

General Description

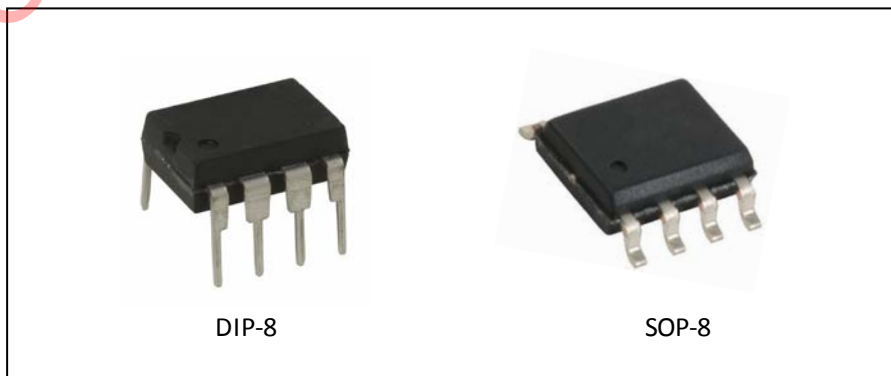
SDC3106 is a high performance off-line PSR controller for low-power AC/DC charger and adapter applications which integrates 700V power BJT. It works in Pulse Frequency Modulation Mode and provides operating frequency dithering function to improve EMC performance of power supply. It operates in primary-side sensing and regulation. Consequently, opto-coupler and TL431 could be eliminated. SDC3106 provides $\pm 5\%$ constant voltage and constant current regulation at universal AC input.

Features

- Primary side control without opto-coupler and TL431
- 30mW standby power, meeting six-star standard
- Built-in output cable voltage drop compensation
- Built-in AC compensation
- CV/CC regulation $\pm 5\%$
- Flyback topology in DCM operation
- Pulse frequency modulation mode
- Enhanced audio noise suppression
- Built-in leading edge blanking
- Over voltage protection
- Short circuit protection
- Package: DIP-8/SOP-8
- Output power range^[note1]:
SDC3106(SOP-8) $\leq 6W$
SDC3106(DIP-8) $\leq 7.5W$

Applications

- Adapters/Chargers for cell/cordless phones, PDAs, MP3 and other portable devices
- LED driver
- Standby and auxiliary power supplies



Note1 : Typical continuous power in a non-ventilated enclosed adapter measured at +45°C ambient.

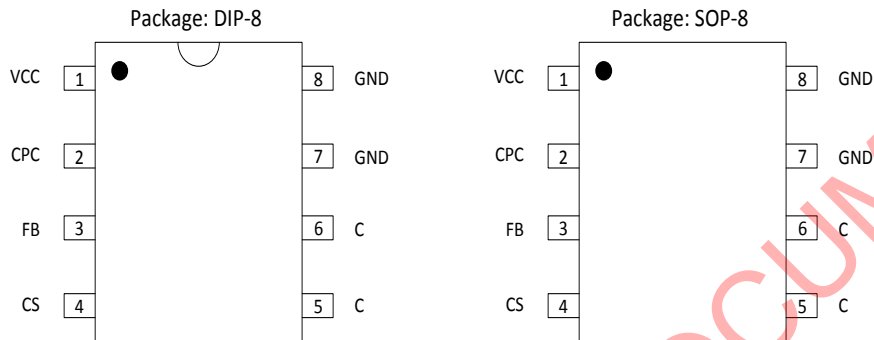
Pin Configuration


Figure 2. Pin Configuration

| Pin Number | Pin Name | Function |
|------------|----------|--|
| 1 | VCC | Power supply pin |
| 2 | CPC | This pin connects a capacitor for output cable voltage drop compensation and audio noise suppression |
| 3 | FB | The voltage feedback from the auxiliary winding |
| 4 | CS | The primary current sense pin, this pin connects a current sense resistor |
| 5、6 | C | This pin is connected to an internal power BJT's collector |
| 7、8 | GND | Ground |

