

ZD3215EVB Evaluation Board Manual
General Description

The ZD3215EVB demonstration board is populated to show the function of the ZD3215 as a low noise, variable frequency, regulated charge pump DC/DC converter that uses 2 phase conversion for high power output applications such as flash and torch White LED applications. The LED current is regulated in this converter and can be determined by the regulator's feedback voltage and feedback resistor and can be adjusted with the control pins, D1 and D0. The LED current is independent of the LED's forward-bias voltage variation.

The ZD3215EVB is a standard boost demo circuit with switches and all controlling logic circuits integrated in the ZD3215 device. Apart from the LED, only five external components are required in the application of the demo circuit which include the bypass capacitor, the charge pump capacitors, a feedback resistor and an output integrating capacitor. The converter design operates at a variable frequency and small external capacitors can be used for space saving application circuitry. Figure 1 shows a typical demo board circuit schematics.

The demo board can be powered from 2.9V to 5V at the VIN tap. The LED current can be controlled by the Logic Input pins, D1 and D0. The LED current can be calculated using the equation $I_{LED} = (V_{FB}) / (R_{SET})$. The ZD3215 device can be put into low quiescent shutdown mode by setting the D1 and D0 pins both to the GND.

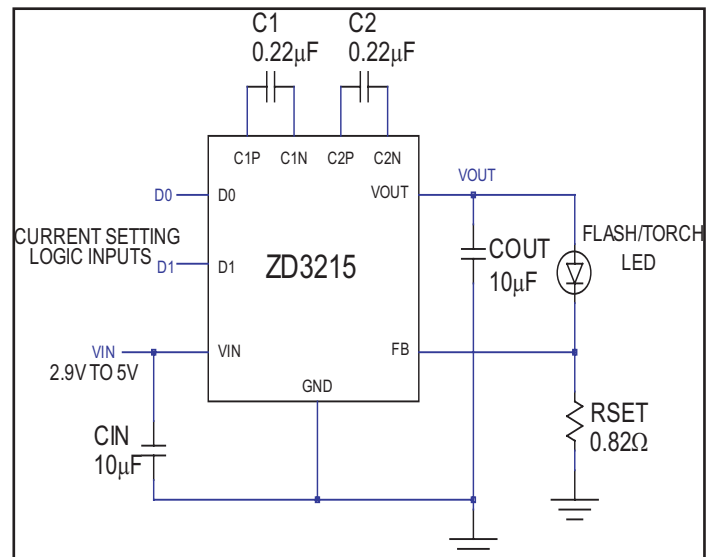
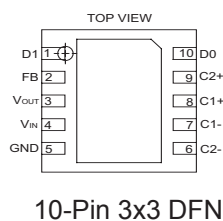



PCB Circuit Schematics


Figure 1. Typical Demo Circuit Driver for White LED

ZD3215 Pin Configuration

Product Ordering Information

Part Number	Temperature Range	Package Type
ZD3215LED	-40°C to +85°C	10-Pin 3x3 DFN 
ZD3215EVB	n/a	Evaluation Board

Please contact the factory for pricing and availability on Tape-on-Reel and Green Package  option.

Electrical Characteristics Of The ZD3215

Specifications are at $T_A = 25^\circ\text{C}$. $V_{IN} = 3.6\text{V}$, $C_1=C_2=0.22\mu\text{F}$, $C_{OUT}=C_{IN}=10\mu\text{F}$; unless otherwise noted.

