Texas Instruments

PMP4432 Test Procedure

China Power Reference Design

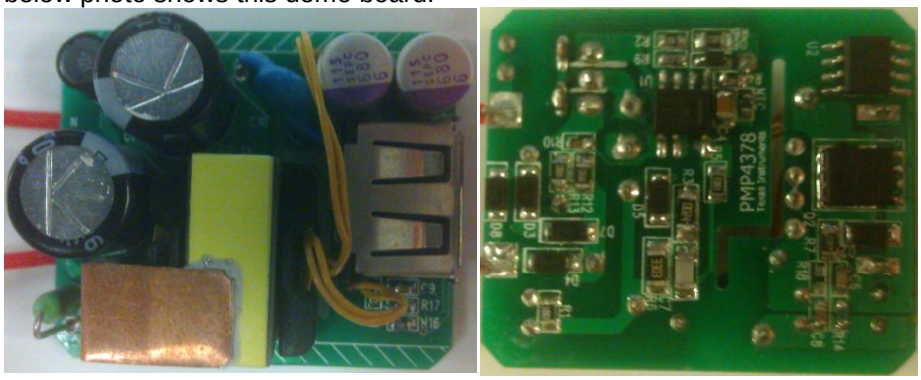
REV A

7/25/2014

1 GENERAL

1.1 PURPOSE

To provide detailed data for evaluating and verifying the PMP4432, which uses TI new Primary Side Controller UCC28713 5V2A adapter with size 37mmx31mmx15mm. The below photo shows this demo board.



1.2 REFERENCE DOCUMENTATION

Schematic PMP4432_SCH.PDF
Assembly PMP4432_PCB.PDF
BOM
Promotion tools

1.3 TEST EQUIPMENTS

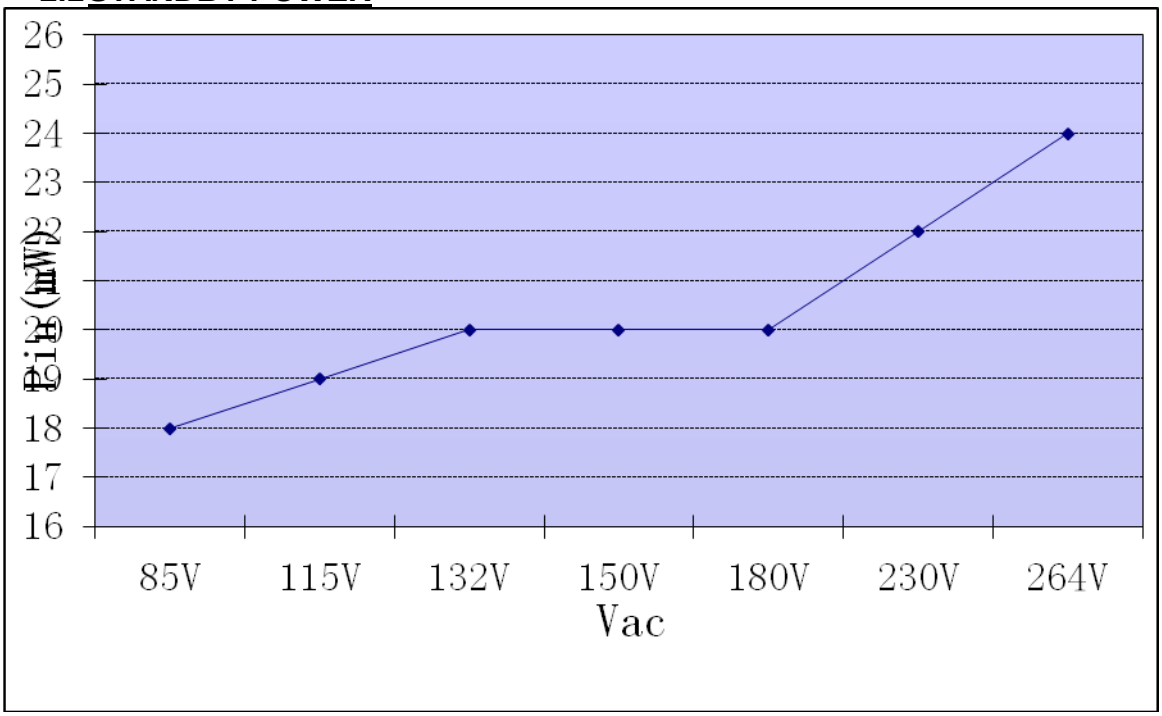
Power-meter: YOKOGAWA WT210
Multi-meter(current): Fluke 8845A
Multi-meter(voltage): Fluke 187
AC Source: Chroma 61530
Electronic load: Chroma 63105A module
Testing demoboard

2 INPUT CHARACTERISTICS

Efficiency is tested on USB-end

Otherwise Specified, the test is under the condition with 100cm cable

2.1 STANDBY POWER



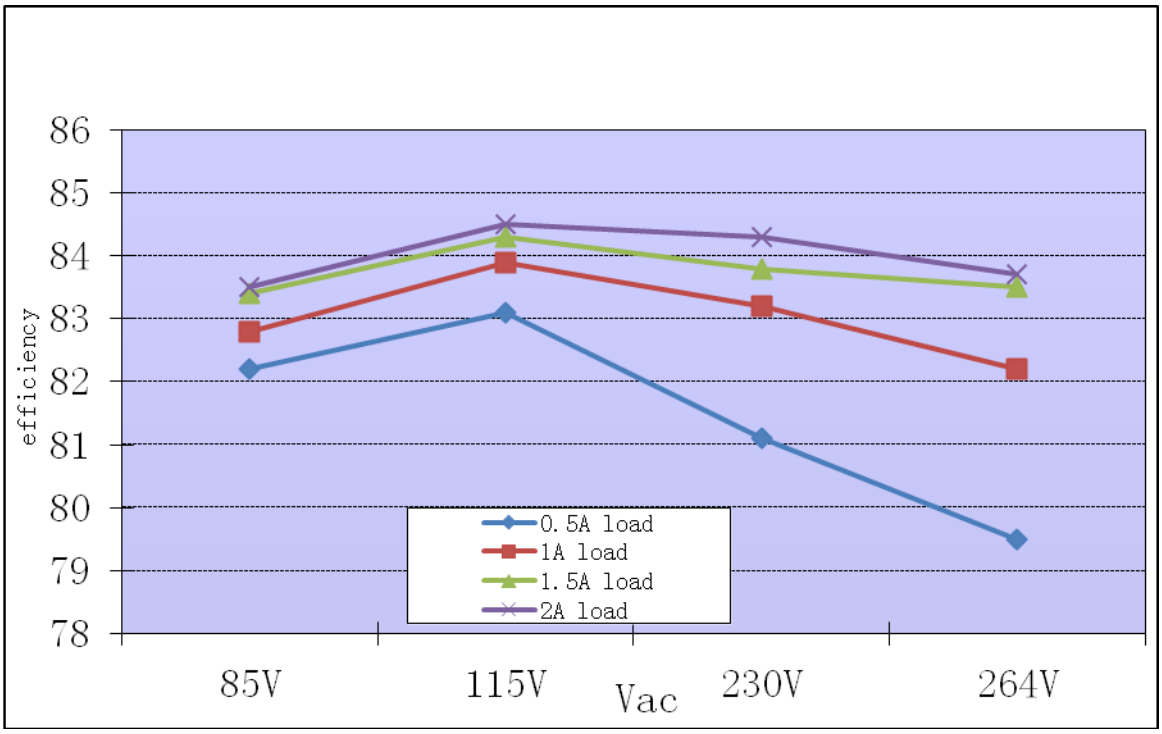
2.2 EFFICIENCY DATA

Notes: efficiency test is based USB port

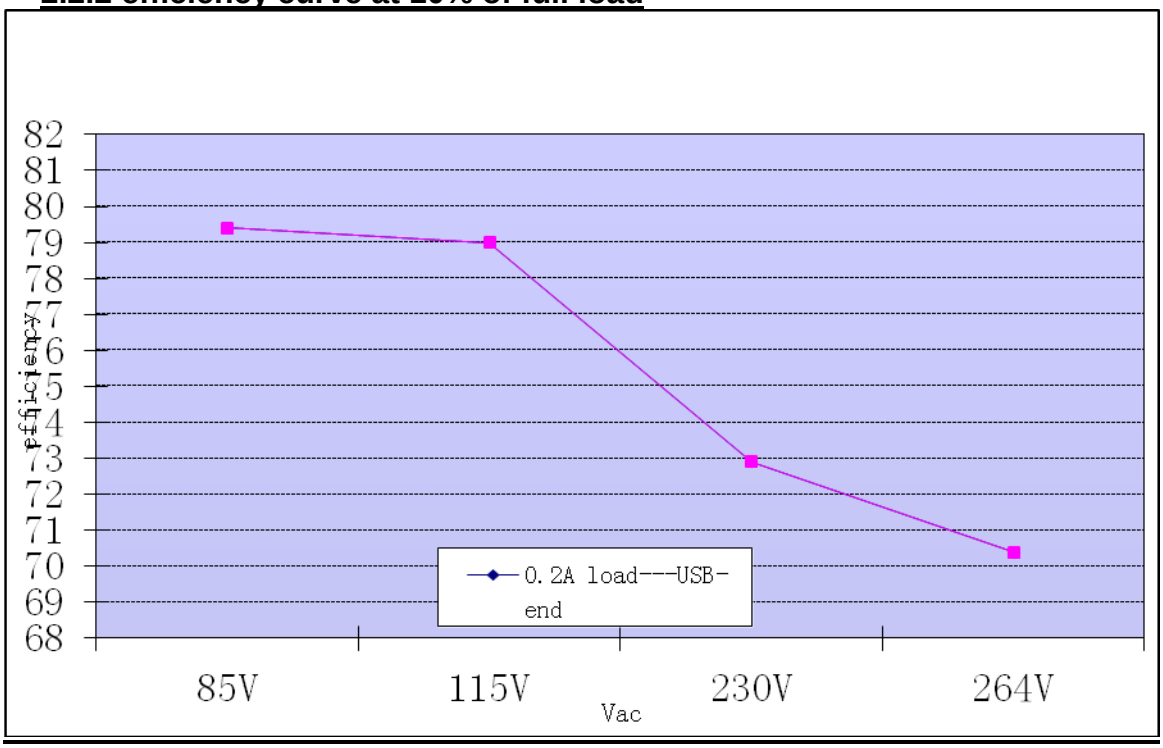
85v			
Pi(w)	Io(A)	Vo(V)	efficiency
1.264	0.2	5.019	0.794
3.077	0.5	5.056	0.822
6.207	1	5.127	0.826
9.35	1.5	5.2	0.834
12.62	2	5.272	0.835
230v			
Pi(w)	Io(A)	Vo(V)	efficiency
1.375	0.2	5.011	0.729
3.108	0.5	5.04	0.811
6.153	1	5.119	0.832
9.286	1.5	5.186	0.838
12.49	2	5.262	0.843

