DEMO BOARD TEST REPORT

600W Non-isolated PWM Dimming LED Driver with KP1469

FEATURES

- 120V~350V Wide Output Voltage Range
- Ultra High Efficiency, up to 99.3%@350Vo
- Wide PWM Dimming Range 1%~100%
- Externally Vset for Maximum Current Setting
- Excellent Load Regulation
- All-Around Protection: OVP, SCP, OTP
- Low Standby Power <100mW

APPLICATIONS

- Two stage dimmable LED driver (2-nd stage)
- High-pole lamp, Plant grow lighting

INTRODUCTION

This DEMO board is a high performance non-isolated 600W constant current LED driver which is controlled by KP1469.Besides the multi-protection function (OVP, SCP, OTP), this demo also has very good efficiency, load regulation, low standby power loss and wide dimming range.

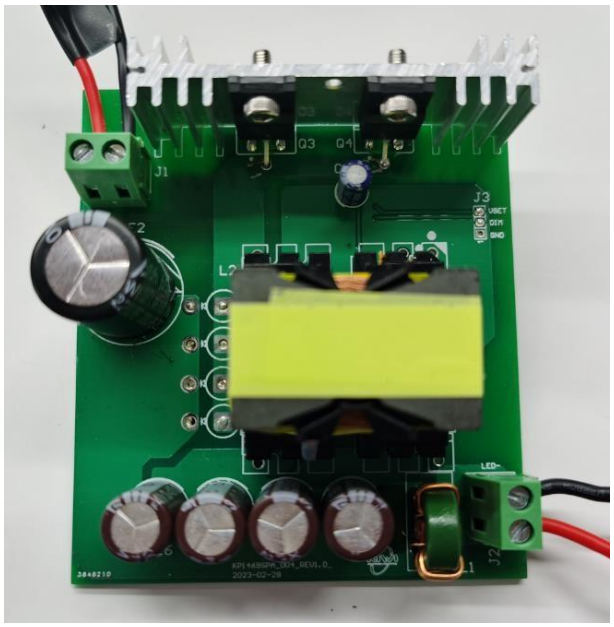
After combining this non-isolated buck circuit with front-end PFC (KP2822) and dimming interface (KP1402), it can form a complete two-stage intelligent dimming solution, achieving high PF, low THD, and flicker-free dimming. It is applied in high-power LED lightings such as high-pole lamps and plant lighting.

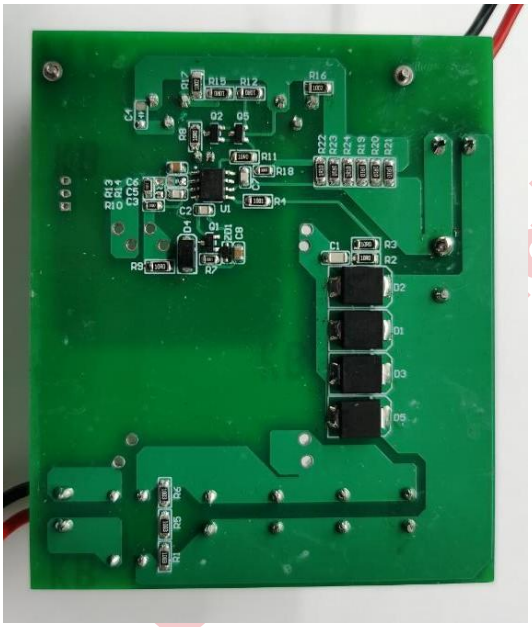
DEMO BOARD SEPCIFICATION

Description	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	Vin	390	410	430	Vdc	
Output Voltage Range	Vout	120		350	Vdc	
Maximum Output Current	Iomax		1.72		A	
Output Current Dimming Range	Io	1%Iomax		100%Iomax		
Total Output Power	Pout			602	W	
System Efficiency	η		99.3		%	Vin=410Vdc,Vo=350V
			98.1		%	Vin=410Vdc,Vo=120V
Output Current Ripple(pk-pk)	Iripple		5%Iomax	10%Iomax		Vin=410Vdc,Vo=350V
Load Regulation			2		%	Vin=410Vdc,Vo=120V~350V
Standby Power	Pstandby			30	mW	Vin=410Vdc@DIM OFF
Startup Overshoot Current			0		%	
Turn on delay time	Tst			0.2	s	Tested at Vin=410Vdc
No Load Output Voltage	Vovp		380		V	Vin=410Vdc@No load