Parameter	Condition	Min	Typ	Max	Units
Input Power Supply					
V_{IN} Operating Voltage		2.9		5.0	V
I_{CC} Operating Current	$I_{OUT} = 0\text{mA}$, $D1 = V_{IN}=3.6\text{V}$, $D0 = 0\text{V}$		0.5	1	mA
I_{SHDNB} Shutdown Current	$D1 = D0 = 0\text{V}$			1	μA
I_{FB}	$V_{FB} = 0.8\text{V}$		50		nA
Torch Mode					
I_{OUT}	$D1=0\text{V}$, $D0=V_{IN}$; $2.9\text{V} \leq V_{IN} \leq 4.2\text{V}$; $R_{SET}=0.82\Omega$		300		mA
V_{FB}	$D1=0\text{V}$, $D0=V_{IN}$; $2.9\text{V} \leq V_{IN} \leq 4.2\text{V}$; $I_{OUT}=0\text{mA}$		250		mV
Red-Eye Mode					
I_{OUT}	$D1=V_{IN}$, $D0=0\text{V}$; $V_{IN}=3.6\text{V}$; $RSET=0.82\Omega$; Pulse Width=50ms~300ms; 1Hz max		600		mA
V_{FB}	$D1=V_{IN}$, $D0=0\text{V}$; $I_{OUT}=0\text{mA}$		500		mV
Flash Mode					
I_{OUT}	$D1=D0=V_{IN}$; $V_{IN}=4.2\text{V}$; $RSET=0.82\Omega$; Pulse Width=50ms~100ms; 1Hz max		800		mA
V_{FB}	$D1=D0=V_{IN}$; $I_{OUT}=0\text{mA}$		650		mV
Charge Pump					
Efficiency	$D1=V_{IN}$, $D0=0\text{V}$; $V_{IN}=3.0\text{V}$; $I_{OUT}=200\text{mA}$		70		%
Data Input, D0, D1					
High Level Input Voltage (V_{IH})	$V_{IN}=3.6\text{V}$;	1.5			V
Low Level Input Voltage (V_{IL})	$V_{IN}=3.6\text{V}$;			0.4	V
Input Current (I_{IH})	$D1 = D0 = V_{IN}$	-1		1	μA
Input Current (I_{IL})	$D1 = D0 = 0\text{V}$	-1		1	μA

Input Operation Description

Input Voltage Setting

A DC voltage power source is needed to drive the LED. In this application, a typical 2.9V to 5V DC is the input voltage power source and it should be able to provide a 1.5A load current. An internal 2-bit DAC allows LED current to be adjusted for LED brightness control. The ZD3215EVB demo board is capable of providing a constant current of 300mA or a flash current up to 800mA for the LED over this input voltage range (V_{IN}) of 3.6V to 5V.

Logic Input Settings

An internal 2-bit DAC allows LED current to be adjusted for LED brightness control. The D1 and D0 control inputs are high impedance CMOS inputs and should not be left floating. Ensure that they are always driven with valid logic levels.

Shutdown Current

The ZD3215 has a low-power shutdown mode controlled by the control pins, D0 and D1. When both control pins are held at a low logic level, the ZD3215 enters power down mode and draws only leakage current, about 1.0 μA max range, from the V_{IN} supply. All internal circuitry is disabled and V_{OUT} is disconnected from V_{IN} . This will help to prolong battery life of the power source and increase the standby time.

Output Operation Description

Adjustable Regulated Output

Regulation is provided by a feedback loop from the FB pin to the charge pump modulator, resulting in stable output voltages over the device's wide operating range. The regulated output can be adjusted with the control pins, D0 and D1. The ZD3215 integrates a digital-to-analog converter to allow dynamic, digital control of the regulated voltage. Table 1 shows the feedback Set Point Voltage as a function of D0 and D1.

D1	D0	Operation Mode	Output ($R_{SET}=0.82\Omega$)
0	0	Shutdown	0mA
0	1	Torch Application	300mA
1	0	Red-Eye Application	600mA
1	1	Flash Application	800mA

Table 1. Feedback Control Voltage Settings

Output Noise And Ripple

To maintain a constant current output, the output ripple should be kept as minimum as possible or less than 100mV after the demo circuit is powered up. A filter cap (COUT) of 10 μ F is required.

Efficiency

The efficiency of the demo circuit can be achieved at 65% for a 200mA LED current.

Short Circuit/Thermal Protection

The ZD3215 has integrated short-circuit current limiting circuitry designed to protect the device. Thermal protection circuitry has also been integrated. These protection circuits allow for robust designs during manufacturing and industrial, as well as consumer environments. The current limit is set to approximately 1A and the thermal protection will shut down the charge pump when the die temperature reaches approximately 180°C. The charge pump will be re-started when the die temperature reaches approximately 175°C. The ZD3215 will continue to cycle, without latchup or damage, until the fault is corrected.

