GL2595L

2A STEP-DOWN VOLTAGE SWITCHING REGULATORS

Description

The GL2595L series are monolithic IC designed for a step-down DC/DC converter, and own the ability of driving a 2A load without additional transistor. It saves board space. The external shutdown function can be controlled by logic level and then come into standby mode. The internal compensation makes feedback control have good line and load regulation without external design. Regarding protected function, thermal shutdown is to prevent over temperature operating from damage, and current limit is to prevent over current operating of the output switch. If current limit function occurred and Vfb is down to 0.5V below, the switching frequency will be reduced. The GL2595L series operate at a switching frequency of 150 KHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Other features include a guaranteed ±4% tolerance on output voltage under specified input voltage and output load conditions, and ±15% on the oscillator frequency. The output version included fixed 3.3V, 5V, 12V, and an adjustable type. The chips are available in a standard 8-lead SOP8F package.

Features

- 3.3V, 5V, 12V, Adjustable output versions
- Adjustable output version output voltage range 1.23V to 18V ±4% max over line and load conditions
- 2A output current
- operating voltage can be up to 22V
- Requires only 4 external components
- High efficiency
- TTL shutdown capability, low power standby mode
- Thermal shutdown, current limit protection
- SOP8F Package
- 150 kHz ± 15% fixed frequency internal oscillator

Application

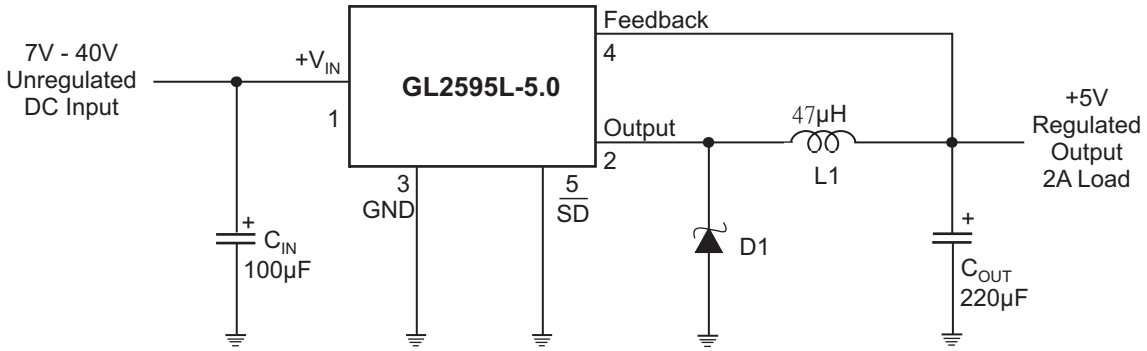
Pre-regulator for linear regulators

High-efficiency step-down buck regulator

On-card/ board switching regulators

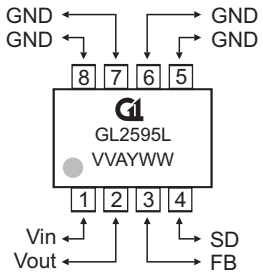
Positive to negative converter (buck-boost)

TYPICAL APPLICATIONS



◆ MARKING INFORMATION & PIN CONFIGURATIONS (Top View)

SOP- 8F



V V, VVV = Output Voltage (33 = 3.3V, 120= 12V, A =A dj)
A = Assembly Location
Y =Year
W W =Weekly

◆ ORDERING INFORMATION (Green Package Products are available now!)

Ordering Number	Output Voltage	Package	Shipping
GL2595L-ASF8R	A d j	SOP-8F	2,500 Units/ Tape & Reel
GL2595L-3.3SF8R	3.3	SOP-8F	2,500 Units/ Tape & Reel
GL2595L-5.0SF8R	5.0	SOP-8F	2,500 Units/ Tape & Reel
GL2595L-12SF8R	12	SOP-8F	2,500 Units/ Tape & Reel

* For detail Ordering Number identification, please see last page.

