AT2722

38V 5A Synchronous Buck Converter

Immense Advance Tech.

FEATURES

- Wide 8V to 38V Operating Input Range
- Integrated 80mΩ Power MOSFET Switches
- Output Adjustable from VFB(1V) to 20V
- Up to 95% Efficiency
- Internal Soft-Start
- Stable with Low ESR Ceramic Output Capacitors
- Fixed 160KHz Frequency
- Cycle-by-Cycle Over Current Protection
- Input Under/Over Voltage Lockout

DESCRIPTION

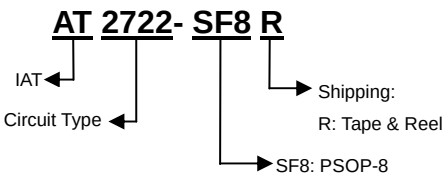
The AT2722 is a monolithic synchronous buck regulator. The device integrates internal high side and external low side power MOSFETs, and provides 5A of continuous load current over a wide input voltage of 8V to 38V. Current mode control provides fast transient response and cycle-by-cycle current limit.

An internal soft-start prevents inrush current at turn-on, This device available in PSOP-8 (Exposed pad) package, provides a very compact solution with minimal external components.

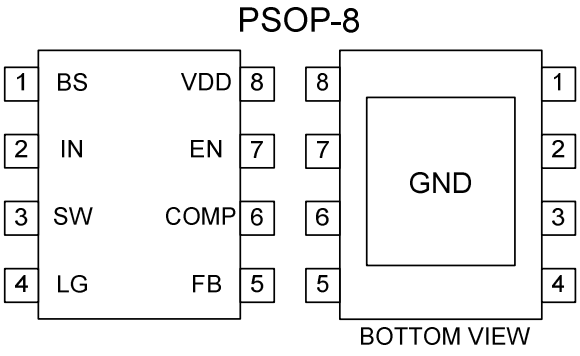
APPLICATION

- Cellular Telephones
- Laptop, Notebook, and Palmtop Computers
- Battery-Powered Equipment
- PCMCIA V_{CC} and V_{PP} Regulation / Switching
- Consumer / Personal Electronics
- SMPS Post-Regulator / DC-to-DC Modules
- High-Efficiency Linear Power Supplies

ORDER INFORMATION



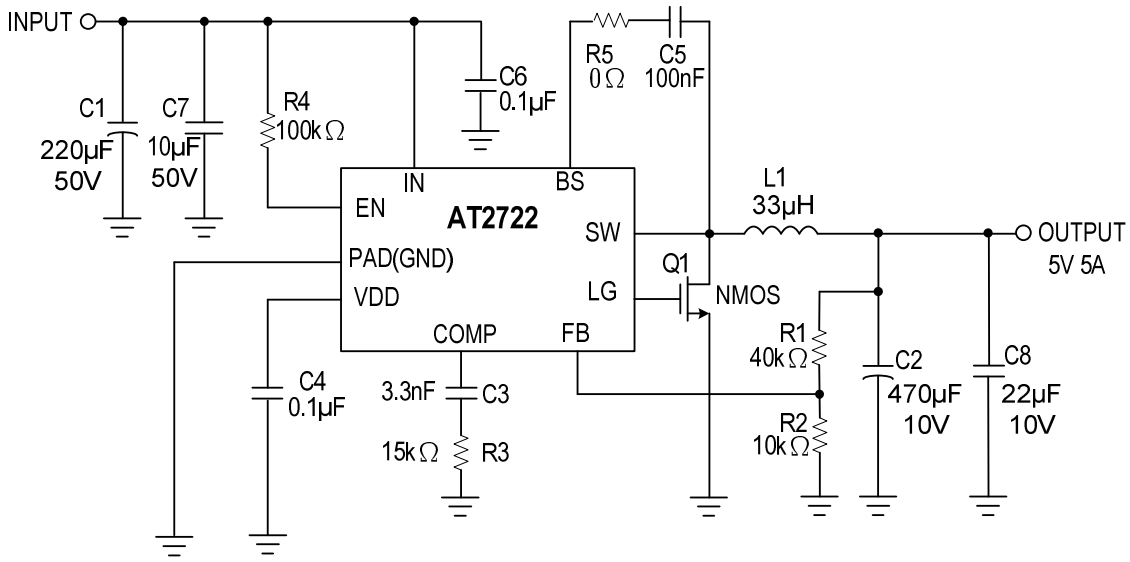
PIN CONFIGURATIONS (TOP VIEW)



