GENERAL DESCRIPTION

The PJ 5121 is a step-up DC/DC converter designed for driving up to 8 white LEDs in series from a single cell Lithium Ion battery with constant current. Because it directly regulates output current, the PJ5121 is i deal for driving light emitting diodes (LEDs) whose light intensity is proportional to the current passing through them, not the voltage across their terminals. A single external resistor sets LED current between 5mA and 20mA, which can then be easily adjusted using either a DC voltage or a pulse width modulated (PWM) signal. Its low 225mV feedback voltage reduces power loss and improves efficiency. The OV pin monitors the output voltage and turns off the converter if an over-voltage condition is present due to an open circuit condition. The PJ5121 is available in SOT23-6 and QFN8 packages.

FEATURES

- Drives Up to 5 Series White LEDs from 2.5V
- Drives Up to 6 Series White LEDs from 3.6V
- Up to 87% Efficiency
- 1.2MHz Fixed Switching Frequency
- Low 225mV Feedback Voltage
- Open Load Shutdown
- Soft Start/PWM Dimming
- SOT23-6 and QFN-8 Packages

APPLICATIONS

- Cell Phones
- Handheld Computers and PDAs
- Digital Cameras
- Small LCD Displays

TYPICAL APPLICATIONS

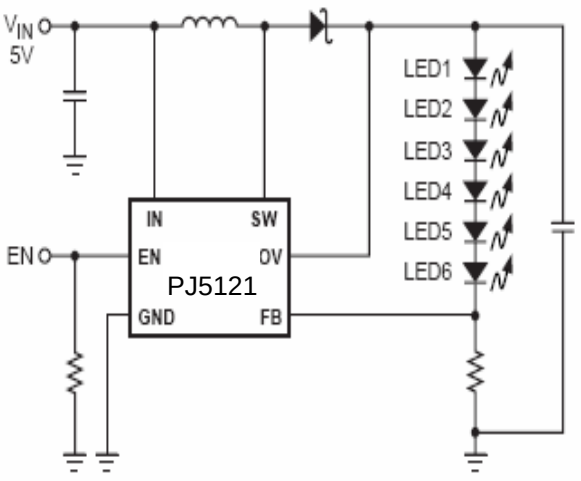


Figure 1. Li-Ion Driver for Six White LEDs

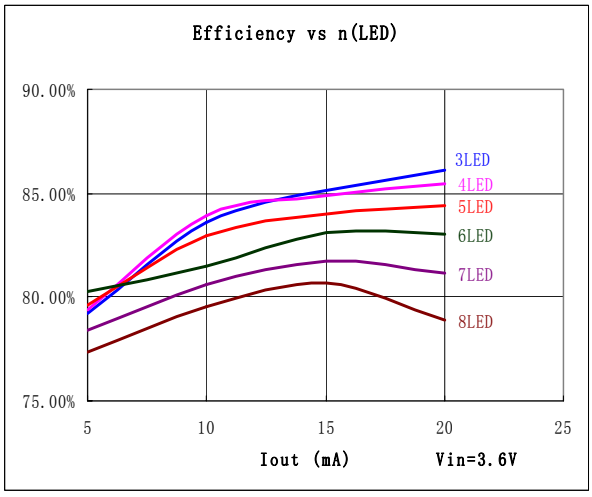


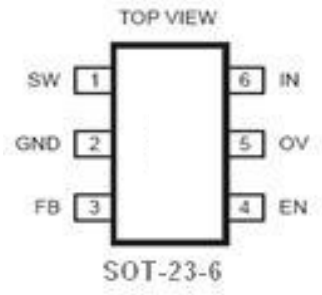
Figure 2. Efficiency vs Number of LEDs

ORDERING INFORMATION

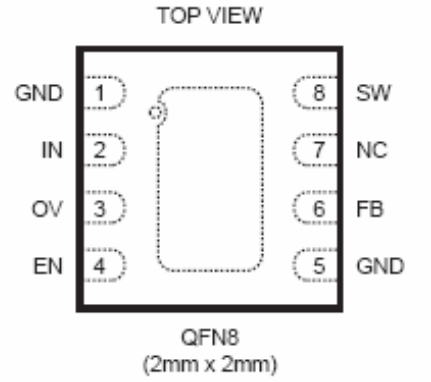
PJ5121APPP

- Package Type
  - MR: SOT-23-6
  - QFN: QFN-8 2x2
- E: Pb Free Package

PACKAGES



Note: Pin 1 at the bottom-left corner of the digit "4"



