DATA SHEET

GPMQ9019B

QI Compliant Wireless Medium Power Transmitter

SEP. 18, 2017

Version 1.1

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QI COMPLIANT WIRELESS POWER TRANSMITTER SERIES

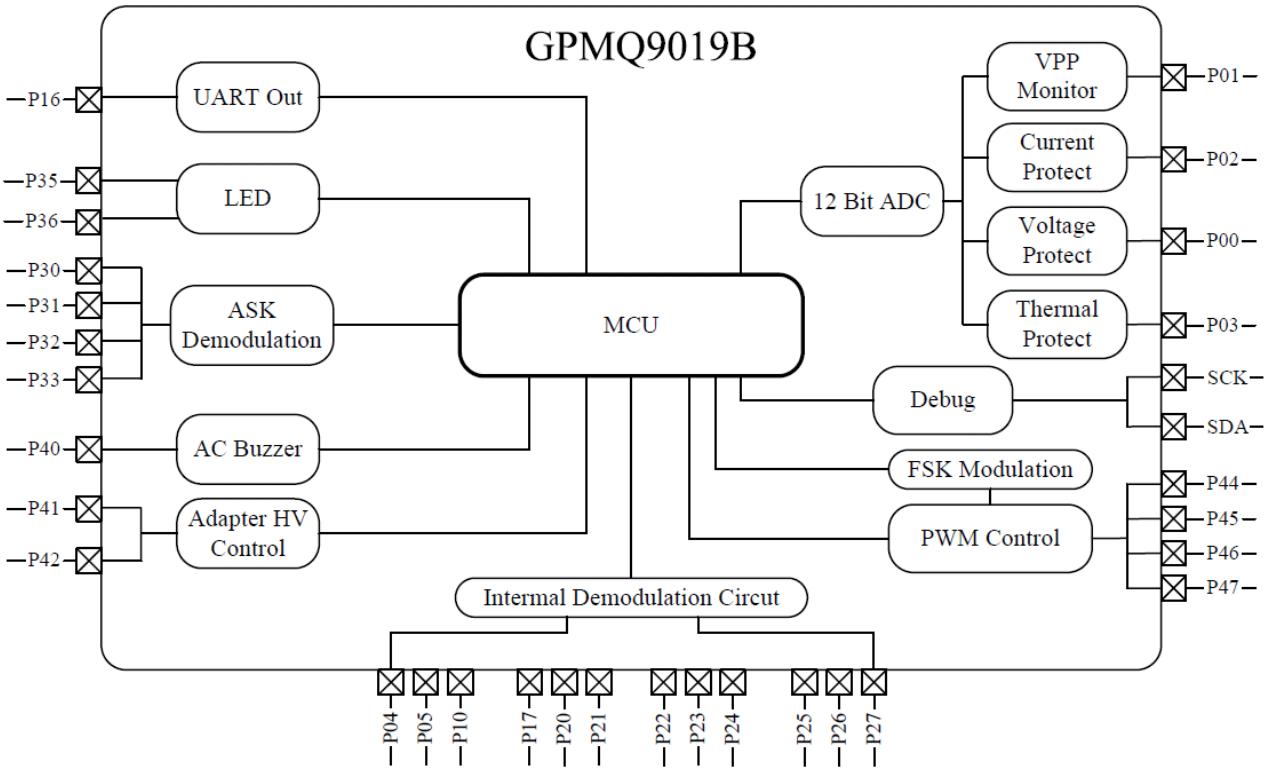
1. GENERAL DESCRIPTION

GPMQ9019B is a high-integrated solution for QI Compliant Wireless Power Transmitter. It integrates the WPC Qi standard of Version V1.2.3 and has high performance in PACKET (Signal) Demodulation. Several protection approaches are included to avoid system run into abnormal condition such as overcurrent, low voltage, thermal protection, Q-Factor protection, and offset protection. **The demodulation circuit and offset protection are under patent pending in many countries.**

2. FEATURES

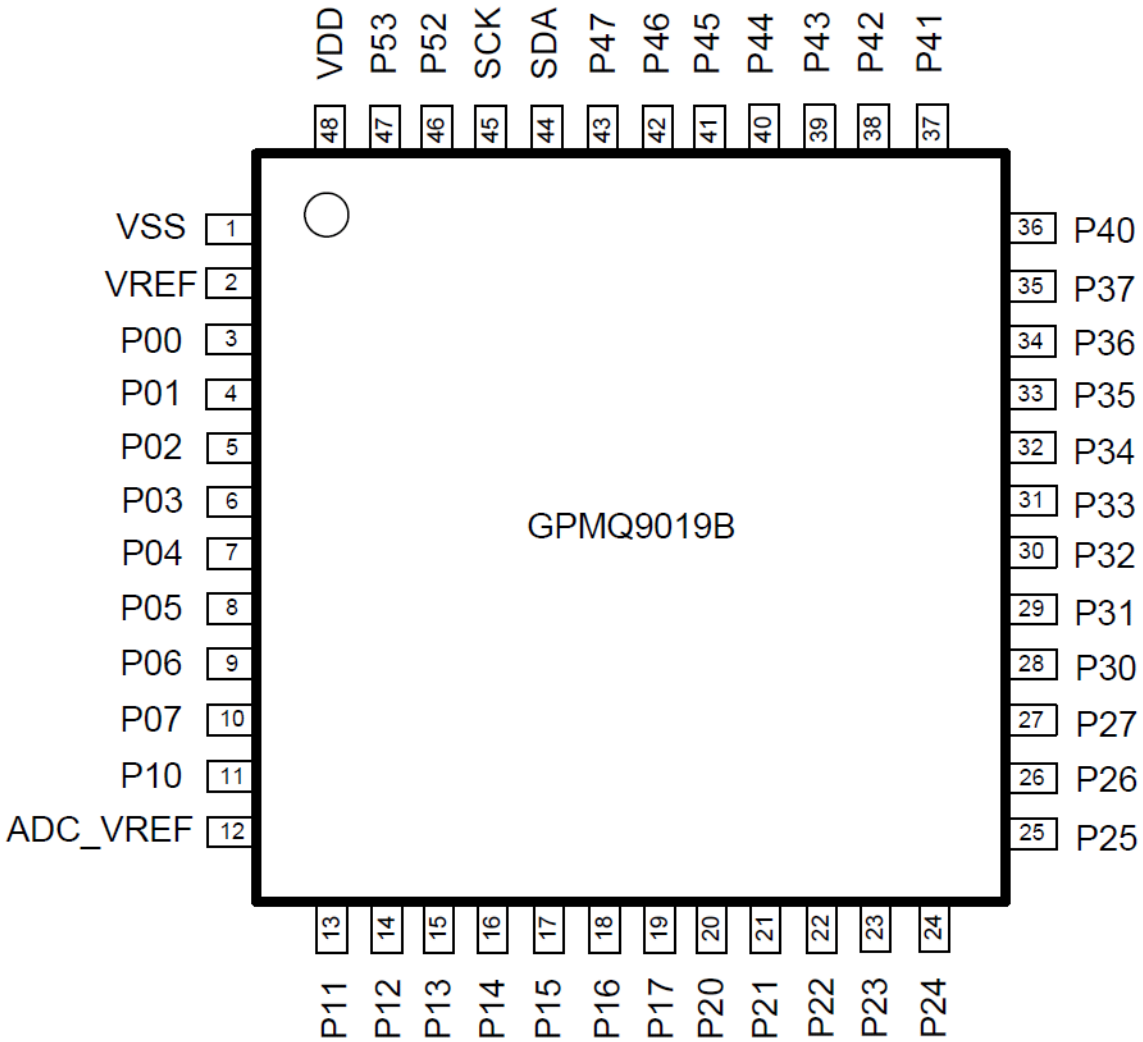
- Conforms to the Wireless Power Consortium (WPC) Wireless Middle Power Transfer Transmitter V1.2.3 Specification.
- GPMQ9019B: 12V DC supply system. Base on MP-A4 coil type, it is uses 12V DC input.
- Supports application of fast-charge adapters.
- Support Wireless fast charger.
- High performance at signal demodulation. The demodulation circuit is built in at GPMQ9019B.
- Specification of frequency modulation.
- Status Indicators for:
  - Charge completed
  - Charging
  - Error (Transmitter over current , QI standard error message)
  - Standby
- Auto detecting the object put-on and removal
- Over current protection.
- Over voltage protection.
- Over Thermal protection.
- Q-Factor protection
- Package: LQFP 48,
- Chip is 5V input.

