DESCRIPTION

The A7221 is a current mode monolithic buck voltage converter. Operating with an input range of 4.7V~20V, the A7221 delivers 2A of continuous output current with two integrated N-Channel MOSFETs. At light loads, regulators operate in low frequency to maintain high efficiency and low output ripple.

The A7221 guarantees robustness with over current protection, thermal protection, start-up current run-away protection, and input under voltage lockout.

The A7221 is available in TSOT-26 package.

ORDERING INFORMATION

Package Type	Part Number	
TSOT-26	TE6	A7221TE6R
		A7221TE6VR
Note	V: Halogen free Package R: Tape & Reel SPQ:3,000pcs/Reel	
AiT provides all RoHS products Suffix " V " means Halogen free Package		

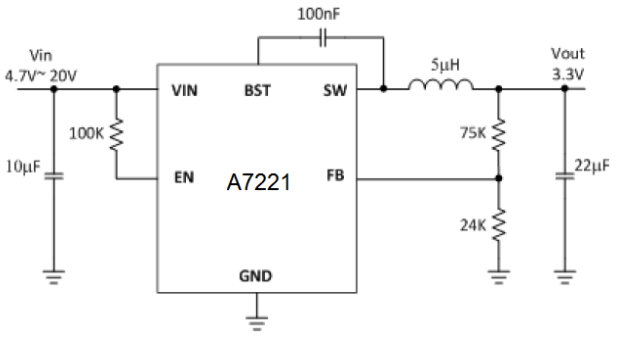
FEATURES

- 4.7V to 20V operating input range 2A output current
- Up to 95% efficiency
- High efficiency (>80%) at light load
- Fixed 500kHz Switching frequency
- Input under voltage lockout
- Start-up current run-away protection
- Over current protection and Hiccup
- Thermal protection
- Available in TSOT-26 Package

APPLICATION

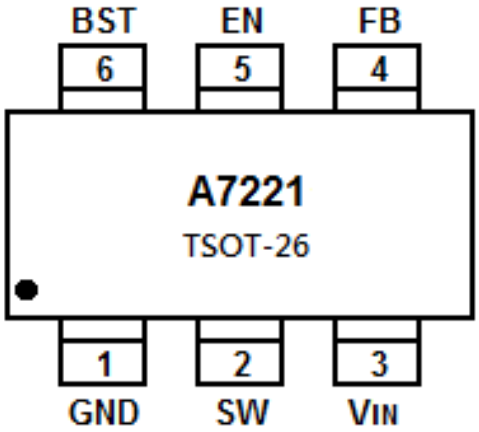
- Distributed Power Systems
- Networking Systems
- FPGA, DSP, ASIC Power Supplies
- Green Electronics/ Appliances
- Notebook Computers

TYPICAL APPLICATION



2A Buck Voltage Converter

PIN DESCRIPTION



Top View

Pin #	Symbol	Function
1	GND	Power ground pin.
2	SW	SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load.
3	V_{IN}	Input voltage pin. V_{IN} supplies power to the IC. Connect a 4.7V to 20V supply to V_{IN} and bypass V_{IN} to GND with a suitably large capacitor to eliminate noise on the input to the IC.
4	FB	Output feedback pin. FB senses the output voltage and is regulated by the control loop to 0.8V. Connect a resistive divider at FB.
5	EN	Drive EN pin high to turn on the regulator and low to turn off the regulator.
6	BST	Boostrap pin for top switch. A 0.1uF or larger capacitor should be connected between this pin and the SW pin to supply current to the top switch and top switch driver.

ABSOLUTE MAXIMUM RATINGS

V_{IN}, EN, SW PIN	-0.3V~22V
BST PIN	SW-0.3V~SW+5V
All other pins	-0.3V~6V
Junction Temperature[NOTE1,2]	150℃
Lead Temperature	260℃
Storage Temperature	-65℃~+150℃

Stress beyond above listed “Absolute Maximum Ratings” may lead permanent damage to the device. These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN	MAX	Units
Input Voltage V_{IN}		4.7	20	V
Output voltage V_{OUT}		0.8	18	V
Junction Temperature	T_J	-40	125	℃

THERMAL PERFORMANCE[NOTE3]

Package	θ_{JA}	θ_{JC}
TSOT-26	110℃/W	55℃/W

NOTE1: The A7221 guarantees robust performance from -40°C to 150°C junction temperature. The junction temperature range specification is assured by design, characterization and correlation with statistical process controls.

