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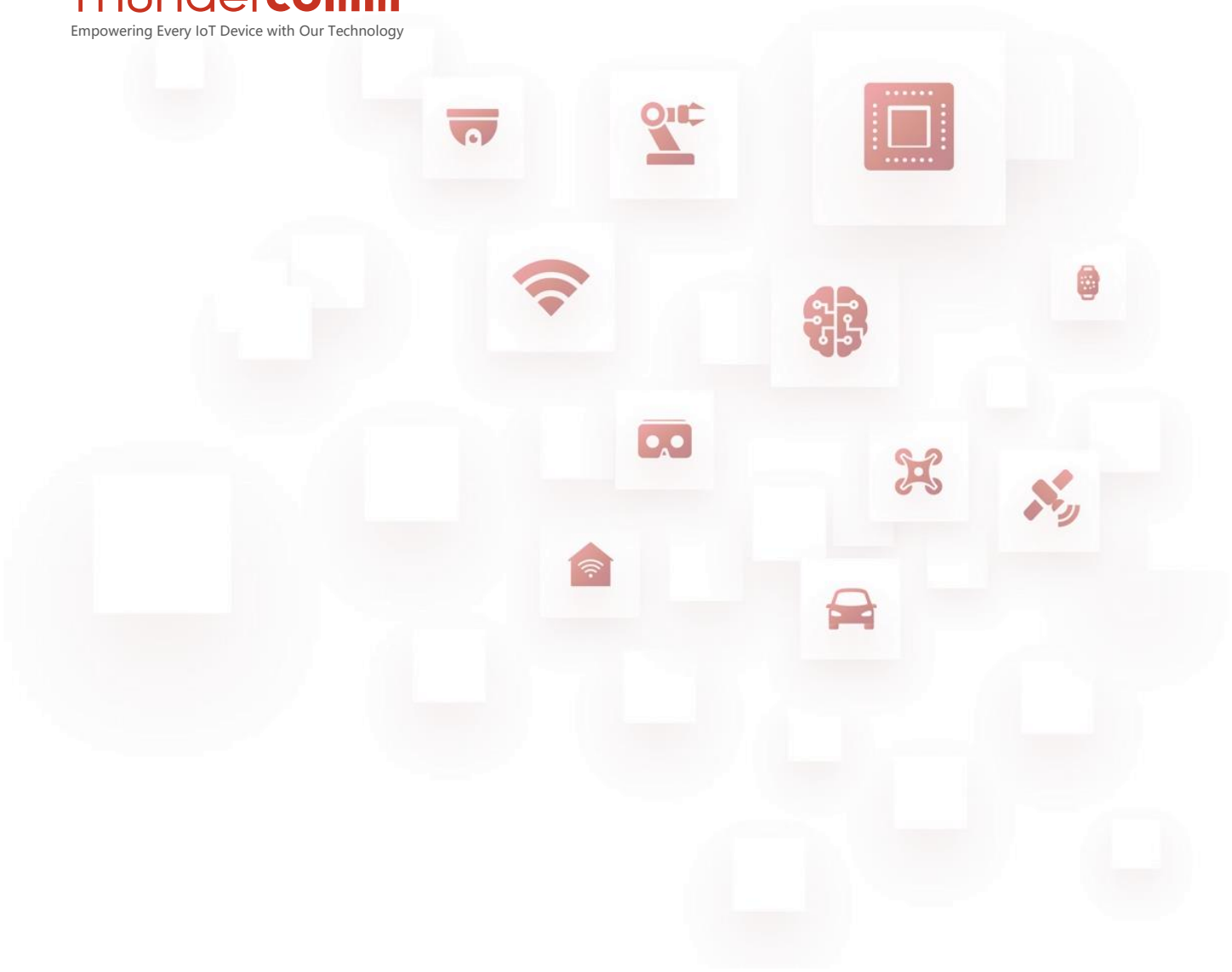

Thundercomm Turbox™ SOM

Datasheet

Machine Type: CM450, C450, CM625, and C626.

Rev. V1.2

May 20, 2021

DN: TC_4&6_13112

Revision History

Revision	Date	Description
1.0	Feb 23, 2021	Initial release
1.1	May 06, 2021	Add Appendix 1. Statement and Compliance.
1.2	May 20, 2021	Add declaration contents in Appendix 1. Statement and Compliance.

Table List

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Chapter 1. Introduction

The C450 CM450 CM625 C626 is a high-performance SOM (Software on Module) based on the Qualcomm 626 (APQ8053Pro) platform. It brings high-value features to mid-tier devices, designed to support all-day battery life, enhanced camera, advanced graphics, and more. The ultra-compact form factor of the module can be fit into any mobile device such as translator,handheld pos and tablet. It is ideal platform for OEMs to rapidly develop cost-effective cellular devices to the market.

Usage scenarios:

The SOMs are ideal for many applications including (but not limited to): dash camera, new retail device, video conference, handheld device, etc.

1.1. Key features

Table 1-1: Key features and performance of APQ8053 Pro/SDA450 processor

Applications Processor	• Customized 64-bit ARM Cortex-A53 octa-core CPU • Up to 2.2GHz (APQ8053 Pro)/1.8GHz (SDA450), 14nm FinFET process technology
DSP	Qualcomm® Hexagon™ V56 DSP
Graphics	• Qualcomm® Adreno™ 506 GPU • OpenGL ES 3.1 + AEP
Display support	Dual DSI 4 lanes, D-PHY 1.1 FHD+; VESA DSC 1.1
Camera support	Dual 14-bit image signal processing (ISP): • 13 MP and 13 MP, 21 MP at 30 fps ZSL with dual-ISP, or 13 MP 30 fps ZSL with single-ISP • Three 4-lane CSI (4 + 4 + 4) D-PHY 1.2 at 2.1 Gbps per lane*1
Video Encode	• Encode 4K@60fps, H.264, H.265, VP8, and VP9 • Wireless display support • Decode +Encode 1080p60D + 1080p30E
Video Decode	• Decode 4K@60fps, H.264, H.265, and VP8

Table 1-2: Key features and performance of C626/C450 SOM

Processor	Snapdragon™ APQ8053 Pro/SDA450
Memory	2GB LPDDR3 +16GB eMMC5.1
WLAN	Not supported
Display Interfaces	2x 4-lane MIPI DSI
Camera Interfaces	3x 4-lane MIPI CSI
Audio Interface	• One port SLIMbus interface to WCD9326/WCD9335 • One CDC PDM interface for PM8953 for audio application • 2x MI2S • 1x DMIC ports supports up to 2 DMICs
USB	• 1x USB 3.0 SS • 1x USB 2.0 HS
Display Port	Not supported

RGMII	Not supported
Other Interfaces	• 1x SDC for SD card • 8x BLSP, be configured as 8x SPI or 8x I2C or 4x UART • 2x camera dedicated I2Cs
Charger	Not supported
Operating Environment	• Operation Temperature: -20℃ ~ 70℃ • Operation Humidity: 5%~95%, non-condensing
Power supply	3.6V ~ 4.4V, typ. 3.8V
Dimension	34.0 x 35.0x 3.0mm @295 pin
RoHS	All hardware components are fully compliant with EU RoHS 2.0 directive

