



Engineering Test Report

Design of 5V*2A ; 9V*2A; 12V@1.5A Quick Charger with SC1223K (InnoSwitch) and CHY100D (Quick Charge 2.0 Interface IC)

Features :

- Build in Secondary Sync-Rectification. Efficiency Ratings exceeded DoE & CoC_v5.0;
- Qualcomm Quick Charge QC2.0 Compliance;
- Less than 10mW No-Load (USB disconnected or output set to 5V);
- Output CC Tracked Voltage Changes, Support Any Output CC Profile;
- Integrated-Secondary Side Regulation for Fast DLR;
- Complete System and Output Protections (SCP, OPP, OCP, OTP).

4-May-2014, Rev-1
ZL (PI-Shenzhen)

Demo Design # PI-C-USB-45 (Rev-1)

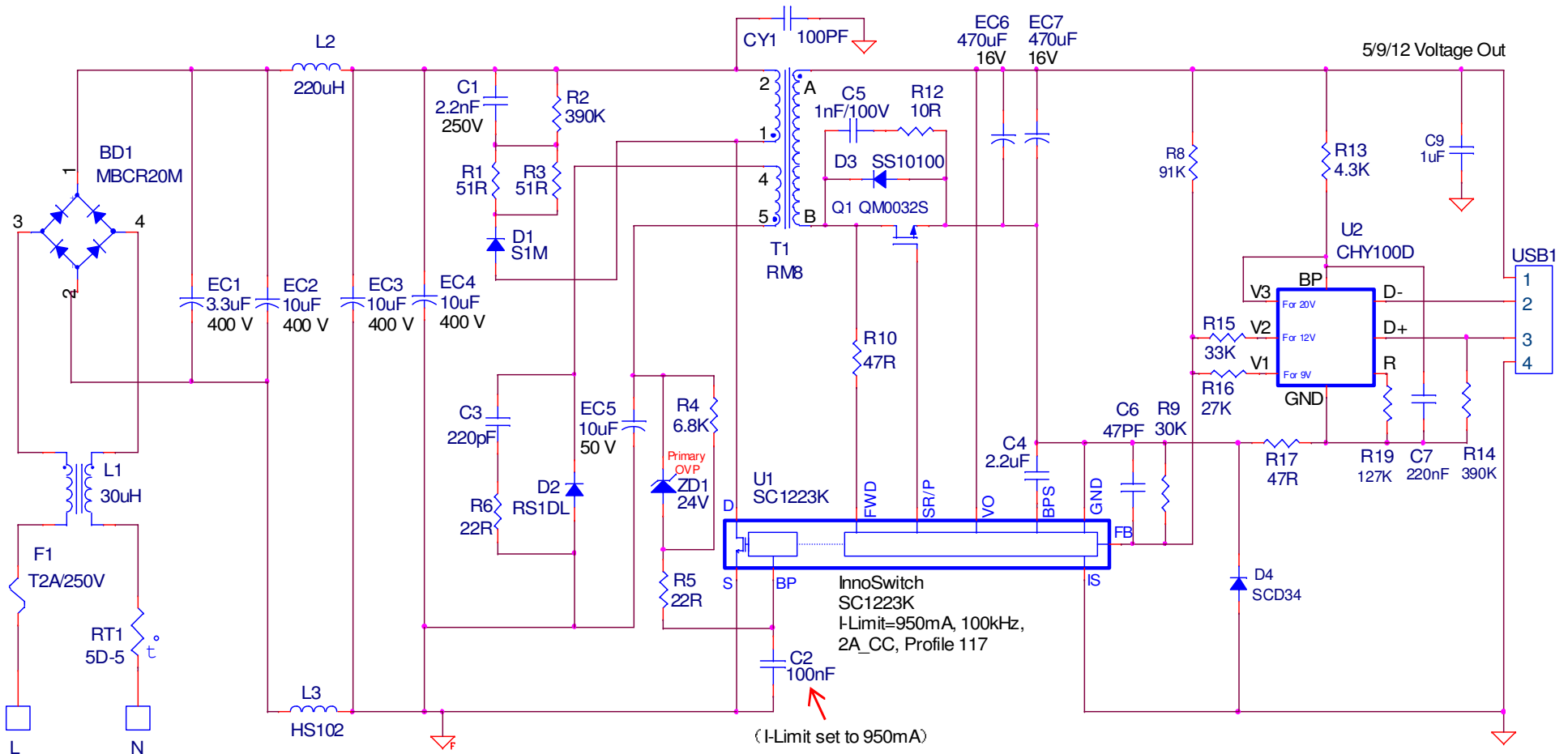


1. Power Supply Specification

Description	Symbol	Min	Typ	Max	Units	Comment/Conditions
INPUT						
Voltage	V_{IN}	90		265	V_{AC}	2 Wire no P.E
Frequency	f_{LINE}	47	50/60	63	Hz	
No-load Input Power	P_{IN}			10	mW	Input 230 V_{AC} @ $V_{out}=5V$
OUTPUT						
Output Voltage (5V)	V_{OUT}	4.75	5.2	5.25	V	Measured at the End of Cable
Output Current (5V)	I_{OUT}	2			A	
Output Ripple Voltage (5V) ①	V_{RIPPLE}			150	mV _{P-P}	See note 1
Output Voltage (9V)	V_{OUT}	8.55	9.0	9.45	V	Measured at the End of Cable
Output Current (9V)	I_{OUT}	2			A	
Output Ripple Voltage (9V) ①	V_{RIPPLE}			150	mV _{P-P}	See note 1
Output Voltage (12V)	V_{OUT}	11.4	12.0	12.6	V	Measured at the End of Cable
Output Current (12V)	I_{OUT}	1.5			A	
Output Ripple Voltage (12V) ①	V_{RIPPLE}			150	mV _{P-P}	See note 1
Total Output Power						
Continuous Output Power	P_{OUT}		18		W	For 9V output
Peak Output Power	$P_{OUT PK}$				W	
Conducted EMI Margin		6			dB	CISPR22B/EN55022 class B
Average Efficiency	η	73.66			%	115 and 230 V_{AC} for 5.2V output
Ambient Temperature	T_{AMB}	0		40	°C	Free convection, sea level
Surge Test			1		kV	Differential Mode:2Ω
ESD(Air Discharge)				15	kV	On each output terminals; +/-
Safety		Designed to meet IEC950, UL1950 Class II				

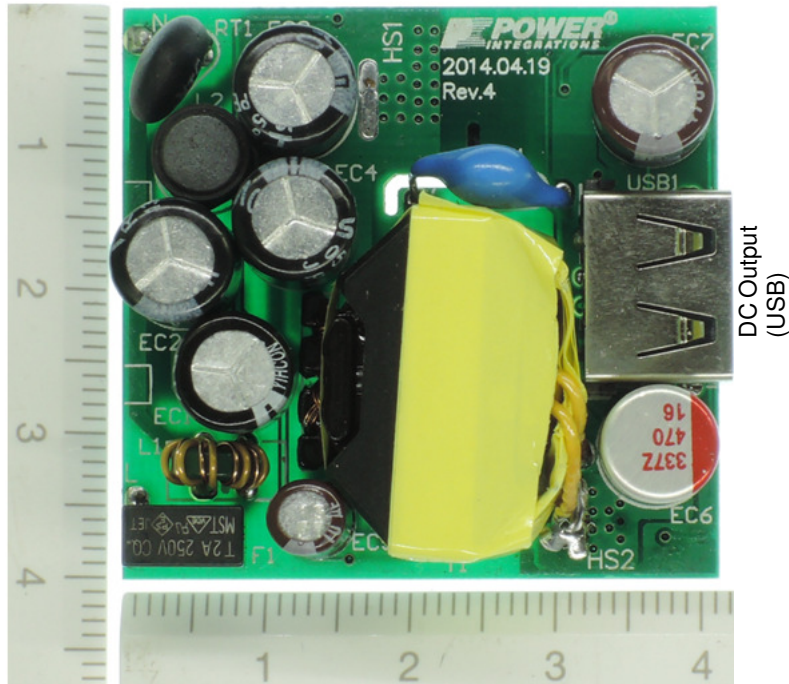
Note: 1 . Ripple Measured at the End of USB cord 1.0m, 20 MHz Bandwidth

2. Schematic



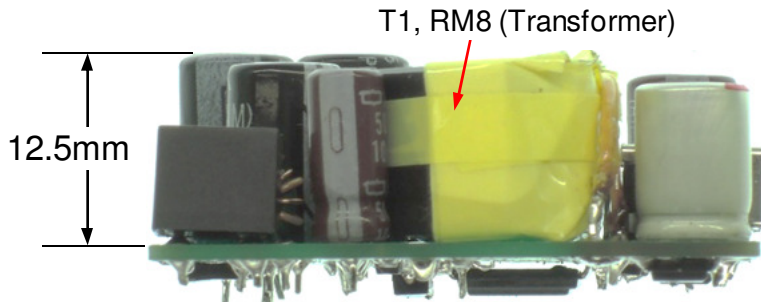
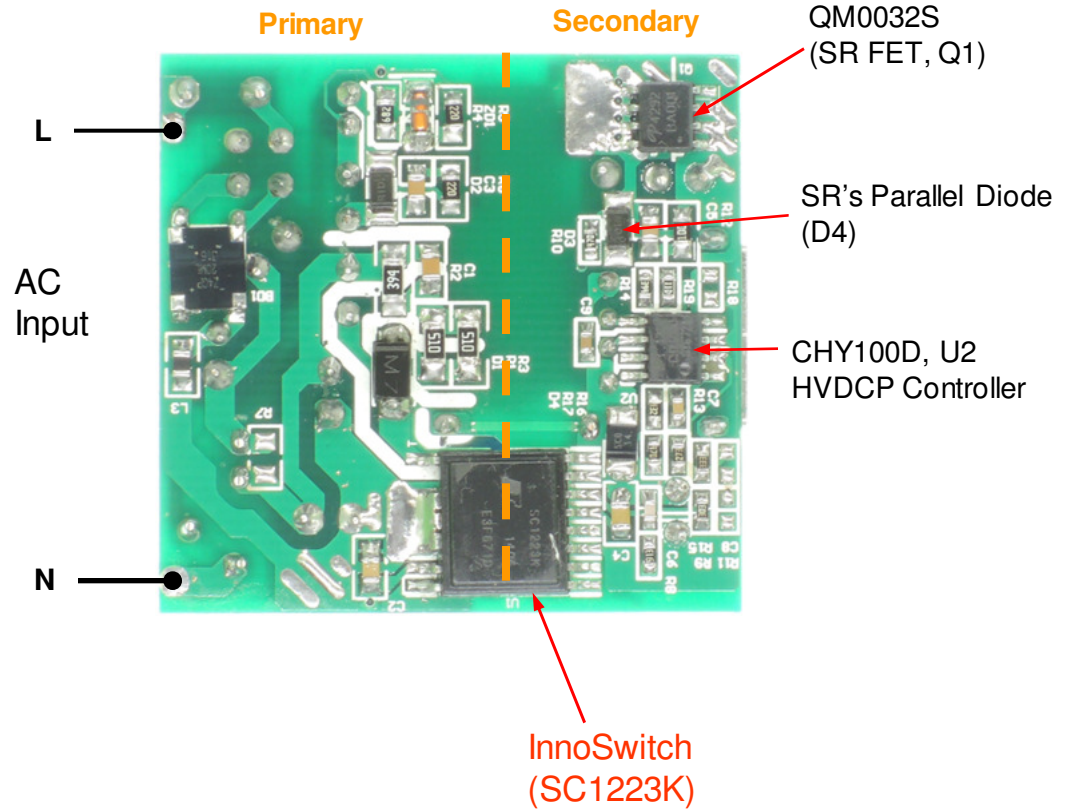
3.1 Circuit board

Component side



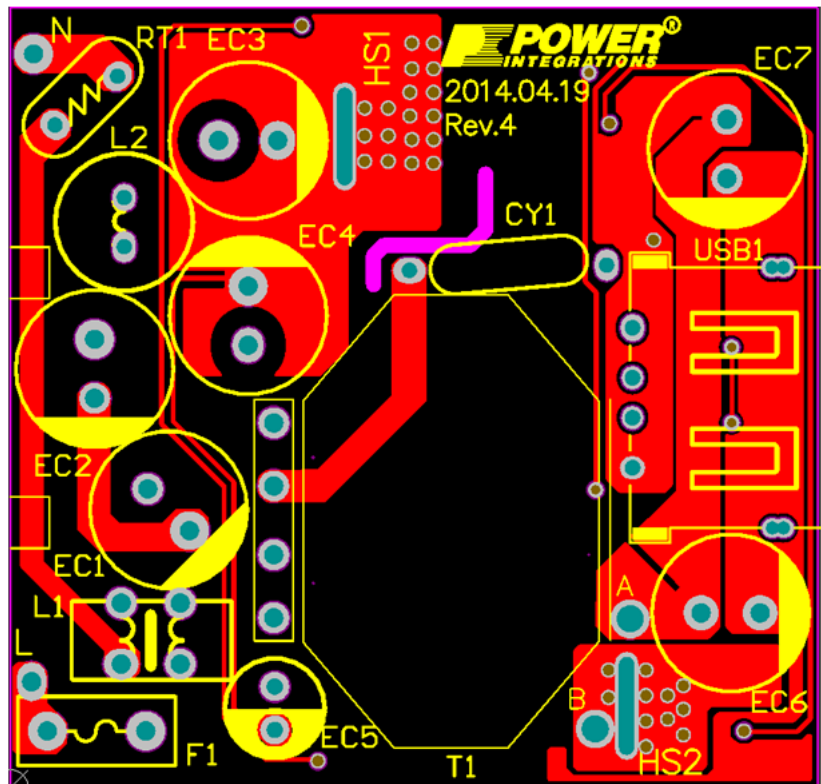
DC Output (USB)

