




CCFL Inverters



What Sets Us Apart?



- Wide Range Dimming
 - First to pioneer this technique.
- Lamp Strike Technique
 - Generates unlimited strike voltage potential
- Efficiency
 - First to pioneer Direct-Drive single stage power conversion
-  Minimum External Components
 - No one has fewer needed components.



High Efficiency, Wide Range/Digital Dimming

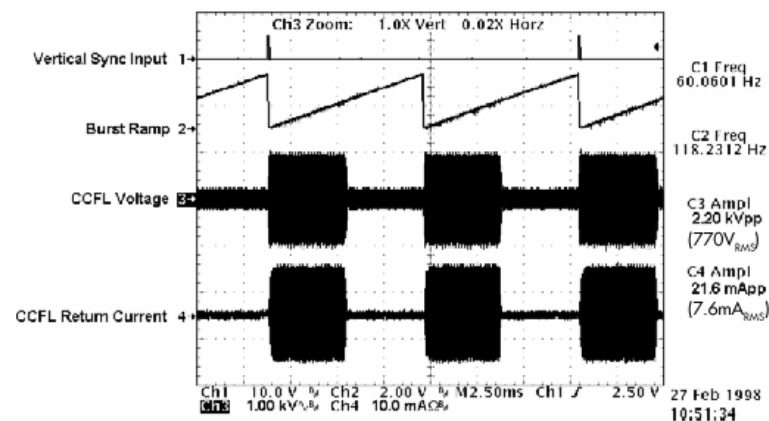
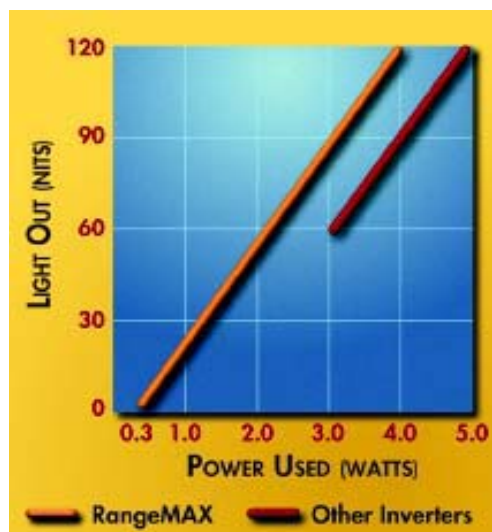


