



GPMQ8018A, GPMQ8012A GPMQ8005A

Qi Compliant Wireless Power Transmitter Series

Preliminary

Jan. 06, 2016

Version 0.4

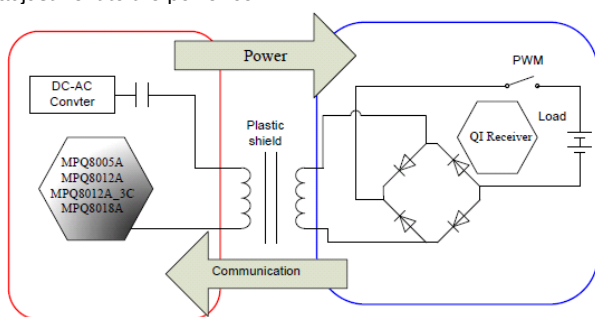
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QI COMPLIANT WIRELESS POWER TRANSMITTER SERIES

1. GENERAL DESCRIPTION

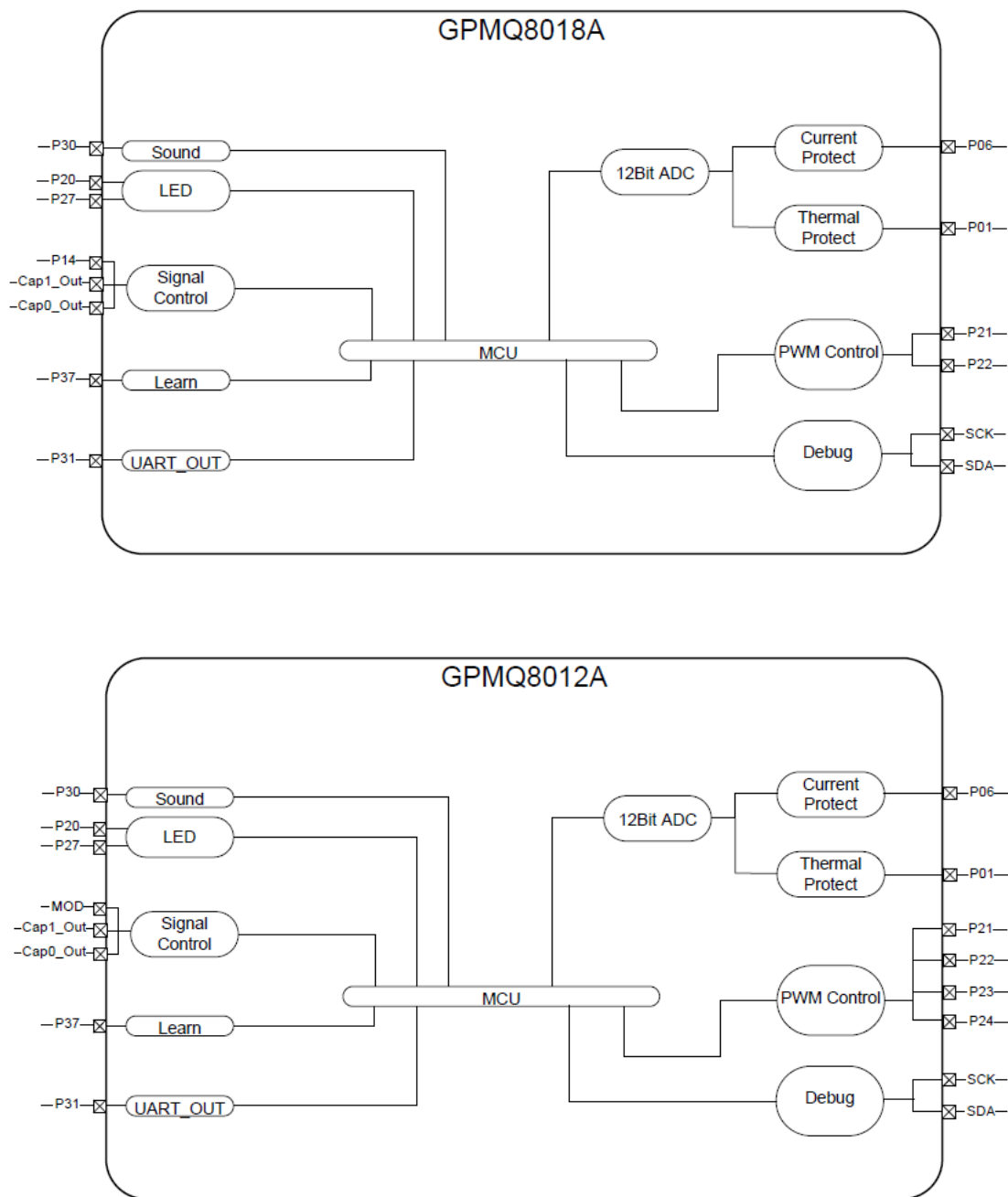
GPMQ80XXA is a highly integrated solution for QI Compliant Wireless Power Transmitter where XX represents the DC supply voltage: 5V, 12V, and 18V. This series is designed to monitor the QI Compliant Mobile Device, Voltage, Current, Environment Temperature, and to perform a well control in charging functions. Two LEDs indicate the conditions of the charge system. In general QI format, the Wireless Power Transfer Transmitter should monitor all the communications from Mobile device and make power adjustment to the power coil.

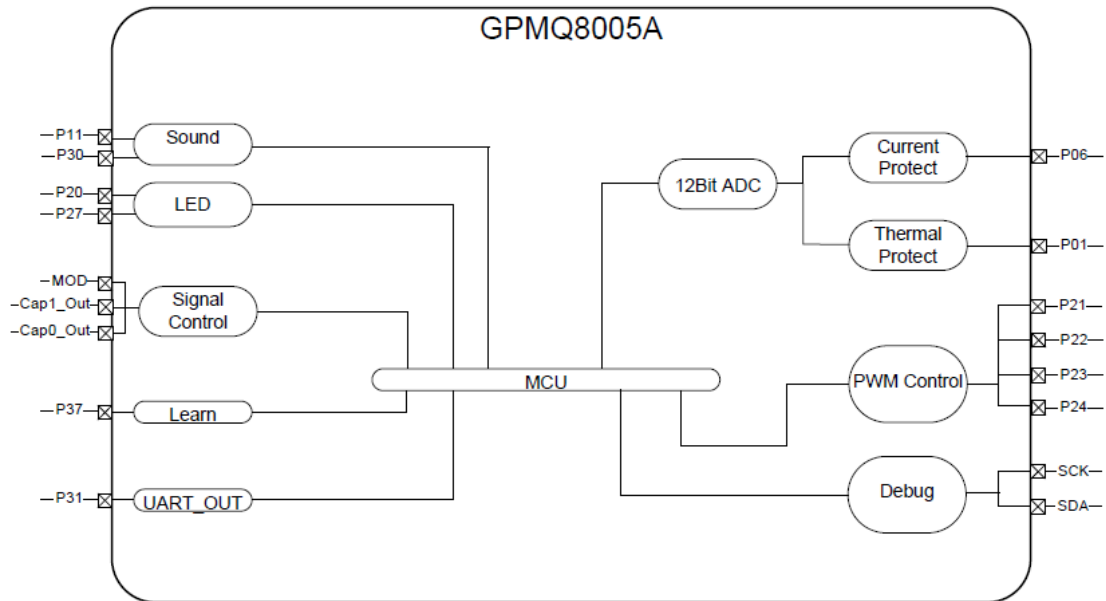


2. FEATURES

- Conforms to the Wireless Power Consortium (WPC) Wireless Power Transfer Transmitter V1.1.2 Specification.
- Various types of supply voltage
 - GPMQ8018A: An 18V DC supply system, using QI Transmitter A1 or A10 type coil and capacitor. This chip also supports A6S coil, one of A6 coil types, but limited with a 12V VPP input. Some IO settings in different schematics may vary when using these types of coils. Please refer to application circuit for more details.
 - GPMQ8012A: A 12V DC supply system, using QI Transmitter A6 type coil and capacitor.
 - GPMQ8005A: A 5V DC supply system, using QI Transmitter A11 type coil and capacitor.
- High performance at signal demodulation
- Status Indicator
 - Charge completed
 - Charging
 - Error (Transmitter over current, QI standard error message)
 - Standby
 - Sound alarm (alert)
- Auto detecting whether an object is put on and removed on charger.
- Over temperature protection.
- Over current protection
- Learning function when coil is changed.
- Package: LQFP 44
- Input voltage: 5V

