

# LX1991 EVALUATION BOARD USER'S GUIDE

## LX1991 Six Output Programmable LED Current Sink



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## OVERVIEW

The LX1991 six channel current sink driver is ideal for controlling brightness of high quality dimmable LED's. The evaluation board demonstrates how this low cost bipolar IC enables precise current regulation in LED display lighting applications, yet requires far fewer parts than discrete solutions.

The evaluation board ships with six (Microsemi UBLED470A) white surface mount LED's whose cathodes are connected to each sink output of the LX1991. The anodes of the LED's are connected together to a test point called VLOAD which the user can connect to an external voltage source (typically 5V, maximum is 40V) LED6 requires an external jumper between TP7 and TP8 to allow current to flow. This demonstrates that one or more channels can be left open without effecting the other channels. In addition these test points allow the easy addition of a application specific load or a current probe loop. Use of a current probe will allow easy viewing of the current rise and fall times.

A small rheostat (Current Adjust) in series with R8 (1.02K which sets the maximum current at 30mA) varies the  $R_{SET}$  resistance such that the output LED currents will vary from about 1.5mA to 30mA. Two other jumpers are included, EXT\_EN which enables/disables the LX1991, and PWM\_IN which allows an externally supplied PWM signal to toggle the DIG\_DIM input to allow duty cycle dimming.

## Evaluation Board Features

- One channel is left open for application specific loads to be added or current probe loop
- Included rheostat allows output current to be set from 1 to 30mA
- Jumpers allow external PWM signal to burst dim the LED's and an external enable control

## EVALUATION BOARD OPERATION

The evaluation board has four possible inputs of which at least two must be used to operate the circuit. In the simplest configuration connect 5V to both EXT VDD and VLOAD and the common (ground return) to RTN. With power connected to these two pins and the a jumper (factory installed) between PWM\_IN and PULL-UP the evaluation board should be operational. The LX1991 integrated circuit itself requires a input supply voltage (EXT VDD) in the range of 4.5 to 5.5V. When using the included white LED's a supply voltage of at least 4V is required on the VLOAD input depending on the current setting (current adjust). All inputs are described in table 1 below.

The other two inputs PWM\_IN and ENABLE allow external control over dimming and shutdown. The evaluation board comes with a built in 10K pull-up resistor R1 that is connected between the ENABLE input and EXT VDD. R1 will enable the device unless a jumper is placed between EXT\_EN and RTN (GND).

Input	Allowable Range	Description
EXT VDD	4.5 to 5.5V	LX1991 power supply. Quiescent current draw is between 4 and 13mA depending on voltage and temperature and the programmed output sink currents
VLOAD	3 to 40V (5V typ.)	LED voltage supply. Required voltage depends on forward voltage requirements of LED's and 700-1000mV chip overhead. This current will vary between 9 and 180mA depending on the programmed output sink current and if all six LED are connected.
EXT_EN	0 to VDD	Input for external enable control, board ships with 10K pull-up to EXT VDD
PWM_IN	0 to VDD	Input to allow duty cycle dimming of output 150hz to 100Khz logic signal, active high
RTN/GND	0V	Common ground reference

**Table 1** – Evaluation Board Connections

An external voltage signal or open collector logic can be applied to this point to disable the device. This external signal must be able to drive the 10K pull-up resistor low (less than 0.8V). The PWM\_IN header input allows an external PWM signal to control the output current by duty cycle dimming. This is accomplished by switching the device's DIG\_DIM input with a logic signal. The practical limit to this switching frequency is about 100Khz, at frequencies greater than this internal delays will add errors to the expected output duty cycle. The evaluation board comes with a 470pF CSLOPE capacitor. This value can be increased to vary the rise and fall times of the output current waveform. For greater detail see the LX1991 datasheet.

Test Points SINK1 to SINK6 allow you to monitor the voltage drop across these pins to ground. This voltage will change to maintain the

correct forward voltage across the LED's for the programmed sink current. It can range from as low as 400mV to 40V when the outputs are off depending on the VLOAD supply voltage.