1.2. Hardware block diagram

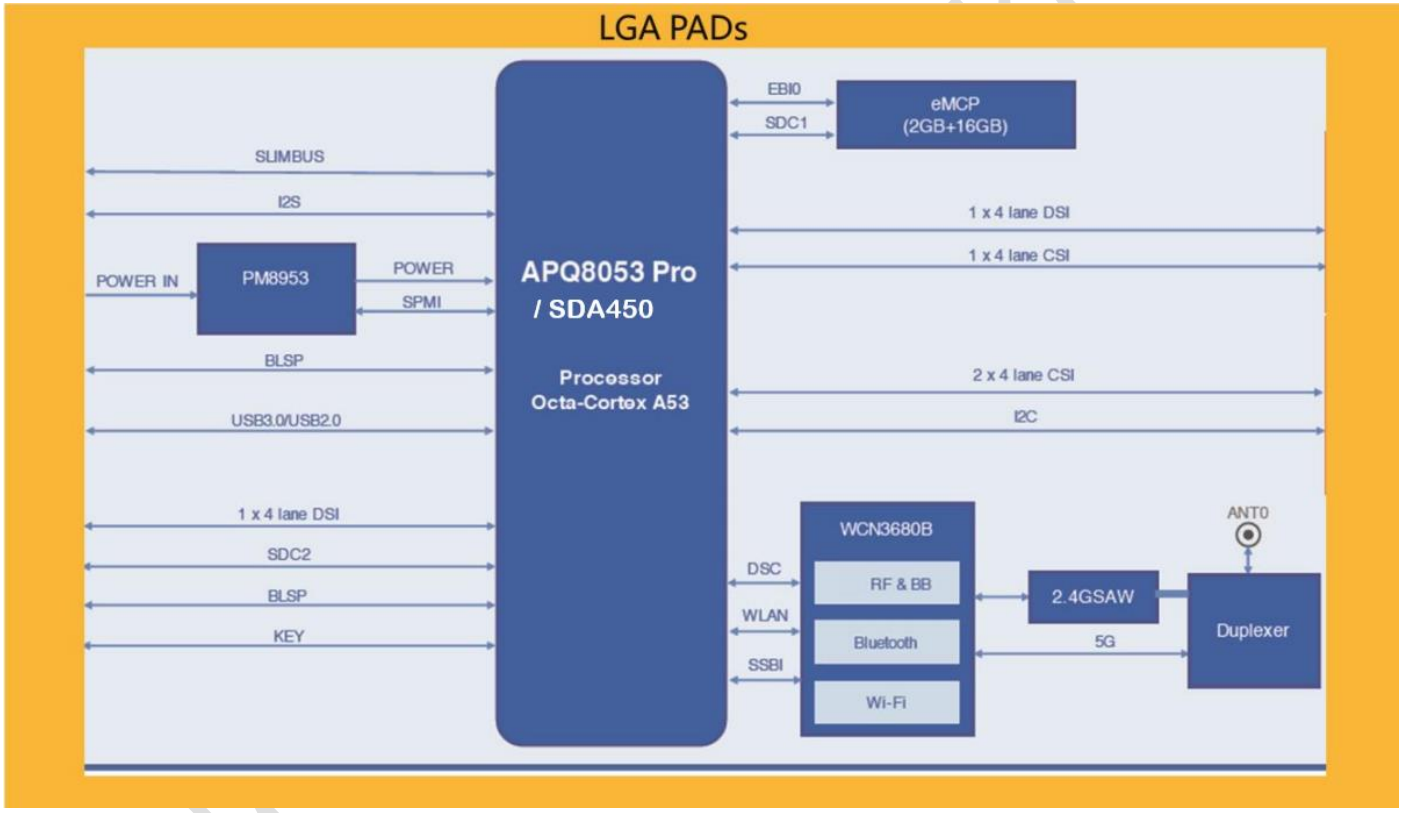

Figure 1-1. Block Diagram

NOTE:

- C450 CPU: SDA450
- C626 CPU: APQ8053 Pro

1.3. Mechanical size

The size of Turbox™ C626/450 SOM is 19mm x 16mm x 2.3mm, and you can check the size of BTB (board to bord) connectors through their datasheets.

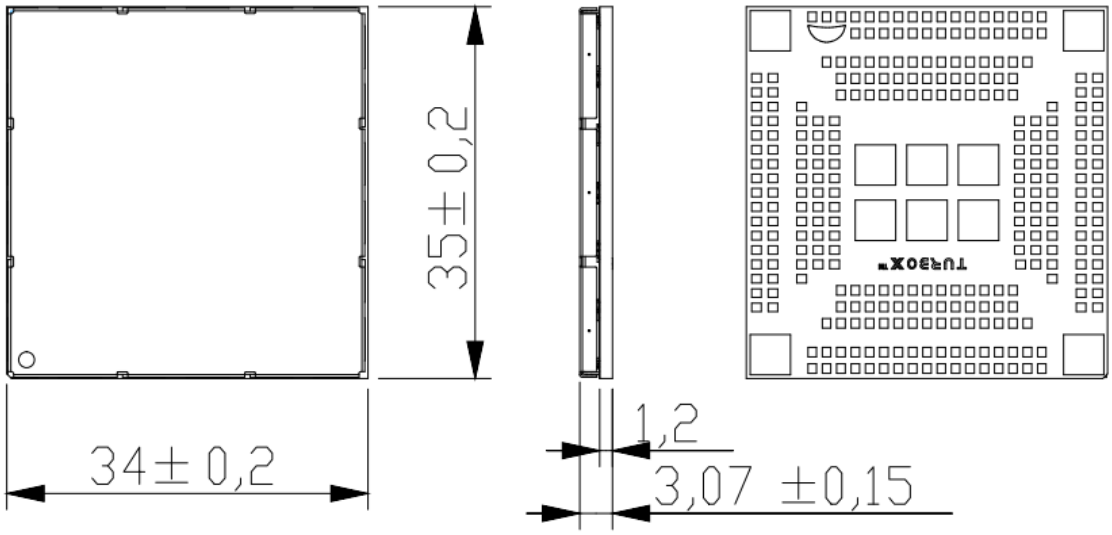

Figure 1-2. Chipset Overview

1.4. Daily maintenance

It is strongly recommended that the module should be mounted after reflow soldering for the other side of PCB (printed circuit board) has been completed (otherwise, the SOM would be on the bottom side of the PCB and cause process risk during the 2nd reflow due to the tin remelting and SOM gravity). Therefore, we need to take SOM placement into consideration during layout design to satisfy the process requirements. It is highly recommended that LGA SOM should be placed on the same side with DIP (dual in-line package) components. Refer to the graphic instruction below to maintain the SOM.

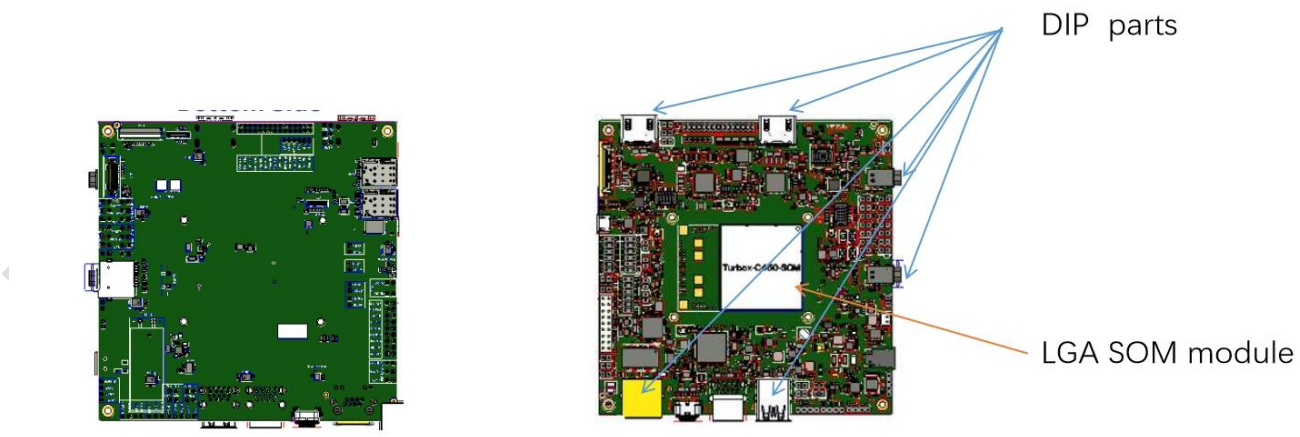

Figure 1-3. SOM Overview

Chapter 2. Interface Description

This chapter introduces all the interfaces definition, aiming to help developer design and test Thundercomm Turbox C626 series SOM easily.