NOTE2: The A7221 includes thermal protection that is intended to protect the device in overload conditions. Thermal protection is active when junction temperature exceeds the maximum operating junction temperature. Continuous operation over the specified absolute maximum operating junction temperature may damage the device.

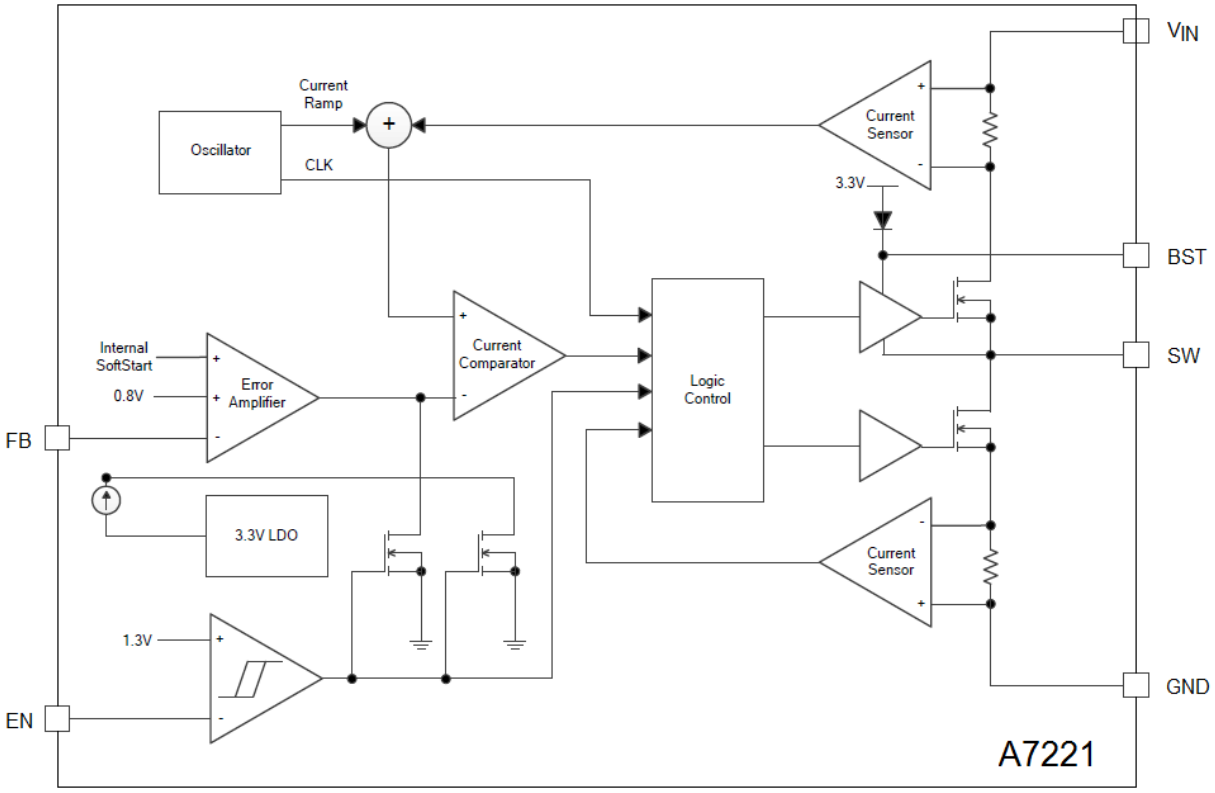
NOTE3: Measured on JESD51-7, 4-layer PCB.