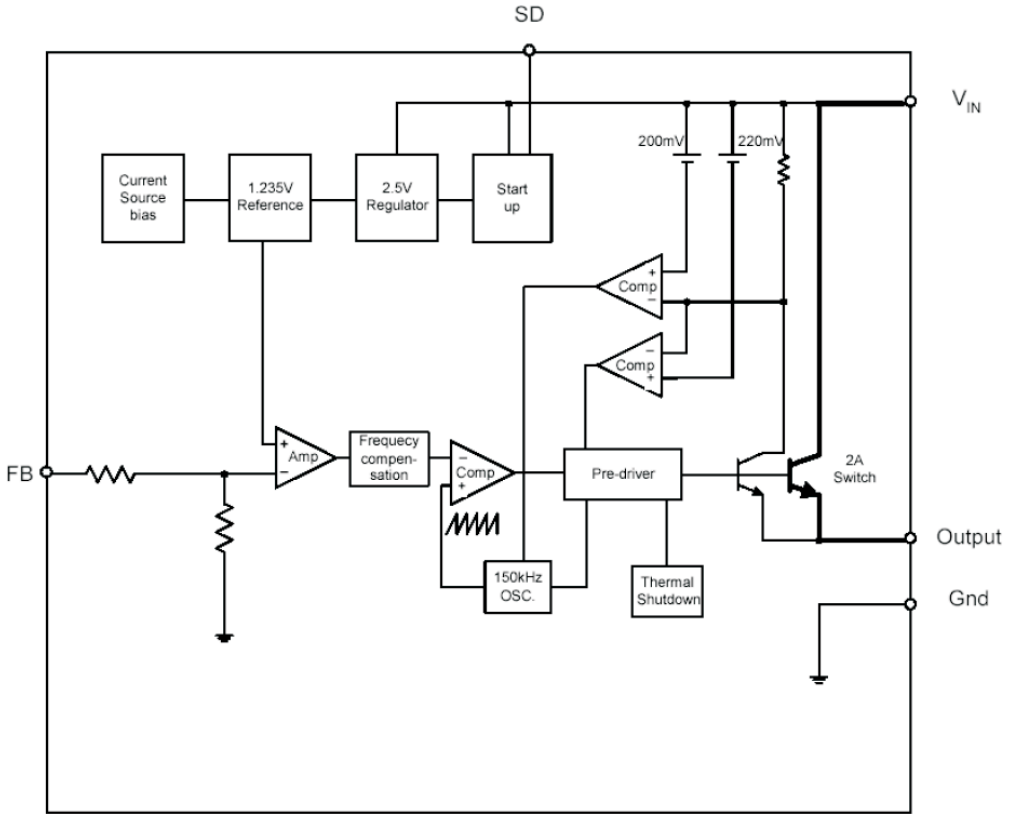
◆ ABSOLUTE MAXIMUM RATINGS

Rating	Value	Unit
Maximum Supply Voltage	24	V
$\overline{SD}$ Pin Input Voltage	-0.3 to 18	V
Feedback Pin Voltage	-0.3 to 18	V
Operating Voltage	4.5 to 22	V
Output Voltage to Ground (Steady State)	-1.0	V
Power Dissipation	Internally Limited	-
Storage Temperature Range	-65 to + 150	°C
Maximum Junction Temperature	+150	C
Minimum ESD Rating (C=100pF, R=1.5kΩ)	2	kV
Lead Temperature (Soldering, 10 seconds)	+260	C

◆ OPERATING RATINGS

Rating	Value	Unit
Operating Temperature Range	$-40 \leq T_J \leq 125$	°C
Supply Voltage	24	V

◆ BLOCK DIAGRAM



◆ ELECTRICAL CHARACTERISTICS: GL2595L-3.3

(Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over full Operating Temperature Range)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Output Voltage - GL2595L	4.75V≤V_{IN}≤22V, 0.2A≤ I_{LOAD}≤2.0A	V_{OUT}	3.168/ **3.135**	3.3	3.432/ **3.465**	V
Efficiency	V_{IN} = 12V, I_{LOAD} = 2.0A	η	-	78	-	%

◆ ELECTRICAL CHARACTERISTICS: GL2595L-5.0

(Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over full Operating Temperature Range)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Output Voltage - GL2595L	7V≤ V_{IN} ≤ 22V, 0.2A ≤I_{LOAD} ≤2.0A	V_{OUT}	4.800/ **4.750**	5.0	5.200/ **5.250**	V
Efficiency	V_{IN}= 12V, I_{LOAD} = 2.0A	η	-	83	-	%

