T&J ELECTRIC (SINGAPORE) PTE LTD

Company Registration No: 200205797Z
10 Ubi Crescent, #02-24, Ubi Techpark, Singapore 408564
Telephone: +65 6547-4333 Fax: +65 6547-4666

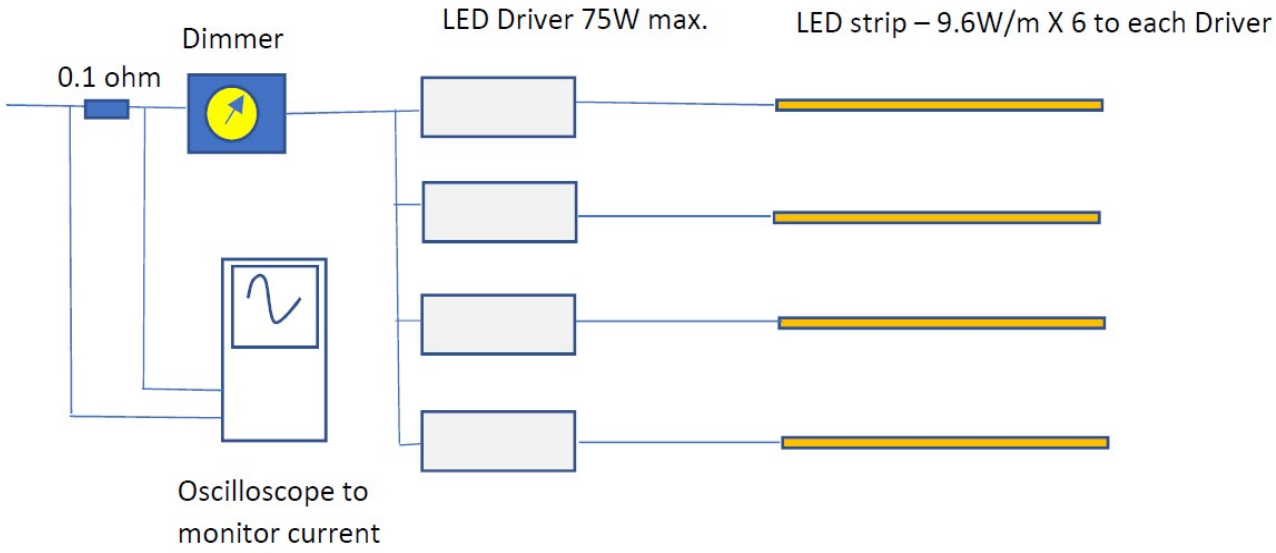
Date: 13th June 2018

Subject: W2747 Dimmer - Estimation of Inrush & Repetitive peak current of LED dimming

Test Samples:

- Dimmer: W2747 rated max. 400W, Push-on Switch 6A (Resistive load)
- LED Dimming Driver: EUCHIPS EUP75T-1H24V-0 (75W, 24VDC output, 3.1Amax) x 4 units
- LED light strip: 1 metre (9.6W each) x 24 units

Test Setup:



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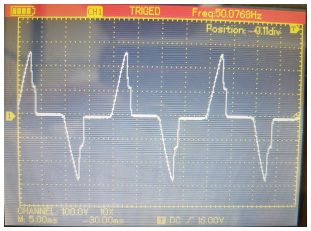
Basic test parameters measured based on the Test setup:

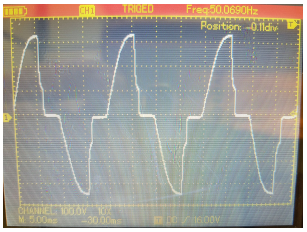
Ambient Temperature	~25°C	
AC input	238VAC	
AC load current (4 drivers)	0.36A (at min. dimming)	1.65A (at max. dimming)
AC load voltage (at driver input)	30V (at min. dimming)	210V (at max. dimming)
Power measured (with 4 drivers)	5W (at min. dimming)	225W (max. dimming)
Power factor measured	0.58*	
LED Driver DC output current	1.8A per Driver@24VDC	

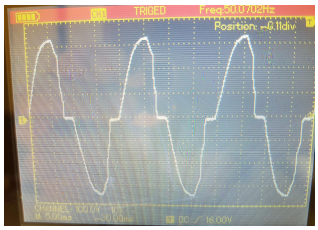
*Lower than Driver datasheet specs. of 0.99

