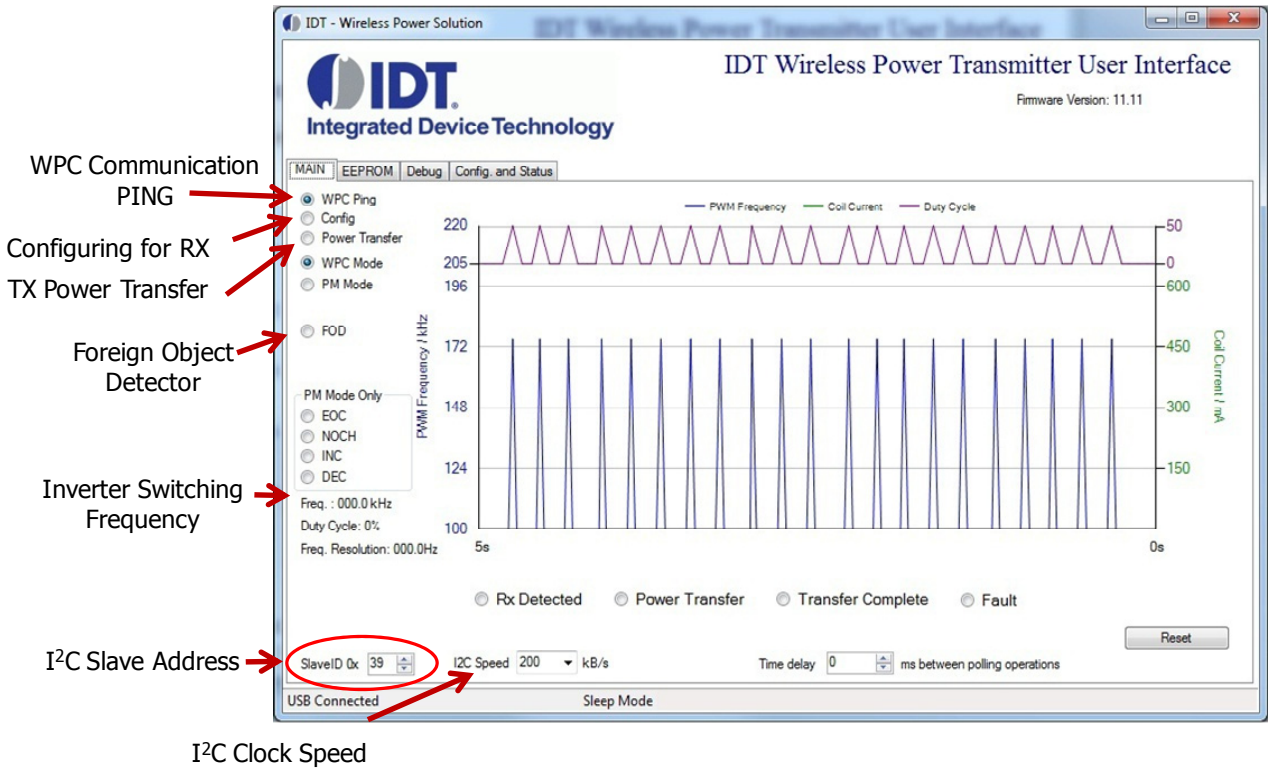
Verifying Connectivity

You can verify that the IDTP9035A is properly connected to your computer and able to communicate to the evaluation board by looking at the lower left of Figure 4. It should state "USB Connected". Otherwise it will state in Red letters: "USB Disconnected – Check Connection".

If it states USB Disconnected, it might be that the driver was not properly installed on the PC. Check to see that a USB Connector icon appears and disappears, at the lower right of the Taskbar, as the Cable's USB Connector is plugged and unplugged from the USB port. If it does not appear, then proceed to Troubleshooting section, item 4.

1) The MAIN tab of GUI provides 3 real time signals: PWM Frequency, Coil Current, and Duty Cycle.

2) Placing different objects and loads onto the coil will change the real time signals, and it will change the location of the Blue dot at the left side of the GUI's MAIN tab (Figure 4). For example, when the system is first turned-on, and without a load on the coil, the Blue dot will flash, i.e, "ping", at the WPC Ping text location, at the very top left hand side of GUI. Then, when a load is placed on the coil, the flashing Blue dot at WPC Ping will cease and a solid Blue dot will appear at the Power Transfer Line text location on the left hand side of the GUI. Also, it should be noted that the blue LED will be lit on the eval board. Note, however, that if the load is not perfectly centered on the coil, the blue dot on the eval board will not be lit. In this case, readjust the load to make sure it is very well centered. Also, once the RX has established good communication with the evaluation board, both the RXDET and PWR XFR LEDs should be glowing on the eval board, and this should correspond with the Rx Detected and Power Transfer "non flashing" solid Blue dots located just below the real time signals on the MAIN tab of the GUI.



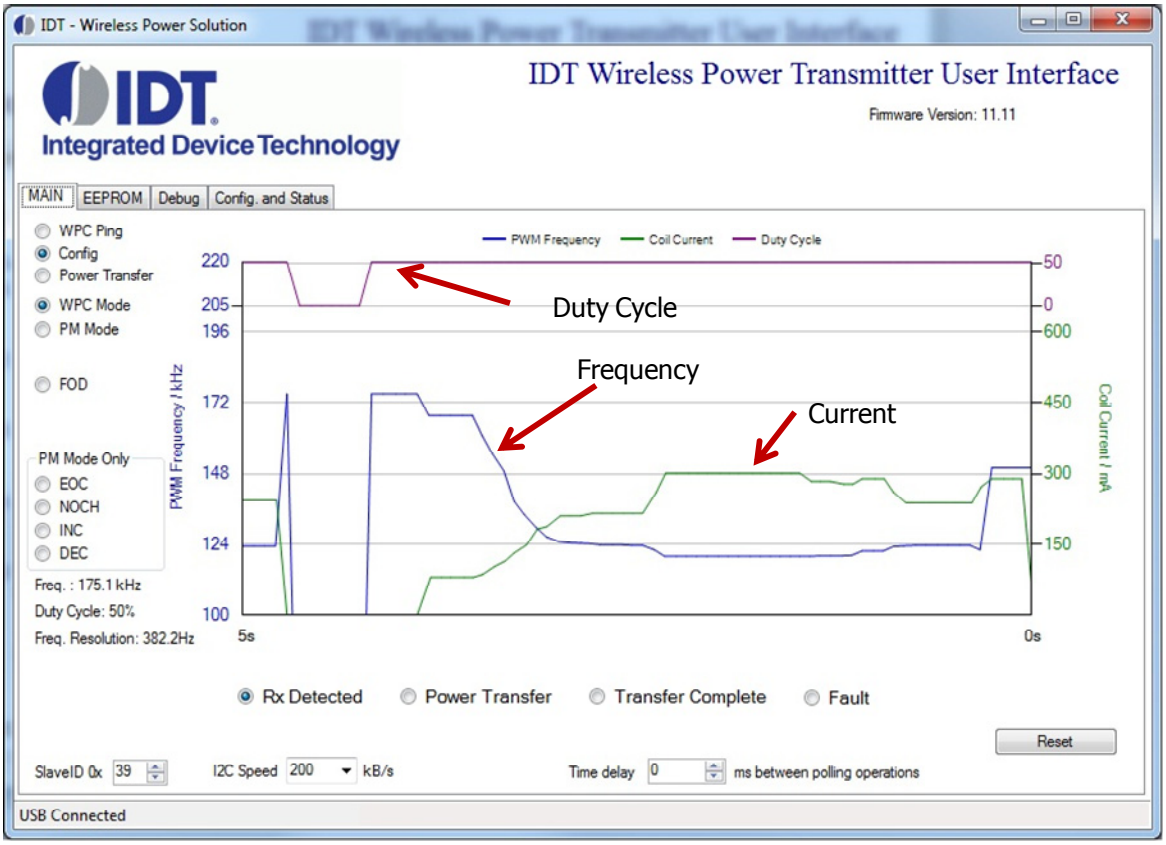


Figure 4. Windows GUI MAIN Tab Details and Signals.

Installing the Windows GUI

For the first time use of the IDTP9035A-DEMO board or to write a new .bin file into the EEPROM, the Windows Drivers and GUI must be installed to communicate with the JM60 USB to I²C controller that is located on the JM60 Programmer Dongle board. The JM60 Dongle board is attached to the left side of the DEMO board, and is connected via a 10pin keyed header on the bottom side of the board. The purpose of this controller is to be able to write different .bin files into the EEPROM on the DEMO board, and to be able to acquire real time signals showing system operation. Different .bin files can be made available, for example, when a different output power setting test is desired.

Example installation of the Windows USB-to I²C-Drivers on a Win7 32-bit or 64-bit system is shown in the following steps:

To install the GUI, open the IDTP9035A-DEMO CD and run the file: setup-1.0.0.11.exe within the 9035Tool_final folder. I.e. the path is 9035Tool_final/setup-1.0.0.11.exe shown in figure 5. Follow the Setup Wizard instruction shown in Figure 6. This will install the GUI and driver automatically. After the installation process is complete, you may connect the evaluation board to the computer with the USB cable, via the Dongle, and use the software tool. *At this point, a little USB icon should appear at the lower right of the desktop screen. If it does not, then the machine being used should be rebooted. Now connect the JM60 dongle board into the evaluation board and then connect the 5V supply.* Now plug the USB cable into the dongle board, and plug the USB cable into the PC.

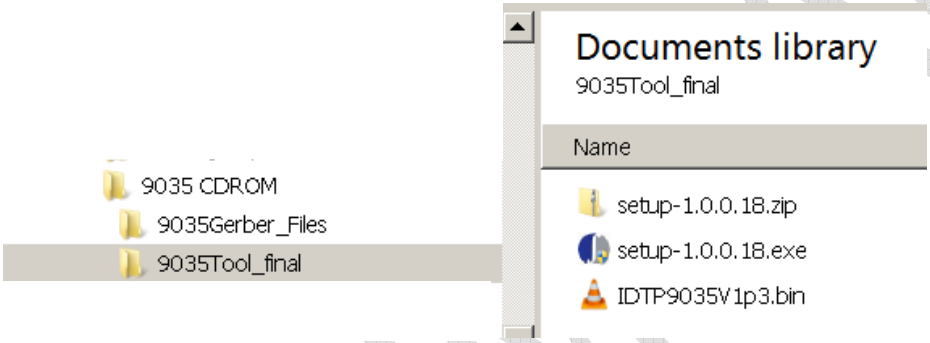


Figure 5. Path to driver setup.exe.

Figure 6. Setup Wizard.

