

Introduction

BI206D is a CCFL inverter which operates the very high brightness (VHB) backlights in Landmark 6.4" to 8.4" sunlight readable LCD modules. The inverter has an on-board pulse width modulation (PWM) dimming circuit to provide an extremely wide luminance adjustment range. Over the entire dimming range, there is no noticeable lamp flickering and the uniformity of the backlight is well maintained. When using the BI206D with Landmark LCD modules, it is not necessary to synchronize the PWM dimming circuit to the vertical sync signal of the LCD.

The BI206D inverter operates at a 12V DC input and can drive up to 6 CCFLs for a maximum lamp power of 15 Watts. In addition, the inverter has a regulated +5V output which serves as a voltage source for the dimming control circuit.

Absolute Maximum Rating

Parameters	Min.	Max.	Units
Inverter Input Voltage (Vin)	11.0	13.0	Vdc
Operating Temperature Range	0	50	°C
Storage Temperature Range	-20	80	°C

Electrical Characteristics

Parameters	Min.	Typ.	Max.	Units	Conditions
Input Voltage (Vin)	11.5	12	12.5	Vdc	
Input Current (I) (With LM129-08C351 LCD Module)		1.4		Adc	Vin = 12V, Vd = 5V
Lamp Starting Voltage (Vst)		1,200		Vrms	Vin = 12V, Vd = 5V
Frequency (f)	65	67	69	KHz	
ON/OFF Control					
OFF	0	0.2		Vdc	
ON		4.8	5	Vdc	
Dimming Control Voltage (Vd)					
At 100% Luminance		4.9	5	Vdc	PWM duty cycle = 100%
AT 0% Luminance	0.54	0.56	0.58	Vdc	PWM duty cycle = 0%
+5V Output (+5VOUT)	4.85	5	5.25	Vdc	11.5 < Vin < 12.5V
+5V Output Source Current			5	mA	

Connector Pin Assignments

Input Connector CN1 JST S 5B-XH-A-1		Output Connectors CN2 & CN3 JST SM04 (4.0)B-BHS-1-TB	
Pin #	Function	Pin #	Function
1	+5 V Output	1, 2, 3	Lamp Connections
2	+12 V Input	4	Lamp Commons
3	Dimming Control		
4	Ground		Mating Connector for CN1 JST XHP-5
5	On/Off Control		Mating Connector for CN2, CN3 JST BHR-04VS-1

Accessories

- LC206 Inverter input connector (JST XHP-5) assembly with 8" wires
- DP064 64-level Digital Potentiometer for dimming control with a pair of push buttons
- PS200 Photosensor for automatic dimming control based on ambient light levels.

Typical Dimming Characteristics

The BI206D inverter accepts a 0 - 5V analog voltage for dimming control. The inverter has a pulse width modulation (PWM) circuit for luminance adjustment. As the dimming voltage V_d decreases from +5V, the lamp current waveform is pulse width modulated, and the duty cycle of the PWM waveform reduces from 100% to 0% as the V_d values reduces. In the meantime, both the backlight luminance and the inverter current drop down roughly in proportion to the duty cycle of the PWM waveform.

When V_d input reaches about 0.56V, the duty cycle of the PWM waveform reaches 0% and thus, the lamps are turned "OFF" and the luminance of the backlight reaches zero. In order to fully utilize the available dimming range without turning the LCD to totally dark, the minimum dimming control voltage V_d should be set slightly above 0.56V and then adjusted to 5.0V for maximum brightness.

Typical dimming characteristics with some Landmark sunlight readable LCD modules are shown in Fig 2 and Fig 3. The LCD luminance and the inverter current vary almost linearly if V_d is plotted in log scale. Thus, it is recommended to use a logarithmic voltage step generating circuit to have a nearly linear luminance adjustment.

In general, inverters with PWM dimming have a very wide luminance adjustment range. For most practical cases, the BI206D inverter can achieve a maximum dimming ratio of about 200:1. Hence, the luminance of the backlight or the LCD screen can be adjusted from 100% to 0.5%.

