



## DEMO BOARD TEST REPORT

# 5W Smart Dimmable RGBCW LED Driver with KP28162+KP18056+KP35026

## FEATURES

- Patented Link-Dim<sup>®</sup> Technology for High PF and Flicker-less
- Input Voltage 176~264Vac for EMEA
- PF>0.7
- High Peak Efficiency >89%
- Total Smart Dimming & Color Mix Solution with 5-channel RGBCW
- Wide Dimming Range for 0.1%-100%
- Analog Dimming for CW Channel, and Chopping Dimming for RGB Channel
- Fast Start up Time <0.5s @ 0.1%
- Low Standby Power<0.2W

## APPLICATIONS

- Smart LED Bulbs with Zigbee/Bluetooth Control

## INTRODUCTION

The demo board is designed to demonstrate the total smart dimmable RGBCW solution with LED driver and MCU/wireless module. The demo board uses the patented Link-Dim<sup>®</sup> technology to build an adaptive LED driver architecture for high PF and flicker-less. The front-stage is a Buck converter which has high PF and adaptive constant output voltage, the secondary stage is KP18026 with constant current through I2C (Inter-Integrated-Circuit Bus) signal, dimming control and feedback LED voltage to first stage. The dimming control part of the demo board consists of an auxiliary power supply chip KP35026 and a Bluetooth dimming module.

The demo board is typically designed for 5W application with 176VAC to 264VAC, High PF>0.7, and with output 100V/43mA of CW channels and output 100V/15mA of RGB channels within LED Bulb.

## DEMO BOARD SEPCIFICATION

Description	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V <sub>in</sub>	176		264	Vac	Within 5W
Output	V <sub>OUT</sub>	100V				
	I <sub>OUT</sub>	CW:43mA; RGB:15mA				
Dimming Range	CW	0.1		100	%	Analog Dimming
	RGB	0.1		100	%	Chopping Dimming @1kHz
System Efficiency	η	89			%	@230Vac Within Wireless Module
Standby Loss	P <sub>STB</sub>			0.2	W	Within Wireless Module
Power Factor	PF	0.7				
Startup Time	T <sub>ST</sub>			0.5	S	
EMI Margin	CE/RE	6			dB	EN55015
Surge Test		1			kV	Differential Mode

**Note:** The table above shows the minimum acceptable performance of the design. Actual performance is listed in the results section.





**Bill of Material**

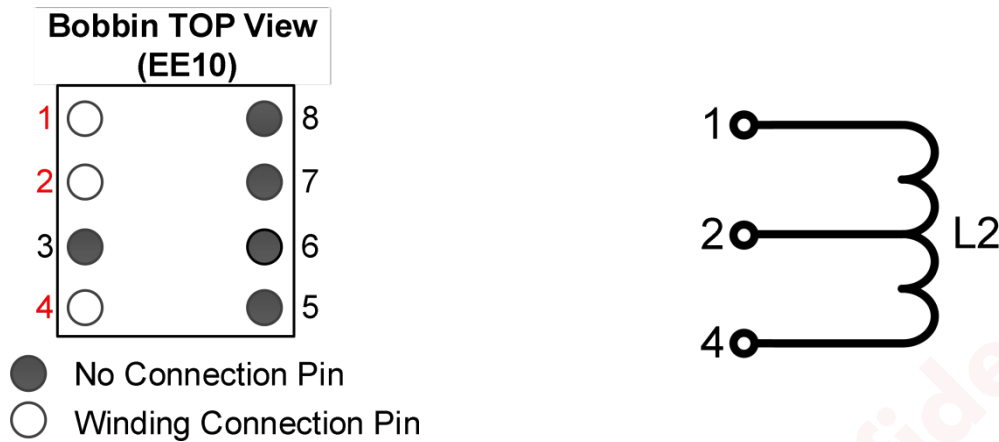
No.	Designator	Value	Description	Package	Manufacturer	Part Number
<b>KP28162SGA+KP18056ESSGA+KP35026VGA_Driver_D02</b>						
1	BD1	1000V/1A	BRD 1A 1000V 1.1V	MBF	MDD	MB10F
2	C1, C2	100nF/400V	CBB 400Vdc 12*5*9 P10	TH	STE	B22G104JN1B0120 090050EOZ
3	C3, C7	1uF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	885012207103
4	C4	22nF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	885012207094
5	C5	2.2uF/50V	Ceramic Cap 50V ±10% X7R	0805	YAGEO	CC0805KKX7R9BB 225
6	C6, C10	33uF/160V	Electrolytic Cap 160V 10*12 P5.0	TH	AISHI	EW2CM330G120 T
7	C8	470uF/6.3V	Solid capacitor 10V 6.3*11 P2.5	TH	AISHI	SPZ1AM471E0800 0RAXXX
8	C9	1uF/450V	Electrolytic Cap 450V 6.3*9 P2.5	TH	AISHI	ERK2WM010E090 T
9	D1, D4	1000V/1A	DIO FRD 1A 1000V 1V	SOD-123FL	DIYI	A7
10	D2	600V/1A	DIO FRD 1A 600V 35nS 1.7V	SMA	MDD	ES1J
11	D3,D6	1000V/1A	DIO FRD 1A 1000V 500nS 1.3V	SOD-123FL	DIYI	F7
12	D5	600V/1A	DIO FRD 1A 600V 35nS 1.65V	SOD-123FL	YFW	
13	FR1	6.8R	Fuse Resistor ±5% 1W	TH	SY	RFB01J6R80A520S C
14	L1	2.2mH	Inductor Isat 0.40A Rdc 2.90Ω 8*12	TH	WE	7447452222
15	L2	10mH	EE10,N1=0.15mm*60Ts;N2=0.15m m*340Ts	TH	Any	
16	L3	0.33mH	Inductor Isat 0.88A Rdc 0.70Ω 8*9.5	TH	WE	7447720331
17	R1	5.1k	Chip Resistor ±1% 1/4W	1206	FH	RS-06K5101FT
18	R3	10k	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1002FT
19	R4	82K	Chip Resistor ±1% 1/8W	0805	FH	RS-05K8202FT
20	R5	4.7R	Chip Resistor ±1% 1/4W	1206	FH	RS-06L4R70FT
21	R7	3M	Chip Resistor ±1% 1/8W	0805	FH	RS-05L3004FT
22	R8	43k	Chip Resistor ±1% 1/8W	0805	FH	RS-05K4302FT
23	R9	3k	Chip Resistor ±1% 1/8W	0805	FH	RS-05K3001FT
24	R10	15R	Chip Resistor ±1% 1/8W	0805	FH	RS-05K15R0FT
25	Rad1, Rad2	4.7M	Chip Resistor ±1% 1/4W	1206	FH	RS-06L4704FT
26	Rad3	1.3M	Chip Resistor ±1% 1/8W	0805	FH	RS-05L1304FT
27	Rad4	220k	Chip Resistor ±1% 1/8W	0805	FH	RS-05K2203FT
28	RV1	7D471	VARISTOR 300VAC 35J 1200A	TH	WE	820573011
29	U1	KP28162SG	PF>0.7, Adaptive Constant Voltage high side BUCK controller	SOP8	Kiwi Instrument	KP28162SG
30	U3	KP35026VG	Low Cost Fast Dynamic Response Non-isolated PWM Power Switch	SOP-4	KIWI	KP35026VGA
31	Zad1	15V	Diode Zener 15V 2% 200mW	SOD-323	PANJIT	BZT52-B15S
32	J1-1	Connector	Connector, FH1.5,P=1.5mm, 2*3P	TH	Shuolian	Connector

<b>KP28162SGA+KP18056ESSGA+KP35026VGA_LED_D02</b>						
33	RJ1,RJ2,RJ3, RJ4	0R	Chip Resistor $\pm 1\%$ 1/4W	1206	FH	RS-06000FT
34	Z1, Z2	24V	Diode Zener 24V 2% 200mW	SOD-323	PANJIT	BZT52-B24S
35	U2	KP18056ESSG	Adaptive LED Voltage Feedback Low Voltage Five-channel Linear I2C Protocol Dimmable LED Driver	ESSOP- 10	KIWI	KP18056ESSG
36	J1-2	Connector	Connector, FH1.5,P=1.5mm, 2*3P	TH	Shuolian	Connector
37	DC1~DC12	Cool LED	Cool White LED-W-2835, 9V/1W	2835	Any	
38	DW1~DW12	Warm LED	Warm White LED-2835, 9V/1W	2835	Any	
39	DR1~DR6	Red LED	Red LED-W-2835, 18V/1W	2835	Any	
40	DG1~DG6	Green LED	Green LED-W-2835, 18V/1W	2835	Any	
41	DB1~DG6	Blue LED	Blue LED-W-2835, 18V/1W	2835	Any	
<b>KP28162SGA+KP18056ESSGA+KP35026VGA_WIFI_D01</b>						
42	CS1	1uF/50V	Ceramic Cap 50V $\pm 10\%$ X7R	0805	WE	885012207103
43	CS2	100nF/50V	Ceramic Cap 50V $\pm 10\%$ X7R	0805	WE	85012207098
44	RS1, RS2	10k	Chip Resistor $\pm 1\%$ 1/8W	0805	FH	RS-05K1002FT
45	U4	Dimming Module	Dimming module ESP8685		ESPRESSIF	ESP8685

