DESCRIPTION

The A7235 consists of step-down switching regulator with PWM control. These devises include a reference voltage source, oscillation circuit, error amplifier, internal PMOS and etc.

A7235 provides low-ripple power, high efficiency and external transient characteristics. The PWM control circuit is able to the duty ratio linearly from 0 up to 100%. The converter is build out soft start function that prevents overshoot and inrush current at startup. An over current protect function and short circuit protect function are built inside, and when OCP or SCP happens, the operation frequency will be reduced. Also, an internal compensation block is built in to minimum external component count.

With the addition of an internal P-channel Power MOS, a coil, capacitors, and a diode connected externally, these ICs can function as step-down switching regulators. They serve as ideal power supply units for portable devices when coupled with the SOP8 package, providing such outstanding features as low current consumption. Since this converter can accommodate an input voltage up to 20V, it is also suitable for the operation via an AC adapter.

The A7235 is available in SOP8 package.

FEATURES

- Input voltage : 3.6V to 20V
- Output voltage : 0.8V to V_{CC}
- Duty ratio : 0% to 100% PWM control
- Oscillation frequency is 300KHz
- Current limit, Short Circuit Protect (SCP) and Thermal Shutdown protection
- Built-in internal SW P-channel MOS
- Available in SOP8 Package

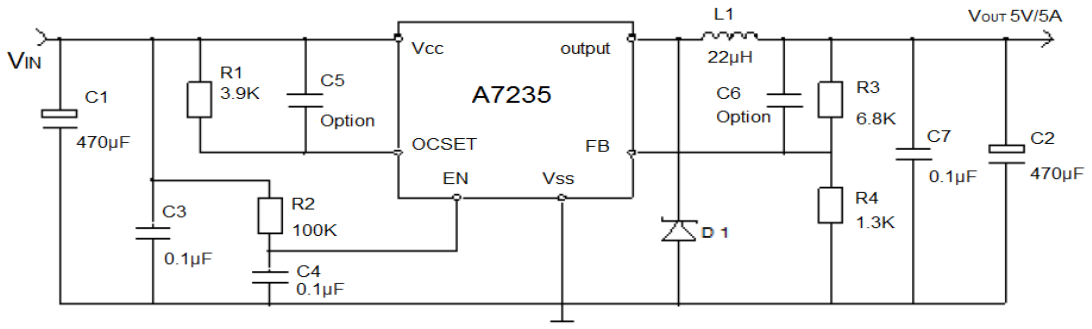
APPLICATION

- Portable DVD Players
- Car Application
- Telecom/Networking Equipment
- Set Top Boxes
- USB 3.0 device
- LCD TV

TYPICAL APPLICATION

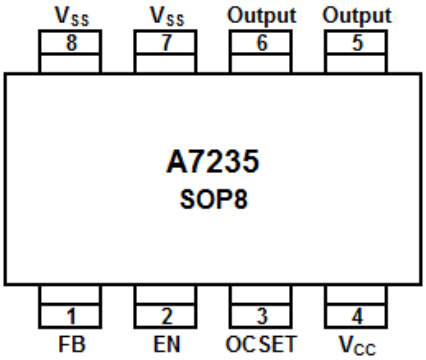
Package Type	Part Number	
SOP8	M8	A7235M8R
		A7235M8VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products Suffix " V " means Halogen free Package		

ORDERING INFORMATION



NOTE:$V_{OUT}=V_{FB}$ x(1+R3/R4),R4=0.7K to 5K

PIN DESCRIPTION



Top View

Pin #	Symbol	Function
1	FB	Feedback voltage to internal error amplifier, the threshold voltage is 0.8V
2	EN	Enable control input. Drive high to turn on the converter, low to turn it off.
3	OCSET	Add an external resister to set max. Output current.
4	V_{CC}	Power supply.
5,6	Output	Switch pin. Connect external inductor & diode here. Minimize trace area at this pin to reduce EMI.
7,8	V_{SS}	Power GND.

ABSOLUTE MAXIMUM RATINGS

T_A=25°C, Unless Otherwise Noted

V_{CC}, Supply Voltage	V_{SS}-0.3V to V_{SS}+23V
V_{FB}, Feedback Voltage	V_{SS} -0.3V to V_{CC}
V_{EN}, EN pin Voltage	V_{SS} -0.3V to V_{IN}+0.3V
V_{OUT}, Output pin Voltage	V_{SS} -0.3V to V_{IN}+0.3V
T_{ST}, Storage Temperature Range	-65℃ to 150℃
T_{OP}, Operation Temperature Range	-20℃ to 85℃
V_{OP}, Operation Supply Voltage	4.5V to 23V
θ_{JA}, Thermal Resistance (Junction to Ambient)	105℃/W
θ_{JC}, Thermal Resistance (Junction to Case)	50℃/W
T_{STG}, Soldering Temperature	300℃ , 5sec

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.