Solder side

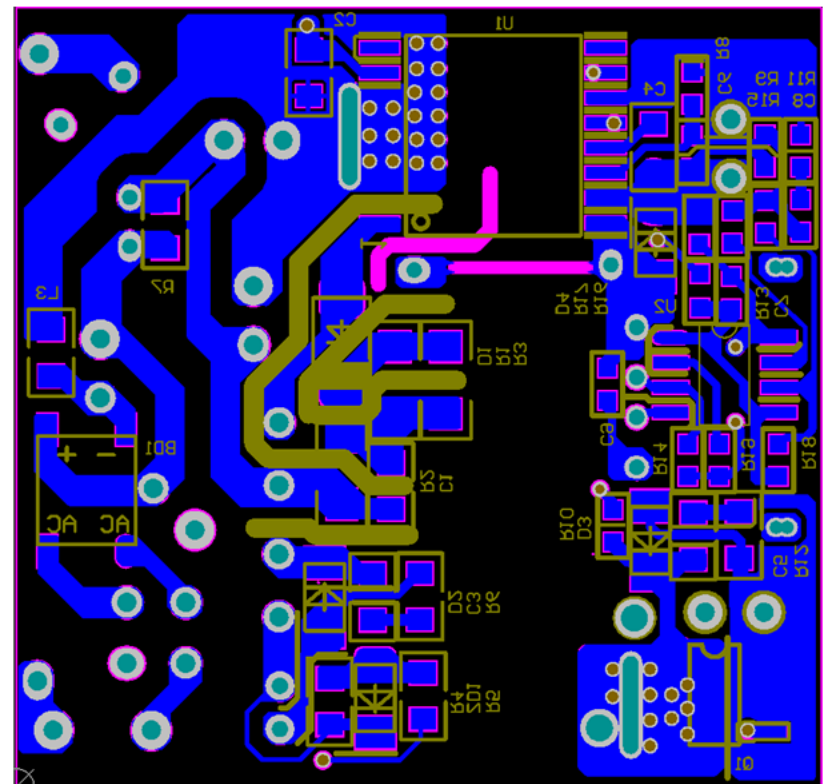


3.2 Circuit board

Component side



Solder side



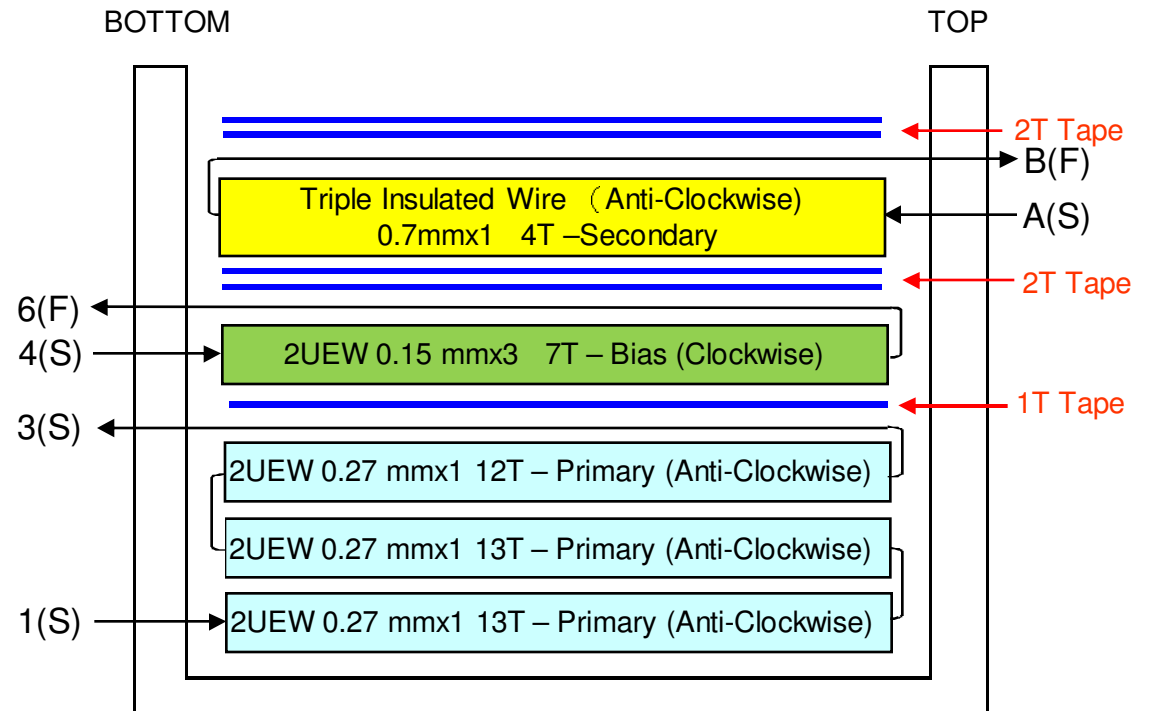
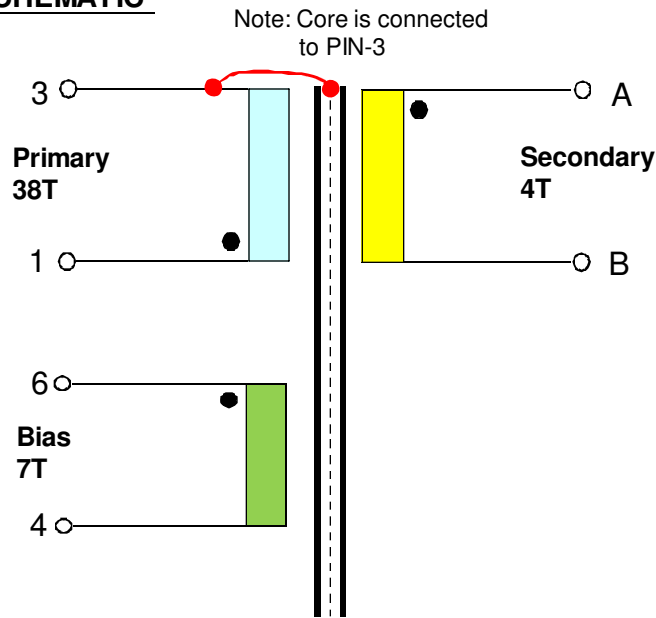
4. BOM

Primary Side Components			
Item	Qty	C/C Referen	Description
1	1	EC1	3.3uF, 400 V, Electrolytic, (8X12)
2	3	EC2, EC3, EC4	10uF, 400 V, Electrolytic, (8X12)
3	1	EC4	10uF, 50V, Electrolytic, (5X11)
4	1	CY1	Y-Cap, Y1, 100pF
5	1	C1	2.2nF, 250V, Ceramic, X7R, 0805
6	1	C2	100nF, 16V, Ceramic, X7R, 0805
7	1	C3	220pF, 250V, Ceramic, X7R, 0805
8	2	R1, R3	51R, 5%, Thick Film, 1206
9	1	R2	390K, 5%, Thick Film, 0805
10	1	R4	8.2K, 5%, Thick Film, 0603
11	1	R5	22R, 5%, Thick Film, 0603
12	1	R6	22R, 5%, Thick Film, 0805
13	1	BD1	Z4GP20M, 1000V, 2A, Bridge Rectifier, SMD, MBCN
14	1	D1	M7, 1A 1000V Rectifier, SMA
15	1	D2	RS1DL, Fast Recovery, 0.8A, 200V, SOD-123
16	1	L1	30uH, Common choke, 0.25mm, 9T, T6*3*2 core
17	1	L2	220uH, I-Core, 6 x 8
18	1	L3	HS102, 0805
19	1	F1	2A 250V, Time-lag Fuse
20	1	RT1	NTC, 5D-5
21	1	ZD1	24V, 5%, Zenner, SOD-80
22	1	T1	RM8, 6+2Pin
23	1	U1	SC1223K, eSOP-R16B (or K-package), I-Limit = 950mA, 100kHz, 2A CC, Profile 117.
24	1	PCB	FR-4, 39.5mm*41mm
	26		

Secondary Side Components			
Item	Qty	C/C Refe	Description
1	1	EC6	470uF, 16V, Solid Cap, (8X11)
2	1	EC7	470uF, 16V, E-Cap, (8X12)
3	1	C4	2.2uF, 16V, Ceramic, X5R, 0805
4	1	C5	1nF, 100V, Ceramic, X7R, 0805
5	1	C6	47pF, 16V, Ceramic, NPO, 0603
6	1	C7	220nF, 16V, Ceramic, X7R, 0603
7	1	C9	1uF, 16V, Ceramic, X5R, 0805
8	1	R8	91K, 1%, Thick Film, 0603
9	1	R9	30K, 1%, Thick Film, 0603
10	2	R10, R17	47R, 5%, Thick Film, 0603
11	1	R12	10R, 5%, Thick Film, 0805
12	1	R13	4.3K, 5%, Thick Film, 0603
13	1	R14	390K, 5%, Thick Film, 0603
14	1	R15	33K, 1%, Thick Film, 0603
15	1	R16	27K, 1%, Thick Film, 0603
16	1	R19	127K, 5%, Thick Film, 0603
17	1	D3	SS1010, 100V, 1A, Schottky, SOD-123
18	1	D4	SCD34, 40V, 3A, Schottky, SOD-123
19	1	Q1	1) UBIQ, QM0032S, FET, 100V, 7A, 22mΩ, SO-8. 2) AOS, AO4292, FET, 100V, 6A, 33mΩ, SO-8.
20	1	U2	CHY100, SO-8
	21		

5. Transformer Information

SCHEMATIC



ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (Lp) = 525uH± 7% @10KHz
2. Primary Leakage Inductance < 50uH
3. Electrical Strength = 3KV, 50/60Hz,1Min

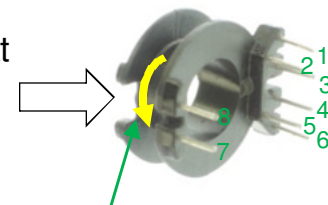
MATERIALS:

1. Core : RM8 (Ferrite Material TDK PC40 or equivalent, Ae=62mm^2)
2. Bobbin : RM8 (6+2pin).
3. Magnet Wires (Pri) : Type 2-UEW
4. Magnet Wire (Sec) : Triple Insulated Wires

FINISHED :

1. Varnish the assembly completely

Wire started in Anti-clockwise direction from pin-1 and ended at pin-3 when looking from the Top side of the bobbin(right photo)



Wire dressing direction

6.1 Regulation, Ripple & Efficiency Measurement (5V)

*** Note: Output voltage is measured at USB end. (Set HVDCP Output to 5V)**

V _{IN} (V _{AC})	P _{IN} (W)	V _{OUT} on PCB(V)	I _{OUT} (mA)	V _{RIPPLE} (mV _{P-P})	P _{OUT} (W)	η (%)	Average η(%)	DOE η (%)
90	0.007	5.08	0	40			86.41	78.70
	2.950	5.16	500	40	2.58	87.52		
	6.060	5.24	1000	74	5.24	86.50		
	9.270	5.32	1500	70	7.97	86.00		
	12.580	5.38	2000	87	10.77	85.61		
115	0.008	5.08	0	34			87.06	
	2.940	5.16	500	42	2.58	87.81		
	6.010	5.24	1000	76	5.24	87.25		
	9.190	5.32	1500	88	7.97	86.76		
	12.470	5.39	2000	82	10.77	86.40		
230	0.009	5.08	0	42			86.70	
	3.020	5.16	500	46	2.58	85.48		
	6.020	5.25	1000	82	5.25	87.18		
	9.150	5.32	1500	83	7.98	87.18		
	12.390	5.39	2000	82	10.78	86.97		
264	0.013	5.08	0	30			86.16	
	3.060	5.16	500	38	2.58	84.36		
	6.040	5.25	1000	70	5.25	86.90		
	9.190	5.32	1500	83	7.98	86.80		
	12.450	5.39	2000	78	10.78	86.55		

6.2 Regulation, Ripple & Efficiency Measurement (9V)

*** Note: Output voltage is measured at USB end. (Set HVDCP Output to 9V)**

V _{IN} (V _{AC})	P _{IN} (W)	V _{OUT} on PCB(V)	I _{OUT} (mA)	V _{RIPPLE} (mV _{P-P})	P _{OUT} (W)	η (%)	Average η(%)	DOE η (%)
90	0.037	9.05	0	22	/	/	87.56	85.00
	5.14	9.02	500	60	4.51	87.75		
	10.20	9.01	1000	66	9.01	88.31		
	15.43	8.99	1500	70	13.48	87.36		
	20.63	8.96	2000	72	17.91	86.83		
115	0.039	9.04	0	22	/	/	88.40	
	5.12	9.02	500	44	4.51	88.13		
	10.16	9.01	1000	60	9.01	88.64		
	15.24	9.00	1500	88	13.50	88.56		
	20.33	8.97	2000	88	17.94	88.25		
230	0.040	9.04	0	22	/	/	87.61	
	5.33	9.02	500	52	4.51	84.62		
	10.24	9.01	1000	62	9.01	87.99		
	15.18	9.01	1500	94	13.51	89.01		
	20.24	8.99	2000	90	17.98	88.83		
264	0.050	9.04	0	22	/	/	87.09	
	5.37	9.02	500	60	4.51	83.99		
	10.32	9.01	1000	66	9.01	87.31		
	15.25	9.01	1500	101	13.51	88.62		
	20.33	8.99	2000	93	17.98	88.43		

6.3 Regulation, Ripple & Efficiency Measurement (12V)

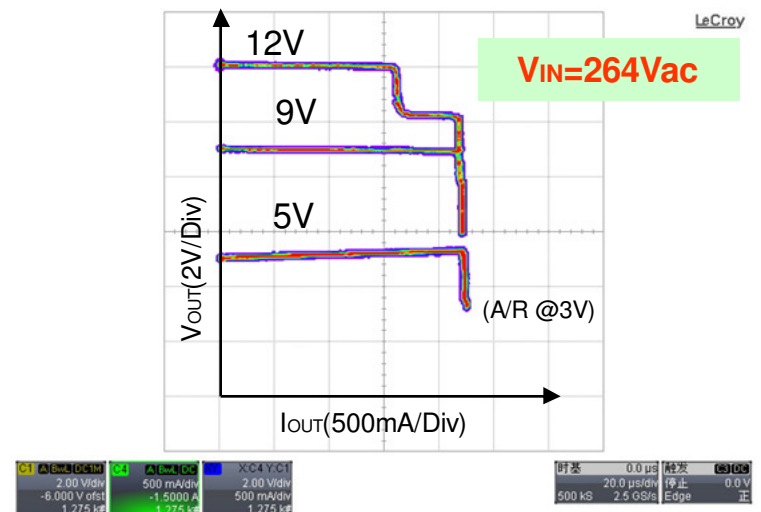
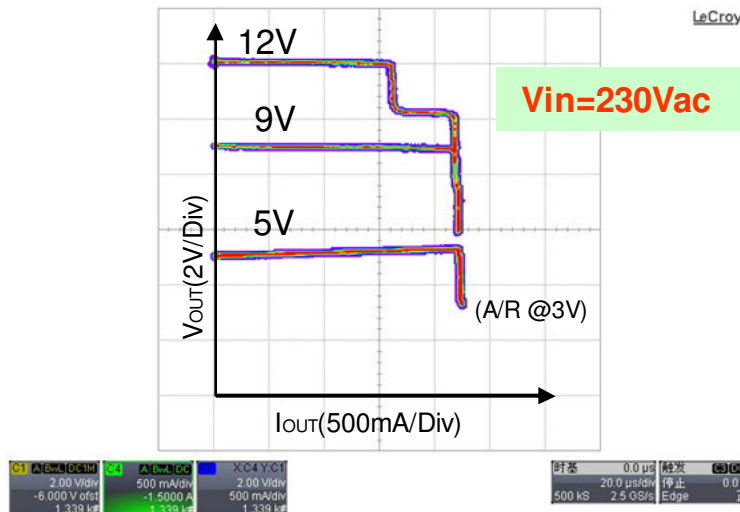
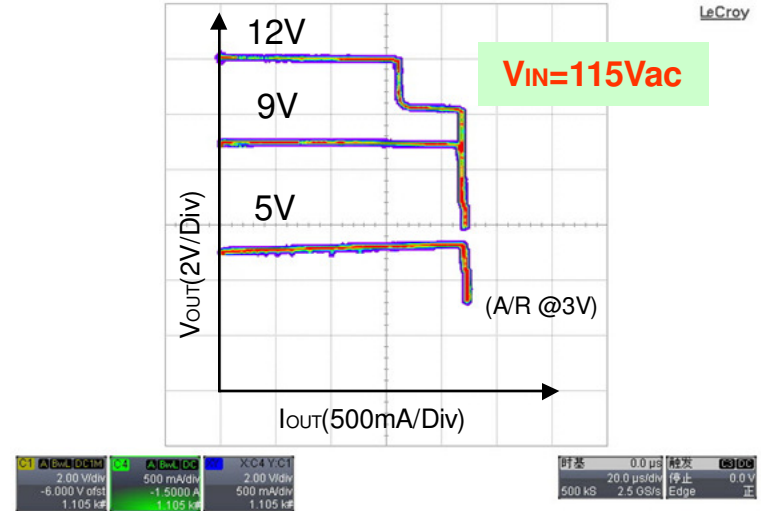
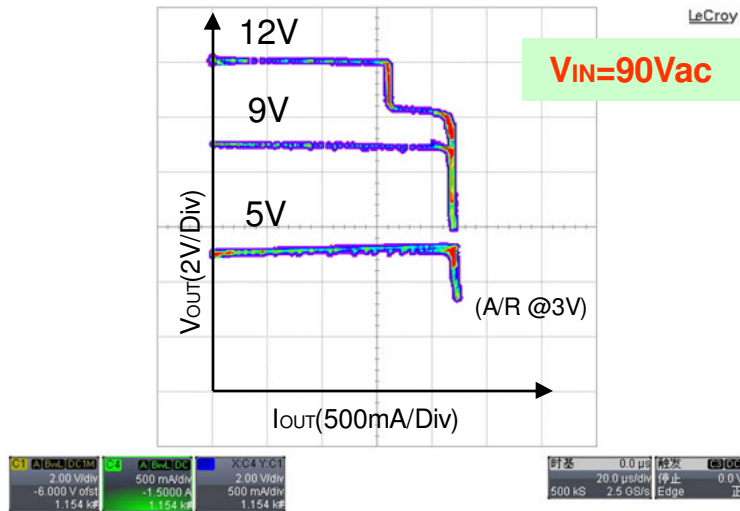
*** Note: Output voltage is measured at USB end. (Set HVDCP Output to 12V)**