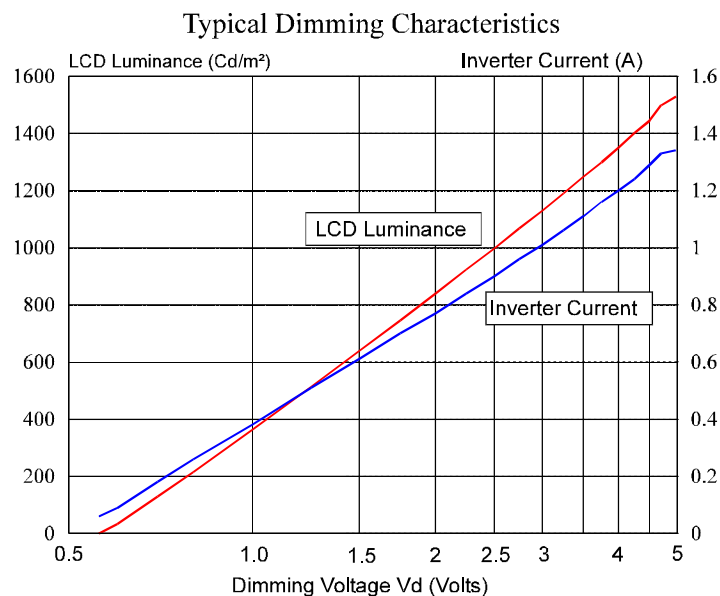


Fig. 2. Typical LCD Screen Luminance & Inverter Current vs. Dimming Voltage - LM129-08C351 8.4" sunlight readable LCD module with BI206D inverter

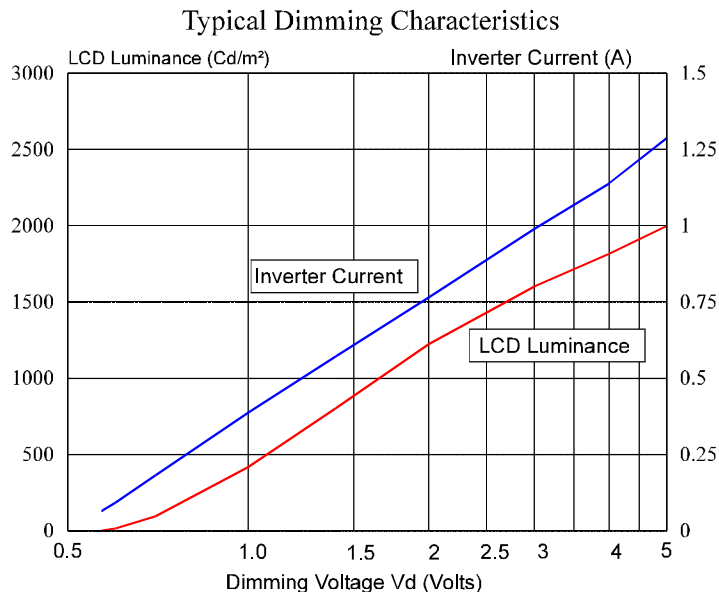


Fig. 3. Typical LCD Screen Luminance & Inverter Current vs. Dimming Voltage - LM171-065J-AG, 6.5" VHB LCD module with BI206D inverter

Typical Dimming Control Circuits

The dimming voltage V_d can be generated simply by using a potentiometer (Fig. 4). The inverter provides a +5V source (pin #1 of the input connector CN1) to power this dimming circuit. However, if potentiometers with other resistance values are used, please make sure that the maximum current drain from this +5V source is kept at or less than 5 mA.

In Fig. 4, a series resistor R_1 is used to control the minimum dimming such that the backlight is not completely turned off. It is also possible to add another resistor above the 10 K Ω potentiometer to limit the maximum dimming voltage and the maximum screen luminance. This option can be used to relax the thermal issues and/or to increase the lamp life beyond the specified values.

With the BI206D inverter, using an R_1 value of 1.5K Ω will set the minimum V_d to about 0.65V. Over the full potentiometer adjustment, a luminance adjustment range of about 50:1 can be achieved. Use a logarithmic potentiometer to obtain a linear luminance adjustment.

The luminance control range can be increased by lowering the R_1 value to, for example, 1.41 K Ω . Then, the luminance adjustment range is increased to about 100:1. However, further reducing the value of R_1 may turn the backlight off when the potentiometer is adjusted to its lowest setting.

