TEST REPORT: HVG-240-30

240W Constant Voltage + Constant Current LED Driver

■ DESIGN VERIFY TEST

- Output Function Test
- Input Function Test
- Protection Function Test
- Control Function Test
- Component Stress Test

■ SAFETY & E.M.C. TEST

- Safety Test
- E.M.C. Test

■ RELIABILITY TEST

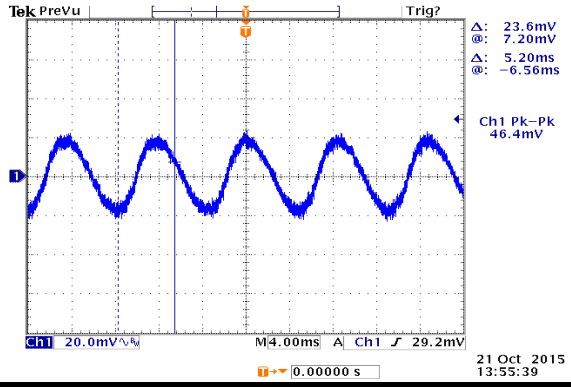
- ENVIRONMENT TEST

DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

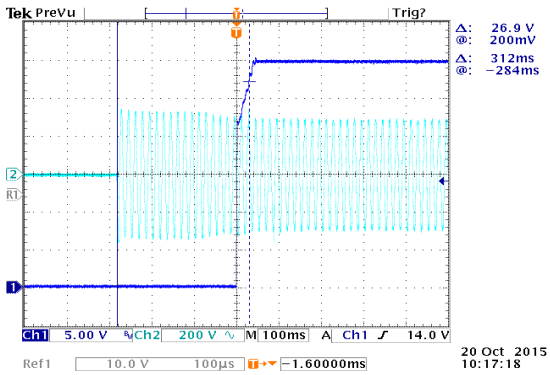
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 28.00V ~ 32.00V	I/P : 347VAC O/P: MIN LOAD TA : 25℃	CH1: 25.87V ~ 32.98V
2	CONSTANT CURRENT REGION	CH1: 15V ~ 30V	I/P : 347VAC O/P: FULL LOAD TA : 25℃	CH1: 0.22V ~ 30V
3	CURRENT ADJ. RANGE	CH1: 4A ~ 8A	I/P : 347VAC I/P : 230VAC O/P: CV MIN& CV MAX-1V TA : 25℃	2.64A ~ 8.51A 347VAC-CV MAX-1V 2.57A ~ 8.41A 347VAC-CV MIN 2.65A ~ 8.52A 230VAC-CV MAX-1V 2.6A ~ 8.42A 347VAC-CV MIN
4	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 1.0% ~ -1.0%	I/P : 180VAC / 528VAC O/P: FULL / MINLOAD TA= 25℃	V1: 0.12% ~ -0.12%
5	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 180VAC / 528VAC O/P: FULL LOAD TA : 25℃	V1: 0.00% ~ 0.00%
6	LOAD REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 347VAC O/P: MIN LOAD ~ FULL LOAD TA : 25℃	V1: 0.10% ~ -0.13%
7	OVER/UNDERSHOOT TEST	< ±5%	I/P : 347VAC O/P: FULL LOAD TA : 25℃	TEST < ±5%
8	RIPPLE & NOISE(Max)	V1 : 200 mVp-p	I/P : 347VAC O/P: FULL LOAD TA : 25℃	V1 : 46.4 mVp-p
9	SET UP TIME (MAX.)	347VAC : 400ms 230VAC : 500ms 480VAC : 400ms	I/P : 347VAC I/P : 230VAC I/P : 480VAC O/P: FULL LOAD TA : 25℃	347VAC: 296ms 230VAC 312ms 480VAC 306ms

low frequency :



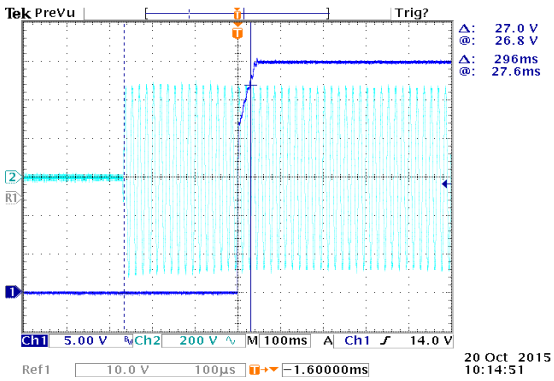
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=347VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