PIN DESCRIPTIONS

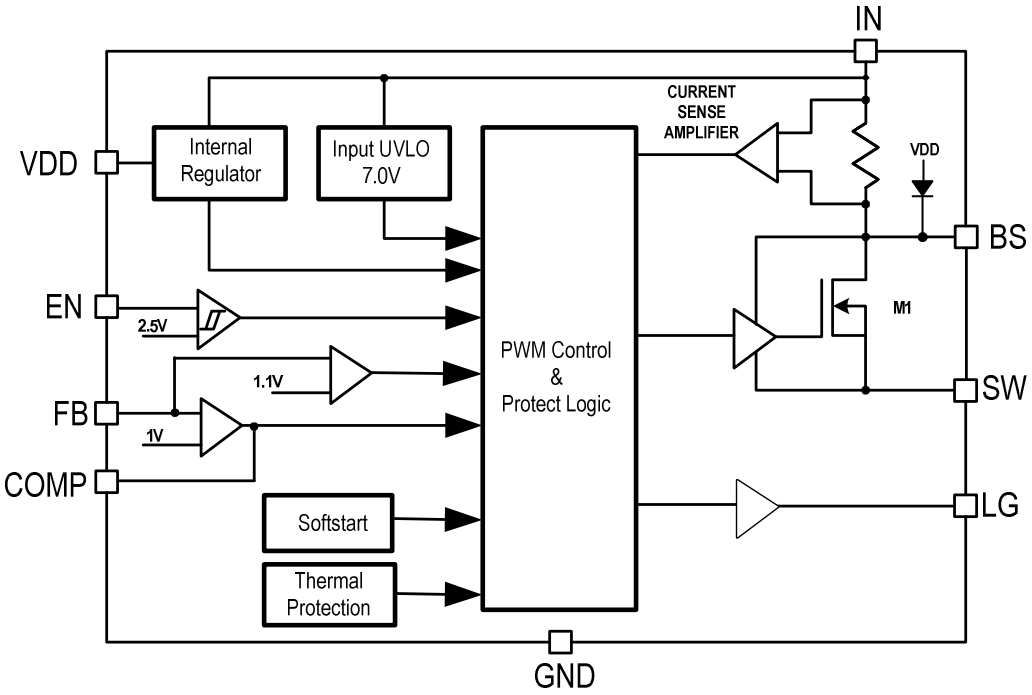
Pin Name	Pin Description
BS	Boot-Strap Pin. Supply high side gate driver. Decouple this pin to SW pin with 0.1uF ceramic cap.
IN	Power Input pin. Bypass IN to GND with a suitably large capacitor to eliminate noise on the input to the IC.
SW	Power Switching Output. SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load.
LG	Gate drive for external low side N-MOSFET..
PAD	Ground (Connect to GND).
FB	Feedback Input. FB senses the output voltage to regulate that voltage. Drive FB with a resistive voltage divider from the output voltage.
COMP	Compensation Node. COMP is used to compensate the regulation control loop. Connect a series RC network from COMP to GND to compensate the regulation control loop.
EN	Enable control. Pull high to turn on. Do not float.
VDD	Internal regulator pin

TYPICAL APPLICATION CIRCUITS



$V_{OUT}=V_{FB} \times (1+R1/R2)$, V_{FB} = 1.00V, R2 suggest 10k~30kΩ

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note 1)