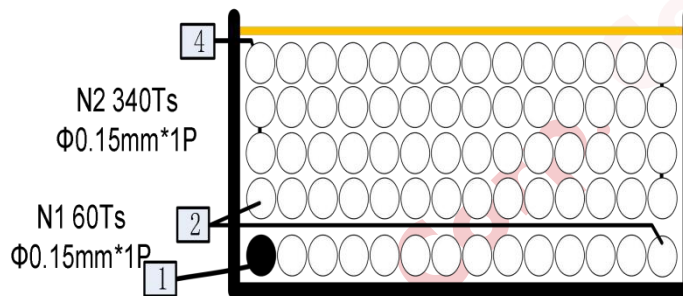


## Transformer Manufacture Guide---L2

### 1. Electrical Diagram



### 2. Winding Diagram



### 3. Winding Order

Number	Winding	Layer	Start	End	Wire Size	Turns
1	N1	Primary1	1	2	0.15d*1P	60Ts
2	N2	Primary2	2	4	0.15d*1P	340Ts

### 4. Electrical Specification

Items	Test Condition	Test Pin	Specification
Primary Inductance	Measured at 40kHz, 1.0 VRMS	Pins 1-4	10mH $\pm$ 5%
DC Resistance	Measured at 40kHz, 1.0 VRMS	Pins 5-8	10.6 $\Omega$

### 5. Transformer BOM

Items	Description
1	<b>Core:</b> EE10, AE=12.10
2	<b>Bobbin:</b> EF10, 4+4 Pin
3	<b>Wire:</b> $\Phi 0.15\text{mm}$ , 2UEW, Class B
4	<b>Tape:</b> 7mm(W) $\times$ 0.06mm(TH)

## Test Result

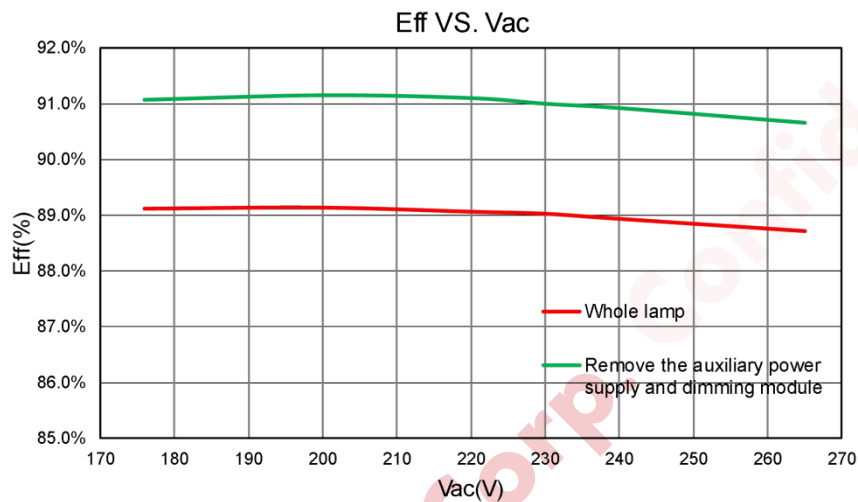
### 1. Steady Characteristics

#### 1.1 System Efficiency

**Test Conditions:** Input: 176-264Vac; Output: 100V/43mA(C&W), 100V/15mA(R&G&B), (C, W, R, G, B) = (100%, 0%, 0%, 0%, 0%), LEDminL=1.5V;

**Standard:** Eff > 88%

**Result:** Pass

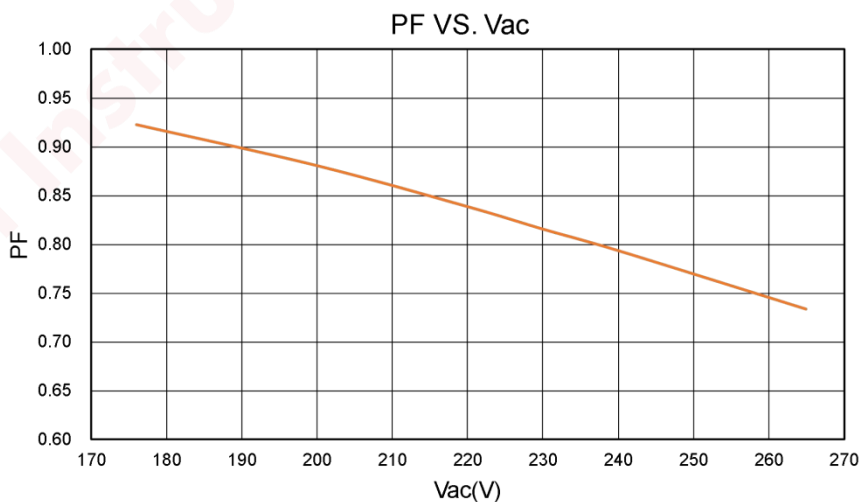


#### 1.2 Power Factor

**Test Conditions:** Input: 176-264Vac; Output: 100V/43mA(C&W), 100V/15mA(R&G&B), (C, W, R, G, B) = (100%, 0%, 0%, 0%, 0%)

**Standard:** PF > 0.7

**Result:** Pass

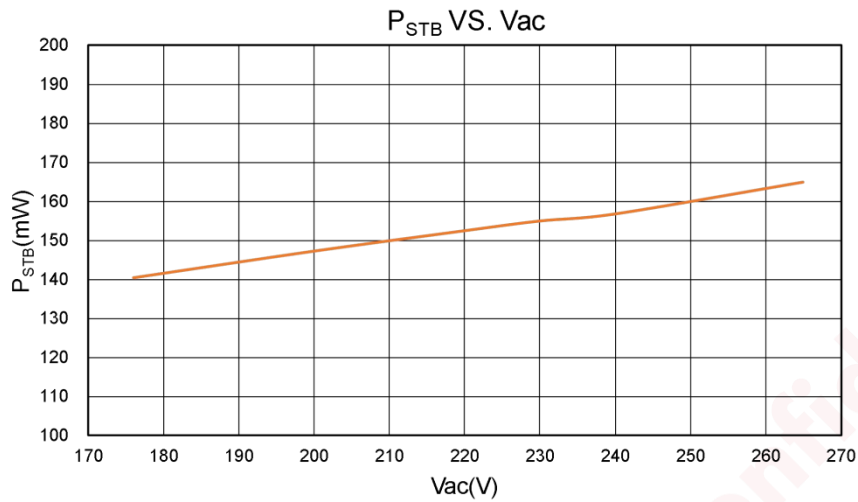


#### 1.3 Standby Power

**Test Conditions:** Input: 176-265Vac; Output: Dim OFF, (C, W, R, G, B) = (0%, 0%, 0%, 0%, 0%)

**Standard:**  $P_{STB} < 200\text{mW}$

**Result:** Pass

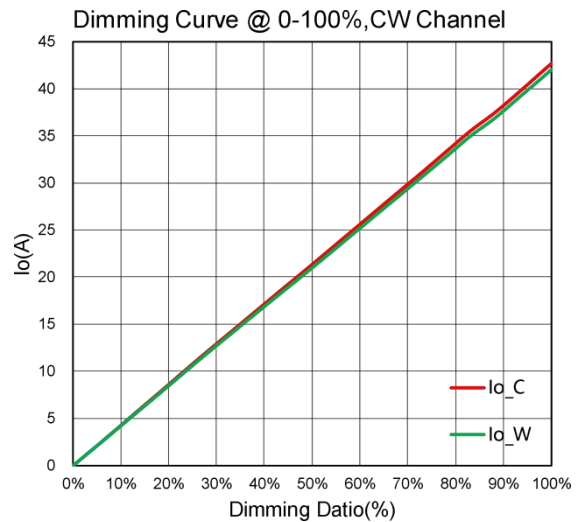
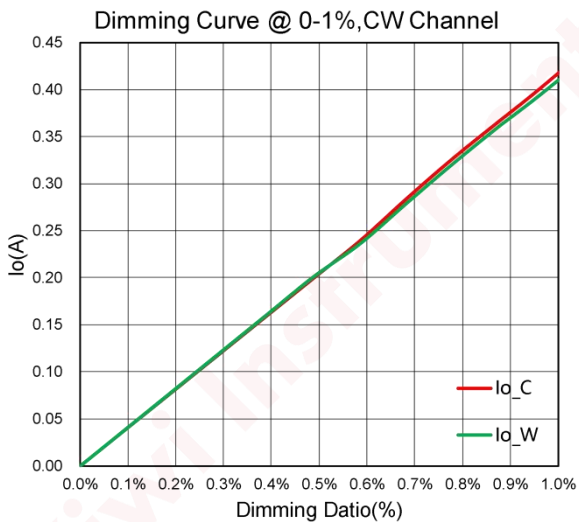


