

# **PanelMatch**<sup>TM</sup>

LXMG1626-12-64

12V Dual 6W CCFL Programmable Inverter Module

**PRODUCTION DATASHEET** 

### **DESCRIPTION**

The LXMG1626-12-64 is a Dual 6W Output Direct Drive<sup>TM</sup> CCFL (Cold Technique Cathode Fluorescent Lamp) Inverter brightness control in any wide range Module specifically compatible with the Sharp LQ150X1LGN2(A),(H), 15" or similar dual lamp displays that have both specifically to ensure that no premature individual lamp output connectors on the one side of the panel.

LXMG1626 modules provide the designer with a vastly superior display achievable with virtually any LCD display. to high frequency, high-voltage waves

dimming input that permits brightness control from either, a DC voltage source, a PWM signal or external Potentiometer.

externally programmable (through the provides a number of input connector) over a range of 3.5 to performance advantages due 5mA in 0.5mA steps. This allows the controller's high level of integration. inverter to match the panel's lamp current specifications, or it can be used to are stable fixed-frequency operation, purposely drive the lamps at a lower or secondary-side strike-voltage regulation higher current to decrease or increase and both open/shorted lamp protection nominal brightness.

RangeMAX Digital Dimming provides flicker-free designed to be typically (100:1+) dimming application.

> The resultant "burst drive" energizes the lamp is designed lamp degradation occurs, while allowing significant power savings at lower dim levels.

The modules convert DC voltage from brightness range. This brightness range is the system battery or AC adapter directly The modules are available with a required to ignite and operate CCFL lamps.

The modules design Microsemi's LX1691 Enhanced Mult-The maximum output current is mode CCFL backlight controller, which cost and

> Other benefits of this new topology with fault timeout.

IMPORTANT: For the most current data, consult MICROSEMI's website: http://www.microsemi.com Protected By U.S. Patents: 5,923,129; 5,930,121; 6,198,234; Patents Pending

### **KEY FEATURES**

- Externally Programmable Maximum Output Current
- Easy to Use Brightness Control
- RangeMAX Wide Range Dimming
- Output Open & Short-Circuit Protection and Automatic Strike-Voltage Regulation and Timeout
- **Fixed Frequency Operation**
- Rated From -20 to 70°C
- UL60950 E175910
- **RoHS Compliant**

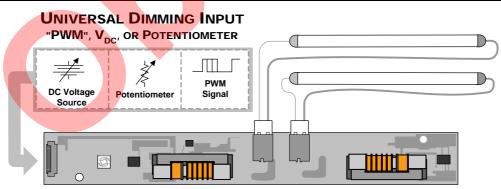
### **APPLICATIONS**

- LCD's requiring both output connectors on one side of panel Sharp LQ150X1LGN2(A)(H)
- Desktop Displays Industrial Display Controls

### **BENEFITS**

- Smooth, Flicker Free 1%-100% Full-Range Brightness Control
- Programmable output current allows inverter to mate with a wide variety of LCD panel's specifications
- Output Open Circuit Voltage Regulation Minimizes Corona Discharge For High Reliability

### **PRODUCT HIGHLIGHT**



**SELECTABLE MAXIMUM OUTPUT CURRENT 3.5MA** TO 5MA RMS

	PACKAGE ORDER INFO	
PART NUMBER	OUTPUT CONNECTOR	INVERTER MATES DIRECTLY TO PANEL CONNECTORS
LXMG1626-12-64	JST SM02B-BHSS-1-TB(LF)(SN) or Yeon Ho 35001WR-02A00	JST BHSR-02VS-1

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ABSOLUTE MAXIMUM RATINGS (NO	OTE 1)
Input Signal Voltage (V <sub>IN1</sub> )	0.3V to 16V
Output Voltage, no load Output Current Output Power (each output)	Internally Limited to 1800V <sub>RMS</sub> 7.5mA <sub>RMS</sub> (Internally Limited)
Input Signal Voltage (SLEEP Input)	-0.3V to V <sub>IN1</sub>
Ambient Operating Temperature, zero airflow	20°C to 70°C
Storage Temperature Range  Note 1: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground.	

### RECOMMENDED OPERATING CONDITIONS (R.C.)

This module has been designed to operate over a wide range of input and output conditions. However, best efficiency and performance will be obtained if the module is operated under the condition listed in the 'R.C.' column. Min. and Max. columns indicate values beyond which the inverter, although operational, will not function optimally.