FIGURE 3 — 50% Burst Duty Cycle

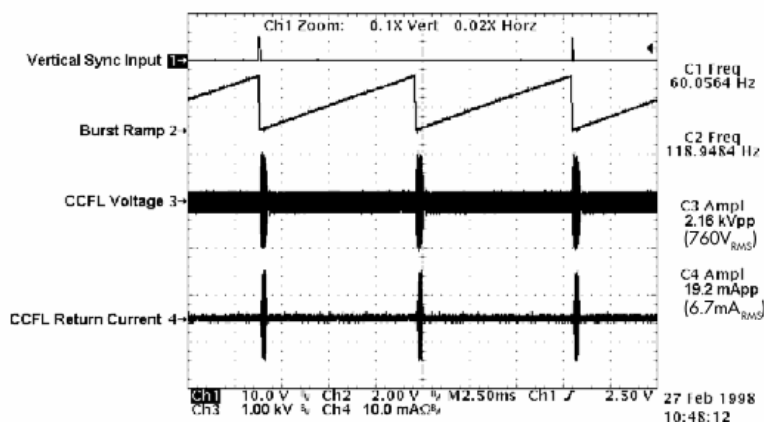


FIGURE 4 — 2% Burst Duty Cycle

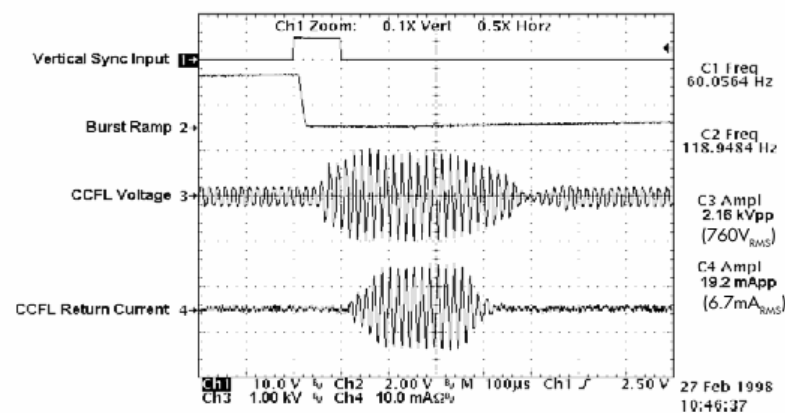
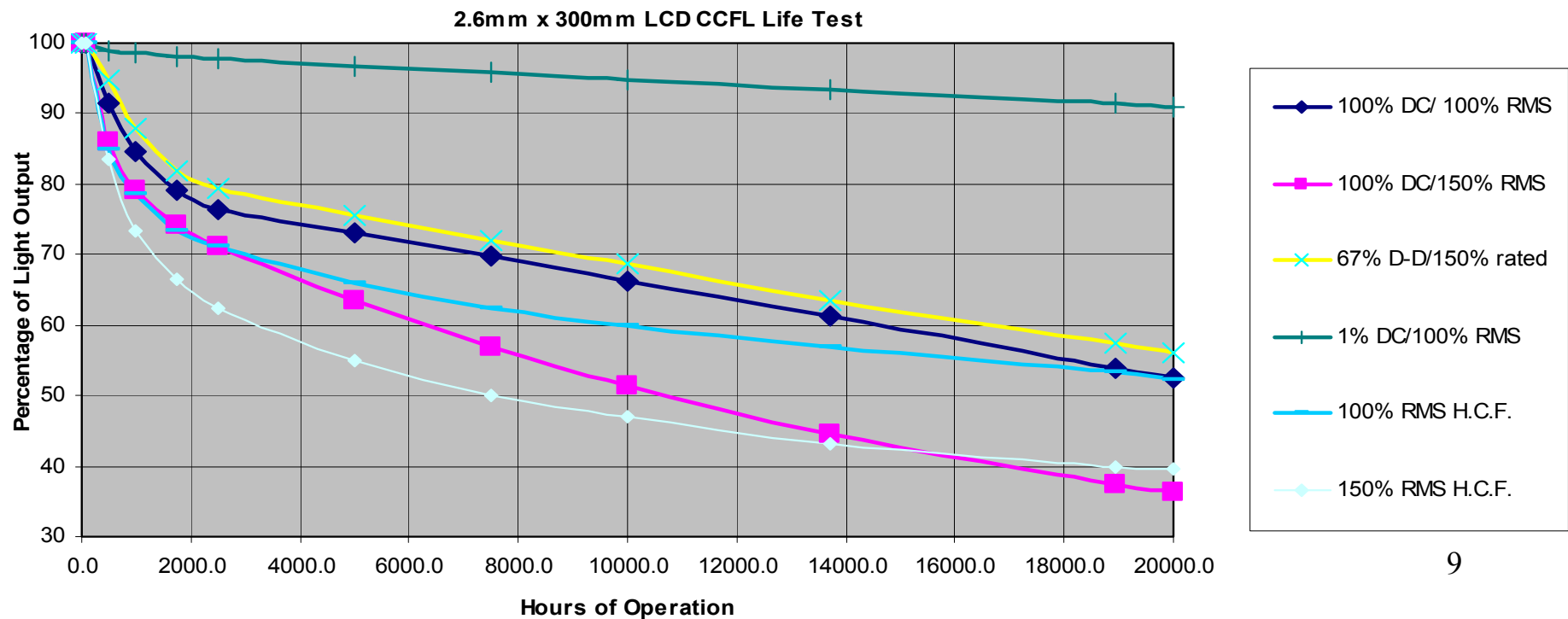


FIGURE 5 — 2% Burst Duty Cycle (Expanded Time Base)



