

FLASH LED DRIVER

January 2012

GENERAL DESCRIPTION

The IS31BL3231 is a current-regulated charge pump and ideal for powering high brightness LEDs for camera flash and torch applications. The charge pump can be set to regulate two current levels for FLASH and TORCH modes. The IS31BL3231 automatically switches between linear and boost modes ensuring that LED current does not depend on the LED forward voltage. IS31BL3231 provides low cost, space saving solution for driving LED. It also integrates thermal and short circuit protection function.

IS31BL3231 is available in DFN-10 (3mm × 3mm). It operates from 2.7V to 5.5V over the temperature range of -40°C to +85°C.

FEATURES

- Operates from 2.7V to 5.5V
- Up to 90% efficiency in Torch Mode
- Output current up to 750mA
- Adjustable output current in Flash Mode
- Minimum external components, no external inductor required
- Automatic boost mode
- Less than 1μA shutdown current
- Low ripple and EMI
- Over voltage protection on output
- Short and over temperature protections
- Available in DFN-10 (3mm × 3mm) package

APPLICATIONS

- White LED backlighting
- Cellular phones
- Generic lighting/flash/strobe applications

TYPICAL APPLICATION CIRCUIT

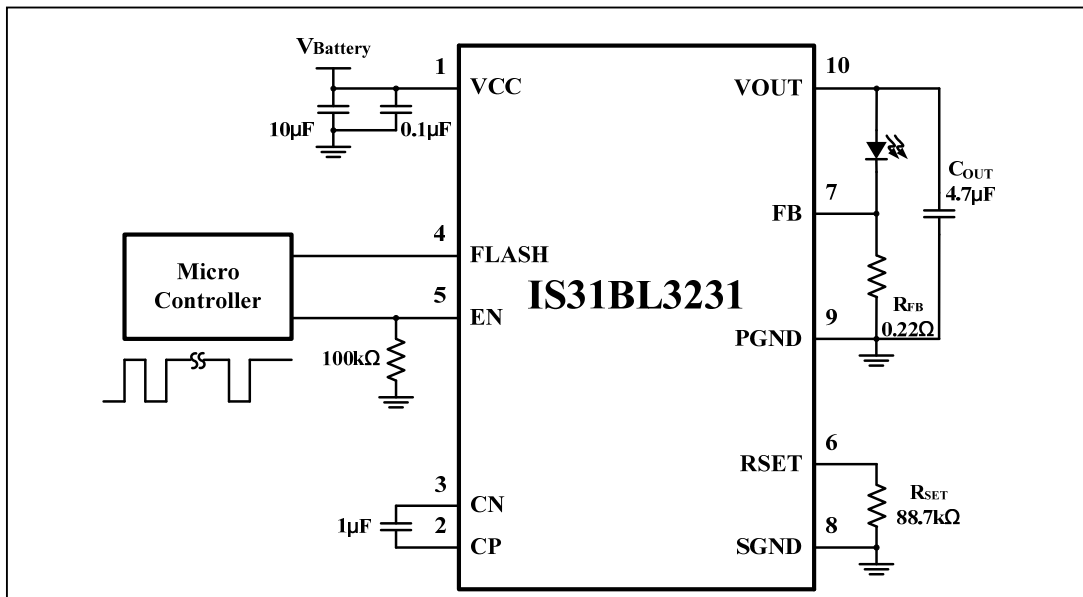


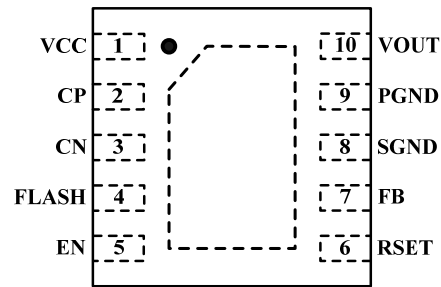
Figure 1 Typical Application Circuit

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- the risk of injury or damage has been minimized;
- the user assume all such risks; and
- potential liability of Integrated Silicon Solution, Inc is adequately protected under the circumstances

