G5126

High Efficiency, Constant Current, Boost DC/DC White-LEDs Drive

Features

- **Operating Voltage：2.7V to 5.5V**
- **High Operating Frequency：1MHz**
- **High Output Voltage：28V**
- **Shutdown Current：<1μA**
- **Over-Voltage Protection**
- **Digital Dimming Control**
- **Built-in Cycle-by-Cycle Current-Limiting**
- **Soft-Start Function**
- **0.2V Low Reference Voltage**
- **SOT-23-6 & TDFN2X2-8 Package**

General Description

The G5126 boost converter contains a 0.7Ω internal switch. The IC operates at constant frequency 1MHz, allowing the use of tiny, low cost and low height inductors and capacitors. The IC operates from a 2.7V to 5.5V supply voltage. High inrush current at start-up is eliminated using the soft-start function. Constant frequency current mode PWM architecture results in low, predictable output noise. The G5126 includes cycle-by-cycle 850mA current limiting to maximum inductor current and over-temperature protection circuit. The over-voltage protection will be enabled when VOUT exceeds 28V. The current of LED is set by a resistor connected between FB and GND. The G5126 is available in SOT-23-6 & TDFN2X2-8 package.

Applications

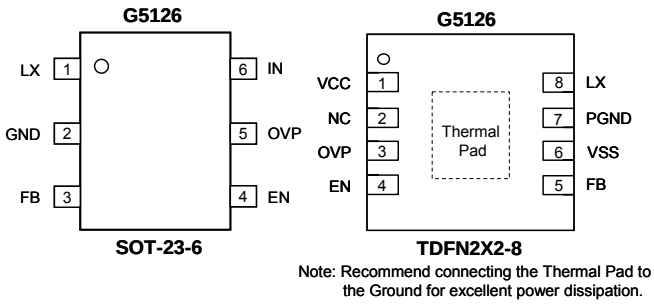
- **LED Module**
- **Compact Back Light Module**
- **Constant Current Source**

Ordering Information

ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G5126TB1U	5126x	-40°C to 85°C	SOT-23-6
G5126RC1U	5126	-40°C to 85°C	TDFN2X2-8

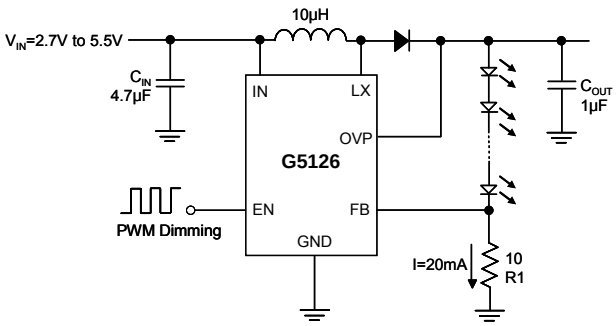
Note: TB: SOT-23-6 RC: TDFN2X2-8
1 : Bonding Code
U: Tape & Reel

Pin Configuration



Note: Recommend connecting the Thermal Pad to the Ground for excellent power dissipation.

Typical Application Circuit



Absolute Maximum Ratings

IN to GND. . . . . .-0.3V to 7V
LX, OVP to GND. . . . . -0.3V to 35V
EN to GND. . . . . -0.3V to VIN
FB to GND. . . . . -0.3V to VIN
Thermal Resistance Junction to Ambient, (θ_{JA})*
SOT-23-6 . . . . . 240°C/W
TDFN2X2-8 . . . . . 225°C/W

Continuous Power Dissipation (T_A = +25°C)*
SOT-23-6 . . . . . 400mW
TDFN2X2-8 .. . . . . 400mW
Operating Temperature Range[1] . .. . . -40°C to +85°C
Junction Temperature . . . . . +150°C
Storage Temperature . . . . . -65°C to +150°C
Reflow Temperature (soldering, 10sec) . . . . . .260°C

Note:
1. It is guaranteed to meet performance specifications from 0°C to 85°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with statistical process controls.

* Please refer to Minimum Footprint PCB Layout Section.

Electrical Characteristics

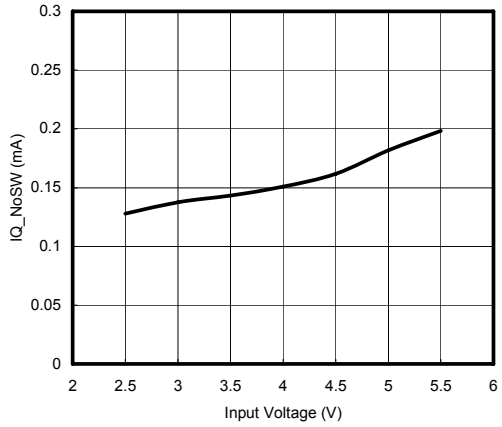
V_{IN}=V_{EN}=3.6V, T_A = 25°C.

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
Operating Input Voltage			2.7	---	5.5	V
Over-voltage Threshold			---	28	---	V
Over-voltage Hysteresis			---	2	---	V
Quiescent Current		No Switching	---	0.2	0.3	mA
Shutdown Supply Current		EN=0V	---	0	1	μA
EN Input Level	V_{IH}		1.5	---	---	V
	V_{IL}		---	---	0.8	V
$UVLO_{RISING}$			2	2.25	2.5	V
Oscillator Frequency			---	1	---	MHz
Maximum Duty Cycle			---	90	---	%
Feedback Regulation Voltage			0.19	0.2	0.21	V
NMOS R_{DS-ON}		I_{LX}=200mA	---	700	---	mΩ
LX Leakage Current		EN=0, V_{LX}=35V	---	---	10	μA
Switching Current Limit		V_{IN}=3.0V,duty cycle=80%	500	850	1300	mA
Over Temperature		Trigger	---	120	---	°C
		Hysteresis	---	20	---	°C
Soft Start			---	0.5	---	ms

