

# **INDICE SEMICONDUCTOR**

EVAL02-MR16

MR16 Starter Kit Guide

# MR16 STARTER KIT OVERVIEW



## •What is it?

- EVAL02-MR16 which is a fast way to evaluate Indice's dimmable MR16 driver solutions

## •What does it contain?

- 3 x 8W dimmable MR16 LED lamps, lamp evaluation documentation

## •How much is it?

- The price for this kit is US\$99 + handling + delivery.

## •Why would I buy it?

- Proven product, compliance tested to C-TICK, CE, UL, high performance reference design.

## •What are the key benefits to me?

- Rapid evaluation, no need to build up demo boards.

## •How do I use the evaluation kit?

- Follow the steps in this manual

# WHAT NEXT AFTER EVALUATION?

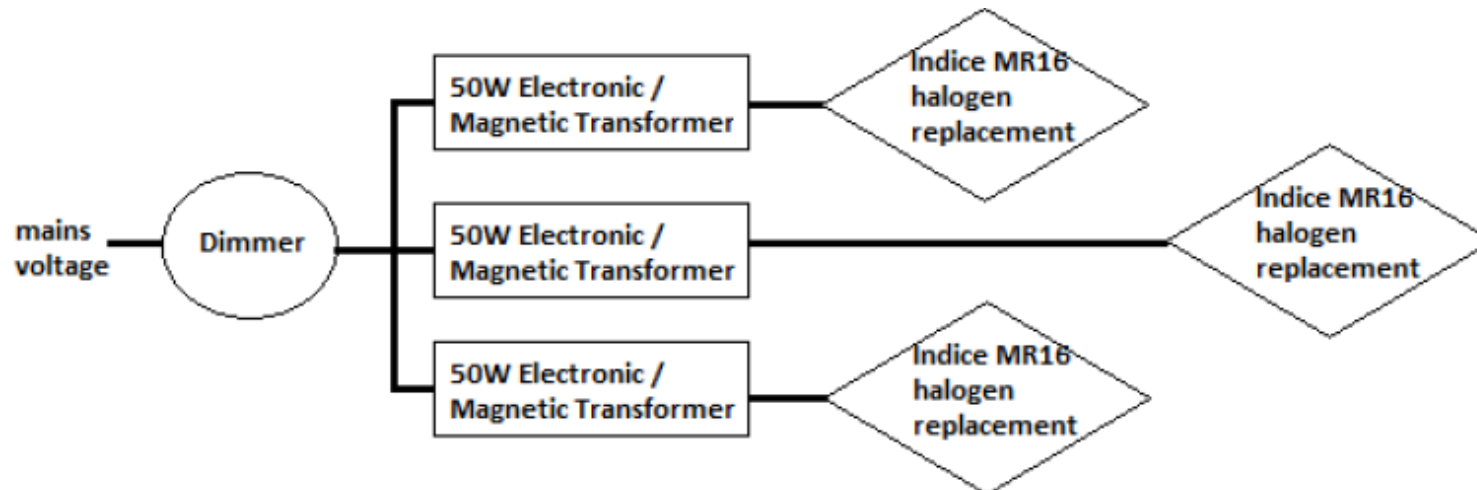


Once you are satisfied with the performance and high compatibility of the Indice dimmable LED reference lamp with a wide range of transformers and dimmers, you can do one of the following:

