

#### PanelMatch™ "A Series" LXMG1618A-03-2x

3.3V 2.2W CCFL Programmable Inverter Module

**PRODUCTION DATASHEET** 

## DESCRIPTION

Output 2.2W Direct Drive<sup>TM</sup> CCFL (Cold directly to high frequency, high-voltage Cathode Fluorescent Lamp) Inverter waveform required to ignite and operate Module designed for driving LCD CCFL lamps. A 5V input inverter is also backlight lamps. It is ideal for driving available (LXMG1618A-05-2x). typically 3.9" to 6.4" panels.

externally programmable over a range of CCFL backlight controller to provide a 3.5 to 5mA in 0.5mA steps (PanelMatch) wider temperature range (-30°C to 80°C) to allow the inverter to properly match to a compared to the existing solutions offered wide array of LCD panel lamp current by Microsemi. specifications. The modules include a dimming input that permits brightness topology include stable fixed-frequency control from a DC voltage source, a PWM operation, secondary-side strike voltage signal or an external potentiometer.

LXMG1618A modules unlike the protection with fault timeout. LXMG1617A series do not provide wide range 'burst' mode dimming, rather modules are designed therefore as a dimming is provided by amplitude control higher of the output current waveform, and this limits the potential dim range to typically less than 5:1.

The module converts a DC voltage

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

The LXMG1618A-03-2x<sup>TM</sup> is a Single from the system battery, or AC adapter

The LXMG1618A modules contain The maximum output current is the newer highly integrated LX1691B

> Other benefits of the inverter's regulation and both open/shorted lamp

> The new LXMG1618A ("A Series") performance near replacement (see BRITE minimum input) for those customers and applications currently using the LXMG1618 inverters.

#### **KEY FEATURES**

- **Externally Programmable** Maximum Output Current
- Easy to Use Brightness Control
- Output Short-Circuit Protection and Automatic Strike-Voltage Regulation and Timeout
- Analog Current Amplitude **Dimming Method**
- Fixed Frequency Operation
- Rated From -30°C to 80°C
- UL60950 E175910
- **RoHS Compliant**

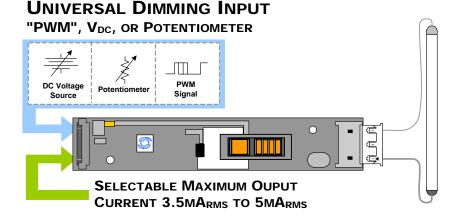
# **APPLICATIONS**

- Medical Instrument Displays
- Portable Instrumentation (GPS, etc.)
- **Industrial Display Controls**

# **BENEFITS**

- 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



,	PACKAGE ORDER INFO						
	PART NUMBER	OUTPUT CONNECTOR	INVERTER MATES DIRECTLY TO PANEL CONNECTORS				
	LXMG1618A-03-21	JST SM02(8.0)B-BHS-1-TB (LF)(SN) or Yeon Ho 20015WR-05A00 or equivalent	JST BHR-03VS-1				
	LXMG1618A-03-22	JST SM02B-BHSS-1-TB (LF)(SN) or Yeon Ho 35001WR-02A00 or equivalent	JST BHSR-02VS-1				



# PanelMatch™ "A Series"

LXMG1618A-03-2x

3.3V 2.2W CCFL Programmable Inverter Module

#### **PRODUCTION DATASHEET**

land the Circuit Maltana (M.)	0.07/4- 57/
Input Signal Voltage (V <sub>IN</sub> )	
Input Power	3.000
Output Voltage, no load	Internally Limited to 1300V <sub>RMS</sub>
Output Current	6mA <sub>RMS</sub> (Internally Limited)
Output Power	2.3W
Input Signal Voltage (SLEEP Input)	0.3V to 5V
Input Signal Voltage (BRITE)	0.3V to 5V
Ambient Operating Temperature, zero airflow	30°C to 80°C
Storage Temperature Range	

Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

# 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, may not function optimally.

Parameter	Symbol	Recommended Operating Conditions			Units	
i diametei	Cymbol	Min	R.C.	Max	Office	
Input Supply Voltage Range (Fully Regulated Lamp Current)	V <sub>IN</sub>	3	3.3	3.6	V	
Input Supply Voltage Range (Functional)		3		4.2		
Output Power	Po			2.2	W	
Linear BRITE Control Input Voltage Range¹	$V_{BRT\ ADJ}$	0		2.0	V	
Lamp Operating Voltage	$V_{LAMP}$	325	380	435*	$V_{RMS}$	
Lamp Current (Full Brightness)	I <sub>OLAMP</sub>	3.5		5.0	mA <sub>RMS</sub>	
Operating Ambient Temperature Range	T <sub>A</sub>	-30		80	°C	

