

Realtek Type-C PD Controller, USB Hub Product Roadmap

Agenda: Part-I

- USB Type-C Controller
- USB3.2 Gen1/Gen2 Hub

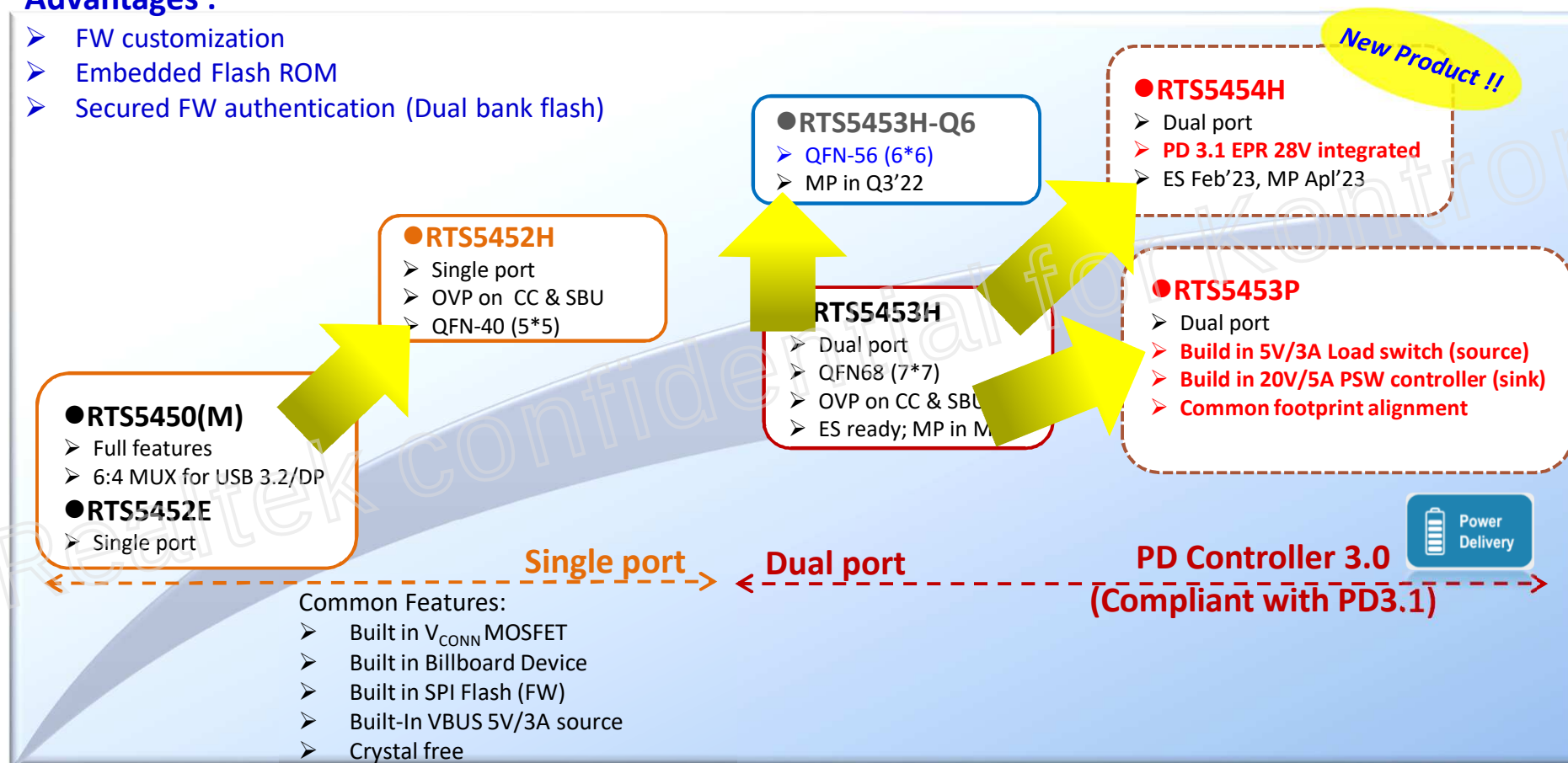


Jul 4th, 2022

USB Type-C/PD Roadmap

Advantages :

