Type-C, USB PD and QC4/4+ Solutions

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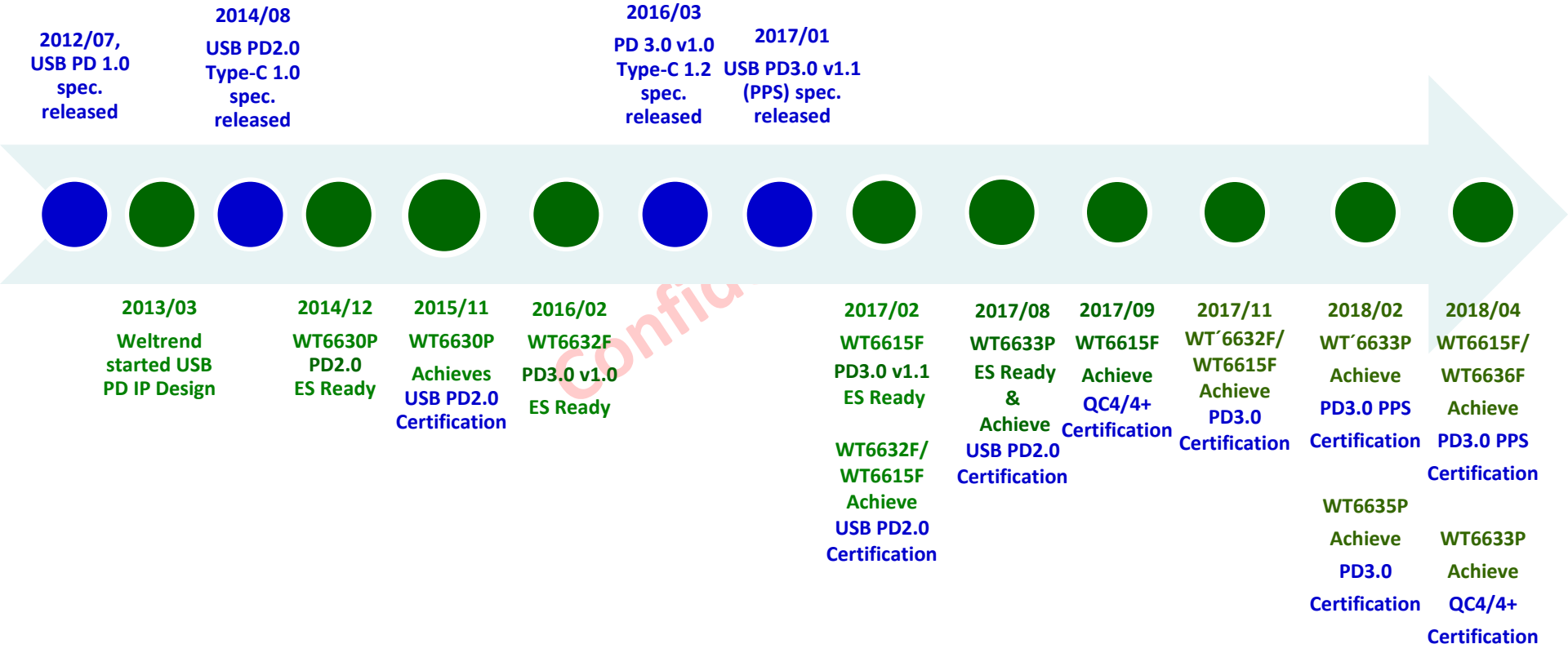
Oct 14, 2019

Weltrend USB PD Controller Key Milestones



Selected USB PD Power Customers

Business Highlights and Selected USB PD and Other Proprietary Fast Charge Controller OEM Customers

- **Market leader** in USB PD controller with most design-wins in the market
- Widely adopted by **tier-one** power ODMs and NB/tablet/smartphone OEMs
- Selected USB PD OEM customers around the world:

*Chromebook

Product Portfolio

Weltrend 偉詮電子

** under development*

	WT66xxx									
xxx	30P	31P	32F	15F	33P	35P	36F	16F	17F	*39F
Type-C Ports	1	1	1	1	1	1	1	1	1	2
USB PD 2.0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
USB PD3.0		✓	✓	✓	✓	✓	✓	✓	✓	✓
PPS (QC4)				3.3V – 11V	3.3V – 21V	✓	3.3V – 21V	3.3V – 21V	3.3V – 21V	3.3 – 21V
QC2/QC3				✓	✓	✓	✓	✓	✓	✓
SCP/FCP					✓	✓	✓		✓	✓
CV	8 PDOs 5 - 20V	100mV 5 - 20V	100mV 3.3 – 20V	20mV 100mV	20mV 3.3 – 21V		20mV 3.3 – 21V	20mV 3.3 – 21V	20mV 3.3 – 21V	20mV 3.3 – 21V
CL (CC)			50mA, 6A	50mA, 6A	50mA, 6A		50mA, 6A	50mA, 6A	50mA, 6A	50mA
OVP/OCP/OTP	✓	✓	✓	✓	✓		✓	✓	✓	✓
UVP		✓	✓	✓	✓		✓	✓	✓	✓
OVP for CC/D+/-		✓			✓	✓	✓	✓	✓	✓
CDC	✓	✓	✓	✓	✓		✓	✓	✓	✓
Prog. Memory	One-Time	One-Time	Multi-Time	Multi-Time	One-Time	One-Time	Multi-Time	Multi-Time	Multi-Time	Multi-Time
Load SW Driver	PMOS	NMOS	PMOS	PMOS	NMOS		NMOS	NMOS	NMOS	NMOS
Vconn Power					✓	✓	✓		✓	
DRP								✓		✓
Oper. Voltage	4 to 30V	4 to 24V	3 to 30V	3 to 30V	3 to 24V	3.0 to 4.3V	3 to 24V	3 to 24V	3 to 24V	3V - 24V
AEC-Q100									✓	
Package	SOP14 QFN16	SOP8/10/1 4 QFN16	SOP14 QFN16	SOP14 QFN16	SOP10/14 QFN16	SOP8/10	SOP10/14 QFN16	QFN16	QFN16	QFN24

USB PD and QC4/4+ Certificates

	PD 2.0	PD 3.0 w/o PPS	PD 3.0 w PPS	QC 2.0	QC 3.0	QC4	QC4+
WT6630P	1020008						
WT6631P	*	1090014					
WT6632F	1030016	1070017					
WT6615F	1030015	1061022	1080015	*	4787939406-2	WD-BE-20062017	4788486761-2
WT6633P	1050000	*	1070018	*	4788149723-2	WD-TP-12111701	4788566324-2
WT6635P	*	1071057	1090015	*	*	*	QC2019040259
WT6636F	*	*	1080018				

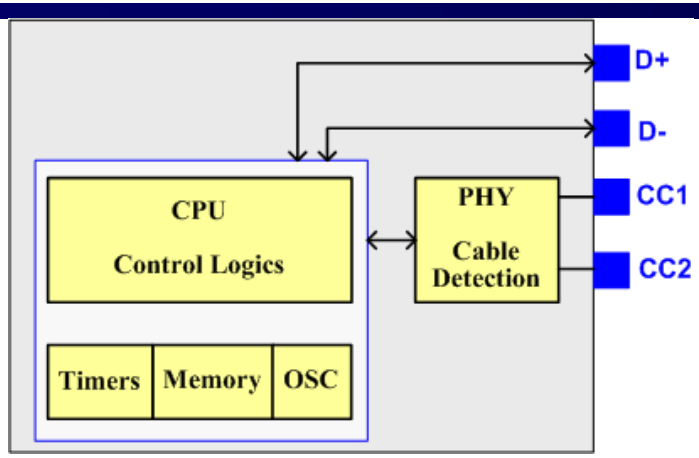
PD2.0/PD3.0/PPS: TID (PD3.0 with PPS is backward compatible with PD3.0 & PD2.0)

QC3.0: UL Certificate Number (QC3.0 is backward compatible with QC2.0)

QC4: GRL Report Number

QC4+: UL Certificate Number & GRL Report Number

Analog & Mixed-signal/Digital Technologies



Physical Layer (PHY) **–**

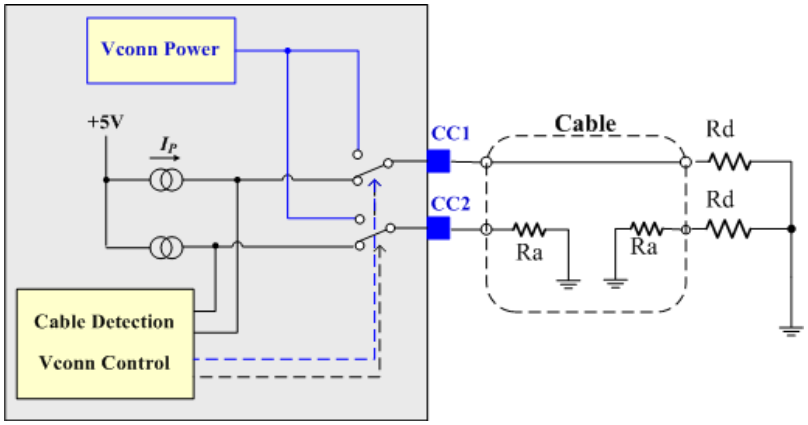
- ***Support Type-C 1.3***
- ***Biphase Mark Coding (BMC) over CC pins***
- ***Encode/Decode packets***
- ***Calculate, append, validate CRC***
- ***Tx/Rx packet data to/from protocol layer***

