



2A STEP-DOWN VOLTAGE SWITCHING REGULATORS

Description

GL2575 of regulators provides all the active functions for a step-down (buck) switching regulator, and drives 2A load with excellent line and load regulation. GL2575 is available in fixed output voltages of 3.3V, 5V, 12V, 15V, and a versatile Adjustable output version. These regulators are simple to use and require a minimum number of external components. Features include internal frequency compensation and a fixed-frequency oscillator. The GL2575 is high-efficiency replacements for popular three-terminal linear regulators, and is requiring a smaller heatsink or even no heatsink. GL2575 performs well with standard inductors from several manufacturers, and simplifying the design of switch-mode power supplies. GL2575 guarantees $\pm 4\%$ tolerance on output voltage within specified input voltages and output load conditions, and $\pm 10\%$ on the oscillator frequency. External shutdown is included with $50\mu\text{A}$ (typical) standby current. The output switch has cycle-by-cycle current limiting as well as thermal shutdown for full protection under fault conditions.

Application

Pre-regulator for linear regulators

High-efficiency step-down buck regulator

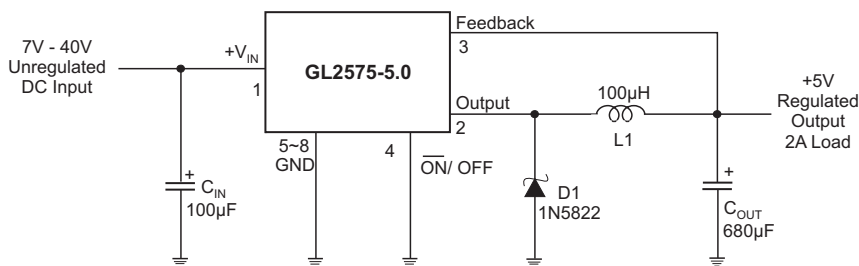
Features

- ◆ 3.3V, 5V, 12V, 15V, Adjustable output versions
- ◆ Adjustable output version output voltage range 1.23V to $37\text{V} \pm 4\%$ max over line and load conditions
- ◆ 2A output current
- ◆ Input voltage range up to 40V
- ◆ Requires only 4 external components
- ◆ High efficiency
- ◆ TTL shutdown capability, low power standby mode
- ◆ Thermal shutdown, current limit protection
- ◆ Uses standard inductors
- ◆ 52 kHz fixed frequency internal oscillator

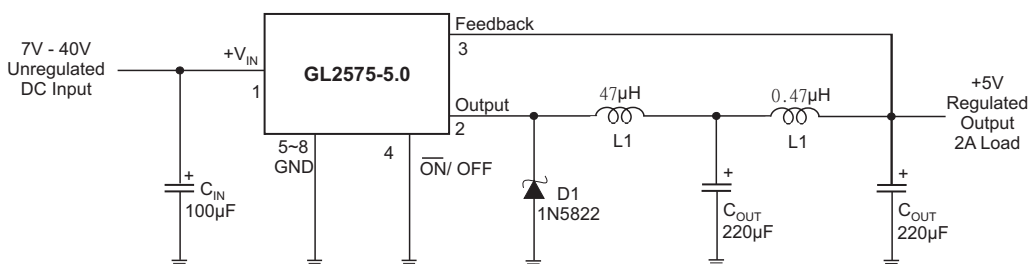
On-card/ board switching regulators

Positive to negative converter (buck-boost)

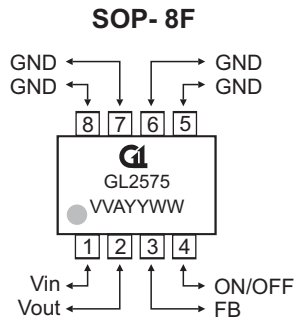
TYPICAL APPLICATIONS



Low Noise APPLICATIONS



◆ MARKING INFORMATION & PIN CONFIGURATIONS (Top View)



