1.4A Boost for White LED Driver

❖ GENERAL DESCRIPTION

The MA2001A 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 MA2001A uses current mode, 1.0MHz fixed frequency architecture to regulate the LED current, 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 MA2001A 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.

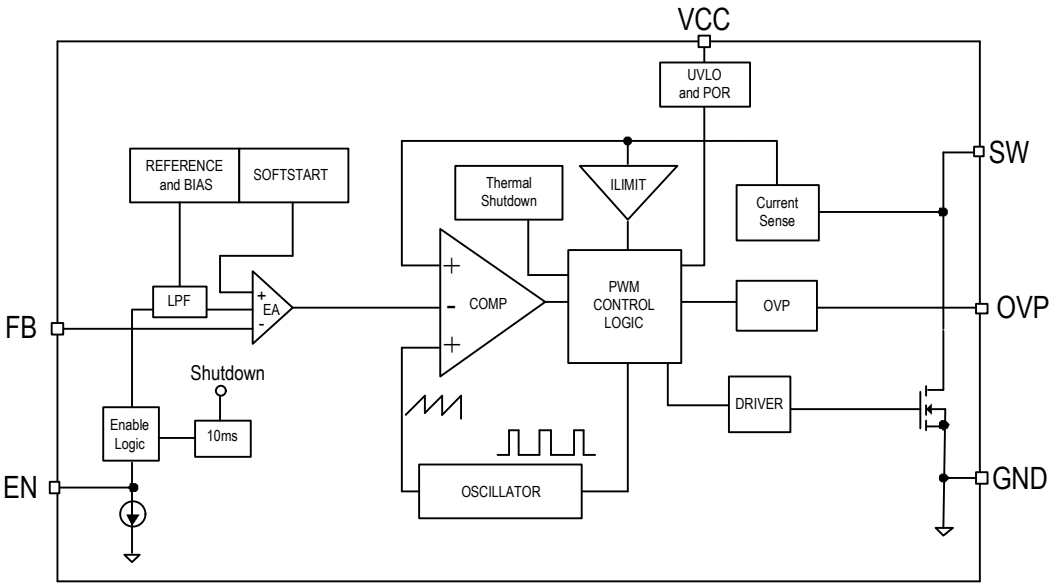
❖ FEATURES

- 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

❖ APPLICATIONS

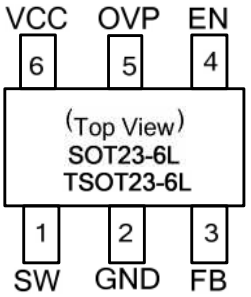
- Cellular Phones
- Digital Cameras
- Tablet PC and Handheld Computers
- PDA, DVD and GPS Receivers
- Portable Instruments

❖ BLOCK DIAGRAM



❖ PIN ASSIGNMENT

The package of MA2001A are SOT23-6L & TSOT23-6L ; the pin assignment is given by:



Name	Description
VCC	Power Input Pin
GND	Ground Pin.
FB	Feedback Pin.
EN	Chip Enable & Dimming pin. Active high. Internal pull low.
OVP	Over voltage detect pin
SW	Switching Pin

❖ ORDER/MARKING INFORMATION

Order Information	Top Marking
MA2001AXXX Package Type C: SOT23-6L CT: TSOT23-6L Packing Blank : Bag A : Taping	A2 Y W X → ID Code: Internal Week: 01~26(A~Z) 27~52(a~z) Year : 2 = 2012 3 = 2013

❖ ABSOLUTE MAXIMUM RATINGS (at T_A=25°C)

Characteristics	Symbol	Rating	Unit
VCC pin voltage	V_{IN}	-0.3 to 6	V
SW pin voltage	V_{SW}	-0.3 to 33	V
OVP pin voltage	V_{OVP}	-0.3 to 33	V
EN, FB pins voltage		-0.3 to V_{IN}+0.3	V
Continuous Power Dissipation	PD	(T_J-T_A) / θ_{JA}	mW
Operating Junction Temperature	Top	-40 to 125	°C
Storage Temperature Range		-65 to 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 are (need connect to GND pin) of approximately 1 in^2 (Multi-layer).

