DESCRIPTION

The A7120H is a monolithic integrated circuit designed for step-down (buck) DC/DC converter applications. It features a low EMI signature, making it ideal for noise-sensitive environments. The device supports up to 2A continuous output current with excellent load and line regulation, ensuring stable performance across varying conditions.

Key performance features include the ability to operate at up to 97% duty cycle, allowing for low dropout operation, which is critical for maximizing output voltage in low-input voltage scenarios. An internal soft start minimizes inrush current during startup, helping to extend battery life in portable applications.

Protection Features are Cycle-by-cycle peak current limit, Short-circuit protection, Thermal shutdown, and Under-voltage lockout (UVLO)

The A7120H is offered in a PSOP-8 package, providing a compact, thermally efficient solution for a variety of power management.

ORDERING INFORMATION

Package Type	Part Number	
PSOP8 SPQ:4,000pcs/Reel	MP8	A7120HMP8VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

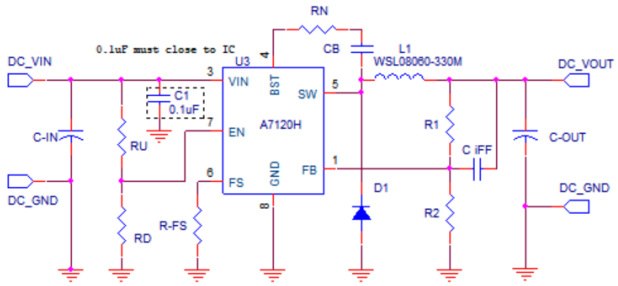
FEATURES

- Wide input voltage Range: 4.5V~100V
- Adjustable Output Voltage: 0.78V to V_{IN}
- 2A Continuous Output Current
- Low $R_{DS(ON)}$ Internal Switches: 900mΩ
- Adjustable Switching Frequency: 150K/ 270K/ and 450K
- High Duty Cycle Operation: up to 97%
- Short Circuit Protection
- Over Current Protection
- Internal Soft Startup
- Thermal Shutdown Protection

APPLICATION

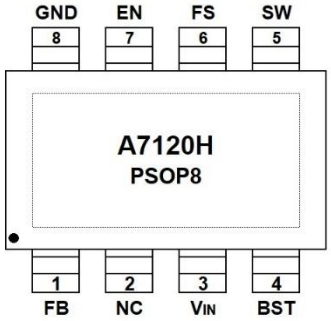
- LCD Monitor and LCD TVs
- Battery-powered Equipment
- Entertainment Devices
- Digital Home Appliances (e.g., Digital TVs)
- ADSL Modem and Portable Instruments

TYPICAL APPLICATION



L1: WSL08060-330M
WSL10040-470M
D1:SM580A

PIN DESCRIPTION



PSOP8, MP8

Top View

PIN#	Symbol	Function
1	FB	Feedback: Provides input to the internal control loop. Connect this pin to an external resistor divider from the output to set the regulated output voltage.
2	NC	Do not connect
3	V_{IN}	Power supply voltage input
4	BST	Bootstrap: A capacitor must be connected between the BST and SW pins to create a floating voltage supply that drives the high-side MOSFET gate.
5	SW	Switch pin connected to the internal FET switches and inductor terminal. Connect the inductor of the output filter to this pin.
6	FS	Switching Frequency Set
7	EN	Enable: Logic input for device enable control. A logic high enables the device, while a logic low disables it and places it into shutdown mode. Do not leave floating.
8	GND	Ground pin.

ABSOLUTE MAXIMUM RATINGS

Over operating temperature range(25°C) (unless otherwise noted)

Voltage (1)	V_{IN}	-0.3V ~ +110V
	EN	-0.3V ~ +6.5V
	BST	V_{SW}+5V
	SW (less than 10ns) (2)	-0.3V ~ +V_{IN}+0.5V
	FB	-0.3V ~ +6.5V
T_J, Operating Junction Temperature		-40°C ~ +150°C
T_{STG}, Storage Temperature		-55°C ~ +150°C
$R_{\theta JA}$, Junction-to-Ambient Thermal Resistance		48.8 °C/W
$R_{\theta JC(top)}$, Junction-to-Case (top) Thermal Resistance		52.5 °C/W

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(1) All voltage values are with respect to network ground terminal.

