AT6145

1.2MHz 2A SOT-26 Step Up DC-DC Converter

Immense Advance Tech.

FEATURES

- up to 93% Efficiency
- Integrated 80mΩ Power MOSFET
- 2.3V to 24V Input Voltage
- 1.2MHz Fixed Switching Frequency
- Internal 4A Switch Current Limit
- Adjustable Output Voltage up to 28V
- Internal Compensation
- Automatic Pulse Frequency Modulation Mode at Light Loads
- SOT26 Package Available

DESCRIPTION

The AT6145 is a constant frequency, 6-pin SOT23-6L current mode step-up converter intended for small, low power applications.

The AT6145 switches at 1.2MHz and allows the use of tiny, low cost capacitors and inductors 2mm or less in height. Internal soft-start results in small inrush current and extends battery life.

The AT6145 features automatic shifting to pulse frequency modulation mode at light loads.

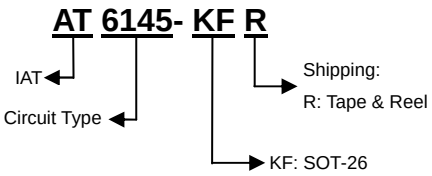
The AT6145 includes under-voltage lockout, current limiting, and thermal overload protection to prevent damage in the event of an output overload.

The AT6145 is SOT26 Package Available

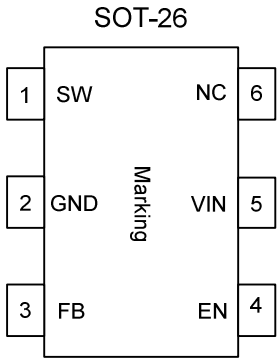
APPLICATION

- Battery-Powered Equipment
- Set-Top Boxed
- LCD Display
- DSL and Cable Modems and Routers
- Networking cards powered from PCI
- SMPS Post-Regulator / DC-to-DC Modules
- High-Efficiency Linear Power Supplies or PCI express slots

ORDER INFORMATION



PIN CONFIGURATIONS (TOP VIEW)



PIN DESCRIPTIONS

Pin Name	Pin Description
SW	Power Switching Output. SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load.
GND	Ground.
FB	Feedback Input. The FB voltage is 0.6V. Connect a resistor divider to FB.
EN	Regulator On/Off Control Input. A high input at EN turns on the converter, and a low input turns it off. When not used, connect EN to the input supply for automatic startup.
VIN	Input Supply Pin. Must be locally bypassed.
NC	No connected.