NOTE1: θ_{JA} is measured with the PCB copper area (need connect to Exposed PAD) of approximately 1.5 in^2(Multi-layer).

ELECTRICAL CHARACTERISTICS

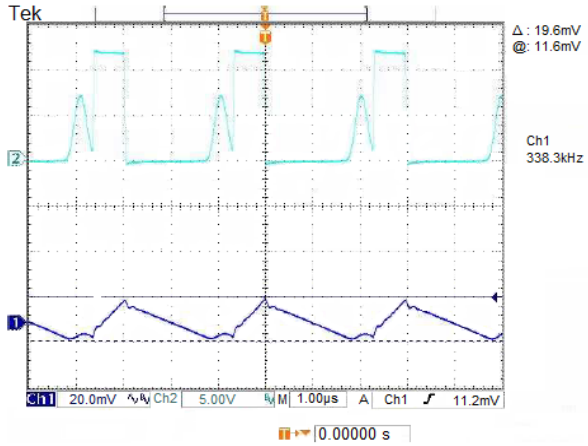
V_{CC} =12V, T_A =25°C, unless otherwise noted

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Voltage	V_{IN}		3.6		20	V
Feedback Voltage	V_{FB}	I_{OUT}=100mA	0.784	0.800	0.816	V
Feedback Bias Current	I_{FB}	I_{OUT}=0.1A		0.1	0.5	μA
Shutdown Supply Current	I_{SD}	V_{EN}=0V		10	40	μA
Switch Current	I_{SW}		3.5			A
Line Regulation	$\frac{\Delta V_{OUT}}{V_{OUT}}$	V_{IN}=5V to 20V, I_{OUT}=0.2A		1	2	%
Load Regulation	$\frac{\Delta V_{OUT}}{V_{OUT}}$	I_{OUT}= 0.2 to 3A		0.2		%
Oscillation Frequency	F_{OSC}	Measure waveform at SW pin	260	300	360	KHz
Frequency of Current Limit or Short Circuit Protect	F_{OSC1}	Measure waveform at SW pin	10	50	90	KHz
EN pin Shutdown logic input threshold voltage	V_{SH}	Logic High	2.0			V
	V_{SL}	Logic Low			0.8	
EN pin Input Leakage Current	I_{SH}	Logic High		20		μA
	I_{SL}	Logic Low		-10		
Internal MOSFET On-state Resistance	R_{DSON}	V_{IN}=5V, V_{FB}=0V		44	58	mΩ
		V_{IN}=12V, V_{FB}=0V		28	35	
Efficiency	η	V_{IN}=12V, V_{OUT}=5V, I_{OUT}=3.5A		90		%
Thermal Resistance Junction-to-Ambient	θ_{JA}			60		°C /W

