# GS8206
# 3 channel constant current LED driver

## General Descriptions

The GS8206 is a 3-channel constant current LED drive with resumable data transfers and internal display patterns. There are three open-drain constant current outputs, with a build-in PWM of grayscale. The range of input power is from +5V to +24V, and voltage-endurance of LED port is +24V. There is a built-in 12bits GAMMA correction module. PWM maximum refresh frequency is 8kHz. The GS8206 use the e-RZ (extended return to zero code) as the signal transmission mode, which can control the output current channel by channel and cascade infinitely. GS8206 provides two-signal data input as redundant control, which ensures the transmission of the signal if any single chip damages. In the absence of signal input, GS8206 displays the built-in display patterns that is suitable for those applications without a controller. There is the built-in power-on and power-off protection in the drive, which can enhance the service life of the chip. It also has the automatic test function while power on, which is convenient for the customer to test. The GS8206 provides SOP8 packaging, working environment is from -40 ° C to + 85 ° C.

## Features

·5v-24v operating supply voltage with 7805 module inside
·Default 17mA constant current output, the minimum is 11mA
·Use e-RZ code, serial data frequency 800kHz
·8bits data transfer, 12bits build-in GAMMA correction of PWM display
·Built-in PWM technology, supports 8kHz PWM refresh rate
·With resumable data transfer function, single chip damage does not infect data transmission
·Built-in display pattern for the applications without a controller
·Built-in automatic test mode, power-on and power-off protection
·ESD：2kV
·working environment is from -40 ° C to + 85 ° C
·Packaging：SOP8

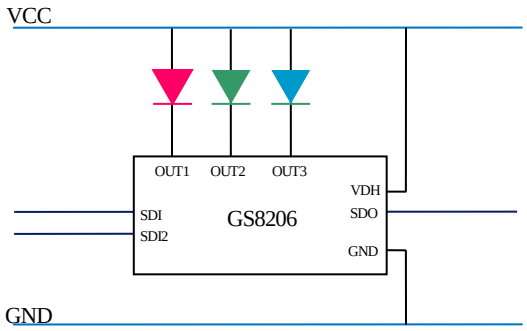
## Applications

- LED Display
- LED lighting/light engineering

## Order Information

| Number | Packaging Info. | |
|---|---|---|
| GS8206 | SOP8 | 4000PCS/Reel |
| | SOP8 | 100PCS/Strip |

## Typical Applications



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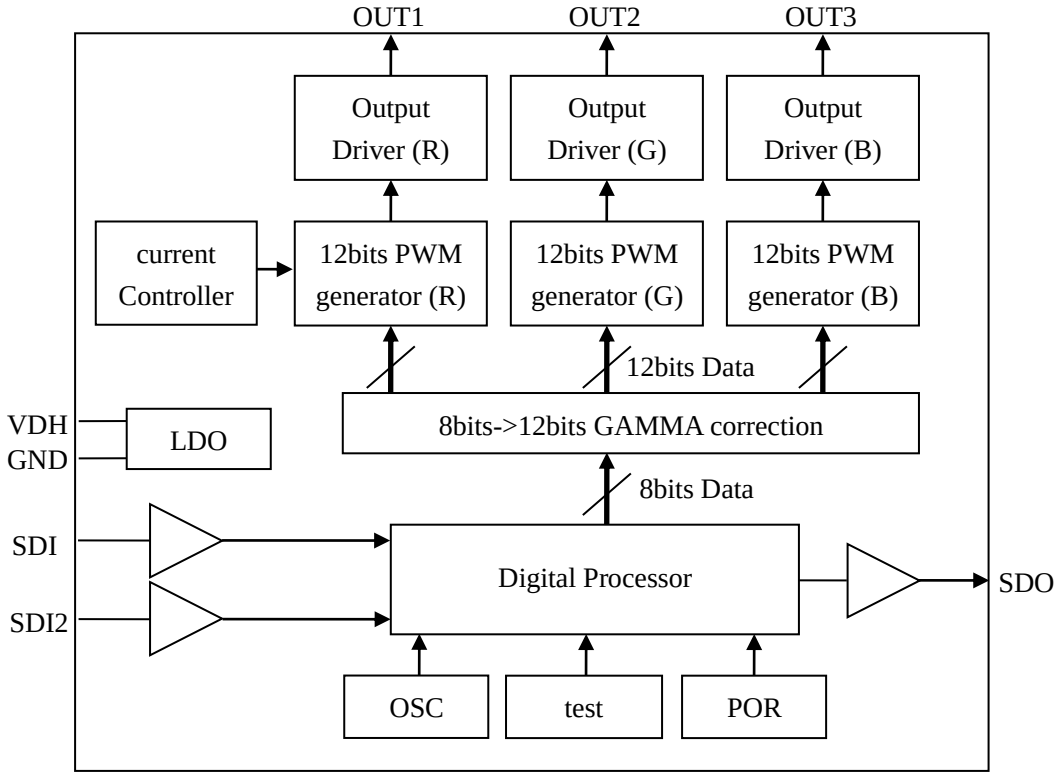
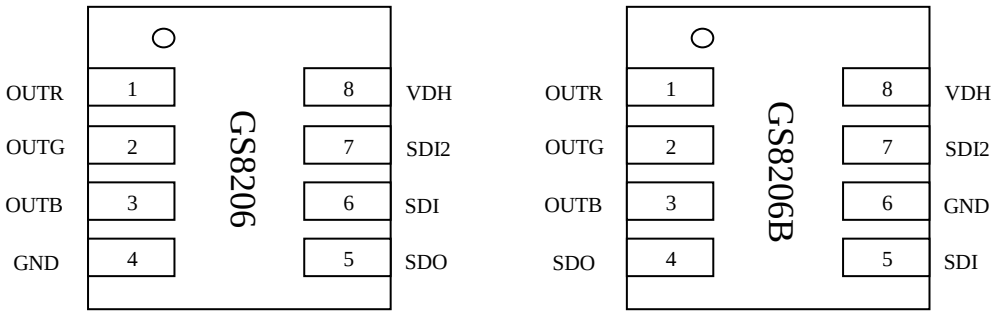
## Block Diagram




