

LXMG1617-12-6x

12V 6W CCFL Programmable Inverter Module

PRODUCTION DATASHEET

DESCRIPTION

The LXMG1617-12-6x is a Single Output 6W Direct DriveTM CCFL (Cold energizes the lamp Cathode Fluorescent Lamp) Inverter specifically to ensure that no premature Module specifically designed for driving lamp degradation occurs, while allowing LCD backlight lamps. It is ideal for significant power savings at lower dim driving typical 12.1" to 15" TFT panels.

LXMG1617 modules provide the designer with a vastly superior display the system battery or AC adapter directly brightness range. This brightness range is to high frequency, high-voltage waves

externally programmable over a range of 5 available (LXMG1617-05-6x). to 8mA in 1mA steps to allow the inverter to properly match to a wide array of LCD Microsemi's new LX1689 backlight panel lamp current specifications. The controller, which provides a number of modules include a dimming input that cost and performance advantages due to permits brightness control from a dc the controller's high level of integration. voltage source, a PWM signal or an external potentiometer.

RangeMAXTM **Digital** Technique provides flicker-free brightness and both open/shorted lamp protection control in any wide range typically (50:1+) with fault timeout. dimming application.

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 resultant "burst drive" was designed levels.

The modules convert DC voltage from achievable with virtually any LCD display. required to ignite and operate CCFL The maximum output current is lamps. A 5V input inverter is also

The modules design is based on

Other benefits of this new topology are stable fixed-frequency operation, Dimming secondary-side strike-voltage regulation

KEY FEATURES

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

APPLICATIONS

- Notebook And Sub-Notebook
- Portable Instrumentation
- **Desktop Displays**
- **Industrial Display Controls**

BENEFITS

- Smooth, Flicker Free 2%-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

Universal Dimming Input "PWM", V_{DC}, OR POTENTIOMETER **PWM** DC Voltage Potentiometer Signal Source SELECTABLE MAXIMUM OUPUT CURRENT 5MA TO 8MARMS

,		PACKAGE ORDER INFO					
	PART NUMBER	OUTPUT CONNECTOR	INVERTER MATES DIRECTLY TO PANEL CONNECTORS				
	LXMG1617-12-61	JST SM02(8.0)B-BHS-1-TB(LF)(SN) or Yeon Ho 20015WR-05A00	JST BHR-03VS-1				
	LXMG1617-12-62	JST SM02B-BHSS-1-TB(LF)(SN) or Yeon Ho 35001WR-02A00	JST BHSR-02VS-1				

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ABSOLUTE MAXIMUM RATINGS (NOTE 1)
Input Signal Voltage (V _{IN1}) Input Power Output Voltage, no load Output Current Output Power	
Input Signal Voltage (SLEEP Input)	-0.3V to 5.5V 20°C to 70°C
Note 1: Exceeding these ratings could cause damage to the device. All voltages are with respect to Groterminal.	und. Currents are positive into, negative out of specified

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	Recommended Operating Conditions			Units	
i didiletei	Symbol	Min	R.C.	Max	Offics	
Input Supply Voltage Range (Fully Regulated Lamp Current)	V _{IN1}	10.8	12	13.2	V	
Input Supply Voltage Range (Functional)		10.2	12	13.8		
Output Power	Po			6.0	W	
Linear BRITE Control Input Voltage Range	V_{BRT_ADJ}	0.5		2.0	V	
Lamp Operating Voltage	V_{LAMP}	545	640	735*	V_{RMS}	
Lamp Current (Full Brightness)	I _{OLAMP}	5		8	mA _{RMS}	
Operating Ambient Temperature Range	T _A	-20		70	°C	

^{*} Total output power must not exceed 6W. Higher voltage lamps may require maximum output current to be set lower than 8mA_{RMS}

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		LXMG1617-12-6x		
	Farameter	Symbol Test Conditions		Min	Тур	Max	Units
•	OUTPUT PIN CHARACTERISTICS						
	Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = Ground$, $I_{SET2} = Ground$	4.4	5	5.6	mA _{RMS}
	Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = Ground$, $I_{SET2} = Open$	5.4	6	6.6	mA _{RMS}
	Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = Open$, $I_{SET2} = Ground$	6.4	7	7.6	mA _{RMS}
	Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = Open$, $I_{SET2} = Open$	7.4	8	8.6	mA _{RMS}
	Min. Average Lamp Current	I _{L(MIN)}	$V_{BRT_ADJ} \le 0.5V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = I_{SET2} = Ground$		0.30		mA _{RMS}
	Lamp Start Voltage	V_{LS}	$-20^{\circ}\text{C} < \text{T}_{A} < 70^{\circ}\text{C}, \text{V}_{\text{IN1}} > 10.8\text{V}_{\text{DC}}$	1400	1650		V_{RMS}
	Operating Frequency	fo	$V_{BRT_ADJ} = 2.5V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V$	57	60	63	kHz
	Burst Frequency	f _{BURST}	Output Burst Frequency	222	234	246	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.