#### 1.4 Dimming Curve

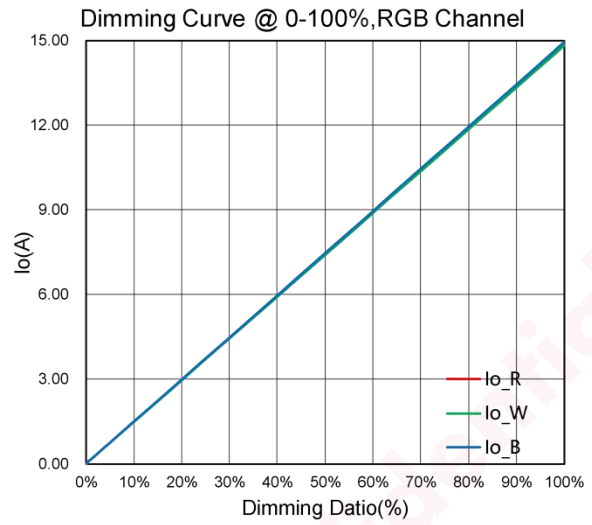
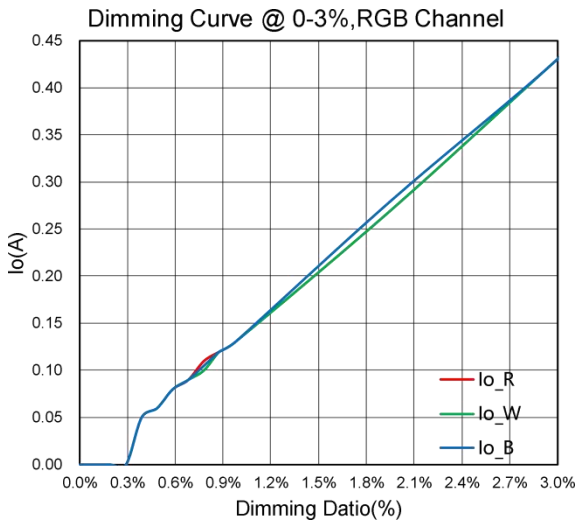
**Test Conditions:** Input: 220Vac; Output: 100V/43mA(C&W), 100V/15mA(R&G&B); CW: analog dimming;  
RGB: chopping dimming, 1kHz;

**Standard:** High linearity of dimming curve

**Result:** Pass

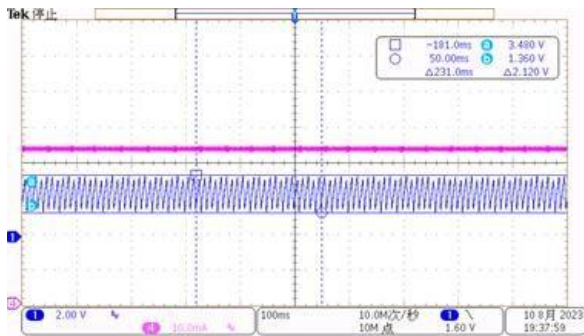






**Waveforms (CW Mode):**

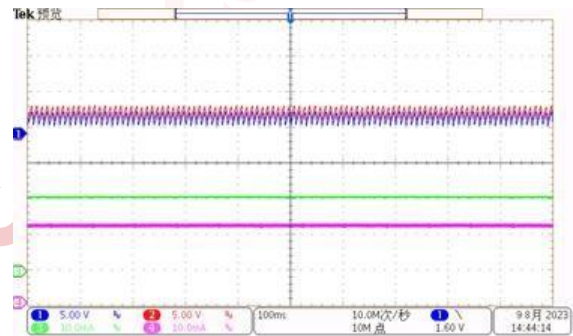
**Test Condition:** 220Vac/50Hz Input,  
Duty: (C: 100%, W: 0%)



(CH1-LEDC-, CH4-Io\_C)

**Comments:** OK, No flicker; LED-voltage ripple is 2.1V.

**Test Condition:** 220Vac/50Hz Input,  
Duty: (C: 50%, W: 50%)

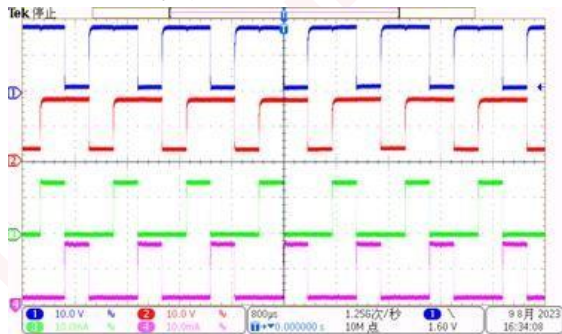


(CH1-LEDC-, CH2-LEDW-, CH3-Io\_C, CH4-Io\_W)

**Comments:** OK, No flicker.

**Waveforms (RGB Mode):**

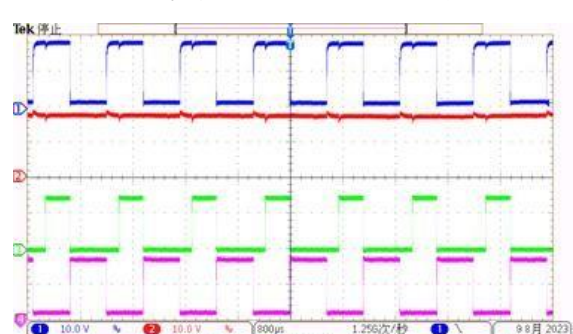
**Test Condition:** 220Vac/50Hz Input,  
Duty: (R: 33%, G: 33%, B: 033)



(CH1-LEDB-, CH2-LEDR-, CH3-Io\_G, CH4-Io\_B)

**Comments:** OK, No flicker, RGB channel conduction phase delay 120 degrees.

**Test Condition:** 220Vac/50Hz Input,  
Duty: (R: 0%, G: 33%, B: 50%)



(CH1-LEDB-, CH2-LEDR-, CH3-Io\_G, CH4-Io\_B)

**Comments:** OK, No flicker.

## 2. Dynamic Characteristics

### 2.1 Power On

**Test Conditions:** Input: 220Vac; Output: 100V/43mA(C&W), 100V/15mA(R&G&B); CW: analog dimming; RGB: chopping dimming, 1kHz; Dimming change speed gear: 500ms.

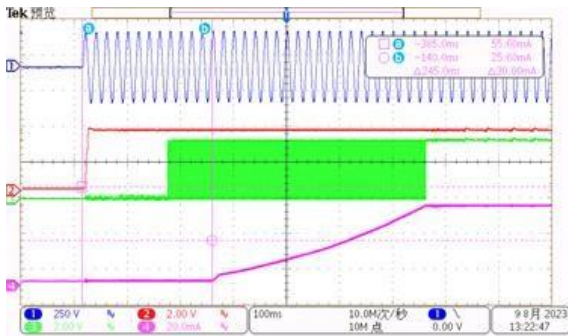
**Standard:** No flicker and no overshoot, turn on delay time < 0.5s

**Result:** Pass

Vin(Vac)	Dimming Ratio(%)	Turn on delay time	Current Rise Time	Module delay
176	100%	245	404	147
220	100%	238	408	148
220	50%	236	168	147
220	10%	235	17	147
220	1%	235	1	147
264	100%	230	414	148

### Waveforms (CW Mode):

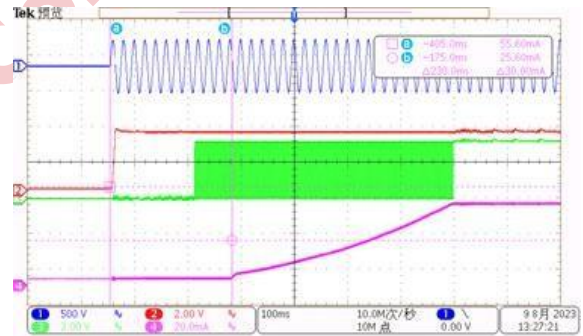
**Test Condition:** 176Vac/50Hz Input,  
Duty: (C: 100%, W: 0%)



(CH1-Vin, CH2-3.3V, CH3-CLK, CH4-Io\_C)

