

DESCRIPTION

Dual Drive, RangeMAX Wide Range Dimming, Single Output Inverter.

The LXM1614 series of Direct Drive™ CCFL (Cold Cathode Fluorescent Lamp) Inverter Modules is specifically designed for driving LCD backlight lamps. Although similar to the RangeMAX LXM1612 wide range dimming inverters, the LXM1614 family offers two separate brightness controls for lamp current amplitude and duty cycle. This innovation of dual brightness controls with extended dimming, combined with Linfinity's high efficiency Direct Drive topology provides the industry's most feature rich, small form factor inverter available. The wide range dimming provides exceptional display readability at less than 1% of full brightness, allowing both power savings and low ambient light operating capability.

Dual Drive Dimming Control.

The inverters provide brightness adjustments utilizing standard lamp current amplitude control as well as supporting Linfinity's RangeMAX wide range dimming technique. Combining both brightness controls into a single inverter supports the "self heating" lamp technology by using a "boost" current feature and still offers duty cycle control for low brightness operation. This controlled overdrive capability eliminates the need for traditional resistive heater wire methods to ensure light output at extremely low temperatures. The LXM1614 brightness controls support temperature monitoring with look-up table applications by accepting either a PWM input or DC voltage. Large panel lamps with greater thermal inertia can also uti-

lize this "instant-bright" feature and minimize warm up time.

RangeMAX Digital Dimming Technique.

Digital dimming provides flicker-free brightness control in any wide range dimming application. Dimming ratios greater than 100:1 can be achieved. A video synchronization feature allows wide ratio dimming without the display disturbances and interference seen with competitive products. The resultant "burst drive" that energizes the lamp was designed specifically to ensure that no premature lamp degradation occurs. Even in overdrive boost mode, the waveform is carefully controlled to minimize the effects detrimental to lamp life. Individual panel specifications should be referenced for specific thermal and electrical parameters.

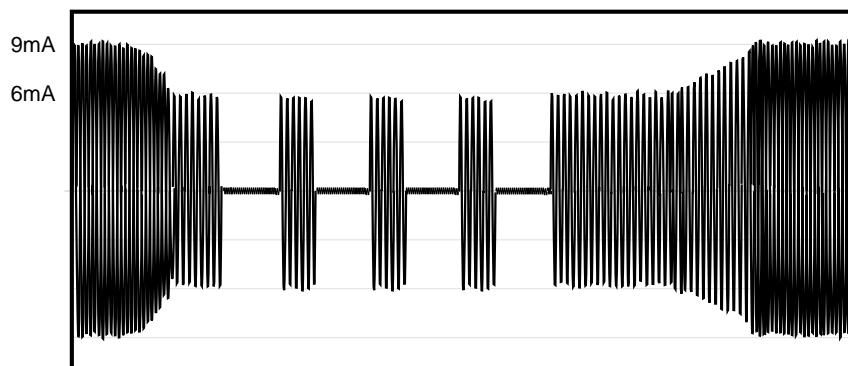
Direct Drive Technology. The module design is based on the Direct Drive topology, which provides a number of cost, performance, and form factor advantages. The LXM1614 series inverters eliminate the classic resonant inductor/capacitors, and integrate the wide range dimming logic into the controller.

Additional Features. Other benefits of this new topology are fixed-frequency operation and secondary-side strike-voltage regulation. Strike-voltage regulation minimizes corona discharge in the output transformer and related circuitry, providing longer life and higher reliability. All LXM1614 modules feature both open and shorted lamp protection. The dual drive LXM1614 is fully customizable (electronically and mechanically) to specific customer requirements.

NOTE: For current data & package dimensions, visit our web site: <http://www.linfinity.com>.

PRODUCT HIGHLIGHT

BACKLIGHT INVERTER COMBINES CURRENT AMPLITUDE AND DIGITAL TECHNIQUES



KEY FEATURES

- Independent Dual Brightness Controls For Lamp Current Amplitude And Duty Cycle
- RangeMAX 1-100% Wide Range Dimming With Controlled Overdrive Boost
- Available In +5V, +12V, and 10V-16V Input Voltage Versions
- High Efficiency, Single Stage Direct Drive Topology
- -30°C to +85°C Ambient Temperature Operation
- Output Open/Short Circuit Protection
- Automatic Strike-Voltage Regulation
- Up to 1800V Output Voltage Capability
- Supports A Wide Variety of Lamp Connectors
- Single Sided PCB Component Layout

APPLICATIONS

- Self Heating Lamp Technology
- Extended Cold Temperature Operation
- Automotive And Aircraft Cabin Displays
- Navigation/GPS Systems/Auto PC
- CCFL Panels With Reduced Lamp Current Specifications
- Low Ambient Light Conditions Requiring Wide Range Dimming
- "Instant On" To Full Brightness For Large LCD Backlight Panels

