

TYPEC & PD Power Solutions

December-2020



- **USB Type-C basic review**
- **USB-C Port Controller and DCDC Product Summary**
 - MP5031 PD3.0 USB PD Controller working principle
 - USB PD car charger solution product introduction
 - 100W Buck-Boost USB PD Car Charger solution
- **ACDC Product Summary for USB-C PD wall charger**
 - Secondary Sync Rec Drivers and Ideal Diodes
 - All-in-One Flyback Solution for up to 65W PD wall charger
 - Digital PFC / LLC Combo for more than 100W PD wall charger
- **Bi-directional buck-boost Charger for USB-C**
 - 45W PD Power Bank solution
- **Other USB-C PD power application solutions**

USB-C application



AC Adapters



Notebooks



Smartphones



Headphones



Car Charger



BT Speakers



Power Banks



Accessories

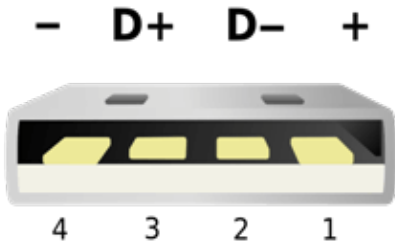
USB-C Introduction

1. Type-C Port

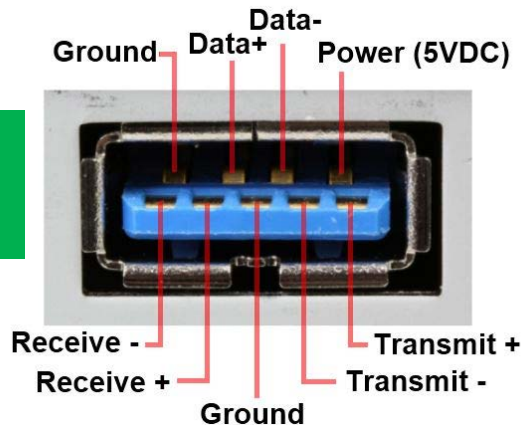


- Convenience: slim connector with reversible plug orientation and cable direction.
- Performance: delivers up to **40Gbps** supporting all of the data transfer (**USB 2.0 480Mbps, USB 3.2 gen 1 5Gbps**).
- Power: Delivers up to **20V/5A 100W (PD)** and charging for all your devices.

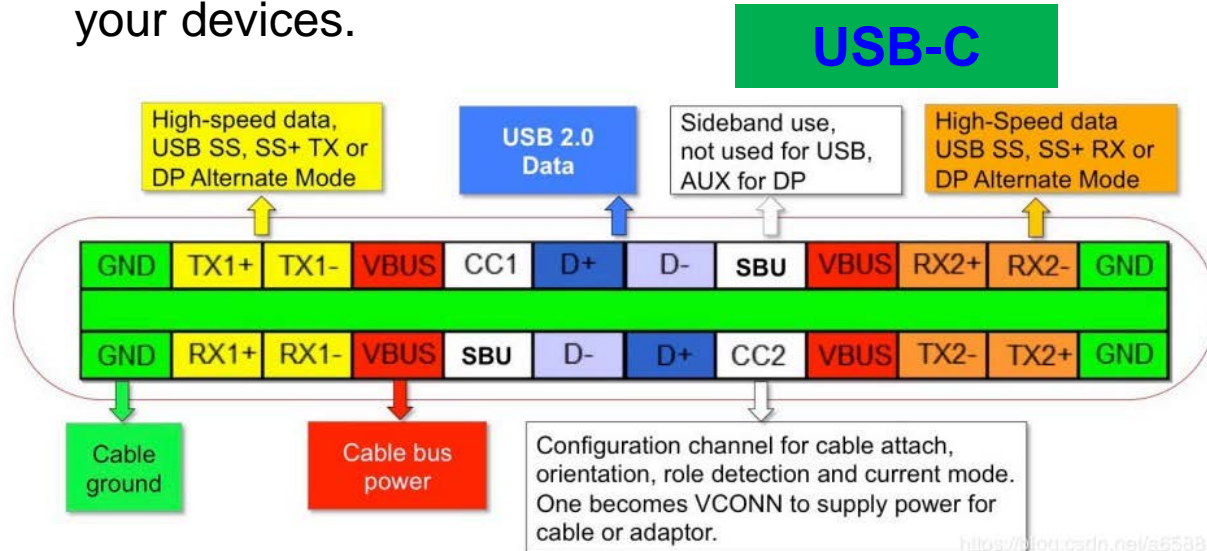
USB-A
2.0



USB-A
3.0



USB-C



USB-C Introduction

2. Charging Port

Power stage

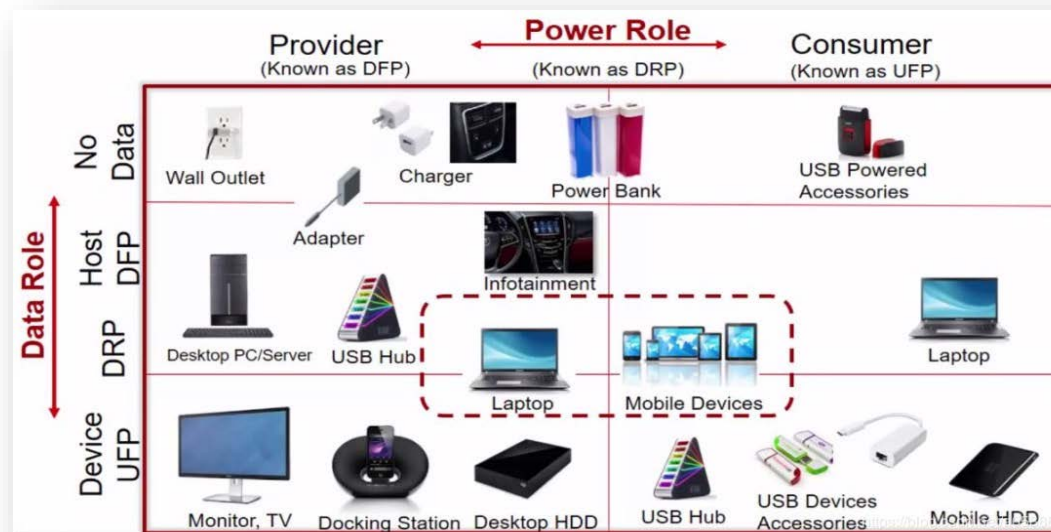
- USB3.2 Gen2 protocol support 1.5A
- BC1.2 DCP mode support 1.5A
- QC3.0 protocol support max 3A
- PD2.0/3.0 protocol support max 5A

Precedence	Mode of Operation	Nominal Voltage	Maximum Current
Highest ↓ Lowest	USB PD (including USB4)	Configurable	5 A
	USB Type-C Current @ 3.0 A	5 V	3.0 A
	USB Type-C Current @ 1.5 A	5 V	1.5 A
	USB BC 1.2	5 V	Up to 1.5 A
	Default USB Power	USB 3.2 x2 operation	5 V
USB 3.2 x1 operation		5 V	900 mA*
USB 2.0		5 V	500 mA*

* Current available depends on device and bus operating state, e.g. unconfigured, low power, high power, suspend.

USB-C Power Role

- Source(DFP)—host or hub downstream port
- Sink(UFP)—typical of device upstream port
- Dual-Role Power(DRP)—Source or Sink



USB-C Introduction

3. Qualcomm® Quick Charge™ (QC)

	Max Power	Voltage	Current	Update	USB-PD Compatible	Speed
QC 1.0	10W	5V	2A		Independent	
QC 2.0	36W	5V/9V/12V (class A)	2A or 3A (connector dependent)	Handshake Protocol	Independent	75% faster than conventional charge
QC 3.0	36W	3.6V-12V (class A)	2A or 3A (connector dependent)	INOV: 200mV adjustable	Independent	Charge a smartphone up to 50% in 30 minutes. 100% faster than QC 1.0*
QC 4.0	100W	3.3V-21V	3A or 5A (connector dependent)	<ul style="list-style-type: none">• 200mV→20mV• Dual Charge	Compliant	Charge a smartphone up to 50% in 15 minutes**
QC 4+	100W	3.3V-21V	3A or 5A (connector dependent)	<ul style="list-style-type: none">• Dual Charge• Intelligent Thermal Balancing• Advanced Safety Features	Compliant	Charge a smartphone up to 50% in 15 minutes**

*Based on Qualcomm® Quick Charge™ internal tests charging a 2750mAh fast charge battery (1.5C charge rate) and using the maximum power for a thermal limit of 40C for all charging implementations.

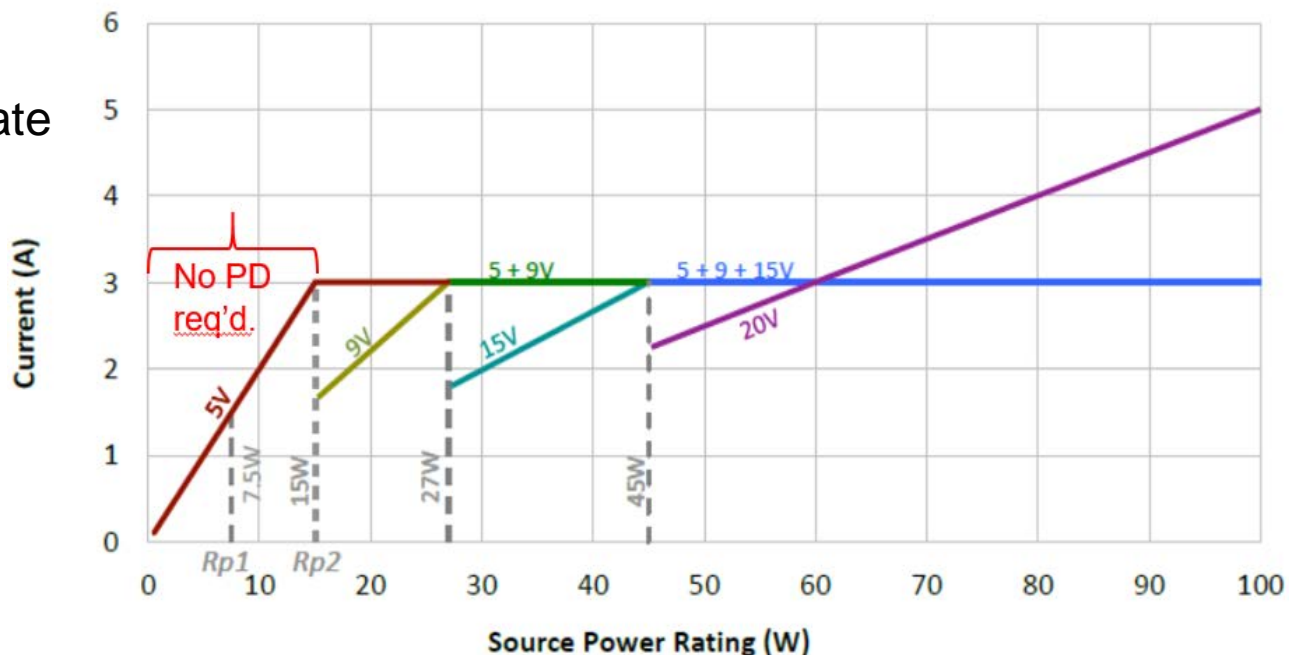
**Based on internal tests charging a 2750mAh fast charge battery and using the maximum power for a thermal limit of 40° C for all charging implementations.

USB-C Introduction

4. USB Power Delivery (PD)

	Max Power	Voltage	Current	Update
PD 2.0	100W	5V/9V/15V/20V	1.5A/2A/3A/5A	
PD 3.0	100W	3.3V-21V	5A (max)	<ul style="list-style-type: none">PPS(Programmable Power Supply) 20mV/50mA step adjustable

- USB PD3.0(PPS)=QC4.0
- QC4.0 also use D+/D- communicate to compatibility with QC2.0/3.0
- PD3.0 PDO Min 3.3V,Max 21V
- 5V/9V/15V PDO max 3A
- Only 20V PDO current up to 5A



Discussion Agenda

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USB-C Port Controller and DCDC Product Summary

USB Charging Port Controller	Boost	Buck	Buck - Boost
<p>MP5031 USB PD 3.0+ PPS Controller QFN-20 (4x4)</p> <p>MP5029-C Up to 22V USB Charging Port Controller with Current-Limit Switch, Supporting CDP, DCP, and QC3.0 Modes QFN-14 (2x3)</p> <p>MP5061 28V, 7mΩ R_{DSon} hot-swap protection device with current monitoring QFN-22 (3x5)</p> <p>MP5030C USB current limit switch with charging port identification QFN-10 (1.5x2)</p> <p>MP5032/4 QC3.0, 3.6-14V, compatible w/ BC1.2 / divider mode / 1.2V</p>	<p>MP3435 22Vout, 19A SW limit 600KHz, Fully sync 3x4mm QFN</p> <p>MP3434 22Vout, 3A SW limit 1.2MHz, Fully sync 1.5x2mm SOT583</p> <p>MP3428A >17A, SW current for 25W boost, Vo_max: 22V QFN-22 (3x4)</p> <p>MP3429 2.7-16V, 30W, fully integrated boost with CC QFN -22 (3x4)</p> <p>MP3425/3426 3.1V-22Vin, 3.5A/6A, prog. Fsw, 0.65mA I_Q, non-sync QFN-14 (3x4)</p>	<p>MP4255 4-36V, Dual Buck converters, 2x (9Vx2A) or 2x (11Vx3A), or 2x (20Vx3A), with I2C/MTP, Support dual port with USB PD 3.0 PPS QFN-21 (4x5)</p> <p>MP5408 36V, 6A, Buck+ dual channel CLS, DCP, Type-C 5V @ 3A DFP QFN-26 (5x5)</p> <p>MP2499A 36V, 2.5A, Buck, 250kHz, adjustable current limit QFN-16 (3x3)</p> <p>MP2491C 32V, 6A, Buck, prog. limit, Vout scaling control, PG, QFN-13 (2.5x3)</p>	<p>MP4247 4-36V, 100W Buck-boost converter with 2 integrated power FET, with I2C, Support USB PD 3.0 PPS QFN-20 (3x5)</p> <p>MP4245 4-36V, buck-boost converter with 4 integrated power switches, 60W, up to 5A, with I2C QFN-21 (4x5)</p> <p>MP2984 6V-to-40V, 100W four switch buck-boost controller w/ I2C QFN -32 (4x4)</p> <p>MP8859/MP28167-A 2.8-22V, 3A, buck-boost converter, fixed output voltage options QFN-16 (3x3) FB version</p> <p>MP5461 Dual Input, 4-Switch Integrated Buck-Boost Converter CSP-12 (1.4x1.8)</p>
<p>Newly Released</p>	<p>Released</p>	<p>Released</p>	<p>Released</p>
			<p>Sampling</p>



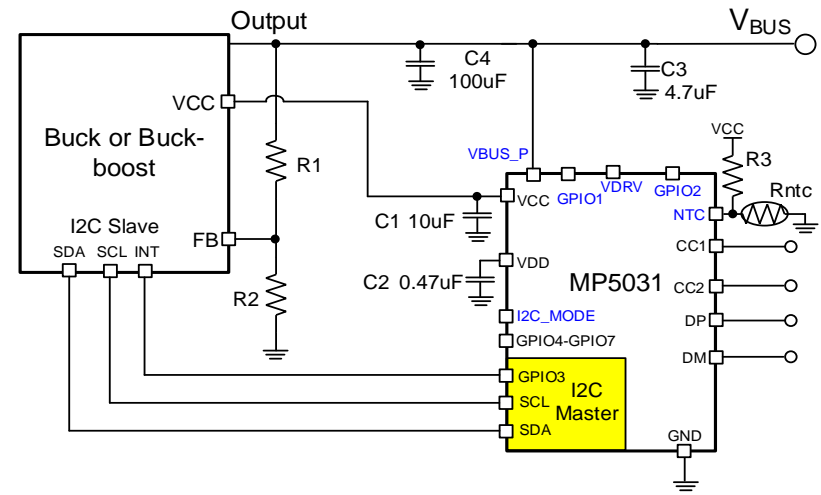
USB PD Controller MP5031

FEATURES

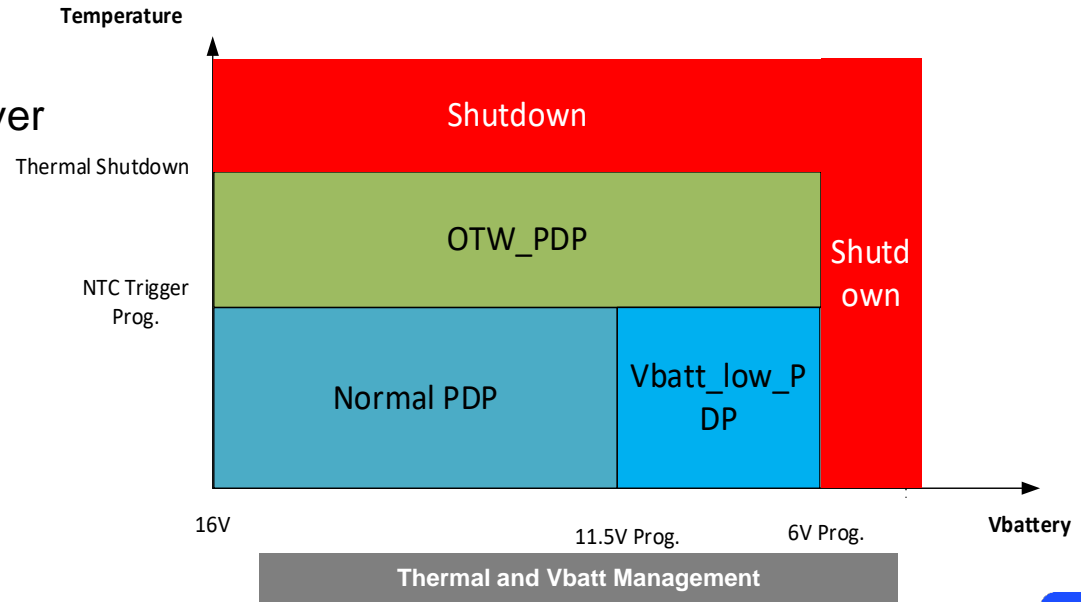
- USB PD3.0 Controller Supports PPS (Provider)
- Wide 2.7V to 21V Operating Input Range
- Integrated Physical Layer for BMC
- Integrated Protocol Layer
- Integrated Policy Engine
- Support USB Type-C and PD3.0 PPS
- Support USB2.0 BC1.2 CDP and DCP Mode
- Support QC4.0, QC2.0/3.0, BC1.2 Short Mode, Apple Charging, Huawei FCP
- High voltage I/O pins: Vbus/CCx/Dp/Dm
- Vbus power path isolation NMOSFET driver
- Two NTC thermal protection pins
- Integrated Vconn Switch and OCP
- Support I2C Master
- 7 GPIO outputs support multiple function