- FW customization
- Embedded Flash ROM
- Secured FW authentication (Dual bank flash)



Type-C/PD Controller Products Table

Power Delivery 3

CC + MUX

CC + Power Switch

RTS P/N	5450M	5452E	5452H	5453H (2 port)	5454H (2 port)	5437	5441S	5444 (P2P TI25810)	5444E (P2P TI25820)	5444V
BC 1.2	--	Support	Support	Support	Support	--	--	--	--	--
Flash	256KB	256KB	256KB	256KB	256KB	--	--	--	--	--
EPR 28V	--	--	--	--	Build-in	--	--	--	--	--
HS MUX	6:4 10G MUX/DP	--	--	--	--	--	4:2 10G MUX	--	--	--
LS MUX	USB2.0 AUX	USB2.0 AUX	USB2.0 AUX	USB2.0 AUX	USB2.0 AUX	--	--	--	--	--
TBT	--	Support	Support	Support	Support	Support	--	--	--	--
Package	QFN-46 6.5x4.5	QFN-32 4x4	QFN-40 5x5	QFN-64 7x7	QFN-64 7x7	QFN-40 5x5	QFN-24 4x4	QFN-20 3x2	QFN-12 3x2	QFN-24 4x4
Billboard	Support	Support	Support	--	--	--	--	--	--	--
PSW	--	--	--	--	--	--	PSW 3A@5V	PSW 3A@5V	PSW 1.5A@5V	PSW 3A@5V VBUS RVP
OVP	--	--	OVP on CC & SBU	OVP on CC & SBU	OVP on CC & SBU	--	--	--	--	--
App.	MNT, Accessory	NB/PC, Accessory	NB/PC, Accessory	NB/PC, Accessory	NB/PC, Accessory	MB	NB/PC	NB/PC	NB/PC	NB/PC

USB-IF Certification and Intel Qualification

PASSED

● USB-IF Type-C PD 3.0 Controller Certification ID

Name	Company	Features	Speed	Marketing Categories	Certification Date
 RTS5452E TID: 1065 Model Number: RTS5452E	Realtek Semiconductor Corp.	Power Delivery 3.0, PD DRP,5V Fixed		PD Controller	04/25/2019
 RTS5452H TID: 137 Model Number: RTS5452H	Realtek Semiconductor Corp.	Power Delivery 3.0, PD DRP,5v Prog,5V Fixed		PD Controller	12/07/2018
 RTS5453H TID: 6994 Model Number: RTS5453H	Realtek Semiconductor Corp.	USB Power Delivery, PD DRP,5V Fixed,USB Power Delivery		PD Controller	01/10/2022

● Intel® Platform AVL List

Device Category	Vendor	Part Number	Device Interface	Category	Windows OS Version	Modern Standby Readiness	PCL Remarks	Validation Platform
TypeC PD Controller	Realtek Semiconductor Corp.	RTS5452E	I2C	ECO	20H2-PV	Yes	GRL test finished in final round internal check	Tiger Lake Client Platform
TypeC PD Controller	Realtek Semiconductor Corp.	RTS5453H	I2C	iPOC	20H2-Alpha		Passed Intel Plugfest testing USBIF certified part	Alder Lake Client Platform
TypeC PD Controller	Realtek Semiconductor Corp.	RTS5452H	I2C	iPOC	20H2-Alpha		Passed Intel Plugfest testing USBIF certified part	Alder Lake Client Platform