115v			
Pi(w)	Io(A)	Vo(V)	efficiency
1.268	0.2	5.011	0.79
3.033	0.5	5.043	0.831
6.104	1	5.12	0.839
9.25	1.5	5.199	0.843
12.48	2	5.27	0.845
264v			
Pi(w)	Io(A)	Vo(V)	efficiency
1.422	0.2	5.005	0.704
3.165	0.5	5.033	0.795
6.171	1	5.112	0.828
9.314	1.5	5.183	0.835
12.56	2	5.258	0.837

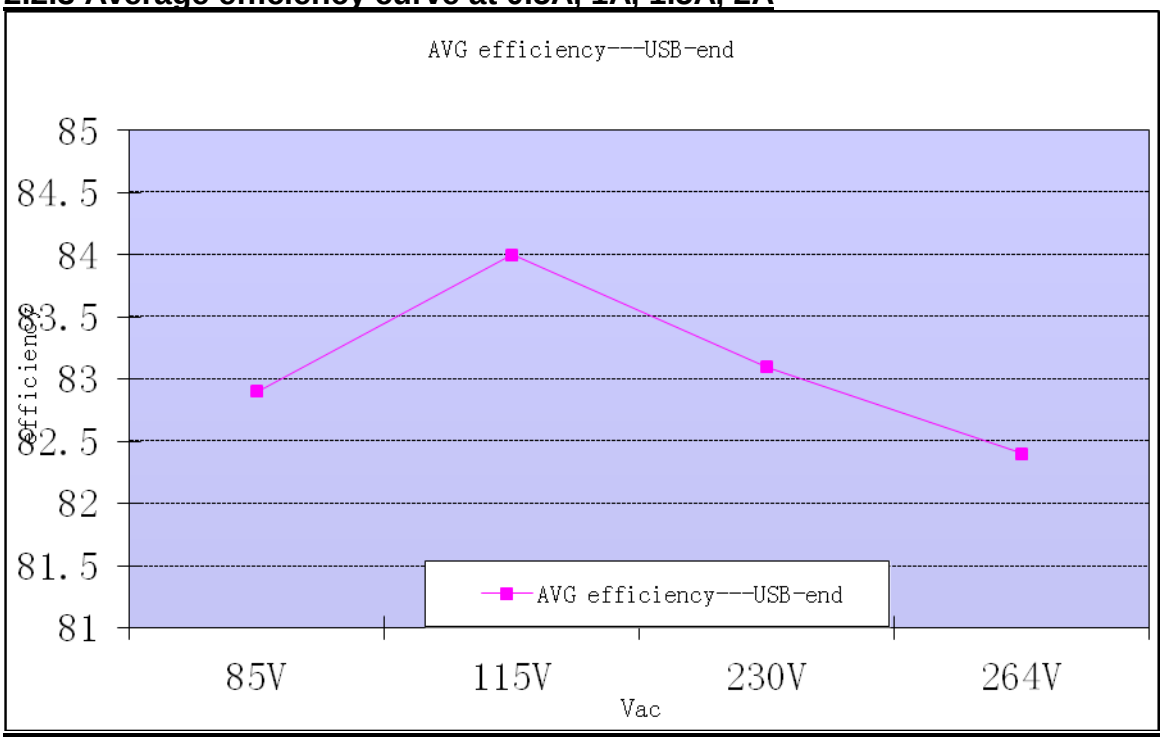
2.2.1 Load and input voltage Vs efficiency curve tested at USB-end



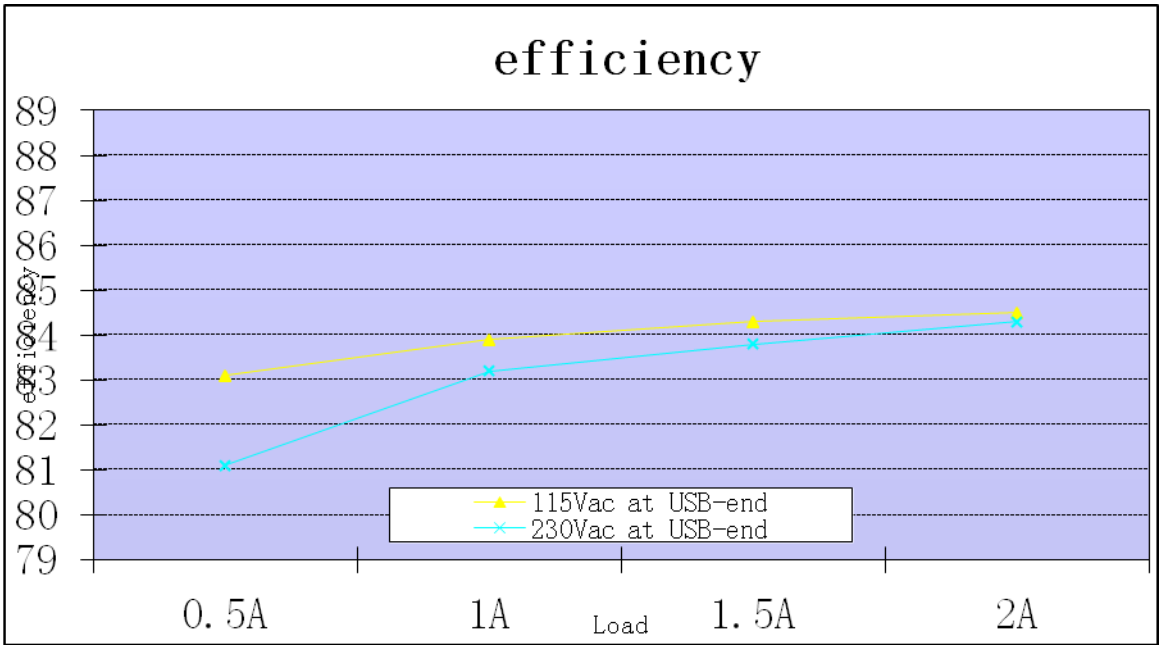
2.2.2 efficiency curve at 10% of full load