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

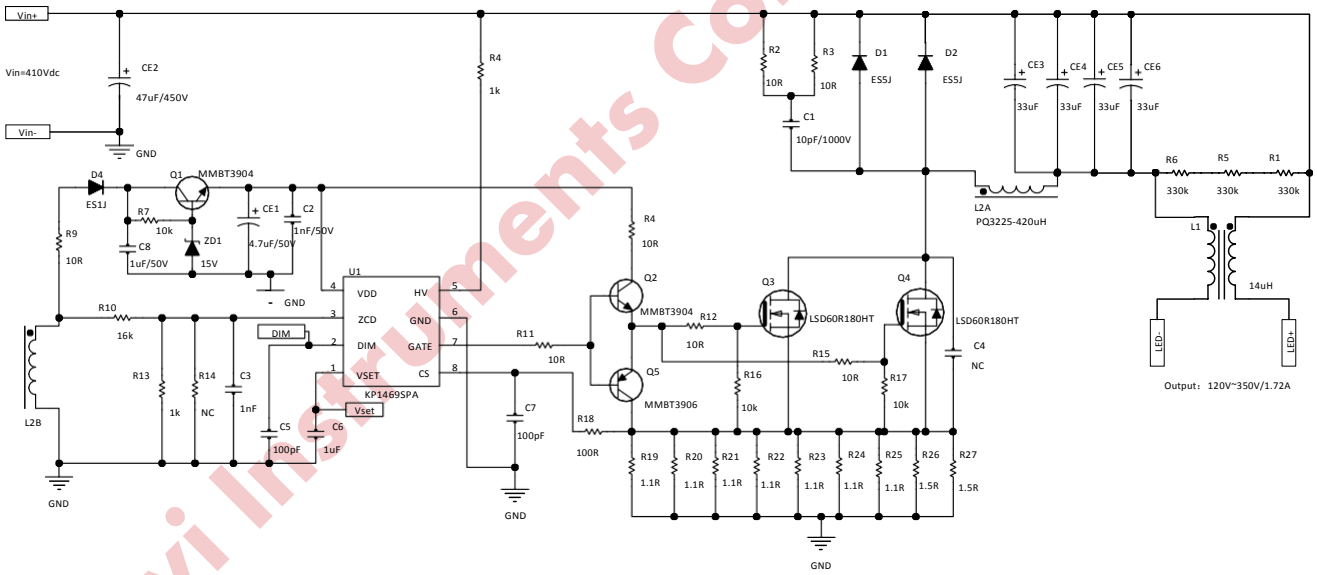
Demo Board of KP1469_D04_REV1.0





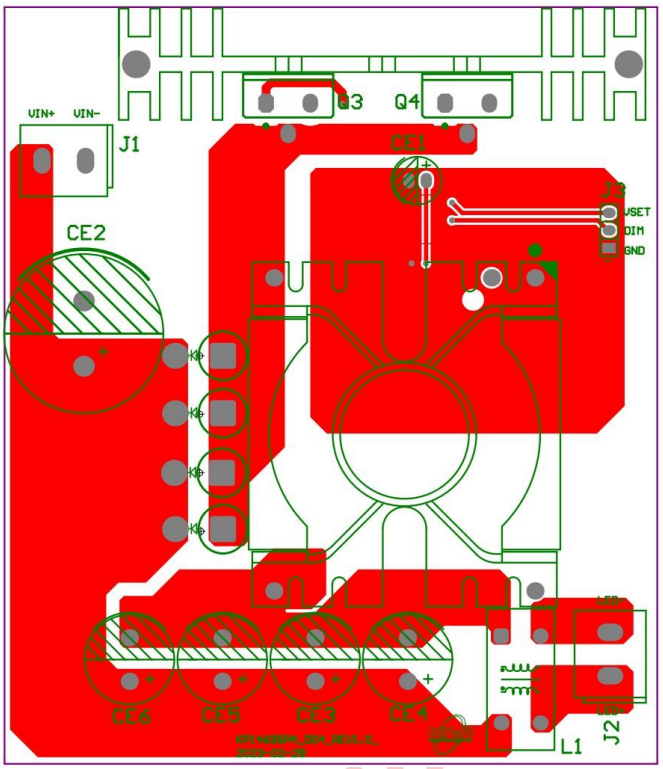
Board Size (in mm): L x W x H=75 x 87 x40