MCU **–** ***firmware implementation***

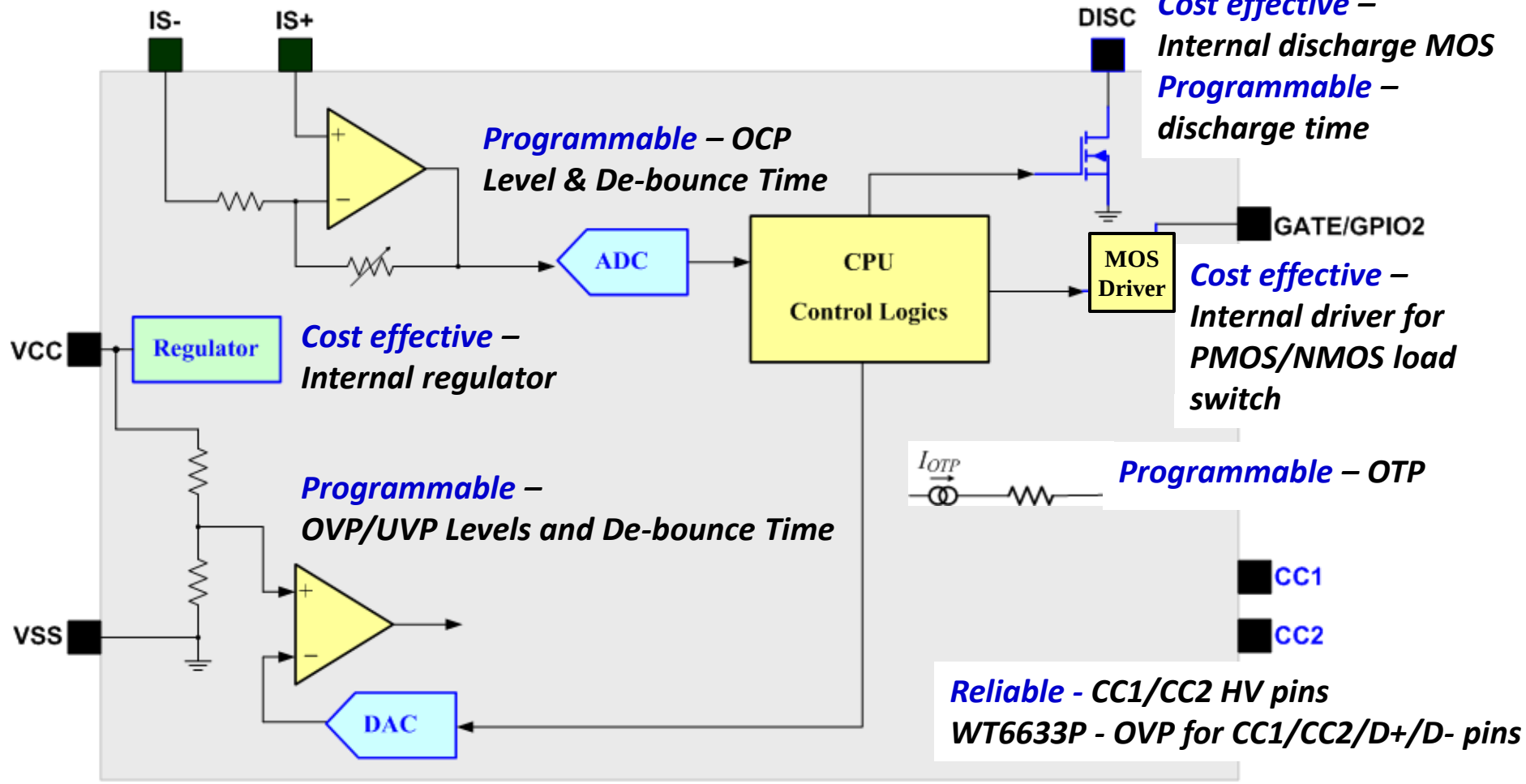
- ***USB PD protocol layer***
- ***USB PD policy engine/manager***
- ***VBUS voltage/current configuration***
- ***Type-C current sources (I_P), 80/180/330uA, configuration***
- ***OVP/OCP/OTP/UVP configuration***
- ***MCU standby mode & wake up control***
- ***CC pin wake up & firmware update features***

Type-C Cable Detection **–**

- ***Cable attach/detach detection***
- ***Plug orientation / cable twist detection***
- ***Vconn power control***



Cost Effective & Reliable Designs



***Cost effective** – Internal discharge MOS*
***Programmable** – discharge time*

***Cost effective** – Internal driver for PMOS/NMOS load switch*

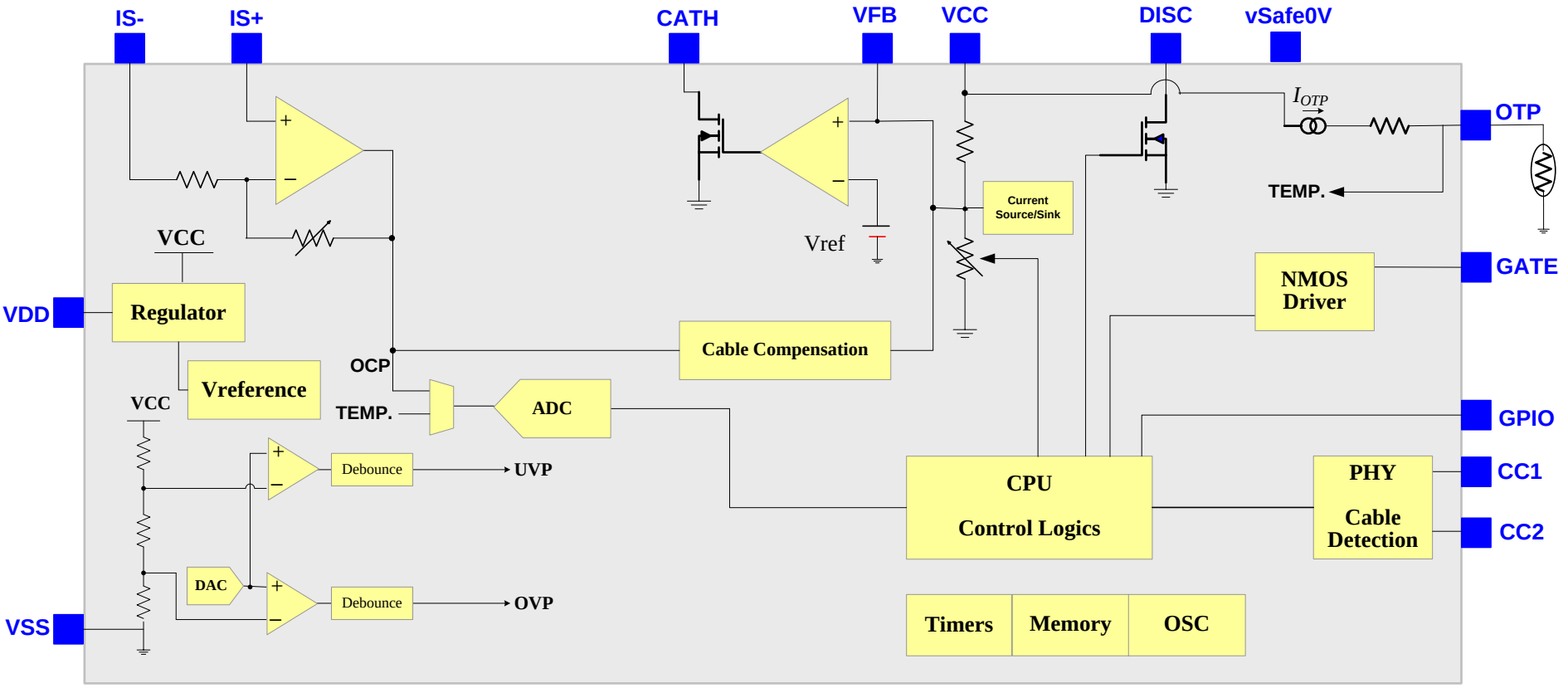
***Cost effective** – Internal regulator*