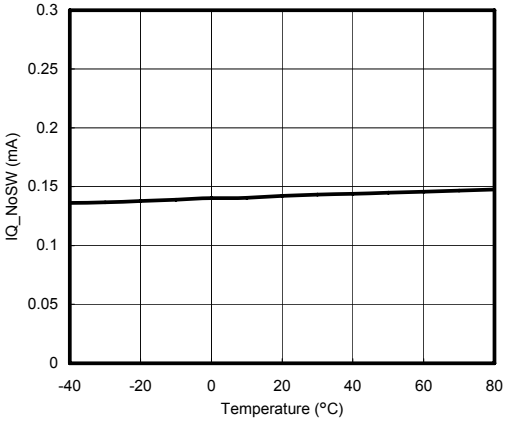
Typical Performance Characteristics

(V_{CC}= +3.6V, V_{EN}= +3.6V, L=10μH, T_A=25°C, unless otherwise noted.)

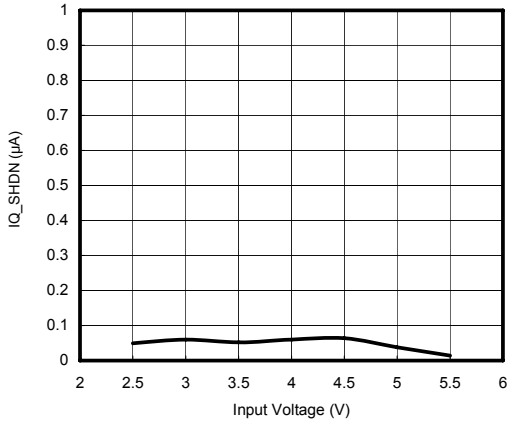
IQ_NoSW vs. Input Voltage



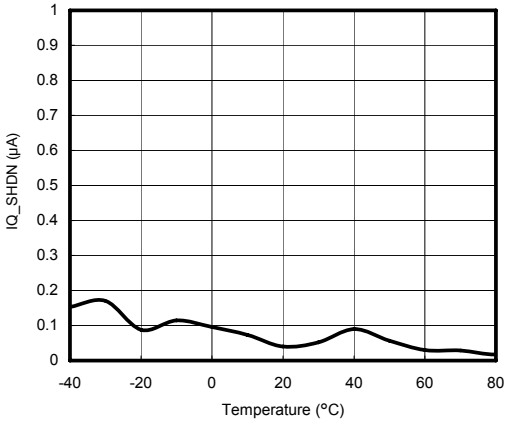
IQ_NoSW vs. Temperature



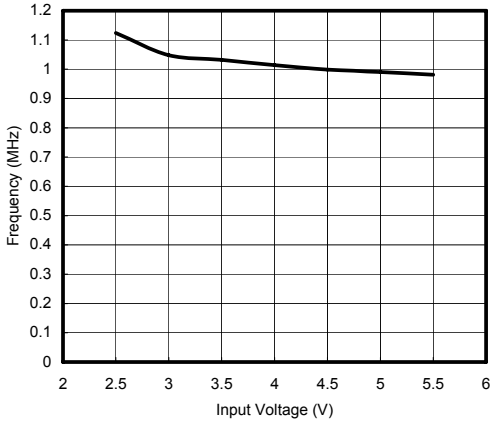
IQ_SHDN vs. Input Voltage



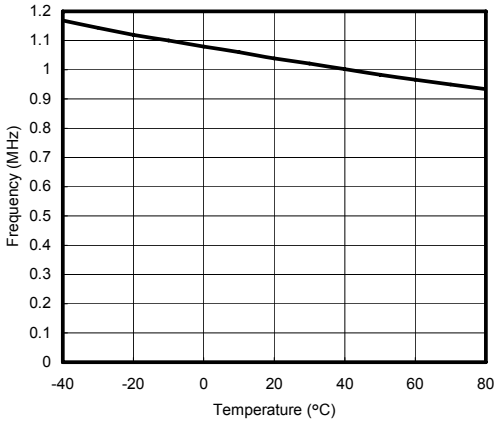
IQ_SHDN vs. Temperature



Frequency vs. Input Voltage

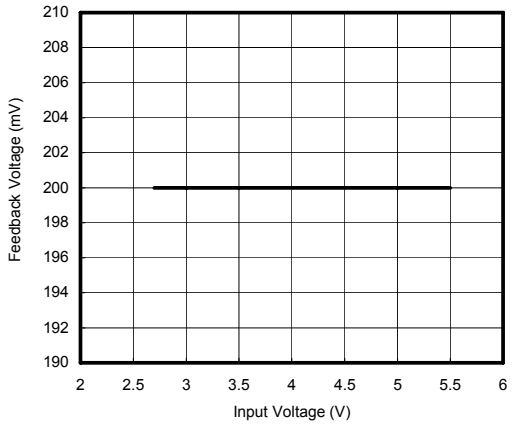


Frequency vs. Temperature

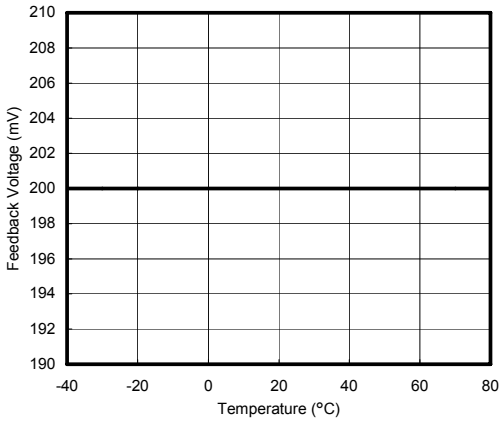


Typical Performance Characteristics (Continued)

