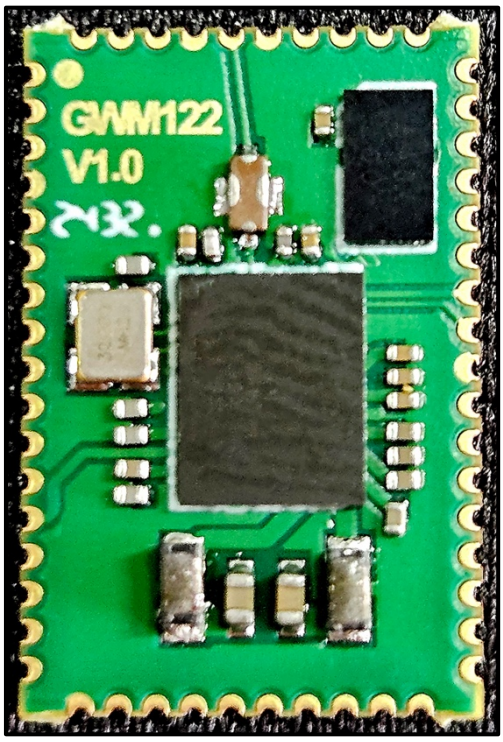
GWM122x module Specifications (ver 1.0)

1. GENERAL INTRODUCTION



GWM122x is a Bluetooth 5.4 dual-mode audio module based on the Qualcomm's latest 3071 / 5171 / 3081 / 3086 / 5181 / 3091 series chips. The module has integrated most of the peripheral components as RF filter and matching network, 32MHz Crystal, DC/DC inductor, thus make it easy to be used in the application circuit without knowing the RF design technics. It's also built-in with 64M-bit SPI Flash.

The 3071/5171/3081/3086/5181/3091 is a system on-chip (SoC) with on-chip Bluetooth, audio and programmable application processor. It includes high-performance, analog, and digital audio codecs, Class-AB and Class-D audio drivers, advanced power management, Li-ion battery charger, light-emitting diode (LED) drivers, and flexible interfaces including inter-integrated circuit sound (I^2S), inter-integrated circuit interface (I^2C), universal asynchronous receiver transmitter (UART), and programmable input/output (PIO).

The flexibility provided by the fully programmable applications processor plus the ability to configure and program the audio processors enables manufacturers to easily differentiate products with new features.

The module is driven by a flexible, software platform with powerful integrated development environment (IDE) support. This enables rapid time-to-market deployment for a broad range of consumer electronic products, including audio, wireless speaker, TWS, and broadcast audio for stereo speaker arrangements.

This is a pre-approved module. It reduces the work and cost for a range of qualifications and let our customers to delivery their products to market more efficiently.

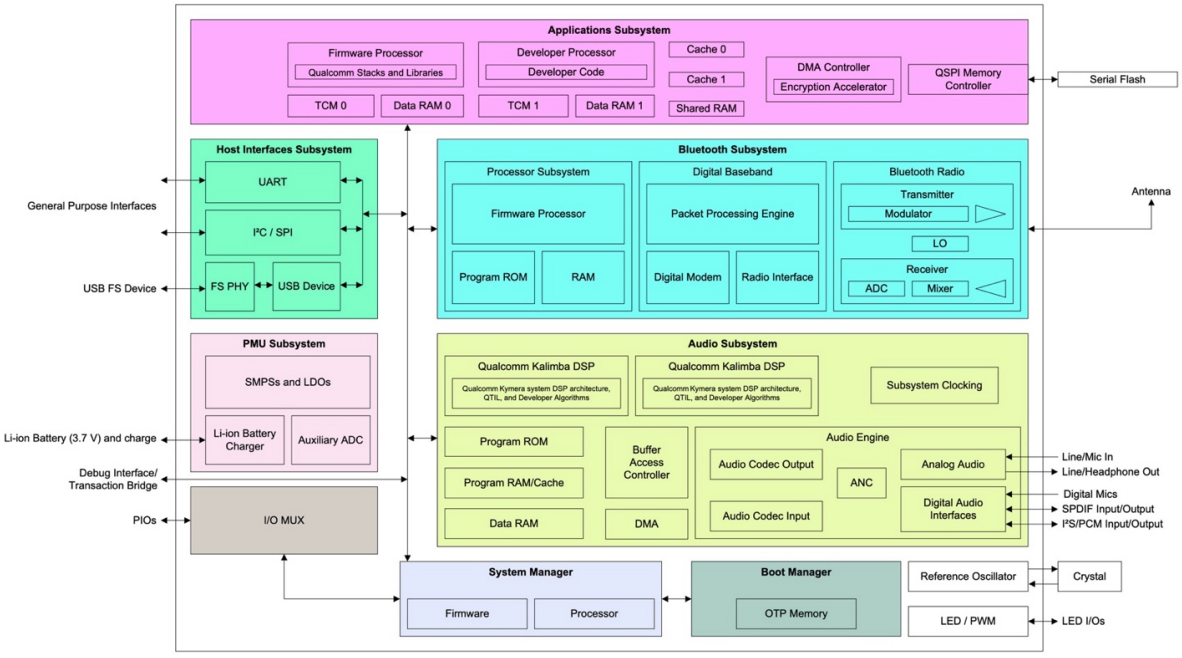
2. APPLICATIONS

- Bluetooth Speakers/Headphones
- True Wireless Stereo Earbuds/ Speakers
- Bluetooth Audio Dongles
- Bluetooth Microphone
- Bluetooth Sound-bar with wireless subwoofer