The various jumper positions are summarized in table 2 and test points in table 3. The factory installed active and passive components list can be found in table 4. Following the two tables you will find the PCB silkscreen figure 1 and the circuit schematic in figure 2. All necessary PCB traces and components are on the topside of the board. However there are PCB traces and silkscreen on the bottom side that when populated is used for a special version of the evaluation board that is used internally by Microsemi for training and demonstration purposes.

Jumper	Function
PWM_IN	Jumper to PULLUP connects PWM_IN through a 10K pull-up resistor to EXT VDD, Jumper to RTN connects PWM_IN to Ground. Open allows hookup to external PWM source.
EXT_EN	Jumper to RTN disables the LX1991 by pulling down on the 10K pull-up resistor ; EXT_EN open enable the LX1991 through the 10K pull-up to EXT VDD

**Table 2 – Jumper Explanation**

Test Point	Description
VLOAD	VLOAD Input, power supply to LED's (3 to 40V)
RTN/GND	Common Ground Reference
EXT VDD	VDD Input to LX1991 (4.5 to 5.5V)
EXT_EN	ENABLE input can be connected to external enable signal; high or floating is on, low is off (LX1991 pin 16)
SINK1	SINK1 (LX1991 pin 3)
SINK2	SINK2 (LX1991 pin 4)
SINK3	SINK3 (LX1991 pin 6)
SINK4	SINK4 (LX1991 pin 7)
SINK5	SINK5 (LX1991 pin 8)
SINK6	SINK6 (LX1991 pin 10)
PWM_IN	PWM Input can be connected to external pulse generator for duty cycle dimming (LX1991 pin 1)

**Table 3 – Test Point Descriptions**

**LX1991 EVALUATION BOARD COMPONENT LIST**

**MISCELLANEOUS COMPONENTS**

Part Description	Manufacturer & Part #	Reference Designators	Qty
IC, Controller	MICROSEMI LX1991ILM	U1	1
LEDs, BLUE Bright	Microsemi UBLED470A Optomite or equivalent	LED1 - LED6	6
Probe Standoffs		Various	8

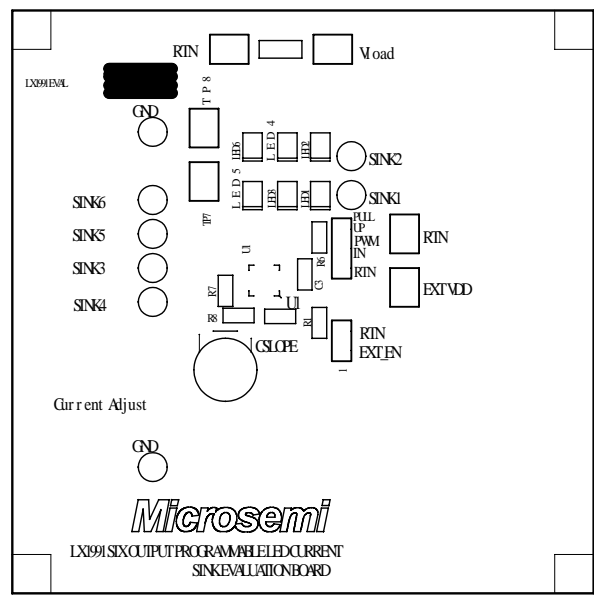
**CAPACITORS**

Part Description	Manufacturer & Part #	Reference Designators	Qty
Capacitor, X7R, 100nF, 50V, 10%	Any	C3, C4	2
Capacitor, CGO, 470pF,	Any	CSLOPE	1

**RESISTORS**

Part Description	Manufacturer & Part #	Reference Designators	Qty
Resistor, Pot Thumbwheel 20K	Any	Current Adjust	1
Resistor, 1.02K, 1%, 1/16W	Any	R8	1
Resistor, 10K, 1%, 1/16W	Any	R1,R6	2
Not Used	n/a	R7	0

