

Features

- Input Voltage: 10V to 40V
- Adjustable Output Voltage from 0.8V to 0.9V_{cc}
- Duty Ratio: 0% to 90% PWM control
- Oscillation Frequency: 300KHz typical
- Short Circuit Protect Frequency: 30 KHz
- 2uA Maximum Standby Current
- Current Limit, Enable Function
- Thermal Shutdown Function
- Built-in Internal SW N-channel MOS
- Lead Free Finish/RoHS Compliant for Lead Free products (Note 1)
- Lead-Free Package: SOP-8L

General Description

AP1580 consists of step-down switching regulator with PWM control. These devices include a reference voltage source, oscillation circuit, error amplifier and internal NMOS.

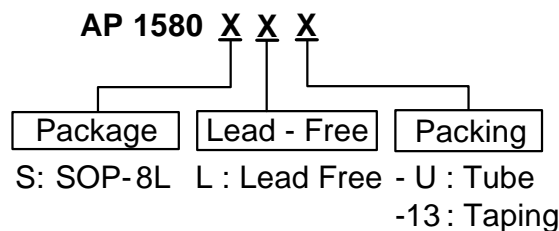
AP1580 provides low-ripple power, high efficiency and excellent transient characteristics. The PWM control circuit is able to vary the duty ratio linearly from 0 up to 90%. An enable function, an over current protect function and a short circuit protect function are built inside, and when OCP or SCP happens, the operation frequency will be reduced from 300 KHz to 30 KHz. Also, an internal compensation block is built to minimize external component count. With built-in power NMOS, a step-down switching regulator is easy to be built by adding a coil, capacitors and a diode.

The high efficiency (>90%), low standby current, high input voltage (40V) and output current (3A) combining with small SOP-8L package give AP1580 unprecedented advantage in high power system applications.

Applications

- Microprocessor Core Supply
- Networking Power Supply
- LCD MNT, TV Power Supply
- Telecom Power Supply

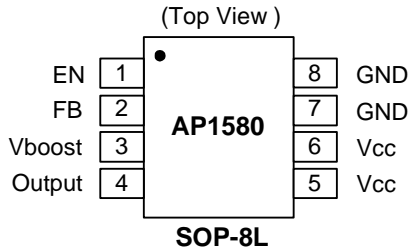
Ordering Information



Device	Package Code	Packaging (Note 2)	Tube		13" Tape and Reel	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
AP1580S	S	SOP-8L	100	-U	2500/Tape & Reel	-13

Notes: 1. RoHS revision 13.2.2003. Glass and High Temperature Solder Exemptions Applied, see *EU Directive Annex Notes 5 and 7*.
2. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