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

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

Ordering Number	Output Voltage	Package	Shipping
GL2575-ASF8R	A d j	SOP-8F	2,500 Units/ Tape & Reel
GL2575-3.3SF8R	3.3	SOP-8F	2,500 Units/ Tape & Reel
GL2575-5.0SF8R	5.0	SOP-8F	2,500 Units/ Tape & Reel
GL2575-12SF8R	12	SOP-8F	2,500 Units/ Tape & Reel
GL2575-15SF8R	15	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	45	V
ON/OFF Pin Input Voltage	$-0.3 \leq V \leq V_{IN}$	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

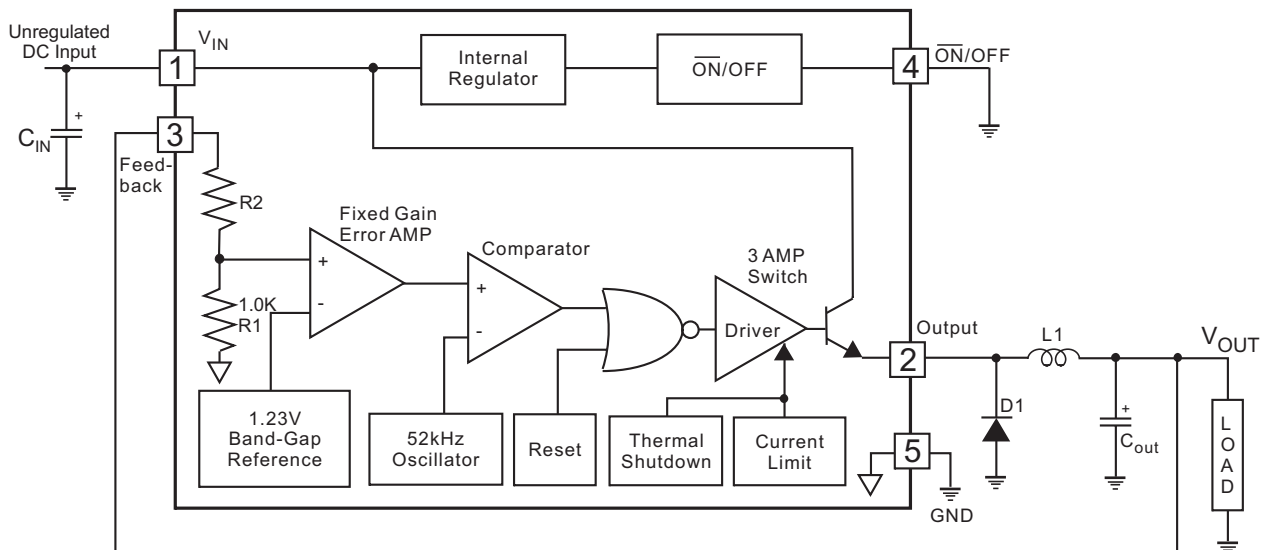


2A STEP-DOWN VOLTAGE SWITCHING REGULATORS

◆ OPERATING RATINGS

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

◆ BLOCK DIAGRAM





2A STEP-DOWN VOLTAGE SWITCHING REGULATORS

◆ ELECTRICAL CHARACTERISTICS: GL2575-3.3

(Specifications with standard type face are for $T_J = 25^\circ\text{C}$, and those with **boldface type** apply over full Operating Temperature Range)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Output Voltage	$V_{IN} = 12\text{V}, I_{LOAD} = 0.5\text{A}$	V_{OUT}	3.234	3.3	3.366	V
Output Voltage - GL2575	$6\text{V} \leq V_{IN} \leq 40\text{V}, 0.5\text{A} \leq I_{LOAD} \leq 2.0\text{A}$	V_{OUT}	3.168/ 3.135	3.3	3.432/ 3.465	V
Efficiency	$V_{IN} = 12\text{V}, I_{LOAD} = 2.0\text{A}$	η	-	75	-	%

◆ ELECTRICAL CHARACTERISTICS: GL2575-5.0

(Specifications with standard type face are for $T_J = 25^\circ\text{C}$, and those with **boldface type** apply over full Operating Temperature Range)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Output Voltage	$V_{IN} = 12\text{V}, I_{LOAD} = 0.5\text{A}$	V_{OUT}	4.900	5.0	5.100	V
Output Voltage - GL2575	$8\text{V} \leq V_{IN} \leq 40\text{V}, 0.5\text{A} \leq I_{LOAD} \leq 2.0\text{A}$	V_{OUT}	4.800/ 4.750	5.0	5.200/ 5.250	V
Efficiency	$V_{IN} = 12\text{V}, I_{LOAD} = 2.0\text{A}$	η	-	77	-	%