2.1. Interface parameter definitions

Table 2-1. Interface description list

Symbol	Description
AI	Analog input
AO	Analog output
B	Bidirectional digital with CMOS input
CSI	Supply voltage for MIPI_CSI circuits and I/O; (1.2 V for low power mode)
DI	Digital input(CMOS)
DSI	Supply voltage for MIPI_CSI circuits and I/O; (1.2 V for low power mode)
DO	Digital output(CMOS)
H	High-voltage tolerant
nppdpukp	Programmable pull resistor. The default pull direction is indicated using capital letters and is a prefix to other programmable options: NP: pdpukp = default no-pull with programmable options following the colon (:) PD: nppukp = default pull-down with programmable options following the colon (:) PU: nppdkp = default pull-up with programmable options following the colon (:) KP: nppdpu = default keeper with programmable options following the colon (:)
KP	Contains an internal weak keeper device (keepers cannot drive external buses)
MIPI	Mobile industry processor interface
NP	Contains no internal pull
OD	Open drain
PD	Contains an internal pull-down device
PI	Power input
PO	Power output
PD	Contains an internal pull-down device
PU	Contains an internal pull-up device
P3	Power group 3, it is 1.8V.
P2	SDC Power group 2, it is 1.8V or 2.95V.
MV	VPH_PWR
LV	1.8V

2.2. Description

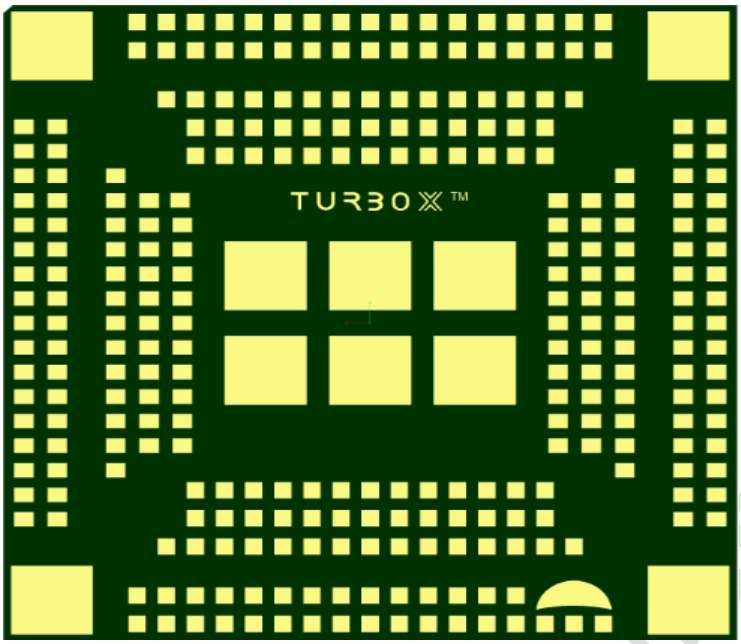

Figure 2-1. Chipset Bottom View

2.3. Pin list

Table 2-2. Pin signal list

No.	Signal	No.	Signal	No.	Signal
1	SDCARD_D1	101	TP1_INT_N	201	NC
2	SDCARD_CMD	102	SENSOR_I2C_SDA	202	NC
3	MIPI_CSI2_LANE3_P	103	SENSOR_I2C_SCL	203	BBCLK1_EN
4	MIPI_CSI2_LANE3_N	104	UART2_TXD	204	NC
5	MIPI_CSI2_LANE2_N	105	GPIO_47	205	NC
6	MIPI_CSI2_LANE2_P	106	NC	206	NC
7	MIPI_CSI2_LANE1_P	107	NC	207	NC
8	MIPI_CSI2_LANE1_N	108	NC	208	NC
9	MIPI_CSI1_LANE1_N	109	NC	209	USB_DM
10	MIPI_CSI1_LANE1_P	110	NC	210	USB_DP
11	MIPI_CSI0_LANE2_P	111	NC	211	NC
12	MIPI_CSI0_LANE2_N	112	NC	212	LCD1_RST_N
13	MIPI_CSI0_LANE1_N	113	NC	213	NFC_CLK_REQ
14	MIPI_CSI0_LANE1_P	114	TP1_RST_N	214	VREG_L2_1P1
15	MIPI_DSI1_LANE0_P	115	GPIO_59	215	PMU_MPP2
16	MIPI_DSI1_LANE1_N	116	TP0_INT_N	216	CBL_PWR_N
17	MIPI_DSI1_LANE1_P	117	TP0_RST_N	217	HPH_L
18	SDCARD_D3	118	GPIO_141	218	VRTC

No.	Signal	No.	Signal	No.	Signal
19	SDCARD_D2	119	TP0_I2C_SCL	219	MIC1_P
20	SDCARD_D0	120	USB_SS_SEL	220	MIC1_M
21	SDCARD_CLK	121	VDISP_M_OUT	221	MIC2_P
22	MIPI_CSI2_LANE0_N	122	DISP_HW_EN	222	CDC_PDM_SYNC
23	MIPI_CSI2_LANE0_P	123	NC	223	CDC_PDM_RX0
24	MIPI_CSI2_CLK_N	124	NC	224	CDC_PDM_TX
25	MIPI_CSI2_CLK_P	125	NC	225	NC
26	MIPI_CSI1_LANE2_N	126	GPIO_140	226	NC
27	MIPI_CSI1_LANE2_P	127	FP_SPI_CLK	227	NC
28	MIPI_CSI1_LANE3_P	128	UART4_TXD	228	NC
29	MIPI_CSI1_LANE3_N	129	UIM1_DATA	229	MCAM_RST_N
30	MIPI_CSI0_LANE3_N	130	UIM1_CLK	230	GPIO_33
31	MIPI_CSI0_LANE3_P	131	UIM2_DATA	231	GPIO_41_CCI_TIMER4
32	MIPI_DSI1_LANE0_N	132	UIM2_CLK	232	GPIO_134_ELDO_EN
33	MIPI_DSI1_LANE3_P	133	GPIO_42_ACCL_INT1	233	SD_DET_N
34	MIPI_DSI1_LANE3_N	134	NC	234	HPH_R
35	CAM_I2C_SCL	135	NC	235	HPH_REF
36	CAM_I2C_SDA	136	NC	236	EAR_M
37	SCAM_MCLK	137	FP_SPI_MISO	237	EAR_P
38	MIPI_CSI1_LANE0_N	138	FP_SPI_MOSI	238	SPK_M
39	MIPI_CSI1_LANE0_P	139	UART4_RXD	239	SPK_P
40	MIPI_CSI1_CLK_P	140	UIM1_RESET	240	CDC_PDM_RX1
41	MIPI_CSI1_CLK_N	141	UIM1_DETECT	241	CDC_PDM_RX2
42	MIPI_CSI0_LANE0_P	142	UIM2_DETECT	242	CDC_PDM_RX0_DRE
43	MIPI_CSI0_LANE0_N	143	LCD1_TE	243	NC
44	MIPI_CSI0_CLK_N	144	GPIO_50	244	NC
45	MIPI_CSI0_CLK_P	145	GND	245	NC
46	MIPI_DSI1_CLK_P	146	NC	246	GPIO_35
47	MIPI_DSI1_CLK_N	147	GND	247	DCAM_PWDN
48	MIPI_DSI1_LANE2_P	148	GPIO_44_MAG_INT_N	248	GPIO_38_CCI_ASYNC_IN0
49	MIPI_DSI1_LANE2_N	149	USBC_CC2	249	MCAM_PWDN
50	SCAM_PWDN	150	NC	250	DCAM_RST
51	CAM4_CLK	151	NC	251	VREG_L11_2P95
52	DCAM_I2C_SCL	152	PM8953_GPIO5	252	LINE_OUT_N
53	LCD0_TE	153	NC	253	LINE_OUT_P
54	UART5_RXD	154	USB_ID	254	SPI_CLK
55	UART5_RTS	155	KEY_VOL_DOWN_N	255	SPI_MISO
56	GPIO_36	156	VREG_L6_1P8	256	VREG_L23_1P2
57	GPIO_0	157	VREG_L10_2P8	257	PM8953_GPIO1