Parameter	Symbol	Recommen	Recommended Operating Conditions		
1 didilletei	Gymbol	Min	R.C.	Max	Units
Input Supply Voltage Range (Fully Regulated Lamp Current)	V <sub>IN1</sub>	10.8	12	13.2	V
Input Supply Voltage Range (Functional)		10.2	12	14.4	
Output Power (each output)	Po		4.4	5.5	W
Linear BRITE Control Input Voltage Range	V <sub>BRT_ADJ</sub>	0.1		2.0	V
Lamp Operating Voltage			1100	1250*	$V_{RMS}$
Lamp Current (Full Brightness)	I <sub>OLAMP</sub>	3.5		5.0	mA <sub>RMS</sub>
Operating Ambient Temperature Range	T <sub>A</sub>	-20		70	°C

<sup>\*</sup> Total output power must not exceed 6W. Higher voltage lamps may require maximum output current to be set lower than 5mA<sub>RMS</sub>

### **ELECTRICAL CHARACTERISTICS**

Unless otherwise specified, the following specifications apply over the recommended operating condition and ambient temperature of 25°C except where otherwise noted.

Parameter	Symbol	Test Conditions	LXMG1626-12-64			Units
raiametei	Symbol	rest Conditions	Min	Тур	Max	Units
OUTPUT PIN CHARACTERISTICS						
Full Bright Lamp Current (each output)	$I_{L(MAX)}$	$V_{BRT\_ADJ} \ge 2.0V_{DC}$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN1} = 12V_{DC}$ $I_{SET1} = Ground$ , $I_{SET2} = Ground$	3.0	3.5	4.0	mA <sub>RMS</sub>
Full Bright Lamp Current (each output)	$I_{L(MAX)}$	$V_{BRT\_ADJ} \ge 2.0V_{DC}$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN1} = 12V_{DC}$ $I_{SET1} = Ground$ , $I_{SET2} = Open$	3.5	4.0	4.5	mA <sub>RMS</sub>
Full Bright Lamp Current (each output)	$I_{L(MAX)}$	$V_{BRT\_ADJ} \ge 2.0V_{DC}$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN1} = 12V_{DC}$ $I_{SET1} = Open$ , $I_{SET2} = Ground$	4.0	4.5	5.0	mA <sub>RMS</sub>
Full Bright Lamp Current (each output)	$I_{L(MAX)}$	$V_{BRT\_ADJ} \ge 2.0V_{DC}$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN1} = 12V_{DC}$ $I_{SET1} = Open$ , $I_{SET2} = Open$	4.5	5.0	5.5	mA <sub>RMS</sub>
Output Current Lamp to Lamp Deviation	I <sub>LL%DEV</sub>	$V_{BRT\_ADJ} \ge 2.0V_{DC}$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN1} = 12V_{DC}$ $I_{SET1} = Open$ , $I_{SET2} = Open$		3		%
Min. Average Lamp Current (each output)	I <sub>L(MIN)</sub>	$V_{BRT\_ADJ} = 0V_{DC}$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN1} = 12V_{DC}$ $I_{SET1} = I_{SET2} = Ground$		0.08		mA <sub>RMS</sub>
Lamp Start Voltage	$V_{LS}$	-20°C < T <sub>A</sub> < 70°C, V <sub>IN1</sub> > 10.8V <sub>DC</sub>	1450	1650		$V_{RMS}$
Operating Frequency	f <sub>O</sub>	$V_{BRT\_ADJ} = 2.5V_{DC}, \overline{SLEEP} \ge 2.0V, V_{IN1} = 12V$	62	65	68	kHz
Burst Frequency	f <sub>BURST</sub>	Output Burst Frequency	121	127	133	Hz

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## **ELECTRICAL CHARACTERISTICS (CONTINUED)**

Unless otherwise specified, the following specifications apply over the recommended operating condition and ambient temperature of 25°C except where otherwise noted.

