

HIGH VOLTAGE GREEN MODE PWM CONTROLLER

AP3107/H

General Description

The AP3107/H series is the high voltage start-up, current mode PWM controller with green mode power-saving operation.

To minimize the standby power consumption, a proprietary adaptive green mode function provides frequency modulation at light load conditions. To avoid acoustic noise problems, the minimum PWM frequency is set at about 26kHz.

The AP3107/H series features proprietary frequency dithering function internally that helps to reduce EMI emission of a power supply with minimum line filters used.

The AP3107/H also integrates a lot of functions such as Leading-Edge Blanking (LEB) of the current sensing, internal slope compensation, line compensation and several protection features. The protection functions include cycle-by-cycle current limit (OCP), over voltage protection, OTP, OLP and brownout protection.

The AP3107/H series is available in SOIC-7 package.

Features

- High-voltage Start-up Circuit
- Low Start-up Current: 15 μ A Max.
- Fixed Oscillation Frequency:
65kHz (AP3107)
130kHz (AP3107H)
- Ultra Low Standby Power Application
- Non-audible-noise Green Mode Control
- LEB (Leading-edge Blanking) on SENSE Pin
- Soft Driving
- Fast OCP for Abnormal Short Circuit
- Frequency Linearly Decreasing at Light Load
- Internal Slope Compensation
- Programmable Brownout Protection
- Useful Pin Fault Protections
SENSE, FB, BNO Pins Floating
FB Short to Ground
- Comprehensive System Protections
VCC Over Voltage Protection (VOVP)
Over Temperature Protection (OTP)
Constant Over Load Protection (COLP)
Short Circuit Protection (SCP)
- Compact Size SOIC-7 Package

Applications

- Switching AC/DC Adaptor
- LCD Monitor/TV Power
- Open Frame Switching Power Supply



Figure 1. Package Type of AP3107/H

HIGH VOLTAGE GREEN MODE PWM CONTROLLER

AP3107/H

Pin Configuration

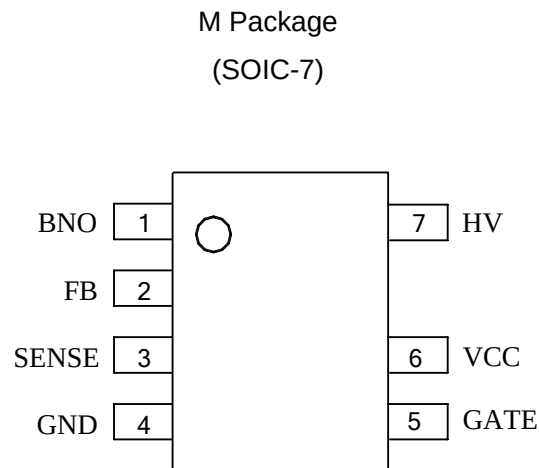


Figure 2. Pin Configuration of AP3107/H (Top View)

Pin Description

Pin Number	Pin Name	Function
1	BNO	Brownout Protection Pin. Connected to GND by a resistor to set the brownout level. This pin is shortened to the ground to set the maximum brownout voltage
2	FB	Voltage Feedback Pin., Connecting it with an opto-coupler to close the control loop can achieve system regulation
3	SENSE	Current Sense Pin. Connect it to sense the MOSFET current
4	GND	Ground
5	GATE	Gate drive output to drive the external MOSFET
6	VCC	Supply Voltage Pin
7	HV	Connect this pin to the positive terminal of bulk capacitor to provide start-up current for the controller. When VCC voltage reaches UVLO (on), this HV loop will be turned off to save the power loss of the start-up circuit