TYPICAL APPLICATION CIRCUITS

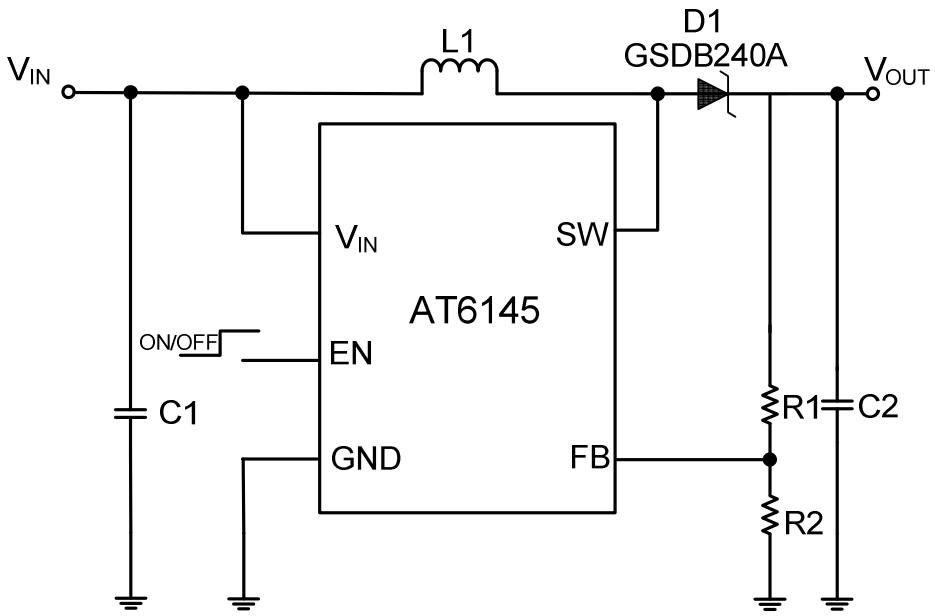
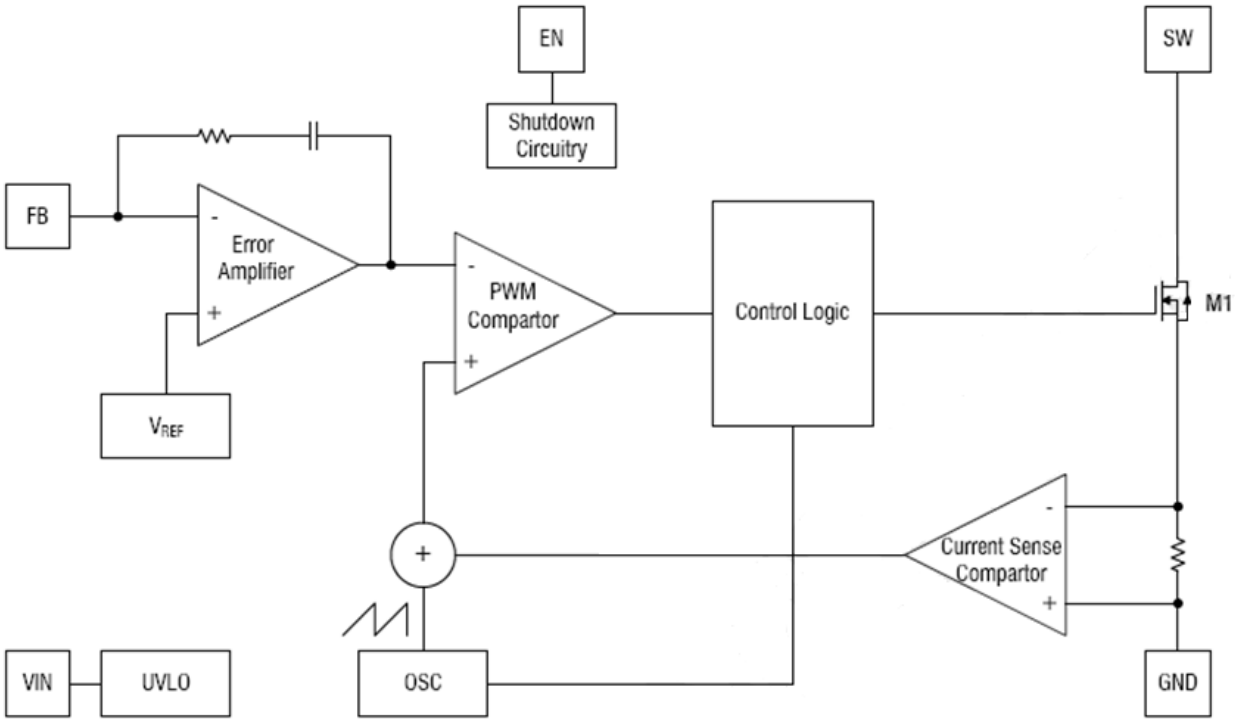


Figure1. Adjustable Output Voltage Regulator

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note 1)

Parameter	Symbol	Max Value	Unit
Input Supply Voltage	V_{IN}	-0.3 to 26	V
EN Voltages	V_{EN}	-0.3 to 26	V
SW Voltage	V_{SW}	-0.3 to 30	V
FB Voltage	V_{FB}	–0.3 to 6	V
Peak SW Sink and Source Current	I_{PEAK}	4	A
Maximum Junction Temperature	T_J	125	℃
Storage Temperature Range	T_{STG}	-60 to +150	℃
Lead Temperature(Soldering) 5 Sec.	T_{LEAD}	260	℃
Power Dissipation P_D @ T_A=25℃	P_D	300	mW
Thermal Resistance Junction to Ambient (Note 2)	θ_{JA}	333	℃ / W
Thermal Resistance Junction to Case	θ_{JC}	106.6	℃ / W

RECOMMENDED OPERATING CONDITIONS (Note 3)

Parameter	Symbol	Operation Conditions	Unit
Supply Input Voltage Range	V_{IN}	2.3 to 24	V
Maximum Output Voltage	Vout	28	V
Operating Junction Temperature Range	T_J	-40 to +125	℃
Operating Ambient Temperature Range	T_{OPA}	-40 to +85	℃

Note 1: Stresses listed as the above “Absolute Maximum Ratings” may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2: Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at T_A=25℃ .

