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Chapter 1. Summary

1.1 General Description

The 18W PD3.0 Class A charger Evaluation Board EV1 is composed of three main parts, AP39303 offers the QR PWM controller, which combines a 700V high performance Power MOSFET, APR34709 is a secondary side switcher, which combines a N-Channel MOSFET and a driver circuit designed for synchronous rectification, and AP43771 is USB PD3.0 PPS and Qualcomm® Quick Charge™ 4/4+ Decoder for implementing quick charger decoder functions. Based on monitoring D+ & D- and CC1 & CC2 signals, AP43771 interprets desired voltage and current setting, and then feeds information back to primary side AP39303 switcher for providing well-regulated voltage and current as well as related power protections.

1.2 Key Features

1.2.1 System Key Features

- SSR Topology Implementation with an Opto-coupler for Accurate Step Voltage Controlling
- QC4+ Offers QC3.0/QC2.0 Backward Compliance
- QC4 supports the USB PD3.0 Function and PPS (3V-11V@20mV/step)
- Meet DOE6 and CoC Tier 2 Efficiency Requirements
- <30mW No-Load Standby Power

1.2.2 AP39303 Key Features

- Quasi-Resonant Operation
- Peak current mode control
- High-Voltage Startup
- Soft Start
- Built-in 120V High Voltage VCC LDO to Guarantee Wide Range Output Voltage Application (3.3V~20V, PPS)
- Built-in 700V High Performance Power MOSFET
- Low VCC Operating Current Reduces Stand-by Power
- Adaptive burst mode operation with output voltage
- Adaptive output power limit with output voltage
- Non-Audible-Noise Quasi-Resonant Control
- Frequency Fold Back for High Average Efficiency
- Secondary Winding Short Protection with FOCP
- Frequency Dithering for Reducing EMI
- VCC Maintain Mode
- Useful Pin Fault Protection:
- SENSE Pin Floating and FB/Opto-Coupler Open/Short
- Comprehensive System Protection Feature:
- Programmable External OTP / OLP / BNO / SOVP / SUVP

1.2.3 APR34709 Key Features

- Synchronous Rectification for DCM QR Operation Flyback
- Built-In a 60V N-MOSFET with low gate charge, low $R_{DS(ON)}$, fast switching speed and body diode reverse recovery performance
- Eliminate Resonant Ring Interference
- Fewest External Components used

1.2.4 AP43771 Key Features

- Supports one USB PD3.0 PPS Type-C and QC4/QC4+
- Drives N-Channel MOSFET for Load Switch
- Built-in VBUS Discharger Pin
- 3V – 21V operation voltage without external regulator
- On-chip OVP, OCP, UVP, and SCP
- Supports OTP through integrated ADC circuit
- USB PD 3.0 PPS Compliance **(TID: 1100026)**

1.3 Applications

- Offer both PD3.0+PPS +QC4/4+ Wall Chargers

1.4 Main Power Specifications (CV & CC Mode)

Parameter	Value
Input Voltage	90Vac to 264Vac
Input standby power	< 30mW
Main Output Vo / Io	5V/3A, 9V/2A,
Per Step Voltage	Continuous Mode 200mV, 3.6V-12V
	PPS 20mV step voltage, 3V-11V
Efficiency	Comply with CoC version 5 tier-2
Total Output Power	18W
Protections	OCP, OVP, UVP, OLP, OTP
Dimension	34 x 48 x 16mm

1.5 Evaluation Board Picture

EVB Top View

EVB Bottom View

Chapter 2. Power Supply Specification

2.1 Specification and Test Results

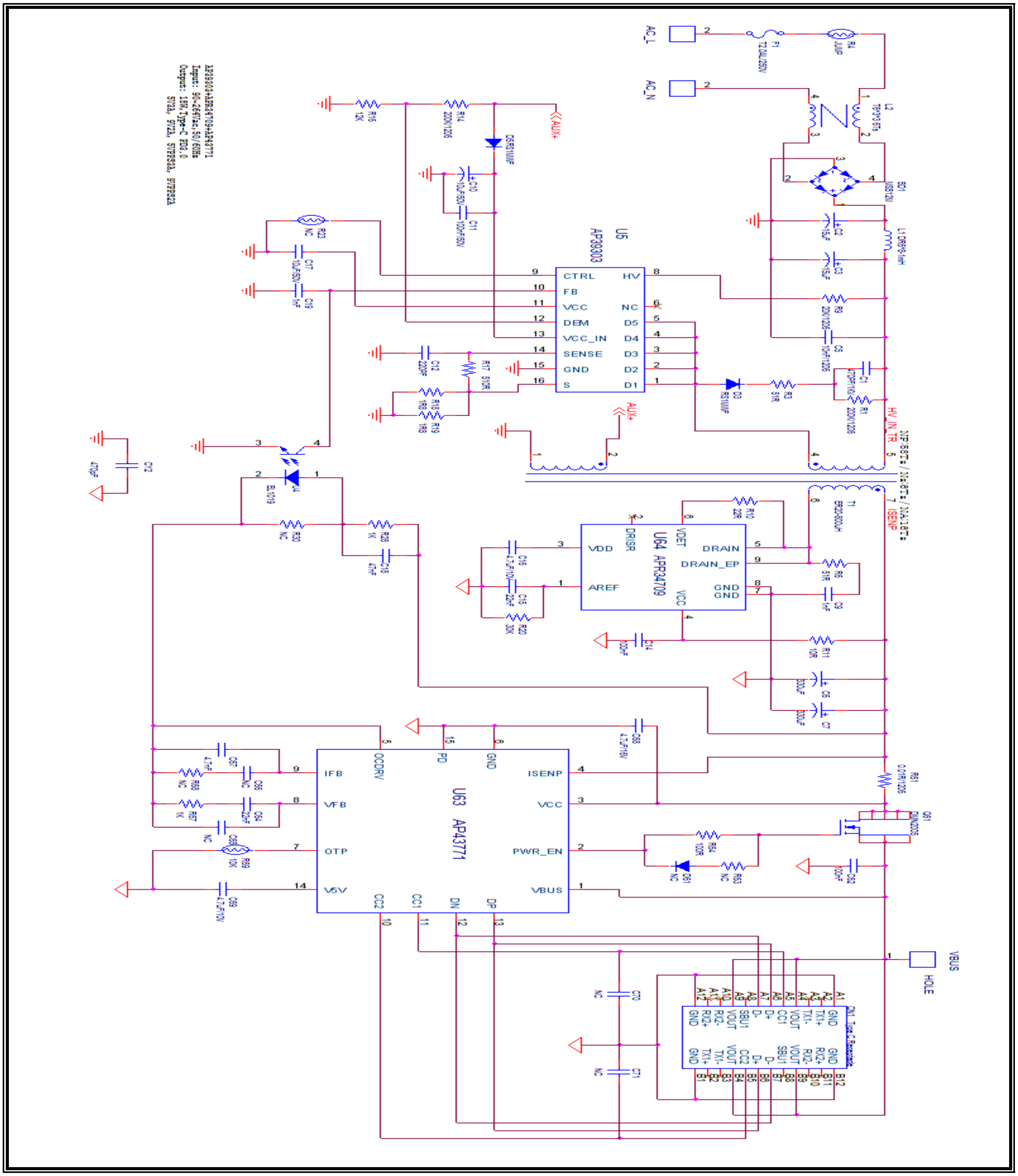
Parameter	Value	Test Summary
Input Voltage	$90V_{AC}$ to $264V_{AC}$	
Input Voltage Frequency	47Hz to 64Hz	
Input Current	$<0.8A_{AC(RMS)}$	
Standby Power	<30mW; no-load	**PASS,** 24.5mW@230VAC/50Hz
5V Average Efficiency	DoE VI Eff >81.39%	**PASS,** 88.21% @115VAC/60Hz, 88.20% @230VAC/50Hz
	Tier2 Eff>81.84%	
5V/0.3A Efficiency (10% Load)	Tier2 Eff>72.48%	**PASS,** 86.3% @115VAC/60Hz, 82.7% @230VAC/50Hz
9V Average Efficiency	DoE VI Eff >85%	**PASS,** 90.23% @115VAC/60Hz, 89.68% @ 230VAC/50Hz
	Tier2 Eff>85.45%	
9V/0.2A Efficiency (10% Load)	Tier2 Eff>75.45%	**PASS,** 86.2% @115VAC/60Hz, 83.8% @230VAC /50Hz
5V Cross Load Regulation	5.0V+/- 2%/0-3A	**PASS,** (MAX: 5.028V, MIN: 5.008V)
9V Cross Load Regulation	9.0V+/- 2%/0-2A	**PASS,** (MAX:9.095V, MIN: 9.082V)
5VPPS	3.3V – 5.9V / 0-3A+/-150mA	
9VPPS	3.3V – 11V / 0-2A+/-150mA	
Conducted EMI	>6dB Margin; according to FCC / EN55032 Class B	
Radiated EMI	>6dB Margin; according to FCC / EN55032 Class B	