**Comments:** Tst=245ms, No flicker and no overshoot

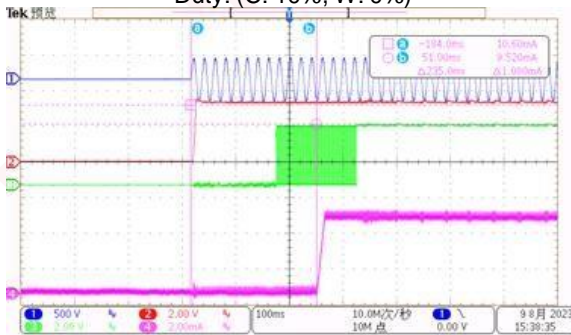
**Test Condition:** 264Vac/50Hz Input,  
Duty: (C: 100%, W: 0%)



(CH1-Vin, CH2-3.3V, CH3-CLK, CH4-Io\_C)

**Comments:** Tst=230ms, No flicker and no overshoot

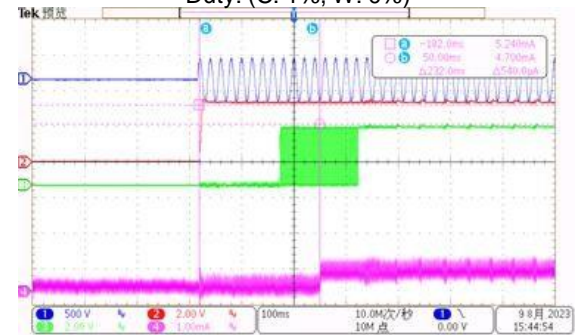
**Test Condition:** 220Vac/50Hz Input,  
Duty: (C: 10%, W: 0%)



(CH1-Vin, CH2-3.3V, CH3-CLK, CH4-Io\_C)

**Comments:** OK, No flicker and no overshoot

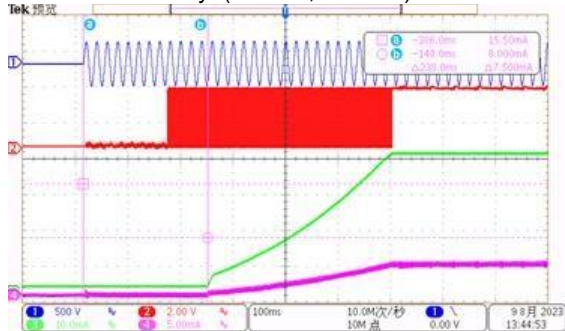
**Test Condition:** 120Vac/60Hz Input,  
Duty: (C: 1%, W: 0%)



(CH1-Vin, CH2-3.3V, CH3-CLK, CH4-Io\_C)

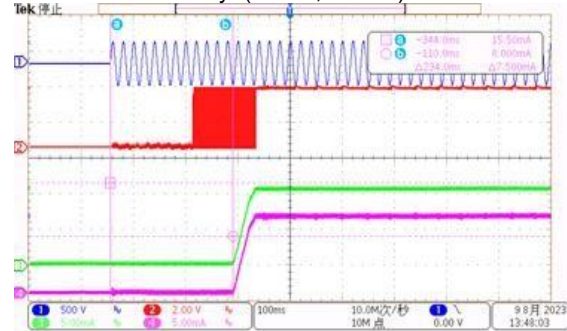
**Comments:** OK, No flicker and no overshoot

**Test Condition: 220Vac/50Hz Input,  
Duty: (C: 10%, W: 90%)**



(CH1-Vin, CH2-CLK, CH3-Io\_W, CH4-Io\_C)  
Comments: OK, No flicker and no overshoot

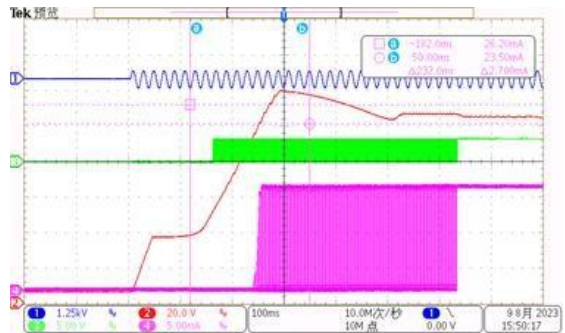
**Test Condition: 220Vac/50Hz Input,  
Duty: (C: 5%, W: 5%)**



(CH1-Vin, CH2-CLK, CH3-Io\_W, CH4-Io\_C)  
Comments: OK, No flicker and no overshoot

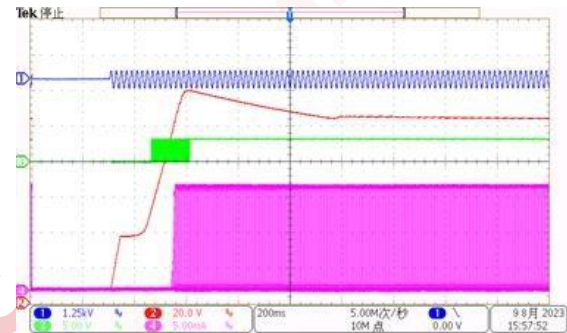
**Waveforms (RGB Mode):**

**Test Condition: 220Vac/50Hz Input,  
Duty: (R: 0%, G: 100%, B: 0%)**



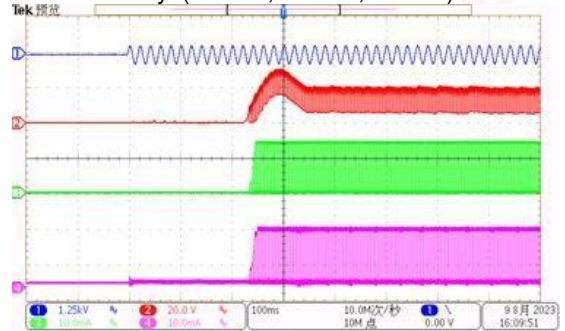
(CH1-Vin, CH2-LED+, CH3-CLK, CH4-Io\_G)  
Comments: OK, No flicker and no overshoot

**Test Condition: 220Vac/50Hz Input,  
Duty: (R: 0%, G: 10%, B: 0%)**



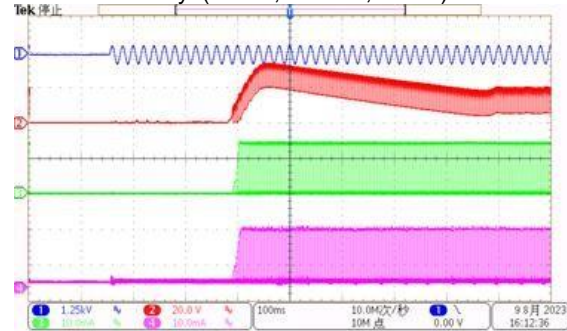
(CH1-Vin, CH2-LED+, CH3-CLK, CH4-Io\_G)  
Comments: OK, No flicker and no overshoot

**Test Condition: 230Vac/50Hz Input,  
Duty: (R: 33%, G: 33%, B: 33%)**



(CH1-Vin, CH2-LEDR-, CH3-Io\_G, CH4-Io\_B)  
Comments: OK, No flicker and no overshoot

**Test Condition: 230Vac/50Hz Input,  
Duty: (R: 5%, G: 10%, B: 1%)**

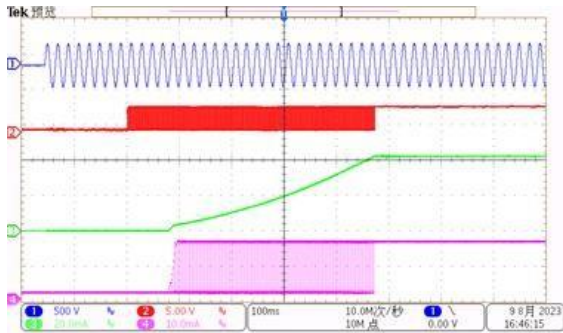


(CH1-Vbus, CH2-LEDR-, CH3-Io\_G, CH4-Io\_B)  
Comments: OK, No flicker and no overshoot



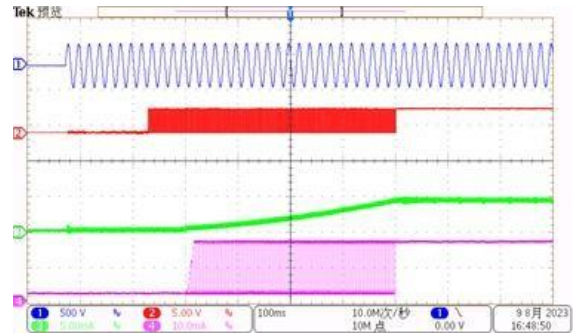
**Waveforms (CWRGB Mode):**

**Test Condition:** 220Vac/50Hz Input,  
Duty: (R: 100%, G: 0%, B: 0%, C: 100%, W: 0%)



(CH1-Vin, CH2-CLK, CH3-Io\_C, CH4-Io\_G)  
**Comments:** OK, No flicker and no overshoot