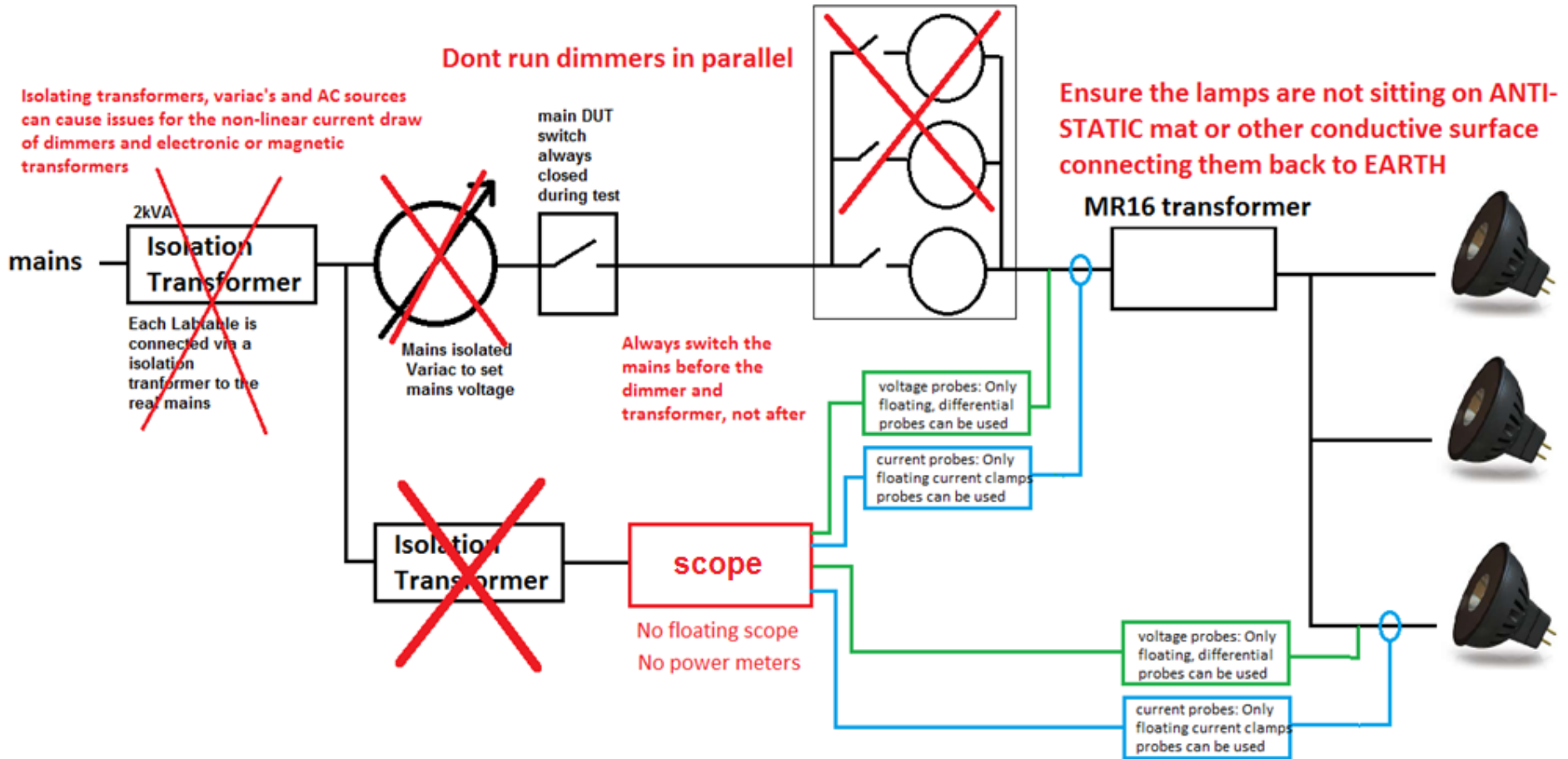
- Go straight into production with this Indice MR16 LED reference design – Indice provides all of the necessary files to produce the PCBA and mechanical housing
- Consider using one of Indice’s wide range of reference design boards with varying board dimensions and features to suit your own mechanical housing
- If you can’t find an Indice reference to suit your mechanical requirements or you require an addition or modification to the features provided, you can:
  - Generate your own board design using the Indice design files as a baseline; or
  - Subject to feasibility Indice may be able to generate a new reference design (for a modest design fee)

# REQUIRED EQUIPMENT

- Good selection of 230VAC or 110VAC to 12VAC halogen transformers common to your target market
- Good selection of 230VAC or 110VAC dimmers common to your target market
- Oscilloscope...with floating current and differential voltage probe
- **Stable** 230VAC or 110VAC voltage source to power transformers/dimmers
- **Minimum 3 LED lamps + transformers – Do NOT test with a single lamp, the minimum load of the dimmer will not be satisfied**