◆ ELECTRICAL CHARACTERISTICS: GL2595L-12

(Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over full Operating Temperature Range)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Output Voltage - GL2595L	15V≤ V_{IN}≤22V, 0.2A ≤ I_{LOAD}≤2.0A	V_{OUT}	11.52/ **11.40**	12.0	12.48/ **12.60**	V
Efficiency	V_{IN} = 15V, I_{LOAD} = 2.0A	η	-	90	-	%

◆ ELECTRICAL CHARACTERISTICS:GL2595L-ADJ

(Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over full Operating Temperature Range.)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Feedback Voltage - GL2595L	4.5V≤ V_{IN}≤ 22V , 0.2A≤ I_{LOAD}≤ 2.0A V_{OUT} = 3V	V_{OUT}	1.193/**1.180**	1.230	1.267/**1.280**	V
Efficiency	V_{IN} = 12V, I_{LOAD} =2.0A, V_{OUT}=3V	η	-	76	-	%

ELECTRICAL CHARACTERISTICS: All Output Voltage Versions

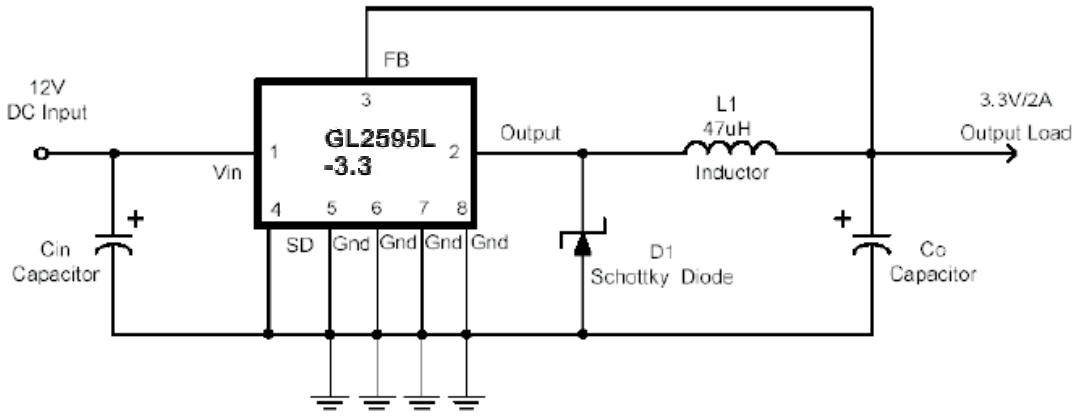
(Specifications with standard type face are for T_J = 25°C, and those with **boldface type** apply over full Operating Temperature Range. Unless otherwise specified, V_{IN}= 12V for the 3.3V, 5.0V and ADJ version, V_{IN}= 18V for 12V version. I_{LOAD} = 500 mA)

Parameter		Conditions	Symbol	Min	Typ	Max	Unit
Feedback Bias Current		V_{FB} = 1.3V (Adjustable Version Only)	I_{fb}	-	-10	-50 / **-100**	nA
Oscillator Frequency			f_o	127 / **110**	150	173 / **173**	kHz
Oscillator Frequency of short circuit protect		When current limit occurred and V_{FB}<0.5V, Ta=25°C	F_{SCP}	10	30	50	kHz
Saturation Voltage		I_{OUT} = 2A no output circuit V_{FB}=0V force driver on	V_{SAT}	-	1.25	1.4 / **1.5**	V
Max Duty Cycle (ON)		V_{FB}=0V force driver on	DC		100	-	%
Max Duty Cycle (OFF)		V_{FB}=12V force driver off	DC		0	-	%
Current Limit		Peakcurrent No ouside circuit V_{FB}=0V force driver on	I_{CL}	3			A
Output Leakage Current	Output = 0 V	No output circuit, V_{FB}=12V force driver off	I_L			-200	uA
	Output = -1V	V_{IN}=22V	I_L		-5		mA
Quiescent Current		V_{FB}=12V force driver off	I_Q	-	5	10	mA
Standby Quiescent Current		$\overline{SD}$ Pin = 5V (OFF), V_{IN}=22V	I_{STBY}	-	70	150/**200**	μA
$\overline{SD}$ Pin Logic Input Level		V_{OUT}=0V	V_{IH}	2.0	1.3	-	V
		V_{OUT} = Nominal Output Voltage	V_{IL}	-	1.3	0.6	V
$\overline{SD}$ Pin Input Current		$\overline{SD}$ Pin = 2.5V (OFF)	I_{IH}	-		-0.01	μA
		$\overline{SD}$ Pin = 0.5V (ON)	I_{IL}	-	-0.1	-1	μA