IS31BL3231

PIN CONFIGURATION

Package	Pin Configuration (Top View)
DFN-10	

PIN DESCRIPTION

No.	Pin	Description
1	VCC	Power supply.
2	CP	Positive input for external flying cap.
3	CN	Negative input for external flying cap.
4	FLASH	Input pin to toggle operation between Flash Mode and Torch Mode.
5	EN	Shutdown control input and Torch reference select pin.
6	RSET	Set the FB voltage in Flash Mode. $V_{FB} = (1.25V / R_{SET}) \times 11.2k\Omega$
7	FB	Feedback input for the current control loop. $I_{LED} = V_{FB} / R_{FB}$
8	SGND	Internal ground pin.
9	PGND	Power ground pin.
10	VOUT	Charge pump output voltage.
	Thermal Pad	Connect to GND.



IS31BL3231

ORDERING INFORMATION

Industrial Range: -40°C to +85°C

Order Part No.	Package	QTY/Reel
IS31BL3231-DLS2-TR	DFN-10, Lead-free	2500

IS31BL3231

ABSOLUTE MAXIMUM RATINGS

Supply voltage, V_{DD}	-0.3V ~ +6.0V
Voltage at EN pin	0V ~ 7V
Output current pulse (Flash Mode)	1A
Output current pulse (Torch Mode)	0.4A
Maximum junction temperature, T_{JMAX}	150°C
Storage temperature range, T_{STG}	-65°C ~ +150°C
Operating temperature range, T_A	-40°C ~ +85°C
ESD (HBM)	7kV

Note:

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC CHARACTERISTICS

$T_A = +25^\circ\text{C}$, $V_{CC} = 2.7\text{V} \sim 5.5\text{V}$, unless otherwise stated. Typical value are $T_A = +25^\circ\text{C}$, $V_{CC} = 4.2\text{V}$.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage		2.7		5.5	V
I_{CC}	Quiescent current	$V_{CC} = 4.2\text{V}$, $V_{FLASH} = 0\text{V}$		0.6		mA
I_{SD}	Shutdown current	$V_{CC} = 5.5\text{V}$, $V_{EN} = 0\text{V}$			1	μA
t_{ON}	Charge pump soft start time			550		μs
V_{FB}	FB reference voltage	$V_{FLASH} = V_{CC}$, $R_{SET} = 88.7\text{k}\Omega$		150		mV
		$V_{FLASH} = 0\text{V}$		50		
T_{OVP}	Over temperature protection			160		$^\circ\text{C}$
V_{IH}	Input logic high		1.4			V
V_{IL}	Input logic low				0.4	V
t_{LO}	EN low time	(Note 1)	0.3		75	μs
t_{HI}	EN high time	(Note 1)	0.1		75	μs
t_{OFF}	EN shutdown timeout	(Note 1)		500		μs
t_{LAT}	EN latch timeout	(Note 1)		500		μs

Note 1: Guaranteed by design.

TYPICAL PERFORMANCE CHARACTERISTICS

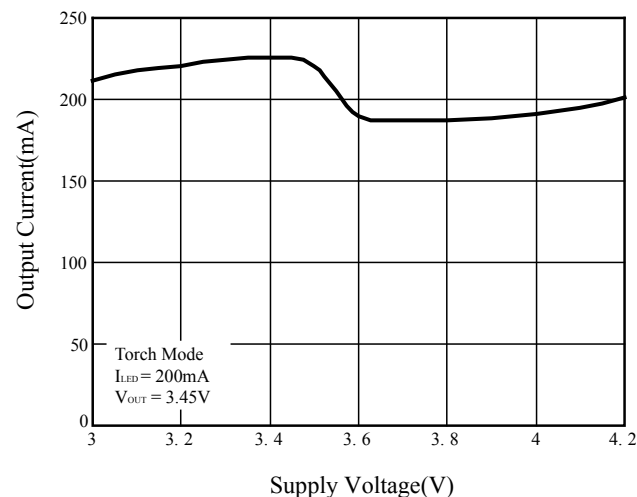


Figure 2 Supply Voltage vs. Output Current (Torch Mode)