Schematic

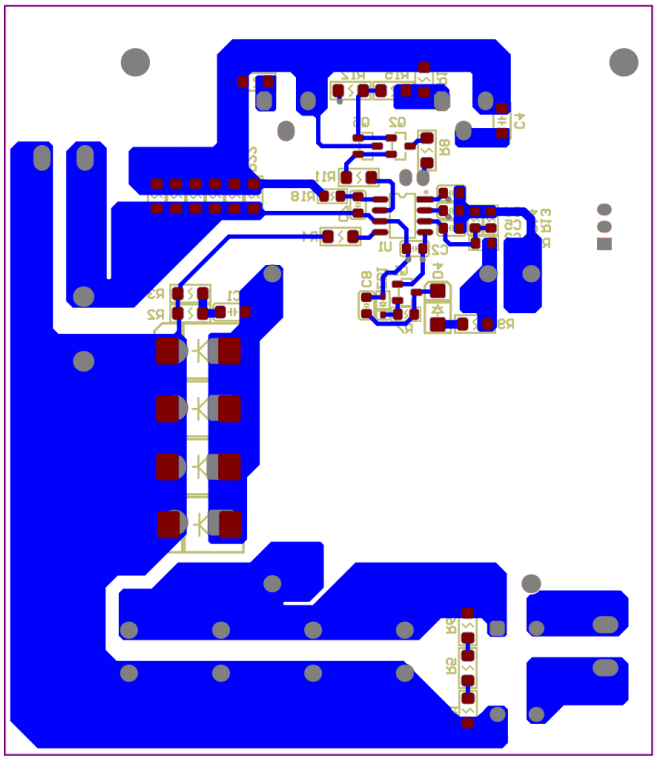


Printed Circuit B ard Layout

Top Layer



Bottom Layer

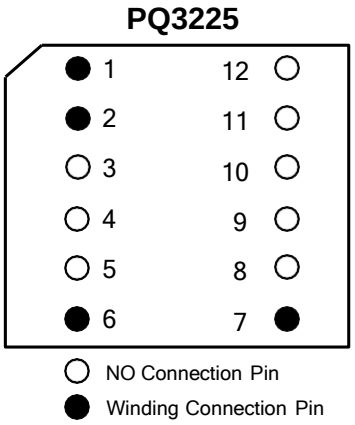


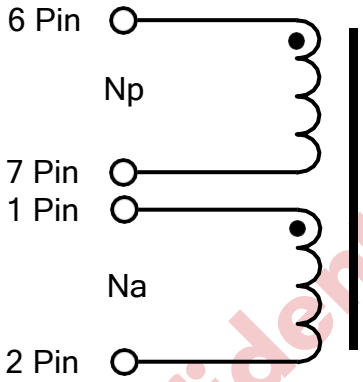
Bill of Material

No.	Designator	Value	Description	Package	Manufacturer	Part Number
1	C1	10pF/1000V	Ceramic Cap 1000V ±5% NPO	1206	YAGEO	CC1206JKNPOCBN100
2	C2, C3	1nF/50V	Ceramic Cap 50V ±5% NPO, Ceramic Cap 50V ±10% X7R	0805	WE	885012207103
3	C4	NC	Ceramic Cap 1000V ±5% NPO	1206	YAGEO	CC1206JKNPOCBN100
4	C5, C7	100pF	Ceramic Cap 50V ±10% X7R	0805	WE	885012207103
5	C6, C8	1μF/50V	Ceramic Cap 50V ±10% X7R	0805	WE	885012206126
6	CE1	4.7μF/50V	Electrolytic Cap 50V 5*11 P2.0	TH	AISHI	ERS1HM4R7D11OT
7	CE2	47μF/450V	Electrolytic Cap 450V 18*35 P7.5	TH	AISHI	EWH2WM101M35OT
8	CE3, CE4, CE5, CE6	33μF/400V	Electrolytic Cap 400V 10*18 P5.0	TH	Ymin	KCXE1802G330MF
9	D1, D2	600V/5A	DIO FRD 5A 600V 35nS 1.68V	SMC	MDD	ES5JC
10	D4	600V/1A	DIO FRD 1A 600V 35nS 1.7V	SMA	MDD	ES1J
11	Q5	40V/0.1A	TRansistor -40V -0.1A PNP	SOT23	LGE	MMBT3906LT1
12	L1	14μH	COMMON INDUCTOR Isat 4A Rdc 15mΩ 16*7.5*17.5	XS	WE	744841414
13	L2	420μH	420uH,PQ3225,37:4,Np=0.1mm*60P*37Ts,Na=0.2mm*4Ts	PQ3225	DMEGC	PQ3225
14	Q1, Q2	40V/0.1A	TRansistor 40V 0.1A NPN	SOT23	LGE	MMBT3904 1AM
15	Q3, Q4	600V/18A	MOSFET 600V 18A 180mohm	TO-220F	Loten	LSD60R180HT
16	R1, R5, R6	330K	Chip Resistor ±1% 1/4W	1206	FH	RS-06K3303FT
17	R2, R3, R8, R9, R11, R12, R15	10R	Chip Resistor ±1% 1/4W	1206	FH	RS-06K10R0FT
18	R4	1k	Chip Resistor ±1% 1/4W	1206	FH	RS-06K1001FT
19	R7	10k	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1002FT
20	R10	16k	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1602FT
21	R13	1k	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1001FT
22	R14	NC	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1001FT
23	R16, R17	10k	Chip Resistor ±1% 1/4W	1206	FH	RS-06K1002FT
24	R18	100R	Chip Resistor ±1% 1/8W	0805	FH	RS-05K1000FT
25	R19, R20, R21, R22, R23, R24, R25	1.1R	Chip Resistor ±1% 1/4W	1206	FH	RS-06L1R10FT
26	R26, R27	1.5R	Chip Resistor ±1% 1/4W	1206	FH	RS-06L1R50FT
27	U1	KP1469SPA	High Power PWM/0-10V Dimming, Quasi-resonant Step-down LED Controller	SOP-8	KIWI	KP1469SPA
28	ZD1	15V	Diode Zener 15V 2% 200mW	SOD-323	PANJIT	BZT52-B15S

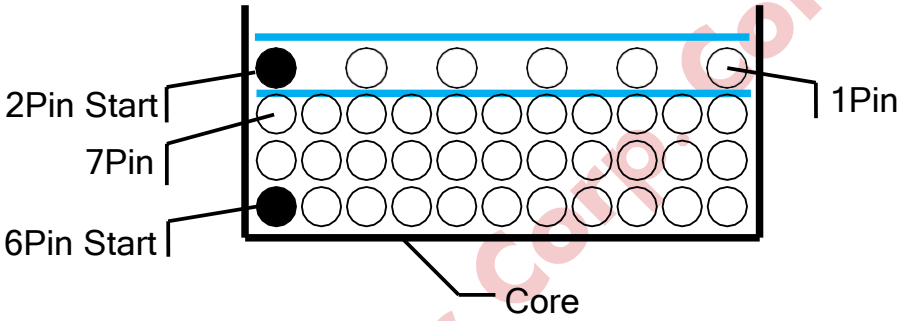
Inductor Manufacture Guide---L2

1. Electrical Diagram





2. Winding Diagram



3. Winding Order

Number	Winding	Layer	Start	End	Wire Size	Turns	Note
1	Np	Primary	6	7	0.1mm*60P	37T	0.1mmΦ*60P 2UEW, Litz
2	Na	Auxiliary	2	1	0.2mm	4T	0.2mmΦ，2UEW

4. Electrical Specification

Items	Test Condition	Test Pin	Specification
Primary Inductance	Measured at 40kHz, 1.0 VRMS	Pins 6 - 7, all other windings open	420μH±5%
DC Resistance	Measured at 40kHz, 1.0 VRMS	Pins 6 - 7	100mΩ Max

5. Inductor BOM

Items	Description
1	**Core:** PQ3225, PC44 or equivalent, AE=161mm^2
2	**Bobbin:** PQ3225, 6+6 Pin
3	**Wire:** Φ0.1mm*60P, 2UEW, Class B
4	**Wire:**Φ0.2mm, 2UEW, Class B
5	**Tape:** 10mm(W)×0.06mm(TH)

