PKE8710ECF-C53-F20 Board

Specification

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REALSIL MICROELECTRONICS (Suzhou) CO. LTD.

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USING THIS DOCUMENT

This document is intended for the software engineer's reference and provides detailed programming information.

Though every effort has been made to ensure that this document is current and accurate, more information may have become available subsequent to the production of this guide.

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- **Technical support:** iot_support@realsil.com.cn
- **SDK website:** https://github.com/Ameba-AIoT/ameba-rtos

Contents

1 Product Overview

1.1 General Description

The PKE8710ECF-C53-F20 development board is designed by Realsil for the PKM8710ECF-C53-F20 module. All the module's GPIOs are pin out for the developers to develop and debug the module conveniently. Standard pin headers on both sides can also make operation easier when using bread boards for development and commissioning.

The PKM8710ECF-C53-F20 is a multi-radio MCU module. With the open CPU architecture, customers can develop advanced applications running on the dual RISC cores. The radio provides support for Wi-Fi 802.11 b/g/n/ax in the 2.4GHz band with 20MHz bandwidth and BLE 5.2 communications. The rich set of peripherals and high performance make it an ideal choice for smart homes, industrial automation, consumer electronics, etc.

The block diagram of PKM8710ECF-C53-F20 module is illustrated in Figure 1.

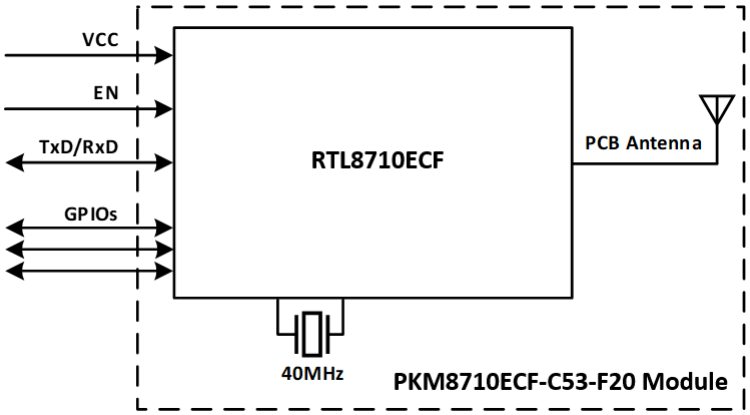


Figure 1. PKM8710ECF-C53-F20 Module Block Diagram

1.2 Characteristics

- Support 802.11 b/g/n/ax 1x1, 2.4GHz and BLE 5.2 (LE-1M/LE-2M/LE-Coded PHY (long range))
- Support 20MHz bandwidth, up to the data rate of MCS9
- Wi-Fi WPA, WPA2, WPA3, WPS; open, shared key, and pair-wise key authentication services
- Power-saving mechanism
- Supports AP/STA/Concurrent mode (802.11ax AP not supported)
- Frame aggregation for increased MAC efficiency (A-MPDU)
- Support LE secure connections
- AoA and AoD (both connection-oriented and connectionless)
- Supports both flooding-mode and scatter-mode SIG mesh
- Supports scatter-net (concurrent central and peripheral mode)
- Support Arm TrustZone-M and secure boot
- Internal co-existence mechanism between Wi-Fi and BT to share the same antenna
- GDMA has 8 channels, the FIFO size of channel 0 and 1 is 128 bytes, and other channel FIFO is 32 bytes

1.3 Application Solution

- Home appliances
- Smart speaker
- Industrial control
- Wearable devices
- Health care devices
- Smart agriculture
- Wi-Fi enabled toys
- …