V _{IN} (V _{AC})	P _{IN} (W)	V _{OUT} on PCB(V)	I _{OUT} (mA)	V _{RIPPLE} (mV _{P-P})	P _{OUT} (W)	η (%)	Average η(%)	DOE η (%)
90	0.092	12.12	0	22	/	/	87.24	85.00
	5.24	12.09	375	60	4.54	86.55		
	10.35	12.09	750	62	9.06	87.57		
	15.50	12.08	1125	80	13.59	87.66		
	20.75	12.06	1500	58	18.09	87.16		
115	0.093	12.13	0	22	/	/	88.04	
	5.22	12.10	375	44	4.54	86.91		
	10.29	12.09	750	52	9.06	88.09		
	15.33	12.08	1125	72	13.59	88.64		
	20.43	12.06	1500	61	18.09	88.53		
230	0.095	12.13	0	22	/	/	87.38	
	5.41	12.10	375	40	4.54	83.84		
	10.34	12.10	750	83	9.07	87.73		
	15.26	12.08	1125	82	13.59	89.09		
	20.37	12.07	1500	70	18.10	88.87		
264	0.098	12.13	0	22	/	/	86.95	
	5.43	12.10	375	38	4.54	83.54		
	10.42	12.09	750	58	9.06	86.99		
	15.32	12.08	1125	78	13.59	88.72		
	20.45	12.07	1500	72	18.11	88.53		

7. Output VI Characteristic

(Measured at PCB End)

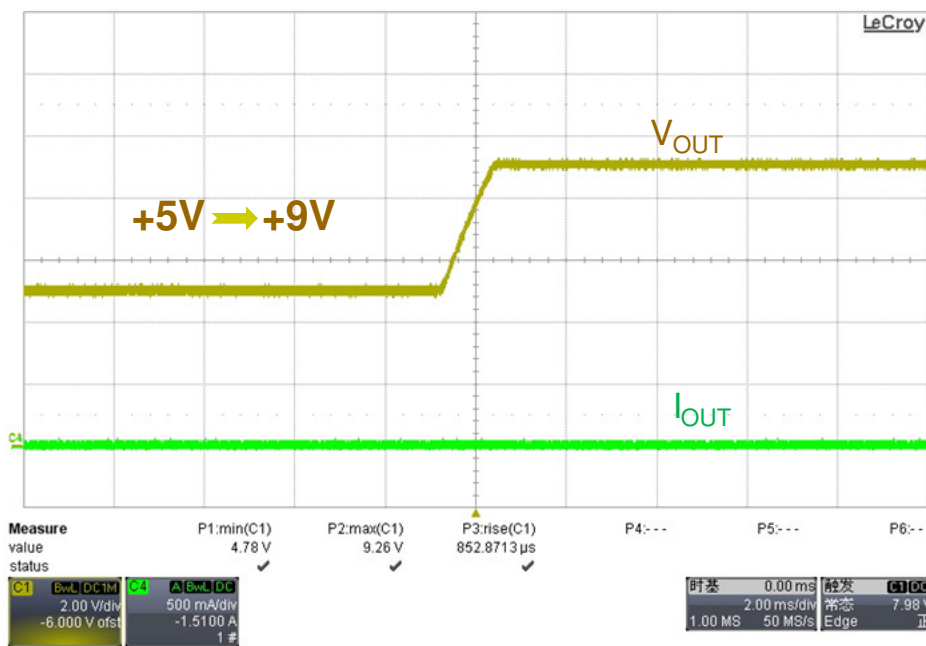
Engineering Report (SC1223K & CHY100D for 5V*2A ; 9V*2A; 12V*1.5A QC Charger)-Rev-1(#45)



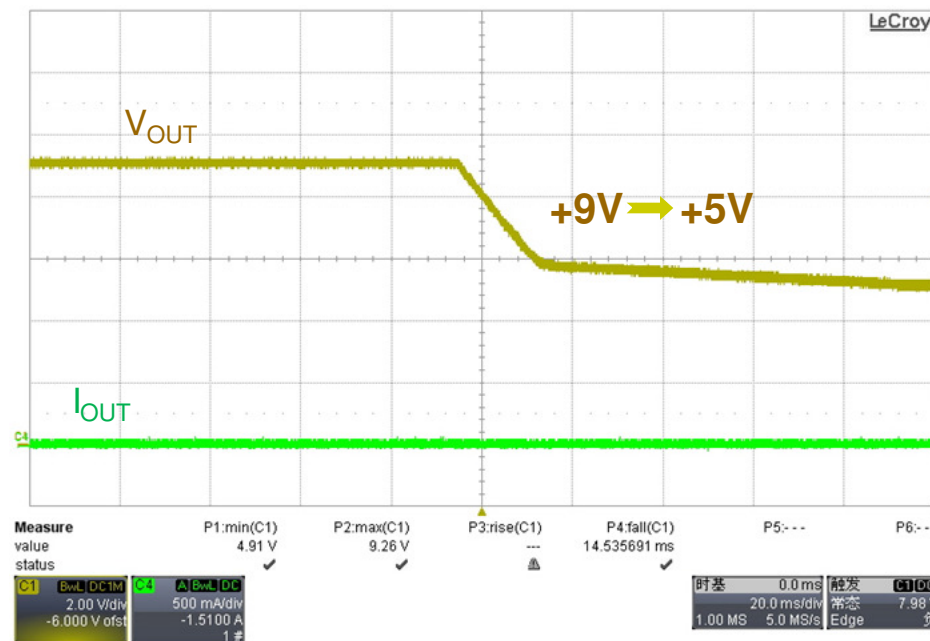
8.1 Voltage Transition-A

Test conditions:

- Output at No-Load
- Output voltage selected by QC2.0 Interface IC via D+ & D- signals



V:2V/div
A: 1A/div
t: 2ms/div



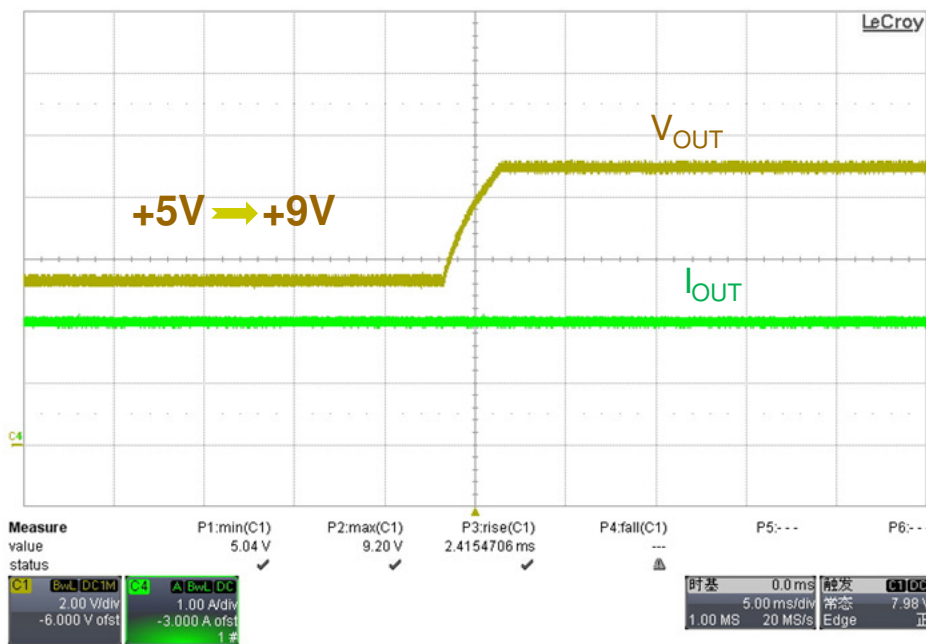
V:2V/div
A: 1A/div
t: 20ms/div

Test result for 90V and 264Vac are compatible

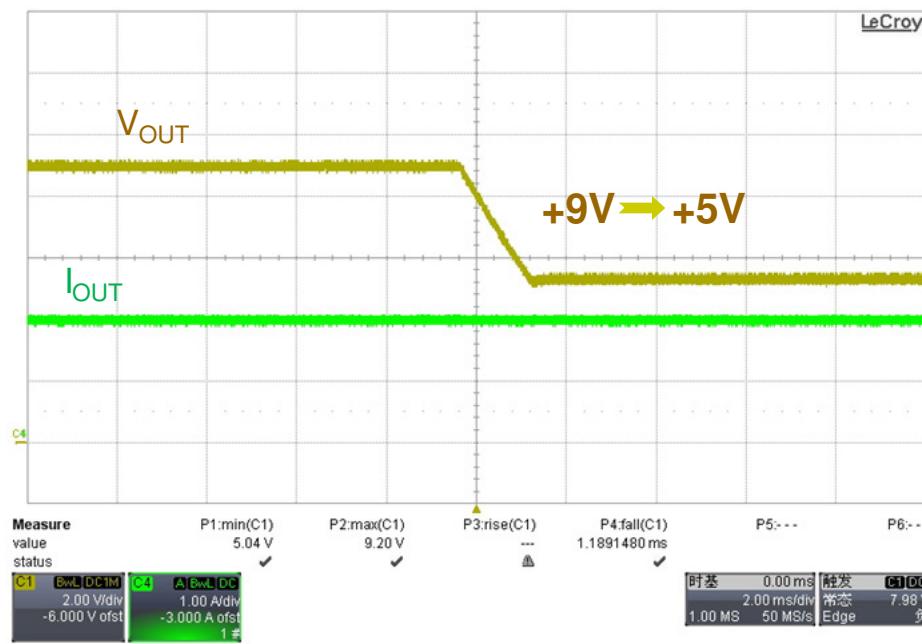
8.2 Voltage Transition-B

Test conditions:

- Output at 2A (Full Load)
- Output voltage selected by QC2.0 Interface IC via D+ & D- signals



V:2V/div
A: 1A/div
t: 2ms/div



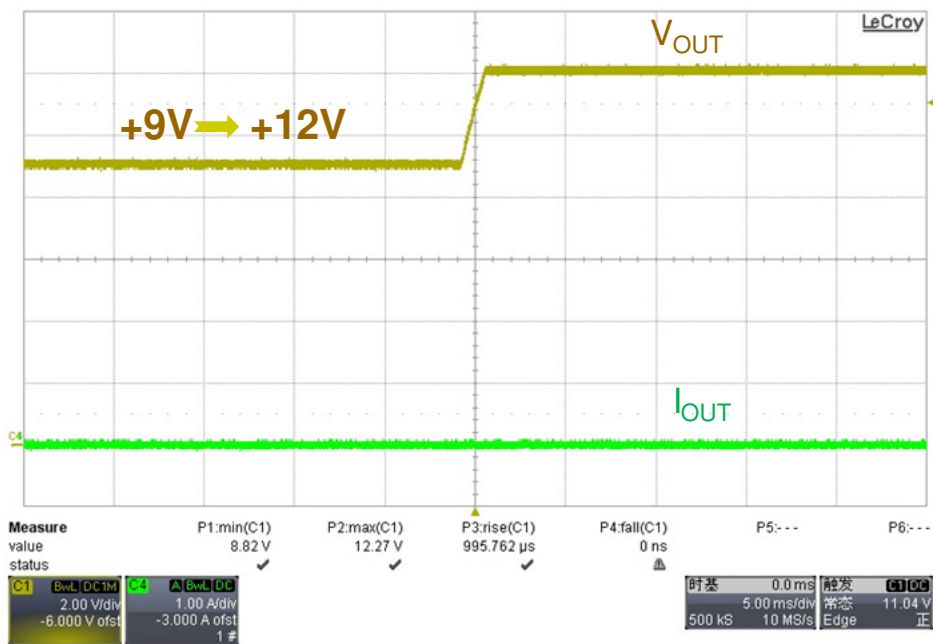
V:2V/div
A: 1A/div
t: 20ms/div

Test result for 90V and 264Vac are compatible

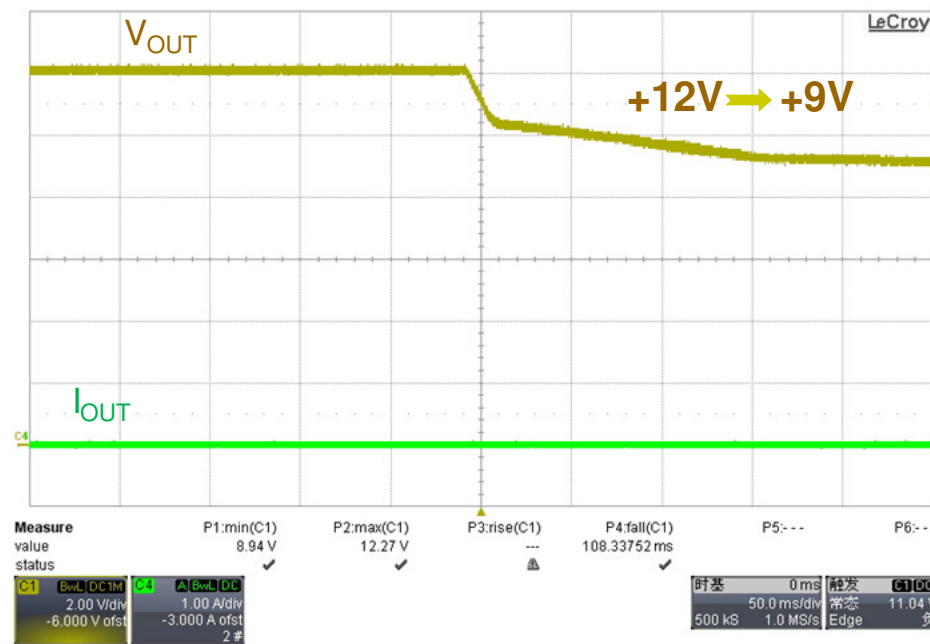
8.3 Voltage Transition-C

Test conditions:

- Output at No-Load
- Output voltage selected by QC2.0 Interface IC via D+ & D- signals