Writing to the EEPROM

Loading the .bin File

As mentioned, the EEPROM already comes with a standard BIN file programmed into it, which is loaded into the IDTP9035A upon power up. However, if another one has been provided by the factory, the way to write the code into the EEPROM is as follows:

1) Plug the USB cable from the computer to the dongles USB type B connector.
2) Plug the dongle into the IDTP9035A Demo board. Make sure if a jumper exists on J4 on the dongle board that it is in a position closest to the USB connector.
3) Plug the 5V power supply into the IDTP9035A Demo Board.
4) Click Start >> All Programs >> Integrated Device Technology (Folder) >> Wireless Power Demo.
5) Click on the EEPROM tab directly right of the MAIN tab.
6) Click on the Load Bin file and browse to the path where the new bin file is located, for example, on the CD (type .bin).
7) Set the EEPROM Slave ID to 52 and select the Scan I2C button (Fig 7 lower right) and check that the slave address for the EEPROM appears as 0x52and then.
8) Click the Write EEPROM button, the green progress bar should increase in size from left to right and two **green passes** should be observed as the file is written to the EEPROM and then the Write OK should appear at the bottom of the screen. If not, click the Write EEPROM button again until Write OK appears.
9) If programmed correctly, the two LEDs A and B on the IDTP9035A board will both been turned ON.

If a Write OK is not shown in step 8, then refer to the Troubleshooting section on page 10. "Error Writing" is shown in place of "Write OK", and it should be easily visible that FF's will be shown across the entire 0x0000 address row or simply that the EEPROM Content View doesn't match the .ROM File Content View. Note: The left Content view shows the current EEPROM contents and can be seen by clicking on the Load EEPROM Content. The Right side Content view is the Bin file that was loaded.

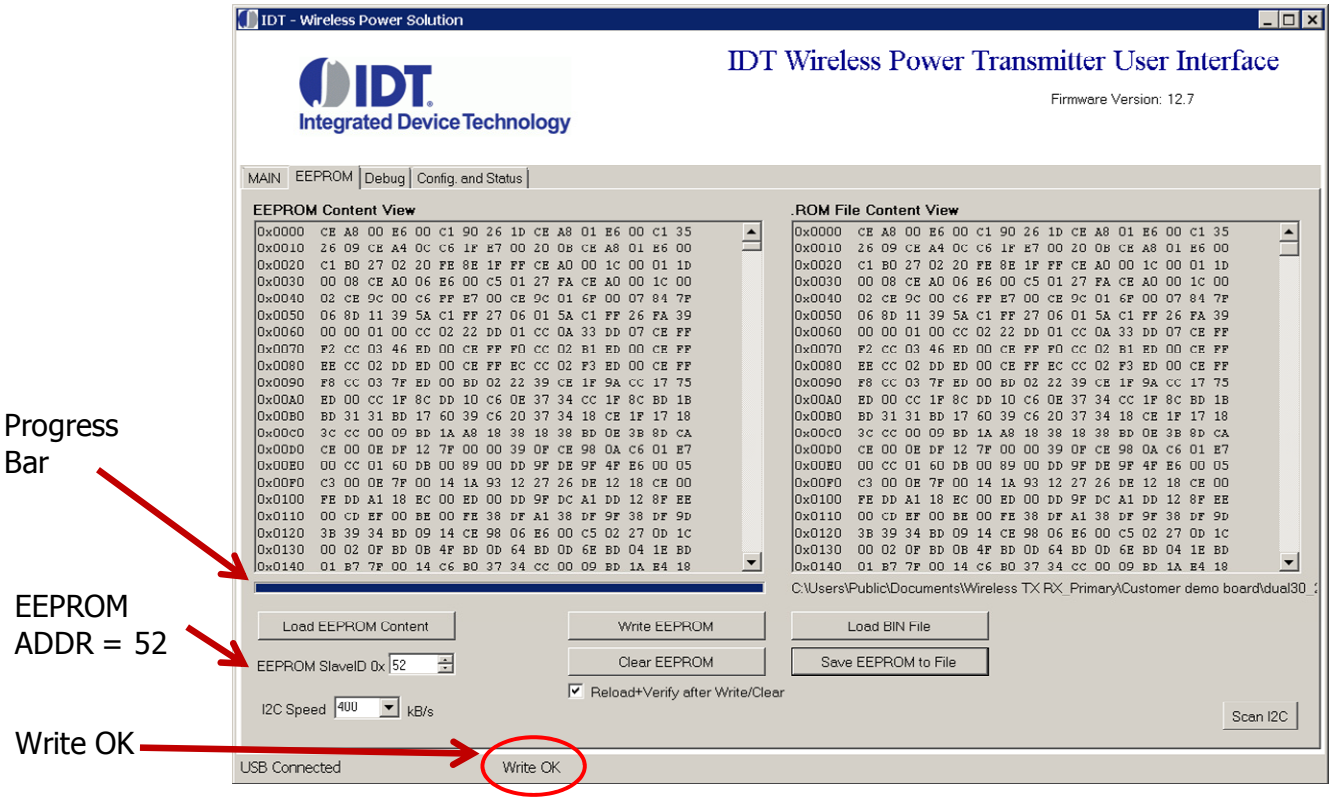


Figure 7. After Loading a BIN File and Writing to the EEPROM.

Overview of GPIO Usage

There are 7 GPIO's on the IDTP9035A transmitter IC, of which four are available for use as follows:

• GPIO3: Green LEDB to indicate standby, power transfer, and power complete. Also includes external resistors or internal pull up/down optioning to select LED modes. See Table 1, eight of the 10 LED modes (those associated with advanced charging modes) are currently designated as "Future" modes.

• GPIO0: Red LEDA to indicate standby, fault conditions, and FOD warnings, see table 1.

• GPIO4: AC or DC buzzer (optional) with resistor optioning for different buzzer configurations (Not Yet Available)

• GPIO2: Temperature sensor input, not available on the IDTP9035A demo board.

• GPIO5 LEDC and GPIO6 LEDD are for future development and currently not supported.

LED FUNCTIONS

GPIO0 and GPIO3 are used to drive LEDs which indicate, through various on/off and illumination options, the state of charging and some possible fault conditions.

The Red LEDA indicates various Fault and FOD ("Foreign Object Detection") states. The Green LEDB indicates Power Transfer and Charge Complete state information. Upon power up, the two LEDs together indicate the Standby State and remain in this state until another of the defined Operational States occurs. See Figure 22.

As shown in Figure 8, one or two resistors Ra (Pull Up) and Rb (Pull Down) configure the defined LED option combinations (R14 and R15 in the schematic Figure 13). The DC voltage set in this way is read one time during power-on to determine the LED configuration. There are 10 valid LED option combinations which are selected through the use of two 1% resistors that create a resistor divider value that are read from the GPIOs – two of the LED options are achieved through only one pull-down or one pull-up resistor. The LED configuration options are detailed in the Table 1.

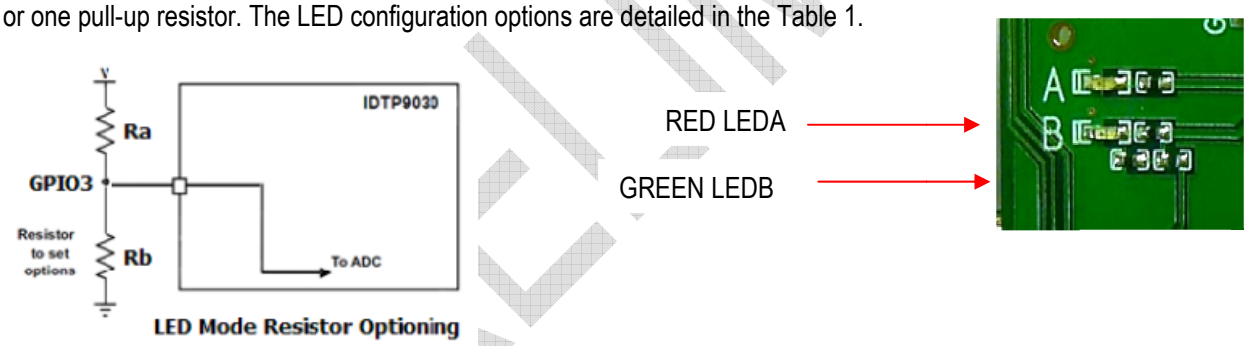


Figure 8. IDTP9035A LED Resistor Options. The IDTP9035A LED indicators are connected to GPIO0,3. Currently only LEDA and LEDB are operational and only Green LEDB contains the resistor options.

LED Pattern Operational Status Definitions:

Blink Slow: 1s ON, 1s OFF, repeat

Blink Fast: 0.4s ON, 0.8s OFF, 0.4s ON, 0.8s OFF, repeat

The red FOD warning LED is synchronized with the buzzer (if implemented) such that a 0.4s tone corresponds with FOD red LED illumination and 0.8s off (no sound) corresponds with LED being off. During the 30s that the buzzer is off/silenced, the FOD LED should continue to blink.

Table 1 – IDTP9035A LED Resistor Optioning (Not all options supported, shaded rows are for future development).

LED Control Option	LED Select Resistor Value	Description	LED #/ Color	Operational Status				FOD Warning
				Standby	Power Transfer	Charge Complete	Fault Condition	
1	Pull Down	Standby LEDs ON	LEDB- Green	ON	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	ON	OFF	OFF	ON	BLINK FAST
2	R1	Standby LEDs ON plus	LEDB- Green	ON	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	ON	OFF	OFF	ON	BLINK FAST
3	R2	Standby LEDs ON plus	LEDB- Green	ON	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	ON	OFF	OFF	ON	BLINK FAST
4	R3	Standby LEDs ON plus	LEDB- Green	ON	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	ON	OFF	OFF	ON	BLINK FAST
5	R4	Standby LEDs ON plus	LEDB- Green	ON	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	ON	OFF	OFF	ON	BLINK FAST
6	Pull Up	Standby LEDs OFF	LEDB- Green	OFF	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	OFF	OFF	OFF	ON	BLINK FAST
7	R5	Standby LEDs OFF plus	LEDB- Green	OFF	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	OFF	OFF	OFF	ON	BLINK FAST
8	R6	Standby LEDs OFF plus	LEDB- Green	OFF	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	OFF	OFF	OFF	ON	BLINK FAST
9	R7	Standby LEDs OFF plus	LEDB- Green	OFF	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	OFF	OFF	OFF	ON	BLINK FAST
10	R8	Standby LEDs OFF plus	LEDB- Green	OFF	BLINK SLOW	ON	OFF	OFF
			LEDA- Red	OFF	OFF	OFF	ON	BLINK FAST
R1-R8 are created using combination of two 1% resistors.								
Designates Future Option								

Buzzer Function

An optional buzzer feature is supported on GPIO4. The default configuration is an "AC" buzzer. The signal is created by toggling GPIO4 active-high/active-low at a 2kHz frequency.

Buzzer Action: Power Transfer Indication

The IDTP9035A supports audible notification when the device operation successfully reaches the Power Transfer state. The duration of the power transfer indication sound is 0.4secs. The latency between reaching the Power Transfer state and the actual buzzer sounding does not exceed 0.5sec. Additionally, the buzzer sound is concurrent within +/-0.25sec of any change to the LED configuration indicating starting the Power Transfer state.