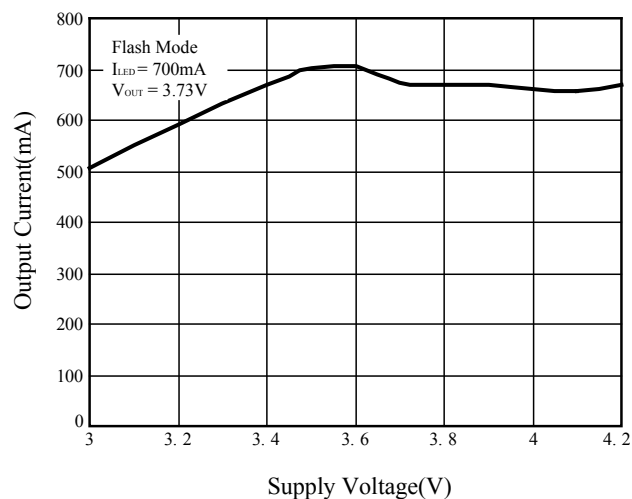


Figure 3 Supply Voltage vs. Output Current (Flash Mode)

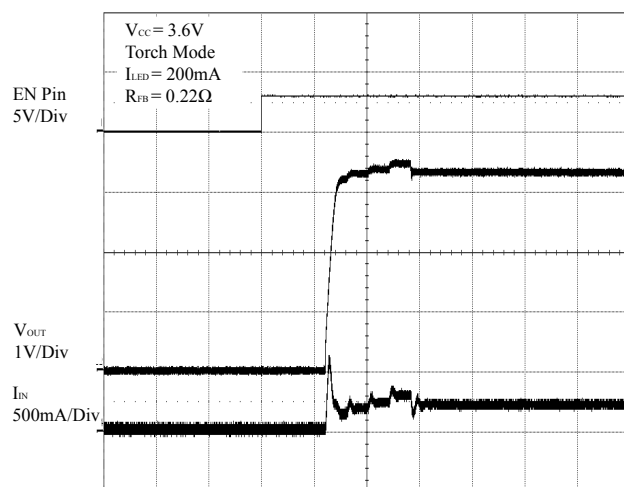


Figure 4 EN On (Torch Mode)

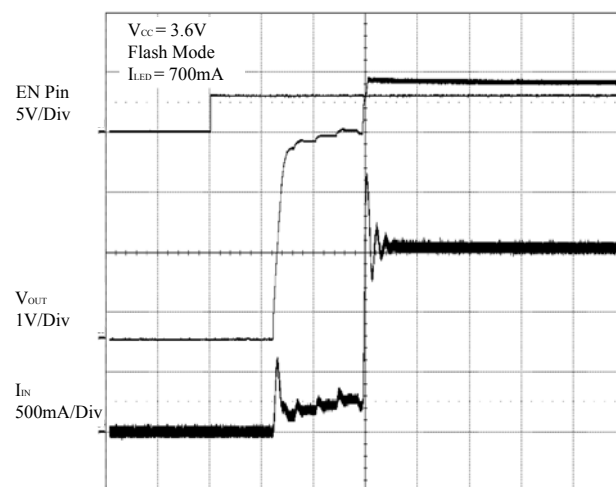


Figure 5 EN On (Flash Mode)