2.2.3 Average efficiency curve at 0.5A, 1A, 1.5A, 2A



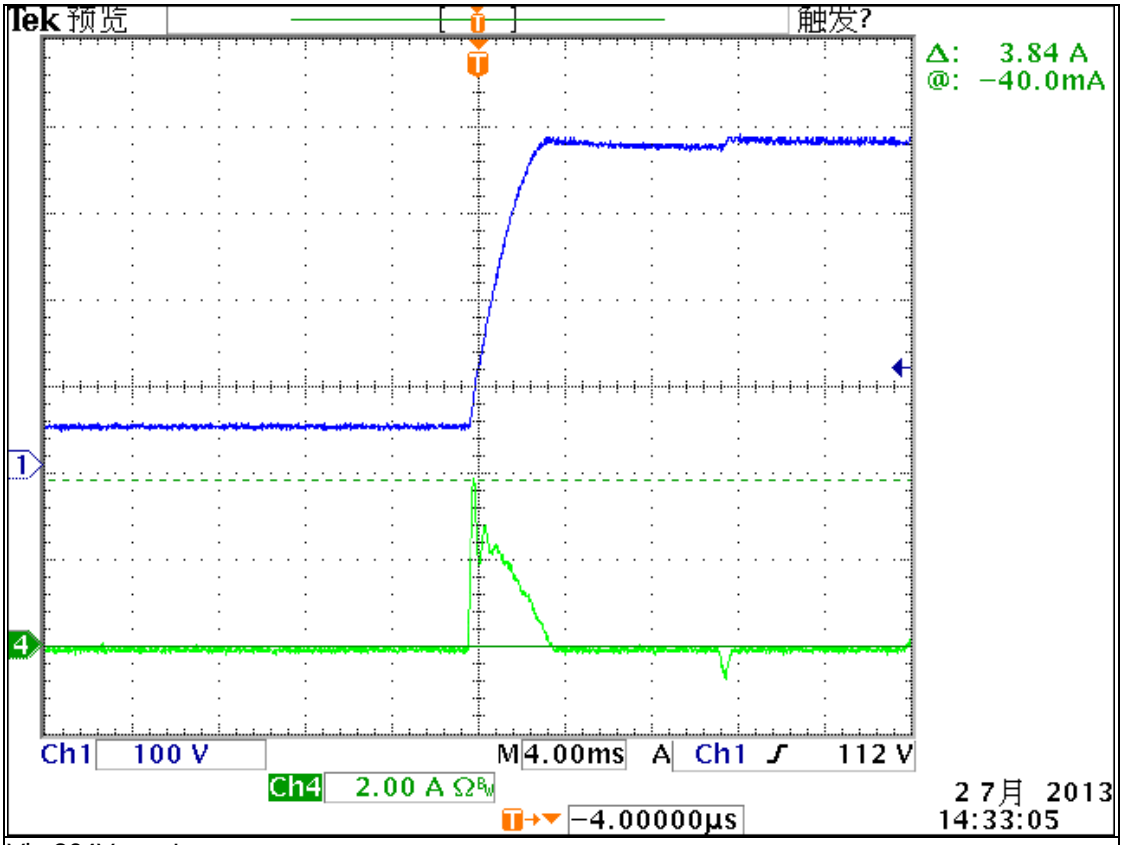
2.2.4 Efficiency Vs load curve



2.3 INPUT CURRENT

Vin(Vac)	Freq(Hz)	Iin(Arms)	Pass/Fail
85	60	**0.28**	

2.4 INPUT INRUSH CURRENT

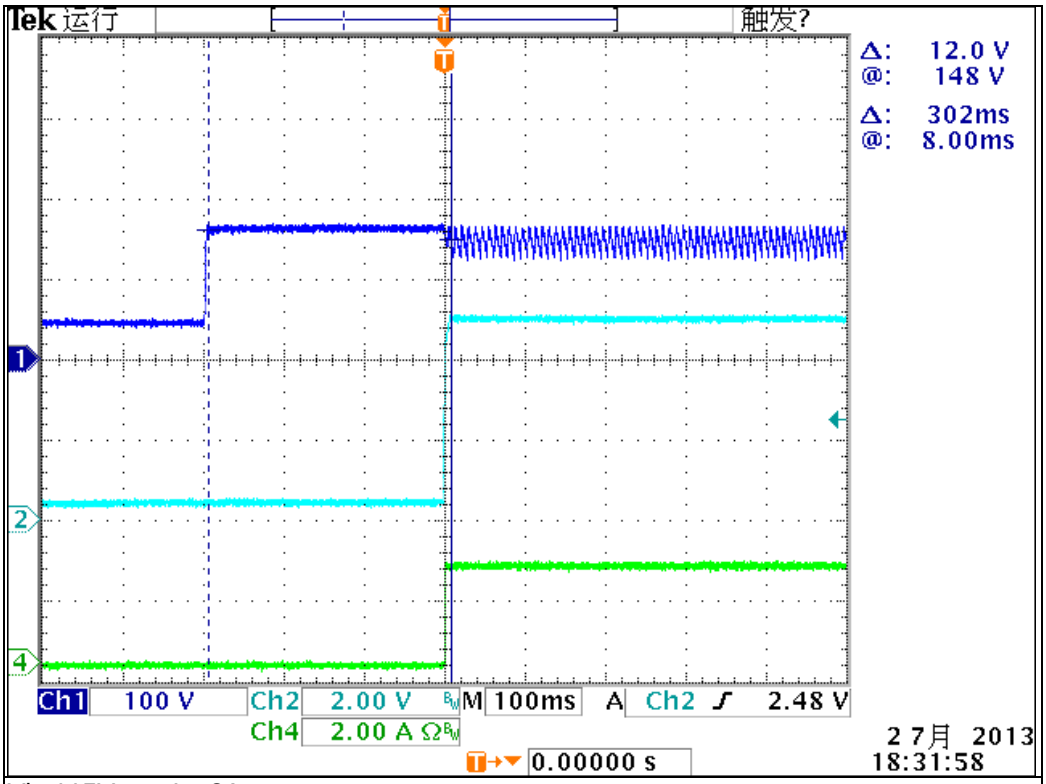


Vin:264Vac Io: 2 A
Ch1: Input bulk CAP voltage 100V/div
Ch4: Input inrush current 2A/div

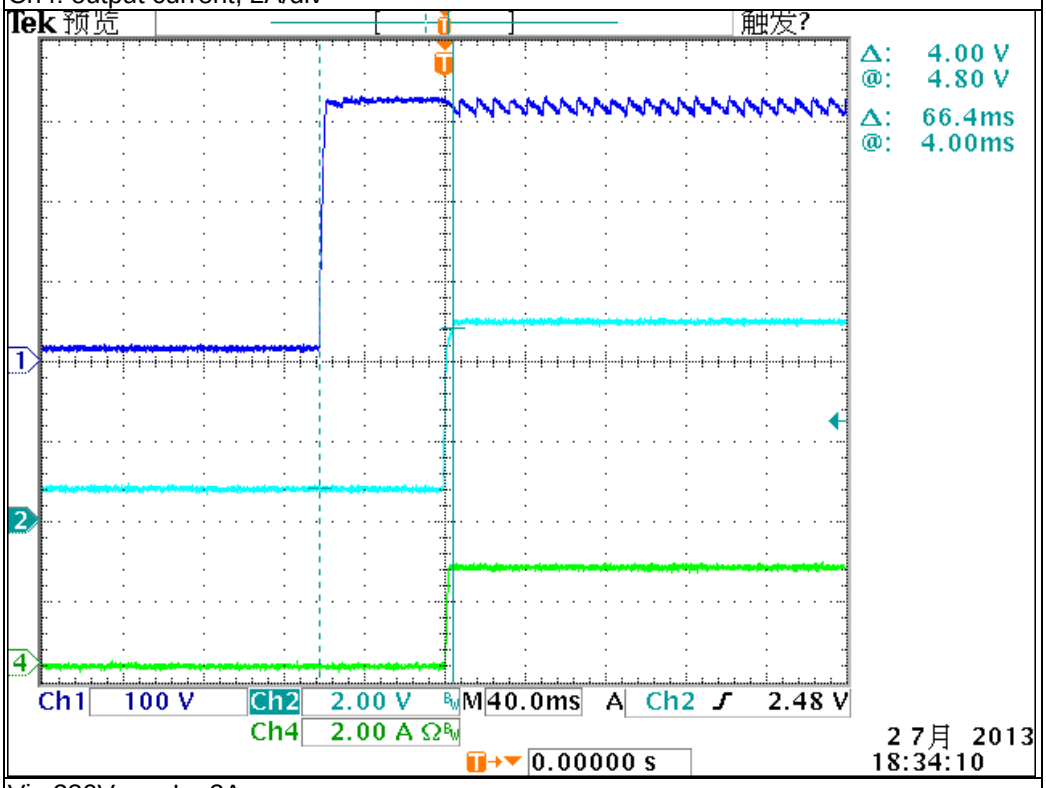
3 OUTPUT CHARACTERISTICS

3.1 STARTUP TIME

Input voltage	Output current	Startup time	Pass/Fail
115Vac	2A	**302mS**	
230Vac	2A	**66.4mS**	



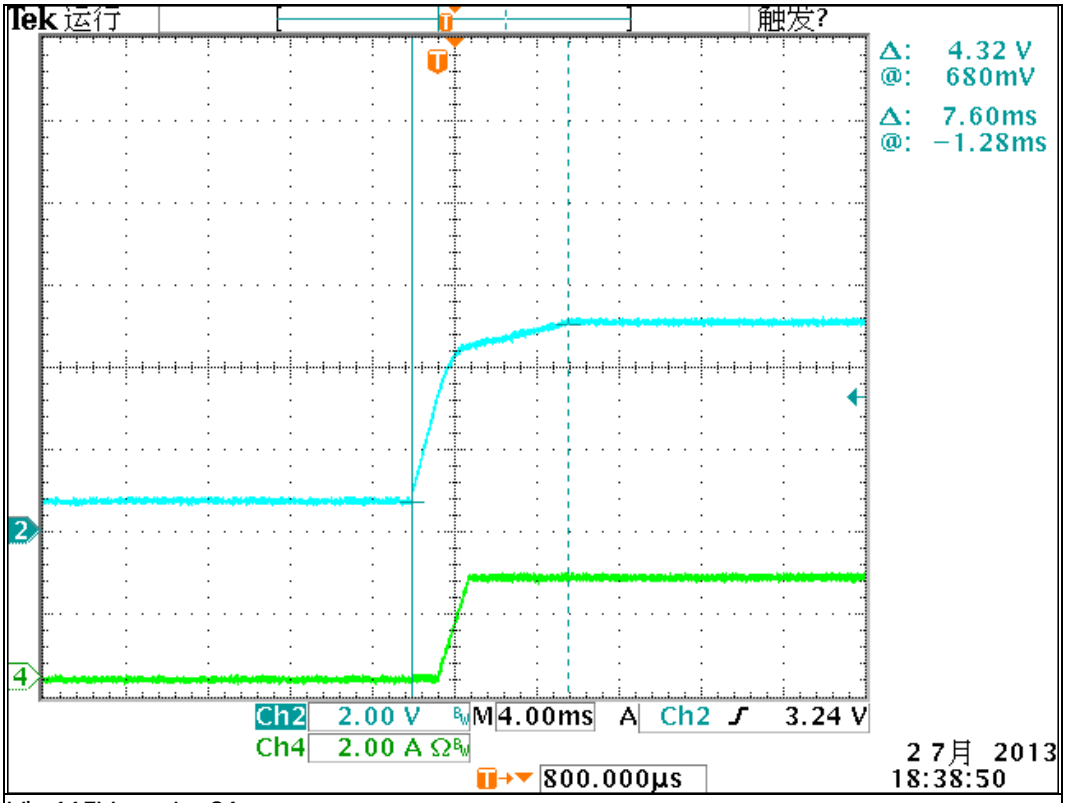
Vin:115Vac Io: 2A
Ch1: MOSFET's drain voltage, 100V/div Ch2: output voltage, 2V/div
Ch4: output current, 2A/div



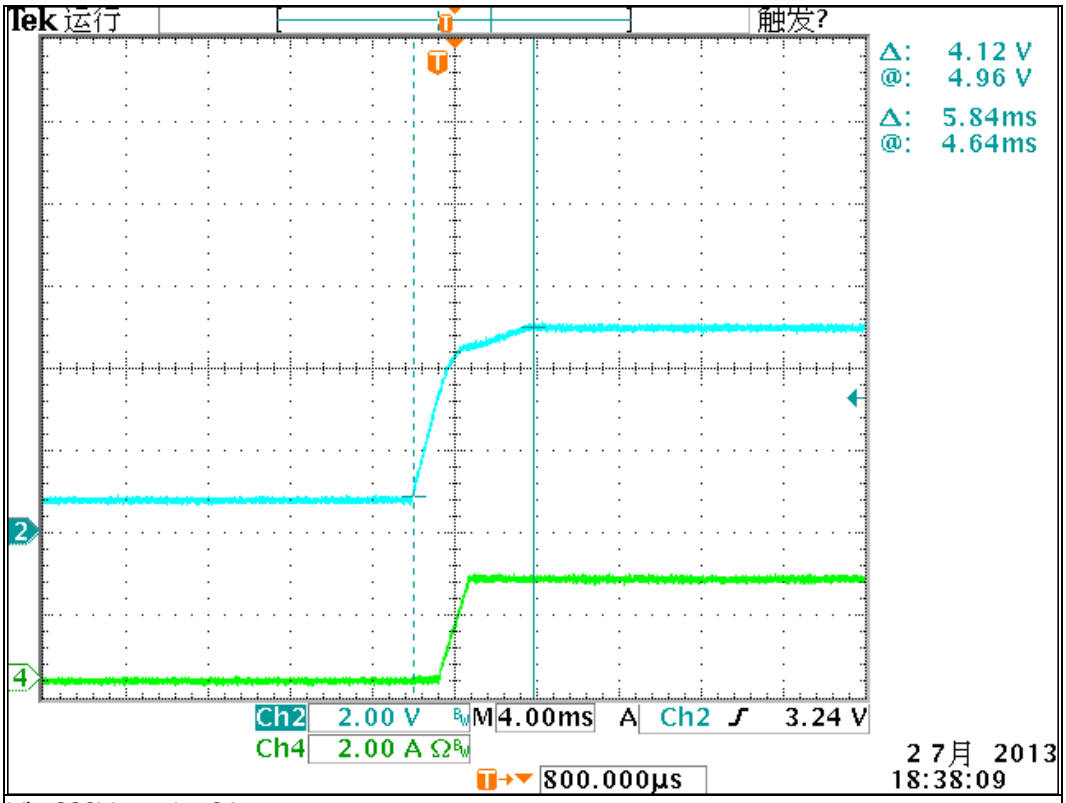
Vin:230Vac Io: 2A
Ch1: MOSFET's drain voltage, 100V/div Ch2: output voltage, 2V/div
Ch4: output current, 2A/div

3.2 OUTPUT VOLTAGE RISE TIME

Input voltage	Output current	Startup time	Pass/Fail
115Vac	2A	**7.6mS**	
230Vac	2A	**5.84mS**	