3. BLOCK DIAGRAM



4. SIGNAL DESCRIPTIONS

LQFP48



4.1. LQFP48 Pins description

No	Name	I/O	Description
1	VSS	S	GND
2	VREF	S	VREF
3	P00	I	VDD Monitor
4	P01	I	Coil Offset Protection
5	P02	I	Current Detector
6	P03	I	Thermal Protection
7	P04	O	Internal De-modulation Circuit1
8	P05	I	Internal De-modulation Circuit1
9	P06	-	NC
10	P07	-	NC
11	P10	I	Internal De-modulation Circuit1
12	ADC_VREF	S	ADC_VREF
13	P11	-	NC
14	P12	-	NC
15	P13	-	NC
16	P14	-	NC
17	P15	-	NC
18	P16	O	UART TX for debug
19	P17	O	Internal De-modulation Circuit2
20	P20	I	Internal De-modulation Circuit2
21	P21	I	Internal De-modulation Circuit2
22	P22	O	Internal De-modulation Circuit3
23	P23	I	Internal De-modulation Circuit3
24	P24	I	Internal De-modulation Circuit3
25	P25	O	Internal De-modulation Circuit4
26	P26	I	Internal De-modulation Circuit4
27	P27	I	Internal De-modulation Circuit4
28	P30	I	Internal De-modulation0
29	P31	I	Internal De-modulation1
30	P32	I	Internal De-modulation2
31	P33	I	Internal De-modulation3
32	P34	-	NC
33	P35	O	RED LED
34	P36	O	GREEN LED
35	P37	I	MASS PRODUCTION LEARN PIN
36	P40	O	AC BUZZER
37	P41	O	Fast Charge Control Port DN
38	P42	O	Fast Charge Control Port DP
39	P43	-	NC
40	P44	O	PWM0 / PMW1_MOSFET_HIGH
41	P45	O	PWM1 / PMW1_MOSFET_LOW
42	P46	O	PMW2 / PMW2_MOSFET_LOW
43	P47	O	PWM3 / PMW2_MOSFET_HIGH
44	SDA	O	PROBE SDA FOR DEBUG

No	Name	I/O	Description
45	SCK	I	PROBE SCK FOR DEBUG
46	P52	-	NC
47	P53	-	NC
48	VDD	S	VDD

5. FUNCTIONAL DESCRIPTIONS

5.1. QI Compliant Wireless Transmitter 1.2.3 Specification.

Accord the QI standard of version 1.2.3. , QI system now supporting up to 15W.

5.2. Support Wireless Fast Charger

Some Wireless Charger Cell phone can support higher Power than 5W. GPMQ9019B also support them. You can use GPMQ9019B to charge them faster.

5.3. Strong Demodulation for QI Packet

Demodulation is very important for QI transmitter. GPMQ9019B follows the GPMQ8005B flexible process to solve this problem. They have high performance at demodulating the PACKET. This method is now patent pending in many countries. GPMQ9019B uses the same method and builds in the circuit inside. External circuits do not require OPA to increase hardware costs.

5.4. Frequency Modulation for QI Packet

QI Medium Power Two-way communication is required to confirm the transmitter version. The need to meet the receiver packet modulation packet frequency and delay, GPMQ9019B are designed in accordance with WPC specifications.

5.5. Q-Factor Protection

QI version 1.2.2 added metal foreign body measurement, in the Negotiation Phase, the abnormal RX coil is turned off, To prevent metal foreign body heating, GP design is currently only supported MP-A4 coil.

5.6. Over Voltage Protection

The system will protect and show the alarm message when the voltage pin (P01) detects the alarm voltage. System will not stop and keep the current limit charging.

Chip	Voltage Pin Protect Voltage	Unit	AC Voltage detect resister
GPMQ9019B	1.4	V	R1,R4

User can modify the Dividing resistor to modify the over voltage protection level.

5.7. Over Current Protection

The system will protect and show FOD message when the current pin (P02) detects the alarm voltage. System will not stop and keep the current limit charging.

Chip	Current Pin Protect Voltage	Unit	Current amplifier resister
GPMQ9019B	1.9	V	R11

User can modify the current amplifier resister to modify the over current protection level.

5.8. Compatible Fast Charge Adapter

GPMQ9019B uses the MP-A4 coil, input voltage setting to 12V and power control use N-MOS full bridge, but when the Adapter does not support fast charge, can still be powered using the QI V1.1.2 protocol.