## Pin Configuration




## Pin Description

| Pin name | type | Function |
|---|---|---|
| VDH | P | 5V-24V Power Supply |
| GND | P | Chip Ground |
| OUTR……OUTB | OUT | Constant-current outputs, connected to LED |
| SDI | IN | Series data input |
| SDI2 | IN | Redundant series data input |
| SDO | OUT | Series data output |



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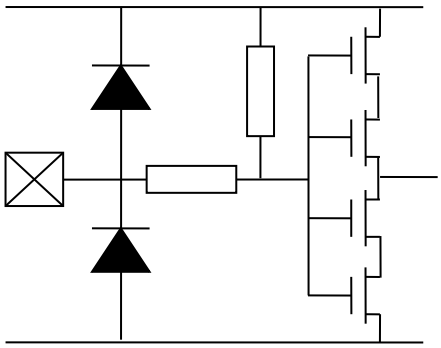
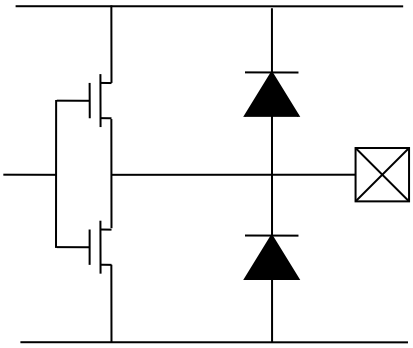
## Equivalent Circuits of Input and Output

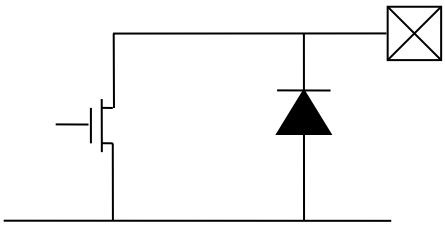
1 SDI/SDI2



2 SDO



3 OUT1~3



## Maximum Ratings

| Characteristic | Symbol | Maximum Working Range | Unit. |
|---|---|---|---|
| Power Source | VDH | -0.4～24V | V |
| On-chip Power Source | VCC | -0.4～6V | V |
| Input Logic Voltage | SDI | -0.5～VCC+0.5 | V |
| Maximum output current | IOUT | 55 | mA |
| Output voltage-endurance | VDS | 24 | V |
| Ground current | IGND | 55 | mA |
| Power dissipation | Pd | 400 | mW |
| Working temperature | TOP | -40～85 | oC |
| Storage temperature | Tstg | -55～150 | oC |
| ESD | HBM | 2000 | V |

（1）Stresses above there ratings may cause permanent damage. Exposure to absolute maximum condition for extended periods may degrade device reliability. These are stress ratings only and functional operation of the device at these or any other condition beyond those specified is not supported.