***Programmable** – OVP/UVP Levels and De-bounce Time*

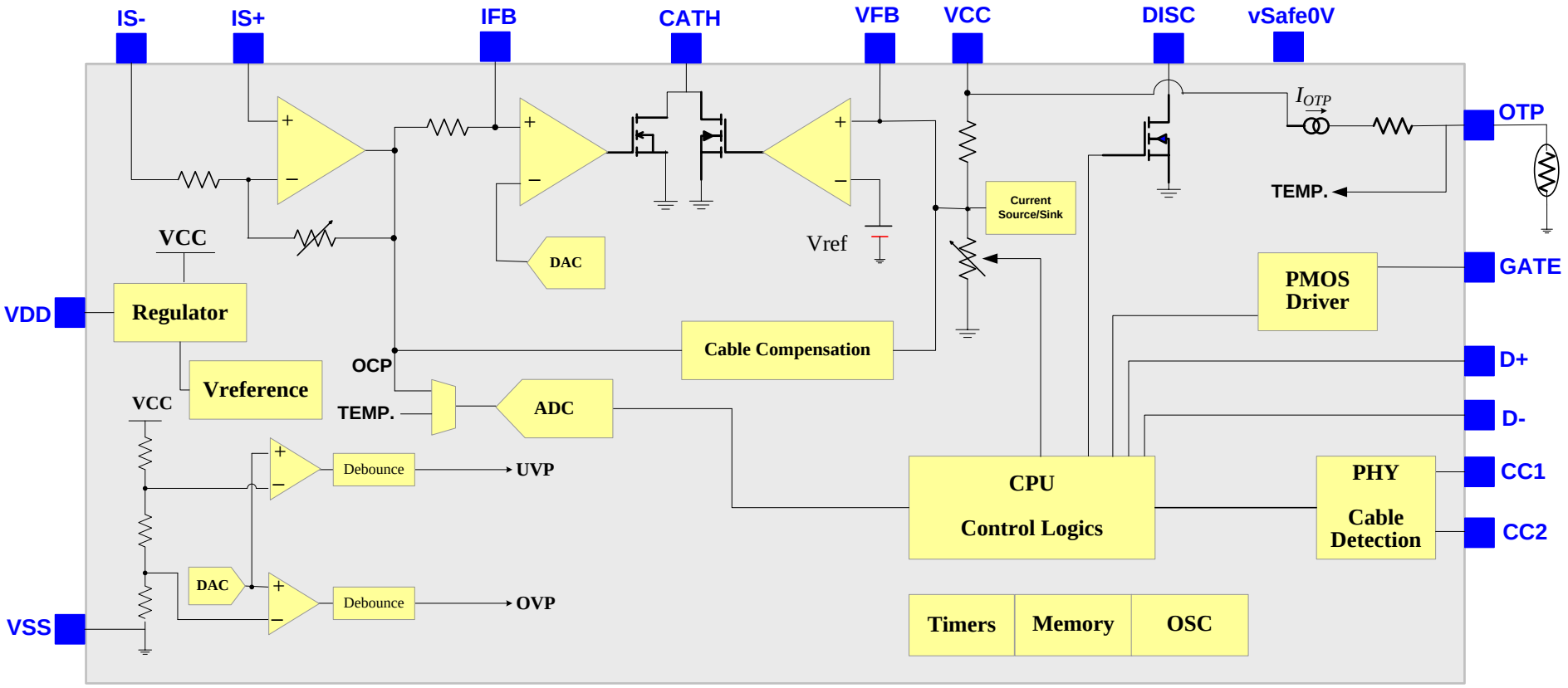
***Programmable** – OTP*

***Reliable** - CC1/CC2 HV pins*
WT6633P - OVP for CC1/CC2/D+/D- pins

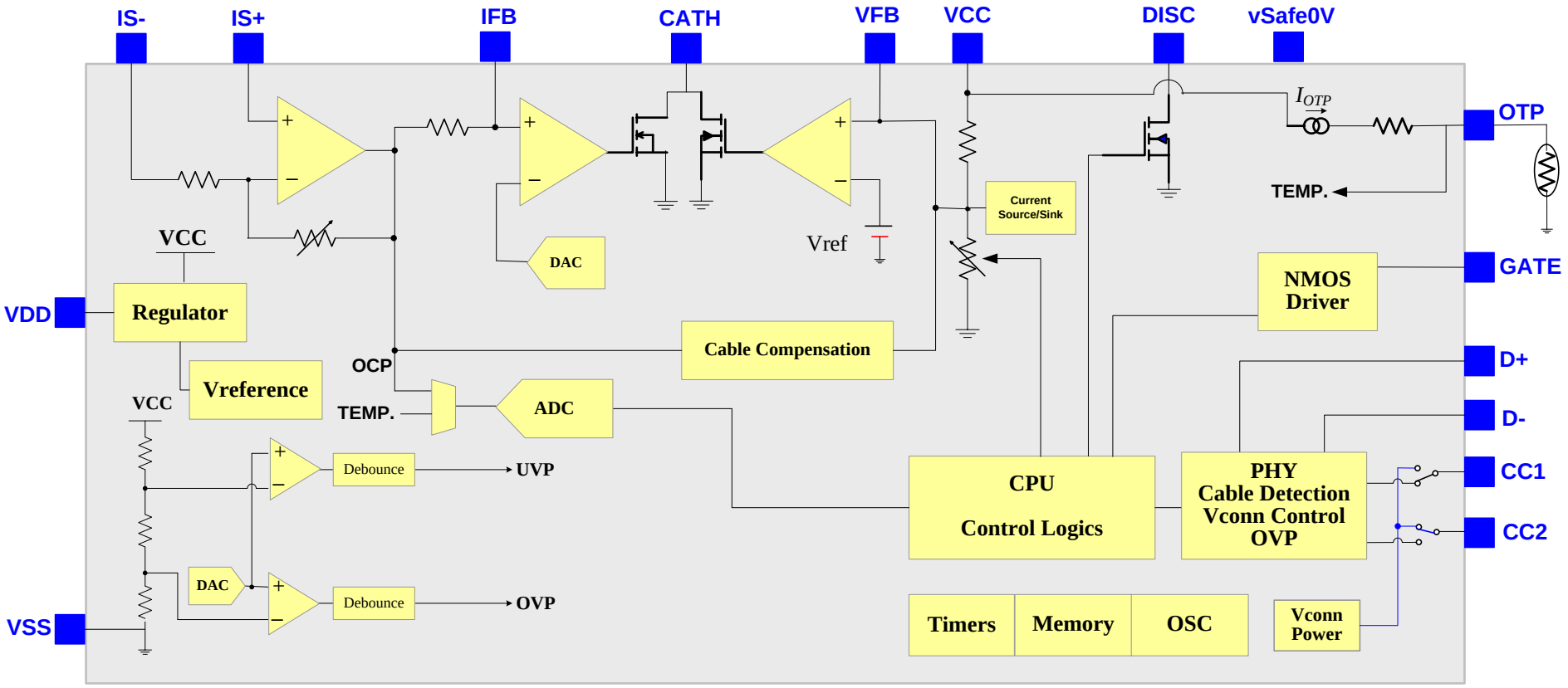
WT6631P Block Diagram



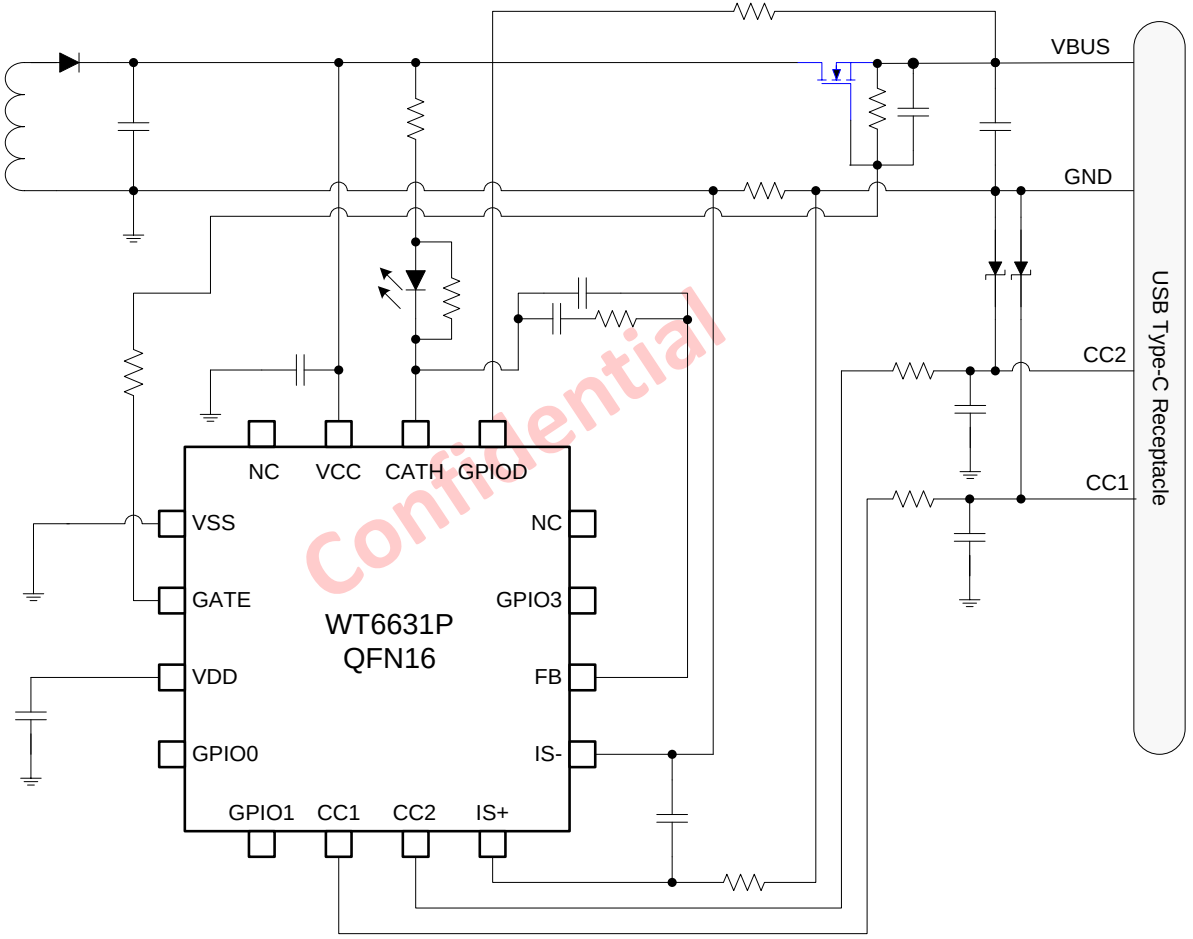
WT6632F/WT6615F Block Diagram



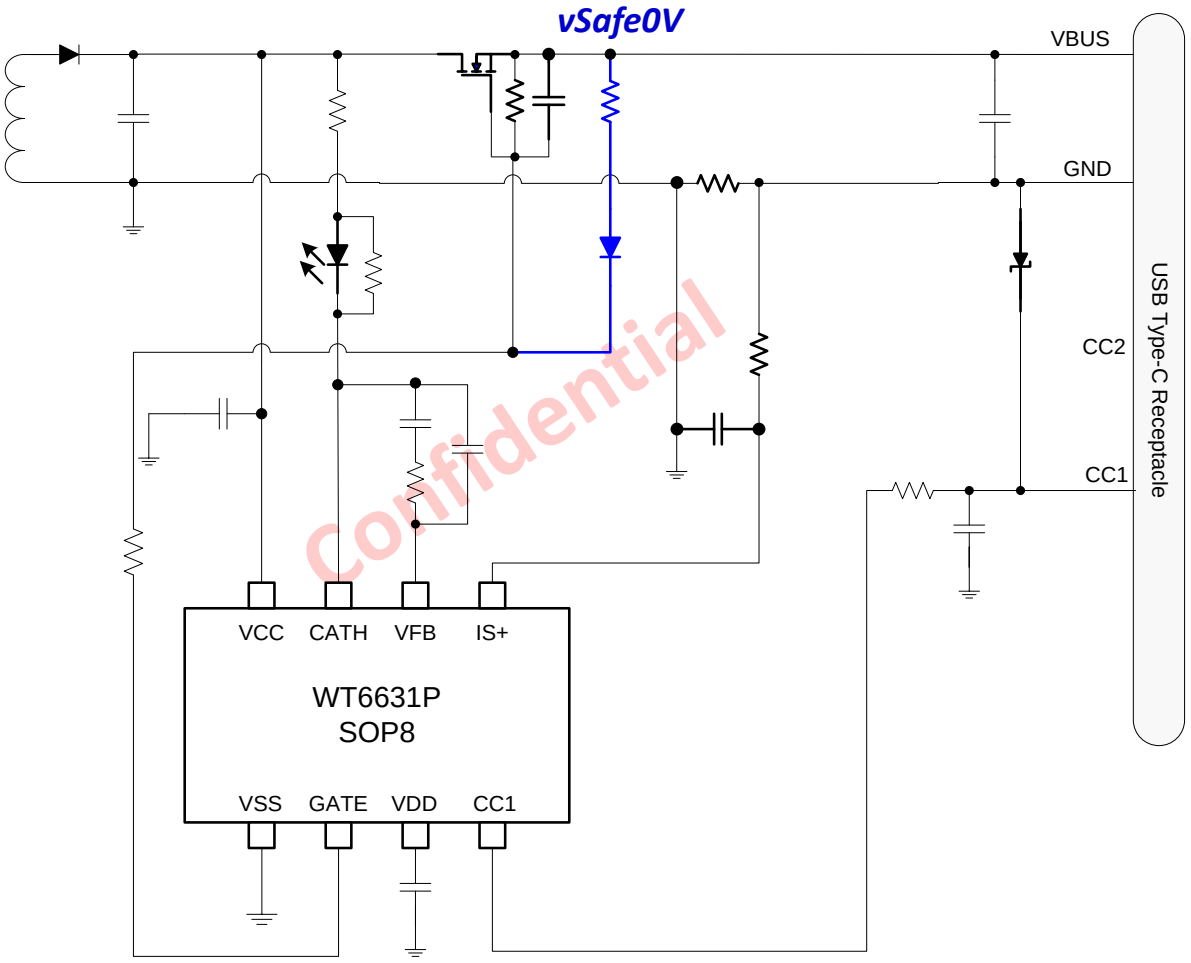
WT6633P/WT6636F Block Diagram



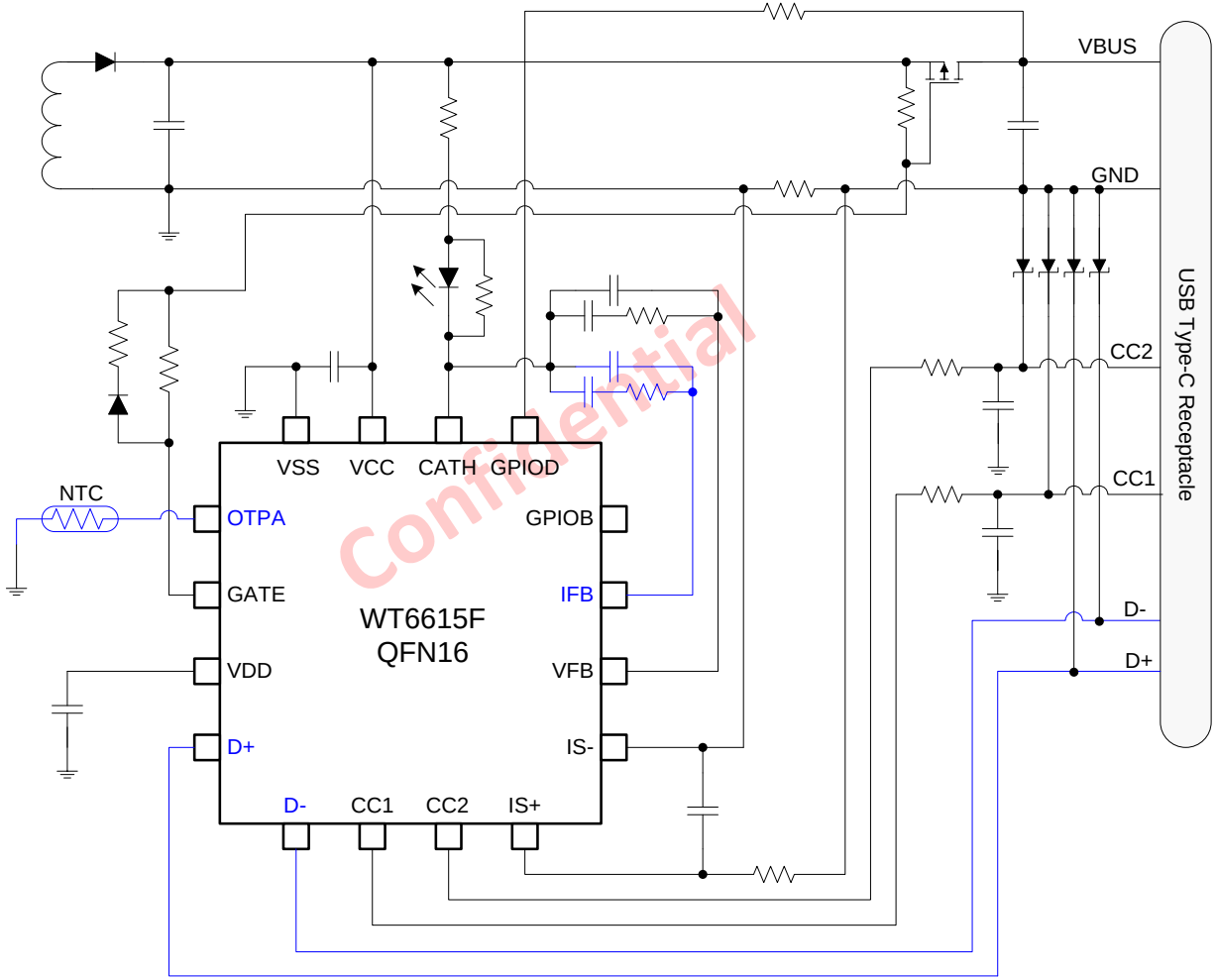
WT6631P Reference Circuit



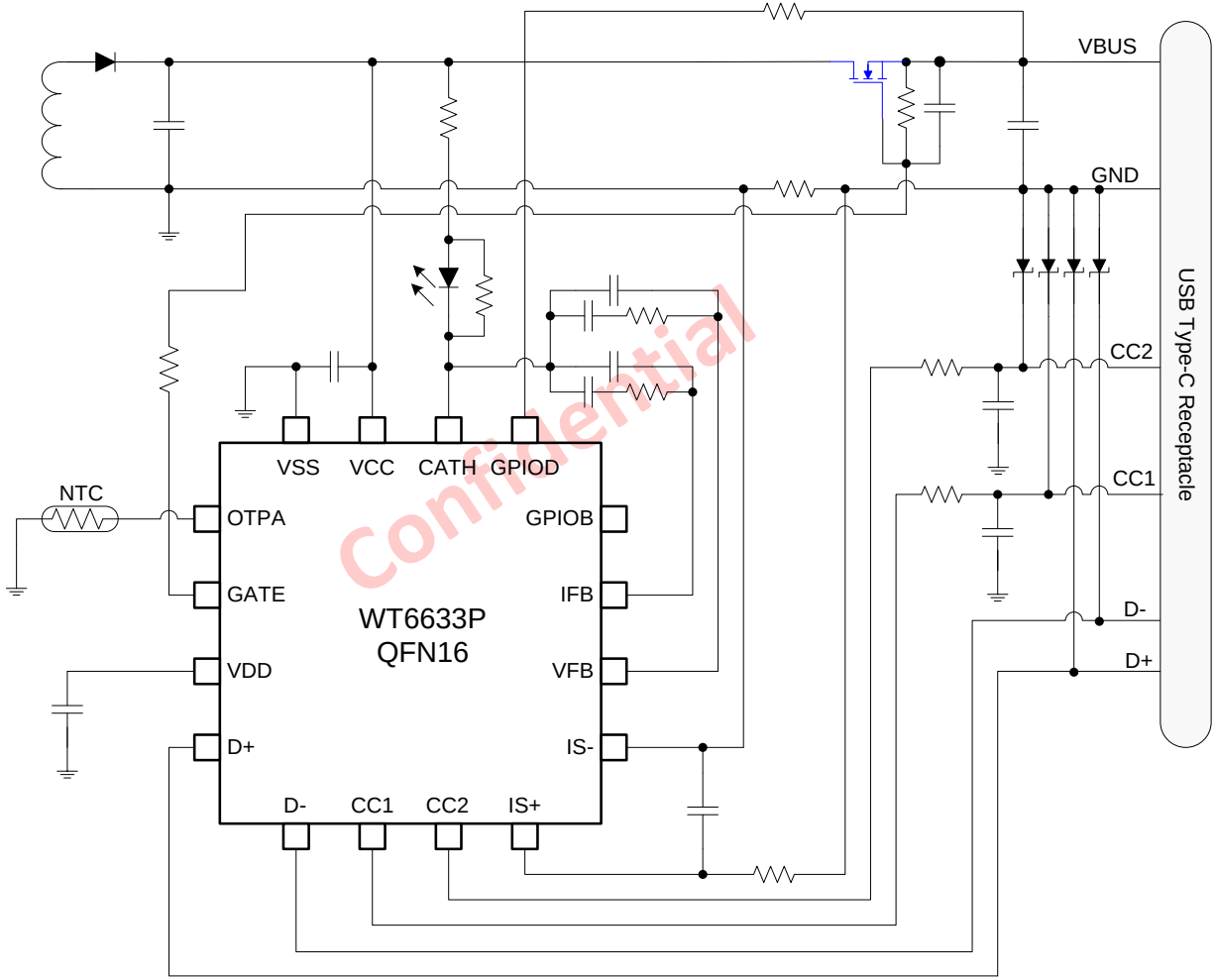