Test Result

1. Steady State Characteristics

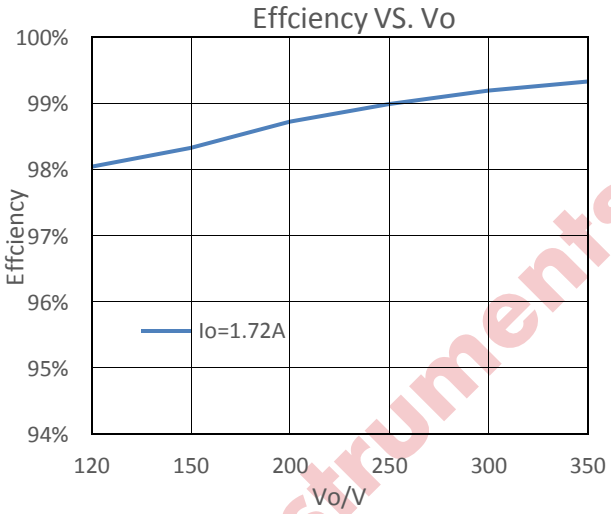
1.1 Efficiency & Load Regulation

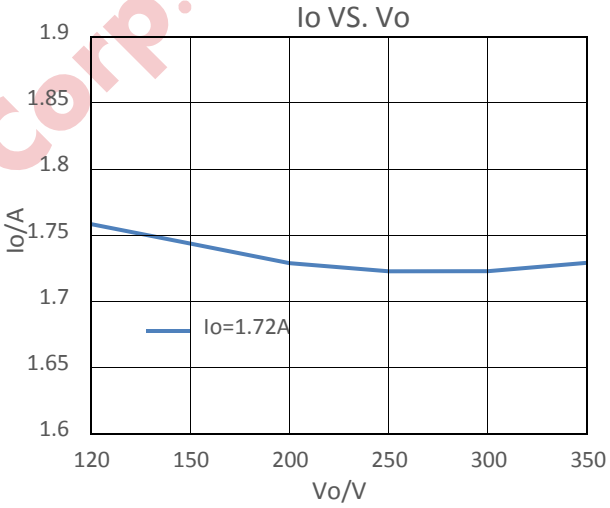
Test Conditions: Input: 410Vdc; Output: 120-350V&1.72A.

Standard: Eff>98%, @410Vdc, 120~350V&1.72A.

Result: Pass

Vin(V)	Vo(V)	Io(A)	Po(W)	Pin(W)	Eff(%)
410Vdc	121.124	1.7547	212.54	216.77	98.05%
	151.113	1.74	262.94	267.4	98.33%
	201.09	1.7252	346.92	351.4	98.73%
	251.08	1.719	431.61	436	98.99%
	301.08	1.7192	517.62	521.8	99.20%
	351.11	1.7255	605.84	609.9	99.33%



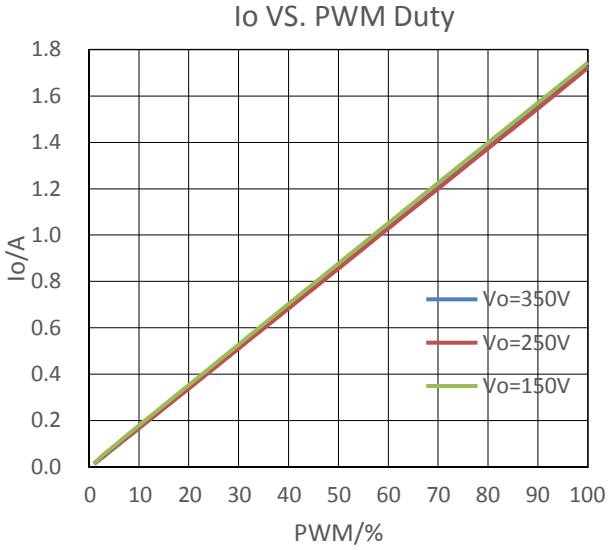


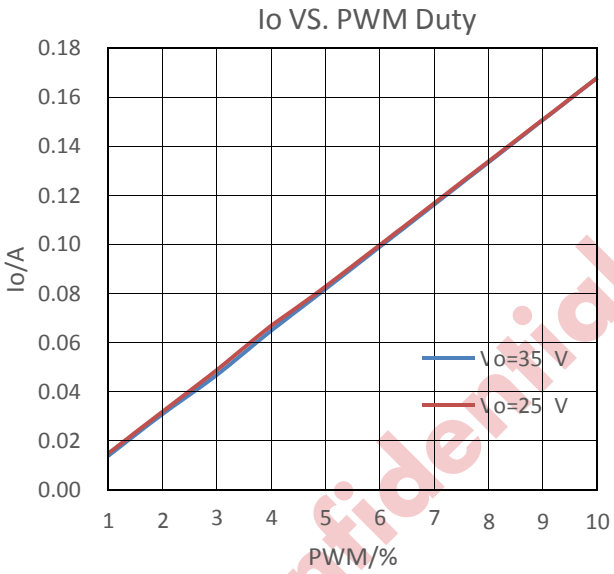
1.2 PWM Dimming Curve

Test Conditions: Input: 410Vdc; Output: 150V/250V/350V.

Standard: High linearity of dimming curve.

Result: Pass

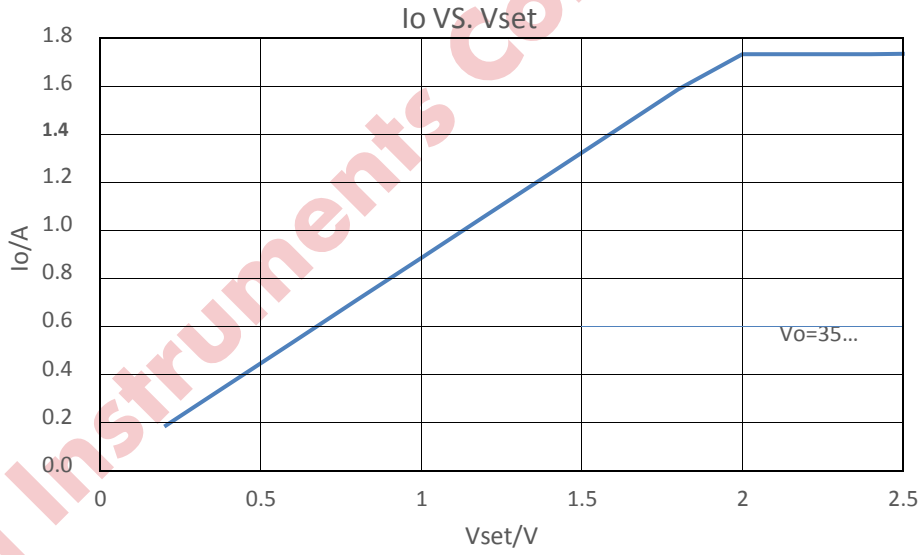




1.3 Set Output Current through Vset

Test Conditions: Input: 410Vdc; Output: 350V&1.72A.