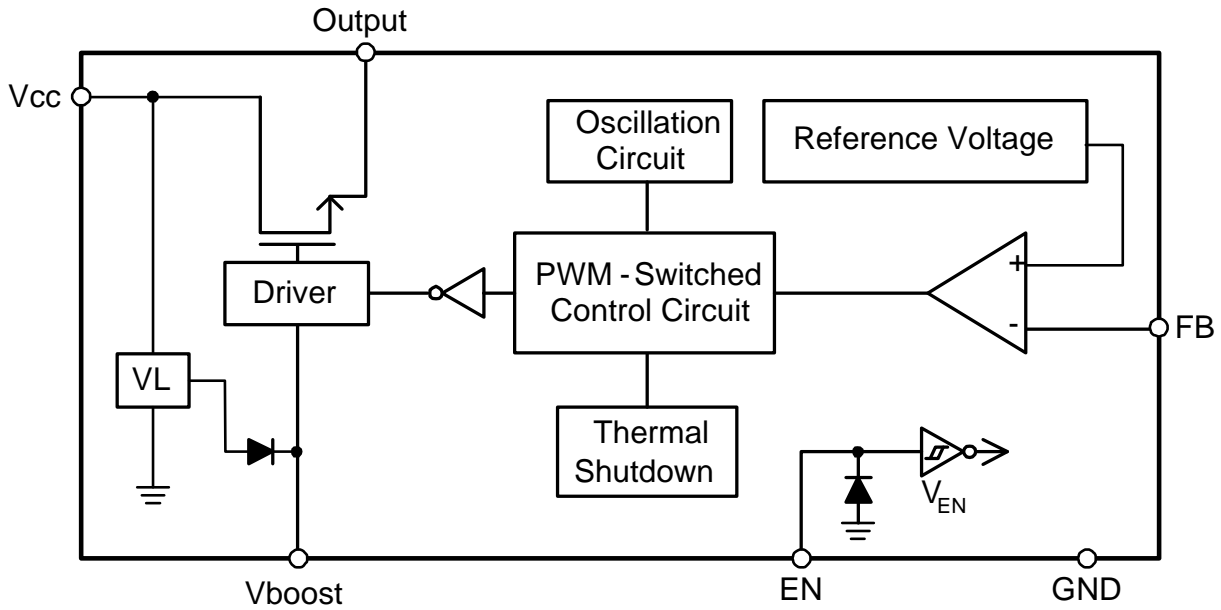
Pin Assignments



Pin Descriptions

Pin Name	Pin #	Description
EN	1	H: Normal operation L: Step-down operation stopped
FB	2	Feedback pin
V _{boost}	3	High-side gate driver boost pin
Output	4	Switch output pin
V _{cc}	5, 6	Signal V _{cc}
GND	7, 8	GND pin

Block Diagram



Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{CC}	V _{CC} Pin Voltage	$V_{SS} - 0.3$ to $V_{SS} + 45$	V
V_{FB}	V _{OUT} Pin Voltage	$V_{SS} - 0.3$ to V_{CC}	V
V_{EN}	EN Pin Voltage	$V_{SS} - 0.3$ to $V_{CC} + 0.3$	V
V_{boost}	V _{boost} Pin Voltage	$V_{OUTPUT} + 5V$	V
V_{OUTPUT}	Switch Pin Voltage	$V_{SS} - 0.3$ to $V_{CC} + 0.3$	V
Top	Operating Junction Temperature Range	-25 to +125	°C
T _{ST}	Storage Temperature Range	-40 to +150	°C

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

Recommended Operating Conditions

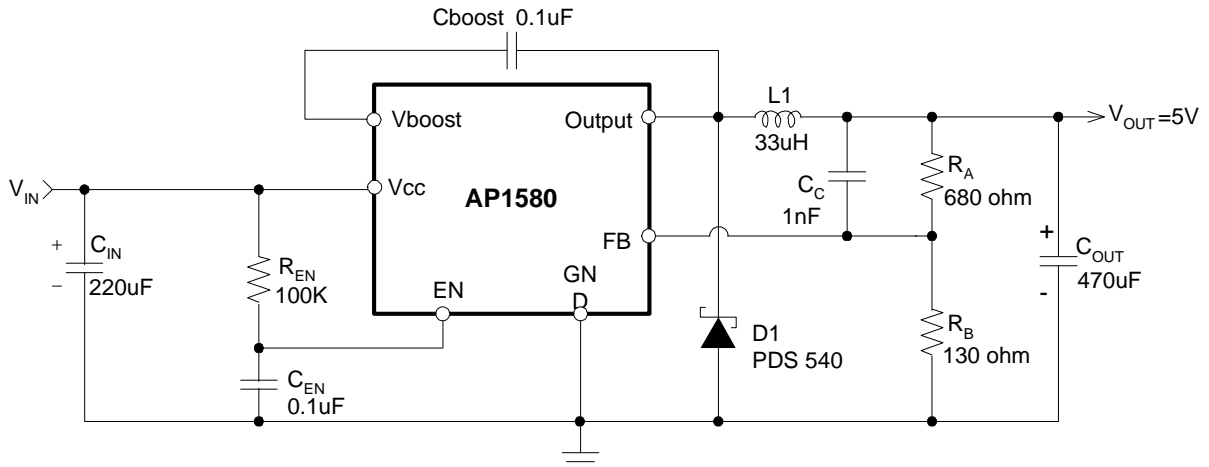
Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	10	40	V
I_{OUT}	Output Current	0	3	A
T_A	Operating Ambient Temperature	-25	85	°C