3. FEATURES

- Qualified to Bluetooth® v5.4 specification
- Dual 240 MHz Qualcomm® Kalimba™ audio DSPs
- 32/80 MHz Developer Processor for applications
- Firmware Processor for system
- Flexible QSPI flash programmable platform
- Advanced audio algorithms
- High-performance 24-bit stereo audio interface
- Digital and analog microphone interfaces
- Active Noise Cancellation: Feedforward, Feedback or Hybrid
- Qualcomm® aptX™ and aptX HD Audio
- aptX Adaptive, enabled using license key
- Serial interfaces: UART, Bit Serializer (I²C/SPI), USB 2.0
- Integrated PMU: Dual SMPS for system/digital circuits, Integrated Li-ion battery Charger
- 22 PIOs, 4 LED pads with PWM
- 4.93 3.936 0.57mm small size design with RF shielding can

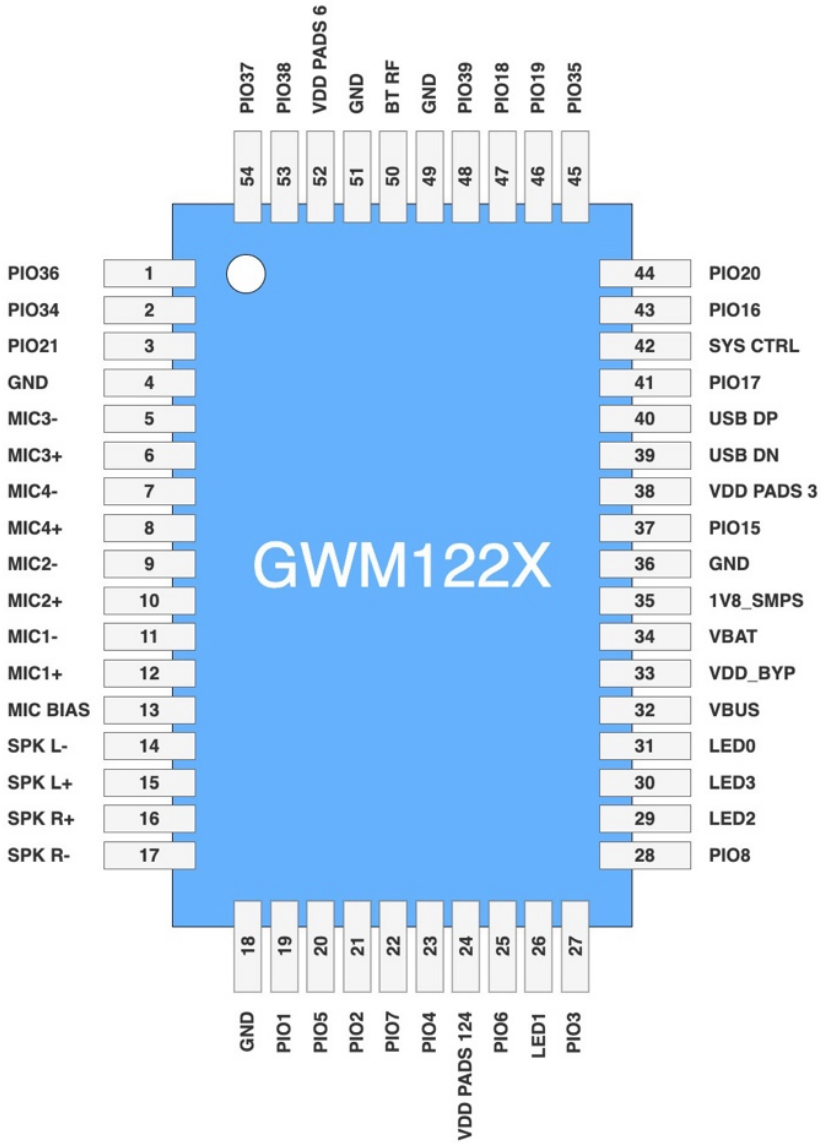
4. BLOCK DIAGRAM



5. TECHNICAL SPCIFICATIONS

Category	Description	Typical
General	VBUS	+5 V
	VBAT	+2.8 V ~ 4.6 V DC
	Antenna	External. (Optional PCB or i-pex for external)
	Digital I/O	UART / USB / SPI / I2C / GPIO / PWM /I2S / SPDIF
	Physical Size	4.930mm * 3.936mm * 0.57mm
	Operation temperature	-40~ +85 °C
Power Consumption	Power Off	2 uA
	500 ms Bluetooth Sniff, four slot no retries, AFH on, Sink App running, Audio off	0.57mA
	A2DP, SBC, EDR2, Headset	5.06 mA
	Qualcomm TrueWireless Mirroring,1 A-Mic Wide Band (SBC) Headset LP DAC 2EV3 SCO, cVc Passthrough	6.03 mA
Bluetooth	Bluetooth Version	Bluetooth V5.4
RF	Frequency Band	2.4GHz ISM (2.402 – 2.480GHz)
	Modulation Method	GFSK, PI/4 DQPSK, 8 DPSK
	Maximum Data Rate	6Mbps
	TX Power	+10 dBm, Class 1
	RX Sensitivity	-96.5 dBm
	RF Range (indoor)	10m
Audio	ADC General	Channels: Stereo
		Bit-depth: 24bit
		Sample rate: 44.1 / 48 / 88.2 / 96 KHz
	ADC Single-ended	SNR: 99.4dB
		Dynamic Range: 99.8dB
		THD+N: -91.9dB
	ADC Differential	SNR: 99 dB
		Dynamic Range: 99.7dB
		THD+N: -94.9dB
	DAC General	Channels: Stereo
		Bit-depth: 24bit
		Sample rate: 44.1 / 48 / 88.2 / 96 / 176.4 /192 / 384 kHz
	DAC Class-D Mode	SNR: 105.1 dB
		Dynamic Range: 101.4dB
		THD+N: -88.1 dB
	DAC Class-AB Mode	SNR: 104.7 dB
		Dynamic Range: 105dB
		THD+N: -93.3 dB
	I2S interface	24bit I2S,
		1 input channels
		3 output channels
	SPDIF	2 configurable as input or output
	Frequency Response	20~20KHz