Result: Output current matches Vset well.



1.4 Standby Power

Test Conditions: Input: 410Vdc; DIM=0V.

Standard: $P_{standby}$ <30mW

Result: Pass

IC	1#	2#
$P_{standby}$	19.2mW	20.2mW

1.5 Output Current Ripple

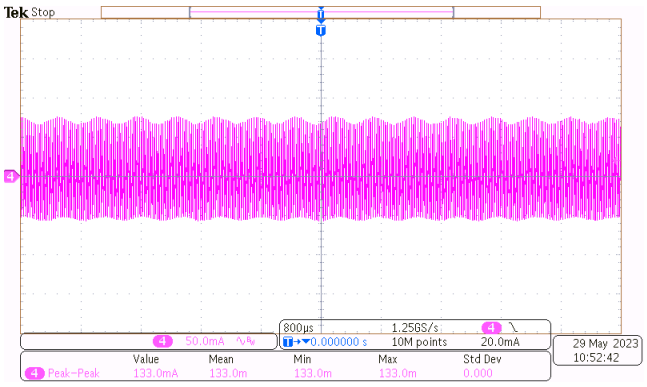
Test Conditions: Input: 410Vdc; Output: 350V&1.72A.

Standard: Pk-pk Ripple <172mA

Result: Pass

Waveforms:

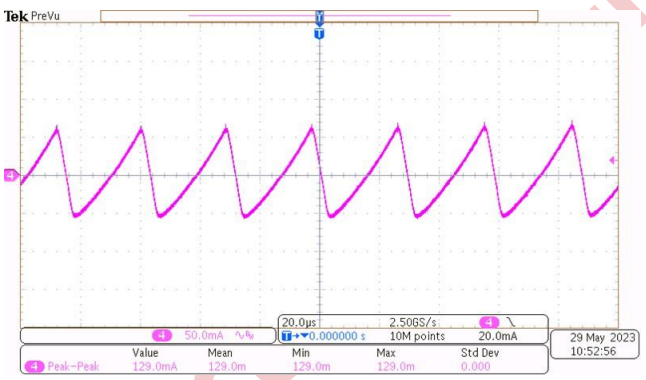
Test Condition: 410Vdc Input, 350V&1.72A Output



(CH4: Io)

Comments: Iripple_pk-pk=133mA

Test Condition: 410Vdc Input, 350V&1.72A Output



(CH4: Io)

Comments: Iripple_pk-pk=129mA

2 Dynamic Characteristics

2.1 Power on/off Characteristics

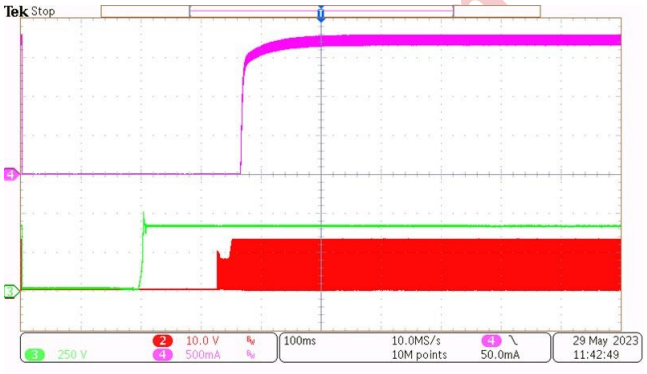
Test Conditions: Input: 410Vdc; Output: 350V&1.72A.

Standard: Start up time <300ms, and no flicker and no overshoot

Result: Pass

Waveforms:

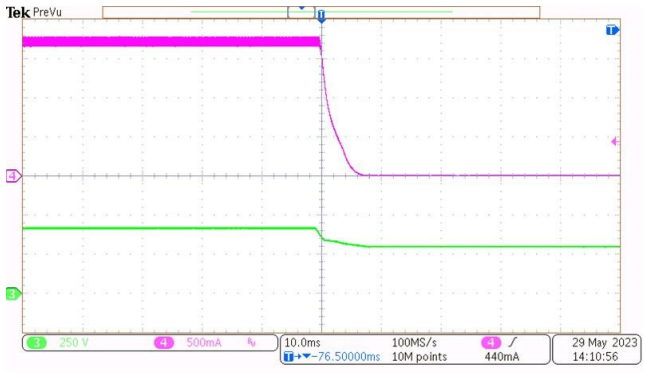
Test Condition: 410Vdc Input, 350V&1.72A Output



(CH3: Vin; CH4: Io)

Comments: Current rise time 170ms, No flicker and no overshoot

Test Condition: 410Vdc Input, 350V&1.72A Output



(CH3: Vin; CH4: Io)

Comments: No flicker and no overshoot

2.2 Dim on/off Characteristics

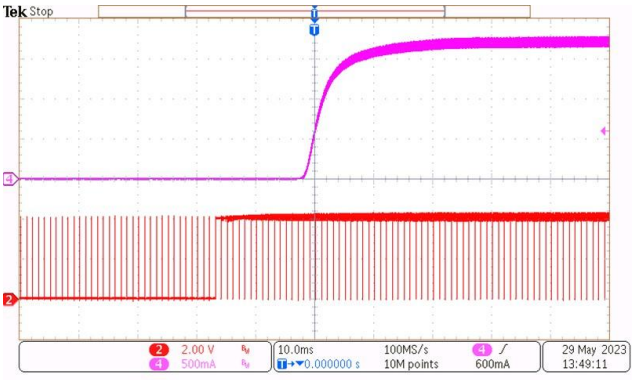
Test Conditions: Input: 410Vdc; Output: 350V&1.72A.