(2) While switching

RECOMMENDED OPERATING CONDITIONS

	MIN.	MAX.	Units
Operating Junction Temperature (1)	-40	125	℃/W
Operating Temperature Range	-40	85	℃/W
V_{IN}, Input Voltage	4.5	100	V
V_{OUT}, Output Voltage	0.8	30	V
Output Current(12V)	0	1.5	A
Output Current(5V)	0	2.0	A
Output Current (5V Load Peak<100mS)	0	3.5	A

(1) All limits specified at room temperature (T_A = 25°C) unless otherwise specified. All room temperature limits are 100% production tested. All limits at temperature extremes are ensured through correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).

ELECTRICAL CHARACTERISTICS

V_{IN}=48V, T_A=25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Input Voltage Range	V_{IN}		4.5	-	100	V
Non Switching Quiescent Current	I_Q	EN=5V	-	175	300	μA
Shut Down Current	I_{OFF}	EN = GND	-	-	3	μA
Regulated Feedback Voltage	V_{FB}		764	780	795	mV
V_{IN} Under Voltage Lockout	$V_{IN(UVLO)}$		-	4.3	-	V
V_{IN} Under Voltage Lockout Hysteresis			-	200	-	mV
ENABLE (EN PIN)						
Enable Threshold	$V_{(EN\_RISING)}$	Rising	1.5	-	-	V
	$V_{(EN\_FALLING)}$	Falling	-		1	V
Threshold Hysteresis	$V_{(EN\_HYS)}$		-	200	-	mV
EN Pull-Up Current	$I_{(ENPULL\_UP)}$	V_{EN}=HIGH	-	4	-	μA
		V_{EN}=LOW	--	1	-	μA
POWER STAGE						
High-Side FET on Resistance	$R_{(HSD)}$	I_{SW}= 1000mA	-	900	-	mΩ
CURRENT LIMIT						
High side FET Current Limit	$I_{(LIM\_HS)}$	FB=90%	-	-	3.5	A
OSCILLATOR						
Centre Switching Frequency	F_{SW}	FS=Float	-	450	-	kHz
		FS=240K	-	270	-	kHz
		FS=75K	-	150	-	kHz
OVER TEMPERATURE PROTECTION						
Rising Temperature	Thermal Shutdown		-	160	-	℃
Hysteresis			-	20	-	℃
Soft Start			1	1.8	3	ms

TYPICAL PERFORMANCE CHARACTERISTICS

Fig.1 Power-on sequence: ~=3mS
C_{IN}=22uFx2, C_{OUT}=47uFx2, L=33uH, T_A=+25℃
V_{IN} =30V, V_{OUT}= 5V, EN=5V. I_{OUT}= 1A

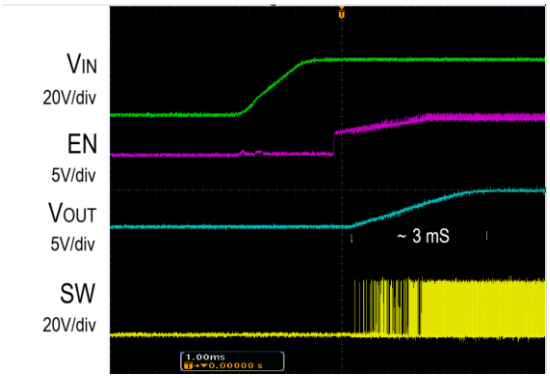


Fig.2 Power Off: ~=16mS
C_{IN}=22uFx2, C_{OUT}=47uFx2, L=33uH, T_A=+25℃
V_{IN} =30V, V_{OUT}= 5V, EN=5V. I_{OUT}=1A