6. PIN ASSIGNMENT

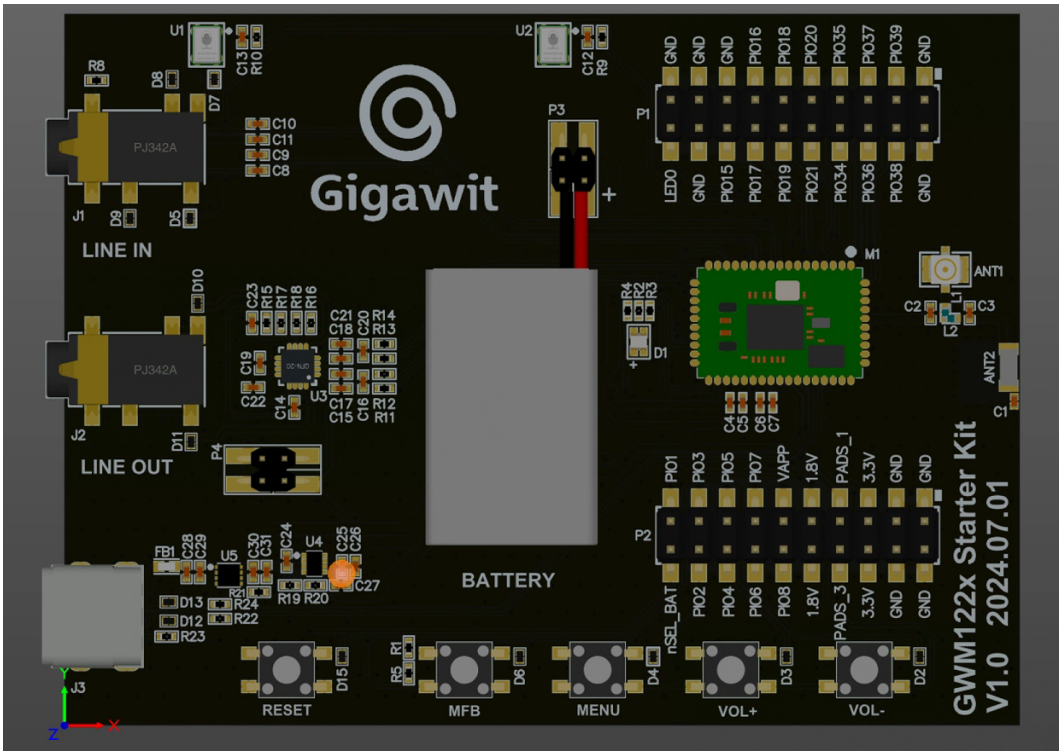


Pin#	Pin name	Pin Type	Description
1	PIO36	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 36. Alternative function: QSPI2_IO[2]
2	PIO34	Digital: Bidirectional with programmable strength internal pull-up/pull-dow	Programmable I/O line 34. Alternative function: QSPI2_IO[0]
3	PIO21	Digital: Bidirectional with programmable strength internal pull-up/pull-dow	Programmable I/O line 18. Alternative function: PCM_DOUT[2]
4	GND	Ground	Ground
5	MIC3-	Analog	Microphone differential 3 input, negative. Alternative function: Differential audio line input left, negative.
6	MIC3+	Analog	Microphone differential 3 input, positive. Alternative function: Differential audio line input right, positive.
7	MIC4-	Analog	Microphone differential 4 input, negative. Alternative function: Differential audio line input left, negative.
8	MIC4+	Analog	Microphone differential 4 input, positive. Alternative function: Differential audio line input right, positive.
9	MIC2-	Analog	Microphone differential 2 input, negative. Alternative function: Differential audio line input left, negative.
10	MIC2+	Analog	Microphone differential 2 input, positive. Alternative function: Differential audio line input right, positive.
11	MIC1-	Analog	Microphone differential 1 input, negative. Alternative function: Differential audio line input left, negative.
12	MIC1+	Analog	Microphone differential 1 input, positive. Alternative function: Differential audio line input right, positive.
13	MIC_BIAS	Analog	Mic bias output.
14	SPK_L-	Analog Output	Headphone/speaker differential left output, negative. Alternative function: Differential left line output, negative.
15	SPK_L+	Analog Output	Headphone/speaker differential left output, positive. Alternative function: Differential left line output, positive.
16	SPK_R+	Analog Output	Headphone/speaker differential right output, positive. Alternative function: Differential right line output, positive.
17	SPK_R-	Analog Output	Headphone/speaker differential right output, negative. Alternative function: Differential right line output, negative.
18	GND	Ground	Ground
19	PIO1	Digital: Bidirectional with	Automatically defaults to RESET# mode when the device is unpowered, or in off modes. Reconfigurable as a PIO after boot. Alternative function: Programmable I/O line 1
20	PIO5	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 5. Alternative function: TBR_MISO[1]
21	PIO2	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 2. Alternative function: TBR_MISO[3]