# SOME COMMON ISSUES TO AVOID

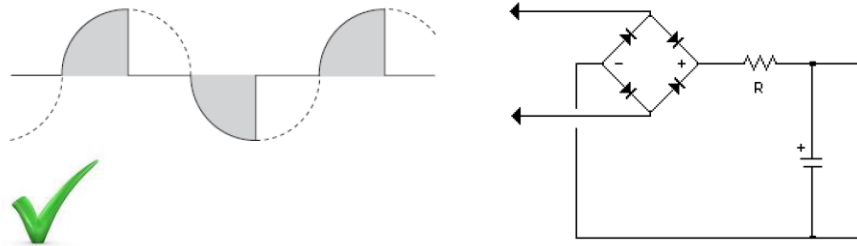


# CORRECT DIMMER & TRANSFORMER MATCH



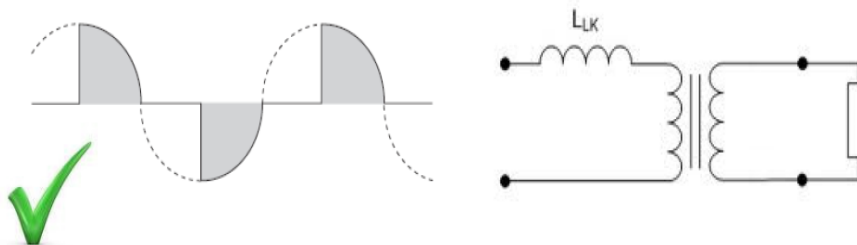
## Electronic Transformers & Trailing edge dimmers (reverse phase control)

This dimmer configuration is optimal for use with an electronic transformer as there is no large  $di/dt$  as the phase control is on the trailing edge



## Magnetic Transformers & Leading edge dimmers (standard phase control)

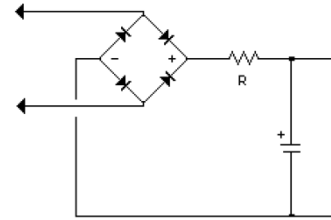
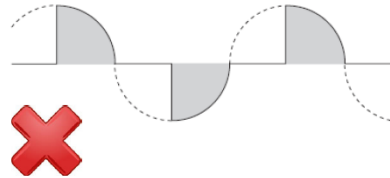
The right combination when used with a low capacitance LED driver such as Indice to reduce any leading edge current spike



# INCORRECT DIMMER & TRANSFORMER MATCH

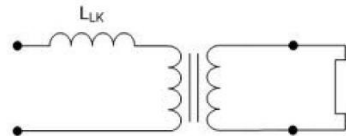
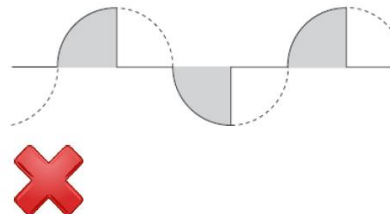
## Electronic Transformers & Leading edge dimmers

The waveform to the right shows the leading edge dimmer results in a step response being delivered to the capacitive rectifier of the electronic transformer or poorly designed LED driver.



## Magnetic Transformers & Trailing edge dimmers (reverse phase control)

Using a trailing edge dimmer on a magnetic transformer will result in large voltage spikes that will damage the dimmer and connected lamp.



# CHECK YOUR TEST SETUP



Does the transformer work with a 35W or 50W halogen GU5.3 lamp?

- If yes, proceed with the evaluation as described below.
- If no, then do not continue testing the LED retrofit lamps (Indice MR16 LED lamps are intended to be a direct replacement for halogen GU5.3 12V lamps)

Observe for:

Flicker/shimmer

Light output

Light colour

Light beam spread / patterning

You should note the following measurements:

Transformer input voltage and waveform (please use care when handling mains AC voltage!)