Parameter	Symbol	Max Value	Unit
Supply Input Voltage	V_{IN}	-0.3 to +42	V
Switch Node Voltage	V_{SW}	-0.3 to V_{IN} +0.3	V
Boost Voltage	V_{BS}	V_{SW} – 0.3 to V_{SW} + 6	V
All Other Pins		–0.3 to +6	V
Output Voltage	V_{out}	V_{FB} to 20	V
Lead Temperature		260	℃
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	2770	mW
Thermal Resistance Junction to Ambient (Note 2)	θ_{JA}	36	℃ / W
Thermal Resistance Junction to Case	θ_{JC}	5.5	℃ / W
ESD rating (Human body mode) (Note 3)	V_{ESD}	2	kV

RECOMMENDED OPERATING CONDITIONS (Note 4)

Parameter	Symbol	Operation Conditions	Unit
Supply Input Voltage	V_{IN}	8 to 38	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: Devices are ESD sensitive. Handing precaution recommended.

Note 4: The device is not guaranteed to function outside its operating conditions.

ELECTRICAL CHARACTERISTICS

V_{IN} = 12V, T_A = +25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		8	—	38	V
Shutdown Supply Current	I_{SHDN}	V_{EN} = 0V	—	0.7	1.3	mA
Quiescent Current	I_{CCQ}	V_{EN} = 5.0V; V_{FB} = 1.05V	—	0.7	1.5	mA
Feedback Voltage	V_{FB}	8V ≤ V_{IN} ≤ 38V	0.98	1.00	1.02	V
Feedback Overvoltage Threshold	$OVP_{(FB)}$		—	1.1X	—	V_{FB}
High-Side Switch On Resistance (Note 5)	$R_{DS(ON)1}$		—	80	—	mΩ
High-Side Switch Leakage Current		V_{EN} = 0V, V_{SW} = 0V	—	—	10	μA
High-Side Switch Current Limit		Minimum Duty Cycle	5.1	6.0	—	A
LG Rise Time	T_{RISE}	C_{LX}=1000pF	—	40	—	ns
LG Fall Time	T_{FAIL}	C_{LX}=1000pF	—	40	—	ns
LG driver bias supply voltage			—	5	—	V
Oscillation Frequency	F_{OSC1}		—	160	—	KHz
Short Circuit Oscillation Frequency	F_{OSC2}	V_{FB} =< 0.5V	—	60	—	KHz
Maximum Duty Cycle	D_{MAX}		—	90	—	%
Minimum On Time (Note5)	$T_{ON(min)}$		—	220	—	ns
EN Lockout Threshold Voltage	$V_{ENH(LOCK)}$		—	2.5	—	V
EN Lockout Hysterisis			—	210	—	mV
Input Under Voltage Lockout Threshold	V_{UVLO}	V_{IN} Rising	6.5	7.0	7.5	V
Input Under Voltage Lockout Threshold Hysteresis	$V_{UVLO-Hys}$		—	800	—	mV
Input Over Voltage Lockout Threshold	V_{OVLO}	V_{IN} Rising	—	40	—	V
Input Over Voltage Lockout Threshold Hysteresis	$V_{OVLO-Hys}$		—	5	—	V
Soft-Start Period			—	3	—	ms
Thermal Shutdown	T_{SD}		—	150	—	℃
Thermal Shutdown Hysterisis	T_{SH}		—	30	—	℃

Note 5: Guaranteed by design

APPLICATION INFORMATION

The AT2722 is a synchronous rectified, current-mode, step-down regulator. It regulates input voltages from 8V to 38V down to an output voltage as low as VFB, and supplies up to 5A of load current.

The AT2722 uses current-mode control to regulate the output voltage. The output voltage is measured at FB through a resistive voltage divider and amplified through the internal Tran conductance error amplifier. The voltage at the COMP pin is compared to the switch current measured internally to control the output voltage.

The converter uses internal N-Channel MOSFET switches to step-down the input voltage to the regulated output voltage. Since the high side MOSFET requires a gate voltage greater than the input voltage, a boost capacitor connected between SW and BS is needed to drive the high side gate. The boost capacitor is charged from the internal 5V rail when SW is low.