Electrical Characteristics ($V_{IN} = 12V$, $T_A = 25^\circ C$, unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{FB}	Feedback Voltage		0.780	0.8	0.820	V
V_{IN}	Input Voltage		10	-	40	V
I_{STBY}	Standby Current	$V_{EN} = 0V$	-	-	2	μA
$\Delta V_{OUT}/V_{OUT}$	Line Regulation	$V_{IN} = 10V \sim 40V$	-	±1.0	±1.5	%
$\Delta V_{OUT}/V_{OUT}$	Load Regulation	$I_{OUT} = 0.1$ to 3A	-	±0.8	±1	%
f_{OSC}	Oscillation Frequency	Measure waveform at SW pin	240	300	360	KHz
f_{OSC1}	Frequency of Current Limit or Short Circuit Protect	Measure waveform at SW pin	-	30	-	KHz
DC	Maximum Duty Cycle	$V_{FB} = 0.5V$	-	90	-	%
	Minimum Duty Cycle	$V_{FB} = 1.0V$	-	0	-	%
V_{IH}	EN Pin Logic Input Threshold Voltage	Regulator ON	2.0	-	-	V
V_{IL}		Regulator OFF	--	-	0.8	
I_{SH}	EN Pin Input Leakage Current		-	20	-	μA
I_{SL}			-	-10	-	μA
$R_{DS(ON)}$	Internal MOSFET $R_{DS(ON)}$		-	80	120	mΩ
I_{LIMIT}	Current Limit		4	4.5	-	A
η	Efficiency	$V_{IN} = 12V$, $V_{OUT} = 5V$, $I_{OUT} = 3A$	-	90	-	%
θ_{JA}	Thermal Resistance Junction-to-Ambient (Note 4)		-	149	-	°C/W
θ_{JC}	Thermal Resistance Junction-to-Case (Note 4)		-	13.4	-	°C/W

Notes: 3. The PCB layout copper area should be much greater than 10*10mm at the V_{cc} pins (5&6) of the AP1580, if you need large PD or low T_c&T_A. The dual V_{cc} pins (5&6) on the SOP-8L package are internally connected.
4. Devices mounted on 2oz copper, minimum recommended pad layout, FR-4 PCB.

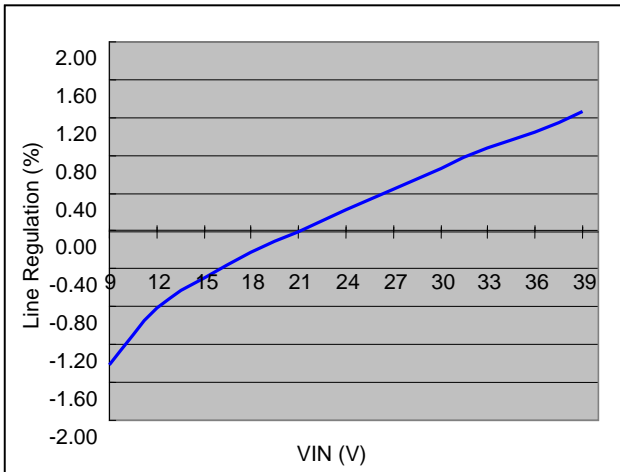
Typical Application Circuit



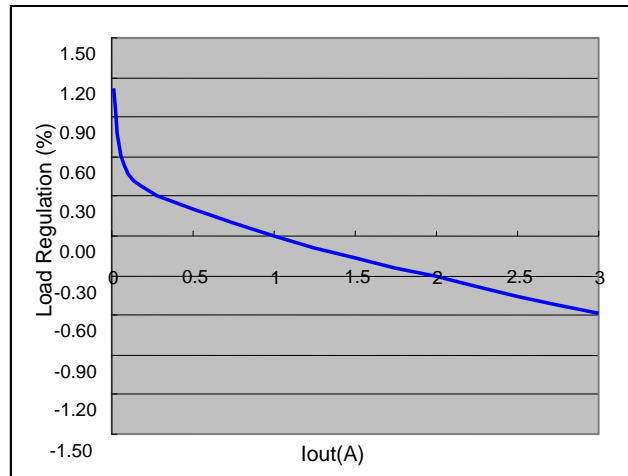
**Note: $V_{OUT} = V_{FB} \times (1 + R_A/R_B)$
 $R_B = 100 \sim 300 \text{ ohm}$**