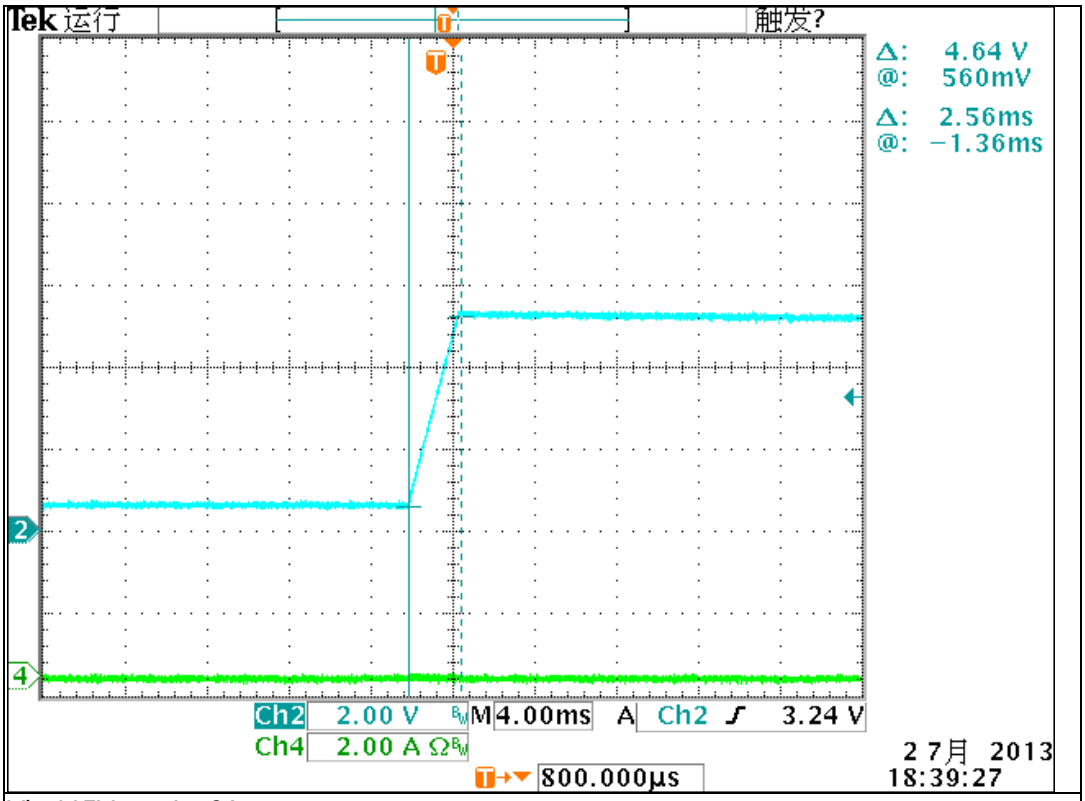
Vin:115Vac Io: 2A
Ch2: output voltage, 2V/div
Ch4: output current, 2A/div



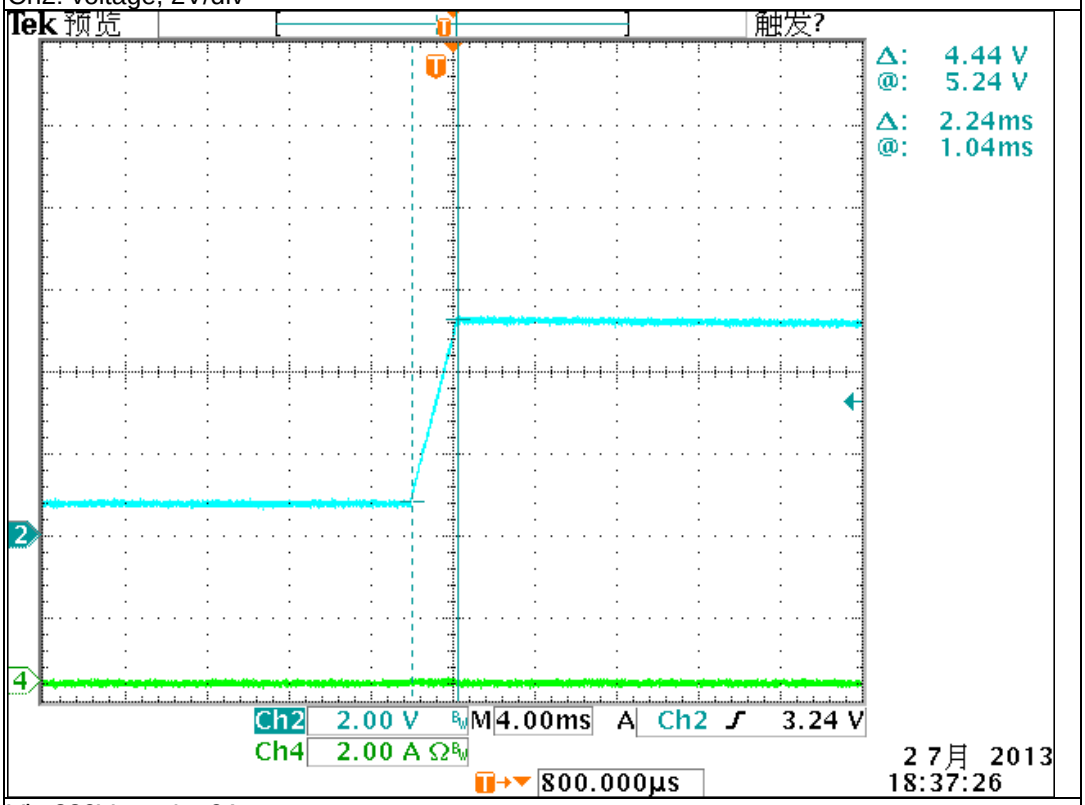
Vin:230Vac Io: 2A
Ch2: output voltage, 2V/div
Ch4: output current, 2A/div

3.3 OUTPUT VOLTAGE OVERSHOOT

Input voltage	Output current	overshoot voltage	Pass/Fail
115Vac	0A	**<1%**	
230Vac	0A	**<1%**	



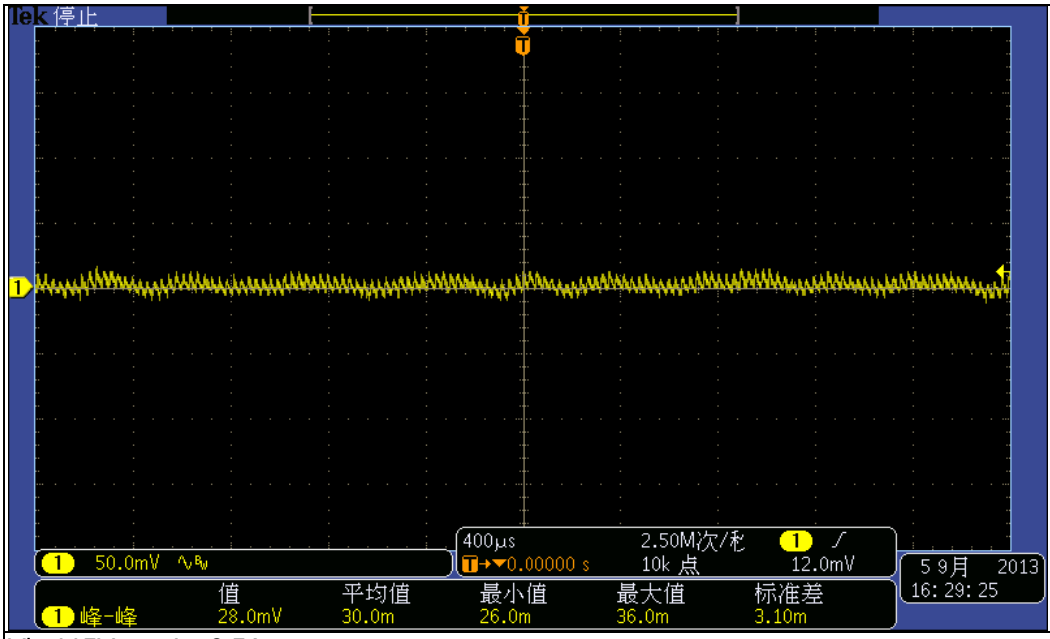
Vin:115Vac Io: 0A
Ch2: voltage, 2V/div



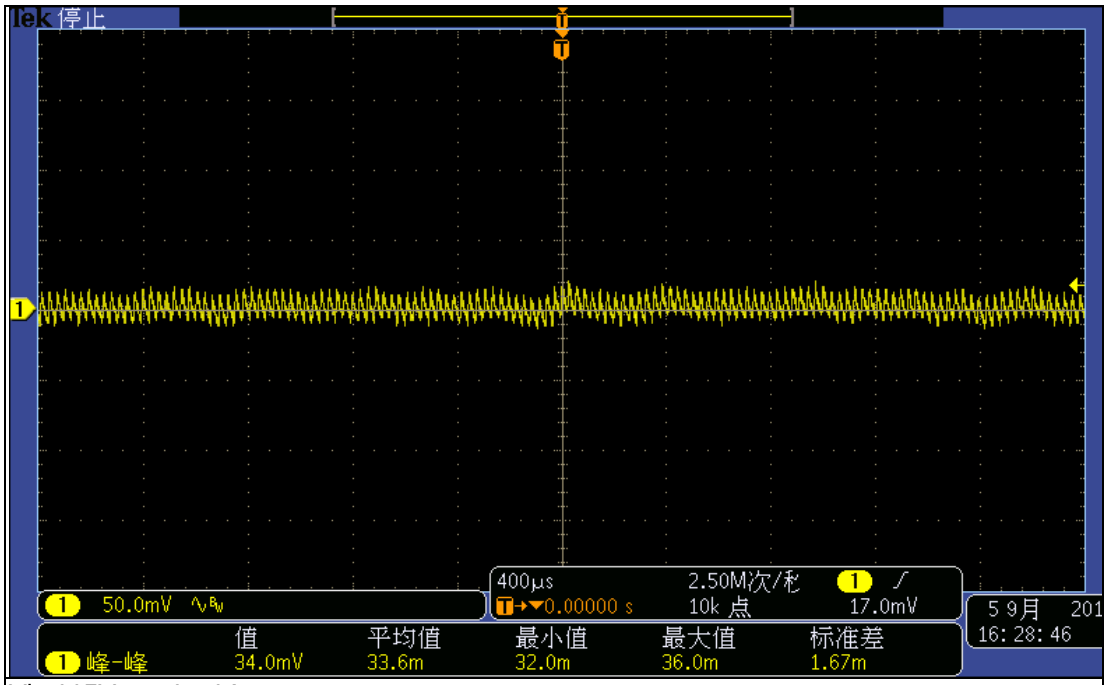
Vin:230Vac Io: 0A
Ch2: output voltage, 2V/div