5.9. LED INDICATE

LED Pin is P35 and P36. The output low sink current is 20mA.
Low(0): LED ON
High(1): LED OFF

GPMQ9019B

Condition	P36	P35	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. System stops charge and wait 5 minutes. After 5 minutes, system will restart again. After restarting for 3 times, system will stop until user removes the RX from the surface of TX.
Error	Keep OFF	Flashing	1. When the transmitter receives QI Error Code list as below. - 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	P36	P35	Description
			- Thermal Protection: If the thermal protection occurs, an error message shows up. 2. When the system receives the package, system will stop and restart again right away. After receiving 5 times of error message, system will stop until user removes the RX from the surface of TX.
FOD/USB warning	P35 ON , P36 OFF(0.5s) ➔ P35 ON , P36 OFF(0.5s) ➔Close Both(0.5s) ➔Repeating		1. USB Power not enough. 2. Foreigner Object detection. 3. Power(Current) Limit

6. Certification.

https://www.wirelesspowerconsortium.com/products/details/2211/gpmq9019b

CERTIFICATE OF REGISTRATION QI-ID 2211

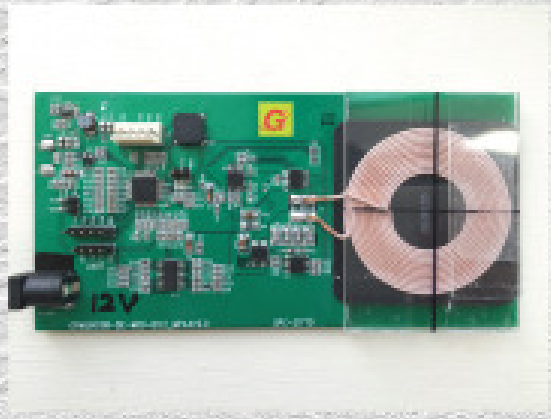
The product GPMQ9019B by Generalplus with type number GPMQ9019B is licensed to use the Qi logo on the product, on the product's packaging, and in the product's user manual.

The product passed the tests defined in the Qi wireless power specification and works correctly when used in combination with other products that are licensed to use the Qi logo.

Sep 22, 2017

Menno Treffers

Chairman



http://www.wirelesspowerconsortium.com/products/details/2211/info

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7. ELECTRICAL SPECIFICATIONS

7.1. Absolute Maximum Rating

Characteristics	Symbol	Ratings
DC Supply Voltage	V_+	-0.3V ~ 6.0V
Input Voltage Range	V_{IN}	-0.3V to V_+ + 0.3V
Operating Temperature	T_A	-40℃ to +85℃
Operation Current	Iop	10mA

7.2. DC Characteristics (TA = 25℃)

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
Operating Voltage	VDD	-	5.0	-	V	
Operating Current	I_{OP}	-	-	15.0	mA	
Standby Current	I_{STBY}	-	-	10.0	uA	
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} = -8mA at VDD = 5.0V
Output Low Level	V_{OL}	-	-	0.2VDD	V	I_{OL} = 20mA at VDD = 5.0V
Input Pull High Resistor	R_{PH1}	30	50	70	KΩ	
Input Pull Low Resistor	R_{PL1}	30	50	70	KΩ	

7.3. ADC Characteristics (TA = 25℃) 12bit

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
Operating Voltage	VDD	-	5.0	-	V	
ADC Input Voltage Range	V_{ADCIN}	0	-	VDD	V	
ADC Clock Period	T_{AD}	-	0.5	-	us	ADCLK=2MHz
Resolution			12		Bit	
No Missing Code			10		bits	
ADC Conversion Time	T_{CON}	-	4	-	us	
Integral Linearity Error	E_{INL}	-	±2	±3	LSB	
Differential Linearity Error	E_{DNL}	-	-1~+2	-1~+3	LSB	