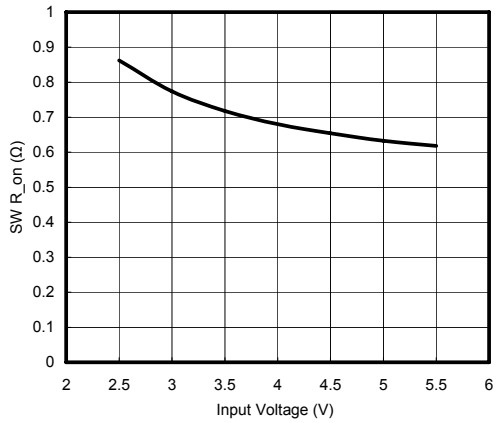
Feedback Voltage vs. Input Voltage



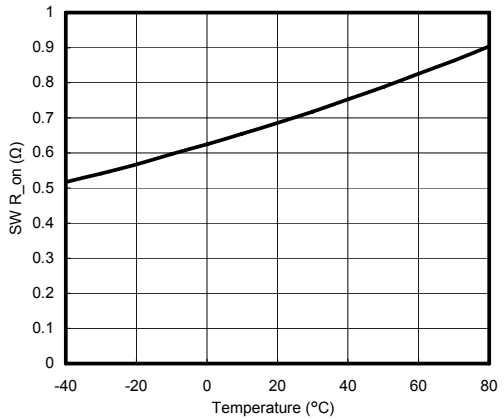
Feedback Voltage vs. Temperature



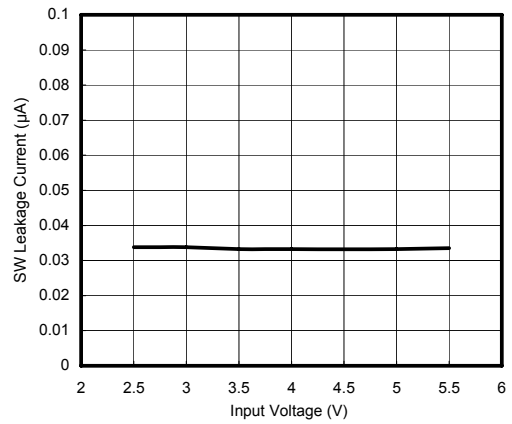
SW R_on vs. Input Voltage



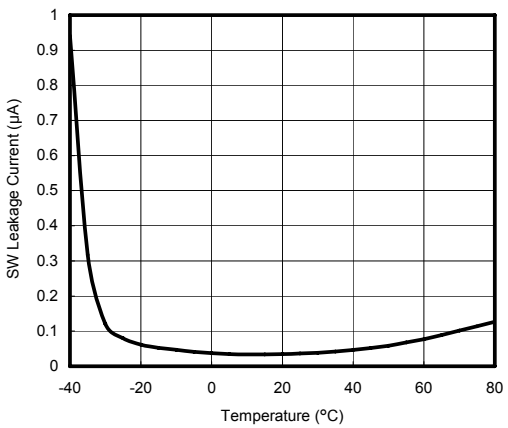
SW R_on vs. Temperature



SW Leakage Current vs. Input Voltage

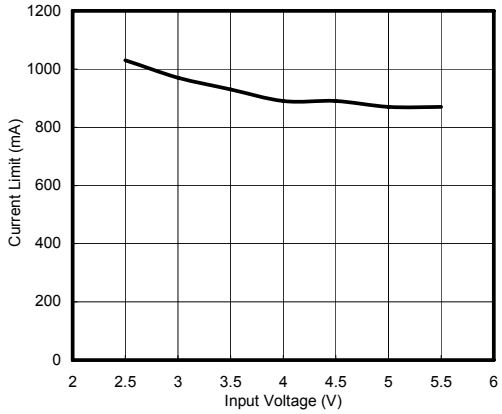


SW Leakage Current vs. Temperature

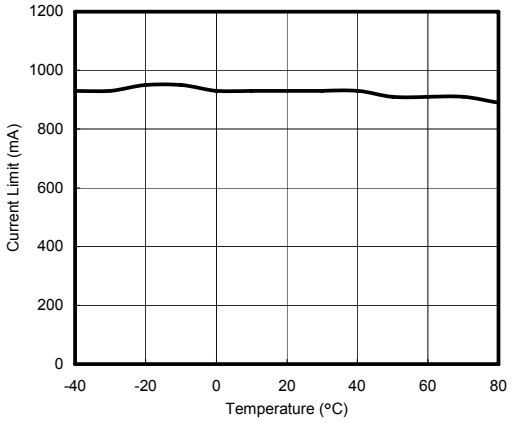


Typical Performance Characteristics (Continued)