22	PIO4	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 4. Alternative function: TBR_MOSI[1]
23	PIO7	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 5. Alternative function: TBR_MISO[0]
24	VDD_PADS_1	Supply	1.8 V/3.3 V PIO supply.
25	AIO[1]/ LED[1]	Analog or digital input/ open drain output.	General-purpose analog/digital input or open drain LED output.
26	PIO6	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 6. Alternative function: TBR_MISO[0]
27	PIO3	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 3. Alternative function: TBR_MISO[0]
28	PIO8	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 8. Alternative function: TBR_CLK
29	AIO[2]/ LED[2]	Analog or digital input/ open drain output.	General-purpose analog/digital input or open drain LED output.
30	AIO[3]/ LED[3]	Analog or digital input/ open drain output.	General-purpose analog/digital input or open drain LED output.
31	AIO[0]/ LED[0]	Analog or digital input/ open drain output.	General-purpose analog/digital input or open drain LED output.
32	VBUS	Power input	Power input of module
33	VDD_BYP	Power output	Power output of module(3.3v)
34	VBAT	Power input	Power input of module
35	1V8_SMPS	Power output	Inductor connection for 1.8 VSMPS.
36	GND	Ground	Ground
37	PIO15	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 15. Alternative function: MCLK_OUT
38	VDD_PADS3	Supply	1.8 V/3.3 V PIO supply.
39	USB_DN	Digital I/O	USB Full Speed device D- I/O. IEC-61000-4-2 (device level) ESD Protection
40	USB_DP	Digital I/O	USB Full Speed device D+ I/O. IEC-61000-4-2 (device level) ESD Protection
41	PIO17	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 17. Alternative function: PCM_SYNC
42	SYS_CTRL	Digital input	Typically connected to an ON/OFF push button. If power is present from the battery and/or charger, and software has placed the device in the OFF or DORMANT state, a button press boots the device. Also usable as a digital input in normal operation. No pull. Additional function: PIO[0] input only
43	PIO16	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 16. Alternative function: PCM_CLK
44	PIO20	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 20. Alternative function: PCM_DOUT[1]
45	PIO35	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 35. Alternative function: QSPI2_CLK

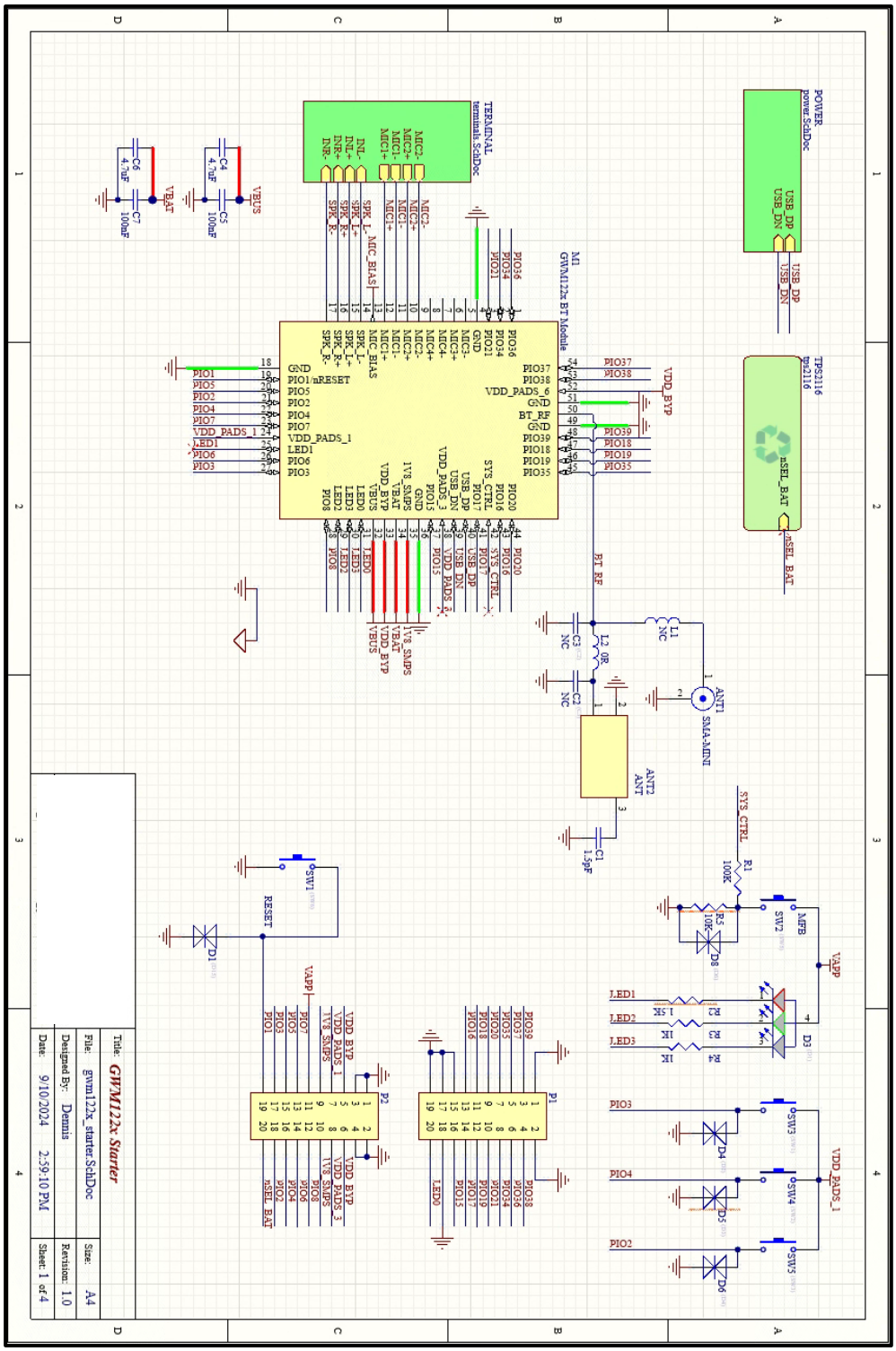
46	PIO19	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 19. Alternative function: PCM_DIN
47	PIO18	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 18. Alternative function: PCM_DOUT[0]
48	PIO39	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 39. Alternative function: QSPI2_IO[3]
49	GND	Ground	Ground
50	BT_RF	BT_RF	Bluetooth transmit/receive.
51	GND	Ground	Ground
52	VDD_PADS_6	Supply	1.8 V/3.3 V PIO supply.
53	PIO38	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 38. Alternative function: QSPI2_CS#0
54	PIO37	Digital: Bidirectional with programmable strength internal pull-up/pull-down	Programmable I/O line 37. Alternative function: QSPI2_IO[1]