Table 1. Pin Description

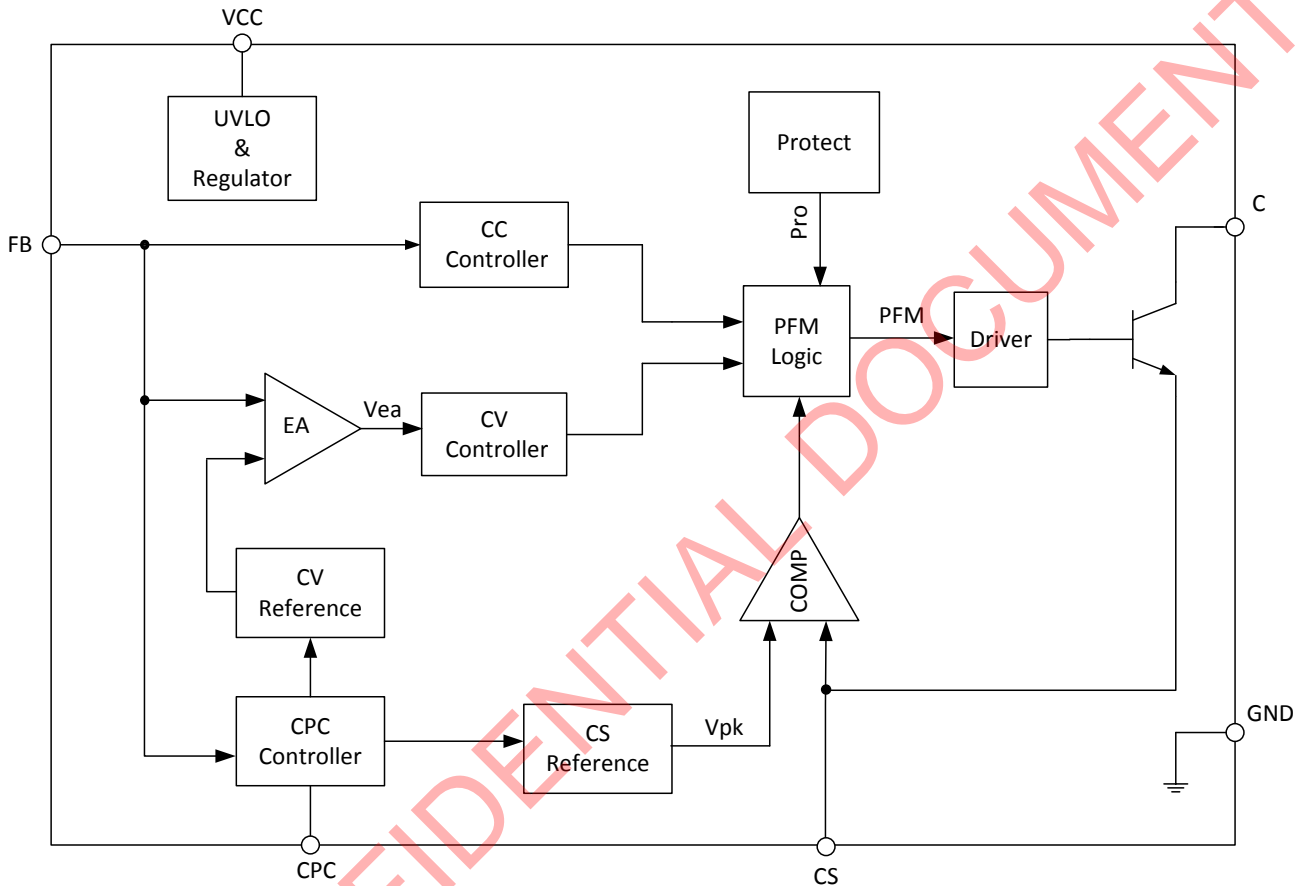
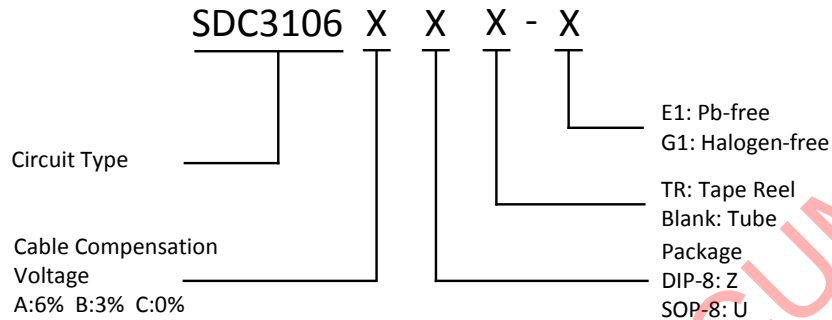
Block Diagram