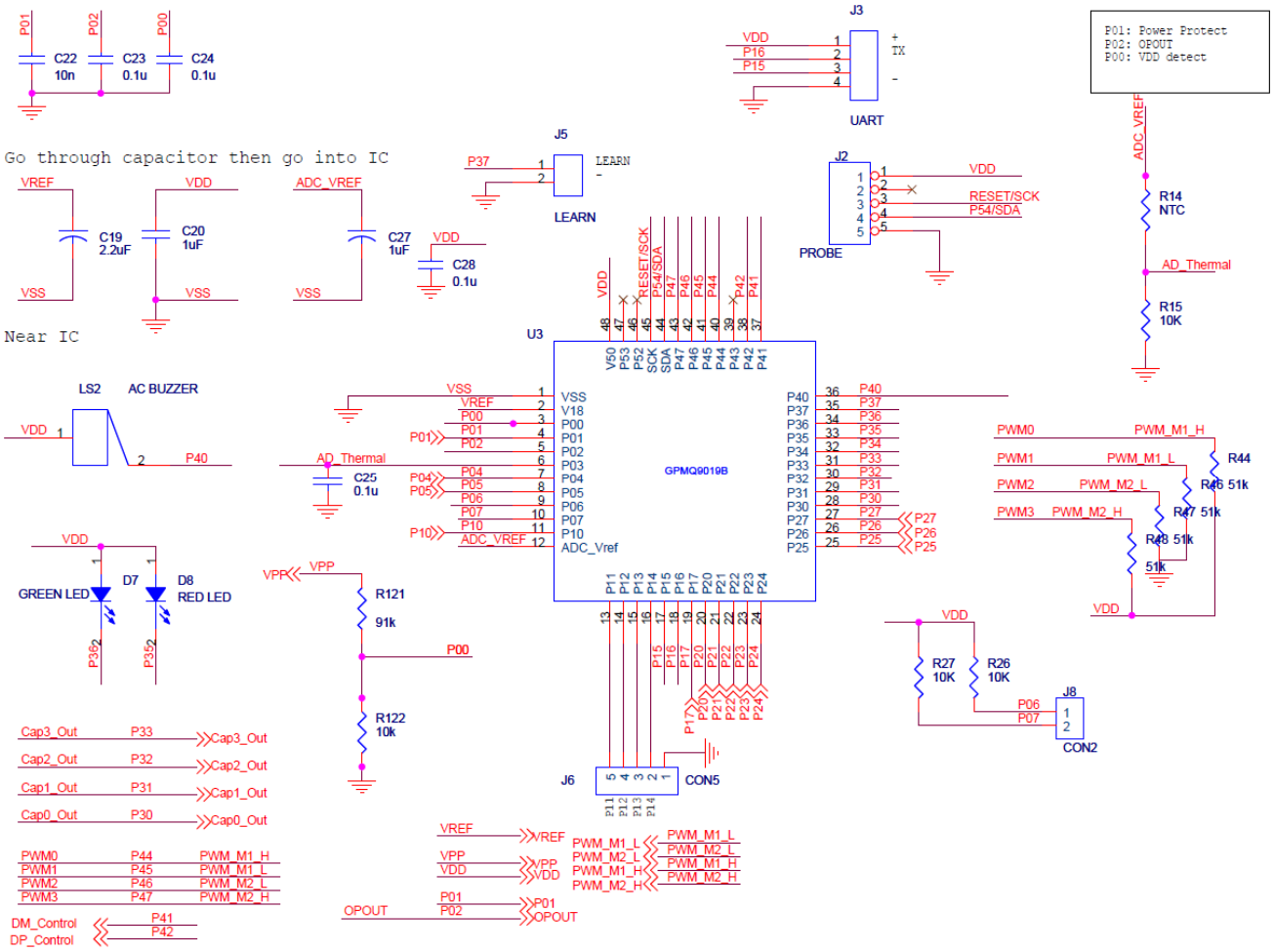
8. APPLICATION CIRCUITS

8.1. Criterion Application (LPFQ 48 Package)

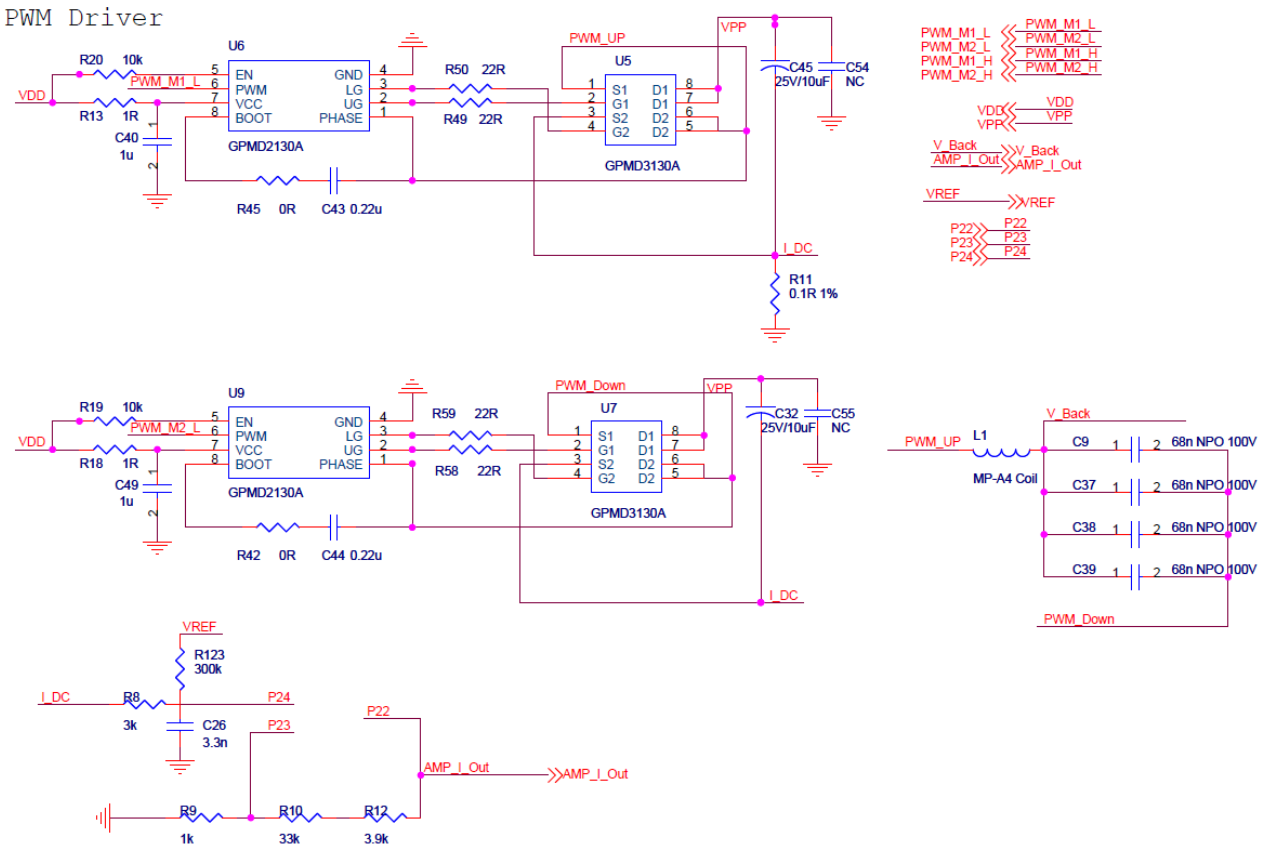
This application is a standard QI Compliant circuit, built-in LED and BUZZER supply user identification state of charge, device contains quad OPA- Amplifier with synchronous execution demodulator, get better demodulation performance.