No.	Signal	No.	Signal	No.	Signal
58	DCAM_I2C_SDA	158	USB_VCONN	258	GPIO_97
59	GPIO_1	159	NFC_CLK	259	DMIC_DATA
60	GPIO_3	160	HS_DET	260	NC
61	UART5_CTS	161	MIC3_P	261	I2S_1_D2
62	GPIO_2	162	GPIO_43_ALSP_INT_N	262	I2S_1_WS
63	GPIO_62_NFC_DWL_REQ	163	USBC_CC1	263	VREG_L12_2P95
64	MCAM_MCLK	164	NC	264	VREG_L14_UIM1
65	SCAM_RST_N	165	NC	265	NC
66	UART5_TXD	166	PM8953_GPIO4	266	SPI_CS
67	NC	167	NC	267	SPI_MOSI
68	NC	168	PM8953_GPIO6	268	FORCE_USB_BOOT
69	NC	169	NC	269	VREG_L13_3P075
70	NC	170	VREG_L5_1P8	270	GPIO_98
71	NC	171	VREG_L16_1P8	271	GPIO_99
72	WDOG_DISABLE	172	VREG_L17_2P85	272	DMIC_CLK
73	GPIO_63	173	VREG_L22_2P8	273	I2S_1_D3
74	GPIO_112	174	MIC_BIAS1	274	I2S_1_SCK
75	GPS_LNA_EN	175	MIC_GND	275	PWM
76	MIPI_DSI0_LANE1_N	176	BOOT_PWR	276	NC
77	MIPI_DSI0_LANE2_N	177	NC	277	USB_SS_RX_P
78	MIPI_DSI0_CLK_P	178	GPIO_48	278	USB_SS_RX_M
79	MIPI_DSI0_LANE0_N	179	GPIO_45_GYRO_INT	279	USB_SS_TX_P
80	MIPI_DSI0_LANE3_P	180	NC	280	USB_SS_TX_M
81	DCAM_MCLK	181	NC	281	GPIO_96
82	TP1_I2C_SDA	182	VPH_PWR	282	I2S_MCLK
83	TP1_I2C_SCL	183	VPH_PWR	283	GPIO_86
84	FP_SPI_CS	184	VPH_PWR	284	I2S_1_D1
85	GPIO_60	185	NC	285	I2S_1_D0
86	VREG_L15_UIM2	186	NC	286	GND
87	NC	187	NC	287	GND
88	UART2_RXD	188	NC	288	GND
89	NC	189	NC	289	GND
90	NC	190	MIC_BIAS2	290	GND
91	NC	191	NC	291	GND
92	NC	192	GPIO_46_PRESSURE_INT	292	GND
93	MIPI_DSI0_LANE1_P	193	PWRKEY	293	GND
94	MIPI_DSI0_LANE2_P	194	UIM2_RESET	294	GND
95	MIPI_DSI0_CLK_N	195	VBAT_BB	295	GND
96	MIPI_DSI0_LANE0_P	196	VBAT_BB		

No.	Signal	No.	Signal	No.	Signal
97	MIPI_DSI0_LANE3_N	197	VBAT_BB		
98	GND	198	NC		
99	LCD0_RST_N	199	NC		
100	TP0_I2C_SDA	200	KEY_VOL_UP_N		

2.3.1. Power supply interface

Table 2-3. Pin list for power supply interface

PIN Name	PIN	Type	Description
VBAT_BB	195,196,197	PI	Module power supply, 3.3 ~ 4.2V, nominal value 3.8V
VPH_PWR	182,183,184	PO	4.2V output for external circuit
VREG_L2_1P1	214	PO	Reserved 1.1V Camera Digital (for Rear camera)
VREG_L5_1P8	170	PO	Reserved 1.8V for Digital IO,GPIO .etc
VREG_L11_2P95	251	PO	Reserved 2.95V or 1.8V for Micro-SD
VREG_L12_2P95	263	PO	Reserved 2.95V
VREG_L13_3P075	269	PO	Reserved 3.075V for Microphone bias
VREG_L14_UIM1	264	PO	Reserved 2.95V or 1.8V for USIM 1
VREG_L15_UIM2	86	PO	Reserved 2.95V or 1.8V for USIM 2
VREG_L16_1P8	171	PO	Reserved 1.8V HKADC
VREG_L17_2P85	172	PO	Reserved 2.85V for Camera and display (Rear camera)
VREG_L22_2P8	173	PO	Reserved 2.85V for Camera analog (Front camera)
VREG_L23_1P2	256	PO	Reserved 1.2V for Camera digital
GND	98,286-295 54-59*8	GND	GND

2.3.2. Touch screen interface

Table 2-4. Pin list for touch screen interface

PIN Name	PIN	Voltage	Type	Description
GPIO_65	116	P3	DI	TP0_INT_N
GPIO_64	117	P3	DO	TP0_RST_N
BLSP3_GPIO_10	100	P3	IO	TP0_I2C_SDA
BLSP3_GPIO_11	119	P3	DO	TP0_I2C_SCL

2.3.3. Display interface

Turbox-C626-P -SOM provides Dual DSI 4 lanes interfaces and supports FHD+.

Table 2-5. Pin list for display interface

Pin Name	IO	Pin No.	instruction
MIPI_DSI0_LANE0_P	AI, AO	96	MIPI display serial interface 0 lane 0 – positive
MIPI_DSI0_LANE0_N	AI, AO	79	MIPI display serial interface 0 lane 0 – negative
MIPI_DSI0_LANE1_P	AI, AO	93	MIPI display serial interface 0 lane 1 – positive
MIPI_DSI0_LANE1_N	AI, AO	76	MIPI display serial interface 0 lane 1 –negative
MIPI_DSI0_LANE2_P	AI, AO	94	MIPI display serial interface 0 lane 2 – positive
MIPI_DSI0_LANE2_N	AI, AO	77	MIPI display serial interface 0 lane 2 –negative
MIPI_DSI0_LANE3_P	AI, AO	80	MIPI display serial interface 0 lane 3 – positive
MIPI_DSI0_LANE3_N	AI, AO	97	MIPI display serial interface 0 lane 3 –negative
MIPI_DSI0_CLK_P	AO	78	MIPI display serial interface 0 clock – positive
MIPI_DSI0_CLK_N	AO	95	MIPI display serial interface 0 clock – negative
LCD0_RST_N	DO	99	LCD0 Reset signal output
LCD0_TE	DI	53	LCD0 TE sync signal input
MIPI_DSI1_LANE0_P	AI, AO	15	MIPI display serial interface 1 lane 0 – positive
MIPI_DSI1_LANE1_N	AI, AO	16	MIPI display serial interface 1 lane 0 – negative
MIPI_DSI1_LANE1_P	AI, AO	17	MIPI display serial interface 1 lane 1 – positive
MIPI_DSI1_LANE0_N	AI, AO	32	MIPI display serial interface 1 lane 1 –negative
MIPI_DSI1_LANE2_P	AI, AO	48	MIPI display serial interface 1 lane 2 – positive
MIPI_DSI1_LANE2_N	AI, AO	49	MIPI display serial interface 1 lane 2 –negative
MIPI_DSI1_LANE3_P	AI, AO	33	MIPI display serial interface 1 lane 3 – positive
MIPI_DSI1_LANE3_N	AI, AO	34	MIPI display serial interface 1 lane 3 –negative
MIPI_DSI1_CLK_P	AO	46	MIPI display serial interface 1 clock – positive
MIPI_DSI1_CLK_N	AO	47	MIPI display serial interface 1 clock – negative
LCD1_RST_N	DO	212	LCD1 Reset signal output
LCD1_TE	DI	143	LCD1 TE sync signal input