1.4 Main Parameters

Table 1. PKM8710ECF-C53-F20 Module Main Parameters

Parameter	Description
Module Name	PKM8710ECF-C53-F20
Module Package	SMD-22
Module Size	24 ± 0.2mm (L) x 16 ± 0.2mm (W) x 2.8 ± 0.1mm (H)
Antenna	On-board PCB antenna
Wi-Fi Frequency Range	● 2412MHz ~ 2484MHz (2.4GHz ISM Band)
Bluetooth	BLE 5.2
Bluetooth Frequency Range	2402MHz ~ 2480MHz
Operating Temperature	-40°C to 105°C
Storage temperature range	-65°C to 150°C, < 90% RH
Power supply Range[1]	(3.3 ± 10%)V, current > 550mA
Interface	UART/GPIO/ADC/Cap touch/PWM/I2C/SPI/SWD/LEDC//DMIC/I2S/PDM
Module Certification	FCC/CE/SRRC

NOTE

[1] When using an external single power supply, the output current needs to reach more than 0.8A, which does not include the power consumption on peripherals and GPIOs.

2 Electrical Characteristics

Table 2. PKM8710ECF-C53-F20 Module Electrical Characteristics

Parameter condition	Min.	Typ.	Max.	Unit
DC 3.3V Supply Voltage	3.0	3.3	3.6	V
Digital I/O Supply Voltage	1.76	1.8~3.3	3.6	V
DC 3.3 Rating Current (with internal regulator and integrated CMOS PA)			550	mA
ESD HBM Condition (TA=25°C, conforming to JESD22-A114F)			Class 2	
ESD CDM Condition (TA=25°C, conforming to JESD22-C101F)			Class C2	

NOTE

The PKM8710ECF-C53-F20 module is electrostatic sensitive devices (ESD) and requires special ESD precautions typically applied to ESD sensitive components. Proper ESD handling and packaging procedures must be applied throughout the processing, handling, transportation and operation of any application that incorporates the PKM8710ECF-C53-F20 module. Do not touch the module by hand or solder with non-anti-static soldering iron to avoid damage to the module.

3 RF Performance

3.1 Wi-Fi 2.4GHz Band RF Specification

Table 3. Wi-Fi 2.4GHz Transmitter Performance Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	Center channel frequency	2412		2484	MHz
Output power with spectral mask and EVM compliance[1]	1 Mbps DSSS		20		dBm
	11 Mbps DSSS		20		dBm
	6 Mbps OFDM		20		dBm
	54 Mbps OFDM		19		dBm
	HT20 MCS0		20		dBm
	HT20 MCS7		18		dBm
	HE20 MCS8		17		dBm
	HE20 MCS9		16		dBm
Tx EVM	6 Mbps OFDM		-32	-5	dB
	54 Mbps OFDM		-34	-25	dB
	HT20 MCS0		-32	-5	dB
	HT20 MCS7		-35	-27	dB
	HE20 MCS8		-36	-30	dB
	HE20 MCS9		-36	-32	dB
Output power variation	TSSI on across operating temperature range, all channels and VSWR≤1.5:1 at RFIO port	-1.5		1.5	dB
Carrier suppression				-32	dBc
Harmonic output power[2]	2nd harmonic		-21		dBm/MHz
	3rd harmonic		-20		dBm/MHz
Harmonic output power[3]	2nd harmonic			-50	dBm/MHz
	3rd harmonic			-50	dBm/MHz

NOTE

[1] Power level is tested after Digital Pre-Distortion (DPD) enable.
[2] Harmonic output power is tested at IC port.
[3] Harmonic output power is measured at RF connector with pi-shape LC low pass filter.