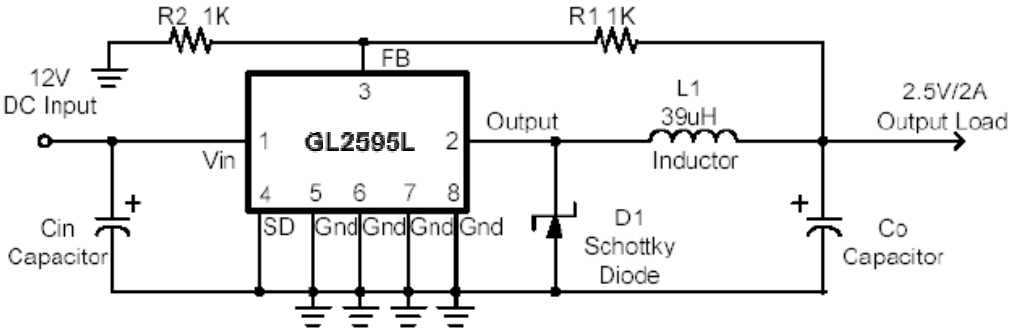
◆ TEST CIRCUIT AND LAYOUT GUIDELINES

Careful layout is important with any switching regulator. Rapidly switching currents associated with wiring inductance generate voltage transients which can cause problems. To minimize inductance and ground loops, the lengths of the leads indicated by heavy lines in Figure 1 below should be kept as short as possible. Single-point grounding (as indicated in Figure 1) or ground plane construction should be used for best results. When using the Adjustable version, place the programming resistors as close as possible to GL2575, to keep the sensitive feedback wiring short.