2.2 Compliance

Parameter	Value	Summary
Output Connector	USB Type C	
Temperature	<100^{o}C at 90Vac Input and 9V/2A output	
Stress	<95%	
Dimensions W/D/H	34 x 48 x 16 (mm)	

Chapter 3. Schematic

3.1 Schematic



3.2 Bill of Material

Item	Quantity	Designator	Description	Manufactory
1	**1**	**U5**	**AP39303 (HSOP-16)**	**Diodes**
2	**1**	**U63**	**AP43771 (U-DFN3030-14)**	**Diodes**
3	**1**	**U64**	**APR34709 (SO-8EP)**	**Diodes**
4	**1**	**BD1**	**MSB12M-13 (MSB)**	**Diodes**
5	**2**	**D3,D5**	**RS1MWF (SOD123F)**	**Diodes**
6	**1**	**Q61**	**DMN2005UFG (POWERDI3333-8)**	**Diodes**
7	1	U4	LTV1009TP-G	Liteon
8	1	C1	470PF/1KV/X5R/1206	
9	1	C5	10nF/1KV/X5R/1206	
10	1	C9	1nF/1KV/X5R/1206	
11	1	C17	10uF/50V/X5R/1206	
12	3	C11,C14,C62	100nF/50V/X7R/0603	
13	1	C12	220PF/50V/X7R/0603	
14	2	C15,C64	22nF/50V/X7R/0603	
15	2	C16,C69	4.7uF/16V/X5R/0603	
16	1	C68	4.7uF/16V/X5R/0805	
17	1	C19	1nF/50V/X7R/0603	
18	1	C67	4.7nF/50V/X7R/0603	
19	1	C18	47nF/50V/X7R/0603	
20	1	R61	0.01R//1%/1206 (Low TCR)	
21	2	R18,R19	1R6/1%/1206	
22	1	R6	51R/1%/1206	
23	1	R9	20K/1%/1206	
24	2	R1,R14	200K/1%/1206	
25	1	R3	51R/1%/0805	
26	2	R10,R11	10R/1%/0603	
27	1	R16	12K/1%/0603	
28	1	R64	100R/1%/0603	
29	1	R17	510R/1%/0603	
30	2	R28,R67	1K/1%/0603	
31	1	R20	30K/1%/0603	
32	1	R69	10K/1%/0603 (NTC)	
33	2	C2,C3	15uF/400V/10*12.5 (E-CAP)	
34	2	C6,C7	470uF/16V/6.3*11 (Polymer CAP)	
35	1	C10	10uF/50V/5*11 (E-CAP)	
36	1	CY2	470pF/Y1-CAP	
37	1	CN1	Type C Receptacle	
38	1	F1	T2.0AL/250V	
39	1	T1	ER20-800uH	
40	1	L1	DR6*8-1mH	
41	1	L2	CM Choke, T6*3*3 6Ts	
42	1	R4	JUMP (0.6Φ)	

Note:

- Not connected location (NC): R30,R63,C65,C66,R68,R69,C70,C71 / 0603; D61 / SOD323; R23 / 0805
- Current sense resistor (R61) should use the Low TCR type resistor (Reference Type: SMF12M1FR010T "http://www.sartfuse.com").

3.3 Schematics Description

3.3.1 Fuse, EMI Filter and Rectifier

The Fuse F1 protects against over-current conditions which occur when some main components failed. The L2 is a common mode choke for the common mode noise suppression. The BD1 is a rectifier witch converts alternating current and voltage into direct current and voltage. The C2, L1, C3 are composed of the Pi filter for filtering the differential switching noise back to AC source.

3.3.2 AP39303 QUASI-RESONANT PWM SWITCHER

AP39303 is a highly integrated power switcher with a built-in Quasi-Resonant (QR) PWM controller and a 700V high performance Power MOSFET. AP39303 has built-in high-voltage start-up function and provides an excellent green power solution. The AP39303 integrates a 120V VCC LDO circuitry and allows a wide voltage range of VCC_IN. This makes to be a good choice in wide output voltage range application such as PD and QC.

3.3.3 APR34709 SYNCHRONOUS RECTIFICATION SWITCHER

APR34709 is a secondary side Combo IC, which combines an N-Channel MOSFET and a driver circuit designed for synchronous rectification (SR). The internal N-MOSFET is optimized for low gate change, low $R_{DS(ON)}$, fast switching speed and body diode reverse recovery performance. The synchronous rectification can effectively reduce the secondary side rectifier power dissipation and provide high performance solution. By sensing primary MOSFET drain-to-source voltage, APR34709 can output ideal drive signal with less external components.

3.3.4 AP43771 QC4/4+ and PD3.0 Decoder

The following pins provide critical protocol decoding and regulation functions in AP43771:

1) **CC1 & CC2 (Pin 10, 11)**: CC1 & CC2 (Configuration Channel 1 & 2) are defined by USB PD spec to provide the channel communication link between power source and sink devices.
2) **D+ & D- (Pin 12, 13):** While defined under USB PD for data transfer only, D+ and D- are used in QC4+ to provide voltage information and backward compatibility with QC2.0 and QC3.0 devices.
3) **Constant Voltage (CV)**: The CV is implemented by sensing VCC (pin 3) via built-in resistor divider and compared with internal reference voltage. The output voltages can be adjusted by firmware programming.
4) **Constant Current (CC)**: The CC is implemented by sensing the current sense resistor (R61, 10mΩ) and compared with internal programmable reference voltage. The output current can be adjusted by firmware programming.
5) **Loop Compensation:** C64, R67 & C65 form the voltage loop compensation circuit, and C66, R68 & C67 form the current loop compensation circuit.
6) **OCDRV (Pin 5):** It is the key interface link from secondary decoder (AP43771) to primary regulation circuit (AP39303). It is connected to Opto-coupler U4 Pin 2 cath for feedback information based on all sensed CC1 & CC2, D+ & D- voltage status for getting desired Vbus voltage & current.
7) **PWR_EN (Pin 2) to N-MOSFET Gate**: The pin is used to turn on and off Vbus load switch (Q61) to enable and disable voltage output to the Vbus respectively.

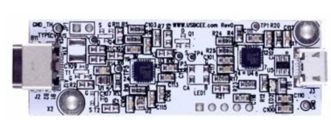
Chapter 4. Evaluation Board Connections

4.1 Quick Start Guide Before Connection

1) Before starting the 18W EVB test, the end user needs to prepare the following tool, software and manuals.

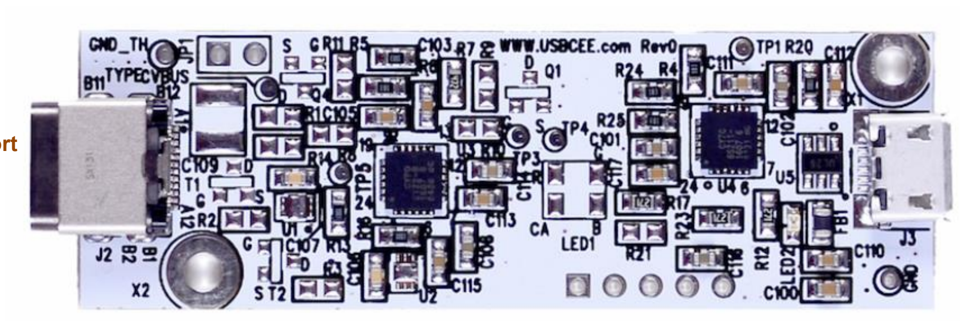
   For details, please contact Canyon Semiconductor local sales for further information.

   - USBCEE PD3.0 Test Kit: USBCEE Power Adapter Tester. https://www.usbcee.com/product-details/4

USBCEE PAT Tester	GUI Display	USB-A to Micro-B Cable	Type-C Cable
			

2) Prepare a certified three-foot Type-C cable and a Standard-A to Micro-B Cable.
3) Connect the input AC L & N wires to AC power supply output "L and N "wires.
4) Ensure that the AC source is switched OFF or disconnected before the connection steps.
5) Use a type-C cable for the connection between EV2 board to Cypress's Type-C receptacles.
6) Use 2 banana jack cables, one port of the cables is connected to E-load + & - terminals while the other port of the cables is connected to 18W QC4 unit's VBUS & GND holes.
7) A Standard-A to Micro-B cable to be connected to the Cypress test kit's Micro-B receptacle & PC Standard-A receptacle respectively.