HIGH VOLTAGE GREEN MODE PWM CONTROLLER

AP3107/H

Functional Block Diagram

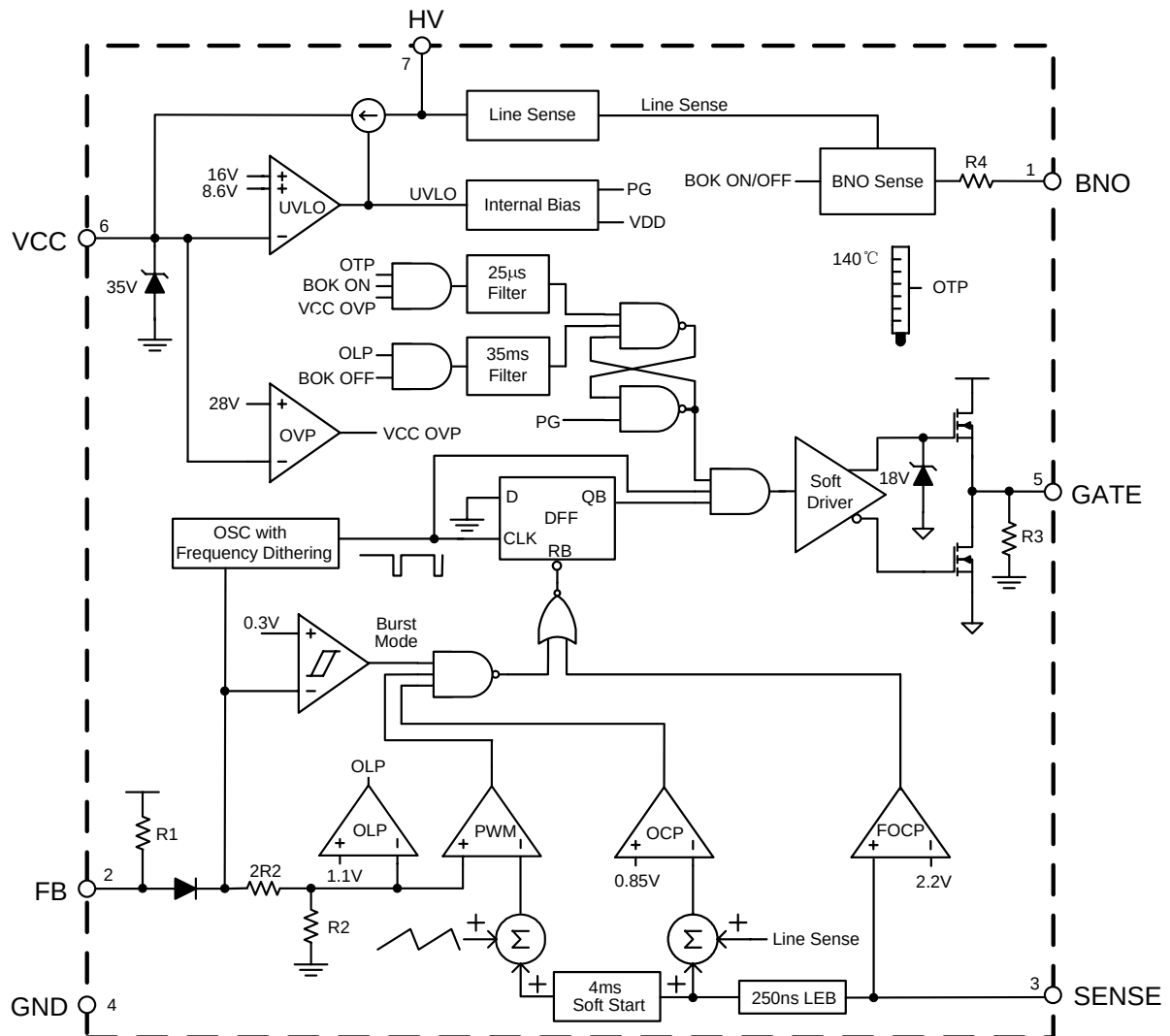
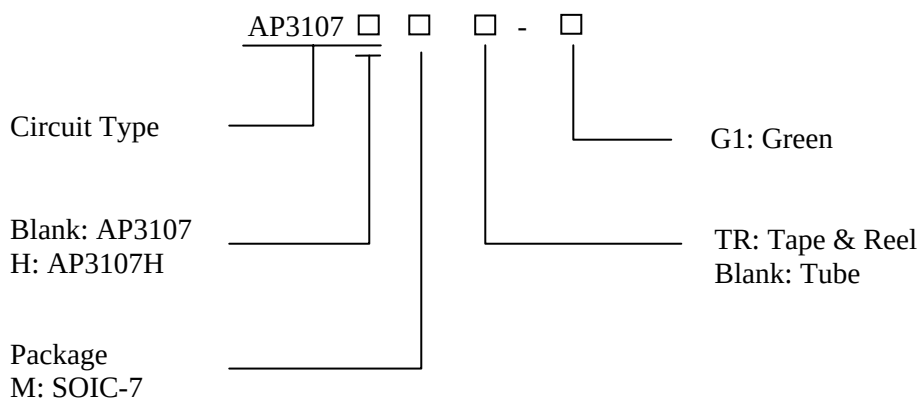


