

5V 4W CCFL Programmable Inverter Module

PRODUCTION DATASHEET

DESCRIPTION

The LXMG1617A-05-4xTM is a Single Output 4W Direct Drive™ CCFL (Cold from the system battery or AC adapter Cathode Fluorescent Lamp) Inverter directly to high frequency, high-voltage Module designed for driving LCD waves required to ignite and operate backlight lamps. It is ideal for driving CCFL lamps. A 12V input inverter is also typically 8.4" to 12.1" TFT panels.

LXMG1617A modules provide the designer with a superior display brightness the newer highly integrated LX1691B range. This brightness range is achievable CCFL backlight controller to provide with virtually any LCD display.

externally programmable over a range of 5 to 6.5mA in 0.5mA steps (PanelMatch) to offered by Microsemi. allow the inverter to properly match to a wide array of LCD panel lamp current topology include stable fixed-frequency specifications. The modules include a operation, secondary-side strike voltage dimming input that permits brightness regulation and both open/shorted lamp control from a dc voltage source, a PWM protection with fault timeout. signal or an external potentiometer.

The resultant "burst drive" energizes the lamp was designed to ensure higher that no premature lamp degradation replacement (see BRITE minimum input occurs, while allowing significant power voltage level and Burst Frequency) for savings at lower dim levels.

The module converts a DC voltage available (LXMG1617A-12-4x).

The LXMG1617A modules contain wider dimming range (typically 100:1+) The maximum output current is and wider temperature range (-30°C to 80°C) compared to the existing solutions

Other benefits of the inverter's

The new LXMG1617A ("A Series") that modules are designed therefore as a performance those customers and applications currently using the LXMG1617 inverters.

IMPORTANT: For the most current data, consult MICROSEMI's website: http://www.microsemi.com Protected By U.S. Patents: 5,923,129; 59320,121; 6,198,234; Patents Pending

KEY FEATURES

- Externally Programmable Maximum Output Current
- Easy to Use Brightness Control
- Output Short-Circuit Protection and Automatic Strike-Voltage Regulation and Timeout
- RangeMAX Wide Range Dimming (typ. 100:1+)
- **Fixed Frequency Operation**
- Rated From -30°C to 80°C
- UL60950 E175910
- **RoHS Compliant**

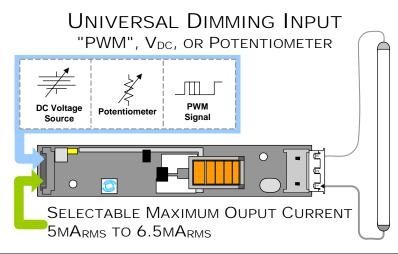
APPLICATIONS

- Medical Instrument Displays
- Portable Instrumentation
- Industrial Display Controls

BENEFITS

- Smooth, Flicker Free 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



PART NUMBER	OUTPUT CONNECTOR	INVERTER MATES DIRECTLY TO PANEL CONNECTORS
LXMG1617A-05-41	JST SM02(8.0)B-BHS-1-TB (LF)(SN), Yeon Ho 20015WR-05A00 or equivalent	JST BHR-03VS-1
LXMG1617A-05-42	JST SM02B-BHSS-1-TB (LF)(SN), Yeon Ho 35001WR-02A00 or equivalent	JST BHSR-02VS-1



5V 4W CCFL Programmable Inverter Module

PRODUCTION DATASHEET

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	
raiailietei	Symbol	Min	R.C.	Max	Offics	
Input Supply Voltage Range (Fully Regulated Lamp Current)	V _{IN}	4.75	5	5.25	V	
Input Supply Voltage Range (Functional)		4.5	5	5.5		
Output Power	Po		3.5	4.0	W	
Linear BRITE Control Input Voltage Range ¹	V _{BRT ADJ}	0		2.0	V	
Lamp Operating Voltage	V_{LAMP}	465	550	635*	V_{RMS}	
Lamp Current (Full Brightness)	I _{O(LAMP)}	5		6.5	mA _{RMS}	
Operating Ambient Temperature Range	T _A	-30		80	°C	

¹ The BRITE minimum input voltage level is 0V, whereas it is 0.5V in the original LXMG1617-05-4x inverter.