Type-C Input port to Test Kit



Mini USB port to computer

The Test Kit Input & Output and E-load Connections

4.2 Connection with E-Load

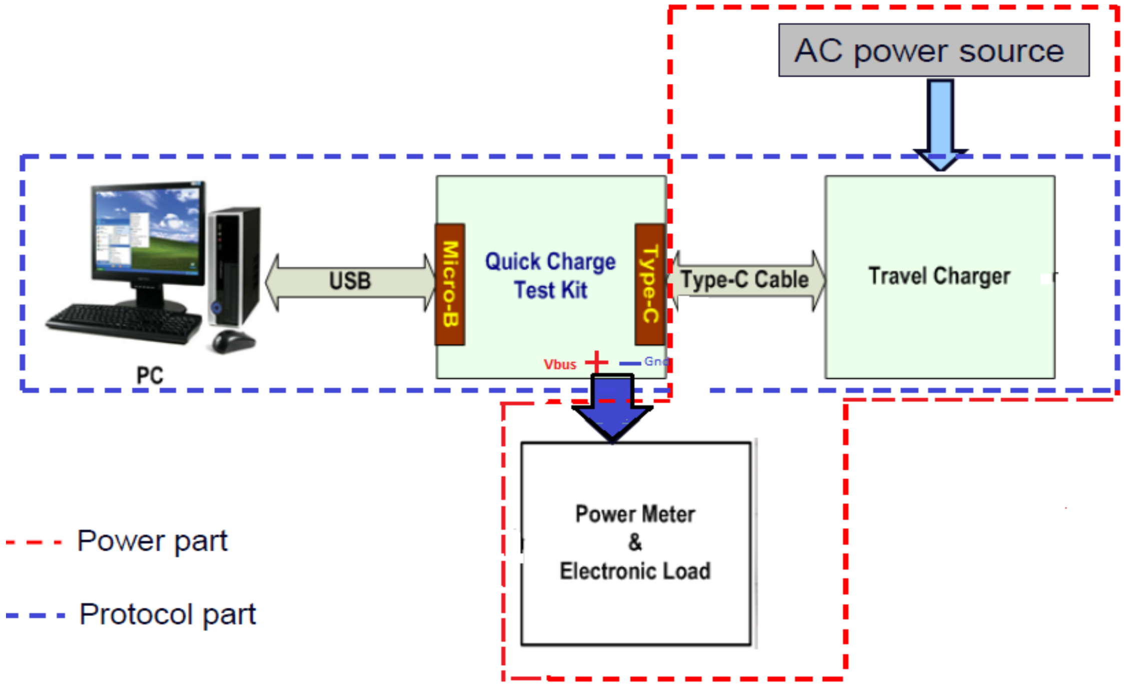
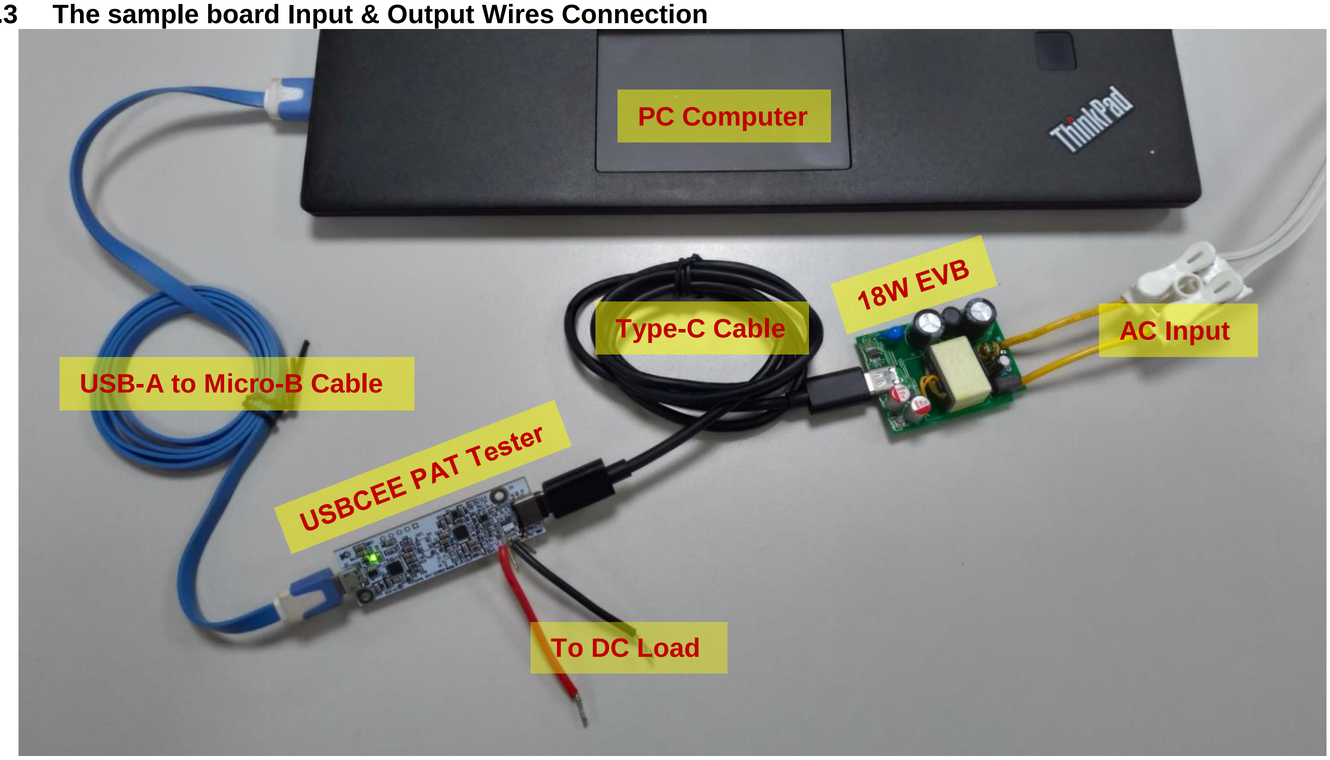


Diagram of Connections in the Sample Board

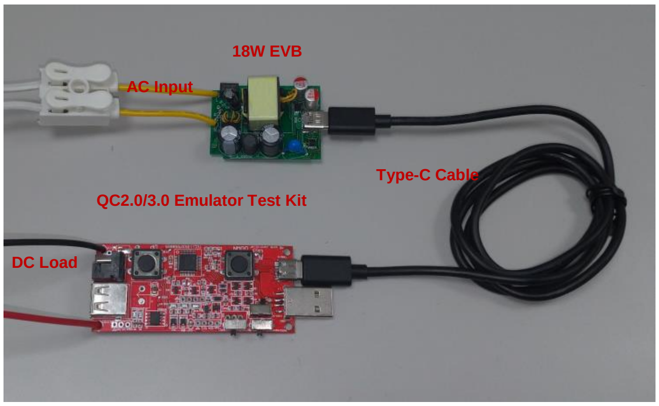
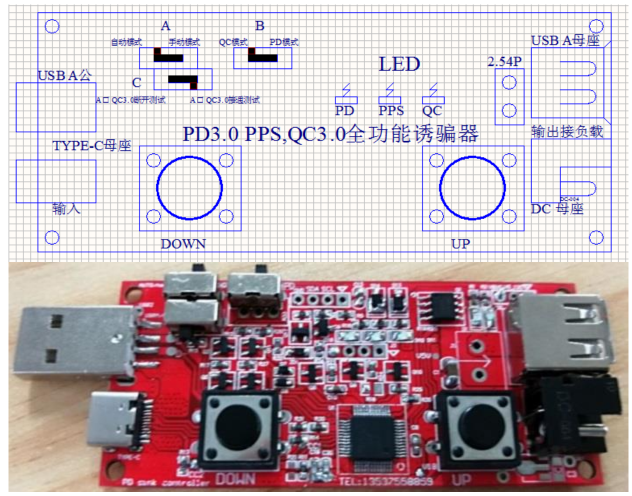
4.3 The sample board Input & Output Wires Connection



Wire Connection of 18W PD3.0 EVB to Test Kit and PC Computer

4.4 QC2.0/3.0 Emulator connection

Or using the QC2.0/QC3.0 emulator test Kit to testing the QC2.0 & QC3.0 functions, see the connection the between testing sample board to DC load by mean of a USB-C to USB A converting cable.

	
Wire Connection of EVB to QC2.0/3.0 Test Kit	**QC2.0/3.0 Emulator Test Kit**

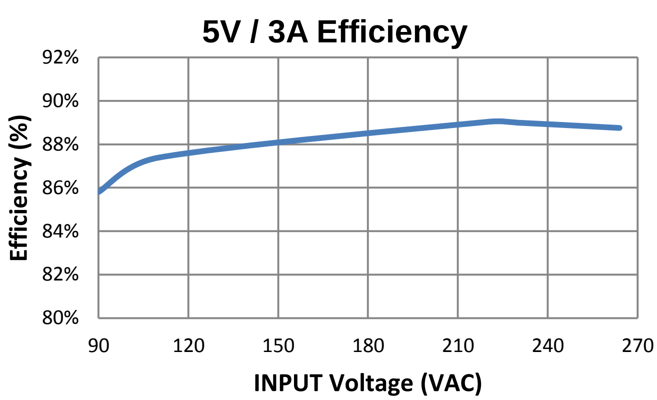
Chapter 5. Input & Output Characteristics