WT6631P Reference Circuit - SOP8



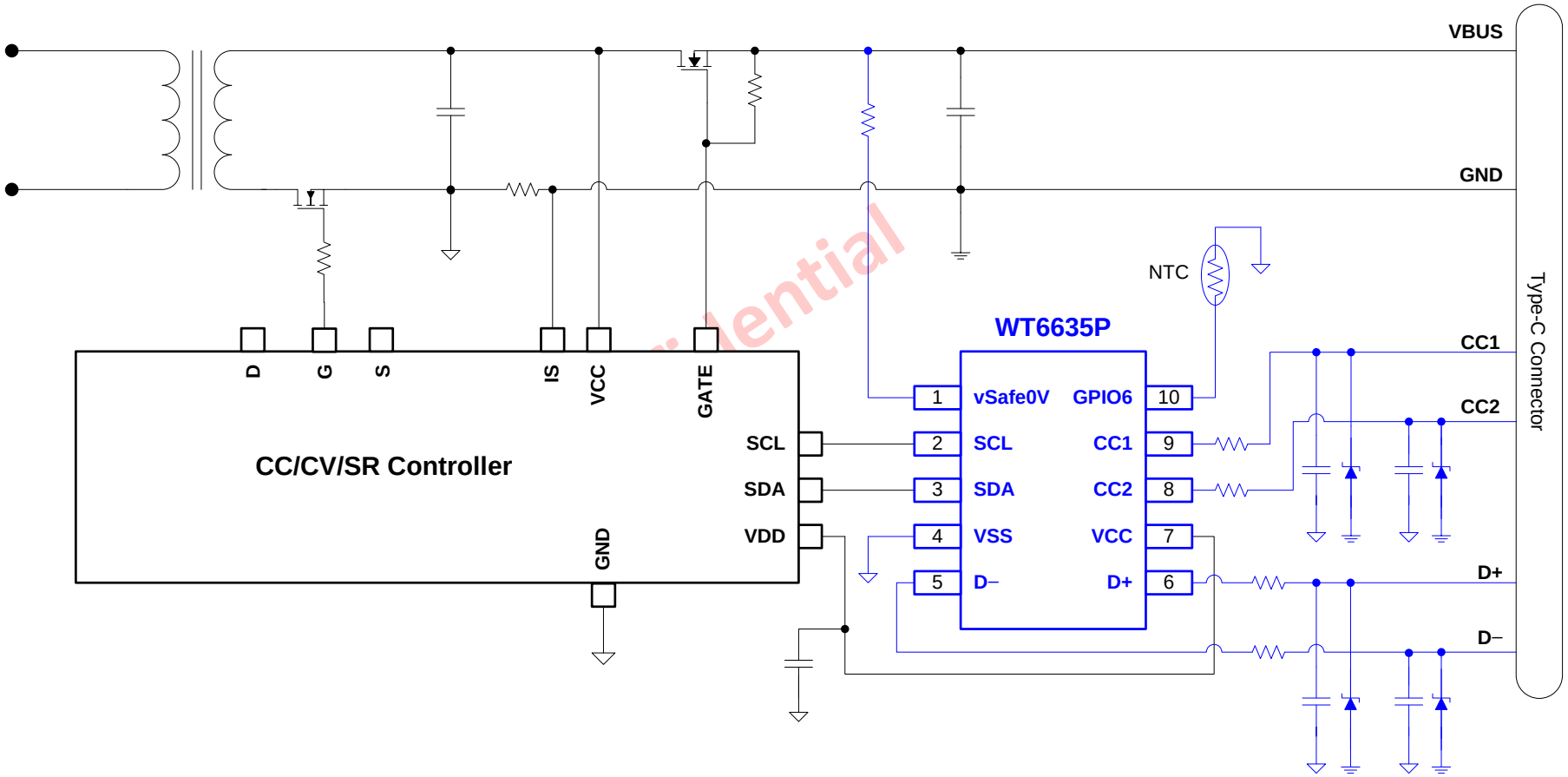
WT6632F/WT6615F Reference Circuit



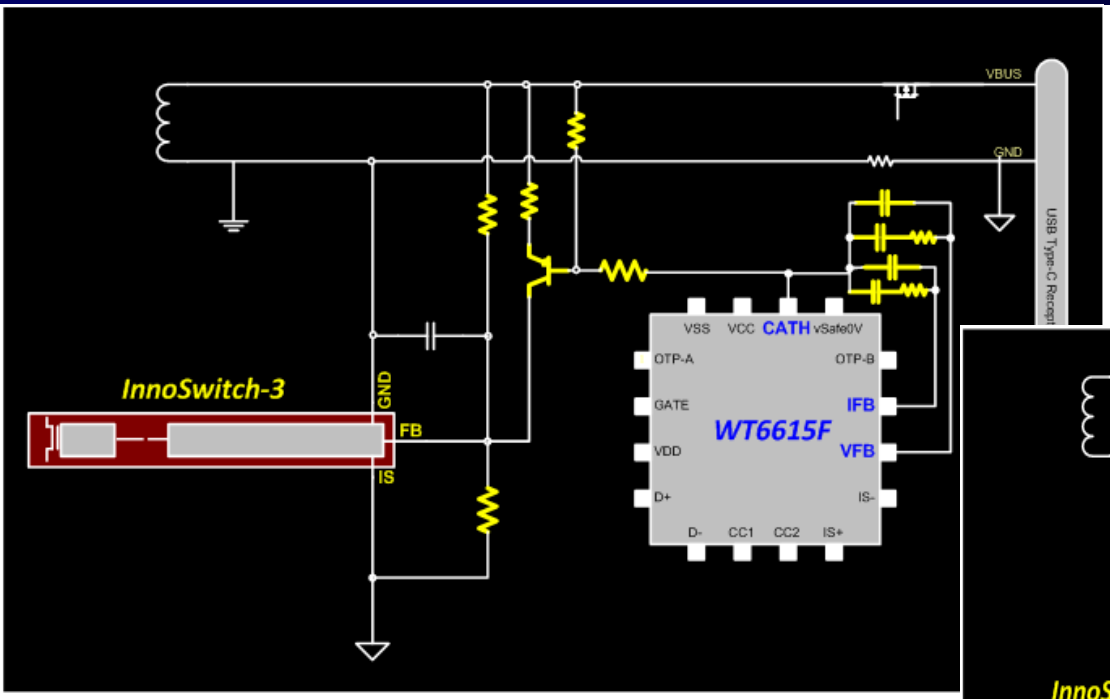
WT6633P/WT6636F
Reference Circuit



WT6635P Reference Circuit

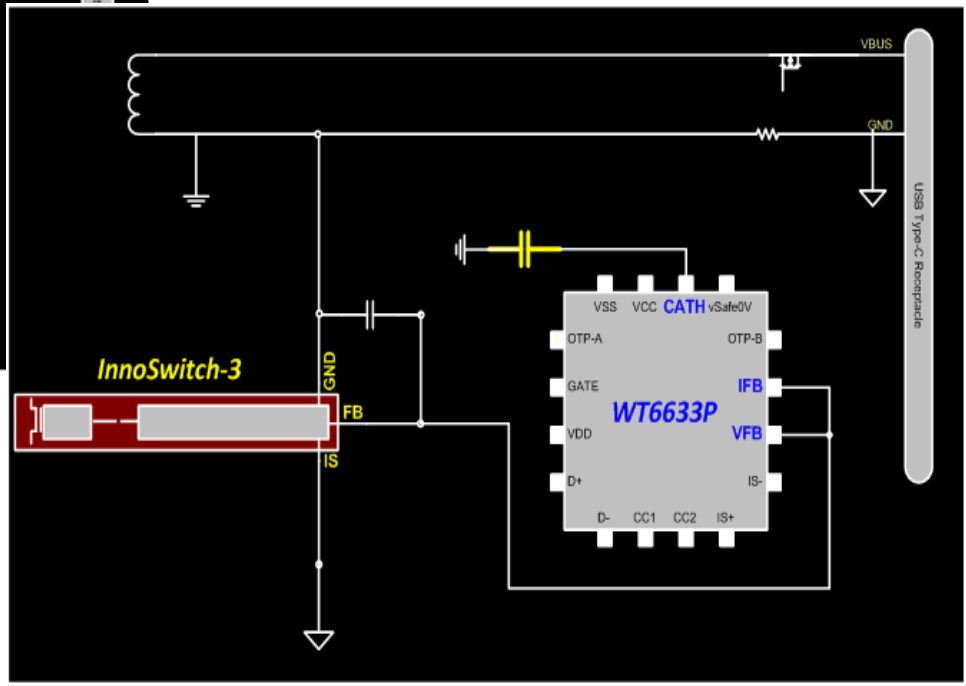


Wall Charger – without Optocoupler

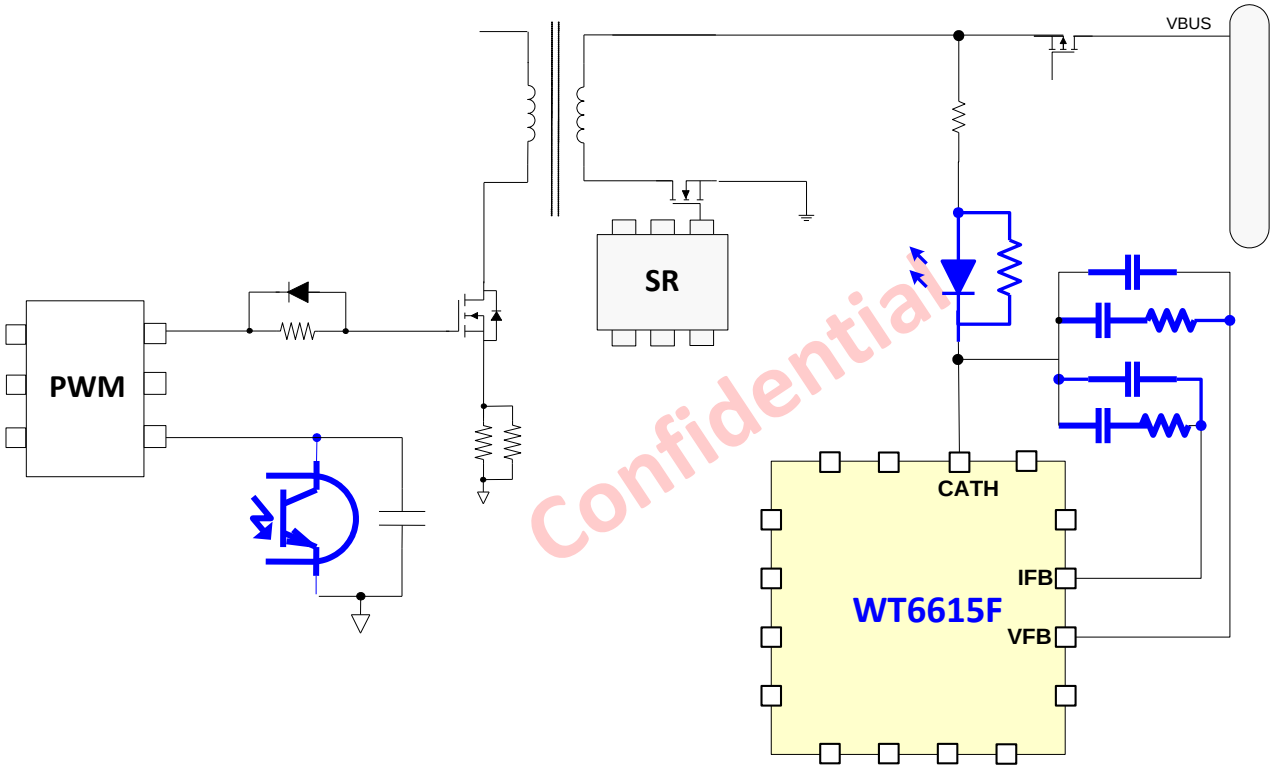


Voltage Feedback

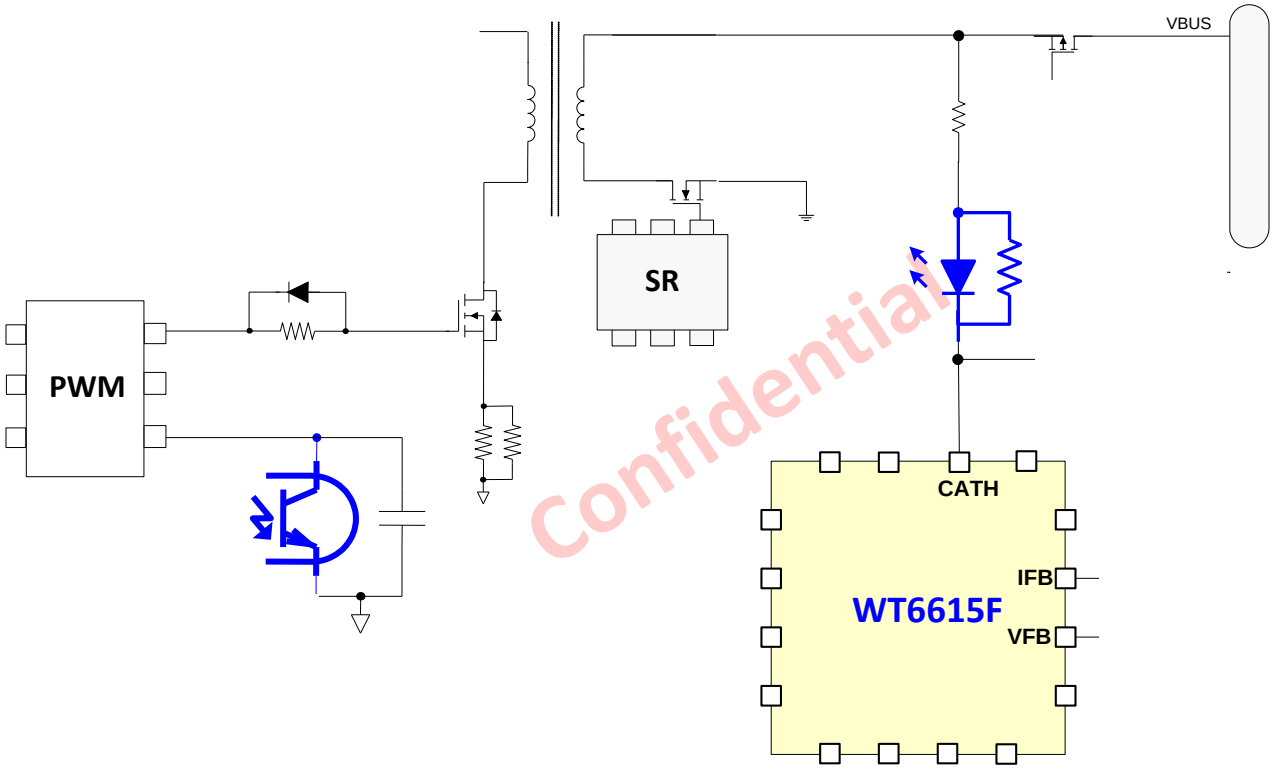
Current Feedback



Wall Charger – pair with opto-coupler



Wall Charger – pair with Digital Link



PD/QC4+ Wall Charger Reference Designs

Power Integrations