V:2V/div
A: 1A/div
t: 2ms/div



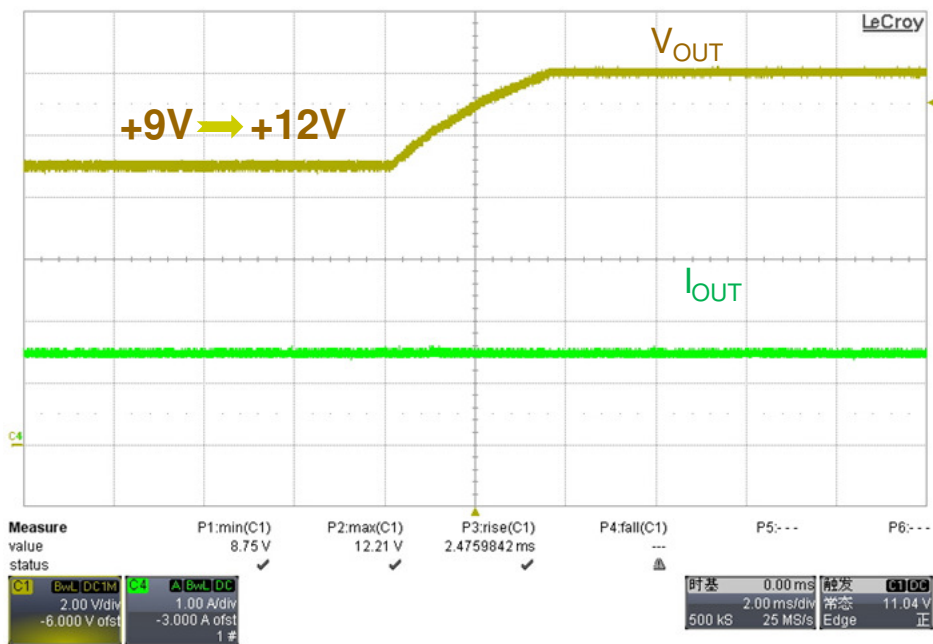
V:2V/div
A: 1A/div
t: 20ms/div

Test result for 90V and 264Vac are compatible

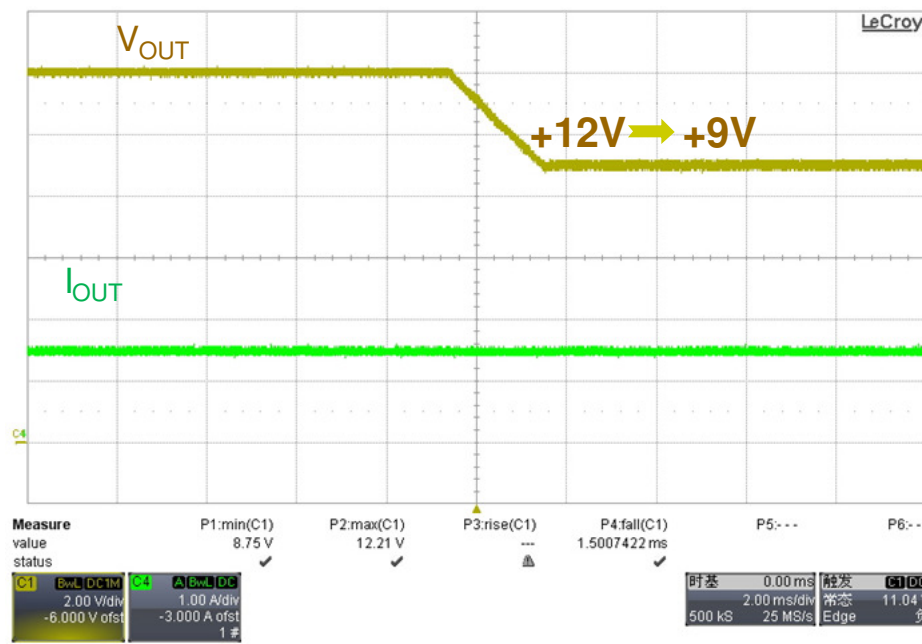
8.4 Voltage Transition-D

Test conditions:

- Output at 1.5A (12V Full Load)
- Output voltage selected by QC2.0 Interface IC via D+ & D- signals



V:2V/div
A: 1A/div
t: 2ms/div



V:2V/div
A: 1A/div
t: 20ms/div

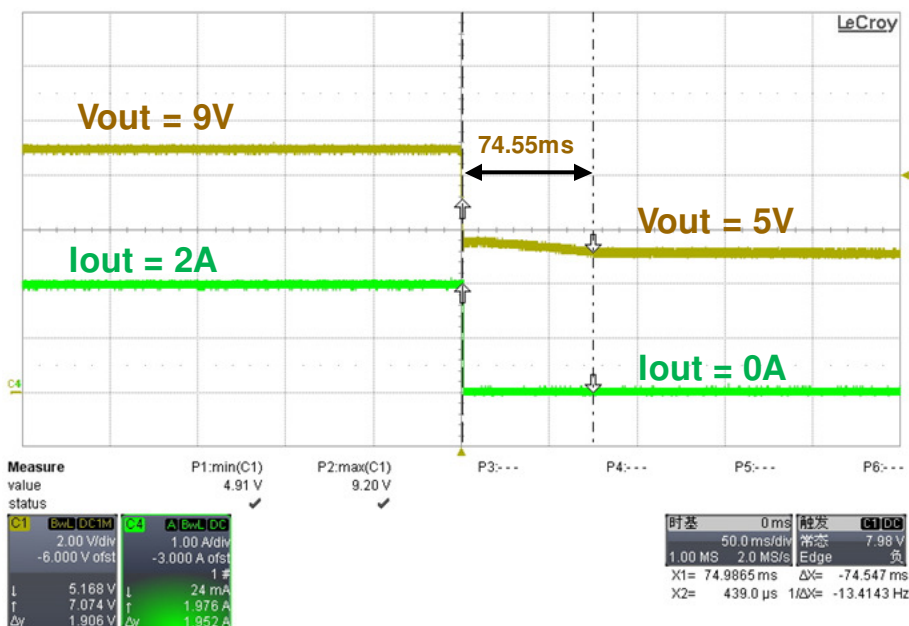
Test result for 90V and 264Vac are compatible

8.5 Output Settling from 9V to 5V

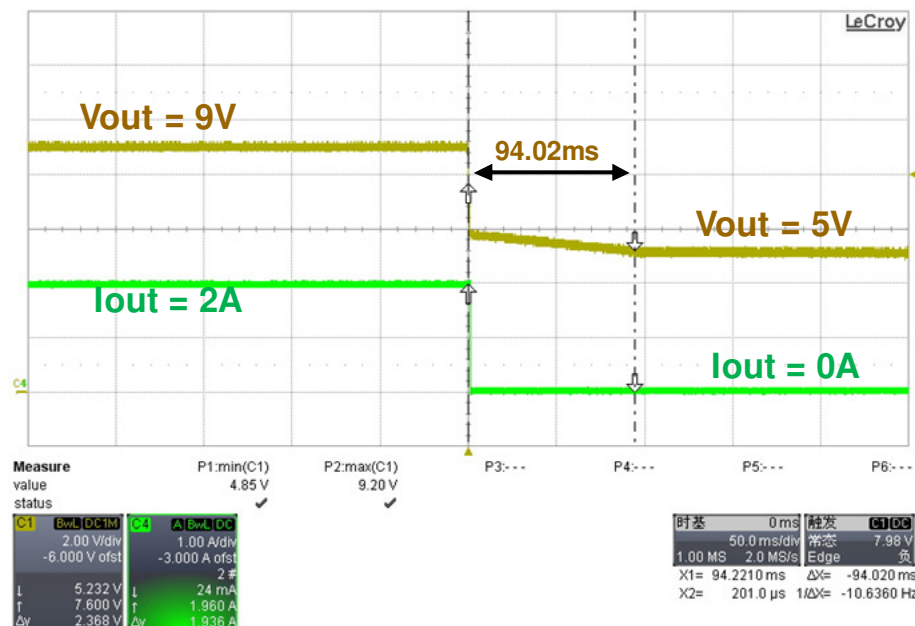
Test conditions:

- Output at 9V@ 2A and Switch to 5V@ 0A
- Output voltage selected by QC2.0 Interface IC via D+ & D- signals, then unplug the USB
- Total Output capacitance is 470uF+470uF or 940uF

90Vac



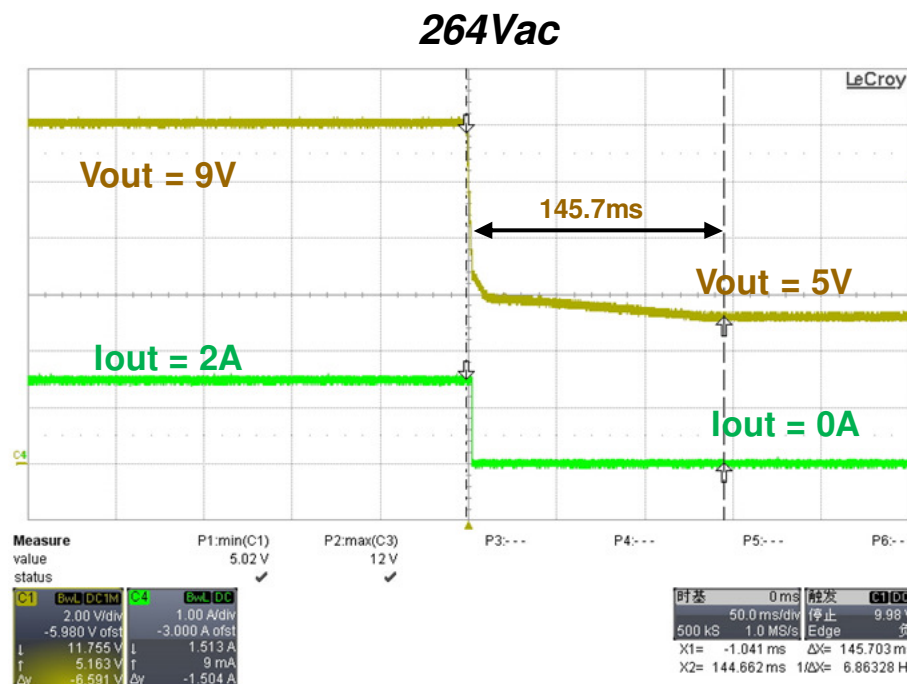
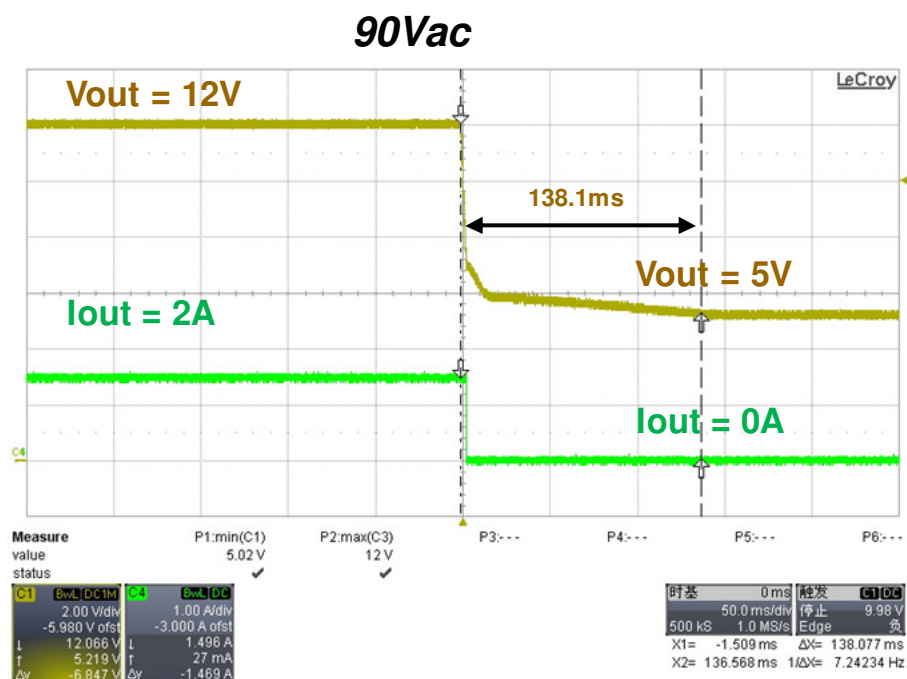
264Vac



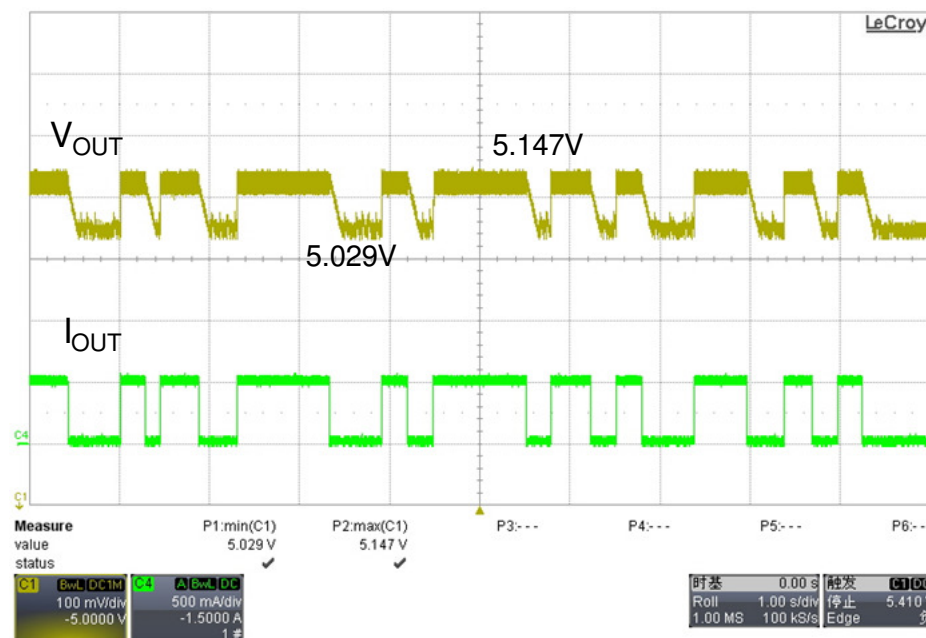
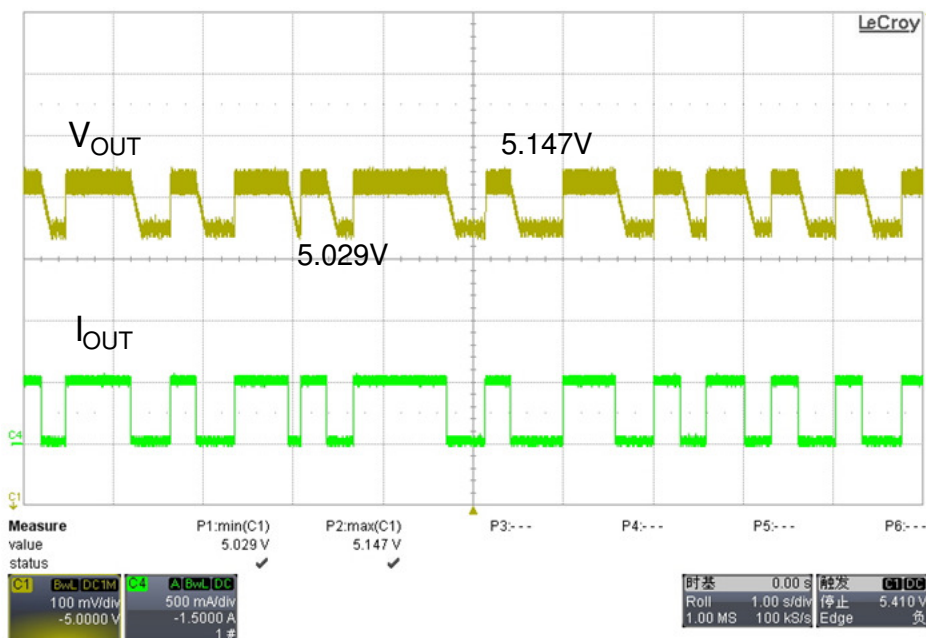
8.6 Output Settling from 12V to 5V

Test conditions:

- Output at 12V@ 1.5A and Switch to 5V@ 0A
- Output voltage selected by QC2.0 Interface IC via D+ & D- signals, then unplug the USB
- Total Output capacitance is 470uF+470uF or 940uF



9. DLR Load Response (5V output, single pulse)



CH1: Output Voltage, 100mV/Div
CH4: Output Current, 0.5A/Div

Test Conditions:

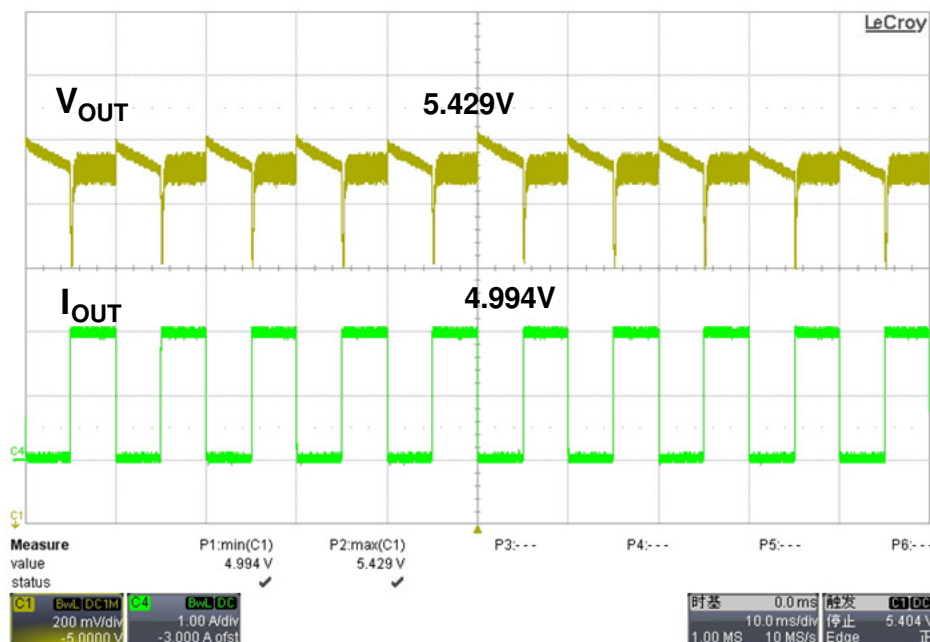
1. AC input = 90VAC
2. Load range: 0.5A single pulse

CH1: Output Voltage, 100mV/Div
CH4: Output Current, 0.5A/Div

Test Conditions:

1. AC input = 264VAC
2. Load range: 0.5A single pulse

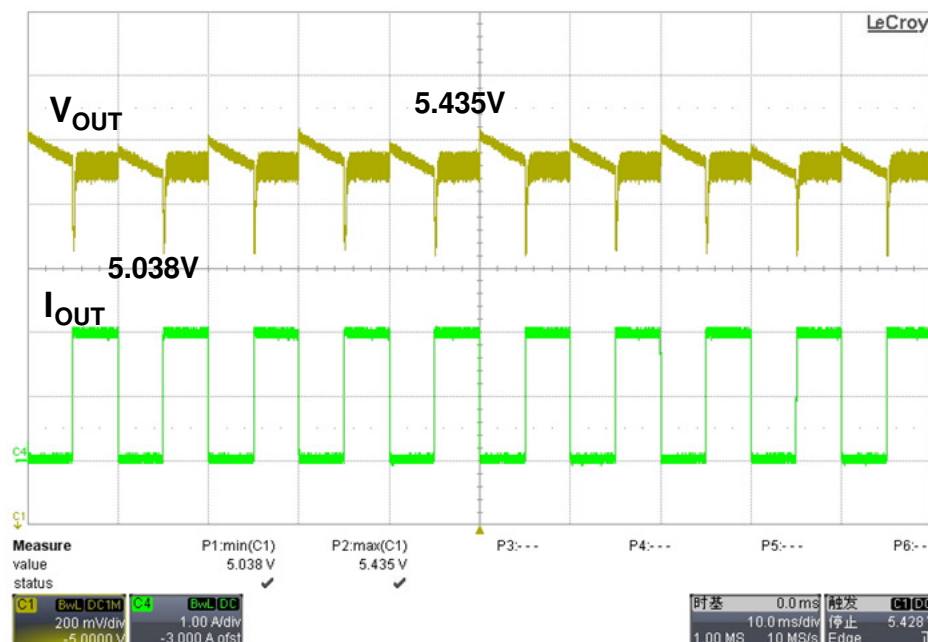
10.1 DLR Load Response (5V output, 5mS/5mS)



CH1: Output Voltage, 200mV/Div
CH4: Output Current, 1A/Div

Test Conditions:

1. AC input = 90VAC
2. Load range: 0A-2A-0A
3. Frequency: 100Hz(5ms/5ms)
4. Slew rate: 0.5A/S

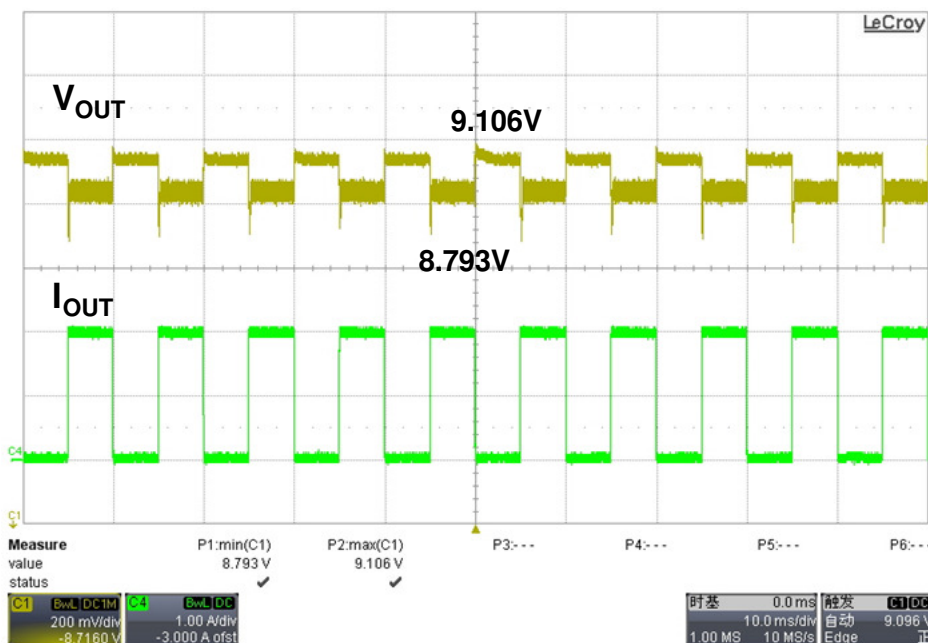


CH1: Output Voltage, 200mV/Div
CH4: Output Current, 1A/Div

Test Conditions:

1. AC input = 264VAC
2. Load range: 0A-2A-0A
3. Frequency: 100Hz(5ms/5ms)
4. Slew rate: 0.5A/S

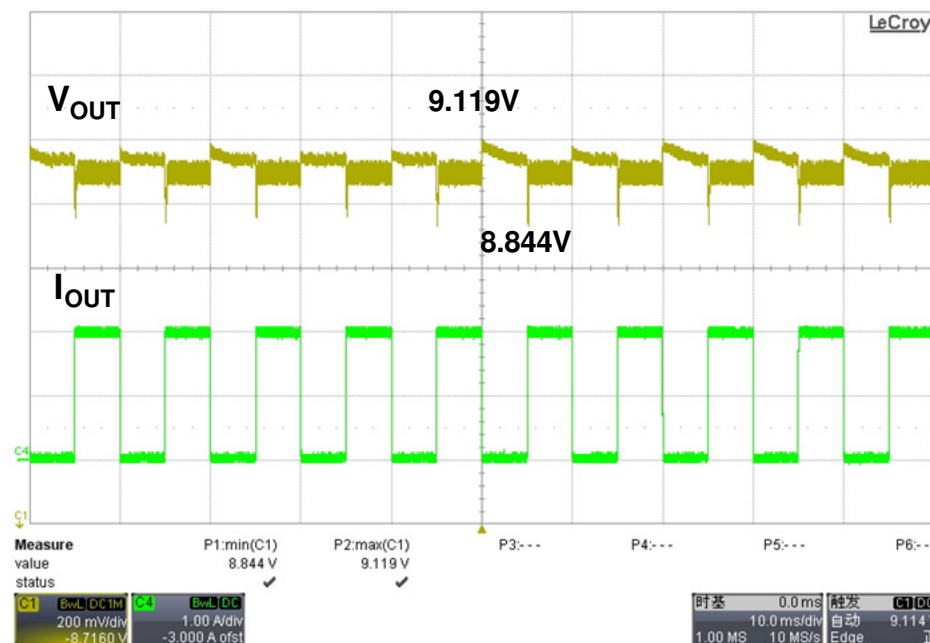
10.2 DLR Load Response (9V output, 5mS/5mS)



CH1: Output Voltage, 200mV/Div
CH4: Output Current, 1A/Div

Test Conditions:

1. AC input = 90VAC
2. Load range: 0A-2A-0A
3. Frequency: 100Hz(5ms/5ms)
4. Slew rate: 0.5A/S

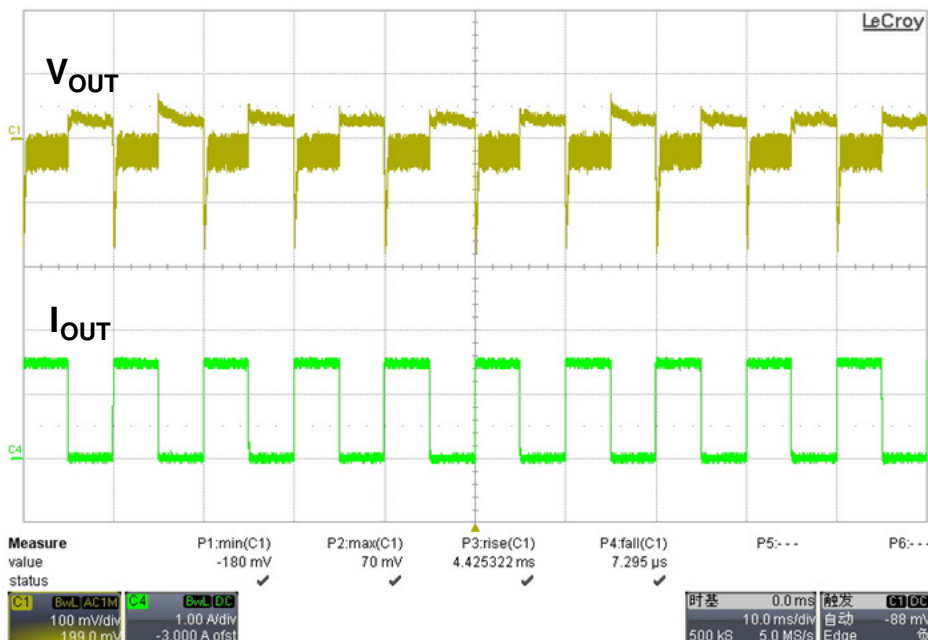


CH1: Output Voltage, 200mV/Div
CH4: Output Current, 1A/Div

Test Conditions:

1. AC input = 264VAC
2. Load range: 0A-2A-0A
3. Frequency: 100Hz(5ms/5ms)
4. Slew rate: 0.5A/S

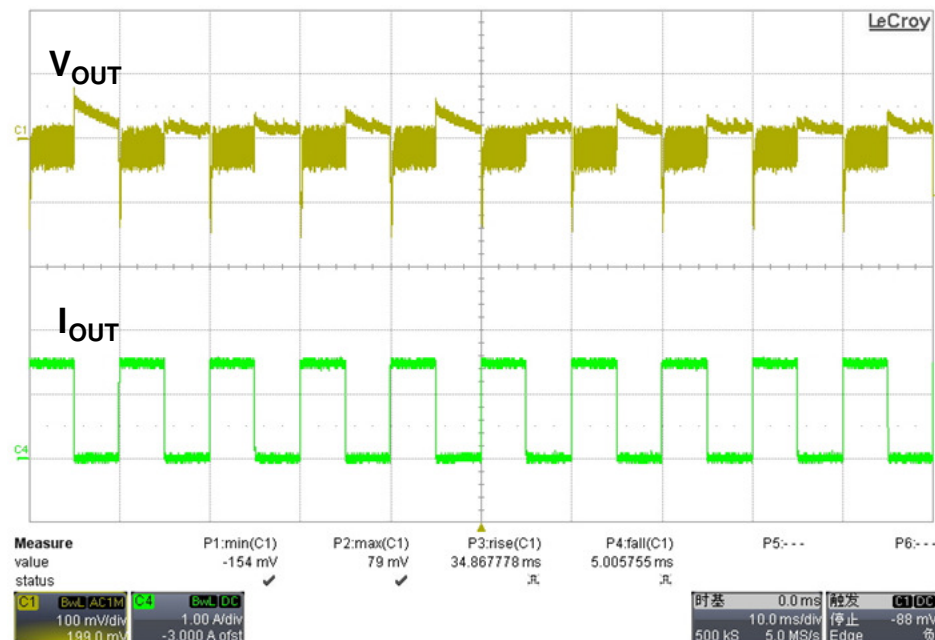
10.3 DLR Load Response (12V output, 5mS/5mS)



CH1: Output Voltage, 100mV/Div
CH4: Output Current, 1A/Div

Test Conditions:

1. AC input = 90VAC
2. Load range: 0A-1.5A-0A
3. Frequency: 100Hz(5ms/5ms)
4. Slew rate: 0.5A/S

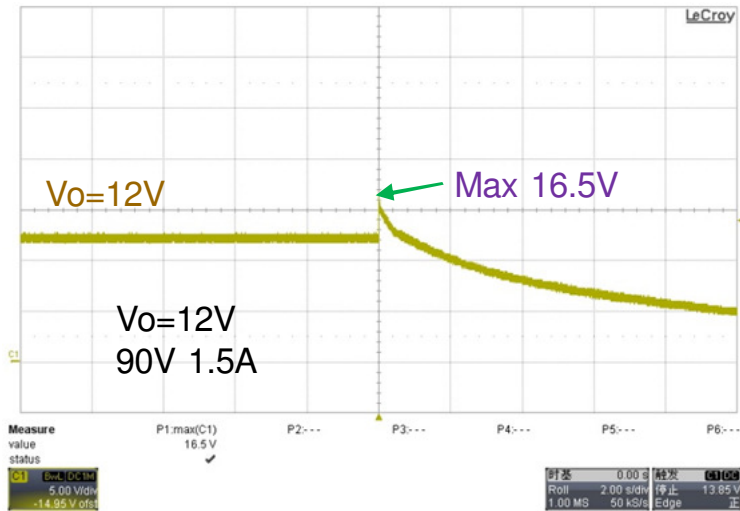


CH1: Output Voltage, 100mV/Div
CH4: Output Current, 1A/Div

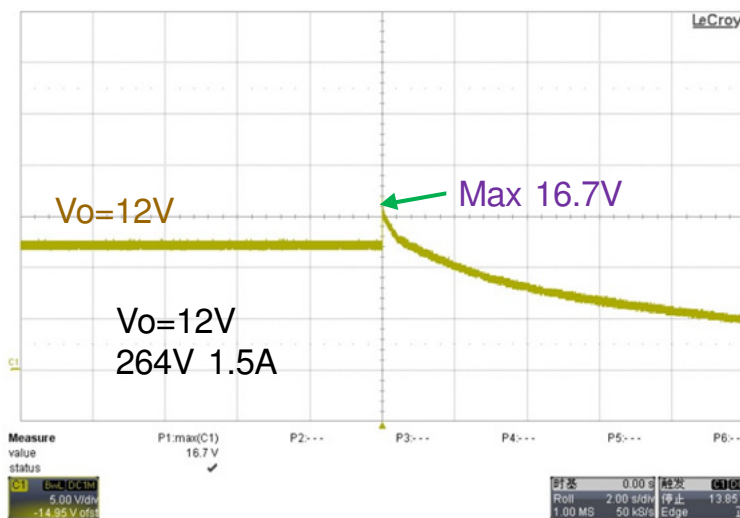
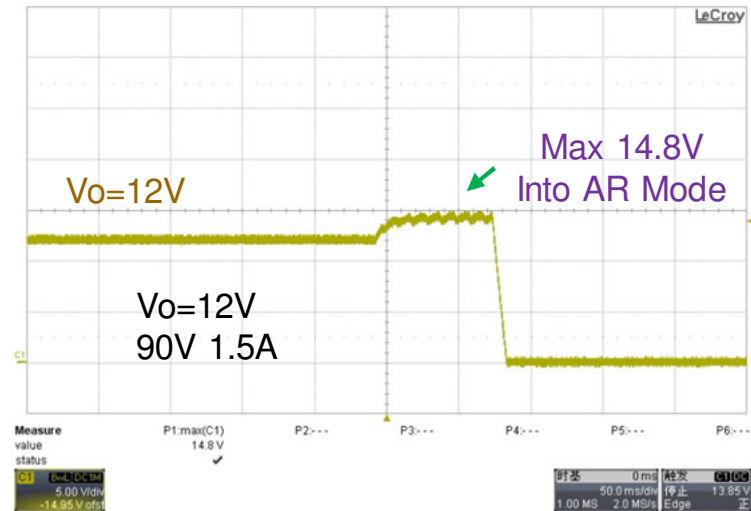
Test Conditions:

1. AC input = 264VAC
2. Load range: 0A-1.5A-0A
3. Frequency: 100Hz(5ms/5ms)
4. Slew rate: 0.5A/S

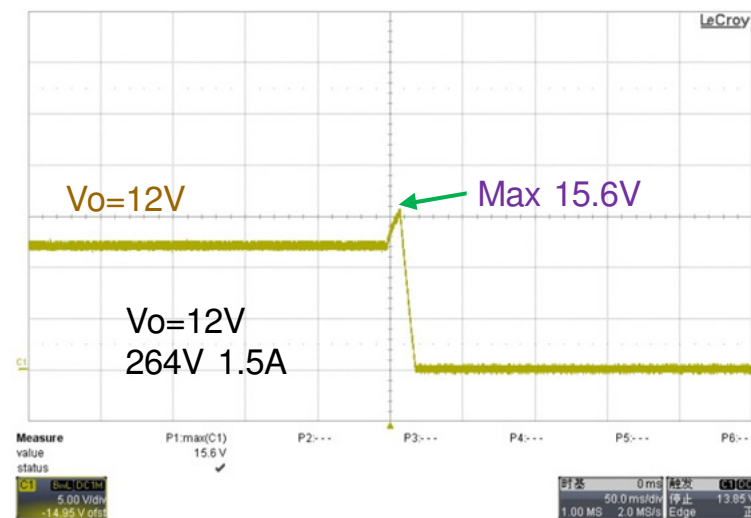
11. OVP test (Test on 12V)



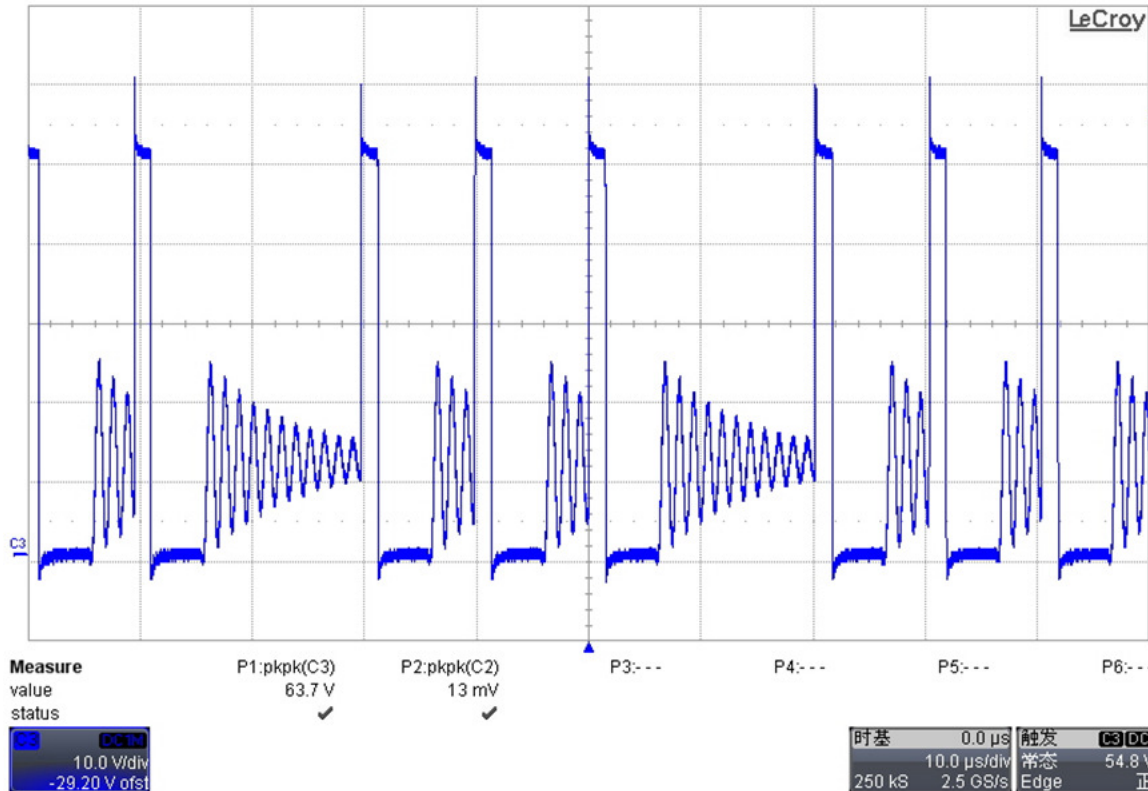
Vo=9V
90V No load



Vo=9V
264V No load



12. Output Rectifier Maximum Invers Voltage



Test Condition:

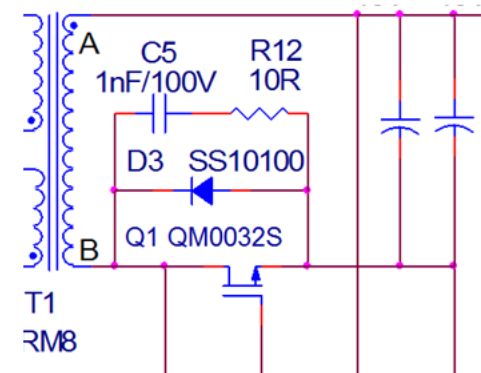
$V_{IN}=264V_{AC}$, $V_{OUT}=12V$, $I_{OUT}=1.5A$

RESULT: PIV= 63.7V

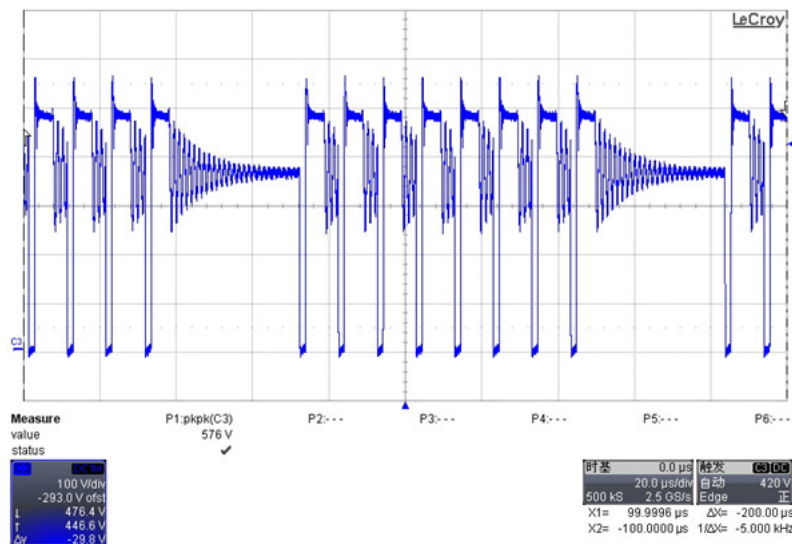
(Out of the 3 Levels, 12V measured the highest)

Component Stress on Output Rectifications :

- QM0032S @7A/100V (Q1);
- SS10100 @1A/100V (D3).



13. Maximum Drain Voltage (9V Output)



Test Condition:

$V_{IN}=264V_{AC}$, $V_{OUT}=12V @ I_{OUT}=1.5A$

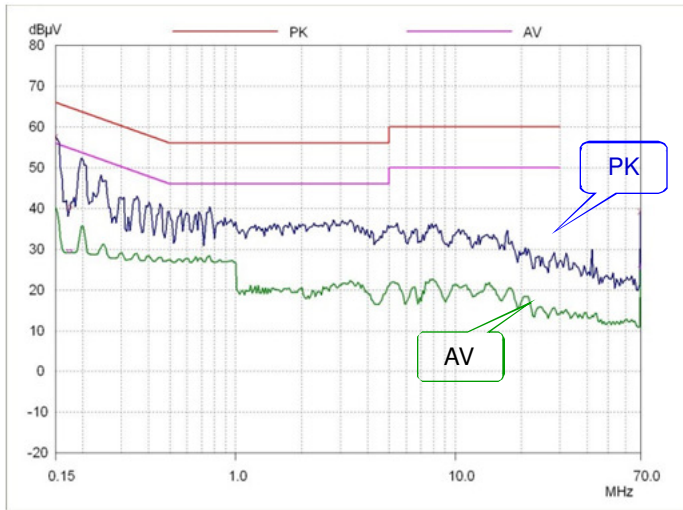
RESULT: $V_{DRAIN-MAX} = 576V$

Absolute Maximum Ratings^{1,2}

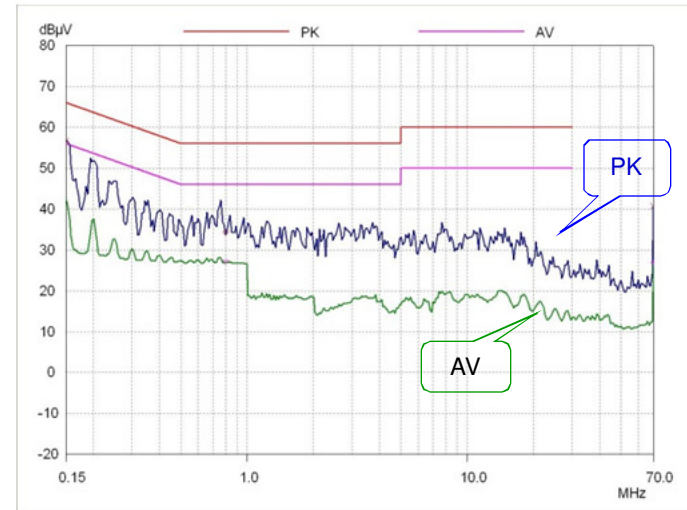
DRAIN Pin Voltage	-0.3 V to 650 V	Lead Temperature	260 °C
DRAIN Pin Peak Current	1360 A (2550) mA ³	Notes:	
PRIMARY BYPASS/SECONDARY BYPASS Pin Voltage	-0.3 V to 9 V	1. All voltages referenced to Source and Secondary Ground, $T_A = 25 °C$.	
PRIMARY BYPASS/SECONDARY BYPASS Pin Current	100 mA	2. Maximum ratings specified may be applied one at a time without causing permanent damage to the product. Exposure to Absolute Maximum Ratings conditions for extended periods of time may affect product reliability.	
FORWARD Pin Voltage.....	-1.5 V to 150 V	3. Higher peak Drain current is allowed while the Drain voltage is simultaneously less than 400 V.	
FEEDBACK Pin Voltage	-0.3 to 9 V	4. Normally limited by internal circuitry.	
SR/P Pin Voltage	-0.3 to 9 V	5. 1/16" from case for 5 seconds.	
OUTPUT VOLTAGE Pin Voltage.....	-0.3 to 15 V		
Storage Temperature	-65 to 125 °C		
Operating Junction Temperature ⁴	-40 to 125 °C		
Ambient Temperature.....	-40 to 85 °C		

14.1 Conducted EMI (Output Float, CR, 5V*2A)

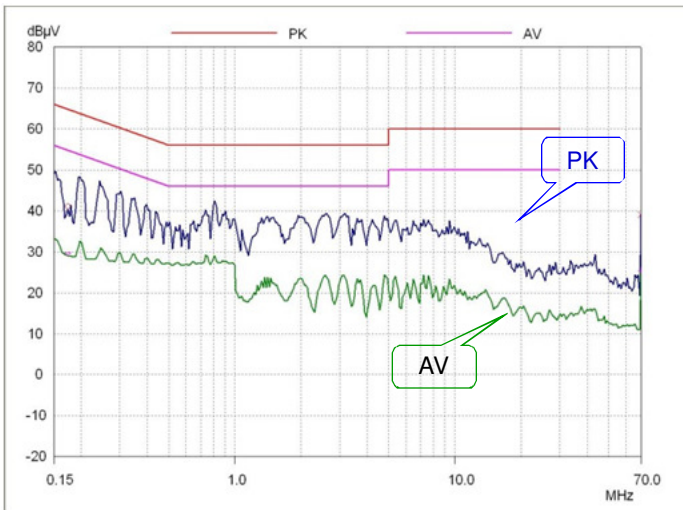
Engineering Report (SC1223K & CHY100D for 5V*2A ; 9V*2A; 12V*1.5A QC Charger)-Rev-1(#45)



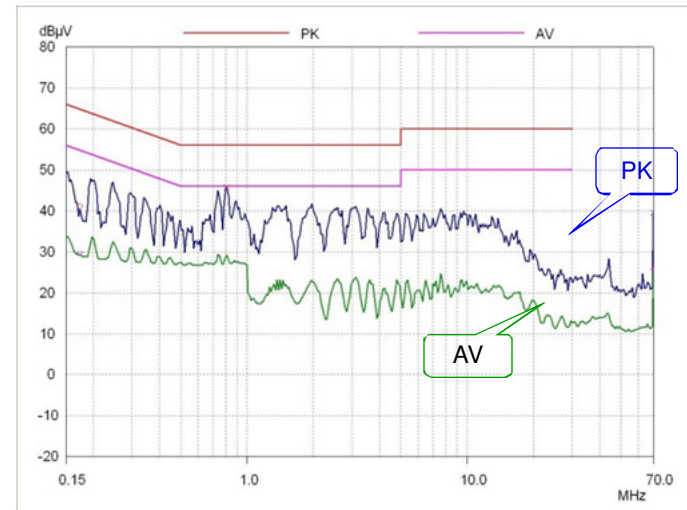
120VAC, Live



120VAC, Neutral



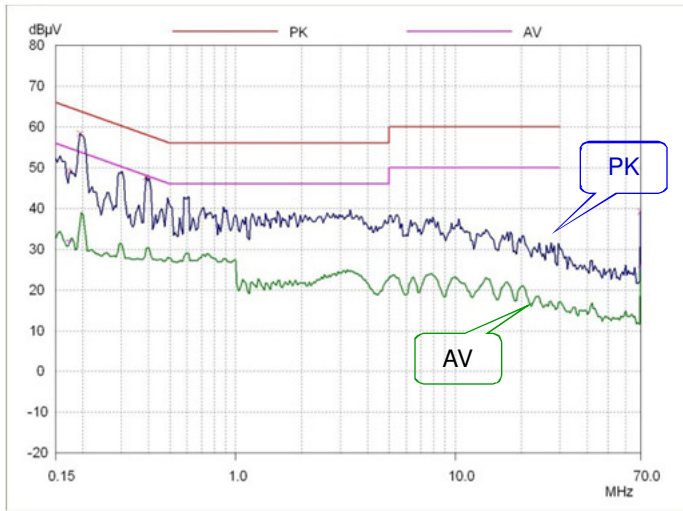
230VAC, Live



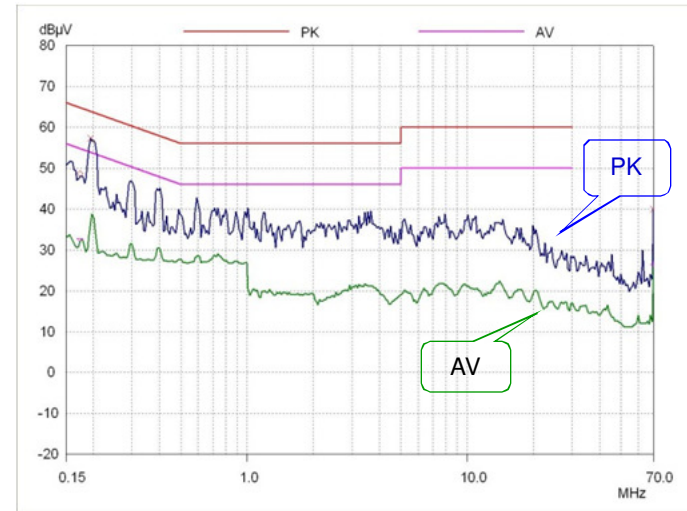
230VAC, Neutral

14.2 Conducted EMI (Output Float, CR, 9V*2A)

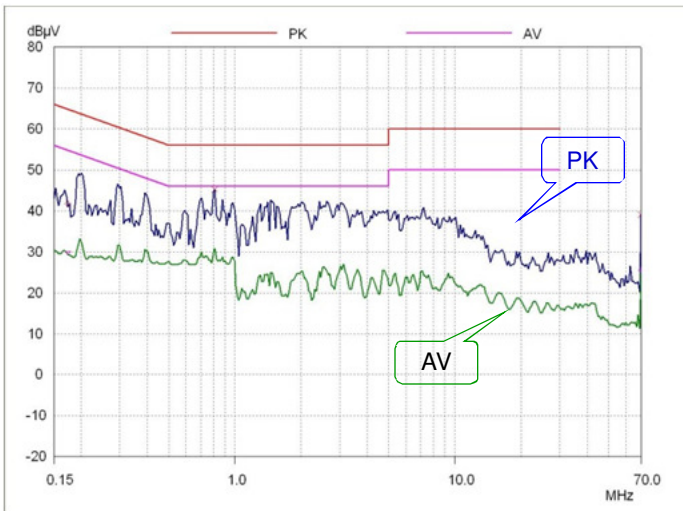
Engineering Report (SC1223K & CHY100D for 5V*2A ; 9V*2A; 12V*1.5A QC Charger)-Rev-1(#45)