Type-C Dual Port PD Solution in PC Market

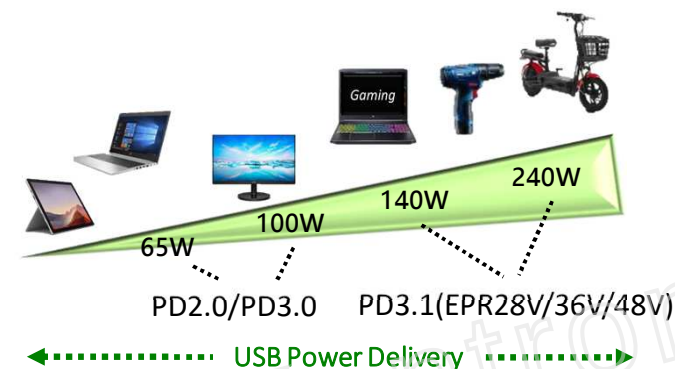
- PD controllers adopted by top 5 PC brands
 - **Realtek : RTS5453H (Single Port : RTS5455H, RTS5452E)**
 - “T” : TPS65994AE (Single Port : TPS65987, TPS65992)
 - “C” : CCG6DF (Single Port : CCG6SF, CCG6)



Feature	RTS5453H (Realtek)	TPS65994AD (“T”)	CCG6DF (“C”)
V _{CONN} MOSFET (switch)	YES	YES	YES
Embedded Flash	256KB 	N/A	64KB
AUX/HPD MUX	YES 	N/A	YES
Built-in Power Switch	N/A	N/A	N/A
BC1.2 (charger)	YES 	N/A	N/A
USB2 MUX	YES	N/A	YES
SBU/CC OVP Protection	26V 	N/A	20V
GPIO 1.8V integrated	YES 	N/A	N/A
Package	QFN-68 (7x7mm)	WLCSP-50 (3.2x3.2mm)  QFN-48 (6x6 mm)	BGA-96 (6x6mm) QFN-48 (6x6 mm)

Type-C PD3.1 EPR Application

- Advanced PD controllers are coming in 2023
 - **Realtek : RTS5454H (ES in Q4'22, MP in Q1'23)**
 - **"T" : Tomcat2**
 - **"C" : CCG8D**



Feature	RTS5454H (Realtek)	Tomcat2 ("T")	CCG8D ("C")
EPR 28V Protection	YES	YES	YES
Embedded Flash	256KB	352KB	128KB
SBU MUX	(3:1 MUX)*2	2:1 MUX, 3:1 MUX	(3:1 MUX)*2
Built-in Power Switch	N/A	(5V/3A)*2	N/A
BC1.2 (charger)	YES	N/A	N/A
USB2 MUX	YES	N/A	N/A
SBU/CC OCP Protection	YES	YES	N/A
GPIO 1.8V integrated	YES	YES	YES
SBU TX/RX Level shifter	YES	YES	YES
Compatible to last generation	P2P RTS5453H	Non-P2P TPS65994AE	Non-P2P CCG6DF
Package	QFN-68 (7x7mm)	QFN (5x8 mm)	BGA (6x6mm)

p/n	PD HW	PD FW	Ref. Schematic	PD3.1 certification	EPR28 (140W)	EVM	Intel RVP	AMD RVP
RTS5454H (dual)	Q4, 22' ES Q1, 23' MP	Feb, 23'	Dec, 22'	Jan, 23'	Add external SWR	Feb, 23'	Target to Meteor Lake	Target to Strix

Realtek USB Type-C/PD Achievement

- 2021 annual shipment with Realtek PD solution is **60M+** pcs
- Popularly adopted by top 5 PC brands, and ODM customers.
- **Comprehensive accessories** are applied in many applications.