8.1.1. Criterion for Compliant Application

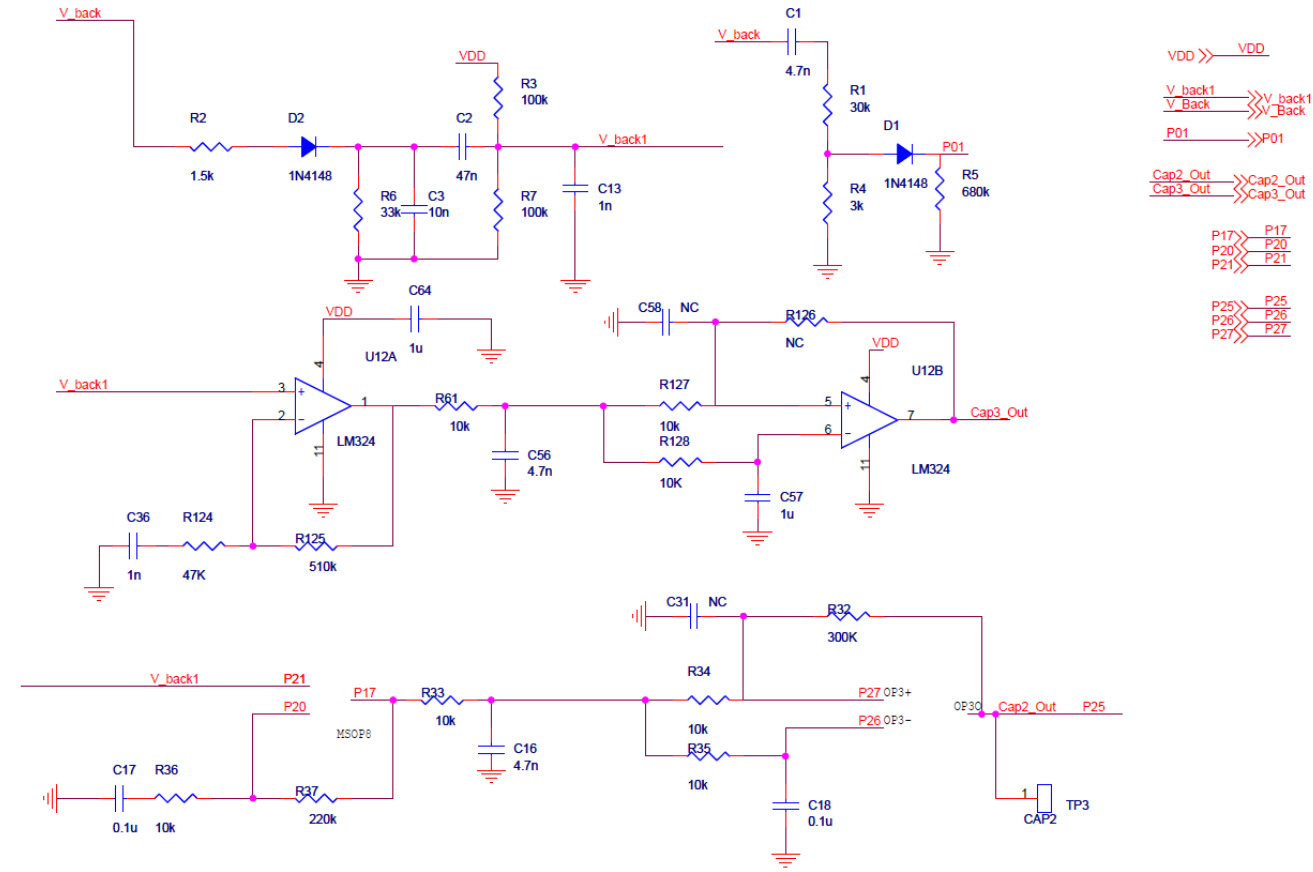
MCU



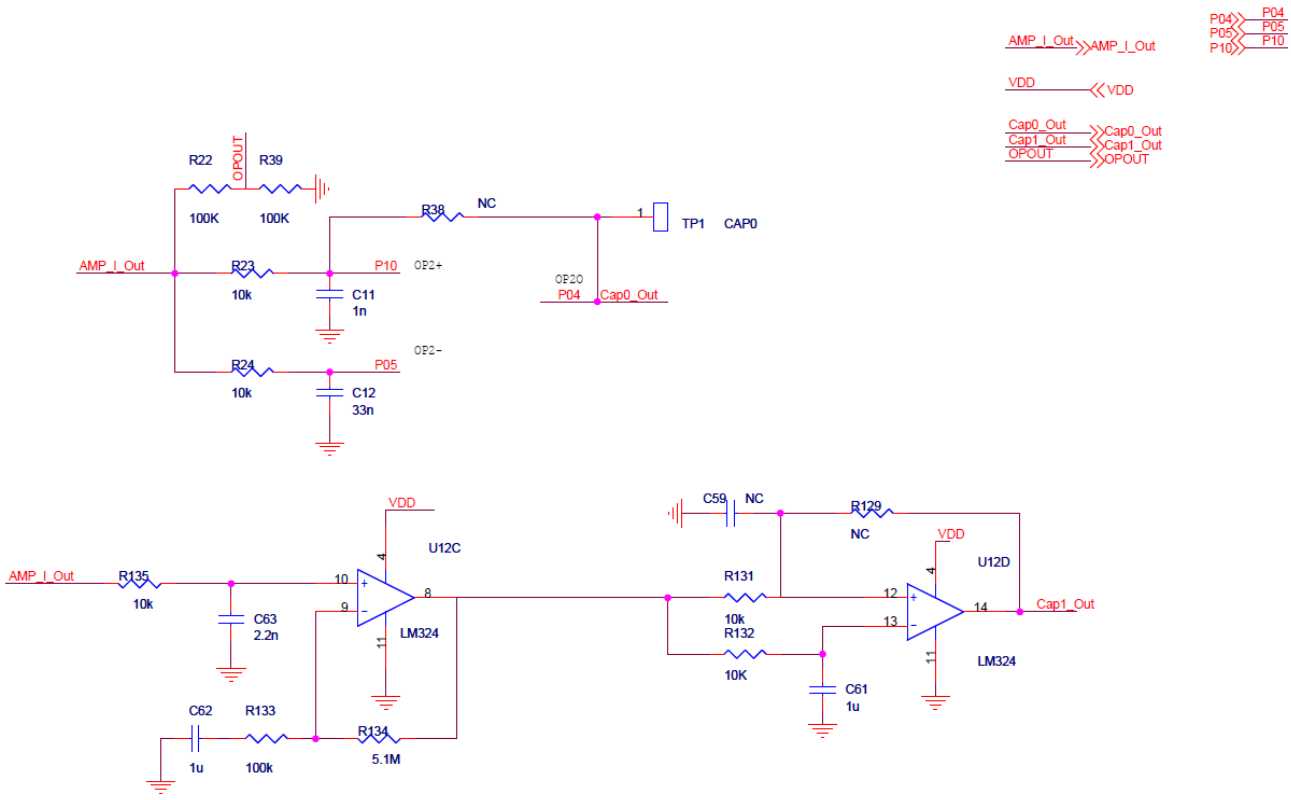
Full Bridge


PWM Driver
U6
R20 10k
VDD
PWM_M1_L
R13 1R
C40 1u
EN
PWM
VCC
BOOT
GND
LG
UG
PHASE
GPMD2130A
R45 0R
C43 0.22u
R50 22R
R49 22R
PWM_UP
U5
S1
G1
S2
G2
D1
D1
D2
D2
GPMD3130A
VPP
C45 25V/10uF
C54 NC
I_DC
R11 0.1R 1%
PWM_M1_L
PWM_M2_L
PWM_M1_H
PWM_M2_H
VDD
VPP
V_Back
AMP_I_Out
VREF
P22
P23
P24
U9
R19 10k
PWM_M2_L
R18 1R
C49 1u
R42 0R
C44 0.22u
R59 22R
R58 22R
PWM_Down
U7
C32 25V/10uF
C55 NC
PWM_UP
L1
MP-A4 Coil
C9 68n NPO 100V
C37 68n NPO 100V
C38 68n NPO 100V
C39 68n NPO 100V
R123 300k
R8 3k
C26 3.3n
R9 1k
R10 33k
R12 3.9k
AMP_I_Out