Standard: No flicker and no overshoot

Result: Pass

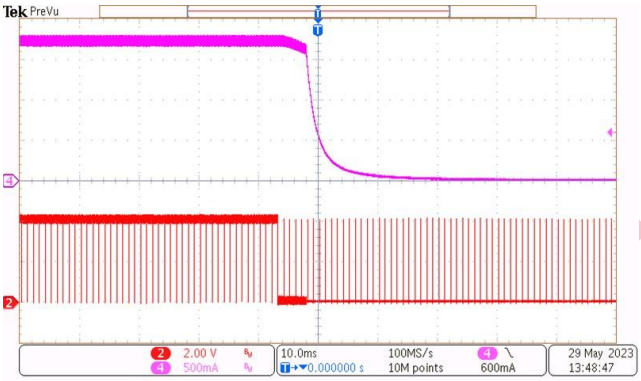
Waveforms:

Test Condition: 410Vdc Input, 350V&1.72A Output



(CH2: Vdim; CH4: Io)
Comments: OK, No flicker and no overshoot

Test Condition: 410Vdc Input, 350V&1.72A Output



(CH2: Vdim; CH4: Io)
Comments: OK, No flicker and no overshoot

3 Reliability Testing

3.1 Output Short Protection

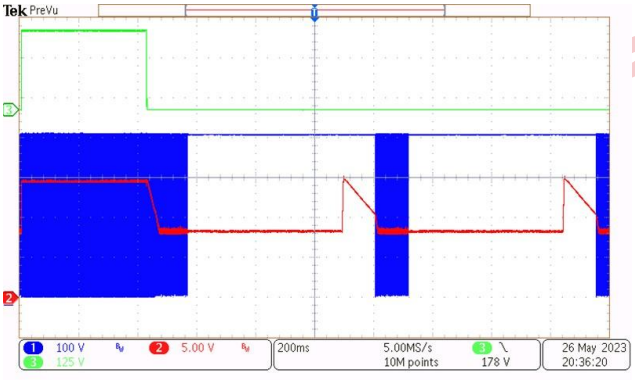
Test Conditions: Input: 410Vdc; Output: 350V&1.72A.

Standard: Output is auto recovery and no component damaged.

Result: Pass

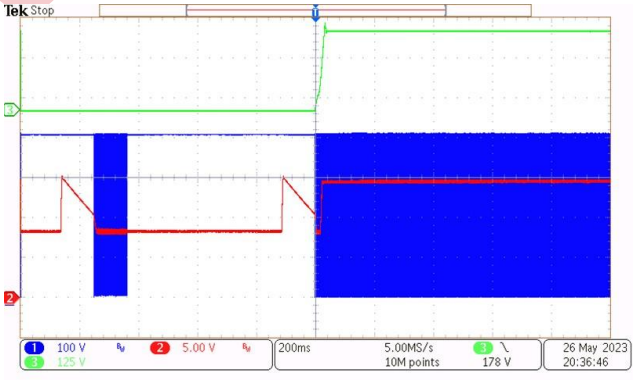
Waveforms:

Test Condition: 410Vdc Input, 350V&1.72A Output



(CH1:Vdrain; CH2: VCC; CH3: Vo)
Comments: Protect function is OK

Test Condition: 410Vdc Input, 350V&1.72A Output



(CH1:Vdrain; CH2: VCC; CH3: Vo)
Comments: Auto recovery function is OK

3.2 Output Open Protection

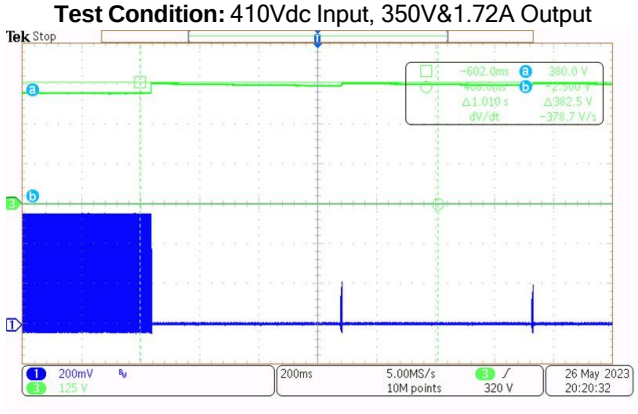
Test Conditions: Input: 410Vdc; Output: 350V&1.72A.

Standard: Output is auto recovery and no component damaged.

Result: Pass

Waveforms:

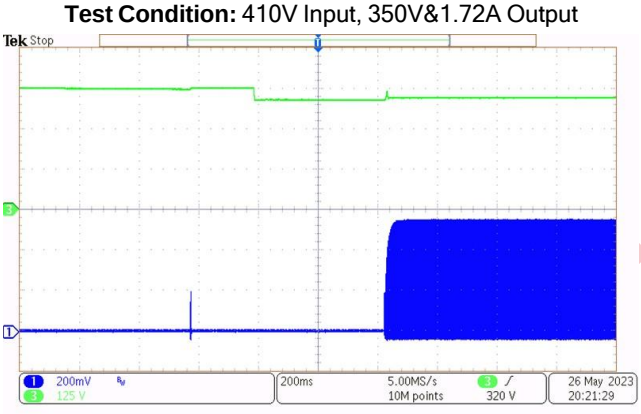
Test Condition: 410Vdc Input, 350V&1.72A Output



(CH1:Vdrain; CH3: Vo)

Comments: Protect function is OK

Test Condition: 410V Input, 350V&1.72A Output



(CH1:Vdrain; CH3: Vo)