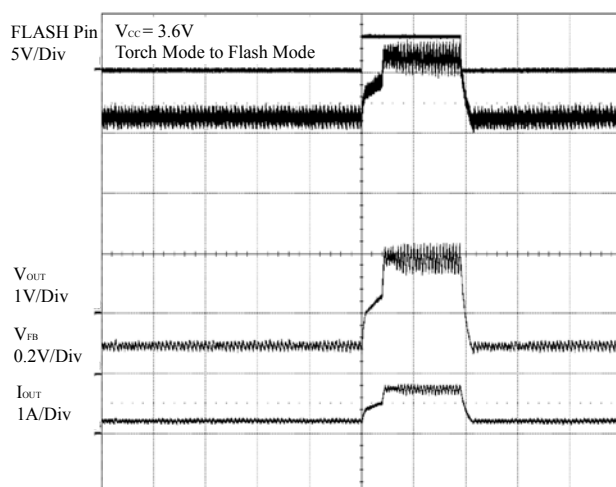


Figure 6 Torch Mode to Flash Mode

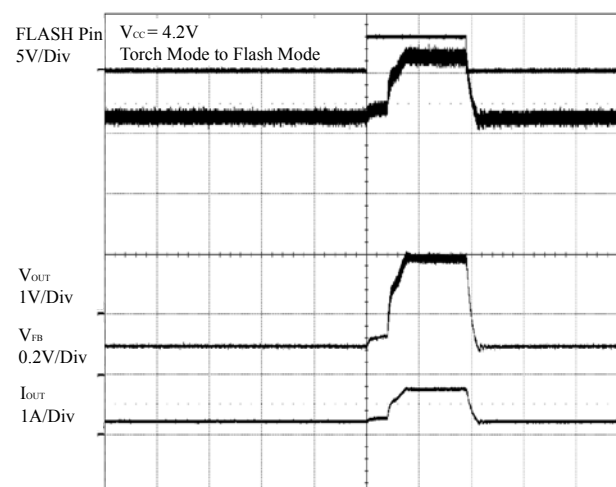


Figure 7 Torch Mode to Flash Mode

IS31BL3231

APPLICATION INFORMATION

GENERAL DESCRIPTION

The IS31BL3231 is a current-regulated charge pump and ideal for powering high brightness LEDs for camera flash and torch applications.

CHARGE PUMP

The charge pump converter boosts input supply voltage (V_{CC}) up to a higher output voltage (V_{OUT}) to drive LED.

The charge pump converter only requires three external components: supply decoupling capacitor, output bypass capacitor and flying capacitor.

Choose low ESR capacitors to ensure the best operating performance and place the capacitors as close as possible to the IS31BL3231.

The charge pump will start up automatically to offer a higher output voltage when V_{FB} is lower than the setting value.

CURRENT SETTING

The LED current is set by the external resistor, R_{FB} , following the Equation (1) below.

$$I_{LED} = V_{FB} / R_{FB} \quad (1)$$

V_{FB} is calculated by the Equation (2) when IS31BL3231 operates in the Flash Mode. V_{FB} is set in the Table 1 when IS31BL3231 operates in the Torch Mode.

OPERATING MODE

FLASH MODE

By pulling the FLASH pin to high, IS31BL3231 operates in the Flash Mode. V_{FB} is set by the R_{SET} .

$$V_{FB} = (1.25V / R_{SET}) \times 11.2k\Omega \quad (2)$$

For example, in Figure 1,

$R_{FB} = 0.22\Omega$, $R_{SET} = 88.7k\Omega$,

So, $V_{FB} = (1.25V / 88.7k\Omega) \times 11.2k\Omega \approx 158mV$

$$I_{LED} = 158mV / 0.22\Omega \approx 718mA$$

TORCH MODE

By pulling the FLASH pin to low, IS31BL3231 operates in the Torch Mode. The V_{FB} is controlled by Pulse Count Control (PCC wire) serial interface. The interface records rising edges of the EN pin and decodes them into 8 different states. The 8 voltage level settings available are indicated in Table 1.

Table 1 V_{FB} Control ($R_{FB} = 0.22\Omega$)

Pulse	V_{FB} (Typ.)	I_{LED} (Typ.)
1	50mV	227mA
2	60mV	273mA
3	70mV	318mA
4	85mV	386mA
5	100mV	455mA
6	120mV	545mA
7	140mV	636mA
≥ 8	170mV	773mA

TIMING CONTROL

The EN pin should be configured as the Figure 8. t_{LAT} is the latch time. High level should be at least t_{LAT} to active the pulse signal. t_{OFF} is the shutdown time. EN pin is pulled low at last t_{OFF} the IC will be shutdown.

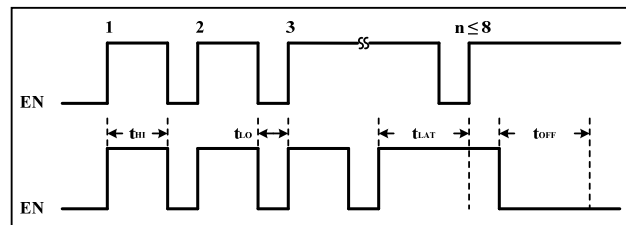


Figure 8 EN pin timing

THERMAL PROTECTION

The IS31BL3231 has a thermal protection circuit that will shut down the chip if the die temperature rises above the thermal limit until the temperature falls down.