RISE TIME (MAX.)	347VAC : 150ms 230VAC : 150ms 480VAC : 150ms	I/P : 347VAC I/P : 230VAC I/P : 480VAC O/P: FULL LOAD TA : 25℃	347VAC: 30.2ms 230VAC 29.4ms 480VAC 27.2ms	

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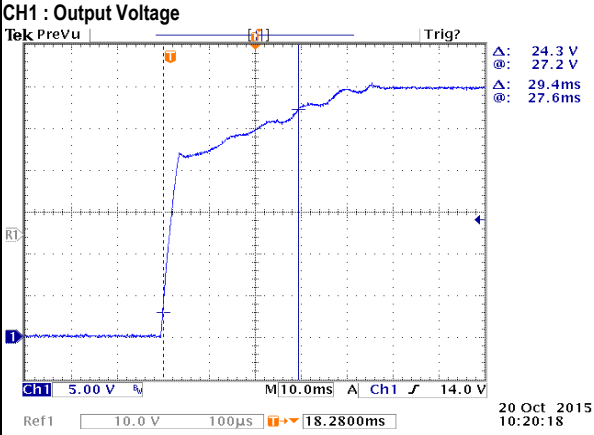
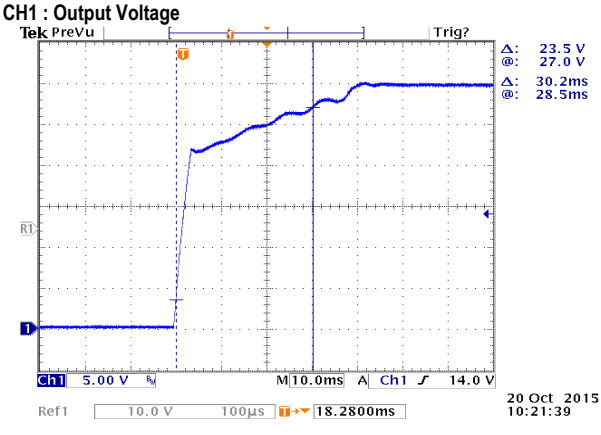
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage



INPUT=347VAC/50HZ @ FULL LOAD

CH1 : Output Voltage



HOLD UP TIME (TYP.)	347VAC : 12ms 480VAC : 12ms	I/P : 347VAC I/P : 480VAC O/P: FULL LOAD TA : 25℃	347VAC: 23.2ms 480VAC: 16.8ms	

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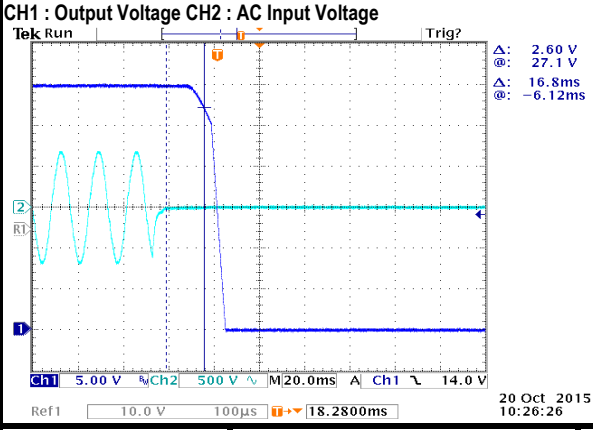
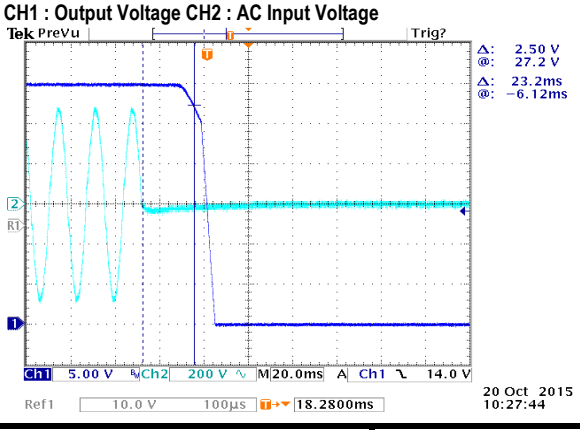
INPUT=480VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=347VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



DYNAMIC LOAD	V1 : 3000 mVp-p	I/P : 347VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA : 25℃	(1). (2). unit:mVp-p V1: 198mv 170mv	

