

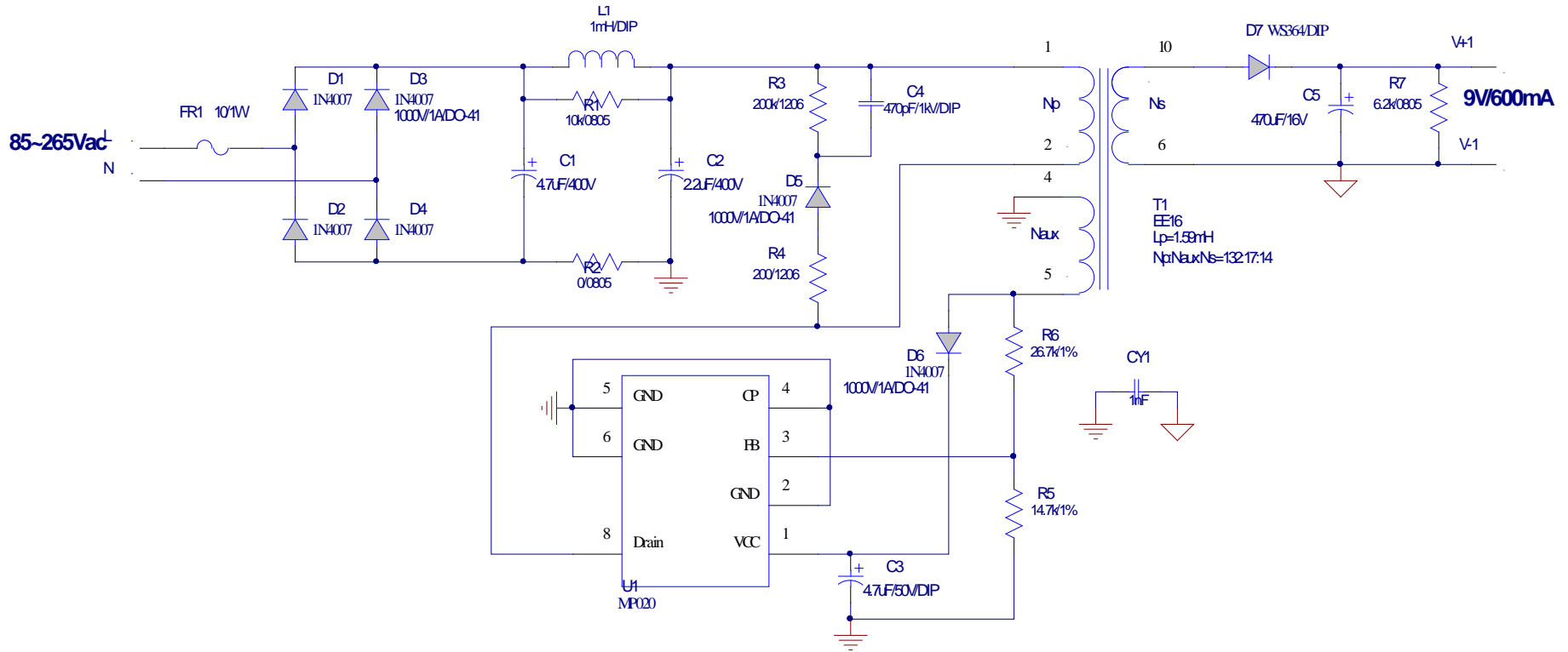
## *MP020*

# *Customer Support Report*

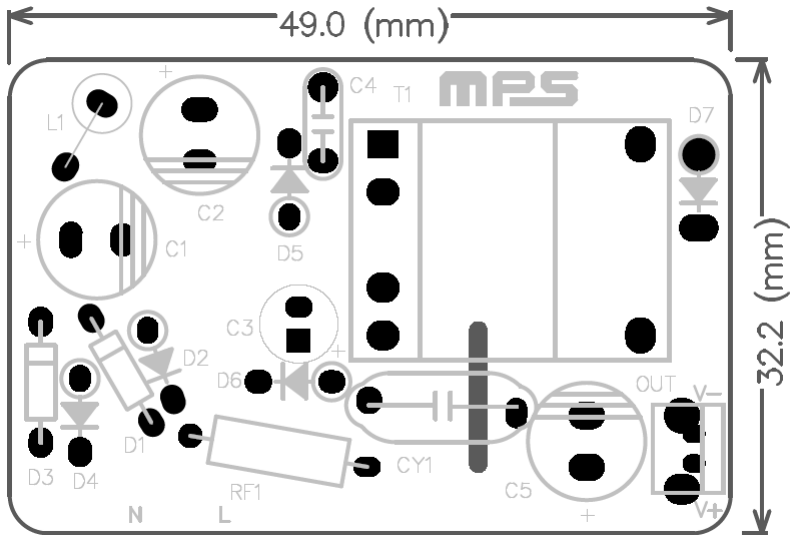
<b>FAE</b>	<b>Alan Zhu</b>
<b>AE</b>	<b>Siran Wang</b>
<b>Manager</b>	<b>En Li</b>