IS31BL3231

CLASSIFICATION REFLOW PROFILES

Profile Feature	Pb-Free Assembly
Preheat & Soak Temperature min (T _{smin}) Temperature max (T _{smax}) Time (T _{smin} to T _{smax}) (t _s)	150°C 200°C 60-120 seconds
Average ramp-up rate (T _{smax} to T _p)	3°C/second max.
Liquidous temperature (T _L) Time at liquidous (t _L)	217°C 60-150 seconds
Peak package body temperature (T _p)*	Max 260°C
Time (t _p)** within 5°C of the specified classification temperature (T _c)	Max 30 seconds
Average ramp-down rate (T _p to T _{smax})	6°C/second max.
Time 25°C to peak temperature	8 minutes max.

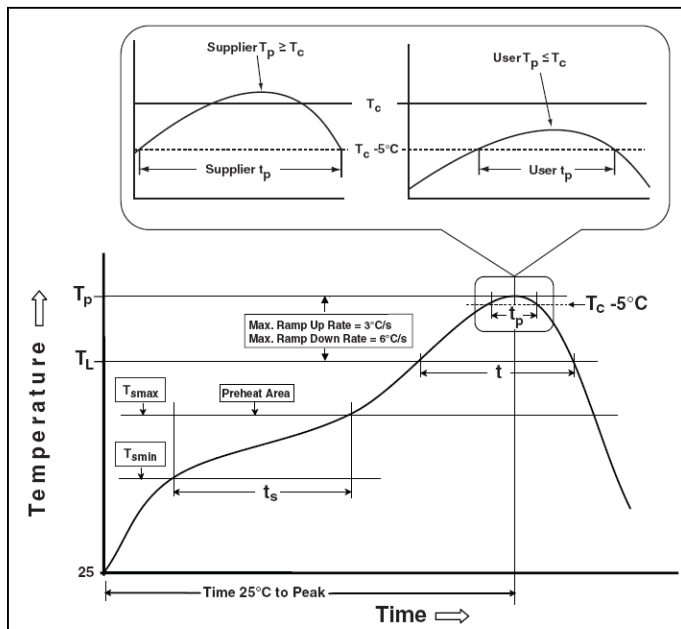
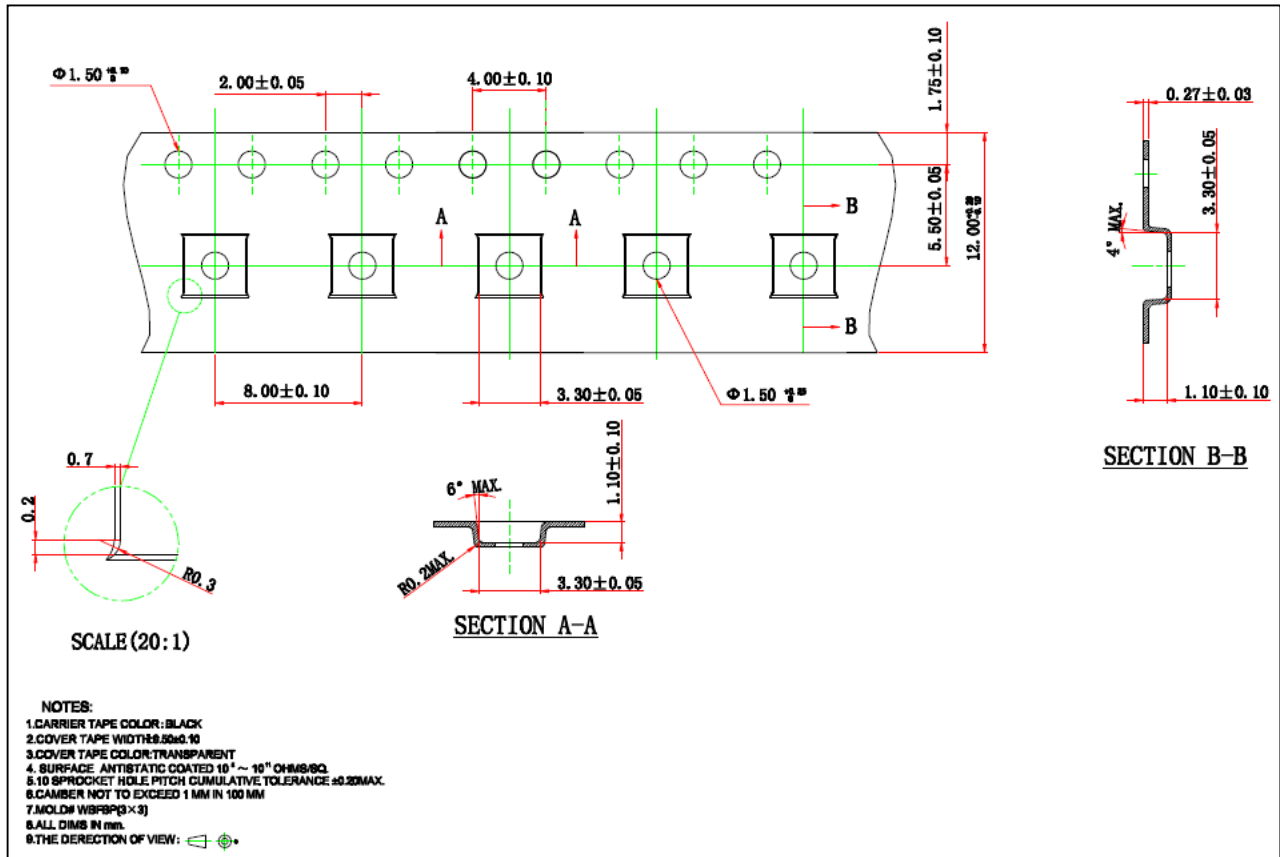