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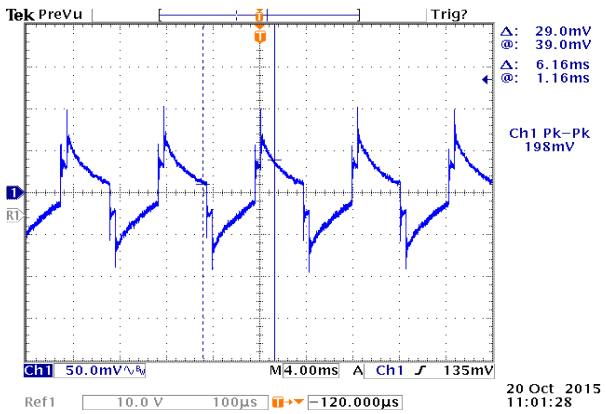
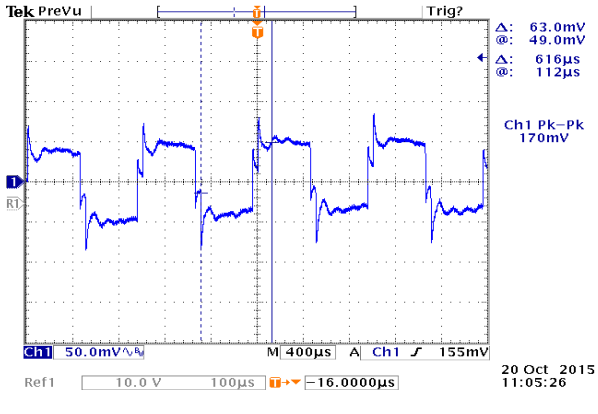
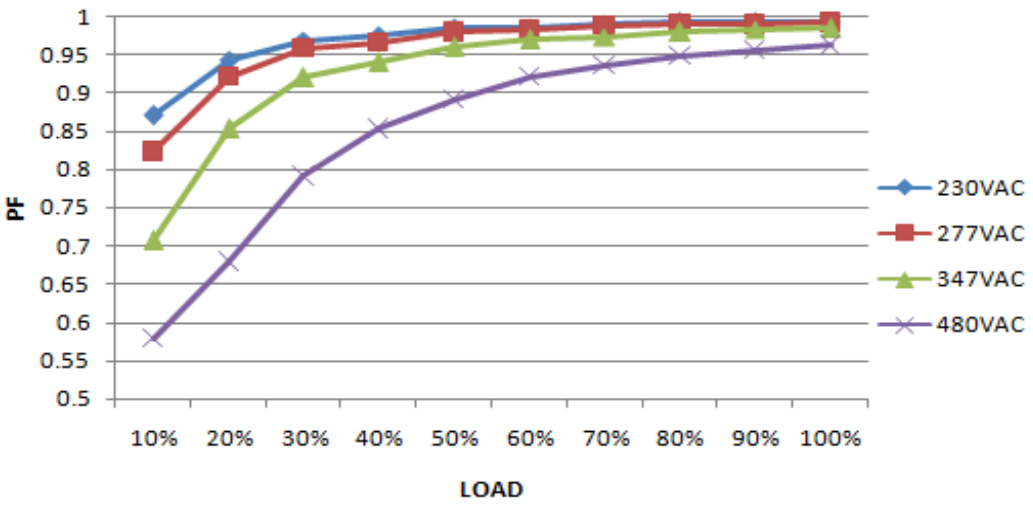
FULL /50% LOAD 50%DUTY / 120HZ



FULL /50% LOAD 50%DUTY / 1KHZ



INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
			I/P : TESTING O/P : FULL LOAD Ta : 25℃	136.0VAC ~ 528VAC
1	INPUT VOLTAGE RANGE	180VAC ~ 528VAC	I/P : LOW-LINE = 177VAC HIGH-LINE = 538VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~ 63HZ NO DAMAGE	I/P : 180VAC ~ 528VAC O/P : FULL~MIN LOAD Ta : 25℃	TEST : OK
3	INPUT CURRENT (TYP.)	0.8 / 347VAC 0.6 / 480VAC	I/P : 347VAC I/P : 480VAC O/P: FULL LOAD TA : 25℃	I= 0.7812 / 347VAC I= 0.5635 / 480VAC
4	LEAKAGE CURRENT	< 0.75mA	I/P : 480VAC O/P: MIN LOAD TA : 25℃	L-FG: 0.32 mA N-FG: 0.31 mA
5	POWER FACTOR (TYP.)	0.95 / 347VAC 0.93 / 480VAC 0.97 / 277VAC 0.98 / 230VAC	I/P : 347VAC I/P : 480VAC I/P : 277VAC I/P : 230VAC O/P: FULL LOAD TA : 25℃	PF= 0.9808 / 347VAC PF= 0.9514 / 480VAC PF= 0.9895 / 277VAC PF= 0.9913 / 230VAC
				