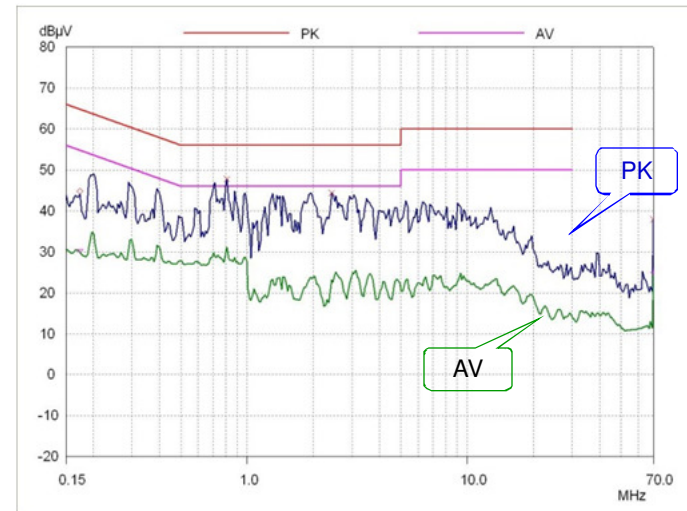
120VAC, Live



120VAC, Neutral



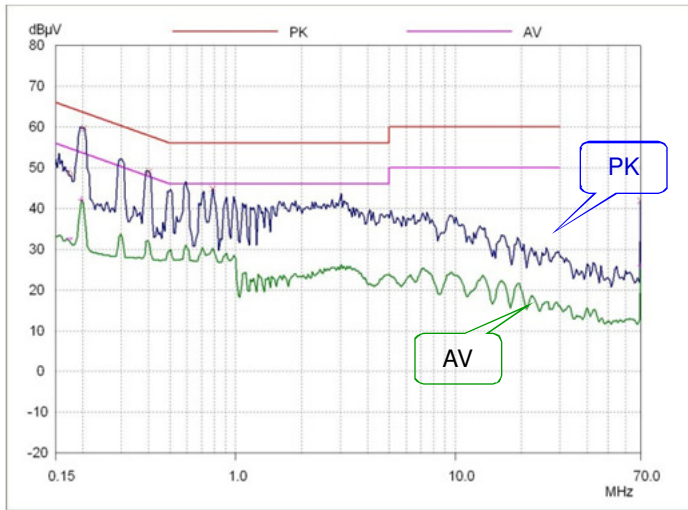
230VAC, Live



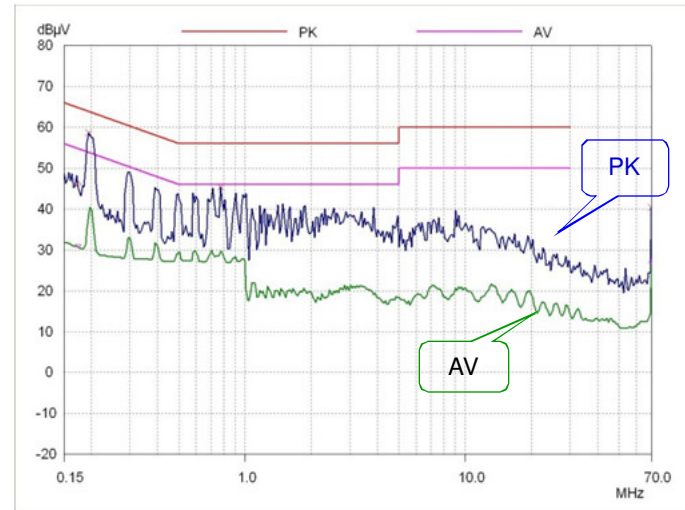
230VAC, Neutral

14.3 Conducted EMI (Output Float, CR, 12V*1.5A)

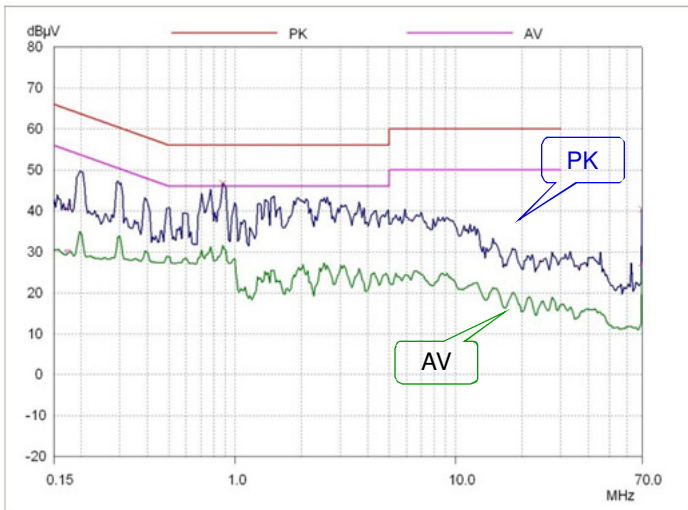
Engineering Report (SC1223K & CHY100D for 5V*2A ; 9V*2A; 12V*1.5A QC Charger)-Rev-1(#45)



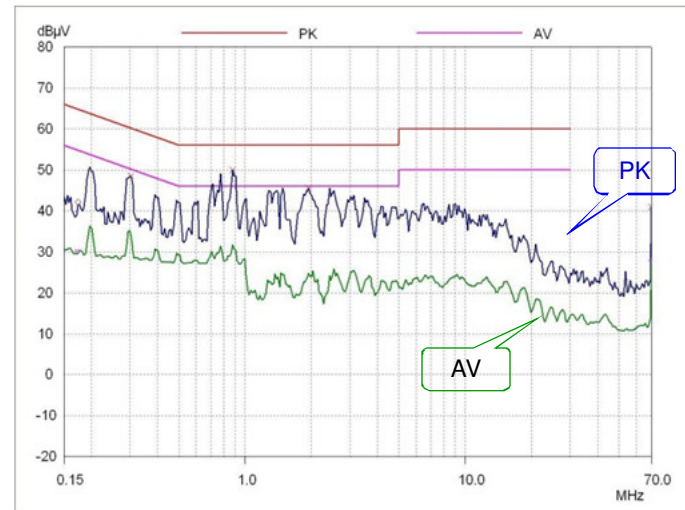
120VAC, Live



120VAC, Neutral



230VAC, Live



230VAC, Neutral

15.1 Radiated EMI PK & AV (Output Floating, CR, 9V*2A@120Vac

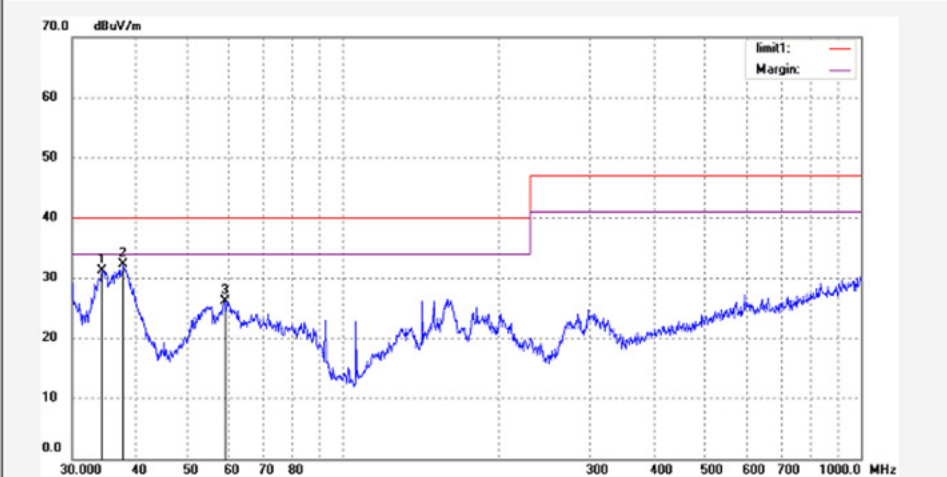


ACCURATE TECHNOLOGY CO., LTD.
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: PI #1350
Standard: EN55022 ClassB Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT:
Mode: FULL LOAD
Model: 9V/2A
Manufacturer:
Polarization: Vertical
Power Source: AC 120V/60Hz
Date: 2014/04/28
Time: 14:35:38
Engineer Signature:
Distance: 3m

Note:



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	34.2852	41.62	-10.35	31.27	40.00	-8.73	peak			
2	37.6970	43.35	-11.02	32.33	40.00	-7.67	peak			
3	59.1052	39.95	-13.76	26.19	40.00	-13.81	peak			

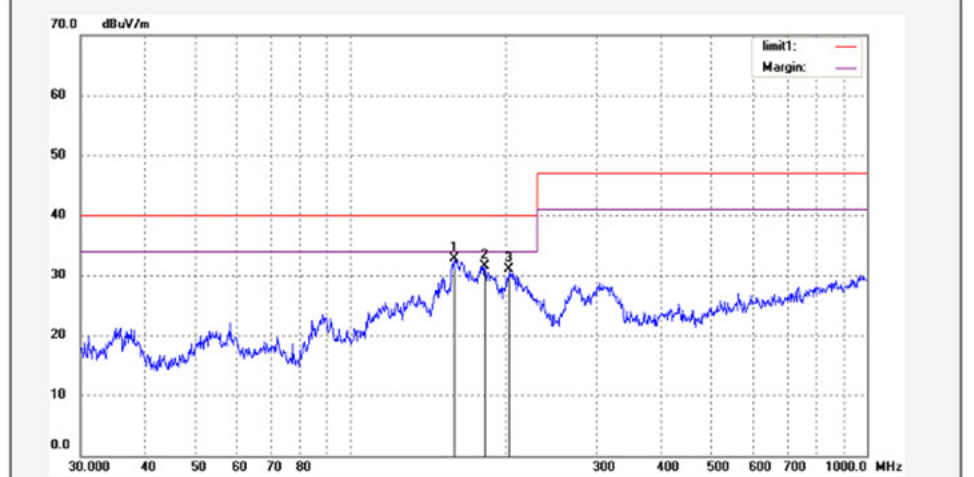


ACCURATE TECHNOLOGY CO., LTD.
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 2# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: PI #1349
Standard: EN55022 ClassB Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT:
Mode: FULL LOAD
Model: 9V/2A
Manufacturer:
Polarization: Horizontal
Power Source: AC 120V/60Hz
Date: 2014/04/28
Time: 14:34:33
Engineer Signature:
Distance: 3m

Note:



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	159.1983	47.49	-14.64	32.85	40.00	-7.15	peak			
2	181.9381	44.82	-13.18	31.64	40.00	-8.36	peak			
3	202.8745	43.35	-12.35	31.00	40.00	-9.00	peak			

15.2 Radiated EMI PK & AV (Output Floating, CR, 9V*2A@230Vac)



ACCURATE TECHNOLOGY CO., LTD.

F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 2# Chamber

Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: PI #1347
Standard: EN55022 ClassB Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT:
Mode: FULL LOAD
Model: 9V/2A
Manufacturer:

Polarization: Vertical
Power Source: AC 230V/50Hz
Date: 2014/04/28
Time: 14:29:46
Engineer Signature:
Distance: 3m

Note:



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	37.1709	43.14	-10.90	32.24	40.00	-7.76	peak			
2	60.1528	39.37	-14.00	25.37	40.00	-14.63	peak			
3	159.1983	44.40	-14.64	29.76	40.00	-10.24	peak			



ACCURATE TECHNOLOGY CO., LTD.

F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

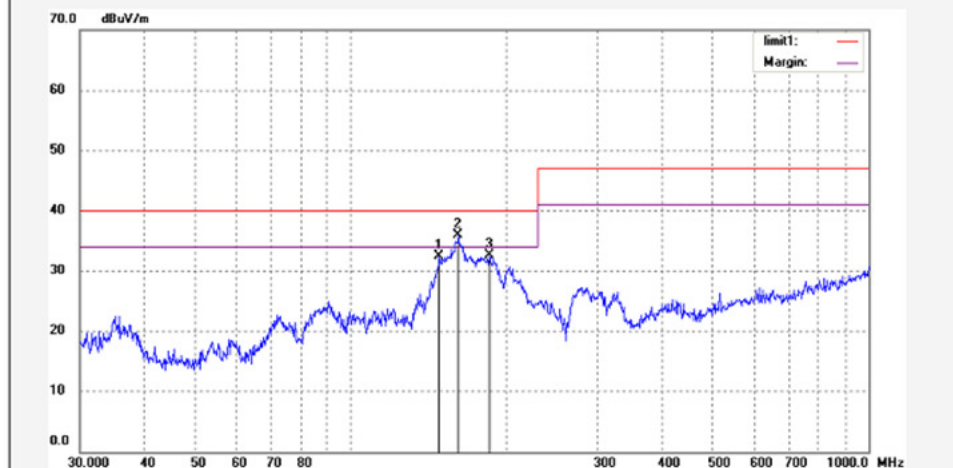
Site: 2# Chamber

Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: PI #1348
Standard: EN55022 ClassB Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 23 C / 48 %
EUT:
Mode: FULL LOAD
Model: 9V/2A
Manufacturer:

Polarization: Horizontal
Power Source: AC 230V/50Hz
Date: 2014/04/28
Time: 14:31:44
Engineer Signature:
Distance: 3m

Note:



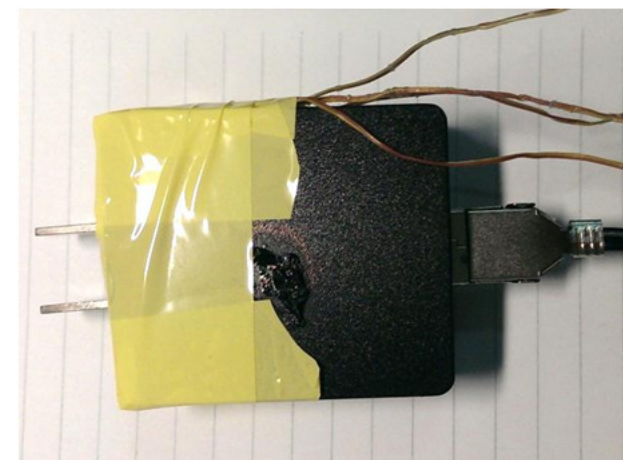
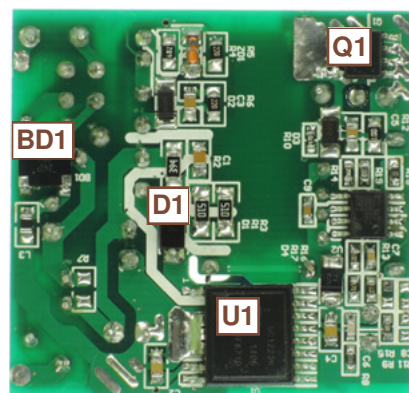
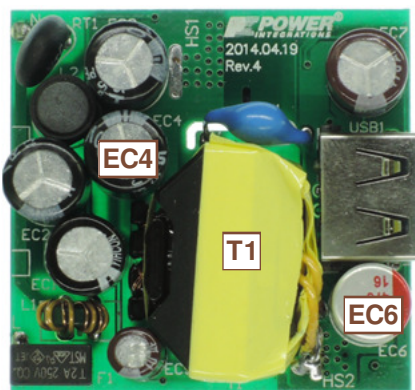
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	148.3951	47.61	-15.18	32.43	40.00	-7.57	peak			
2	161.4515	50.41	-14.52	35.89	40.00	-4.11	peak			
3	185.1626	45.35	-12.71	32.64	40.00	-7.36	peak			

16. Thermal Test (9V*2A)

Device	90VAC 50Hz, 9V*2A		264VAC 50Hz, 9V*2A	
	T (°C)	T _{RISE} (°C)	T (°C)	T _{RISE} (°C)
EC4 (10uF/400V)	88.3	45.0	82.9	39.3
EC6 (470uF/16V)	95.7	52.4	99.0	55.4
T1 (RM8 Winding)	104.5	61.2	106.4	62.8
D1 (M7)	99.1	55.8	94.9	51.3
T1 (Core)	97.0	53.7	99.1	55.5
Q1 (AO4292)	107.4	64.1	111.3	67.7
U1 (SC1223K)	96.5	53.2	95.3	51.7
BD1 (Z4GP20M)	95.2	51.9	76.2	30.6
AMB (°C)	43.3		43.6	

Testing Conditions and Setup :

- Perform under a controlled temperature chamber with restricted air circulation
- PCB is being mounted inside an enclosed simulated plastic housing ;
- Thermal coupler (type-K) are attached to respective measuring points;
- Temperature is recorded after 1 hours from initial turn on.