**LX1991 EVALUATION BOARD SILKSCREEN**



Silkscreen Top PR

Figure 1

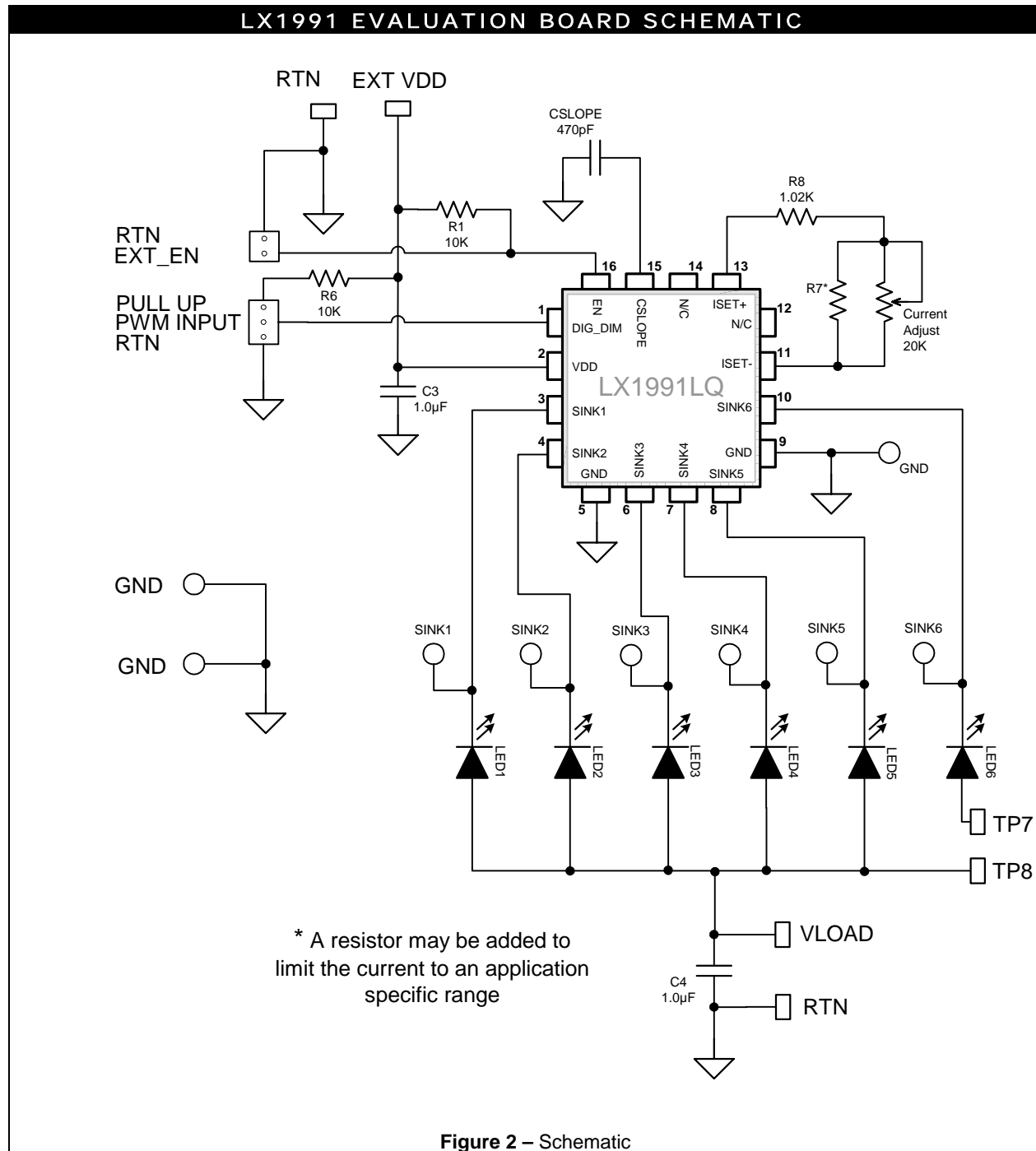


Figure 2 – Schematic