**Test Condition:** 230Vac/50Hz Input,  
Duty: (R: 0%, G: 100%, B: 0%, C: 10%, W: 0%)



(CH1-Vin, CH2-CLK, CH3-Io\_C, CH4-Io\_G)  
**Comments:** OK, No flicker and no overshoot

**2.2 Power Off**

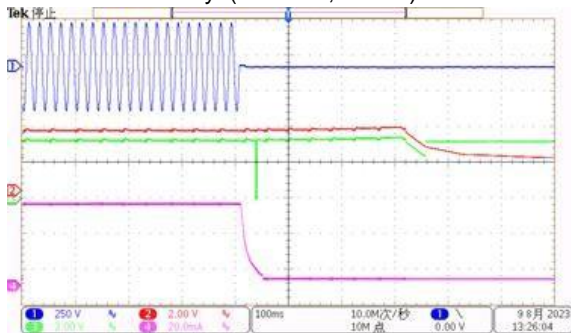
**Test Conditions:** Input: 220Vac; Output: 100V/43mA(C&W), 100V/15mA(R&G&B); CW: analog dimming;  
RGB: chopping dimming, 1kHz;

**Standard:** No flicker and no overshoot

**Result:** Pass

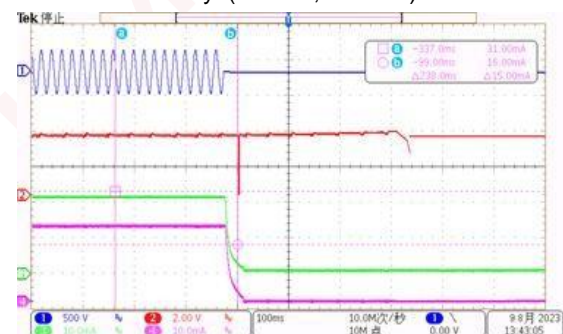
**Waveforms (CW Mode):**

**Test Condition:** 220Vac/50Hz Input,  
Duty: (C: 100%, W: 0%)



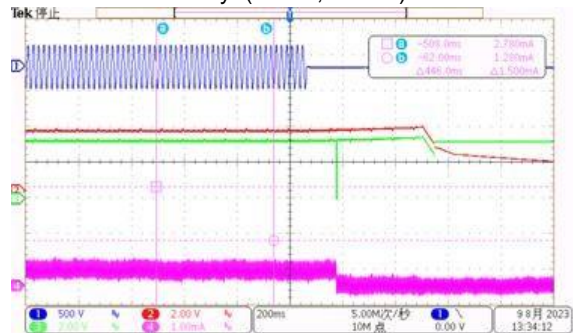
(CH1-Vin, CH2-3.3V, CH3-CLK, CH4-Io\_C)  
**Comments:** OK, No flicker and no overshoot

**Test Condition:** 220Vac/50Hz Input,  
Duty: (C: 50%, W: 50%)



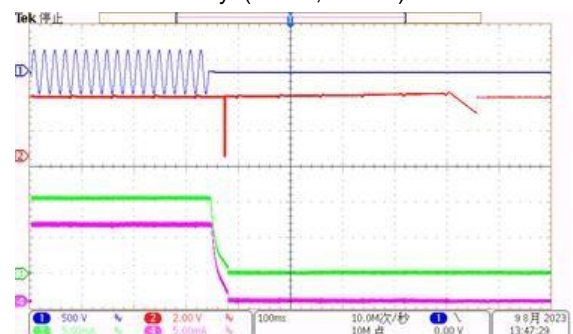
(CH1-Io\_W, CH2: PWMC, CH4-Io\_C)  
**Comments:** OK, No flicker and no overshoot

**Test Condition:** 220Vac/50Hz Input,  
Duty: (C: 1%, W: 0%)



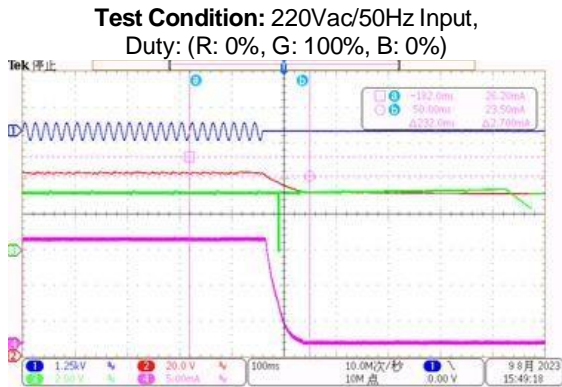
(CH1-Vin, CH2-3.3V, CH3-CLK, CH4-Io\_C)  
**Comments:** OK, No flicker and no overshoot

**Test Condition:** 220Vac/50Hz Input,  
Duty: (C: 5%, W: 5%)

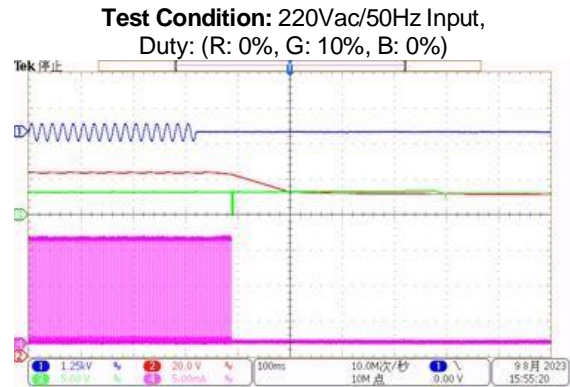


(CH1-Io\_W, CH2: PWMC, CH4-Io\_C)  
**Comments:** OK, No flicker and no overshoot

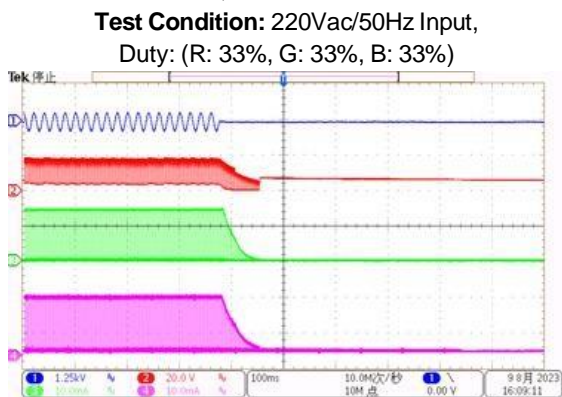
**Waveforms (RGB Mode):**



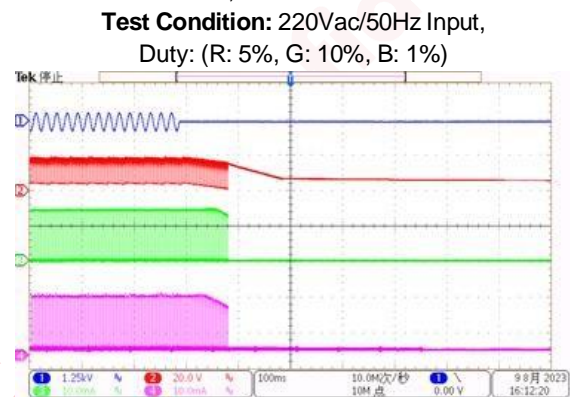
**Comments:** OK, No flicker and no overshoot



**Comments:** OK, No flicker and no overshoot



**Comments:** OK, No flicker and no overshoot



**Comments:** OK, No flicker and no overshoot

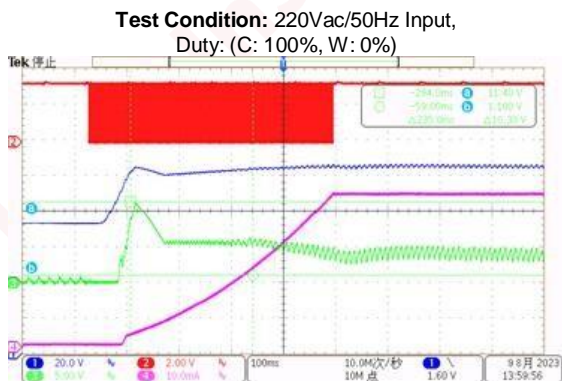
**2.3 Dimming on**

**Test Conditions:** Input: 220Vac; Output: 100V/43mA(C&W), 100V/15mA(R&G&B); CW: analog dimming; RGB: chopping dimming, 1kHz;

