

1.4A Boost for White LED Driver

Features

- 2.5V to 5.5V operating input voltage range
- Drives up to 8 series White LEDs
- 1.0MHz Fixed Switching Frequency
- Wide range for PWM dimming (200Hz to 200KHz)
- Internal 1.4A switching current limit
- Over Voltage Protection (OVP)
- Internal Soft-start Function
- Current limit and Thermal shutdown protection
- Under voltage Lockout

Description

The GR5401A is a high frequency, asynchronous boost converter. The internal MOSFET can support up to 8 White LEDs for backlighting and OLED power application, and the internal soft start function can reduce the inrush current.

The GR5401A uses current mode, 1.0MHz Z fixed frequency architecture to regulate the LED current, which is set through an external current sense resistor, which is set through an external current sense resistor. Its low 200mV feedback voltage reduces power loss and improves efficiency. The OVP pin monitors the output voltage and turns off the converter if an over-voltage condition is present due to an open circuit condition. The GR5401A includes under-voltage lockout, current limiting and thermal shutdown protection preventing damage in the event of an output overload. The driver is available in small 6-pin SOT23 & TSOT23 packages.

APPLICATIONS

Cellular Phones

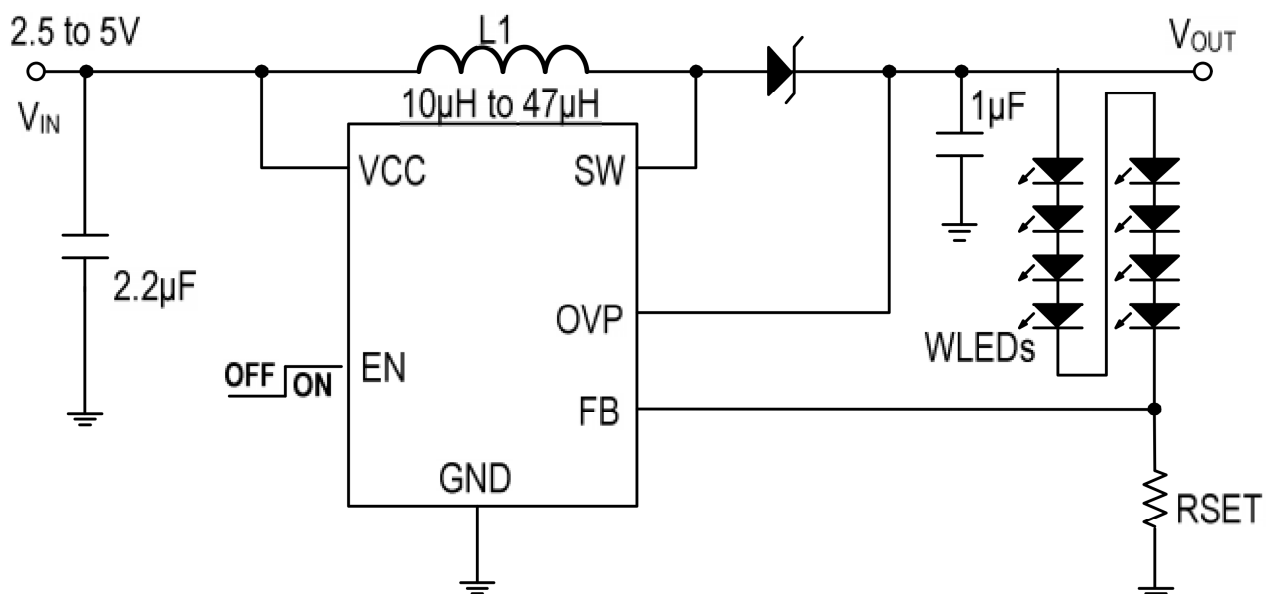
Digital Cameras

Tablet PC and Handheld Computers

PDA, DVD and GPS Receivers

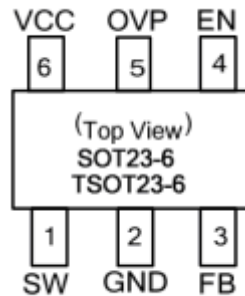
Portable Instruments

Application Circuit



Pin Configuration

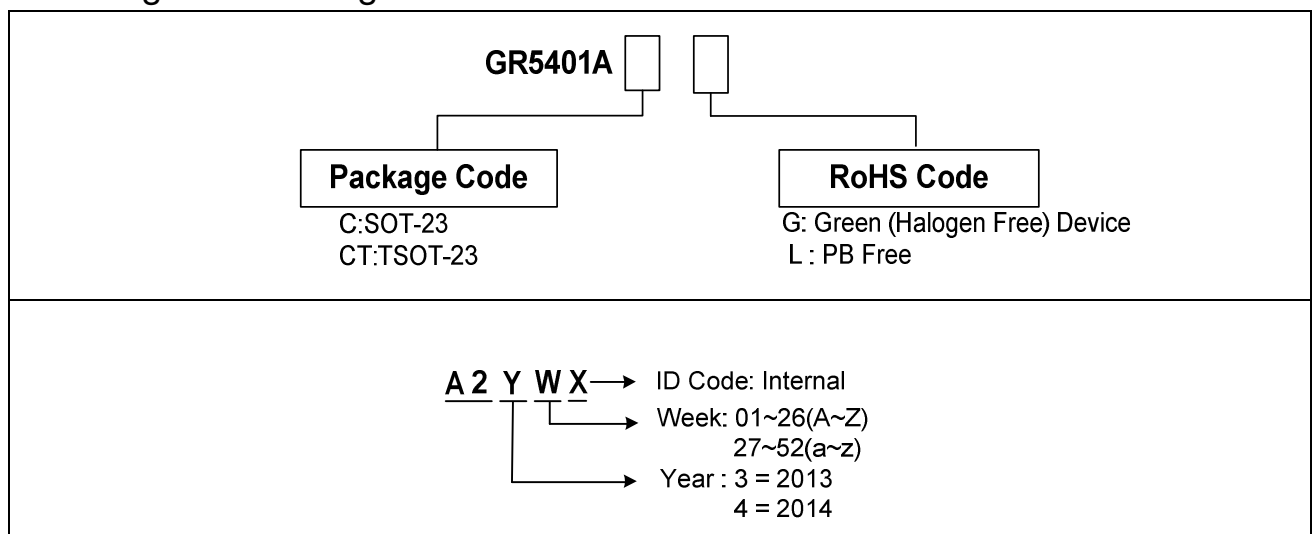
TOP VIEW



Pin Description

Pin No.	Symbol	Description
1	SW	Switching Pin
2	GND	Ground Pin.
3	FB	Feedback Pin.
4	EN	Chip Enable & Dimming pin. Active high. Internal pull low.
5	OVP	Over voltage detect pin
6	VCC	Power Input Pin

Ordering and Marking Information



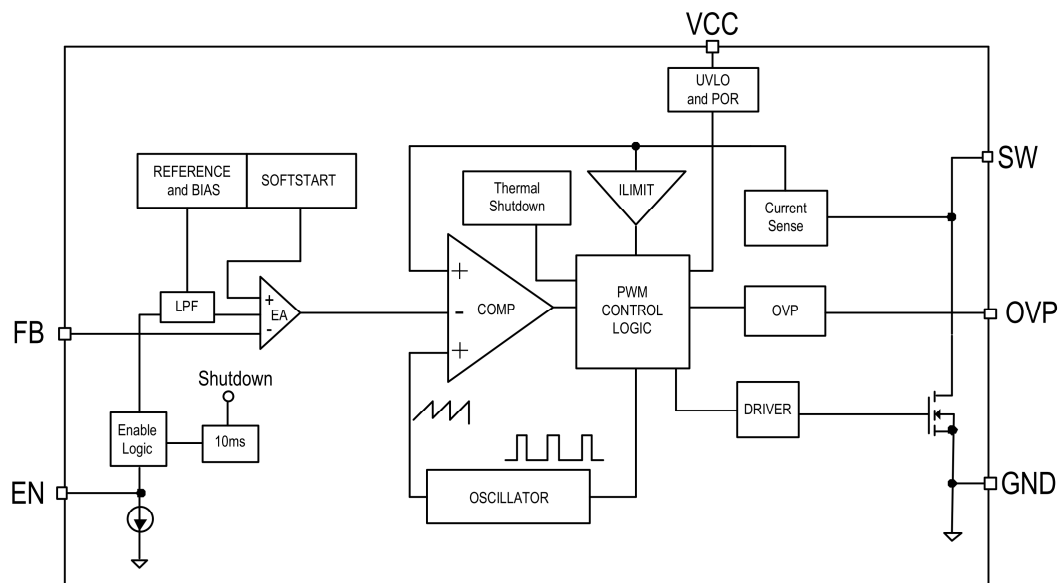
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Absolute Maximum Ratings

VCC pin voltage, V_{IN}	-0.3V ~ 6V
SW pin voltage, V_{SW}	-0.3V ~ 33V
OVP pin voltage, V_{OVP}	-0.3V ~ 33V
EN, FB pins voltage	-0.3 to $V_{IN} + 0.3V$
Continuous Power Dissipation, P_D	$(T_J - T_A) / \theta_{JA}$ mW
Operating Junction Temperature, T_{op}	-40°C ~ 125°C
Storage Temperature Range	-65°C ~ 150°C
Thermal Resistance from Junction to case, θ_{JC}	180°C/W
Thermal Resistance from Junction to ambient, θ_{JA}	250°C/W

Note: θ_{JA} is measured with the PCB copper area of approximately 1 in²(Multi-layer).