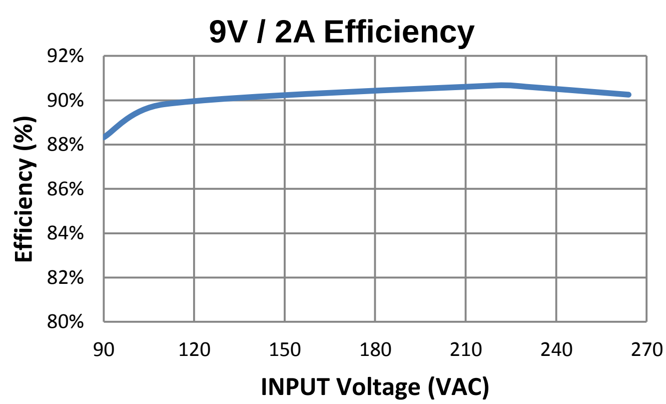
5.1 Input Standby Power

VIN(VAC)	FIN(Hz)	VOUT(V)	Pin(mW)
90	47	5.03	22.67
115	60	5.03	25.15
230	50	5.03	24.72
264	63	5.03	26.81

5.2 Power Efficiency at Different AC Line Input Voltage

VIN	VOUT	IOUT	PIN	EFF	VIN	VOUT	IOUT	PIN	EFF
90VAC/60Hz	4.99V	3.01A	17.5W	85.8%	90VAC/60Hz	9.00V	2.00A	20.4W	88.3%
110VAC/60Hz	4.99V	3.01A	17.2W	87.4%	110VAC/60Hz	9.00V	2.00A	20.0W	89.8%
220VAC/50Hz	4.99V	3.01A	16.9W	89.0%	220VAC/50Hz	9.01V	2.00A	19.9W	90.7%
230VAC/50Hz	4.99V	3.01A	16.9W	89.0%	230VAC/50Hz	9.01V	2.00A	19.9W	90.6%
264VAC/50Hz	4.99V	3.01A	16.9W	88.8%	264VAC/50Hz	9.01V	2.00A	20.0W	90.3%





5.3 Average Efficiency at Different Loading

5.3.1 Average Efficiency (5V / 3A)

VIN(VAC)	FIN(Hz)	IOUT(A)	VOUT(V)	PIN(W)	POUT(W)	Efficiency	Average Efficiency	CoC Tier 2 required
115	**60**	3.00	5.01	17.17	15.03	87.5%	**88.82%**	**81.84%**
		2.25	5.02	12.69	11.29	89.0%		
		1.50	5.02	8.41	7.53	89.6%		
		0.75	5.03	4.23	3.77	89.1%		
230	**50**	3.00	5.01	16.99	15.04	88.5%	**88.24%**	
		2.25	5.02	12.81	11.30	88.2%		
		1.50	5.02	8.49	7.53	88.7%		
		0.75	5.03	4.31	3.77	87.5%		

5.3.2 Average Efficiency (9V / 2A)

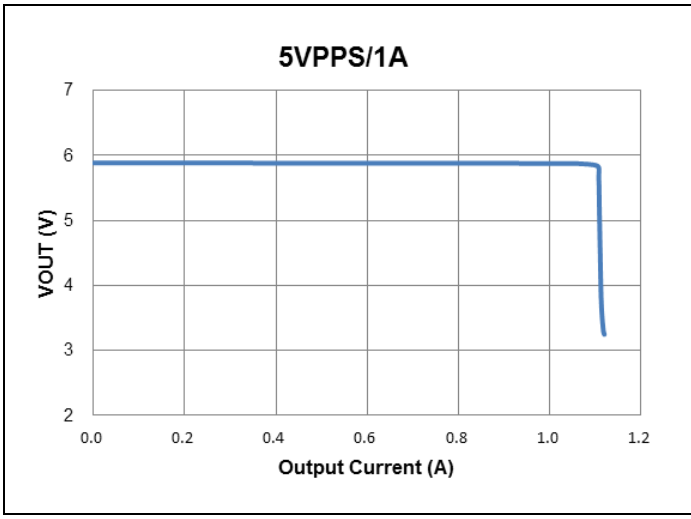
VIN(VAC)	FIN(Hz)	IOUT(A)	VOUT(V)	PIN(W)	POUT(W)	Efficiency	Average Efficiency	CoC Tier 2 required
115	60	2.00	9.08	20.10	18.17	90.4%	90.23%	85.45%
		1.50	9.09	15.04	13.63	90.6%		
		1.00	9.09	10.06	9.10	90.4%		
		0.50	9.09	5.09	4.55	89.4%		
230	50	2.00	9.08	20.06	18.17	90.6%	89.68%	
		1.50	9.09	15.09	13.63	90.3%		
		1.00	9.09	10.14	9.10	89.8%		
		0.50	9.09	5.17	4.55	88.0%		

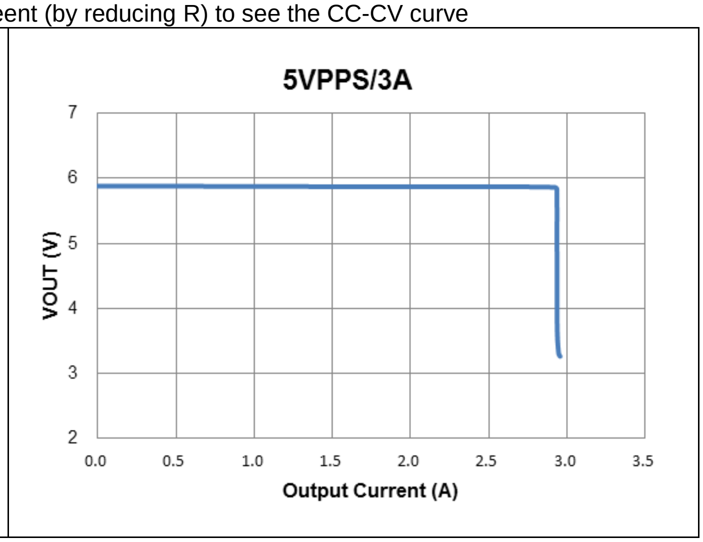
5.4 QC4/4+ & PPS Compatible Mode Testing

5.4.1 CC Mode current limitation function testing

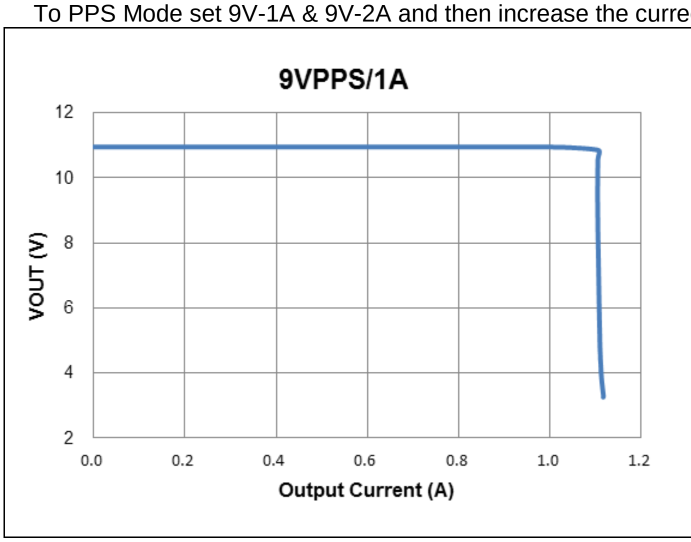
By using E-Load set at CR mode

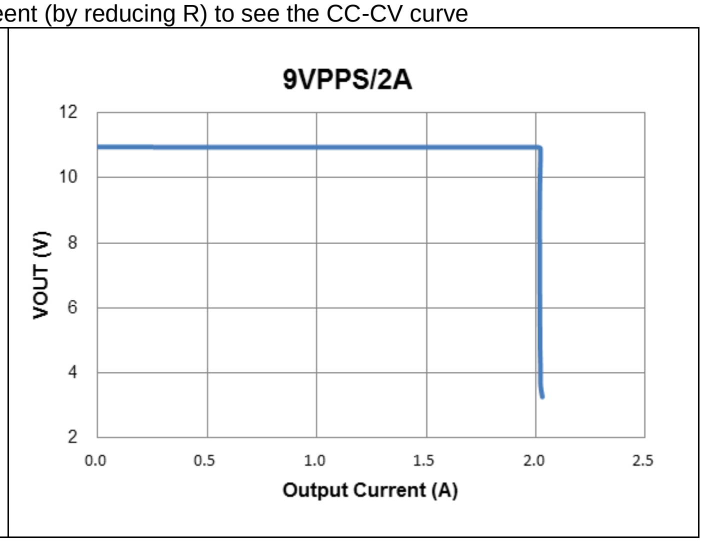
To PPS Mode set 5V-1A & 5V-3A and then increase the curreent (by reducing R) to see the CC-CV curve





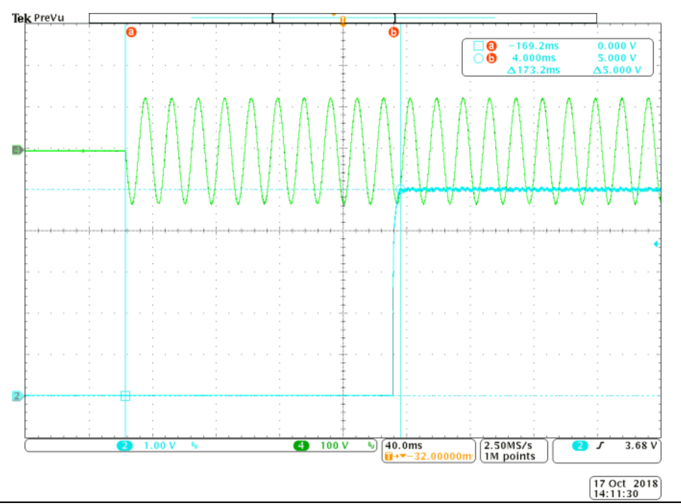
To PPS Mode set 9V-1A & 9V-2A and then increase the curreent (by reducing R) to see the CC-CV curve