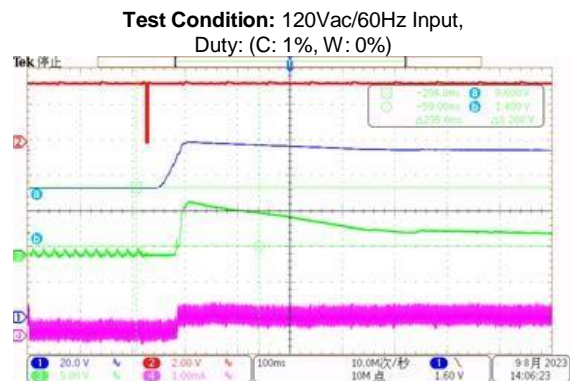
**Standard:** Smoothly and No flicker

**Result:** Pass

**Waveforms (CW Mode):**



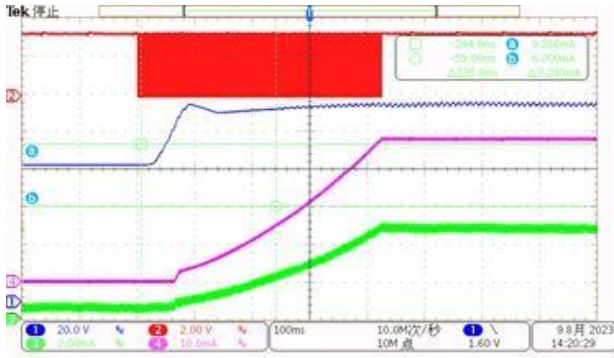
**Comments:** OK, No flicker and no overshoot



**Comments:** OK, No flicker and no overshoot

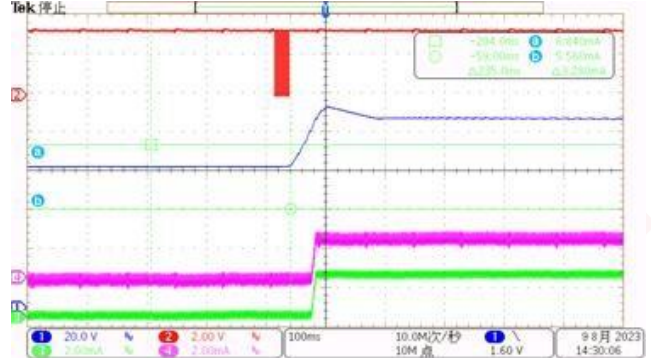


**Test Condition:** 220Vac/50Hz Input,  
Duty: (C: 10%, W: 90%)



(CH1-LED+, CH2-CLK, CH3: io\_W, CH4-io\_C)  
**Comments:** OK, No flicker and no overshoot

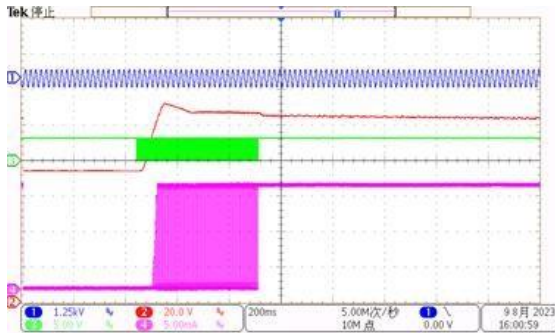
**Test Condition:** 220Vac/50Hz Input,  
Duty: (C: 5%, W: 5%)



(CH1-LED+, CH2-CLK, CH3: io\_W, CH4-io\_C)  
**Comments:** OK, No flicker and no overshoot

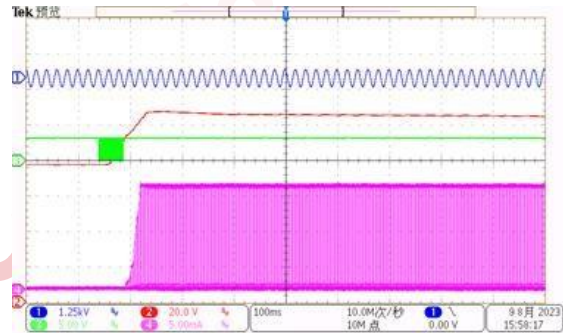
**Waveforms (RGB Mode):**

**Test Condition:** 220Vac/50Hz Input,  
Duty: (R: 0%, G: 100%, B: 0%)



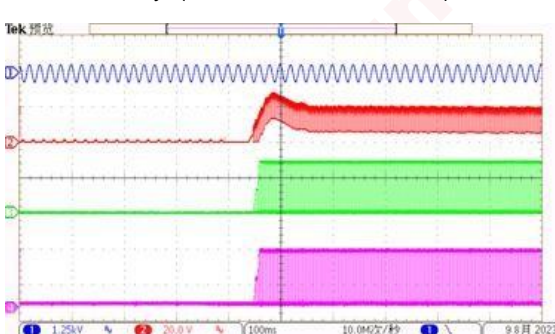
(CH1: Vin, CH2: LED+, CH3: CLK, CH4: io\_G)  
**Comments:** OK, No flicker and no overshoot

**Test Condition:** 120Vac/60Hz Input,  
Duty: (R: 1%, G: 0%, B: 0%)



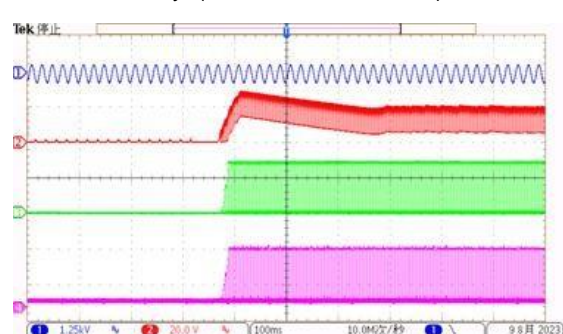
(CH1: Vin, CH2: LED+, CH3: CLK, CH4: io\_G)  
**Comments:** OK, No flicker and no overshoot

**Test Condition:** 220Vac/50Hz Input,  
Duty: (R: 33%, G: 33%, B: 33%)



(CH1: Vin, CH2: LEDR-, CH3: io\_G, CH4: io\_B)  
**Comments:** OK, No flicker and no overshoot

**Test Condition:** 120Vac/60Hz Input,  
Duty: (R: 5%, G: 10%, B: 1%)



(CH1: Vin, CH2: LEDR-, CH3: io\_G, CH4: io\_B)  
**Comments:** OK, No flicker and no overshoot

**2.4 Dimming off**

**Test Conditions:** Input: 220Vac; Output: 100V/43mA(C&W), 100V/15mA(R&G&B); CW: analog dimming;  
RGB: chopping dimming, 1kHz;

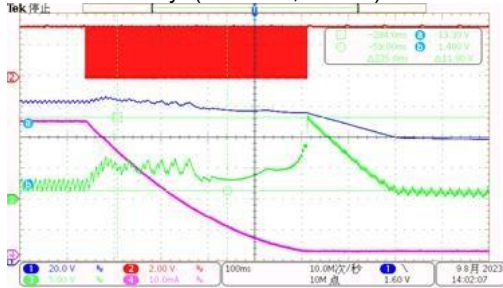
**Standard:** Smoothly and No flicker

**Result:** Pass



**Waveforms (CW Mode):**

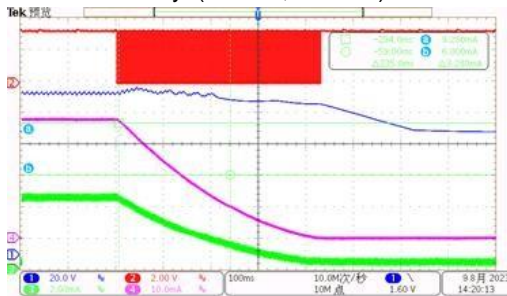
**Test Condition: 220Vac/50Hz Input,  
Duty: (C: 100%, W: 0%)**



(CH1: LED+, CH2: CLK, CH3: LEDC-, CH4: Io\_C)

**Comments: OK, VLED-max=13.4V**

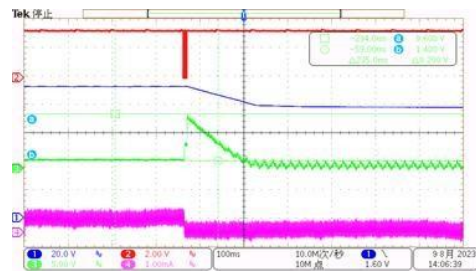
**Test Condition: 220Vac/50Hz Input,  
Duty: (C: 90%, W: 10%)**



(CH1: LED+, CH2: CLK, CH3: Io\_W, CH4: Io\_C)

**Comments: OK, no flicker**

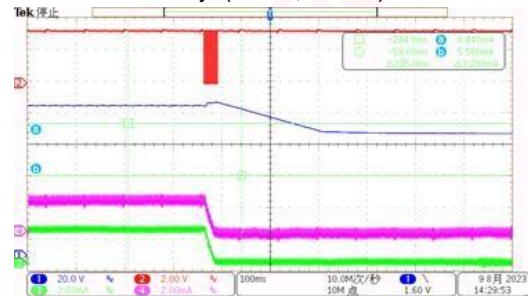
**Test Condition: 220Vac/60Hz Input,  
Duty: (C: 1%, W: 0%)**



(CH1: LED+, CH2: CLK, CH3: LEDC-, CH4: Io\_C)

