HIGH VOLTAGE GREEN MODE PWM CONTROLLER AP3106

General Description

The AP3106 is a high voltage start-up, current mode PWM controller with green-mode power-saving operation.

The PWM switching frequency at normal operation is externally programmable and trimmed to a narrow range.

The AP3106 integrates a proprietary internal frequency dithering function that helps to reduce EMI emission of a power supply with minimum line filters used.

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

The AP3106 integrates a lot of functions such as the Lead-Edge Blanking (LEB) of the current sensing, internal slope compensation, line compensation, and several protection features that include cycle-by-cycle current limit (OCP), over voltage protection, OTP, OLP and brownout protection.

The AP3106 is available in SOIC-7 package to realize a compact size.

Features

- High-voltage Start-up Circuit
- Low Start-up Current: 15μA (Max.)
- Current Mode Control
- Programmable PWM Switching Frequency
- Non-audible-noise Green Mode Control
- LEB (Leading-Edge Blanking) on SENSE Pin
- Fast OCP for Abnormal Short Circuit
- Frequency Linearly Decreasing at Light Load
- Soft Driving
- Internal Slope Compensation
- Built-in Brownout Protection
- Useful Pin Fault Protection
  CS Pin Floating
  RI Pin Short to Ground
  RI Pin Floating
- Comprehensive System Protection
  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



SOIC-7

Figure 1. Package Type of AP3106

Pin Configuration

M Package
(SOIC-7)

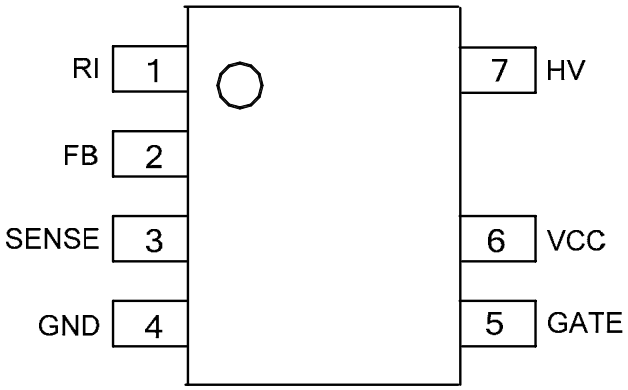


Figure 2. Pin Configuration of AP3106 (Top View)

Pin Description

Pin Number	Pin Name	Function
1	RI	Set the bias current to determine the normal switching frequency
2	FB	Voltage feedback pin. By connecting an opto-coupler to close the control loop, it can achieve the 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 positive terminal of bulk capacitor to provide the startup current for the controller. When VCC voltage reachs UVLO (on), this HV loop will be turned off to save the power loss of the startup circuit