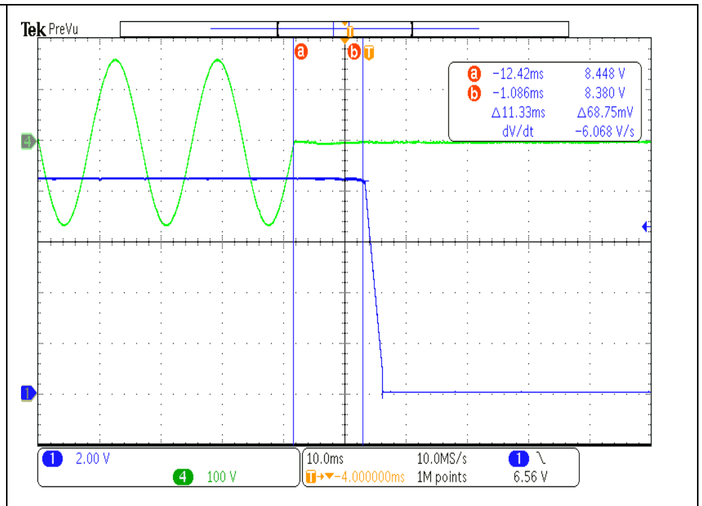
5.5 Key Performance Waveforms

5.5.1 EVB System Start-up Time & Hold-up Time



Start-up Time= 173.2ms

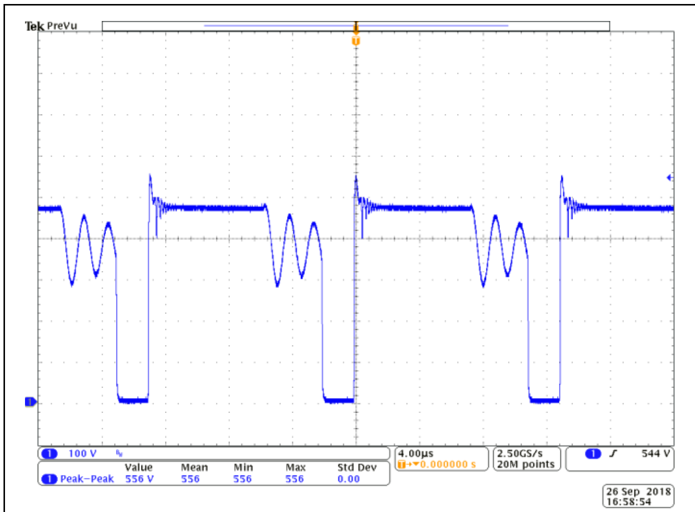
at 5V/3A @ 90Vac



Hold-up Time= 11.33ms

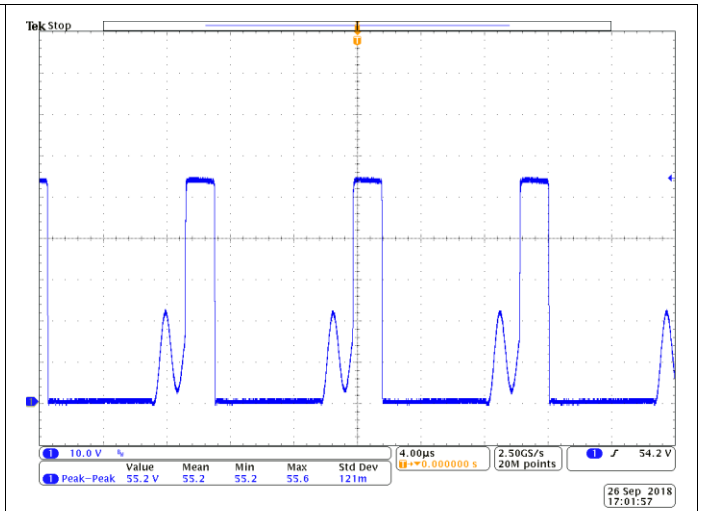
at 9V/2A @ 115Vac

5.5.2 Q1 & U64 Main Switching MOSFET VDS Stress



Q1 VDS(max)= 556Vp-p

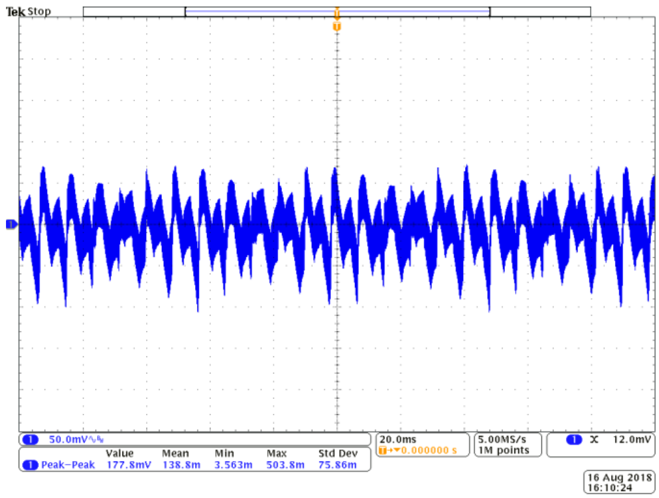
at 9V/ 2A Loading @264Vac



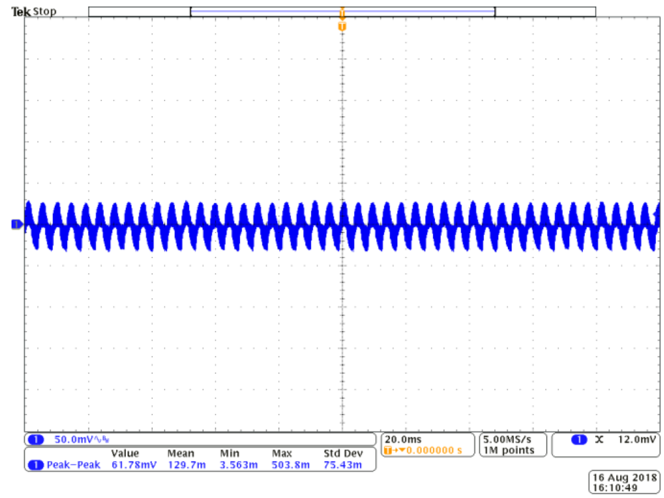
U64 VDS(max) = 55.2Vp-p

at 9V/ 2A Loading @264Vac

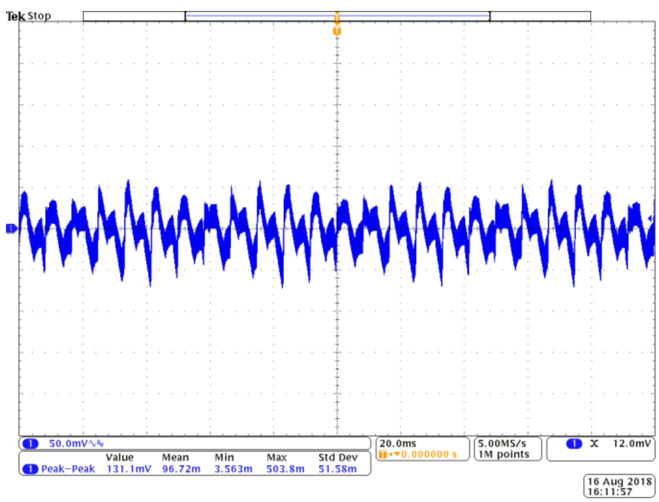
5.5.3 System Output Ripple & Noise @1.2m Cable End