Block Diagram



Electrical Characteristics ($V_{IN}=5V$, $V_{EN} = 5V$, $I_{OUT} = 20mA$, $T_A = +25^{\circ}C$)

Parameter	Symbol	Min.	Typ.	Max.	Unit	
Input Voltage Range	V_{IN}	2.5	-	5.5	V	
Input UVLO, Rising	UVLO	-	2.25	2.45	V	
UVLO Hysteresis		-	0.1	-	V	
OVP Sense Voltage	V_{OV}	27.5	29	-	V	
Quiescent Current, $V_{FB} = 0.5V$, $I_{OUT} = 0mA$	I_{CCQ}	-	200	400	μA	
Supply Current, $V_{FB} = 0V$, Switching	I_{IN}	-	1	2	mA	
Shutdown Current, $V_{EN} = 0V$, $T_{EN} > 20mS$	I_{SD}	-	1	4	μA	
FB Pin Voltage	V_{FB}	0.19	0.20	0.21	V	
FB Pin Current	I_{FB}	-	-	± 100	nA	
Load Regulation, $1mA < I_{OUT} < 20mA$		-	1	-	%	
Line Regulation, $3V < V_{IN} < 4.3V$		-	1	-	%	
EN Pin Voltage High	V_{ENH}	1.4	-	-	V	
EN Pin Voltage Low	V_{ENL}	-	-	0.4	V	
EN Hysteresis		-	0.1	-	V	
EN Pin sink Current	I_{IH}	-	1	-	μA	
Switching Frequency	F_{OSC}	0.75	1	1.25	MHz	
N-Channel MOSFET		C_L	-	1.4	-	A
Current Limit (Note1)	Duty on 50%	C_L	-	1.9	-	A
Switching Maximum Duty	Dmax	-	92	-	%	
Dimming clock rate		0.2	-	200	KHz	
N-Switch $R_{DS(ON)}$, $V_{IN}=3.6V$	$R_{DS(ON)-N}$	-	0.5	1.0	Ω	
Thermal Shutdown	T_{SD}	-	155	-	$^{\circ}C$	
Thermal Shutdown Protection hysteresis	T_{SH}	-	25	-	$^{\circ}C$	

Note: Guaranteed by design.

Function Descriptions

Setting the I_{LED} Current

Application circuit item shows the basic application circuit with GR5401A adjustable output version. The external resistor sets the LED output current according to the following equation:

I_{LED}	RSET	
20mA	10 Ω	4mW
350mA	0.570 Ω	70mW

Under Voltage Lockout (UVLO)

To avoid mis-operation of the device at low input voltages an under voltage lockout is included that disables the device, if the input voltage falls below (2.25V-100mV).

Over Voltage Protection

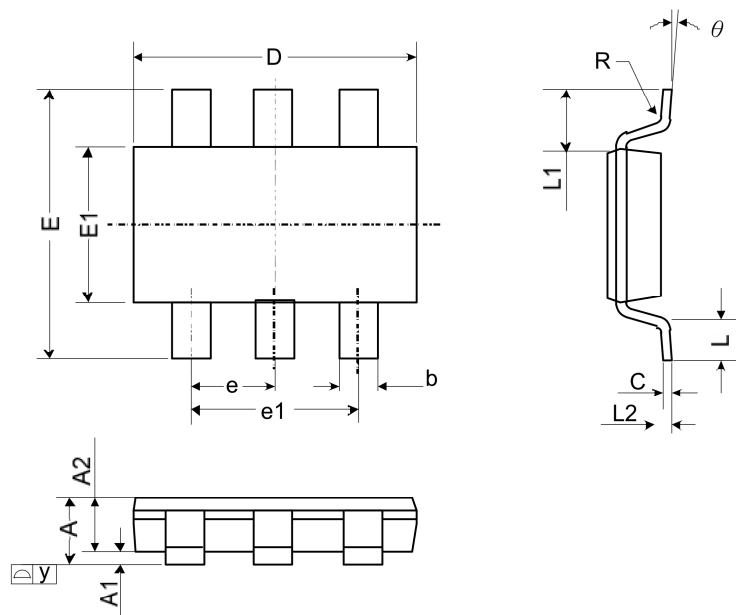
OVP measure the output voltage for open circuit protection. Connect OVP pin to the output at the top of the LED string. If VOUT above 29V, the OVP protection is happened that stops the internal driver until VOUT below 29V.

Input Capacitor Selection

The input capacitor reduces the surge current drawn from the input and switching noise from the device. The input capacitor impedance at the switching frequency shall be less than input source impedance to prevent high frequency switching current passing to the input. A low ESR input capacitor sized for maximum RMS current must be used. Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. A 2.2 μ F ceramic capacitor for most applications is sufficient. For a lower output power requirement application, this value can be decreased.