Buzzer Action: No Power Transfer due to Foreign Object Detected (FOD)

When a major FOD case is detected such that for safety reasons, power transfer is not commenced or that power transfer is terminated, the buzzer is sounded in a repeating sequence:

For 30 seconds: 0.4s on, 0.8s off, 0.4s on, 0.8s off, repeat
Next 30 seconds: OFF/silence (but no change to LED ON/OFF patterns)
The pattern is repeated while the error condition exists

The buzzer is synchronized with the FOD LEDA such that the 0.4s on tone corresponds with the Red LEDA is ON or illuminated and 0.8s off (no sound) corresponds with the Red LEDA OFF.

Bulk Cap

A laboratory test set-up typically consists of two long wires running from the bench power supply to the evaluation board input voltage pins. The inductance of these wires, along with the low-ESR ceramic input capacitor, can create a high Q network that may affect converter performance. This problem often becomes apparent in the form of excessive ringing in the output voltage during load transients. Since the inductance of a short PCB trace feeding the input voltage is significantly lower than the power leads from the bench power supply, most applications do not exhibit this problem. In applications where the input power source lead inductance cannot be reduced to a level that does not affect the device performance, a high ESR tantalum or aluminum electrolytic should be placed in parallel with the low ESR/ESL bypass ceramic capacitor. This dampens the high Q network and stabilizes the system. Space on the evaluation board is available for bulk caps and can be placed in positions C16 and C39. These components are optional, see Figure 13.

Troubleshooting

The IDTP9035A demo board was designed to quickly show the performance of the IDTP9035A. However, if you are experiencing trouble getting started, here are some tips to help accelerate setup and connectivity.

1. Check to make sure that the PC shows it is connected to the demo board. USB connected should always show at the lower left of the Dongle GUI. If it doesn't it is always good practice to disconnect and reconnect the USB cable, and to disconnect and reconnect the 5V power supply. Unplugging and plugging the USB cable should show an icon appearing and disappearing at the lower right of your computer screen.
2. Depress and release the Reset button. This is the RED button on the demo board. If everything in 1 above is connected and the real time signals are still not streaming across the screen, depress the Red button. Also, enabling then disabling the "Reset Target" box on, then off, in the EEPROM Tab (Figure 7) will restart the device. Target field box can be used for clearing GUI I^2C Read Errors or other system errors.
3. Select the Scan I2C button (Fig 7 lower right) and check that the slave address for the EEPROM appears as 0x52
4. Reload the .bin file and re-write it. Make sure WRITE OK shows at the middle of the display after a write takes place.
5. **Update the Driver.** If you have a previous version of the eval tool, the driver will probably need to be updated. The way to check on the version of the driver is to open up the Device Manager as shown in Figure 9. Expand the USB Bridge Devices and double click on it. Click on the Driver Tab, and be sure its' Driver Date is 7/5/2009 and Version is 7.0.0.0. See Figure 10 and 11. If it is not version 7.0.0.0 then go to directory C:\Program Files\IDT Wireless Power Solution\Drv as shown in Figure 12 and double click the DPInst.exe file. The system will then go through a driver update install. Be sure to reboot your machine once the install is complete.

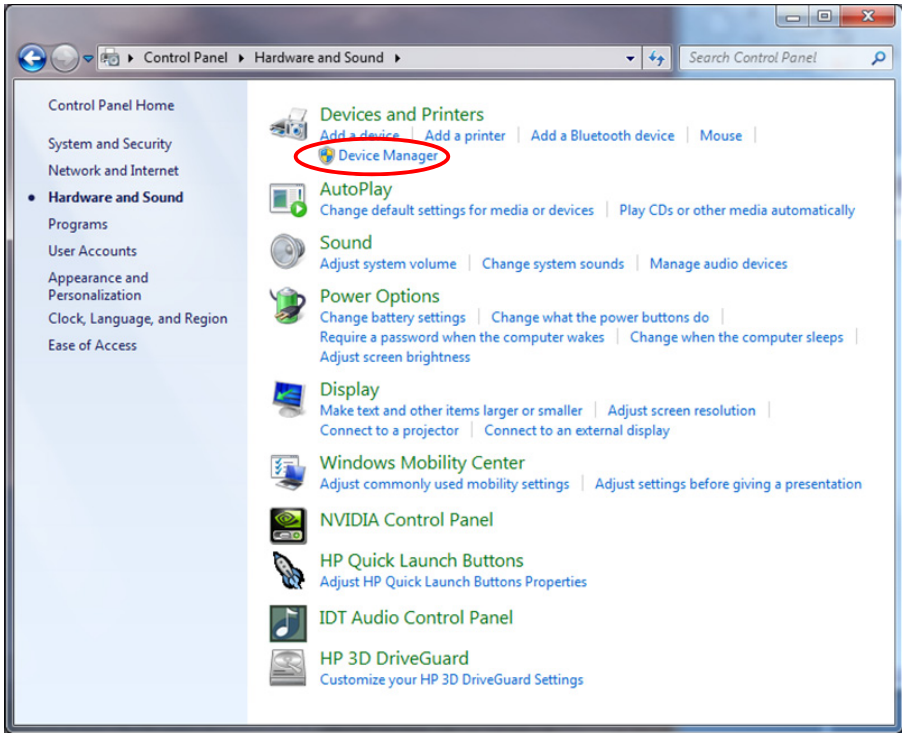


Figure 9. Checking the revision of the driver using Device Manager, shown is a Win7 PC.

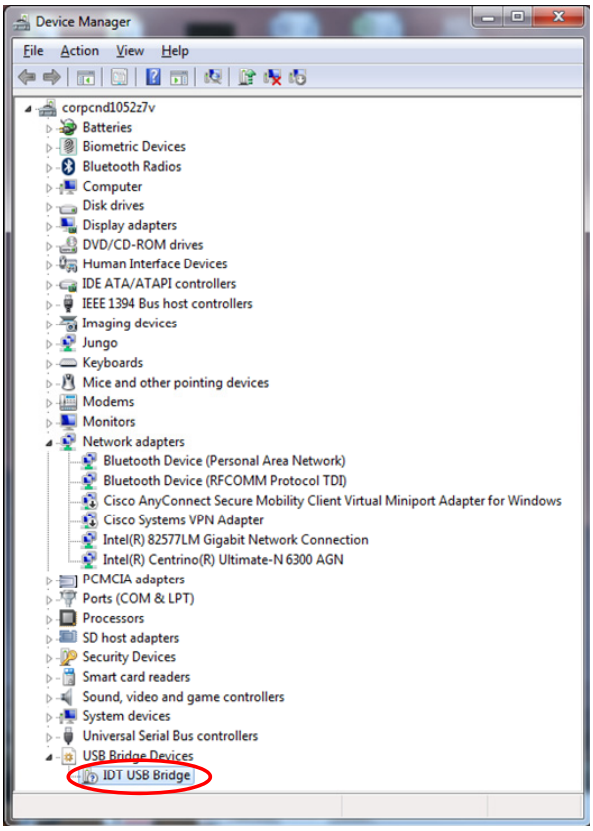


Figure 10. Checking the revision of the driver in Device Manager.

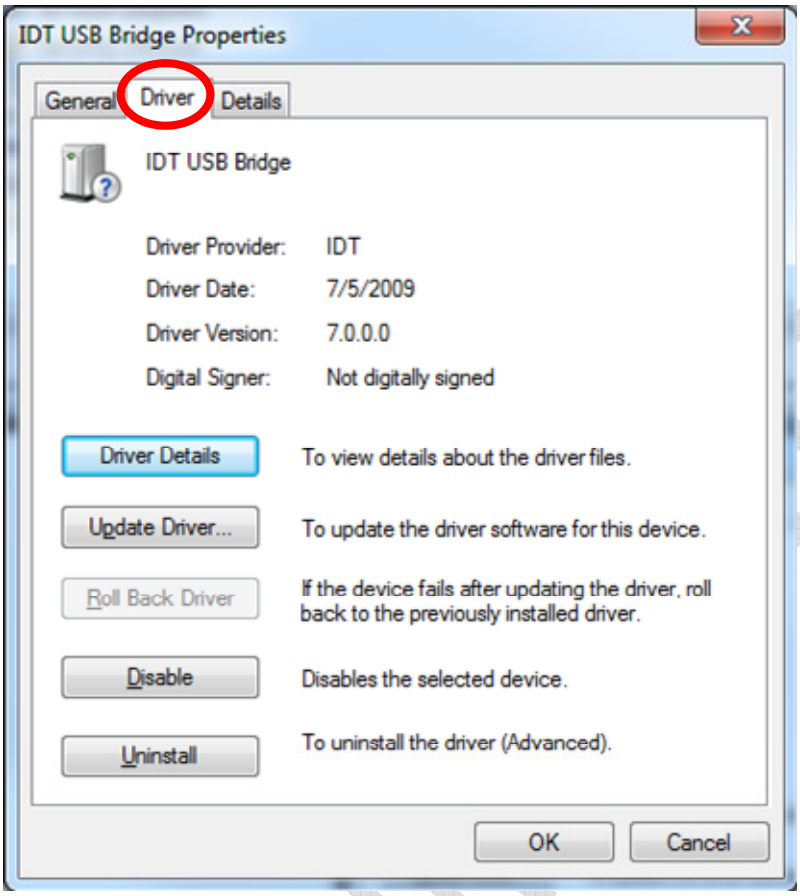


Figure 11. Checking that the revision of the driver is correct.

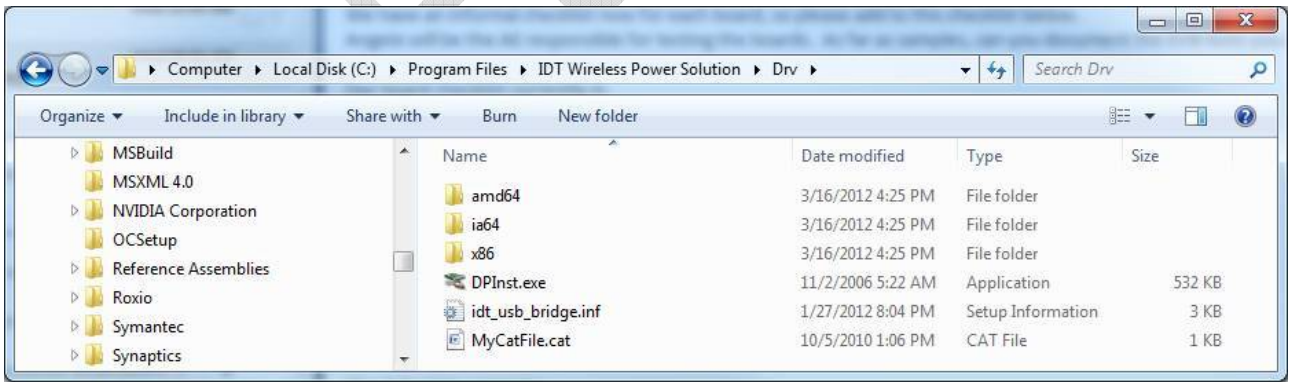


Figure 12. Installed Device Driver Directory.