Table 4. Wi-Fi 2.4GHz Receiver Performance Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	Center channel frequency	2412		2484	MHz
802.11b Rx Sensitivity (8% PER)	1 Mbps CCK		-100		dBm
	2 Mbps CCK		-97		dBm
	5.5 Mbps CCK		-94		dBm
	11 Mbps CCK		-91		dBm
802.11g Rx Sensitivity (10% PER)	BPSK rate 1/2, 6Mbps OFDM		-95		dBm
	BPSK rate 3/4, 9Mbps OFDM		-94		dBm
	QPSK rate 1/2, 12Mbps OFDM		-92.5		dBm
	QPSK rate 3/4, 18Mbps OFDM		-90		dBm
	16-QAM rate 1/2, 24Mbps OFDM		-87		dBm
	16-QAM rate 3/4, 36Mbps OFDM		-83.5		dBm
	64-QAM rate 1/2, 48Mbps OFDM		-79.5		dBm
	64-QAM rate 3/4, 54Mbps OFDM		-78		dBm
802.11n Rx Sensitivity (10% PER) BW=20MHz	MCS 0, BPSK rate 1/2		-95		dBm
	MCS 1, QPSK rate 1/2		-92.5		dBm
	MCS 2, QPSK rate 3/4		-90		dBm
	MCS 3, 16-QAM rate 1/2		-86.5		dBm
	MCS 4, 16-QAM rate 3/4		-83.5		dBm
	MCS 5, 64-QAM rate 2/3		-79.5		dBm
	MCS 6, 64-QAM rate 3/4		-78		dBm

	MCS 7, 64-QAM rate 5/6		-76.5		dBm
802.11ax Rx Sensitivity (10% PER) BW=20MHz	MCS 0, BPSK rate 1/2		-95		dBm
	MCS 1, QPSK rate 1/2		-92		dBm
	MCS 2, QPSK rate 3/4		-89.5		dBm
	MCS 3, 16-QAM rate 1/2		-86.5		dBm
	MCS 4, 16-QAM rate 3/4		-83		dBm
	MCS 5, 64-QAM rate 2/3		-79		dBm