Figure 3. Functional Block Diagram of AP3107/H

**HIGH VOLTAGE GREEN MODE PWM CONTROLLER****AP3107/H****Ordering Information**

Package	Temperature Range	Oscillation Frequency	Part Number	Marking ID	Packing Type
SOIC-7	-40 to 85°C	65kHz	AP3107M-G1	3107M-G1	Tube
			AP3107MTR-G1	3107M-G1	Tape & Reel
		130kHz	AP3107HM-G1	3107HM-G1	Tube
			AP3107HMTR-G1	3107HM-G1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

**HIGH VOLTAGE GREEN MODE PWM CONTROLLER****AP3107/H****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	30	V
Input Voltage to HV	V_{HV}	600	V
GATE Output Current	I_{GATE}	500	mA
Input Voltage to FB, SENSE	V_{FB}, V_{SENSE}	-0.3 to 7	V
Thermal Resistance (Junction to Ambient)	θ_{JA}	186	°C/W
Power dissipation at $T_A < 25^\circ\text{C}$	P_D	550	mW
Operating Junction Temperature	T_J	-40 to 150	°C
Storage Temperature	T_{STG}	150	°C
ESD (Human Body Model)		3000	V
ESD (Machine Model)		300	V

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” 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 under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	10	25	V
Ambient Temperature	T_A	-40	85	°C

**HIGH VOLTAGE GREEN MODE PWM CONTROLLER****AP3107/H****Electrical Characteristics** $V_{CC}=16V$, $T_A=25^{\circ}C$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
High-voltage Supply (HV Pin)					
High-voltage Current Source	$V_{CC}<UVLO$ (on), $V_{HV}=400V$	1	2	3.5	mA
Off-state Leakage Current	$V_{CC}>UVLO$ (off), $V_{HV}=100V$		2.5		μA
	$V_{CC}>UVLO$ (off), $V_{HV}=400V$		10	18	μA
Supply Voltage (VCC Pin)					
Start-up Current	$V_{CC}=14.8V$		5	15	μA
Operation Supply Current	$V_{FB}=0V$, $C_L=1nF$	0	0.4	0.8	mA
	$V_{FB}=3V$, $C_L=1nF$	1.5	2.5	3.5	
UVLO (On)		15	16	17	V
UVLO (Off)		7.6	8.6	9.6	V
VCC OVP		27	28	30	V
VCC Clamp	$I_{CC}=5mA$		35		V
De-latch VCC		3.8	5.7	7	V
Oscillator Section					
Maximum Duty Cycle		70	75	80	%
Minimum Duty Cycle			0		%
Oscillation Frequency	AP3107, center frequency	60	65	70	kHz
	AP3107H, center frequency	120	130	140	
Green Mode Frequency			28		kHz
Frequency Temperature Stability	-40 to 85°C			5	%
Frequency Voltage Stability	$V_{CC}=12V$ to 30V			5	%
Frequency Dithering	Δf /center frequency		± 6		%
Current Sense Section (SENSE Pin)					
Maximum SENSE Voltage	$V_{HV}=100V$	0.8	0.85	0.9	V
The Ratio of Input Voltage to Current Sense Voltage		2.5	3	3.5	V/V
LEB Time of SENSE	AP3107/H, center frequency	150	250	350	ns
Delay to Output			100		ns
Soft Start Time	AP3107, center frequency	3	4	5	ms
Feedback Input Section (FB Pin)					
Short Circuit Current	$V_{FB}=0V$		0.05		mA
Green Mode Threshold, V_{FB}	AP3107		2.1		V
	AP3107H		2.15		V
Burst Mode Threshold, V_{FB}	AP3107	0.89	1.15	1.41	V
	AP3107H	0.89	1.15	1.41	V
Open Loop Voltage	FB pin open	4.8	5.4	6	V