(1) Fixed Type Circuit



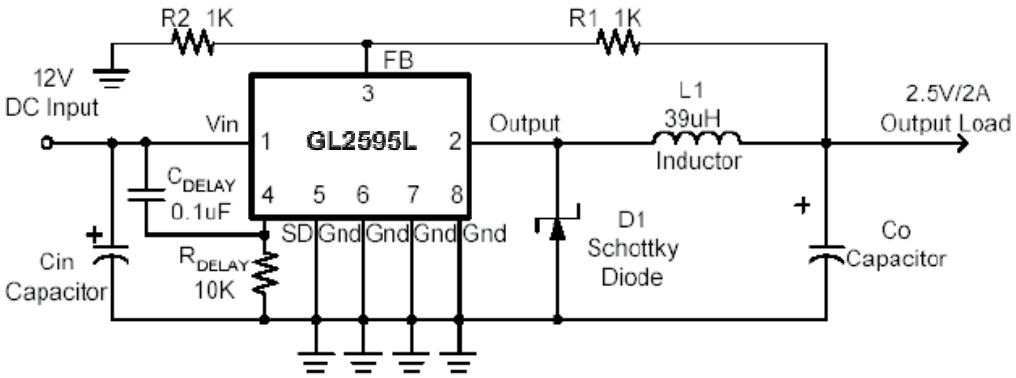
(2) Adjustable Type Circuit



$$Vout = V_{FB} \times (1 + \frac{R1}{R2})$$

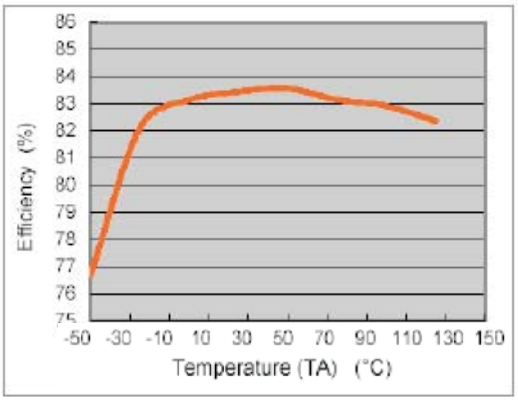
V_{FB} = 1.23V
R2 = 1K ~ 3K

(3) Delay Start Circuit

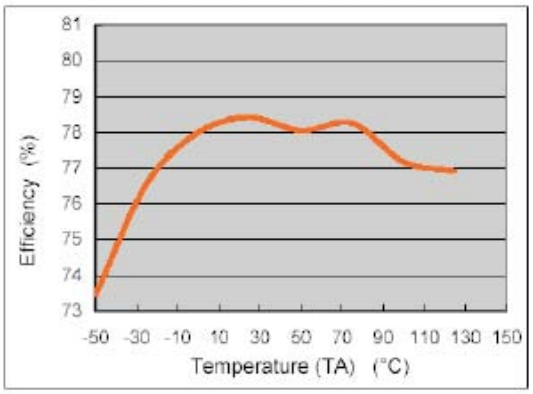


◆ Typical Performance Characteristics

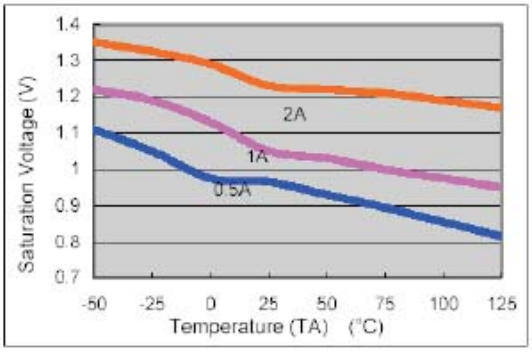
Efficiency v.s. Temperature
(Vin=12V,Vout=5V,Io=2A)



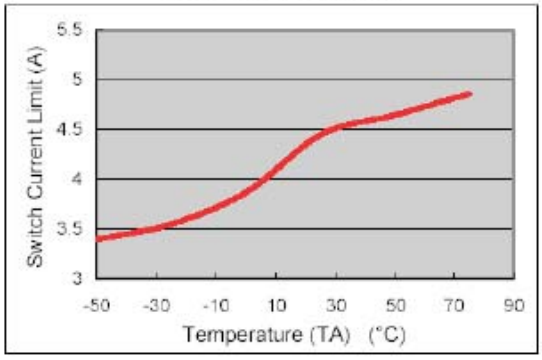
Efficiency v.s. Temperature
(Vin=12V,Vout=3.3V,Io=2A)



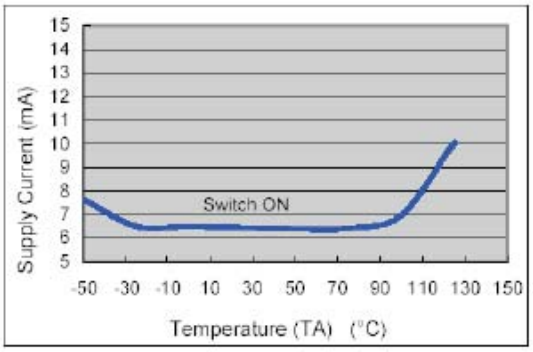
Saturation Voltage v.s. Temperature
(Vcc=12V,Vfb=0V,VSD=0)

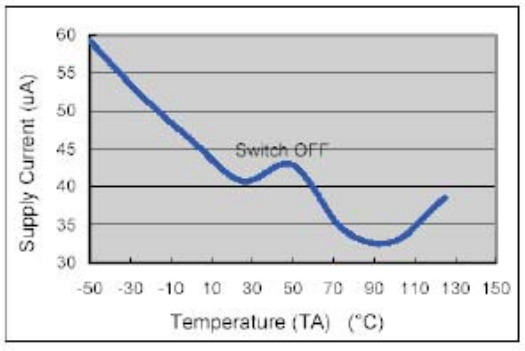


Switch Current Limit v.s. Temperature
(Vcc=12V,Vfb=0V)

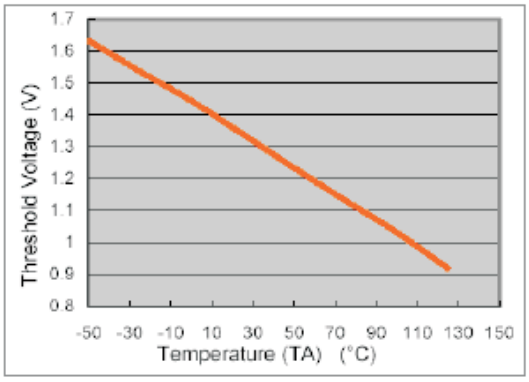


Supply Current v.s. Temperature
(Vcc=12V, No Load, Von/off =0V(Switch ON), Von/off =5V(Switch OFF))