	EFFICIENCY (TYP.)	92.5%	I/P : 347VAC O/P: FULL LOAD TA : 25℃	93 %

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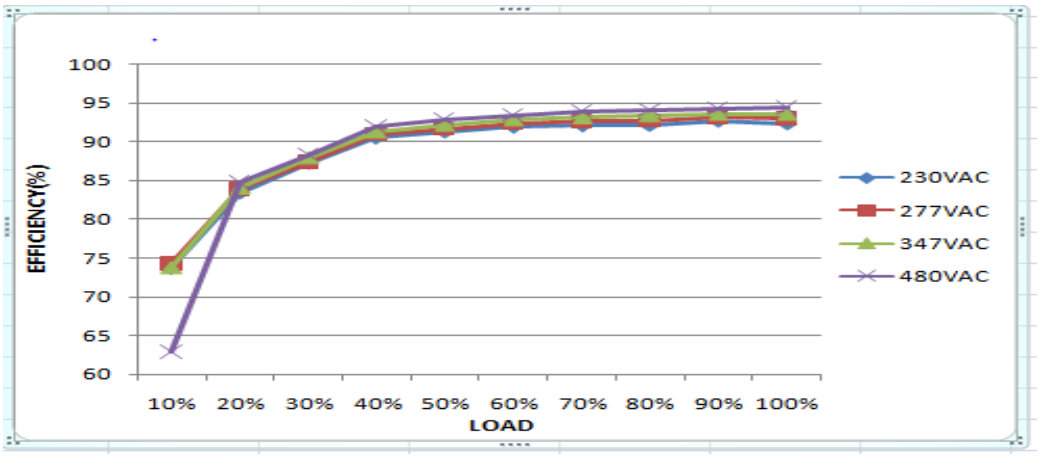

TOTAL HARMONIC DISTORTION	Total harmonic distortion will be lower than 20% when output loading is 50% or higher at 230VAC / 277VAC / 347VAC / 480VAC	I/P : 347VAC / 50% LOAD I/P : 480VAC / 60% LOAD TA : 25℃	THD : 14.136 / 347VAC THD : 14 / 480VAC	

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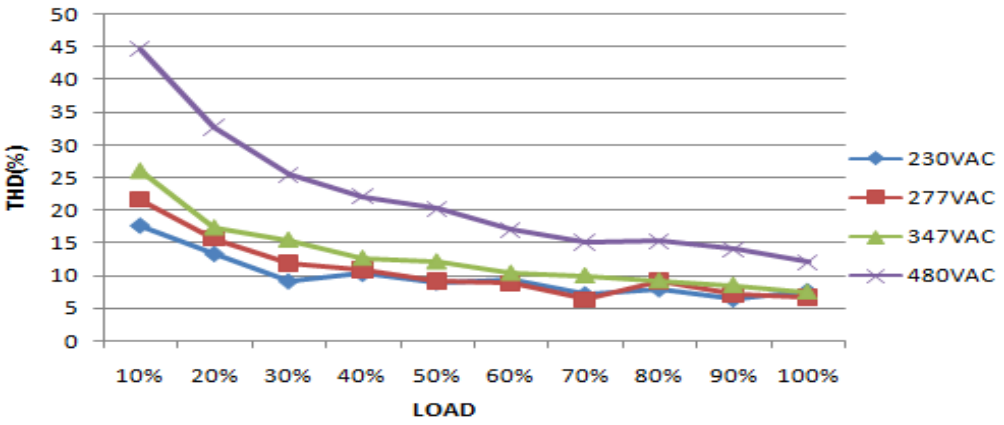

INRUSH CURRENT (TYP.)	50A / 480VAC twidth= 532 us measured at 50% Ipeak COLD START	I/P : 480VAC O/P: FULL LOAD TA : 25℃	I= 41.3 / 480VAC T50= 540 us	

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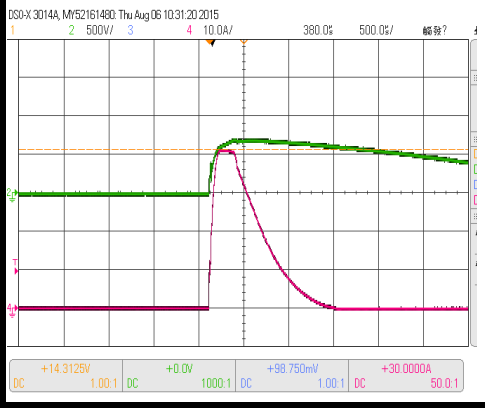
INPUT=480VAC/60HZ @ FULL LOAD

