MIC2846A Evaluation Board

High Efficiency 6 Channel Linear WLED Driver with DAM™, Digital Control and Dual Low I_Q LDOs

Functional Description

The MIC2846A is a six channel linear LED driver with dual 150mA LDOs. The LED driver incorporates a Dynamic Averaged Matching™ (DAM™) technique designed specifically to optimize on current accuracy and matching. It maintains proper current regulation with LED current accuracy of 1.5% while the typical matching between the six channels is 1.5%. The LED currents are driven from the input supply and will maintain regulation with a dropout of 40mV at 20mA. The low dropout of the linear LED Drivers allows the LEDs to be driven directly from the battery voltage and eliminates the need for boost regulator or large and inefficient charge pumps. The maximum LED current for all channels is set via an external resistor while a single-wire digital interface controls LED brightness.

The MIC2846A has two LDOs with a dropout voltage of 150mV at 150mA and consume 35µA of current in operation. Each LDO has an independent enable pin, which reduces the operating current to less than 1µA in shutdown. Both LDOs are stable with just 1µF of output capacitance.

Requirements

The MIC2846A evaluation board requires an input power source that is able to deliver greater than 500mA at 3V.

Precautions

The MIC2846A evaluation board is tailored for a Li-Ion range input supply voltage. The input voltage should never exceed 6V.

Getting Started

1. **Connect an external supply to VIN.** Apply desired input voltage to the VIN and a GND terminal of the evaluation board, paying careful attention to polarity and supply voltage (3.0V≤VIN≤5.5V). An ammeter may be placed between the input supply and the VIN terminal to the evaluation board. Ensure that the supply voltage is monitored at the VIN terminal. The ammeter and/or power lead resistance can reduce the voltage supplied to the input.
2. **Enable/Disable the LDO(s).** Apply a voltage greater than 1.2V to EN1 or EN2 to enable LDO1 and LDO2, respectively. Apply a voltage below 0.2V to EN1 and EN2 to disable LDO1 and LDO2, respectively. The enable pins must be either pulled high or low for proper operation. Do not leave floating as this will cause the regulators to operate in an indeterminate state.
3. **Enable/Disable the White LED Driver.** The DC pin is used to enable and control dimming of the linear drivers. Pulling the DC pin low for more than 1260µs puts the MIC2846A into a low Iq sleep mode. The DC pin cannot be left floating; a floating enable pin may cause an indeterminate state on the outputs. A pull down resistor of 200kΩ is placed from END/DC pin to ground to ensure that the WLEDs are off when there is no signal during the DC pin. See the Digital Dimming Control section for a description on how to generate digital dimming control signals with standard lab test equipment.
4. **Set the peak LED Current.** The peak current of the linear drivers is set by RSET resistor. The average LED current can be calculated by the equation below:

$$I_{LED}\ (mA) = 410 \times ADC / R_{SET}\ (k\Omega)$$

ADC is the average duty cycle of the LED current controlled by the single-wire digital dimming. See Table 5 for ADC values. When the device is fully on the average duty cycle equals 100% (ADC=1).

Note. For detailed timing specifications, please refer to the MIC2846A Datasheet at www.micrel.com

Ordering Information

Part Number	Description
MIC2846A-MFYMT EV	Six Channel WLED Driver With 2.8V, 1.5V LDO EVB
MIC2846A-MGYMT EV	Six Channel WLED Driver With 2.8V, 1.8V LDO EVB
MIC2846A-PGYMT EV	Six Channel WLED Driver With 3.0V, 1.5V LDO EVB

Note. Other voltage options available on request

Digital Dimming Control

A function/arbitrary waveform generator may be used to create the digital dimming commands. Once the commands are created, they can be stored in the non-volatile memory of the function generator to easily switch between count-up and count-down commands. Set the function generator to burst mode and enable the output of the function generator to turn on the evaluation board. Pressing the trigger will then send a single command to move one step on the brightness table.

Waveform	ARB
Period	10ms
Output Impedance	High Z
V High	1.5
V Low	0
Interp	Off
# Points	6

Table 1. Function Generator Setup

Configure the arbitrary waveform as shown in the table below to create the count down mode and single step command.

Step Down 1 Level		
Point #	**Time**	**Voltage**
1	0	1.5V
2	1ms	0V
3	1.45ms	1.5V
4	1.470ms	0V
5	1.490ms	1.5V
6	9.999ms	1.5V

Table 2. Step Down 1 Level

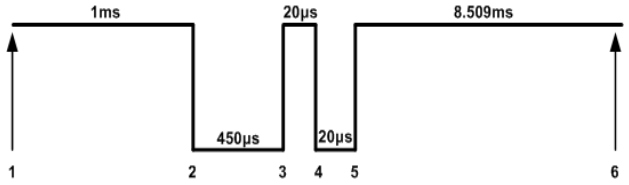


Figure 1. Step Down 1 Level Signal Waveform

Configure the arbitrary waveform as shown in Table 3 to create the count down mode and single step command.