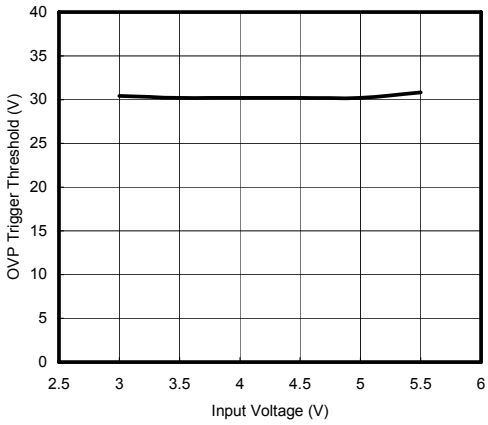
Current Limit vs. Input Voltage



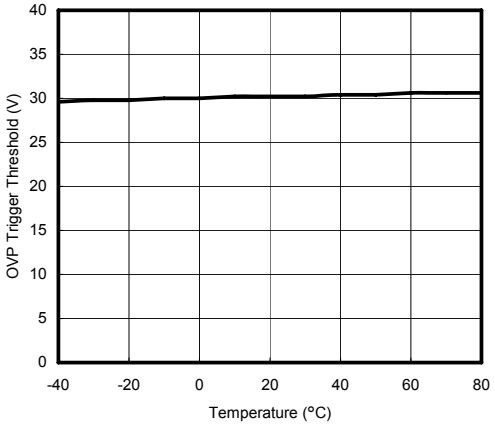
Current Limit vs. Temperature



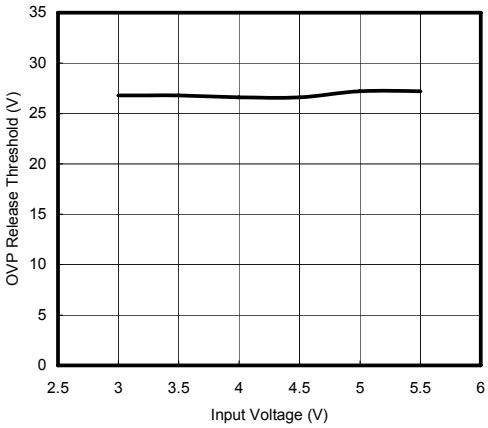
OVP Trigger Threshold vs. Input Voltage



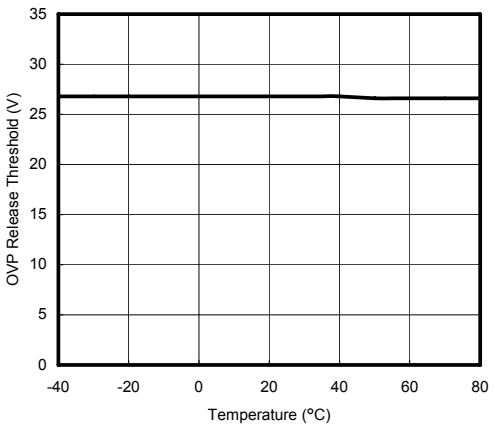
OVP Trigger Threshold vs. Temperature



OVP Release Threshold vs. Input Voltage

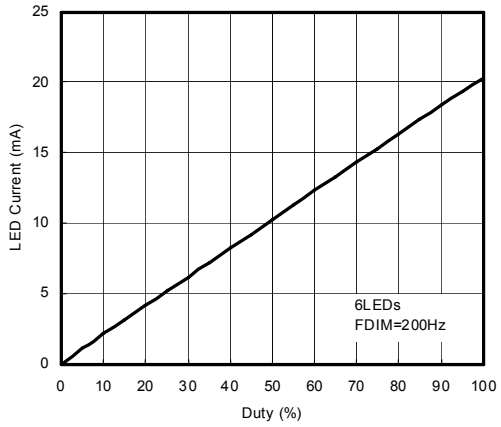


OVP Release Threshold vs. Temperature

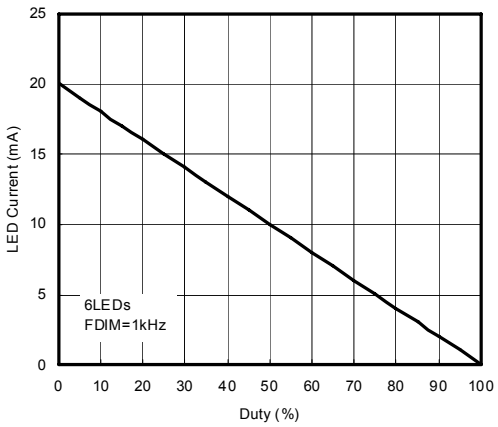


Typical Performance Characteristics (Continued)

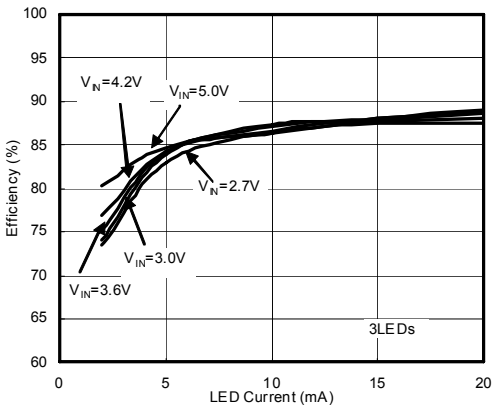
LED Current vs. Duty (EN Dimming)



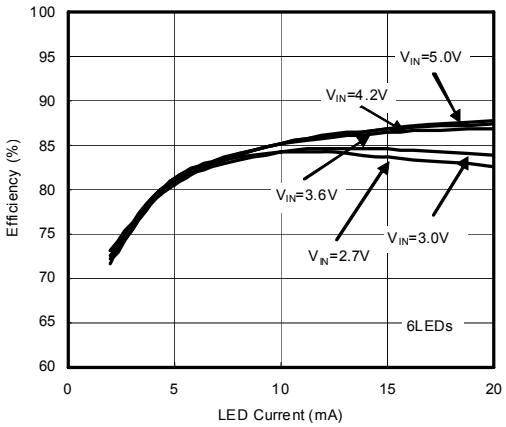
LED Current vs. Duty (PWMN Dimming)