- 1. Specification
- 2. Schematic
- 3. Circuit Board
  - [3.1 PCB Layout](#)
  - [3.2 Board Photograph](#)
- 4. Bill of Materials
- 5. Transformer Information
  - [5.1 Winding Spec](#)
- 6. Performance Data
  - 6.1 Test Setup
    - [6.1.1 Test Equipment](#)
  - 6.2 Efficiency
    - [6.2.1 Efficiency](#)
    - [6.2.1 No Load Power Consumption](#)
  - 6.3 Output and Timing
    - [6.3.1 Load Regulation](#)
    - [6.3.2 Output Voltage Ripple](#)
    - [6.3.3 Startup Time](#)
  - 6.4 Protection
    - [6.4.1 Short Circuit Protection](#)
    - [6.4.3 Over Load Protection](#)
  - 6.5 EMC and Safety
    - [6.5.1 Conducted Emission](#)
  - 6.6 Stress and Steady Status
    - [6.6.1 Steady Status](#)
    - [6.6.2 Mosfet VDS](#)
    - [6.6.3 Output Diode VRRM](#)
  - 6.7 Thermal
    - [6.7.1 Parts Thermal](#)

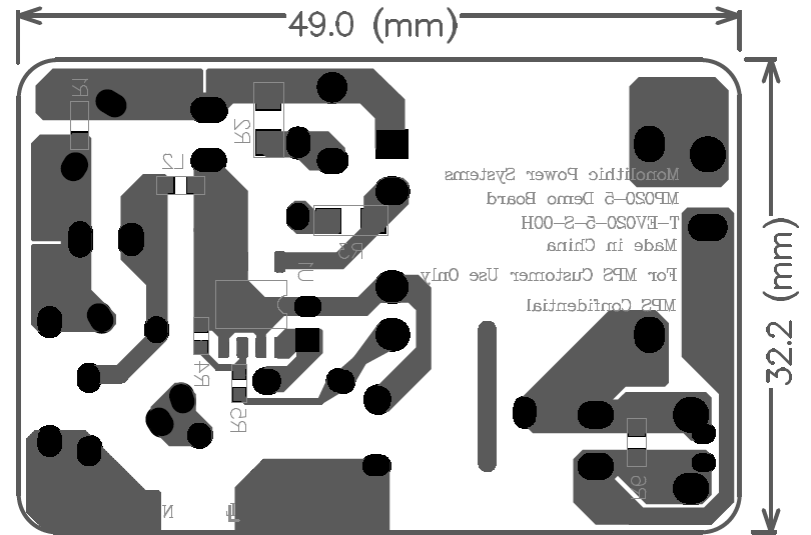
Parameter	Symbol	Condition	Min	Typ	Max	Units
Input Supply Voltage	$V_{IN}$	2 Wire	85	220	265	VAC
Output Voltage	$V_O$			9		V
LED Current	$I_{LED}$			600		mA



## 3.1 PCB Layout



**TOP & TSK**



**BOT & BSK**

### 3.2 Board Photograph



$L*W*H=49\text{mm}*32\text{mm}*15\text{mm}$

*Note: Dimension is strongly needed.*

Item	Qty	RefDes	Value	Description	Package	Manufacturer	Manufacturer_P/N
1	1	C1	4.7uF	Electrolytic Capacitor;400V	DIP	*	*
2	1	C2	2.2uF	Electrolytic Capacitor;400V	DIP	*	*
3	1	C3	4.7uF	Electrolytic Capacitor;50V	DIP	Jianghai	CD287-50V4.7
4	1	C4	470pF	Ceramic Capacitor;1000V	DUP		
5	1	C5	470uF	Electrolytic Capacitor;16V	DUP	*	*
6	1	CY1	1nF	Y1 Capacitor;4000V	DIP	Hongke	JN09E102MY02N
7	4	D2,3,5,6	1N4007	Diode;1000V;1A;	DO-41	Diodes	1N4007
8	1	D7	WS364	*	*	*	*
9	1	FR1	10	Fuse Resistor;5%;1W	DIP	Yageo	FKN1WSJT-52-10R
10	1	L1	1mH	Inductor;1mH;8;100mA	DIP		CKL0510-102
11	1	R1	10K	Film Resistor;5%;	0805	Yageo	RC0805JR-0710KL
12	1	R2	0	Film Resistor;5%;	0805	Yageo	RC0805JR-070L
13	1	R3	200K	Film Resistor;5%;	1206	Yageo	RC1206JR-07200KL
14	1	R4	200	Film Resistor;5%;	1206	Yageo	RC1206JR-07200L
15	1	R5	14.7K	Film Resistor;1%;	0603	Yageo	RC0603FR-0714K7L
16	1	R6	26.7K	Film Resistor;1%;	0603	Yageo	RC0603FR-0726K7L
17	1	R7	6.2K	Film Resistor;5%;	0805	Yageo	RC0805JR-076K2L
18	1	T1		EE16,N1 inductance=1.59mH, N0:N1:N2:N3=44:132:17:14	DIP		
19	1	U1	MP020	MP020, primary side regulator	SOIC8-7A	MPS	MP020

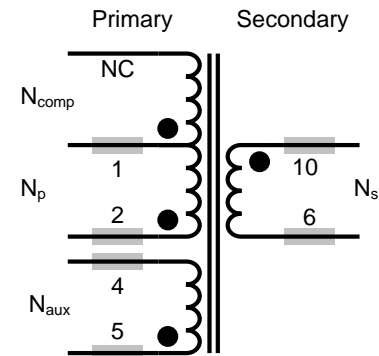
\* Derived from the customer's board.