PIN DESCRIPTION

SOT Pin No.	QFN Pin No.	Pin Names	Description
1	8	SW	Power Switch Output. Connect the inductor and the blocking Schottky diode to SW.
2	1,5	GND	Ground
3	6	FB	Feedback input pin. The reference voltage at this pin is 225mV. Connect the cathode of the lowest LED to FB and a current sense resistor between FB and GND.
4	4	EN	Enable pin. A high input at EN enables the device and a low input disables the devices. When not used, connect EN to the input source for automatic startup.
5	3	OV	Over Voltage Input. OV measures the output voltage for open circuit protection. Connect OV to the output at the top of the LED string.
6	2	IN	Input Supply Pin. Must be locally bypassed.
	7	NC	Not Connected

ABSOLUTE MAXIMUM RATINGS (Note 1)

SYMBOL	ITEMS	VALUE	UNIT
V_{IN}	Input Voltage	-0.3～6	V
V_{SW}	Voltage at SW Pin	-0.5～25	V
V_{IO}	All Other I/O Pins	GND-0.3 to VDD+0.3	V
P_{TR1}	Thermal Resistance，SOT-23-6 Θ_{JA} Θ_{JC}	 220 110	℃/W
P_{TR2}	Thermal Resistance，QFN-8 (2mm x 2mm) Θ_{JA} Θ_{JC}	 80 16	℃/W
Tstg	Storage Temperature	-55 to 150	℃
Tsolder	Package Lead Soldering Temperature	260℃, 10s	

RECOMMANDED OPERATING RANGE (Note 2)

SYMBOL	ITEMS	VALUE	UNIT
V_{IN}	V_{IN} Supply Voltage	2.5 to +6	V
V_{SW}	Output Voltage	V_{IN} to 28	V
T_{OPT}	Operating Temperature	-40 to +85	℃

ELECTRICAL CHARACTERISTICS

V_{IN}=V_{EN}=3V, Topt=25℃ unless specified otherwise.

SYMBOL	ITEMS	CONDITIONS	Min.	Typ.	Max.	UNIT
V_{IN}	Input Voltage		2.5		6	V
Feedback						
V_{FB}	FB Pin Voltage	Driving 4xLED @15mA	200	225	250	mV
Ibias	FB Pin Input Bias Current			0.05	1	μA
Operating Current						
Ioff	Operating Current（Shutdown）	V_{SW-ON} =0V		0.1	1	μA
Isby	Operating Current（Quiescent）	V_{FB}=0.3V		100	350	μA
Fsw	Switching Frequency		1.0	1.25	1.5	MHz
Dmax	Maximum Duty Cycle	V_{FB}=0V	85	90		%
Chip Enable						
V_{EN_H}	EN Minimum High Level		1.5			V
V_{EN_L}	EN Maximum Low Level				0.4	V
V_{HYS}	EN Hysteresis			90		mV
	EN Input Bias Current	V_{SW-ON} =0V, 5V			1	μA

ELECTRICAL CHARACTERISTICS(contd.)

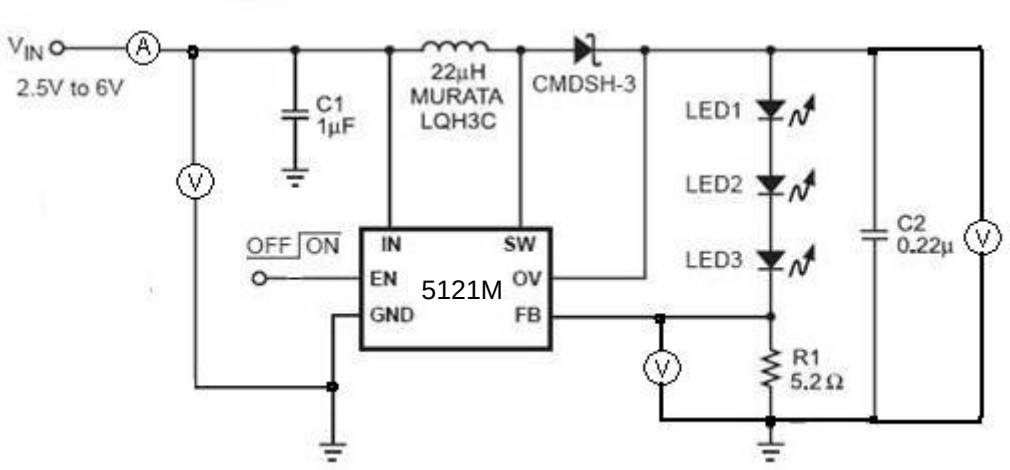
V_{IN}=V_{EN}=3V, Topt=25℃ unless specified otherwise.