	Devemeter	Cumbal	Shell Test Conditions		LXMG1617-12-6x		
	Parameter	Symbol	Test Conditions	Min	Тур	Max	Units
•	BRITE INPUT						
	Input Current	I _{BRT}	$V_{BRT_ADJ} = 0V_{DC}$		-300		μA _{DC}
		IBKI	$V_{BRT_ADJ} = 3V_{DC}$		50		μA _{DC}
	Minimum Input for Max. Lamp Current	V_{BRT_ADJ}	I _{O(LAMP)} = Maximum Lamp Current		2.0	2.05	V_{DC}
	Maximum Input for Min. Lamp Current	V_{BRT_ADJ}	I _{O(LAMP)} = Minimum Lamp Current	0.4	0.5		V_{DC}
•	SLEEP INPUT						
	RUN Mode	V _{SLEEP}		2.0		5	V _{DC}
	SLEEP Mode	V _{SLEEP}		-0.3		0.8	V_{DC}
SET _{1,2} INPUT							
	SET _{1,2} Low Threshold	V_L				0.4	V
	Input Current	I _{SET}	V _{SET} ≤ 0.4V		-300		μΑ
•	POWER CHARACTERISTICS						
	Sleep Current	I _{IN(MIN)}	V _{IN1} = 12V _{DC} , SLEEP ≤ 0.8V	0.0	8	50	μA _{DC}
	Run Current	I _{RUN}	V_{IN1} = 12 V_{DC} , $\overline{SLEEP} \ge 2.0V$, I_{SET1} = Open I_{SET2} = Ground, V_{LAMP} = 640 V_{RMS}		428		mA _{DC}
	Efficiency	η	V_{IN1} = 12 V_{DC} , $\overline{\text{SLEEP}} \ge 2.0V$, I_{SET1} = Open I_{SET2} = Ground, V_{LAMP} = 640 V_{RMS}		88		%

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 _{IN1}	Main Input Power Supply (10.8V < V _{IN1} < 13.2V)						
CN1-2	V IN 1	Wall impact ower ouppry (10.00 \(\sigma\) \(\pi_{\text{INT}} \(\sigma\)						
CN1-3	GND	Power Supply Return						
CN1-4	GIND	Fower Supply Return						
CN1-5	SLEEP ON/OFF Control. (0V < SLEEP < 0.8 = OFF, SLEEP >= 2.0V = ON							
CN1-6 BRITE Brightness Control (0.5V to 2.0V _{DC}). 2.0V _{DC} 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 LX	MG1617-12-6	S1 and -62 (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)						
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						



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TABLE 1

OUTPUT CURRENT SETTINGS

SET₁ (Pin 7)	SET ₂ (Pin 8)	Nominal Output Current
Open*	Open*	8.0mA
Open*	Ground	7.0mA
Ground	Open*	6.0mA
Ground	Ground	5.0mA

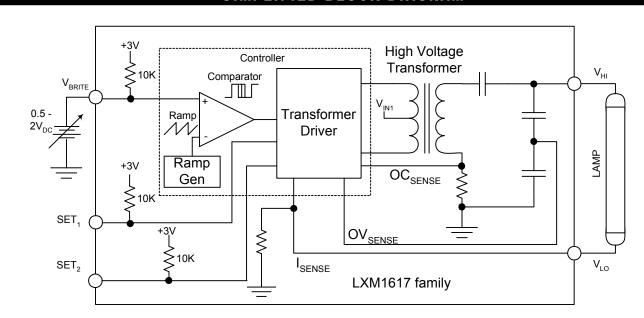
^{*} If driven by a logic signal it should be open collector or open drain only, not a voltage source.

PHYSICAL DIMENSIONS

LXMG1617-12-6X 100mm 85mm MOUNTING HOLE 3.35in CN1 16mm CN2 12.5mm 9mm ±0.2 74mm ±0.2mm Warning GROUNDED MOUNTING 3.5mm High Voltage Present at high side of Transformer and Output Connector HOLE 2.44MM ±.08 DIA 11mm 0.433in. 1.0mm 0.0394in 7.5mm Max PCB tolerances ± 0.2mm , M2 or 2-56 recommended mounting screws Weight: (9g) typ.

All Dimensions are in millimeters, inches for reference only.

SIMPLIFIED BLOCK DIAGRAM



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TYPICAL APPLICATION

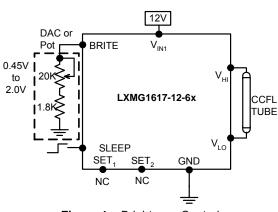


Figure 1 – Brightness Control (Output current set to maximum)

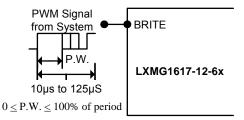


Figure 1A – PWM Brightness Control

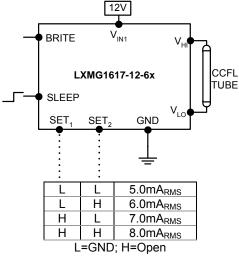


Figure 2 – Max Output Current (SET₁ and SET₂ Inputs)

- The brightness control may be a voltage output DAC or other voltage source, a digital pot or 20K manual pot. The inverter contains an internal 10K pull-up to 3V to bias the pot add a 1.8K resistor to set the lower threshold voltage. A 3.3V Logic Level PWM signal from a micro-controller 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 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 users 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 for several seconds. After about 2 to 4 seconds without success the inverter will shutdown. In order to restart the inverter it is necessary to toggle the sleep input or cycle the V_{IN1} input supply.



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NOTES

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