

Demonstration/Evaluation Board for CAT3647/3648 Quad-Mode® LED Driver

1. INTRODUCTION

This document describes the CAT3647/3648 Demonstration/Evaluation board for the Catalyst Semiconductor CAT3647/3648, Quad-Mode fractional LED driver. The functionality and major parameters of the CAT3647/3648 can be evaluated with the CAT3647/3648DB1 board. To identify between CAT3647 and CAT3648 boards, a black dot is marked under the part number; for example, Figure 1 shows a CAT3648 board.

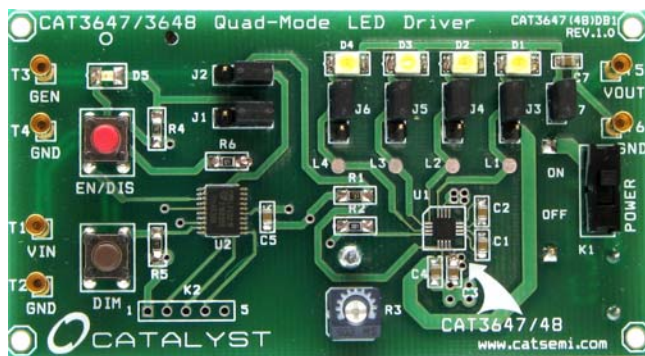


Figure 1. CAT3648 Demo/Eval Board

The CAT3647/3648 is a 3/4-channel charge pump that has been designed to drive with an ultra-high efficiency up to 3 or 4 LEDs connected in parallel. The CAT3647/3648 provides tightly matched regulated current through the LED outputs. The programmable current and dimming control of LEDs are achieved using a 1-wire digital interface. The maximum LED current is set by an external RSET resistor. The LED current dimming is available through 31 different levels by toggling the EN/DIM input. Detailed description and electrical characteristics can be found in the CAT3647 and CAT3648 data sheets.

2. BOARD HARDWARE

The demonstration/evaluation board contains the CAT3647 or CAT3648 in a typical application circuit, driving up to 3 or 4 white LEDs, respectively. The CAT3647/3648 is controlled through 1-wire interface using an 8-bit microcontroller. The board is powered from an attached 3V (2 x 1.5V AA) battery. The board schematic is shown in Figure 2.

The CAT3647/3648 input voltage, V_{IN} , is supplied on board from a +3V voltage, V_{DD} / V_{BAT} or from an external voltage applied to the V_{IN_EXT} (T1) test point. The voltage supplied at the V_{IN} input of the CAT3647/3648 device can be selected using jumper options for the J1 connector (Table 1).

The EN/DIM input is controlled on board through the microcontroller when J2 connector (Table 2) is connected between Pin #2 and Pin #3 (jumper shunt - right position). The user interface for controlling the CAT3647/3648 through the microcontroller is provided by two momentary SPST pushbuttons: EN/DIS and DIM.

The EN/DIS (Enable/Disable) pushbutton allows the user to set the EN/DIM input high (the device enabled) or low (the device shutdown). The action of the EN/DIS pushbutton has a toggle function: first time pressing the switch it sets the EN/DIM high and the associated red LED indicator (D5) will be on. At this time, the CAT3647/3648 device will drive the white LEDs ON at the current set by the combined external RSET resistor ($R2 + R3$). The second action sets the EN/DIM input low and the white LEDs will be OFF.

The DIM pushbutton allows the user to program the LED current. Every time the pushbutton is pressed (short action), an active low pulse ($t_w < 100\mu s$) is generated on the EN/DIM input of the CAT3647/3648 device. At every rising edge of the pulses provided at EN/DIM input, the LED current is lowered by about 3.2% providing 31 different levels of current. On the first transition from low to high on EN/DIM (after the device is enabled), the LED current is set to ~97% of the maximum current (full scale). Each successive pulse on EN/DIM will lower the LED current by ~3.2% of the maximum current until it reaches 0mA. The next pulse will set the device to full scale maximum current and the process can be repeated.

The maximum LED current (full scale) is set through the external resistors connected to the RSET pin ($R2 + R3$). Using the potentiometer R3, the maximum LED current can be set from few mA to 30mA. Most white LEDs are driven at a maximum current between 15mA and 20mA to ensure a pure “white” light.

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When the DIM pushbutton is held down, the microcontroller sends sequential pulses on the EN/DIM input. As a result the LED current will cycle automatically step by step through the whole range of dimming levels.