Figure 3. Functional Block Diagram

Ordering Information


| Package | Temperature Range | Part Number | | Marking ID | | Packing Type |
|---------|-------------------|----------------|----------------|------------|--------------|--------------|
| | | Pb-free | Halogen-free | Pb-free | Halogen-free | |
| DIP-8 | -40~85°C | SDC3106AZ-E1 | SDC3106AZ-G1 | 3106A | 3106AG | Tube |
| | | SDC3106BZ-E1 | SDC3106BZ-G1 | 3106B | 3106BG | Tube |
| | | SDC3106CZ-E1 | SDC3106CZ-G1 | 3106C | 3106CG | Tube |
| SOP-8 | | SDC3106AUTR-E1 | SDC3106AUTR-G1 | 3106A | 3106AG | Tape Reel |
| | | SDC3106BUTR-E1 | SDC3106BUTR-G1 | 3106B | 3106BG | Tape Reel |
| | | SDC3106CUTR-E1 | SDC3106CUTR-G1 | 3106C | 3106CG | Tape Reel |

Absolute Maximum Ratings

(NOTE: Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device.)

| Parameter | Symbol | Value | Unit |
|---|------------------------------------|----------|------|
| VCC to GND | V _{CC} | -0.3~30 | V |
| CS, OUT to GND | V _{CS} , V _{CPC} | -0.3~7 | V |
| FB input voltage | V _{FB} | -40~7 | V |
| Peak value of switching current | I _{PK} | 540 | mA |
| Collector-base voltage of integrated BJT | V _{CB0} | -0.3~700 | V |
| Collector current of integrated BJT | I _C | 1.8 | A |
| Operating junction temperature T _J | T _{Jmax} | 150 | °C |
| Storage temperature T _{STG} | T _{STG} | -55~150 | °C |
| Lead temperature (Soldering, 10sec) | T _{LEAD} | 260 | °C |
| Latch-up test per JEDEC 78 | - | 200 | mA |
| ESD,HBM model per Mil-Std-883H,Method 3015 | HBM | 2000 | V |
| ESD,MM model per JEDEC EIA/JESD22-A115 | MM | 200 | V |

Table 2. Absolute Maximum Ratings

Recommended Operating Conditions

| Parameter | Min | Max | Unit |
|-----------------------------|-----|-----|------|
| VCC supply voltage | 6 | 30 | V |
| Operating temperature range | -40 | 85 | °C |
| Operating frequency | 55 | 100 | kHz |

Table 3. Recommended Operating Conditions

Electrical Characteristics ($T_a=25^{\circ}\text{C}$, $V_{CC}=15\text{V}$, unless otherwise specified)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--|----------------|--------------------------------------|------|------|------|------------------|
| Power Current Section | | | | | | |
| Start-up threshold | V_{TH} | - | 13 | 15.5 | 18 | V |
| Minimal operating voltage | V_{OFF} | - | 5.4 | 6.0 | 6.6 | V |
| Start-up current | I_{ST} | $V_{CC}=V_{TH}-1$, before start-up | 0 | 0.2 | 0.6 | μA |
| Operating current | I_{CC} | - | - | 500 | - | μA |
| Current Sense Section | | | | | | |
| Current sense threshold voltage in CC mode | V_{CS} | - | 475 | 500 | 525 | mV |
| Leading edge blanking | t_{LEB} | - | - | 500 | - | ns |
| Feedback Input Section | | | | | | |
| FB leakage current | I_{FB} | $V_{FB}=4\text{V}$ | 1.6 | 2.2 | 3.0 | μA |
| Feedback threshold | V_{FB} | Full Load | 3.98 | 4.04 | 4.10 | V |
| AC Compensation Section | | | | | | |
| Built-in line compensation current | I_{LINE} | $V_{FB}=-10\text{V}$ | - | 10 | - | μA |
| Built-in line compensation resistor | R_{LINE} | - | - | 3.3 | - | $\text{k}\Omega$ |
| Cable Compensation Section | | | | | | |
| Cable compensation voltage | - | SDC3106A | - | 6 | - | % |
| | - | SDC3106B | - | 3 | - | % |
| | - | SDC3106C | - | 0 | - | % |
| BJT Section | | | | | | |
| Collector-base Voltage | V_{CBO} | $I_C=0.1\text{mA}$ | 700 | - | - | V |
| Collector-base cutoff current | I_{CBO} | $V_{CB}=700\text{V}, I_E=0\text{mA}$ | - | - | 0.1 | mA |
| DC current gain | h_{FE} | $V_{CE}=5\text{V}, I_C=0.5\text{A}$ | 15 | - | 50 | - |
| Protection Section | | | | | | |
| FB over voltage protection | V_{FB_OVP} | - | 7.0 | 8.0 | 9.0 | V |
| Maximum off time of primary side | t_{OFF_MAX} | - | - | 16 | - | ms |
| Maximum on time of primary side | t_{ONP_MAX} | - | - | 18 | - | μs |