◆ ELECTRICAL CHARACTERISTICS: GL2575-12

(Specifications with standard type face are for $T_J = 25^\circ\text{C}$, and those with **boldface type** apply over full Operating Temperature Range)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Output Voltage	$V_{IN} = 25\text{V}, I_{LOAD} = 0.5\text{A}$	V_{OUT}	11.76	12.0	12.24	V
Output Voltage - GL2575	$15\text{V} \leq V_{IN} \leq 40\text{V}, 0.5\text{A} \leq I_{LOAD} \leq 2.0\text{A}$	V_{OUT}	11.52/ 11.40	12.0	12.48/ 12.60	V
Efficiency	$V_{IN} = 15\text{V}, I_{LOAD} = 2.0\text{A}$	η	-	88	-	%

◆ ELECTRICAL CHARACTERISTICS: GL2575-15

(Specifications with standard type face are for $T_J = 25^\circ\text{C}$, and those with **boldface type** apply over full Operating Temperature Range)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Output Voltage	$V_{IN} = 25\text{V}, I_{LOAD} = 0.5\text{A}$	V_{OUT}	14.70	15.0	15.30	V
Output Voltage - GL2575	$18\text{V} \leq V_{IN} \leq 40\text{V}, 0.5\text{A} \leq I_{LOAD} \leq 2.0\text{A}$	V_{OUT}	14.40/ 14.25	15.0	15.60/ 15.75	V
Efficiency	$V_{IN} = 18\text{V}, I_{LOAD} = 2.0\text{A}$	η	-	88	-	%

2A STEP-DOWN VOLTAGE SWITCHING REGULATORS

◆ ELECTRICAL CHARACTERISTICS:GL2575-ADJ

(Specifications with standard type face are for $T_1 = 25^\circ\text{C}$, and those with **boldface type** apply over full Operating Temperature Range.)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Feedback Voltage	$V_{IN} = 12V, I_{LOAD} = 0.5A, V_{OUT} = 5V$	V_{OUT}	1.217	1.230	1.243	V
Feedback Voltage - GL2575	$8V \leq V_{IN} \leq 40V, 0.5A \leq I_{LOAD} \leq 2.0A$ $V_{OUT} = 5V$	V_{OUT}	1.193/ 1.180	1.230	1.267/ 1.280	V
Efficiency	$V_{IN} = 12V, I_{LOAD} = 2.0A, V_{OUT} = 5V$	η	-	77	-	%

◆ ELECTRICAL CHARACTERISTICS: All Output Voltage Versions

(Specifications with standard type face are for $T_J = 25^\circ\text{C}$, and those with **boldface type** apply over full Operating Temperature Range. Unless otherwise specified, $V_{IN} = 12\text{V}$ for the 3.3V, 5.0V and ADJ version, $V_{IN} = 25\text{V}$ for 12V version, and $V_{IN} = 30\text{V}$ for 15V version. $I_{LOAD} = 500\text{mA}$)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Feedback Bias Current	V _{OUT} = 5V (Adjustable Version Only)	I _b	-	50	100 / 500	nA
Oscillator Frequency	(Note 8)	f _o	47 / 42	52	58 / 63	kHz
Saturation Voltage	I _{OUT} = 3A (Notes 4)	V _{SAT}	-	1.4	1.8 / 2.0	V
Max Duty Cycle (ON)	(Note 5)	DC	93	98	-	%
Current Limit	(Note 4, 8)	I _{CL}	4.2 / 3.5	5.8	6.9 / 7.5	A
Output Leakage Current	(Notes 6, 7) Output = -1 V Output = -1V	I _L	- -	- 7.5	2 30	mA
Quiescent Current	(Note 6)	I _Q	-	5	10	mA
Standby Quiescent Current	$\overline{\text{ON}}$ /OFF Pin = 5V (OFF)	I _{STBY}	-	50	200	μA
$\overline{\text{ON}}$ /OFF Pin	V _{OUT} =0V	V _{IH}	2.2 / 2.4	1.4	-	V
Logic Input Level	V _{OUT} = Nominal Output Voltage	V _{IL}	-	1.2	1.0 / 0.8	V
$\overline{\text{ON}}$ /OFF Pin Input Current	$\overline{\text{ON}}$ /OFF Pin = 5V (OFF)	I _{IH}	-	12	30	μA
	$\overline{\text{ON}}$ /OFF Pin = 0V (ON)	I _{IL}	-	0	10	μA