The user can also choose to drive the EN/DIM input of the CAT3647/3648 device with an externally provided signal, if the J2 connector has the jumper between Pin #1 and Pin #2 (jumper shunt - left position). The external signal should be connected to T3/EXT EN/DIM (GEN) test point (Table 2).

The user can connect or disconnect the CAT3647/3648 outputs to the white LEDs using the jumper options for J3, J4, J5, J6 and J7 connectors. To connect the LEDs to the CAT3647/3648 outputs the J3 to J6 connectors should have the jumper between Pin #2 and Pin #3 (on board shunt - up position) and J7 connector jumpered. Any unused LED output pin can be connected to the V_{OUT} pin with the jumper shunt between Pin #1 and Pin #2 (on

board shunt - down position) of the corresponding J3 to J6 connectors. The user can evaluate the LED current through each CAT3647/3648 output channel or the total output current with a current meter connected at the J3 to J7 header pin connectors.

Test points T1 to T6 are available to apply the external voltages/signal generator, or to measure the output voltages/signals provided by the CAT3647/3648.

Notes

1. An additional capacitor C7 (1 μ F) is needed when a current meter is inserted to measure the LED current.
2. The microcontroller requires a supply voltage of 2.6V minimum for proper operation. To test operation of the CAT3647/3648 below 2.6V, please use an additional supply and connect to V_{INEXT} (T1) test point (J1 between pins 1 and 2).