Table 4. Electrical Characteristics

Operation Description

Start-up

The start-up current of SDC3106 is designed to be very low (typ. 0.2uA), so that VCC could be charged up above UVLO threshold level and device starts up quickly. A large value start-up resistor can therefore be used to minimize the power loss in application.

Operating Current

The operating current of SDC3106 is as low as 500uA, so that good efficiency and very low standby power (less than 30mW) is achieved.

CC/CV Operation

SDC3106 is designed to produce CC/CV control characteristic as shown in the figure 4.

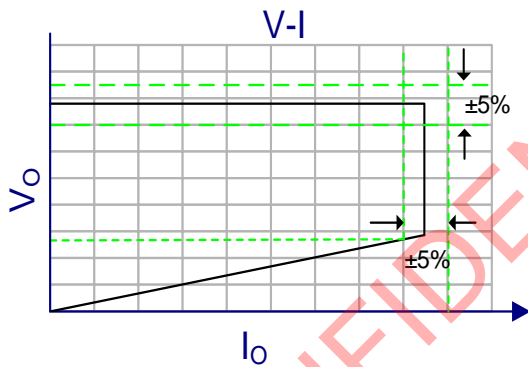


Figure 4. Typical CC/CV Curve

In charger applications, a discharged battery charging starts in the CC portion of the curve until it is nearly full charged and smoothly switches to operate in CV portion of the curve. The CC portion provides output current limiting. In CV operation, the output voltage is regulated through the primary side control. In CC operation mode, SDC3106 will regulate the output current constant regardless of the output voltage drop.

Principle of Operation

To support SDC3106 proprietary CC/CV control, system needs to be designed in DCM mode for flyback system.

In the DCM flyback converter, the output voltage can be sensed via the auxiliary winding. During BJT turn-on time, the load current is supplied from the output filter capacitor, and the current in the primary winding ramps up. When BJT turns off, the energy stored in the primary

winding is transferred to the secondary side such that the output current is:

$$I_O = \frac{1}{2} \times \frac{T_{ONS}}{T_{SW}} \times \frac{N_P}{N_S} \times I_{PK}$$

I_O -- The average current of secondary side

T_{ONS} -- The conduction time when secondary side diode is "ON"

T_{SW} -- The period of switching frequency

N_P -- The primary side winding

N_S -- The secondary side winding

I_{PK} -- Peak value of primary side current

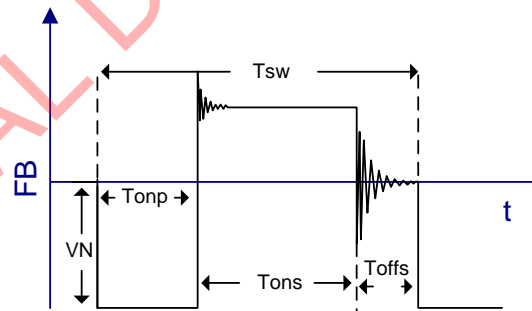


Figure 5. Auxiliary Voltage Waveform

In CC operation mode, SDC3106 calculates the output current through the peak value of primary side current and the ratio of the secondary side diode conduction time and the switching period.