When the AT2722 FB pin exceeds 10% of the nominal regulation voltage of VFB, the over voltage comparator is tripped and the COMP pin is discharged to GND, forcing the high-side switch off.

COMPONENT SELECTION

Setting the Output Voltage

The output voltage is set using a resistive voltage divider from the output voltage to FB pin. The voltage divider divides the output voltage down to the feedback voltage by the ratio.

Thus the output voltage is:

$$V_{OUT} = VFB \times \frac{R1 + R2}{R2}$$

For example, VFB =1.00V for a 5.0V output voltage, R2 is 10kΩ, and R1 is 40kΩ.

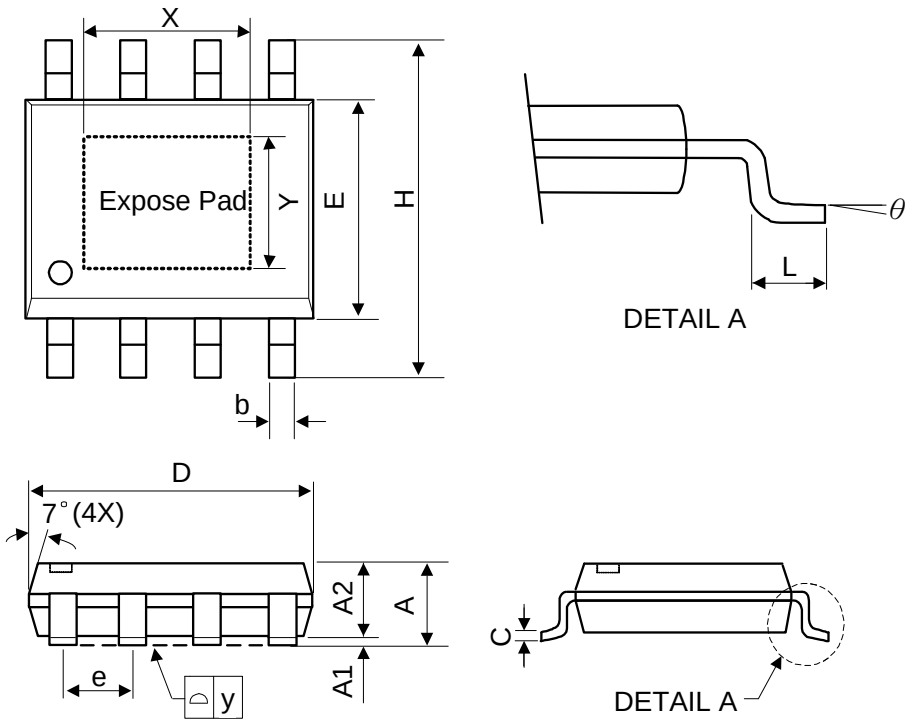
Inductor Selection

The inductor is required to supply constant current to the output load while being driven by the switched input voltage. A larger value inductor will result in less ripple current that will result in lower output ripple voltage. However, the larger value inductor will have a larger physical size, higher series resistance, and/or lower saturation current. A good rule for determining the inductance to use is to allow the peak-to-peak ripple current in the inductor to be approximately 30% of the maximum switch current limit.

VIN	<28V	<35V
Inductor	47uH	33uH

The choice of which style inductor to use mainly depends on the price vs. size requirements and any EMI requirements.

PACKAGE OUTLINE DIMENSIONS
PSOP-8 PACKAGE OUTLINE DIMENSION



Symbol	Dimensions in Millimeters	
	Min.	Max.
A	-	1.75
A1	0	0.15
A2	1.25	-
C	0.1	0.25
D	4.7	5.1
E	3.7	4.1
H	5.8	6.2
L	0.4	1.27
b	0.31	0.51
e	1.27 BSC	
y	-	0.1
X	-	3.33
Y	-	2.54
θ	0^{o}	8^{o}