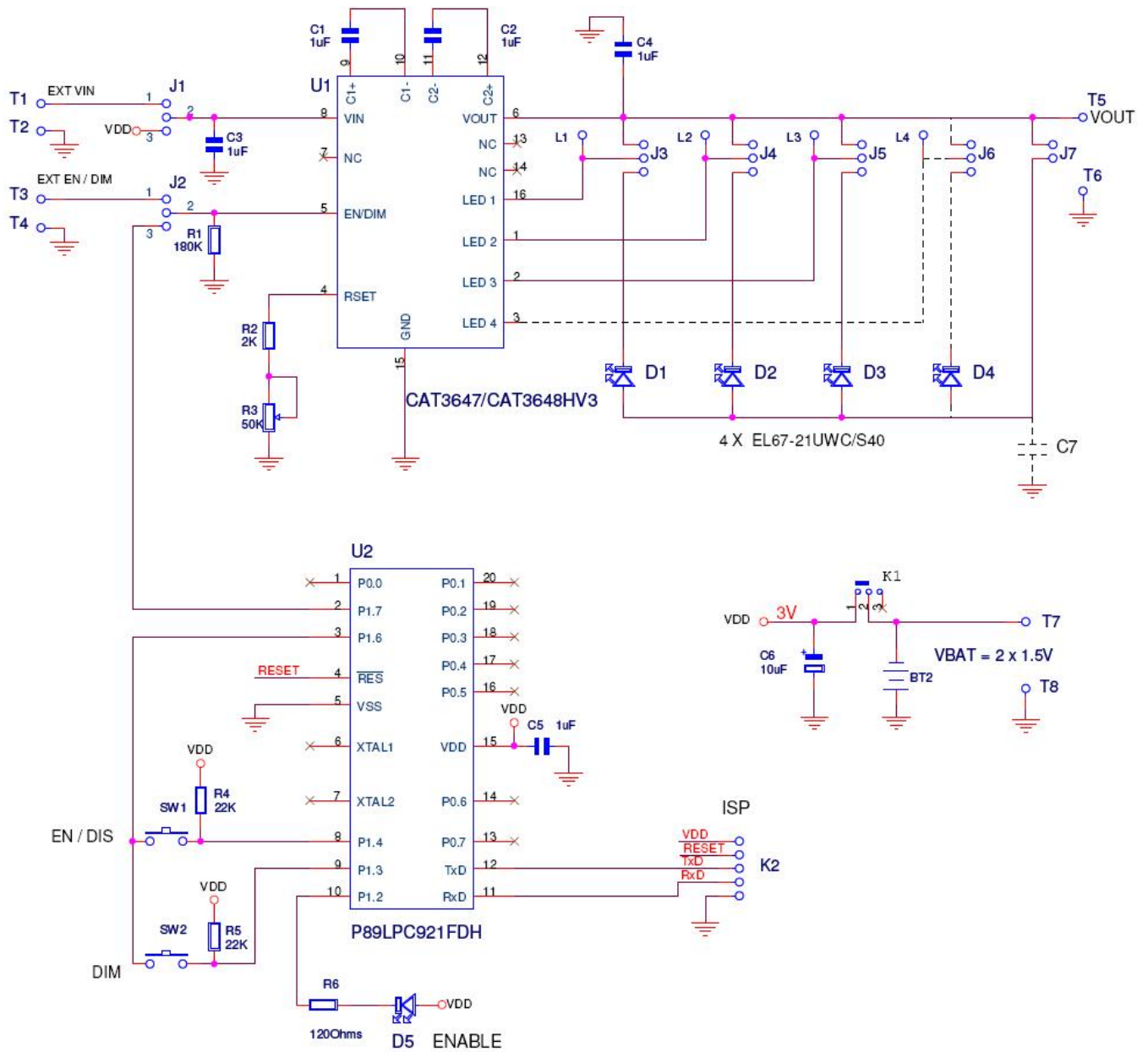


Figure 2. CAT3647/3648 Board Schematic

Table 1. J1 Connector

VIN	
EXTERNAL VIN	INTERNAL VDD=VBAT=3V
Jumper J1 Pin #1-Pin #2 (LEFT position)	Jumper J1 Pin #2-Pin #3 (RIGHT position)
Connect Vext at T1 Test Point (T2 = GND)	N/A

Table 2. J2 Connector

EN/DIM	
EXTERNAL EN/DIM	INTERNAL (microcontroller)
Jumper J2 Pin #1-Pin #2 (LEFT position)	Jumper J2 Pin #2-Pin #3 (RIGHT position)
Connect Signal at T3 Test Point (T4 = GND)	N/A

Table 3. CAT3647/3648DB1 Board List of Components

Name	Manufacturer	Description	Part Number	Units
U1	Catalyst Semiconductor	3(4)-Channel Quad-Mode LED Driver, TQFN-16, 3 x 3mm – CAT3647/3648HV3	CAT3647HV3/3648HV3	1
U2	Philips Semiconductor	8- bit flash microcontroller, TSSOP20	P89LPC922FDH	1
C1 to C5(C7)	AVX	Ceramic Capacitor 1 μ F / 10V, 10%, X5R, Size 0603	0603ZD105KAT2A	6
C6	Kemet	Tantalum Capacitor 10 μ F / 16V, SMD	T491B106K016AS	1
R1	Yageo	SMT Resistor 1/8W, 180k Ω , 0805	Digi-Key 311-180KCCT-ND	1
R2	Yageo	SMT Resistor 1/8W, 2k Ω , 0805	Digi-Key 311-2.0KCCT-ND	1
R3	CKT	Trimmer Potentiometer, 1/4", 50k Ω	PKT50HK50	1
R4, R5	Yageo	SMT Resistor 1/8W, 22k Ω , 0805	Digi-Key 311-22.0KCCT-ND	2
R6	Yageo	SMT Resistor 1/8W, 120 Ω , 0805	Digi-Key 311-120CCT-ND	1
D1 to D3(D4)	Nichia or Everlight	White LED, SMT	NSCW100 (or NSCW335) or EL67-21UWC	3(4)
D5	LiteOn	Red LED, SMT	LTST-T970KRKT	1
EN/DIS, DIM	HDT	Momentary Contact Switch, SPST (On)-Off	Schukat Electronic DTS67R	2
K1	E-Switch	Slide Switch, SPDT	EG1218 (Digi-Key EG1903-ND)	1
J1 to J5(J6)		3-pin Header Connector, 0.1", Single Strip	Digi-Key S1012-03-ND (or equiv)	5(6)
J6 or J7		2-pin Header Connector, 0.1", Single Strip	Digi-Key S1012-02-ND (or equiv)	1
	Specialty Electronics	Shunts	2JM-G	6(7)
T1 to T6	Mil-Max	Pin Receptacle (Test Points)	#0149-0-15-01-30-14-04-0 (or equiv)	6
BTH	Keystone	Battery Holder 2 x AA 1.5V (optional)	Digi-Key 2462K-ND	1

REVISION HISTORY

Date	Revision	Description
08-Apr-08	A	Initial Issue
07-Aug-08	B	Changed "Quad-Mode™" to "Quad-Mode®"

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