http://www.weltrend.com/en-global/news/detail/292/30

https://ac-dc.power.com/design-support/reference-designs/design-examples/der-702-45watt-usb-pd-3-pps-power-supply-using-innoswitch3-pro/?utm_campaign=Inno3ProPPS&utm_medium=email&utm_source=PI&utm_content=DER&utm_term=AC-DC+InnoSwitch3-Pro+USBPD+PI+TW&mkt_tok=eyJpIjoiT1RnMlpEUTJOVEU1TmpNMCIsInQiOiJWT1JGTmk0OGFpcit4YnJlUVwvTXVhdU0zcUhMSVdsOTBTZmRlMnFhbWZzZVFHQVZ3ekRUenhTVGpHYnBoWEdWR0d6NVRUYjdvYXJtSnlMcW55WmJhT3FKTXJQUjRPRzVPSW5tandQNlp2SVN6amxaTjJBK21CZkp5Wlk2Q0hDYzUifQ%3D%3D

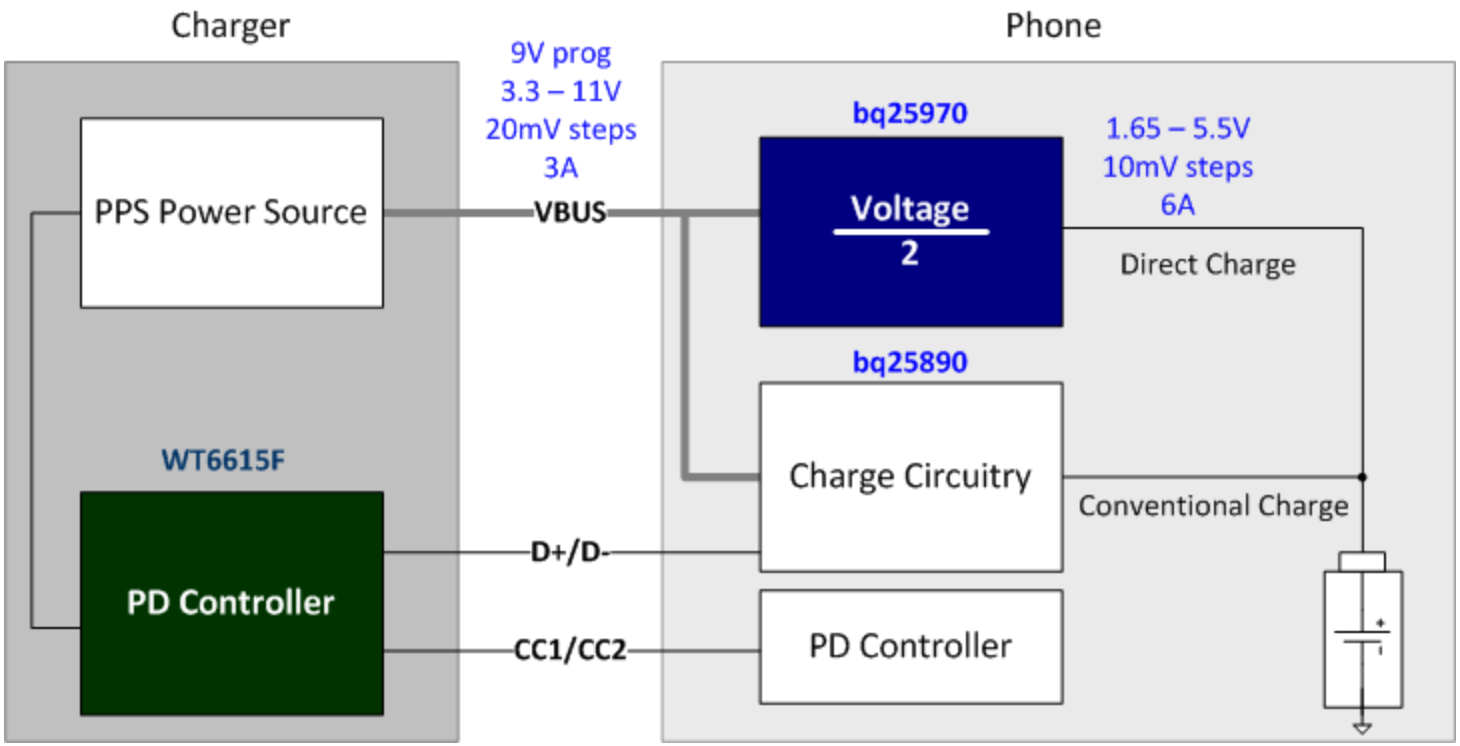
Diodes

http://www.weltrend.com/en-global/news/detail/350/30

ON Semiconductor

http://www.weltrend.com/en-global/news/detail/322/30
http://www.onsemi.com/PowerSolutions/supportDoc.do?type=Design Notes&rpn=NCP1622

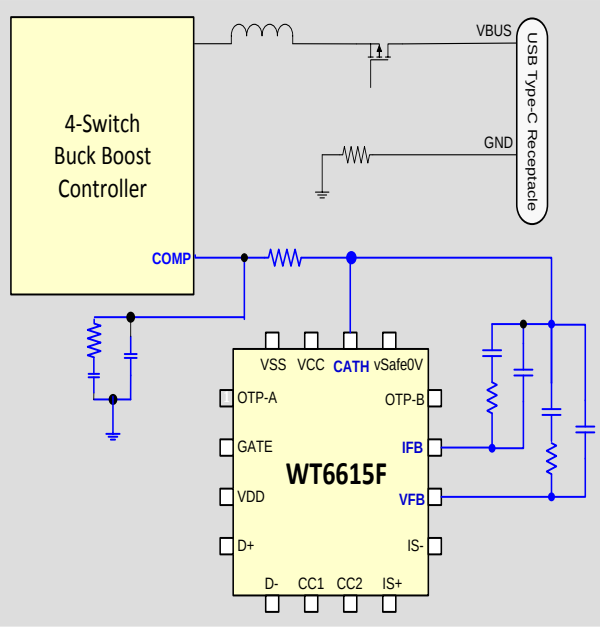
Weltrend's PPS solution is compatible with TI's high eff. switched cap fast charge platform



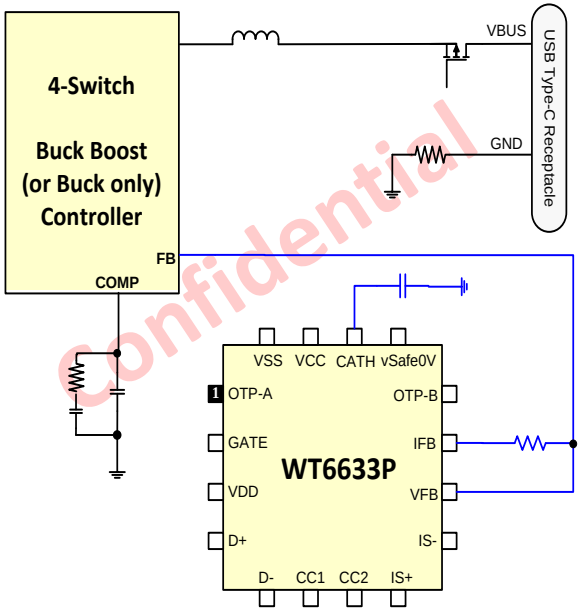
TI has approved the interoperability between Weltrend's PPS solution and TI's mobile platform.