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



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## Electrical Characteristics

| Characteristic | Symbol | Measuring condition | Min | Typical | Max | Unit. |
|---|---|---|---|---|---|---|
| Power supply | VDH | | 3 | 5 | 24 | V |
| internal Power supply | VCC | | 2.5 | 5 | 6 | V |
| High Input Logic Voltage | VIH | | 2 | | | V |
| Low Input Logic Voltage | VIL | | | | 1 | V |
| Output current | IOUT | VDH=5V | 11 | 17.5 | | mA |
| Static current | Ichip | | | 1.8 | | mA |
| Power dissipation | Pd | | | | 150 | mW |
| Current variation(channel) | dIOUT | $I_{out} = 17mA$, | | $\pm 1.5$ | $\pm 3$ | % |
| Current variation(chip) | dIOUT2 | $V_{out} = 1.2V$ | | $\pm 3$ | $\pm 6$ | % |
| Current offset VS Power Source | | | | NA | | |
| Voltage range of outputs | VOUT | | | 1.2 | 24 | V |
| External Power Res | Rvdh | VDH=24V | | 5.1 | | kohm |
| External Power Res | Rvdh | VDH=12V | | 2 | | kohm |
| External Power Cap | Cvdh | | 0.1 | | | uF |

## Switching Characteristics

| Characteristic | Symbol | Measuring condition | Min | Typical | Max | Unit. |
|---|---|---|---|---|---|---|
| Internal Oscillator Frequency | OSC | | | 25 | | MHz |
| PWM refresh rate | | | | 8 | | kHz |
| Data refresh rate | | | | 30 | 1017 | Hz |
| Data refresh delay time | | 1024 points | | 700 | | us |
| Internal program data refresh rate | | | | 100 | | Hz |
| Channel output delay time | | | | 80 | | ns |
| Current output rising time | | 18mA, | | 40 | | ns |
| Current output falling time | | VOUT=1V | | 40 | | ns |
| PWM pulse duration | | | 240 | | | ns |
| RZ data frequency | | | | 800k | | Hz |



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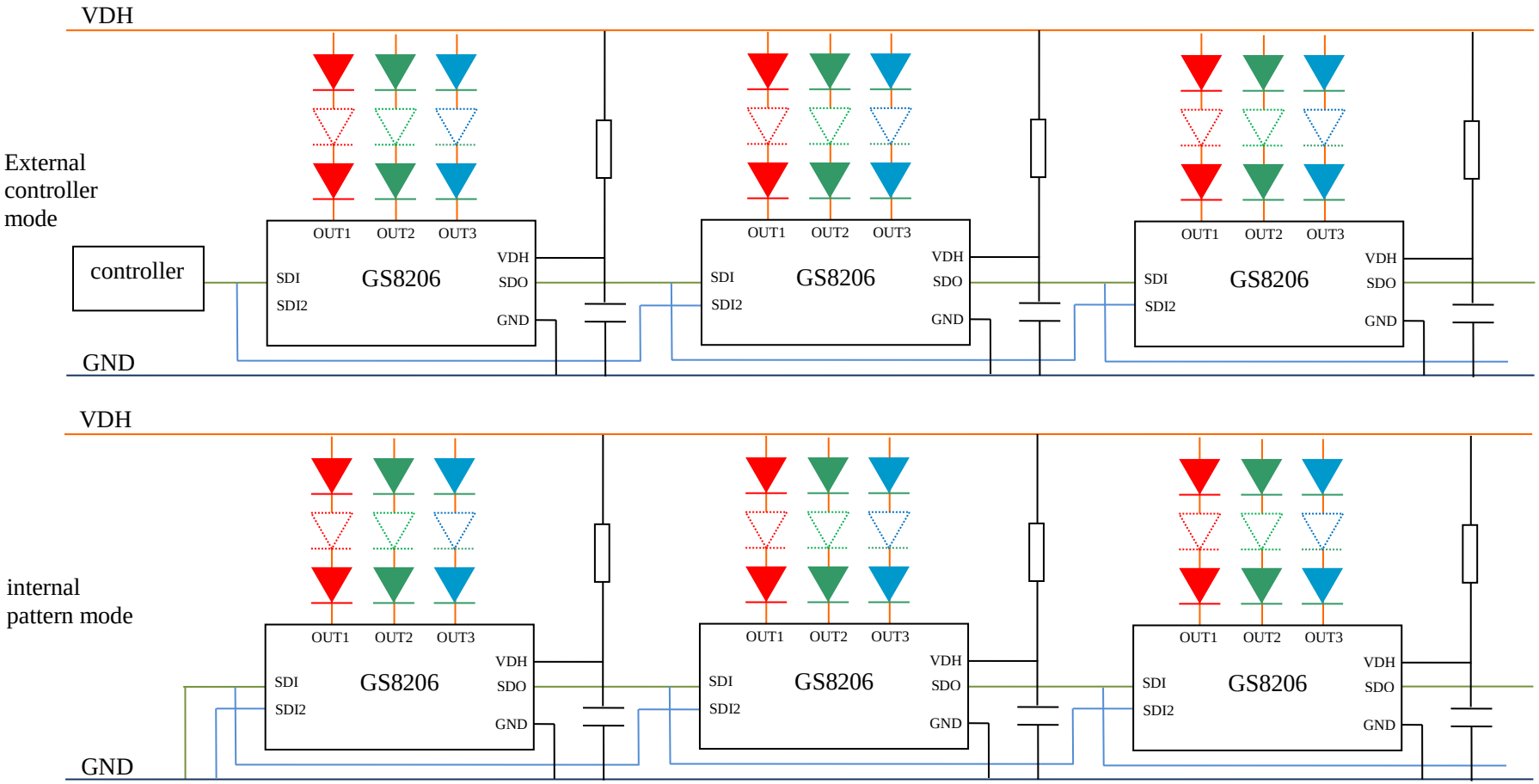
## Typical Application