Alternatively, the DP-064 digital potentiometer can be used to provide 64 levels of brightness adjustments with two push buttons (Fig. 5). With the BI206D inverter, the DP-064 can provide a dimming range about 100:1 with nearly linear luminance adjustment.

Also, the PS200 photosensor can be used with the BI206D to control the screen luminance automatically in response to the ambient light levels (Fig. 6). The range of screen luminance control is about 100:1 when the ambient illumination changes from direct sunlight to total darkness. For details, please refer to the PS200 data sheets.

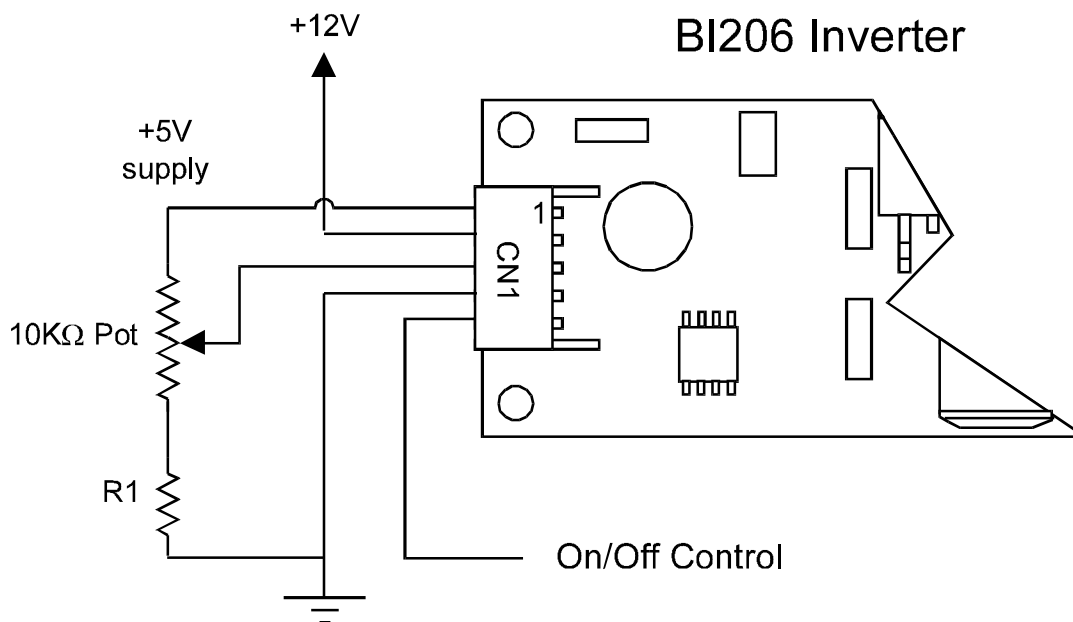
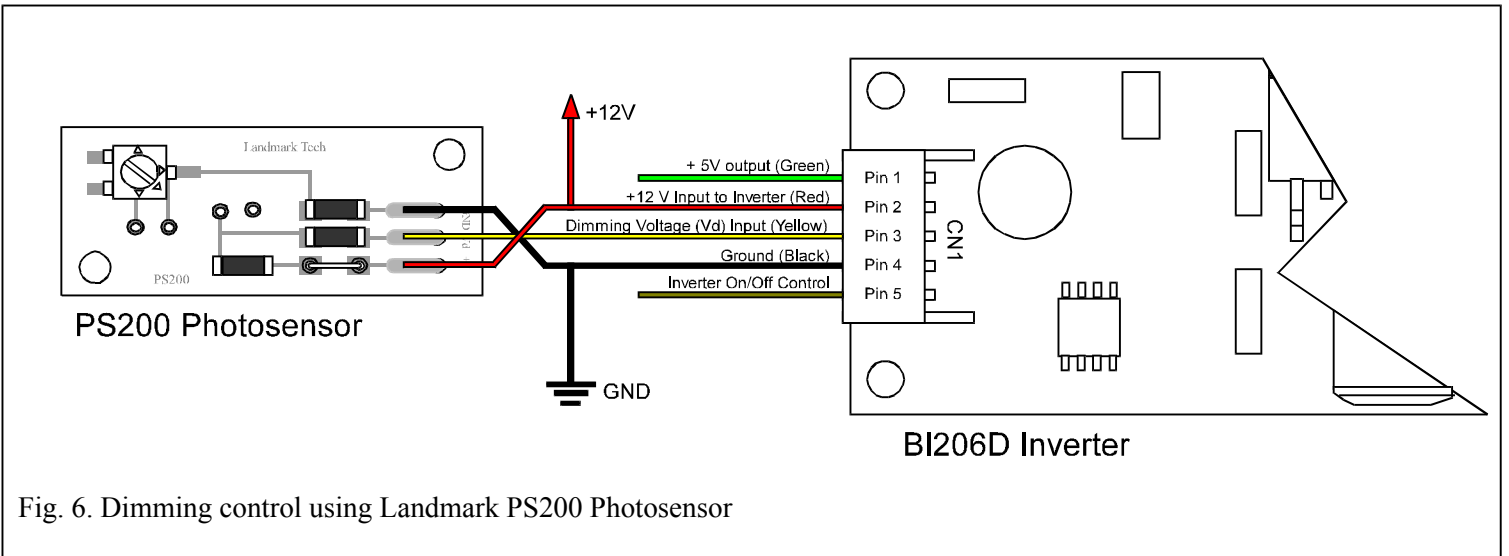
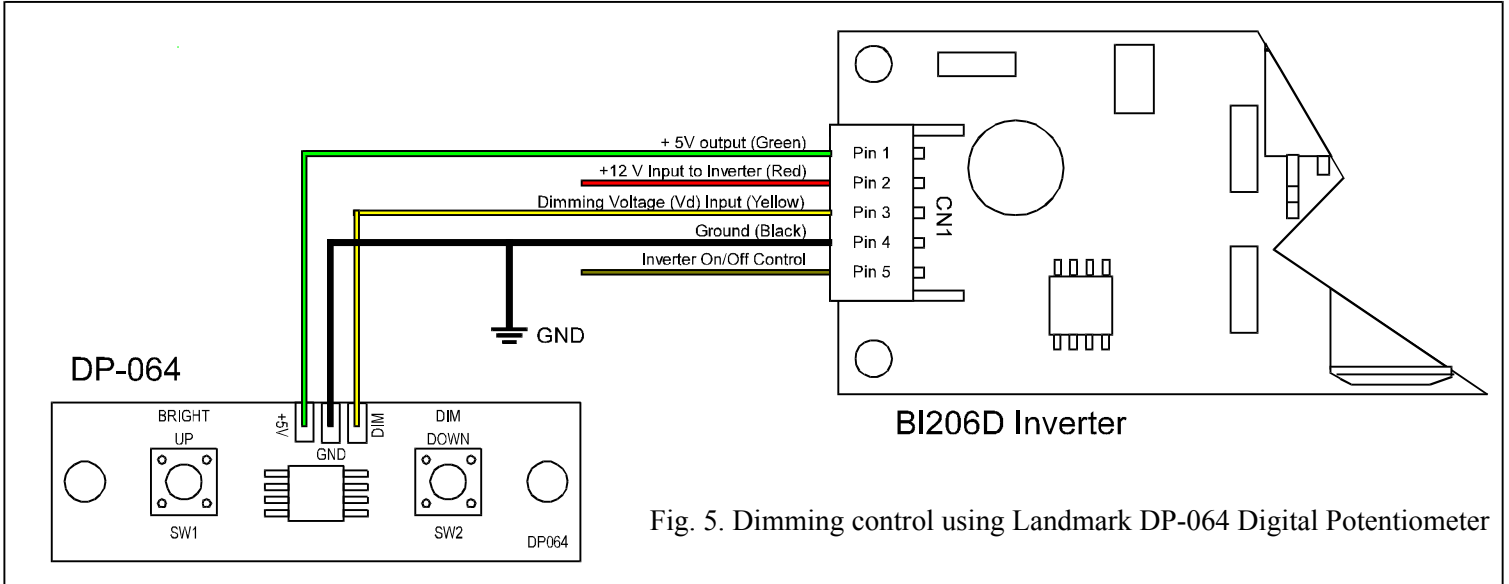


Fig. 4. Dimming control using a 10 K Ω potentiometer with the on-board +5V regulated supply.



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