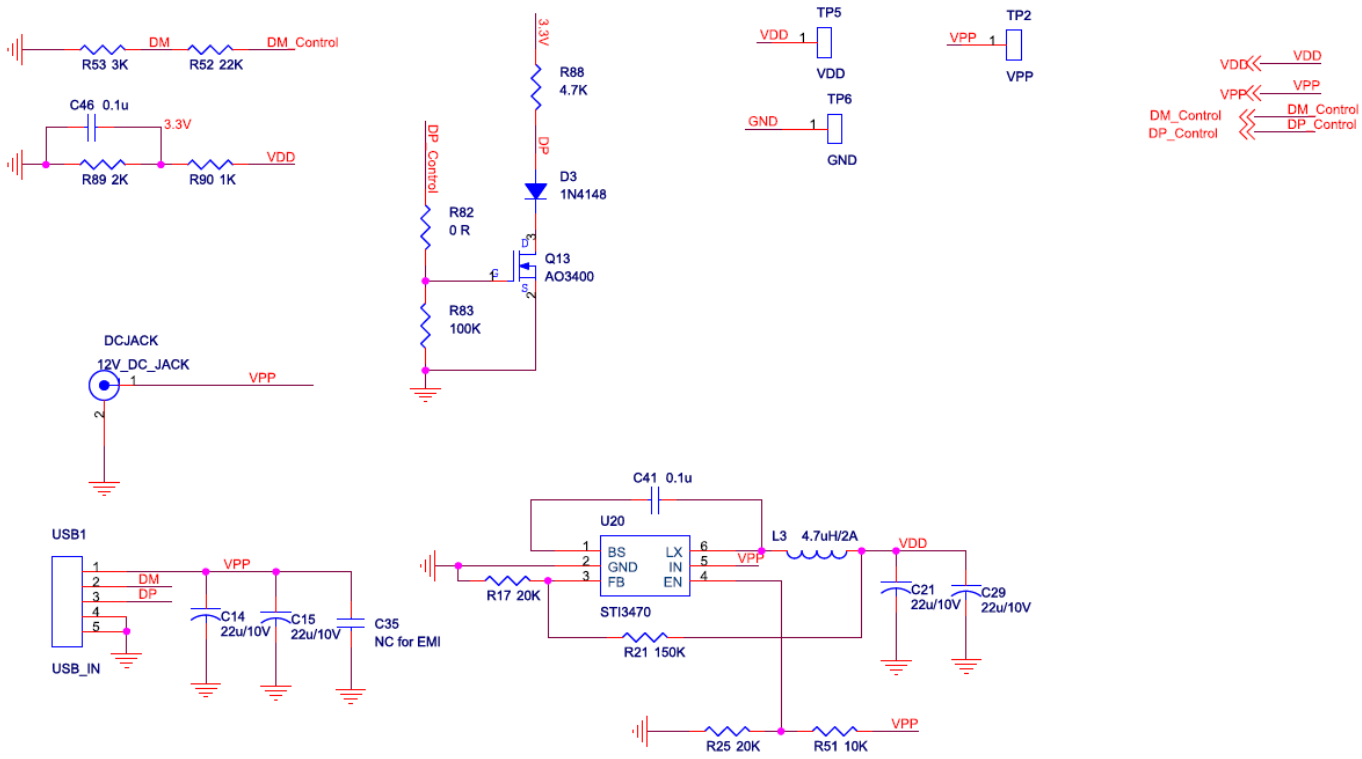
Feedback1


V_back
R2
1.5k
D2
1N4148
VDD
R3
100k
C2
47n
V_back1
R6
33k
C3
10n
R7
100k
C13
1n
C1
4.7n
R1
30k
D1
P01
R4
3k
1N4148
R5
680k
VDD
V_back1
V_Back
P01
Cap2_Out
Cap3_Out
P17
P20
P21
P25
P26
P27
C64
1u
U12A
LM324
C58
NC
R126
NC
U12B
R127
10k
R128
10K
C57
1u
Cap3_Out
C36
1n
R124
47K
R125
510k
C56
4.7n
R61
10k
C31
NC
R32
300K
R34
10k
R35
10k
C18
0.1u
P27.OP3+
P26.OP3-
OP3O
Cap2_Out
P25
TP3
CAP2
P21
P20
P17
MSOP8
R33
10k
C16
4.7n
C17
0.1u
R36
10k
R37
220k

Feedback1


AMP_I_Out
AMP_I_Out
P04
P05
P10
VDD
VDD
Cap0_Out
Cap1_Out
OPOUT
Cap0_Out
Cap1_Out
OPOUT
R22
OPOUT
R39
100K
100K
R38
NC
1
TP1
CAP0
AMP_I_Out
R23
10k
P10
OP2+
C11
1n
OP20
P04
Cap0_Out
R24
10k
P05
OP2-
C12
33n
VDD
U12C
AMP_I_Out
R135
10k
10
9
8
4
11
LM324
C63
2.2n
C62
1u
R133
100k
R134
5.1M
C59
NC
R129
NC
VDD
U12D
R131
10k
R132
10K
12
13
14
4
11
LM324
Cap1_Out
C61
1u

Power


DM
DM_Control
R53 3K
R52 22K
C46 0.1u
3.3V
VDD
R89 2K
R90 1K
3.3V
R88
4.7K
DP
D3
1N4148
DP_Control
R82
0 R
Q13
AO3400
R83
100K
TP5
VDD
VDD
TP6
GND
GND
TP2
VPP
VPP
VDD
VPP
DM_Control
DP_Control
DM_Control
DP_Control
DCJACK
12V_DC_JACK
VPP
C41 0.1u
U20
BS
GND
FB
LX
IN
EN
STI3470
L3 4.7uH/2A
VPP
VDD
R17 20K
R21 150K
C21
22u/10V
C29
22u/10V
USB1
DM
DP
VPP
C14
22u/10V
C15
22u/10V
C35
NC for EMI
USB_IN
R25 20K
R51 10K
VPP