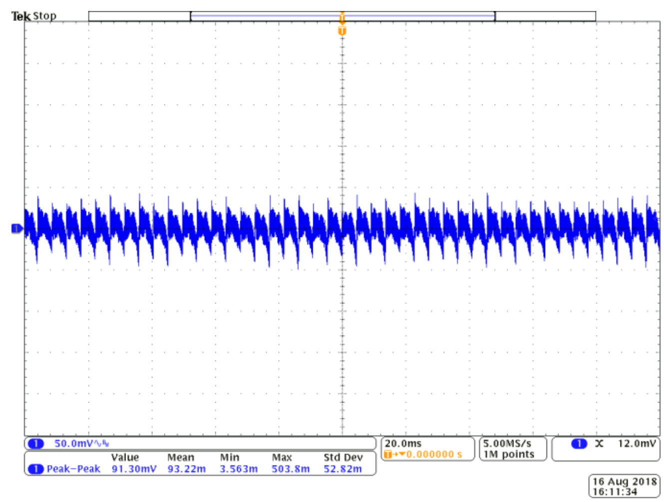
90Vac/60Hz 5V/3A ΔV=177.8mV



264Vac/50Hz 5V/3A ΔV=61.78mv

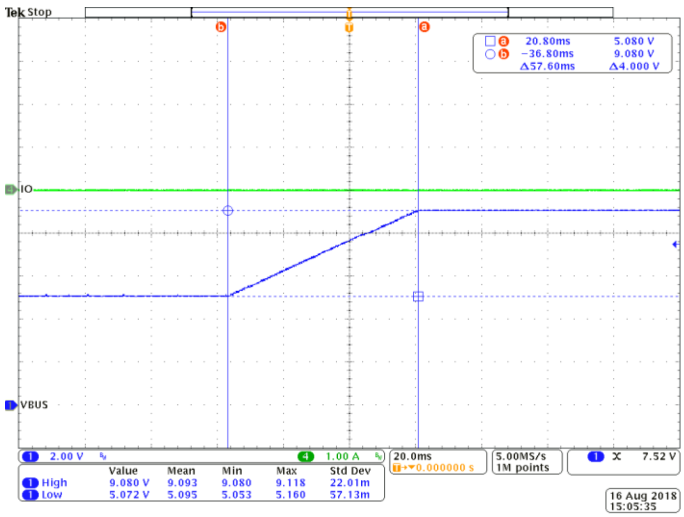


90Vac/60Hz 9V/2A ΔV=131.1mV

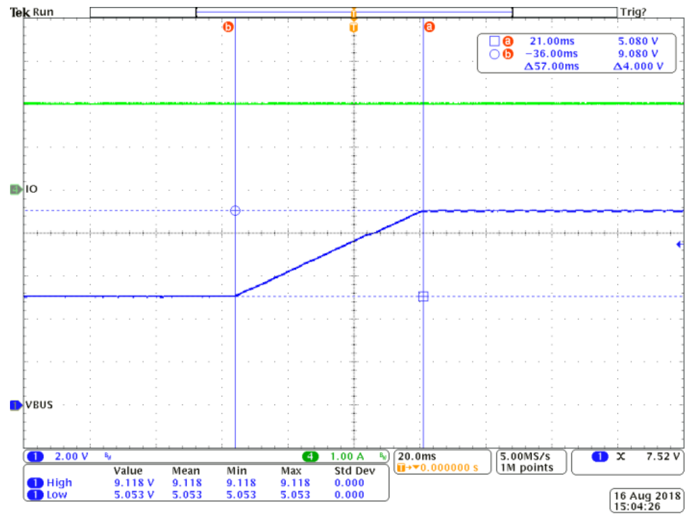


264Vac/50Hz 9V/2A ΔV=91.3mv

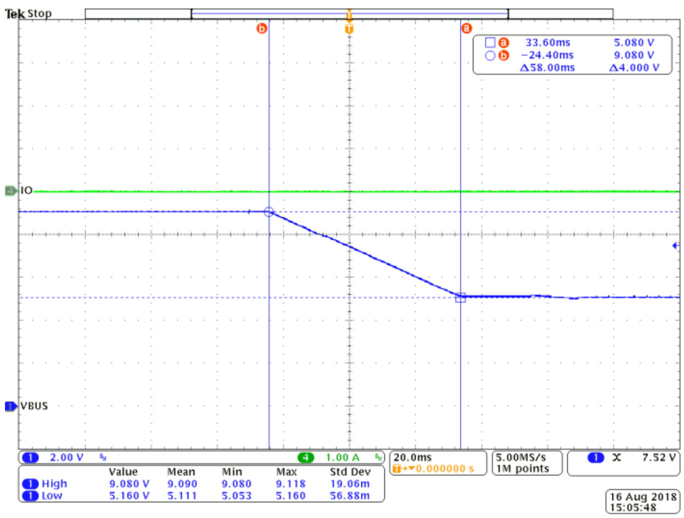
5.5.4 Output Voltage Transition Time



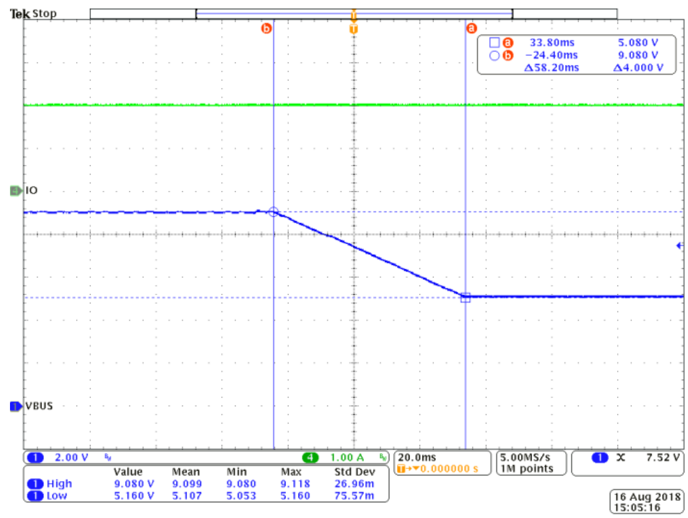
5V -to- 9V Transition Time: 57.6 @ 0A loading



5V -to- 9V Transition time 57.0 @ 2.0A loading



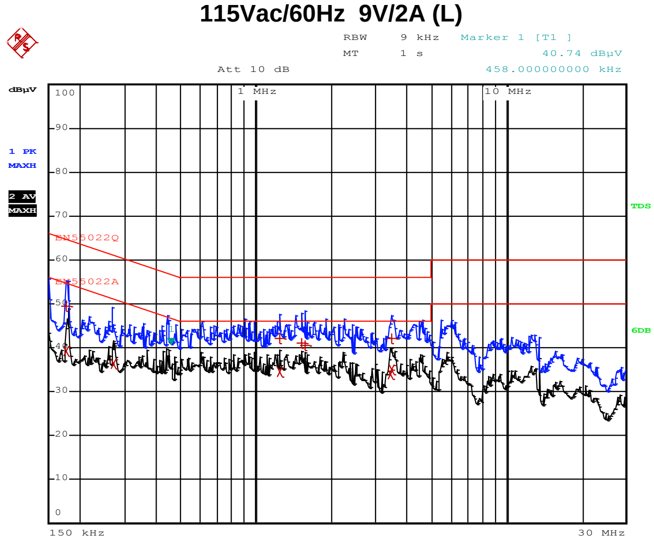
9V -to- 5V Transition Time: 58.0 @ 0A Loading



9V -to- 5V Transition Time: 58.2 @ 2.0A loading

5.5.5 EMI (Conduction) Testing

115Vac/60Hz 9V/2A (L)

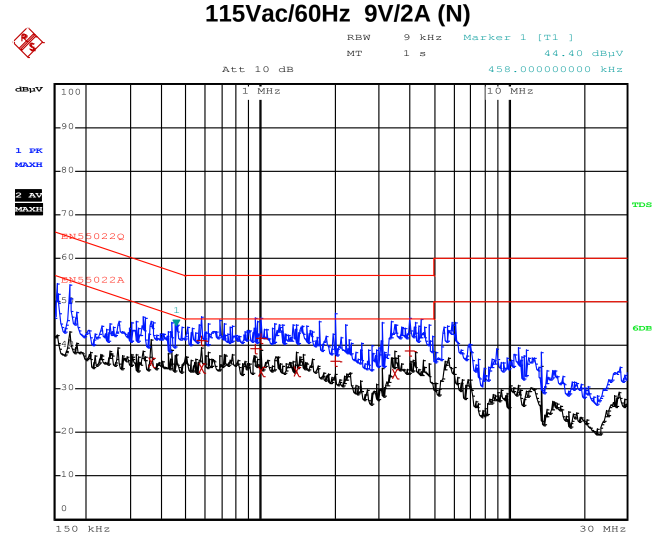


EDIT PEAK LIST (Final Measurement Results)

Trace1: EN55022Q
Trace2: EN55022A
Trace3: ---

TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	178 kHz	49.42	-15.15
2	Average	178 kHz	39.36	-15.21
2	Average	270 kHz	36.36	-14.75
1	Quasi Peak	1.242 MHz	42.24	-13.75
2	Average	1.242 MHz	34.42	-11.57
1	Quasi Peak	1.526 MHz	41.19	-14.80
1	Quasi Peak	1.574 MHz	40.52	-15.47
2	Average	3.438 MHz	34.07	-11.92
1	Quasi Peak	3.482 MHz	42.05	-13.95
2	Average	3.482 MHz	35.02	-10.97

115Vac/60Hz 9V/2A (N)