- RTS5450(M)
- RTS5451
- RTS5459

Type-C & PD
Power + Data/Video

- RTS5452E
- RTS5455H
- RTS5453H

Type-C & PD
Power provider

- RTS5444
- RTS5444E
- RTS5441E
- RTS5441S

Standard Type-C
Max 15W / Data

- RTS5421
- RTS5423
- RTS5429E

Integrated PD
in USB Gen2 Hub

Monitor



Docking



Power bank



Desktop



Laptop



Dongle



POS



VR



Power adaptor



AIO



Agenda: Part-II

- USB Type-C Controller
- USB3.2 Gen1/Gen2 Hub



Realtek USB3.2 Hub Roadmap

Advantages :

- USB-IF KGH
- Market share>60%
- Secured FW authentication
- Dual bank for FW updating
- The lowest power consumption

●RTS5445A

- KVM switch for Monitor
- Multi-control PCs/servers
- Saving cost and space
- ES : Sep'22

●USB4.0 Router - RTS5490

- Speed up to 40Gbps
- Compatible with TBT3
- Display/data bandwidth allocation
- ES : Q2'22

USB4.0 (40G)

Embedded PD Controller

DFP:2A ports

●RTS5412S

DFP:4A ports

●RTS5411S

●RTS5411E

●RTS5411T

●RTS5420

- DFP:4A ports

●RTS5424

- DFP:2A ports

●RTS5421

- DFP:4C ports

●RTS5423

- DFP:1C+3A ports

●RTS5429

- DFP:2C+2A ports

●RTS5481

- DFP: 7 ports

Gen2 *3

Gen1 *3

U2 *1

- Embedded PD controller

ES in Oct/'22

Common Features:

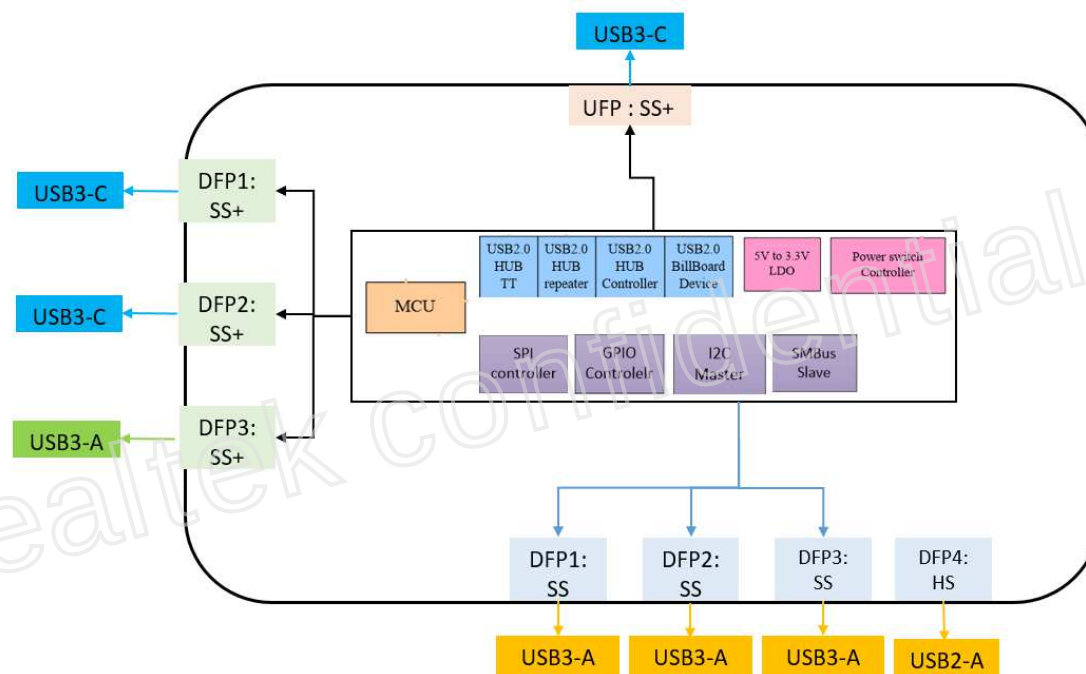
- Multiple-INs Support
- BC1.2, Apple, Samsung Charging
- SMBUS, I²C Configuration
- Dual Bank Secured FW Update
- Billboard, HID Device
- Built-In 5V to 3.3V LDO Regulator