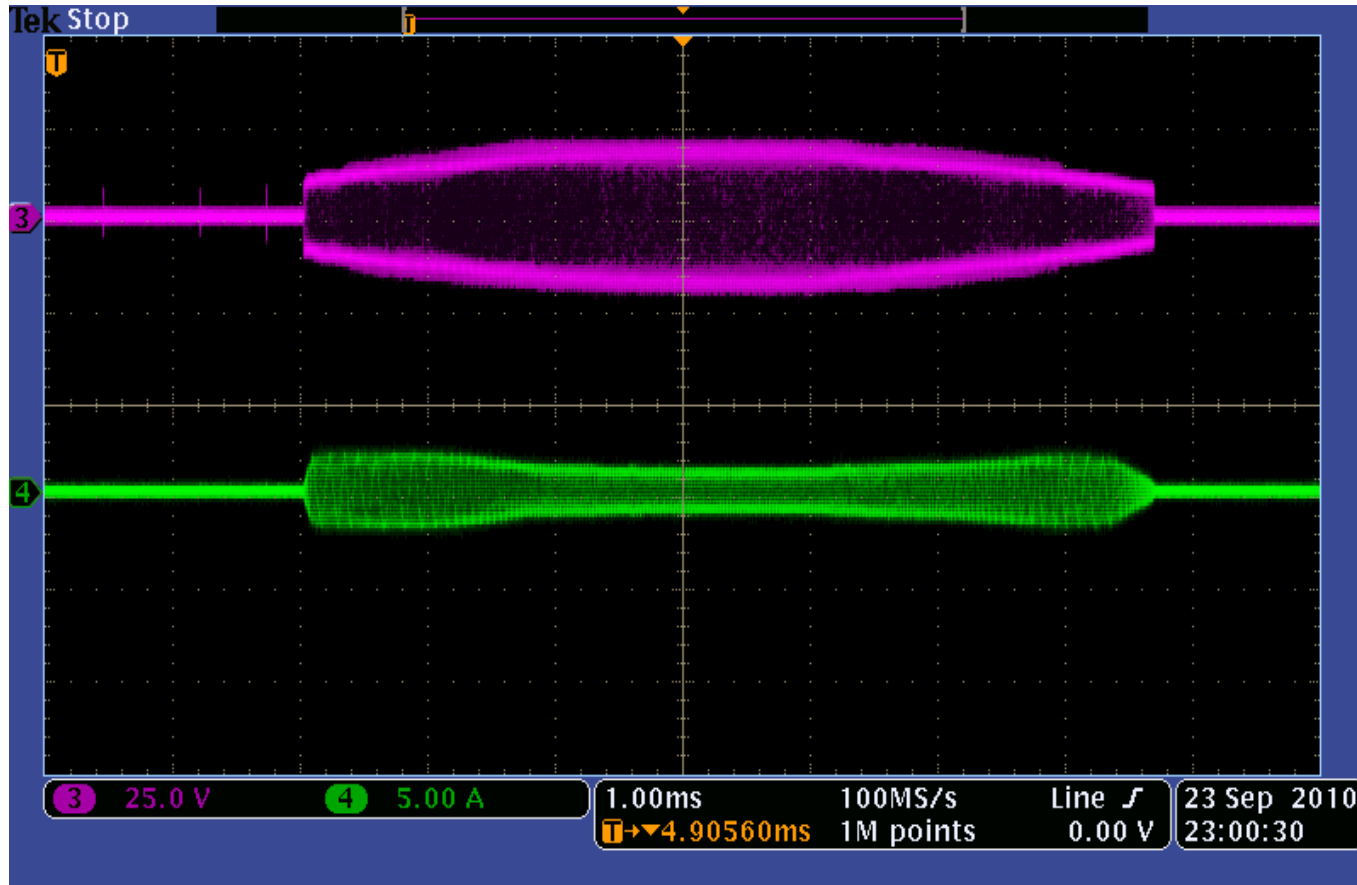
Transformer output voltage and waveform

LED forward voltage

LED forward current