	MCS 6, 64-QAM rate 3/4		-78		dBm
	MCS 7, 64-QAM rate 5/6		-76.5		dBm
	MCS 8, 256-QAM rate 3/4		-72.5		dBm
	MCS 9, 256-QAM rate 5/6		-70.5		dBm
Maximum Receive Level	6Mbps OFDM		0		dBm
	54Mbps OFDM		0		dBm
	11n MCS 0 HT20		0		dBm
	11n MCS 7 HT20		0		dBm
	11ax MCS 0 HE20		0		dBm
	11ax MCS 9 HE20		0		dBm
Adjacent Channel Rejection	11Mbps CCK		46		dBm
	BPSK rate 1/2, 6Mbps OFDM		45		dBm
	64-QAM rate 3/4, 54Mbps OFDM		25		dBm
	HT20, MCS 0, BPSK rate 1/2		42		dBm
	HT20, MCS 7, 64-QAM rate 5/6		24		dBm
	HE20, MCS 0, BPSK rate 1/2		42		dBm
	HE20, MCS 8, 256-QAM rate 3/4		20		dBm
	HE20, MCS 9, 256-QAM rate 5/6		17		dBm

3.2 Bluetooth LE RF Specification

Table 5. Bluetooth LE Transmitter Performance Specification

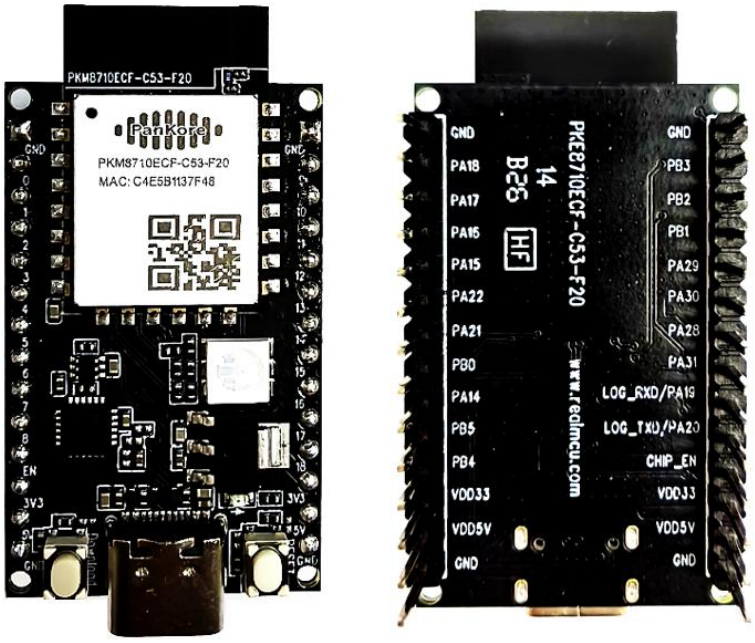
Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	Center channel frequency	2402	2440	2480	MHz
Output Power	At max. power output level		8	10	dBm
Carrier Frequency Offset and Drift	Frequency offset		±10		kHz
	Frequency drift		±10		kHz
	Max. drift rate		±10		kHz
Modulation characteristics	Δf1 avg.		250		kHz
	Δf2 max.	185			kHz
	△f1 avg./Δf2 avg.		0.93		
In-Band Emissions	±2MHz offset		-51		dBm
	≥ ±3MHz offset		-53		dBm