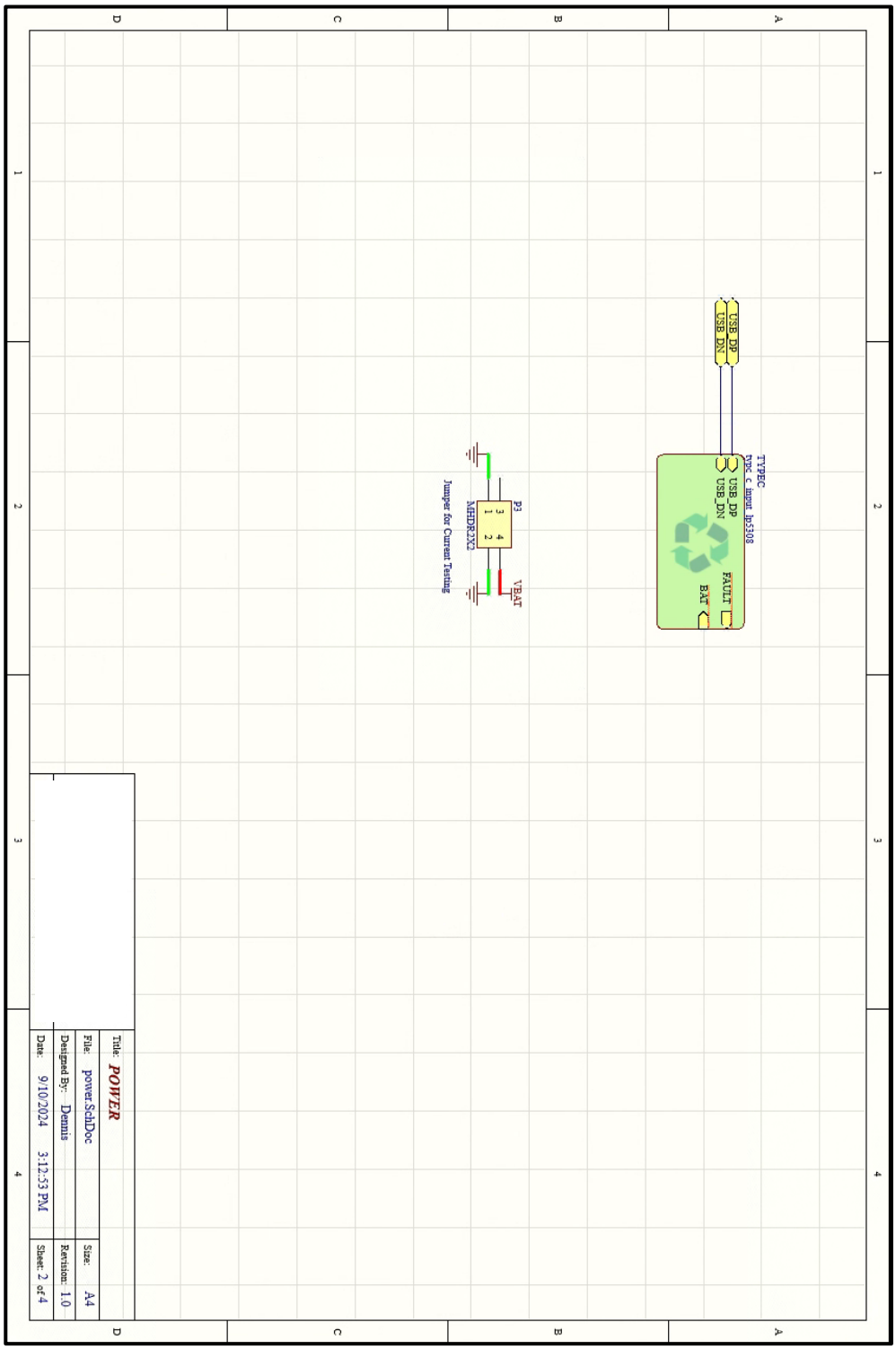
7. DEMO BOARD



GWM122x demo board provides a complete application circuit where customer can evaluate each feature of the standard firmware, or any customized firmware.