Voltage waveform at LED Driver inputs (with trailing-edge dimmer):


Minimum brightness


Mid-range 1


Mid-range 2


Maximum brightness

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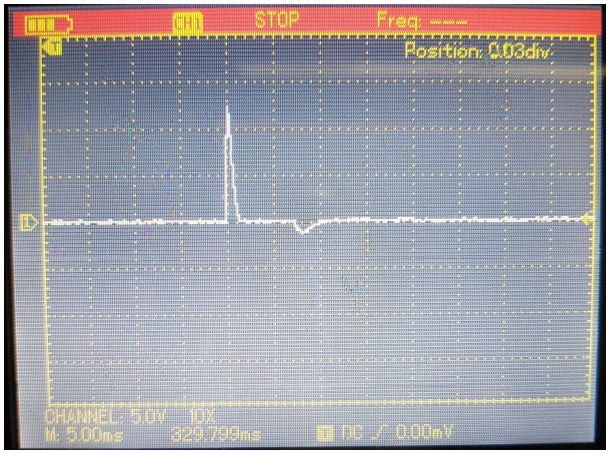
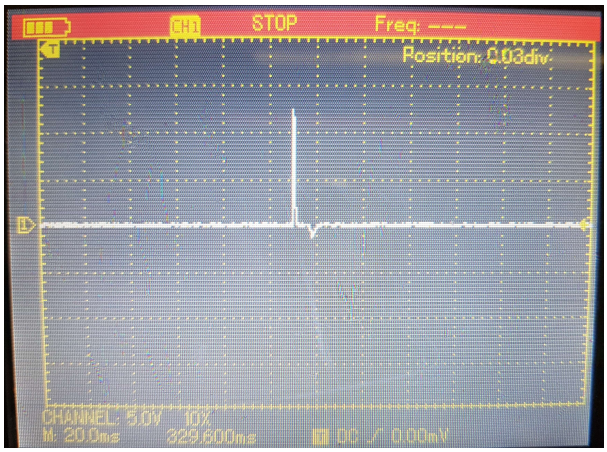
Cold-start Inrush current waveform <u>without</u> Dimmer control:



Scope settings: 5V/Div.;5mS/Div.



Scope settings: 5V/Div.;20mS/Div.

Model		EUP75T-1H24V-0
Output	Channels	1
	Voltage	24VDC
	Current	3.1A
	Power	75W
	Voltage Accuracy	±3%
	R & N (Max)	200mVp-p
Input	Voltage	220VAC – 240VAC
	Frequency	50/60Hz
	Dimming Voltage Range	40-240VAC
	Efficiency(Typ)	86%
	PF	≧0.99@230VAC,full load
	Current	0.5Amax@230VAC,full load
	Inrush current	Cold start,18.2A(t_{width}=700 us measured at 50% I_{peak}) @230VAC

Current spike (highest peak): 2.5x5V/div = 12.5V/0.1ohm = ~125A (4 LED drivers)

Measurement at 50% pulse width of I_{peak} (~1mS) = ~**62.5 A**

Given specs. from Dimming Driver datasheet: 18.2A per driver -> 4x18.2 = 72.8A

Actual measured compared to LED Driver specs. - 62.5A (measured) vs 72.8A (specs.)

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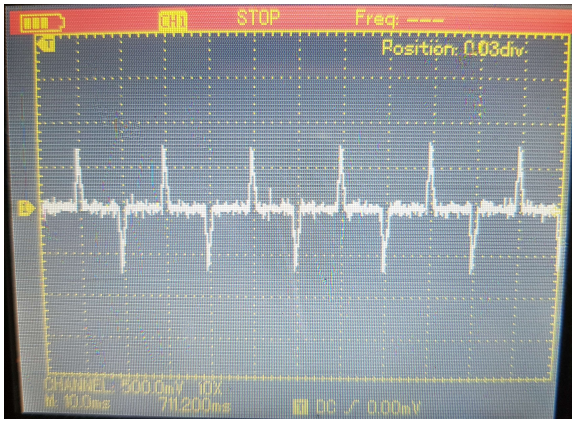
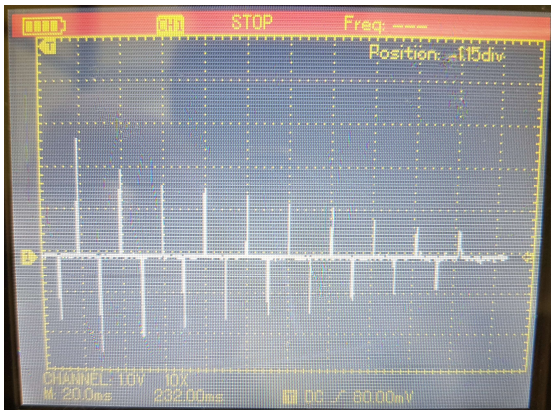
Repetitive Peak current waveform <u>without</u> Dimmer control:



Scope settings: 500mV/Div.;10mS/Div.

