AP1627

High-Efficiency Inverting Controller

■ Features

- Input range: 2.5V ~ 6V
- Transformerless inverting controller
- Up to 400KHz operating frequency
- 1μA shutdown mode
- Drives high-side P-channel MOSFET
- 80% efficiency
- Soft-Start time set-up externally type
- MSOP-8L **Pb-Free** package

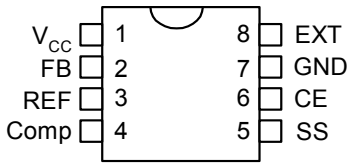
■ Applications

- Cell Phone
- Digital Cameras
- OLED Display Bios Voltage

■ General Description

The AP1627 is a high performance fixed frequency about 400KHz PWM controllers. The controller was specifically designed to be incorporated for step-up and voltage inverting functions with a minimum number of external components.
The AP1627 has a built-in 1.23V reference voltage; a negative voltage can be set with the external components. The soft-start time can be set with a external capacitance.
The AP1627 are available in space-saving 8-pin MSOP package. An evaluation kit is available to expedite designs.

■ Pin Assignments

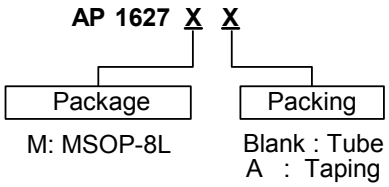


MSOP-8L

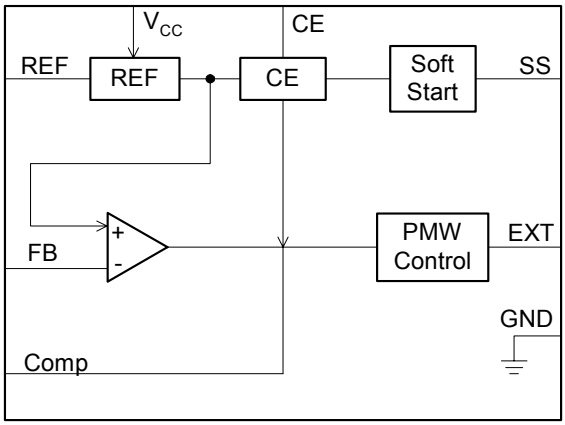
■ Pin Descriptions

Name	Pin	Description
V_{CC}	1	Power Input pin
FB	2	Feedback Pin
REF	3	1.23 Reference Voltage
Comp	4	Compensation Pin
SS	5	Soft-Start Pin
CE	6	Enable Channel
GND	7	Signal Ground
EXT	8	External P-MOSFET Connection

■ Ordering Information



■ Block Diagram



■ Absolute Maximum Ratings

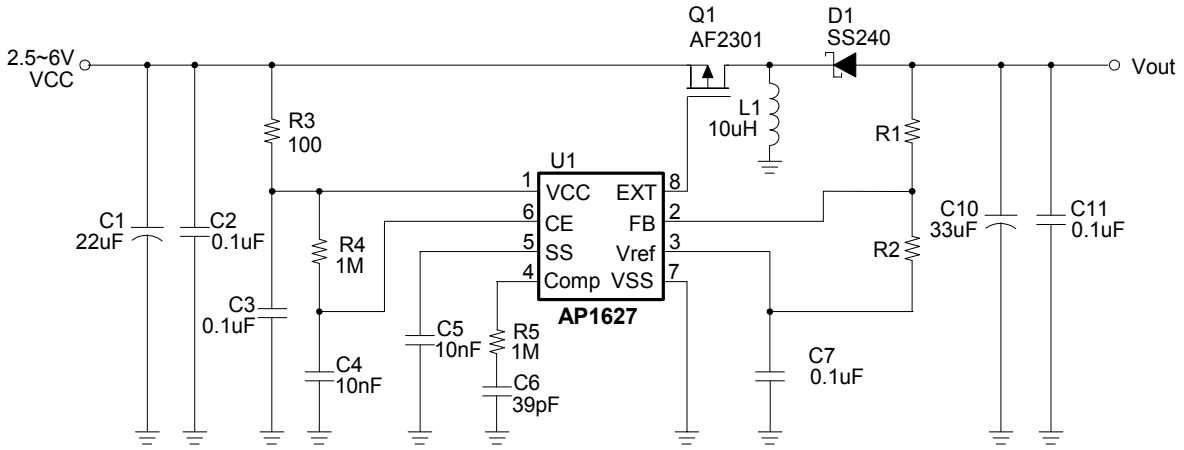
Symbol	Parameter	Rating	Unit
V_{CC}	VIN Pin Voltage	-0.3 ~ 6.5	V
V_{SS}	SS Pin Voltage	-0.3 ~ V_{CC}+0.3	V
V_{COMP}	Comp Pin Voltage	-0.3 ~ V_{CC}+0.3	V
V_{FB}	FB Pin Voltage	-0.3 ~ V_{CC}+0.3	V
V_{CE}	CE Pin Voltage	-0.3 ~ V_{CC}+0.3	V
V_{EXT}	EXT PIN Voltage	-0.3 ~ V_{CC}+0.3	V
I_{EXT}	EXT PIN Current	±100	mA
P_D	Continuous Power Dissipation (T_A = +40°C)	250	mW
T_{OPR}	Operating Temperature Range	-25 to +85	°C
T_J	Junction Temperature	+140	°C
T_{STG}	Storage Temperature Range	-40 to +125	°C