8. DEMO BOARD SCHEMATICS




USB_DP
USB_DN
TYPEC
type c immur hp5308
USB_DP
USB_DN
FAULT
BAT
P3
MHDR2X2
Jumper for Current Testing
VBAT
Title:
POWER
File:
power.SchDoc
Size:
A4
Designed By:
Dennis
Revision:
1.0
Date:
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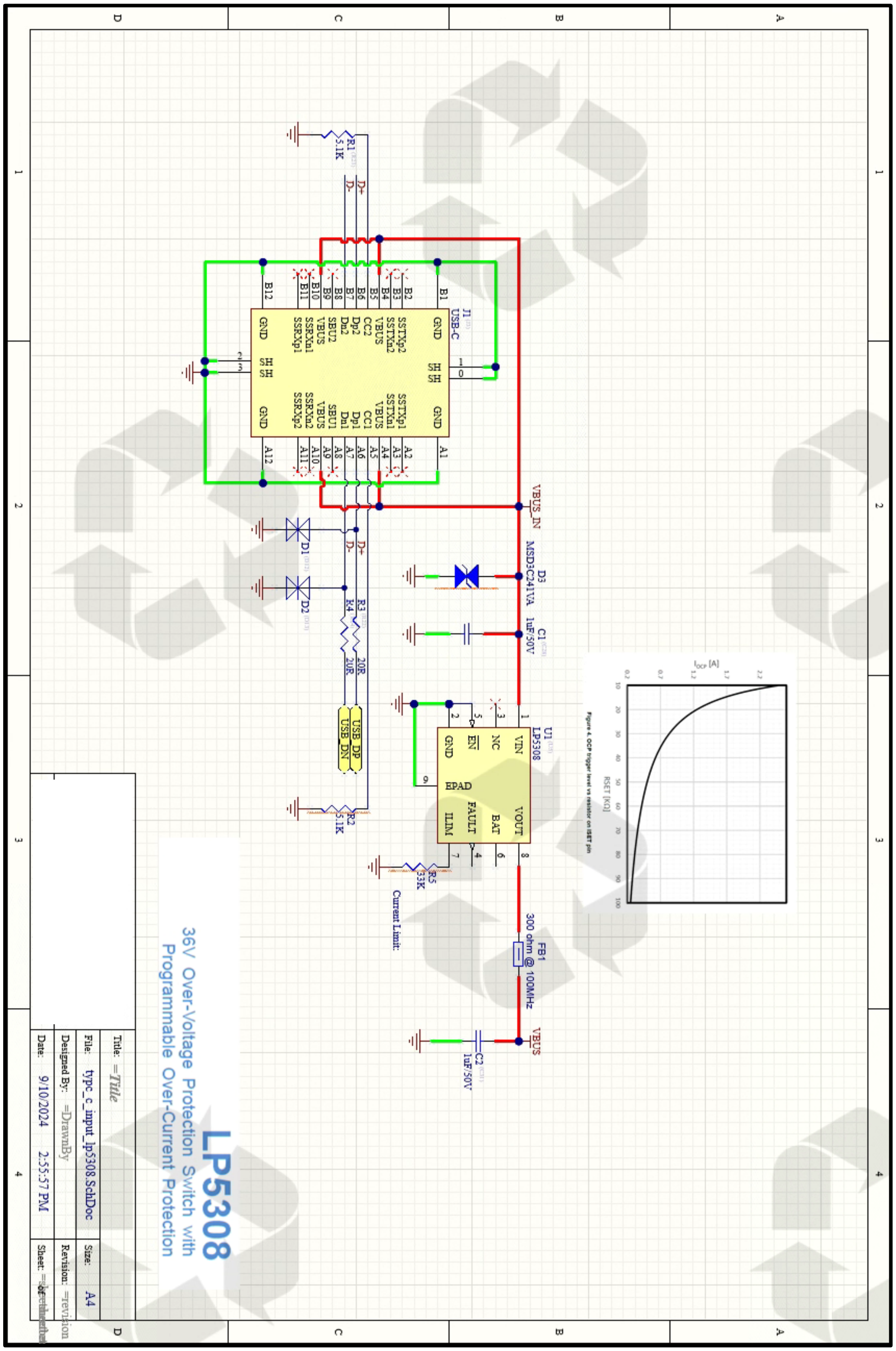
Sheet 2 of 4


LP5308
36V Over-Voltage Protection Switch with
Programmable Over-Current Protection
J1
USB-C
U1
LP5308
VIN
VOUT
NC
BAT
EN
FAULT
GND
ILIM
EPAD
VBUS_IN
VBUS
D3
MSD3C241VA
C1
1uF/50V
C2
1uF/50V
FB1
300 ohm @ 100MHz
R5
33K
Current Limit:
R1
5.1K
R2
5.1K
R3
20R
R4
20R
D1
D2
D+
D-
USB_DP
USB_DN
Figure 4. OCP trigger level vs resistor on ISET pin
RSET [KΩ]
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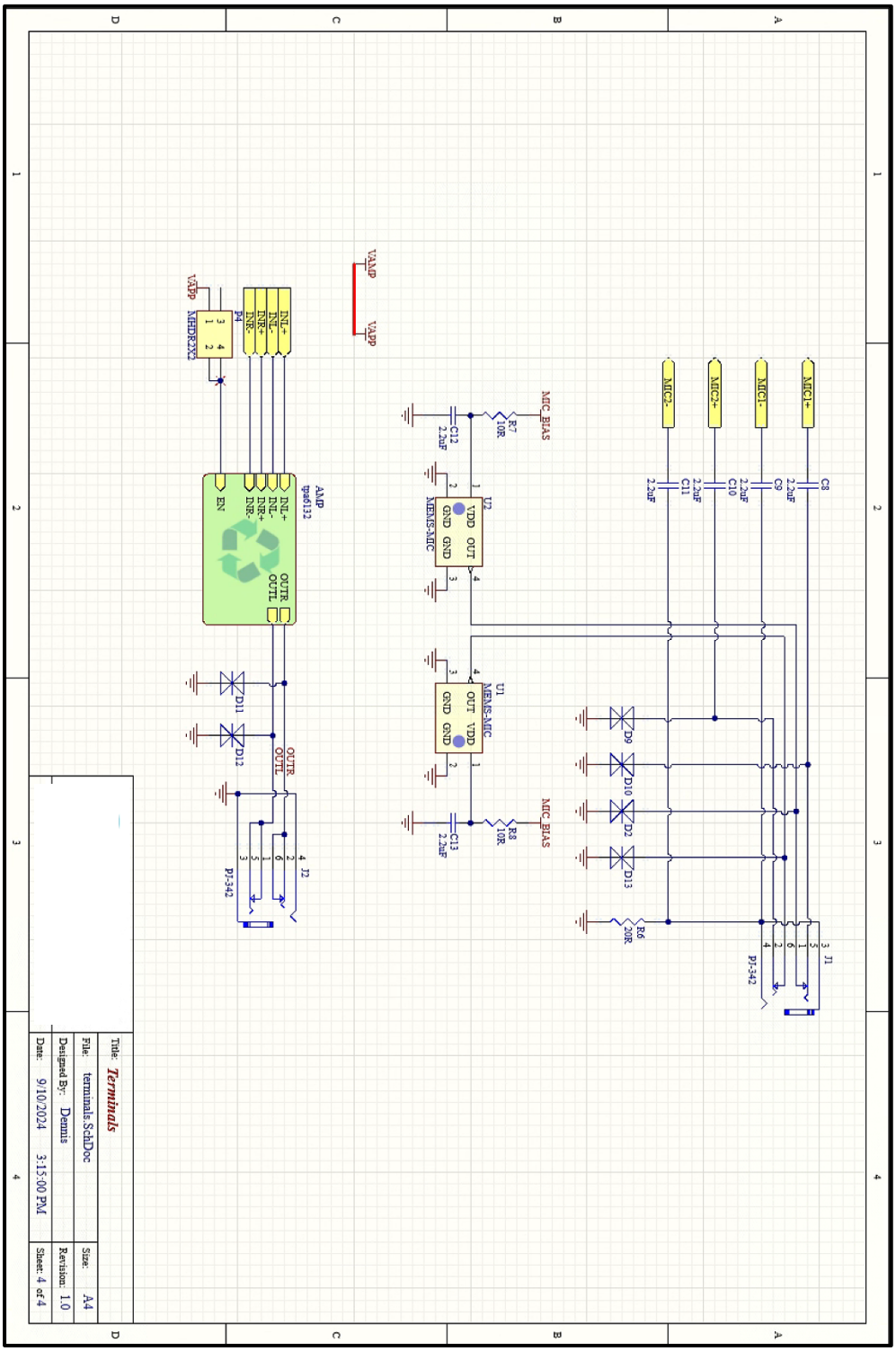
Designed By: =DrawnBy
Date: 9/10/2024 2:55:57 PM
Size: A4
Revision: =revision