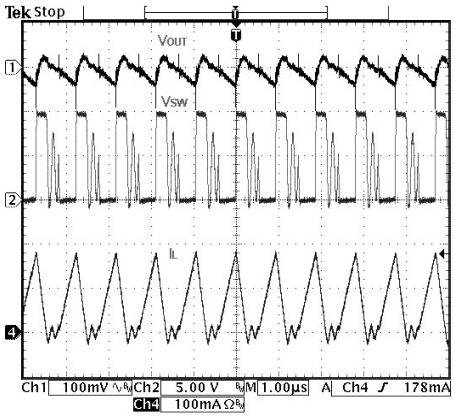
Efficiency vs. LED Current



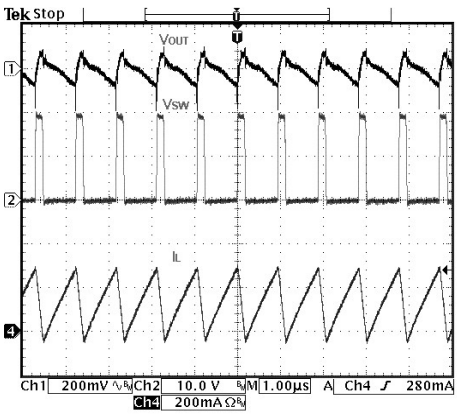
Efficiency vs. LED Current



Stability Waveform 3LEDs

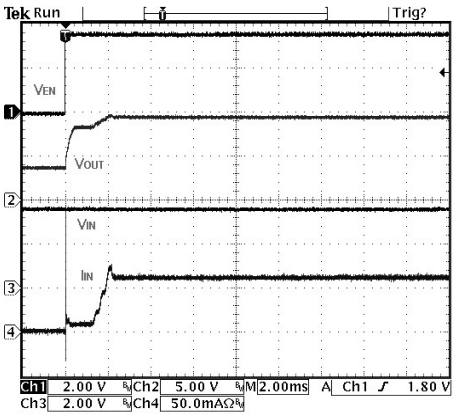


Stability Waveform 6LEDs

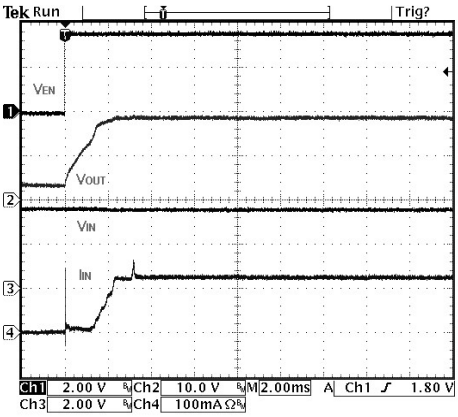


Typical Performance Characteristics (Continued)