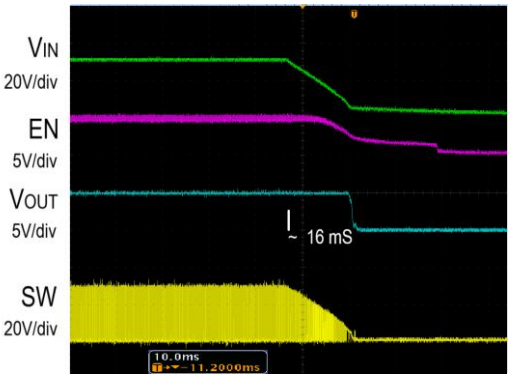


Fig.3 Power Disable by EN: ~=500μS
C_{IN}=22uFx2, C_{OUT}=47uFx2, L=33uH, T_A=+25℃
V_{IN} =30V, V_{OUT}= 5V, EN=5V. I_{OUT}= 1A

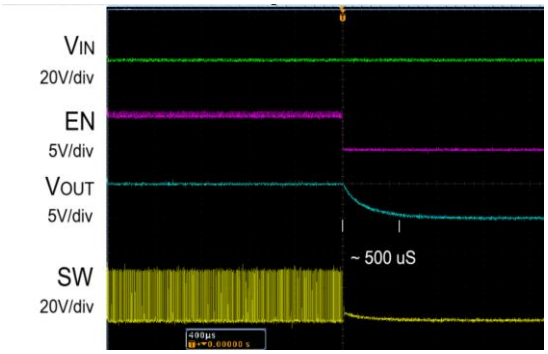


Fig.4 Steady State Test: ~= ±6mV
C_{IN}=22uFx2, C_{OUT}=47uFx2, L=33uH, T_A=+25℃
V_{IN} =30V, V_{OUT}= 5V, EN=5V. I_{OUT}= 1A

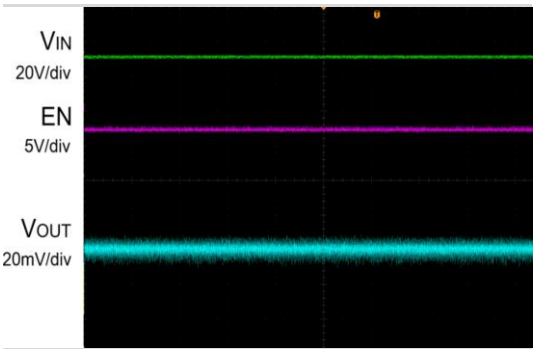


Fig.5 Light Load Transient Response: 230 KHz
C_{IN}=22uFx2, C_{OUT}=47uFx2, L=33uH, T_A=+25℃
V_{IN} =30V, V_{OUT}= 5V, EN=5V. I_{OUT}=0. 1A

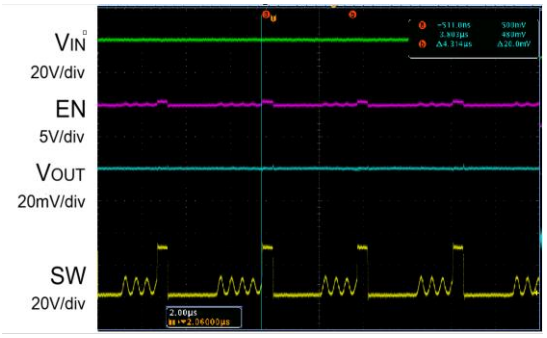


Fig.6 Load Transient Response: 480 KHz
C_{IN}=22uFx2, C_{OUT}=47uFx2, L=33uH, T_A=+25℃
V_{IN} =30V, V_{OUT}= 5V, EN=5V. I_{OUT}=1A

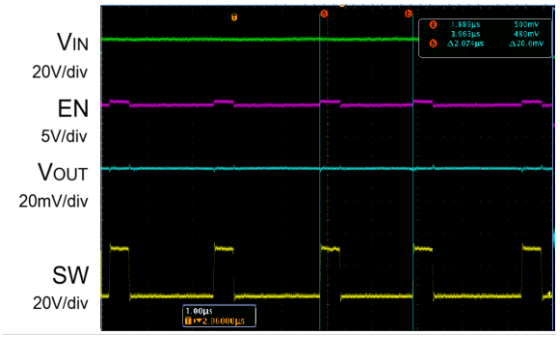


Fig.5 Short Circuit Entry:
C_{IN}=22uFx2, C_{OUT}=47uFx2, L=33uH, T_A=+25℃
V_{IN} =30V, V_{OUT}= 5V, EN=5V. I_{OUT}=0. 1A