Note 3: The device is not guaranteed to function outside its operating conditions.

ELECTRICAL CHARACTERISTICS

V_{IN}=V_{EN}=5V, T_A= 25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}	—	2.3	—	24	V
Under Voltage Lockout	V_{UVLO}	—	—	—	1.98	V
Under Voltage Lockout Hysteresis			—	100	—	mV
Current (Shutdown)	I_S	V_{EN}=0V	—-	0.1	1	μA
Quiescent Current (PFM Mode)	I_Q	V_{FB}=0.7V, NO switch	—	100	200	μA
Quiescent Current (PWM Mode)		V_{FB}=0.5V, switch on	—	1.6	2.2	mA
Switching Frequency	F_{SW}	—	—	1.2	—	MHz
Maximum Duty Cycle	$D_{(MAX)}$	V_{FB}=0V	90	—	—	%
EN Input High Voltage	V_{ENH}	—	1.5	—	—	V
EN Input Low Voltage	V_{ENL}	—	—	—	0.4	V
FB Voltage	V_{FB}	—	0.588	0.6	0.612	V
FB Input Bias Current	I_{FB}	V_{FB}=0.6V	-50	-10	—	nA
SW On Resistance (Note 4)	$R_{DS(ON)}$	—	—	80	150	mΩ
SW Current Limit (Note 4)	I_{SW}	V_{IN}=5V,Duty cycle=50%	—	4	—	A
SW Leakage	I_{sw}_Leak	V_{SW}=20V	—	—	1	uA
Thermal Shutdown	T_{SD}	—	—	160	—	℃

Note 4: Guaranteed by design, not tested.

APPLICATION INFORMATION

Operation

The AT6145 uses a fixed frequency, peak current mode boost regulator architecture to regulate voltage at the feedback pin. The operation of the AT6145 can be understood by referring to the block diagram. At the start of each oscillator cycle the MOSFET is turned on through the control circuitry. To prevent sub-harmonic oscillations at duty cycles greater than 50 percent, a stabilizing ramp is added to the output of the current sense amplifier and the result is fed into the negative input of the PWM comparator. When this voltage equals. The output voltage of the error amplifier the power MOSFET is turned off. The voltage at the output of the error amplifier is an amplified version of the difference between the 0.6V bandgap reference voltage and the feedback voltage. In this way the peak current level keeps the output in regulation. If the feedback voltage starts to drop, the output of the error amplifier increases. These results in more current to flow through the power MOSFET, thus increasing the power delivered to the output.

The AT6145 has internal soft start to limit the amount of input current at startup and to also limit the amount of overshoot on the output.

Setting the Output Voltage

The internal reference VREF is 0.6V (Typical).The output voltage is divided by a resistor divider,R1 and R2 to the FB pin. The output voltage is given by:

$$V_{OUT}=V_{REF}x\,(1+\frac{R1}{R2})$$

Inductor Selection

The recommended values of inductor are 4.7 to 22μH. Small size and better efficiency are the major concerns for portable device, such as AT6145 used for mobile phone. The inductor should have low core loss at 1.2MHz and low DCR for better efficiency. To avoid inductor saturation current rating should be considered.

Capacitor Selection

Input and output ceramic capacitors of 22μF are recommended for AT6145 applications. For better voltage filtering, ceramic capacitors with low ESR are recommended. X5R and X7R types are suitable because of their wider voltage and temperature ranges.