Pair with DC-DC Controllers

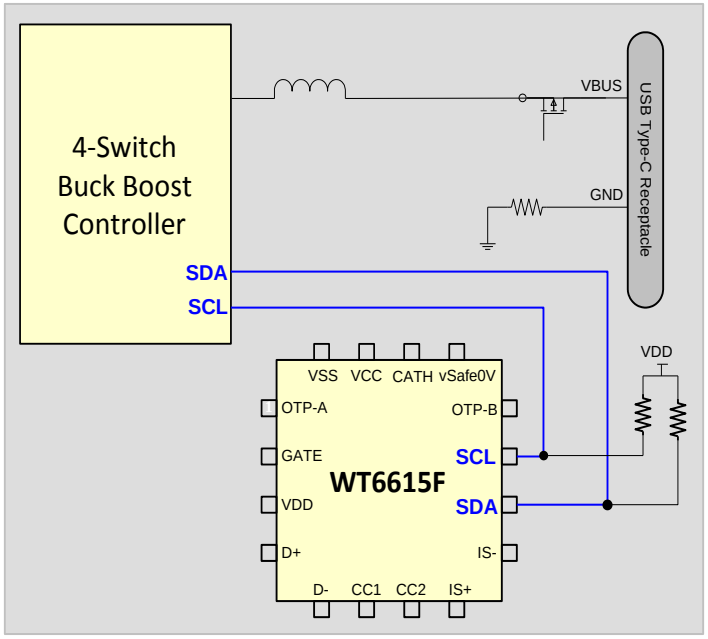
1. Voltage Feedback



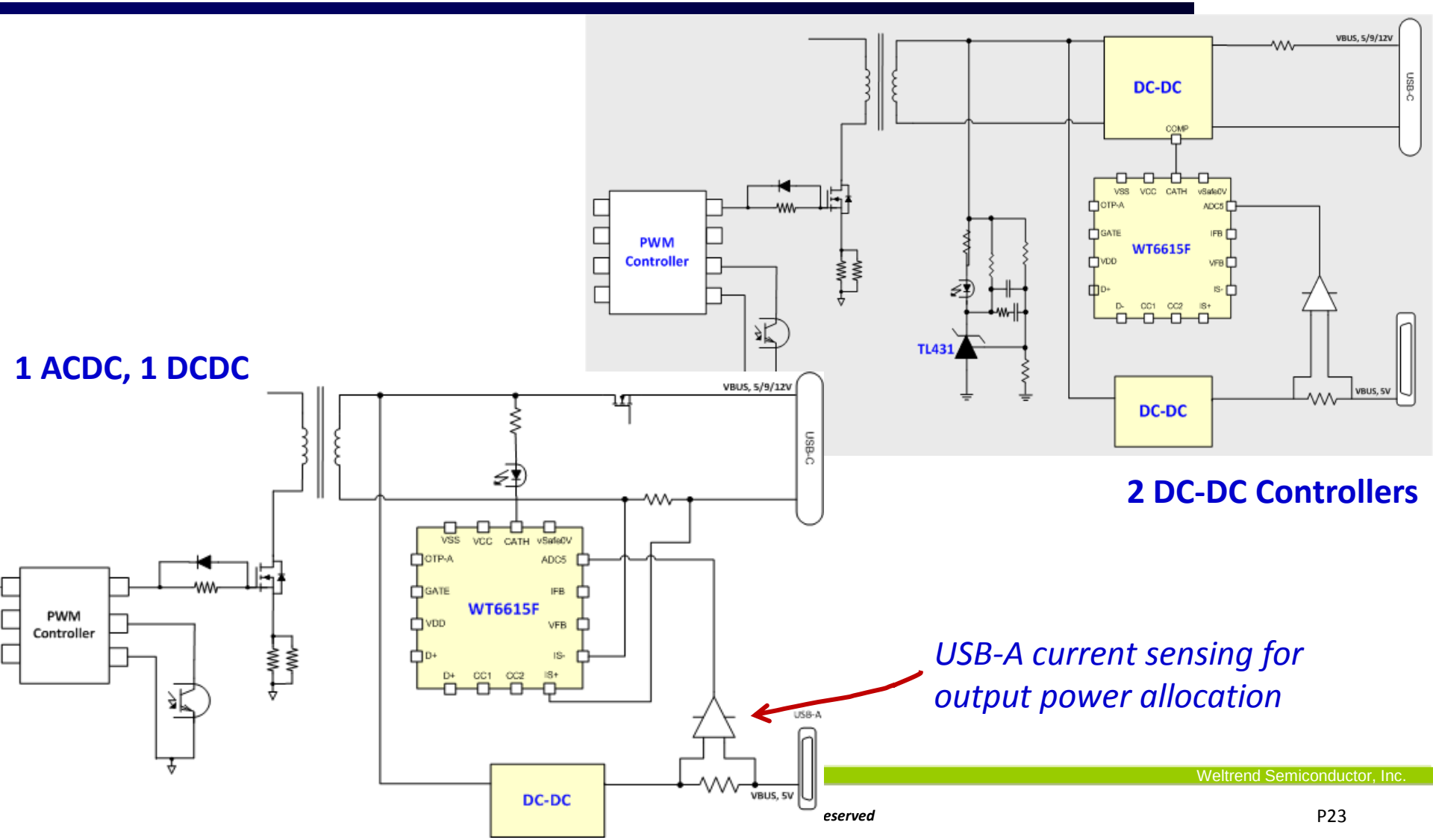
2. Current Feedback



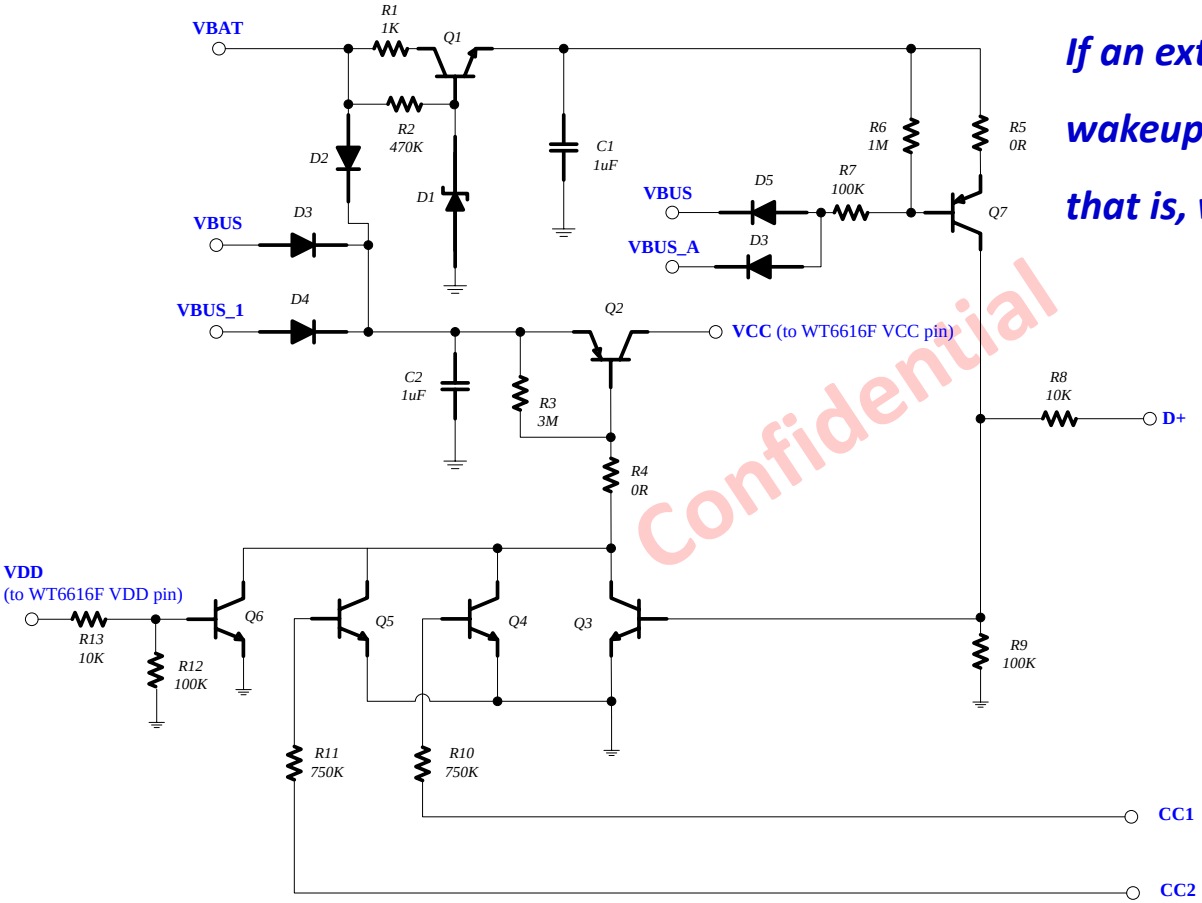
3. IIC Interface



Dual-port Charger - 1C1A



DRP – wakeup circuit (w/o external MCU)



If an external MCU exists,

wakeup could be implemented by that MCU

that is, wakeup circuit is not necessary

WPD016 – PD3.0/PPS/QC4+ Test Kit

PC

USB

Micro-B

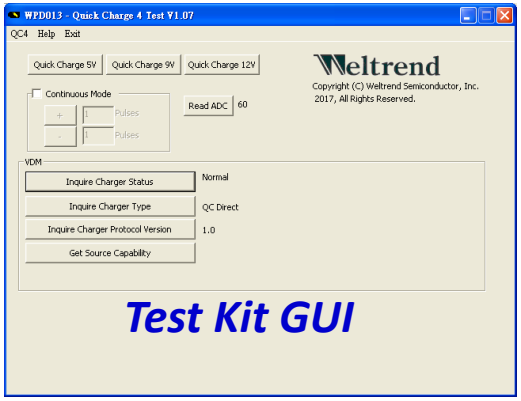
Quick Charge 4
Test Kit
(WPD016)

Type-C

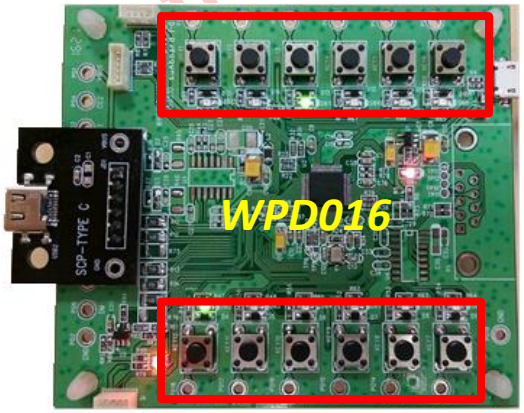
Type-C Cable

Wall/Car Charger
With
WT6615F

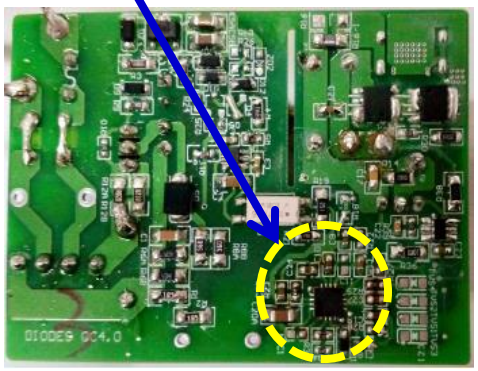
Power Meter
&
Electronic Load



Test Kit GUI



WPD016



WPD016 could negotiate power profiles by GUI or buttons

WPD012 - PD IC Programmer (Writer)

WT6615F Firmware @ PC

WT6615F IC @ Wall/Car Charger

PC

Type -A

WT6615F WRITER (WPD012)