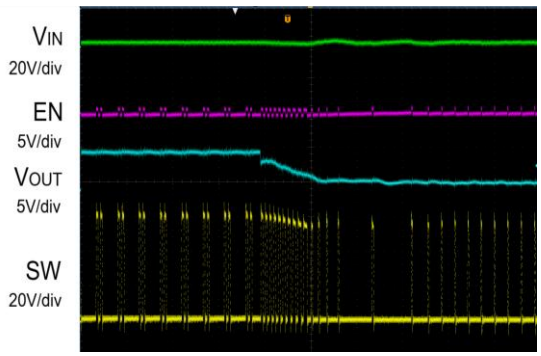
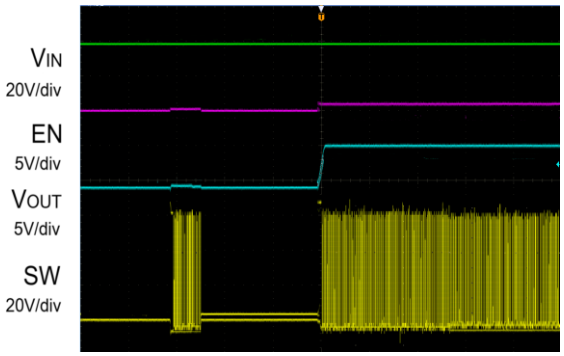
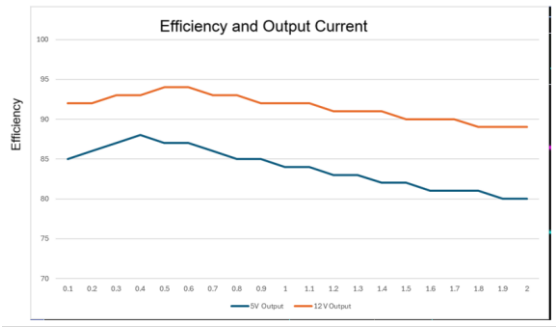


Fig.6 Short Circuit Exit :
C_{IN}=22uFx2, C_{OUT}=47uFx2, L=33uH, T_A=+25℃
V_{IN} =30V, V_{OUT}= 5V, EN=5V. I_{OUT}=1A