3.4 RIPPLE VOLTAGE

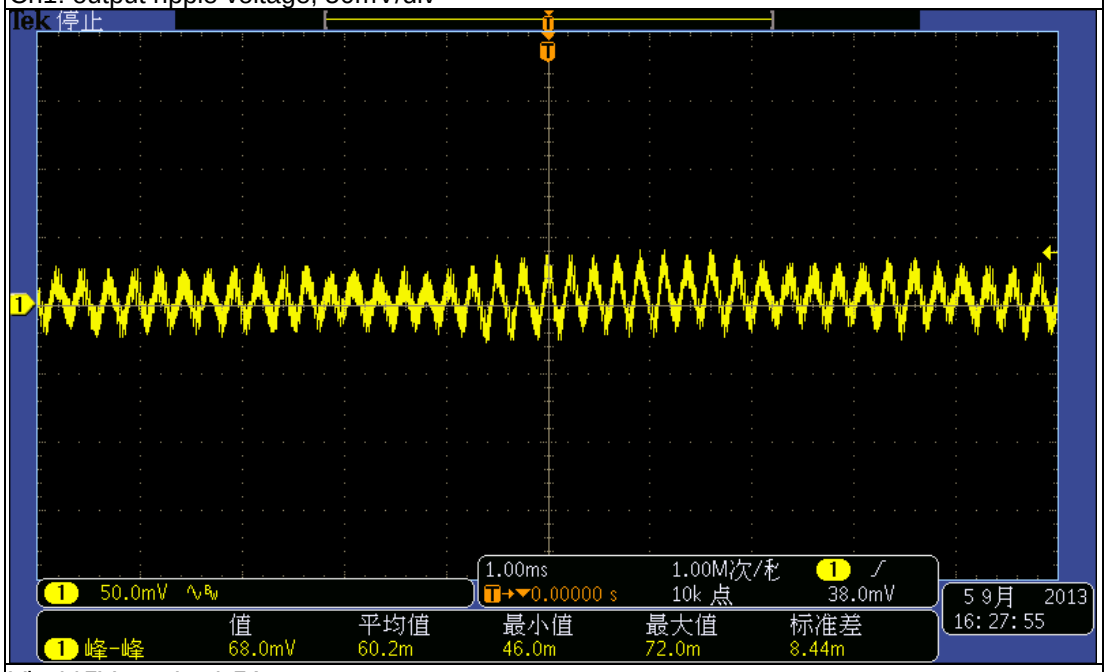
Input voltage	Output current	Ripple voltage	Pass/Fail
115Vac	0.5A	**28mV**	
115Vac	1A	**34mV**	
115Vac	1.5A	**68mV**	
115Vac	2A	**56mV**	
230Vac	0.5A	**30mV**	
230Vac	1A	**32mV**	
230Vac	1.5A	**48mV**	
230Vac	2A	**66mV**	



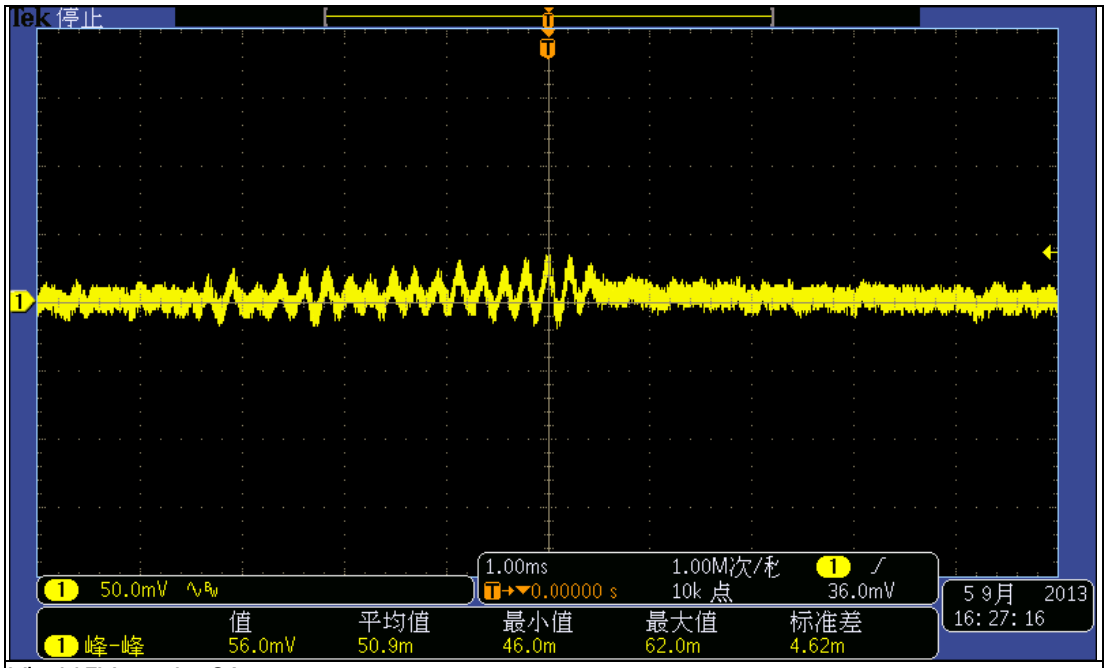
Vin:115Vac Io: 0.5A
Ch1: output ripple voltage, 50mV/div



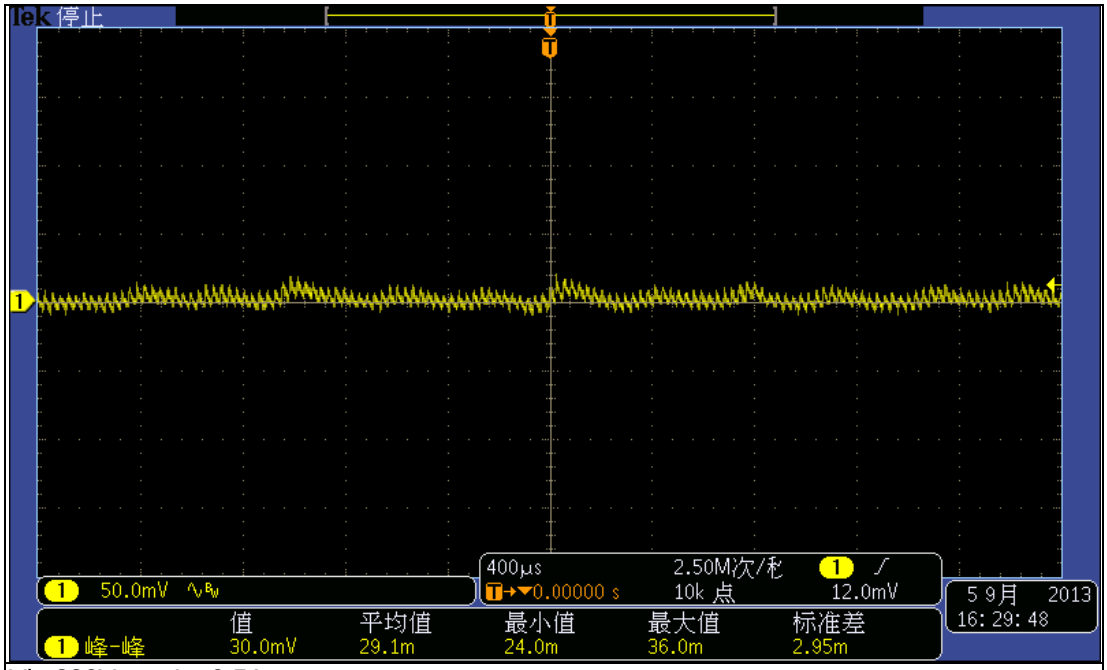
Vin:115Vac Io: 1A
Ch1: output ripple voltage, 50mV/div



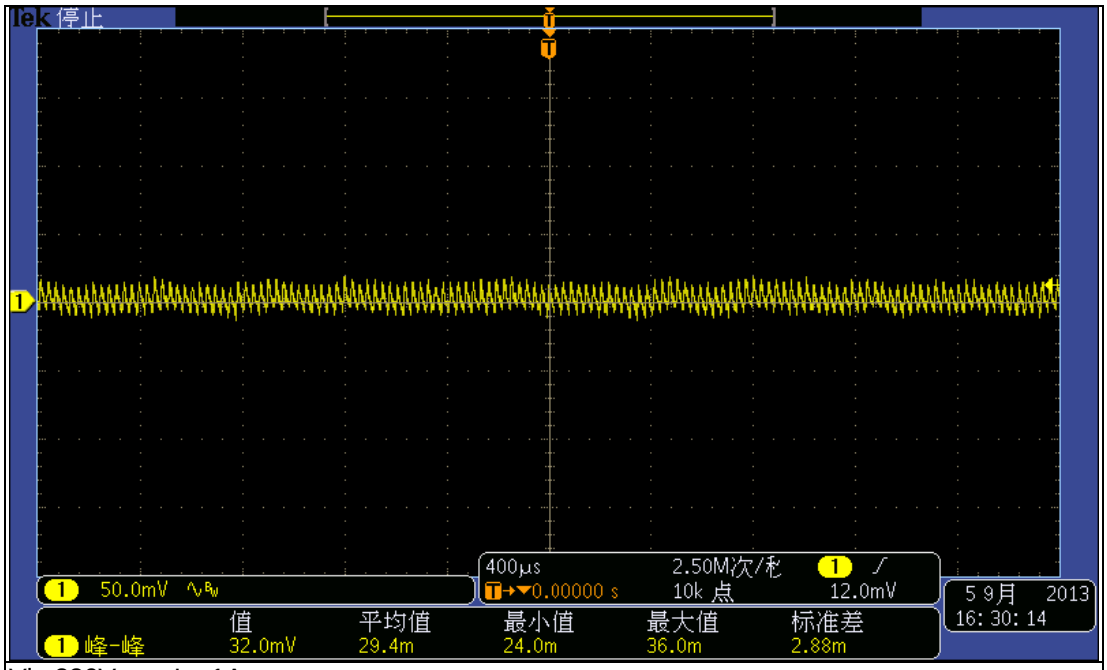
Vin:115Vac Io: 1.5A
Ch1: output ripple voltage, 50mV/div