ELECTRICAL CHARACTERISTICS

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
V_{IN} Under voltage Lockout Threshold	V_{IN_MIN}	V_{IN} falling		3.88		V
V_{IN} Under voltage Lockout Hysteresis	$V_{IN_MIN_HYST}$			360		mV
Shutdown Supply Current	I_{SD}	V_{EN}=0V			1	μA
Supply Current	I_Q	V_{EN}=5V, V_{FB}=2V		50		μA
Feedback Voltage	V_{FB}		776	800	824	mV
Top Switch Resistance	$R_{DS(ON)T}$			160		mΩ
Bottom Switch Resistance	$R_{DS(ON)B}$			80		mΩ
Top Switch Leakage Current	I_{LEAK_TOP}	V_{IN}=20V, V_{EN}=0V, V_{SW}=0V			0.5	μA
Bottom Switch Leakage Current	I_{LEAK_BOT}	V_{IN}=20V, V_{EN}=0V, V_{SW}=0V			0.5	μA
Top Switch Current Limit	I_{LIM_TOP}	Minimum Duty Cycle		3.8		A
Switch Frequency	F_{SW}			500		kHz
Minimum On Time	T_{ON_MIN}			100		ns
Minimum Off Time	T_{OFF_MIN}	V_{FB}=0.7V		100		ns
EN shut down threshold voltage	V_{EN_TH}	V_{EN} falling, FB=0V		1.2		V
EN shut down hysteresis	V_{EN_HYST}			100		mV
Thermal Shutdown	T_{TSD}			145		℃
Temperature Hysteresis	T_{HYS}			15		℃

BLOCK DIAGRAM



DETAILED INFORMATION

FUNCTIONAL DESCRIPTION

The A7221 is a synchronous, buck voltage converter.

Current-Mode Control

The A7221 utilizes current-mode control to regulate the FB voltage. Voltage at the FB pin is regulated at 0.8V so that by connecting an appropriate resistive divider between V_{OUT} and GND, designed output voltage can be achieved.

PFM Mode

The A7221 operates in PFM mode at light load. In PFM mode, switch frequency decreases when load current drops to boost power efficiency at light load by reducing switch-loss, while switch frequency increases when load current rises, minimizing output voltage ripples.

Internal Soft-Start

Soft-Start makes output voltage rising smoothly follow an internal SS voltage until SS voltage is higher than the internal reference voltage. It can prevent overshoot of output voltage when startup.

Power Switch

N-Channel MOSFET switches are integrated on the A7221 to down convert the input voltage to the regulated output voltage. Since the top MOSFET needs a gate voltage greater than the input voltage, a boost capacitor connected between BST and SW pins is required to drive the gate of the top switch. The boost capacitor is charged by the internal 3.3V rail when SW is low.

V_{IN} Under-Voltage Protection

A resistive divider can be connected between V_{IN} and GND, with the central tap connected to EN, so that when V_{IN} drops to the pre-set value, EN drops below 1.2V to trigger input under voltage lockout protection.

Output Current Run-Away Protection

At start-up, due to the high voltage at input and low voltage at output, current inertia of the output inductance can be easily built up, resulting in a large start-up output current. A valley current limit is designed in the A7221 so that only when output current drops below the valley current limit can the top power switch be turned on. By such control mechanism, the output current at start-up is well controlled.

Over Current Protection and Hiccup

A7221 has a cycle-by-cycle current limit. When the inductor current triggers current limit, A7221 enters hiccup mode and periodically restart the chip.

A7221 will exit hiccup mode while not triggering current limit.