MIC1+
MIC1-
MIC2+
MIC2-
C8
2.2nF
C9
2.2nF
C10
2.2nF
C11
2.2nF
J1
PJ-342
D9
D10
D2
D13
R6
20R
MIC_BIAS
R7
10R
C12
2.2nF
U2
MEMS-MIC
VDD
OUT
GND
GND
U1
MEMS-MIC
OUT
VDD
GND
GND
R8
10R
C13
2.2nF
VAMP
VAPP
AMP
tpa6132
INL+
INL-
INR+
INR-
EN
OUTR
OUTL
P4
MHDR2X2
D11
D12
J2
PJ-342
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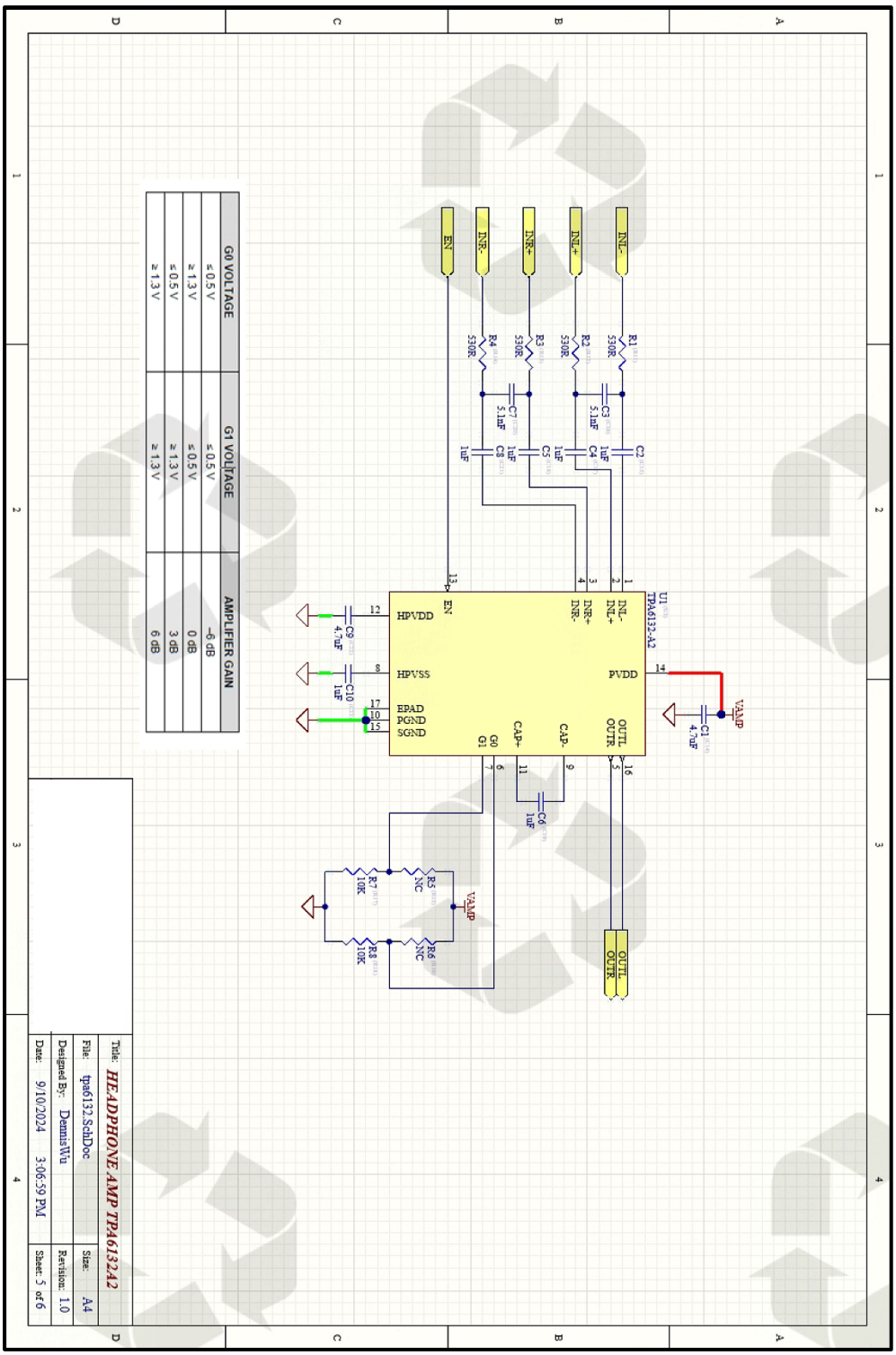
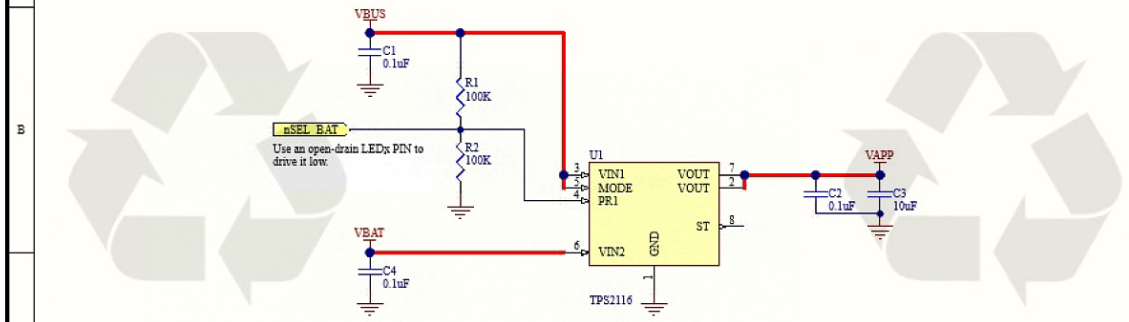
Size: A4
Revision: 1.0
Sheet: 4 of 4