CH2 : Input current (1V=1A) CH4 : AC Input Voltage



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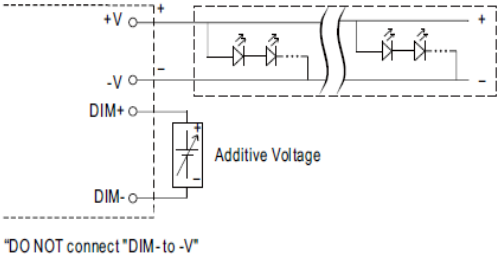
DIMMING OPERATION (for B-Type)

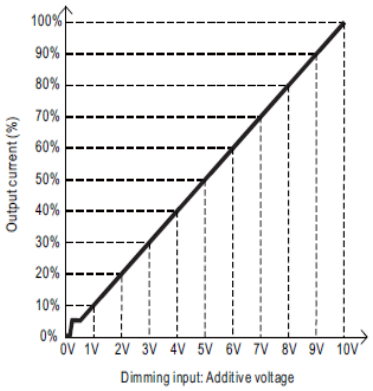
※ 3 in 1 dimming function (for B-Type)

- Output constant current level can be adjusted by applying one of the three methodologies between DIM+ and DIM-: 0 ~ 10VDC, or 10V PWM signal or resistance.
- Direct connecting to LEDs is suggested. It is not suitable to be used with additional drivers.
- Dimming source current from power supply: 100μA (typ.)

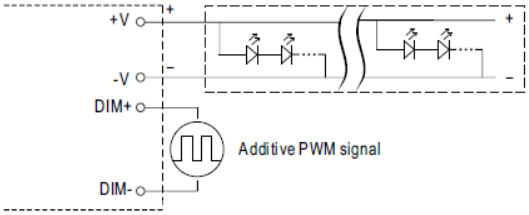
◎ Applying additive 0 ~ 10VDC



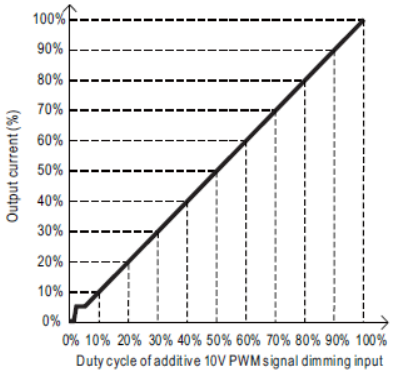
"DO NOT connect "DIM- to -V"



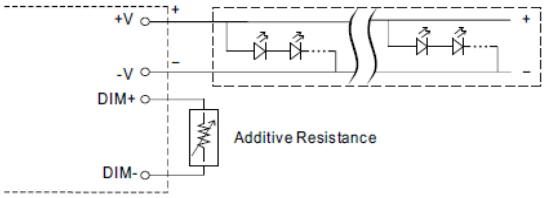
◎ Applying additive 10V PWM signal (frequency range 100Hz ~ 3KHz):



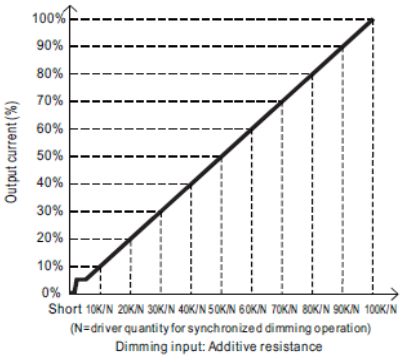
"DO NOT connect "DIM- to -V"



◎ Applying additive resistance:



"DO NOT connect "DIM- to -V"

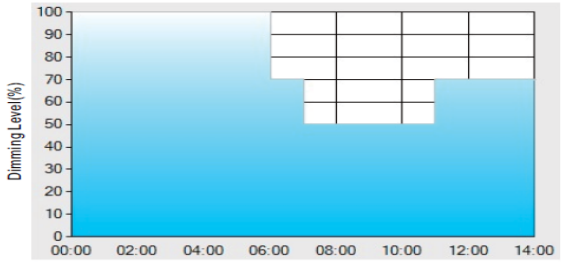


Note : 1. Min. dimming level is about 5% and the output current is not defined when 0%< Iout<5%.
2. The output current could drop down to 0% when dimming input is about 0k Ω or 0Vdc, or 10V PWM signal with 0% duty cycle.