Figure 9 Classification Profile

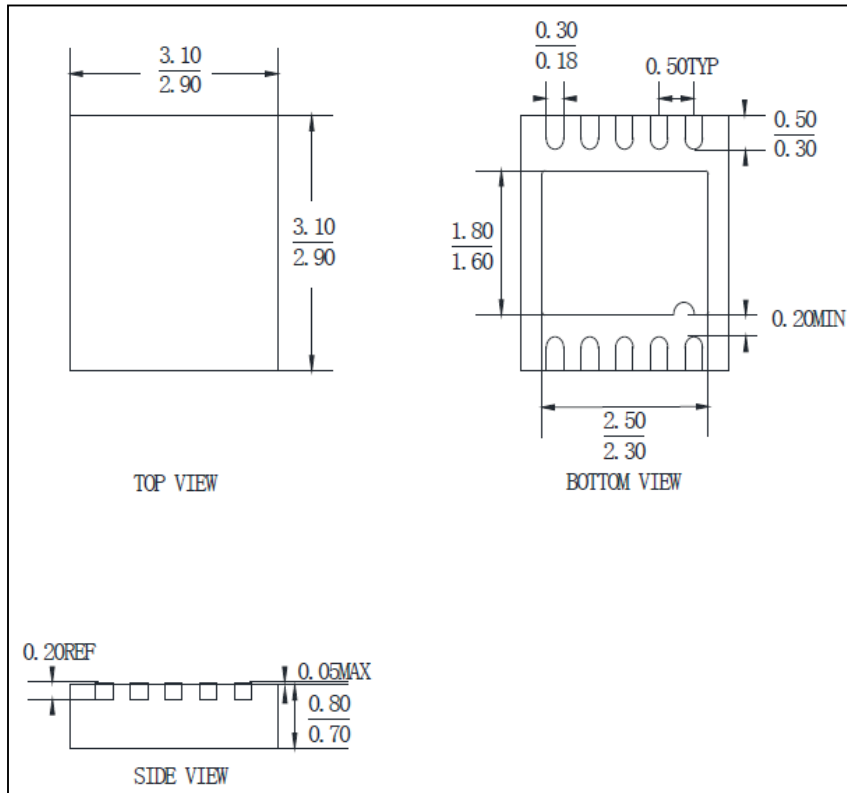
TAPE AND REEL INFORMATION



IS31BL3231

PACKAGE INFORMATION

DFN-10



Note: All dimensions in millimeters unless otherwise stated.