SYMBOL	ITEMS	CONDITIONS	Min.	Typ.	Max.	UNIT
Output Switch						
R_{ON}	SW On Resistance (Note 3)			0.5		Ω
I_{LIMIT}	SW Current Limit			400		mA
I_{LEAK}	SW Leakage Current	Vsw＝5V		0.01	1	μA
Open Circuit Protection						
V_{OV}	Open Circuit Shutdown Threshold	V_{OV} Rising		30		V
Soft Start						
tss	Soft Start Time (Note 3)	V_{IN} Power On		160		μS

Notes:

1. Exceeding these ratings may damage the device
2. The device is not guaranteed to function outside of its operating rating.
3. Guaranteed by design.

TESTING CIRCUIT



TYPICAL PERFORMANCE CHARACTERISTICS

1. Driving Capability

Vin	I_{LED}=15mA	I_{LED}=20mA
2.5V	5 x LED	4 x LED
3.0V	6 x LED	5 x LED
3.6V	8 x LED	8 x LED

2.Efficiency

Figure 3. Efficiency vs Vin and I_{LED}

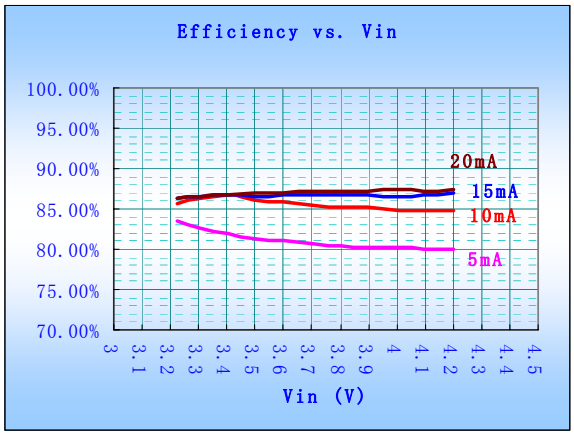
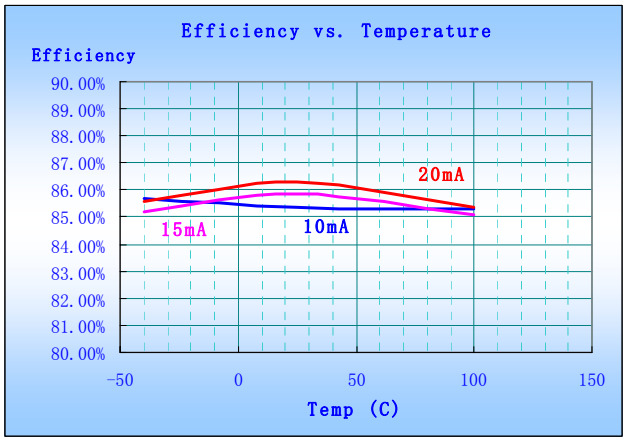
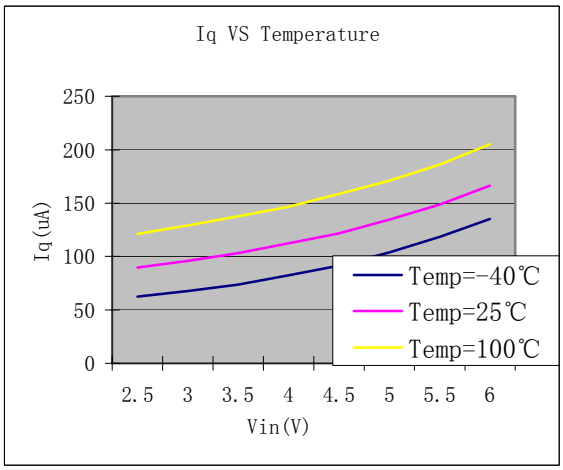