Table 6. Bluetooth LE Receiver Performance Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	Center channel frequency	2402	2440	2480	MHz
Receiver Sensitivity	PER<30.8%		-99		dBm
Max. Usable Signal	PER<30.8%		0		dBm
C/I co-channel (PER<30.8%)	Co-channel sensitivity		5		dB
C/I 1MHz (PER<30.8%)	Adjacent channel selectivity		-7		dB
C/I 2MHz (PER<30.8%)	2nd adjacent channel selectivity		-48		dB
C/I >= 3MHz (PER<30.8%)	3rd adjacent channel selectivity		-56		dB
C/I Image Channel (PER<30.8%)	Image channel selectivity		-25		dB
C/I Image 1MHz (PER<30.8%)	1MHz adjacent to image channel selectivity		-29		dB
Inter-modulation			-27		dB
Out-of-band blocking	30MHz to 2000MHz	-30			dBm
	2003MHz to 2399MHz	-35			dBm
	2484MHz to 2997MHz	-35			dBm
	3000MHz to 12.75GHz	-30			dBm

4 Appearance Dimensions

Board dimension: 46.6 ± 0.2mm (L) x 25.4 ± 0.2mm (W) x 3.3 ± 0.2mm (H)



Top View Bottom View

Figure 2. PKE8710ECF-C53-F20 Board Appearance

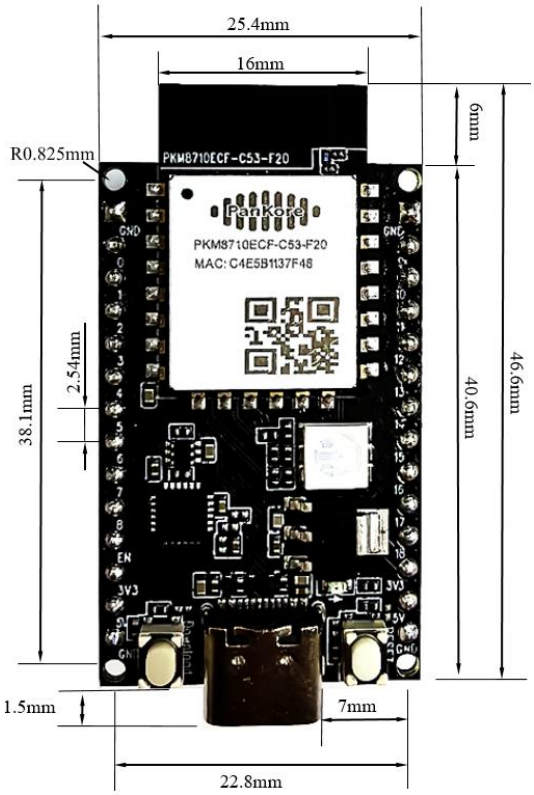


Figure 3. PKE8710ECF-C53-F20 Board Dimensions

5 LED and Keys

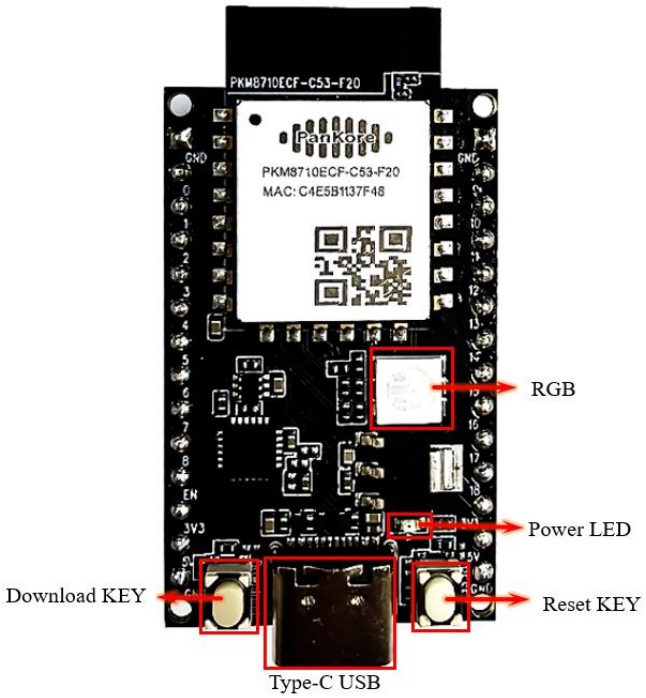


Figure 4. LED and Keys

Table 7. Information of LED and Keys

LED & Keys	Function	Note
Power LED	3.3 V power light	LED lights up when 3.3V is available.
RGB	RGB light	The red, blue and green colors are controlled by PA29, PA30 and PA28
Reset KEY	Reset button	-
Download KEY	Set the module to download mode	Follow these steps to enter the download mode: (1) Press and hold the Download KEY (2) Press the Reset KEY and release it (3) Release the Download KEY

6 Pin Definition

The PKE8710ECF-C53-F20 development board leads out 19 I/O interfaces. Figure 5 describes the board interfaces, and the pin function definition table is also layout to list the interface definition.