IDTP9035A LV DEMO V4.1 Generic Application Schematic

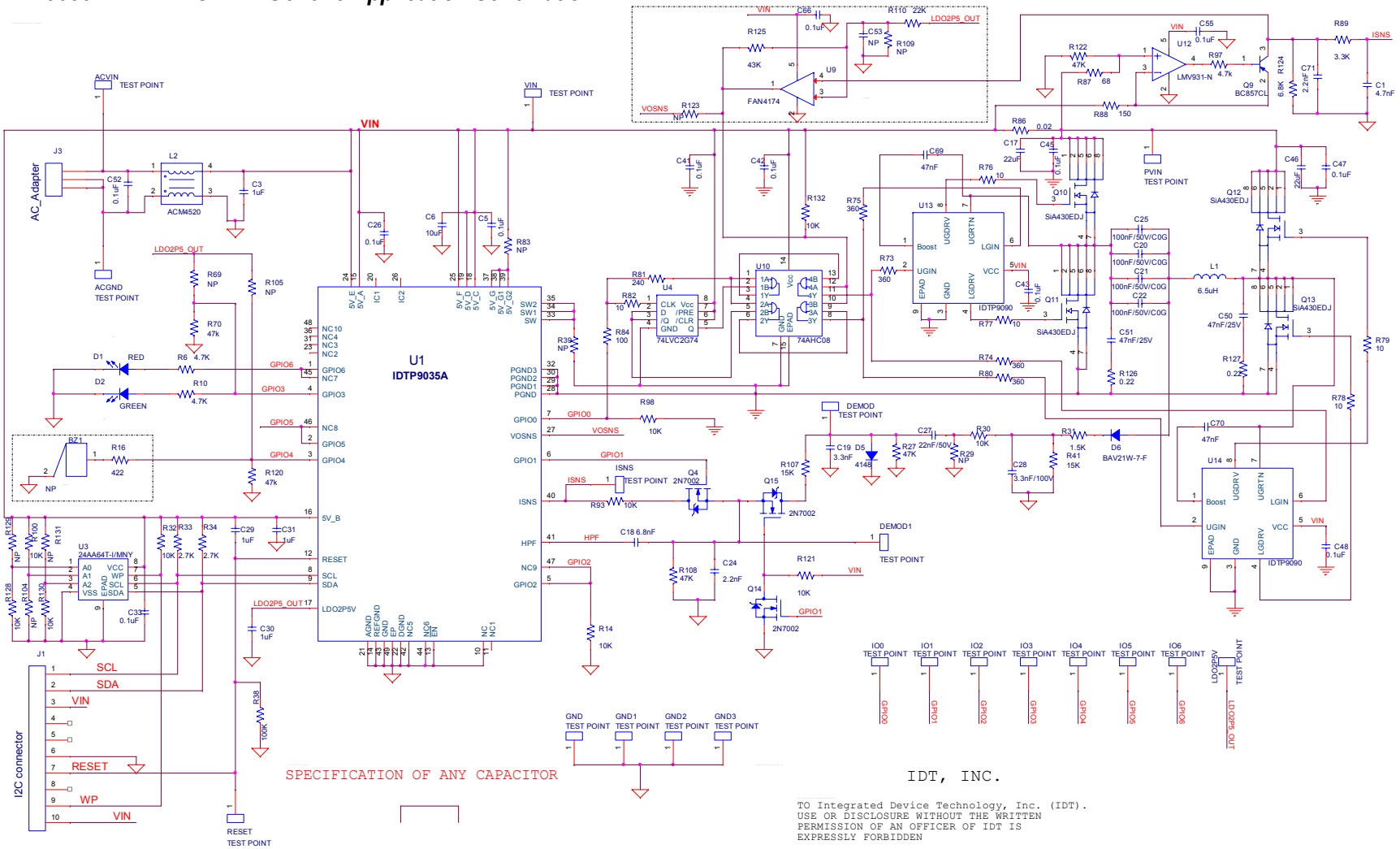


Figure 13. Complete IDTP9035A Application Schematic

The application schematic and the PCB layout are subject to change and they're not intended to be used for production purpose. Other components, which are not showed or populated, may be necessarily in order to comply with EMC test or thermal requirements.

Bill of materials - IDTP9035A A5 DEMO Schematic V4.1 Revised: Tuesday, April 16, 2013

Item	Quantity	Reference	Part	Description	Manufacturer	Part_Number	PCB Footprint
1	14	IO1,GND1,IO2,GND2,IO3,	TEST POINT			5015	TEST_PT_SM_135X70
		GND3,IO4,IO5,IO6,VIN,					
		PVIN,GND,ACVIN,ACGND					
2	1	BZ1	Buzzer	BUZZER PIEZO 4KHZ 12.2MM PC MNT	TDK	PS1240P02CT3 (Optional)	buzz_ps1240
3	1	C1	4.7nF	CAP CER 4700PF 50V 10% X7R 0402	TDK	C1005X7R1H472K050BA	402
4	4	C3,C29,C30,C31	1uF	CAP CER 1UF 25V 10% X7R 0603	TDK	C1608X7R1E105K	603
5	3	C5,C26,C33	0.1uF	CAP CER 0.1UF 50V 10% X7R 0603	Murata	GRM188R71H104KA93D	603
6	1	C6	10uF	CAP CER 10UF 25V 20% X5R 0805	TDK	C2012X5R1E106M	805
7	2	C17,C46	22uF	CAP CER 22UF 25V 10% X5R 1206	Murata	GRM31CR61E226KE15L	1206
8	1	C18	6.8nF	CAP CER 6800PF 50V 10% X7R 0402	TDK	C1005X7R1H682K	402
9	1	C19	3.3nF	CAP CER 3300PF 50V 10% X7R 0402	TDK	C1005X7R1H332K	402
10	4	C20,C21,C22,C25	100nF/50V/C0G	CAP CER 0.1UF 50V 5% NP0 1206	TDK	C3216C0G1H104J160AA	1206
11	2	C24,C71	2.2nF	CAP CER 2200PF 25V 10% X7R 0402	TDK	C1005X7R1E222K	402
12	1	C27	22nF/50V	CAP CER 0.022UF 50V 10% X7R 0603	TDK	C1608X7R1H223K	603
13	1	C28	3.3nF/100V	CAP CER 3300PF 100V 10% X7R 0603	TDK	C1608X7R2A332K	603
14	9	C41,C42,C43,C45,C47,C48,	0.1uF	CAP CER 0.1UF 50V 10% X7R 0402	TDK	C1005X7R1H104K	402
		C52,C55,C66					
15	2	C50,C51	47nF/25V	CAP CER 0.047UF 25V 5% NP0 0805	Kemet	C0805C473J3GACTU	805
16	2	C53,R69	NP			NP	402
17	2	C69,C70	47nF	CAP CER 0.047UF 16V 10% X7R 0603	Murata	GRM188R71C473KA01D	603
18	6	DEMOD1,LDO2P5V,RESET,	TEST POINT			NP	test_pt30dpad
		ISNS,IO0,DEMOD					
19	1	D1	RED	LED SMARTLED 630NM RED 0603 SMD	OSRAM	L29K-G1J2-1-0-2-R18-Z	0603_DIODE
20	1	D2	GREEN	LED SMARTLED GREEN 570NM 0603	OSRAM	LG L29K-G2J1-24-Z	0603_DIODE
21	1	D5	4148	DIODE SWITCH 100V 0.15A SOD123	Micro Comm	1N4148W-TP	sod123
22	1	D6	BAV21W-7-F	DIODE SWITCHING 200V 0.2A SOD123	Diodes Inc.	BAV21W-7-F	SOD123
23	1	J1	I2C connector	CONN HEADER LOPRO STR 10POS GOLD	TE Connectivity	5103308-1	LOPRO8PIN01INREVB
24	1	J3	AC_Adapter	CONN POWER JACK 2.5X5.5MM HI CUR	CUI Inc.	PJ-002BH	CONN_POWER_JACK5_5MM
25	1	L1	6.5uH	INDUCTOR WPC TX A11 COIL UNIT	TDK	WT-505060-10K2-A11-G	ind_a11_Tx_Coil_smd
					Wurth	760308111	
26	1	L2	ACM4520	CHOKE COMMON MODE 900 OHM SMD	TDK	ACM4520-901-2P-T000	TDK_ACM4520
27	3	Q4,Q14,Q15	2N7002	N-CHANNEL ENHANCEMENT MODE MOS	Fairchild	2N7002	SOT23_3
28	1	Q9	BC857CL	TRANS PNP LP 100MA 45V SOT23	ON Semi	BC857CLT1G	SOT23_3
29	4	Q10,Q11,Q12,Q13	SiA430EDJ	MOSFET N-CH 20V 12A SC70-6	Vishay	SIA430EDJ-T1-GE3	sc70_6ld_fet
30	3	R6,R10,R97	4.7k	RES 4.7K OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ472X	402

Bill of materials(Continued) - IDTP9035A A5 DEMO Schematic V4.1 Revised: Tuesday, April 16, 2013

Item	Quantity	Reference	Part	Description	Manufacturer	Part_Number	PCB Footprint
31	7	R14,R32,R98,R100,R128,	10K	RES 10K OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ103X	402
		R130,R132					
32	1	R16	422	RES 422 OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF4220V	603
33	5	R27,R70,R108,R120,R122	47K	RES 47K OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ473X	402
34	1	R29	NP			NP	603
35	1	R30	10K	RES 10K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF1002V	603
36	1	R31	1.5K	RES 1.5K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF1501V	603
37	2	R33,R34	2.7K	RES 2.7K OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ272X	402
38	1	R38	100K	RES 100K OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ104X	402
39	4	R39,R105,R109,R123	NP			TBD	402
40	1	R41	15K	RES 15K OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ153V	603
41	4	R73,R74,R75,R80	360	RES 360 OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ361V	603
42	4	R76,R77,R78,R79	10	RES 10 OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ100V	603
43	1	R81	240	RES 240 OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ241X	402
44	1	R82	10	RES 10 OHM 1/20W 5% 0201 SMD	Panasonic	ERJ-1GEJ100C	201
45	1	R83	NP			OPEN	603
46	1	R84	100	RES 100 OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ101V	603
47	1	R86	0.02	RES .02 OHM 1/8W 1% 0805 SMD	Vishay Dale	WSL0805R0200FEA	805
48	1	R87	68	RES 68 OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ680X	402
49	1	R88	120	RES 120 OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1200X	402
50	1	R89	3.3K	RES 3.3K OHM 1/10W 5% 0402 SMD	Panasonic	ERJ-2GEJ332X	402
51	2	R93,R121	10K	RES 10.0K OHM 1/16W 1% 0402 SMD	Yageo	RC0402FR-0710KL	402
52	3	R104,R129,R131	NP			OPEN	402
53	1	R107	15K	RES 15K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF1502X	402
54	1	R110	22K	RES 22K OHM 1/10W 1% 0402 SMD	Panasonic	ERJ-2RKF2202X	402
55	1	R124	6.8K	RES 6.80K OHM 1/20W 1% 0201 SMD	Vishay Dale	CRCW02016K80FKED	201
56	1	R125	43K	RES 43K OHM 1/16W 5% 0402 SMD	Vishay Dale	CRCW040243K0JNED	402
57	2	R126,R127	0.22	RES .22 OHM 1/5W 1% 0603	Susumu	RL0816S-R22-F	603
58	1	U1	IDTP9035A	Single-Chip 5V Wireless Power Tx-A5/11	IDT	IDTP9035A	NTG_48LD_6X6MM_0P4PITCH
59	1	U3	24AA64T-I/MNY	Transmitter IC for TX-A5 and A11	Microchip	24AA64T-I/MNY	DFN8
60	1	U4	74LVC2G74	IC SNGL D FF POS-EDG TRIG 8TSSOP	NXP	74LVC2G74DP,125	TSSOP_8LD
61	1	U9	FAN4174	IC AMP SINGLE R-R I/O SOT23-5	Fairchild	FAN4174IS5XCT	SOT_23_5
62	1	U10	74AHC08	IC QUAD 2-IN AND GATE 14-DHVQFN	NXP	74AHC08BQ,115	DHVQFN_14LD_2p5x3mm
63	1	U12	LMV931-N	IC OP AMP RRIO SNGL 1.8V SOT23-5	TI	LMV931-N	SC70_5LD
64	2	U13,U14	IDTP9090	High and Low Side N-Channel Gate Driver	IDT	IDTP9090	nlg8LD_3x3_0p65mm

