PanelMatch™ VEasyLIT™ LXMG1811-05-6xS

5V 6W CCFL Programmable Inverter Module

PRODUCTION DATASHEET

DESCRIPTION

The LXMG1811-05-6xS is a Single Output 6W CCFL (Cold Cathode Fluorescent Lamp) Inverter Module designed for the driving LCD backlight lamps for panels in the range of 3.9" to 15".

Utilizing the full-bridge drive topology capabilities of the Microsemi's highly integrated LX6512 CCFL backlight controller the inverter allows a wider lamp output voltage range 280V to 730V compared to Microsemi's existing Direct Drive™ inverter solutions.

Also this 'S' version includes an additional input connector which links the inverter to a light sensor board (the LXMG1800_LS). So connected the inverter is capable of automatically adjusting (VEasyLIT™) the brightness of the LCD display to ambient lighting conditions.

Automatic brightness control can extend the life of the display and save power (particularly important for battery powered products). For applications needing full manual control of lamp brightness (dimming) we recommend the LXMG1811-05-6x (non-S), which does not offer the light sensor input.

The maximum output current of the inverter is externally programmable over a range of 4mA to 7mA in 1mA steps to allow the inverter to properly match (PanelMatch™) to a wide array of LCD panel lamp current specifications. For higher input voltage requirements the LXMG1813-12-6x or -6xS will work from a 9V to 16V input supply.

Other benefits of the inverter's topology include stable fixed-frequency operation, secondary-side strike voltage regulation and both open/shorted lamp protection 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

- Automatic Lamp Dimming Using External LXMG1800_LS Light Sensor Board Assembly
- Externally Programmable Maximum Output Current
- Wide Lamp Voltage Range
- Fixed Frequency Operation
- Output Short-Circuit Protection and Automatic Strike-Voltage Regulation and Timeout
- RangeMAX Wide Range Dimming (50:1+)
- Rated From -30°C to 80°C
- UL60950 Pending
- RoHS Compliant

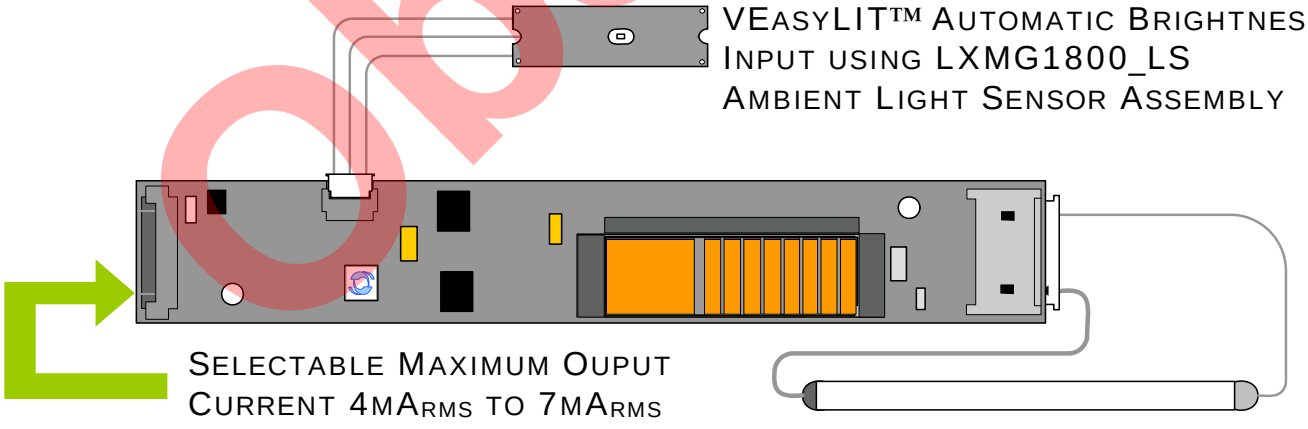
APPLICATIONS

- Medical Instrument Displays
- Portable Instrumentation
- Desktop Displays
- 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