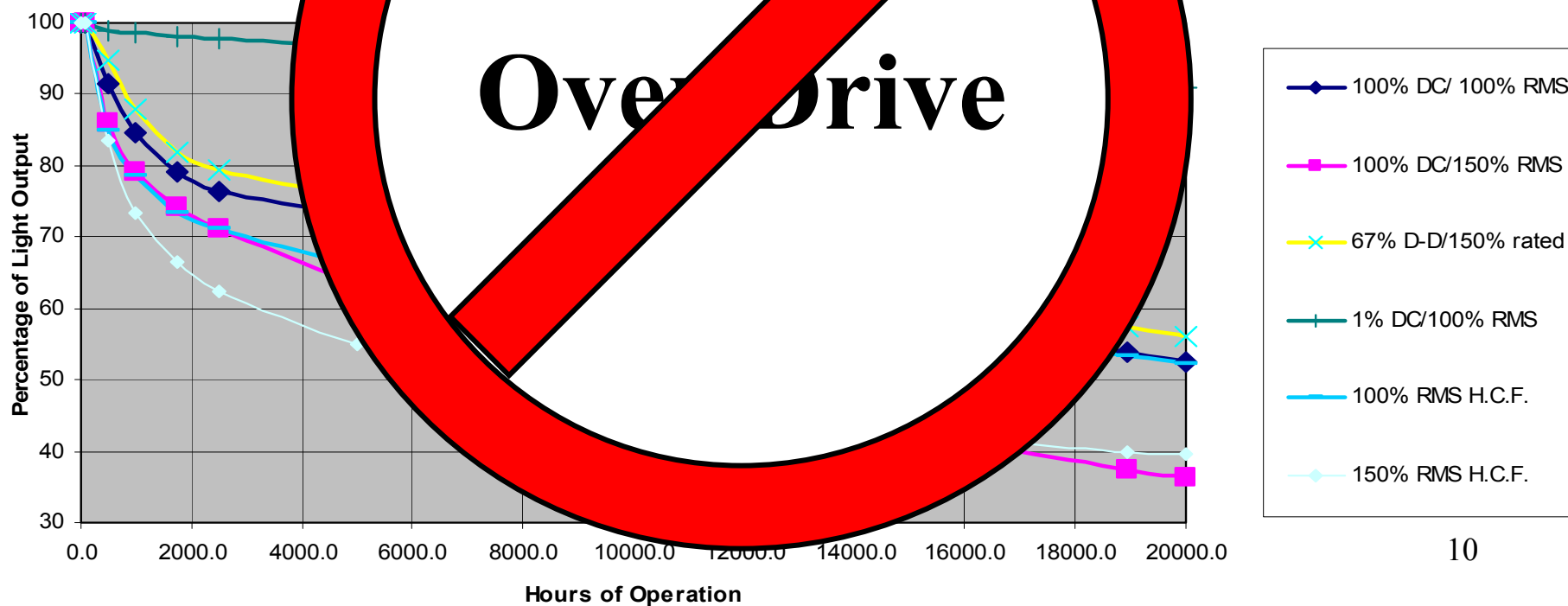
Lamp Life

- Lamps love digital dimming. 100:1 (2% burst /100% amplitude) provides >80% or >90% light output after 20k hours.
- Lamps do not like 150% overdrive, especially with high crest factor.
- Panels prefer sine waves. 100% rated amplitude was typically 5%-10% more light compared to the “high crest factor” setting.



Lamp Life

- Lamps love digital dimming. 100:1 (28%) dimming provides >80% or >90% light output after 20k hours.
- Lamps do not like 150% of rated output.
- Panels prefer sine wave dimming compared to the “high crest factor” setting.





Benefits

- Digital Dimming can increase play time saving power.
- If power doesn't matter
 - Digital dimming can increase the life of the bulb.
 - Ergonomic benefits.



CCFL Inverter Solution Options

- IC:
 - Reference Design
 - Kit solution available
- Standard Module (Value Add):
 - Complete line of standard inverter modules
 - PanelMatch Inverter Family
- Custom Module:
 - Inverters available for custom opportunities
 - Unique form factor and/or electrical requirement
 - Typically involves full panel characterization





RangeMax™ CCFL Products

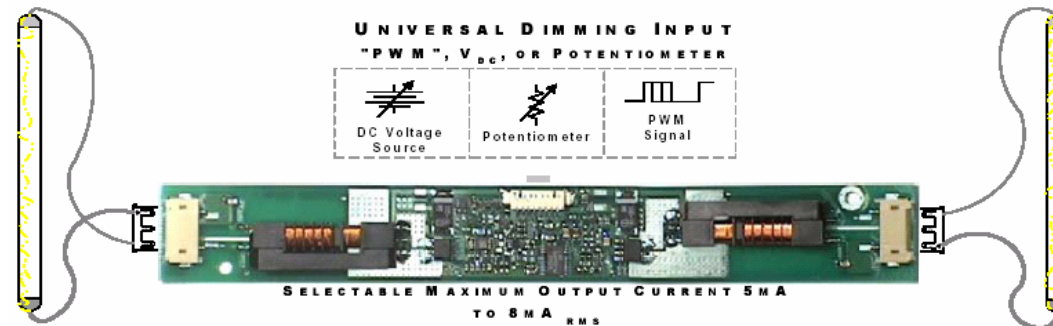
- RangeMax™ Inverter Control ICs
- LX1686E
 - Digital Dimming CCFL Controller
- LX1688
 - Multiple Lamp CCFL Controller
- LX1689
 - 3rd Generation CCFL Controller
- LX1691/91A/91B
 - 4th Generation CCFL Controller
- LX1695
- LX1692/92A - Coming Soon
- LX1696 - Coming Soon
- PanelMatch™ Inverter Modules
- LXM1617 and LXM1618 Series
 - (Single Lamp) CCFL Programmable Inverter Modules
- LXM1623 and LXM 1624 Series
 - (Dual Lamp) CCFL Programmable Inverter Module
- LXM1643 and LXM1644 Series
 - (Quad Lamp) CCFL Programmable Inverter Module