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		LXMG1617A-05-4x			Units
	Farameter	Syllibol	rest Conditions		Тур	Max	Units
>	OUTPUT PIN CHARACTERISTICS						
	Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V$, $\overline{SLEEP} \ge 2.0V$, $V_{IN} = 5V$ $I_{SET1} = Ground$, $I_{SET2} = Ground$	4.5	5	5.5	mA _{RMS}
	Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V$, $\overline{SLEEP} \ge 2.0V$, $V_{IN} = 5V$ $I_{SET1} = Ground$, $I_{SET2} = Open$	5.0	5.5	6.0	mA _{RMS}
	Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V$, $\overline{SLEEP} \ge 2.0V$, $V_{IN} = 5V$ $I_{SET1} = Open$, $I_{SET2} = Ground$	5.5	6	6.5	mA _{RMS}
	Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V$, $\overline{SLEEP} \ge 2.0V$, $V_{IN} = 5V$ $I_{SET1} = Open$, $I_{SET2} = Open$	6.0	6.5	7.0	mA _{RMS}
	Min. Average Lamp Current	I _{L(MIN)}	$V_{BRT_ADJ} = 0V$, $\overline{SLEEP} \ge 2.0V$, $V_{IN} = 5V$ $I_{SET1} = I_{SET2} = Gnd I_{L(MIN)} = I_{L(MAX)} * \sqrt{(Min Duty Ratio)}$		0.56		mA _{RMS}
	Lamp Start Voltage	V _{LS}	-30°C < T _A < 80°C, V _{IN} > 4.5V	1300	1450		V_{RMS}
	Operating Frequency	f _O	$V_{BRT_ADJ} = 2.0V$, $\overline{SLEEP} \ge 2.0V$, $V_{IN} = 5V$	76	80	83	kHz
	Burst Frequency ²	f _{BURST}	Output Burst Frequency	297	313	328	Hz

 $^{^{\}rm 2}$ The Burst Frequency of the LXMG1617A-05-4x is twice that of the original LXMG1617-05-4x inverter.

^{*} Total output power must not exceed 4W. Higher voltage lamps may require maximum output current to be set lower than 6.5mA_{RMs}



5V 4W CCFL Programmable Inverter Module

PRODUCTION DATASHEET

ELECTRICAL CHARACTERISTICS (CONTINUED)

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		LXMG1617A-05-4x			1126-		
Parameter	Symbol	rest Conditions	Min	Тур	Max	Units		
BRITE INPUT								
Input Current	I _{BRT}	$V_{BRT_ADJ} = 0V$		-13		μA		
Minimum Input for Max. Lamp Current	V _{BRT_ADJ}	$V_{BRT_ADJ} = 3V$ $I_{O(LAMP)} = Maximum Lamp Current$		1.9	2.0	μA		
Maximum Input for Min. Lamp Current ³		I _{O(LAMP)} = Minimum Lamp Current	0	1.0	2.0	V		
Minimum PWM Input Frequency	F _{BRT_PWM}	(2.5)	2			kHz		
SLEEP BAR INPUT								
RUN Mode	V _{SLEEP}		2.0		V _{IN}	V		
SLEEP Mode	V _{SLEEP}		-0.3		0.8	V		
SET _{1,2} INPUT	SET _{1,2} INPUT							
SET _{1,2} Low Threshold	V_L			0		V		
Input Current	I _{SET}	V _{SET} = 0V		-120		μΑ		
POWER CHARACTERISTICS								
Sleep Current	I _{IN(MIN)}	V _{IN} = 5V, SLEEP ≤ 0.8V		5	50	μΑ		
Run Current	I _{RUN}	V_{IN} = 5V, $\overline{SLEEP} \ge 2.0V$, I_{SET1} = Open I_{SET2} = Ground, V_{LAMP} = $550V_{RMS}$		830		mA		
Run Current Ripple Voltage	I _{RIPPLE}	V_{IN} = 5V, $\overline{SLEEP} \ge 2.0V$, I_{SET1} = Open I_{SET2} = Ground, V_{LAMP} = $550V_{RMS}$		375		mVpp		
Typical Efficiency	η	$V_{IN} = 5V$, $\overline{SLEEP} \ge 2.0V$, $I_{SET1} = Open$ $I_{SET2} = Ground$, $V_{LAMP} = 550V_{RMS}$		80		%		