PRODUCT HIGHLIGHT



PACKAGE ORDER INFO

PART NUMBER	OUTPUT CONNECTOR	INVERTER MATES DIRECTLY TO PANEL CONNECTORS
LXMG1811-05-61S	JST SM02(8.0)B-BHS-1-TB(LF)(SN), Yeon Ho 20015WR-05A00 or equivalent	JST BHR-03VS-1
LXMG1811-05-62S	JST SM02B-BHSS-1-TB(LF)(SN), Yeon Ho 35001WR-02A00 or equivalent	JST BHSR-02VS-1

Microsemi
Analog Mixed Signal Group
11861 Western Avenue, Garden Grove, CA. 92841, 800-877-6458, 714-898-8121, Fax: 714-893-2570

ABSOLUTE MAXIMUM RATINGS

Input Signal Voltage (V_{IN}) ..... -0.3V to 6V
Input Power 8W
Output Voltage, no load ..... $1800V_{RMS}$
Output Current ..... $8mA_{RMS}$
Output Power 6W
Input Signal Voltage ($\overline{SLEEP}$ Input) ..... -0.3V to V_{IN}
Input Signal Voltage (ALS_IN) ..... -0.3V to 5.5V
Analog Output (ALS_VCC external load current) ..... -5mA
Ambient Operating Temperature, zero airflow ..... -30°C to 80°C
Storage Temperature Range ..... -40°C to 85°C

Note: 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
		Min	R.C.	Max	
Input Supply Voltage Range (Fully Regulated Lamp Current)	V_{IN}	4.75	5.0	5.25	V
Input Supply Voltage Range (Functional)		4.5	5.0	5.5	
Output Power	P_O		4.2	6.0	W
Lamp Operating Voltage	V_{LAMP}	280	500	730	V_{RMS}
Lamp Current (Full Brightness)	$I_{O(LAMP)}$	4.0		7.0	mA_{RMS}
Operating Ambient Temperature Range	T_A	-30		80	°C

ELECTRICAL CHARACTERISTICS

The following specifications apply over the recommended operating condition and ambient temperature of 0°C to 60°C except where otherwise noted; ALS_IN ≥ 2.75V, $\overline{SLEEP}$ ≥ 2.1V, V_{IN} = 5V.

Parameter	Symbol	Test Conditions	LXMG1811-05-6xS			Units
			Min	Typ	Max	
OUTPUT PIN CHARACTERISTICS						
Full Lamp Current	$I_{L(MAX)}$	SET_1 = Ground, SET_2 = Ground	3.5	4.0	4.5	mA_{RMS}
Full Lamp Current	$I_{L(MAX)}$	SET_1 = Ground, SET_2 = Open	4.5	5.0	5.5	mA_{RMS}
Full Lamp Current	$I_{L(MAX)}$	SET_1 = Open, SET_2 = Ground	5.4	6.0	6.6	mA_{RMS}
Full Lamp Current	$I_{L(MAX)}$	SET_1 = Open, SET_2 = Open	6.3	7.0	7.7	mA_{RMS}
Full Lamp Current	$I_{L(MAX)}$	V_{IN} = 4.5 to 5.5V; SET_1 = Open, SET_2 = Ground	5.3	6.0	6.7	mA_{RMS}
Min. Average Lamp Current	$I_{L(MIN)}$	ALS_IN ≤ 0.9V, SET_1 = SET_2 = Ground, V_{BRT_ADJ} floating; $I_{L(MIN)} = I_L * \sqrt{}$(Min Duty Ratio)		1.0		mA_{RMS}
Lamp Start Voltage	V_{LS}	-30°C < T_A < 80°C, V_{IN} ≥ 4.5V	1400	1650		V_{RMS}
Operating Frequency	f_O		47.7	53	58.3	kHz
Burst Frequency	f_{BURST}	Output Burst Frequency	173	206	239	Hz

Microsemi
Analog Mixed Signal Group
11861 Western Avenue, Garden Grove, CA. 92841, 800-877-6458, 714-898-8121, Fax: 714-893-2570

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; ALS_IN ≥ 2.75V, $\overline{SLEEP}$ ≥ 2.1V, V_{IN} = 5V.