APPLICATIONS

- USB Power Delivery charging port
- USB Car Charger, Wall Adapter

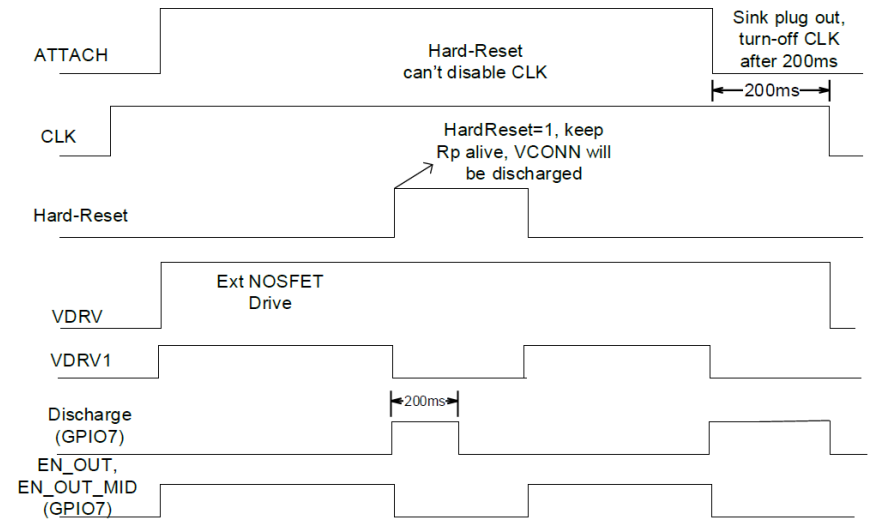
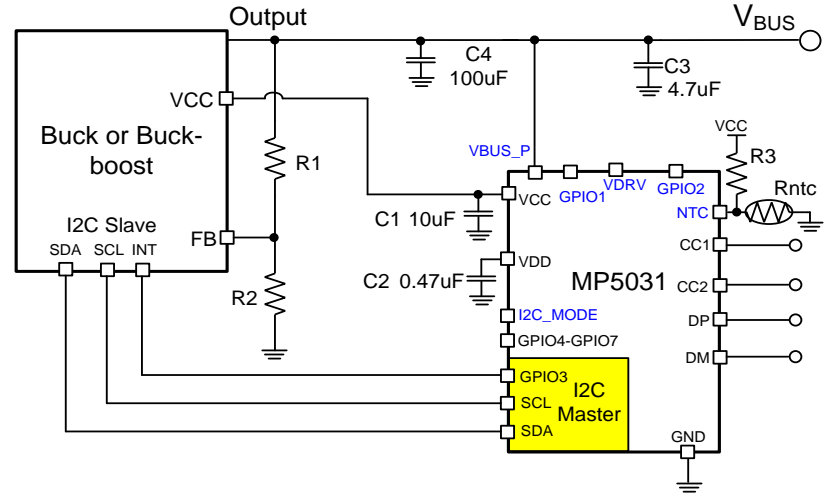
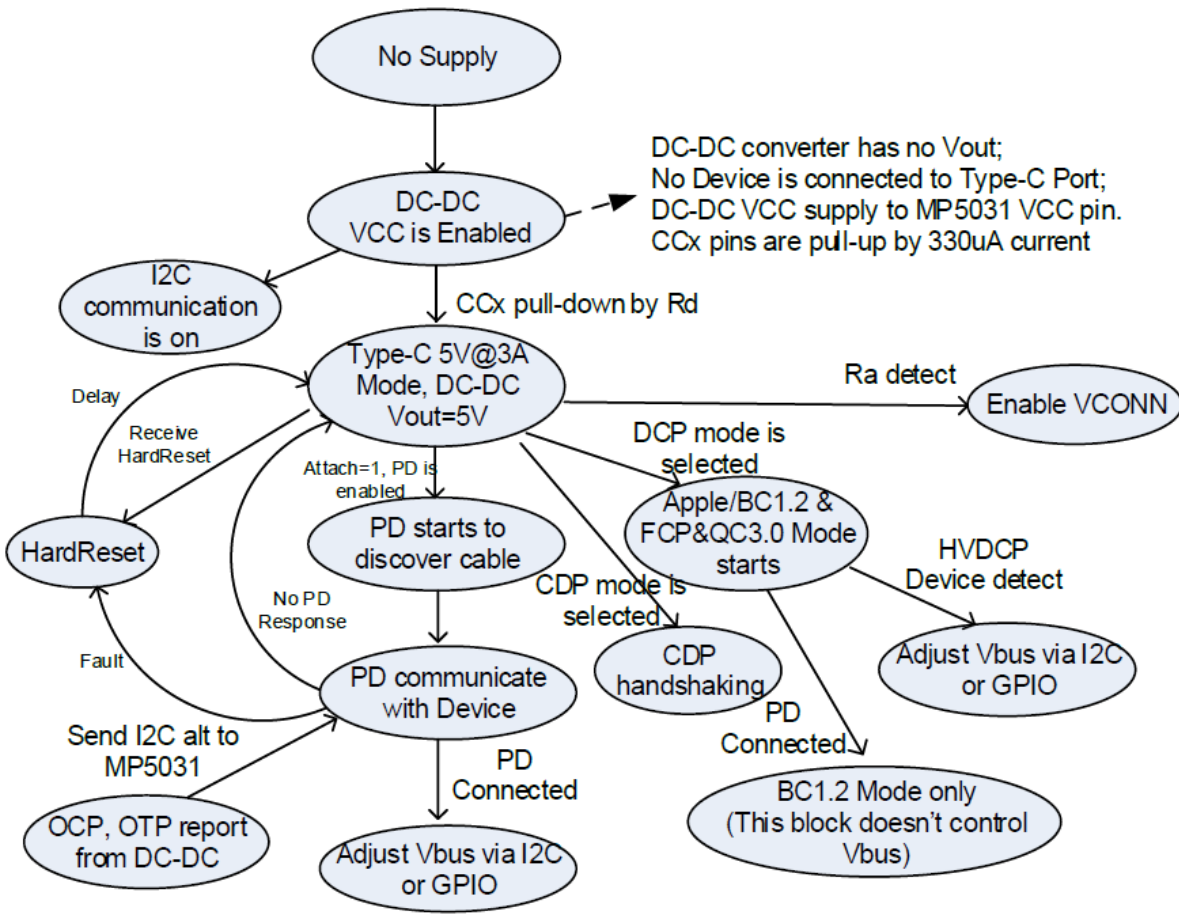


MP5031 Available in a QFN (4mmx4mm) Package



USB PD Controller MP5031

MP5031 State Machine and Timing Sequence



MP2491C+MP5031 – Buck Converter for USB PD

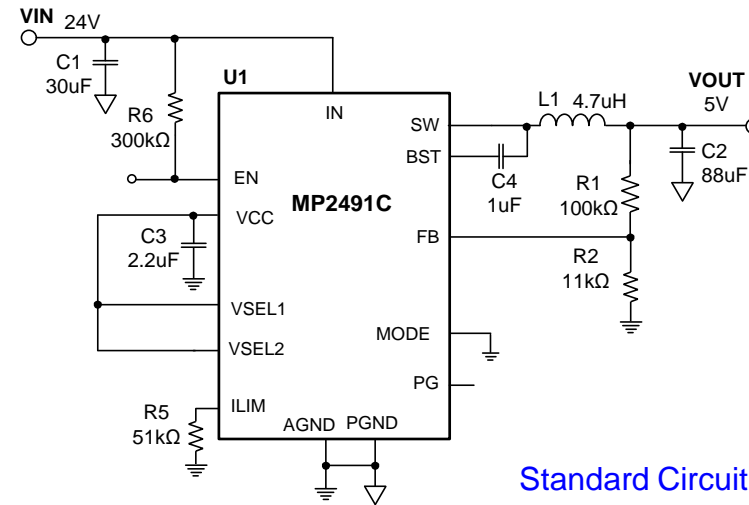
MP2491C (4 - 32V, 6A)

FEATURES

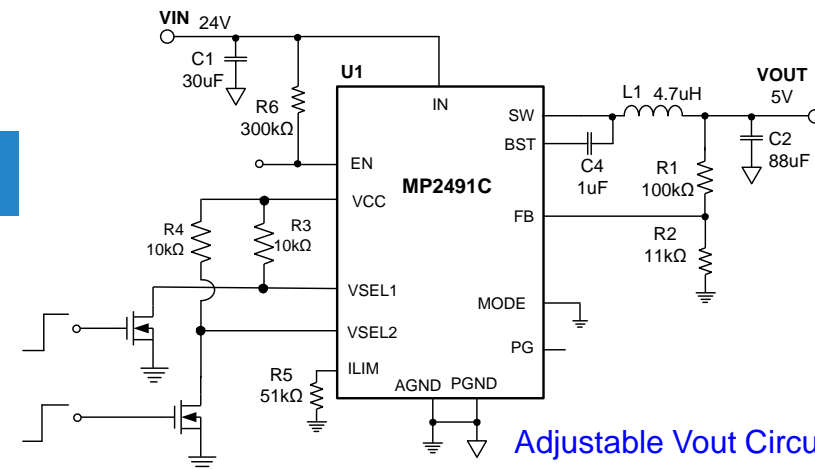
- **0.5-20V** Output Voltage Range Adjustment
- **Adjustable Current Limit**
- **Up to 97.5% Efficiency**
- 33mΩ/22mΩ Internal MOSFET Switches
- **Power Good, EN Shutdown Discharge**
- Adjustable **Auto PFM/PWM** Mode or **Forced PWM** Mode

ADDITIONAL FEATURES FOR USB PD

- **Low Drop Mode Operation**
- **Output Line Drop Compensation**
- **5/9/12/15/20 Vout** Set through 2 Dedicated Voltage Scaling Control pins (VSEL1/2)



Standard Circuit



Adjustable Vout Circuit

Available in a QFN-13 (2.5mmx3mm) Package



MP2491C+MP5031 – Buck Converter for USB PD

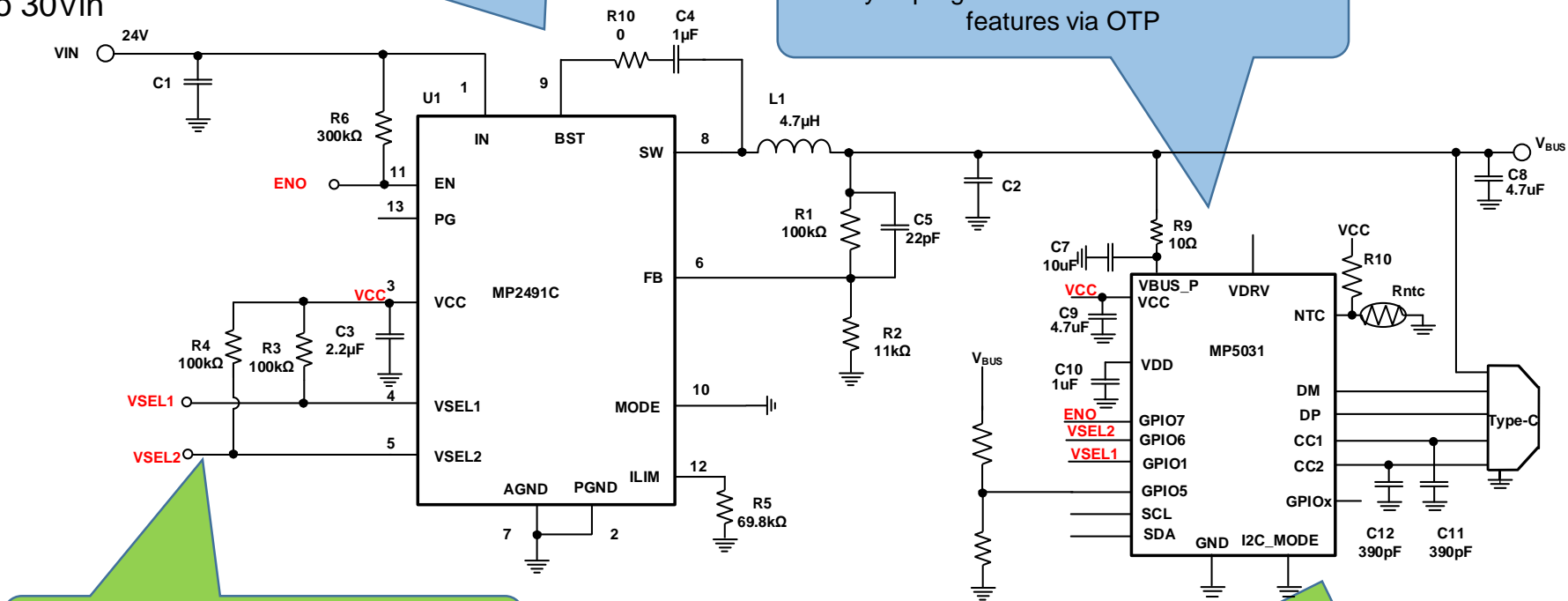
MP2491C+MP5031 Buck PD

- ✓ *Small Size*
- ✓ *Easy to use*
- ✓ *Total Solution*

Simple BOM for total solution

Easy to programmable PDO List and other features via OTP

Up to 30Vin



MP5031 set Vbus via VSEL1 and VSEL2.
Accurate, stable and simple!

Default PDO list:
5V@3A, 9V@3A, 15V@3A, 20V@5A.
Also support Apple divider mode, QC2.0, BC1.2,
Samsung 1.2V/1.2V mode, FCP.



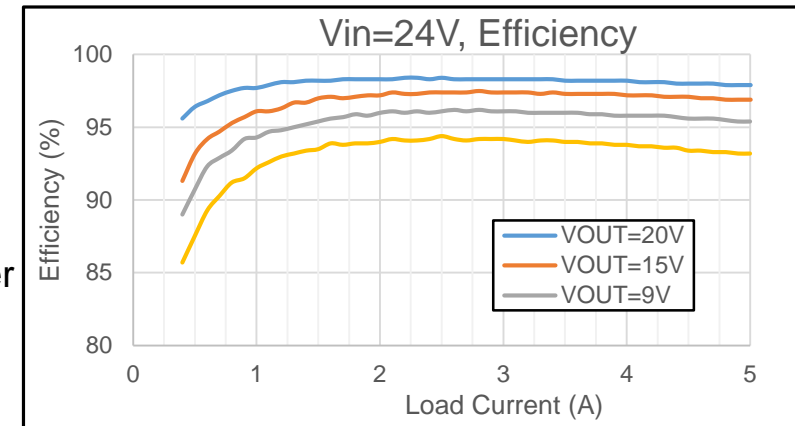
FEATURES

- **Up to 100W USB PD Power Rating**
- **USB PD 3.0 with 5V@3A, 9V@3A, 15V@3A, 20V@5A PDO List**
- Integrated Physical Layer for BMC, Protocol Layer, Policy Engine
- Slew Rate Control during Voltage Transition
- Supporting DCP schemes for BC1.2, Divider Mode, and 1.2V/1.2V Mode, QC2.0, Huawei FCP
- **Low Dropout Mode Operation**
- Load Shedding with NTC or Input Voltage Low Detection Function
- 33mΩ/22mΩ Internal MOSFET Switches for Buck Converter
- Fixed 490kHz Switching Frequency
- Output Line Drop Compensation when VOUT=5V
- **EN Shutdown Discharge**
- Output Over-Voltage Protection (OVP)
- Adjustable Auto-PFM/PWM Mode or Forced PWM Mode
- **Adjustable Current Limit**

Application

- AC/DC Wall Adapter USB PD Charging Port
- TV, Monitor USB PD Charging Port

Efficiency



Benefits

- Simple BOM and Low Cost to support 100W USB PD.
- No need external LDO to supply PD controller.

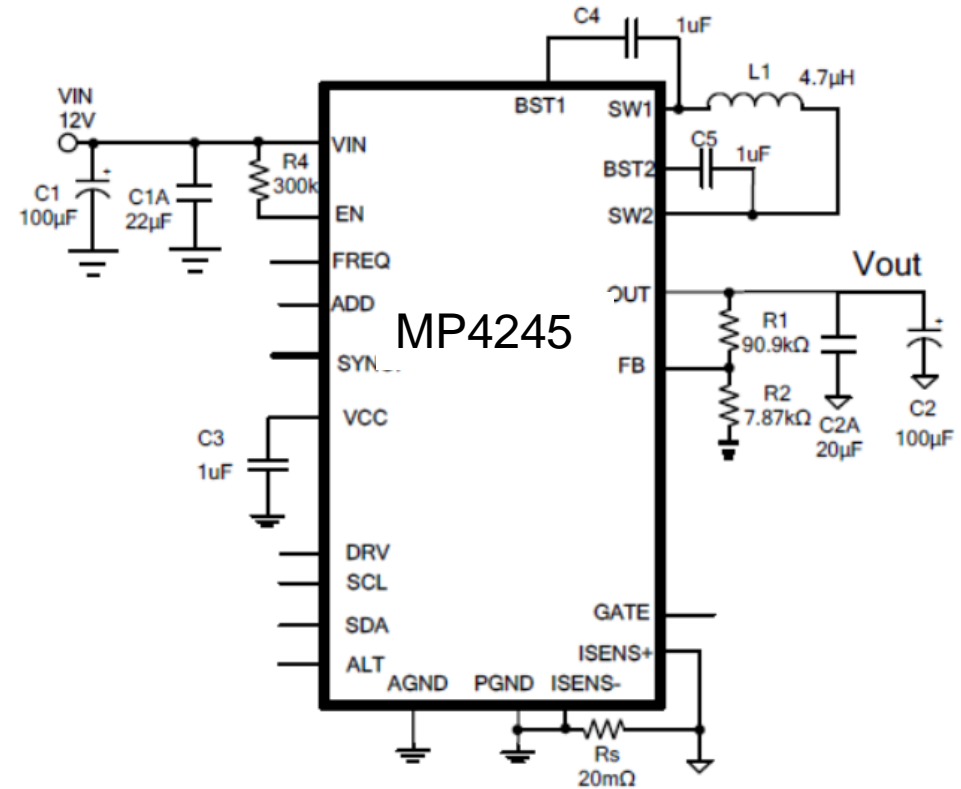
FEATURES

- Support **60W** Buck-Boost or 5A Peak Iout
- Wide 3.4V to 36V Operating Input Voltage Range
- 10mOhm/12mOhm Rds(on)
- **0.4V to 20.47V Output-Voltage Range, 10mV Resolution**
- 250kHz, 350kHz and 420kHz Frequency Selectable
- **Frequency Spread Spectrum Selectable**
- Line Drop Compensation
- **Accurate CC Output-Current Limit, 50mA/step, ±5%**
- **I²C Interface with ALT**
- PFM/PWM Mode, Current Limit, Output Voltage, Frequency Spread Spectrum, Line Drop Comp, etc. Programmable
- CRC Check for MTP Integrity
- **Load Shedding Send Alert**
- EN Shutdown **Active Discharge**

APPLICATIONS

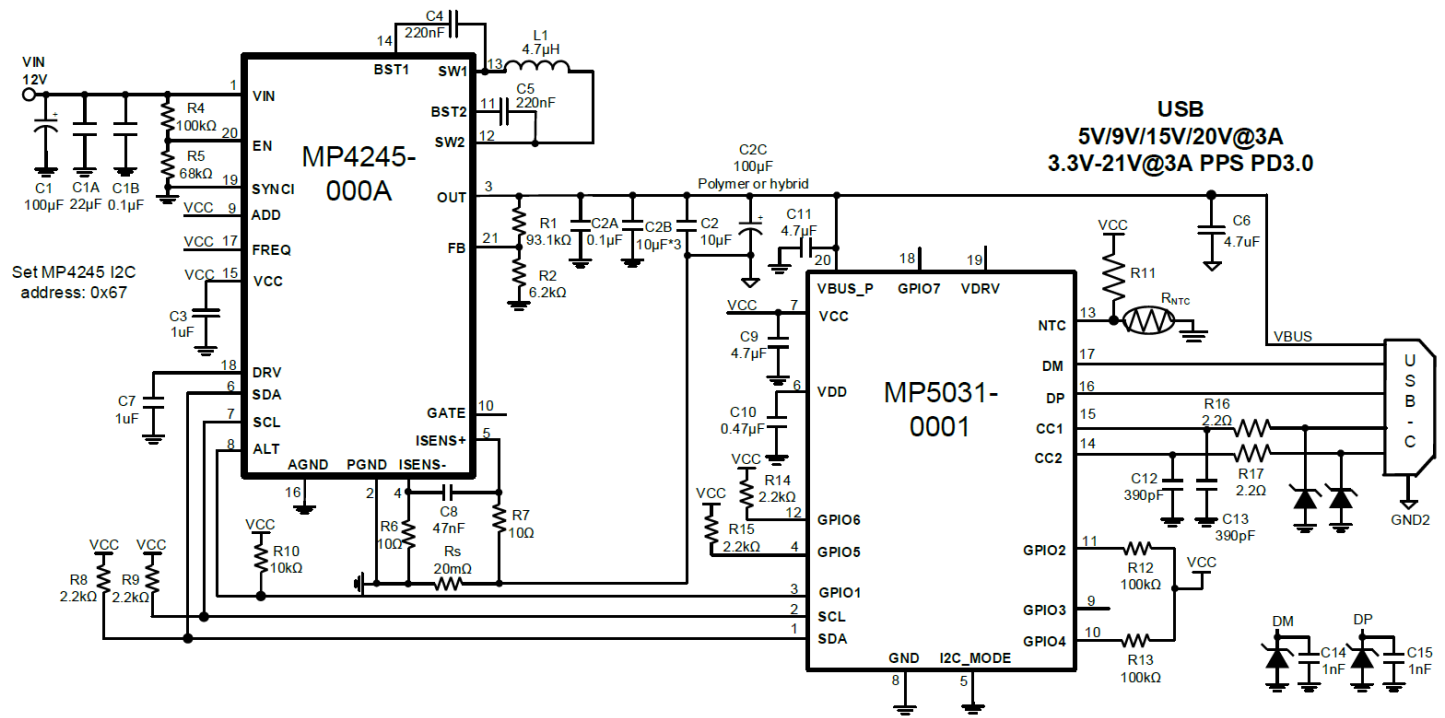
- USB Type-C Port
- USB Type-C Hub
- USB Dedicated Charging Ports (DCP)

Fully Support PD PPS



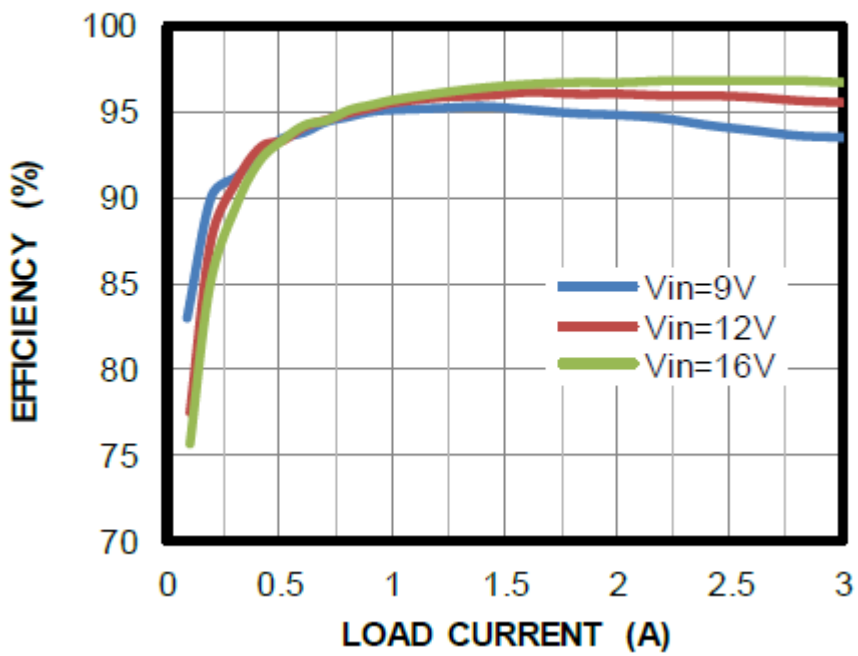
MP4245 +MP5031 –for 60W Buck-Boost USB PD Car Charger

MP4245+MP5031 for 60W PD application.