G0 VOLTAGE
G1 VOLTAGE
AMPLIFIER GAIN
≤ 0.5 V
≥ 1.3 V
≤ 0.5 V
≥ 1.3 V
≤ 0.5 V
≤ 0.5 V
≥ 1.3 V
≥ 1.3 V
−6 dB
0 dB
3 dB
6 dB
HEADPHONE AMP TPA6132A2
tpa6132.SchDoc
DennisWu
9/10/2024
3:06:59 PM
A4
1.0
5 of 6
U1
TPA6132-A2
INL-
INL+
INR-
INR+
EN
HPVDD
HPVSS
EPAD
PGND
SGND
CAP+
CAP-
PVDD
OUTL
OUTR
G0
G1
VAMP
R1 590R
R2 590R
R3 590R
R4 590R
C1 4.7uF
C2 1uF
C3 5.1nF
C4 1uF
C5 1uF
C6 1uF
C7 5.1nF
C8 1uF
C9 4.7uF
C10 1uF
R5 NC
R6 NC
R7 10K
R8 10K



7.3.1 Truth Table

The below table shows the expected behavior of the TPS2116. For Priority mode, VIN1 is connected to PR1 through a resistor divider.

MODE	VIN1	VIN2	PR1	ST	VOUT
VIN1 (Priority mode)	High ($V_{PR1} > V_{REF}$)	X	VIN1 through resistor divider	High	VIN1
	Low ($V_{PR1} < V_{REF}$)	≥ 1.6 V		Low	VIN2
External Bias ≥ 1 V (Manual mode)	≥ 1.6 V	X	High	High	VIN1
	X	≥ 1.6 V	Low	Low	VIN2
External Bias ≤ 0.35 V (Manual mode)	X	X	High	Low	Hi-Z
	> V_{IN2}	X	Low	High	VIN1
	X	> V_{IN1}	Low	Low	VIN2

TEXAS INSTRUMENTS

TPS2116

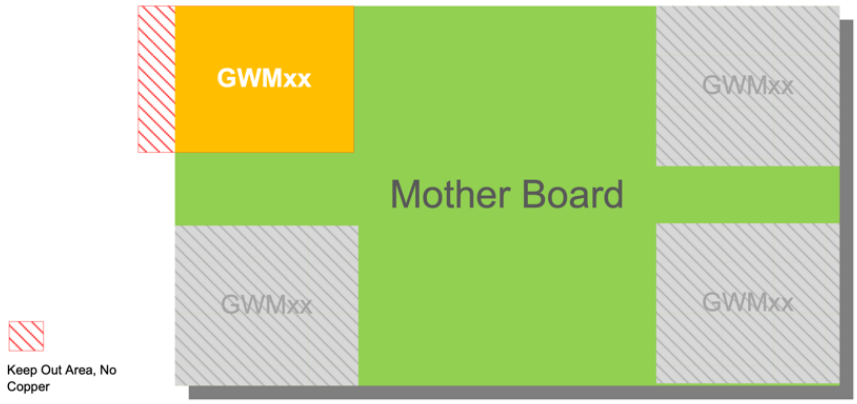
SLVSFG1A – JANUARY 2021 – REVISED MAY 2021

TPS2116 1.6 V to 5.5 V, 2.5-A Low I_Q Power Mux with Manual and Priority Switchover

Title: *TPS2116*		
File: tps2116.SchDoc		Size: A4
Designed By: Dennis		Revision: 1.0
Date: 9/10/2024	3:11:24 PM	Sheet: 7 of 8

9. MOUNTING REQUIREMENTS

GWM122x is a sensitive RF part; it needs to be mounted at the corner of the mother circuit board and reserve some keep out space to the components on the mother board. Try to keep them away with metal components like Speakers, Transformers, Batteries, Big Aluminum Capacitors, Heat Sinks and Metal Panels.



The figure illustrates how to mount the GWM122x module. Improper mounting will decrease the RF performance dramatically.

10. PHYSICAL DIMENSIONS