	Parameter	Symbol	mbol Test Conditions		LXMG1626-12-64		
	raidilletei	Symbol Test Conditions		Min	Тур	Max	Units
•	BRITE INPUT						
	Input Current	I <sub>BRT</sub>	$V_{BRT\_ADJ} = 0V_{DC}$ $V_{BRT\_ADJ} = 3V_{DC}$		-15 1		μA <sub>DC</sub>
	Minimum Input for Max. Lamp Current	$V_{BRT\_ADJ}$	I <sub>O(LAMP)</sub> = Maximum Lamp Current		2.0	2.05	$V_{DC}$
	Maximum Input for Min. Lamp Current	$V_{BRT\_ADJ}$	I <sub>O(LAMP)</sub> = Minimum Lamp Current	0			$V_{DC}$
•	SLEEP INPUT						
	RUN Mode	V <sub>SLEEP</sub>		2.1		V <sub>IN1</sub>	$V_{DC}$
	SLEEP Mode	V <sub>SLEEP</sub>		-0.3		8.0	$V_{DC}$
•	SET <sub>1,2</sub> INPUT						
	SET <sub>1,2</sub> Low Threshold	$V_L$				0.4	V
	Input Current	I <sub>SET</sub>	V <sub>SET</sub> ≤ 0.4V		-300		μΑ
•	POWER CHARACTERISTICS						
	Sleep Current	I <sub>IN(MIN)</sub>	V <sub>IN1</sub> = 12V <sub>DC</sub> , <u>SLEEP</u> ≤ 0.8V	0.0	10	50	$\mu A_{DC}$
	Run Current	I <sub>IN(RUN)</sub>	$V_{IN1} = 12V_{DC}$ , SLEEP $\ge 2.0V$ , $I_{SET1} = Ground$ $I_{SET2} = Open$ , $V_{LAMP} = 1050V_{RMS}$		960		mA <sub>DC</sub>
	Efficiency	η	$V_{IN1} = 12V_{DC}$ , $\overline{SLEEP} \ge 2.0V$ , $I_{SET1} = Ground$ $I_{SET2} = Open$ , $V_{LAMP} = 1050V_{RMS}$		78		%

	FUNCTIONAL PIN DESCRIPTION						
CONN	PIN	DESCRIPTION					
CN1 (Molex	(53261-0871)	Mates with 51021-0800 housing, 50079-8100 pins. Mates with LX9501G input cable assembly					
CN1-1	V <sub>IN1</sub>	Main Input Power Supply (10.8V < V <sub>IN1</sub> < 13.2V)					
CN1-2	VINI	Wall input I owel Supply (10.0 v \( \sigma\) v <sub>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</sub>					
CN1-3	GND	Power Supply Return					
CN1-4	GND	1 ower outpry Neturn					
CN1-5	SLEEP	ON/OFF Control. (0V < SLEEP < 0.8 = OFF, SLEEP >= 2.1V = ON					
CN1-6	BRITE	Brightness Control (0V to 2.0V <sub>DC</sub> ). 2.0V <sub>DC</sub> gives maximum lamp current.					
CN1-7	SET <sub>1</sub>	SET <sub>1</sub> MSB Connecting this pin to ground decreases the output current (see Table 1)					
CN1-8	SET <sub>2</sub>	SET <sub>2</sub> LSB Connecting this pin to ground decreases the output current (see Table 1)					
CN2, CN3 for LXMG1626-12-64 (JST SM02B-BHSS-1-TB(LF)(SN) or Yeon Ho 35001WR-02A00 )							
CN2-1 CN3-1	V <sub>HI</sub>	High voltage connection to high Side of lamp. Connect to lamp terminal with shortest lead length. <b>DO NOT</b> connect to Ground.					
CN2-2 CN3-2	$V_{LO}$	Connection to low side of lamp. Connect to lamp terminal with longer lead length. <b>DO NOT</b> connect to Ground					

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### TABLE 1

### **OUTPUT CURRENT SETTINGS**

SET₁ (Pin 7)	SET <sub>2</sub> (Pin 8)	Nominal Output Current
Open*	Open*	5.0mA
Open*	Ground	4.5mA
Ground	Open*	4.0mA
Ground	Ground	3.5mA

PHYSICAL DIMENSIONS

#### LXMG1626-12-64 165mm 6.50in. GROUNDED MOUNTING HOLE 3MM ±.08 DIA. 14mm 5MM HEAD CLEARANCE BOTH HOLES 0.559in $\odot$ 3.0mm 21mm 0.118in. 0.827in. 18mm 0.709in. 137mm 14mm 0.551in. 5.394in.

PCB tolerances ± 0.5mm , 4-40 recommended mounting screws

All Dimensions are in millimeters, inches for reference only.

### SIMPLIFIED BLOCK DIAGRAM High Voltage Controller Transformer $V_{\rm HI}$ 215k Comparator V<sub>BRITE</sub> ЈШ Transformer 9.09K Ramp Driver LAMP Ramp +3V OC<sub>SENSE</sub> Gen 10K SET₁ 10K SET<sub>2</sub> SENSE One of two

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7.5mm 0.295in. Max 1.0mm 0.0394in.

Typical weight: 18g

<sup>\*</sup> If driven by a logic signal it should be open collector or open drain only, not a voltage source.