Typical Performance Characteristics

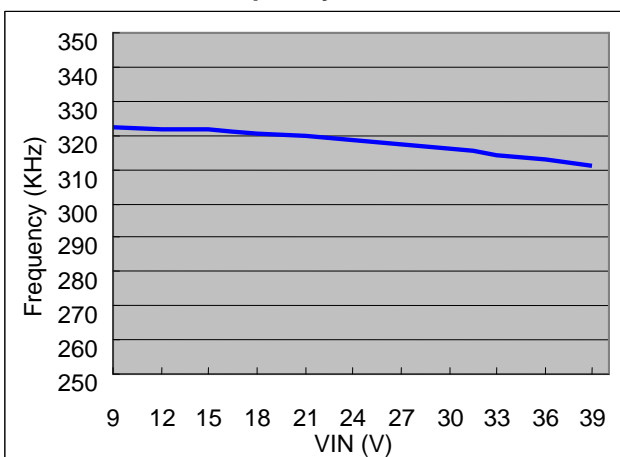
Line Regulation



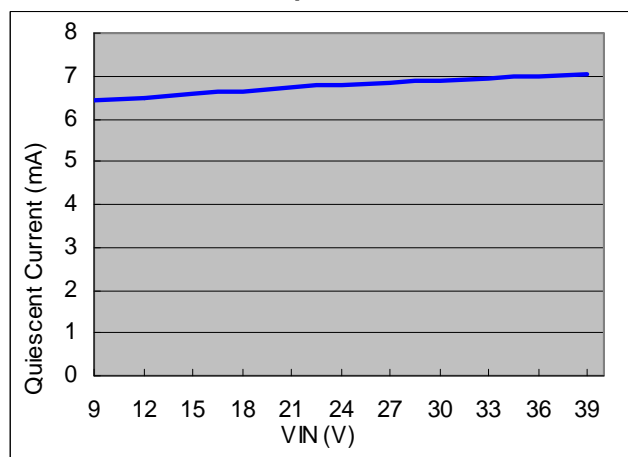
Load Regulation



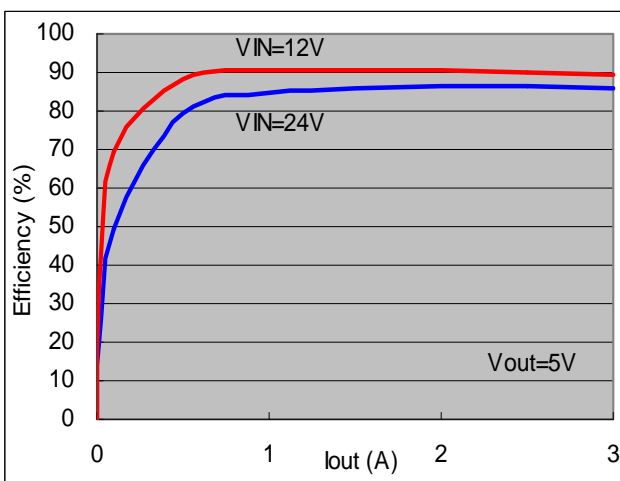
Frequency vs. Vin



Iccq vs. Vin

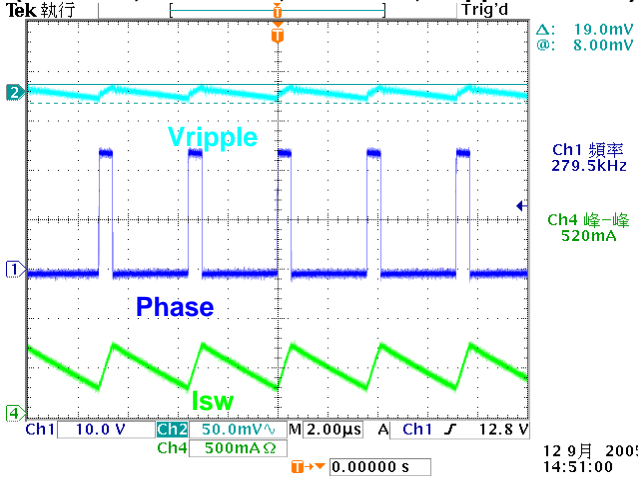


Efficiency

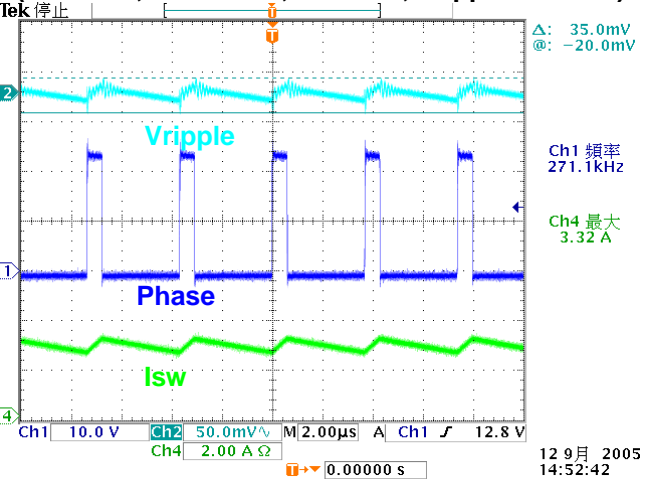


Typical Performance Characteristics (Continued)