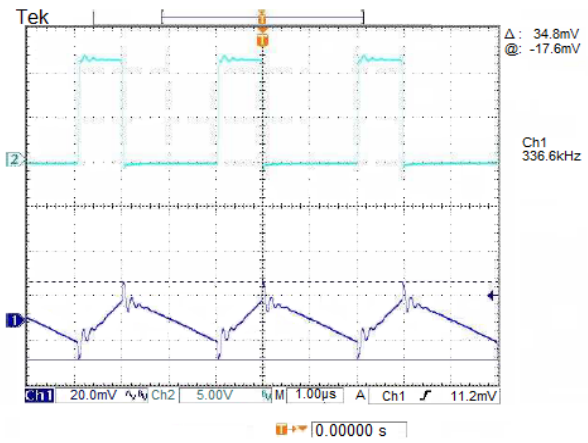
TYPICAL PERFORMANCE CHARACTERISTICS

T_A=25°C, Unless Otherwise Noted

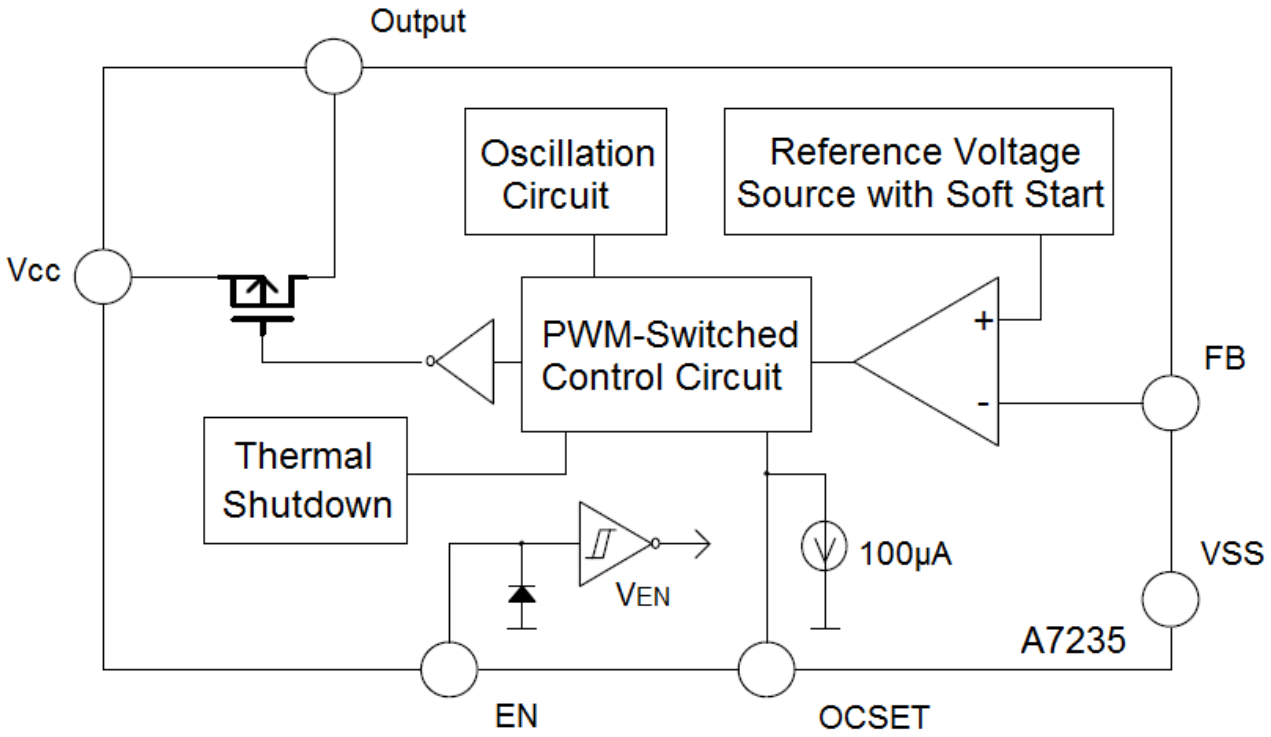
1. V_{OUT} Ripple, V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=0.1A



2. V_{OUT} Ripple, V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=3A



BLOCK DIAGRAM



DETAILED INFORMATION

PWM Control

The A7235 consists of DC/DC converters that employ a pulse-width modulation (PWM) system. In converters of the A7235, the pulse width varies in a range from 0 to 100%, according to the load current. The ripple voltage produced by the switching can easily be removed through a filter because the switching frequency remains constant.

Therefore, these converters provide a low-ripple power over broad ranges of input voltage and load current.

Under Voltage Lockout

The under voltage lockout circuit of the A7235 assures that the high-side MOSFET driver outputs remain in the off state whenever the supply voltage drops below 3.3V. Normal operation resumes once V_{CC} rises above 3.5V.

$R_{DS(ON)}$ Current Limiting

The current limit threshold is setting by the external resistor connecting from V_{CC} supply to OCSET. The internal 100uA sink current crossing the resistor sets the voltage at pin of OCSET.

When the PWM voltage is less than the voltage at OCSET, an over-current condition is triggered.

$$I_{LOAD} \times R_{DS(ON)} = I_{OCSET} \times R_{OCSET}$$

See above formula for setting the current limit value.

EN

This pin can be supplied shutdown function. It is inside pull high function. For normal application, the pin must be connected a capacitor to ground. Allow the switching regulator circuit to be shutdown pulling this pin below a 0.8V threshold voltage; the shutdown supply current is approximately 150uA.

OCSET

The current limit threshold is setting by the external resister connecting from V_{CC} supply to OCSET. The internal 60uA sink current crossing the resistor sets the voltage at pin of OCSET. When the V_S voltage is less than the voltage at OCSET, an over-current condition is triggered.