Efficiency vs. Load Current

V_{OUT}=20V, L=4.7μH, DCR=8mΩ, F_{sw}=420kHz



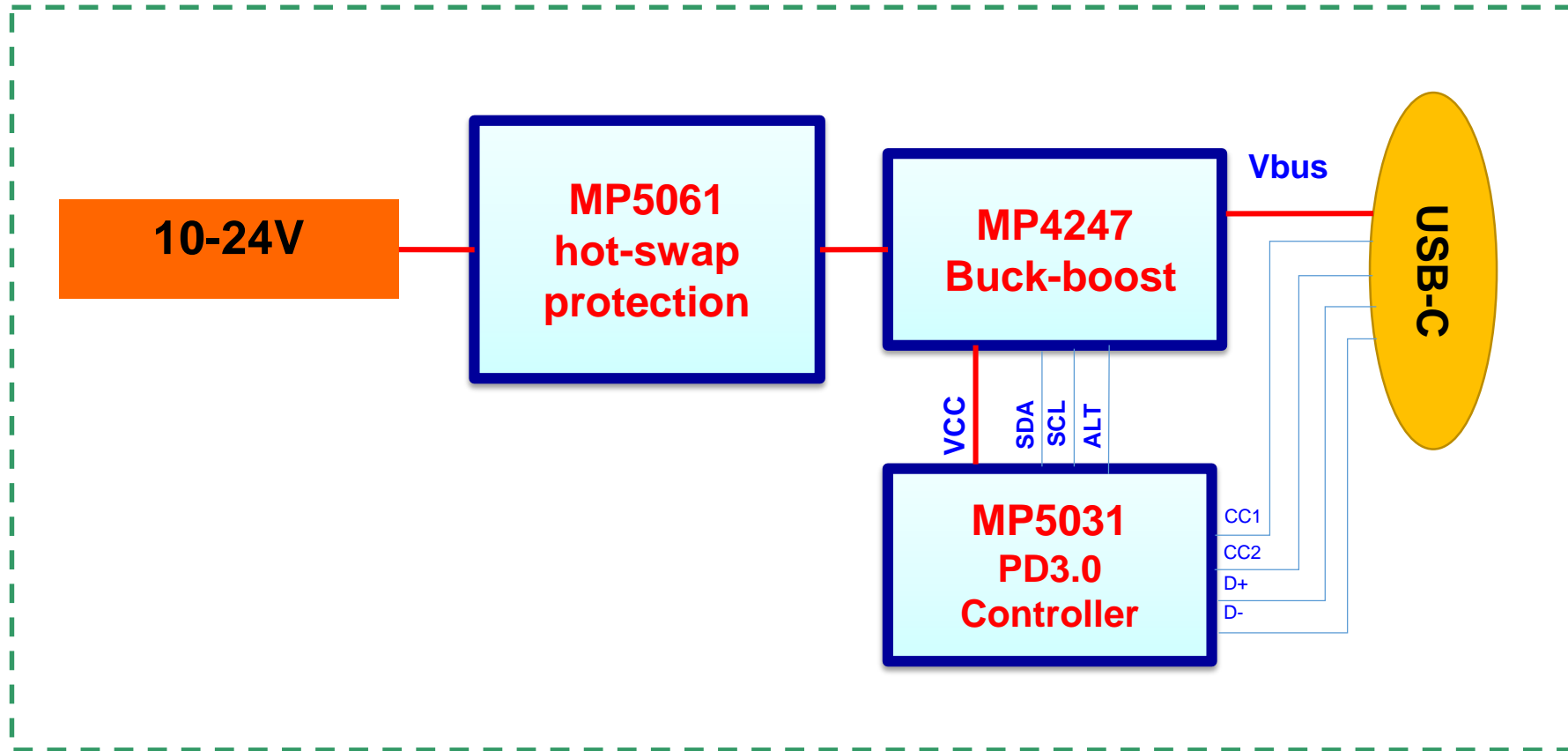
Test Condition: F_{sw}=250kHz

V _{in} (V)	I _{in} (A)	V _{out} (V)	I _{out} (A)	Efficiency	Power Loss(W)	Thermal Rise(°C)	Load Power(W)
19.028	3.2287	19.924	2.9987	97.25%	1.690	32.9	59.75
19.001	3.5063	19.928	3.2493	97.19%	1.871	36.8	64.75

Confidential and Proprietary – INTERNAL USE ONLY



MP4247 +MP5031 –for 100W Buck-Boost USB PD Car Charger



OUTPUT
5V-9V-15V@3A, 20V@5A
3.3V-21V@5A PPS PD3.0

MP4247 +MP5031 –for 100W Buck-Boost USB PD Car Charger

10-24V

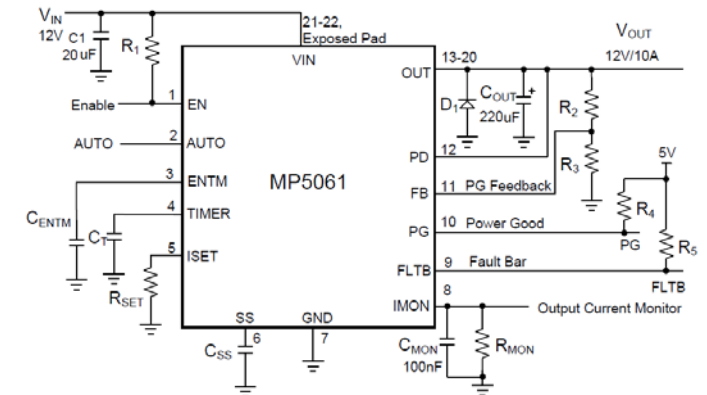
MP5061
hot-swap
protection

FEATURES

- Integrated 7mΩ Power FET
- Adjustable Current Limit (5A to 15A)
- 36V Input Transient before VOUT Startup
- Output Current Measurement
- ±10% Current Monitor Accuracy
- Fast Response (<200ns) for Short Protection
- PG Detector and FLT B Indication
- PG Assert Low at VIN = 0
- Damaged MOSFET Detection
- External Soft Start
- Under-Voltage Lockout
- Thermal Protection

APPLICATIONS

- Hot Swappable
- PC Card
- Disk Drives
- Laptops



Available in a QFN-22 (3mmx5mm) Package

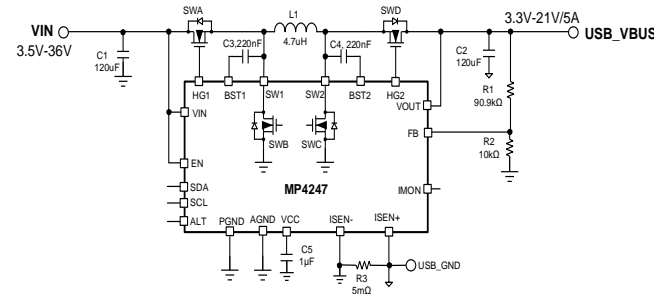
MP4247 +MP5031 –for 100W Buck-Boost USB PD Car Charger

MP4247 Hybrid Buck-boost

FEATURES

- High Efficiency Buck-boost (with 2 integrated Low-side FETs)
- Good Thermal Distribute
- Support 60W/100W PD Ports
- 10mΩ Boost LS Ron, 18mΩ Buck LS Ron.
- 3.4V to 36V Startup Input-Voltage Range
- I2C interface 20mV VID Supports 1-22Vout
- Iout CC LIMIT 50mA adjustable blank time (up to 10ms)
- 200kHz, 420kHz and 600kHz Frequency Selectable
- Internal Current Sense and Peak Current Limit
- 5.5V High-side SWA and SWD Power FET Driver
- Line Drop Compensation
- Output Discharge Function
- I2C Interface: ALT for OCP/OTP
- Output Current IMON Function

Schematic

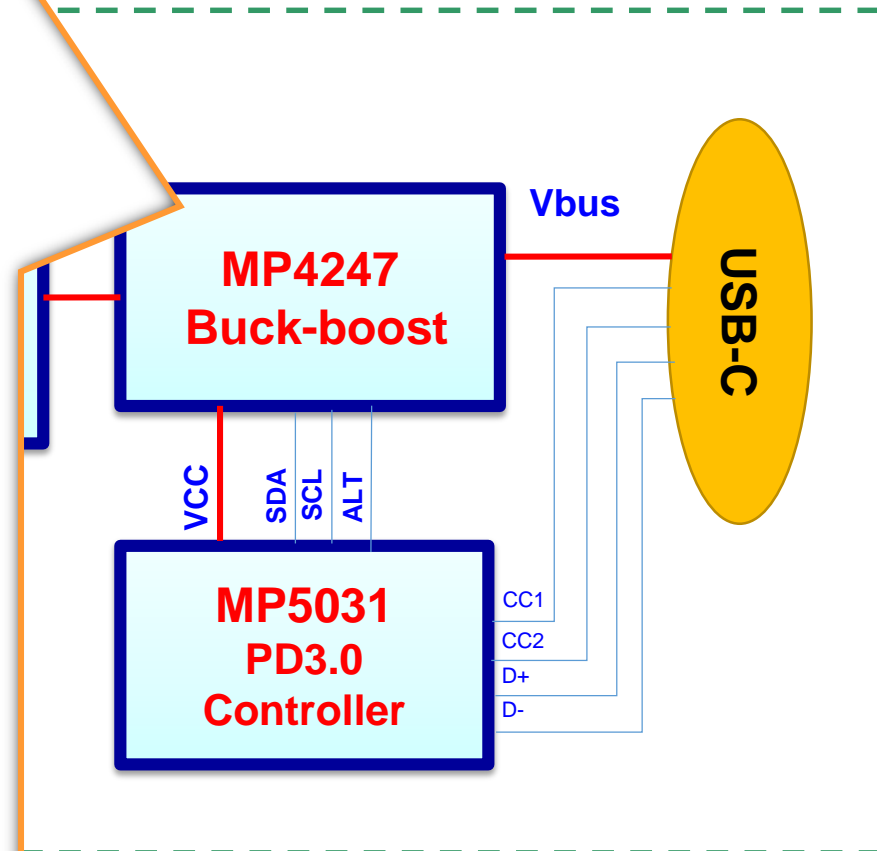


QFN-20(3mmx5mm)

APPLICATIONS

- USB-PD Sourcing Port
- Monitor, Car Charger, Wall Adapter

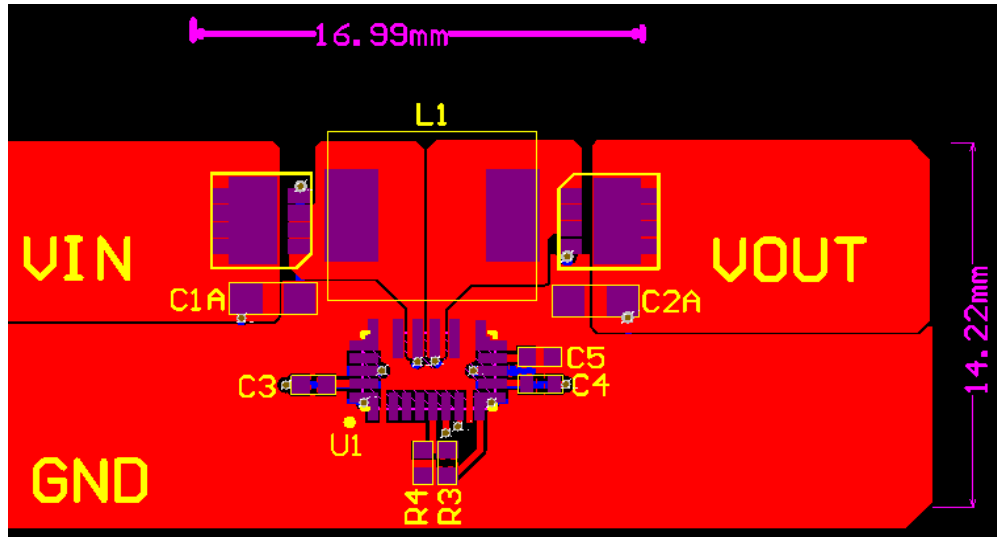
OUTPUT
5V-9V-15V@3A, 20V@5A
3.3V-21V@5A PPS PD3.0



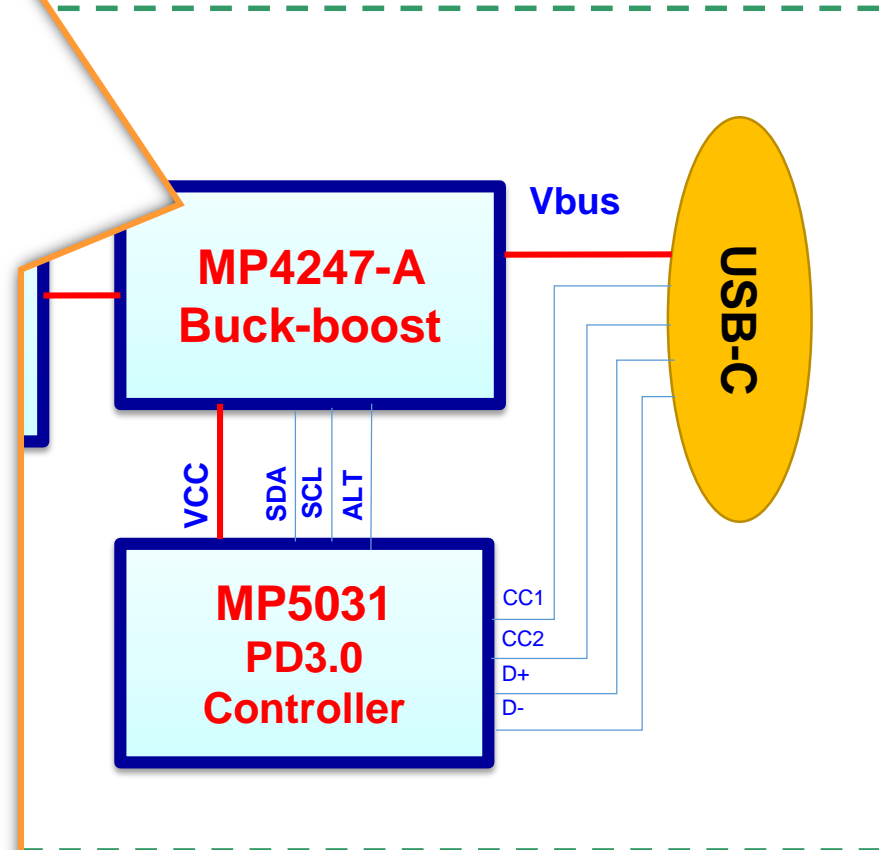
MP4247 +MP5031 –for 100W Buck-Boost USB PD Car Charger

Why integrate two low-side FETs?

- Eliminate external current sense resistor
- More optimized thermal performance for worst-case condition
 - At 60W/100W PD (9Vin to 20Vout/3A,5A) application, only SWC is switching, resulting in less power loss and no thermal issue
- External SWD MOSFET can accept lower voltage (30V) rating
- Two Internal Low-side FETs and External High-side FETs offer an optimal balance between efficiency/thermal, cost, and solution size.



OUTPUT
5V-9V-15V@3A, 20V@5A
3.3V-21V@5A PPS PD3.0



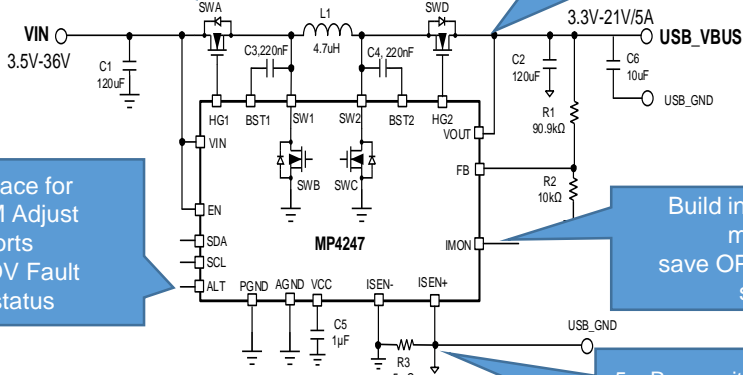
MP4247 +MP5031 –for 100W Buck-Boost USB PD Car Charger

Summary of MP4247 key advantage

2 external MOSFETs provide high efficiency and good thermal performance

Build in HV output discharge

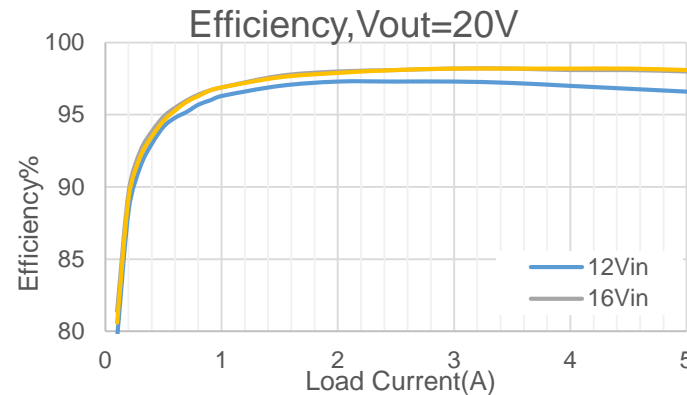
- I2C interface for Vout/ILIM Adjust
- Alert reports OC/OT/OV Fault and PG status



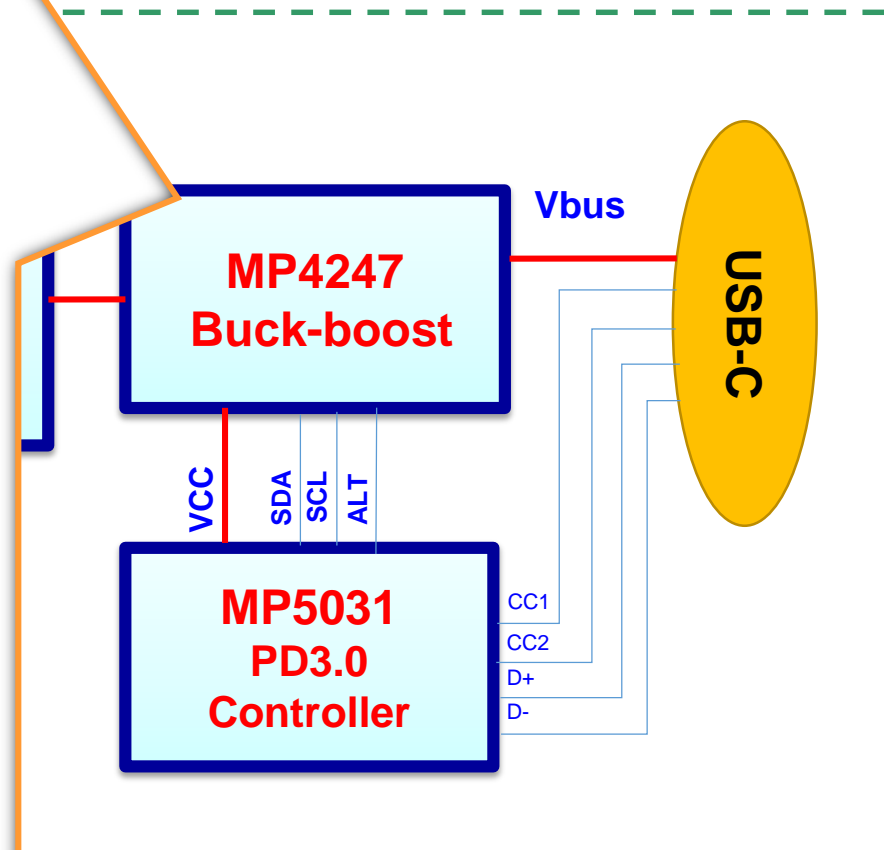
Build in lout current monitor, save OPAMP current sense

5m Rsens with 5% CC accuracy, less Power Loss. Adjustable CC Blank timer up to 15ms, meet PD Peak Current spec.