³ The BRITE minimum input voltage level is 0V, whereas it is 0.5V in the original LXMG1617-05-4x 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 (4.75V < V _{IN} < 5.25V)					
CN1-2		Wall liput I owel Supply (4.75% = VIN = 5.25%)					
CN1-3	GND	Power Supply Return					
CN1-4	GIVD	i ower ouppry return					
CN1-5 SLEEP ON/OFF Control. (0V < SLEEP ≤ 0.8V = OFF, SLEEP ≥ 2.0V = ON							
CN1-6 BRITE Brightness Control (0V to 2.0V). 2.0V gives maximum lamp current.							
CN1-7 SET ₁ SET ₁ MSB Connecting this pin to ground decreases the output current (see Table 1)							
CN1-8 SET ₂ SET ₂ LSB Connecting this pin to ground decreases the output current (see Table 1)							
CN2 for LXMG1617A-05-41 and -42 (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 _{HI} High voltage connection to high side of lamp. Connect to lamp terminal with shortest lead length. DO NOT connect to Ground.							
CN2-2 V _{LO} Connection to low side of lamp. Connect to lamp terminal with longer lead length. DO NOT connect to Ground							



5V 4W CCFL Programmable Inverter Module

PRODUCTION DATASHEET

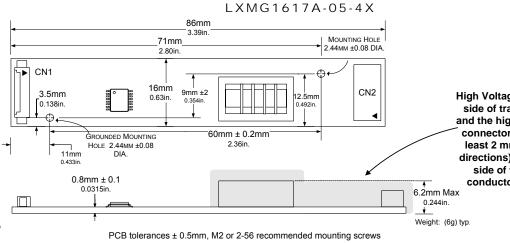
TABLE 1 SETTING OUTPUT CURRENT

OUTPUT CURRENT SETTINGS

SET.	SET ₂				
SET₁ (Pin 7)	(Pin 8)	Nominal Output Current			
Open*	Open*	6.5mA			
Open*	Ground	6.0mA			
Ground	Open*	5.5mA			
Ground	Ground	5.0mA			

^{*} If driven by a logic signal it should be open collector or open drain only, not a voltage source.

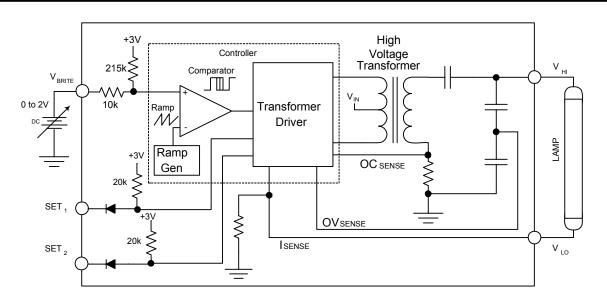
PHYSICAL DIMENSIONS



Warning High Voltage is present at high side of transformer, its core and the high side of the output connector, please provide at least 2 mm clearance (in all directions) on the component side of the board to any conductor when mounting

All dimensions are in millimeters, inches are for reference only

SIMPLIFIED BLOCK DIAGRAM



Copyright © 2007 Rev. 1.0, 2007-11-14



5V 4W CCFL Programmable Inverter Module

PRODUCTION DATASHEET

TYPICAL APPLICATION

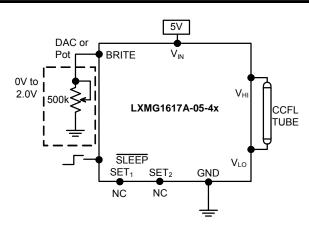


Figure 1 – Brightness Control (output current set to maximum)

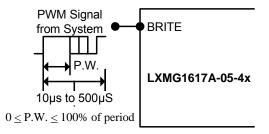


Figure 1A - PWM Brightness Control

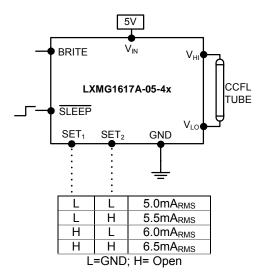


Figure 2 – Max Output Current (SET₁ and SET₂ Inputs)

- 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, if desired; add a resistor to set the lower threshold voltage above the absolute minimum dim level capability. 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_{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.
- 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 manufacturers. Generally the best lamp lifetime correlates with driving the CCFL at the manufacturer's 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 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 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 the inverter will attempt to strike the lamp up to about one second, after which (without success) the inverter will shutdown, in this mode the inverter will draw about 8mA from VIN. In order to restart the inverter it is necessary to toggle the sleep input or cycle the V_{IN} input supply.



5V 4W 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.