**HIGH VOLTAGE GREEN MODE PWM CONTROLLER****AP3107/H****Electrical Characteristics (Continued)** $V_{CC}=16V$, $T_A=25^{\circ}C$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Input Impedence		10	16	22	k Ω
Output Section (GATE Pin)					
Output Low Level	$I_{GATE}=50mA$, $V_{CC}=12V$			1	V
Output High Level	$I_{GATE}=50mA$, $V_{CC}=12V$	8			V
Output Clamping		15.5	17.5	19.5	V
Rising Time	$C_L=1nF$	150	250	350	ns
Falling Time	$C_L=1nF$	30	50	90	ns
Brownout Protection					
Turn-on DC Input (HV), V_{ON}	$R=0k$	92	99	106	V
Turn-off DC Input (HV), V_{OFF}	$R=0k$		$V_{ON}-5$		V
De-bounce Time of Enable			25		μs
De-bounce Time of Turn off	$V_{FB}=3V$	25	35	45	ms
Over-temperature Protection					
Shutdown Temperature			140		$^{\circ}C$
Temperature Hysteresis			20		$^{\circ}C$
Delay Time Section					
Delay 1	AP3107/H, center frequency Short circuit, OLP	25	35	45	ms
Delay 2	AP3107/H, center frequency VCC OVP, brown out		25		μs