3. BLOCK DIAGRAM





4. SIGNAL DESCRIPTION

GPMQ8005A/GPMQ8018A

Pin		I/O	GPMQ8018A	GPMQ8005A	Description
No.					
1	P14/Mod	I	●	●	Packet Demodulation input2
2	NC	-	-	-	NC
3	SCK	I	●	●	Debug communication Clock.
4	NC	-	-	-	NC
5	P30	O	●	●	Sound alarm. High active
6	P31	O	●	●	UART TX. Send the information from Transmitter
7	NC	-	-	-	NC
8	P33	O	●	●	LED Indicator. Output low when active.
9	NC	-	-	-	NC
10	NC	-	-	-	NC
11	NC	-	-	-	NC
12	P36	O	●	-	In GPMQ8018A, AC Buzzer Sound alarm.
13	P37	I	●	●	Learning when P37 is low level after reset.
14	GND	S	●	●	Ground.
15	P27	O	●	●	LED Indicator. Output low when active.
16	P20	O	●	●	LED Indicator. Output low when active.
17	P21	O	●	-	PWM Control Output /PWM0
18	P22	O	●	●	PWM Control Output /PWM1
19	P23	O	-	●	PWM Control Output /PWM2
20	NC	-	-	-	NC
21	NC	-	-	-	NC
22	NC	-	-	-	NC
23	NC	-	-	-	NC
24	NC	-	-	-	NC
25	Vref	S	●	●	Regulator output, needs 2.2uF Cap.
26	NC	-	-	-	NC
27	NC	-	-	-	NC
28	SDA	I/O	●	●	Debug communication Data.
29	NC	-	-	-	NC
30	NC	-	-	-	NC
31	NC	-	-	-	NC
32	P07	I	●	-	VPP Detect Pin
33	P06	I	●	●	Current Detect Pin.
34	NC	-	-	-	NC
35	NC	-	-	-	NC
36	NC	-	-	-	NC
37	P02	I	-	●	AC Voltage Detect Pin
38	P01	I	●	●	Thermal Detect Pin.
39	P00	I	●	●	GPMQ8018A = AC Voltage Detect Pin GPMQ8005A = USB Voltage Detect Pin
40	VDD	S	●	●	Power 5V input
41	NC	-	-	-	NC

Pin		I/O	GPMQ8018A	GPMQ8005A	Description
No.					
42	P11	O	-	●	In GPMQ8005A , AC Buzzer Sound alarm.
43	Cap0_Out	I	●	●	Packet Demodulation input0
44	Cap1_Out	I	●	●	Packet Demodulation input1

GPMQ8012A

Pin		I/O	GPMQ8012A	Description
No.				
1	P14/Mod	I	●	Packet Demodulation input2
2	NC	-	-	NC
3	SCK	I	●	Debug communication Clock.
4	NC	-	-	NC
5	P30	O	●	Sound alarm. High active
6	P31	O	●	UART TX. Send the information from Transmitter
7	SS_C1	O	●	Coil selection pin
8	SS_C2	O	●	Coil selection pin
9	SS_C3	O	●	Coil selection pin
10	NC	-	-	NC
11	NC	-	-	NC
12	P36	O	●	AC Buzzer Sound alarm.
13	P37	I	●	Learning when P37 is low level after reset.
14	GND	S	●	Ground.
15	P27	O	●	LED Indicator. Output low when active.
16	P20	O	●	LED Indicator. Output low when active.
17	P21	O	●	PWM Control Output /PWM0
18	P22	O	●	PWM Control Output /PWM1
19	P23	O	●	PWM Control Output /PWM2
20	P24	O	●	PWM Control Output /PWM3
21	NC	-	-	NC
22	NC	-	-	NC
23	P25	O	●	PWM Control Output /PWM4
24	P26	O	●	PWM Control Output /PWM5
25	Vref	-	●	Regulator output, needs 2.2uF Cap.
26	NC	-	-	NC
27	NC	-	-	NC
28	SDA	I/O	●	Debug communication Data.
29	NC	-	-	NC
30	NC	-	-	NC
31	NC	-	-	NC
32	P07	I	●	VPP Detect Pin
33	P06	I	●	Current Detect Pin.
34	P05	I	●	Thermal Detect Pin.
35	P04	I	●	Thermal Detect Pin.
36	P03	I	●	AC Voltage Detect Pin
37	P02	I	●	AC Voltage Detect Pin

Pin		I/O	GPMQ8012A	Description
No.				
38	P01	I	●	Thermal Detect Pin.
39	P00	I	●	AC Voltage Detect Pin
40	VDD	S	●	Power 5V input
41	NC	-	-	NC
42	NC	-	-	NC
43	Cap0_Out	I	●	Packet Demodulation input0
44	Cap1_Out	I	●	Packet Demodulation input1

5. FUNCTION DESCRIPTION

Qi Compliant wireless transmitter 1.1.2 Specification

Conforms Qi standard of v1.1.2, now supporting up to 5W.

Strong Demodulation for Qi packet

Demodulation plays a major role in Qi transmitter. GPMQ80XXA uses an approach of flexible process to achieve its performance in demodulating the PACKET.

Thermal Protection

The system is able to protect and display a warning message when the thermal pin (p01) reaches the alert voltage. After 5 minutes, system will restart again. For a total of five restarts has been performed, system will stop running until RX is removed from TX surface.

Chip	Thermal Pin Protect Voltage	Unit
GPMQ8018A	3.86	V
GPMQ8012A	3.45	V
GPMQ8005A	3.86	V

User is able to change the setting of over-temperature protection by adjusting differential voltage of NTC and resistor.

Over Current Protection

The system is able to protect and show FOD/USB message when the current pin (P06) detects the alert voltage. System will not stop and will still keep the current limit charging.

Chip	Current Pin Protect Voltage	Unit	Current amplifier resister
GPMQ8018A	12	watt	R55
GPMQ8012A	12	watt	R63
GPMQ8005A	12	watt	R63

User is able to change the setting of over-current protection by adjusting the current amplifier's resistor.

LED Indicate

LED Pins are P20 and P27. The output low sink current is 20mA.

Low(0): LED ON

High(1): LED OFF

GPMQ8005A/GPMQ8018A

Condition	P33	P20	P27	Description
Standby	Keep ON	Keep OFF	Keep OFF	When the transmitter does not detect any Qi Mobile device.
Charging	Keep OFF	Keep OFF	Keep ON	When the transmitter receives Qi mobile device.
Charge Completed	Keep OFF	Keep ON	Keep OFF	When the transmitter receives the charge complete packet. System stops charging and waits for 5 minutes. After 5 minutes, system will restart again. After restarting three times, system will stop running until RX is removed from TX surface.
Error	Keep OFF	Keep OFF	Flashing	1. When the transmitter receives Qi Error Code (listed as follows). - D_QI_EndPowerTransfer_InternalFault - D_QI_EndPowerTransfer_OverVoltage - D_QI_EndPowerTransfer_OverCurrent - D_QI_EndPowerTransfer_BatteryFailure - D_QI_EndPowerTransfer_Unkown - D_QI_EndPowerTransfer_NoResponse

Condition	P33	P20	P27	Description
				- Thermal Protection: If the Thermal protection occurs, the error message will be displayed. 2. When the system receives the package, system will stop and restart again immediately. After receiving 5 times of error message, system will stop running until RX is removed from the TX surface.
FOD/USB warning	Keep OFF	P20 ON , P27 OFF(0.5s) → P27 ON , P20 OFF(0.5s) → P27 OFF , P20 OFF (0.5s) →Repeating		1. Insufficient USB Power 2. Foreigner Object detection 3. Power(Current) Limit
Learning	Keep OFF	Keep ON	Keep ON	When Learning PIN (P37) shorts to GND after reset.