Parameter	Symbol	Test Conditions	LXMG1811-05-6xS Min	Typ	Max	Units
BRITE INPUT						
Potentiometer Max Impedance	BRT_{POT}	Full Lamp Current	400	500		kΩ
Potentiometer Min Impedance		Minimum Lamp Current		0		kΩ
SLEEP BAR INPUT						
RUN Mode	$V_{\overline{SLEEP}}$		2.1		V_{IN}	V
SLEEP Mode	$V_{\overline{SLEEP}}$		0		0.8	V
$SET_{1,2}$ INPUT						
$SET_{1,2}$ Low Threshold	V_L			0		V
Input Current	I_{SET}	V_{SETx} = 0V		-400		µA
ALS (AMBIENT LIGHT SENSOR)						
ALS_VCC	ALS_{VCC}	I_{LOAD} = 3mA	4.5		5.5	V
POWER CHARACTERISTICS						
Sleep Current	$I_{IN(MIN)}$	$\overline{SLEEP}$ ≤ 0.8V		10	20	µA
Run Current	I_{RUN}	SET_1 = Open SET_2 = Ground, V_{LAMP} = 500V_{RMS}		750		mA
Strike (Open Lamp)	T_{S_DWELL}		1.0	1.4	2.0	Sec
Supply Current under Fault condition	I_{FAULT}	Fault condition		5		mA
Typical Efficiency	η	SET_1 = Open SET_2 = Ground, V_{LAMP} = 500V_{RMS}	75	80		%

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 (Functional 4.5V to 5.5V)
CN1-2		
CN1-3	GND	Power Supply Return
CN1-4		
CN1-5	$\overline{SLEEP}$	ON/OFF Control. (0V ≤ $\overline{SLEEP}$ ≤ 0.8V = OFF, $\overline{SLEEP}$ ≥ 2.1V = ON
CN1-6	BRITE	Can be left open or connected to a 500k potentiometer to reduce brightness when the LX1800_LS is connected. It is not recommended as brightness control voltage input.
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 (Molex 53261-0371 or equivalent) mates with 51021-0800 housing, 50079-8100 pins. Mates with LXMG1800_LS ALS Assembly		
CN2-1	ALS_VCC	Nominal 5V Supply for ALS Board Assembly. 3mA maximum output load
CN2-2	ALS_IN	Brightness Control Voltage input from light sensor board.
CN2-3	ASL_GND	ALS Board Power Supply Return.

Microsemi
Analog Mixed Signal Group
11861 Western Avenue, Garden Grove, CA. 92841, 800-877-6458, 714-898-8121, Fax: 714-893-2570

FUNCTIONAL PIN DESCRIPTION

CONN	PIN	DESCRIPTION
CN3 for LXMG1811-05-61S and -62S (JST SM02(8.0)B-BHS-1-TB(LF)(SN) ; Yeon Ho 20015WR-05A00, SM02B-BHSS-1-TB(LF)(SN) ; Yeon Ho 35001WR-02A00) or equivalent		
CN3-1	V_{HI}	High voltage connection to high side of lamp. Connect to lamp terminal with shortest lead length. **DO NOT** connect to Ground.
CN3-2	V_{LO}	Connection to low side of lamp. Connect to lamp terminal with longer lead length. **DO NOT** connect to Ground

