3A 700KHz Asynchronous Boost Converter

❖ GENERAL DESCRIPTION

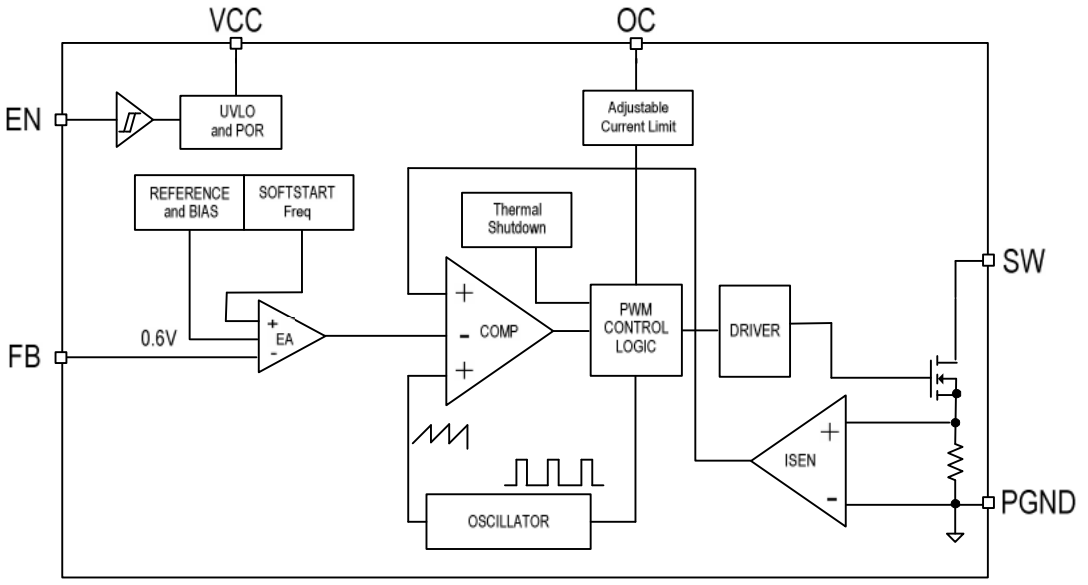
The MA2004 is a current mode step up converter, fixed frequency, inrush current limiting and internal soft-start. It includes an error amplifier, ramp generator, comparator, built-in 150mΩ N-Channel power MOSFET make this regulator highly power efficient.

The 700KHz switching frequency allows for smaller external components producing a compact solution for a wide range of load currents. The MA2004 regulates the output voltage up to 5.5V and provides up to 1A output.

❖ FEATURES

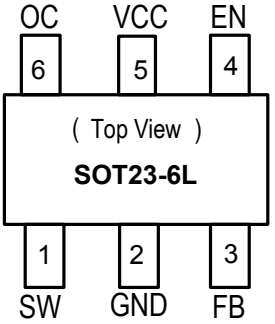
- Over 90% Efficiency
- Adjustable Output from V_{IN} to 5.5V
- Programmable Current Limit
- +2.8V to +5.5V Input Range
- 700KHz Fixed Switching Frequency
- 1μA Shutdown Current
- Internal Soft-Start
- Thermal Shutdown
- 150mΩ N-Channel power MOSFET
- SOT-23-6L Pb-free Package

❖ BLOCK DIAGRAM



❖ PIN ASSIGNMENT

The package of MA2004 is SOT23-6L; the pin assignment is given by:



Name	Description
VCC	VCC Input Pin
EN	Chip Enable pin. Active high. Internal pull high for auto start up.
GND	Ground Pin.
FB	Feedback Pin.
SW	Switching Pin
OC	Adjustable Current limit

❖ ORDER/MARKING INFORMATION

Order Information	Top Marking
MA2004XX X Package Type C: SOT23-6L Packing Blank : Bag A : Taping	A4 Y W X → ID Code: Internal Week: 01~26(A~Z) 27~52(a~z) Year : 3 = 2013

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

Characteristics	Symbol	Rating	Unit
Vin pin voltage	V_{IN}	-0.3 to 6.0	V
EN,OC,FB pin voltage		-0.3 to V_{IN}+0.3	V
SW pin voltage	V_{SW}	Internal limit	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 LX) of approximately 1 in^2 (Multi-layer).

❖ ELECTRICAL CHARACTERISTICS

(V_{IN} = 3.6V, V_{EN} =3.6V, V_{OUT} = 5V, T_A = 25°C)

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage Range	V_{IN}		2.8	-	5.5	V
Input UVLO	UVLO		2	2.3	2.6	V
Quiescent Current	I_{CCQ}	V_{FB} = 1.3V	-	200	-	μA
Shutdown Current	I_{SD}	V_{EN} = 0V	-	1	3	μA
FB Pin Voltage	V_{FB}		0.588	0.6	0.612	V
Load Regulation		0A < I_{OUT}<3A	-	0.2	-	%
Line Regulation		2.8V<V_{IN}<5.5V	-	0.5	-	%
EN Pin Voltage High	V_{ENH}		1.4	-	-	V
EN Pin Voltage Low	V_{ENL}		-	-	0.6	V
EN Pin Leakage Current		V_{EN} = 3V	-	0.1	1	μA
Switching Frequency	F_{OSC}		-	700	-	KHz
Programmable Current Limit	C_L	Roc=30k	-	3	-	A
Switching Maximum Duty	Dmax		-	65	-	%
Minimum Duty	Dmin		0	-	-	%
N-Switch $R_{DS(ON)}$ **(Note1)**	$R_{DS(ON)-N}$		-	150	-	mΩ
Thermal Shutdown	T_{SD}		-	150	-	°C
Thermal Shutdown Protection hysteresis	T_{SH}		-	30	-	°C

Note1: Guaranteed by design.