BENEFITS

- High Efficiency And Sleep Mode Feature Extends Computer Battery Life
- Lamp Current Amplitude Control Allows "Boost" And Accelerated Warm Up For Cold Temperature Operation
- "Instant On" Minimizes Warm Up Time In Standard CCFL Applications
- Optimized To Support Applications Utilizing Lamp Temperature Detection and Microprocessor Control Techniques
- Power Efficient, "Low Brightness" Capability Allows For Advanced Power Management And Extends Battery Life In Portable Applications
- Fixed Frequency Operation Reduces EMI and Display Interference Problems
- Transformer Designed To Minimize Corona Discharge For Long Life And High Reliability
- Controlled "Strike" Waveform Minimizes Damaging Overshoots

MODULE ORDER INFORMATION

LXM1614-12-01

LINFINITY MICROELECTRONICS INC.

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12V HIGHLY-INTEGRATED, DIGITAL DIMMING CCFL INVERTER MODULE

PRODUCT PREVIEW DATA SHEET

ABSOLUTE MAXIMUM RATINGS (Note 1)

| | |
|-------------------------------------------------|--------------------------------------------|
| Input Supply Voltage (V_{IN1}) | -0.3V to 16V |
| Output Voltage, no load | Internally Limited to 1800V _{RMS} |
| Output Current | 10mA _{RMS} (Internally Limited) |
| Output Power | 7.5W |
| Input Signal Voltage (BRITE Input) | -0.3V to $V_{IN1} + 0.3V$ |
| Input Signal Voltage (SLEEP, V_{SYNC} Inputs) | -0.3V to $V_{IN1} + 0.3V$ |
| Ambient Operating Temperature, zero airflow | -30°C to 85°C |
| Storage Temperature Range | -40°C to 85°C |

Note 1. Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of the 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, will not function optimally.

| Parameter | Symbol | Recommended Operating Conditions | | | Units |
|----------------------------------------|----------------|----------------------------------|------|----------|-------------------|
| | | Min. | R.C. | Max. | |
| Input Supply Voltage Range | V_{IN1} | 10 | 12 | 16 | V |
| Output Power | P_O | | 3.5 | 4.0 | W |
| Brightness Control Input Voltage Range | $V_{BRT\ ADJ}$ | 0.0 | 2.5 | V_{IN} | V |
| Lamp Operating Voltage | V_{LAMP} | 500 | 700 | 1000 | V _{RMS} |
| Lamp Current (Full Brightness) | I_{OLAMP} | | 6.5 | | mA _{RMS} |
| Operating Ambient Temperature Range | T_A | -30 | | 85 | °C |

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, these specifications apply over the recommended operating conditions and 25°C ambient temperature for the LXM1614-12-01.

| Parameter | Symbol | Test Conditions | LXM1614-12-01 | | | Units |
|-------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------|---------------|------|------|-------------------|
| | | | Min. | Typ. | Max. | |
| ► Output Pin Characteristics | | | | | | |
| Full Bright Lamp Current | $I_{L(MAX)}$ | $V_{BRT\ ADJ} = 2.5V_{DC}$, $\overline{SLEEP} = HIGH$, Burst Duty=100%, $V_{IN1} = 12V$ | 5.7 | 6.5 | 7.3 | mA _{RMS} |
| Maximum Lamp Boost Current | $I_{LBOOST(MAX)}$ | $V_{BRTADJ} = 2.5V$, $V_{BOOST} = 2.5V$, $SLEEP = HIGH$, $T_A \leq 0^{\circ}C$, $V_{IN1} = 12V$ | 8.2 | 9 | 9.8 | mA _{RMS} |
| Min. Average Lamp Current (Note 2) | $I_{L(MIN)}$ | $V_{BRT\ ADJ} = 0V_{DC}$, $SLEEP = HIGH$, Burst Duty= 2%, $V_{IN1} = 12V$ | | 0.12 | | mA _{RMS} |
| Lamp Start Voltage | V_{LS} | $-30^{\circ}C < T_A < 85^{\circ}C$, $V_{IN1} \geq 5.0V_{DC}$ | 1500 | 1650 | 1800 | V _{RMS} |
| Operating Frequency | f_O | $V_{BRT\ ADJ} = 2.5V_{DC}$, $\overline{SLEEP} = HIGH$, $V_{IN1} = 5V_{DC}$ | 63 | 68 | 73 | KHz |
| ► BRITE Input | | | | | | |
| Input Current | I_{BRT} | $V_{BRT\ ADJ} = 0V_{DC}$ | | -700 | | μA_{DC} |
| | | $V_{BRT\ ADJ} = 2.5V_{DC}$ | | -270 | | μA_{DC} |
| Input Voltage for Max. Lamp Current | $V_{BRT\ ADJ}$ | $I_O(LAMP) = 100\%$ Duty Cycle | | 2.4 | | V _{DC} |
| Input Voltage for Min. Lamp Current | $V_{BRT\ ADJ}$ | $I_O(LAMP) = \text{Minimum Duty Cycle}$ | | 0 | | V _{DC} |
| ► BOOST Input | | | | | | |
| Input Current | I_{BST} | $V_{BST\ ADJ} = 0V_{DC}$ | | -700 | | μA_{DC} |
| | | $V_{BST\ ADJ} = 2.5V_{DC}$ | | -270 | | μA_{DC} |
| Input Voltage for Max. Lamp Current | $V_{BST\ ADJ}$ | $I_O(LAMP) = \text{Maximum Boost}$ | | 2.4 | | V _{DC} |
| Input Voltage for Min. Lamp Current | $V_{BST\ ADJ}$ | $I_O(LAMP) = \text{Minimum Boost}$ | | 0 | | V _{DC} |
| ► SLEEP Input | | | | | | |
| RUN Mode | $V_{\overline{SLEEP}(HI)}$ | $V_{IN1} = 10V$ | | 2.1 | | V _{DC} |
| SLEEP Mode | $V_{\overline{SLEEP}(LO)}$ | $V_{IN1} = 16V$ | | 1.9 | | V _{DC} |
| Input Current | I_{SLEEP} | $\overline{SLEEP} = 5.0V$ | | 400 | | μA_{DC} |
| | | $\overline{SLEEP} = 0V$ | | 0 | | μA_{DC} |