- 2 Flexible external High-side FETs to support **60W / 100W**
- 2 integrated Low-side FETs
 - eliminate external current sense resistor
 - save external FETs cost
- Support USB PD3.0 PPS feature
- Line Drop Compensation set by I2C
 - save external components and PCB area
- IMON feature to save external OPAMP BOM

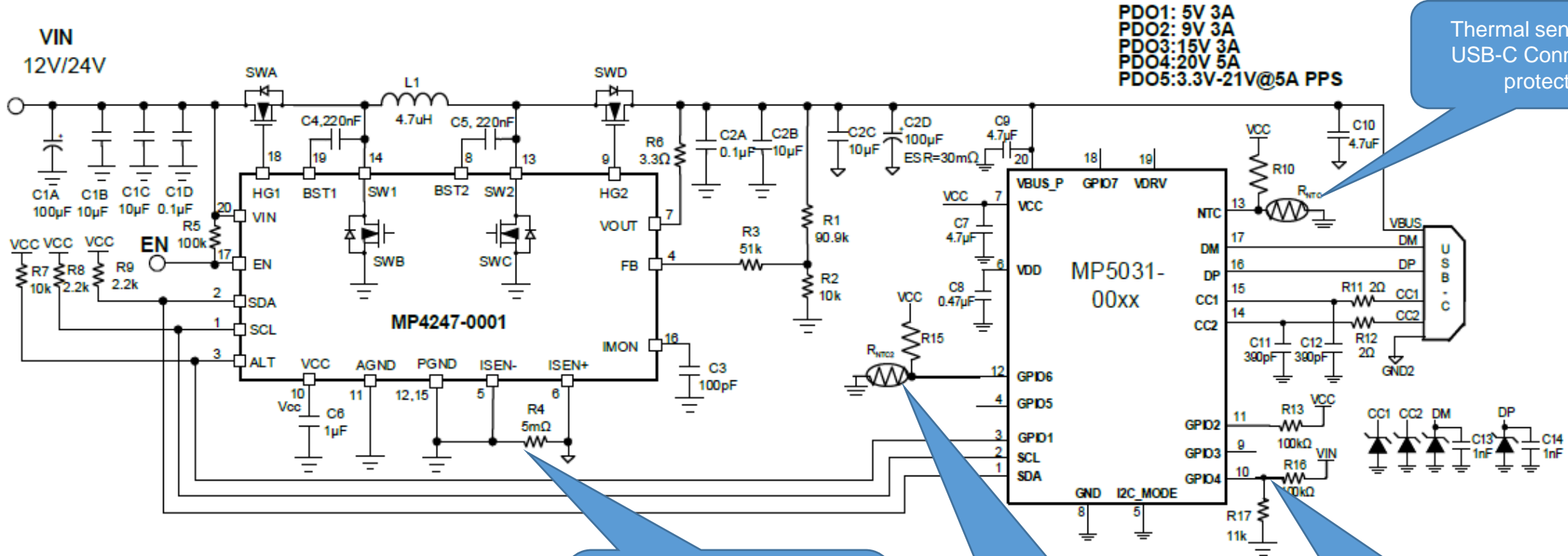


OUTPUT
 5V-9V-15V@3A, 20V@5A
 3.3V-21V@5A PPS PD3.0



MP4247 +MP5031 –for 100W Buck-Boost USB PD Car Charger

MP4247+MP5031 for 100W PD Car Charger



Thermal sense for USB-C Connector protect

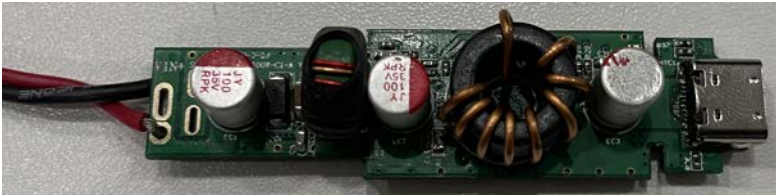
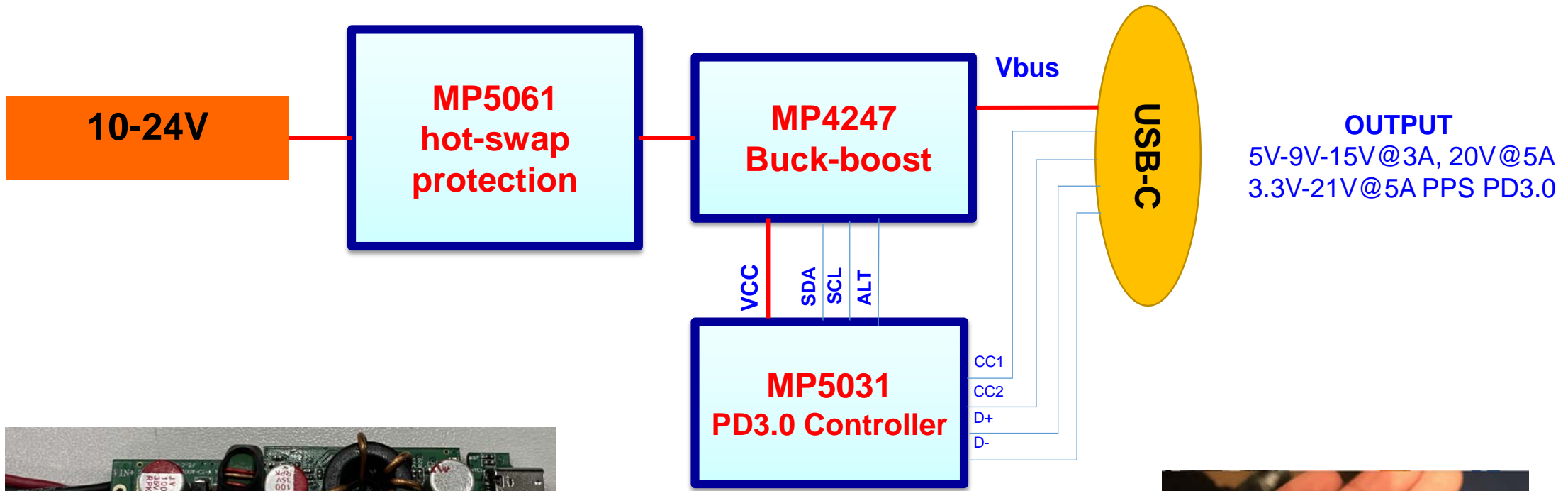
5m Rsens with 5% CC accuracy, less Power Loss. Adjustable CC Blank timer up to 15ms, meet PD Peak Current spec.

Thermal sense When NTC2 is triggered Reduce PDO to PWR_SHARE_TO_PDP

Input Voltage Low Detection When VIN < 11.1V Reduce PDO to PWR_SHARE_TO_PDP



MP4247 +MP5031 –for 100W Buck-Boost USB PD Car Charger



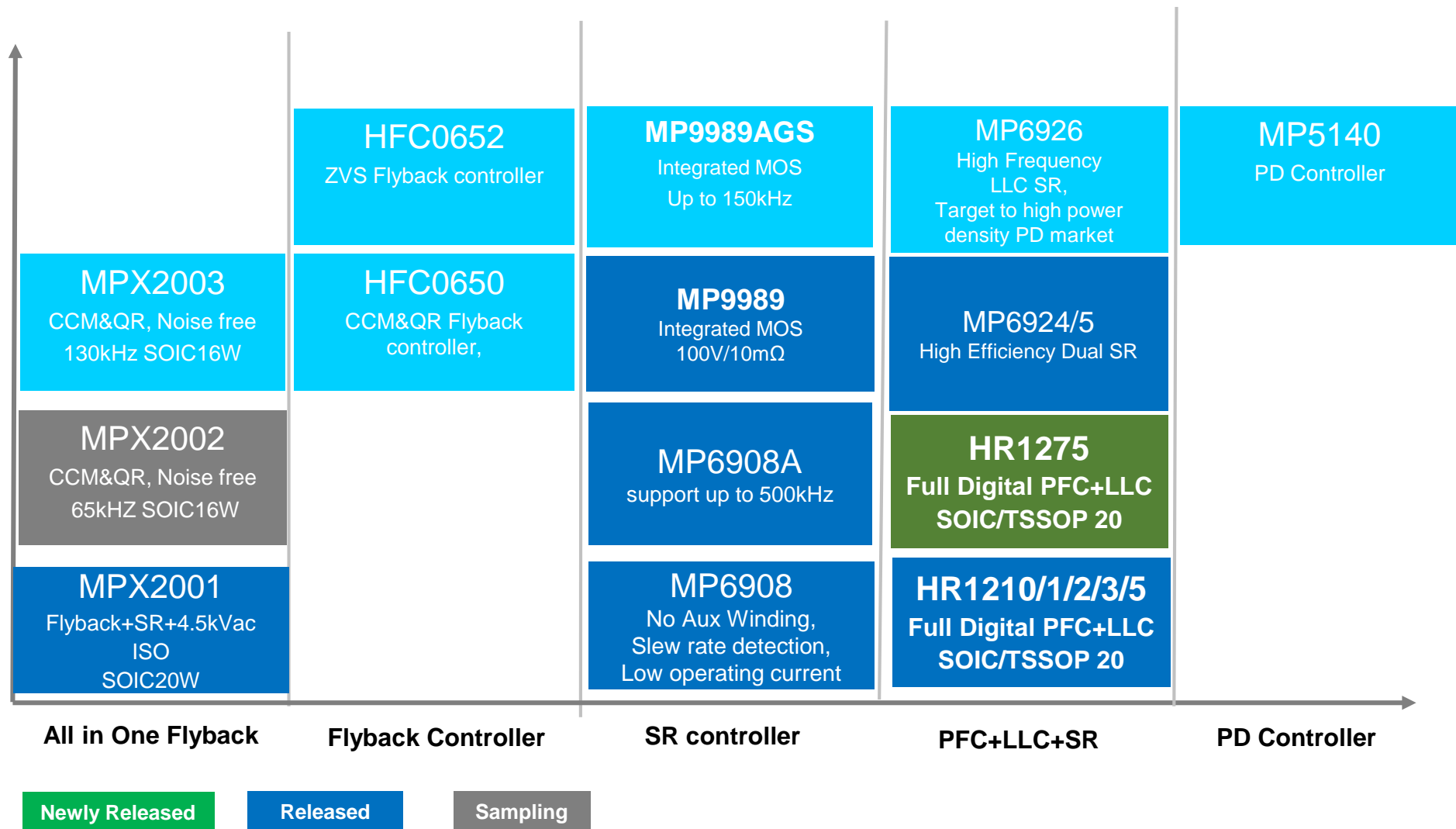
6.5cm x 1.6cm x 1.6cm



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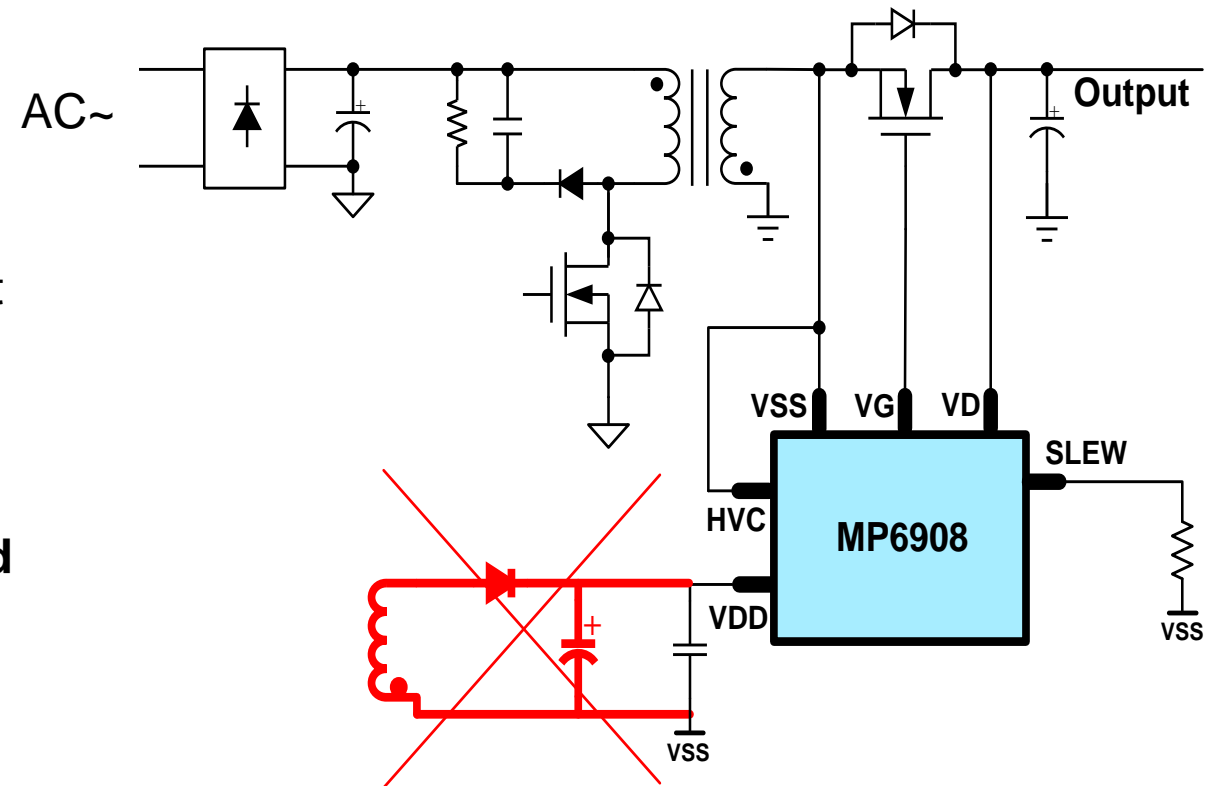
ACDC Products for USB PD



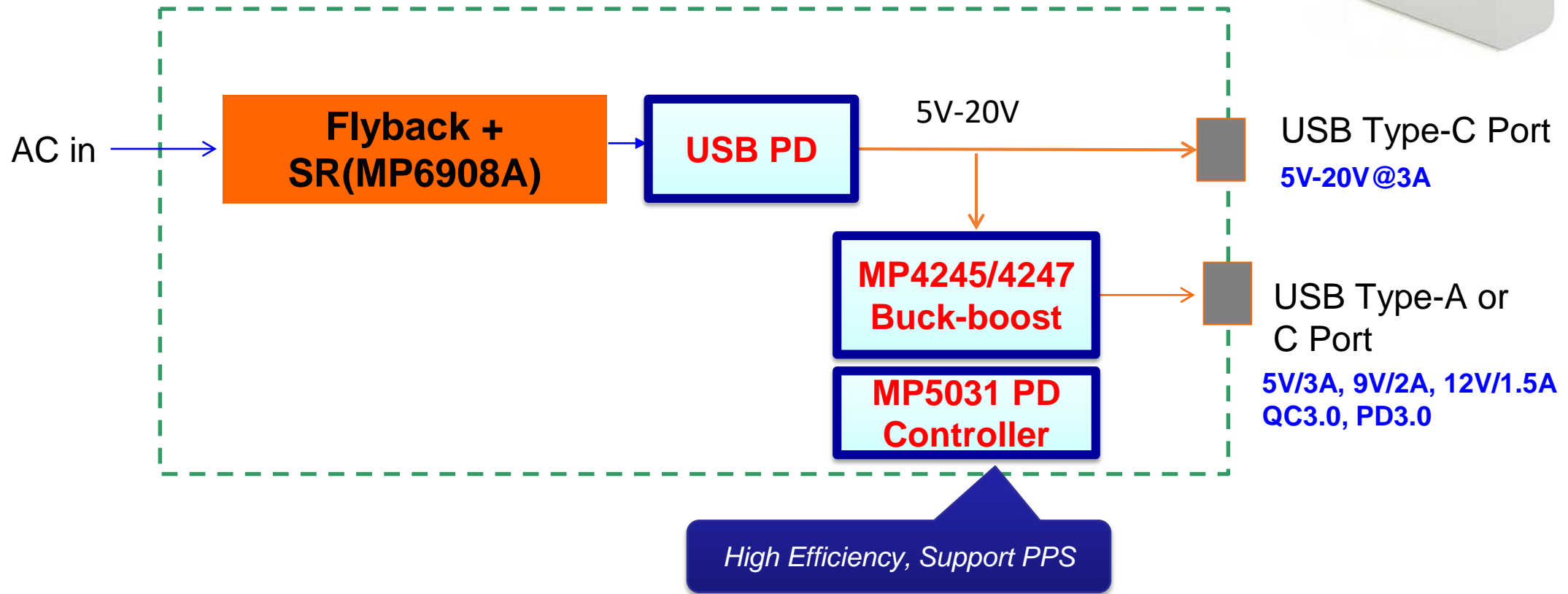
MP6908 Family – The best SR Controllers on the market

Key Features

- **Powers high side SR without Aux winding**
 - high side SR improves EMI up to 5dB
- **Supports output voltage down to zero volt without Aux winding**
 - body diode does not conduct at short circuit
- **<150uA Quiescent Current – super low standby power**
- **Patented VDS Slew rate detection for good noise immunity**
 - no cross conduction concern
- **<20ns Fast turn-off delay**
 - supports CCM, QR and DCM flyback



SR typical application: C+A or Dual C Wall Charger



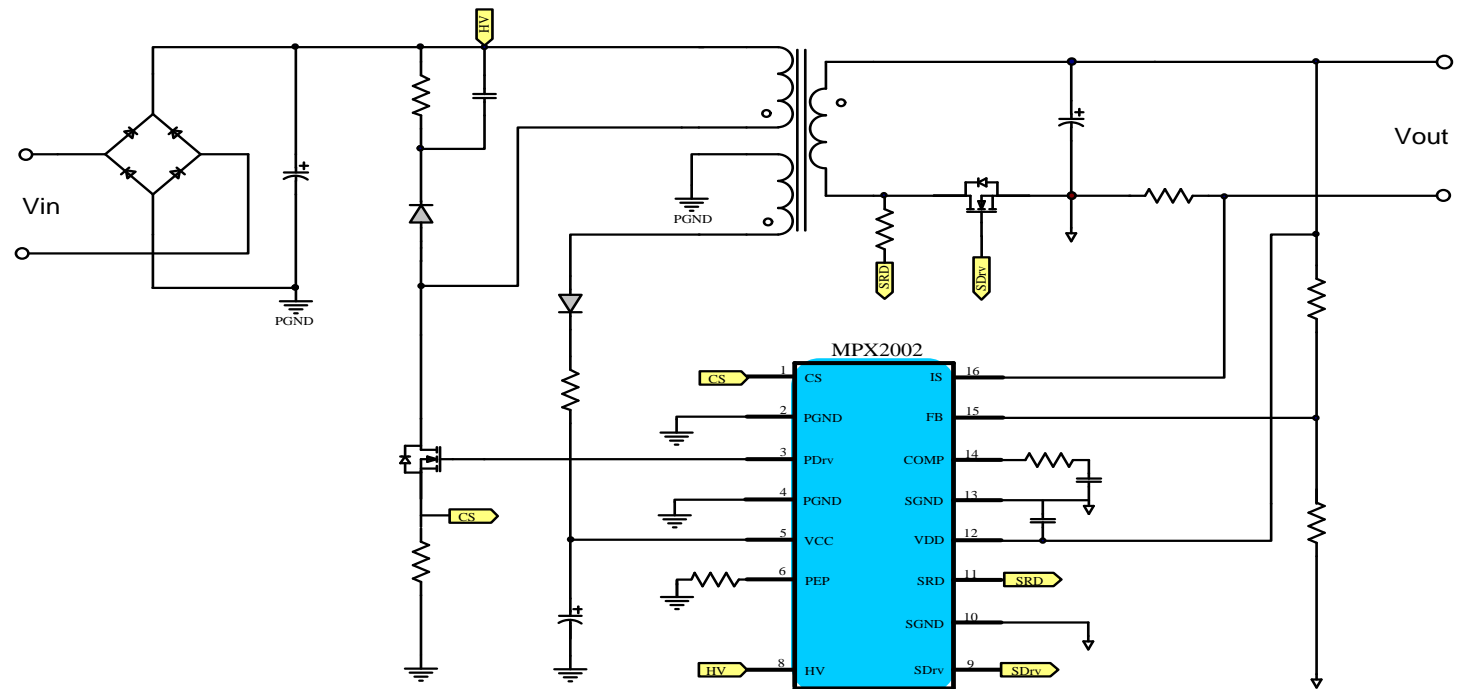
MPX2002 New Features

Features

- Low BOM Count & Superior Reliability
- Safety and Regulatory Compliance
- 650V Integrated HV Current Source and 180V Integrated SR Controller,
- Noise Proof Burst Mode
- CCM/Novel QR mode in DCM
- SRD self-charging function
- Rich Protections

Applications

- High Efficiency USB PD + PPS/QC Adaptors/Chargers
- High Performance Offline Charger for Mobile Device
- Consumer Electronics Power Supply