Functional Block Diagram

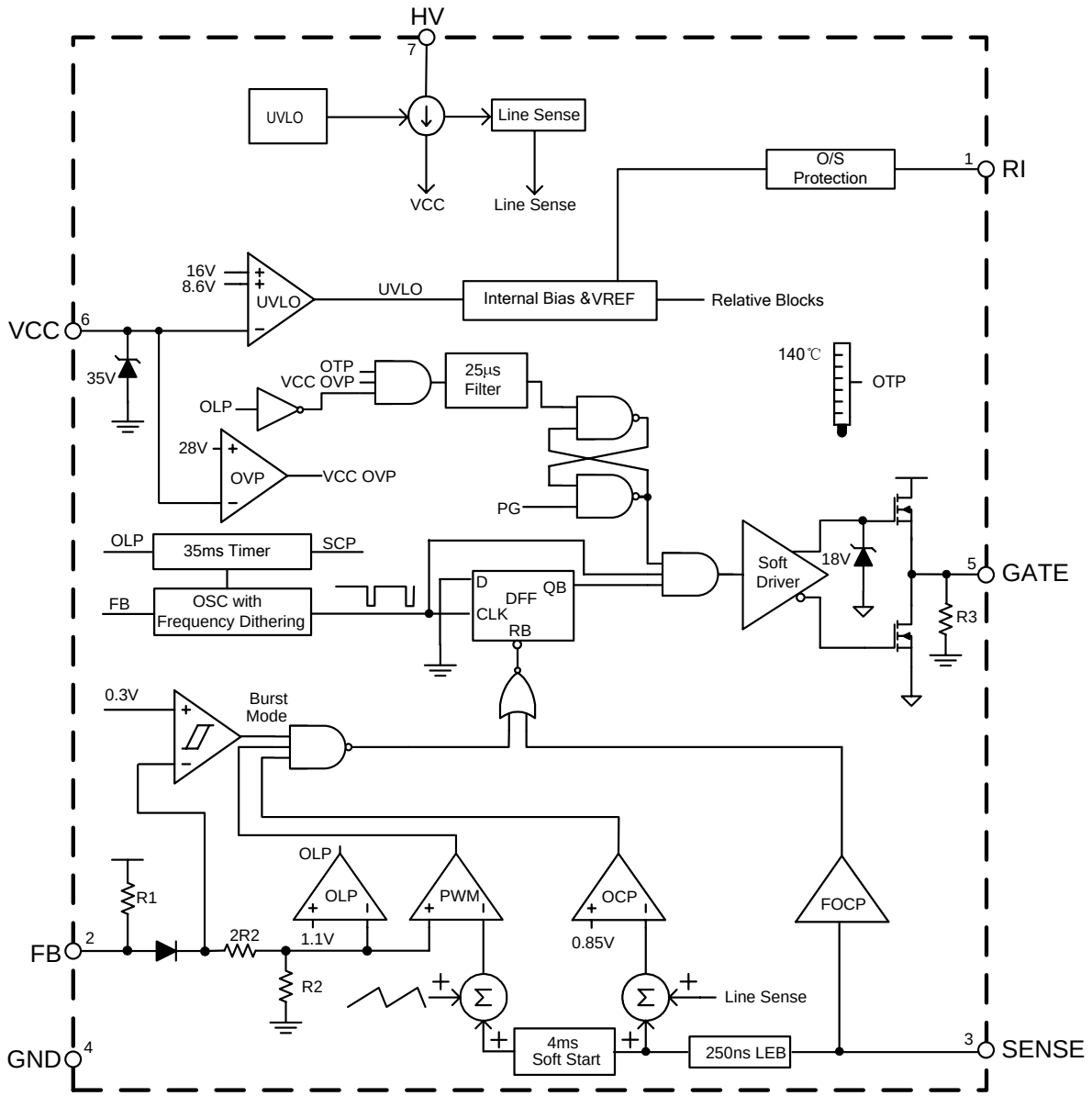
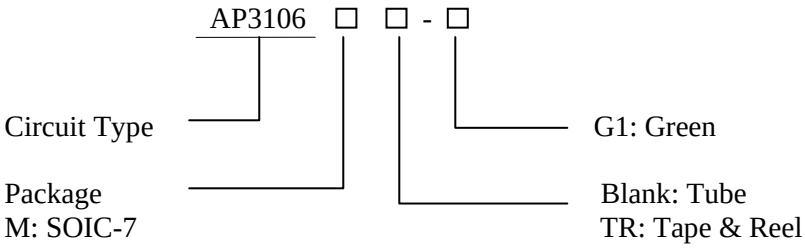


Figure 3. Functional Block Diagram of AP3106

HIGH VOLTAGE GREEN MODE PWM CONTROLLER AP3106

Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOIC-7	-40 to 85°C	AP3106M-G1	3106M-G1	Tube
		AP3106MTR-G1	3106M-G1	Tape & Reel

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

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	30	V
Input Voltage to High Voltage Pin (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° 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

Electrical Characteristics

V_{IN} =16V, T_A=25°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	
SUPPLY VOLTAGE (VCC Pin)					
Start-up Current	V_{CC}=14.8V		5	15	μA
Operating Supply Current	V_{FB}=0V, C_L=1nF	0.2	0.6	1	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	R_I=100kΩ	60	65	70	kHz
Green Mode Frequency	R_I=100kΩ		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	R_I=100kΩ	150	250	350	ns
Delay to Output			100		ns
Soft Start Time	R_I=100kΩ	3	4	5	ms
FEEDBACK INPUT SECTION (FB Pin)					
Short Circuit Current	V_{FB}=0V	-0.6	-0.3		mA
Green Mode Threshold VFB			2.1		V
Burst Mode Threshold VFB		0.89	1.15	1.41	V
Open Loop Voltage	FB pin open	4.8	5.4	6	V
Input Impendence		10	16	22	kΩ

Electrical Characteristics (Continued)