<sup>1</sup> The BRITE minimum input voltage level is 0V, whereas it is 0.65V in the original LXMG1618-03-2x inverter, see application info on page 5. The minimum V<sub>BRT</sub> ADJ voltage depends on the panel characteristics and minimum lamp current specification, depending on the panel it can vary from 0V to 0.5V \*Total output power must not exceed 2.2W. Higher voltage lamps may require maximum output current to be set lower than 5mA<sub>RMS</sub>

## **ELECTRICAL CHARACTERISTICS**

The following specifications apply over the recommended operating condition and ambient temperature of 0°C to 60°C except where otherwise noted.

Parameter	Symbol	Test Conditions	LXMC	LXMG1618A-03-2x		
Farameter Symbol		rest Conditions	Min	Тур	Max	Units
OUTPUT PIN CHARACTERISTICS						
Full Bright Lamp Current	I <sub>L(MAX)</sub>	$V_{BRT\_ADJ} \ge 2.0V$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN} = 3.3V$ $I_{SET1} = Ground$ , $I_{SET2} = Ground$	3.0	3.5	4.0	mA <sub>RMS</sub>
Full Bright Lamp Current	I <sub>L(MAX)</sub>	$V_{BRT\_ADJ} \ge 2.0V$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN} = 3.3V$ $I_{SET1} = Ground$ , $I_{SET2} = Open$	3.5	4.0	4.5	mA <sub>RMS</sub>
Full Bright Lamp Current	I <sub>L(MAX)</sub>	$V_{BRT\_ADJ} \ge 2.0V$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN} = 3.3V$ $I_{SET1} = Open$ , $I_{SET2} = Ground$	4.0	4.5	5.0	mA <sub>RMS</sub>
Full Bright Lamp Current	I <sub>L(MAX)</sub>	$V_{BRT\_ADJ} \ge 2.0V$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN} = 3.3V$ $I_{SET1} = Open$ , $I_{SET2} = Open$	4.5	5	5.5	mA <sub>RMS</sub>
Min. Average Lamp Current <sup>2</sup>	I <sub>L(MIN)</sub>	$V_{BRT\_ADJ} = 0V$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN} = 3.3V$ $I_{SET1} = I_{SET2} = Ground$		1.5		mA <sub>RMS</sub>
Lamp Start Voltage	$V_{LS}$	-30°C < T <sub>A</sub> < 80°C, V <sub>IN</sub> > 3V	1000	1200		$V_{RMS}$
Operating Frequency	f <sub>O</sub>	$V_{BRT\_ADJ} = 2V$ , $\overline{SLEEP} \ge 2.0V$ , $V_{IN} = 3.3V$	85	90	94	kHz

<sup>&</sup>lt;sup>2</sup> The inverter is capable of a lower output current than may be recommended by the panel manufacturer. It is the user responsibility to set the minimum brightness (BRITE) input at or above the panel specification for minimum lamp current.



PanelMatch™ "A Series"

LXMG1618A-03-2x

3.3V 2.2W CCFL Programmable Inverter Module

## **PRODUCTION DATASHEET**

# **ELECTRICAL CHARACTERISTICS (CONTINUED)**

The following specifications apply over the recommended operating condition and ambient temperature of  $0^{\circ}$ C to  $60^{\circ}$ C except where otherwise noted.