GPMQ8012A

Condition	P20	P27	Description
Standby	Keep OFF	Keep OFF	When the transmitter does not detect any Qi Mobile device.
Charging	Keep OFF	Keep ON	When the transmitter receives Qi mobile device.
Charge Complete	Keep ON	Keep OFF	When the transmitter receives the charge complete packet.
Error	Keep OFF	Flashing	1. When the transmitter receives QI Error Code (listed as follows). - D_QI_EndPowerTransfer_InternalFault - D_QI_EndPowerTransfer_OverVoltage - D_QI_EndPowerTransfer_OverCurrent - D_QI_EndPowerTransfer_BatteryFailure - D_QI_EndPowerTransfer_Unkown - D_QI_EndPowerTransfer_NoResponse - Thermal Protection: If the Thermal protection occurs, the error message will be displayed. 2. When the system receives the package, system will stop running and restart again immediately. After receiving 5 times of error message, system will stop until the RX is removed from Tx surface.
FOD/USB warning	P20 ON , P27 OFF(0.5s) → P27 ON , P20 OFF(0.5s) → P27 OFF , P20 OFF (0.5s) →Repeating		1. Insufficient USB Power 2. Foreigner Object detection 3. Power (Current) Limit
Learning	Keep ON	Keep ON	When Learning PIN (P37) shorts to GND after reset.

Sound alarm

P30 is the DC buzzer sound alarm pin. When P30 outputs high, sound is ON; otherwise it is OFF.

High(1): Sound ON

Low(0): Sound OFF

In GPMQ8005A , P11 is AC buzzer sound alarm pin. It can output 2KHz PWM.

Condition	Content	Description
PUT ON Alarm	B	The QI Mobile Device is identified. If the TX restarts again and RX is not removed for over 2 seconds, the buzzer will not alarm again.
Error Alarm	B-B-B	When the transmitter receives QI Error Code (listed as follows). <ul style="list-style-type: none"> - D_QI_EndPowerTransfer_InternalFault - D_QI_EndPowerTransfer_OverVoltage - D_QI_EndPowerTransfer_OverCurrent - D_QI_EndPowerTransfer_BatteryFailure - D_QI_EndPowerTransfer_Unkown - D_QI_EndPowerTransfer_NoResponse

Learning Function

P37 is the learning Pin. When system changes the resonant coil or capacitor, it needs to learn again.

1. Remove the power supply VPP.
2. Check if there is any receiver or other objects on the Coil.
3. Short P37 to ground.
4. Check if both LED indicators (P20, P27) are ON.
5. Wait and See if only one LED is ON. (P20 off , P27 ON)
6. Lastly, remove the P37 short pin and reset again.

If learning fails, both LED indicators will keep ON.

6. ELECTRICAL SPECIFICATIONS

6.1. Absolute Maximum Rating

Characteristics	Symbol	Ratings
DC Supply Voltage	V_+	5V
Input Voltage Range	V_{IN}	$V_+ - 0.3V$ to $V_+ + 0.3V$
Operating Temperature	T_A	-40°C to +85°C
VDD Total MAX Current	I_{VDDM}	100mA
VSS Total MAX Current	I_{VSSM}	150mA

6.2. DC Characteristics ($T_A = 25^\circ\text{C}$)

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
Operating Voltage	VDD	2.4	3.3	5.5	V	
Operating Current	I_{OP}	-	-	10.0	mA	SYSCCLK= 24.5MHz @ 5.0V, no load
Standby Current	I_{STBY}	-	-	5.0	uA	VDD = 5.5V
Input High Level	V_{IH}	0.7VDD	-	-	V	VDD = 5.0V
Input Low Level	V_{IL}	-	-	0.3VDD	V	VDD = 5.0V
Output High Level	V_{OH}	0.8VDD	-	-	V	$I_{OH} = -8\text{mA}$ at VDD = 5.0V
Output Low Level	V_{OL}	-	-	0.2VDD	V	$I_{OL} = 20\text{mA}$ at VDD = 5.0V
Input Pull High Resistor 1	R_{PH1}	30	50	70	K Ω	Pn_R_SEL=0 (n=0.1.2.3.4) @VDD=5.0V
Input Pull High Resistor 1	R_{PL1}	30	50	70	K Ω	Pn_R_SEL=0 (n=0.1.2.3.4) @VDD = 5.0V
Input Pull High Resistor 2	R_{PH2}	1	2	3	K Ω	Pn_R_SEL=1 (n=0.1.2.3.4) @VDD=5.0V
Input Pull High Resistor 2	R_{PL2}	1	2	3	K Ω	Pn_R_SEL=1 (n=0.1.2.3.4) @VDD = 5.0V
Low Voltage Reset	V_{LVR}	2.2×(1-5%)	2.2	2.2×(1+5%)	V	

6.3. ADC Characteristics ($T_A = 25^\circ\text{C}$) 12bit

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
Operating Voltage	VDD	2.4	-	5.5	V	
ADC Input Voltage Range	V_{ADCIN}	0	-	VDD	V	
ADC Clock Period	T_{AD}	0.3265	-	-	us	ADCLKmax=24.5MHz/8
Input Channel		-	-	8	channel	
Resolution		12			Bit	
No Missing Code		10			bits	
ADC Conversion Time	T_{CON}	5.224	-	-	us	ADCLK*16@ADCFG[1:0]=2'b00
Integral Linearity Error	E_{INL}	-	±2	±3	LSB	
Differential Linearity Error	E_{DNL}	-	-1~+2	-1~+3	LSB	

7. APPLICATION CIRCUITS

GPMQ8018A 18V application

As the attachment A.1

GPMQ8012A 12V application

As the attachment A.2

GPMQ8005A 5V application

As the attachment A.3

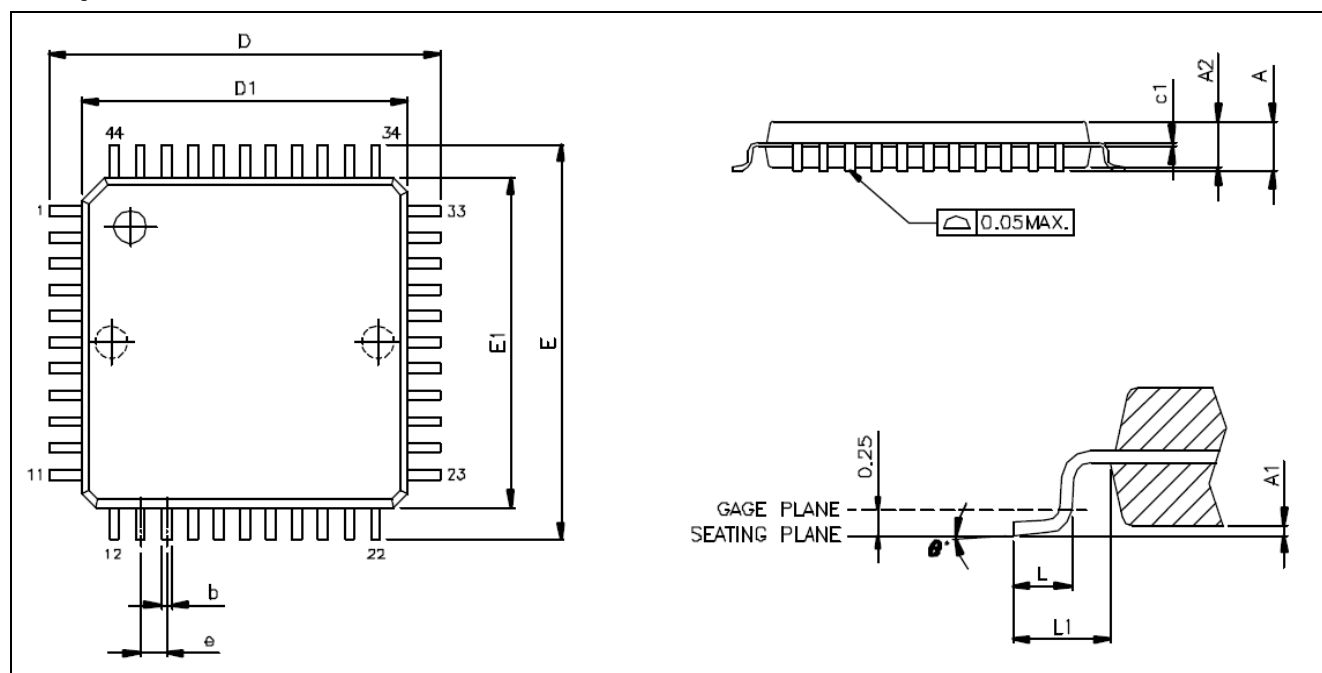
8. PACKAGE/PAD LOCATIONS

8.1. Ordering Information

Product Number	Package Type
GPMQ8018A	Halogen Free Package
GPMQ8012A	Halogen Free Package
GPMQ8012A_3C	Halogen Free Package
GPMQ8005A	Halogen Free Package