❖ ELECTRICAL CHARACTERISTICS

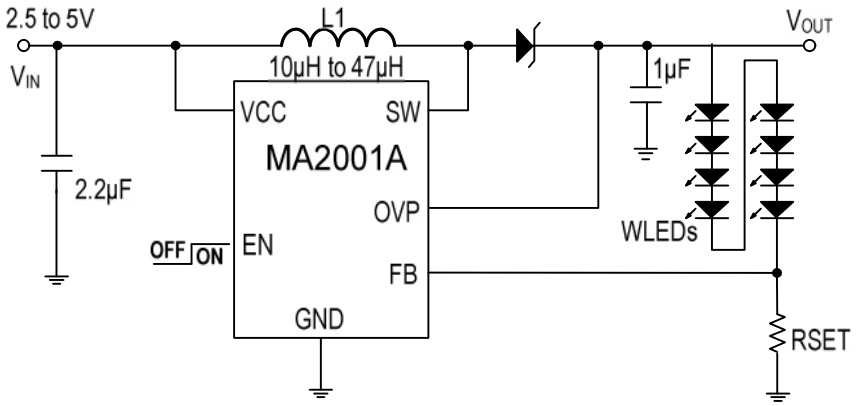
(V_{IN} = 5V, V_{EN} = 5V, I_{OUT} = 20mA, T_A = 25°C)

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage Range	V_{IN}		2.5	-	5.5	V
Input UVLO	UVLO	Rising	-	2.25	2.45	V
UVLO Hysteresis			-	0.1	-	V
OVP Sense Voltage	V_{OV}		27.5	29	-	V
Quiescent Current	I_{CCQ}	V_{FB} = 0.5V , I_{OUT} = 0mA	-	200	400	μA
Supply Current	I_{IN}	V_{FB} = 0V , Switching	-	1	2	mA
Shutdown Current	I_{SD}	V_{EN} = 0V , T_{EN} > 20mS	-	1	4	μA
FB Pin Voltage	V_{FB}		0.190	0.200	0.210	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 Current Limit (Note1)	C_L		-	1.4	-	A
	C_L	Duty on 50%	-	1.9	-	A
Switching Maximum Duty	Dmax		-	92	-	%
Dimming clock rate			0.2	-	200	KHz
N-Switch $R_{DS(ON)}$	$R_{DS(ON)-N}$	Vin=3.6V	-	0.5	1.0	Ω
Thermal Shutdown	T_{SD}		-	155	-	°C
Thermal Shutdown Protection hysteresis	T_{SH}		-	25	-	°C

Note1: Guaranteed by design.

❖ APPLICATION CIRCUIT



❖ FUNCTION DESCRIPTION

Setting the I_{LED} Current

Application circuit item shows the basic application circuit with MA2001A adjustable output version. The external resistor sets the LED output current according to the following equation:

I_{LED}	RSET	
20mA	10Ω	4mW
350mA	0.570Ω	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 V_{OUT} above 29V, the OVP protection is happened that stops the internal driver until V_{OUT} below 29V.