8.1.2. BOM for Criterion Application

GPMQ9019B-DE-M00-QI1.2_MPA4V1.0

Item	Quantity	Reference	Part	PCB Footprint
1	3	C1,C16,C56	4.7n	C-0603
2	1	C2	47n	C-0603
3	2	C3,C22	10n	C-0603
4	4	C9,C37,C38,C39	68n NPO 100V	C-1210
5	3	C11,C13,C36	1n	C-0603
6	1	C12	33n	C-0603
7	4	C14,C15,C21,C29	22u/10V	C-0805
8	8	C17,C18,C23,C24,C25,C28,C41,C46	0.1u	C-0603
9	1	C19	2.2uF	C-0603
10	2	C20,C27	1uF	C-0603
11	1	C26	3.3n	C-0603
12	5	C31,C54,C55,C58,C59	NC	C-0603
13	2	C32,C45	25V/10uF	C-1210
14	1	C35	NC for EMI	C-0603
15	6	C40,C49,C57,C61,C62,C64	1u	C-0603
16	2	C43,C44	0.22u	C-0603
17	1	C63	2.2n	C-0603
18	1	DCJACK	DCJACK	DCJACK
19	3	D1,D2,D3	1N4148	D-1206
20	1	D7	GREEN LED	LED-0603
21	1	D8	RED LED	LED-0603
22	1	LS2	AC BUZZER	FMQ-SMD
23	1	L1	MP-A4 Coil	L-SMD-6.0
24	1	L3	4.7uH/2A	L-SMD-4.4
25	1	Q13	AO3400	SOT-23-1
26	1	R1	30k	R-0603
27	1	R2	1.5k	R-0805
28	6	R3,R7,R22,R39,R83,R133	100k	R-0603
29	3	R4,R8,R53	3K	R-0603
30	1	R5	680k	R-0603
31	2	R6,R10	33k	R-0603
32	2	R9,R90	1K	R-0603
33	1	R11	0.1R 1%	R-1206
34	1	R12	3.9k	R-0603
35	2	R13,R18	1R	R-0603
36	1	R14	NTC	SIP2
37	19	R15,R19,R20,R23,R24,R26,R27,R33,R34,R35,R36,R51,R61,R122,R127,R128,R131,R132,R135	10k	R-0603

38	2	R17,R25	20K	R-0603
39	1	R21	150K	R-0603
40	2	R32,R123	300k	R-0603
41	1	R37	220k	R-0603
42	3	R38,R126,R129	NC	R-0603
43	2	R42,R45	0R	R-0603
44	4	R44,R46,R47,R48	51k	R-0603
45	4	R49,R50,R58,R59	22R	R-0603
46	1	R52	22K	R-0603
47	1	R82	0 R	R-0603
48	1	R88	4.7K	R-0603
49	1	R89	2K	R-0603
50	1	R121	91k	R-0603
51	1	R124	47K	R-0603
52	1	R125	510k	R-0603
53	1	R134	5.1M	R-0603
54	1	USB1	USB_IN	USBMICRO
55	1	U3	GPMQ9019B	QFP48-0.5
56	2	U5,U7	GPMD3130A	DIP8-SOP150
57	2	U6,U9	GPMD2130A	DIP8-SOP150
58	1	U12	LM324	DIP14-SOP150
59	1	U20	STI3470	SOT-23-6

Note: (1) R11、R121、R122 demand precision resistors (1%), all resistors power& precision are standard values.

(2) Unlabeled capacitive voltage specifications 25V.

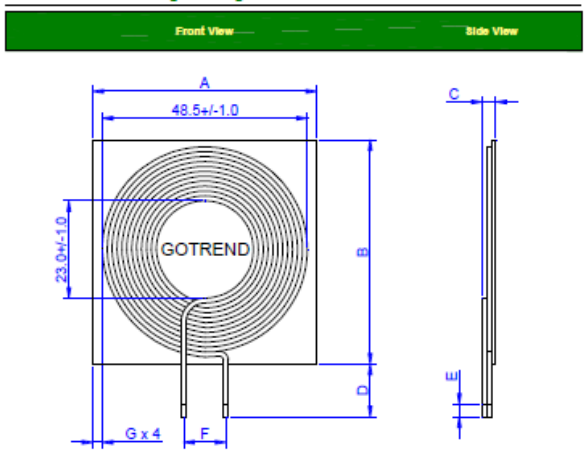
8.1.3. Coil spec for Criterion Application

Part No Example:

GW	535304	P	T	-	11	A	11	R	TN
1	2	3	4		5	6	7	8	9

1. Product Code : GW
2. Size Code : 535304 = 53.0 x 53.0 x 4.0
3. P = Pb Free < 1000ppm
4. T = Tx
5. Wire Size : 11 = 11.0 mm ..... etc.
6. Wire Count : A = Single , B = 2 Wire , C = 3 Wire ..... etc.
7. Wire Turns (Ts) : 11 = 11.0 Ts
8. Wire Color : Y = Copper Yellow , R = Copper Red
9. TN : Material Code

DIMENSION : [mm]



Size	A[+/-1.0]	B[+/-1.0]	C[Max.]	D[+/- 3.0]	E[+/-1.0]	F[+/-3.0]	G[Min.]
535304	53.0	53.0	4.0	10.0	3.0	10.0	2.0

Test Equipment :

* HP4284A , HP42841A - L , DCR

Standard Atmospheric Conditions :
Ambient Temp : 20 +/- 15°C
Relative Humidity : 65 +/- 20%
If there may be any doubt on the result,
measurement shall be made within the following limits :
Ambient Temp : 25 +/- 5°C
Relative Humidity : 75 +/- 10%

Operating & Storage Condition :

OPERATING TEMP : -25 ~ +85°C

STORAGE TEMP : -40 ~ +85°C
STORAGE LIFE TIME : 12 MONTH @25°C , RH 40~65%

Attention & Caution :