■ Electrical Characteristics

AP1627 （V_{IN}=3.3V, V_{OUT}= -9V, Load=100mA） Ta=25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Voltage	V_{CC}		2.5	-	6	V
Reference Voltage	V_{REF}		1.205	1.23	1.255	V
Reference Drift		T_A=-25°C~85°C	-	50	-	ppm/°C
Quiescent Current	I_{CCQ}	No external components, CE=V_{IN}, V_{FB}=-0.4V	-	50	100	μA
Stand-by Current	I_{STB}	No external components, CE=0V, V_{FB}=-0.4V	-	-	2	μA
Oscillator Frequency	Fosc		300	400	500	kHz
Maximum Duty Ratio	MAXDTY		-	80	-	%
CE"High" Voltage	V_{CEH}	Apply above 0.65Vcc (min.) to CE, Operating mode	0.65	-	-	*Vcc
CE"Low" Voltage	V_{CEL}	Apply under 0.2Vcc (min.) to CE, Standby mode	-	-	0.20	*Vcc
Line Regulation		V_{CC}=3V~6V	-	-	0.4	%
Load Regulation		Load=0~400mA	-	-	0.2	%
Efficiency	EFFI		-	80	-	%

■ Typical Application Circuit



Vout = Vref * (R1/R2)
Vref=1.23V
R2 suggest 50K~100K

■ Function Description

The AP1627 is an inverting controller that generates a regulated negative output voltage, typically for OLED display bias. This is useful in height-limited designs where transformers may not be desired.
The MOSFET driver EXT in the AP1627 is designed to drive P-channel MOSFETs.

Reference
The AP1627 has a precise 1.23V reference. Connect a 0.1uF ceramic bypass capacitor from REF to GND within 0.2in (5mm) of the REF pin. REF can source up to 100μA and is enabled whenever ON is high and V_{CC} is above 2.5V. If the 100μA REF load limit must be exceeded, buffer REF with an external op amp.

Shutdown
When CE voltage is lower than 0.2*Vcc, the internal reference and biasing circuit totally turn off, the output voltage drops to zero and the supply current drops to 1uA.

Output Adjustable
The output voltage for the AP1627 is set by two resistors, R1 and R2, which form a voltage divider between the output, FB pin and REF pin, R2 can be any value from 50KΩ to 100KΩ. R1 is given by the following formula:

$$R1=\frac{|Vout|}{1.23}\times R2$$

Soft-Start
A capacitor connects with SS to GND. It can cause the start-up current to rise preventing output voltage overshoot slowly and high inrush current. The capacitor value directly effect start-up time.