TABLE 1

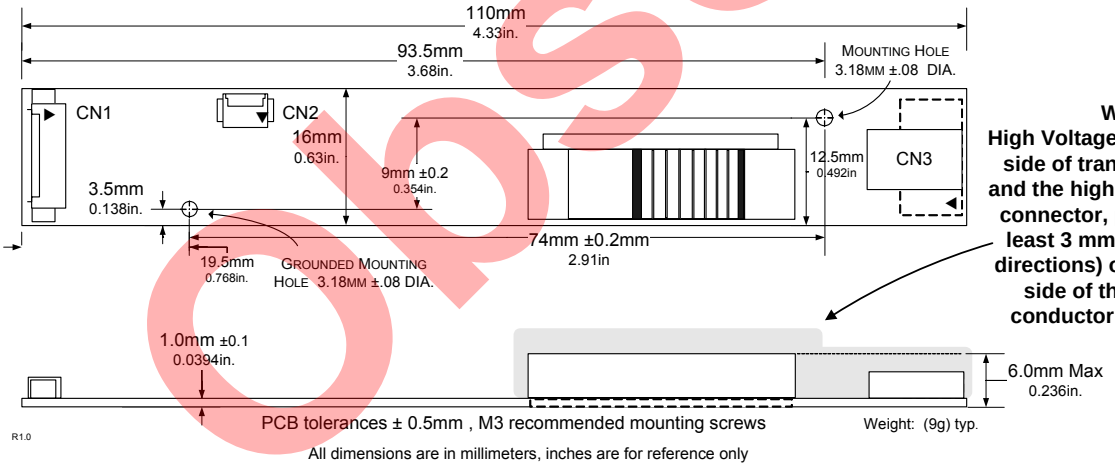
OUTPUT CURRENT SETTINGS

SET_1 (Pin 7)	SET_2 (Pin 8)	Nominal Output Current
Open*	Open*	7.0mA
Open*	Ground	6.0mA
Ground	Open*	5.0mA
Ground	Ground	4.0mA

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

PHYSICAL DIMENSIONS

LXMG1811-05-6xS



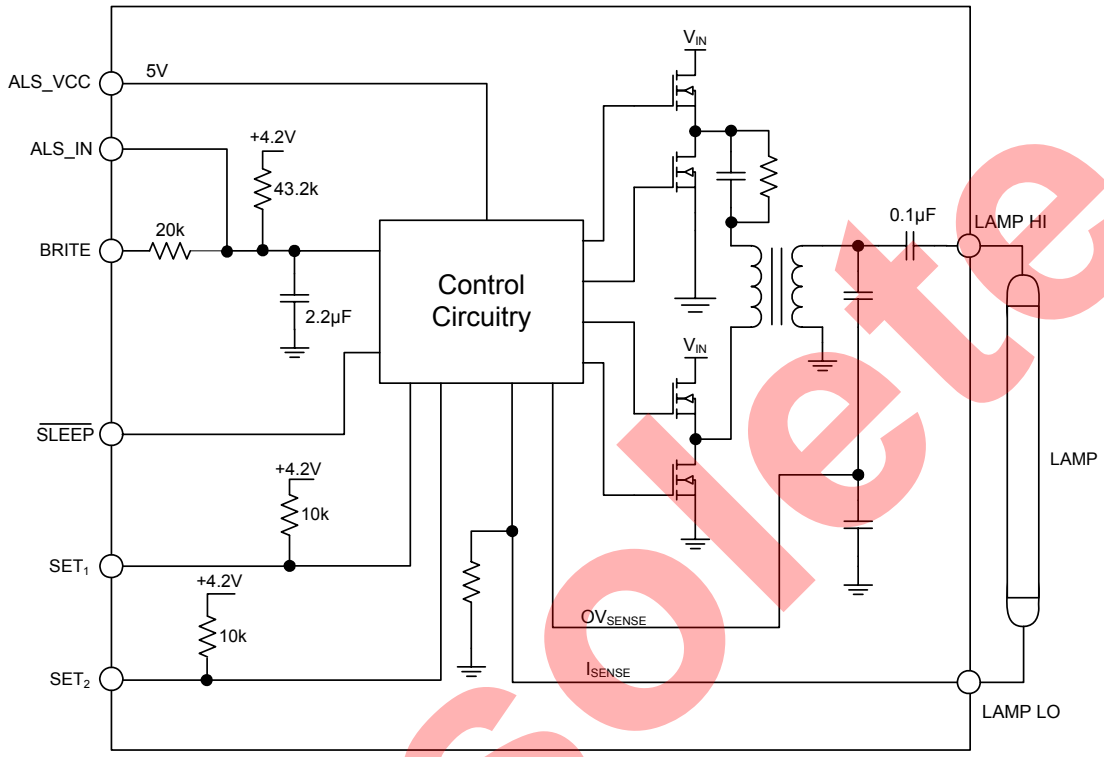
Warning
High Voltage is present at high side of transformer, its core and the high side of the output connector, please provide at least 3 mm clearance (in all directions) on the component side of the board to any conductor when mounting

PCB tolerances ± 0.5mm , M3 recommended mounting screws

Weight: (9g) typ.