2.3.4. Camera interfaces

The SOM supports 3x 4-lanes camera interfaces: CSI0 and CSI1 and CIS2.

Table 2-6. Pin list for camera interfaces

Camera1 Interface			
Pin Name	**IO**	**Pin No.**	**instruction**
MCAM_MCLK	AO	64	Camera0 main clock output,CAM_MCLK0
MIPI_CSI0_CLK_N	AO	44	MIPI camera serial interface 0 clock – negative
MIPI_CSI0_CLK_P	AO	45	MIPI camera serial interface 0 clock – positive
MIPI_CSI0_LANE0_N	AIO	43	MIPI camera serial interface 0 lane 0 – negative
MIPI_CSI0_LANE0_P	AIO	42	MIPI camera serial interface 0 lane 0 – positive
MIPI_CSI0_LANE1_N	AIO	13	MIPI camera serial interface 0 lane 1 – negative
MIPI_CSI0_LANE1_P	AIO	14	MIPI camera serial interface 0 lane 1 – positive
MIPI_CSI0_LANE2_N	AIO	12	MIPI camera serial interface 0 lane 2 – negative

MIPI_CSI0_LANE2_P	AIO	11	MIPI camera serial interface 0 lane 2 – positive
MIPI_CSI0_LANE3_N	AIO	30	MIPI camera serial interface 0 lane 3 – negative
MIPI_CSI0_LANE3_P	AIO	31	MIPI camera serial interface 0 lane 3 – positive
Camera2 Interface			
Pin Name	**IO**	**Pin No.**	**instruction**
MCAM_MCLK	AO	37	Camera0 main clock output,CAM_MCLK1
MIPI_CSI1_CLK_N	AO	41	MIPI camera serial interface 1 clock – negative
MIPI_CSI1_CLK_P	AO	40	MIPI camera serial interface 1 clock – positive
MIPI_CSI1_LANE0_N	AIO	38	MIPI camera serial interface 1 lane 0 – negative
MIPI_CSI1_LANE0_P	AIO	39	MIPI camera serial interface 1 lane 0 – positive
MIPI_CSI1_LANE1_N	AIO	9	MIPI camera serial interface 1 lane 1 – negative
MIPI_CSI1_LANE1_P	AIO	10	MIPI camera serial interface 1 lane 1 – positive
MIPI_CSI1_LANE2_N	AIO	26	MIPI camera serial interface 1 lane 2 – negative
MIPI_CSI1_LANE2_P	AIO	27	MIPI camera serial interface 1 lane 2 – positive
MIPI_CSI1_LANE3_N	AIO	29	MIPI camera serial interface 1 lane 3 – negative
MIPI_CSI1_LANE3_P	AIO	28	MIPI camera serial interface 1 lane 3 – positive
Camera3 Interface			
Pin Name	**IO**	**Pin No.**	**instruction**
MCAM_MCLK	AO	81	Camera0 main clock output,CAM_MCLK2
MIPI_CSI2_CLK_N	AO	24	MIPI camera serial interface 2 clock – negative
MIPI_CSI2_CLK_P	AO	25	MIPI camera serial interface 2 clock – positive
MIPI_CSI2_LANE0_N	AIO	22	MIPI camera serial interface 2 lane 0 – negative
MIPI_CSI2_LANE0_P	AIO	23	MIPI camera serial interface 2 lane 0 – positive
MIPI_CSI2_LANE1_N	AIO	8	MIPI camera serial interface 2 lane 1 – negative
MIPI_CSI2_LANE1_P	AIO	7	MIPI camera serial interface 2 lane 1 – positive
MIPI_CSI2_LANE2_N	AIO	5	MIPI camera serial interface 2 lane 2 – negative
MIPI_CSI2_LANE2_P	AIO	6	MIPI camera serial interface 2 lane 2 – positive
MIPI_CSI2_LANE3_N	AIO	4	MIPI camera serial interface 2 lane 3 – negative
MIPI_CSI2_LANE3_P	AIO	3	MIPI camera serial interface 2 lane 3 – positive
Camera I2C Interface			
Pin Name	**IO**	**Pin No.**	**instruction**
CCI_0_I2C_SDA	IO	36	camera I2C 0 serial data
CCI_0_I2C_SCL	DO	35	camera I2C 0 serial clock
CCI_1_I2C_SDA	IO	58	camera I2C 1 serial data
CCI_1_I2C_SCL	DO	52	camera I2C 1 serial clock

2.3.5. Audio interface

The SOM provides SLIMBUS interface, I2S (Inter-IC Sound) interfaces, and PCM interface as audio interface. SLIMBUS interface is dedicated for external codec IC, which can build system's audio functions. I2S and PCM (Pulse Code Modulation) share the same interfaces.

Table 2-7. Pin list for audio interfaces

SlimBus Interface (WCD9335)			
Pin Name	**IO**	**Pin No.**	**instruction**
MCLK2_GPIO66	DO	282	Primary MI2S master clock C Secondary MI2S master clock B
SLIMBUS_DATA1_GPIO72	DO	223	Low-power audio SLIMbus data 1
RESET_N_GPIO67	DO	242	SLIMbus RESET
INTR1_GPIO73	DI	240	SLIMbus INTR1
INTR2_GPIO74	DI	241	SLIMbus INTR2
SLIMBUS_CLK_GPIO70	DO	222	Low-power audio SLIMbus clock
SLIMBUS_DATA0_GPIO71	DO	224	Low-power audio SLIMbus data 0
RF_PA_ON_GPIO112	DO	74	SLIMbus GPIO
PM8953_GPIO1	DO	27	PM8953_GPIO1
I2S1 Interface			
Pin Name	**IO**	**Pin No.**	**instruction**
GPIO_25_STBYB	DO	143	PRI_MI2S_MCLK_A SEC_MI2S_MCLK_A
I2S_1_SCK	B	274	MI2S 1 bit clock
I2S_1_WS	B	262	MI2S 1 word select (L/R)
I2S_1_D0	B	285	MI2S 1 serial data channel 0
I2S_1_D1	B	284	MI2S 1 serial data channel 1
MI2S_1_D2	B	261	MI2S 1 serial data channel 2
MI2S_1_D3	B	273	MI2S 1 serial data channel 3
I2S2 Interface			
Pin Name	**IO**	**Pin No.**	**instruction**
GPIO_66_I2S_MCLK	DO	282	SEC_MI2S_MCLK_B
I2S_2_SCK	B	127	MI2S 2 bit clock
I2S_2_WS	B	84	MI2S 2 word select (L/R)
I2S_2_D0	B	138	MI2S 2 serial data channel 0
I2S_2_D1	B	137	MI2S 2 serial data channel 1
Digital microphone interface			
Pin Name	**IO**	**Pin No.**	**instruction**
DMIC_CLK	DO	272	Digital MIC0 clock
DMIC_DATA	DI	259	Digital MIC0 data

2.3.6. USB interface

The SOM provides a USB 2.0 high-speed interface or USB 3.0 Super-speed interface.