Step Up 1 Level		
Point #	**Time**	**Voltage**
1	0	1.5V
2	1ms	0V
3	1.13ms	1.5V
4	1.15ms	0V
5	1.17ms	1.5V
6	9.999ms	1.5V

Table 3. Step Up 1 Level

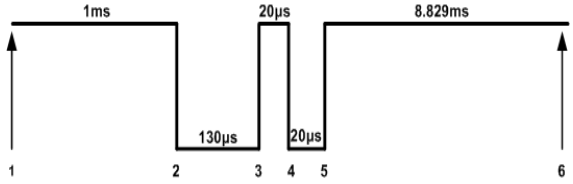


Figure 2. Step Up 1 Level Signal Waveform

Configure the arbitrary waveform as shown in Table 4 below to preset the brightness from default Level 48 to Level 41.

Preset from Level 48 to Level 41		
Point #	**Time**	**Voltage**
1	0	1.5V
2	1ms	0V
3	3ms	1.5V
4	3.04	0V
5	3.06	1.5V
6	3.08	0V
7	3.1	1.5V
8	3.12	0V
9	3.14	1.5V
10	3.16	0V
11	3.18	1.5V
12	3.2	0V
13	3.22	1.5V
14	3.24	0V
15	3.26	1.5V
16	3.28	0V
17	3.3	1.5V
18	9.999	1.5V

Table 4. Preset from Level 48 to Level 41

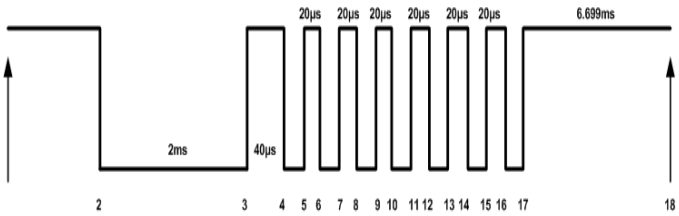


Figure 3. Preset to Level 41

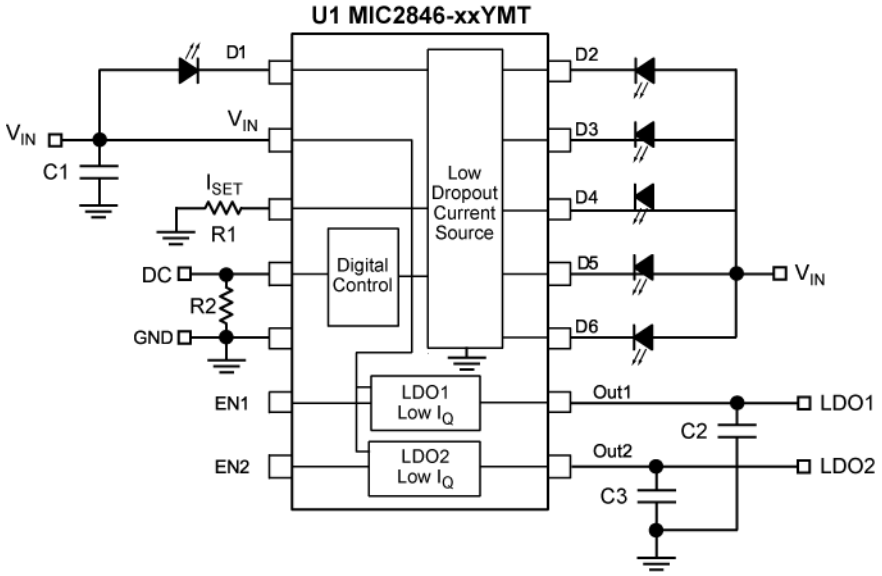
Digital Dimming

Brightness levels 0 through 15 are logarithmically spaced with a peak current equal to 60% of the current programmed by R_{SET}. Brightness level 16 is provided for applications that want to "fade to black" with no current flowing through the LEDs. Brightness Level 17 has the same duty cycle as level 18, but the peak current is only 60% of the current set by R_{SET}; therefore, the average current is 0.1mA. Brightness levels 18 through 48 are also logarithmically spaced, but the peak current is equal to 100% of the current determined by R_{SET}. Refer to Table 5 for the translation from brightness level to average LED duty cycle and current.