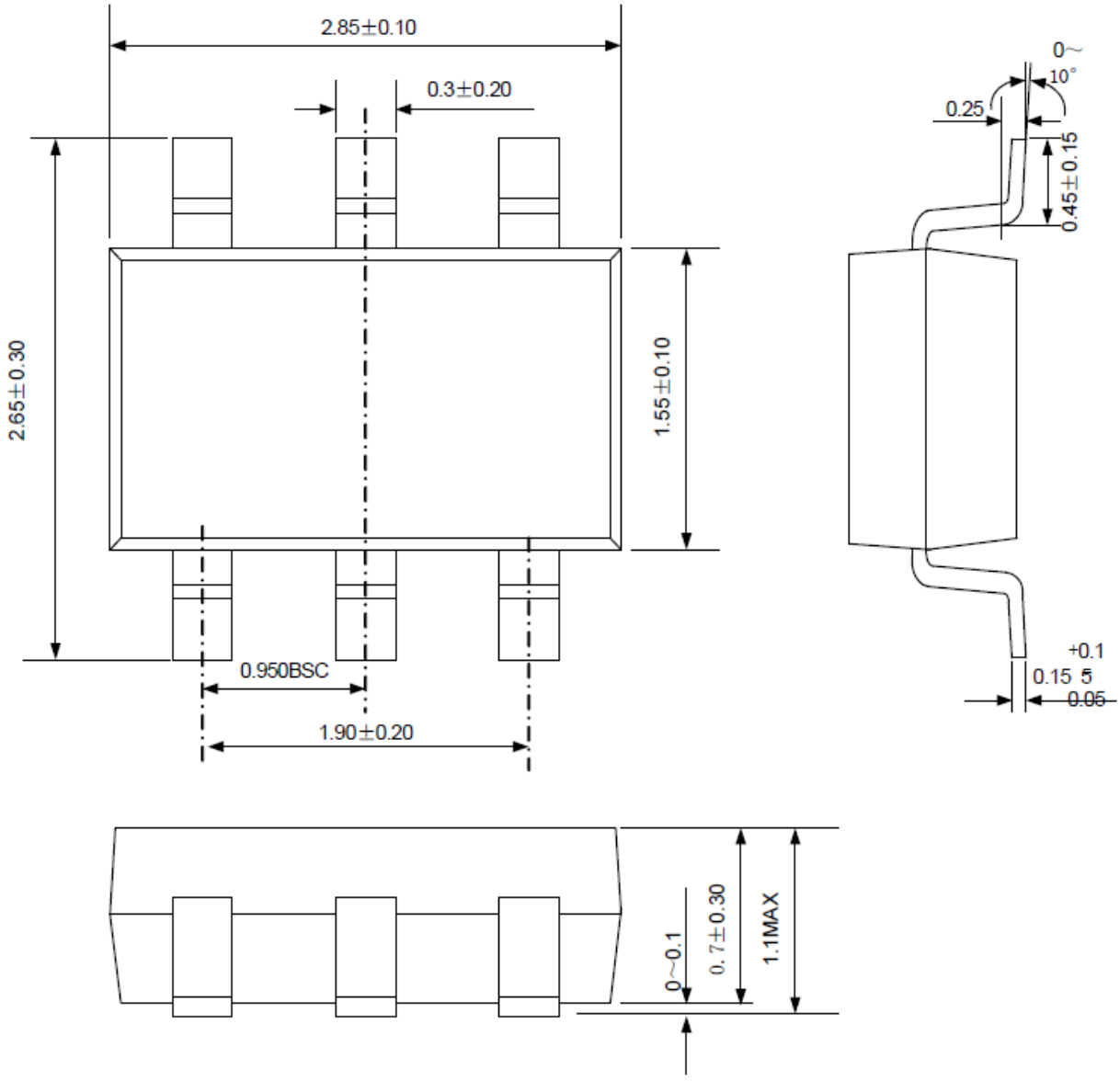
Thermal Protection

When the temperature of the A7221 rises above 145°C, it is forced into thermal shut-down.

Only when core temperature drops below 130°C can the regulator becomes active again.

PACKAGE INFORMATION

Dimension in TSOT-26 (Unit: mm)



IMPORTANT NOTICE

AiT Semiconductor Inc. (AiT) reserves the right to make changes to any its product, specifications, to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

AiT Semiconductor Inc.'s integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life support applications, devices or systems or other critical applications. Use of AiT products in such applications is understood to be fully at the risk of the customer. As used herein may involve potential risks of death, personal injury, or servere property, or environmental damage. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

AiT Semiconductor Inc. assumes to no liability to customer product design or application support. AiT warrants the performance of its products of the specifications applicable at the time of sale.