## 5.1 Winding Spec

### Electric Characteristic

Parameter	Condition	Test Value
Primary Inductance	$L_p$ (1-4)	1.589mH $\pm$ 5%
Leakage Inductance		50 $\mu$ H (Max)
Core/Bobbin		EE16
Core material		PC40
Turn Ratio	$N_{comp}:N_p:N_{aux}:N_s$	44:132:17:14

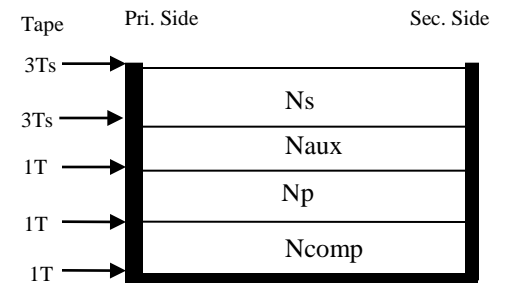
### Electrical Diagram



### Winding Order

Tape Layer Number	Winding No.	Margin Tape (Pri. Side)	Start & End	Margin Tape (Sec. Side)	Turns	Magnet Wire ( $\Phi$ )
1	N <sub>comp</sub>	\	1 to NC	\	44	0.15*1
1	N <sub>p</sub>	\	2 to 1	\	132	0.2*1
1	N <sub>aux</sub>	\	5 to 4	\	17	0.15*1
3	N <sub>s</sub>	\	10 to 6	\	14	T.I.W0.6*1

### Winding Diagram





### 6.1 Test Setup

#### 6.1.1 Test Equipment

- AC Source: **Chroma, Model 61601**
- Power Meter: **Yokogawa, Model WT210**
- Oscilloscope: **Tektronix, Model TDS3014C**
- Current Probe/Amplifier: **Tektronix, Model TCP305/TCPA300**
- EMC Receiver: **Rohde & Schwarz, Model ESPI3+ESPI-B2**

## 6.2 Efficiency

### 6.2.1 Efficiency

#### Test Conditions:

➤ The unit was set to maximum load and well pre-heated until temperature stabilization was achieved.

#### Criteria To Pass:

➤ The average efficiency must be > **75%**

	Pin(W)	Vo(V)	Io(mA)	Po(W)	Efficiency(%)
220Vac	1.81	9.04	150	1.36	74.9
	3.54	9.05	300	2.72	76.7
	5.25	9.05	450	4.07	77.6
	6.95	9.05	600	5.43	78.1

**Comment: Pass**

### 6.2.2 No-load Power Consumption

#### Test Conditions:

- The unit was set to maximum load and well pre-heated.
- The no-load input power measurements were recorded after stabilization of the input power reading.

#### Criteria To Pass:

- The power consumption must be < 100mW at the maximum input voltage.