Comments: Auto recovery function is OK

3.3 Maximum Stress of Buck MOSFET

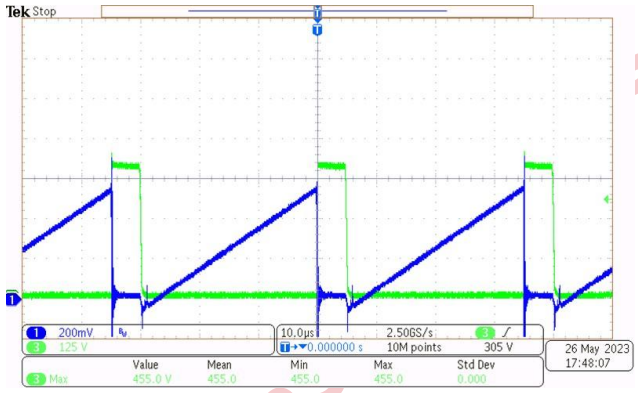
Test Conditions: Input: 410Vdc; Output: 350V&1.72A.

Standard: VDS_peak < 90% *Vdsmax

Result: Pass

Waveforms:

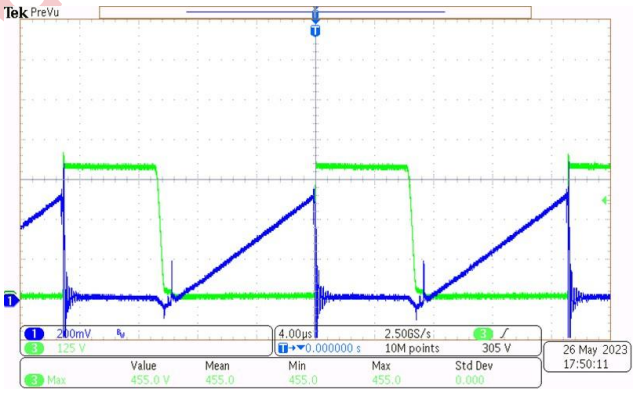
Test Condition: 410Vdc Input, 350V&1.72A Output
Stable state



(CH1:Vcs; CH3: VDS)

Comments: OK VDS_peak=455V

Test Condition: 410Vdc Input, 250V&1.72A Output
Stable state



(CH1:Vcs; CH3: VDS)

Comments: OK VDS_peak=455V

3.4 Maximum Stress of Buck Output Diode

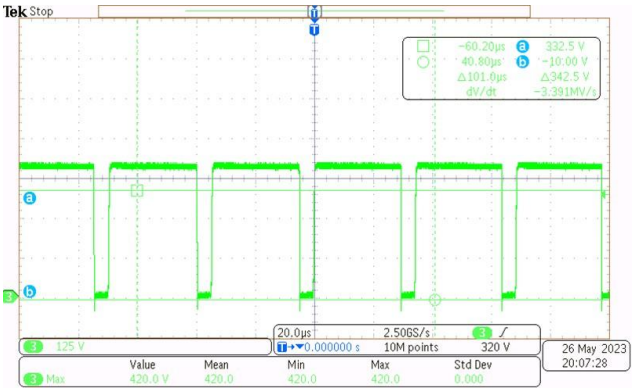
Test Conditions: Input: 410Vdc; Output: 350V&1.72A.

Standard: VDS_peak < 90% *Vdsmax

Result: Pass

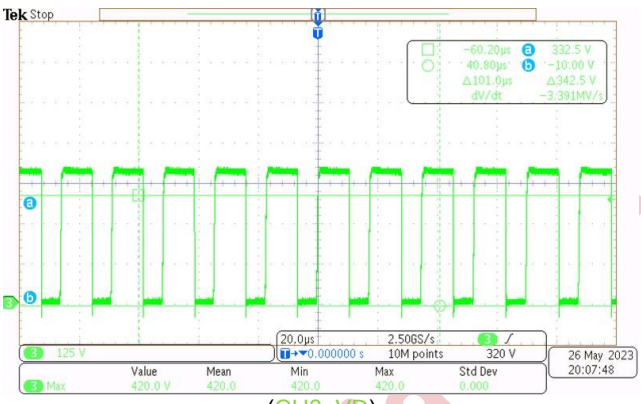
Waveforms:

Test Condition: 410Vdc Input, 350V&1.72A Output
Stable state



(CH3: VD)
Comments: OK VD_peak=420V

Test Condition: 410Vdc Input, 250V&1.72A Output
Stable state



(CH3: VD)
Comments: OK VD_peak=420V

3.5 Maximum Stress of Transformer

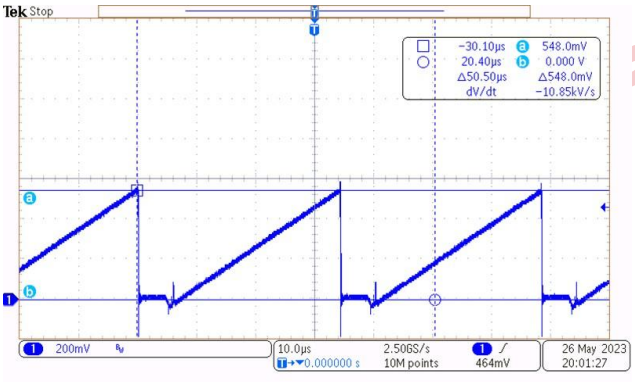
Test Conditions: Input: Input: 410Vdc; Output: 120~350V&1.72A.