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### TYPICAL APPLICATION

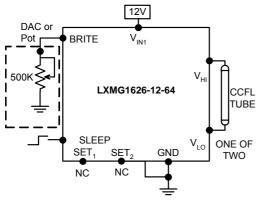


Figure 1 – Brightness Control (Output current set to maximum)

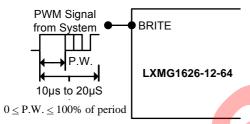


Figure 1A – PWM Brightness Control

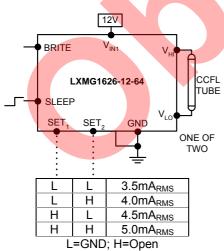


Figure 2 – Max Output Current (SET<sub>1</sub> and SET<sub>2</sub> Inputs)

- The brightness control may be a voltage output DAC or other voltage source, a digital pot or 500K manual pot. The inverter contains an internal 215K pull-up to 3V to bias the pot. A 3.3V Logic Level PWM signal from a microcontroller may also be used as shown in Figure 1A.
- If you need to turn the inverter ON/OFF remotely, connect to TTL logic signal to the SLEEP input.
- Connect V<sub>HI</sub> to high voltage wire from the lamp. Connect V<sub>LO</sub> to the low voltage wire (wire with thinner insulation). Never connect V<sub>LO</sub> to circuit ground as this will defeat lamp current regulation. If both lamp wires have heavy high voltage insulation, connect the longest wire to V<sub>LO</sub>. This wire is typically white.
- Use the SET₁ and SET₂ (see Figure 2) inputs to select the desired maximum output current. Using these two pins in combination allows the inverter to match a wide variety of panels from different manufactures. Generally the best lamp lifetime correlates with driving the CCFL at the manufactures nominal current setting. However the SET₁ and SET₂ inputs allow the user the flexibility to adjust the current to the maximum allowable output current to increase panel brightness at the expense of some reduced lamp life.
- Although the SET pins are designed such that just leaving them open or grounding them is all that is needed to set the output current, they can also be actively set. Using a open collector or open drain logic signal will allow you to reduce the lamp current for situations where greater dim range is required, as an example in nighttime situations. In conjunction with a light sensor or other timer the panel could be set to higher brightness (maximum output current) for daytime illumination and lower brightness (minimum or typical output current) at nighttime. Since the dim ratio is a factor of both the burst duty cycle and the peak output current, using this technique the effective dim ratio can be increased greater than the burst duty cycle alone. Conversely, the SET inputs could be used to overdrive the lamp temporarily to facilitate faster lamp warm up at initial lamp turn on. Of course, any possible degradation on lamp life from such practices is the user's responsibility since not all lamps are designed to be overdriven.
- The inverter has a built in fault timeout function. If the output is open (lamp disconnected or broken) or shorted to ground the inverter will attempt to strike the lamp for number of cycles. After about 800 milliseconds without success the inverter will shutdown. In order to restart the inverter it is necessary to toggle the SLEEP input or cycle the V<sub>INI</sub> input supply

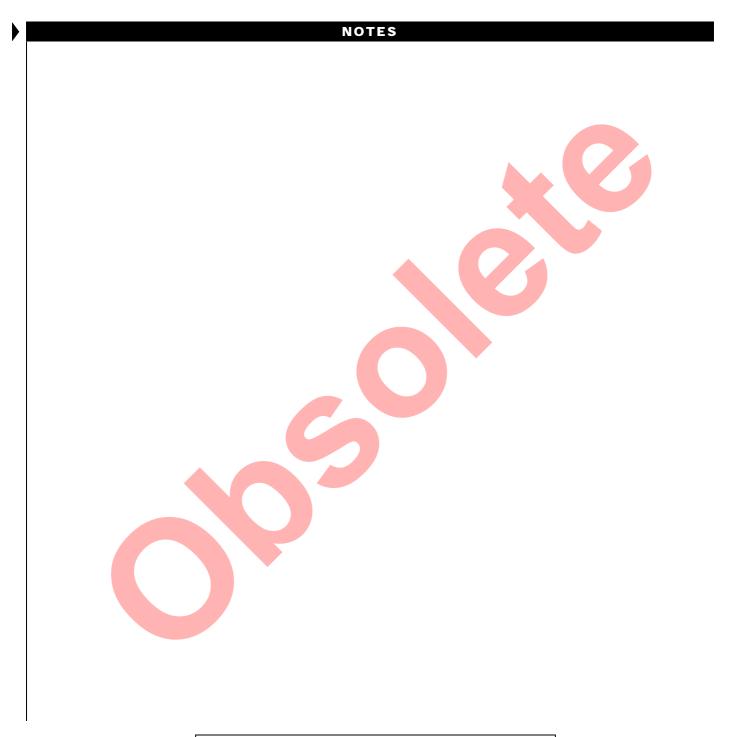


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