PanelMatch Inverters Support Multiple Panels With Programmable Lamp Current

<i>Manu</i>	<i>Panel</i>	<i>Size</i>	<i># Lamps</i>	<i>Min Cur</i>	<i>Typ Cur</i>	<i>Max Cur</i>	<i>Connector</i>
Samsung	LTM150XS-T01	15"	2	2.5	6	6.5	Two BHR-03VS-1
Sharp	LQ150X1DG16	15"	2	2.5	6	6.5	Two BHR-03VS-1
LG Philips	LM151X2	15"	2	3	8	9	Two BHR-03VS-1

LXM1623-12-61	12V, 6W, extended dimming range
LXM1623-05-61	5V, 6W, extended dimming range
LXM1624-12-61	12V, 6W, standard dimming range





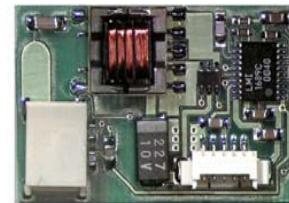
LX1691 Single Lamp CCFL Controller

- FEATURES

- Simultaneous Amplitude And Duty Cycle Dimming Modes
- Resistor programmable min and max lamp currents
- Digital Dimming Can Synch To External Or Internal Clocks
- 100 ms Power On Delay
- Open Or Shorted Lamp And Over Voltage Shutdown With Fault Output Indicator
- “On Chip” Full Wave Lamp Current & Voltage Rectifiers
- 16 Pin TSSOP Package
- Very Stable Oscillator with On-Chip timing capacitor

- APPLICATIONS

- Low Component Count / Module Cost / And Size
- High “Nits/Watt” Efficiency
- Operates Directly From A Single Li_Ion Cell
- Industries Safest And Highest Performing Strike Voltage Generation (Patented)
- Tight Operating Frequency Tolerance For Easier System Level RFI Control



LX1691 package is 16-pin TSSOP
(LX1689 shown)





Versions of the LX1691

- There are three versions
 - LX1691, LX1691A, and the LX1691B
- LX1691 is for Direct-Drive Applications
 - Narrow input voltage or Fixed V_{IN}
- LX1691A is for Direct-Drive Applications
 - Longer time-out for no-strike condition
- LX1691B is for Full-Bridge Applications
 - Wide input voltage applications like notebooks