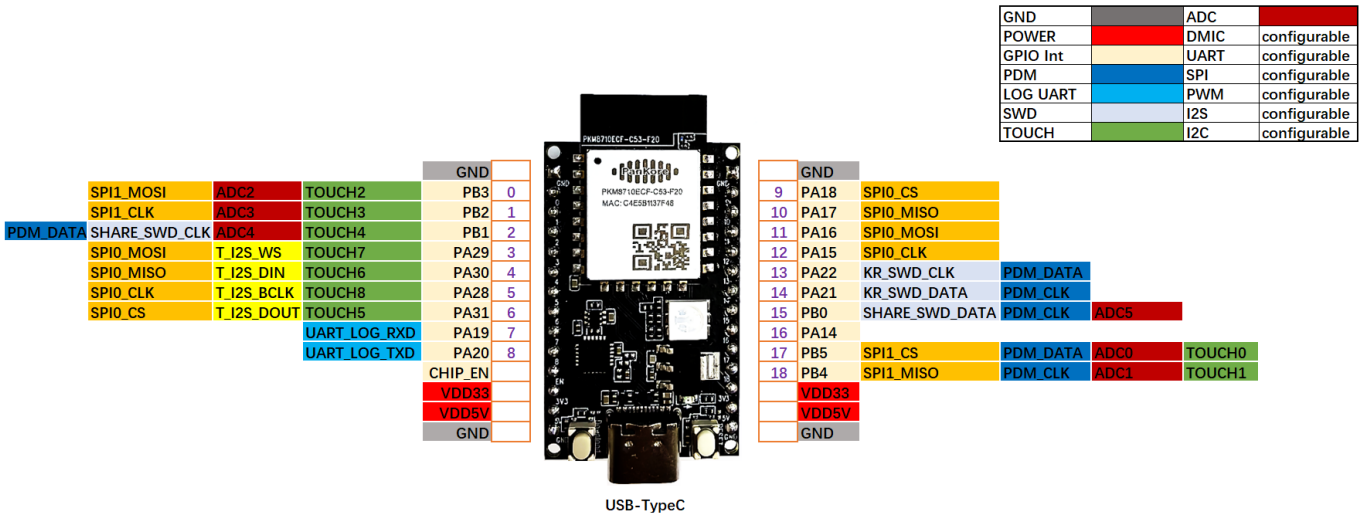


Figure 5. PKE8710ECF-C53-F20 Board Interface Description

Table 8. PKE8710ECF-C53-F20 Board Pin Definition

Pin No.	Pin Name	Description
0	PB3	TOUCH2/ADC2/SPI1_MOSI/UART/LDEC/I2S/I2C/PWM/DMIC
1	PB2	TOUCH3/ADC3/SPI1_CLK/UART/LDEC/I2S/I2C/PWM/DMIC
2	PB1	TOUCH4/ADC4/SHARE_SWD_CLK/PDM_DATA/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
3	PA29	TOUCH7/T_I2S_WS/SPI0_MOSI/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
4	PA30	TOUCH6/T_I2S_DIN/SPI0_MISO/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
5	PA28	TOUCH8/T_I2S_BCLK/SPI0_CLK/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
6	PA31	TOUCH5/T_I2S_DOUT/SPI0_CS/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
7	PA19	UART_LOG_RXD/UART
8	PA20	UART_LOG_TXD/UART
9	PA18	SPI0_CS/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
10	PA17	SPI0_MISO/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
11	PA16	SPI0_MOSI/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
12	PA15	SPI0_CLK/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
13	PA22	KR_SWD_CLK/PDM_DATA /SPI1/LDEC/I2S/I2C/PWM/DMIC/UART TX (Default)
14	PA21	KR_SWD_DATA/PDM_CLK /SPI1/LDEC/I2S/I2C/PWM/DMIC/UART RX (Default)
15	PB0	SHARE_SWD_DATA/PDM_CLK/ADC5/UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
16	PA14	UART/SPI1/LDEC/I2S/I2C/PWM/DMIC
17	PB5	SPI1_CS/PDM_DATA/ADC0/TOUCH0/UART/LDEC/I2S/I2C/PWM/DMIC
18	PB4	SPI1_MISO/PDM_CLK/ADC1/TOUCH1/UART/LDEC/I2S/I2C/PWM

NOTE

UART/SPI/LEDC/I2S/I2C/PWM/DMIC is configurable, refer to the excel documentation for details (PKM8710ECF_pin_mux.xls).