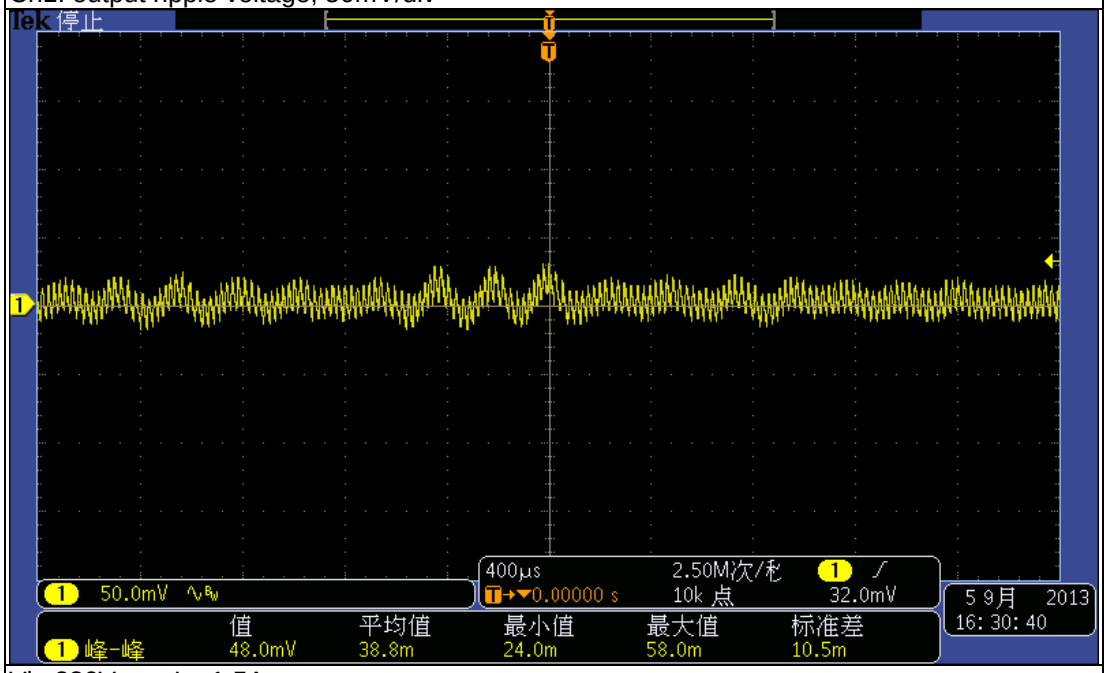
Vin:115Vac Io: 2A
Ch1: output ripple voltage, 50mV/div



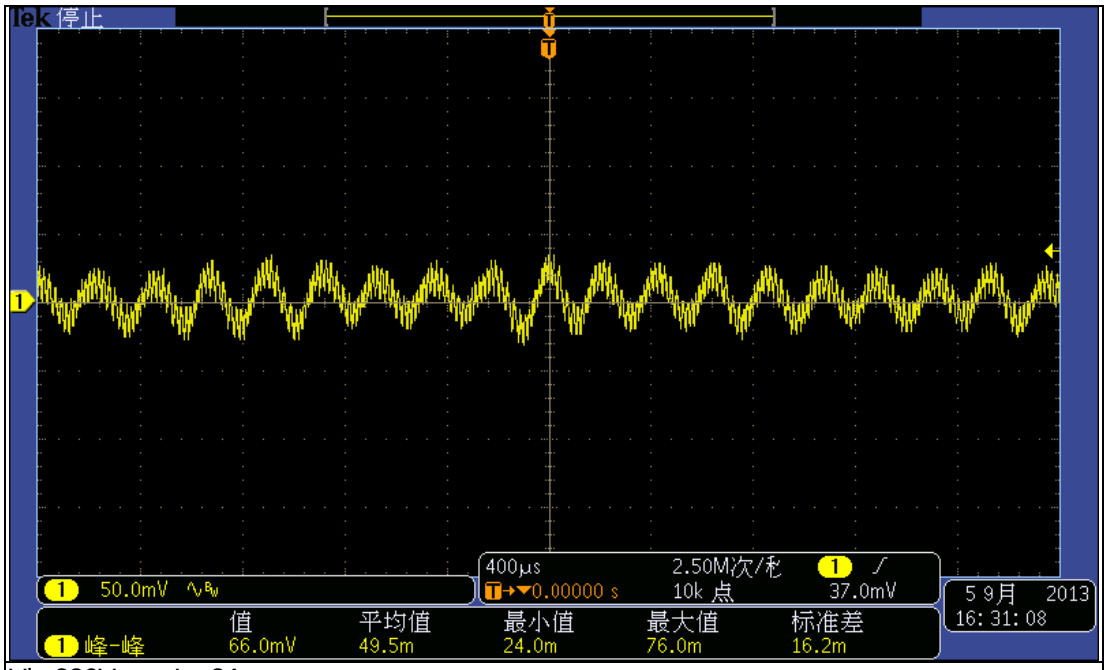
Vin:230Vac Io: 0.5A
Ch1: output ripple voltage, 50mV/div



Vin:230Vac Io: 1A
Ch1: output ripple voltage, 50mV/div



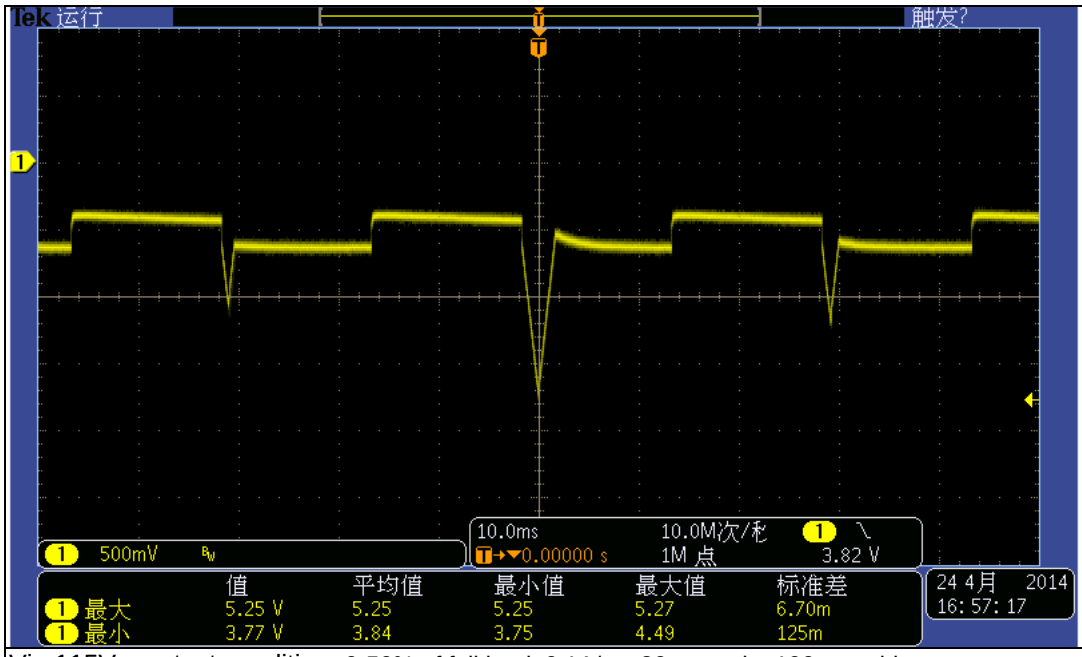
Vin:230Vac Io: 1.5A
Ch1: output ripple voltage, 50mV/div



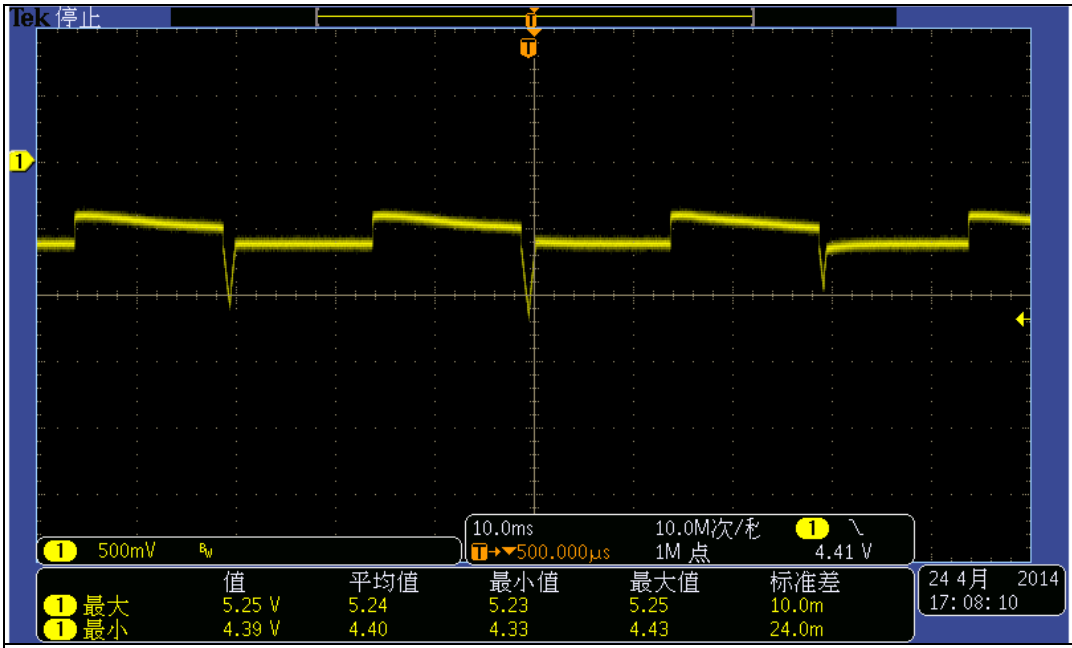
Vin:230Vac Io: 2A
Ch1: output ripple voltage, 50mV/div

3.5 DYNAMIC RESPONSE

Input voltage	Output current	Max voltage	Min voltage
115Vac	0-50% of full load	**5.25V**	**3.77V**
115Vac	0-50% of full load with 10mA pre-load	**5.25V**	**4.39V**