Voltage or Current Programming of the ZD3215

The ZD3213 is configurable to regulate either voltage or current. In white LED applications, the ratio of the feedback set point and a sense resistor controls the current through the white LED, as shown in Figure 1

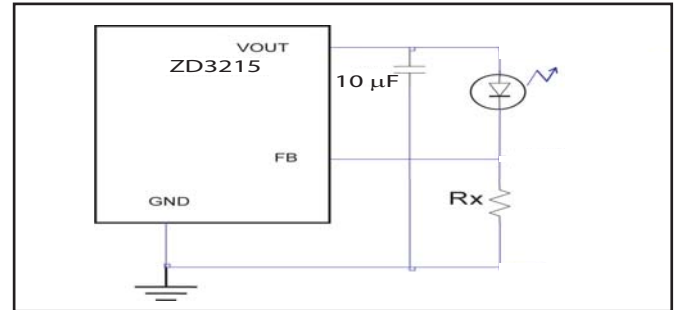


Figure 1 Current Control Mode

This configuration requires the largest amount of output capacitance to maintain stability, due to the high loop gain caused by relatively low impedance of the white LED as compared to the sense resistor.

In constant voltage applications. The output voltage is set by the ratio of two resistors and the feedback set point, as shown in Figure 2. $V_{OUT} = \text{set point voltage} * (1 + R1/R2)$. The closed-loop output resistance is impacted by the resistor ratio R1:R2, the higher the ratio, the higher the output resistance. Typically the total resistance of the voltage divider, R1:R2, will be in the range of several K Ω to 1M Ω .

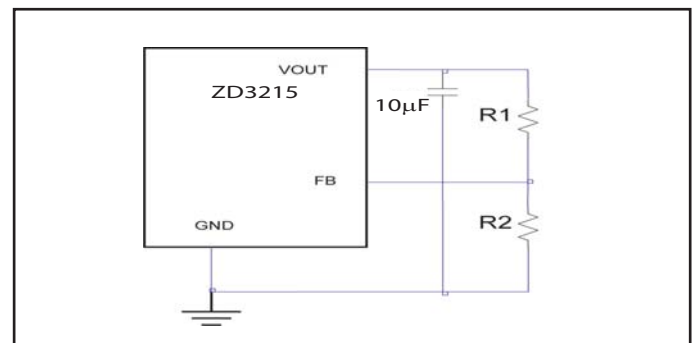


Figure 2. Voltage Control Mode

Components Selection

Capacitor Selection

The small size of ceramic capacitors makes them ideal- for ZD3215 applications. X5R and X7R types retain their capacitance over wider voltage and temperature ranges and are recommended over Y5V or Z5U types. A 10uF filtering output capacitor and a 0.22uF input capacitor are sufficient for most ZD3215 applications.

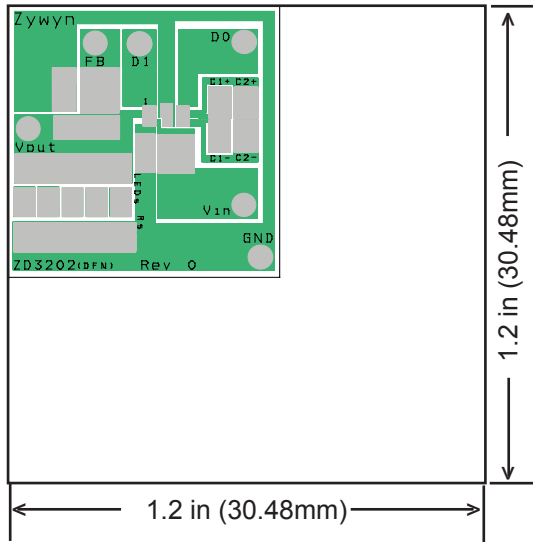
AVX	www.avxcorp.com
Kemet	www.kemet.com
Murata	www.murata.com
Taiyo Yuden	www.t-yuden.com