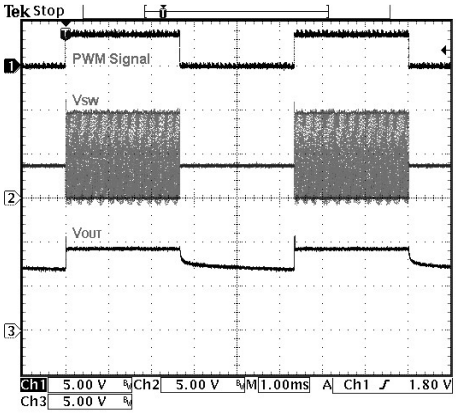
Inrush Current Waveform 3LEDs



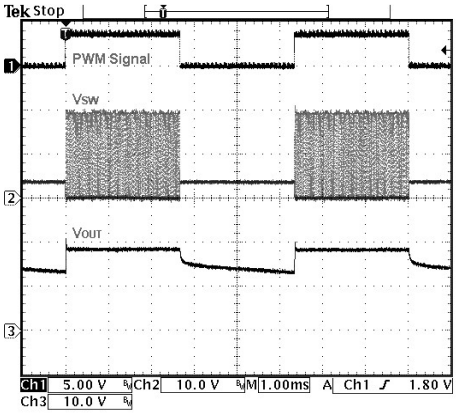
Inrush Current Waveform 6LEDs



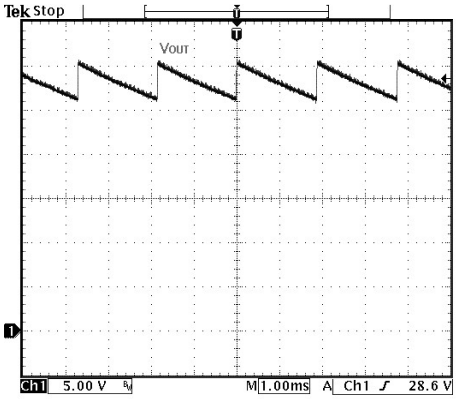
EN Dimming Control Waveform 3LEDs



EN Dimming Control Waveform 6LEDs

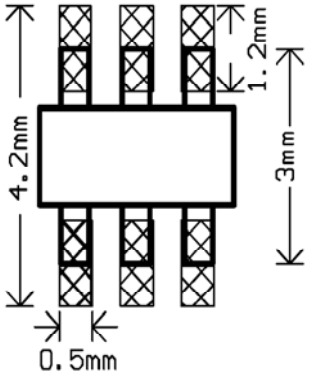


OVP Waveform

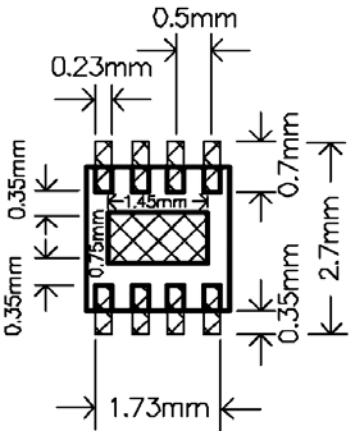


Minimum Footprint PCB Layout Section

SOT-23-6



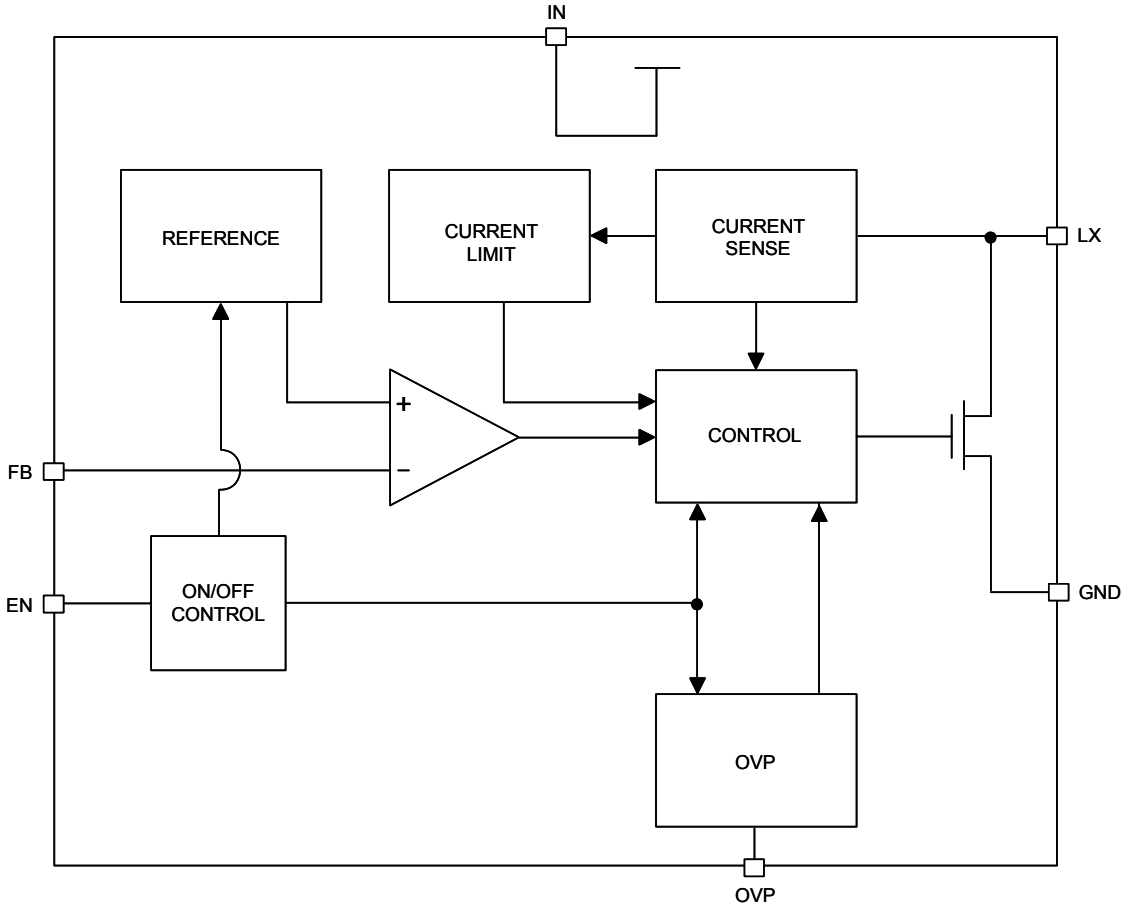
TDFN2X2-8



Pin Descriptions

PIN		Name	FUNCTION
SOT-23-6	TDFN2X2-8		
1	8	LX	Power Switching Output
2		GND	Ground Pin.
3	5	FB	Feedback Input.
4	4	EN	Enable Input. Drive EN high to turn on the regulator, drive it low to turn it off.
5	3	OVP	Over-voltage protection input. Connect to the output.
6		IN	Power Input Pin. It must be bypassed with a low-ESR capacitor.
	1	VCC	Power Input Pin. It must be bypassed with a low-ESR capacitor.
	2	NC	No Connection
	6	VSS	Analog Ground
	7	PGND	Ground Pin.

Block Diagram



Operating

The G5126 step-up DC-DC converter operates from a 2.7V to 5.5V supply. The device includes an internal switching MOSFET with a 0.7Ω on-resistance and consumes 200μA of supply current. During startup, the G5126 limits the maximum on-time to limit initial battery inrush current. Adjusting the output voltage by changing the resistance of R1 and the number of LEDs that connect in series from VOUT to FB the output voltage may up to 28V. The current of LED is set by the resistor R1 which connect from FB to GND. The current equals to voltage of FB (0.2V) to divide the resistance of R1. The G5126 built in a cycle-by-cycle 850mA current-limit function to maximum inductor current. The G5126 consumes 0.1μA when voltage of EN is Low. The over-voltage protection is included.

Application Information

Inductor Selection

The inductor's saturation current rating should be greater than the peak switching current. The large inductance prevents the large inductor's current ripple to induce maximum current limit in on-time period and output voltage ripple can be reduced also. Inductor with low core losses and small DCR (cooper wire resistance) is recommended.

Capacitor Selection

The small size of ceramic capacitors makes them suitable for G5126 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 minimum 1μF capacitor for output is required for most applications. Larger input/output capacitor minimizes input/output ripple.

Diode Selection

Schottky diodes, with their low forward voltage drop and fast reverse recovery, are the ideal choices for G5126 applications. The forward voltage drop of a Schottky diode represents the conduction losses in the diode, while the diode capacitance (C_T or C_D) represents the switching losses. For diode selection, both forward voltage drop and diode capacitance need to be considered. Schottky diodes with higher current ratings usually have lower forward voltage drop and large diode capacitance, which can cause significant switching losses at the 1MHz switching frequency of the G5126.