8.2. Package Information

8.3. LQFP 44



符号	尺寸单位 mm		
	Min.	Nom.	Max.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45
c1	0.09	-	0.16
D	12.00 BSC		
D1	10.00 BSC		
E	12.00 BSC		
E1	10.00 BSC		
e	0.80 BSC		
b	0.30	0.37	0.45
L	0.45	0.60	0.75
L1	1.00 REF		
θ °	0 °	3.5 °	7 °

9. DISCLAIMER

The information appearing in this publication is believed to be accurate.

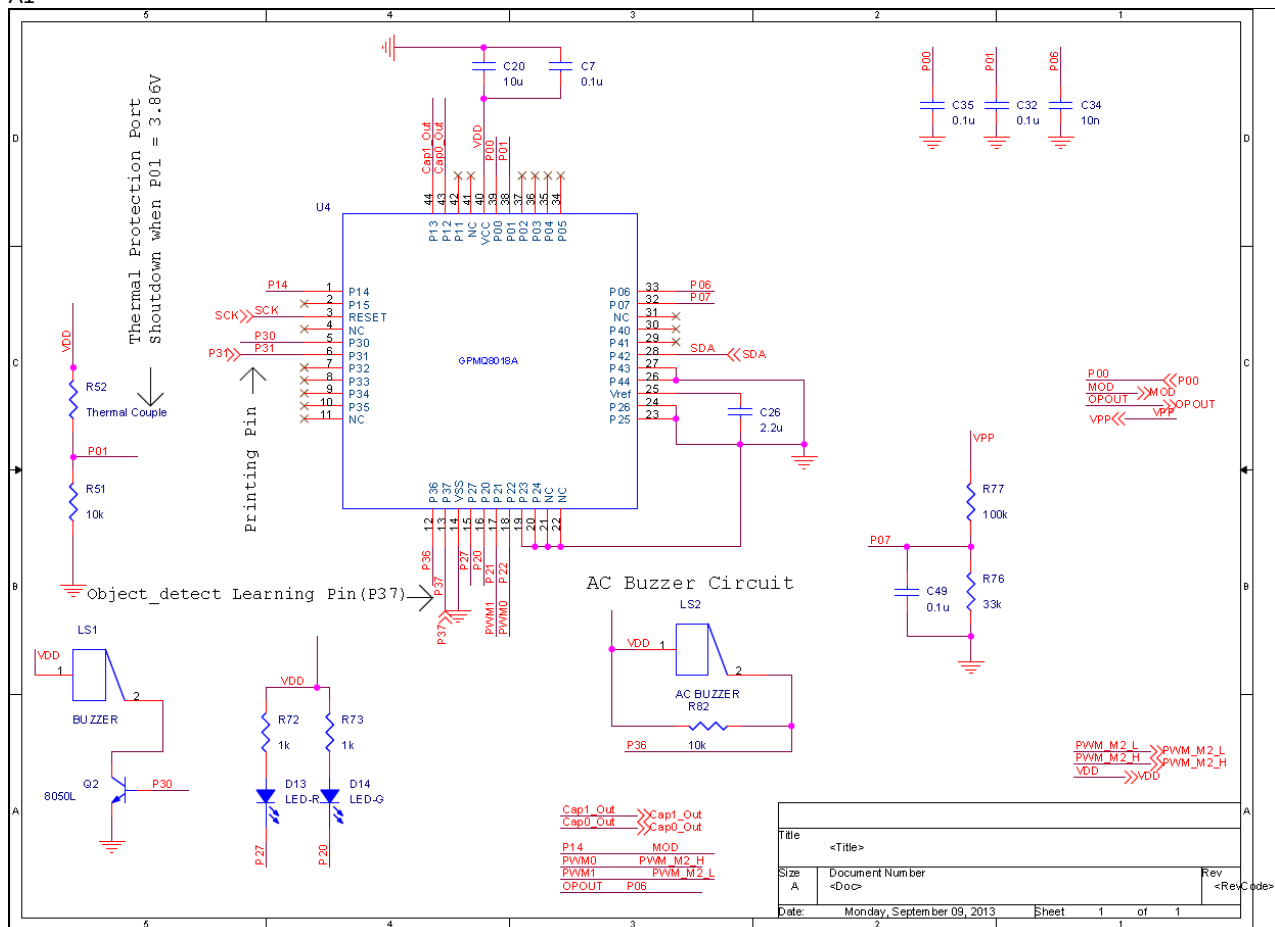
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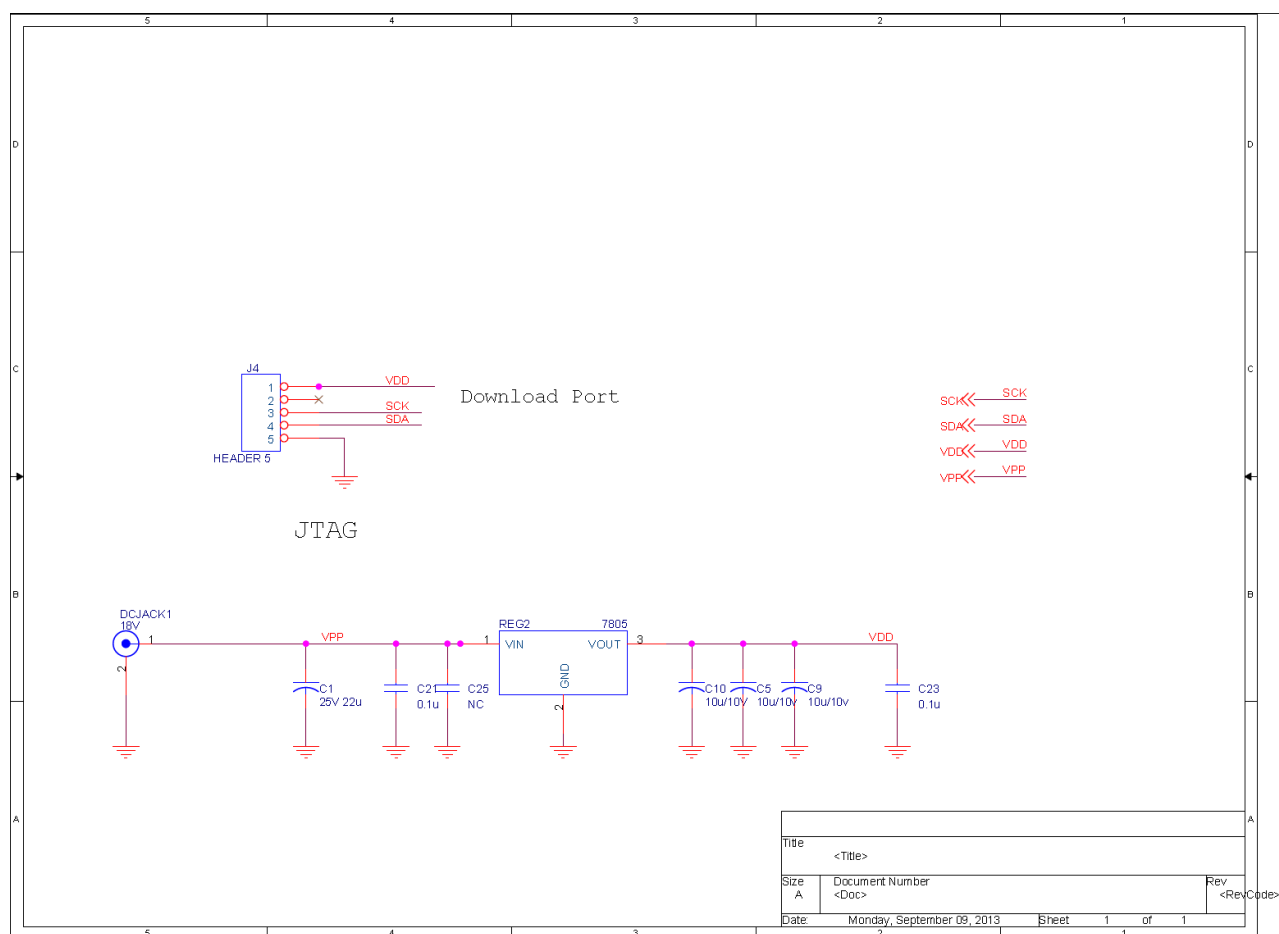