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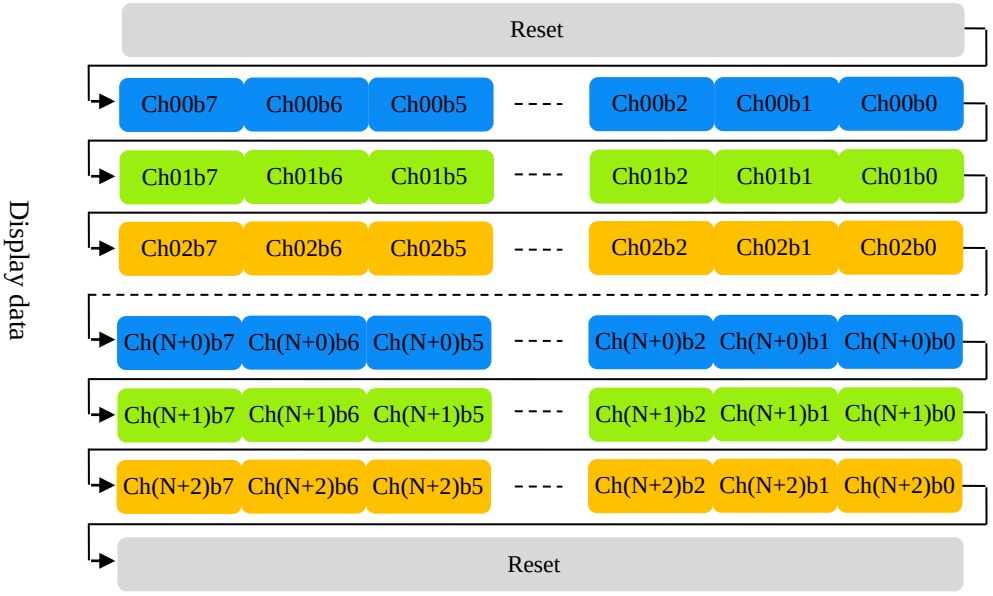
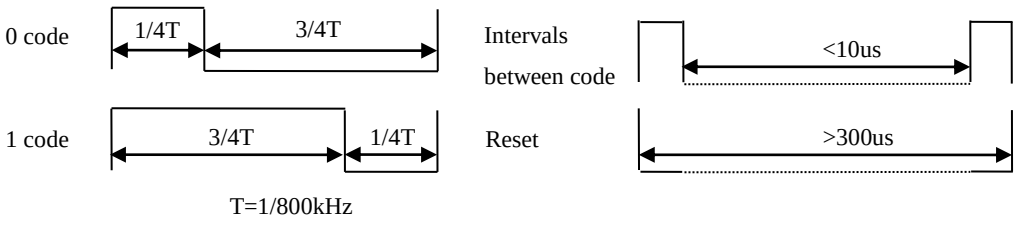
## Data Format

GS8206 adopts the extended return to zero code (e-RZ) data transmission mode, 8bits data for single channel, each IC supports 3 channel for display. The transmission data is filtered internally to support the data anti-jitter function. The extension type is compatible with the traditional RZ code. So it is suitable for most of the RZ code controller in the market.