❖ APPLICATION CIRCUIT

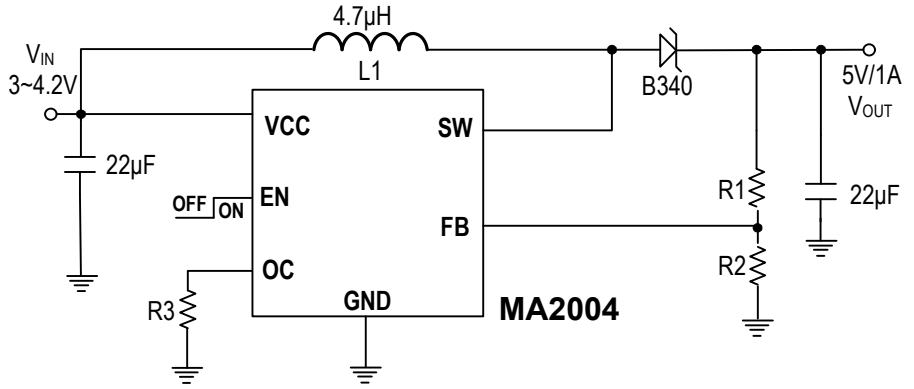


Figure 3. Typical Application Circuit

The MA2004 uses a 700KHz fixed-frequency, current-mode regulation architecture to regulate the output voltage. The MA2004 measures the output voltage through an external resistive voltage divider and compares that to the internal 0.6V reference to generate the error voltage. The current-mode regulator compares the error voltage to the inductor current to regulate the output voltage. The use of current-mode regulation improves transient response and control loop stability.

At the beginning of each cycle, the N-Channel MOSFET switch is turned on, forcing the inductor current to rise. The current at the source of the switch is internally measured and converted to a voltage by the current sense amplifier. That voltage is compared to the error voltage. When the inductor current rises sufficiently, the PWM comparator turns off the switch, forcing the inductor current to the output capacitor through the SBD, which forces the inductor current to decrease. The peak inductor current is controlled by the error voltage, which in turn is controlled by the output voltage. Thus the output voltage controls the inductor current to satisfy the load.

Soft-Start

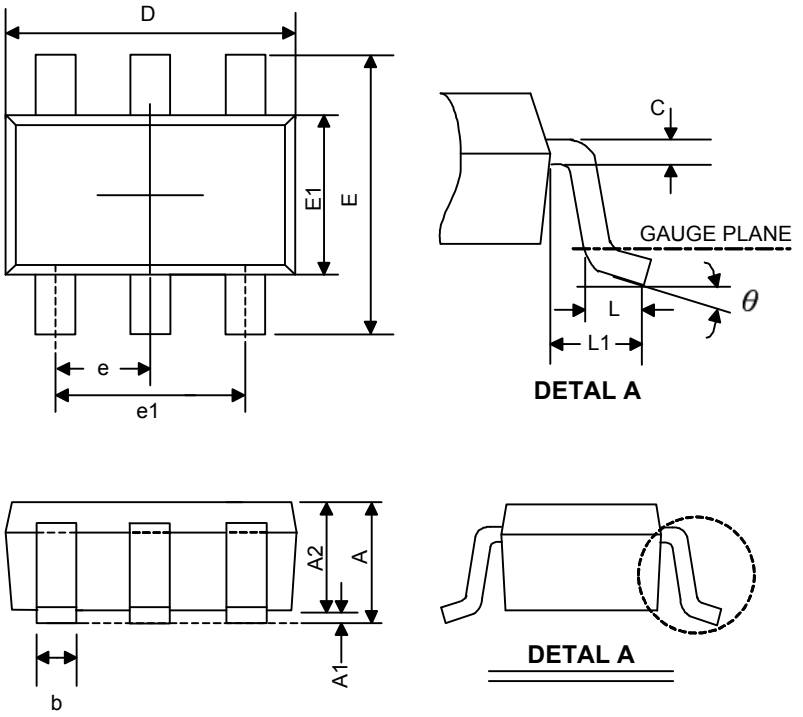
The MA2004 includes a soft-start timer that limits the voltage at the error amplifier output during startup to prevent excessive current at the input. This prevents premature termination of the source voltage at startup due to inrush current. This also limits the inductor current at startup, forcing the input current to rise slowly to the amount required to regulate the output voltage during soft-start.

Current Limit

A resistor between OC and GND pin programs peak switch current. The resistor value should be between 30k to 150k. the current limit will be set from 3A to 1A. Keep traces at pin as short as possible. Do not put capacitance at OC pin. To set the over current point according to the following equation:

ICL=180000/(R3+30k)

❖ PACKAGE OUTLINES



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°