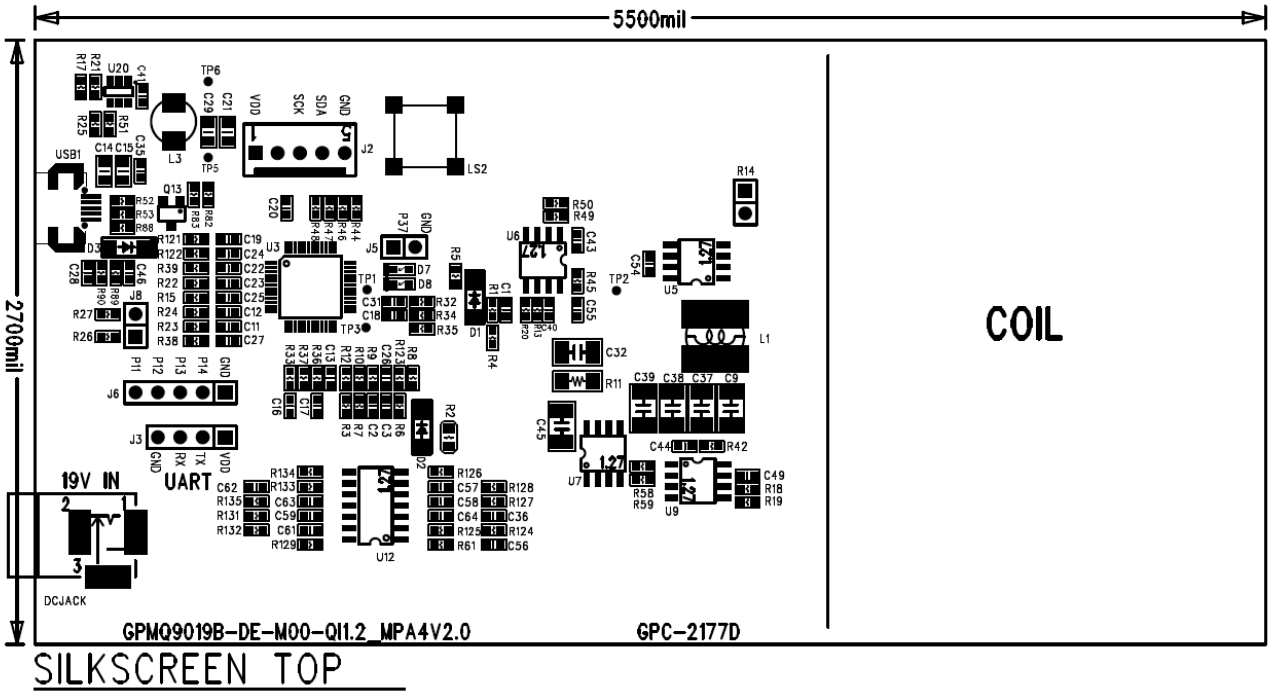
Please avoid following matters:
* Splashing water or salt water
* Toxic Gas (Hydrogen sulfide, Sulfurous acid, Chlorine, Ammonia)
* Vibrations or shocks which exceed the specified condition
* Dew condenses
* Please be careful for the stress to this product by board flexure or something after the mounting.

Electrical Characteristics :

GOTREND PN	Inductance (uH)	DCR (m Ohm)
GW535304PT-11A11RTN	8.90 +/- 10%	65.0 +/- 20%

* Inductance Test Condition@100KHz,1.0Vrms, 25°C Ambient

8.1.4. Silkscreen Layer for Criterion Application



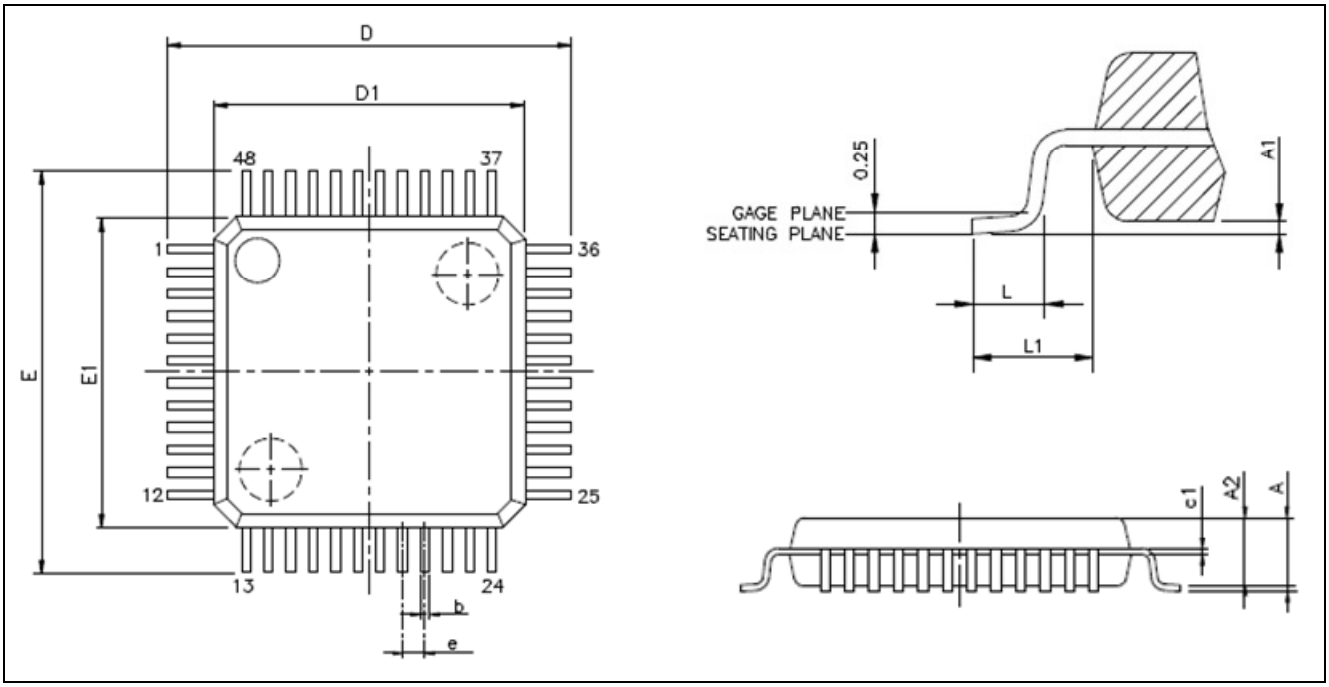
9. PACKAGE/PAD LOCATIONS

9.1. Ordering Information

Product Number	Package Type
GPMQ9019B-xxxA-QL23x	LQFP48

9.2. Package Information

9.3. LQFP 48



Symbol	Millimeter		
	Min.	Nom.	Max.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	-	1.45
c1	0.09	-	0.16
D	9.00 BSC		
D1	7.00 BSC		
E	9.00 BSC		
E1	7.00 BSC		
e	0.50 BSC		
b	0.17	-	0.27
L	0.45	-	0.75
L1	1.00 REF		

10. DISCLAIMER

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

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11. REVISION HISTORY

Date	Revision #	Description	Page
Nov. 8, 2016	1.0	Original	21
SEP. 18, 2017	1.1	Update Q-factor& four-channel demodulator function and Certification	21