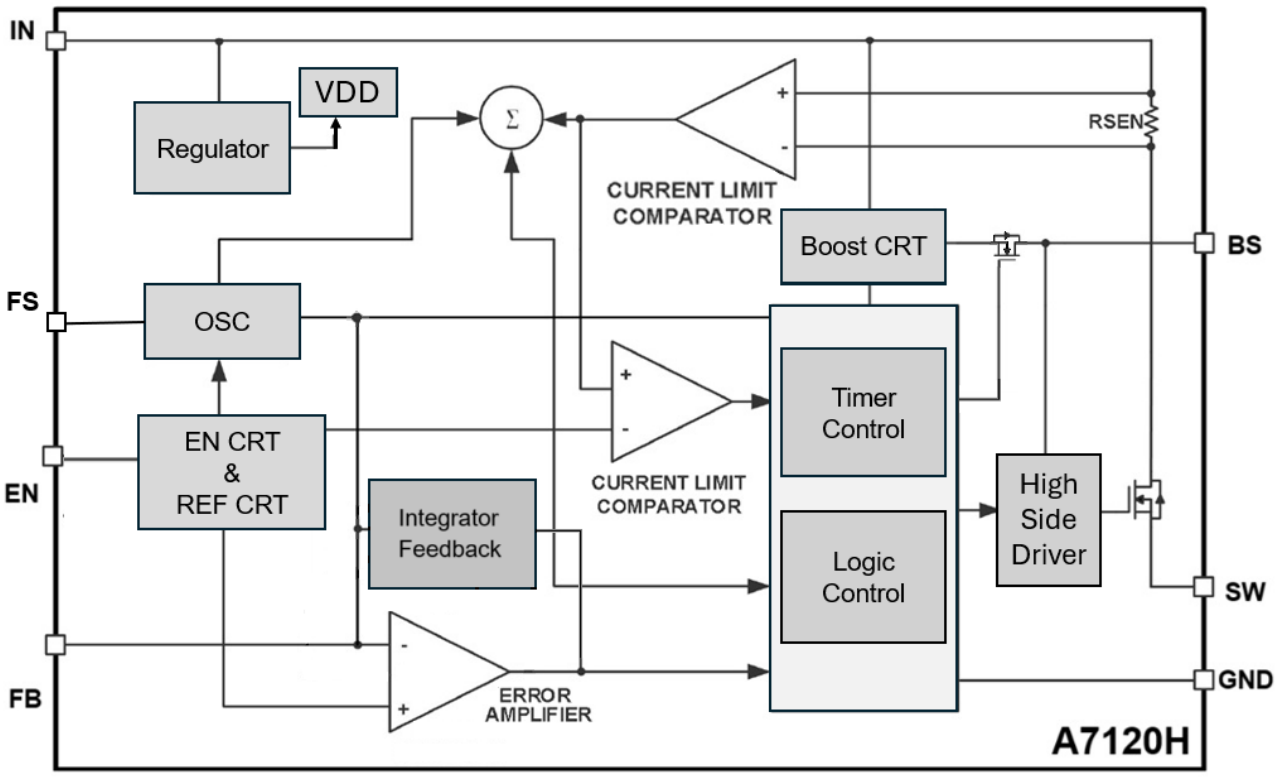


C_{IN}=22uFx2, C_{OUT}=47uFx2, L=33uH, T_A=+25℃

Fig.9 Efficiency & Output Current
Vout=5V vs Vout =12V



BLOCK DIAGRAM



DETAILED INFORMATION

Operation Overview

The A7120H is a high-performance monolithic switch-mode step-down (buck) DC-DC converter capable of delivering up to 2A continuous output current from a wide input voltage range of 4.5V to 100V.
It features an adjustable high-frequency operation and is built on a slope-compensated current-mode control architecture, ensuring fast transient response and stable regulation. The internal feedback compensation provides excellent line and load regulation without the need for external components.
An external shutdown pin allows logic-level control for enabling or disabling the device, placing it into low-power standby mode when not in use.
Protection Features:

- Thermal shutdown prevents damage during high-temperature operation.
- Cycle-by-cycle current limiting protects the internal power switch during overcurrent conditions.
- If the feedback voltage V_{FB} drops below 0.78V due to a fault or overload, the switching frequency is automatically reduced, improving system stability and reducing thermal stress.

Application information

The A7120H is a high-performance step-down DC/DC converter with a wide input voltage range of 4.5V to 100V, capable of delivering up to 2A continuous output current. It requires minimal external components—just input and output capacitors (C_{IN}, C_{OUT}) and an inductor (L_1)—making it ideal for space-constrained designs. The output voltage is adjustable via an external feedback network, allowing it to be set from 0.78V up to the input voltage, providing flexibility for a wide range of applications.

$$V_{OUT} = 0.78 \times \left(1 + \frac{R1+R2}{R2}\right)$$

V_{OUT}(V)	L1 (μH)	C_B (μF)	C_{IN} (μF)	C_{OUT}(μF)	C_{iFF} Opt.(pF)	R1 (kΩ)	R2 (kΩ)	D1
5	33	0.1	2.2+2.2	22+22	47	54	10	SM580A
12	47	0.1	2.2+2.2	22+22	10	144	10	SM580A

Table 1. Recommended Component Values

RU and RD are fixed by design at 200 kΩ and 20 kΩ, respectively, when the system does not use the EN pin connection. RN is an optional resistor, with an allowable value from 0 to 10 Ω. R-FS is by frequency selection.