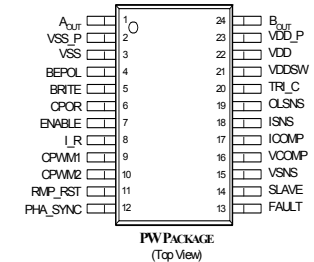
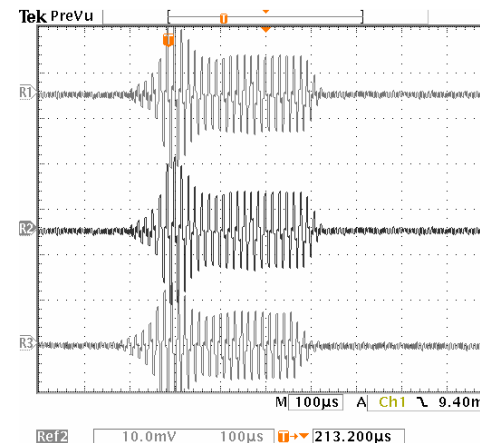
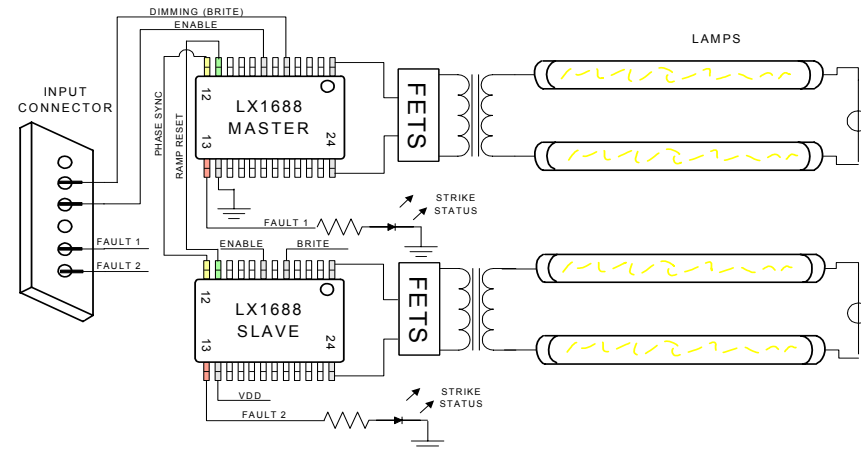
LX1688 Multiple Lamp CCFL Controller

FEATURES

- Provision to synchronize lamp current & frequency with slave controllers
- Dimming with analog (3:1) or external digital (PWM) methods (>100:1)
- Programmable Fixed frequency
- Adjustable Power-up reset
- ENABLE/BRITE Polarity Selection
- Open lamp timeout circuitry
- Switched VDD output (10mA)

APPLICATIONS

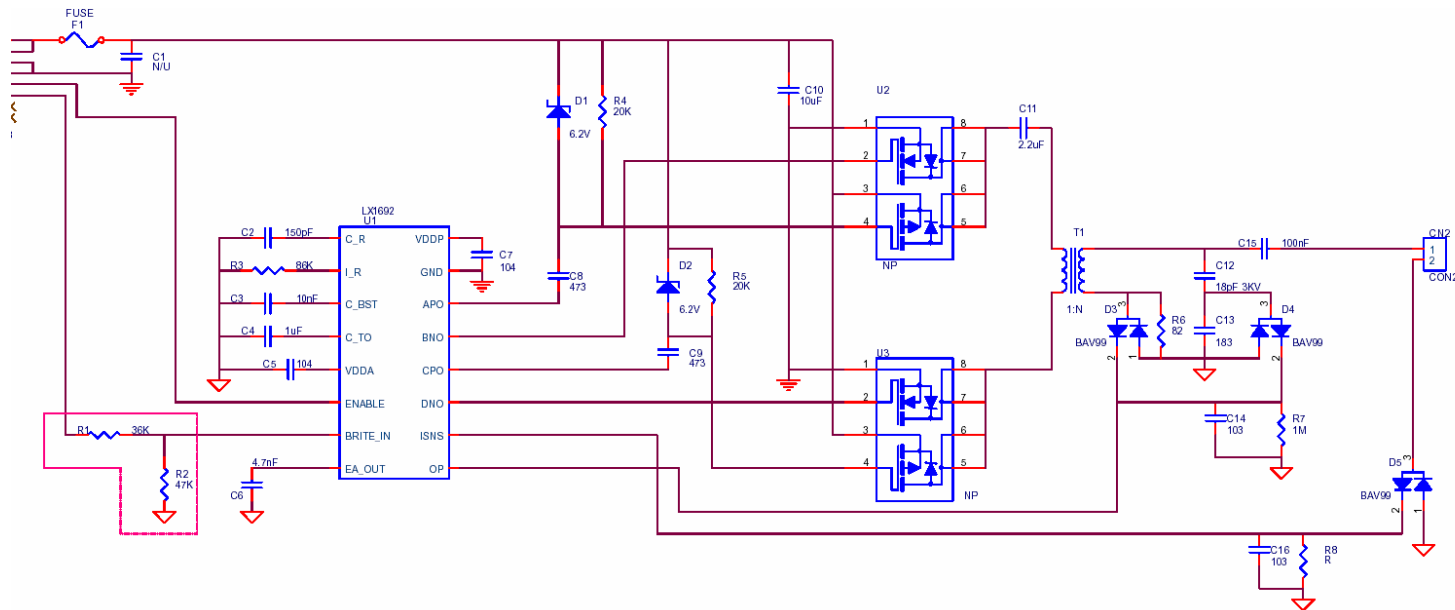
- LCD TV
- Desktop LCD Monitors
- Multiple lamp panels
- Low Ambient Light Displays
- High Efficiency
- Improved Lamp Strike Capability
- Improved Over-Voltage Control