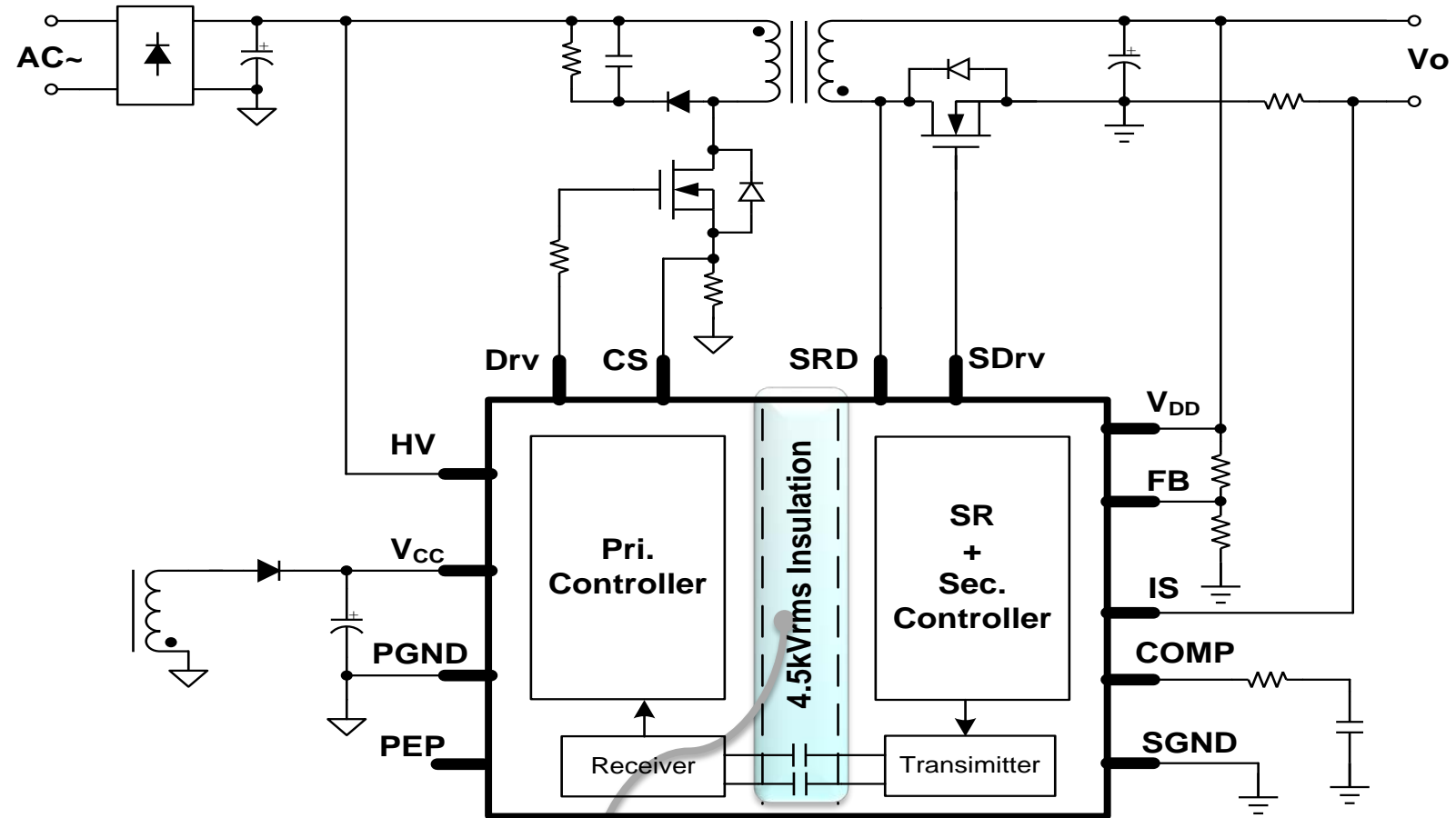
SOICW-16

Package



MPX2002 New Features

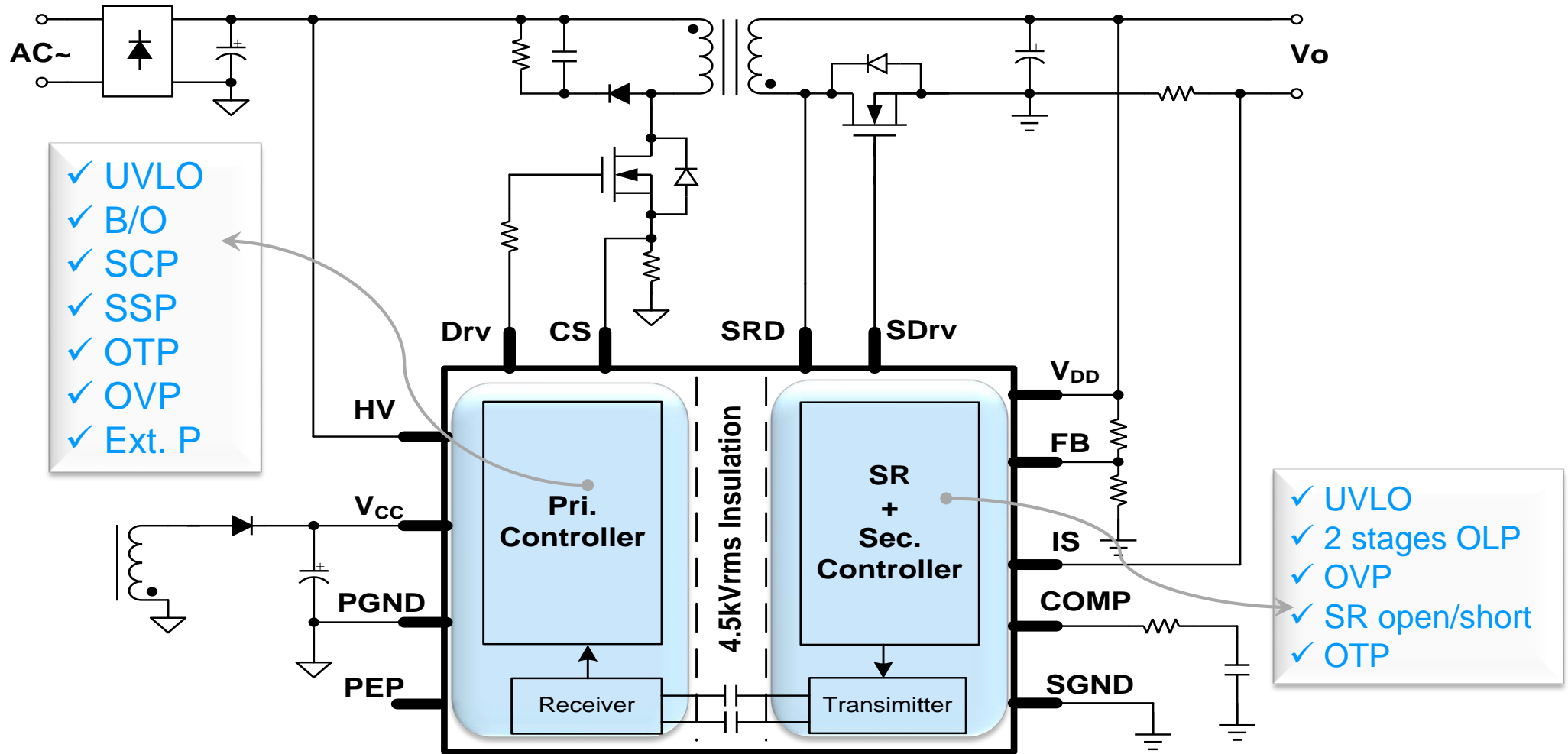
Reliability



- ✓ Advanced integration technology with 4.5kVrms isolation;
- ✓ No life time concern as opto – isolators;
- ✓ UL1577, IEC62368 approved (pending)

MPX2002 New Features

Thorough Protections



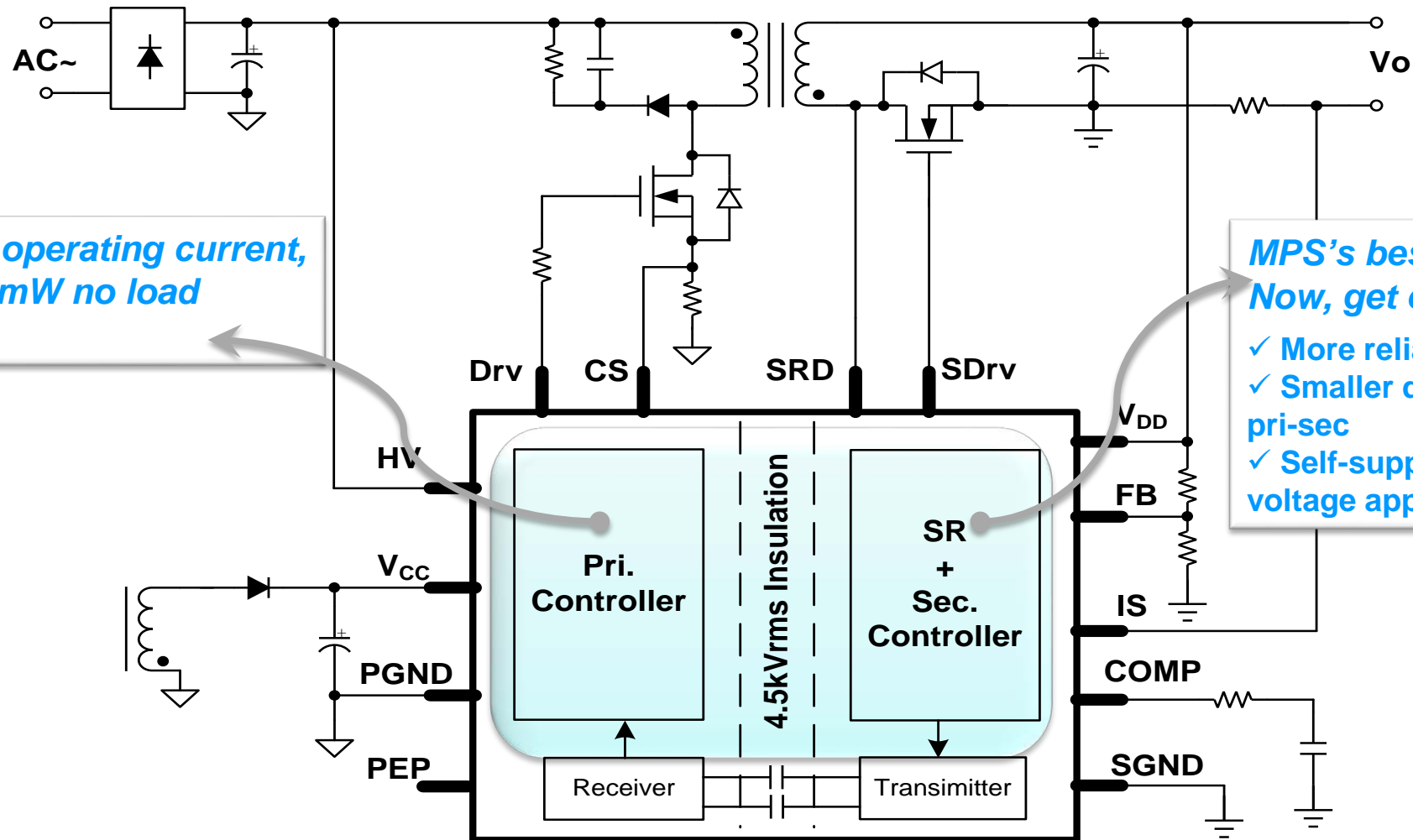
MPX2002 New Features

□ Better Performance

Extremely low operating current, to achieve <20mW no load consumption.

MPS's best SR controller. Now, get even better!

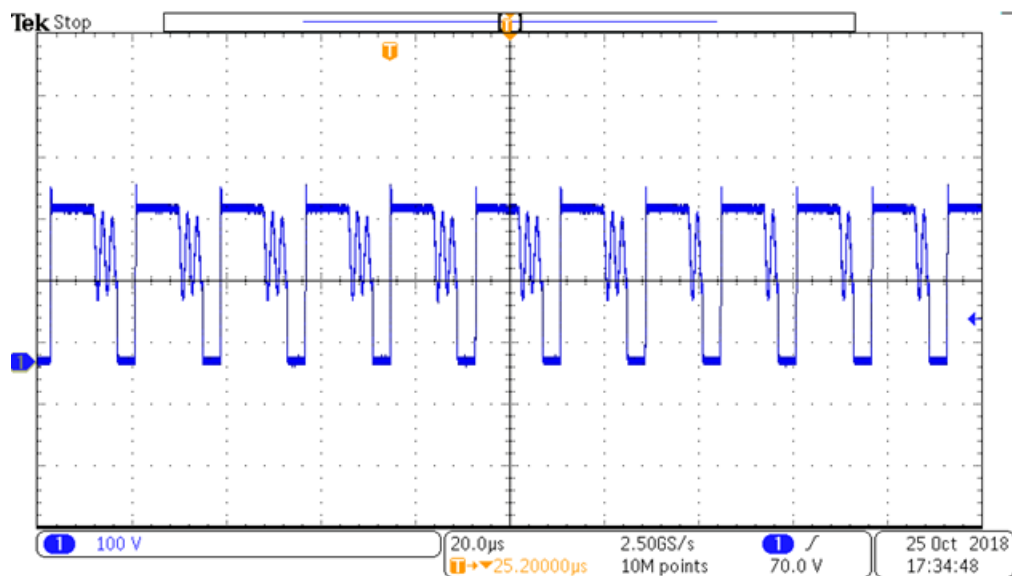
- ✓ More reliable CCM operation
- ✓ Smaller dead time between pri-sec
- ✓ Self-supplied for low output voltage application



MPX2002 New Features

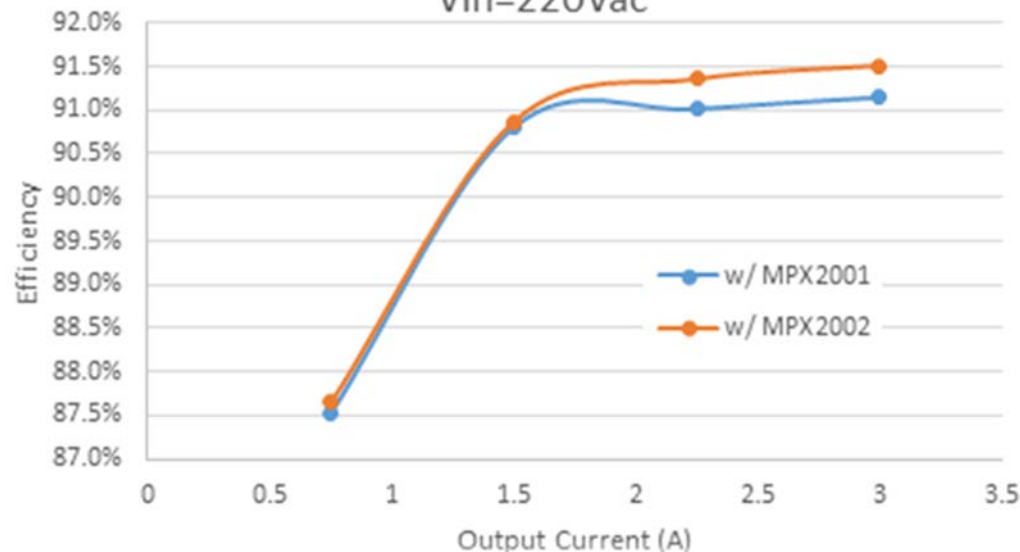
➤ Improved Efficiency

- Hybrid CCM&QR control mode
- Only 50ns dead time in CCM operation



Efficiency Comparison

Vin=220Vac



➤ Acoustic Noise Free

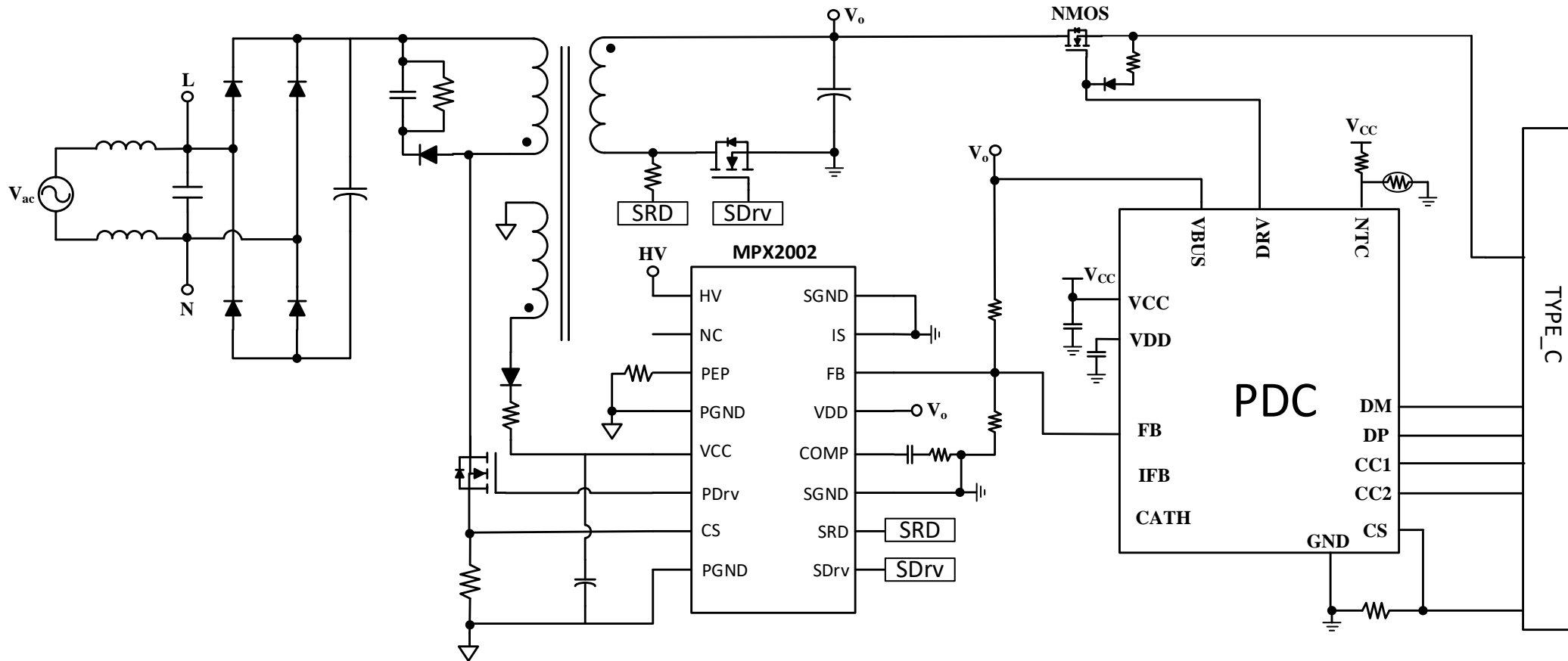
- QR with smooth valley transition
- Burst mode with frequency control

➤ Support Zero Output w/ Internal Bias

➤ Advanced SR fault protection features

➤ Smaller package, in SOICW-16

MPS Total PD Solution based on MP5140



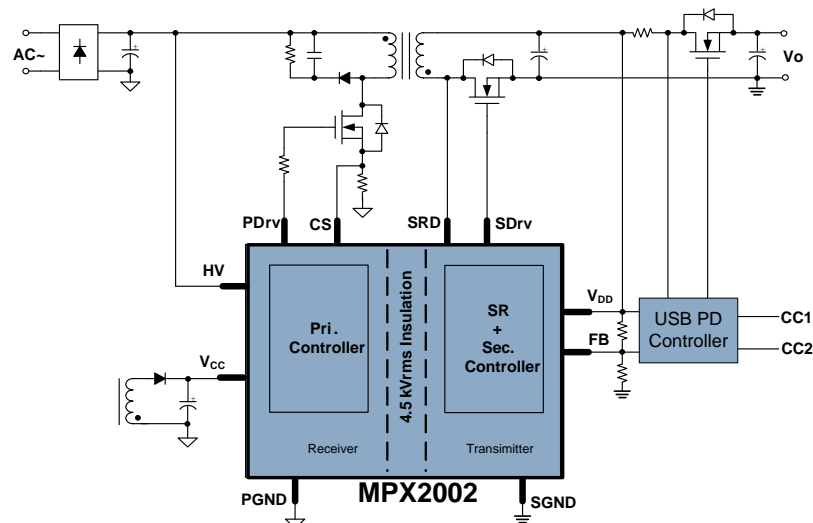
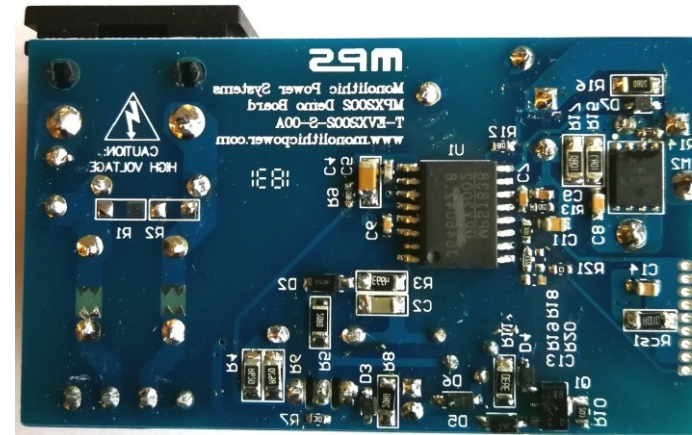
Full function Cost-Effective AC/DC PD PPS Controller