30V	R	SHORT	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN
	O/P CURRENT	0.00000A	0.930A	1.697A	2.480A	3.259A	4.001A	4.746A	5.501A	6.225A	6.964A	7.653A	8.311A
	%	0.00%	11.63%	21.21%	31.00%	40.74%	50.01%	59.33%	68.76%	77.81%	87.05%	95.66%	103.89%
	V	0V	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
	O/P CURRENT	0.00000A	0.986A	1.717A	2.550A	3.375A	4.114A	4.940A	5.714A	6.486A	7.217A	8.001A	8.311A
	%	0.00%	12.33%	21.46%	31.88%	42.19%	51.43%	61.75%	71.43%	81.08%	90.21%	100.01%	103.89%
	PWM (100HZ)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
	O/P CURRENT	0.00000A	0.974A	1.759A	2.596A	3.373A	4.153A	4.932A	5.716A	6.496A	7.272A	8.045A	8.311A
	%	0.00%	12.18%	21.99%	32.45%	42.16%	51.91%	61.65%	71.45%	81.20%	90.90%	100.56%	103.89%

10	**DIMMING OPERATION (for Dxx-Type by User definition)**	※ **Smart timer dimming function (for Dxx-Type by User definition)** MEAN WELL Smart timer dimming primarily provides the adaptive proportion dimming profile for the output constant current level to perform up to 14 consecutive hours. 3 dimming profiles hereunder are defined accounting for the most frequently seen applications. If other options may be needed, please contact MEAN WELL for details.

Ex : ◎ D01-Type: the profile recommended for residential lighting

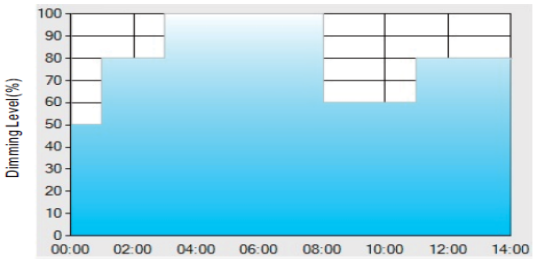


Set up for D01-Type in Smart timer dimming software program:

	T1	T2	T3	T4
TIME**	06:00	07:00	11:00	---
LEVEL**	100%	70%	50%	70%

**: TIME matches Operating Time in the diagram whereas LEVEL matches Dimming Level.
Example: If a residential lighting application adopts D01-Type, when turning on the power supply at 6:00pm, for instance:
[1] The power supply will switch to the constant current level at 100% starting from 6:00pm.
[2] The power supply will switch to the constant current level at 70% in turn, starting from 0:00am, which is 06:00 after the power supply turns on.
[3] The power supply will switch to the constant current level at 50% in turn, starting from 1:00am, which is 07:00 after the power supply turns on.
[4] The power supply will switch to the constant current level at 70% in turn, starting from 5:00am, which is 11:00 after the power supply turns on. The constant current level remains till 8:00am, which is 14:00 after the power supply turns on.

Ex: ◎ D02-Type: the profile recommended for street lighting

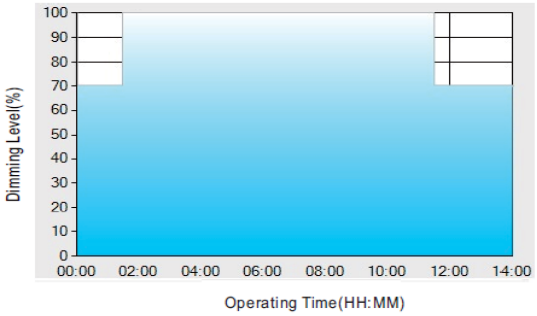


Set up for D02-Type in Smart timer dimming software program:

	T1	T2	T3	T4	T5
TIME**	01:00	03:00	8:00	11:00	---
LEVEL**	50%	80%	100%	60%	80%

**: TIME matches Operating Time in the diagram whereas LEVEL matches Dimming Level.
Example: If a street lighting application adopts D02-Type, when turning on the power supply at 5:00pm, for instance:
[1] The power supply will switch to the constant current level at 50% starting from 5:00pm.
[2] The power supply will switch to the constant current level at 80% in turn, starting from 6:00pm, which is 01:00 after the power supply turns on.
[3] The power supply will switch to the constant current level at 100% in turn, starting from 8:00pm, which is 03:00 after the power supply turns on.
[4] The power supply will switch to the constant current level at 60% in turn, starting from 1:00am, which is 08:00 after the power supply turns on.
[5] The power supply will switch to the constant current level at 80% in turn, starting from 4:00am, which is 11:00 after the power supply turns on. The constant current level remains till 6:30am, which is 14:00 after the power supply turns on.