Coming Soon – LX1692

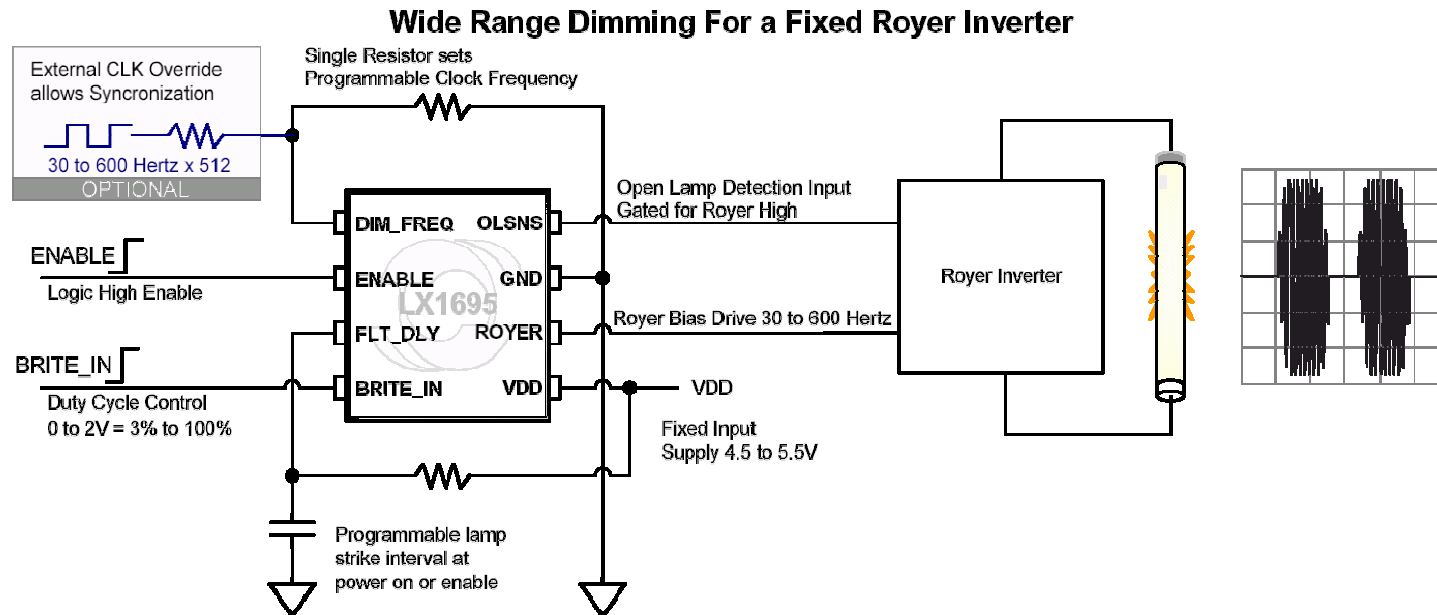
- Wide Input Voltage – 5V to 22V
- Inexpensive!!! There is no way you will lose on IC price.
- Compatible With Existing Transformers





LX1695 – Royer Supervisor

- Single Resistor Programs Output Frequency
- Allows External Synchronized PWM
- Open Lamp Sense Protection
- Programmable Fault Delay
- Enable and UV Lockout
- Preset 3.125% Minimum Output Duty Cycle