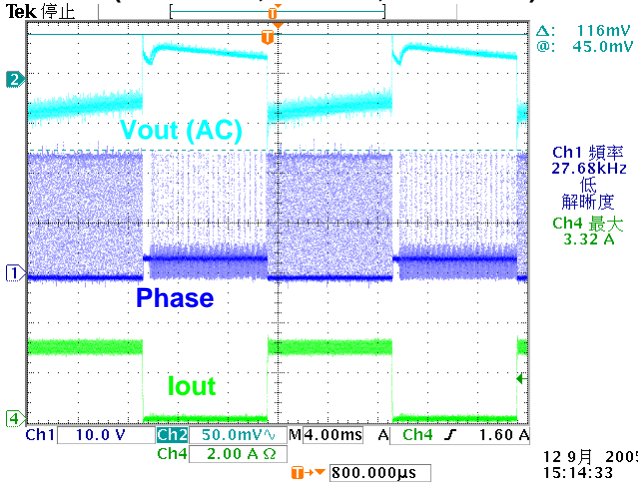
Vout Ripple
(Vcc=24V; Vout=3.3V, Iout=0.5A, Vripple=19.0mV)



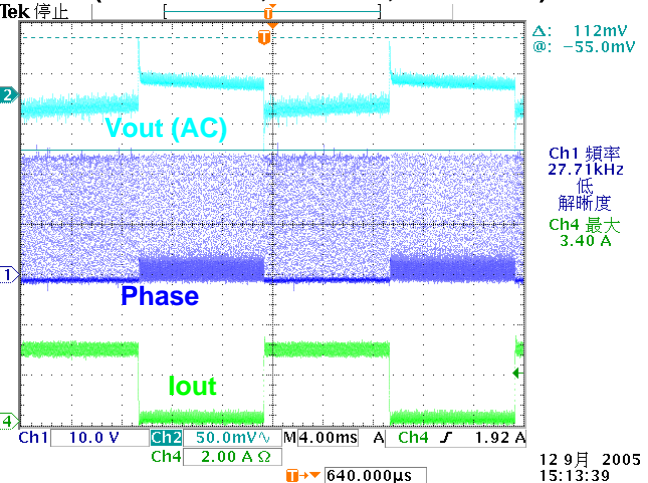
Vout Ripple
(Vcc=24V; Vout=3.3V, Iout= 3A, Vripple=35.0mV)



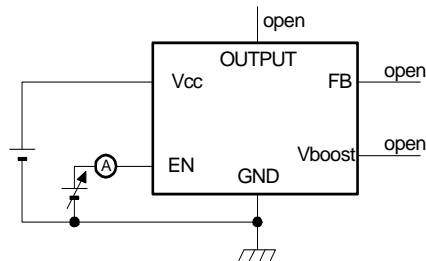
Power Transient Wave
(Iout=0~3 A, Vin=24V, Vout =3.3V)



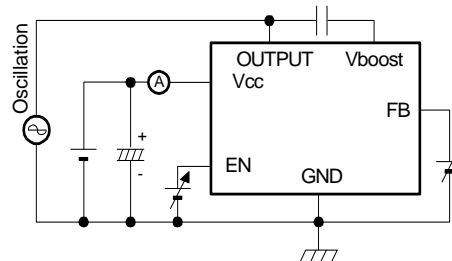
Power Transient Wave
(Iout=0.1~3 A, Vin =12V, Vout =3.3V)



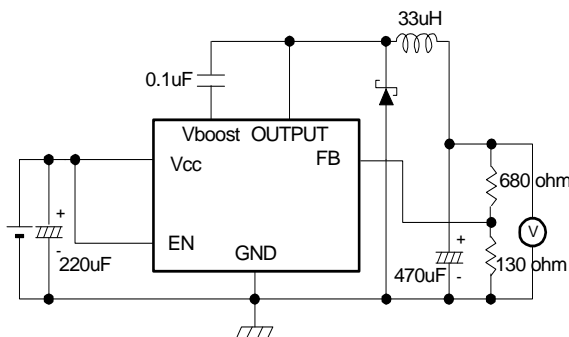
Test Circuit



Enable function test



Feedback function test



Operation function test

Function Description

PWM Control

The AP1580 consists of DC/DC converters that employ a pulse-width modulation (PWM) system. The PWM controller is internally clocked by a fixed 300KHz oscillator.