In CC mode of SDC3106, the ratio of T_{ONS} and T_{SW} is 0.5, and the V_{CS} is about 0.5V. So the output current can be approximated as:

$$I_O = \frac{1}{8} \times \frac{1}{R_{CS}} \times \frac{N_P}{N_S}$$

The auxiliary voltage reflects the output voltage as shown in Figure 5 and it is given by

$$V_{AUX} = \frac{N_{AUX}}{N_S} \times (V_O + V_D)$$

V_{AUX} -- The transient voltage at auxiliary winding

N_{AUX} -- The auxiliary winding

N_S -- The secondary side winding

V_O -- The average voltage of secondary side

V_D -- The drop voltage of the output diode

In CV mode, the output voltage is stabilized through the sampled FB voltage being regulated to a constant value of 4.04 V (typ.). The relationship between V_{AUX} and V_{FB} is given by

$$V_{AUX} = V_{FB} \left(1 + \frac{R_{FB1}}{R_{FB2}} \right)$$

Where V_{FB} is the voltage of FB pin, R_{FB1} is the upper resistor of FB, and R_{FB2} is the lower resistor of FB.

Thus, the full load output voltage V_o can be expressed as:

$$V_o = \frac{V_{FB} \times N_s \times \left(1 + \frac{R_{FB1}}{R_{FB2}} \right)}{N_{AUX}} - V_D$$

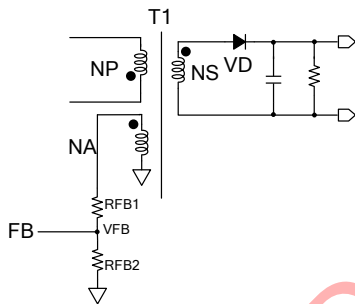


Figure 6. FB Feedback Scheme

Operation Switching Frequency and Audio Noise Suppression

The switching frequency of SDC3106 is adaptively controlled according to the load conditions and the operation modes. Considering power BJT is integrated, the operation switching frequency is recommended below 100 kHz.

Since the system working in DCM mode, the maximum output power is given by

$$P_o = \frac{1}{2} \times L_p \times F_{SW} \times I_{PK}^2$$

Where L_p is transformer primary inductance, I_{PK} is primary peak current in a switching cycle, F_{SW} is switching frequency.

Via a resistor divider connected between the auxiliary winding and FB, the output voltage is sampled indirectly. Then, SDC3106 regulates the switching frequency by controlling the switching off time according to the voltage on FB pin, thus constant voltage (CV) output can be achieved.

The switching frequency decreases along with the load conditions, so it will drop into audio frequency range (20Hz~20kHz) inevitably, which causes audio noise. SDC3106 uses two-stage peak current controlling technology, whose peak current switches to a smaller value under light load condition. Thus, the switching frequency is increased, and audio noise is suppressed.

To ensure that the audio noise suppression function is effective, the maximum switching frequency of the system is recommended above 55 kHz.

Protection Functions

Good power supply system reliability is achieved with SDC3106 rich protection features including short/open circuit protection of current sense resistor and FB upper/lower resistors, FB over voltage protection (OVP), VCC under voltage lockout (UVLO) protection, and maximum on-time protection.