Component placement map

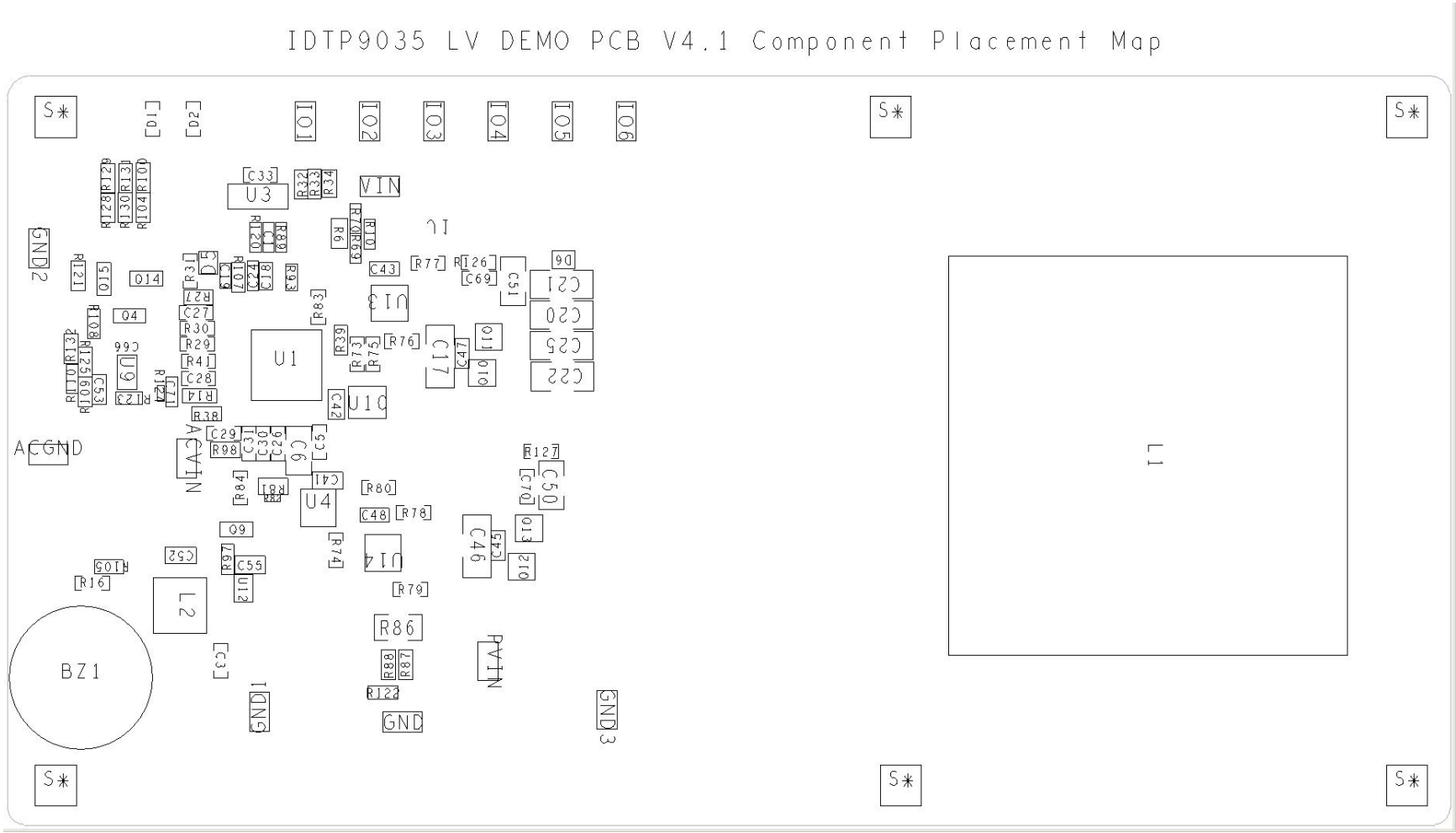


Figure 14. Top layer component map

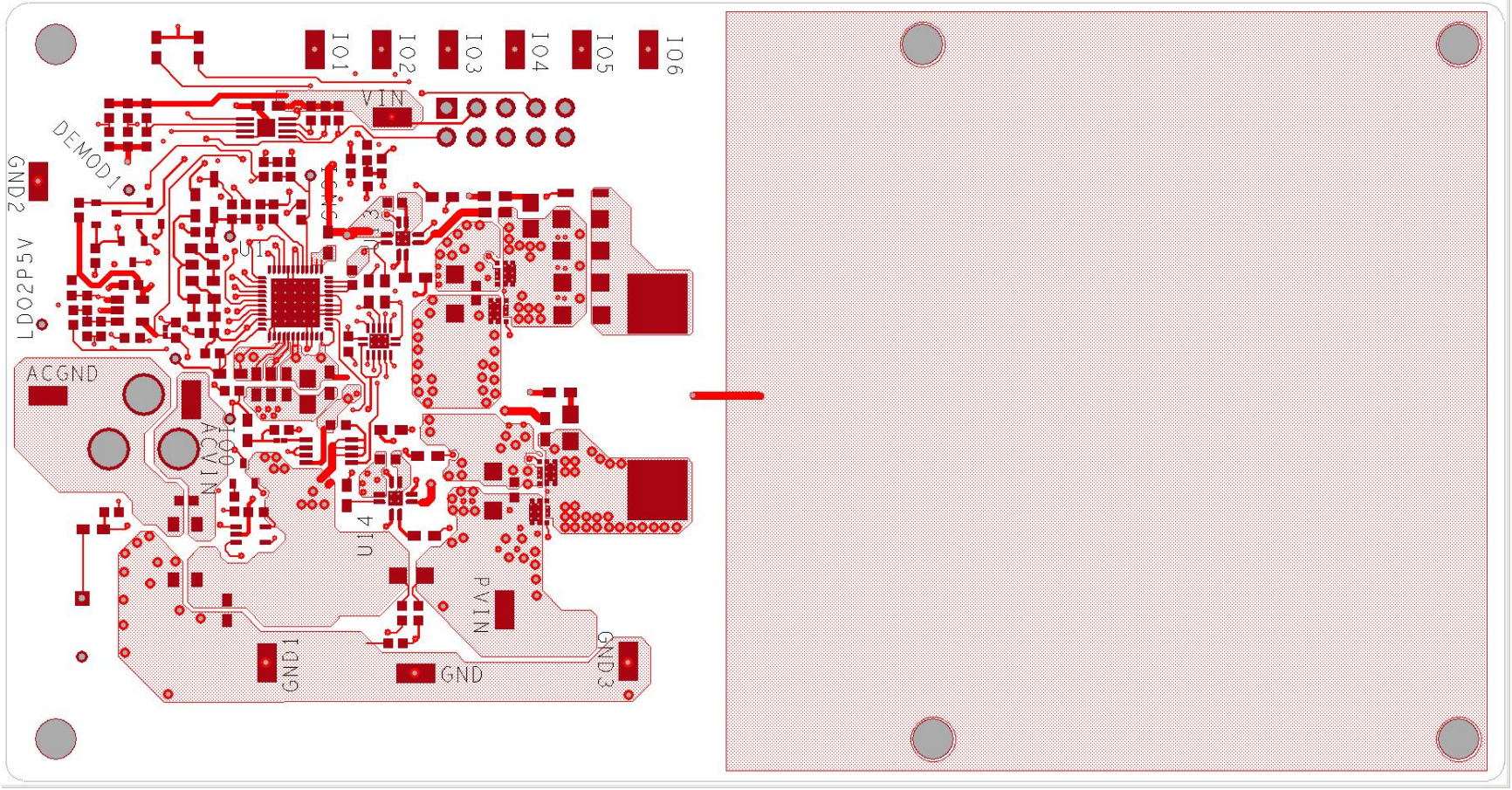


Figure 15. Top and Top Silkscreen Layer

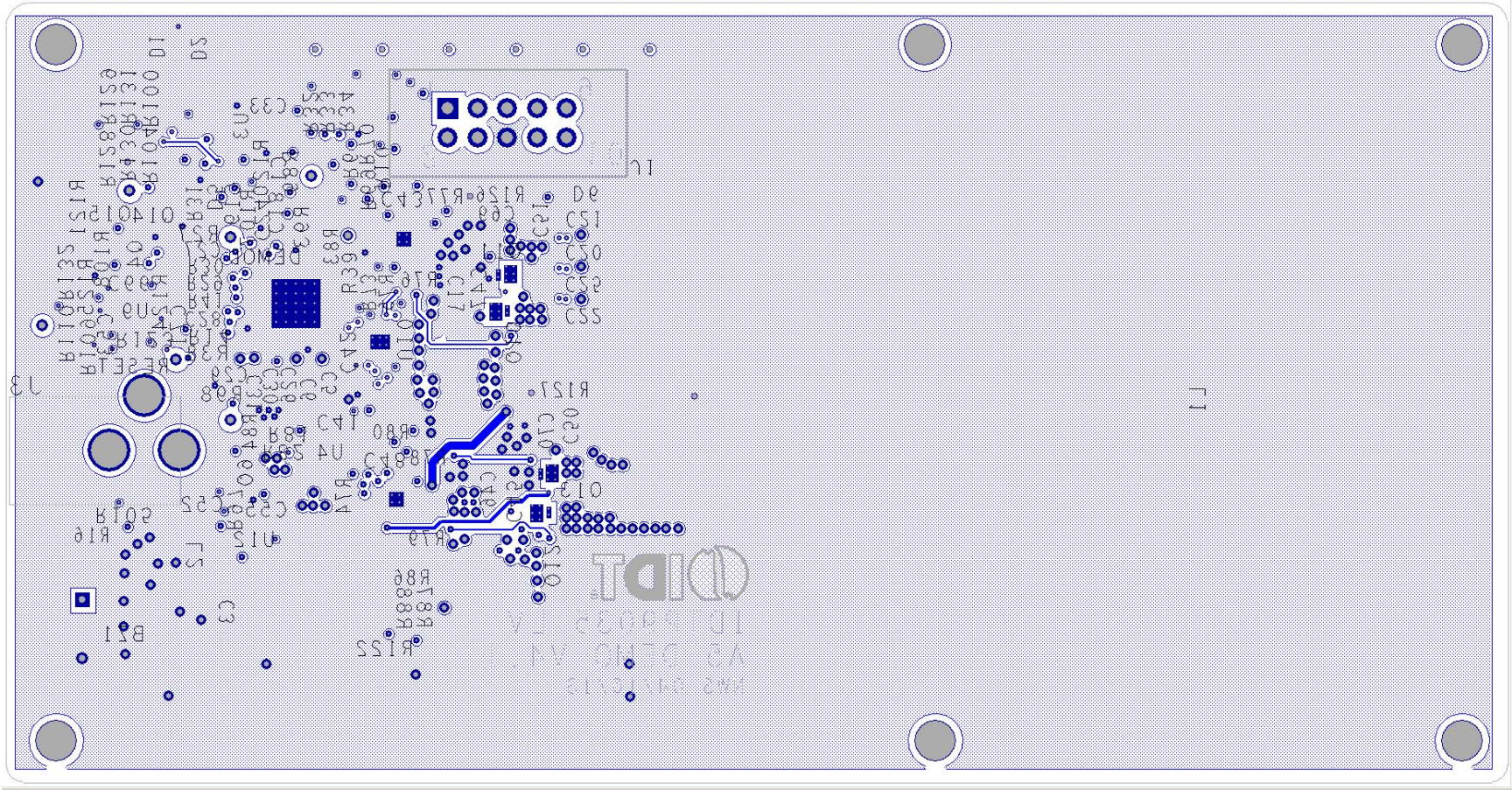


Figure 16. Bottom and Bottom Silkscreen Layer

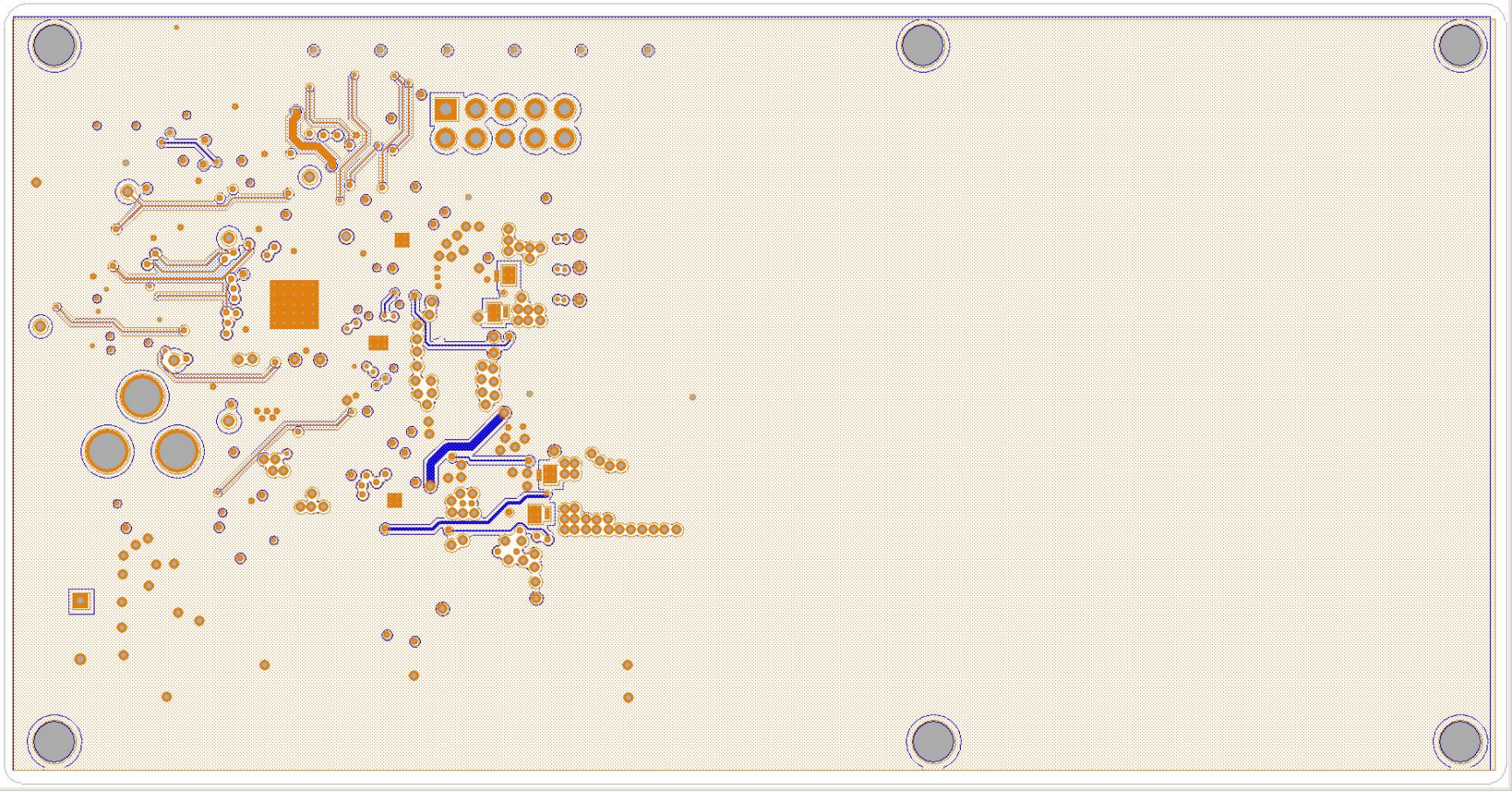


Figure 17. Mid 1 Layer

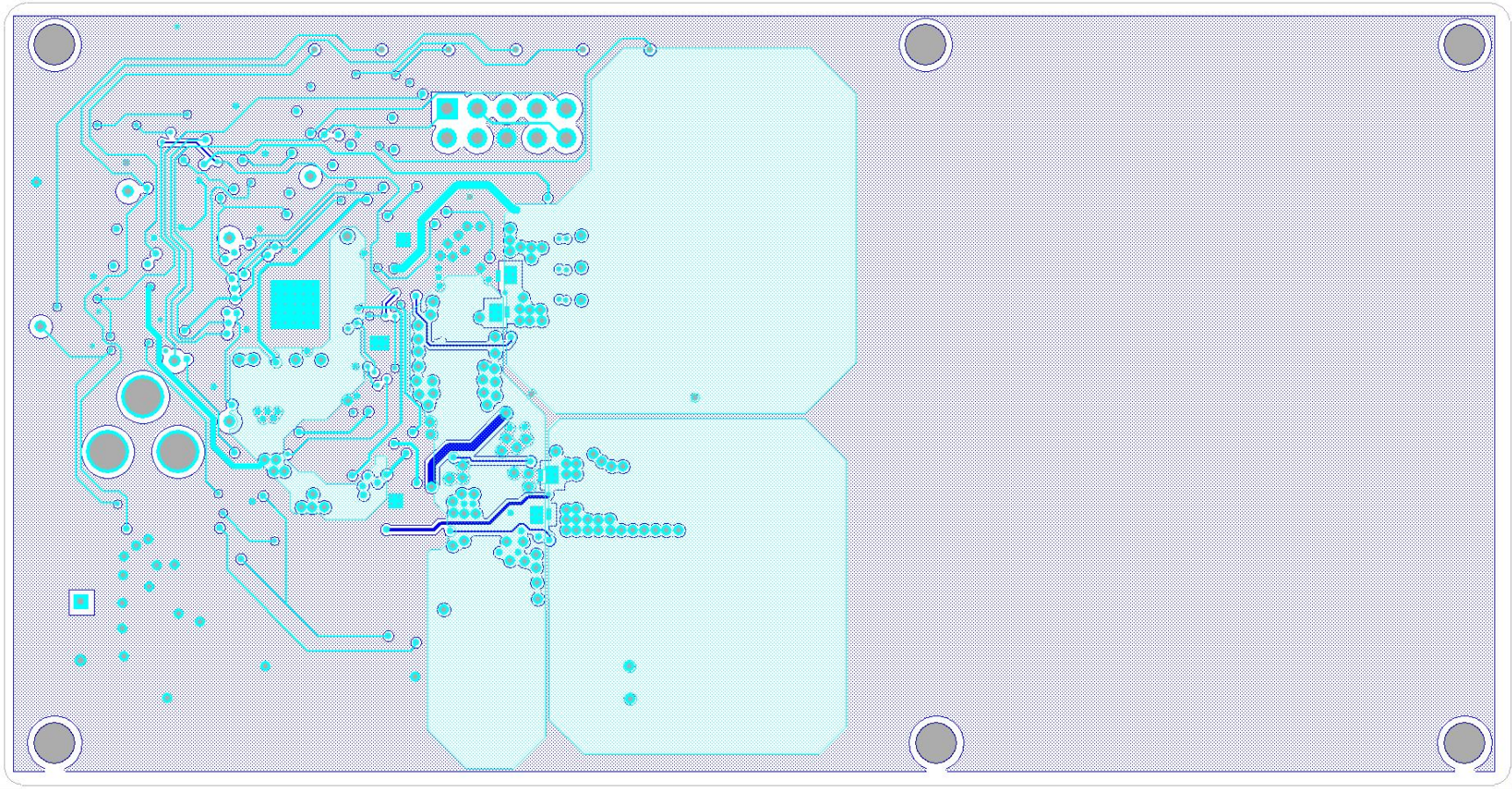


Figure 18. Mid 2 Layer

IMPORTANT NOTES

PGND Layout Guide- Care should be taken when routing the PGND connections of Input capacitors (C39, C9, C8), The Source of Q6, Q4, and Q2 (N-CH), and C17, C16. The provided layout file should be followed as closely as possible and deviations should regard the following image for priority. In general, Q6 must be placed close to the SW pins and PGND pins with Q4 placed close by. Q2 should be adjacent to the resonance capacitors.