Diode Selection

Schottky diode is a good choice for AT6145 because of its low forward voltage drop and fast reverses recovery. Using Schottky diode can get better efficiency. The high speed rectification is also a good characteristic of Schottky diode for high switching frequency. Current rating of the diode must meet the root mean square of the peak current and output average current multiplication as following:

$$I_D(RMS) \approx \sqrt{I_{OUT}XI_{PEAK}}$$

The diode' s reverse breakdown voltage should be larger than the output voltage

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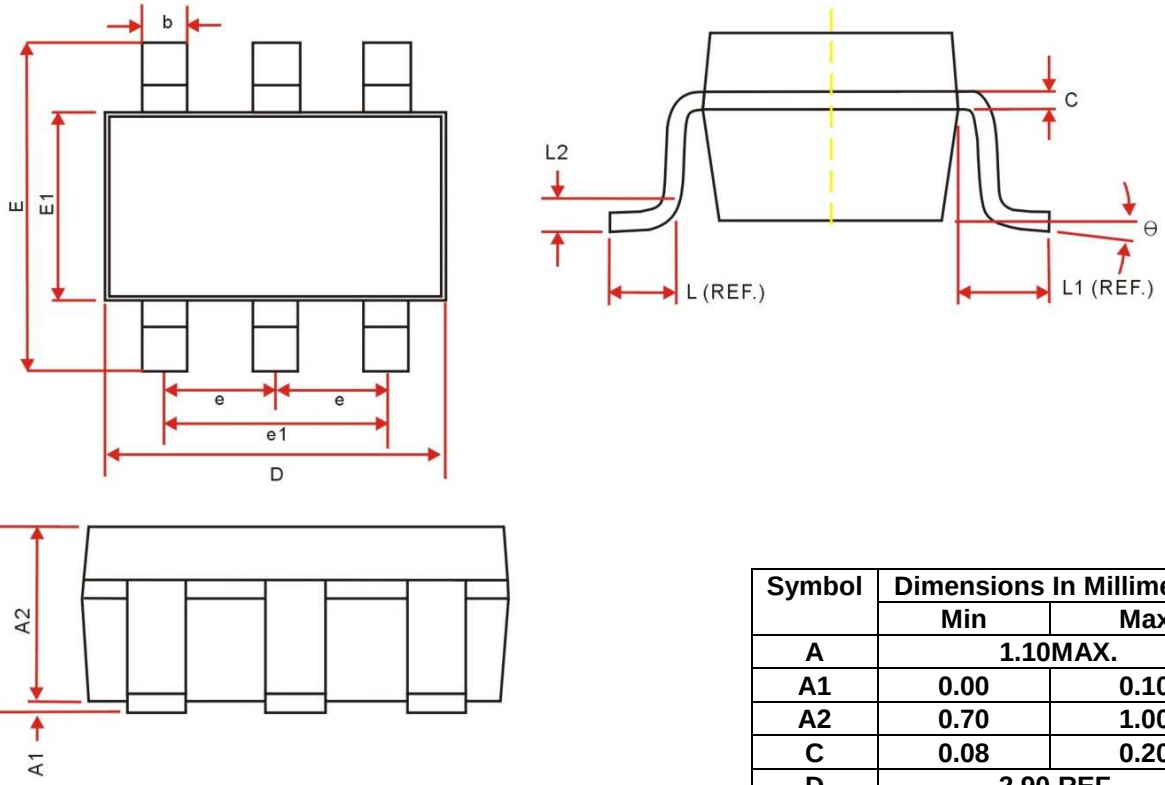
Layout Consideration

For best performance of the AT6145, the following guidelines must be strictly followed.

1. Input and Output capacitors should be placed close to the IC and connected to ground plane to reduce noise coupling.
2. The GND should be connected to a strong ground plane for heat sinking and noise protection.
3. Keep the main current traces as possible as short and wide.
4. SW node of DC-DC converter is with high frequency voltage swing. It should be kept at a small area.
5. Place the feedback components as close as possible to the IC and keep away from the noisy devices.

PACKAGE OUTLINE DIMENSIONS

SOT-26 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters	
	Min	Max
A	1.10MAX.	
A1	0.00	0.10
A2	0.70	1.00
C	0.08	0.20
D	2.90 REF.	
E	2.80 REF.	
E1	1.60 REF.	
L	0.30	0.60
L1	0.60 REF.	
L2	0.25 REF.	
θ	0°	10°
b	0.30	0.50
e	0.95 REF.	
e1	1.90 REF.	