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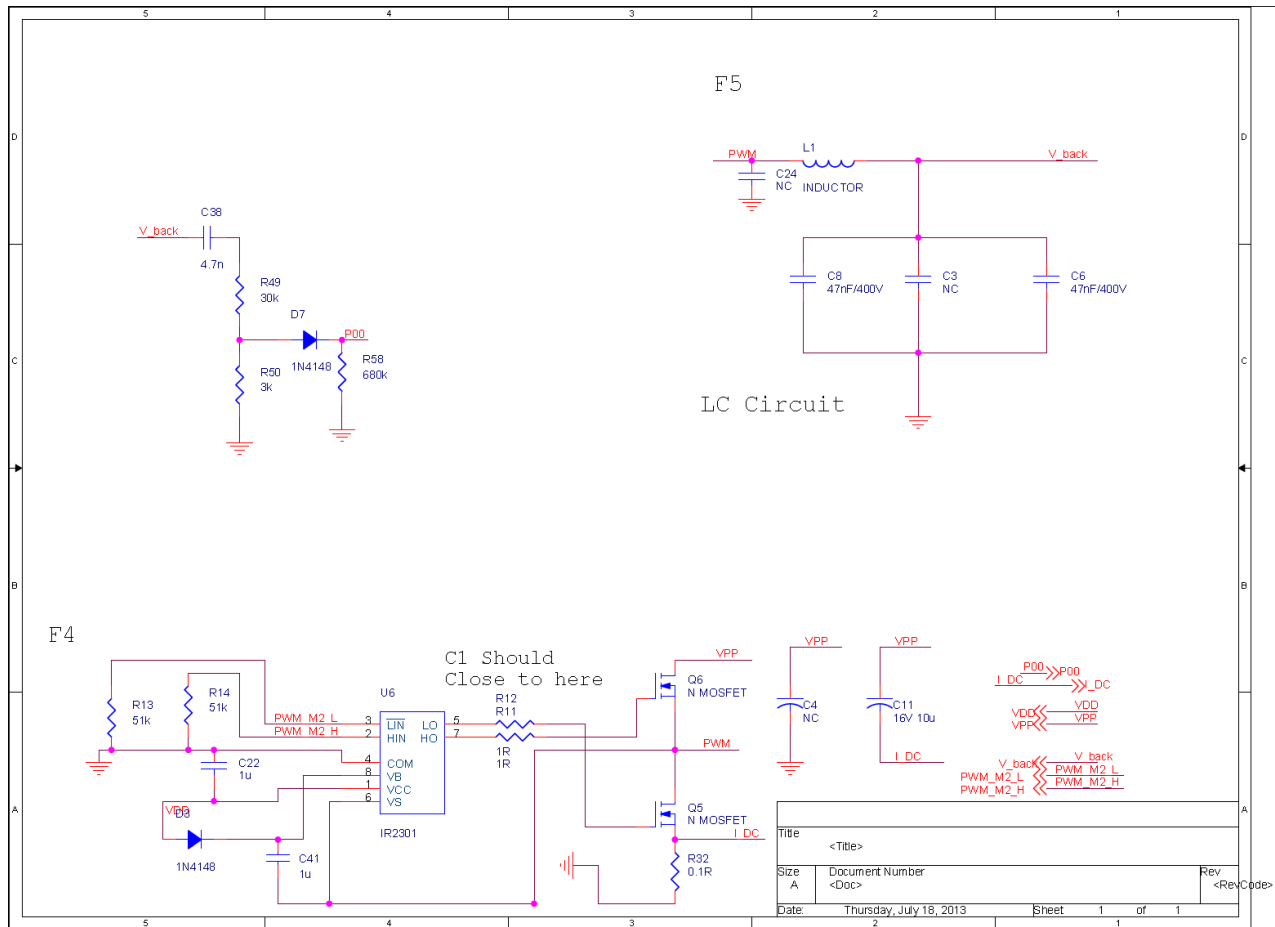
Date	Revision #	Description	Page
Jan. 06, 2016	0.4	1. Modify pin description	6,7
		2. Modify FUNCTION DESCRIPTION : Conforms to the Wireless Power Consortium (WPC) Wireless Power Transfer Transmitter V1.1.2 Specification.	3,9
		3. Modify LED Indicate description and Add P11 as AC Sound alarm	10
Feb. 07, 2014	0.3		16
May. 16, 2013	0.2	Remove BOM table and SCH	15
		Remove GPMQ8012A_3C	
OCT. 11, 2012	0.1	Original	31