Built-in Vcon Power to support full range PD applications

Support both MPS all-in-one and general primary controllers

MPX2002 for 45W USB-C PD Wall Charger

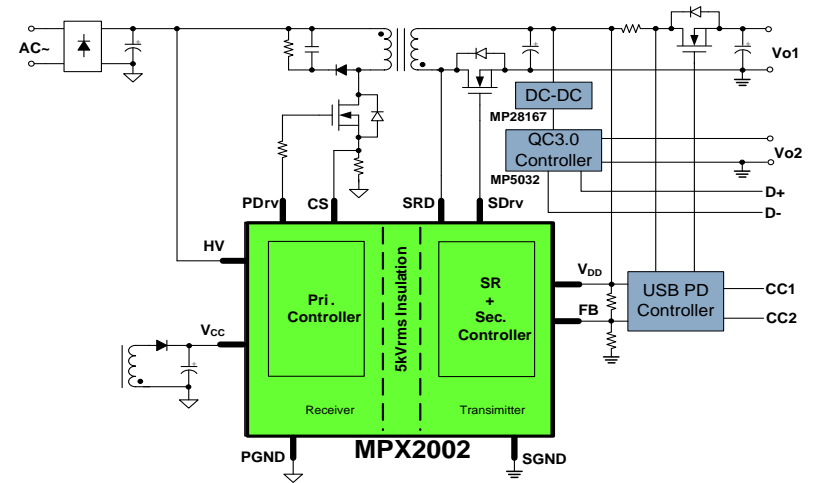
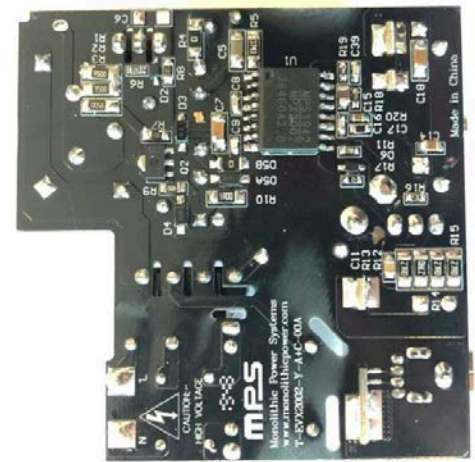
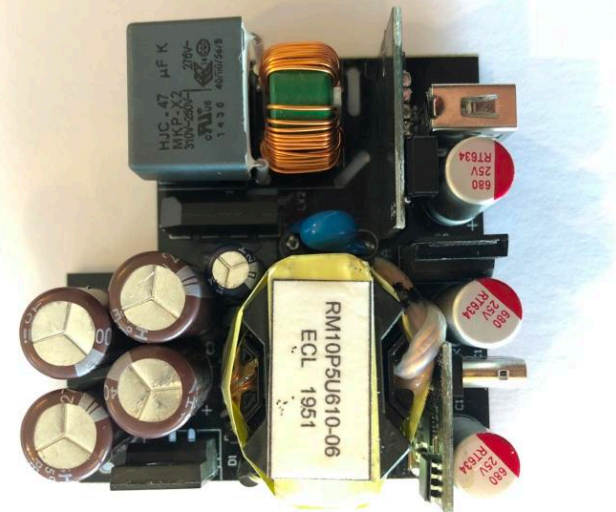
45W PD Type C Adaptor (69mm*39mm*25mm)



Output (PD Type C)	
Vout (V)	Iout (A)
5	0 - 3
9	0 - 3
15	0 - 3
20	0 - 2.25

MPX2002 for 61W Wall Charger

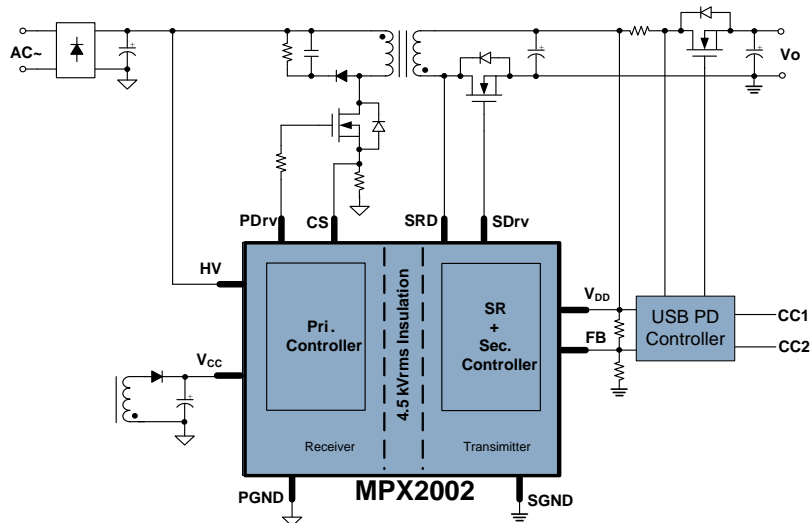
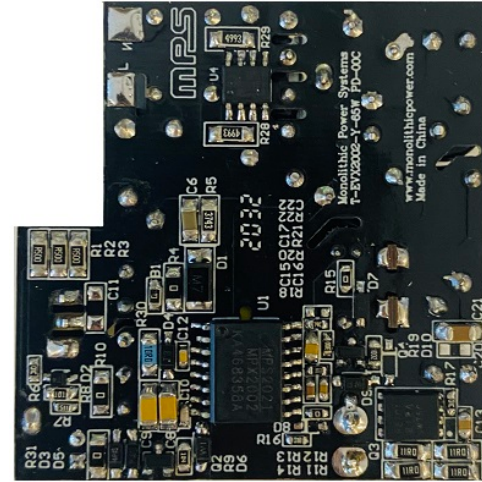
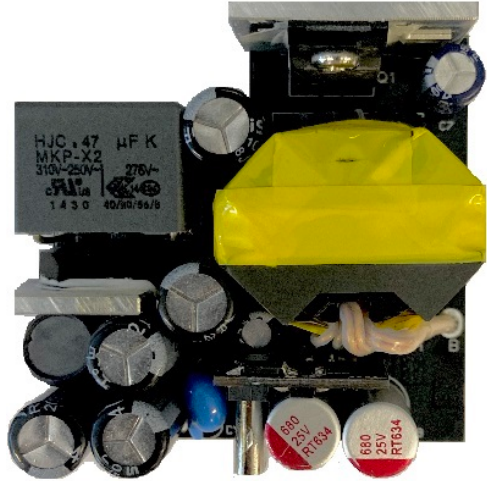
45W PD Type C+ 18W QC3.0 Type A Adaptor (57mm*57mm*25mm)



Output 1 (PD Type C)		Output 2 (QC3.0 Type A)	
Vout (V)	Iout (A)	Vout (V)	Iout (A)
5	0 - 3	5	0 - 3
9	0 - 3	9	0 - 2
15	0 - 3	12	0 - 1.5
20	0 - 2.25		

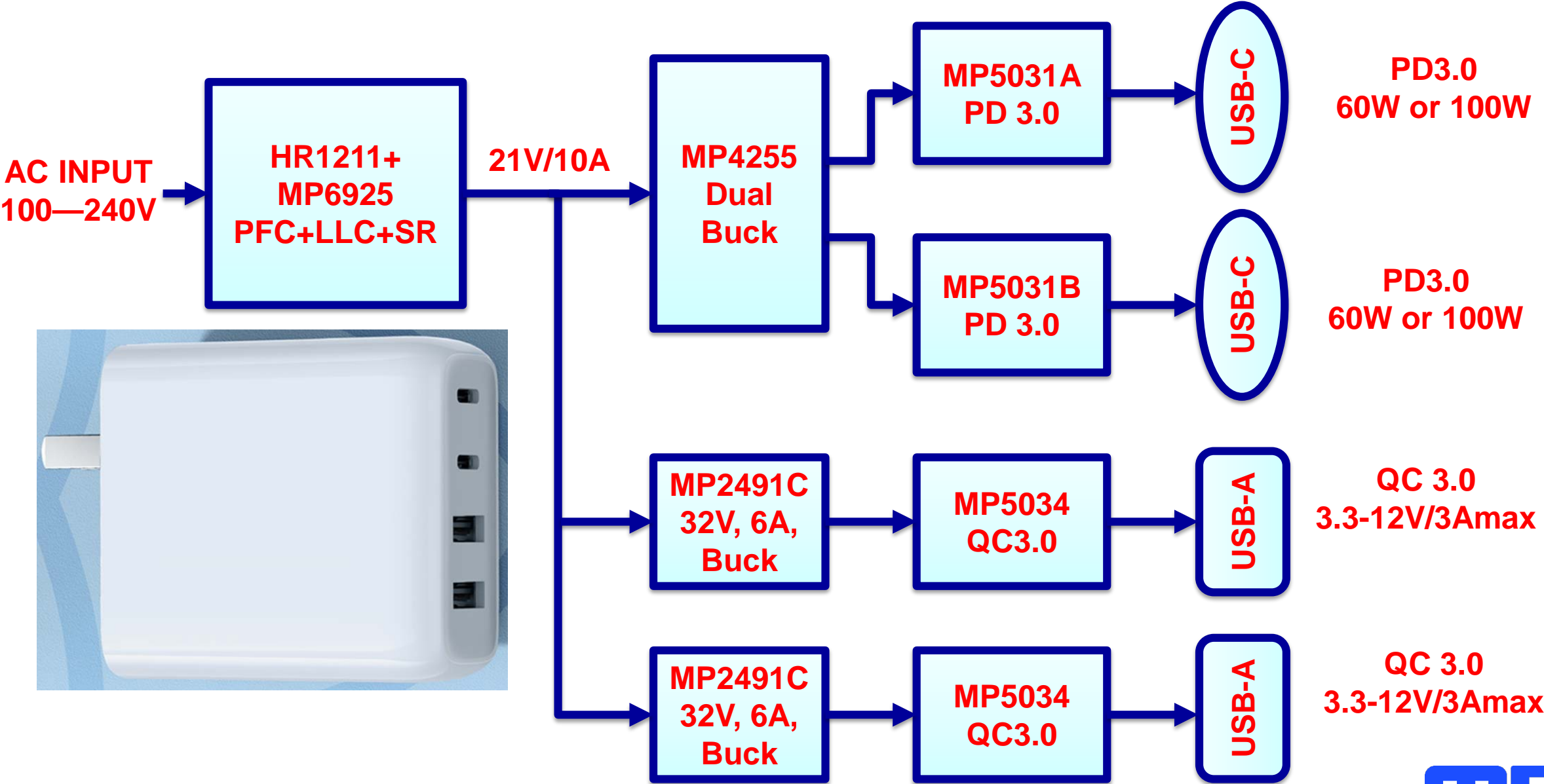
MPX2002 for 65W USB-C PD Wall Charger

65W PD Type C Adaptor (50mm*49mm*25mm)



Output (PD Type C)	
Vout (V)	Iout (A)
5	0 – 3
9	0 – 3
15	0 – 3
20	0 – 3.25

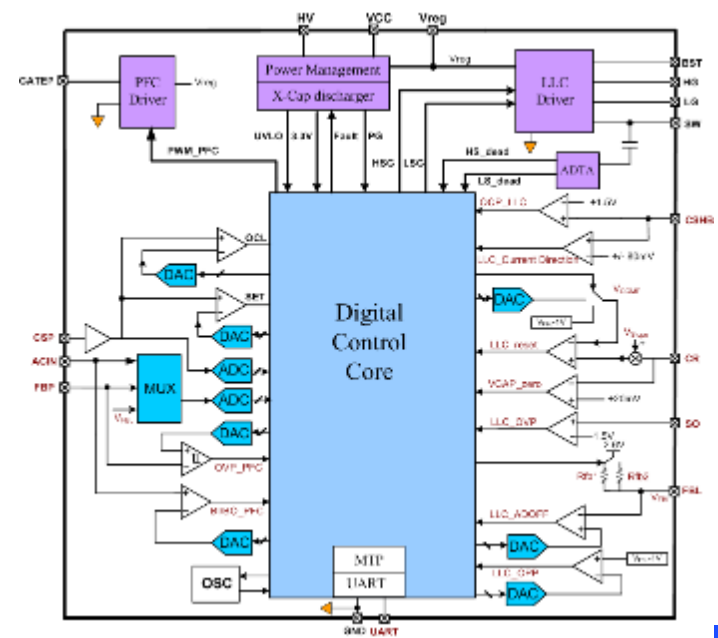
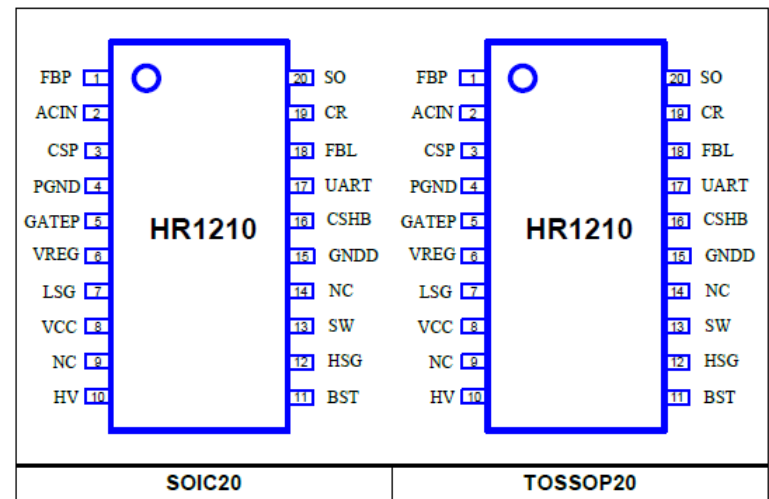
200W Multi-port USB-C PD charger solution



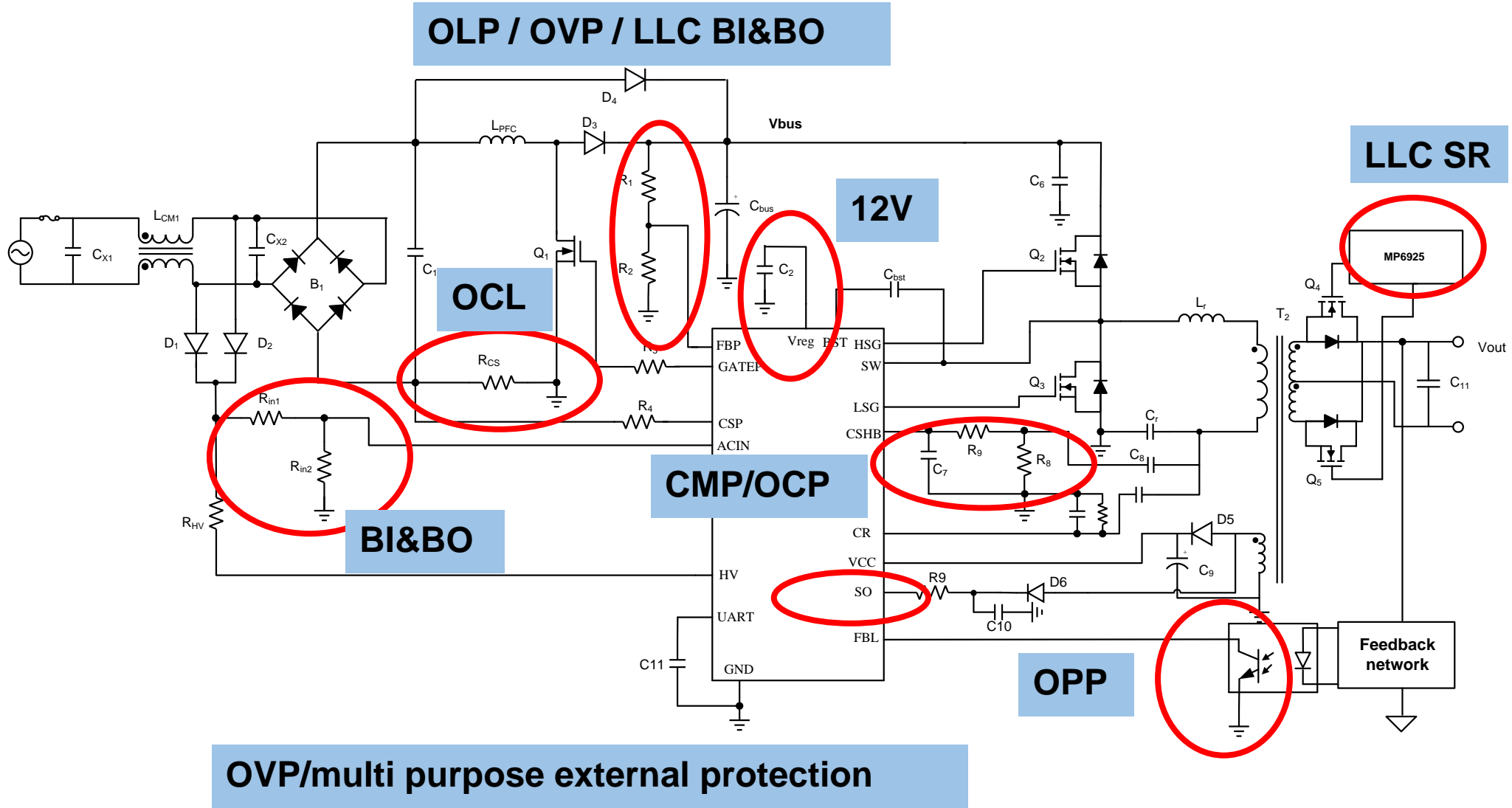
HR1210/1 – Digital PFC+ Digital LLC Combo with GUI

Key Features

- $\eta > 90\%$ @ $P_{out}=15W\sim 20W$
- $<100mW$ no load power loss
- GUI for easy parameter configuration
- Auto-tuning for the highest efficiency. (Labview + GUI)
- >0.9 PF at 10% load
- Built-in high voltage start-up and X-cap discharger.
- Digital control for both PFC and LLC.
- Current Mode Control for LLC
- Improved skip mode control of LLC for low audible noise
- Adaptive dead time adjustment of LLC.
- Capacitive mode protection of LLC.
- Programmable soft start.
- Comprehensive protections. Brown-in/out, OVP, OCP,OLP.



HR1211 Typical application

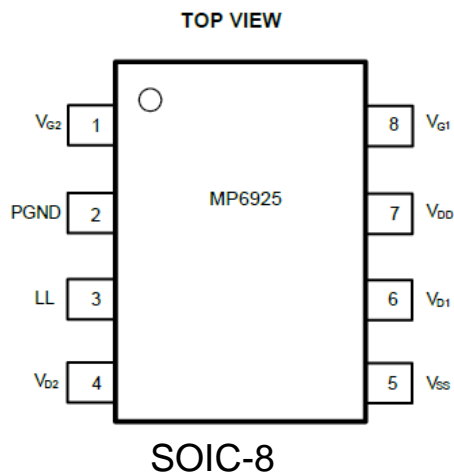


OVP/multi purpose external protection

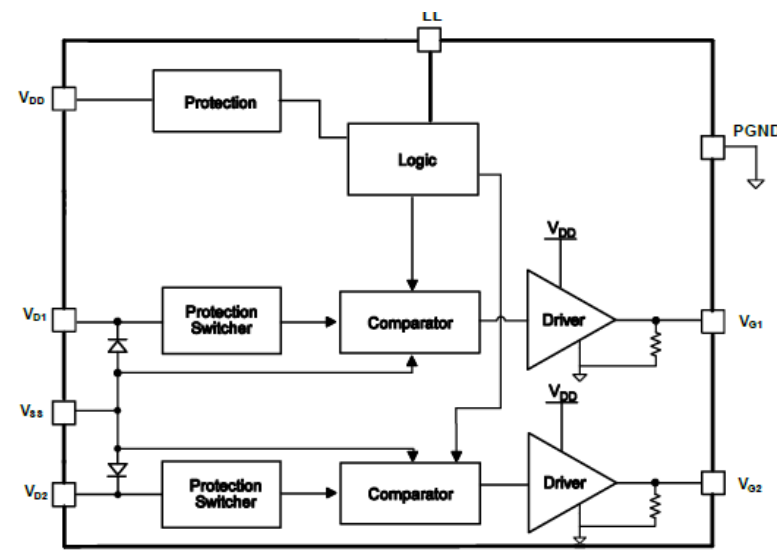
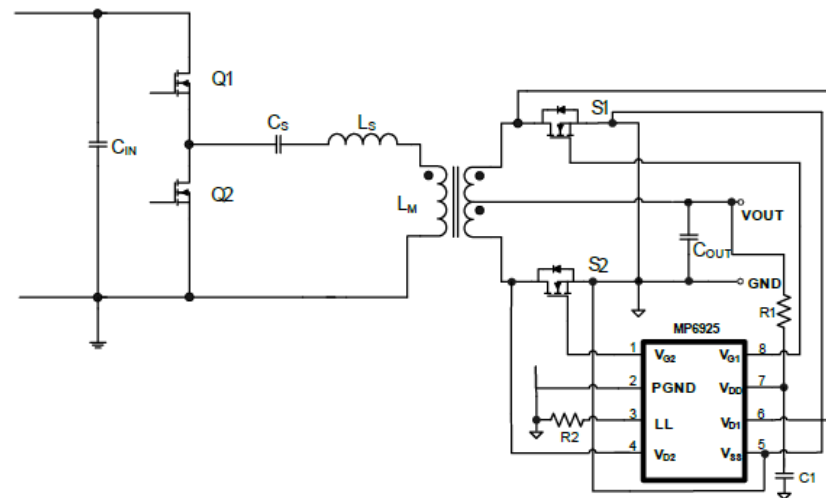
MP6925 – LLC SR