USB3.2 Gen1 (5G) Family

USB3.2 Gen2 (10G) Family

RTS5481

USB Gen2 multiple downstream port hub



7 DFPs :

USB3.2 Gen 2 * **3** ports
(Type C*2+Type A*1)

USB3.2 Gen 1 * **3** ports
(Type A*3)

USB2.0 * **1** port

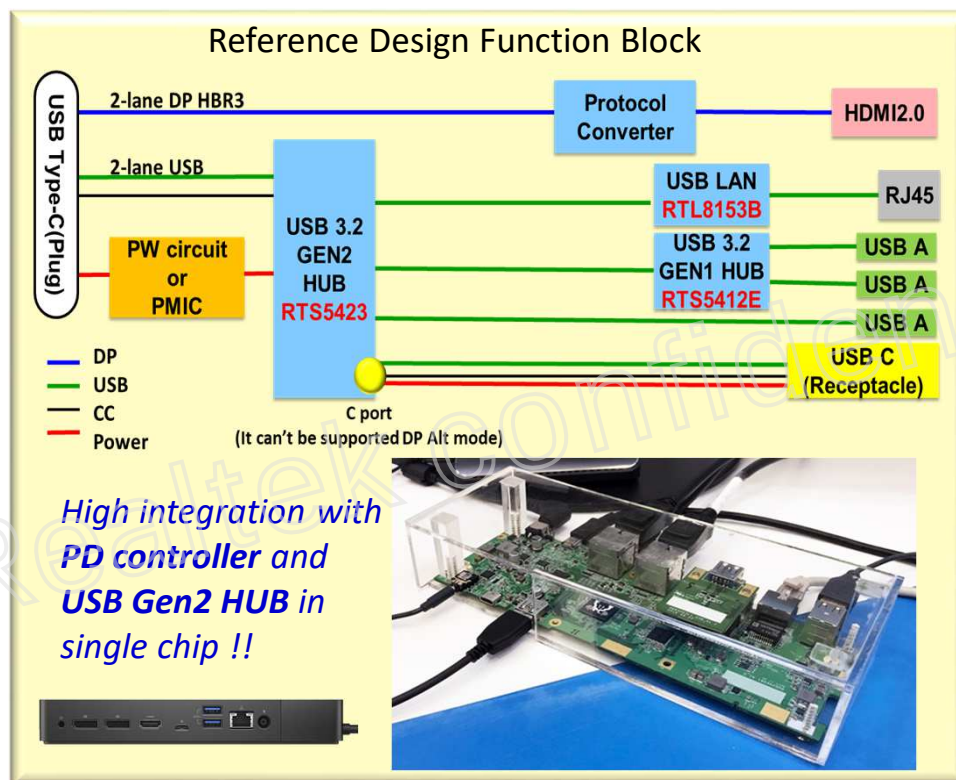
USB3.2 Hub Products Table

USB3.2 Gen1

USB3.2 Gen2x1

PTS P/N	RTS5412S	RTS5411S/E/T	RTS5420	RTS5421	RTS5423	RTS5429E	RTS5481 (Under development)
UFP	Type B	Type B	Type B	Type C	Type C	Type C	Type C
DFP	Type A	Type A	Type A	4C	1C3A	2C2A	2C4A + UBS2
USB3.2 Spec	Gen1 5G	Gen1 5G	Gen2 10G	Gen2 10G	Gen2 10G	Gen2 10G	Gen2 10G *3 Gen1 5G * 3 USB2 * 1
USB3.2 DFPs	2	4	4	4	4	4	7
10G 4:2 MUX	X	X	X	5	2	3	3
USB 2.0 MUX	X	X	X	○	X	X	X
AUX MUX	X	X	X	○	X	X	X
PD3 Controllers	X	X	X	5	2	3	3
Billboard	X	○	○	○	○	○	○
HID Device	X	○	○	○	○	○	○
BC1.2	○	○	○	○	○	○	○
Display port	X	X	X	X	X	X	X
HDMI	X	X	X	X	X	X	X
Package	QFN-56, 7x7	QFN-76, 9x9	QFN-88 10x10	BGA-169, 8.5x8.5	QFN-88, 10x10	QFN-128, 10x10	BGA-169, 9x9 (ball pitch 0.65mm)