2A STEP-DOWN VOLTAGE SWITCHING REGULATORS

◆ ELECTRICAL CHARACTERISTICS

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. Guaranteed specifications and Test conditions are shown in Electrical Characteristics.

Note 2: All limits guaranteed at 25°C (standard type face) and over full operating temperature range (bold type Face). All 25°C limits are 100% production tested. All limits over full operating temperature range are guaranteed via correlation using standard Statistica Quality Control methods.

Note 3: External components such as the catch diode, inductor, input and output capacitors can affect switching regulator system performance. When the GL2575 is used as shown in the Figure 1 test circuit, system performance will be as shown in system parameters section of Electrical Characteristics.

Note 4: Output pin sourcing current. No diode, inductor or capacitor connected to output.

Note 5: Feedback pin removed from output and connected to 0V.

Note 6: Feedback pin removed from output and connected to +12V for the Adjustable, 3.3V, and 5V versions, and +25V for the 12V and 15V versions, to force the output transistor OFF.

Note 7: $V_{IN} = 40V$

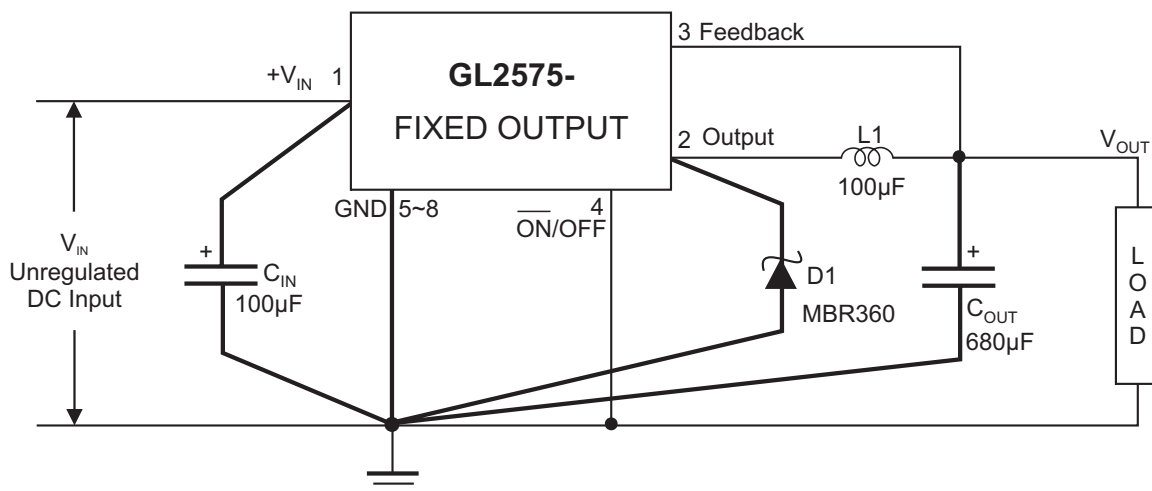
Note 8: The oscillator frequency reduces to approximately 11 kHz in the event of an output short or an overload which causes the regulated output voltage to drop approximately 40% from the nominal output voltage. This self-protection feature lowers the Average power dissipation of GL2575 by lowering the minimum duty cycle from 5% down to approximately 2%.