Figure 4. Efficiency vs Temperature



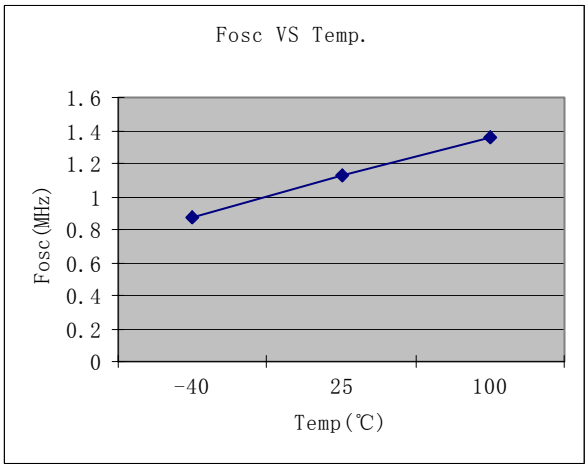
3. Quiescent Current vs VIN and Temperature

Figure 5. Iq vs. Temperature



4.Switching Frequency vs Temperature

Figure 6. Fosc vs. Temperature



OPERATION

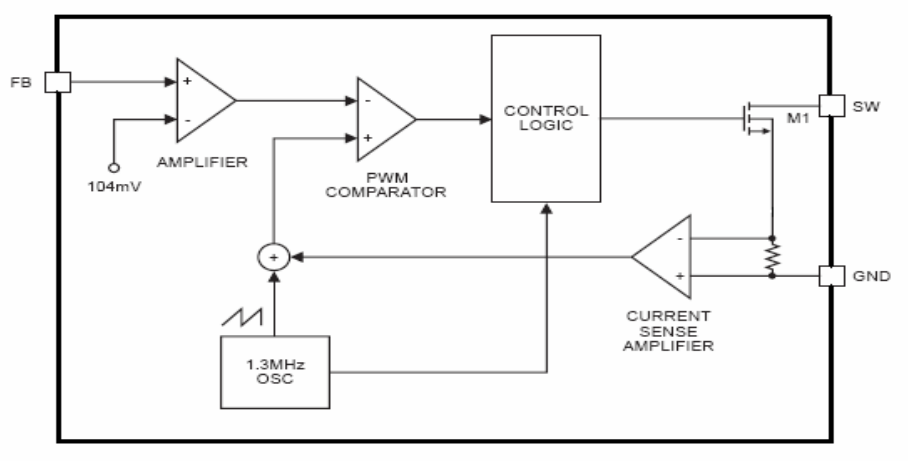


Figure 7. Simplified Block Diagram of the PJ5121

The PJ5121 uses a constant frequency, peak current mode boost regulator architecture to regulate the series string of white LEDs. The operation of the PJ5121 can be understood by referring to the simplified block diagram shown above in Figure 7. At the start of each oscillator cycle, the control logic turns on the power switch M1. The signal at the non-inverting input of the PWM comparator is proportional to the switch current, summed together with a portion of the oscillator ramp. When this signal reaches the level set by the output of error amplifier, the PWM comparator resets the latch in the control logic and turns off the power switch. In this manner, error amplifier sets the correct peak current level to keep the LED current in regulation. If the feedback voltage starts to drop, the output of the error amplifier increases. This results in more current to flow through M1, hence increasing the power delivered to the output.

APPLICATION INFORMATION

■ Inductor Selections

For most of the applications of the PJ5121, it is recommended to use an inductor of 22uH. Although small size is one of the major factors in selecting an inductor, the smaller and thinner inductors give higher core losses at 1.25MHz and DRC, resulting in lower efficiencies. The following table provides a list of recommended inductors:

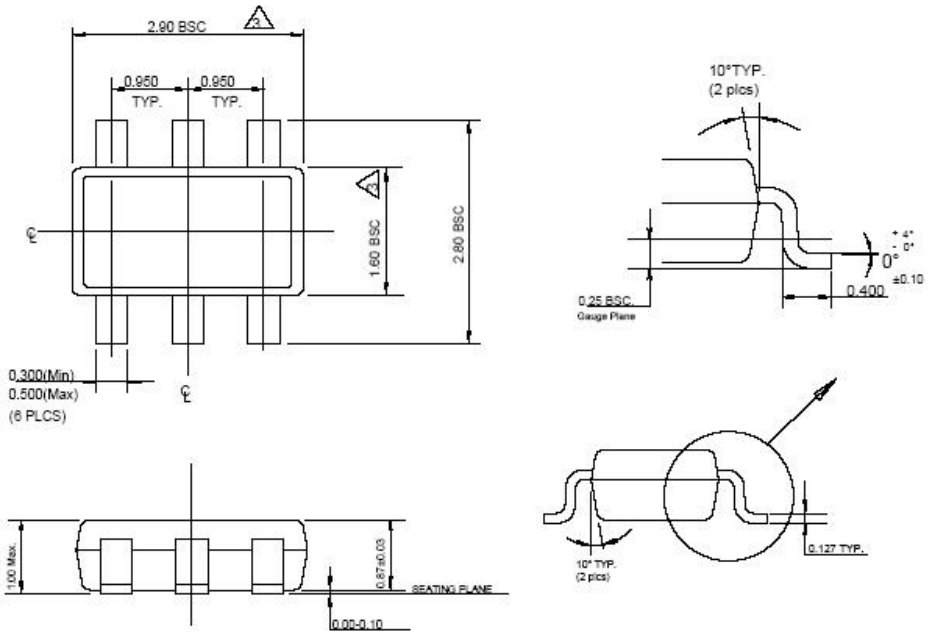
PART NUMBER	DCR (Ω)	CURRENT RATING (mA)	MANUFACTURER
LQH3C220	0.71	250	MURATA
CDRH3D16-220	0.53	350	SUMIDA
LB2012B220M	1.7	75	TAIYO YUDEN
LEM2520-220	5.5	125	TAIYO YUDEN
EJPC220KF	4.0	160	PANASONIC

■ Capacitor Selection

The small size of ceramic capacitors makes them ideal for PJ5121 applications. X5R and X7R types are recommended because they retain their capacitance over wider voltage and temperature ranges than other types such as Y5V or Z5U. A 1μF input capacitor and a 0.22 μF output capacitor are sufficient for most PJ5121 applications.

PACKAGE INFORMATION

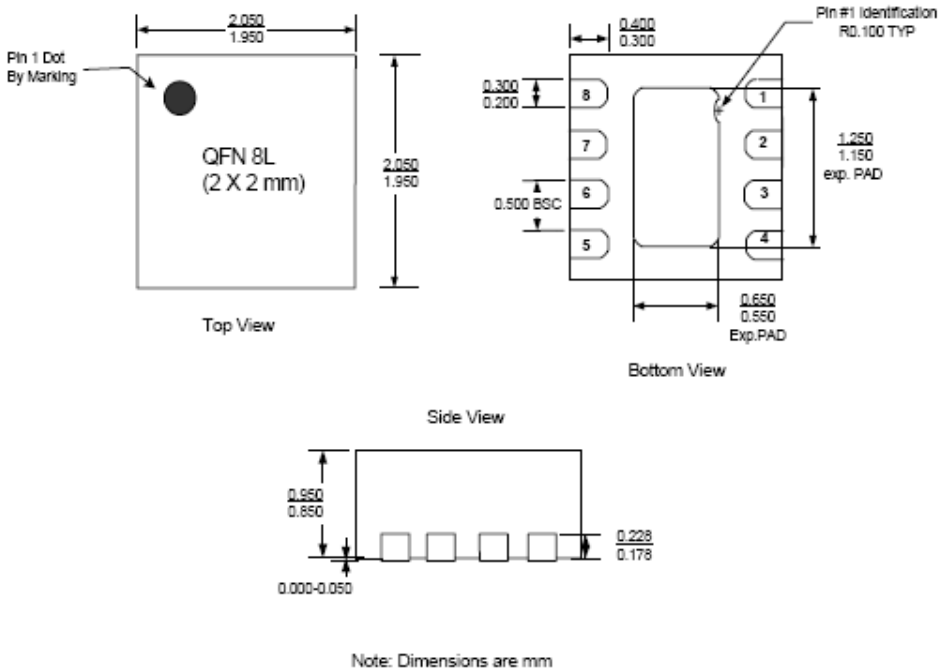
1. SOT-23-6



NOTE:

1. Dimensions and tolerances are as per ANSI Y14.5M, 1994.
2. Die is facing up for mold. Die is facing down for trim/form, ie. reverse trim/form.
3. Dimensions are exclusive of mold flash and gate burr.
4. The footlength measuring is based on the gauge plane method.
5. All specification comply to Jedec Spec MO193 Issue C.

2. QFN8 2x2



Note: Dimensions are mm

www.s-manuals.com