Power Supply Recommendations

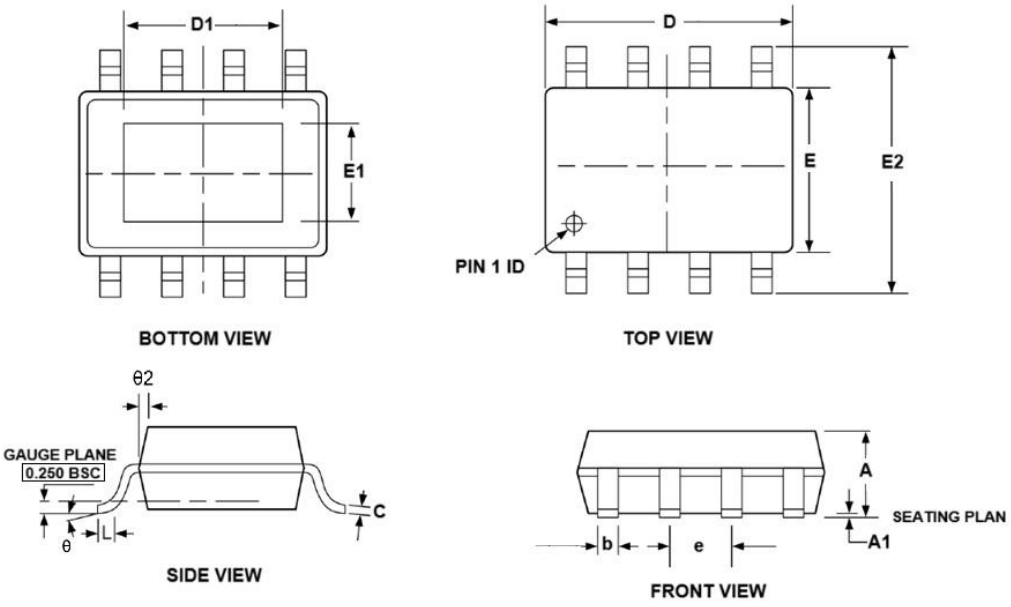
The devices are designed to operate from an input voltage supply range of 4.5V to 100V. For optimal performance, the input supply must be well regulated. If the power source is located more than a few inches away from the device or converter, additional bulk capacitance is recommended to compensate for voltage drops and ensure stable operation. In such cases, an electrolytic capacitor with a typical value of 47 μF can be used alongside ceramic bypass capacitors to maintain input stability.

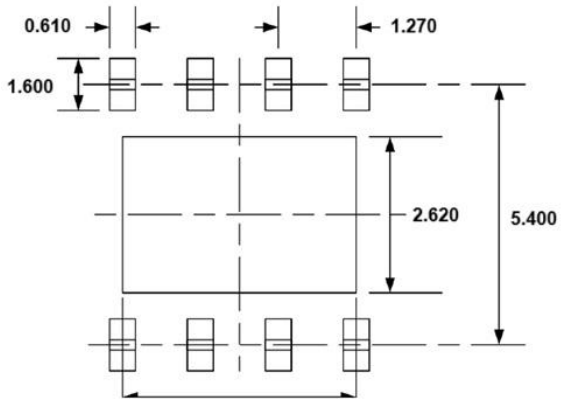
PCB Layout Guidelines

- VIN and GND traces should be as wide as possible to reduce impedance and improve thermal dissipation.
- Input and output capacitors should be placed as close to the device as possible to minimize trace inductance and impedance.
- Provide adequate vias for both input and output capacitors to ensure solid grounding and current flow.
- Keep the SW (switching) trace as short and wide as possible to minimize radiated EMI.
- Avoid routing switching current beneath the IC to reduce potential noise and ground bounce.
- Use a dedicated VOUT trace to connect to the upper feedback resistor for accurate regulation.
- Implement a Kelvin connection from the feedback path to the GND pin for precise voltage sensing.
- Keep the voltage feedback loop away from high voltage switching traces, and shield it with a ground plane if possible.
- Minimize the trace area of the VFB node to reduce susceptibility to noise coupling.
- The GND trace between the output capacitor and the IC's GND pin should be as wide as possible to reduce voltage drop and ensure solid grounding.

PACKAGE INFORMATION

Dimension in PSOP8 (Unit: mm)





Symbol	Millimeters	
	Min	Max
A	1.300	1.700
A1	0.000	0.150
b	0.330	0.510
c	0.190	0.250
D	4.800	5.000
E	3.800	4.000
E1	2.260	2.560
D1	3.150	3.450
E2	5.800	6.200
e	1.270 BSC	
L	0.410	1.270
θ	0°	8°
θ2	11.25°	22.5°

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.