Type-C

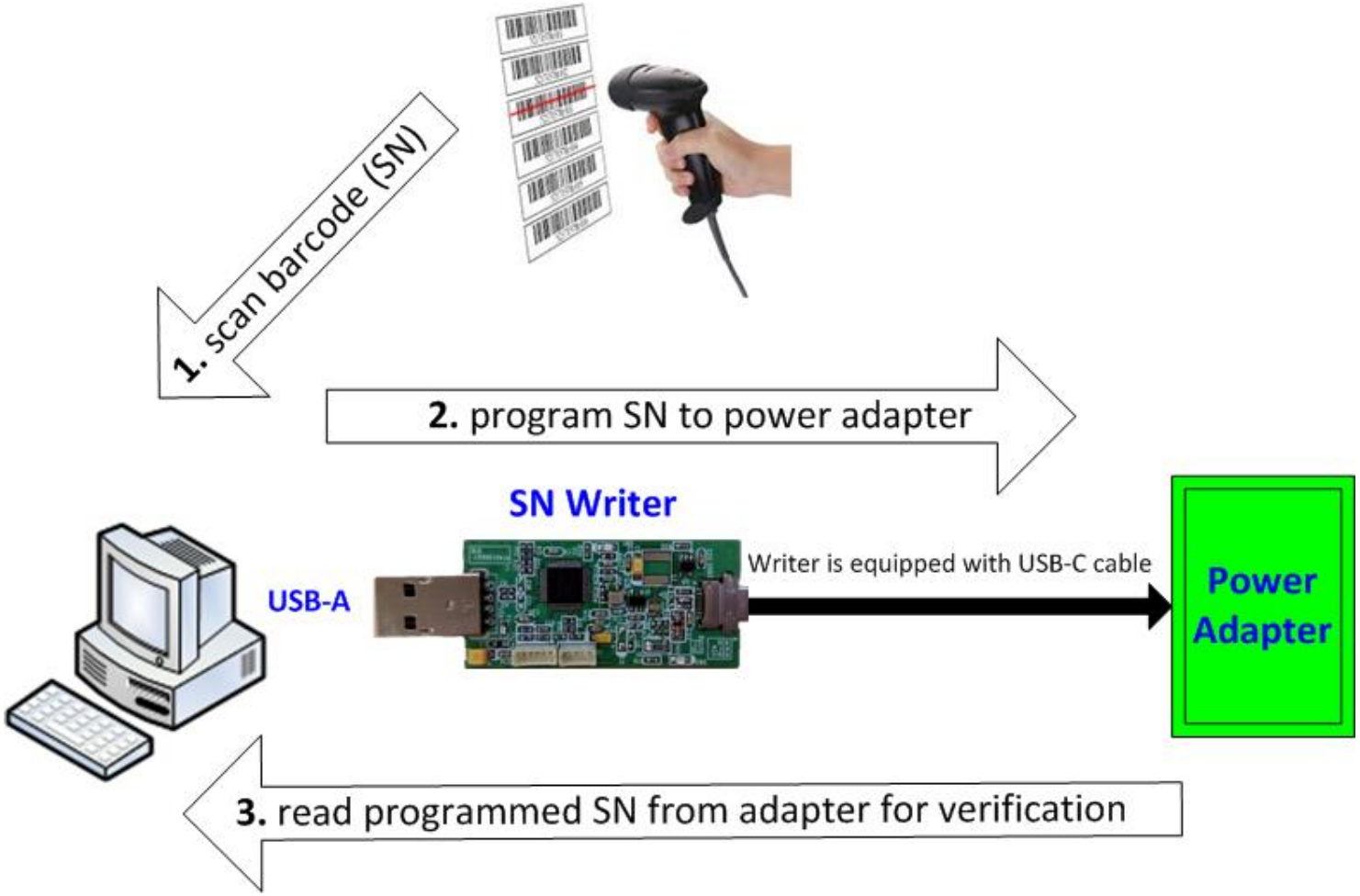
Wall/Car Charger w/WT6615F

Powered by WRITER
No AC Power Required

WRITER GUI

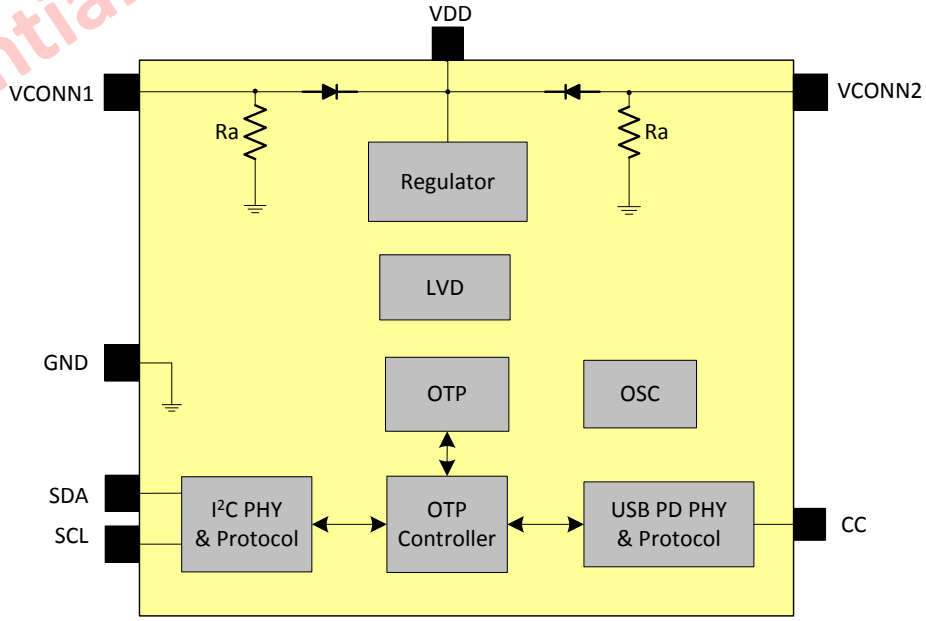
WPD012

Serial Number Writer System Architecture

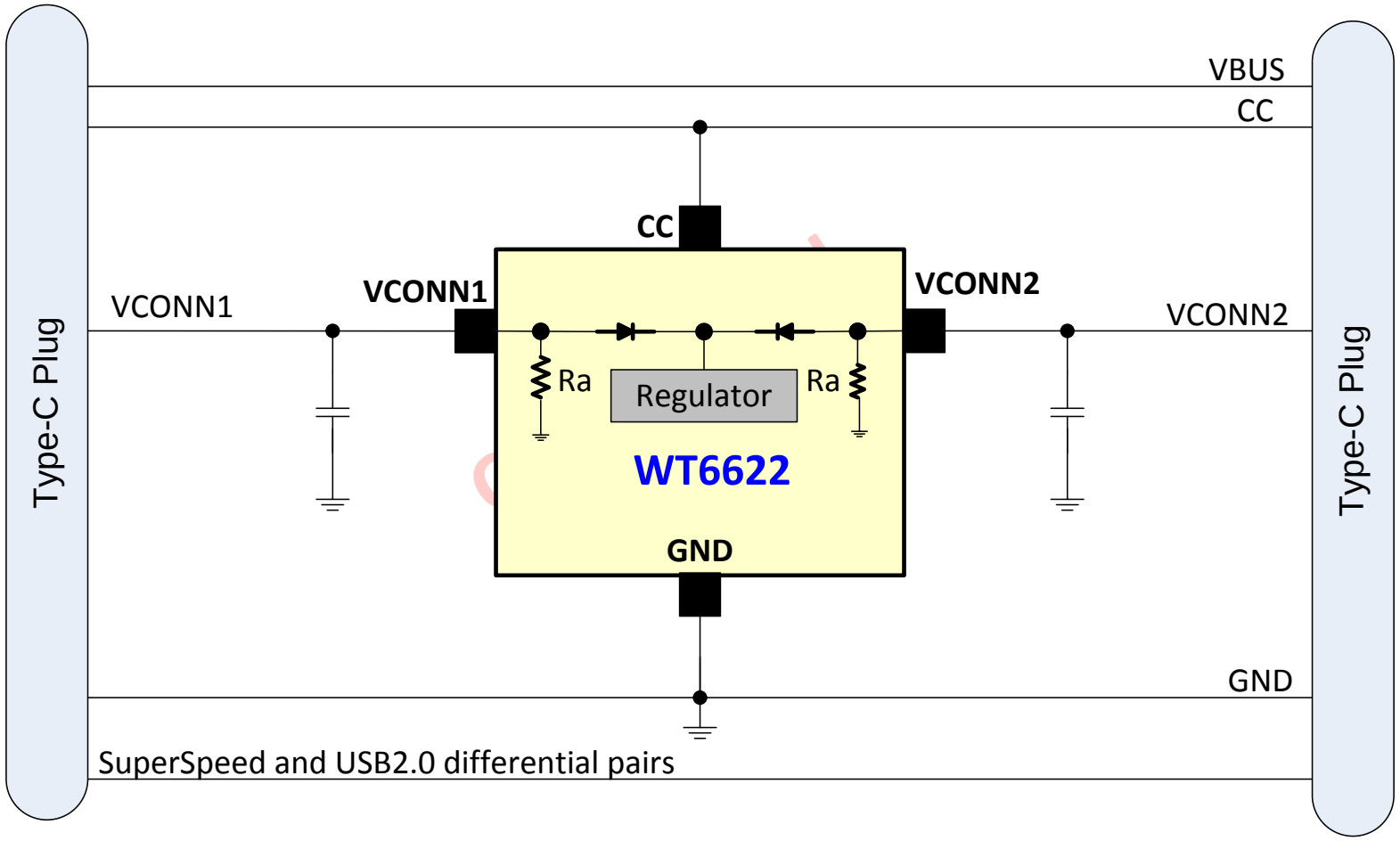


WT6622 eMarker IC

USB PD Spec.	Type-C 1.3/PD 3.0 v1.1
Operating Voltage	3V to 5.5V
Structured VDM Discover Identity Command	SOP’
Get Manufacturer Information	SOP’
Programming Pin for Customized VDM message	CC pin/multi-time
Max. Operation/Standby Power Consumption	50mW/17.5mW
Iso Diodes	Embedded
Ra Resistors	Embedded
HBM/MM	±8KV/±700V



WT6622 Reference Circuit



PPS PDOs and APDOs based on the PDP

PDP	PDO				APDO			
	5V	9V	15V	20V	3.3V – 5.9V	3.3V – 11V	3.3V – 16V	3.3V – 21V
≤ 15W	✓				✓			
15W < PDP ≤ 27W	✓	✓			✓	✓		
27W < PDP ≤ 45W	✓	✓	✓		✓	✓	✓	
45W < PDP ≤ 100W	✓	✓	✓	✓	✓	✓	✓	✓

Quick Charge 4/4+

Class	Required Voltage Levels	Power capability	Connector	Negotiation protocol (adapter compliancy requirements)			Negotiation protocol (device compliancy requirements)		
				D+/D-	USB PD PDO	USB PD APDO (PPS)	D+/D-	USB PD PDO	USB PD APDO (PPS)
Class A	5V, 9V, 12V[1] 3.3V-5.9V, 3.3V-11V	18W - 27W	Type-C	Required for QC2/QC3	Required	Required	Optional	Required	Required
Class B	5V, 9V, 12V[1],15 V 3.3V-11V, 3.3V-16V,	>27W	Type-C	Required for QC2/QC3	Required	Required	Optional	Required	Required

note:

1. ***12V is required for QC2 and QC3***

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THANK YOU!