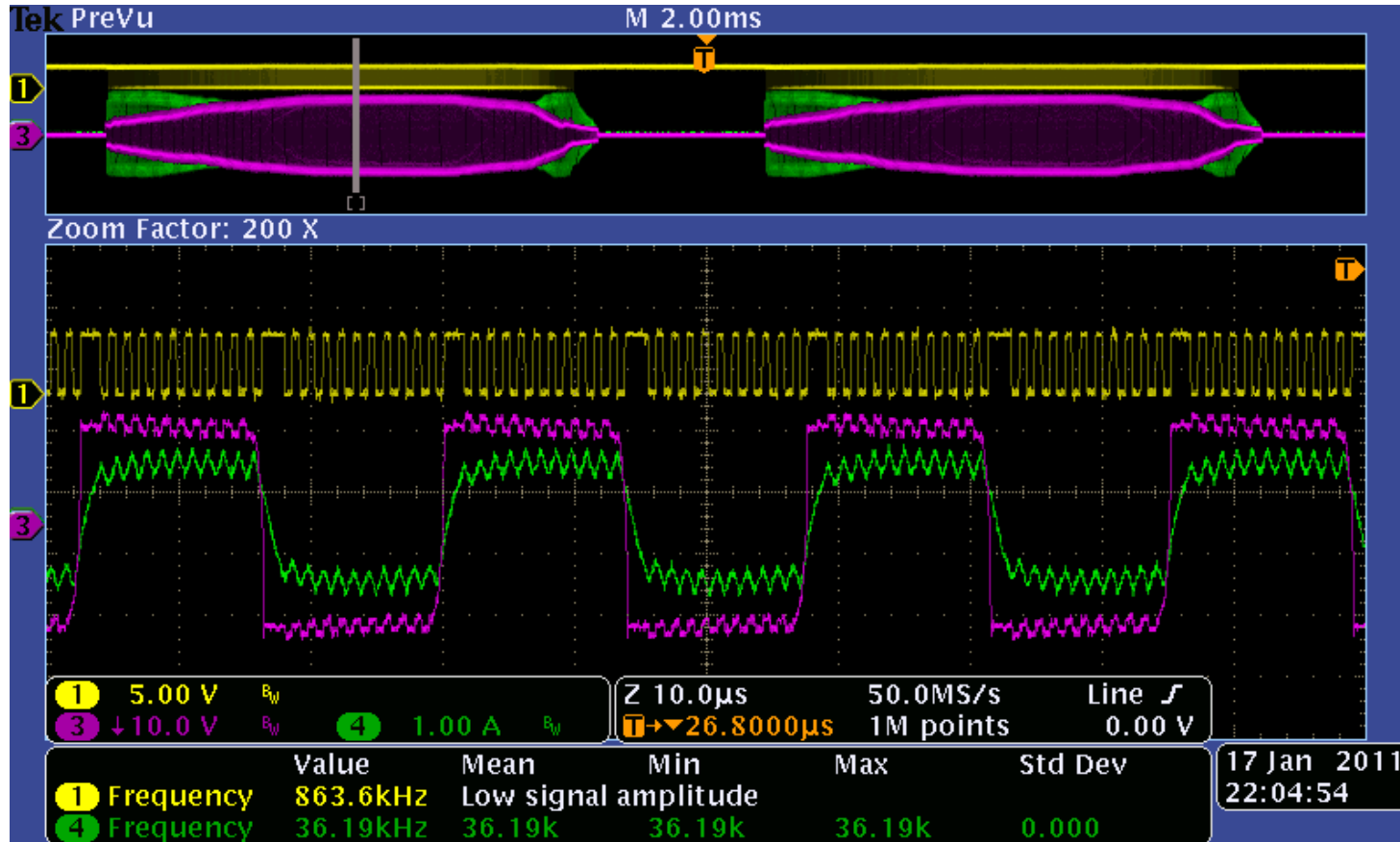


# EXPECTED TEST RESULTS: INDICE MR16 DRIVER



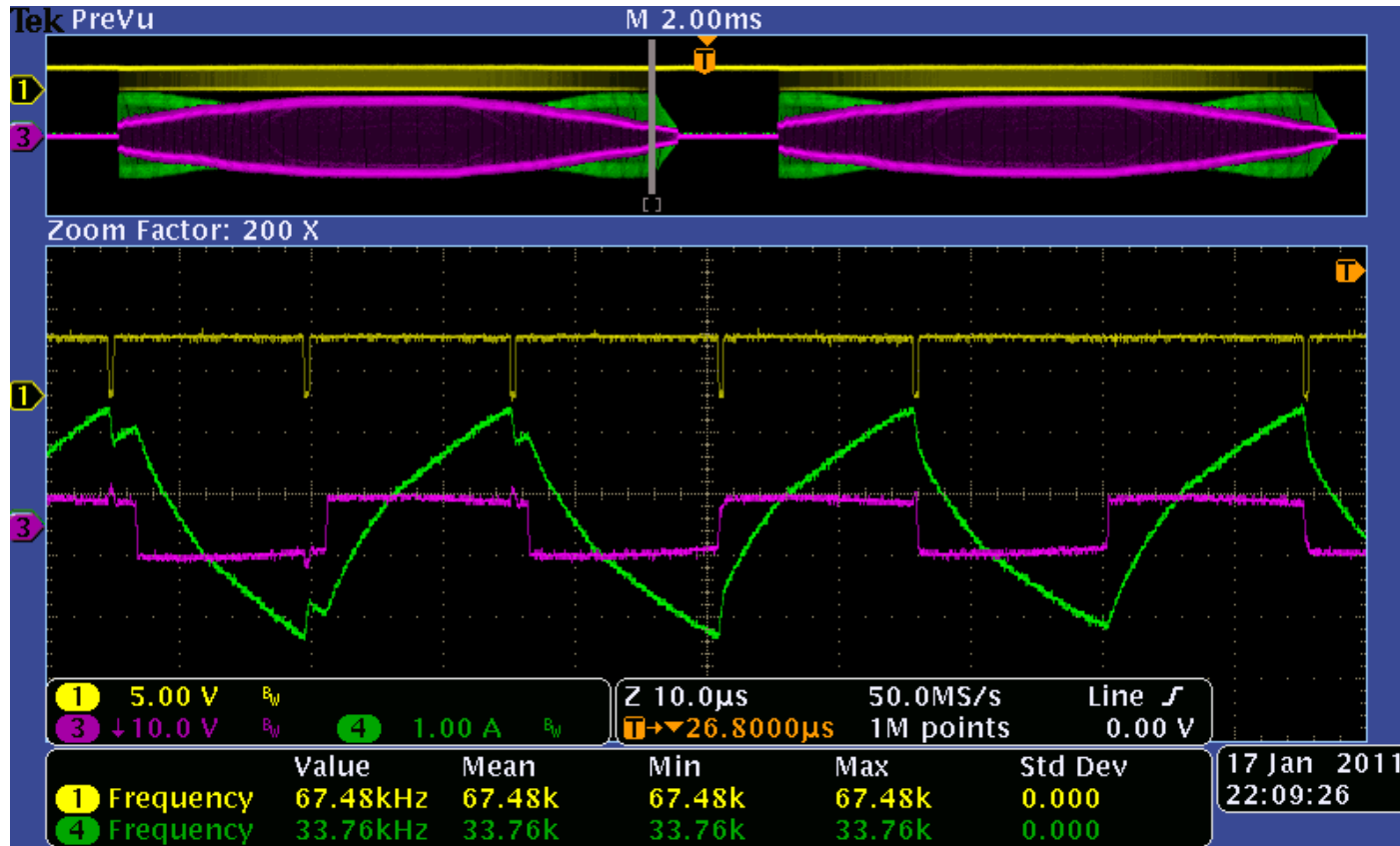
- **Purple:** Voltage on MR16 cable between lamp and transformer
- **Green:** Current on MR16 cable between lamp and transformer