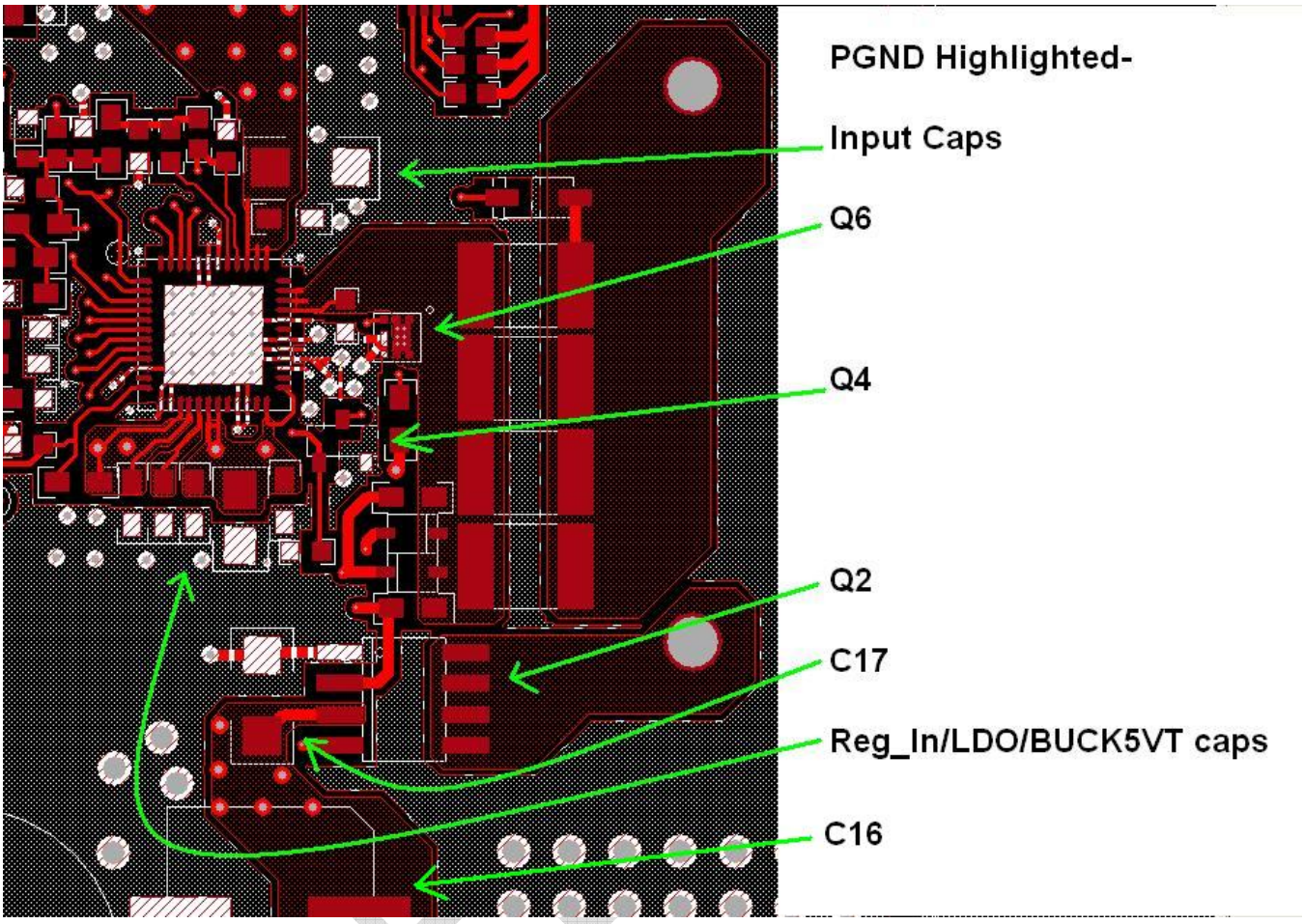


Figure 19. PGND routing and component placement.

There should be an abundance of vias connecting these PGND connections to the ground layer which is best when placed on the layer directly below the Top layer of the board. This ground plane should not be used for routing and be directly connected to the E-PAD. The LDO and BUCK5VT capacitors should be placed in a row in close proximity of the device.

VIN Power Connections- The connection from the EMI filter to the Input capacitors should be made with a wide trace of metal or a plane and is best when kept on the top layer of the board. Multiple vias should be used when changing layers with these connections and layer changes should be kept to a minimum. See the image below for the optimal way to connect VIN to C16, C17 and the LDO/BUCK5VT capacitors to the main input capacitors C8, C9, and C39.

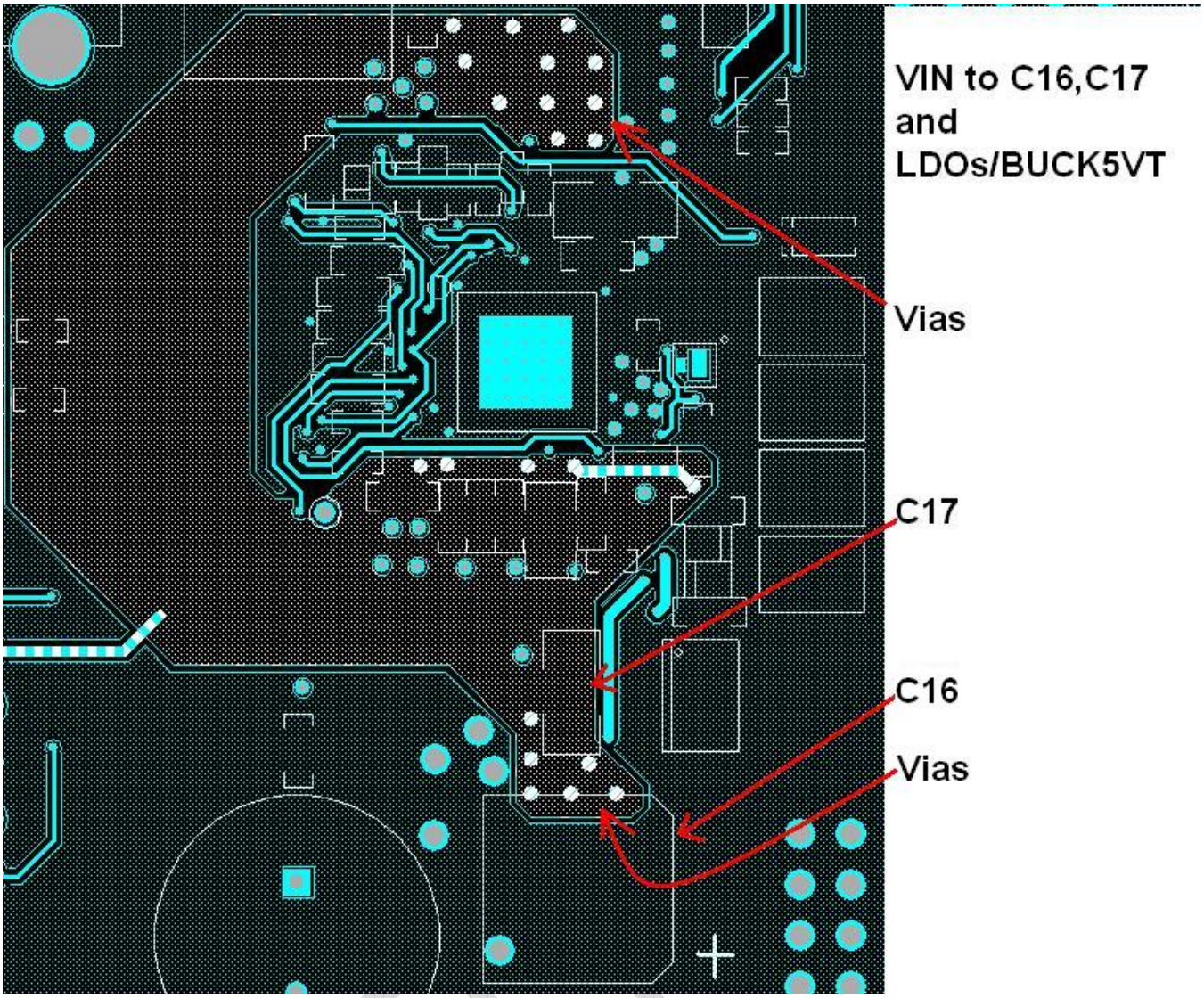


Figure 20. VIN route to C16, C17 and LDO/BUCK5VT caps on inner layer using many vias for layer transitions

DEMODULATION noise considerations- Noise can cause interference with proper operation when injected into the DEMODULATION circuit, therefore the components should be placed near the PIN 1 corner of the device and the placement and orientation should be matched to the provided layout when placing the components and routing the signal lines. Furthermore to reduce the opportunity for noise injection they should be routed with 5 mil or 6 mil trace widths. In the attached image, the most critical signal lines have been highlighted and then circled in the schematic image for further clarification.

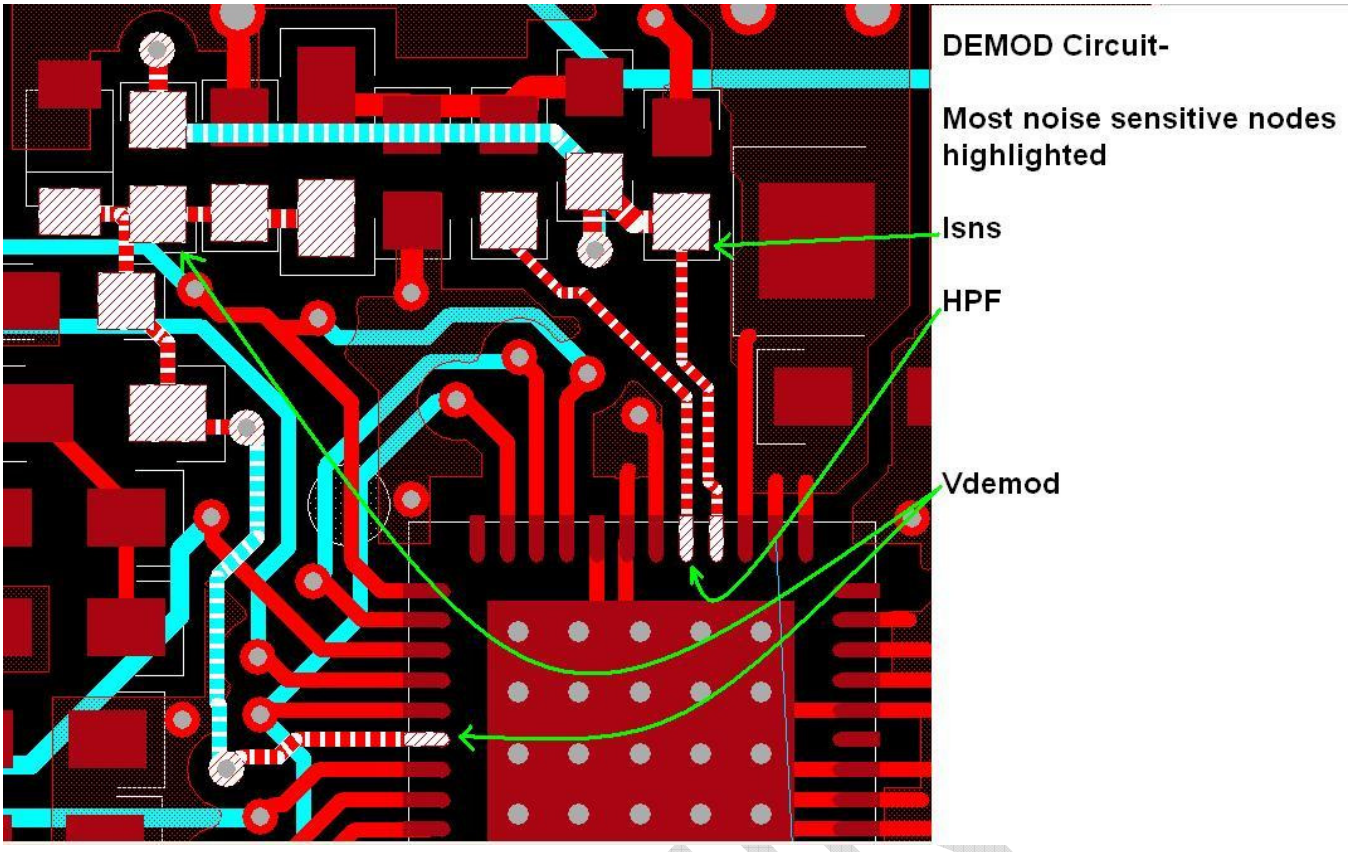


Figure 21. DEMODULATION most noise sensitive nodes, placement routing recommendations