LED Current Setting

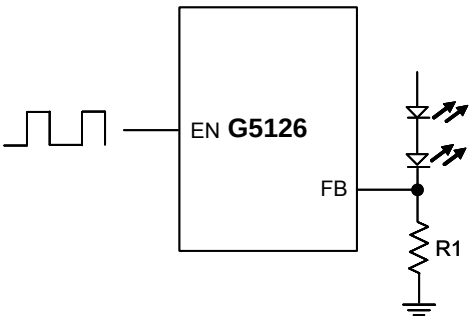
LED current can be set with feedback resister (R1)

I_{LED} = 0.2 / R1

LED Dimming Control, Softstart

LED Dimming Control by PWM Signal to EN Pin

LED dimming control is pos sible by forcing PWM signal to EN pin. When the power-on or start up with EN pin, softstart function works, however, after that, if the EN pin is set as "L" and set EN pin "H" again during the shutdown delay time, softstart function is disabled and starts up fast to normal mode, therefore 200Hz to 2kHz PWM signal is standard. By the EN pin input, LED turns on and off. Average LED current varies depending on the duty cycle of EN input. Too high frequency PWM signal is not effective because of its delay.

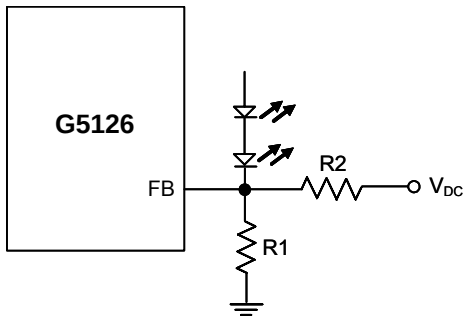


Dimming Control by EN Pin Input

Dimming Control by DC Voltage

LED dimming control is also possible by using the DC voltage to FB pin. LED current is adjustable by DC voltage and resisters, R1 and R2 in the following figure.

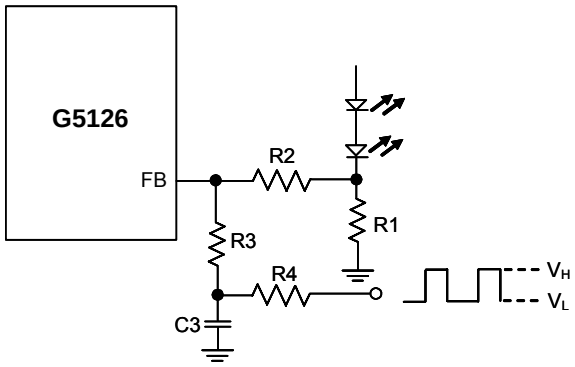
$I_{LED} = 0.2 / R1 - (V_{DC} - 0.2) / R2$



Dimming Control by DC Voltage

Dimming Control by Feedback Voltage and Filtered PWM Signal

LED dimming control is also possible by using the feedback voltage and filtered PWM signal. LED current is adjustable according to the "H" level (V_H) and "L" level (VL) of PWM signal and resisters.



Dimming Control by Filtered PWM Signal

Duty=0% to 100% PWM signal duty cycle can be used up to the maximum LED current and minimum LED current as in the next formulas.

$I_{LEDMIN} = (0.2 - R2 \times (V_H - 0.2) / (R3 + R4)) / R1$

$I_{LEDMAX} = (0.2 - R2 \times (V_L - 0.2) / (R3 + R4)) / R1$

For example, supposed that the PWM signal level is set as 3.3V/0V, to adjust the LED current range from 0mA to 20mA by the duty cycle, our recommendation external components values are, R1=10Ω, R2=12kΩ, R3=39kΩ, R4=150kΩ or around.

C3 should be set large enough to regard the PWM signal as adjustable DC voltage by the filter. In this method, higher frequency control than the frequency against the EN pin can be used for dimming control.

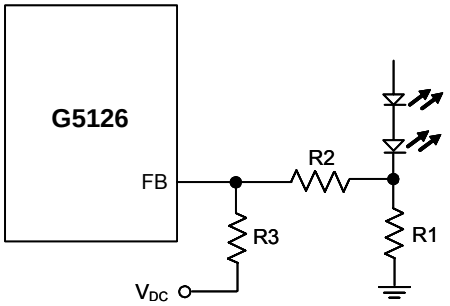
Dimming Control by DC Voltage and Feedback Voltage

LED dimming control is also possible by using the DC voltage and feedback voltage. LED current is adjustable according to DC voltage and resisters. R1, R2 and R3 in the following figure.

$I_{LEDMIN} = (0.2 - R2 \times (V_{DC} - 0.2) / R3) / R1$

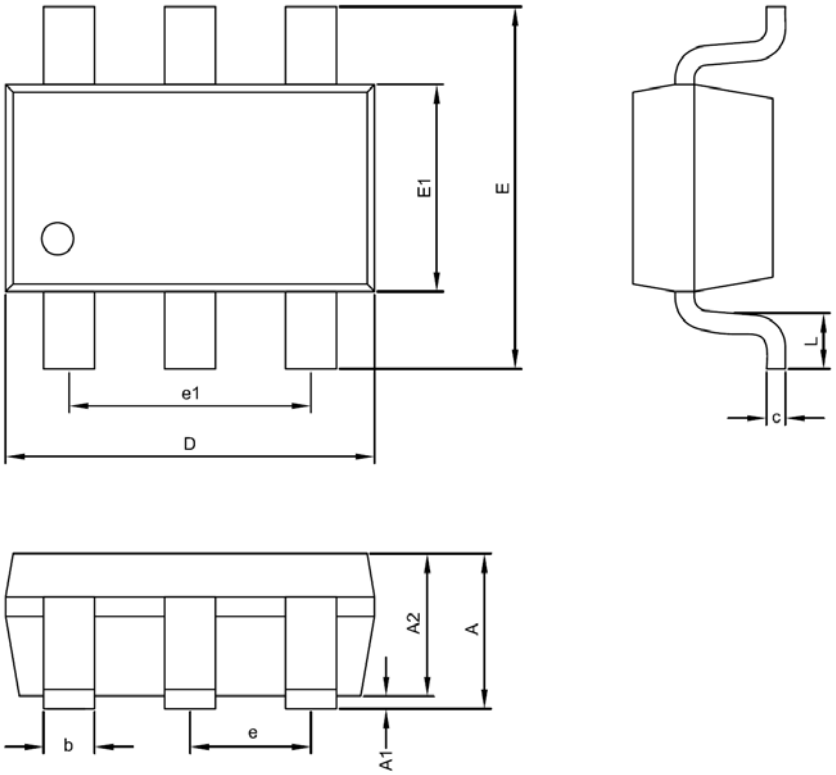
$I_{LEDMAX} = (0.2 - R2 \times (0 - 0.2) / R3) / R1$