Single code with 1:3 duty cycle and a standard 800kHz transmission speed. The maximum frequency can reach 1MHz. GS8206 re-code the data before transmission. Data delay is less than 0.7us from chip to chip, meets the dynamic image needs.



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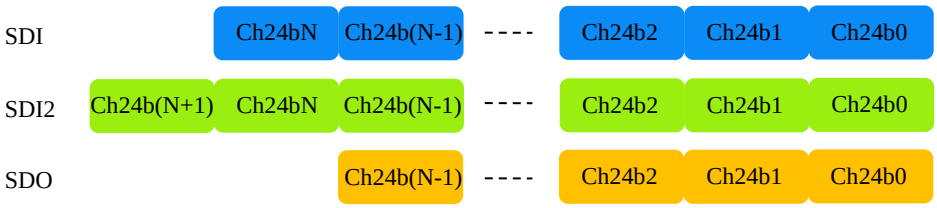
## Dual channel redundant control

Dual channel redundant control can be used to effectively avoid the failure of any single device damage, and reduce the damage rate of the driving system to one millionth. The SDI signal is used as the default transmission channel while the system is power on. The transmission channel priority is switched between SDI and SDI2 when the transmission data is abnormal. The device will choose the clear transmission channel after data detection.




When the external control data is transmitted, SDI uses the 1-24bits received data as the display data, meanwhile, SDI2 will discard the 1-24bits data and use 25-48bits data as the display data.

## Data channel status testing during production

In the production process, any one of the abnormal data channel will not affect display because the chip uses dual SDI input. It is difficult to detect the problem data channel during the production process, which may cause the dual channel is equivalent to a single channel.

In order to avoid this situation, the status of the data channel can be detected by using the test controller in the external control situation. While any channel appears Weld, short, open or other abnormal communication, the chip will display in white to facilitate the detection of problem position.

## Internal control patterns

GS8206 gets into RGB test mode right after power on. If the device does not receive the external display data for a long time, the chip will go into the built-in display patterns mode. Pattern on a total of six categories of 32 series, including integral color jump, integral color gradient, meteors, waves, colorful gradient, color jump of water circulation. It is 10 minutes about, and the image refresh frequency is 100hz.

Under the internal display mode, the first chip's SDI/SDI2 needs to be connected to GND.



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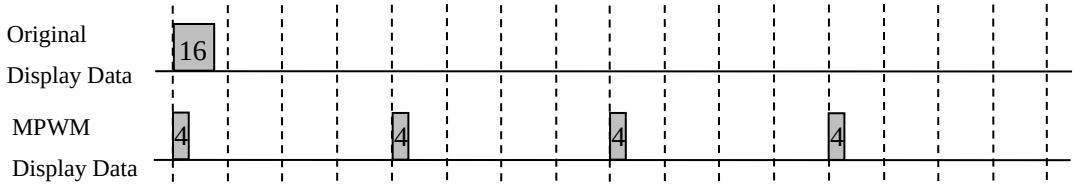
## Power-on automatic test function

The chip enters to the test mode automatically after power on. The system shows the red, green and blue mode for the production and debugging of the product. After the test mode is over, the chip enters the internal display pattern mode.