V_{IN} =16V, T_A=25°C, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
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	97	105	113	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, R_I=100kΩ	25	35	45	ms
OVER-TEMPERATURE PROTECTION SECTION					
Shutdown Temperature			140		°C
Temperature Hysteresis			20		°C
DELAY TIME SECTION					
Delay 1	Short circuit, OLP, R_I=100kΩ	25	35	45	ms
Delay 2	VCC OVP, brown out, R_I=100kΩ		25		μs

Typical Performance Characteristics

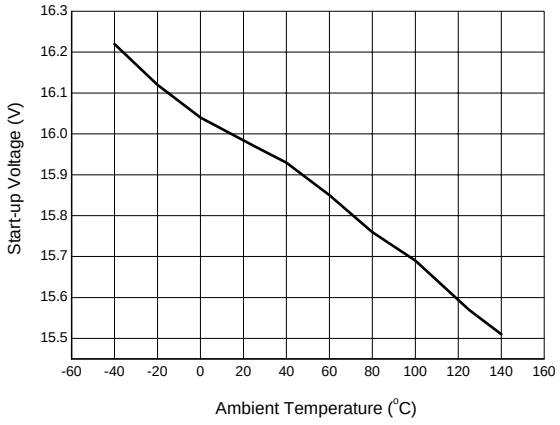


Figure 4. Start-up Voltage vs. Ambient Temperature

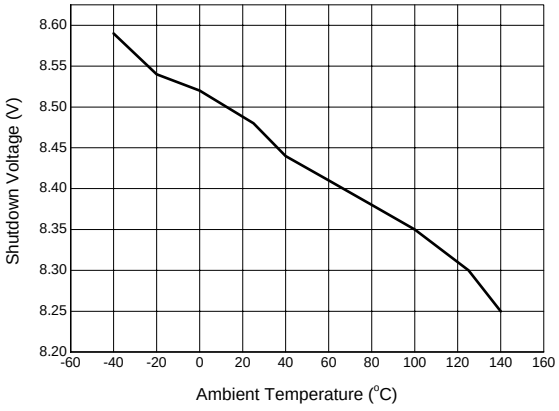


Figure 5. Shutdown Voltage vs. Ambient Temperature

Typical Performance Characteristics (Continued)