$V_{AC}$	220V	265V
$P_{IN}(mW)$	24.5mW	29.2mW

**Comment: Pass**

## 6.3 Output and Timing

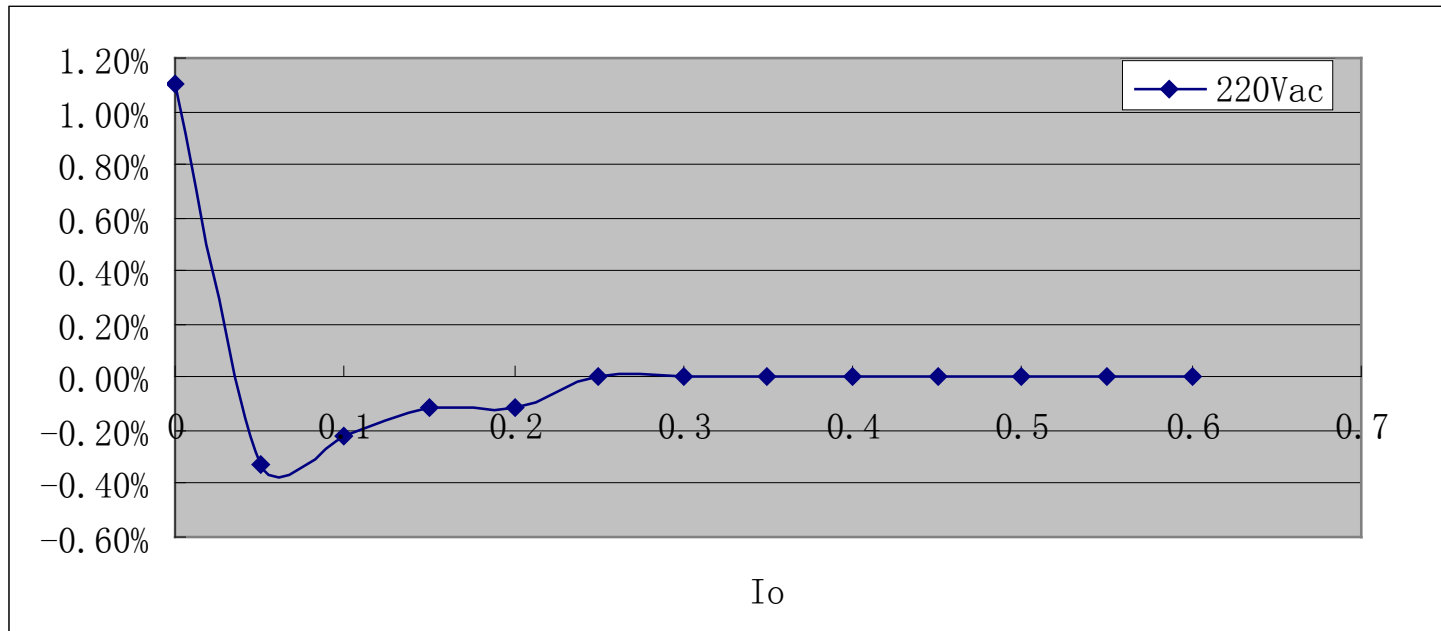
### 6.3.1 Load Regulation

#### Test Conditions:

➤ The output voltage deviation was measured while the load current was increased from 0 to 600mA

#### Criteria To Pass:

➤ The output voltage must remain within  $\pm 2\%$ .



**Comment: Pass**

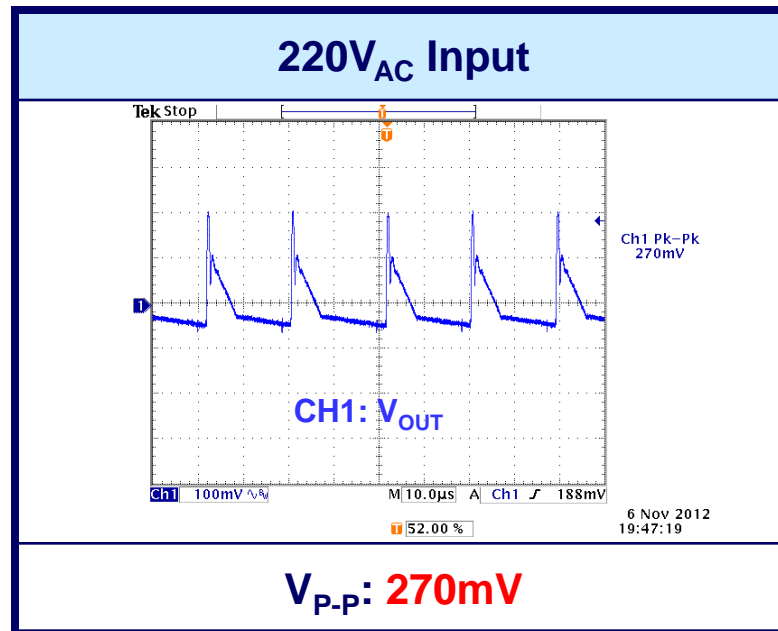
## 6.3.2 Output Voltage Ripple

### Test Conditions:

- The output voltage ripple and noise are measured at output terminal with full load.

### Criteria To Pass:

- The ripple of the output current must remain within the specified limits  $V_{P-P}$ : **500mV** at a maximum load current.



**Comment: Pass**

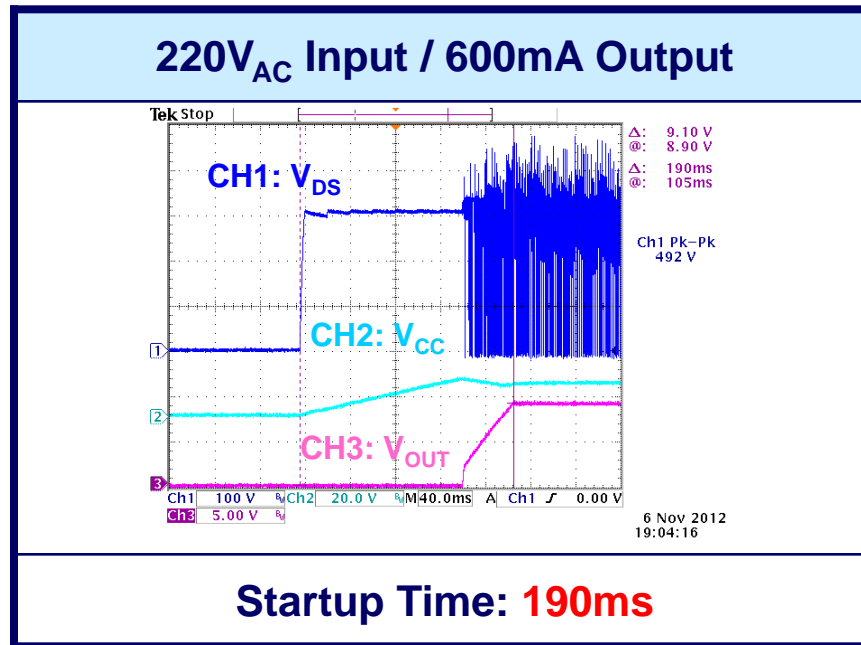
## 6.3.3 Startup Time

### Test Conditions:

- The Unit start with full load
- The startup time is measured from the time when V<sub>CC</sub> voltage starts ramping up to the time when the output voltage ramps to 90% of the rated value.

### Criteria To Pass:

- The startup time must remain in **1 second**.