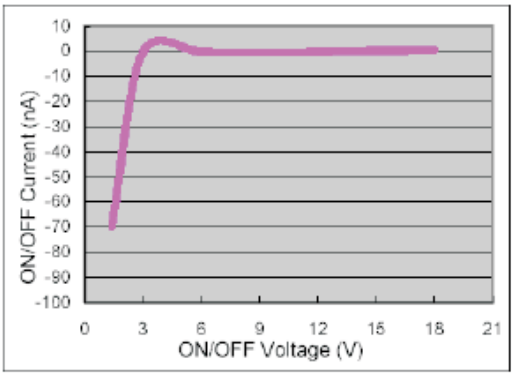




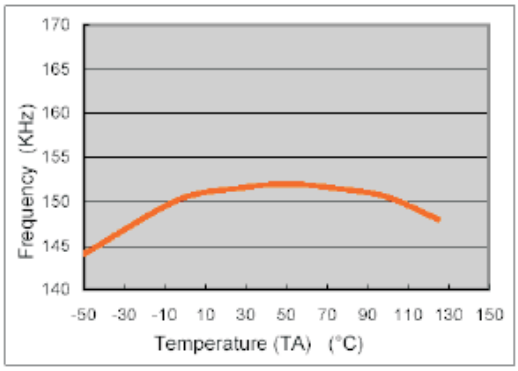
Threshold Voltage v.s. Temperature (Vcc=12V , Io=100mA)



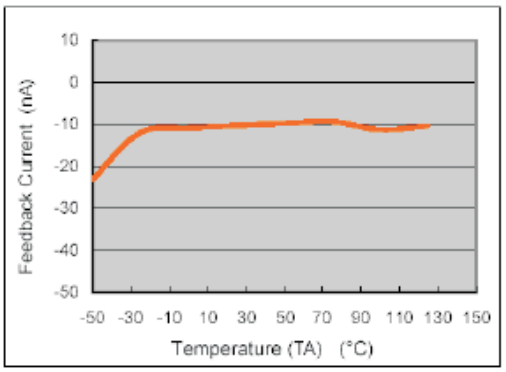
ON/OFF Current v.s. ON/OFF Voltage (Vin=12V)



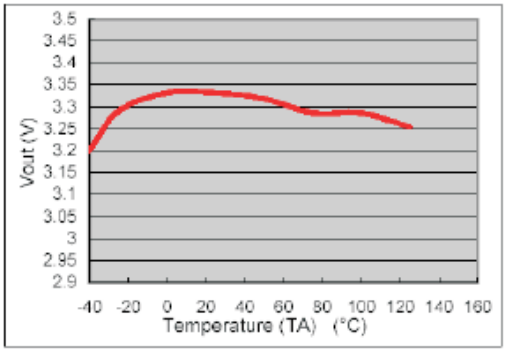
Frequency v.s. Temperature (Vcc=12V, Io=500mA, Vout=5V)



Feedback Current v.s. Temperature (Vcc=12V, Vout=5V, Vfb=1.3V)



Output Voltage v.s. Temperature (Vin=12V, Io=2A)



FUNCTION DESCRIPTION

Pin Functions

$+V_{IN}$

This is the positive input supply for the IC switching regulator. A suitable input bypass capacitor must be present at this pin to minimize voltage transients and to supply the switching currents needed by the regulator.

Ground

Circuit ground.

Output

Internal switch. The voltage at this pin switches between ($+V_{IN} - V_{SAT}$) and approximately – 0.5V, with a duty cycle of approximately V_{OUT} / V_{IN}. To minimize coupling to sensitive circuitry, the PC board copper area connected to this pin should be minimized.

Feedback

Senses the regulated output voltage to complete the feedback loop.

SD

Allows the switching regulator circuit to be shutdown using logic level signals thus dropping the total input supply current to approximately 150uA. Pulling this pin below a threshold voltage of approximately 1.3V turns the regulator on, and pulling this pin above 1.3V (up to a maximum of 18V) shuts the regulator down. If this shutdown feature is not needed, the SD pin can be wired to the ground pin.