**Comments: OK, VLED-max=9.6V**

**Test Condition: 220Vac/50Hz Input,  
Duty: (C: 5%, W: 5%)**

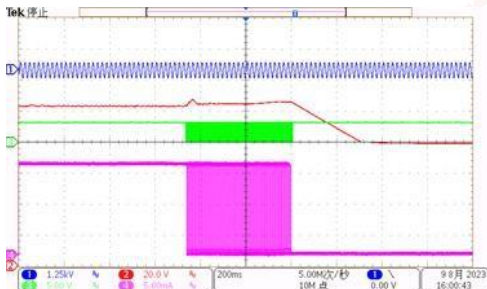


(CH1: LED+, CH2: CLK, CH3: Io\_W, CH4: Io\_C)

**Comments: OK, no flicker**

**Waveforms (RGB Mode):**

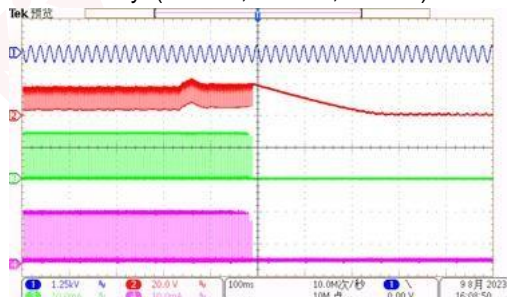
**Test Condition: 220Vac/50Hz Input,  
Duty: (R: 0%, G: 100%, B: 0%)**



(CH1: Vin, CH2: LED+, CH3: CLK, CH4: Io\_G)

**Comments: OK, no flicker**

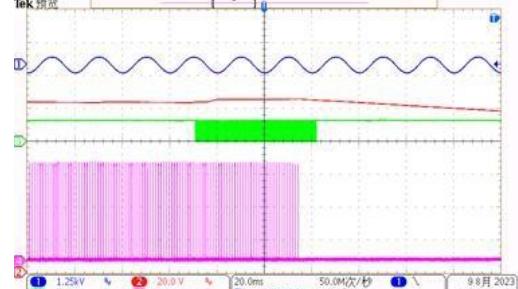
**Test Condition: 220Vac/50Hz Input,  
Duty: (R: 33%, G: 33%, B: 33%)**



(CH1: Vin, CH2: LEDR-, CH3: Io\_G, CH4: Io\_B)

**Comments: OK, no flicker**

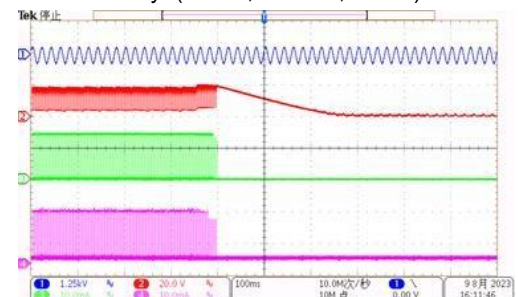
**Test Condition: 220Vac/50Hz Input,  
Duty: (R: 0%, G: 10%, B: 0%)**



(CH1: Vin, CH2: LED+, CH3: CLK, CH4: Io\_G)

**Comments: OK, no flicker**

**Test Condition: 120Vac/60Hz Input,  
Duty: (R: 5%, G: 10%, B: 1%)**



(CH1: Vin, CH2: LEDR-, CH3: Io\_G, CH4: Io\_B)

**Comments: OK, no flicker**

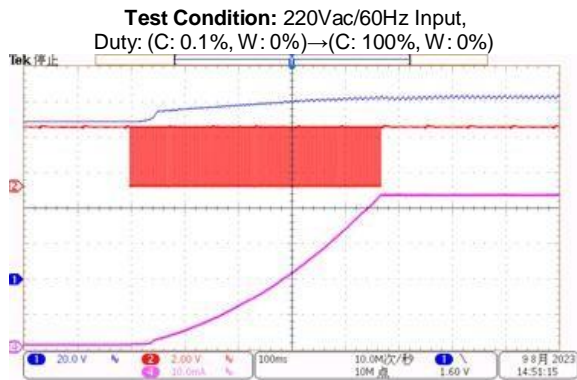
## 2.5 Dynamic Dimming

**Test Conditions:** Input: 220Vac; Output: 100V/43mA(C&W), 100V/15mA(R&G&B); CW: analog dimming;  
RGB: chopping dimming, 1kHz;

**Standard:** Smoothly and No flicker

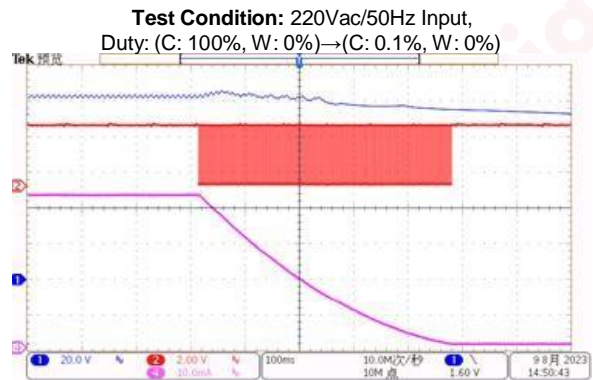
**Result:** Pass

### Waveforms (CW Mode):



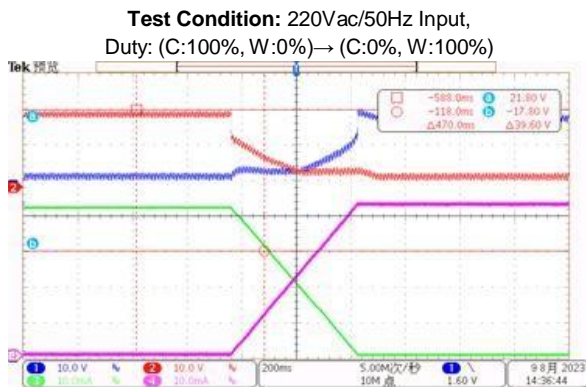
(CH1-LED+, CH2: CLK; CH4-Io\_C)

Comments: OK



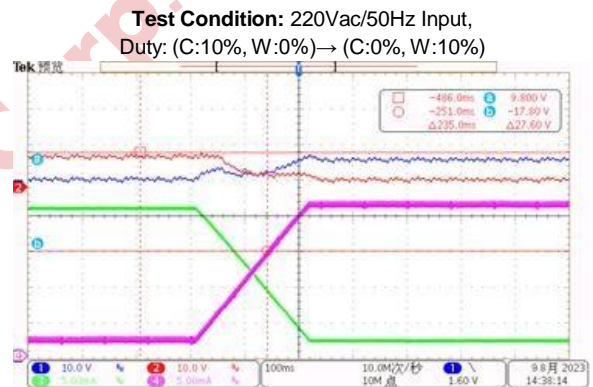
(CH1-LED+, CH2: CLK; CH4-Io\_C)

Comments: OK



(CH1: LEDC-, CH2: LEDW-, CH3: Io\_C, CH4: Io\_W)

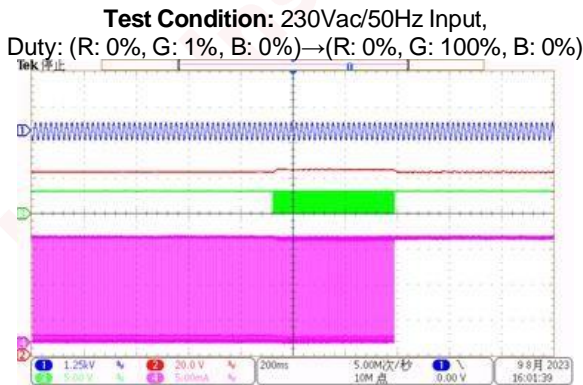
Comments: OK, VLED\_max=21.8V



(CH1: LEDC-, CH2: LEDW-, CH3: Io\_C, CH4: Io\_W)

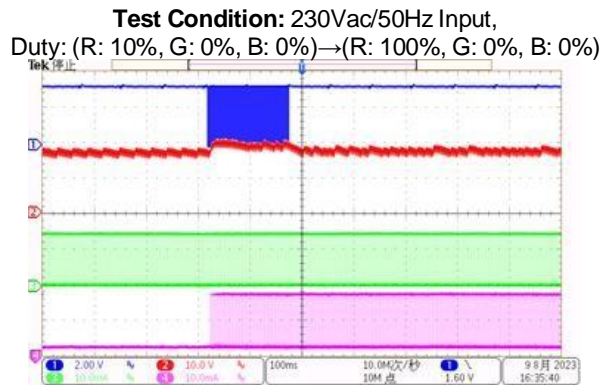
Comments: OK, VLED-max=9.8V

### Waveforms (RGB Mode):



(CH1: Vin, CH2: LED+, CH3: CLK, CH4: Io\_G)