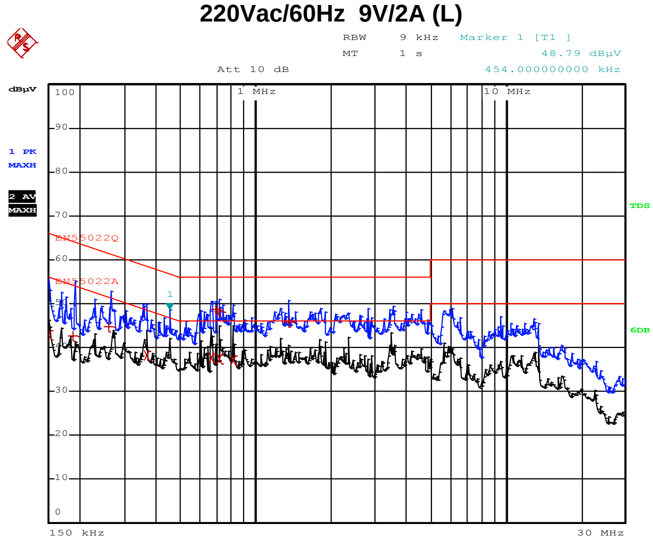


EDIT PEAK LIST (Final Measurement Results)

Trace1: EN55022Q
Trace2: EN55022A
Trace3: ---

TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2	Average	362 kHz	35.99	-12.69
1	Quasi Peak	578 kHz	41.00	-14.99
2	Average	578 kHz	34.73	-11.26
1	Quasi Peak	950 kHz	39.18	-16.81
1	Quasi Peak	1.002 MHz	41.55	-14.44
2	Average	1.002 MHz	34.08	-11.91
2	Average	1.406 MHz	33.92	-12.08
1	Quasi Peak	2.002 MHz	36.40	-19.59
2	Average	3.498 MHz	33.41	-12.58
1	Quasi Peak	4.022 MHz	38.65	-17.34

220Vac/60Hz 9V/2A (L)

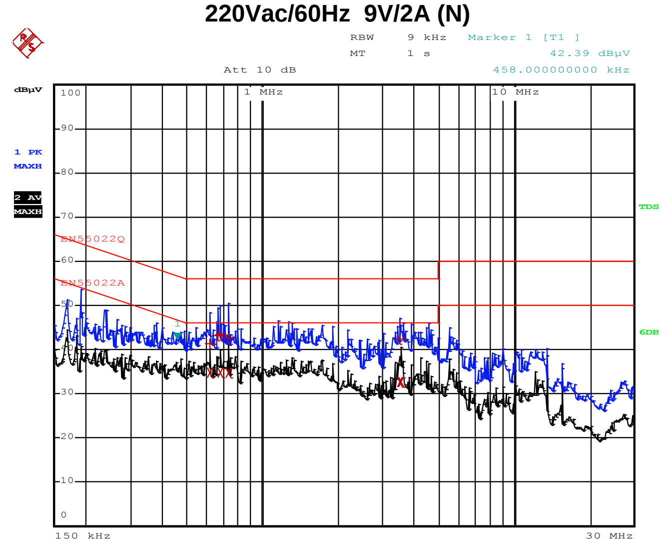


EDIT PEAK LIST (Final Measurement Results)

Trace1: EN55022Q
Trace2: EN55022A
Trace3: ---

TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2	Average	150 kHz	42.95	-13.04
1	Quasi Peak	190 kHz	42.74	-21.29
1	Quasi Peak	262 kHz	44.83	-16.53
2	Average	366 kHz	38.15	-10.43
2	Average	666 kHz	37.57	-8.42
1	Quasi Peak	690 kHz	48.81	-7.18
1	Quasi Peak	718 kHz	48.16	-7.83
2	Average	718 kHz	37.40	-8.59
2	Average	814 kHz	37.22	-8.77
1	Quasi Peak	1.35 MHz	45.68	-10.31

220Vac/60Hz 9V/2A (N)



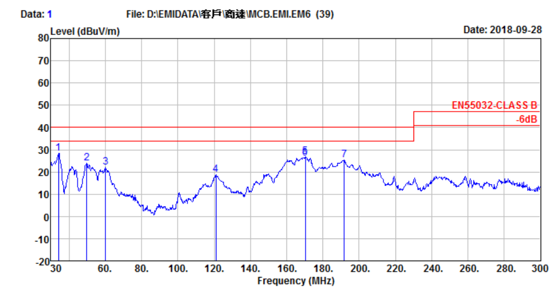
EDIT PEAK LIST (Final Measurement Results)

Trace1: EN55022Q
Trace2: EN55022A
Trace3: ---

TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	614 kHz	41.24	-14.75
2	Average	614 kHz	34.83	-11.16
1	Quasi Peak	662 kHz	43.18	-12.81
1	Quasi Peak	682 kHz	43.36	-12.63
2	Average	682 kHz	34.87	-11.12
1	Quasi Peak	730 kHz	42.74	-13.25
2	Average	730 kHz	34.90	-11.09
1	Quasi Peak	3.51 MHz	42.49	-13.50
2	Average	3.53 MHz	32.58	-13.41
2	Average	3.554 MHz	32.66	-13.33

5.5.6 EMI (Radiation) Testing

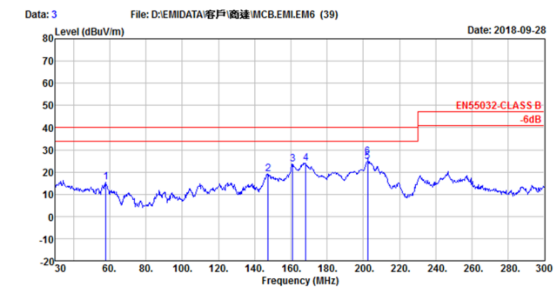
110Vac/60Hz 9V/2A (Vertical)



Site : 03CH04-HY
Condition: EN55032-CLASS B 3m ANT2724+ATTENUATOR VERTICAL
EUT : 18W PD3.0
MODEL :
POWER : 110V / 60Hz
MEMO : Sample 1
: 9V 2A

	Freq (MHz)	Limit Line (dBuV/m)	Level (dBuV/m)	Over Limit (dB)	Read Level (dBuV)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Factor (dB/m)	A/Pos (cm)	T/Pos (deg)	Remark
1 pp	34.05	40.00	28.45	-11.55	45.87	0.72	30.32	22.93	---	---	Peak
2	49.71	40.00	23.94	-16.06	45.61	0.70	30.33	15.16	---	---	Peak
3	60.24	40.00	22.01	-17.99	41.95	1.04	30.31	11.99	---	---	Peak
4	120.99	40.00	18.76	-21.24	39.11	1.22	30.13	17.68	---	---	Peak
5	170.40	40.00	26.83	-13.17	46.63	1.41	29.91	15.59	---	---	Peak
6 qp	170.40	40.00	26.01	-13.99	45.81	1.41	29.91	15.59	---	---	QP
7	191.73	40.00	25.29	-14.71	45.72	1.39	29.82	14.89	---	---	Peak

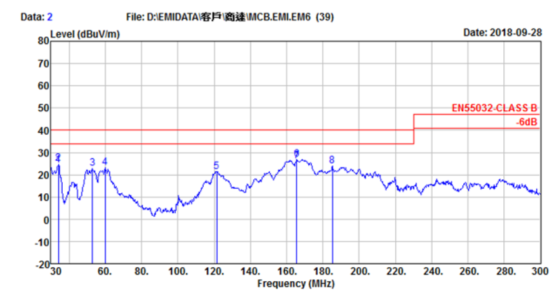
110Vac/60Hz 9V/2A (Horizontal)



Site : 03CH04-HY
Condition: EN55032-CLASS B 3m ANT2724+ATTENUATOR HORIZONTAL
EUT : 18W PD3.0
MODEL :
POWER : 110V / 60Hz
MEMO : Sample 1
: 9V 2A

	Freq (MHz)	Limit Line (dBuV/m)	Level (dBuV/m)	Over Limit (dB)	Read Level (dBuV)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Factor (dB/m)	A/Pos (cm)	T/Pos (deg)	Remark
1	57.81	40.00	15.39	-24.61	32.10	0.97	30.31	12.13	---	---	Peak
2	147.45	40.00	19.16	-20.84	34.12	1.35	30.01	17.20	---	---	Peak
3	160.95	40.00	23.54	-16.46	40.17	1.46	29.95	16.46	---	---	Peak
4	168.24	40.00	24.01	-15.99	42.53	1.42	29.92	15.72	---	---	Peak
5 pk	202.53	40.00	24.83	-15.17	39.45	1.42	29.77	15.10	---	---	Peak
6 pp	202.53	40.00	26.69	-13.31	41.31	1.42	29.77	15.10	---	---	QP

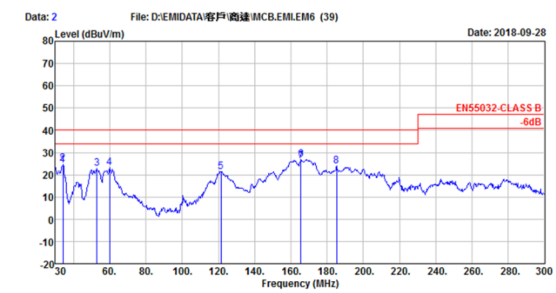
230V/50Hz 9V/2A (Vertical)



Site : 03CH04-HY
Condition: EN55032-CLASS B 3m ANT2724+ATTENUATOR VERTICAL
EUT : 18W PD3.0
MODEL :
POWER : 230V / 50Hz
MEMO : Sample 1
: 9V 2A