Brightness Level (0 - 48)	Average Duty Cycle (%)	Average I_{LED} (mA)	I_{PEAK} (mA)
0	100	12	**60% of I_{PEAK} R_{SET} = 20.5kΩ I_{PEAK} = 12mA**
1	80	9.6	
2	60	7.2	
3	48.33	5.8	
4	36.67	4.4	
5	29.17	3.5	
6	21.67	2.6	
7	16.67	2	
8	11.67	1.4	
9	9.17	1.1	
10	6.67	0.8	
11	5	0.6	
12	3.33	0.4	
13	2.5	0.3	
14	1.67	0.2	
15	0.83	0.1	
16	0	0	0
17	0.83	0.1	**60% of I_{PEAK}**
18	0.83	0.17	**100% of I_{PEAK} R_{SET} = 20.5kΩ I_{PEAK} = 20mA**
19	1.25	0.25	
20	1.67	0.33	
21	2.08	0.42	
22	2.5	0.5	
23	2.92	0.58	
24	3.33	0.67	
25	4.17	0.83	
26	5	1	
27	5.83	1.17	
28	6.67	1.33	
29	7.92	1.58	
30	9.17	1.83	
31	10.42	2.08	
32	11.67	2.33	
33	14.17	2.83	
34	16.67	3.33	
35	19.17	3.83	
36	21.67	4.33	
37	25.42	5.08	
38	29.17	5.83	
39	32.92	6.58	
40	36.67	7.33	
41	42.5	8.5	
42	48.33	9.67	
43	54.17	10.83	
44	60	12	
45	70	14	
46	80	16	
47	90	18	
48	100	20	

Table 5. Digital Interface Brightness Level Table

Evaluation Board Schematic



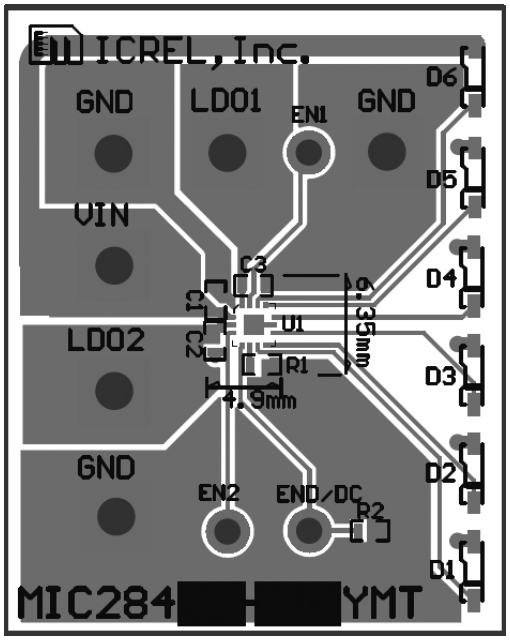
Bill of Materials

Item	Part Number	Manufacturer	Description	Qty.
C1, C2, C3	C1608X5R0J105K	TDK[1]	Ceramic Capacitor, 1µF, 6.3V, X5R, Size 0603	3
	06036D105KAT2A	AVX[2]		
	GRM188R60J105KE19D	Murata[3]		
	VJ0603G225KXYAT	Vishay[4]		
D1 – D6	SWTS1007	Seoul Semiconductor[5]	WLED	6
	99-116UNC	EverLight[6]		
R1	CRCW060320K5F5EA	Vishay[4]	Resistor, 20.5k, 1%, 1/16W, Size 0603	1
R2	CRCW06032003FKEA	Vishay[4]	Resistor, 200k, 1%, 1/16W, Size 0603	1
U1	**MIC2846A-xxYMT**	**Micrel, Inc.[7]**	**6 Channel Digital Control Linear WLED Driver with DAM™ and Dual Low I_Q LDOs**	**1**

Notes:

1. TDK: www.tdk.com
2. AVX: www.avx.com
3. Murata: www.murata.com
4. Vishay: www.vishay.com
5. Seoul Semiconductor: www.seoulsemicon.com
6. EverLight: www.everlight.com
7. **Micrel, Inc.: www.micrel.com**

Printed Circuit Board Layout



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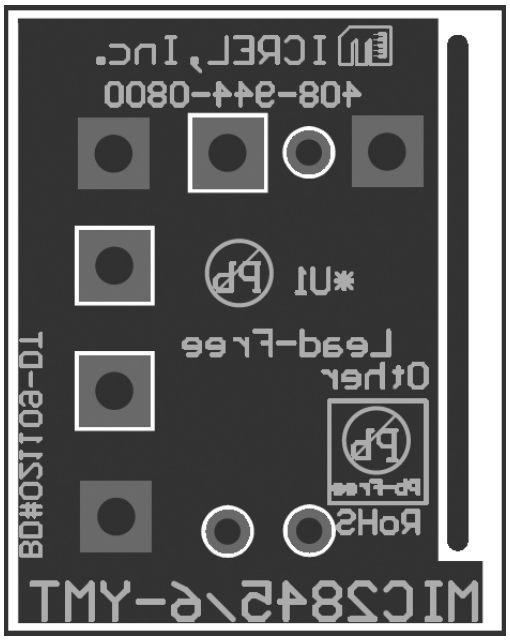

Bottom Layer

MICREL, INC. 2180 FORTUNE DRIVE SAN JOSE, CA 95131 USA
TEL +1 (408) 944-0800 FAX +1 (408) 474-1000 WEB http://www.micrel.com