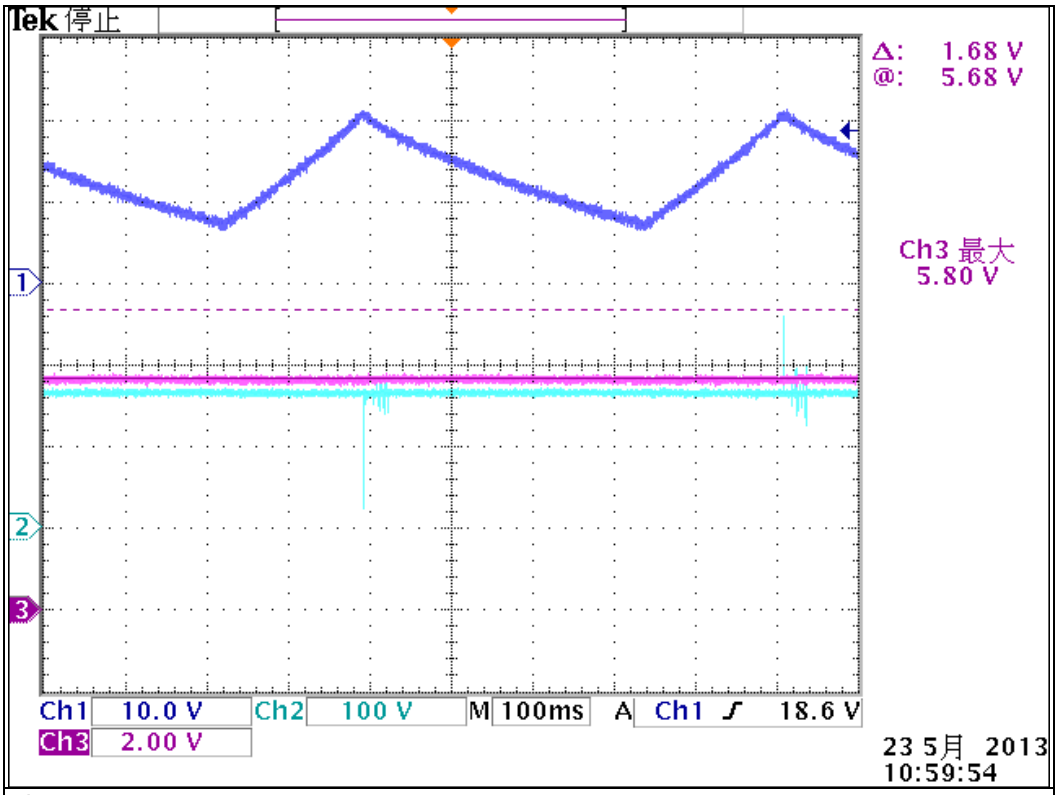
Vin:115Vac test condition: 0-50% of full load, 0.1A/us, 30ms cycle, 100cm cable
Ch1: output voltage



Vin:115Vac
test condition: 0-50% of full load with 10mA pre-load, 0.1A/us, 30ms cycle, 100cm cable
Ch1: output voltage

3.6 OUTPUT VOLTAGE PROTECTION

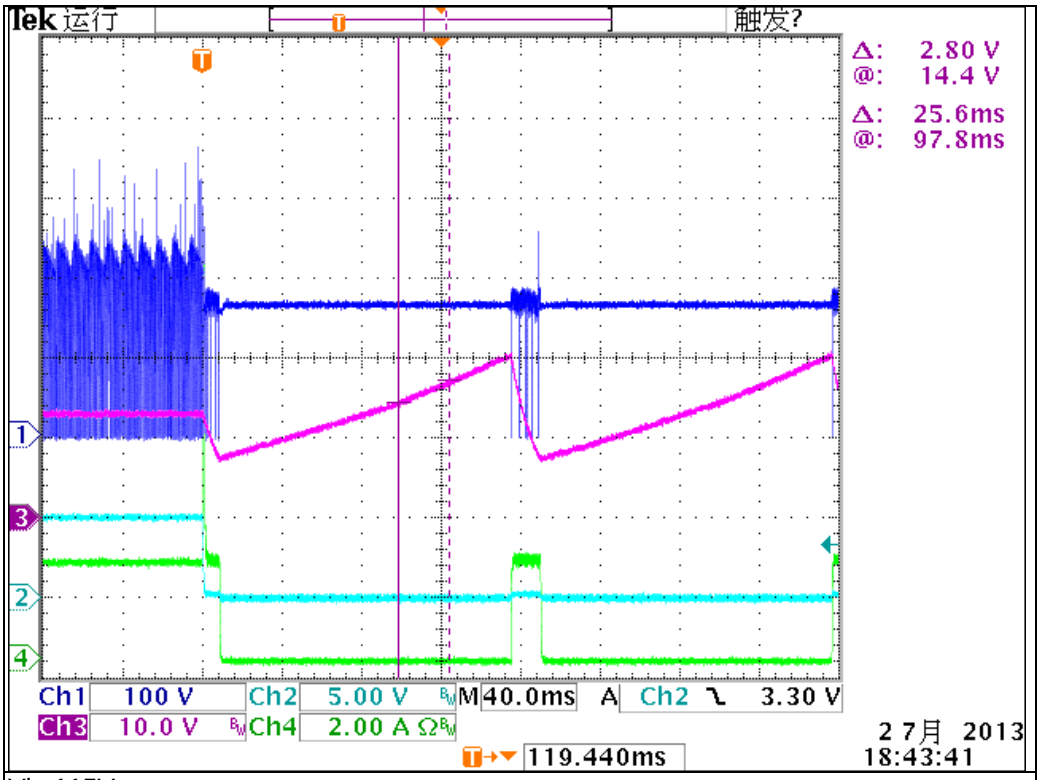
CONDITIONS Vin (Vac)	Protection voltage（V）	Pass/Fail
115&230	5.8	



Vin: 115Vac OVP: 5.8V
CH1: Vdd voltage, 10V/div
CH2: Vds voltage of MOSFET, 100V/div
CH3: output voltage, 2V/div

3.7 OUTPUT SHORT PROTECTION

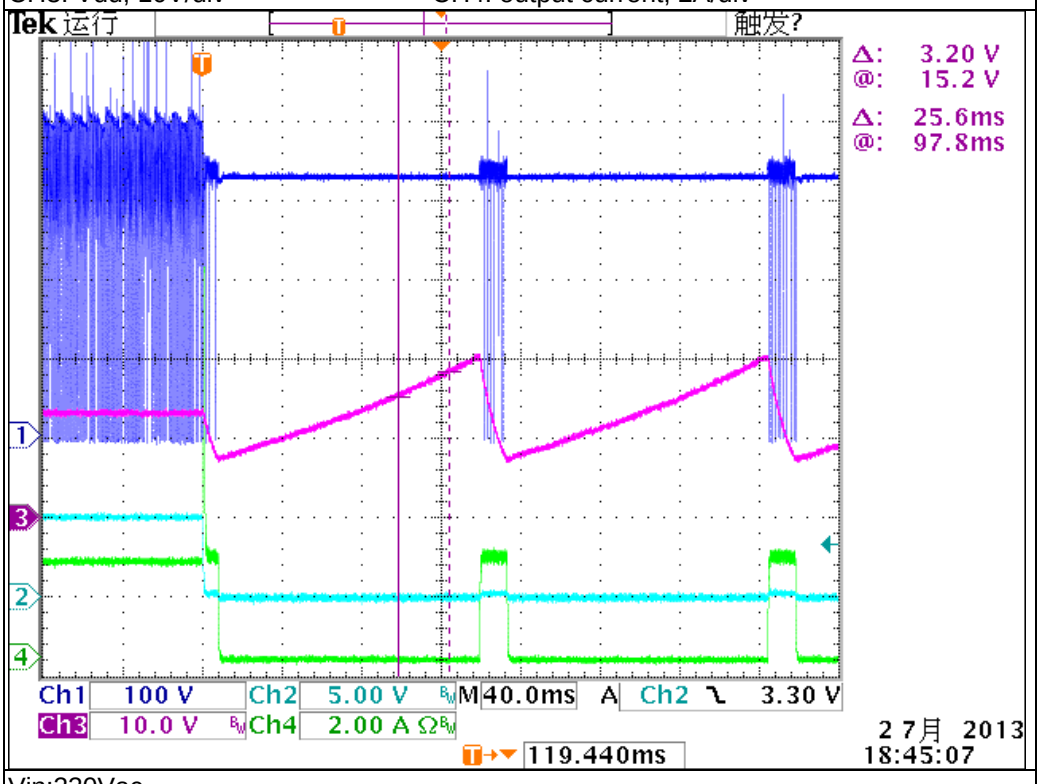
Input voltage	Output short protection
115&230Vac	**Hiccup up mode**



Vin:115Vac

CH1: Vds of MOSFET, 100V/div CH2: output voltage, 5V/div

CH3: Vdd, 10V/div CH4: output current, 2A/div

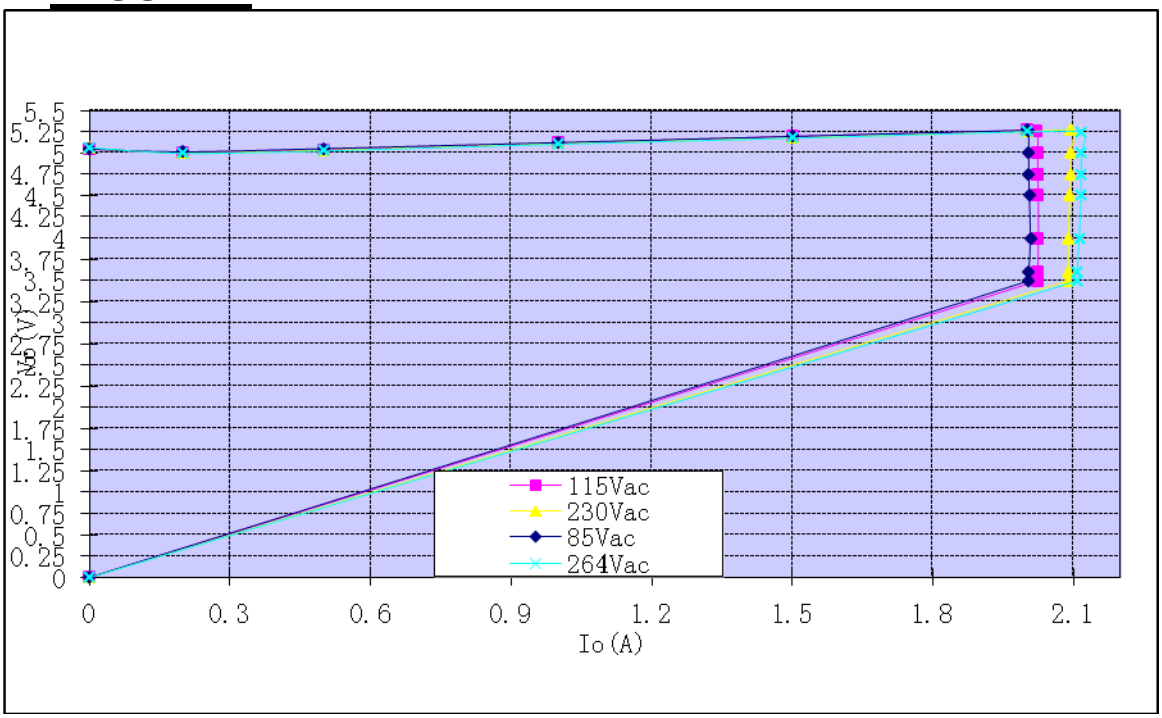


Vin:230Vac

CH1: Vds of MOSFET, 100V/div CH2: output voltage, 5V/div

CH3: Vdd, 10V/div CH4: output current, 2A/div

4 IV CURVE


5.5
5.25
5
4.75
4.5
4.25
4
3.75
3.5
3.25
3
2.75
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
Vo(V)
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
Io(A)
115Vac
230Vac
85Vac
264Vac

