

LXMG1618-12-4x

12V 4W CCFL Programmable Inverter Module

PRODUCTION DATASHEET

DESCRIPTION

The LXMG1618-12-4x is a Single Output 4W Direct DriveTM CCFL (Cold range dimming, amplitude control results Cathode Fluorescent Lamp) Inverter in lower ripple on the input supply and Module specifically designed for driving reduced LCD backlight lamps. It is ideal for generation. Many STN type panels are driving typical 8.4" to 12.1" panels.

The maximum output current is amplitude dimming. externally programmable over a range of 5 to 6.5mA in 0.5mA steps to allow the the system battery or AC adapter directly inverter to properly match to a wide array of LCD panel lamp current specifications. The modules are include a dimming input that permits brightness control from either available (LXMG1618-05-4x). a DC voltage source, a PWM signal or an external potentiometer.

LXMG1618 modules unlike LXMG1617 series does not provide wide range 'burst' mode dimming, rather dimming is provided by amplitude control of the output current waveform, this limits are stable fixed-frequency operation, the potential dim range to typically less than 5:1.

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

For applications not requiring wide potential transient particularly well suited for current

The modules convert DC voltage from to high frequency, high-voltage waves required to ignite and operate CCFL lamps. A 5V input inverter is also

The modules design is based on Microsemi's new LX1689 backlight the controller, which provides a number of cost and performance advantages due to the controller's high level of integration.

Other benefits of this new topology secondary-side strike-voltage regulation and both open and shorted lamp protection with fault timeout.

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 -20 to 70°C
- UL60950 E175910
- **RoHS Compliant**

APPLICATIONS

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

BENEFITS

- Compact, Low Profile Design
- Mates to Wide Variety of LCD Panels
- Output Open Circuit Voltage **Regulation Minimizes** Corona Discharge For High Reliability

PRODUCT HIGHLIGHT

UNIVERSAL DIMMING INPUT "PWM", V_{DC}, OR POTENTIOMETER **PWM** DC Voltage Potentiomete Source Signal SELECTABLE MAXIMUM OUPUT CURRENT 5м**А** то 6.5м**А_{RMS}**

PACKAGE ORDER INFO						
PART NUMBER	OUTPUT CONNECTOR	INVERTER MATES DIRECTLY TO PANEL CONNECTORS				
LXMG1618-12-41	JST SM02(8.0)B-BHS-1-TB(LF)(SN) or Yeon Ho 20015WR-05A00	JST BHR-03VS-1				
LXMG1618-12-42	JST SM02B-BHSS-1-TB (LF)(SN) or Yeon Ho 35001WR-02A00	JST BHSR-02VS-1				

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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	
r arameter	Syllibol	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		3.5	4.0	W	
Linear BRITE Control Input Voltage Range ¹	$V_{BRT\ ADJ}$	0.65 to 0.9		2.0	V	
Lamp Operating Voltage	V_{LAMP}	465	550	635 ²	V_{RMS}	
Lamp Current (Full Brightness)	I _{OLAMP}	5		6.5	mA _{RMS}	
Operating Ambient Temperature Range	T _A	-20		70	°C	

¹ The minimum V_{BRT ADJ} voltage depends on the panel characteristics, depending on the panel it can vary from 0.65V to 0.9V

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 -		LXMG1618-12-4x			Units
r ai ailletei			Min	Тур	Max	Units
OUTPUT PIN CHARACTERISTICS	OUTPUT PIN CHARACTERISTICS					
Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = Ground$, $I_{SET2} = Ground$	4.5	5	5.5	mA _{RMS}
Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = Ground$, $I_{SET2} = Open$	5.0	5.5	6.0	mA _{RMS}
Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = Open$, $I_{SET2} = Ground$	5.5	6	6.5	mA _{RMS}
Full Bright Lamp Current	I _{L(MAX)}	$V_{BRT_ADJ} \ge 2.0V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = Open$, $I_{SET2} = Open$	6.0	6.5	7.0	mA _{RMS}
Min. Average Lamp Current	I _{L(MIN)}	$V_{BRT_ADJ} = 0.65V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $V_{IN1} = 12V_{DC}$ $I_{SET1} = I_{SET2} = Ground$		1.5 ³		mA _{RMS}
Lamp Start Voltage	V_{LS}	$-20^{\circ}\text{C} < \text{T}_{A} < 70^{\circ}\text{C}, \text{V}_{\text{IN1}} > 10.8\text{V}_{\text{DC}}$	1300	1400		V_{RMS}
Operating Frequency	f _O	$V_{BRT_ADJ} = 2.5V_{DC}, \overline{SLEEP} \ge 2.0V, V_{IN1} = 12V$	76	80	83	kHz

³ The inverter is capable of a lower output current than may be recommended by the panel manufacturer. It is the user's responsibility to set the minimum brightness (BRITE) input at or above the panel specification for minimum current.