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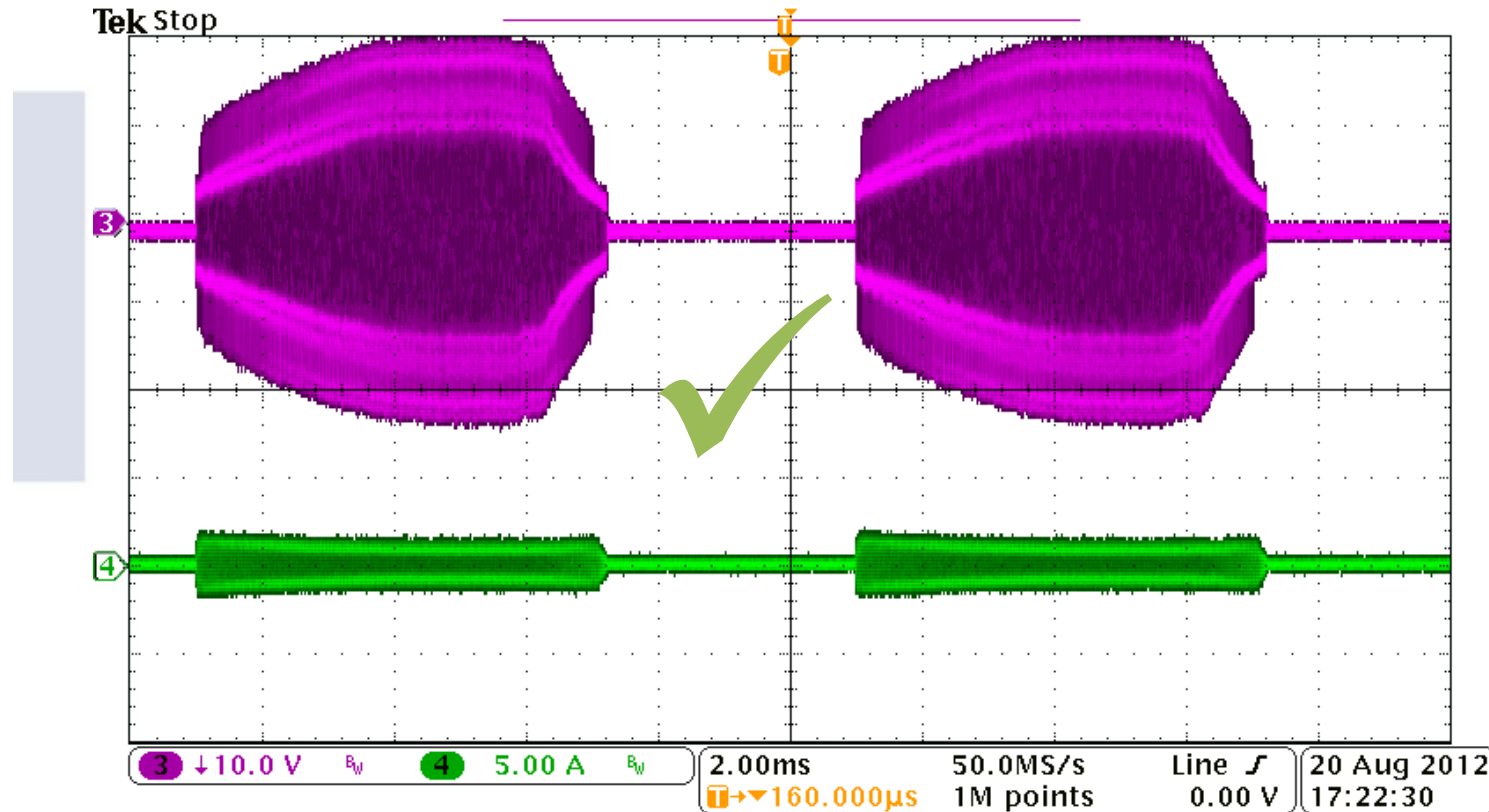
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- **Yellow:** Drive line to booster MOSFET, the control logic from the Indice MR16 IC

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# TEST RESULT - TRAILING EDGE DIMMER WITH ELECTRONIC TRANSFORMER



Electronic transformer with electronic dimmer and Indice MR16 drive set at max duty range (75%)