5 EMI Test

5.1 Conduction emission

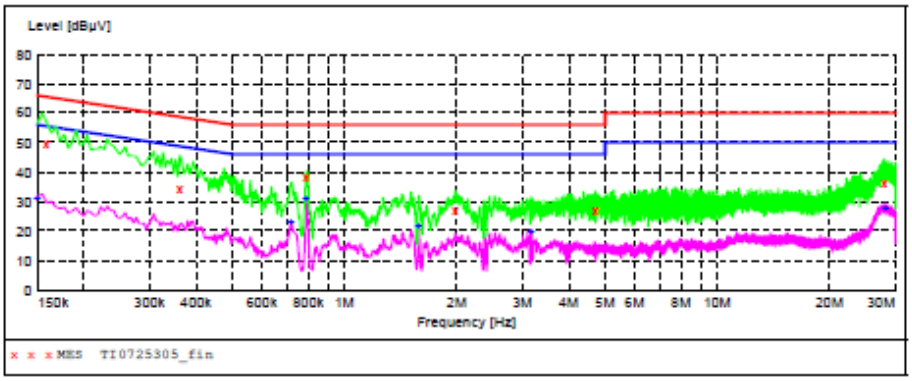
Shenzhen Huatongwei International Inspection CO.,Ltd

Voltage Mains Test EN 55022 CLASS B

```
EUT:                    PMP4378
Manufacturer:           TI
Operating Condition:    LOAD
Test Site:              3# SHIELDED ROOM
Operator:               ZHANGBAO.SUN
Test Specification:     AC 230V/50Hz
Comment:
Start of Test:          7/25/2013 / 6:41:43PM
```

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "TI0725305_fin"

7/25/2013 6:44PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.159000	49.60	10.1	66	15.9	QP	L1	GND
0.361500	34.10	10.1	59	24.6	QP	L1	GND
0.789000	38.60	10.1	56	17.4	QP	L1	GND
1.977000	27.20	10.2	56	28.8	QP	L1	GND
4.695000	26.80	10.2	56	29.2	QP	L1	GND
28.018500	36.70	10.9	60	23.3	QP	L1	GND

MEASUREMENT RESULT: "TI0725305_fin2"

7/25/2013 6:44PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	30.70	10.1	56	25.3	AV	L1	GND
0.717000	22.90	10.1	46	23.1	AV	L1	GND
0.789000	30.80	10.1	46	15.2	AV	L1	GND
1.576500	21.50	10.2	46	24.5	AV	L1	GND
3.160500	19.90	10.2	46	26.1	AV	L1	GND
28.122000	28.00	10.9	50	22.0	AV	L1	GND

Page 1/1 7/25/2013 6:44PM TI0725305

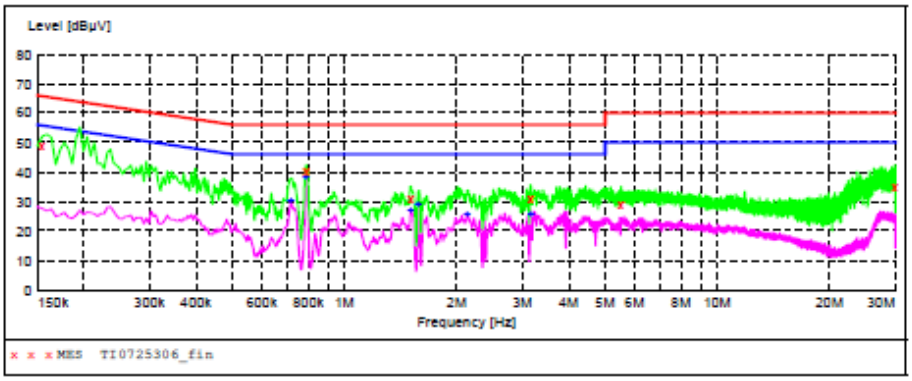
Vin: 230Vac, Line, Io: 2A
Test condition: 1.5m cable with 2.5R load resistor

Shenzhen Huatongwei International Inspection CO.,Ltd

Voltage Mains Test EN 55022 CLASS B

```
EUT:                    PMP4378
Manufacturer:           TI
Operating Condition:    LOAD
Test Site:              3# SHIELDED ROOM
Operator:               ZHANGBAO.SUN
Test Specification:     AC 230V/50Hz
Comment:
Start of Test:          7/25/2013 / 6:44:29PM
```

SCAN TABLE: "Voltage (9K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "TI0725306_fin"

7/25/2013 6:46PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	48.80	10.1	66	17.0	QP	N	GND
0.789000	40.30	10.1	56	15.7	QP	N	GND
1.504500	30.90	10.2	56	25.1	QP	N	GND
3.156000	31.20	10.2	56	24.8	QP	N	GND
5.514000	29.30	10.2	60	30.7	QP	N	GND
29.881500	35.00	11.0	60	25.0	QP	N	GND

MEASUREMENT RESULT: "TI0725306_fin2"

7/25/2013 6:46PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.717000	30.10	10.1	46	15.9	AV	N	GND
0.789000	38.60	10.1	46	7.4	AV	N	GND
1.504500	27.10	10.2	46	18.9	AV	N	GND
1.576500	28.70	10.2	46	17.3	AV	N	GND
2.134500	25.80	10.2	46	20.2	AV	N	GND
3.160500	25.90	10.2	46	20.1	AV	N	GND

Vin:230Vac, Neutral, Io: 2A
Test condition: 1.5m cable with 2.5R load resistor

6.2 Radiated emission

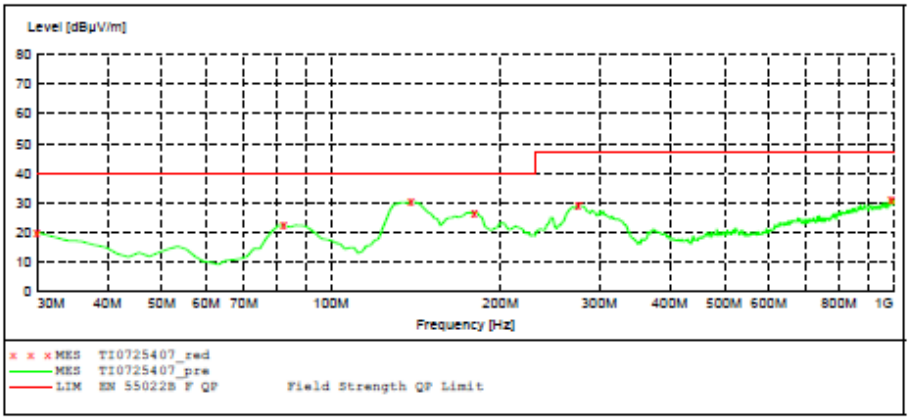
SHENZHEN HUATONGWEI INTERNATIONAL INSPECTION CO.,LTD

RADIATED EMISSION TEST EN 55022 CLASSB

```
EUT:                  PMP4378
Manufacturer:         TI
Operating Condition:  LOAD
Test Site:            3M CHAMBER
Operator:             MINGHUA.FAN
Test Specification:   AC 230V/50Hz
Comment:
Start of Test:        7/25/2013 / 5:13:25PM
```

SWEEP TABLE: "test (30M-1G)"

Short Description: Start Frequency	Stop Frequency	Detector	Field Strength Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	120 kHz	HL562 201106



MEASUREMENT RESULT: "TI0725407_red"

7/25/2013 5:15PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	19.90	-10.0	40.0	20.1	---	300.0	76.00	HORIZONTAL
82.484970	22.40	-19.9	40.0	17.6	---	300.0	221.00	HORIZONTAL
138.857715	30.20	-19.8	40.0	9.8	---	300.0	197.00	HORIZONTAL
179.679359	26.70	-20.5	40.0	13.3	---	100.0	358.00	HORIZONTAL
274.929860	29.00	-16.3	47.0	18.0	---	100.0	45.00	HORIZONTAL
990.280561	31.10	-3.1	47.0	15.9	---	100.0	316.00	HORIZONTAL

Vin:230Vac, HORIZONTAL, Io: 2A
Test condition: 1.5m cable with 2.5R resistor

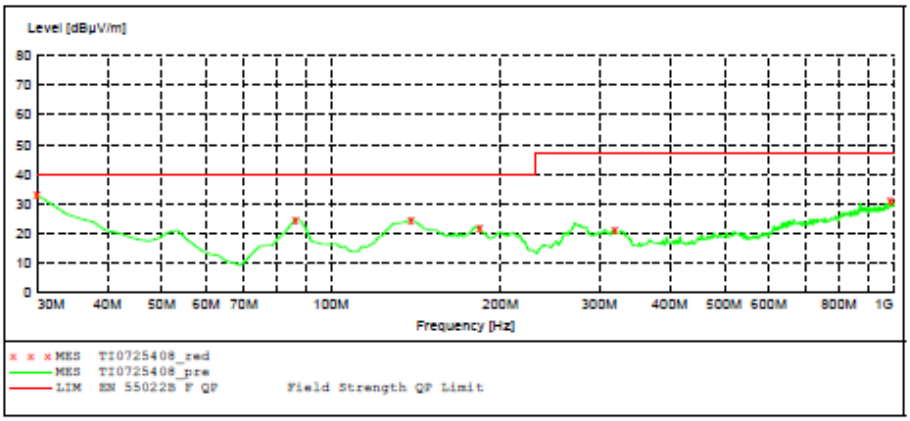
SHENZHEN HUATONGWEI INTERNATIONAL INSPECTION CO.,LTD

RADIATED EMISSION TEST EN 55022 CLASSB

EUT: PMP4378
Manufacturer: TI
Operating Condition: LOAD
Test Site: 3M CHAMBER
Operator: MINGHUA.FAN
Test Specification: AC 230V/50Hz
Comment:
Start of Test: 7/25/2013 / 5:15:48PM

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	120 kHz	HL562 201106



MEASUREMENT RESULT: "TI0725408_red"

7/25/2013 5:17PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	33.00	-10.0	40.0	7.0	---	100.0	53.00	VERTICAL
86.372745	24.80	-19.4	40.0	15.2	---	100.0	296.00	VERTICAL
138.857715	24.80	-19.8	40.0	15.2	---	100.0	242.00	VERTICAL
183.567134	22.20	-20.5	40.0	17.8	---	100.0	94.00	VERTICAL
319.639279	21.10	-14.6	47.0	25.9	---	100.0	248.00	VERTICAL
988.336673	31.00	-3.1	47.0	16.0	---	100.0	278.00	VERTICAL

Vin:230Vac, VERTICAL, Io: 2A
Test condition: 1.5m cable with 2.5R resistor

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