Ex: ◎ D03-Type: the profile recommended for tunnel lighting



Set up for D03-Type in Smart timer dimming software program:

	T1	T2	T3
TIME**	01:30	11:00	---
LEVEL**	70%	100%	70%

**: TIME matches Operating Time in the diagram whereas LEVEL matches Dimming Level.
Example: If a tunnel lighting application adopts D03-Type, when turning on the power supply at 4:30pm, for instance:
[1] The power supply will switch to the constant current level at 70% starting from 4:30pm.
[2] The power supply will switch to the constant current level at 100% in turn, starting from 6:00pm, which is 01:30 after the power supply turns on.
[3] The power supply will switch to the constant current level at 70% in turn, starting from 5:00am, which is 11:00 after the power supply turns on.
The constant current level remains till 6:30am, which is 14:00 after the power supply turns on.

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	95% ~ 108%	I/P: 528VAC I/P: 180VAC O/P: TESTING TA : 25℃	102.3% /528VAC 102.2% /180 VAC Constant Current Limiting
2	OVER VOLTAGE PROTECTION	33.00V ~ 39.00V	I/P: 528VAC I/P: 180VAC O/P: MIN LOAD TA : 25℃	36V 36.5V Shut down Re- power ON
3	OVER TEMPERATURE PROTECTION	Shut down Re- power ON	I/P: 347VAC O/P: FULL LOAD	O.T.P. Active Shut down Re- power ON
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 528VAC O/P: FULL LOAD Ta: 25℃	NO DAMAGE Constant Current Limiting

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor	Q901 Rated : 950V 9.0A	I/P : 531VAC I/P : 177VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue (4)Dynamic Load Full/Min Load 90%Duty/1KHz (5)Dynamic Load Full/Min Load 90%Duty/5KHz (6)Dynamic Load Full/Min Load 50%Duty/120Hz (7)0%→400% Load Ta : 25℃	VIN: 531VAC 177VAC VDS: VDS: (1). 879.0V 847.0V (2). 879.0V 871.0V (3). 799.0V 807.0V (4). 863.0V 863.0V (5). 871.0V 855.0V (6). 863.0V 855.0V (7). 879.0V 863.0V
2	O/P Diode (MOSFET)	Q101 Rated : 100V 80.0A Q102 Rated : 100V 80.0A	I/P : 531VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue (4)Dynamic Load Full/Min Load 90%Duty/1KHz (5)Dynamic Load Full/Min Load 90%Duty/5KHz (6)Dynamic Load Full/Min Load 50%Duty/120Hz (7)0%→400% Load (8) NO LOAD Ta : 25℃	Q101 Q102 VDS : VDS : (1). 67.1V 68.6V (2). 13.1V 11.7V (3). 67.0V 67.9V (4). 67.8V 68.7V (5). 67.8V 68.7V (6). 67.0V 67.9V (7). 65.4V 69.5V (8). 65.4V 67.1V
3	Input Capacitor	C5 Rated : 82uf 450V	I/P : 531VAC O/P : (1)Full Load Turn on /Off (2)Min load Turn on /Off (3)Full Load /Min load Change Ta : 25℃	C5 (1). 382.0V (2). 431.0V (3). 411.0V
4	Control IC	U1 Rated : 20V (max) 10V (min)	I/P : 531VAC O/P : (1)Full Load (2)Output Short Change (4)O.V.P (5)Low Line No Load Vo(min) Ta : 25℃	U1 (1). 15.3V (2). 13.3V (3). 13.3V (4). 15.3V (5). 11.9V
5	PFC Power Transistor	Q1 Rated : 1050V 9.0A	I/P : 531VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue (4)Dynamic Load Full/Min Load 90%Duty/1KHz (5)Dynamic Load Full/Min Load 90%Duty/5KHz (6)Dynamic Load Full/Min Load 50%Duty/120Hz (7)0%→400% Load Ta : 25℃	VIN: 531VAC VDS: (1). 847.0V (2). 911.0V (3). 823.0V (4). 871.0V (5). 887.0V (6). 911.0V (7). 855.0V

■SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P : 3.75KVAC /min I/P-FG : 2.0KVAC /min O/P-FG : 1.5KVAC /min	I/P-O/P: 4.13KVAC /min I/P-FG: 2.40KVAC /min O/P-FG: 1.80KVAC /min Ta : 25℃	I/P-O/P: 1.88mA I/P-FG: 1.9mA O/P-FG: 1.0mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ I/P-FG : 500VDC>100MΩ O/P-FG : 500VDC>100MΩ	I/P-O/P: 500VDC I/P-FG: 500VDC O/P-FG: 500VDC Ta : 25℃/70%RH	I/P-O/P: 10.3GΩ I/P-FG: 3.8GΩ O/P-FG: 14.4GΩ NO DAMAGE
2	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25℃/70%RH	26 mΩ