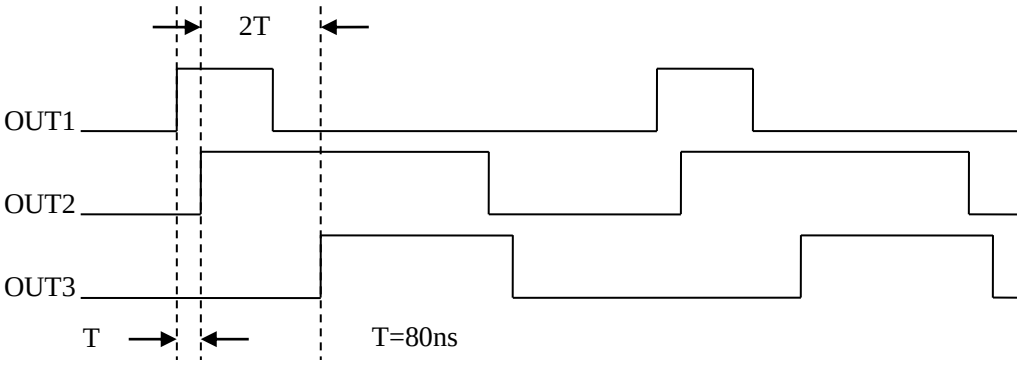
## MPWM（multi-PWM）

In order to increase the refresh rate of PWM output, MPWM adopts a unique method of dispersibility to distribute the periodic N in the display time, as shown in the figure below. GS8206 adopts MPWM technology, and the PWM refresh rate increases to 8kHz, which shows gentle effect and does not affect the accuracy of output current.




## Stagger output delay

In order to prevent the large power interference from the LED switching, reduce the power circuit voltage fluctuations, GS8206 has a built-in output hysteresis function. OUT1, OUT2, OUT3 will work in accordance with the 80ns interval sequence, to improve the system's anti-jamming performance. Meanwhile, the current peak output stagger will reduce the system EMI radiation, to meet environmental requirements.



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## Power dissipation

When all the three output channels are turned on, the practical power dissipation is determined by the following equation:

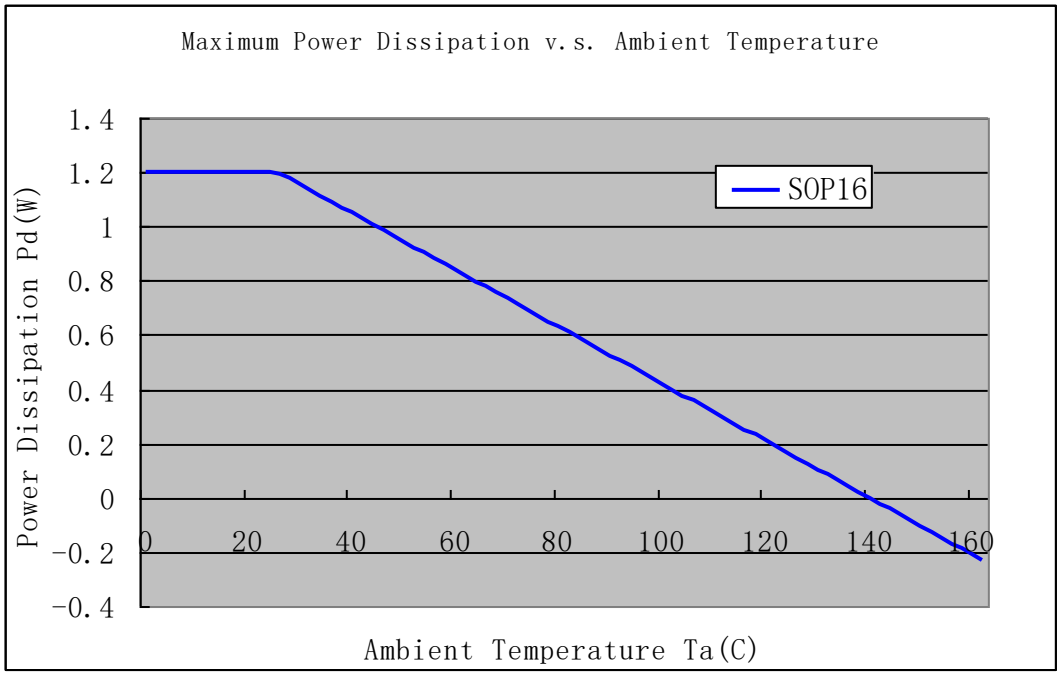
(Vout represents the output terminal voltage when the current is turned on; Duty represents the ratio of the time at which the current is turned on)

$$PD(practical) = VccxIcc + VoutA2xIoutA2xDutyA2 + ... + VoutD0xIoutD0xDutyD0$$

In secure operating conditions, the power consumption of an integrated chip should be less than the maximum permissible power dissipation which is determined by the package types and ambient temperature. The formula for maximum power dissipation is described as follows:

$$PD(\max) = \frac{Tj(\max)(C) - Ta(C)}{Rth(j-a)(C/Watt)}$$

The PD (max) declines as the ambient temperature rises. Therefore, suitable operating conditions should be designed with caution according to the chosen package and the ambient temperature. The following figure illustrates the relation between the maximum power dissipation and the ambient temperature of the SOP8 package.