**Comment: Pass**

### 6.4 Protection

#### 6.4.1 Short Circuit Protection (SCP)

##### Test Conditions:

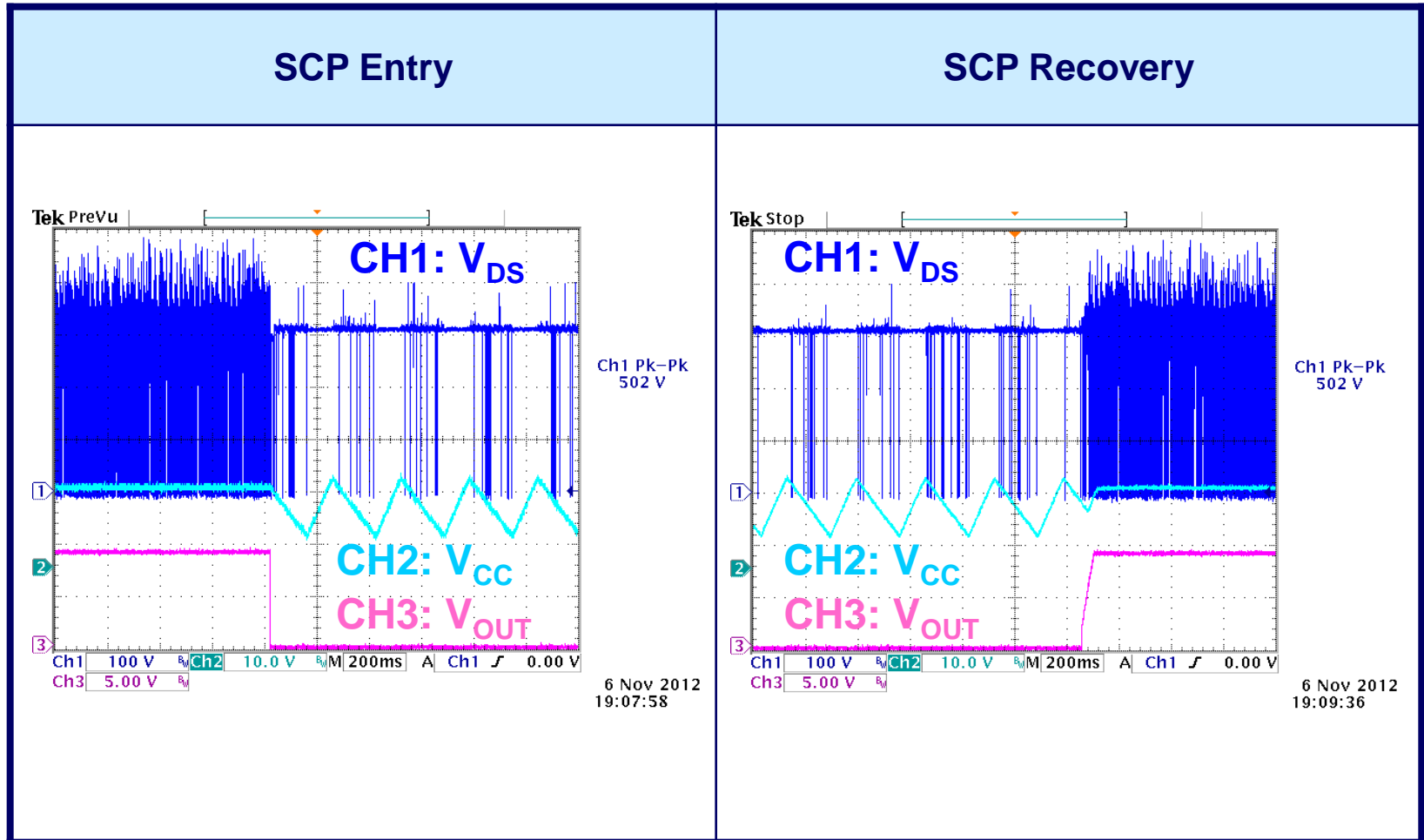
- The unit was switched on with normal load on the output. A short circuit was applied manually to the output at the end of the cable. The mains voltage was adopted to obtain the worst-case condition.
- A short circuit was applied to the output at the end of the cable before startup of the unit. The unit was switched on with a short circuit at the output. The mains voltage was adopted to obtain the worse-case condition.

##### Criteria To Pass:

- The unit shall be capable of withstanding a continuous short-circuit at the output without damage or overstress of the unit under any input conditions.
- After removal of the short circuit, the unit shall recover automatically.