Duty Cycle
The maximum duty cycle of the AP1627 is 80%. The duty cycle for a given application inverting topology is given by:

$$\text{Duty cycle}=\frac{|Vout|}{Vcc+|Vout|}$$

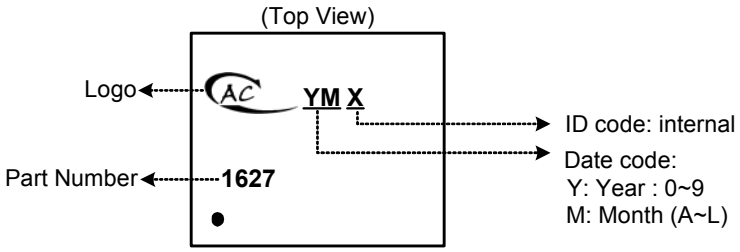
■ Applications Information

Designing a PC Board

Good PC board layout is important to achieve optimal performance from the AP1627. Poor design can cause excessive conducted and/or radiated noise. Conductors carrying discontinuous currents and any high-current path should be made as short and wide as possible. A separate low-noise ground plane containing the reference and signal grounds should connect to the power-ground plane at only one point to minimize the effects of power-ground currents. Typically, the ground planes are best joined right at the IC.

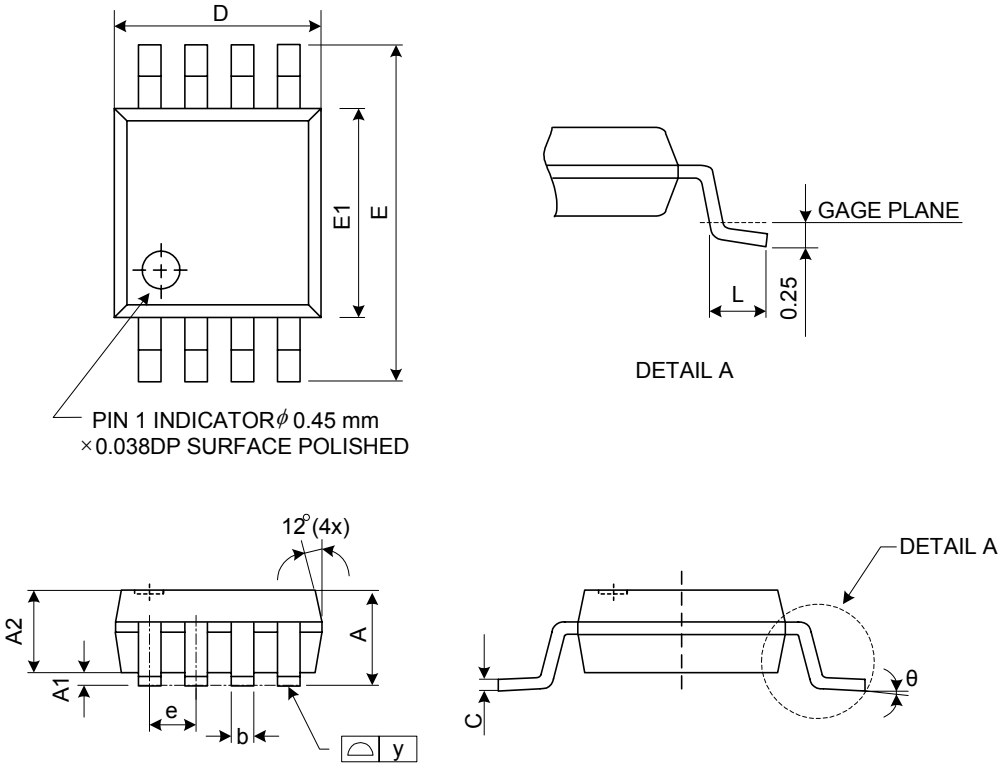
Keep the voltage-feedback network very close to the IC, preferably within 0.2in (5mm) of the FB pin. Nodes with high dV/dt (switching nodes) should be kept as small as possible and should be routed away from high-impedance nodes such as FB.

■ Marking Information



■ Package Information

Package Type: MSOP-8L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.81	1.02	1.22	0.032	0.040	0.048
A1	0.05	-	0.15	0.002	-	0.006
A2	0.76	0.86	0.97	0.030	0.034	0.038
b	0.28	0.30	0.38	0.011	0.012	0.015
C	0.13	0.15	0.23	0.005	0.006	0.009
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.80	4.90	5.00	0.189	0.193	0.197
E1	2.90	3.00	3.10	0.114	0.118	0.122
e	-	0.65	-	-	0.0256	-
L	0.40	0.53	0.66	0.016	0.021	0.026
y	-	-	0.076	-	-	0.003
θ	0º	3º	6º	0º	3º	6º