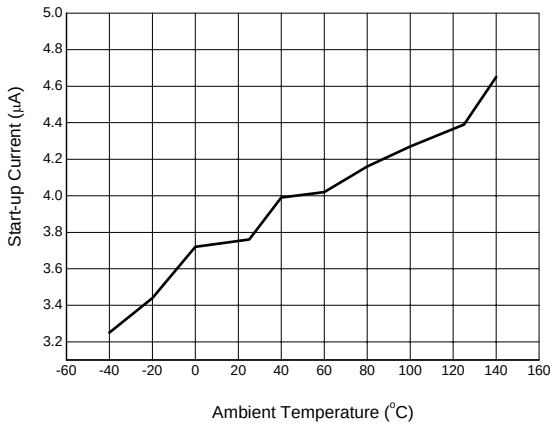


Figure 6. Start-up Current vs. Ambient Temperature

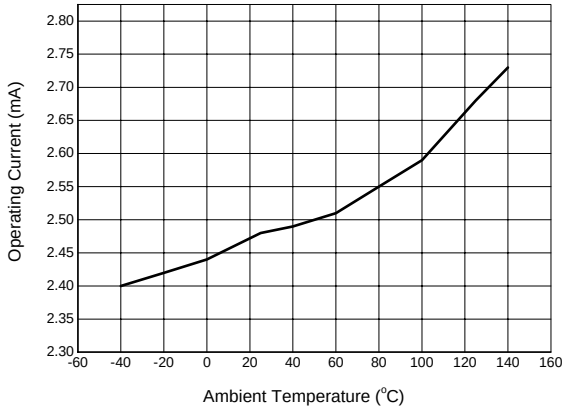


Figure 7. Operating Current vs. Ambient Temperature

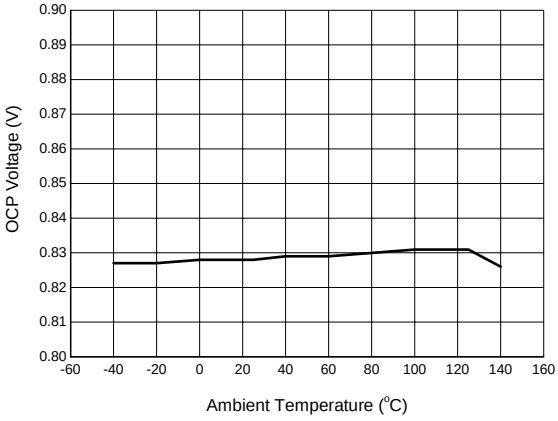


Figure 8. OCP Voltage vs. Ambient Temperature

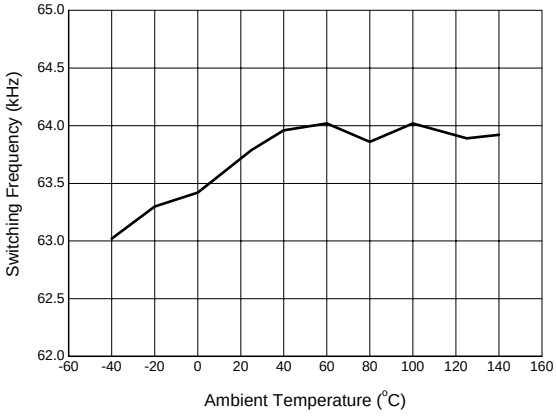


Figure 9. Switching Frequency vs. Ambient Temperature