	Freq (MHz)	Limit Line (dBuV/m)	Level (dBuV/m)	Over Limit (dB)	Read Level (dBuV)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Factor (dB/m)	A/Pos (cm)	T/Pos (deg)	Remark
1	34.05	40.00	24.19	-15.81	41.61	0.72	30.32	22.93	---	---	Peak
2	34.05	40.00	25.00	-15.00	42.42	0.72	30.32	22.93	---	---	QP
3	52.95	40.00	22.75	-17.25	46.60	0.80	30.32	13.32	---	---	Peak
4	59.97	40.00	23.21	-16.79	43.15	1.04	30.31	11.99	---	---	Peak
5	121.53	40.00	21.51	-18.49	41.86	1.22	30.13	17.68	---	---	Peak
6 pp	165.54	40.00	26.96	-13.04	47.65	1.43	29.93	15.89	---	---	Peak
7 qp	165.54	40.00	26.27	-13.73	46.96	1.43	29.93	15.89	---	---	QP
8	185.25	40.00	23.85	-16.15	46.20	1.37	29.85	14.81	---	---	Peak

230Vac/50Hz 9V/2A (Horizontal)

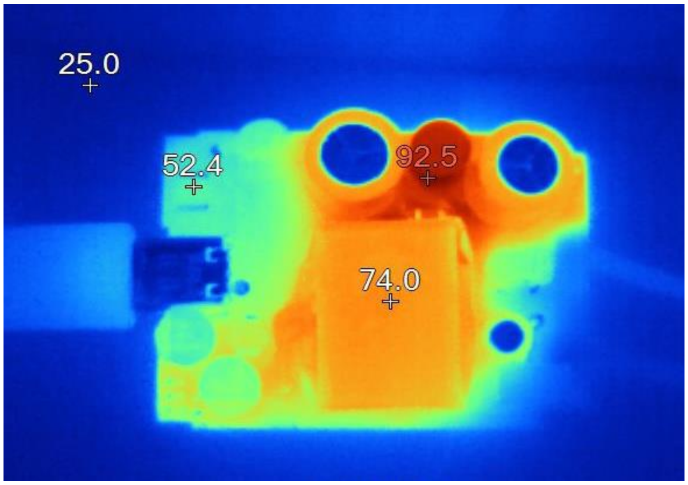


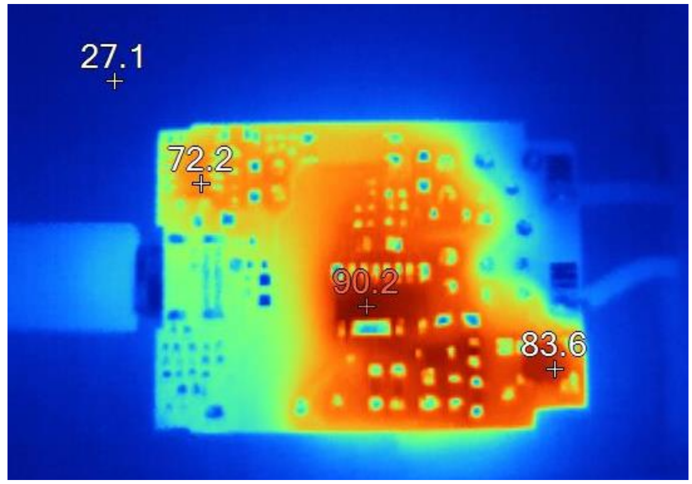
Site : 03CH04-HY
Condition: EN55032-CLASS B 3m ANT2724+ATTENUATOR VERTICAL
EUT : 18W PD3.0
MODEL :
POWER : 230V / 50Hz
MEMO : Sample 1
: 9V 2A

	Freq (MHz)	Limit Line (dBuV/m)	Level (dBuV/m)	Over Limit (dB)	Read Level (dBuV)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Factor (dB/m)	A/Pos (cm)	T/Pos (deg)	Remark
1	34.05	40.00	24.19	-15.81	41.61	0.72	30.32	22.93	---	---	Peak
2	34.05	40.00	25.00	-15.00	42.42	0.72	30.32	22.93	---	---	QP
3	52.95	40.00	22.75	-17.25	46.60	0.80	30.32	13.32	---	---	Peak
4	59.97	40.00	23.21	-16.79	43.15	1.04	30.31	11.99	---	---	Peak
5	121.53	40.00	21.51	-18.49	41.86	1.22	30.13	17.68	---	---	Peak
6 pp	165.54	40.00	26.96	-13.04	47.65	1.43	29.93	15.89	---	---	Peak
7 qp	165.54	40.00	26.27	-13.73	46.96	1.43	29.93	15.89	---	---	QP
8	185.25	40.00	23.85	-16.15	46.20	1.37	29.85	14.81	---	---	Peak

5.5.7 Thermal Testing

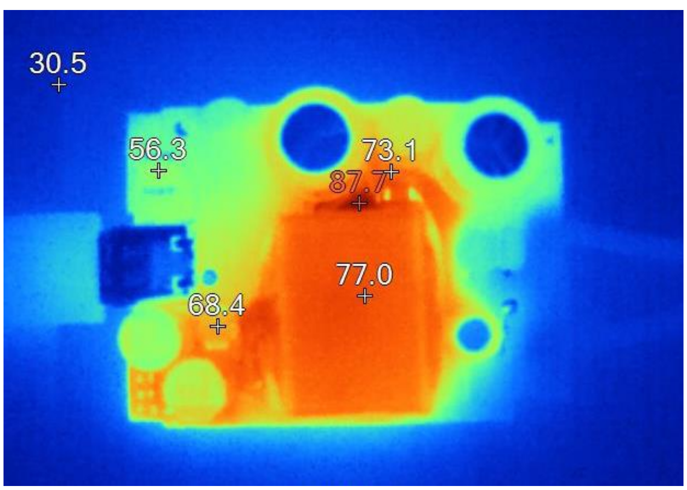
Test Condition: Vin=90VAC   Vo=9V Io=2A, Set up the EVB into the closed box at room temperature +25 °C

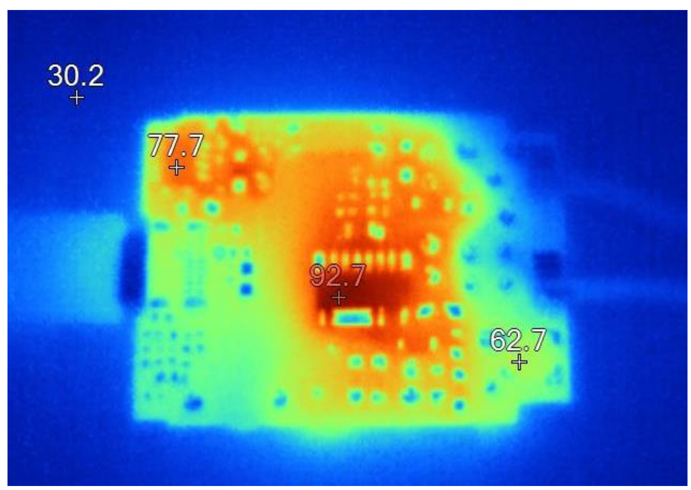
<table>
<tr><th>90VAC 18W TOP Side</th><th>90VAC 18W Bottom Side</th></tr>
<tr><td>

Ambient Temperature ---------- 25.0 °C
L1 (DR6*8) -------------------------- 92.5 °C
T1 (Transformer) ---------------- 83.6 °C
U61 (AP43771) ------------------- 52.4 °C</td>
<td>

Ambient Temperature --------- 27.1 °C
U5 (AP39303) -------------------- 90.2 °C
BD1 (MSB12M) ------------------ 83.6 °C
U64 (APR34709) ---------------- 72.2 °C</td></tr>
</table>

Test Condition: Vin=264VAC   Vo=9V Io=2A, Set up the EVB into the closed box at room temperature +25 °C

<table>
<tr><th>264VAC 18W TOP Side</th><th>264VAC 18W Bottom Side</th></tr>
<tr><td>

Ambient Temperature ---------- 30.5 °C
L1 (DR6*8) -------------------------- 73.1 °C
T1 (Transformer) ---------------- 77.0 °C
U61 (AP43771) ------------------- 56.3 °C</td>
<td>

Ambient Temperature --------- 30.2 °C
U5 (AP39303) -------------------- 92.7 °C
BD1 (MSB12M) ------------------ 62.7 °C
U64 (APR34709) ---------------- 77.7 °C</td></tr>
</table>

Chapter 6. USB IF Power Brick Certification Test detail

1). USB IF Power Brick Certification name: PD3.0 with PPS
2). Diodes Product Marketing name: PD3.0 18W Charger (with AP43771 decoder)
3). Product Model / Part Number: USB-PD3-PPS-18W-EV1 (REV:1)
4). Test TID: 1100026
5). Certification Testing & Passing date: 8-31-2018
6). USB IF Certified list link: https://www.usb.org/products

Chapter 7. Revision Control

7.1 Revision table

Revision	Items Changed & added	The changing reason
1.0	Release	

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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

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