Key Features

- Fast Turn-Off Total Delay of 35ns
- Wide 4.2V to 35V V_{DD} Operating Range
- 175 μ A Low Quiescent Current in Light-Load Mode
- Supports CCM, CrCM, and DCM Operation
- Supports High-Side and Low-Side Rectification
- Compatible with Energy Star



TYPICAL APPLICATION



Block diagram

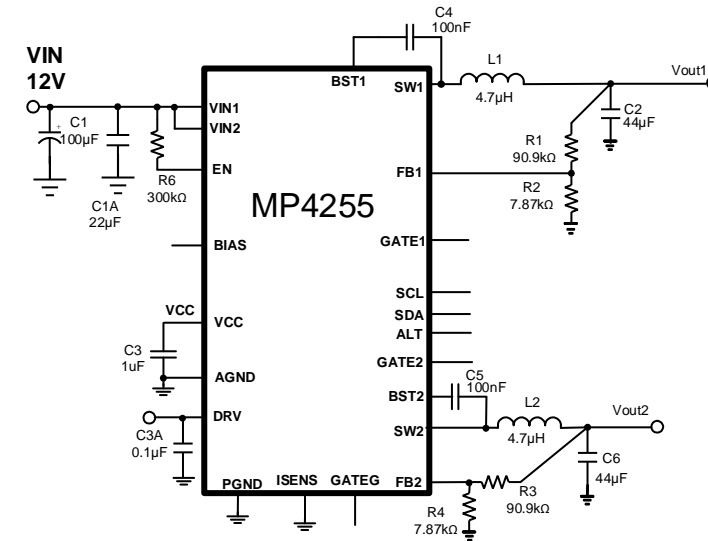
MP4255: Dual 3A or Shared 6A High Voltage Buck with I2C

FEATURES

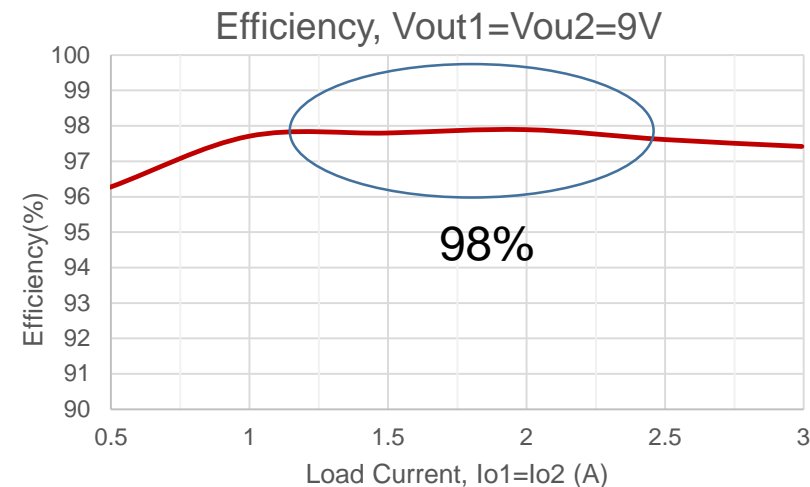
- Dual 36V/3A or 6A shared Buck Converter
- Wide 3.4V to 36V Operating Input-Voltage Range
- 0.4V to 20.47V or $V_{in} * D_{MAX}$ Output-Voltage Range, 10mV resolution
- 250kHz/420kHz/1.1MHz/2.1MHz Selectable Switching Frequency
- Frequency Spread Spectrum
- Low Dropout Mode
- Line Drop Compensation
- Accurate +/-5% adjustable CC Output-Current Limit 50mA/step via I2C
- Battery Short to Ground Protection Driver
- I/O Pin Short to Battery Protection Driver
- V_{BUS} Isolation NMOS Gate Driver
- EN Shutdown Passive Discharge

APPLICATIONS

- USB Power Delivery
- Industrial PC Power Supplies



Available in a QFN (4mmx5mm) Package with Wettable Flanks



Dual Buck MP4255+PD controller MP5031*2 for Dual USB-C

Simple BOM for dual channel PD supply

Easy to programmable PDO List and other features via OTP

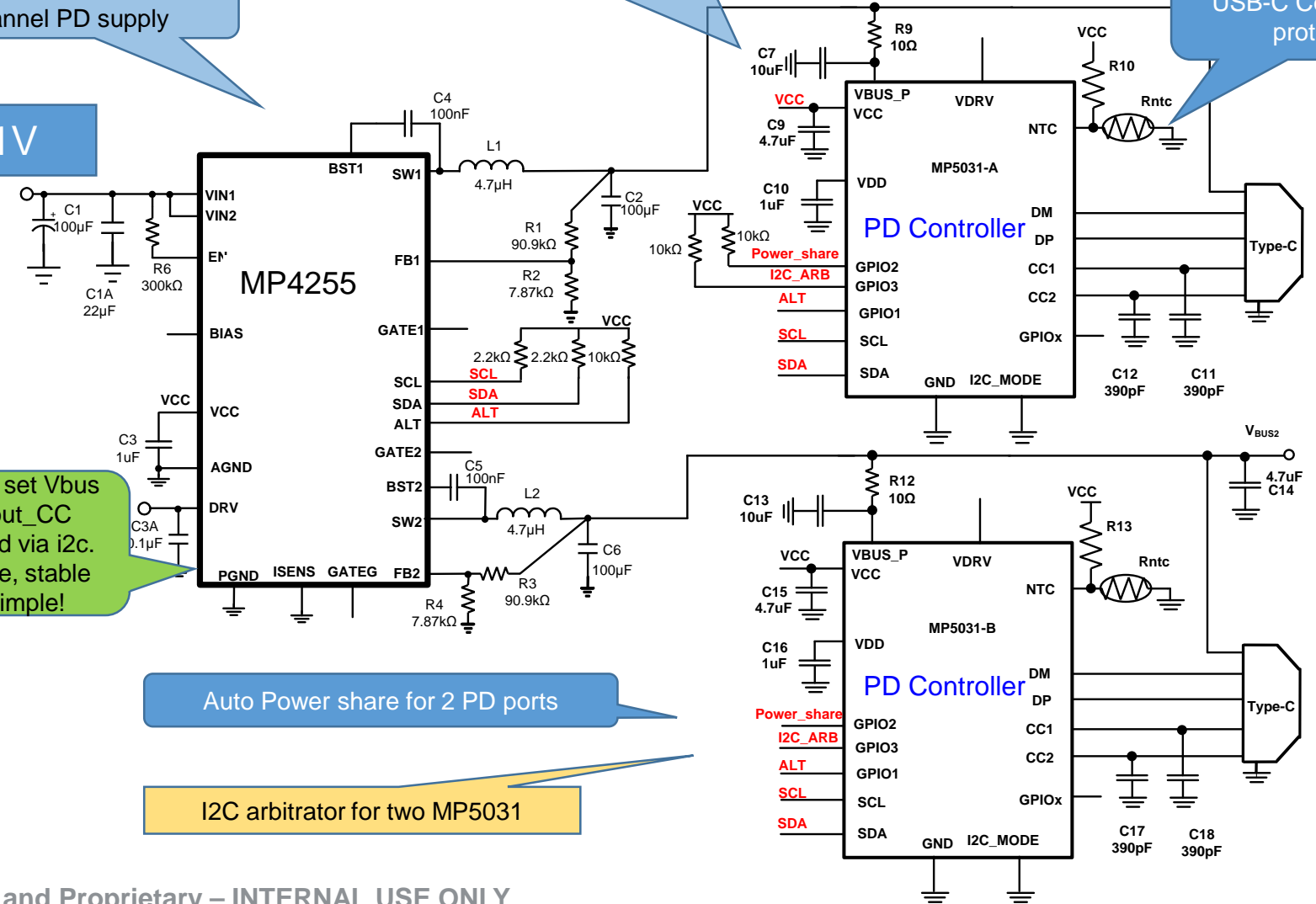
Thermal sense for USB-C Connector protect

21V

MP5031 set Vbus and lout_CC threshold via i2c. Accurate, stable and simple!

Auto Power share for 2 PD ports

I2C arbitrator for two MP5031



60W/100W

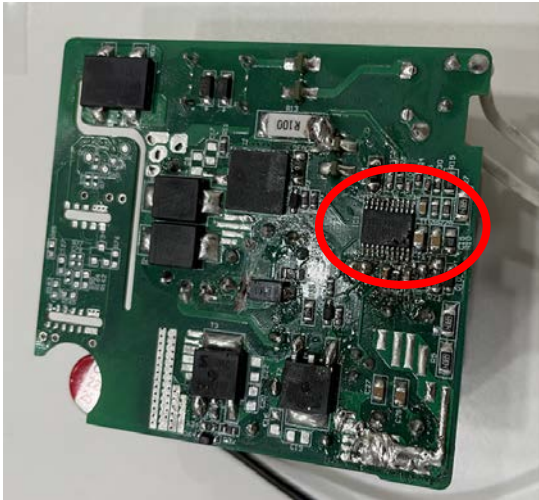
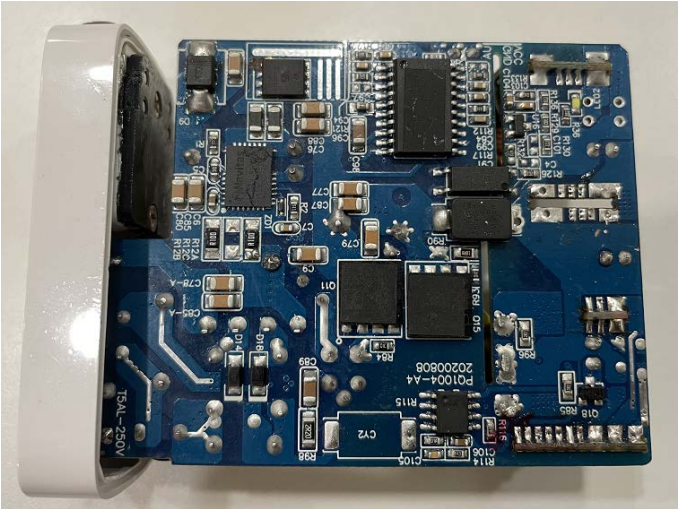
USB-C	Port 1	Port 2
1	100W	X
2	X	100W
3	60W	60W

60W/100W



HR1211+MP6925 for 120W Multi-port wall charger

(70mm*55mm*20mm)



**TSSOP-20 package
6.4mm*6.2mm**

Discussion Agenda

- USB Type-C basic review
- **USB-C Port Controller and DCDC Product Summary**
 - MP5031 PD3.0 USB PD Controller working principle
 - USB PD car charger solution product introduction
 - 100W Buck-Boost USB PD Car Charger solution
- **ACDC Product Summary for USB-C PD wall charger**
 - Secondary Sync Rec Drivers and Ideal Diodes
 - All-in-One Flyback Solution for up to 65W PD wall charger
 - Digital PFC / LLC Combo for more than 100W PD wall charger
- **Bi-directional buck-boost Charger for USB-C**
 - 45W PD Power Bank solution
- Other USB-C PD power application solutions

MP2651: 1-4 cell 6A bi-directional buck-boost Charger for PD

Features

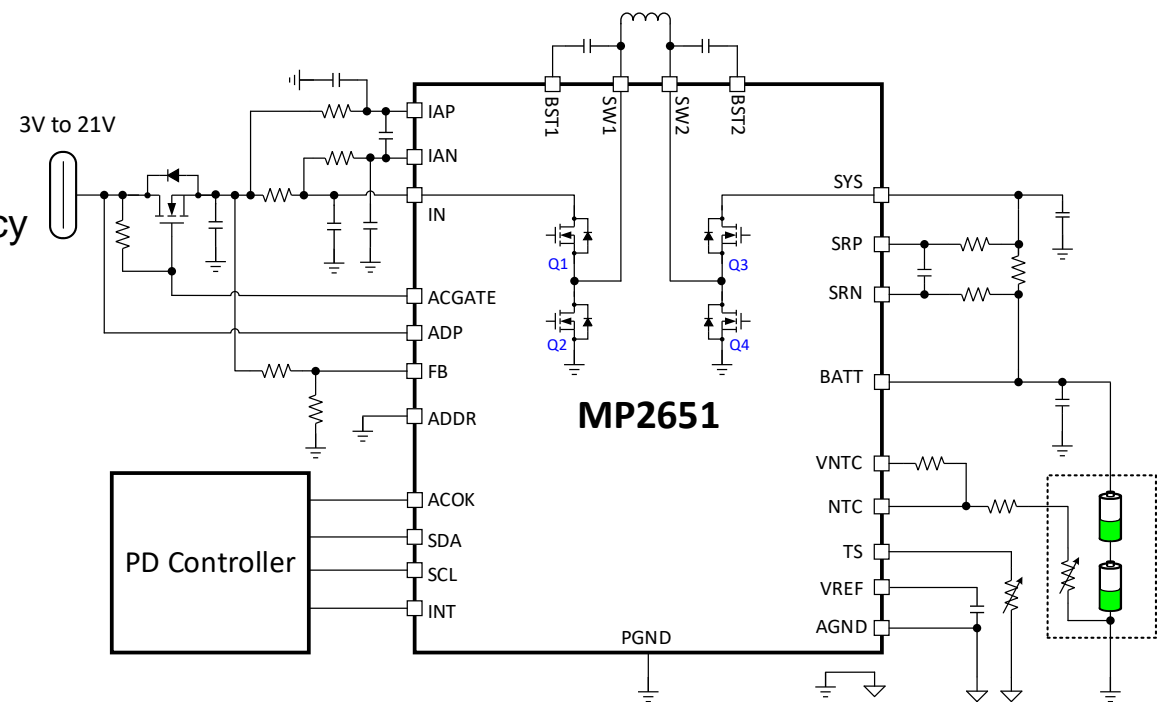
- Up to 26V Absolute Max Input Voltage (OVP)
- 3.6V to 20V Operating Input Voltage
- USB PD 3.0 PPS Compatible
- 1-4 Cell support with up to 6A charge current in 2s mode
- I2C programmable charging/discharging parameters including:
 - Input current limit from 100mA to 5A
 - Minimum input voltage from 4V to 13.8V for Solar MPPT
 - Output current limit from 500mA to 5A with 50mA step
 - Output voltage from 3V to 20V with 20mV step
 - Charge current from 500mA to 6.4A
 - Battery full voltage from 2.56V to 14.5V with +/- 0.5% accuracy
 - Die junction temp regulation from 80C to 120C
- 10-bit ADC for I_{IN} , V_{IN} , I_{BAT} , V_{BAT} , V_{SYS} , T_{NTC}
- Custom JEITA Battery NTC Monitoring Thresholds
- 4x5 FCQFN-28 Package

Applications

- Bluetooth Speakers
- Power Bank

Key Benefits

- 45W Buck-Boost Charging Solution Compliant with USB PD 3.0
- Fully Integrated Power FETs with bi-directional Power from 5V to 20V
- Integrated cell balancing for 2 cell applications

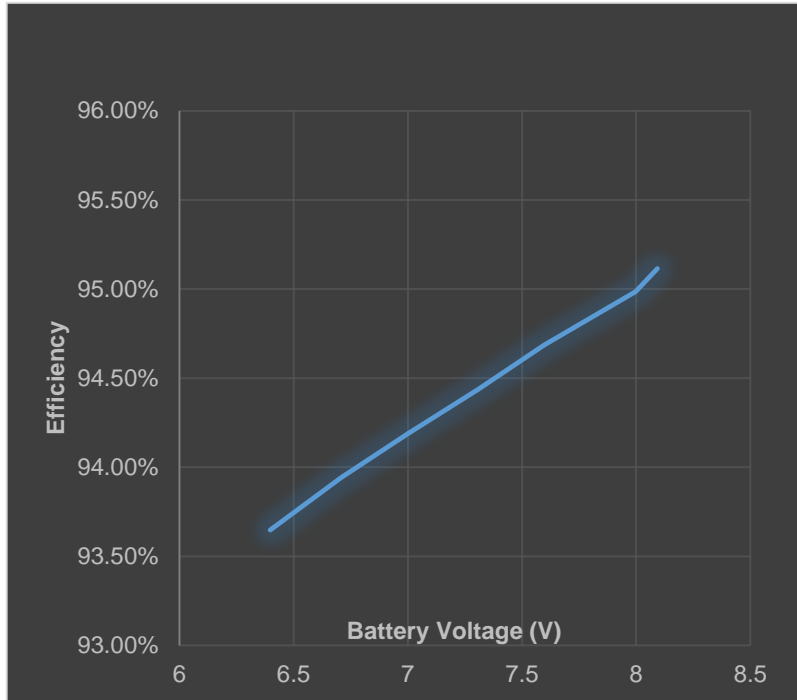


QFN-28 (4mmx5mm) Package

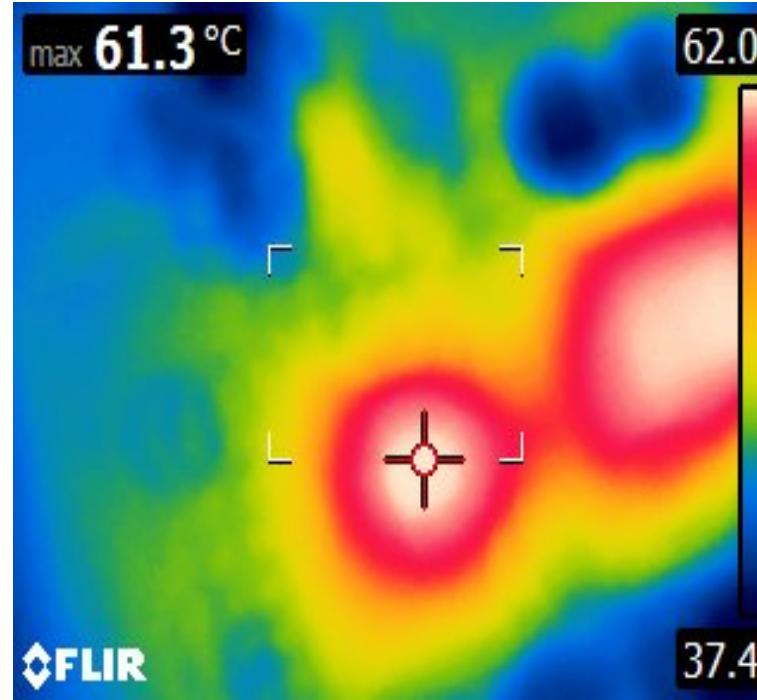


MP2651:2Cell 45W Bidirectional Buck-boost charger for PD

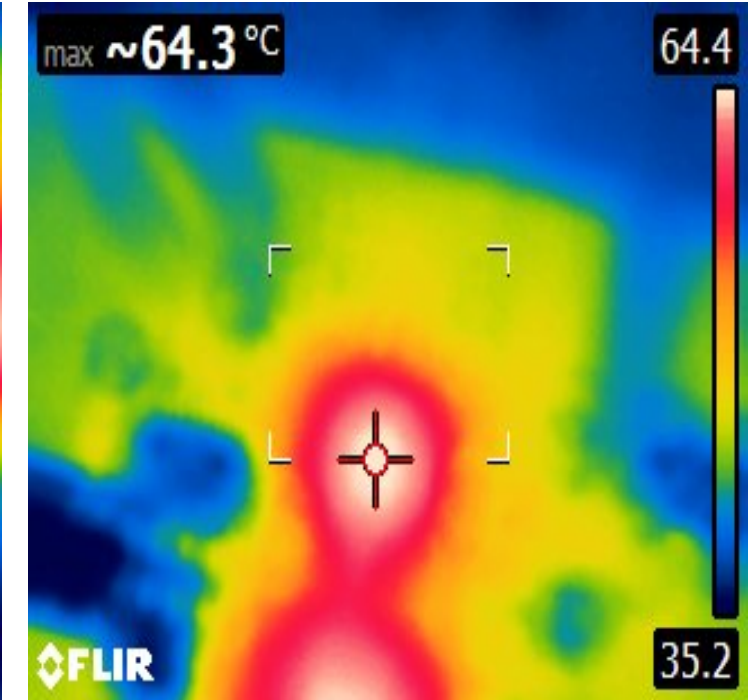
Charge efficiency $V_{in}=15V, 2s$ battery