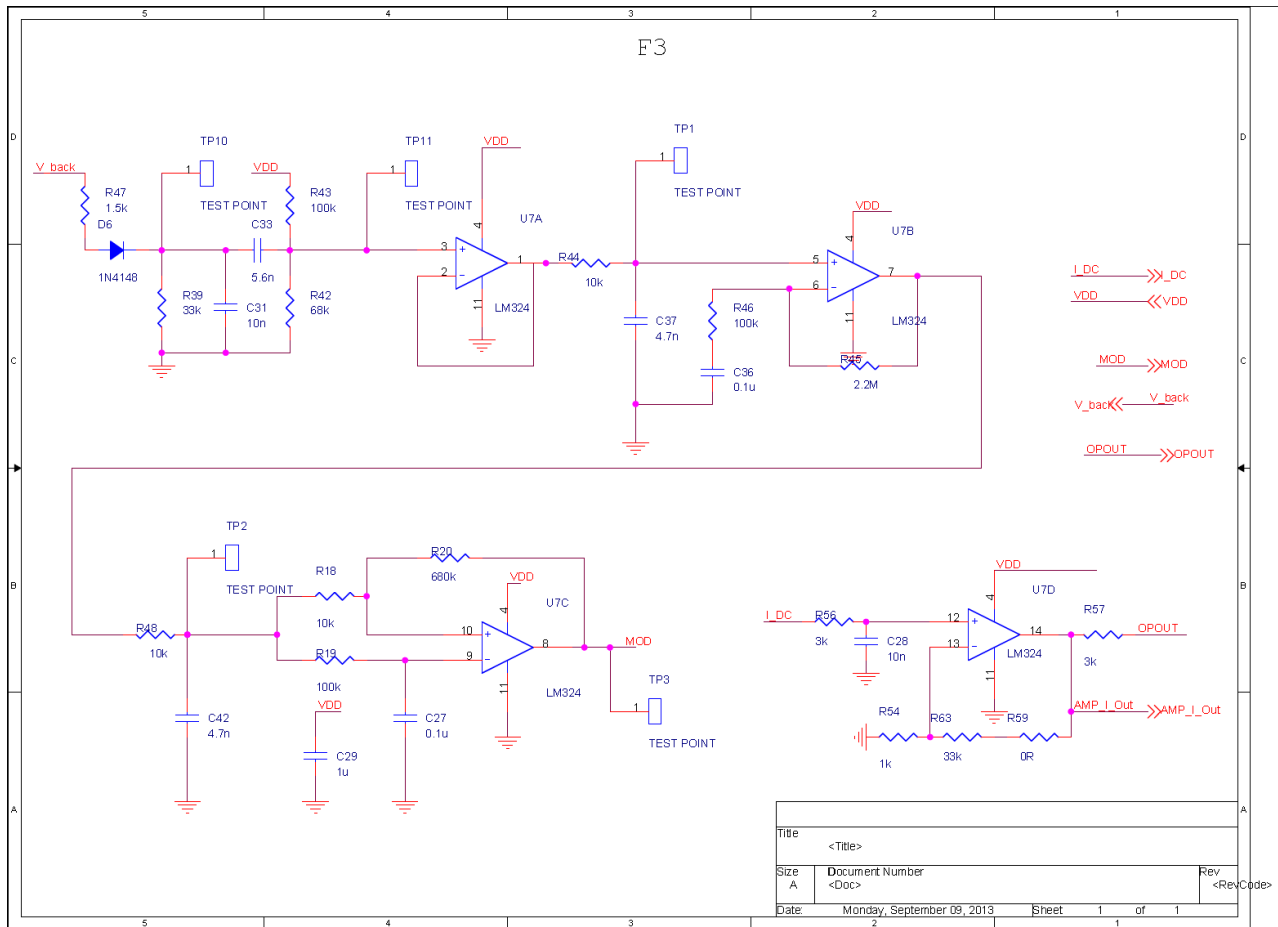
11. APPENDIX

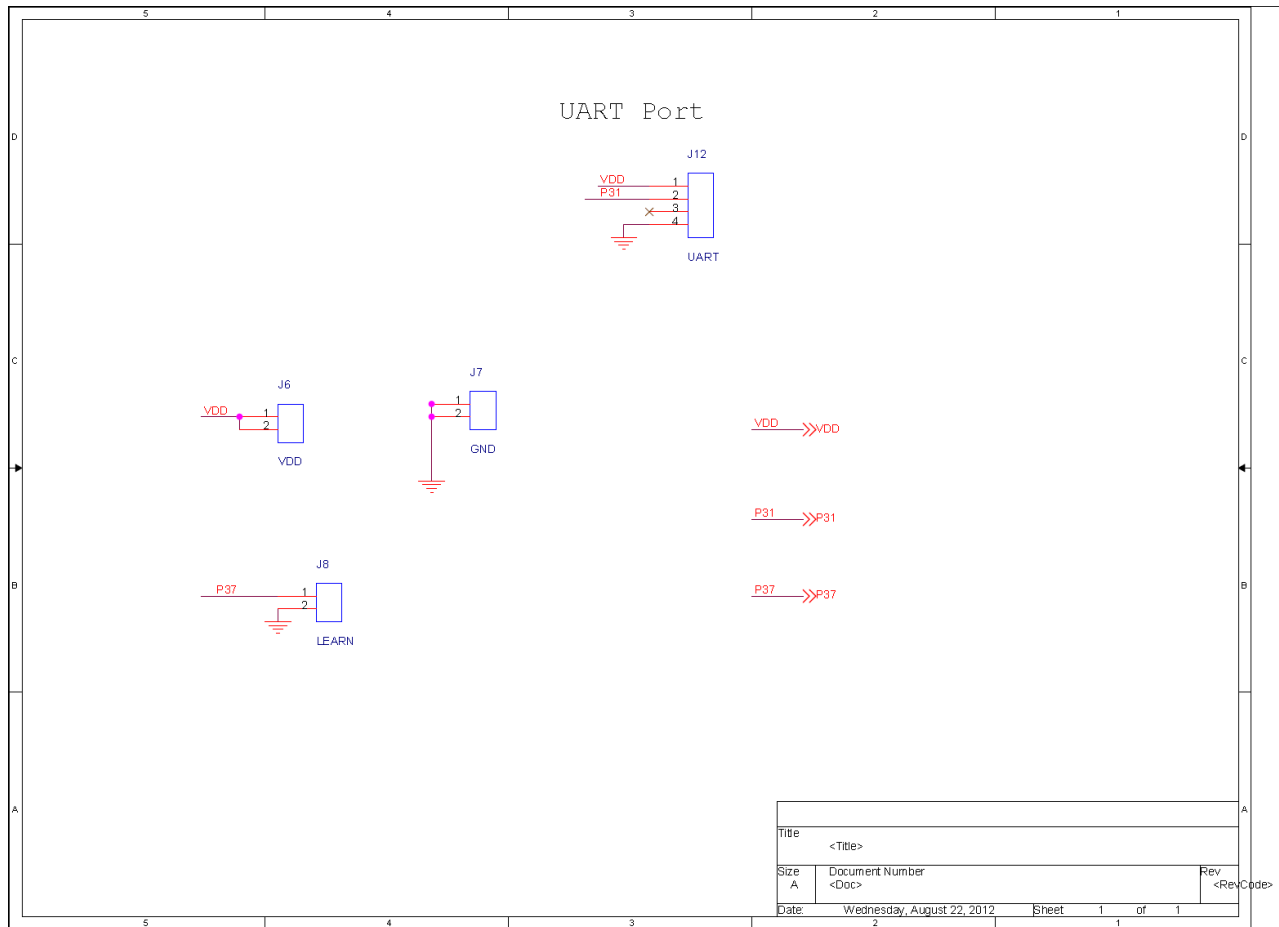
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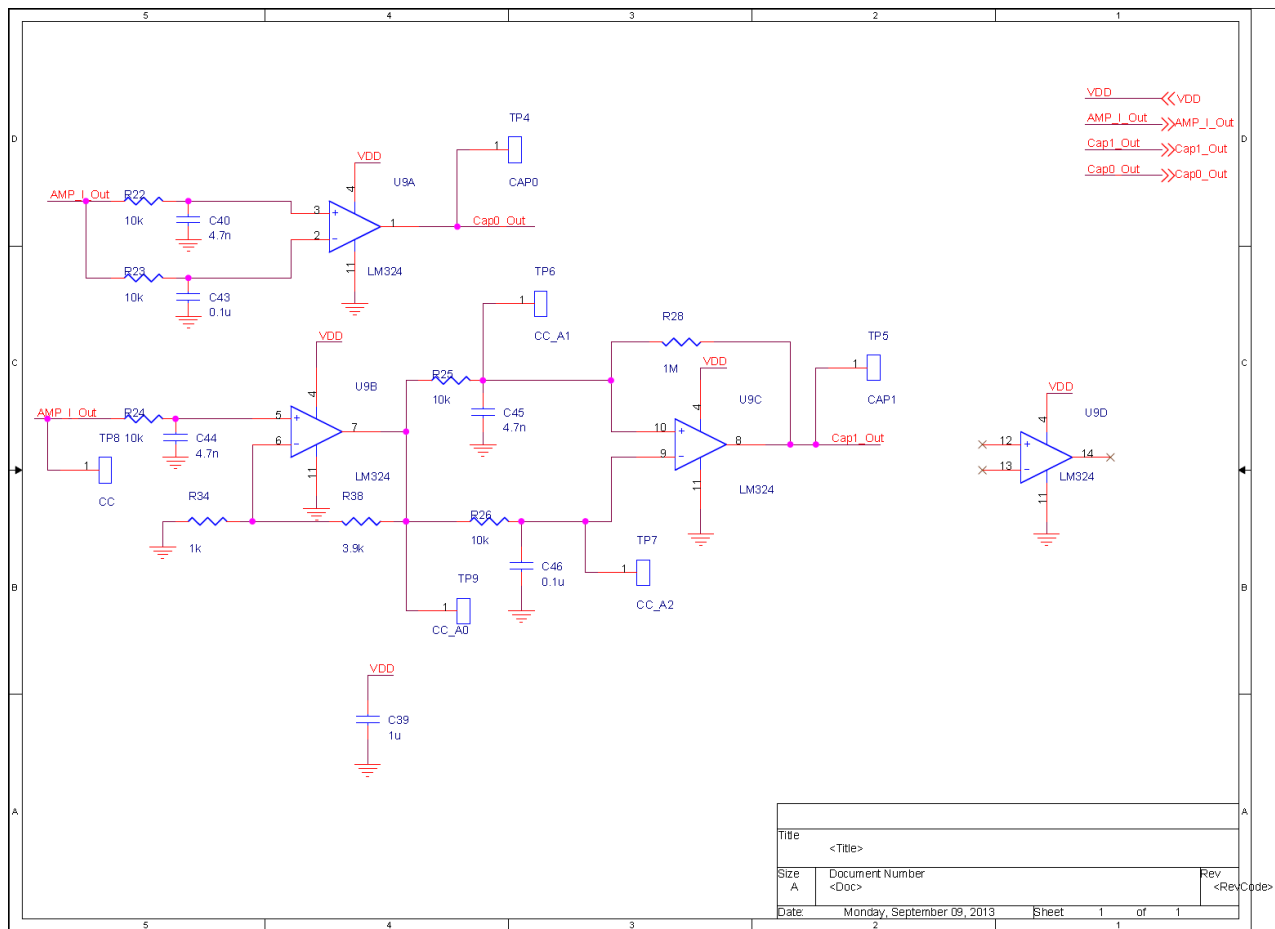