Comments: OK



((CH1: CLK, CH2: LEDR-, CH3: Io\_G, CH4: Io\_B)

Comments: OK

## 3. Reliability Testing

### 3.1 Voltage stress of RGBCW channel

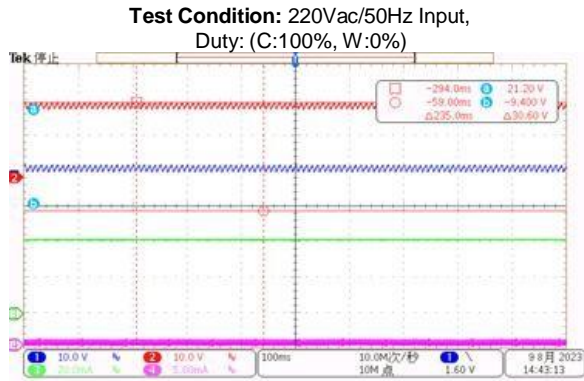


**Test Conditions:** Input: 220Vac; Output: 100V/43mA(C&W), 100V/15mA(R&G&B);

**Standard:** VLED-max<32V.

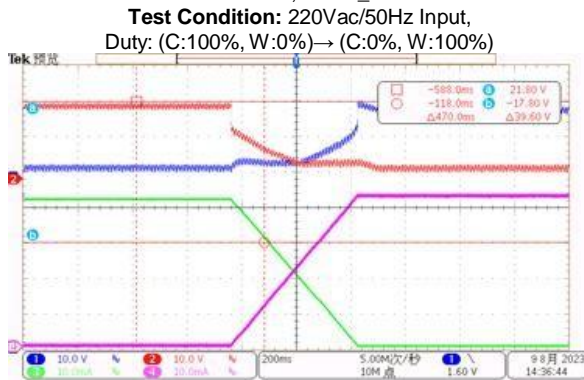
**Result:** Pass

**Waveforms:**



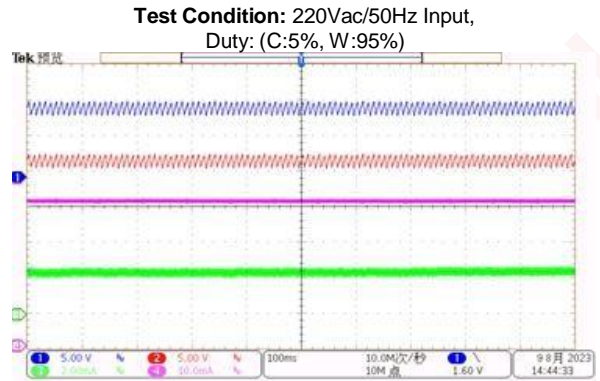
(CH1: LEDC-, CH2: LEDW-, CH3: Io\_C, CH4: Io\_W)

**Comments:** OK, VLED\_max=21.2V



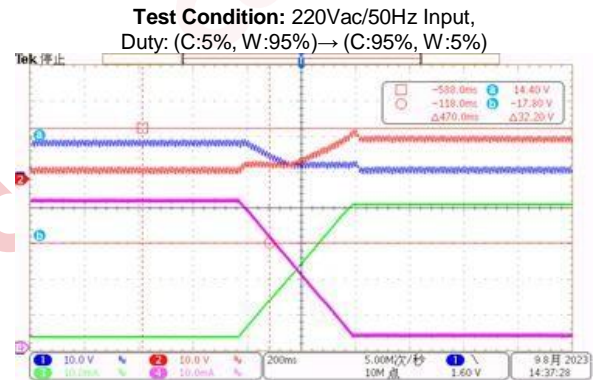
(CH1: LEDC-, CH2: LEDW-, CH3: Io\_C, CH4: Io\_W)

**Comments:** OK, VLED\_max=21.8V



(CH1: LEDC-, CH2: LEDW-, CH3: Io\_C, CH4: Io\_W)

**Comments:** OK



(CH1: LEDC-, CH2: LEDW-, CH3: Io\_C, CH4: Io\_W)

**Comments:** OK, VLED\_max=14.4V


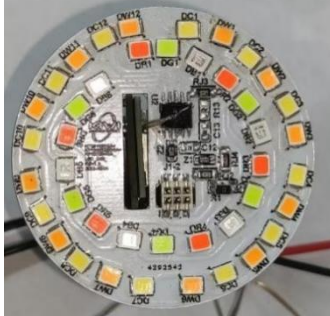
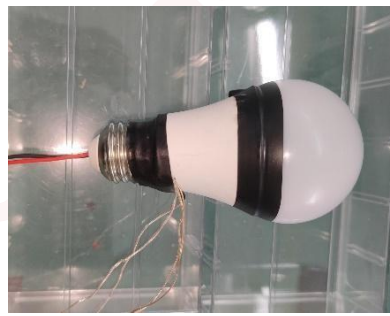
**3.2. Thermal Test**

**Test Condition:** Burn in for 1 hour within A60 lamp cavity @ confined container (60cm\*40cm\*40cm plastic box) and steady environment with no airflow, Ta is the temperature inside the plastic box.

**Standard:** The maximum temperature is less than 80°C

**Result:** Pass

Test Condition: CW Mode, Input Power 5W						
Component	176Vac		220Vac		264Vac	
	Ta=27.5°C		Ta=27.4°C		Ta=26.6°C	
	T(°C)	Trise(°C)	T(°C)	Trise(°C)	T(°C)	Trise(°C)
KP28162SG	61.7	34.2	62.6	35.2	62.5	35.9
KP18056ESSG	63.9	36.4	64	36.6	63.6	37
KP35026VG	61.2	33.7	62.2	34.8	62.3	35.7
LED board	63.7	36.2	63.9	36.5	63.2	36.6

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### 3.3. EMC Test Result

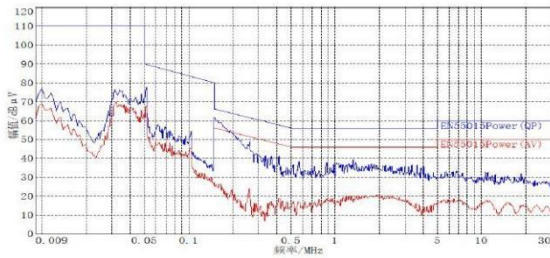
**Test Conditions:** Input :220VAC; Output: 5W@CW Mode

**Standard:**

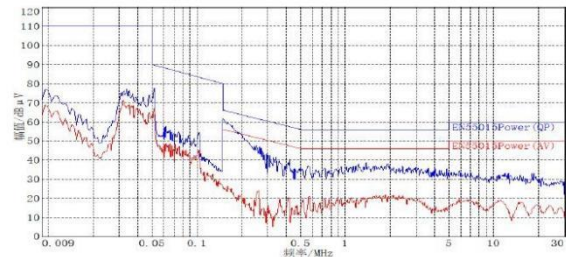
Standard	EN55015
Content	CE/CDN
Requirement	Margin>=6dB

**Result:** Pass

**Test Condition:** Vin=220Vac/50Hz, CE

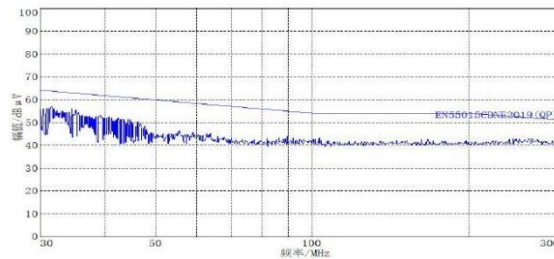


CE EMI--LINE



CE EMI--NEUTRAL

**Test Condition:** CDN



Conduction CDN---220Vac/50Hz

### 3.4. Surge Test

Line to Line 1kV surge testing was completed according to IEC61000-4-5. Input voltage was set at 220VAC/50Hz. Output was loaded at full load and operation was verified following each surge event. Each injection phase below is tested with 5 times and hold for 25 seconds before next one.

Input Voltage (VAC)	Surge Level (V)	Injection Location	Injection Phase (°)	Test Result (Pass/Fail)
220Vac/50Hz	+1000	L to N	0	Pass
	+1000	L to N	90	Pass
	+1000	L to N	180	Pass
	+1000	L to N	270	Pass
	-1000	L to N	0	Pass
	-1000	L to N	90	Pass
	-1000	L to N	180	Pass
	-1000	L to N	270	Pass

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## **Test Setup Guide**

1. Set the AC Power Source between 176VAC and 264VAC.
2. Connect the AC Power Source terminal to the “L” and “N” terminals on the Demo Board.
3. The dimming program for Espressif modules is in the file "Dimming code-28162+18056+35026\_D02\_REV1.0"

Turn on the AC Power Source to make system startup; and Turn off the AC Power Source to make system shutdown.

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## Revision History

DATE	REV	DESCRIPTION
2023/08/11	1.0	First Release

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