Standard: Bmax <0.3T

Result: Pass

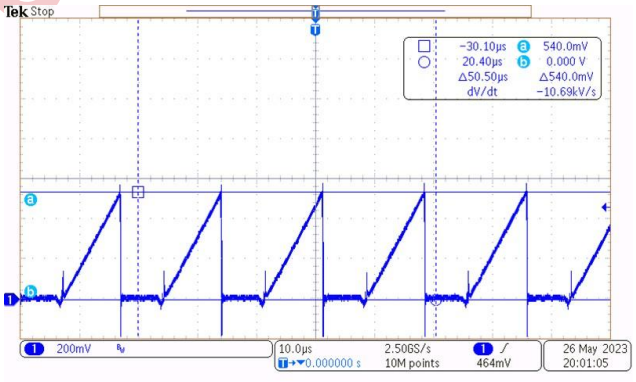
Waveforms:

Test Condition: 410Vdc Input, 350V&1.72A Output
Stable state



(CH1: Vcs)
Comments: OK Bmax=0.27T

Test Condition: 410Vdc Input, 250V&1.72A Output AC
Stable state



(CH1: Vcs)
Comments: OK Bmax=0.27T

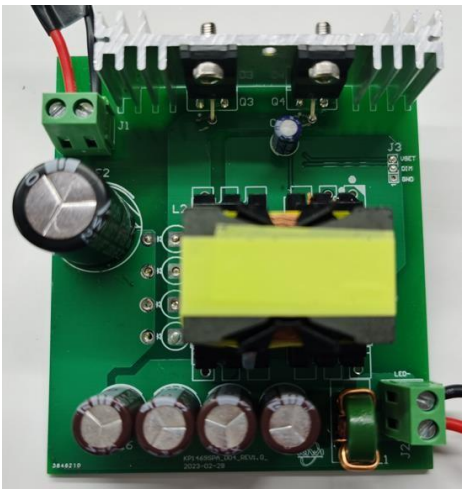
3.6 Thermal Test

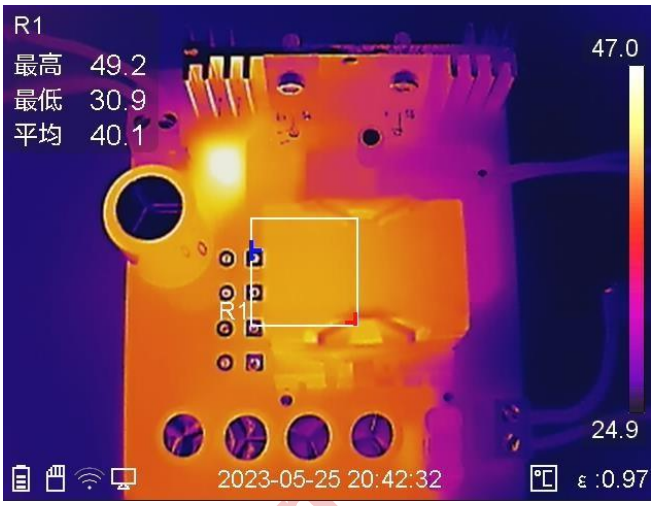
Test Conditions: Input: 410Vdc; Output: 350V&1.72A. Burn-in 0.5Hour @ confined container and steady environment with no airflow, Ta is the temperature inside the cardboard box.

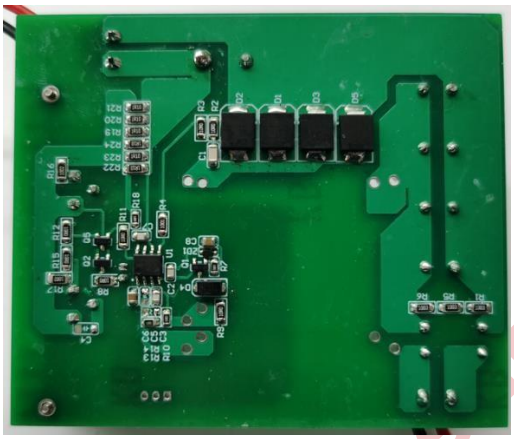
Standard: Final product will be cased and potted, the open frame thermal test data is only for reference.

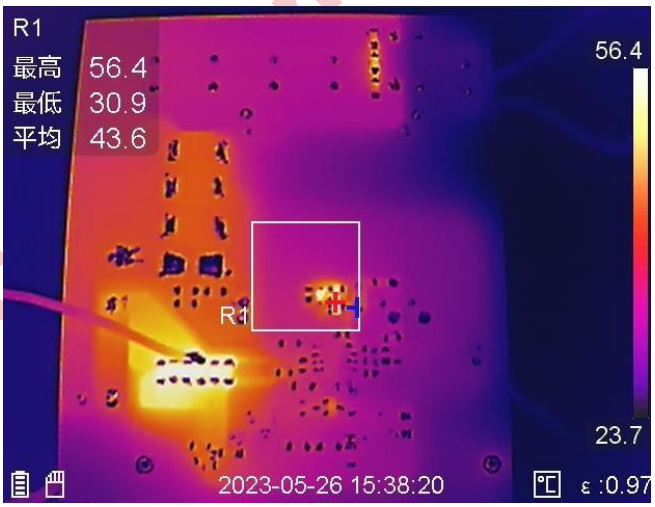
Result: Pass

410Vdc, Ta=25℃









Revision History

DATE	REV	DESCRIPTION
2023/06/06	1.0	First Release
2023/07/21	1.01	Change the Inductor Pin

Disclaimer

Kiwi reserves the right to make any change to its product, datasheet or specification without any notice. Users shall obtain the latest information before placing an order. Kiwi herein makes no guarantee or warranty, expressed or implied, including without limitation the warranties of merchantability, fitness for any purpose or non-infringement of third party rights, nor does Kiwi convey any license or permission including without limitation the intellectual property rights of Kiwi or any third party. Users should warrant that third party intellectual property right or other right is not infringed when integrating Kiwi products into any application or in use. Kiwi will not assume any liability arising from any said application or use, and especially disclaim any liability including without limitation any consequential or incidental damage. Without written declaration, Kiwi products are not designed for use in surgical device implant into the body or other life sustain systems. This disclaimer supersedes the disclaimers in previous versions.