Table 2-8. Pin list for USB interfaces

Pin Name	IO	Pin No.	instruction
NC	PI	205,206	
USB_DM	AI AO	209	USB2 high-speed data – minus
USB_DP	AI AO	210	USB2 high-speed data –plus
USB_ID	AI	154	USB 2.0 for ID input
USB_SS_RX_P	AI	277	USB1 super-speed receive – plus
USB_SS_RX_M	AI	278	USB1 super-speed receive – minus
USB_SS_TX_P	AO	279	USB1 super-speed transmit – plus
USB_SS_TX_M	AO	280	USB1 super-speed transmit – minus
USB_SS_SEL	DO	120	USB Type-C switch control input
USBC_CC1	AI AO	163	USB Type-C connector configuration channel
USBC_CC2	AI AO	149	USB Type-C connector configuration channel
USB_VCONN	AI	158	Power input pin (5 V, 210 mA from VBUS) to drive active cables during the DFP mode. An internal mux connects VCONN power to either CC1 or CC2 based on the cable orientation.

➲ **NOTE**: Do not use Type-C. Float Pin: 163,149, and 158.

2.3.7. SDIO interface

The SOM provides one SDC interfaces and supports 1.8V or 3.0V power supply.

Table 2-9. Pin list for SDIO interface

Pin Name	IO	Pin No.	instruction
SDCARD_D1	IO	1	Data line bit 1
SDCARD_CMD	IO	2	Input and output command
SDCARD_D3	IO	18	Data line bit 3
SDCARD_D2	IO	19	Data line bit 2
SDCARD_D0	IO	20	Data line bit 0
SDCARD_CLK	DO	21	Clock signal
SD_DET_N	DI	233	card detection Configurable
VREG_L11_2P95	PO	251	Supply voltage 3.0V

2.3.8. UART interface

The SOM provides three UART interfaces, one of which is a 4-wire serial port.

- UART2 is a 2-wire serial port used for debug by default.
- UART4 is a 2-wire serial port reserved for users.
- UART5 is a 4-wire serial port reserved for users.

Table 2-10. Pin list for UART interface

Pin Name	IO	Pin No.	instruction
UART2_RXD	DI	88	Receive Data
UART2_TXD	DO	104	Transmit Data
UART4_RXD	DI	139	Receive Data
UART4_TXD	DO	128	Transmit Data
UART5_RXD	DI	54	Receive Data
UART5_TXD	DO	66	Transmit Data
UART5_CTS	DI	61	Clear to Send
UART5_RTS	DO	55	Request to send

➲ **NOTE**:

- Turbox C626 SOM UART Level is 1.8V. Add level conversion IC when connecting peripherals.
- RTS & CTS of DCE and DTE need cross connection.

Chapter 3. Function Description

3.1. Power supply sequence

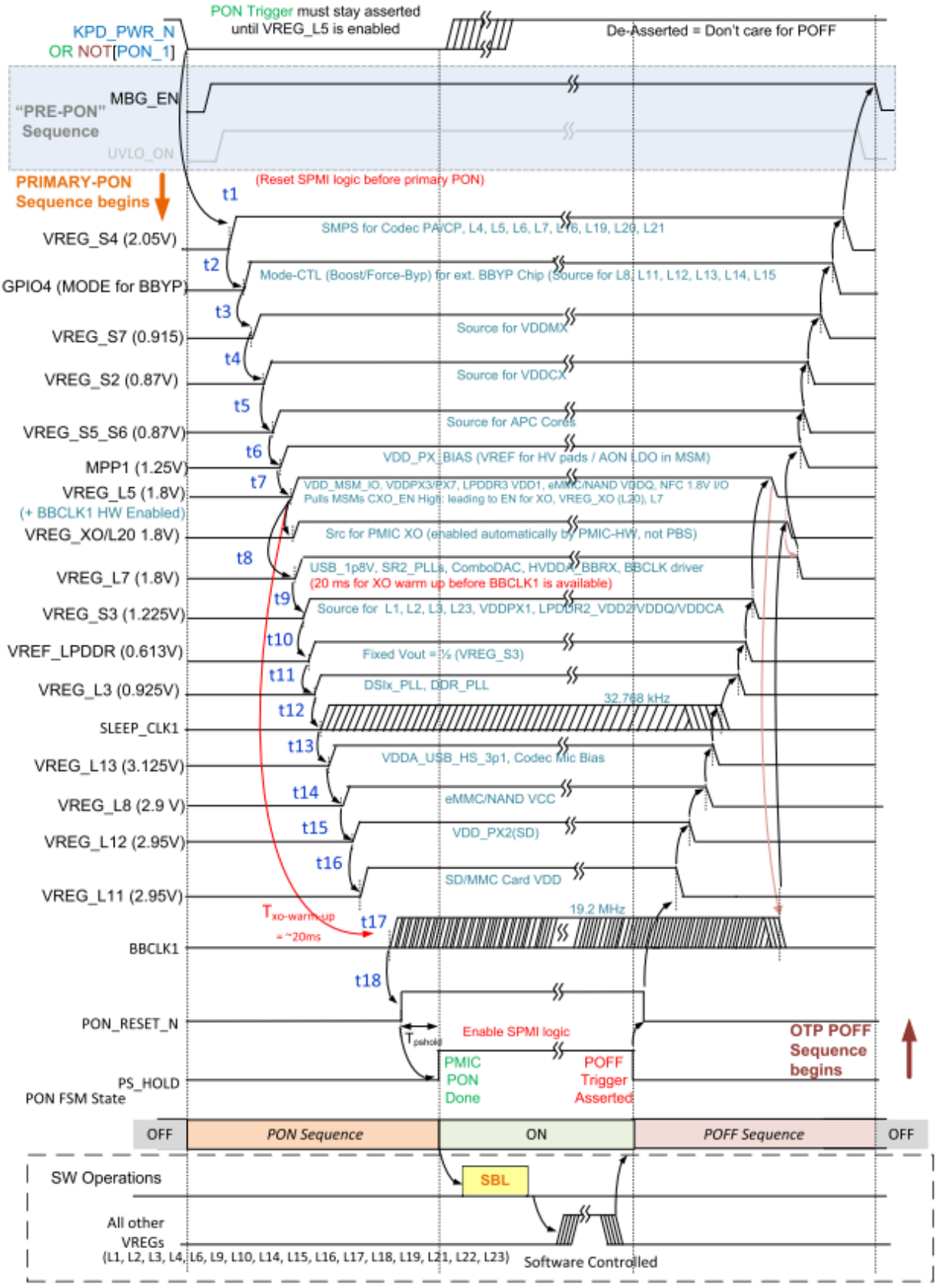

Figure 3-1. Power on Sequence Diagram

3.2. Power supply interface

Dedicated PMIC (Power Management Integrated Circuit) continuously monitors events that might trigger a power-on sequence. If an event occurs, these circuits will power on the IC (Integrated Circuit), check and enable power sources for the device.

Two methods to power on your device:

- Press the power-on key to power on the device, and wait for 3s to boot up the system.
- When using **CBL_PWR_N** pin to connect to ground, SOM will power on automatically with the battery or power supply installed.