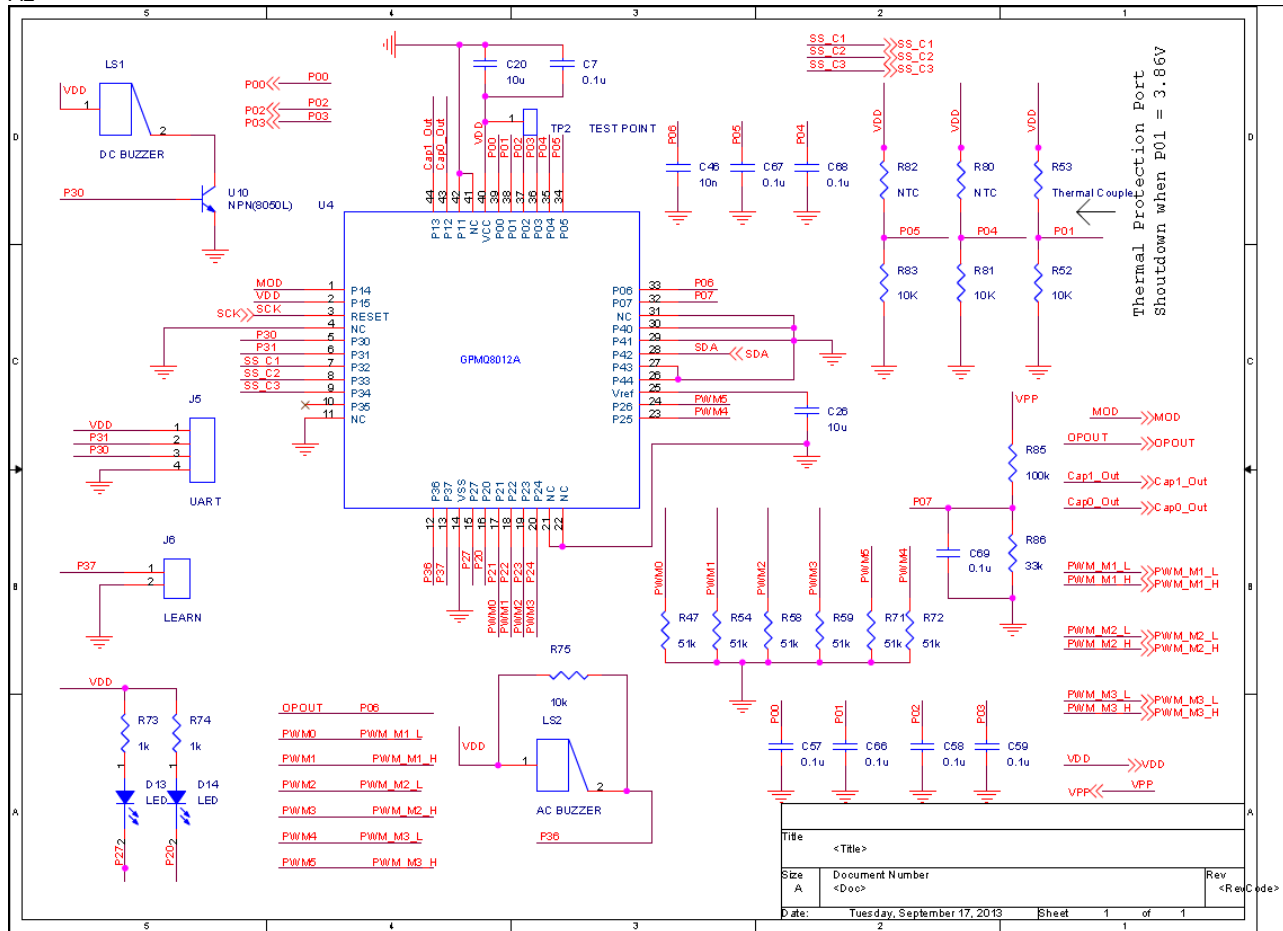


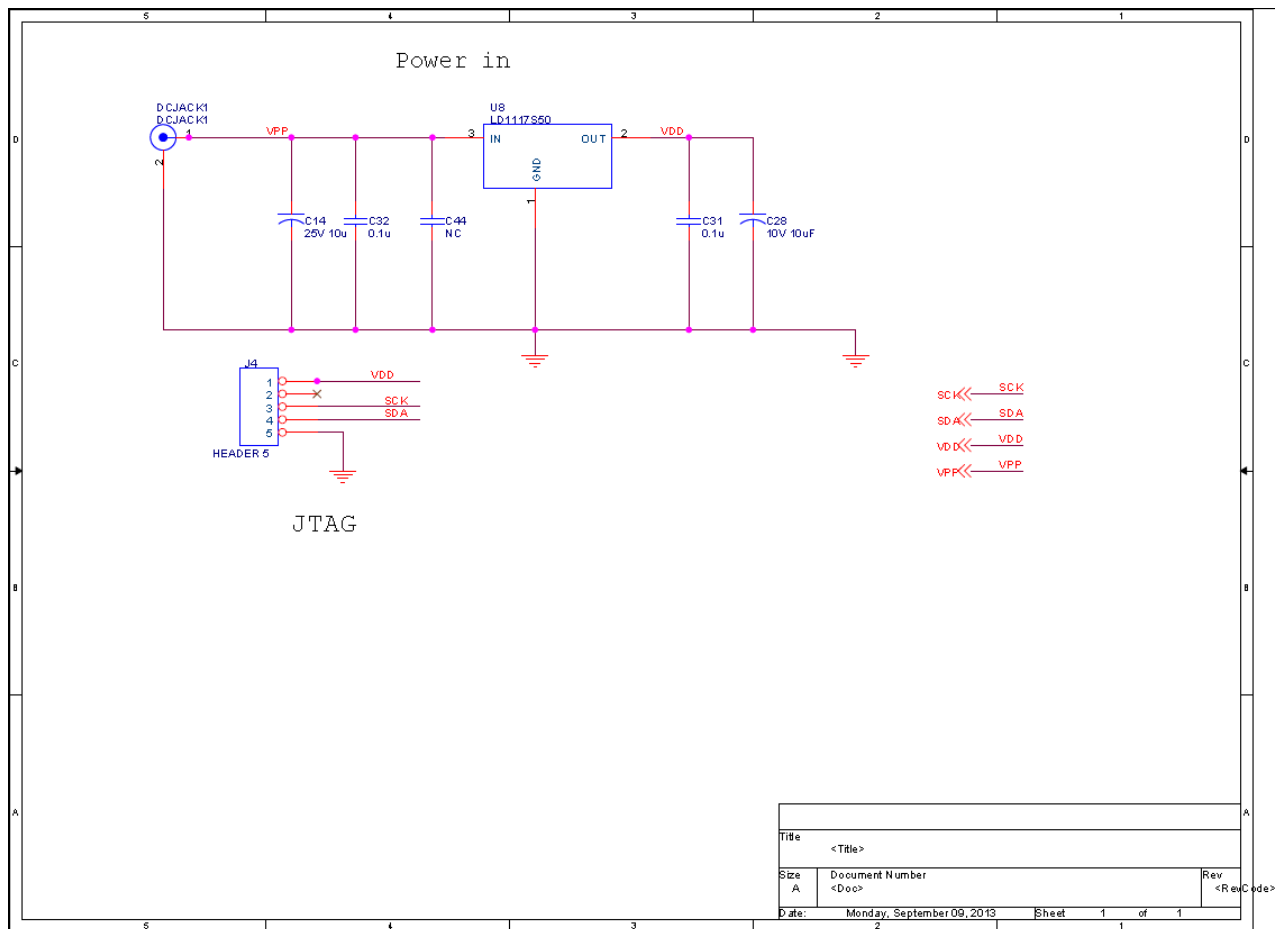


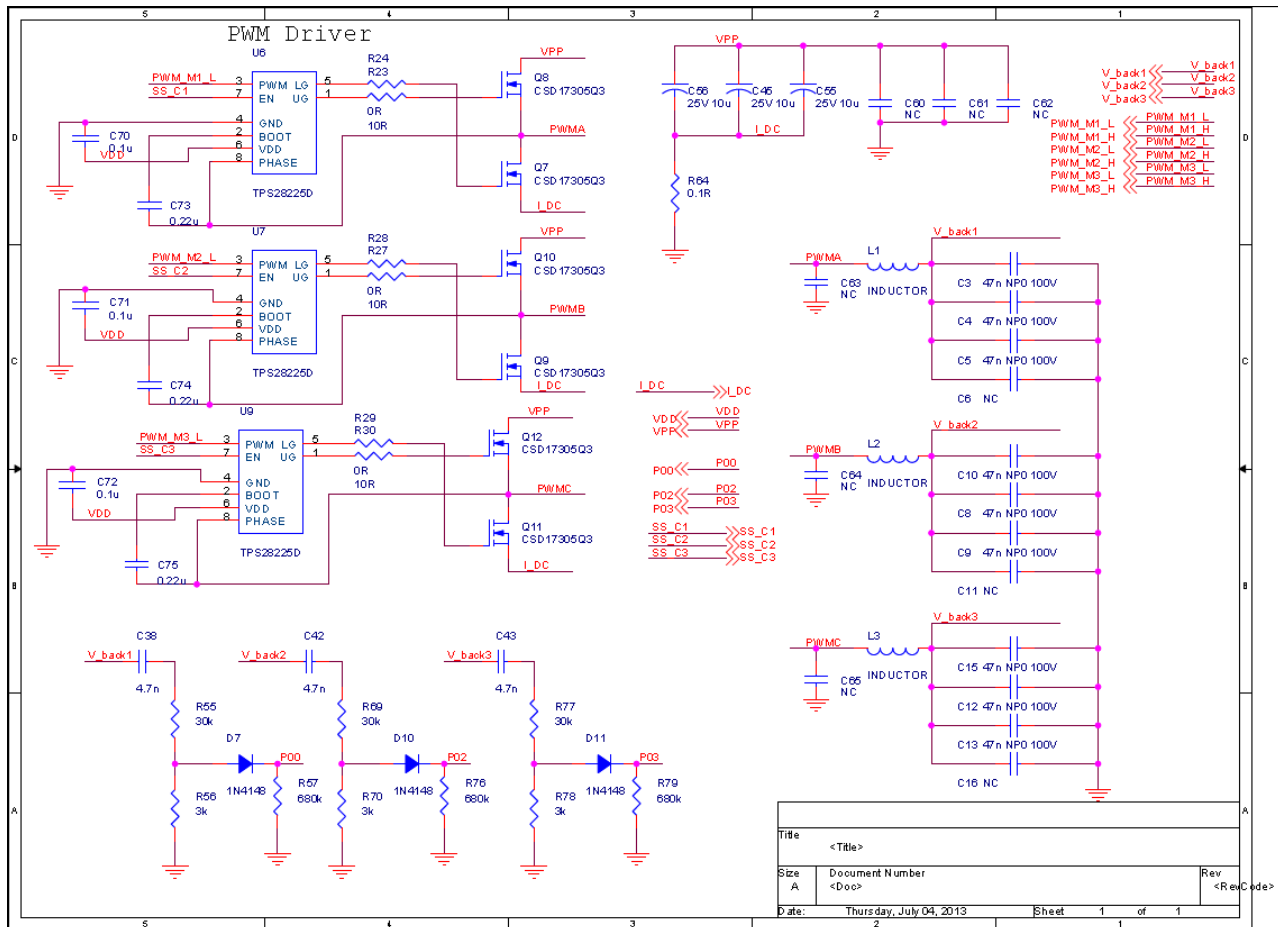