$V_{AC}$	220
SCP	ok

## SCP at 220V<sub>AC</sub>



**Comment: Pass**



### 6.4.2 Over Load Protection (OLP)

#### Test Conditions:

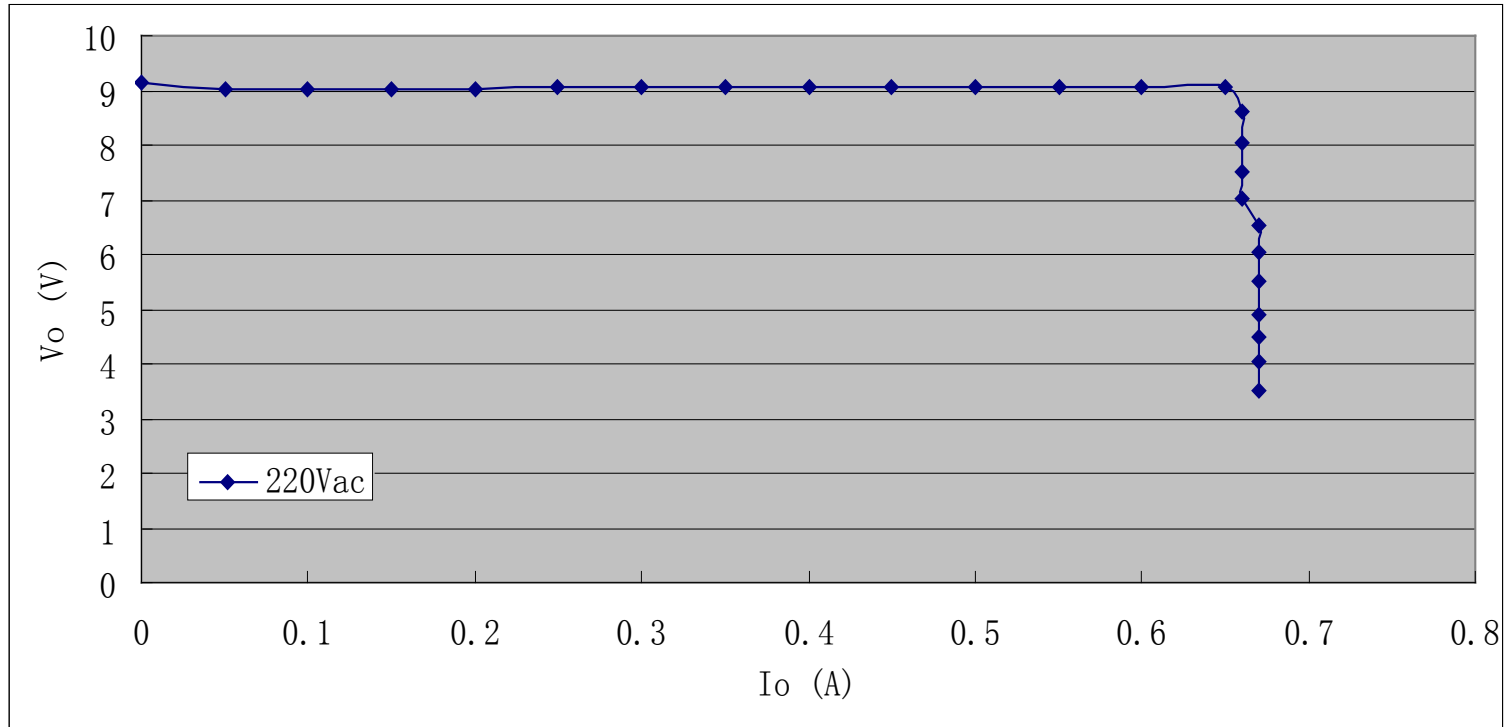
- An overload condition was applied to the unit;
- An AC input voltage was selected so that the worst-case condition occurred.

#### Criteria To Pass:

- The unit should be operating in the constant current mode, in order to prevent the overload operation.

Input	220
OCP	ok

## V-I Characteristics at 220V<sub>AC</sub>



**Comment: Pass**

## 6.5 EMC and Safety

### 6.5.1 Conducted Emission

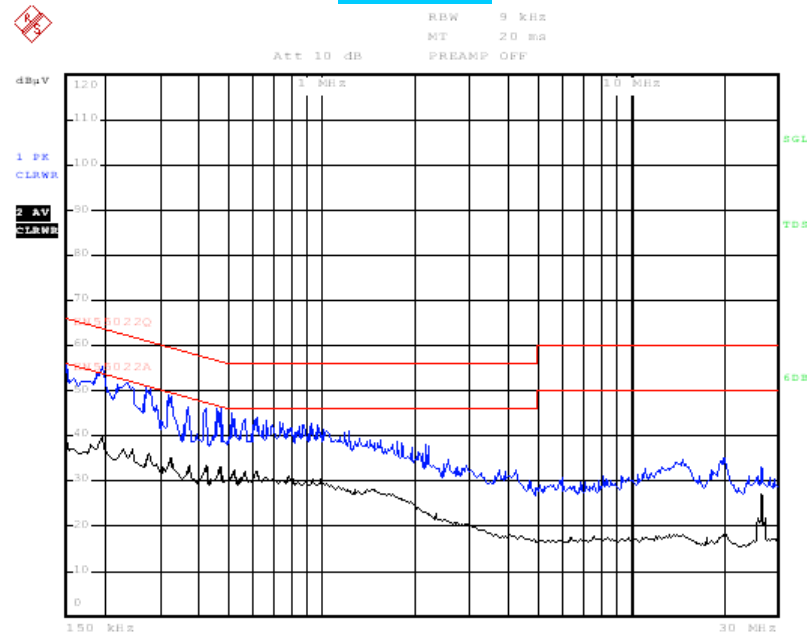
#### Test Conditions:

- The unit was subjected to **220V<sub>AC</sub>** line and with maximum load.
- The ground connection of the output cable was connected to EMC ground.