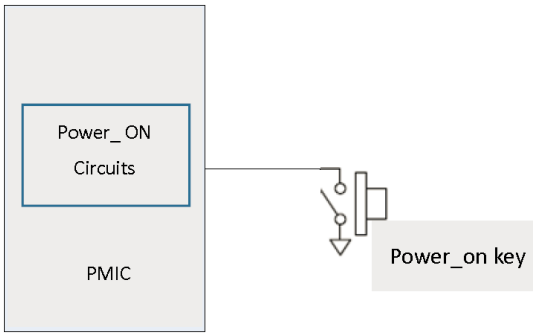

Figure 3-2. Power on signal

Table 3-1. Pin list for power on interface

PIN Name	PIN	Voltage	Type	Description	Notes
KYPD_PWR_N1	193	pulled up internally through a 200K resistor to 1.8V	DI	Power on/off key signal	Low level active
CBL_PWR_N	216	pulled up internally through a 200K resistor to 1.8V	DI	Signal use for auto power on when you plug in a battery, active low, internal pull up	

3.3. Reset interface

Hold the volume button will initiate a shutdown or reset (software selectable).

Stage 1. reset – software-configurable bark

PMIC generates interrupt, giving the soc device the opportunity to fix the problem or gracefully reset the system. Example events that can cause a bark: Over temperature indicates system is getting too hot. PMIC watchdog indicates that it has not kicked.

Stage 2. –software-configurable bite

If reset is ignored, PMIC will force a reset event (selectable by software).

Stage 3 –hardware mandatory bite

The user can generate a mandatory reset by a long key press of PM_RESIN_N, or KYPD_PWR_N1, or PM_RESIN_N + KYPD_PWR_N1.

The standalone or combination of reset triggers can also be selected as SBL by directly writing to the appropriate registers

Table 3-2. Reset interface definition

PIN Name	PIN	Voltage	Type	Description	Notes
PM_RESIN_N	155	pulled up internally to 1.8V	DI	Volume down/Reset key signal, Low active	

3.4. PWMs

All PWM output are made by Light Pulse Generators. Independent programmable duty cycle and period via LPGs (6- or 9-bit resolution) are for digital dimming.

Table 3-3. Pin list for PWMs

Pin Name	IO	Pin	instruction
PWM	DO	275	PM8953 MPP4 PWM control for the external WLED driver
PM8953_GPIO8	DO	154	PWM control for the external WLED driver.

3.5. Boot configuration

Special boot-related GPIO features:

- They are detected for device bootup during IC reset (during fuse sense).
- After device bootup, use them as normal GPIO interface.
- Do not have pull-ups on Boot configuration GPIO (GPIO_106, GPIO_107, GPIO_109, GPIO_113)

Forced USB boot:

(During development or factory production, boot from USB3.1 port are forced by using GPIO_37.)

- FORCED_USB_BOOT (GPIO_37) always takes precedence, regardless of the state of the BOOT_CONFIG GPIOs or FAST_BOOT_SEL fuses.
- FORCED_USB_BOOT is checked first during the boot device detection prior to BOOT_CONFIG GPIOs.
- GPIO_37 = 1 forces the SDM device to boot from USB0 port.

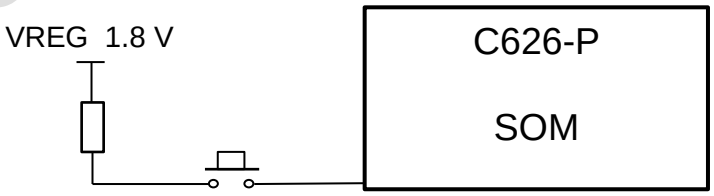

Figure 3-3. Power on Signal

Chapter 4. Electrical Characteristics

4.1. Operating conditions

Table 4-1. Power supply operating condition list

Parameters	Min	Typical	Max	Units
Input Power voltage				
USB_IN	3.8		6	V
VBATT, VPH_PWR	+2.7	3.8	+4.8	V
Thermal conditions				
Device operating temperature (case)	-30	25	85	°C

4.2. Power output

Table 4-2. Power output parameters

Function	Default voltage(V)	Programble range(V)	Rated current(mA)	Default State	Expected use
VREG_S1_0P8625	0.87	0.32–2.04	3000	Off	MSM modem
VREG_S2_0P8625	0.87	0.32–2.04	4000	ON	MSM core and graphics
VREG_S3_1P225	1.225	0.32–2.04	2000	ON	DDR, MIPI, LDOs
VREG_S4_2P05	2.04	0.32–2.04	2000	ON	LDOs
VREG_S5_S6_APC_1P225	0.87	0.350–1.355	7000	ON	applications processor
VREG_S7_0P915	0.915	0.32–2.04	2000	ON	VDD memory
WTR0_VREG_L1_RF_1P0	1.000	0.375–1.5375	600	Off	RFICs
VREG_L2_1P1	1.100	0.375–1.5375	1200	Off	Camera: digital
VREG_L3_0P925	0.925	0.375–1.5375	600	ON	MSM DSI PLL and USB
VREG_L4_1P8	1.800	1.750–3.3375	450	Off	RFICs and GPS eLNA
VREG_L5_1P8	1.800	1.750–3.3375	600	ON	digital I/Os LPDDR, and eMMC
VREG_L6_1P8	1.800	1.750–3.3375	300	Off	camera, TP, display, and sensors
VREG_L7_1P8	1.800	1.750–3.3375	300	ON	MSM analog, USB and PLLs, WCN XO
VREG_L8_2P9	2.900	1.750–3.3375	600	ON	eMMC
VREG_L9_3P3	3.3	1.750–3.3375	600	Off	WCN
VREG_L10_2P8	3.0	1.750–3.3375	150	Off	Sensors, TP
VREG_L11_2P95	2.950	1.750–3.3375	800	ON	Micro SD

Function	Default voltage(V)	Programble range(V)	Rated current(mA)	Default State	Expected use
VREG_L12_2P95	2.950	1.750–3.3375	50	ON	MSM pad group 2
VREG_L13_3P075	3.125	1.750–3.3375	150	ON	USB, external codec audio
VREG_L14_UIM1	1.800	1.750–3.3375	50	Off	UIM1
VREG_L15_UIM2	1.800	1.750–3.3375	50	Off	UIM2
VREG_L16_1P8	1.800	1.750–3.3375	5	Off	PMIC HKADC
VREG_L17_2P85	2.850	1.750–3.3375	300	Off	Camera and display
VREG_L18_2P7	2.700	1.750–3.3375	150	Off	QTI RF front-end
VREG_L19_1P3	1.350	0.375–1.5375	600	Off	MSM analog, WCN
VREG_L22_2P8	2.800	1.750–3.3375	150	Off	Camera: analog
VREG_L23_1P2	1.15	0.375–1.5375	600	Off	Camera: digital

4.3. Digital GPIO interface

The digital I/O (Input/Output) performance depends on its pad type, usage, and power supply voltage. The interfaces of I2C, USB, SPI and UART are complied with their standards with no additional specifications. Performance specifications for all other digital I/Os are organized in this section. The GPIOs can be programmed for a variety of configurations.

Table 4-3: Electrical characteristics for GPIOs

Parameter	Description	Min	Max	Units
VIH	High-level input voltage, CMOS/Schmitt,	0.65* VIO	VIO + 0.3	V
VIL	Low-level input voltage, CMOS/Schmitt,	-0.3	0.35* VIO	V
VOH	High-level output voltage, CMOS	VIO-0.45	VIO	V
VOL	Low-level output voltage, CMOS	0	0.45	V

4.4. USB interface

Table 4-4: USB standards and exceptions

Applicable standard	Feature exception
Universal Serial Bus Specification, Revision 3.1 (August 11, 2014 or later).	*Feature exceptions SS Gen2.*

4.5. I2S interface

Legacy I2S interfaces are designed for connecting microphones and speakers. The multiple I2S (MI2S) interface is designed for connecting microphones and speakers with HDMI audio function.