Charge, $V_{IN}=15V, V_{BATT}=8V, I_{CHG}=5A$

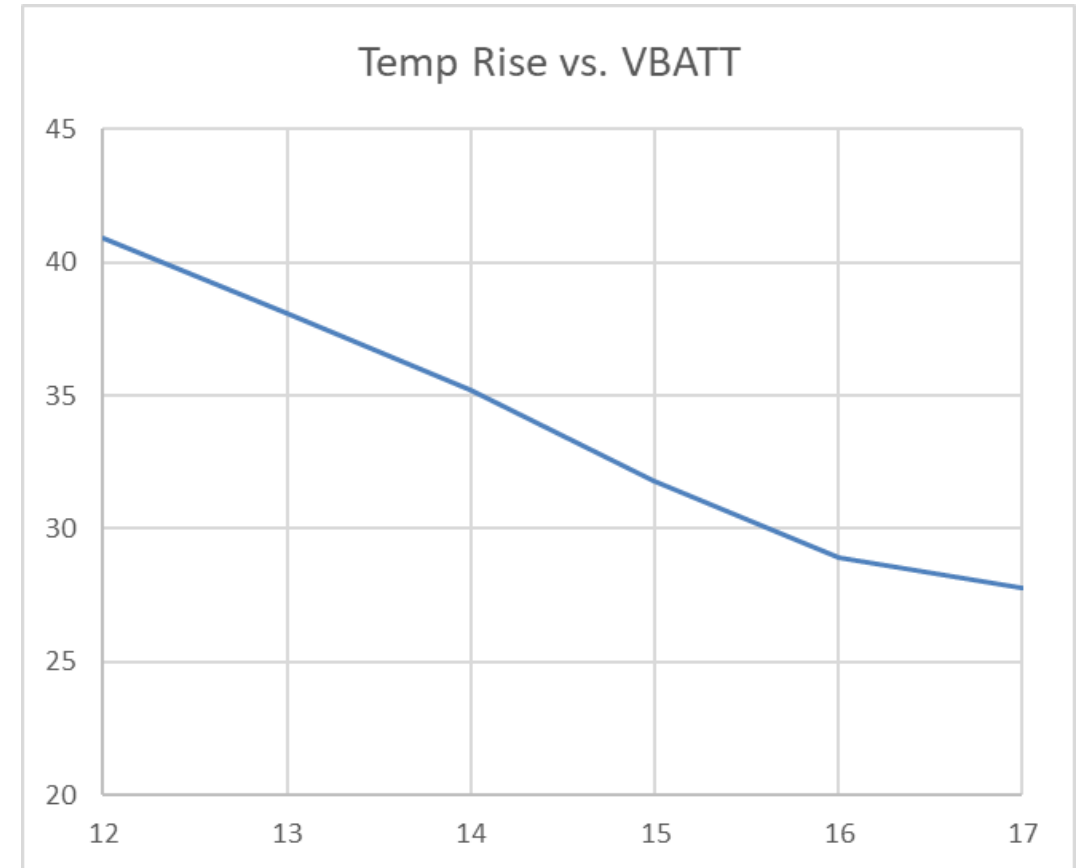
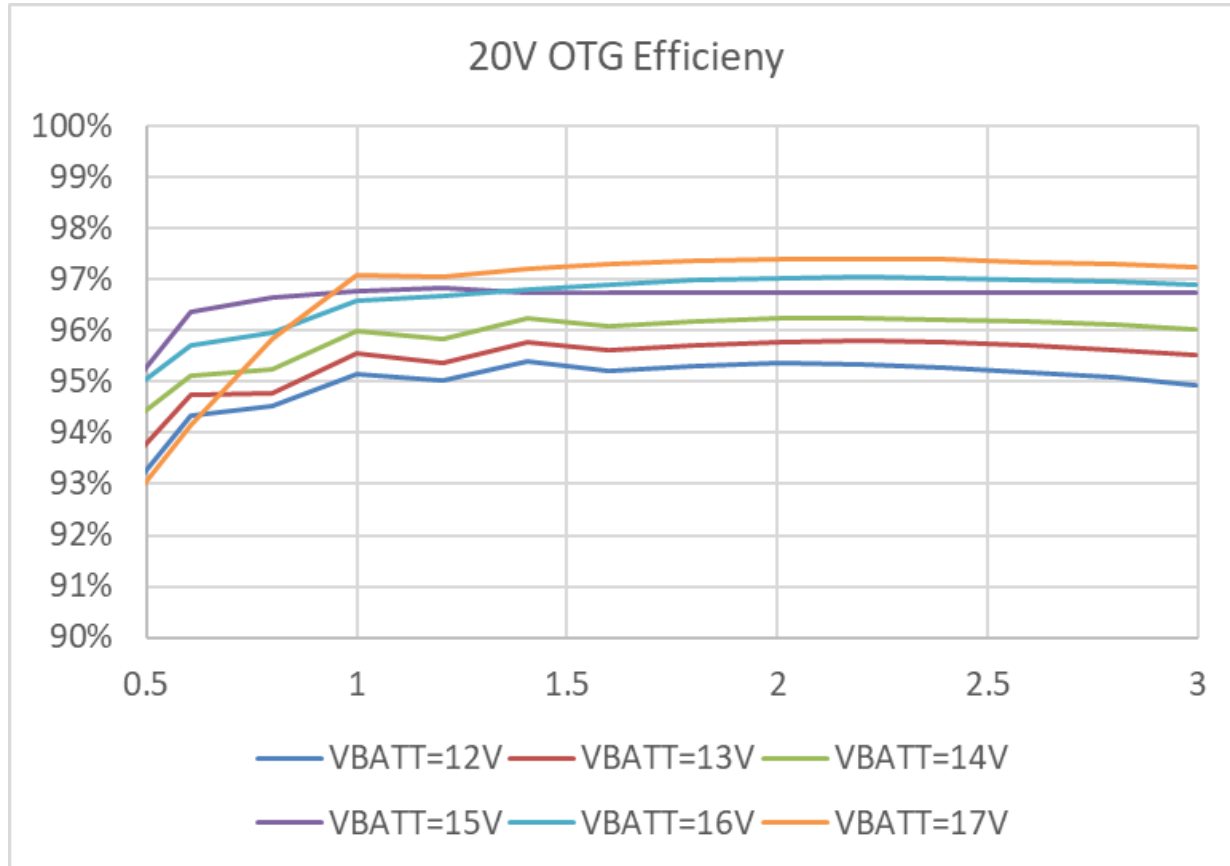


OTG, $V_{BATT}=8V, V_{OUT}=15V, I_{LOAD}=3A$

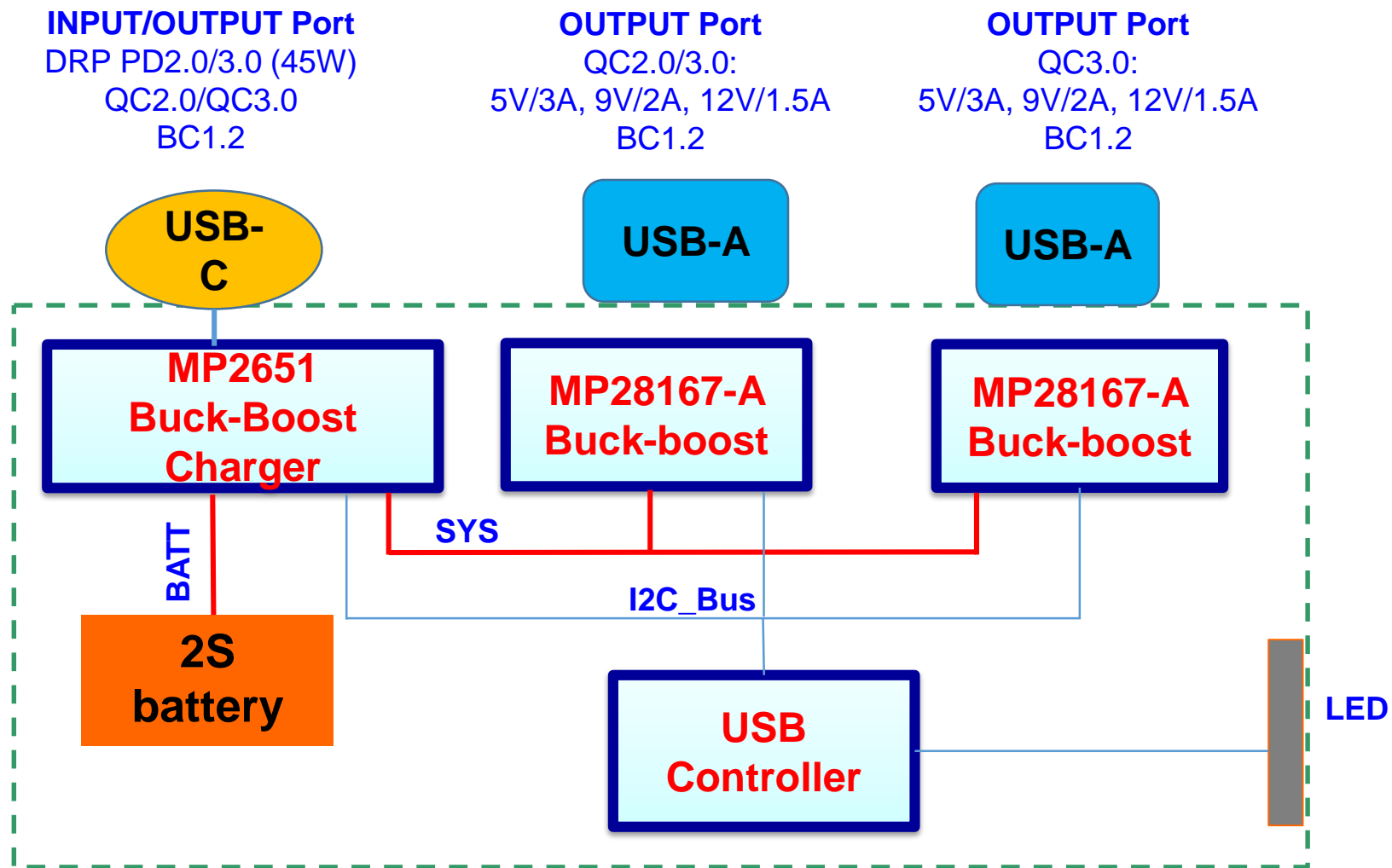


MP2651:3Cell 60W Bidirectional Buck-boost charger for PD

Test Setup: 4 layers, 1oz/layer, 89mmX89mm, RS1=10mOhms, RS2=10mOhms L=1.5uF/8.6mOhm, Fsw=600kHz.
Room temp is 25C.



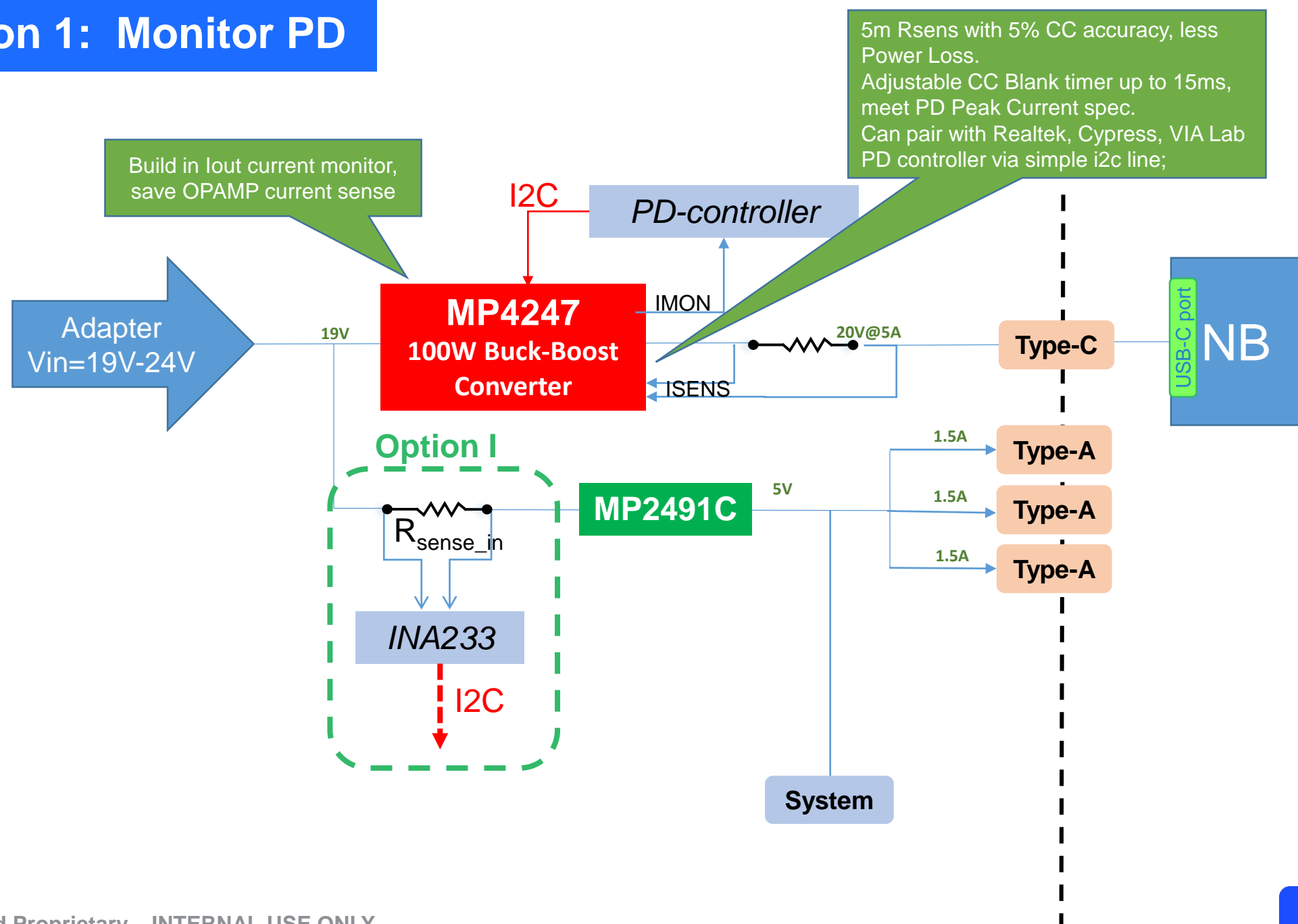
MP2651+MP28167-A for 45W USB-C PD Power bank



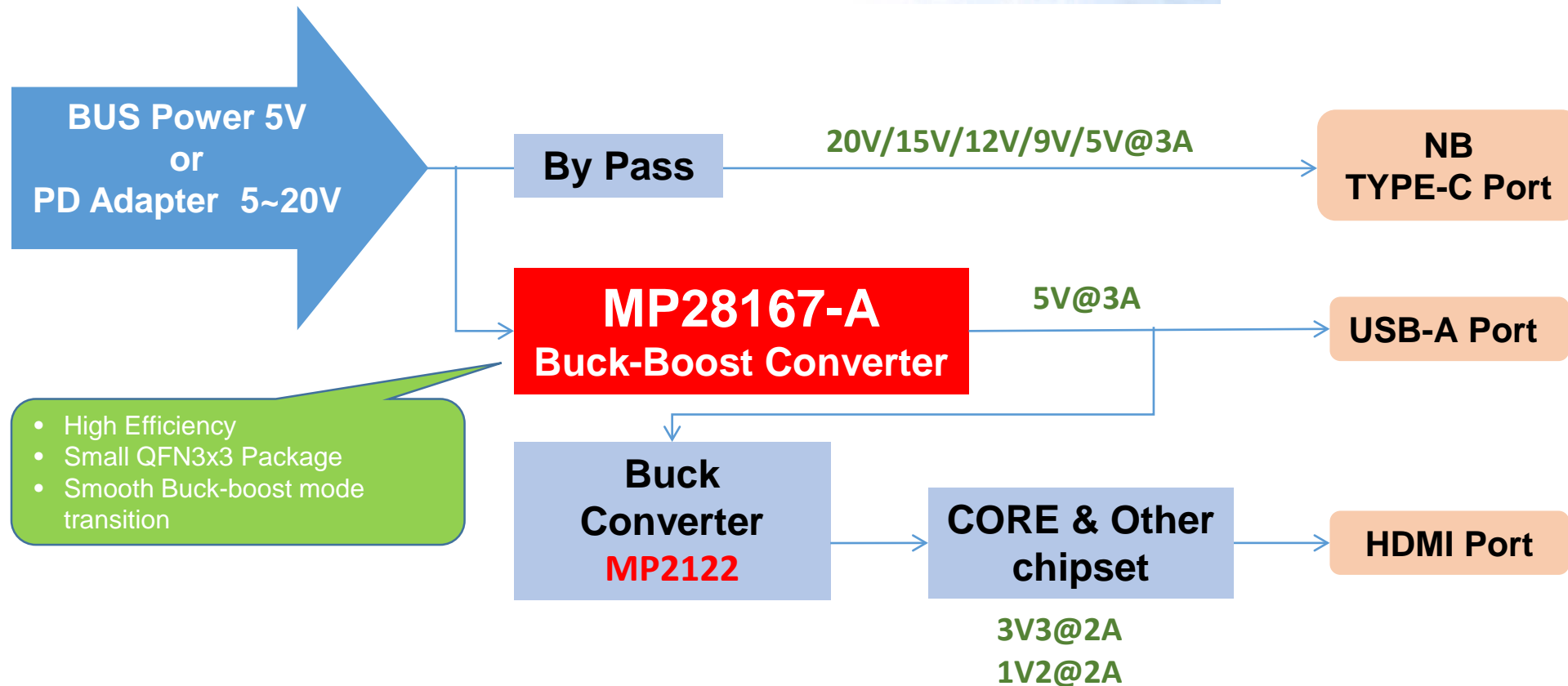
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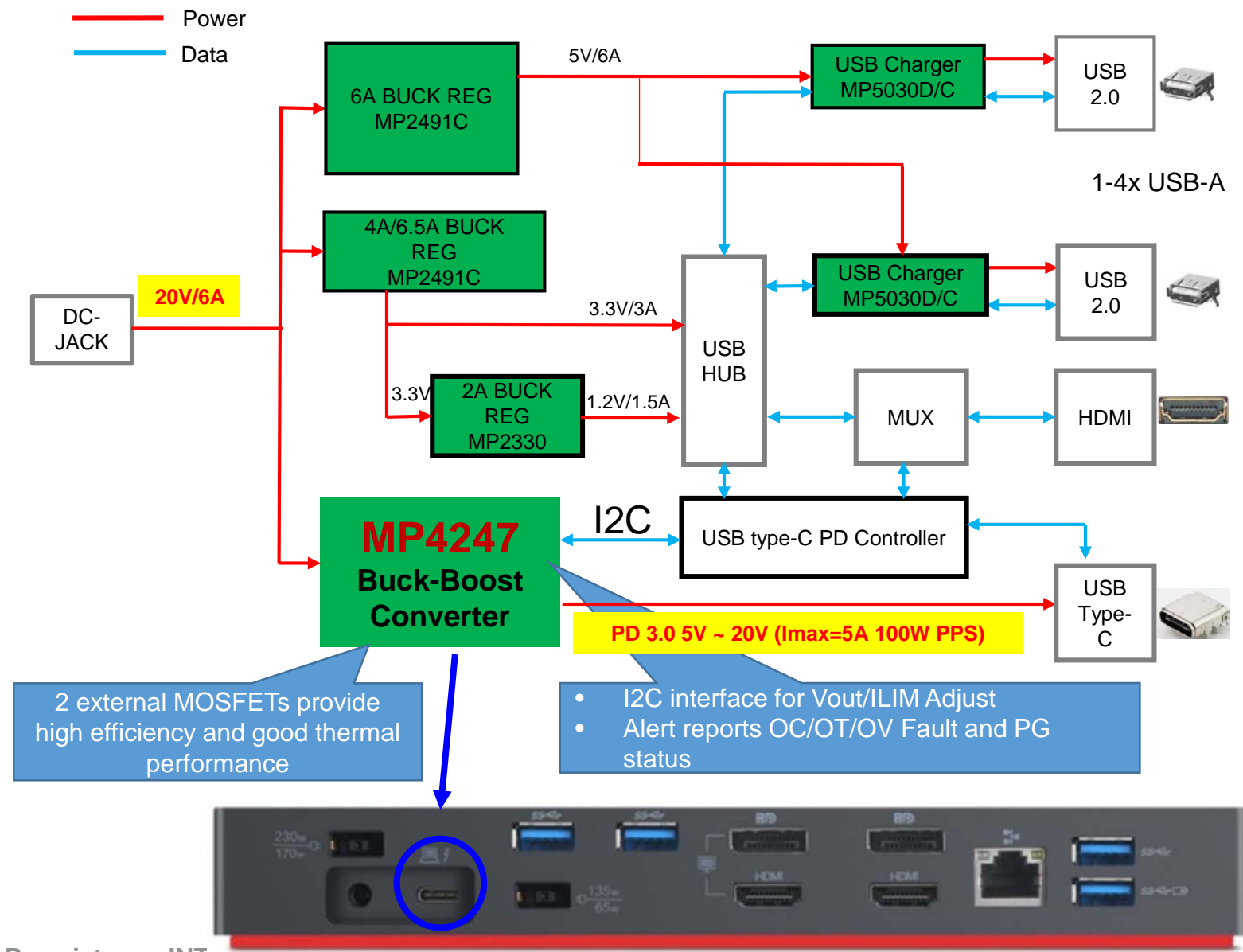
Application 1: Monitor PD



Application 2: Dongle Adapter



Application 3: Docking Station Power Tree



Summary

- MPS offers a total Typec& PD power solutions including ACDC, DCDC, battery charger products.
- Easy to design, less outside components, high power density, better efficiency and thermal performance.
- With proprietary process and package technology, MPS will continue develop new product with tiny package and good performance

Thanks