Note 2. Minimum lamp current required to maintain even light output may vary with display panel.
Average RMS current = (burst duty cycle) x (burst amplitude of 6.5mA_{RMS})

12V HIGHLY-INTEGRATED, DIGITAL DIMMING CCFL INVERTER MODULE

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ELECTRICAL CHARACTERISTICS (continued)

Unless otherwise specified, these specifications apply over the recommended operating conditions and 25°C ambient temperature for the LXM1614-12-01.

| Parameter | Symbol | Test Conditions | LXM1614-12-01 | | | Units |
|-------------------------------------------|-------------------------|-----------------------------------------------------|---------------|------|------|------------------|
| | | | Min. | Typ. | Max. | |
| ▶ V_{SYNC} Characteristics | | | | | | |
| Logic High Level | V _{SYNCH (HI)} | V _{IN1} = 10V | 1.5 | 2.5 | 5 | V _{DC} |
| Logic Low Level | V _{SYNCH (LO)} | V _{IN1} = 16V | -0.3 | 0.8 | 1.2 | V _{DC} |
| Input Impedance | Z _{IN} | | | 27 | | kΩ |
| Input Frequency | f _{SYNC} | | 20 | | 200 | Hz |
| ▶ Power Characteristics | | | | | | |
| Sleep Current | I _{IN (MIN)} | V _{IN1} = 16V _{DC} , SLEEP = 0.0V | 0.0 | 0.5 | 10 | μA _{DC} |

FUNCTIONAL PIN DESCRIPTION

| Conn. | Pin | Description |
|------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| CN1 | | |
| CN1-1 | V _{IN1} | Main Input Power Supply. (10V ≤ V _{IN1} ≤ 16V) |
| CN1-2 | | |
| CN1-3 | GND | Power Supply Return. |
| CN1-4 | | |
| CN1-5 | SLEEP | ON/OFF Control. (2.1V < SLEEP < V _{IN2} = ON, 0V < SLEEP < 0.8V = OFF, SLEEP Floating = OFF) |
| CN1-6 | BRITE | Duty Cycle Brightness Control (0 to 2.5V). 2.5V gives 100% Duty Cycle. |
| CN1-7 | BOOST | Current Amplitude Control (0 to 2.5V) 0V = Nominal Current, 2.5V = Maximum Boost Current. |
| CN1-8 | V _{SYNC} | Vertical Synchronization Input. 2.5 to 5V Logic High Level (20Hz < f _{SYNC} < 200Hz) |
| CN2 | | |
| 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. |

CONNECTORS

Connectors:

CN-1 = JST 06FMS-1.0SP-TF

Recommended Mate:

FFC and FPC: Lead pitch / 1.0mm(.039")
Lead width / 0.7mm(.028")
Mating part thickness /
0.30 ±0.05mm(.012" ±0.002)

CN-2 = JST SM02B-BHSS-1-TB

Pins: SBHS-002T-P0.5, Housing: BHSR-02VS-1

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