USB3.2 Gen2 HUB integrates PD Controller



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USB3.2 Gen2 Hub

PTS P/N	RTS5421	RTS5423	RTS5429E
UFP	Type C	Type C	Type C
DFP	4C	1C3A	2C2A
USB3.2 Spec	Gen2 10G	Gen2 10G	Gen2 10G
USB3.2 DFPs	4	4	4
10G 4:2 MUX	5	2	3
PD3 Controllers	5	2	3
USB 2.0 MUX	○	X	X
AUX MUX	○	X	X
Billboard	○	○	○
HID Device	○	○	○
BC1.2	○	○	○
Display port	X	X	X
HDMI	X	X	X
Package	BGA-169	QFN-88	QFN-128

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Realtek USB4.0 Router Solution



4th Generation -RTS5490

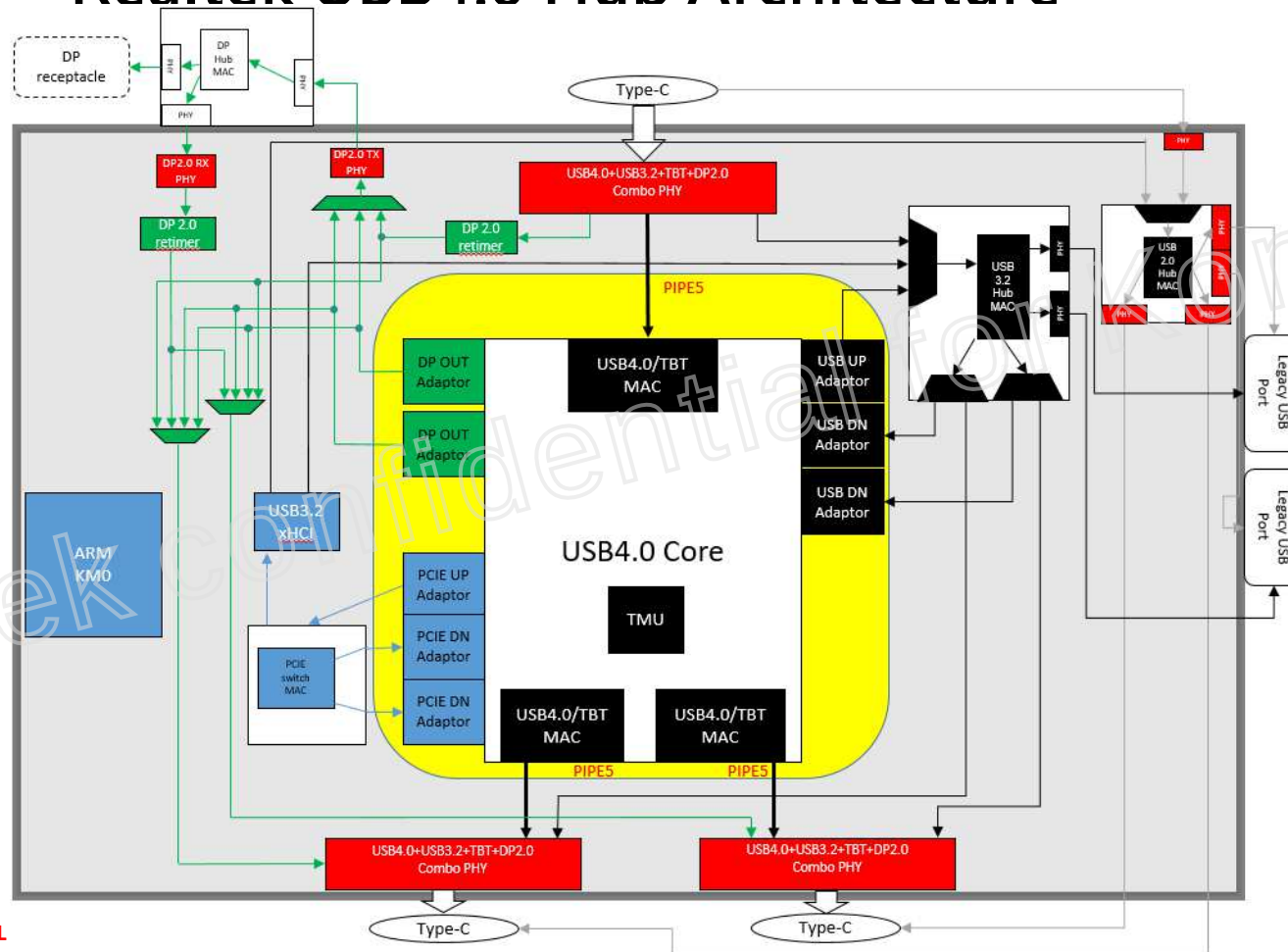
➤ USB4.0 Hub Controller

- USB4.0 Hub Router
- USB 3.2 xHCI Host
- PCIe Switch controller
- TBT3.0 Compatible
- USB3.2 Gen2x2 Hub
- DP2.0 Alt mode/Re-Timer
- Type-C V2.0
- PD 3.0 V2.0

ES: Q4'2022

	Realtek RTS5490
UFP	USB4, TBT3, USB3.2 Gen2 x2, DP2.0 Alt mode
DFP	4 DFPs USB4/TBT3 *2 + USB3.2 Gen2 x2 *2 DP2.0 Alt mode, DP Src
DP retimer	DP2.0 retimer
DP Src/Snk	Dedicated DP Src x1, DP Snk x1 2 DP Src shared with DFPs
External MST Hub Usage	Using dedicated DP Src/Snk
PCIe switch	Integrated
PCIe endpoint	None
xHCI Controller	Integrated
USB3.2 Hub	Integrated(Gen2 x2)