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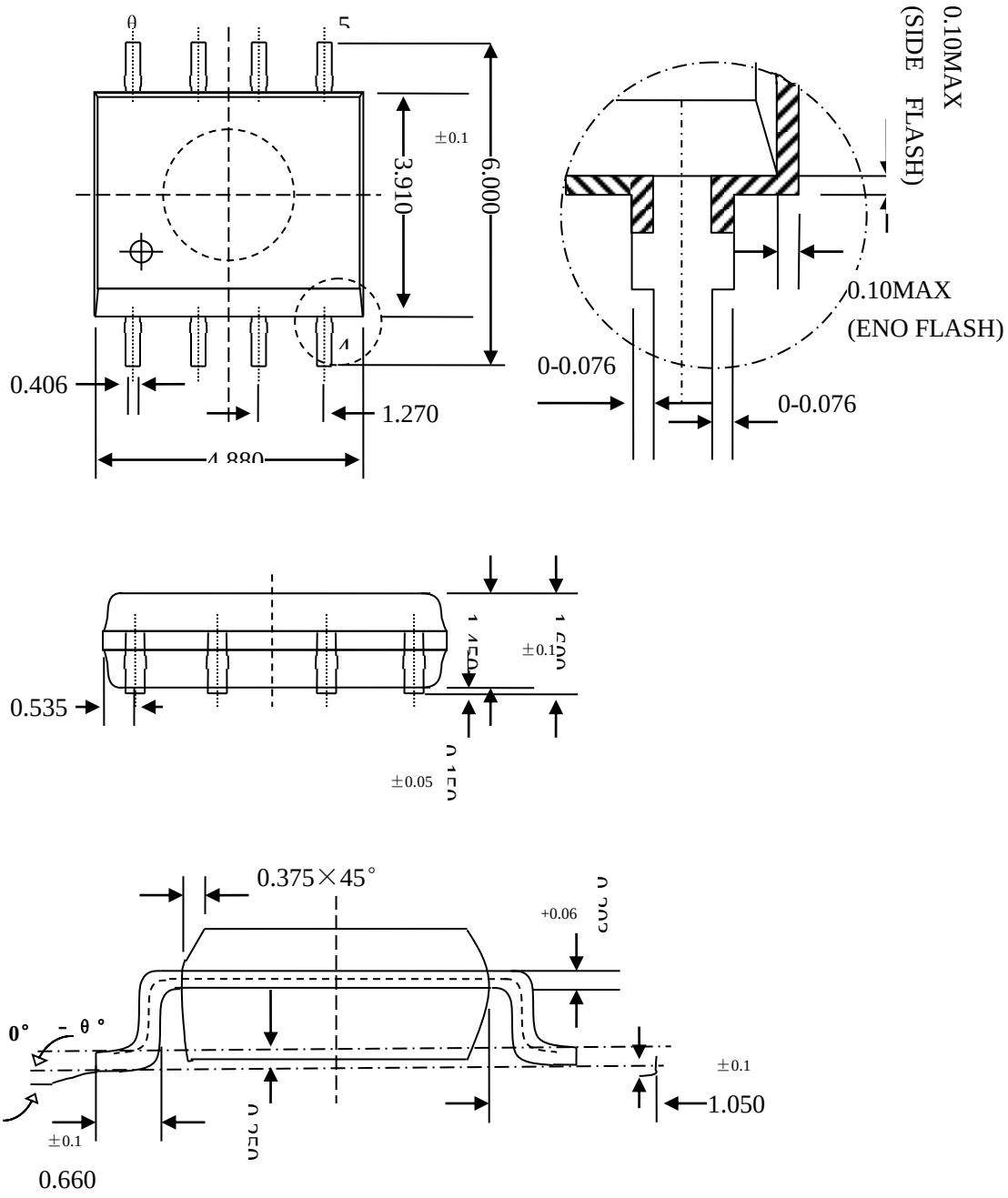
## Package Outline Dimension

SOP8



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