2A STEP-DOWN VOLTAGE SWITCHING REGULATORS

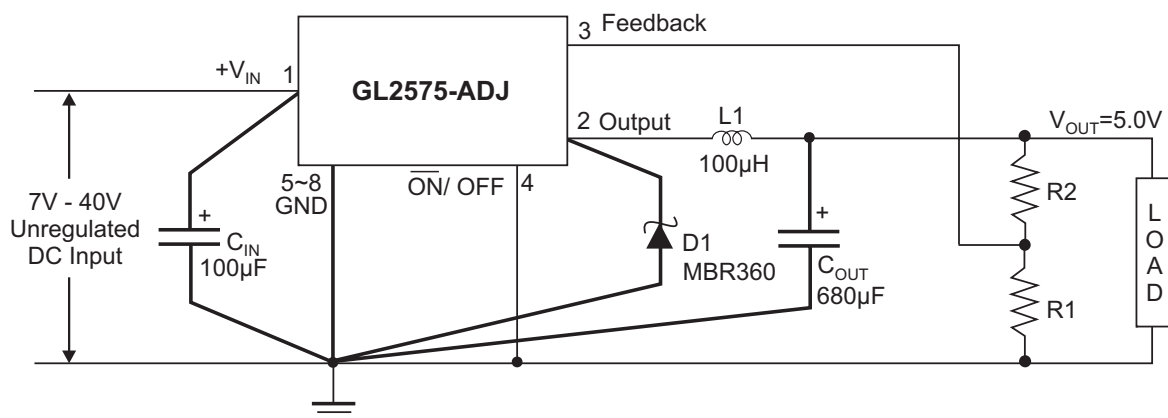
♦ TEST CIRCUIT AND LAYOUT GUIDELINES

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.

Figure 1(a). Fixed Output Voltage Versions



- C_{IN} - 100µF, 75V, Aluminum Electrolytic
- C_{OUT} - 680µF, 25V, Aluminum Electrolytic
- D1 - Schottky, MBR360
- L1 - 100µH, 3L Electronic Corp. TC-101M-3.0A-6826
- R1 - 2k, 0.1%
- R2 - 6.12k, 0.1%



$$V_{OUT} = V_{REF} \left(1 + \frac{R2}{R1} \right)$$

$$R2 = R1 \left(\frac{V_{OUT}}{V_{REF}} - 1 \right)$$

where $V_{REF} = 1.23V$, $R1$ between 1k and 5k.