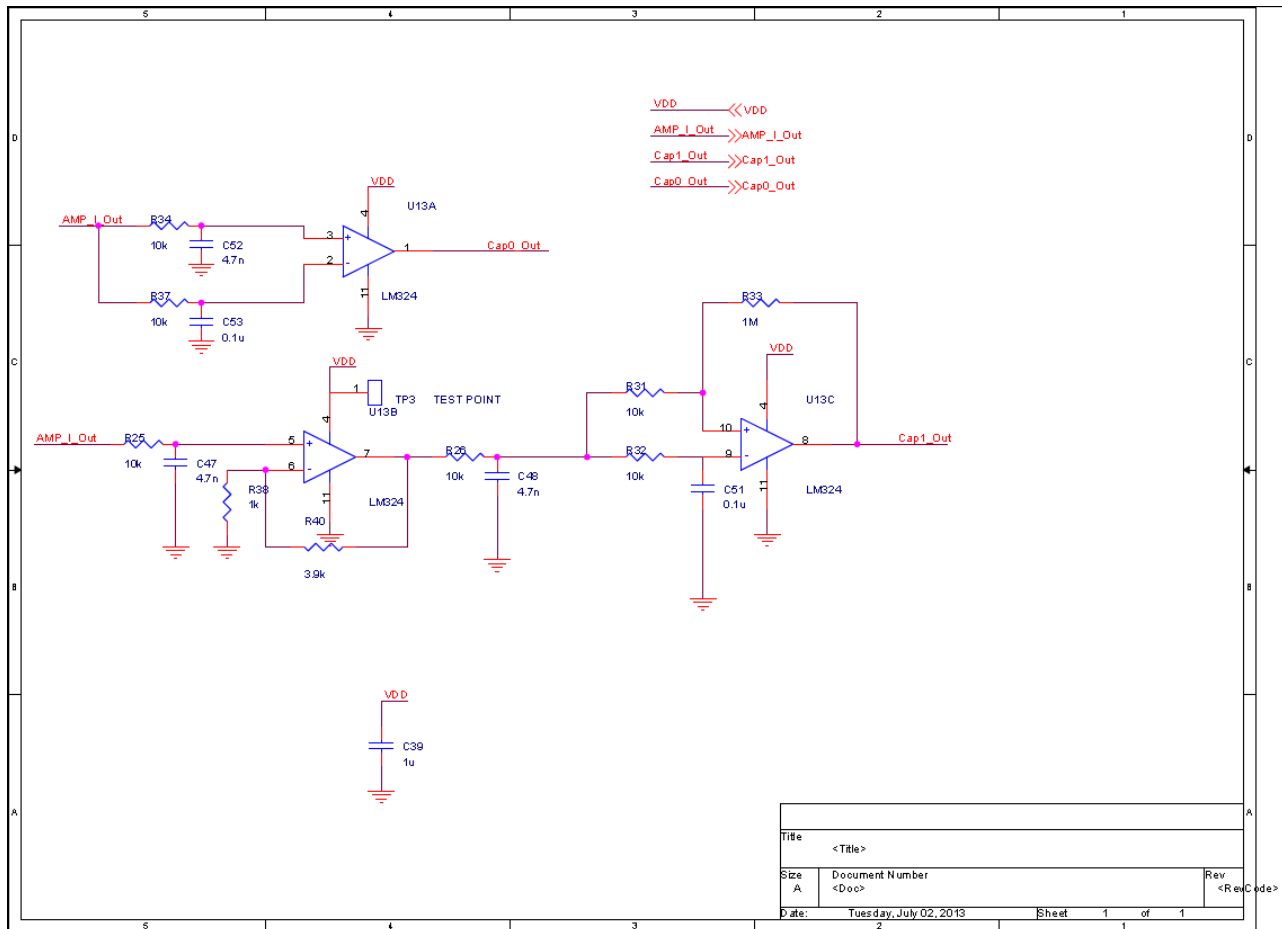


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A3