Input Capacitor Selection

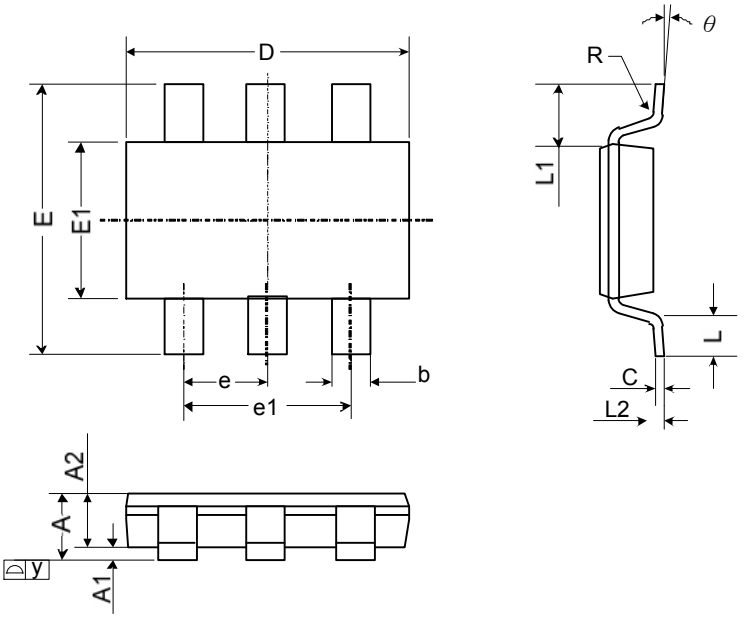
The input capacitor reduces the surge current drawn from the input and switching noise from the device. The input capacitor impedance at the switching frequency shall be less than input source impedance to prevent high frequency switching current passing to the input. A low ESR input capacitor sized 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 2.2uF 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 1uF ceramic capacitors works for most of the applications. Higher capacitor values can be used to improve the load transient response.

❖ PACKAGE OUTLINES

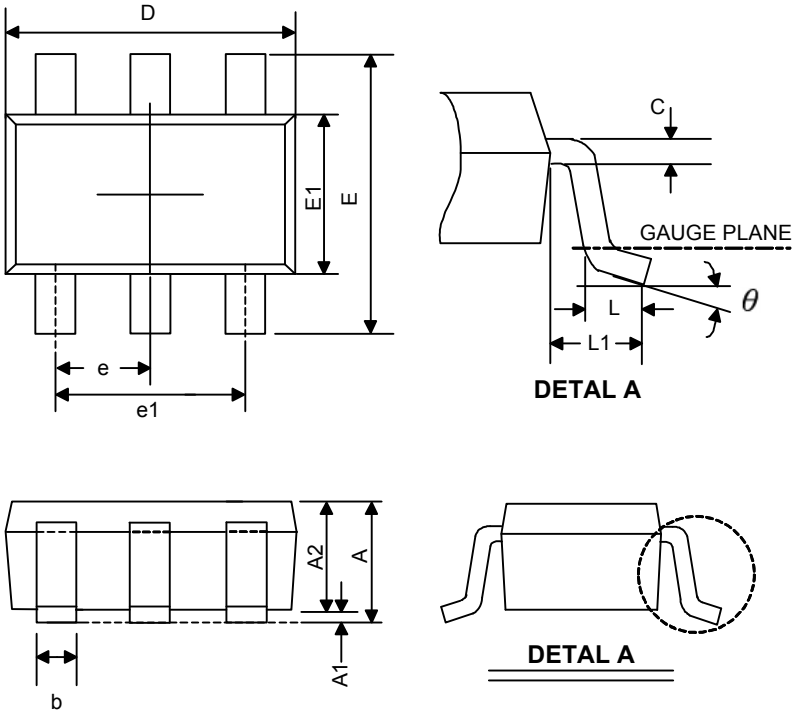
(1) TSOT23-6L



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°

JEDEC outline: MO-193 AA

(2) SOT23-6L



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.05	-	1.45	0.041	-	0.057
A1	0.05	-	2.15	0.002	-	0.085
A2	0.90	1.10	1.30	0.035	0.043	0.051
b	0.30	-	0.50	0.012	-	0.020
C	0.08	-	0.22	0.003	-	0.009
D	2.70	2.90	3.10	0.106	1.114	0.122
E1	1.40	1.60	1.80	0.055	0.063	0.071
E	2.60	2.80	3.00	0.102	0.110	0.118
L	0.30	-	0.60	0.012	-	0.024
L1	0.50	0.60	0.70	0.020	0.024	0.028
e1	1.80	1.90	2.00	0.071	0.075	0.079
e	0.85	1.00	1.15	0.033	0.037	0.045
θ	0°	4°	8°	0°	4°	8°