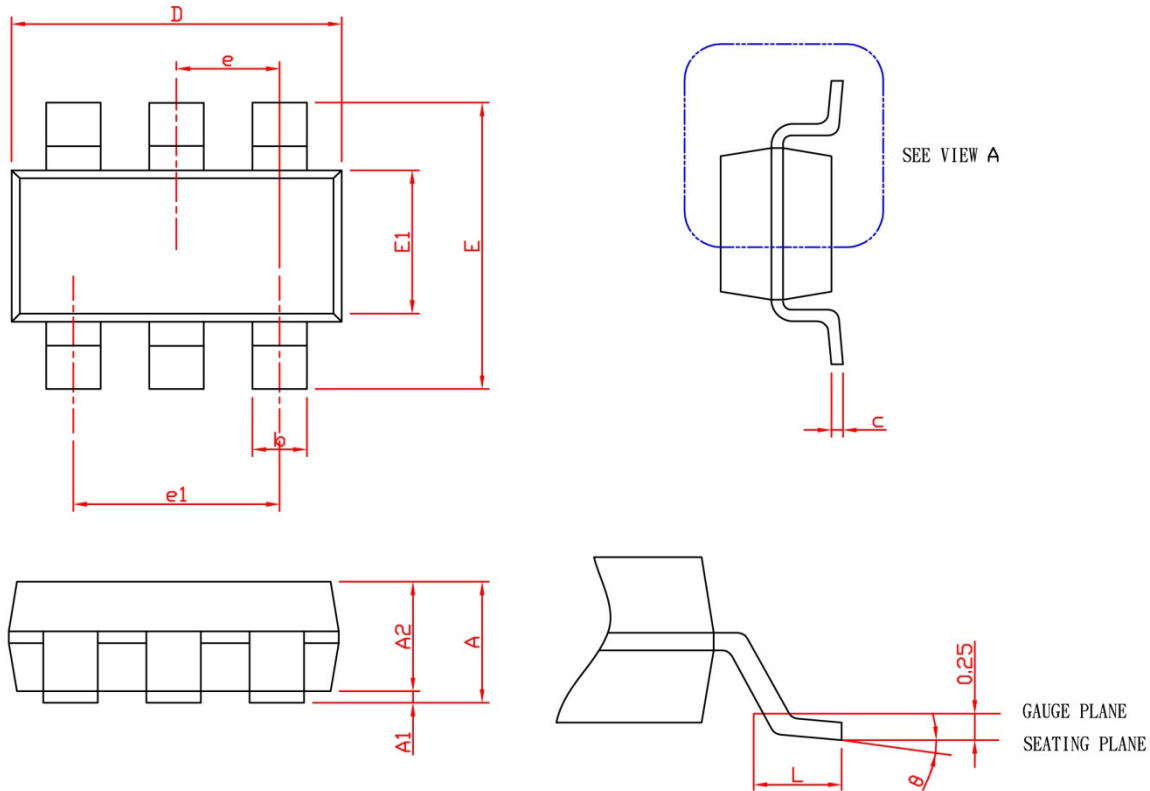
Output Capacitor Selection

The output capacitor is required to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended due to their low ESR and high ripple current. A 1 μ F ceramic capacitors works for most of the applications. Higher capacitor values can be used to improve the load transient response.

Package Information
TSOT-23


Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.10	-	-	0.043
A1	0.00	-	0.10	0	-	0.004
A2	0.70	0.90	1.00	0.028	0.035	0.039
b	0.30	0.40	0.50	0.012	0.016	0.020
C	0.08	0.14	0.20	0.003	0.006	0.008
D	2.80	2.90	3.00	0.110	0.114	0.118
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
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
L1	0.60 REF.			0.024 REF.		
L2	0.25 BSC.			0.010 BSC.		
y	-	-	0.10	-	-	0.004
R	0.10	-	-	0.004	-	-
θ	0°	-	8°	0°	-	8°

Note: 1. Followed from JEDEC outline: MO-193 AA.

**Carrier Tape & Reel Dimensions
SOT-23**


SYMBOL	SOT-23			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.45		0.057
A1	0.00	0.15	0.000	0.006
A2	0.90	1.30	0.035	0.051
b	0.30	0.50	0.012	0.020
c	0.08	0.22	0.003	0.009
D	2.70	3.10	0.106	0.122
E	2.60	3.00	0.102	0.118
E1	1.40	1.80	0.055	0.071
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.30	0.60	0.012	0.024
θ	0°	8°	0°	8°

Note: 1. Followed from JEDEC TO-178 AB.

2. Dimension D and E1 do not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 10 mil per side.

Taping Direction Information

SOT-23



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