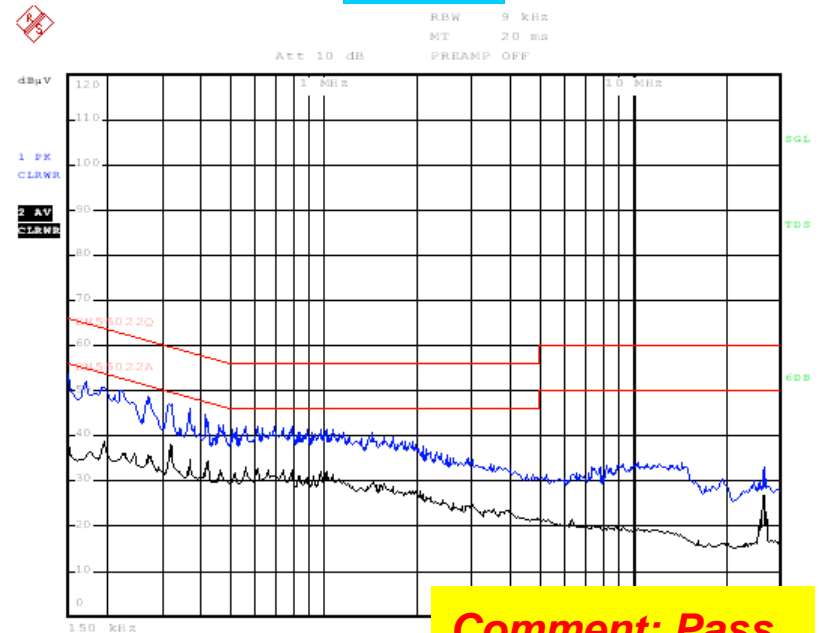
#### Criteria To Pass:

- EN55022 with **-8dB** margin.

L line



N line



**Comment: Pass**

## 6.6 Stress and Steady Status

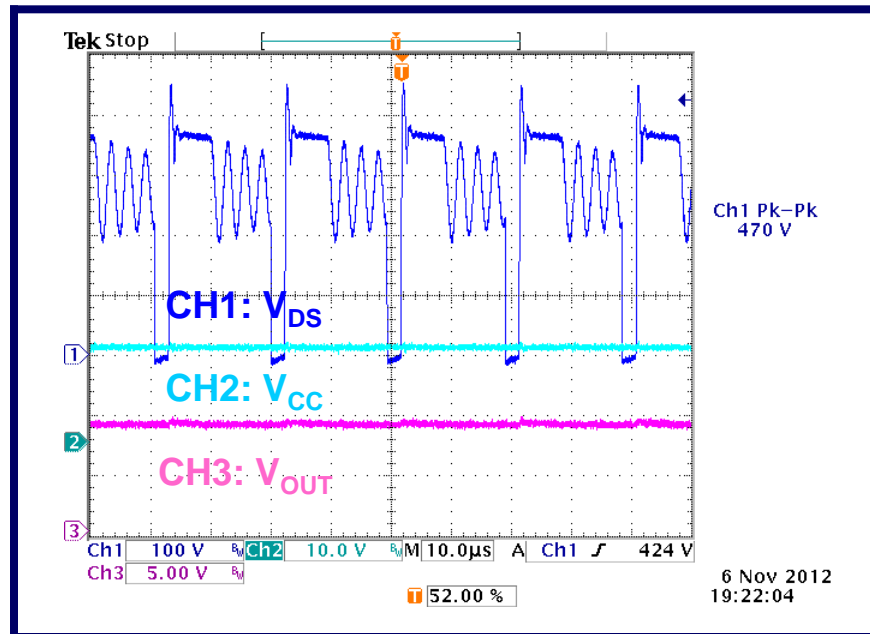
### 6.6.1 Steady Status

#### Test Conditions:

- The main input voltage was set to  $220V_{AC}$ .
- The unit is loaded at maximum output current.

#### Criteria To Pass:

- The  $V_{DS}$ ,  $V_{CC}$ ,  $V_{OUT}$  should be at steady status.