Application Information

Setting the Output Voltage

Application circuit item shows the basic application circuit with adjustable output version. The external resistor sets the output voltage according to the following equation:

Table 1 Resistor select for output voltage setting

V_{OUT}	R4	R5
5V	1.3K	6.8K
3.3V	1.5K	4.7K
2.5V	2.2K	4.7K
1.8V	2K	2.5K
1.5V	2.2K	2K
1.2V	2K	1K

Input Capacitor Selection

The capacitor should be located close to the IC using shout leads and the voltage rating should be approximately 1.5 times the maximum input voltage. The RMS current rating requirement for the input capacitor of a buck regulator is approximately 1/2 the DC load current. A low ESR capacitor sized for maximum RMS current must be used. A 470uF low ESR capacitor for most application is sufficient.

Output Capacitor Selection

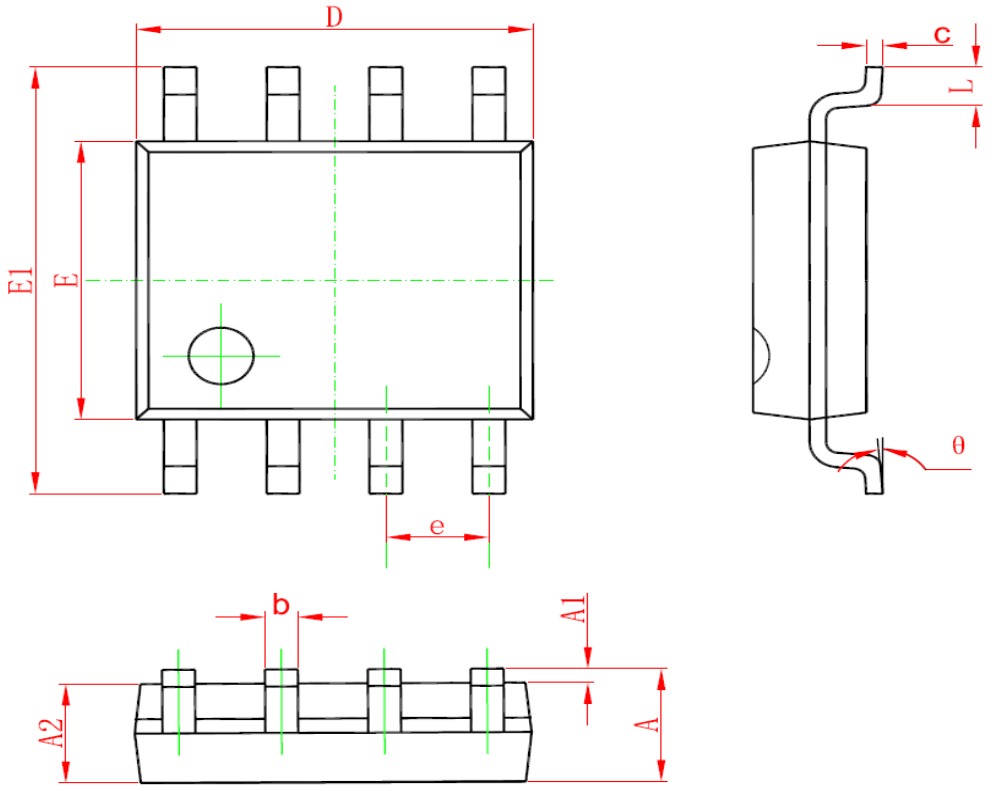
The output capacitor is required to filter the output provide regulator loop stability. The important capacitor parameters are; the 300KHz Equivalent Series Resistance (ESR), the RMS ripples current rating, voltage rating, and capacitor value. For the output capacitor, the ESR value is the most important parameter. The ESR can be calculated from the following formula.

$$V_{RIPPLE} = \Delta I_L \times ESR = 0.6A \times 80m\Omega = 48mV$$

An aluminum electrolytic capacitor's ESR value is related to the capacitance and its voltage rating. In most case, higher voltage electrolytic capacitors have lower ESR values. Most of the time, capacitors with mush higher voltage ratings may be needed to provide the low ESR values required for low output ripple. It is recommended to replace this low ESR capacitor by using a 470uF low ESR values < 80mΩ.

PACKAGE INFORMATION

Dimension in SOP8 (Unit: mm)



Symbol	Min	Max
A	1.350	1.750
A1	0.100	0.250
A2	1.350	1.550
b	0.350	0.490
c	0.190	0.250
D	4.800	5.000
E	3.800	4.000
E1	5.800	6.200
e	1.270(TYP)	
L	0.400	0.900
θ	0°	8°

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.