4.6. I2C interface

Table 4-5: I2C standards and exceptions

Applicable standard	Feature exception
I²C Specification, version 5.0, October 2012	None

Appendix 1. Statement and Compliance

FCC statements:

The device for operation in the band 5150–5350 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.

Federal Communication Commission (FCC) Radiation Exposure Statement

When using the product, maintain a distance of 20cm from the body to ensure compliance with RF exposure requirements.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

This device is intended only for OEM integrators under the following conditions: 1. The antenna must be installed such that 20 cm is maintained between the antenna and users. 2. The transmitter module may not be co-located with any other transmitter or antenna. As long as the two conditions above are met, additional transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for the installed module.

Important Note: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Federal Communications Commission of the U.S. Government (FCC) and the Canadian Government authorizations are no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator shall be responsible for re-evaluating the end-product (including the transmitter) and obtaining a separate FCC authorization in the U.S. and Canada.

OEM Integrators - End Product Labeling Considerations: This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains, FCC ID: 2AOHHTURBOXC450, FCC ID: 2AOHHTURBOXC626". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

OEM Integrators - End Product Manual Provided to the End User: The OEM integrator shall not provide information to the end user regarding how to install or remove this RF module in end product user manual. The end user manual must include all required regulatory information and warnings as outlined in this document.

CE statements:

Do not use the moudule in the environment at too high or too low temperature, never expose the moudule under strong sunshine or too wet environment.

The suitable temperature for the product and accessories is -20℃-70℃.

RF exposure information: The Maximum Permissible Exposure (MPE) level has been calculated based on a distance of d=20 cm between the device and the human body. To maintain compliance with RF exposure requirement, use product that maintain a 20cm distance between the device and human body.

Receiver category: 1

Maximum output power:

Frequency		Max. EIRP
Bluetooth	BLE:2402-2480MHz	5.26dBm
	BR+EDR:2402-2480MHz	9.28dBm
Wi-Fi	2412~2472MHz	17.58dBm
	5180-5240MHz	19.08dBm
	5260-5320MHz	18.56dBm
	5500-5700MHz	19.64dBm
	5745-5825MHz	13.49dBm

EU Regulatory Conformance

Hereby, Thundercomm Technology Co., Ltd declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

The device for operation in the band 5150–5350 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.

	AT	BE	BG	CH	CY	CZ	DE	DK
	EE	EL	ES	FI	FR	HR	HU	IE
	IS	IT	LI	LT	LU	LV	MT	NL
	PL	PT	RO	SE	SI	SK	TR	UK(NI)

EU Declaration of Conformity (DoC)

Hereby we,

Name of manufacturer:	***Thundercomm Technology Co., Ltd***
Address:	***Building 4, No. 99, Data Valley Middle Road, Xiantao District, Yubei District, Chongqing, China***
Zip code & City:	***Chongqing***
Country:	***China***
Telephone number:	***18664928002***

declare that this DoC is issued under our sole responsibility and that this product:

Product description:	**TurboX C450 SOM**
Type designation(s):	**TurboX C450**
Trademark:	**TurboX**

Hardware version:	**TURBOX-C450_SOM**
Software version:	**2020.10.22**

Software version note:Some software updates will be released by the manufacturer to fix some bug or enhance some function after placing on the market. All versions released by the manufacturer have been verified and still compliance with the related rules. All RF parameters (e.g.: frequency range, output power) are not accessible to the user, and can't be changed by the user.

This product can be used across EU member states.

Object of the declaration

TurboX C450 are TurboX C450 SOM and incorporate Wi-Fi, Bluetooth technologies.

is in conformity with the relevant Union harmonization legislation:

Radio Equipment directive: **2014 / 53 / EU**

and other Union harmonization legislation where applicable:

RoHS directive: **2011 / 65 / EU**

WEEE directive: **2012 / 19 / EU**

with reference to the following standards applied:

Health:EN 62311:2020;

Safety:EN IEC 62368-1:2020+A11:2020;

EMC:ETSI EN 301 489-1 V2.2.3; Draft ETSI EN 301 489-3 V2.1.2; ETSI EN 301 489-17 V3.2.4;

RF:ETSI EN 300 328 V2.2.2; ETSI EN 301 893 V2.1.1; ETSI EN 300 440 V2.2.1;

The Notified Body *Telefication* with Notified Body number *0560* performed:

Applicable Modules: B+C

Where applicable: The issued the EU-type examination certificate: 212140181/AA/00

Description of accessories and components, including software, which allow the radio equipment to operate as intended and covered by the DoC:

Antenna Type	Bluetooth : Dipole Antenna, 3dBi WIFI: Dipole Antenna, 3dBi(2.4GHz), 4dBi(5GHz) Manufacturer:MOLEX Part No.:146153

Note: This product will not be sold with the antenna. The above two types of antennas are only used for testing.

……

Qiyong Zhou

Signed for and on behalf of:

Chongqing 2021.04.30

Place and date of issue

Name, Function, and signature

EU Declaration of Conformity (DoC)

Hereby we,

Name of manufacturer:	***Thundercomm Technology Co., Ltd***
Address:	***Building 4, No. 99, Data Valley Middle Road, Xiantao District, Yubei District, Chongqing, China***
Zip code & City:	***Chongqing***
Country:	***China***
Telephone number:	***18664928002***

declare that this DoC is issued under our sole responsibility and that this product:

Product description:	**TurboX C626 SOM**
Type designation(s):	**TurboX C626**
Trademark:	**TurboX**
Hardware version:	**TURBOX-C626_SOM**
Software version:	**2020.10.22**

Software version note:Some software updates will be released by the manufacturer to fix some bug or enhance some function after placing on the market. All versions released by the manufacturer have been verified and still compliance with the related rules. All RF parameters (e.g.: frequency range, output power) are not accessible to the user, and can't be changed by the user.

Object of the declaration

TurboX C626 are TurboX C626 SOM and incorporate Wi-Fi, Bluetooth technologies.

is in conformity with the relevant Union harmonization legislation:

Radio Equipment directive: **2014 / 53 / EU**

and other Union harmonization legislation where applicable:

RoHS directive: **2011 / 65 / EU**

WEEE directive: **2012 / 19 / EU**

with reference to the following standards applied:

Health:EN 62311:2020;

Safety:EN IEC 62368-1:2020+A11:2020;

EMC:ETSI EN 301 489-1 V2.2.3; Draft ETSI EN 301 489-3 V2.1.2; ETSI EN 301 489-17 V3.2.4;

RF:ETSI EN 300 328 V2.2.2; ETSI EN 301 893 V2.1.1; ETSI EN 300 440 V2.2.1;

The Notified Body *Phoenix* with Notified Body number*0700* performed:
Applicable Modules: B+C
Where applicable: The issued the EU-type examination certificate: .

Description of accessories and components, including software, which allow the radio equipment to operate as intended and covered by the DoC:

Antenna Type	Bluetooth: Dipole Antenna, 3dBi WIFI: Dipole Antenna, 3dBi(2.4GHz), 4dBi(5GHz) Manufacturer:MOLEX Part No.:146153

Note: This product will not be sold with the antenna. The above two types of antennas are only used for testing.

……

Signed for and on behalf of:

Qiyong Zhou

Chongqing 2021.05.17

Place and date of issue

Name, Function, and signature

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