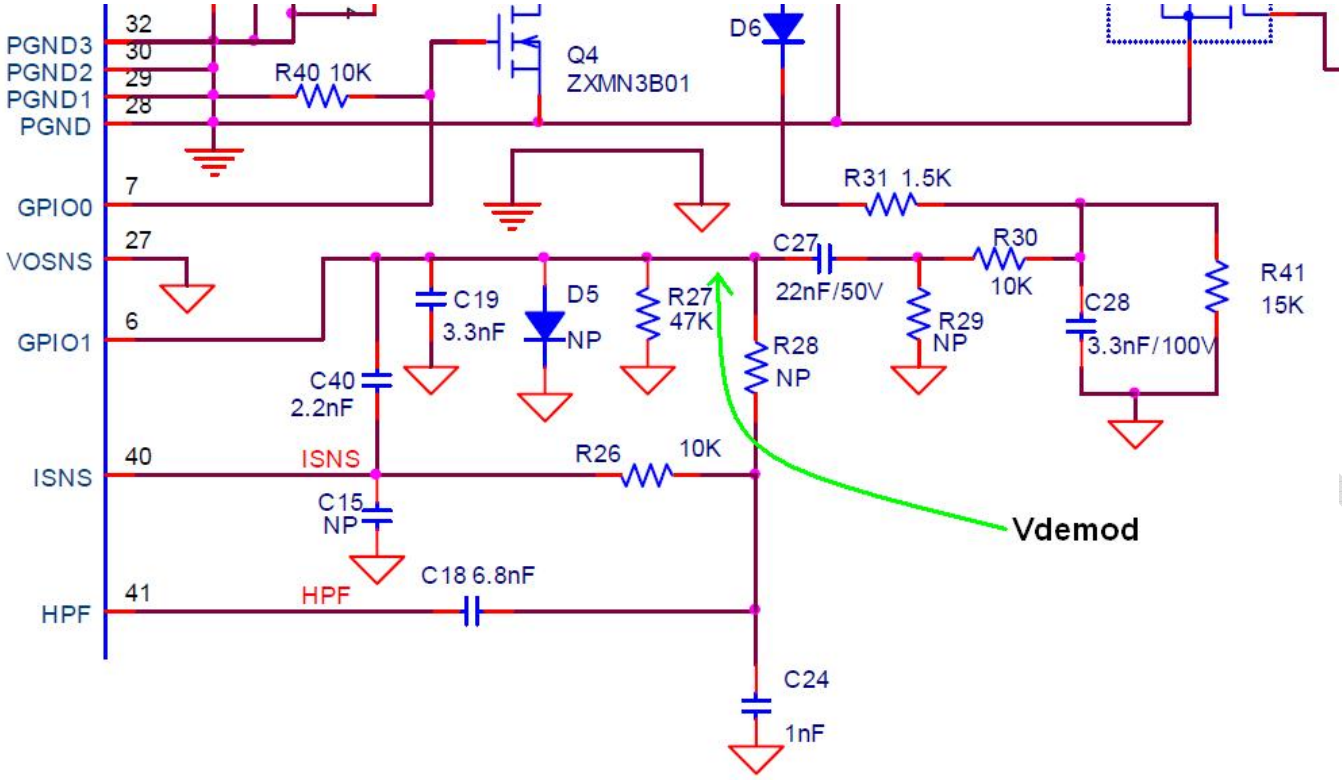


Figure 22. DEMODULATION most noise sensitive nodes, schematic highlight (Isns, HPF, Vdemod)

Finally R31 should be kept close to the PIN 1 corner of the IDTP9035A to improve noise immunity of the circuit.

Thermal Considerations- A 5x5 matrix of 12 mils vias spaced at 33 mils apart should be placed within the EPAD. The Bottom Layer should be electrically tied to GND and directly connected to the E-PAD while being used as a solid ground plane as much as possible. Any signals on the bottom layer ground plane should not be placed in the area of the E-PAD in a manner that would impede heat dissipation from the E-PAD to the ground plane. Unused sections of the layout on inner layers should be filled with GND planes in order to improve noise shielding, increase heat dissipation, and reduce GND impedance.

Reference: Debug and Configuration Tabs

These Tabs are for development purposes. One of the features of the Debug tab is the ability to view Real Time System Messages depending upon which of the three fields at the left of the message window is chosen. The Config and Status Tab indicate the status register readings from the device. By default, the Debug and Config and Status Tab functions are disabled in the Firmware.

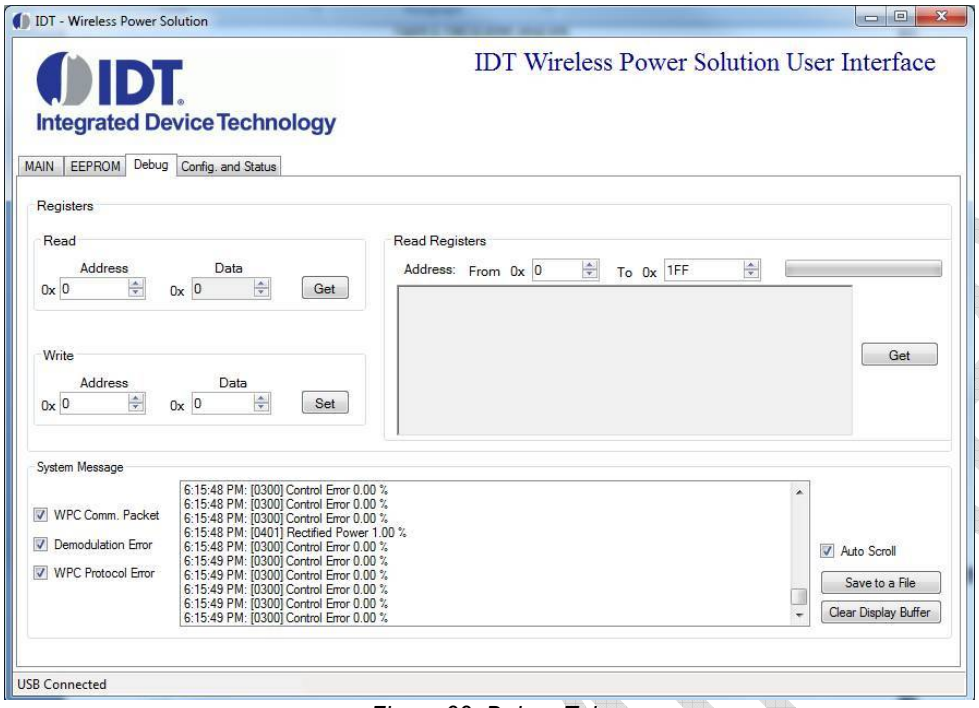


Figure 22. Debug Tab

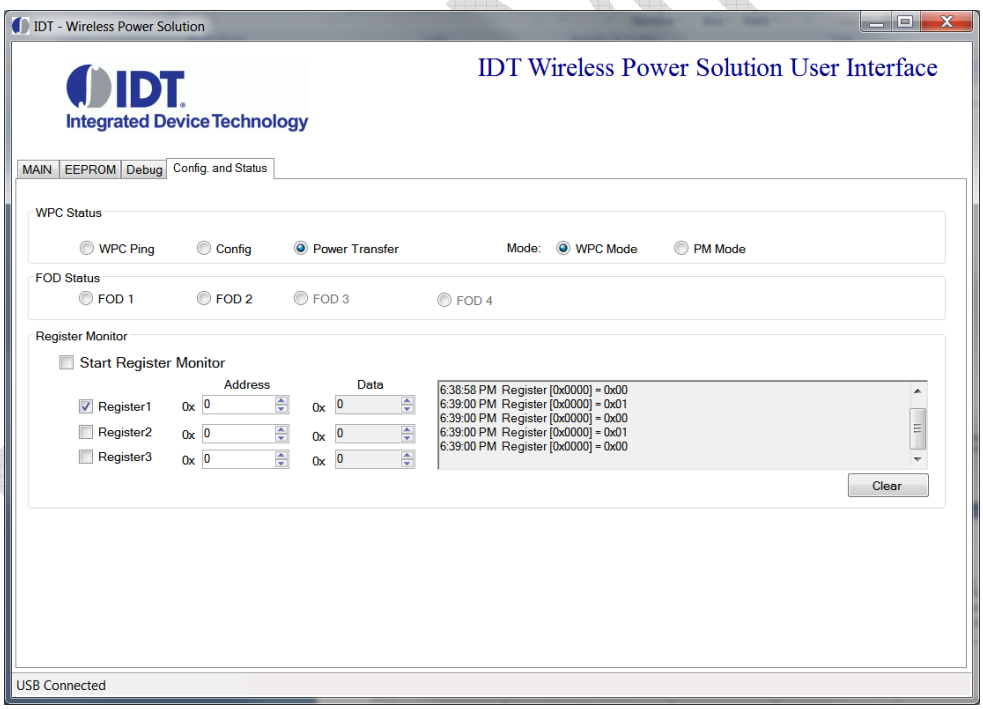


Figure 23. Configuration and Status Tab

ORDERING GUIDE

Table 1. Ordering Summary

PART NUMBER	MARKING	PRICE	AMBIENT TEMP. RANGE	SHIPPING CARRIER	QUANTITY
IDTP9035ATX LV DEMO V4.1	IDTP9035ATX LV DEMO V1.0	$149.00	0°C to +70°C	Box 14”x10”x2”	1

Revision History

November 6, 2012 Version V1.4. Add R70 and R71 pulldown resistors to LEDB and Buzzer.

February 5, 2013 Version 1.5. Correct BOM reference designators.

March 21, 2013 Version 1.6. Add WPC A11 coils to the BOM, add GUI description.

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