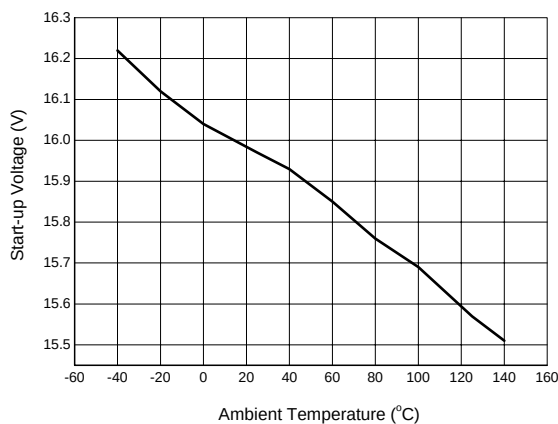
Typical Performance Characteristics

Figure 4. Start-up Voltage vs. Ambient Temperature

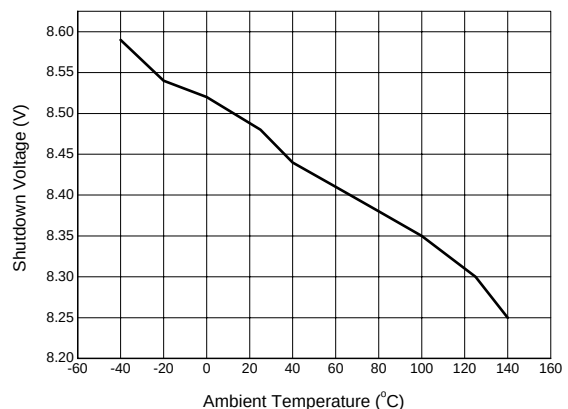


Figure 5. Shutdown Voltage vs. Ambient Temperature

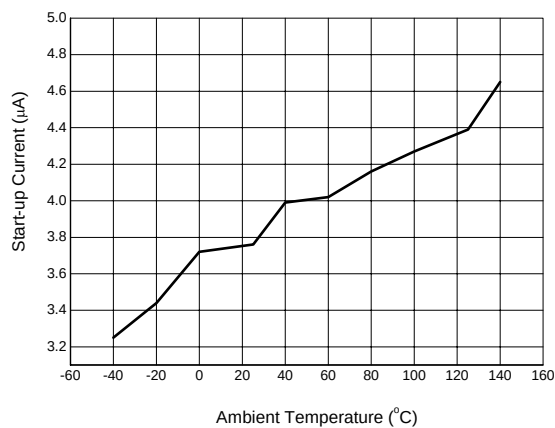
**Typical Performance Characteristics (Continued)**