7 Schematic Diagram & Layout

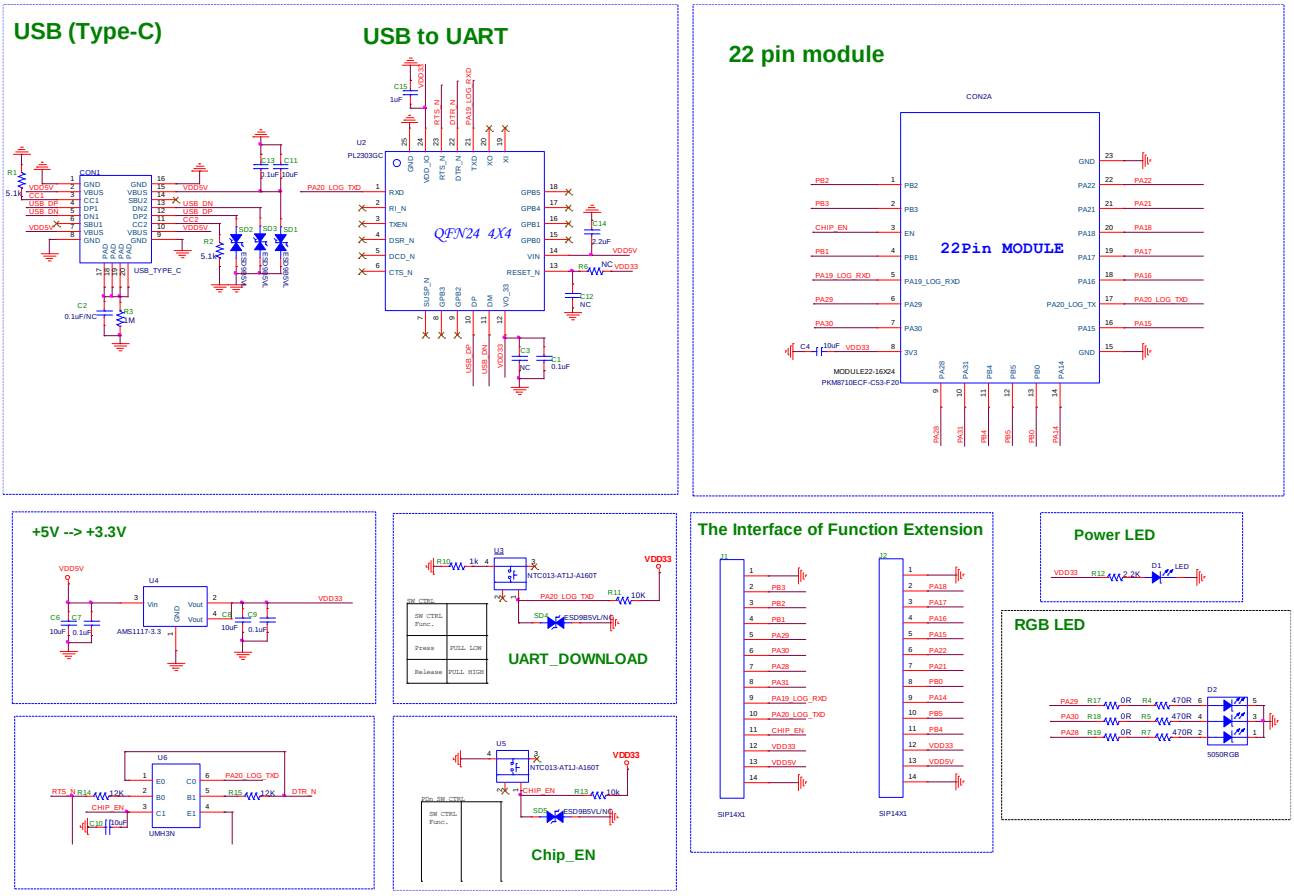


Figure 6. PKE8710ECF-C53-F20 Schematic Diagram

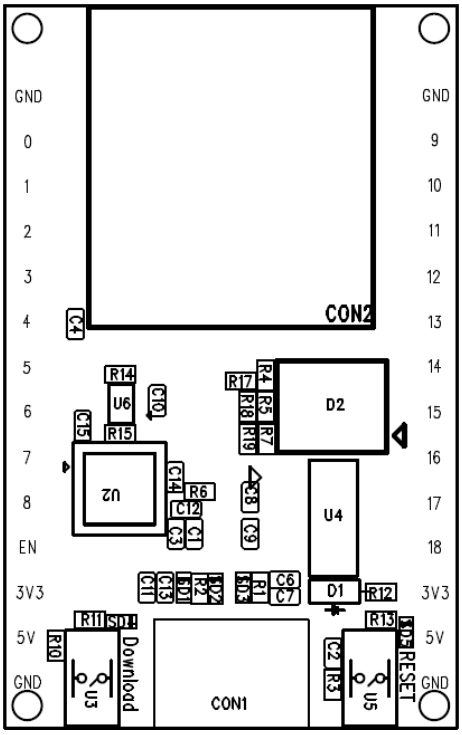


Figure 7. PKE8710ECF-C53-F20 Layout

8 Package Information

The PKE8710ECF-C53-F20 development board is packaged for inserted pearl cotton with electrostatic bags.

Revision History

Data	Revision	Summary
2024-10-10	1.0	Initial release
2025-09-25	1.1	Correct some formats