Typical Application

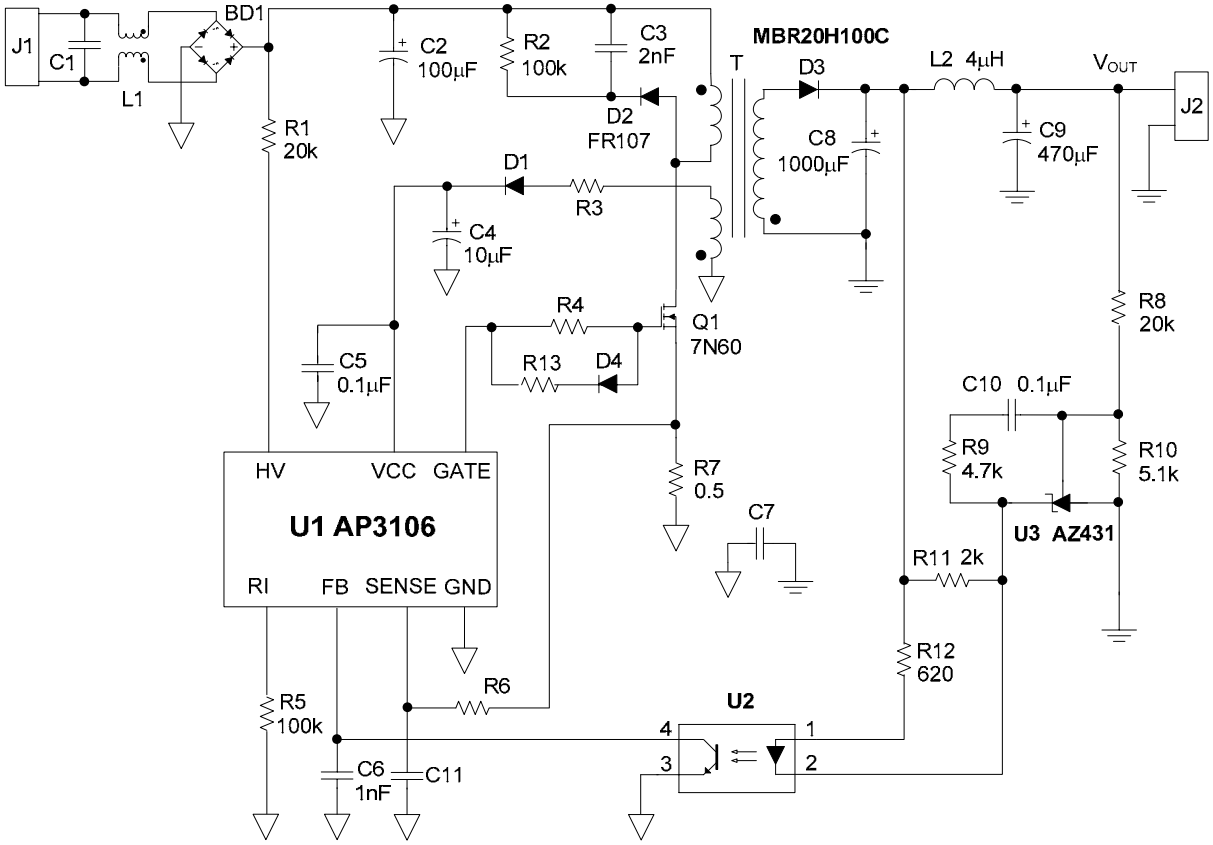
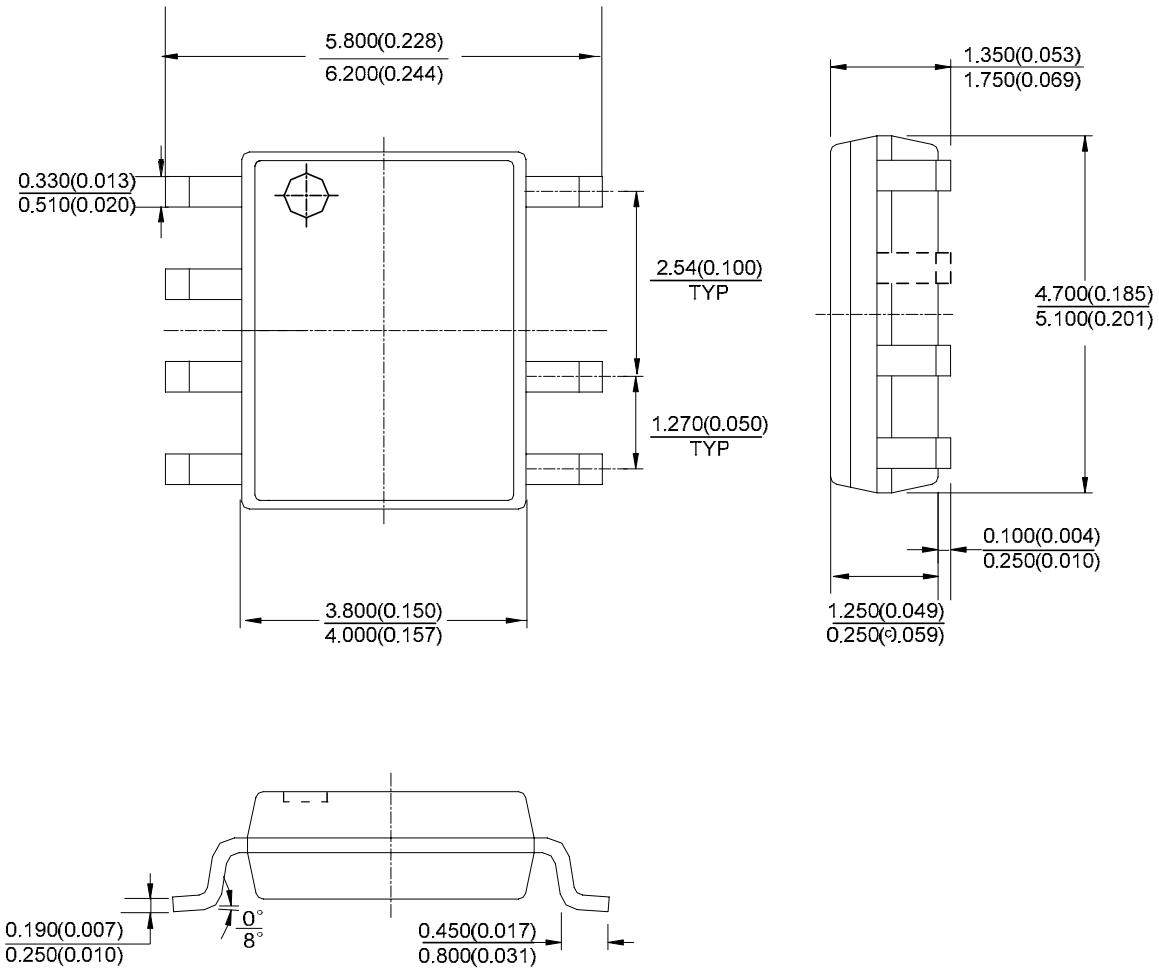


Figure 10. Typical Application of AP3106

Mechanical Dimensions

SOIC-7 **Unit: mm(inch)**



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



BCD Semiconductor Manufacturing Limited

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