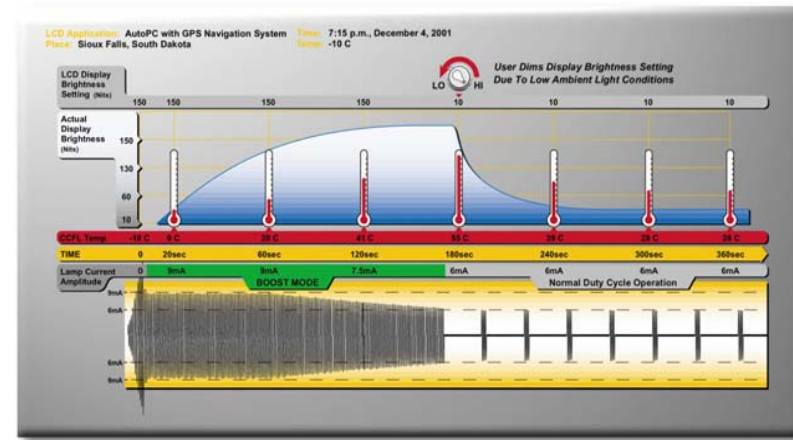
LCD Panel Cross Reference

- Where is the panel cross reference?
- How often is it updated?
- What if a panel is not listed?
- www.microsemi.com
 - Home page
 - Inverter search
 - Choose Panel Manufacturer
 - <http://www.microsemi.com/products/backlight/overview.asp>



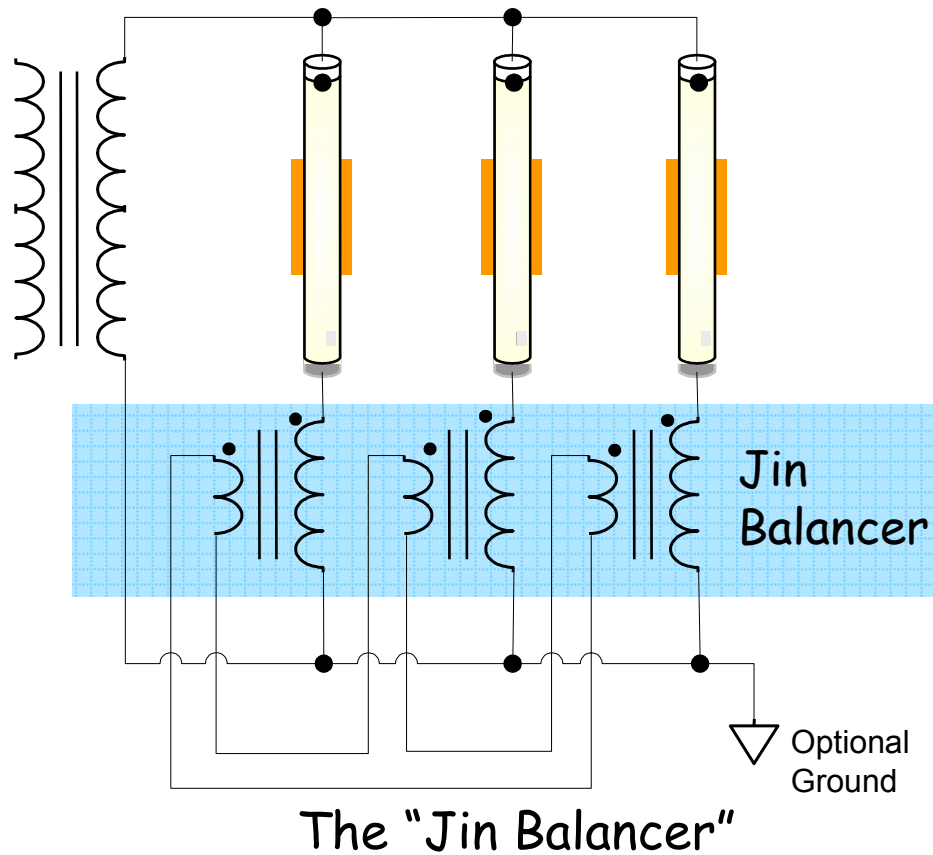
Automotive Market Overview

- Microsemi QS9000 Automotive Supplier
 - 12 “automotive display” customers
 - Product is in approximately 32 different vehicle platforms
- Dimming Performance
 - 50:1 to as high as 400:1
- Our Business remains dominated by “complete module” sales
- Certain customers will evaluate reference design and “kits” as they go forward



Lamp Current Balance Methods

Microsemi Patent Protected



- Forces All Lamp Currents to Same Value by Adjusting Lamp Voltage
- Lower Cost Than 1 Transformer per Lamp
- Allows Floating and Grounded Lamp
- Works With Any Number of Lamps from Two and Up
- Easy Fault Detection



The Position – CCFL Products

- Microsemi will offer IC, Kit, or module solution
 - Custom inverter design available
- No one has better technology
 - Strike Technique guarantees operation in low temperatures
 - Digital dimming yields lowest power consumption and display brightness
 - Wide input voltage or fixed voltage designs
 - Current balance techniques in multi-lamp applications is second to none.
- Patent Litigation Indemnity
 - Microsemi offers indemnity on all CCFL products