Recurring current spikes (peak) = ~1.5 x 500mV= 750mV/0.1ohm = **~7.5A**

Inrush Current <u>with</u> Dimmer Control (4 Drivers):



Scope settings: 1V/Div.;20mS/Div.

Current spike (highest peak): 2.5x1Vdiv = 2.5V/0.1ohm = ~25A

Measurement at 50% pulse width of I_{peak} (~1mS) = ~**12.5A**

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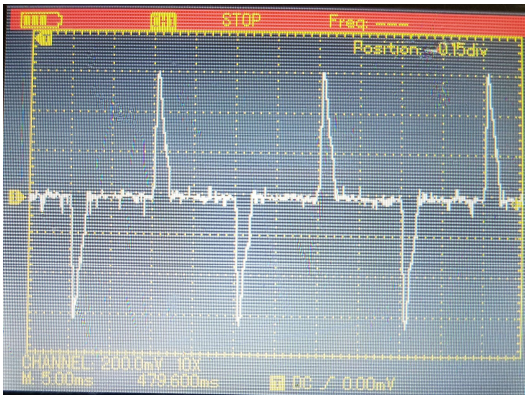
Repetitive Peak current with Dimmer control (4 Drivers):



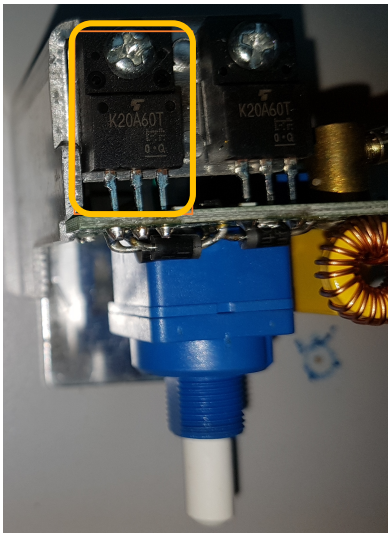
Scope settings: 200mV/Div.;5mS/Div.

Recurring current spikes (peak) = 3x200mV= 600mV/0.1ohm **= ~6A**

Output Power Device used in W2747 Dimmer:

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V_{DSS}	600	V
Gate-source voltage		V_{GSS}	±30	V
Drain current	DC (Note 1)	I_D	20	A
	Pulse (t = 1 ms) (Note 1)	I_{DP}	40	
Drain power dissipation (Tc = 25°C)		P_D	45	W
Single pulse avalanche energy (Note 2)		E_{AS}	209	mJ
Avalanche current		I_{AR}	20	A
Repetitive avalanche energy (Note 3)		E_{AR}	4.5	mJ
Channel temperature		T_{ch}	150	°C
Storage temperature range		T_{stg}	-55 to 150	°C

Note 1: Ensure that the channel temperature does not exceed 150°C.



From manufacturer (Toshiba) data sheet:

MOSFET K20A60T: I_D (Drain current) = 20A;

I_{DP} (peak current) = 40A @1mSec

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Result Interpretation:

Based on the sample of 4 Dimming Drivers and 24 LED strip lights provided:

1. The Inrush current with Dimmer control is approximately 25A peak (12.5A@1mS width), as the MOSFET is rated at 40A peak@1mS, theoretically, it should able to handle this transient.

2. The Repetitive Peak current with Dimmer control is approximately 6A peak, with the MOSFET rated current at 20A (I_D), it should be adequately able to sustain these repetitive peak currents.

3. The measured power consumed by max. brightness is ~225W which is about 56% of the specified max. load 400W of W2747 dimmer. Therefore, de-rating factor is 0.56, slightly higher than recommended factor of 0.4 to 0.5.

4. Do note that the push-on switch is rated at 6A for resistive load, derating is required for capacitive-inductive load.