**Comment: Pass**

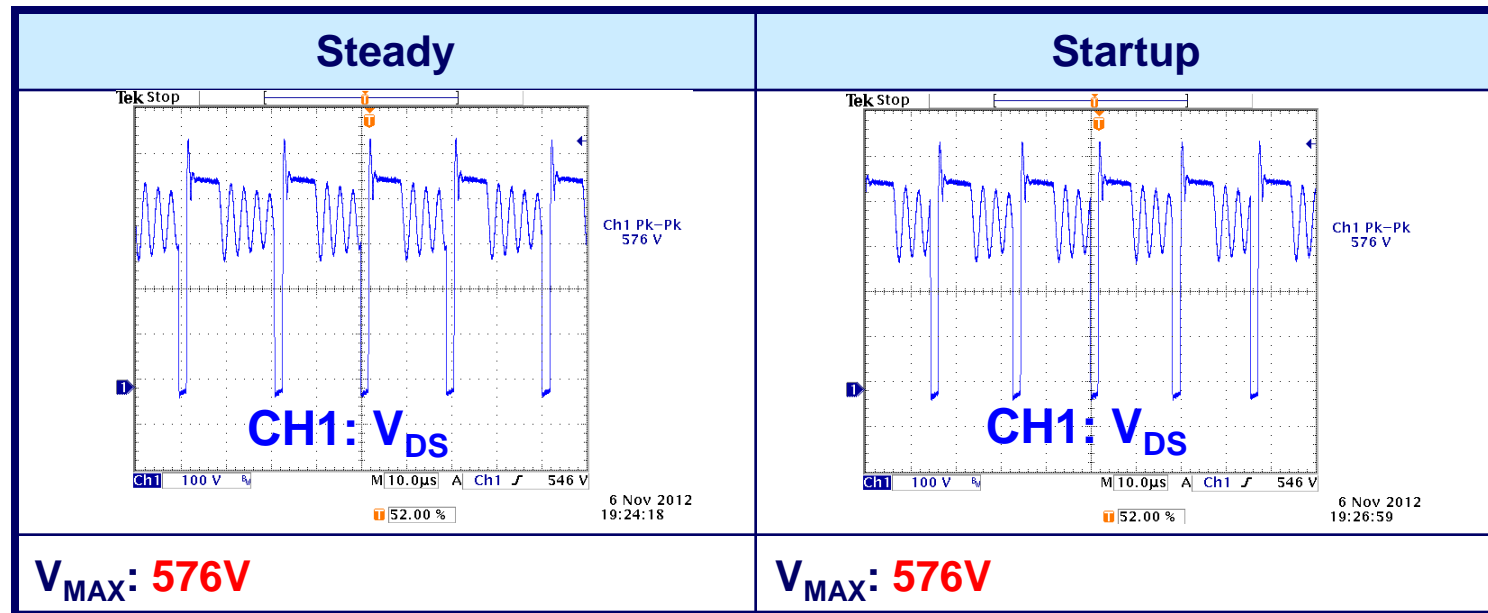
## 6.6.2 Mosfet $V_{DS}$

### Test Conditions:

- The main input voltage was set to  $265V_{AC}$ .
- The unit is loaded at maximum output current.

### Criteria To Pass:

- The mosfet  $V_{DS}$  must be  $< 700V$  at both startup and steady status.



**Comment: Pass**

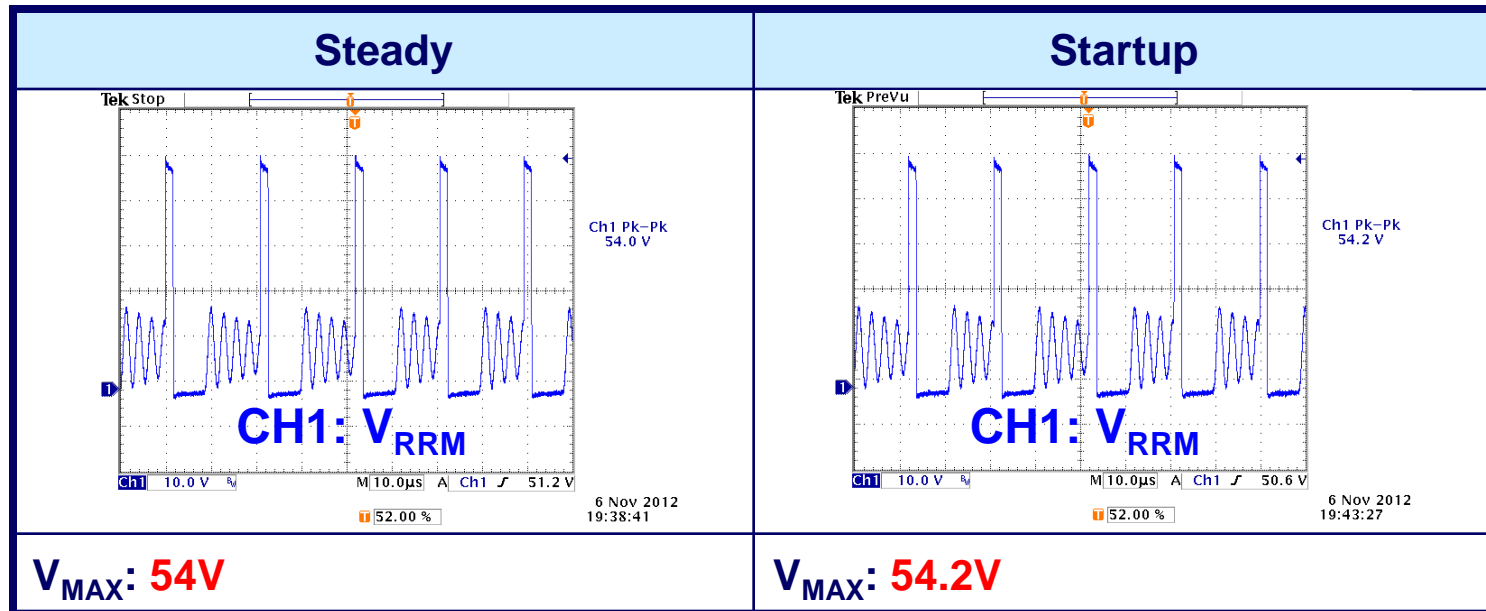
## 6.6.3 Output Diode $V_{RRM}$

### Test Conditions:

- The main input voltage was set to  $265V_{AC}$ .
- The unit is loaded at maximum output current.

### Criteria To Pass:

- The diode  $V_{RRM}$  must be  $< 80V$  at both startup and steady status.



**Comment: Pass**

### 6.7 Thermal

#### 6.7.1 Parts Thermal

##### Test Conditions:

- The input voltage was set to 220Vac.
- The electronic load was set to the maximum output current.
- The unit was covered, and the data was recorded until temperature stabilization was achieved. Ta=25°C

##### Criteria To Pass:

- The  $\Delta$  temperature must be < 50°C.

...Continued