For example, supposed that the DC voltage from or to 3.3V, to adjust the LED current range from 0mA to 20mA, our recommendation external components values are, R1 = 10Ω , R2 = 10kΩ, R3 = 188kΩ or around.



Dimming Control by DC Voltage and Feedback Voltage

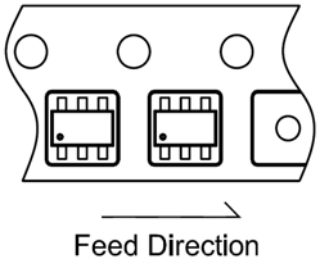
Package Information



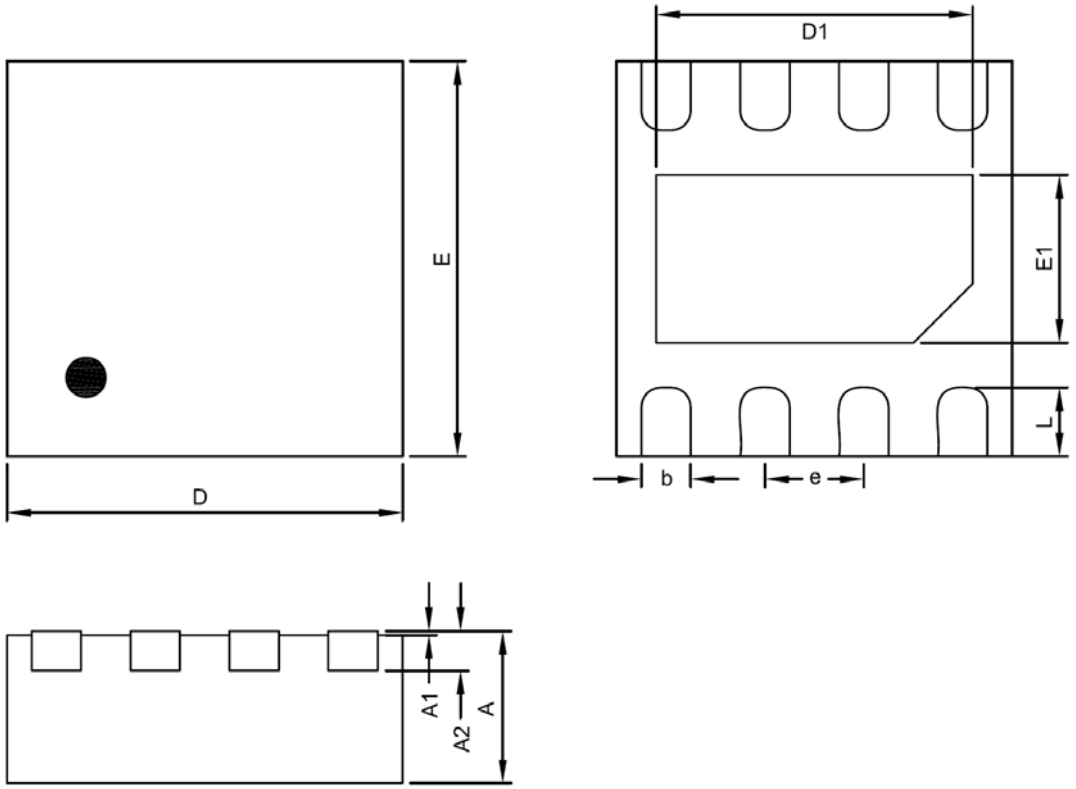
SOT-23-6 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.00	1.10	1.45	0.039	0.043	0.057
A1	0.00	- - -	0.15	0.000	- - -	0.006
A2	1.00	1.10	1.30	0.039	0.043	0.051
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
c	0.08	0.15	0.25	0.003	0.006	0.010
b	0.30	0.40	0.50	0.012	0.016	0.020
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.30	0.45	0.60	0.012	0.018	0.024

Taping Specification



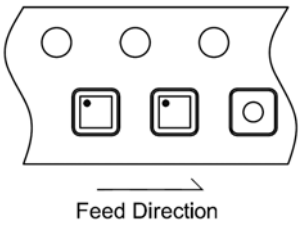
PACKAGE	Q'TY/REEL
SOT-23-6	3,000 ea



TDFN2X2-8 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.0276	0.0295	0.0315
A1	0.00	---	0.05	0.0000	---	0.0020
A2	0.19	0.20	0.21	0.0075	0.0079	0.0083
D	1.95	2.00	2.05	0.0768	0.0787	0.0807
E	1.95	2.00	2.05	0.0768	0.0787	0.0807
D1	1.45	1.55	1.65	0.0571	0.0610	0.0650
E1	0.75	0.85	0.95	0.0295	0.0335	0.0374
b	0.18	0.23	0.28	0.0071	0.0091	0.0110
e	0.50 BSC			0.0197 BSC		
L	0.30	0.35	0.40	0.0118	0.0138	0.0157

Taping Specification



PACKAGE	Q'TY/REEL
TDFN2X2-8	3,000 ea

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