	Parameter	Symbol Test Conditions		LXMG1618A-03-2x			Units		
	Farameter	Syllibol	rest Conditions	Min	Тур	Max	Ullits		
•	BRITE INPUT								
	Input Current	I <sub>BRT</sub>	$V_{BRT\_ADJ} = 0V$		-9		μA		
		·BICI	$V_{BRT\_ADJ} = 3V$		0		μA		
	Minimum Input for Max. Lamp Current	$V_{BRT\_ADJ}$	I <sub>O(LAMP)</sub> = Maximum Lamp Current		1.8	2.0	V		
	Maximum Input for Min. Lamp Current <sup>3</sup>	$V_{BRT\_ADJ}$	I <sub>O(LAMP)</sub> = Minimum Lamp Current	0			V		
	Minimum PWM Input Frequency	$F_{BRT\_PWM}$		2			kHz		
•	SLEEP BAR INPUT	SLEEP BAR INPUT							
ľ	RUN Mode	V <sub>SLEEP</sub>		2.0			V		
	SLEEP Mode	V <sub>SLEEP</sub>		-0.3		0.8	V		
SET <sub>1,2</sub> INPUT			<u>.</u>						
	SET <sub>1,2</sub> Low Threshold	$V_L$				0.4	V		
	Input Current	I <sub>SET</sub>	V <sub>SET</sub> = 0V		-300		μA		
	POWER CHARACTERISTICS								
	Sleep Current	I <sub>IN(MIN)</sub>	V <sub>IN</sub> = 3.3V, <u>SLEEP</u> ≤ 0.8V		3	10	μA		
	Run Current	I <sub>RUN</sub>	$V_{IN}$ = 3.3V, $\overline{SLEEP} \ge 2.0V$ , $I_{SET1}$ = Open $I_{SET2}$ = Ground, $V_{LAMP}$ = 380 $V_{RMS}$		690		mA		
	Run Current Ripple Voltage	I <sub>RIPPLE</sub>	$V_{IN}$ = 3.3V, $\overline{SLEEP} \ge 2.0V$ , $I_{SET1}$ = Open $I_{SET2}$ = Ground, $V_{LAMP}$ = 380 $V_{RMS}$		400		mVpp		
	Efficiency	η	$V_{IN}$ = 3.3V, $\overline{SLEEP} \ge 2.0V$ , $I_{SET1}$ = Open $I_{SET2}$ = Ground, $V_{LAMP}$ = 380 $V_{RMS}$		75		%		

<sup>&</sup>lt;sup>3</sup> The BRITE minimum input voltage level is 0V, whereas it is 0.65V in the original LXMG1618-03-2x inverter.

	FUNCTIONAL PIN DESCRIPTION							
Conn	Pin	DESCRIPTION						
CN1 (Molex 53261-0871 or equivalent) Mates with 51021-0800 housing, 50079-8100 pins. Mates with LX9501G input cable assembly								
CN1-1	$V_{IN}$	Main Input Power Supply (3V < V <sub>IN</sub> < 3.6V)						
CN1-2	VIN	Main input rower supply (5 $v \le v_{ N } \le 3.0v_j$						
CN1-3	GND	Power Supply Poturn						
CN1-4	GND	Power Supply Return						
CN1-5	SLEEP	ON/OFF Control. (0V < SLEEP ≤ 0.8 = OFF, SLEEP≥ 2.0V = ON)						
CN1-6 BRITE		Brightness Control (0V to 2.0V). 2.0V gives maximum lamp current.						
CN1-7	SET <sub>1</sub>	SET <sub>1</sub> MSB Connecting this pin to ground decreases the output current ~ 1mA (see Table 1)						
CN1-8	SET <sub>2</sub>	SET <sub>2</sub> LSB Connecting this pin to ground decreases the output current ~ 0.5mA (see Table 1)						
CN2 for LXMG1618A-03-21 and -22 (JST SM02(8.0)B-BHS-1-TB(LF)(SN) / Yeon Ho 20015WR-05A00 or SM02B-BHSS-1-TB(LF)(SN) / Yeon Ho 35001WR-02A00) or equivalent								
CN2-1 V <sub>HI</sub> High voltage connection to high side of lamp. Connect to lamp terminal with shortest lead len								
CN2-2 V <sub>LO</sub> Connection to low side of lamp. Connect to lamp terminal with longer lead length. <b>DO NOT</b> connect to Ground								



# PanelMatch™ "A Series" LXMG1618A-03-2x

3.3V 2.2W CCFL Programmable Inverter Module

#### **PRODUCTION DATASHEET**

Weight: (5.7g) typ.

# 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

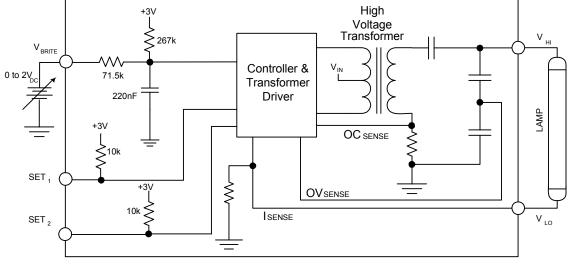
<sup>\*</sup> If driven by a logic signal it should be open collector or open drain only, not a voltage source.