USB2.0 Hub	Integrated
U2 MUX	Integrated
Billboard device	Integrated
Legacy USB ports	2 legacy USB3.2 x2 ports
Type-C 2.0 CC logic	Integrated
PD3.0 BMC PHY	Integrated
Package	BGA-576 ball (16*16mm)

Realtek USB4.0 Hub Architecture



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Juctor Corp.

RTS542X Verified Items

◆ Approved KGH from USB-IF

- USB-IF USB3.2 Gen2 Hub Certified
- USB-IF KGH

PASSED

RTS5423 TID: 2101	Realtek Semiconductor Corp.	Power Delivery 3.0, PD DRP, 5V Fixed	PD Controller	12/05/2019
USB3.1 Hub Controller / RTS5411S, RTS5413D, RTS5412S, RTS5419S, RTS5412E, RTS5411E, RTS5409S TID: 330000075 Model Number: RTS5411S, RTS5413D, RTS5412S, RTS5419S, RTS5412E, RTS5411E, RTS5409S	Realtek Semiconductor Corp.		SuperSpeed USB 5Gbps Development > Hubs Silicon > USB 3.1 Gen 1 > Hubs	04/03/2018

◆ Approved from Intel Modern Standby

Sub-system	Item	Vendor	Part number	Interface	Category	Type	Windows* 10 64b Status	Modern Standby Readiness	Remark
USB	USB HUB	Realtek*	RTS5411S	USB	MS-CC	IHV	MS-CC-IV	Yes	Passed MS compliance on WHL
USB	USB HUB	Realtek*	RTS5420	USB	MS-CC	IHV	MS-CC-IV	Yes	Passed MS compliance on WHL