Thermal Considerations

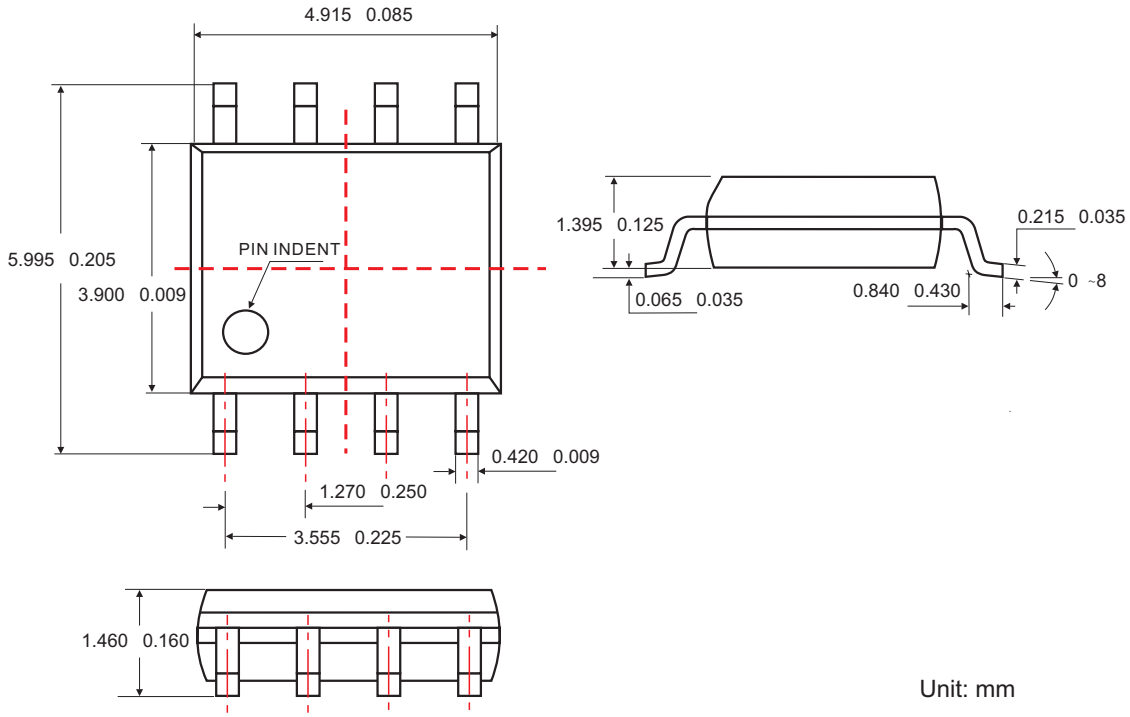
The SOP-8 package needs a heat sink under most conditions. The size of the heatsink depends on the input voltage, the output voltage, the load current and the ambient temperature. The **GL2595L** junction temperature rises above ambient temperature for a 2A load and different input and output voltages. The data for these curves was taken with the AP1509K (SOP-8 package) operating as a buck-switching regulator in an ambient temperature of 25ºC (still air). These temperature increments are all approximate and are affected by many factors. Higher ambient temperatures requires more heat sinker.

For the best thermal performance, wide copper traces and generous amounts of printed circuit board copper should be used in the board layout. (One exception is the output (switch) pin, which should not have large areas of copper.) Large areas of copper provide the best transfer of heat (lower thermal resistance) to the surrounding air, and moving air lowers the thermal resistance even further.

Package thermal resistance and junction temperature increments are all approximate. The increments are affected by a lot of factors. Some of these factors include board size, shape, thickness, position, location, and even board temperature. Other factors are, trace width, total printed circuit copper area, copper thickness, single or double-sided, multi-layer board and the amount of solder on the board.

The effectiveness of the PC board to dissipate heat also depends on the size, quantity and spacing of other components on the board, as well as whether the surrounding air is still or moving. Furthermore, some of these components such as the catch diode will add heat to the PC board and the heat can vary as the input voltage changes. For the inductor, depending on the physical size, type of core material and the DC resistance, it could either act as a heat sink taking heat away from the board, or it could add heat to the board.

SOP-8F PACKAGE OUTLINE DIMENSIONS



Unit: mm

ORDERING NUMBER