#### PHYSICAL DIMENSIONS LXMG1618A-03-2X 86mm 3.39ir MOUNTING HOLF 71mm 2.44MM ±0.08 DIA. 2.80in Warning CN1 High Voltage is present at high 16mm 3.5mm side of transformer, its core CN2 0.138in. and the high side of the output connector, please provide at least 2 mm clearance (in all 11mm 0.433in. GROUNDED MOUNTING directions) on the component side of the board to any 60mm +0.2mm conductor when mounting 0.8mm ±0.1 0.0315in. 4.7mm Max 0.185in.

# SIMPLIFIED BLOCK DIAGRAM +3V High Voltage

PCB tolerances  $\pm$  0.5mm, M2 or 2-56 recommended mounting screws

All dimensions in millimeters, inches are for reference only.



Copyright © 2008 Rev. 1.1, 2009-11-03



# PanelMatch™ "A Series" LXMG1618A-03-2x

3.3V 2.2W CCFL Programmable Inverter Module

#### **PRODUCTION DATASHEET**

# TYPICAL APPLICATION

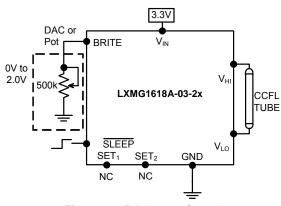


Figure 1 – Brightness Control (Output current set to maximum)

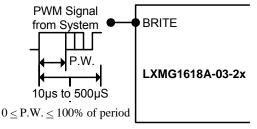


Figure 1A - PWM Brightness Control

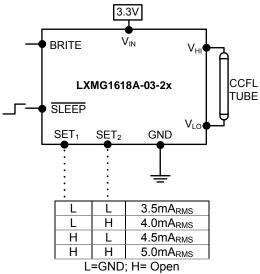


Figure 2 – Max Output Current (SET<sub>1</sub> and SET<sub>2</sub> Inputs)

- The brightness control may be a voltage output DAC or other voltage source, a digital pot or 500K manual pot. The inverter contains effectively an internal 338k pull-up to 3V to bias the pot, if desired; add a resistor to set the lower threshold voltage above the absolute minimum dim level capability. A PWM logic level signal (figure 1A) may be used up to 5V; however the inverter will reach maximum current at less than 100% duty cycle. This can be calculated as approximately 2V divided by the logic high voltage level; with 3.3V logic level this corresponds to about 60% duty cycle for maximum lamp current.
- If you need to turn the inverter ON/OFF remotely, connect to TTL logic signal to the SLEEP input.
- $\begin{array}{ll} \bullet & Connect \ V_{HI} \ to \ high \ voltage \ wire \ from \ the \ lamp. \ Connect \ V_{LO} \ to \ the \ low \ voltage \ wire \ (wire \ with \ thinner \ insulation). \ Never \ connect \ V_{LO} \ to \ circuit \ ground \ as \ this \ will \ defeat \ lamp \ current \ regulation. \ If \ both \ lamp \ wires \ have \ heavy \ high \ voltage \ insulation, \ connect \ the \ longest \ wire \ to \ V_{LO}. \ This \ wire \ is \ typically \ white. \end{array}$
- Use the SET<sub>1</sub> and SET<sub>2</sub> (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 manufacturers. Generally the best lamp lifetime correlates with driving the CCFL at the manufacturer's nominal current setting. However the SET<sub>1</sub> and SET<sub>2</sub> 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 an 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 the peak output current, using this technique the effective dim ratio can be increased. 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 the inverter will attempt to strike the lamp up to about one second, after which (without success) the inverter will shutdown. Supply current draw in the shutdown mode is about 8mA. In order to restart the inverter it is necessary to toggle the sleep input or cycle the V<sub>IN</sub> input supply.



PanelMatch™ "A Series" LXMG1618A-03-2x

3.3V 2.2W CCFL Programmable Inverter Module

**PRODUCTION DATASHEET** 

NOTES

PRODUCTION DATA – Information contained in this document is proprietary to Microsemi and is current as of publication date. This document may not be modified in any way without the express written consent of Microsemi. Product processing does not necessarily include testing of all parameters. Microsemi reserves the right to change the configuration and performance of the product and to discontinue product at any time.