Figure 6. Start-up Current vs. Ambient Temperature

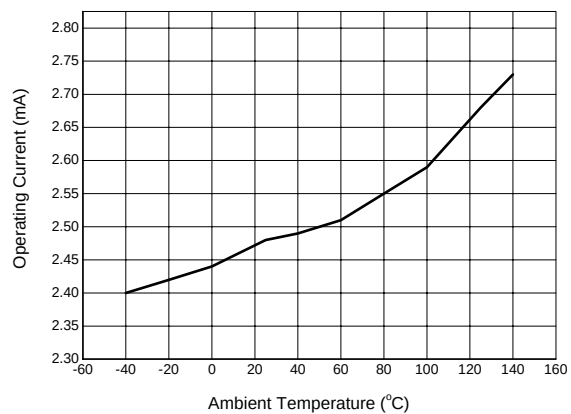


Figure 7. Operating Current vs. Ambient Temperature

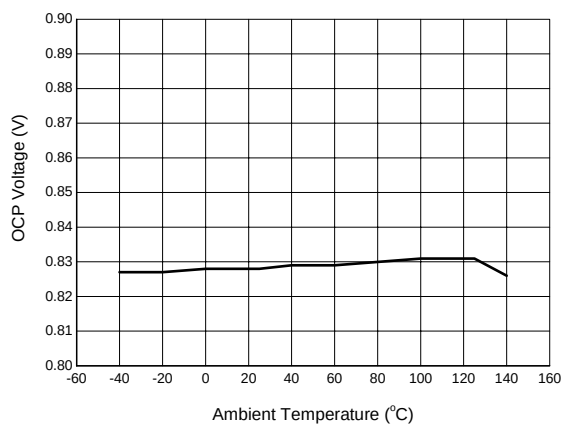


Figure 8. OCP Voltage vs. Ambient Temperature

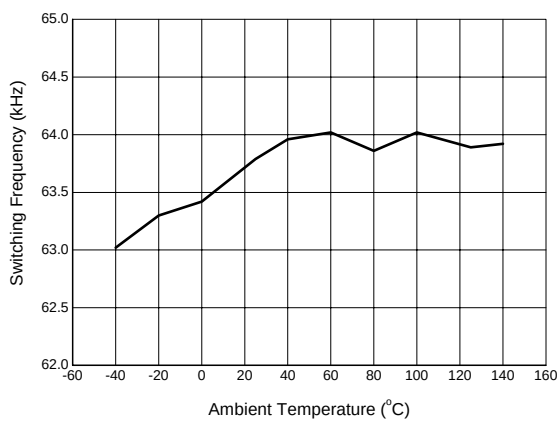


Figure 9. Switching Frequency vs. Ambient Temperature

HIGH VOLTAGE GREEN MODE PWM CONTROLLER

AP3107/H

Typical Application

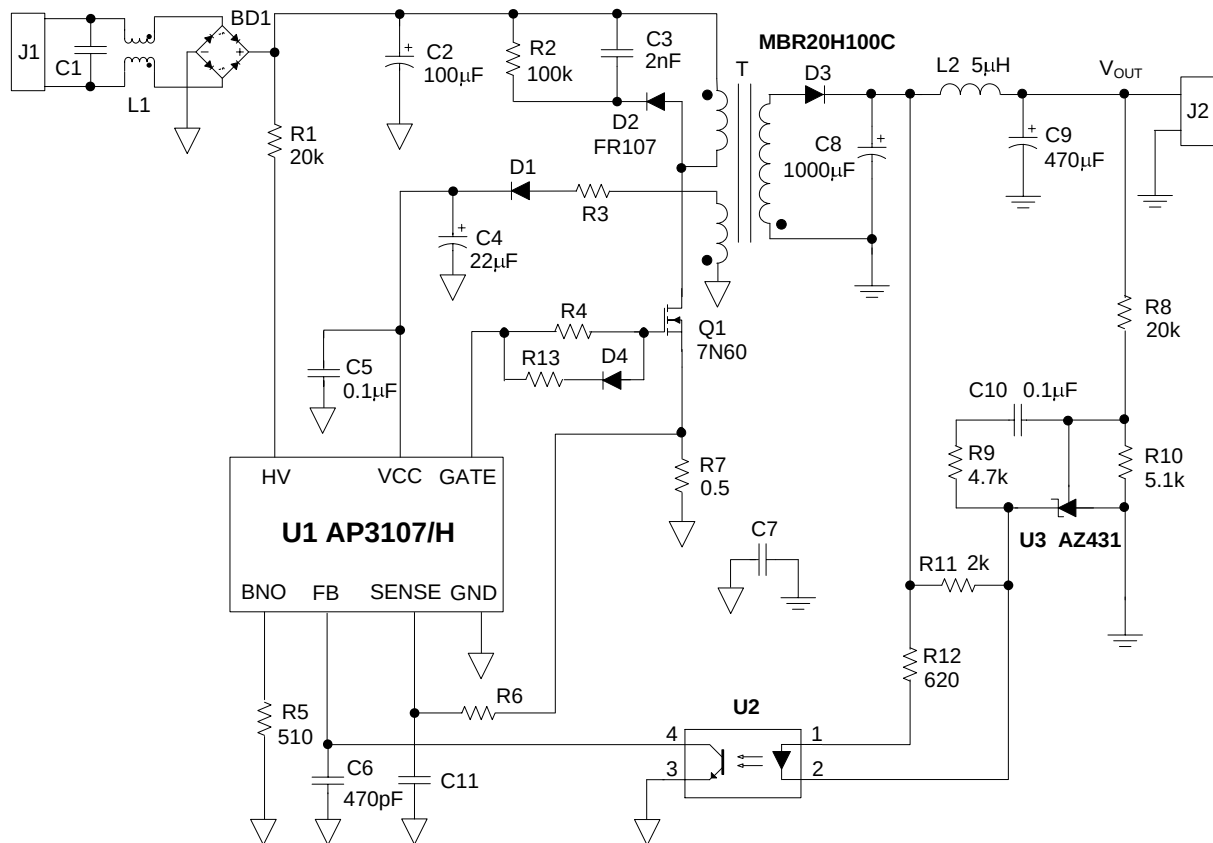
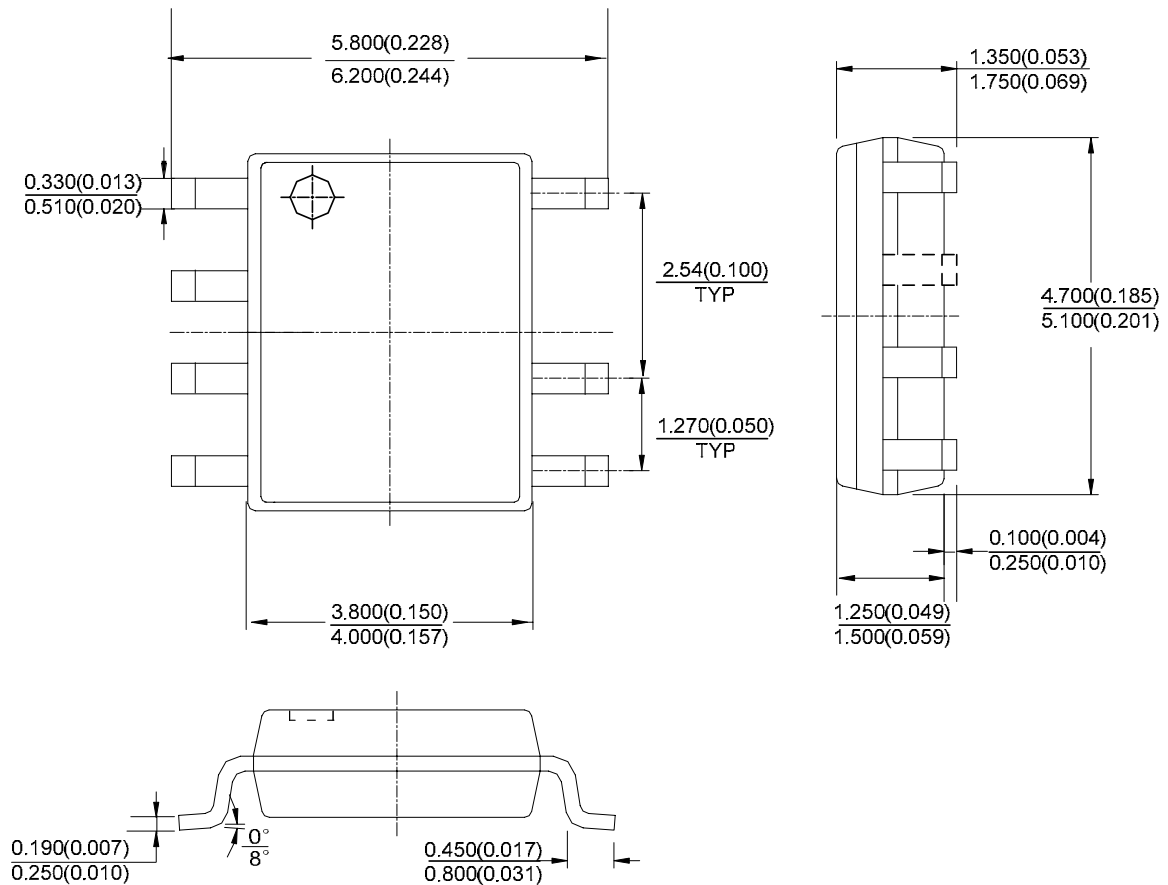