E.M.C. TEST

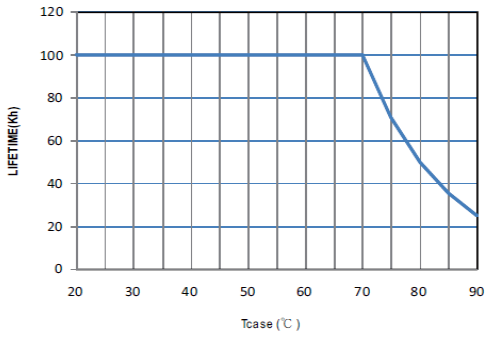
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	FCC Part 15 Subpart B	I/P : 440VAC/60HZ O/P : FULL LOAD / 30% LOAD Ta : 25℃	PASS Test by certified Lab
2	RADIATION	FCC Part 15 Subpart B	I/P : 480VAC/60HZ O/P : FULL LOAD / 10% LOAD Ta : 25℃	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR : 8KV / Contact : 4KV	I/P : 230VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
4	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT : 1KV	I/P : 230VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
5	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV;L/N-PE : 4KV	I/P : 230VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A

■RELIABILITY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL : HVG-240-24 1. ROOM AMBIENT BURN-IN : 3.0hrs IP: 230VAC O/P: 100% LOAD TA= 24.8℃ 2. HIGH AMBIENT BURN-IN : 2.0hrs IP: 230VAC O/P: 100% LOAD TA= 59.2℃		
2	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 528VAC / 180VAC O/P : FULL LOAD Ta : -45.0℃	TEST : OK
	HIGH HUMIDITY	AFTER 12 HOURS	I/P : 528VAC	TEST : OK

CH.	Position	ROOM AMBIENT Ta= 24.8℃	HIGH AMBIENT Ta= 59.2℃
1	BD1	62.0℃	93.3℃
2	Q1	62.5℃	94.5℃
3	Q901	63.9℃	96.4℃
4	L2	60.7℃	91.6℃
5	C2	58.9℃	88.5℃
6	C10	61.3℃	92.9℃
7	L1	64.2℃	97.1℃
8	ZNR2	76.4℃	103.3℃
9	RTH3	58.8℃	90.5℃
10	T1	68.5℃	103.7℃
11	C46	62.0℃	93.8℃
12	C54	60.6℃	92.1℃
13	Q102	62.0℃	94.8℃
14	C102	59.6℃	91.8℃
15	C201	63.0℃	94.5℃
16	C200	61.7℃	93.6℃
17	U1	63.6℃	95.2℃
20	C5	61.9℃	93.4℃

3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	IN CHAMBER ON CONTROL 60℃ NO DAMAGE	O/P： FULL LOAD Ta： 60℃ HUMIDITY= 95.0% RH	
4	TEMPERATURE COEFFICIENT	±0.03% /℃(0~60℃)	I/P： 347VAC O/P： FULL LOAD	±0.01% /℃(0~60℃)
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature： -45℃~ +90℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：5 CYCLE 5. Input/Output condition： STATIC		TEST：OK
6	THERMAL SHOCK TEST	1. Thermal shock Temperature： -45℃ ~ 65℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：16 CYCLE 5. Input/Output condition： 230V Full Load AC ON/OFF te turn on 3sec；turn off 1sec @ 15cycle Full Load burn in@ 1cycle		TEST：OK
7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (4) Acceleration： 5G (5) Test Time：72min in each axis (X.Y.Z) (6) Ta：25℃		TEST：OK
8	CAPACITOR LIFE CYCLE	HVG-240-24 :SUPPOSE C102 IS THE MOST CRITICAL COMPONENT (1) I/P：347VAC O/P：FULL LOAD Ta= 25℃ LIFE TIME (2) I/P：347VAC O/P：FULL LOAD Ta= 60℃ LIFE TIME (3) I/P：347VAC O/P：75% LOAD Ta= 60℃ LIFE TIME (4) I/P：347VAC O/P：50% LOAD Ta= 60℃ LIFE TIME		(1). 288585 HRS (2). 29688 HRS (3). 47188 HRS (4). 84252 HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 114.5K hrs min. MIL-HDBK-217F (25℃)		
10	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase80℃		



TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT ZENG