17.1 Product Specification

SC1223K InnoSwitch™ Family



Off-Line CV/CC Flyback Switcher IC with Integrated MOSFET, Sync-Rect and Feedback

Product Highlights

- Highly Integrated, Compact Footprint**
- Incorporates flyback controller, 650 V MOSFET, secondary-side sensing and synchronous rectification
 - Integrated, HIPOT-isolated, feedback link
 - Exceptional CV/CC accuracy, independent of transformer design or external components
 - Instantaneous transient response $\pm 5\%$ CV with 0-100-0% load step

EcoSmart™ – Energy Efficient

- <10 mW No-load @ 230 VAC with optional bias winding
- Easily meets all global energy efficiency regulations
- Low heat dissipation

Advanced Protection / Safety Features

- Primary sensed output OVP with optional bias winding
- Secondary sensed output overshoot clamp
- Secondary sensed output OCP to zero output voltage
- Hysteretic thermal shutdown

Full Safety and Regulatory Compliance

- 100% production HIPOT compliance testing at 6 kV DC/1 sec
- Reinforced insulation
- Isolation voltage = 3,500 VAC
- UL1577 and TUV (EN60950) safety approved
- EN61000-4-8 (100 A/m) and EN61000-4-9 (1000 A/m) compliant

Green Package

- Halogen free and RoHS compliant

Applications

- Chargers and adapters for smart mobile devices
- LED lighting
- High efficiency, low voltage, high current power supplies

Description

The InnoSwitch family of ICs dramatically simplifies the development and manufacturing of low voltage, high current power supplies, particularly those in compact enclosures or with high efficiency requirements. The InnoSwitch architecture is revolutionary in that the devices incorporate both primary and secondary controllers, with sense elements and a safety-rated feedback mechanism into a single IC.

Close component proximity and innovative use of the integrated communication link permit accurate control of a secondary-side synchronous rectification MOSFET and optimization of primary-side switching to maintain high efficiency across the entire load range. Additionally, the minimal DC bias requirements of the link, enables the system to achieve less than 10 mW no-load in challenging applications such as smart-mobile device chargers.

www.powerint.com

PRELIMINARY

February 2014

This document contains information on a new product. Specifications and information herein are subject to change without notice.

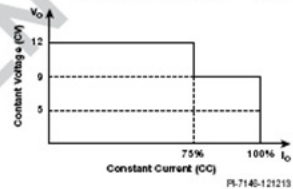
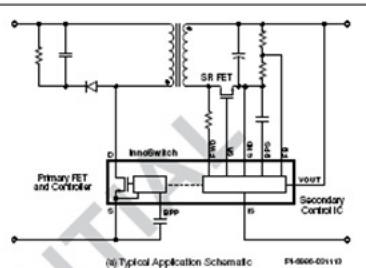


Figure 1. Typical Application Performance.

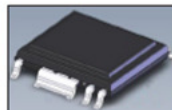


Figure 2. High Creepage, Safety-Compliant uSCP Package.

Output Power Table

Product ²	230 VAC $\pm 15\%$		85-265 VAC	
	Adapter ¹	Peak or Open Frame ³	Adapter ¹	Peak or Open Frame ³
SC1223K	18 W	22 W	18 W	22 W

Table 1. Output Power Table.

- Notes:
1. Minimum continuous power in a typical non-ventilated enclosed adapter measured at 40 °C ambient. Assumes +12 V output.
 2. Minimum peak power capability.
 3. Package: HPC uSCP-P146E.

CHY100 ChiPhy™ Family



Charger Interface Physical Layer IC

Product Highlights

- Fully supports Quick Charge 2.0 specification
- Class A: 5 V, 9 V, and 12 V output voltage
- Class B: 5 V, 9 V, 12 V, and 20 V output voltage
- USB battery charging specification revision 1.2 compatible
- Automatic USB DCP shorting D+ to D- line
- Default 5 V mode operation
- Supports TOPSwitch and TinySwitch
- Very low power consumption
- Below 1 mW at 5 V output
- Fail safe operation
- Adjacent pin-to-pin short-circuit fault
- Open circuit pin fault

Typical Applications

- Battery chargers for smart phones, tablets, netbooks, digital cameras, and bluetooth accessories
- USB power output ports

Description

CHY100 is a low-cost USB high-voltage dedicated charging port (HVDCP) interface IC for the Quick Charge 2.0 specification. It incorporates all necessary functions to add Quick Charge 2.0 capability to Power Integrations' switcher ICs such as TOPSwitch or TinySwitch and other solutions employing traditional feedback schemes.

CHY100 supports the full output voltage range of either Class A or Class B. Optionally Class B can be inhibited for protecting the battery charger from accidental damage.

CHY100 automatically detects whether a connected Powered Device (PD) is Quick Charge 2.0 capable before enabling output voltage adjustment. If a PD not compliant to Quick Charge 2.0 is detected the CHY100 disables output voltage adjustment to ensure safe operation with legacy 5 V only USB PDs.

www.powerint.com

July 2013

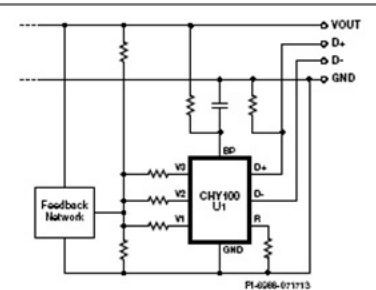



Figure 1. Typical Application Schematic.



Figure 2. Package Option.

17.2 Major Component Specification (SR-FET)



QM0032S

N-Ch 100V Fast Switching MOSFETs

General Description

The QM0032S is the highest performance trench N-ch MOSFETs with extreme high cell density, which provide excellent R_{DS(ON)} and gate charge for most of the synchronous buck converter applications.

The QM0032S meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent Cdv/dt effect decline
- Green Device Available

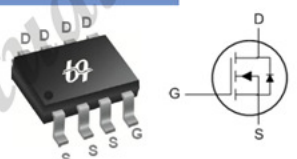
Product Summary

BVDSS	R _{DS(ON)}	ID
100V	22mΩ	7 A

Applications

- Secondary Synchronous Rectifier
- LED TV Back Light

SOP8 Pin Configuration



Absolute Maximum Ratings


Symbol	Parameter	Rating	Units
V _{DS}	Drain-Source Voltage	100	V
V _{GS}	Gate-Source Voltage	±20	V
I _D @T _A =25°C	Continuous Drain Current, V _{GS} @ 10V ¹	7	A
I _D @T _A =70°C	Continuous Drain Current, V _{GS} @ 10V ¹	5	A
I _{DM}	Pulsed Drain Current ²	35	A
EAS	Single Pulse Avalanche Energy ³	16	mJ
I _{AS}	Avalanche Current	13	A
P _D @T _A =25°C	Total Power Dissipation ³	2.5	W
T _{STG}	Storage Temperature Range	-55 to 150	°C
T _J	Operating Junction Temperature Range	-55 to 150	°C

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
R _{θJA}	Thermal Resistance Junction-ambient ¹ (t ≤ 10S)	---	50	°C/W
	Thermal Resistance Junction-ambient ¹ (Steady State)	---	85	°C/W

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1 Rev A.01 D260314C



AO4292

100V N-Channel AlphaMOS

General Description

- Trench Power AlphaMOS (αMOS MV) technology
- Low R_{DS(ON)}
- Low Gate Charge
- Optimized for fast-switching applications
- RoHS and Halogen-Free Compliant


Applications

- Synchronous Rectification in DC/DC and AC/DC Converters
- Isolated DC/DC Converters in Telecom and Industrial

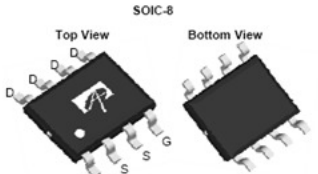
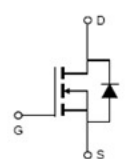
Product Summary

V _{DS}	100V
I _D (at V _{GS} =10V)	8A
R _{DS(ON)} (at V _{GS} =10V)	< 23mΩ
R _{DS(ON)} (at V _{GS} =4.5V)	< 33mΩ

100% UIS Tested
100% Rg Tested



SOIC-8

Orderable Part Number	Package Type	Form	Minimum Order Quantity
AO4292	SO-8	Tape & Reel	3000

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V _{DS}	100	V
Gate-Source Voltage	V _{GS}	±20	V
Continuous Drain Current	I _D	T _A =25°C	8
		T _A =70°C	6.2
Pulsed Drain Current ^C	I _{DM}		32
Avalanche Current ^C	I _{AS}	15	A
Avalanche energy L=0.1mH ^C	E _{AS}	11	mJ
V _{DS} Spike	V _{SPIKE}	120	V
Power Dissipation ^B	P _D	T _A =25°C	3.1
		T _A =70°C	2.0
Junction and Storage Temperature Range	T _J , T _{STG}	-55 to 150	°C

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	R _{θJA}	t ≤ 10s	31	°C/W
Maximum Junction-to-Ambient ^{A,D}		Steady-State	59	°C/W
Maximum Junction-to-Lead	R _{θJL}	16	24	°C/W

18.1 QC 2.0 Test Setup (HVDCP Simulator with E-Load)

Engineering Report (SC1223K & CHY100D for 5V*2A ; 9V*2A; 12V*1.5A QC Charger)-Rev-1(#45)

D+	D-	Output	Switch Status
0.6 V	0.6 V	12 V	N1 = N2 = On, N3 = Off
3.3 V	0.6 V	9 V	N1 = On, N2 = N3 = Off
3.3 V	3.3 V	20 V	N1 = N2 = N3 = On
0.6 V	GND	5 V (default)	N1 = N2 = N3 = Off

Table 1. Output Voltage Lookup Table.

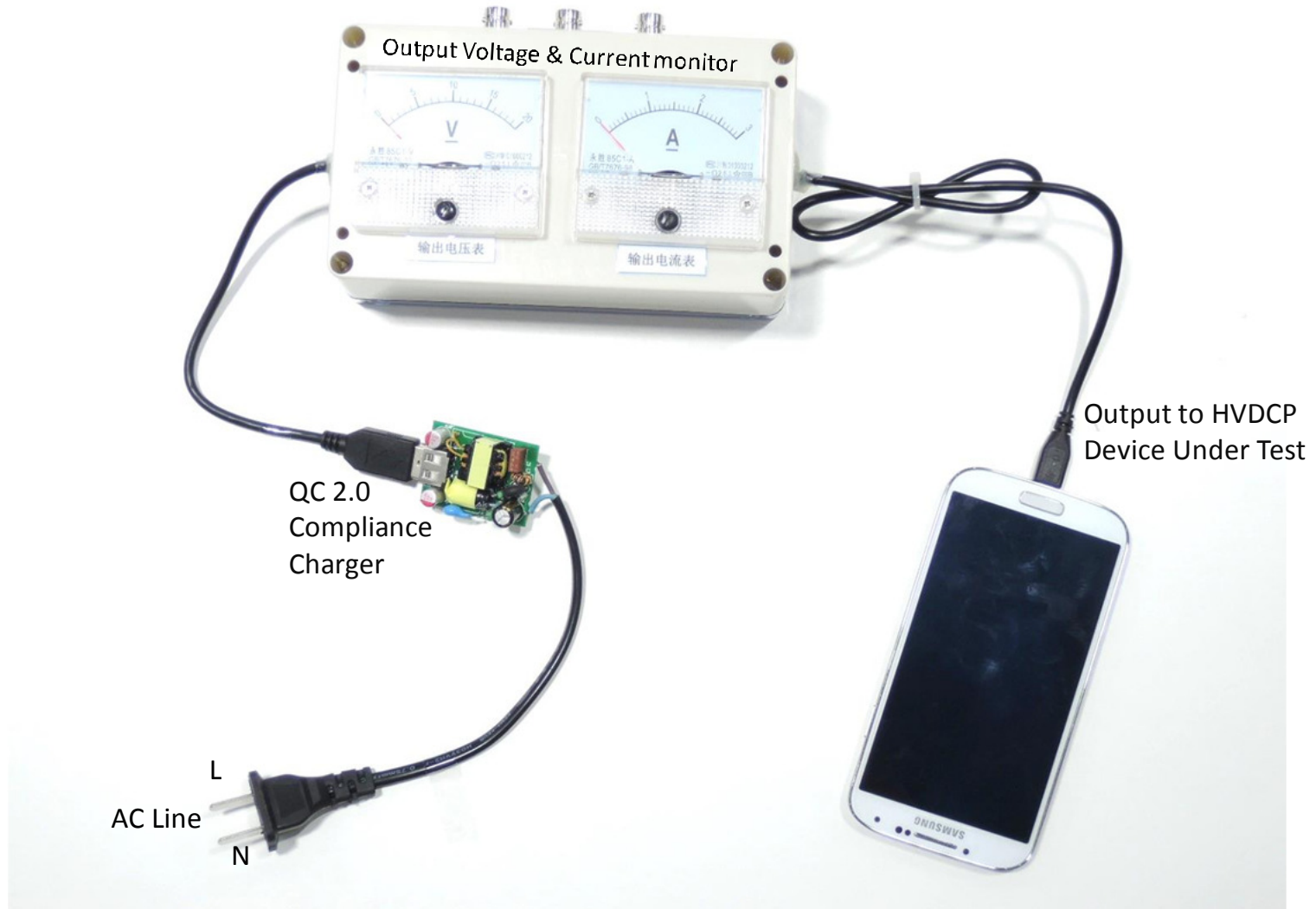
QC 2.0
Compliance
Charger

AC Line

HVDCP Simulator
(To select different
charging voltage)

Output to
Electronics
load

18.2 QC 2.0 Test Setup (HVDCP Device Under Test)



19. Change revision History

Revision History				
Date	Author	Revision	Description & changes	Reviewed
4-Apr-2014	ZL	Rev-1	First Release	EH Quek

China Sale Contacts and Important Note

China Sales Contacts

CHINA (Shanghai)

Room 2410, Charity Plaza,
No. 88, North Caoxi Road,
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