Table 1. Recommended Ceramic Capacitor Manufacturers

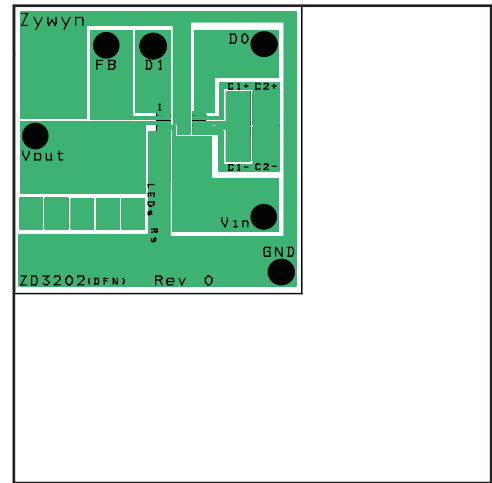
ZD3215EVB Bill Of Material (BOM) Listing

Quantity	Component	Description
1	C1	0.22 μ F
1	C2	0.22 μ F
1	CIN	10 μ F
1	COUT	10 μ F
1	FB	0.82 Ω
1	U1	ZD3215
1	VOUT	LED

PCB Demo Board Dimensions And Layout



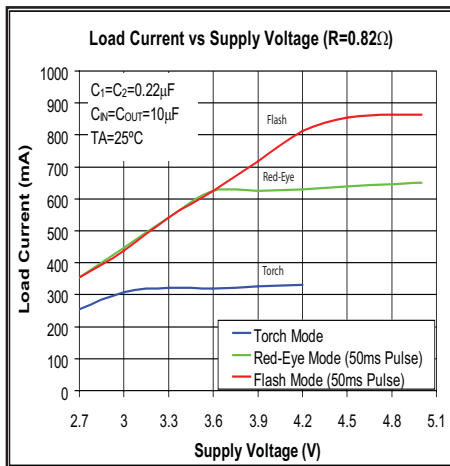
PCB Layout Component Side



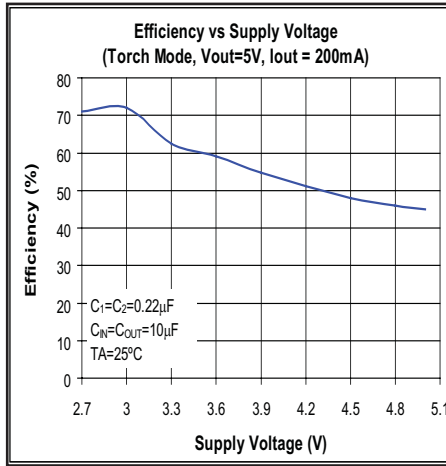
PCB Layout - Negative Side

Typical Switching Performance Characteristics

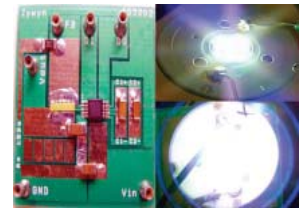
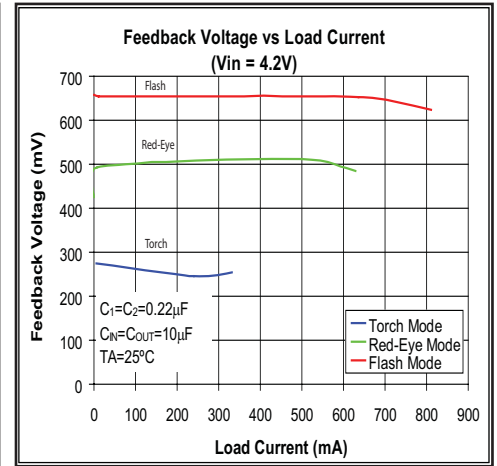
Load Current vs Supply Voltage



Efficiency vs Supply Voltage



Feedback Voltage vs Load Current



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