In converters of the AP1580, the pulse width varies in a range from 0 to 90%, according to the load current. The ripple voltage produced by the switching can easily be removed through a filter because the switching frequency remains constant. Therefore, these converters provide a low-ripple power over broad ranges of input voltage and load current.

Enable Control

This input provides an electrical ON/OFF control of the power supply. Connecting this pin to ground or to any voltage less than 0.8V will completely turn OFF the regulator. The current drain from the input supply when OFF is only 2uA.

C BOOST

A capacitor must be connected from pin 3 to the switch output, pin 4. This capacitor boosts the gate drive to the internal MOSFET above V_{in} to fully turn it ON. This minimizes conduction losses in the power switch to maintain high efficiency. The recommended value for C Boost is 0.1uF.

FEEDBACK

This is the input to a two-stage high gain amplifier, which drives the PWM controller. It is necessary to connect pin 2 to the actual output of the power supply to set the DC output voltage. Two external resistors are required to set the DC output voltage. For stable operation of the power supply, it is important to prevent coupling of any inductor flux to the feedback input.

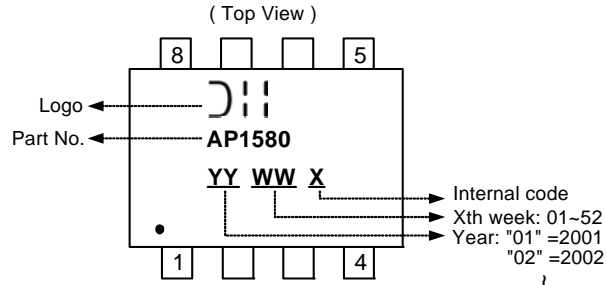
Current Limit

The current limit threshold is set by the internal circuit that minimum switching current is 4A. The output voltage will be reduced immediately and switching frequency will be dropped to 30KHz when switching current over limit threshold.

Thermal shutdown

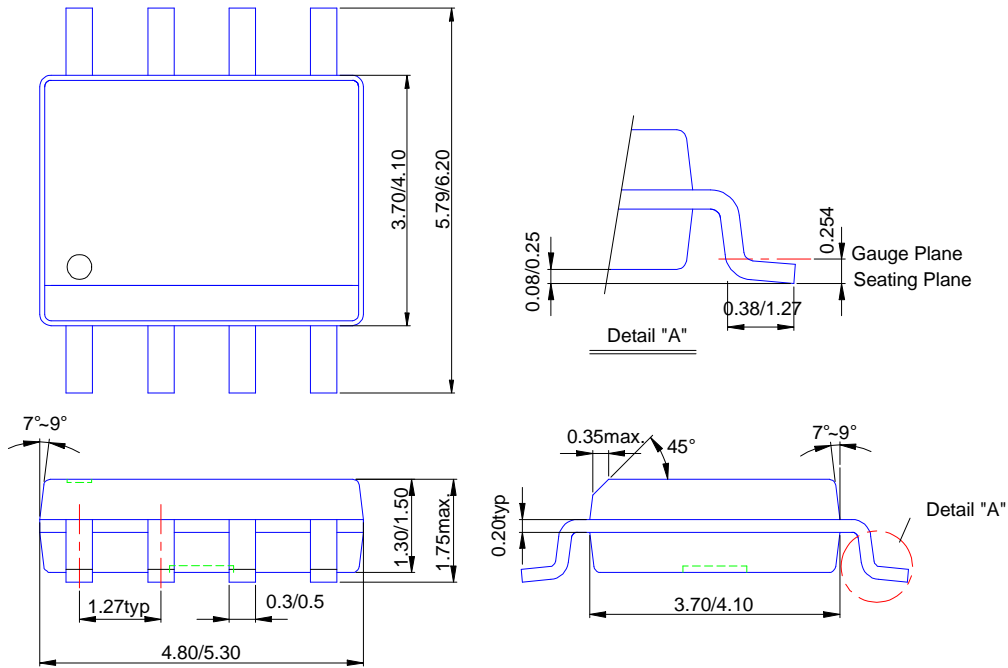
The thermal shutdown temperature depends on internal junction temperature. When junction temperature rises up to 140°C, the device will be shut down and it will be recovered after temperature reduced lower than 90°C.

Marking Information



Package Information (unit: mm)

Package Type: SOP-8L



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