All dimensions are in millimeters, inches are for reference only

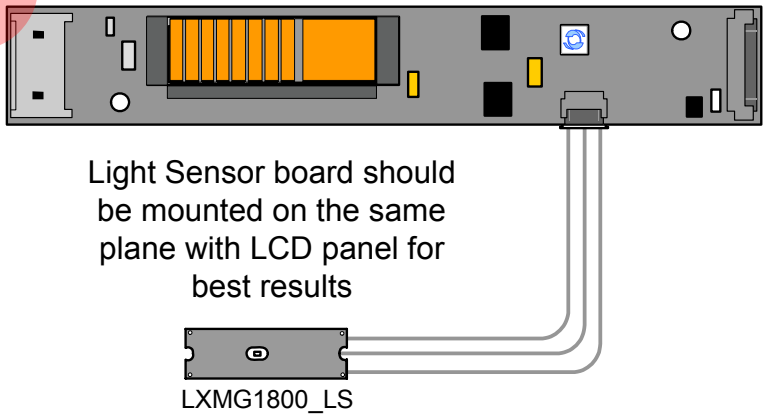
SIMPLIFIED BLOCK DIAGRAM



VeasyLIT™ LXMG1800_LS APPLICATION

Key LXMG1800_LS Features

Small Size 9.5 x 31 x 2.5 mm
Flush Mount on Sensor Side
Board is Powered by Inverter
User Customizable Light Gain
Human Eye Light Response
Flexible Mounting Location



Light Sensor board should be mounted on the same plane with LCD panel for best results

LXMG1800_LS

Microsemi
Analog Mixed Signal Group
11861 Western Avenue, Garden Grove, CA. 92841, 800-877-6458, 714-898-8121, Fax: 714-893-2570

TYPICAL APPLICATION

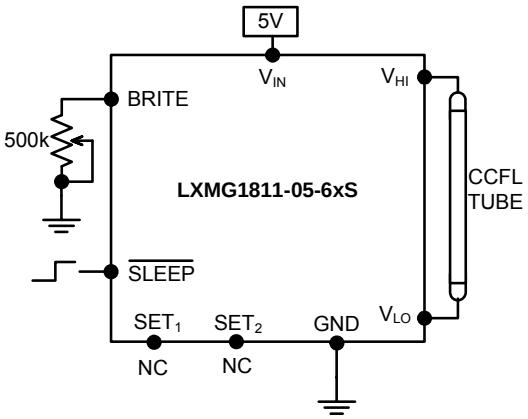
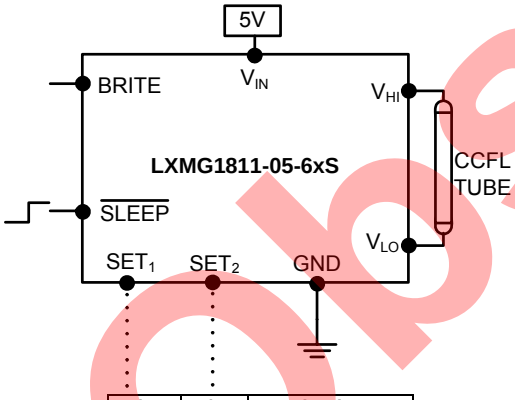


Figure 1 – Brightness Control
(Output current set to maximum)



L	L	4.0mA$_{RMS}$
L	H	5.0mA$_{RMS}$
H	L	6.0mA$_{RMS}$
H	H	7.0mA$_{RMS}$

L=GND; H=Open

Figure 2 – Max Output Current
(SET_1 and SET_2 Inputs)

- It is recommended to use LXMG1811-05-6xS only with the LXMG1800_LS external light sensor assembly. A 500k potentiometer may be added to the inverter's BRITE input pin to allow a degree of manual override to the light sensor. Adjustment of the potentiometer will only dim the display further; it cannot increase the maximum brightness level set by the light sensor. If full manual control of dimming is required by the application we recommend the use of the LXMG1811-05-6x (non-S) version.
- If you need to turn the inverter ON/OFF remotely, connect to TTL logic signal to the $\overline{SLEEP}$ 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 SET_1 and SET_2 (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 manufacture's nominal current setting. However the SET_1 and SET_2 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. 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 two seconds, after which (without success) the inverter will shutdown. In this mode the inverter will draw about 5mA from VIN. In order to restart the inverter it is necessary to toggle the sleep input or cycle the V_{IN} input supply.

NOTES