◆ Intel Thunderbolt (Tortilla Creek) reference design

Titan Ridge EP DD [↓](#)

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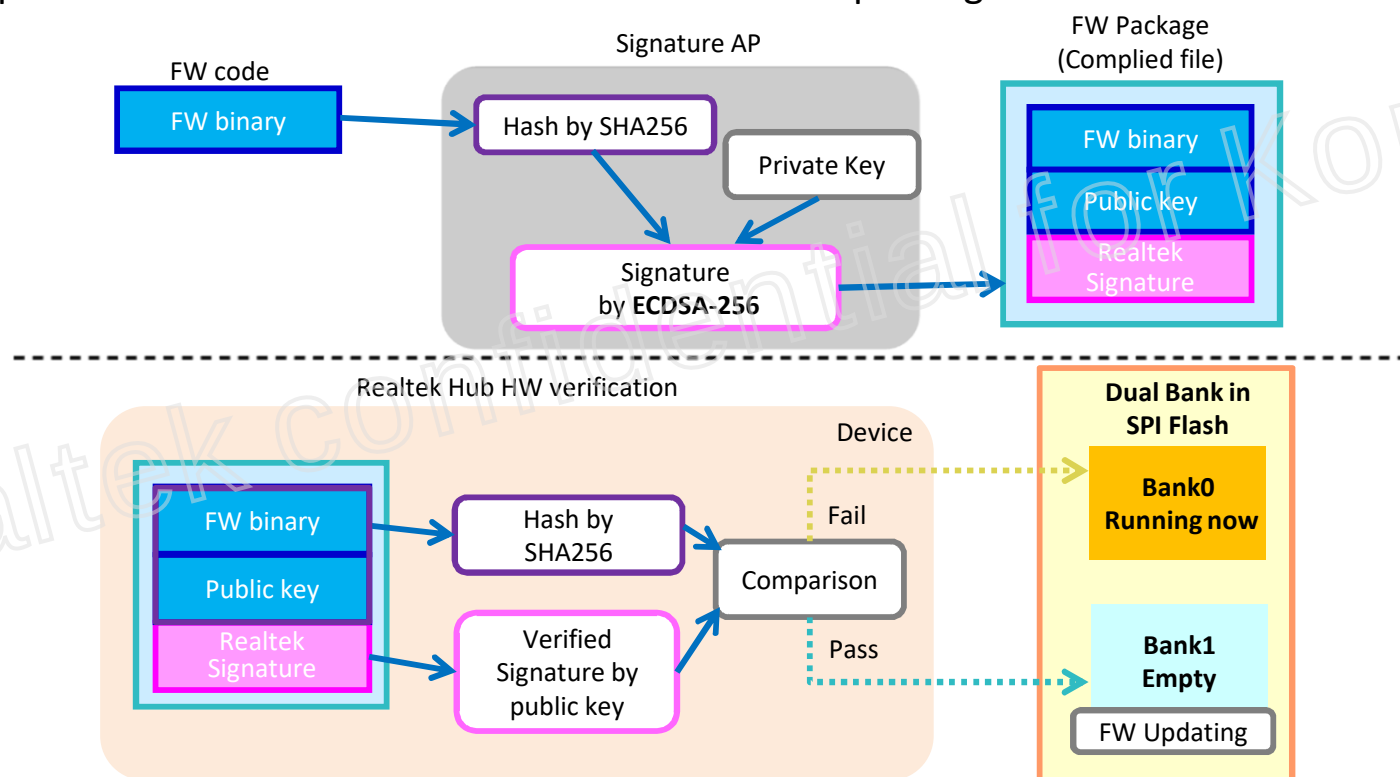
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Dual Bank of Secured FW Updating

- The most efficient authentication embedded in HW design
- Supports dual bank in SPI flash to ensure online FW updating for verified correct firmware





Thank You

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