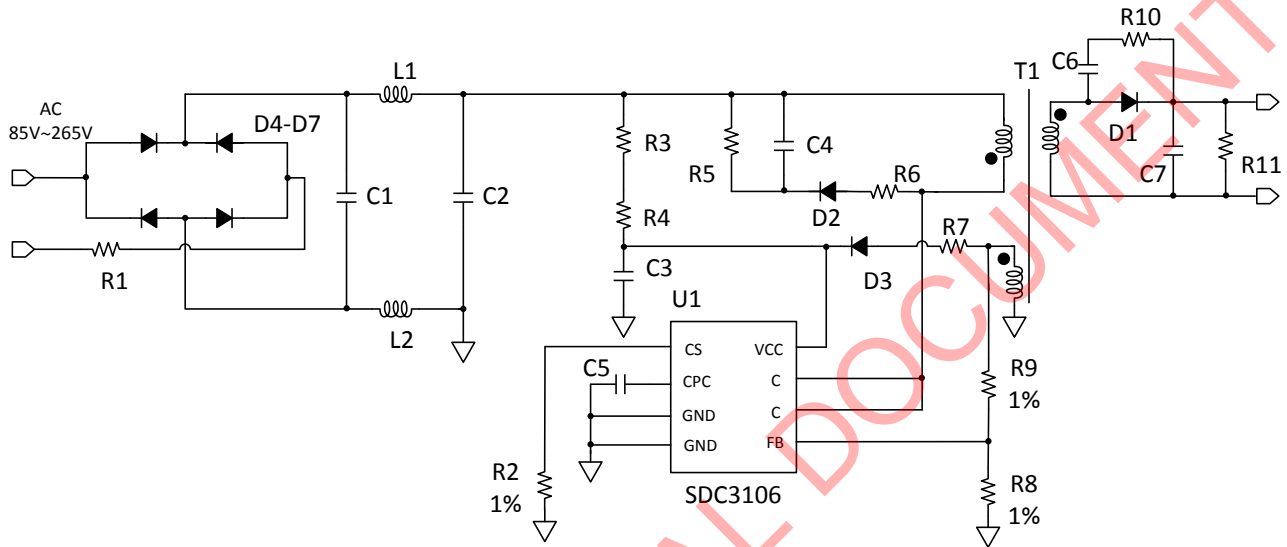
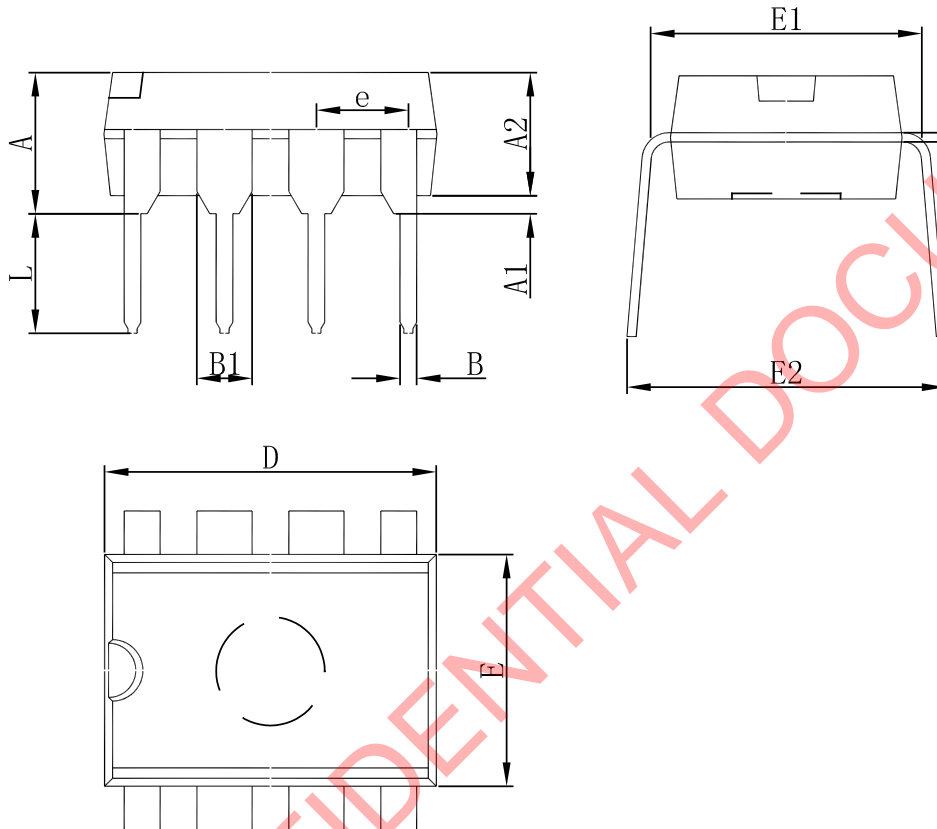
Typical Application