Figure 1(b). Adjustable Output Voltage Versions

◆ Typical Performance Characteristics

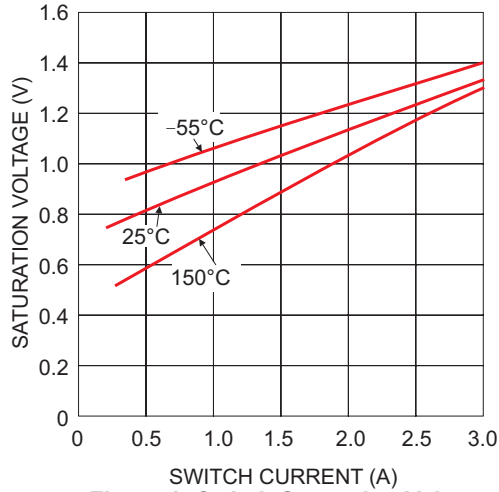


Figure 2. Switch Saturation Voltage

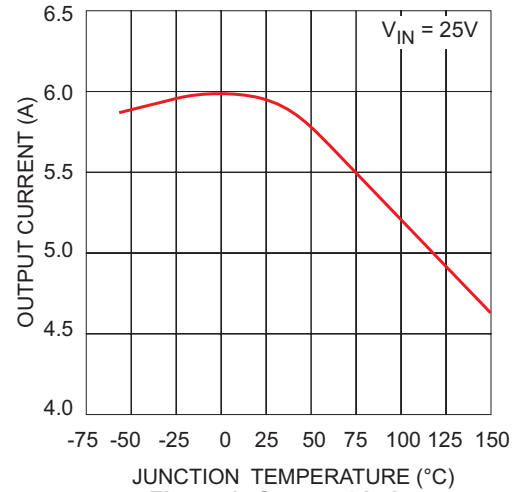


Figure 3. Current Limit

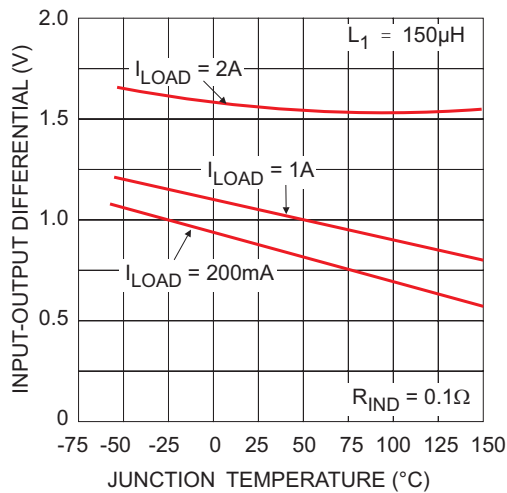


Figure 4. Dropout Voltage

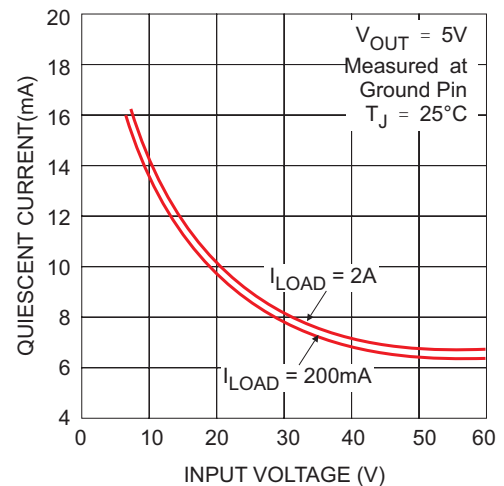


Figure 5. Quiescent Current

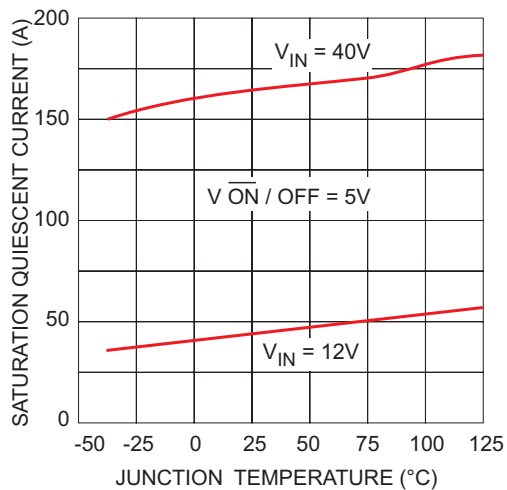


Figure 6. Standby Quiescent Current

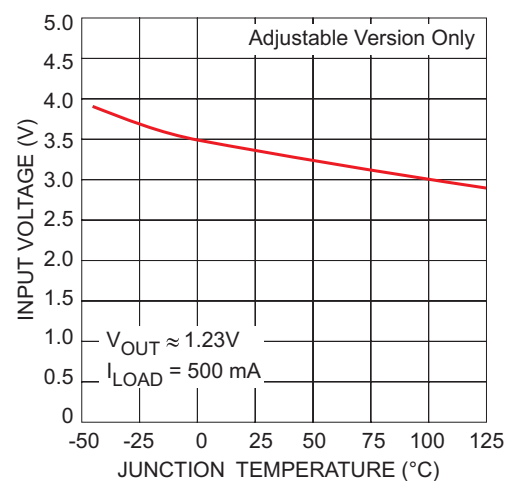


Figure 7. Minimum Operating Voltage

◆ Typical Performance Characteristics