# OTHER TESTING TO CONDUCT



## •Thermal performance

- Test the lamp at the expected running condition

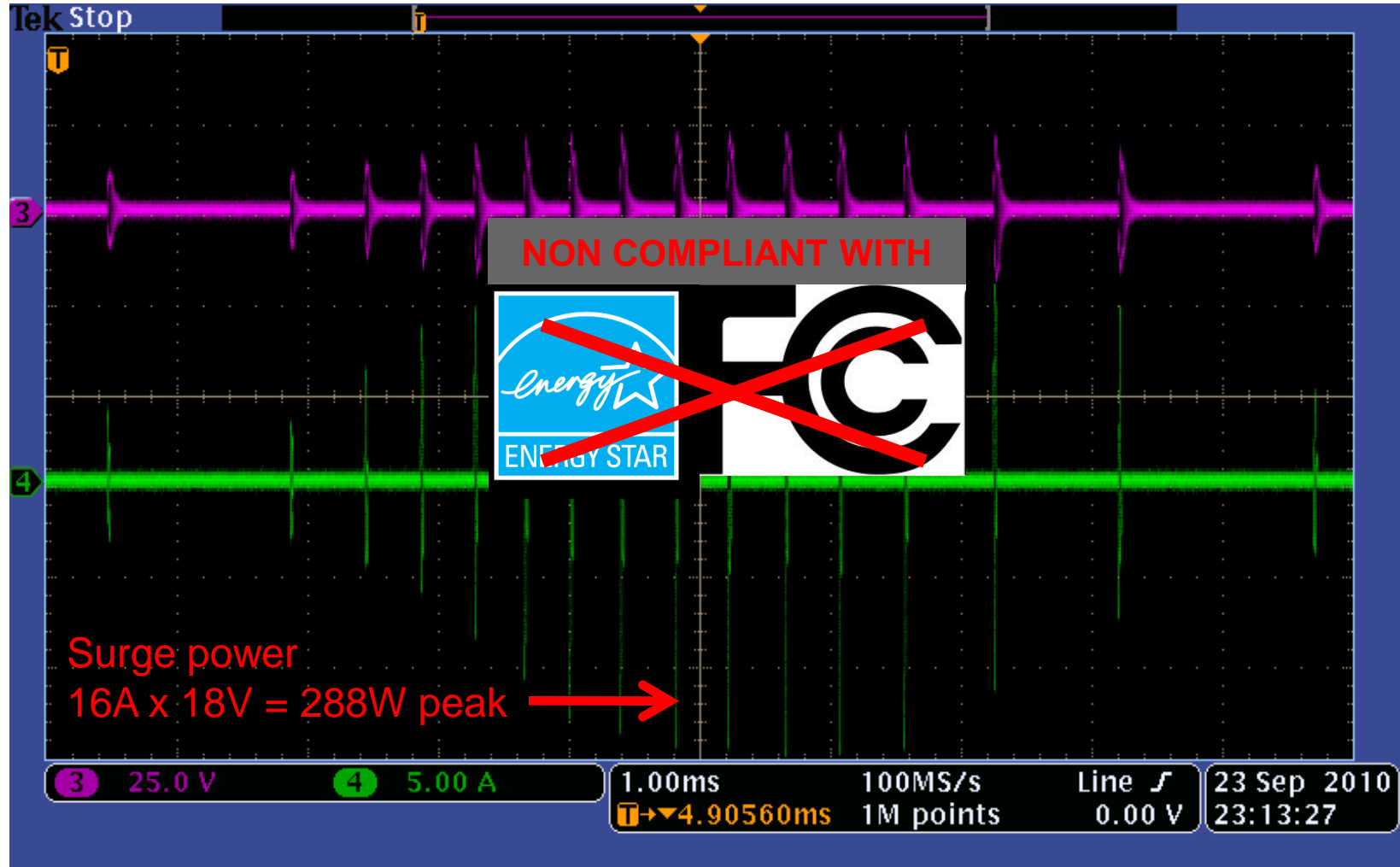
## •EMI Performance

- Evaluate the EMI compliance of the total lamp assembly.
- Perform EMC pre-scans or full testing using appropriate signal analyser equipment
- The Indice MR16 LED reference design is compliant to FCC, CE, CTICK compliance requirements

## •Lumen performance

- Indice matches the best LED's to the MR16 application which produce enough quality light to successfully replace a MR16 halogen lamp

# APPENDIX 1: EXAMPLE OF POORLY DESIGN MR16 LED LAMP



# APPENDIX 2: EXAMPLE OF POORLY DESIGN MR16 LED LAMP