² Total output power must not exceed 4W. Higher voltage lamps may require maximum output current to be set lower than 6.5mA_{RMS}



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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 Test Conditions		LXM	LXMG1618-12-4x		
	Parameter	Symbol	rest Conditions	Min	Тур	Max	Units
•	BRITE INPUT						
-	Input Current	I _{BRT}	$V_{BRT_ADJ} = 0V_{DC}$		-300		μA_{DC}
			$V_{BRT_ADJ} = 3V_{DC}$		50		μA_{DC}
	Minimum Input for Max. Lamp Current	V_{BRT_ADJ}	I _{O(LAMP)} = Maximum Lamp Current		2.0	2.05	V_{DC}
	Minimum Input for Min. Lamp Current	V_{BRT_ADJ}	I _{O(LAMP)} = Minimum Lamp Current	0.65*			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
Þ	POWER CHARACTERISTICS						
	Sleep Current	I _{IN(MIN)}	$V_{IN1} = 12V_{DC}, \overline{SLEEP} \le 0.8V$	0.0	8	20	μA _{DC}
	Run Current	I _{RUN}	$V_{IN1} = 12V_{DC}$, $\overline{SLEEP} \ge 2.0V$, $I_{SET1} = Open$ $I_{SET2} = Ground$, $V_{LAMP} = 550V_{RMS}$		330		mA _{DC}
	Efficiency	η	$V_{\text{IN1}} = 12V_{\text{DC}}$, $\overline{\text{SLEEP}} \ge 2.0V$, $I_{\text{SET1}} = \text{Open}$ $I_{\text{SET2}} = \text{Ground}$, $V_{\text{LAMP}} = 550V_{\text{RMS}}$		85		%

^{*} The Inverter is capable of a lower output current than may be recommended by the panel manufacturer. It is the user's responsibility to set the minimum brightness (BRITE) input at or above the panel specification for minimum current. This is likely greater than the 0.65V minimum input.

	FUNCTIONAL PIN DESCRIPTION							
Conn	Pin	DESCRIPTION						
CN1 (Molex	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 IIV I							
CN1-3	GND	Power Supply Return						
CN1-4	CIVID	i owei Suppiy Netuin						
CN1-5	SLEEP	ON/OFF Control. (0V < SLEEP < 0.8 = OFF, SLEEP >= 2.0V = ON						
CN1-6 BRITE Brightness Control (0.65V to 2.0V _{DC}). 2.0V _{DC} gives maximum lamp current.								
CN1-7	1-7 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	CN2 for LXMG1618-12-41 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)							
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	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

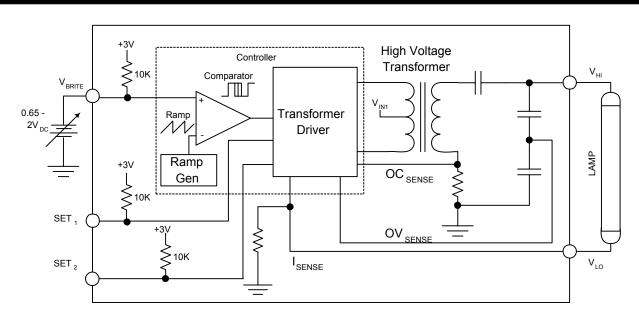
OUTPUT CURRENT SETTINGS

SET₁ (Pin 7)	SET ₂ (Pin 8)	Nominal Output Current
Open*	Open*	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 LXMG1618-12-4X 86mm 3.39in 71mm MOUNTING HOLE 2.80in CN1 16mm CN2 3 5mm 0.63in. 11mm 0.433in. GROUNDED MOUNTING HOLE 2.44MM ±0.08 DIA 60mm ±0.2mm 0.8mm 4.6mm Max Warning 0.181in. High Voltage Present at high side of transformer PCB tolerances ± 0.5mm, M2 or 2-56 recommended mounting screws Weight: (5.7g) typ. and Output Connector All dimensions are in millimeters, inches are for reference.

SIMPLIFIED BLOCK DIAGRAM



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TYPICAL APPLICATION

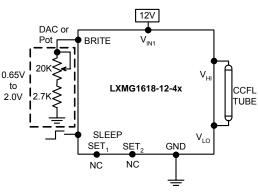


Figure 1 – Brightness Control (Output current set to maximum)

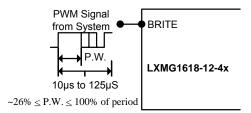


Figure 1A - PWM Brightness Control

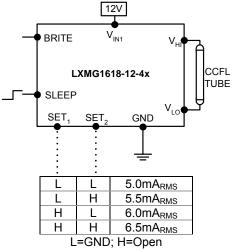


Figure 2 – Max Output Current (SET₁ and SET₂ Inputs)

- 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 2.7K 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 and efficiency 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 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 users responsibility as 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 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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