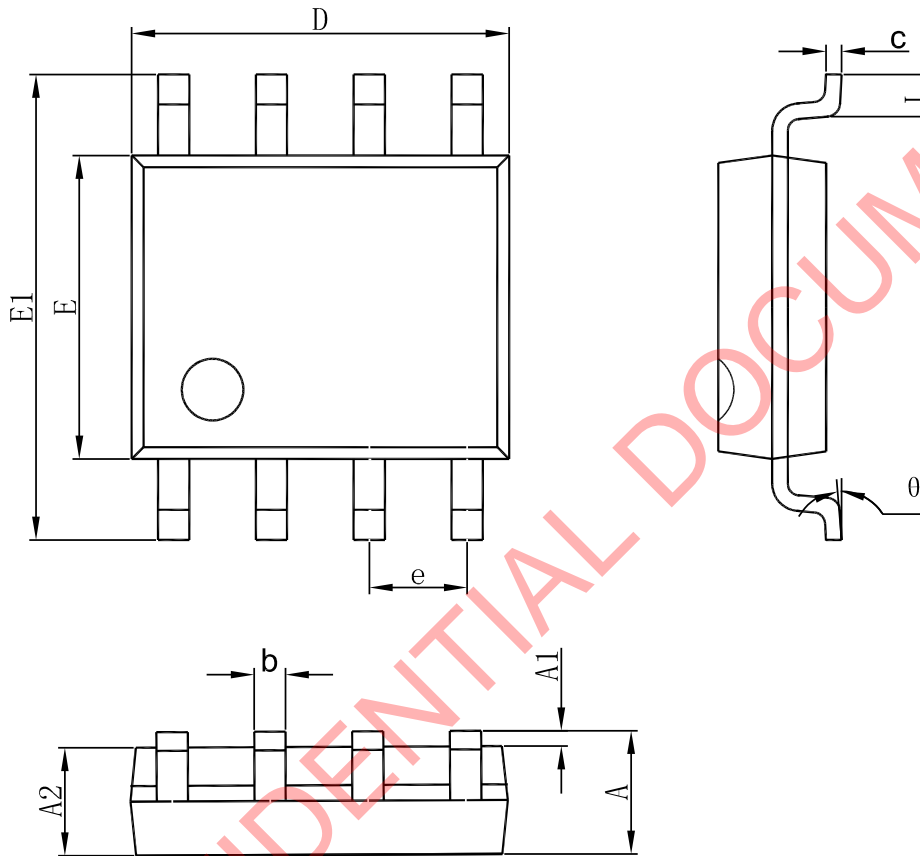
Figure 7. Typical Application

SDC CONFIDENTIAL DOCUMENT

Package Information
DIP-8


| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 3.710 | 4.310 | 0.146 | 0.170 |
| A1 | 0.510 | | 0.020 | |
| A2 | 3.200 | 3.600 | 0.126 | 0.142 |
| B | 0.380 | 0.570 | 0.015 | 0.022 |
| B1 | 1.524 (BSC) | | 0.060 (BSC) | |
| C | 0.204 | 0.360 | 0.008 | 0.014 |
| D | 9.000 | 9.400 | 0.354 | 0.370 |
| E | 6.200 | 6.600 | 0.244 | 0.260 |
| E1 | 7.320 | 7.920 | 0.288 | 0.312 |
| e | 2.540 (BSC) | | 0.100 (BSC) | |
| L | 3.000 | 3.600 | 0.118 | 0.142 |
| E2 | 8.400 | 9.000 | 0.331 | 0.354 |

SOP-8



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.007 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.201 |
| e | 1.270 (BSC) | | 0.050 (BSC) | |
| E | 5.800 | 6.200 | 0.228 | 0.244 |
| E1 | 3.800 | 4.000 | 0.150 | 0.157 |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |



Shaoxing Devechip Microelectronics Co., Ltd.

<http://www.sdc-semi.com/>

IMPORTANT NOTICE

Information in this document is provided solely in connection with Shaoxing Devechip Microelectronics Co., Ltd. (abbr. SDC) products. SDC reserves the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at anytime, without notice. SDC does not assume any responsibility for use of any its products for any particular purpose, nor does SDC assume any liability arising out of the application or use of any its products or drcuits. SDC does not convey any license under its patent rights or other rights nor the rights of others.

© 2013 Devechip Microelectronics - All rights reserved

Contact us:

Headquarters of Shaoxing

Address: Tian Mu Road, No13,

Shaoxing city, Zhejiang province, China

Zip code: 312000

Tel: (86) 0575-8861 6750

Fax: (86) 0575-8862 2882

Shenzhen Branch

Address: 22A, Shangbu building, Nan Yuan Road, No.68,

Futian District, Shenzhen city, Guangdong province, China

Zip code: 518031

Tel: (86) 0755-8366 1155

Fax: (86) 0755-8301 8528