Figure 10. Typical Application of AP3107/H

Mechanical Dimensions

SOIC-7
Unit: mm(inch)


Note: Eject hole, oriented hole and mold mark is optional.



BCD Semiconductor Manufacturing Limited

<http://www.bcdsemi.com>

IMPORTANT NOTICE

BCD Semiconductor Manufacturing Limited reserves the right to make changes without further notice to any products or specifications herein. BCD Semiconductor Manufacturing Limited does not assume any responsibility for use of any its products for any particular purpose, nor does BCD Semiconductor Manufacturing Limited assume any liability arising out of the application or use of any its products or circuits. BCD Semiconductor Manufacturing Limited does not convey any license under its patent rights or other rights nor the rights of others.

MAIN SITE

- Headquarters

BCD Semiconductor Manufacturing Limited

No. 1600, Zi Xing Road, Shanghai ZiZhu Science-based Industrial Park, 200241, China
Tel: +86-21-24162266, Fax: +86-21-24162277

- Wafer Fab

Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd.

800 Yi Shan Road, Shanghai 200233, China
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

REGIONAL SALES OFFICE

Shenzhen Office

Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd., Shenzhen Office

Unit A Room 1203, Skyworth Bldg., Gaoxin Ave. I.S., Nanshan District, Shenzhen, China
Tel: +86-755-8826 7951
Fax: +86-755-8826 7865

Taiwan Office

BCD Semiconductor (Taiwan) Company Limited

4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei, Taiwan
Tel: +886-2-2656 2808
Fax: +886-2-2656 2806

USA Office

BCD Semiconductor Corp.

30920 Huntwood Ave. Hayward, CA 94544, USA
Tel : +1-510-324-2988
Fax: +1-510-324-2788