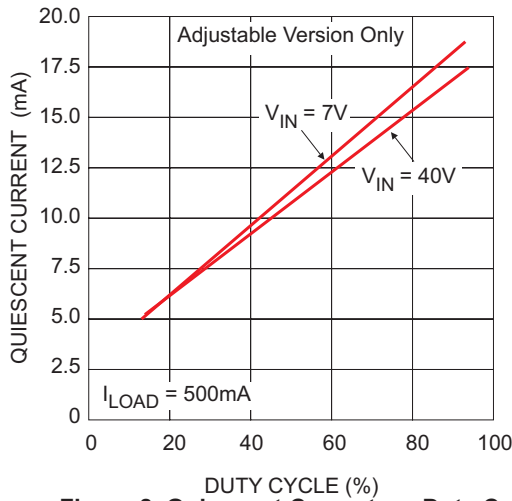


Figure 8. Quiescent Current vs. Duty Cycle

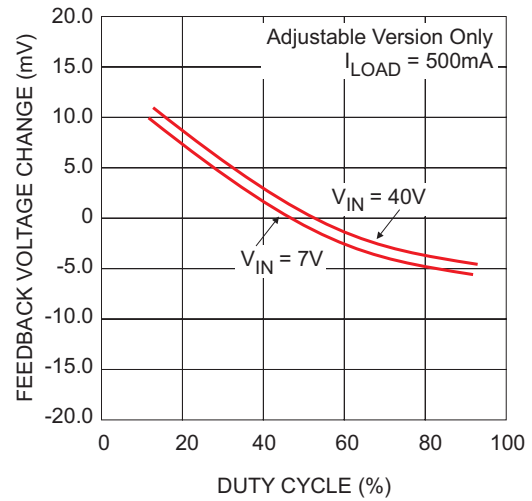


Figure 9. Feedback Voltage vs. Duty Cycle

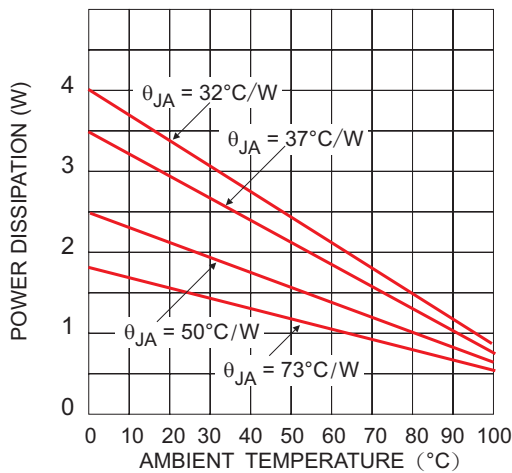


Figure 10. Maximum Power Dissipation(SOP-8F)

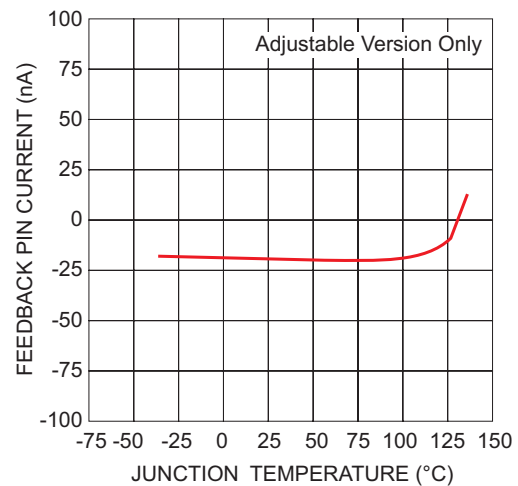
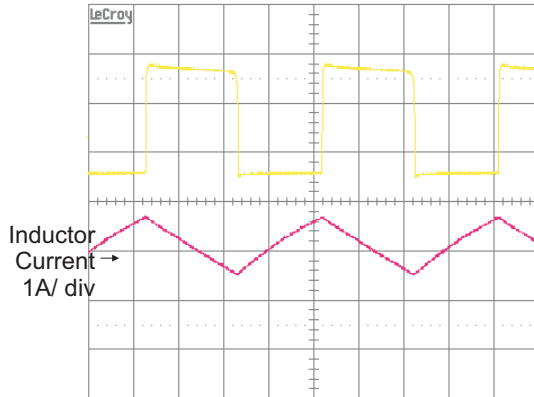


Figure 11. Feedback Pin Current

◆ Typical Performance Characteristics

Figure 12. Switching Waveforms



Input : 12V
Output : 5V @2A

Figure 13. Load Transient Response

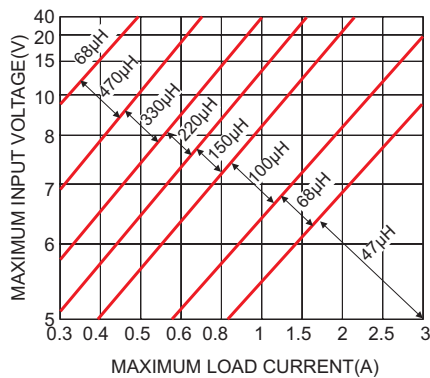
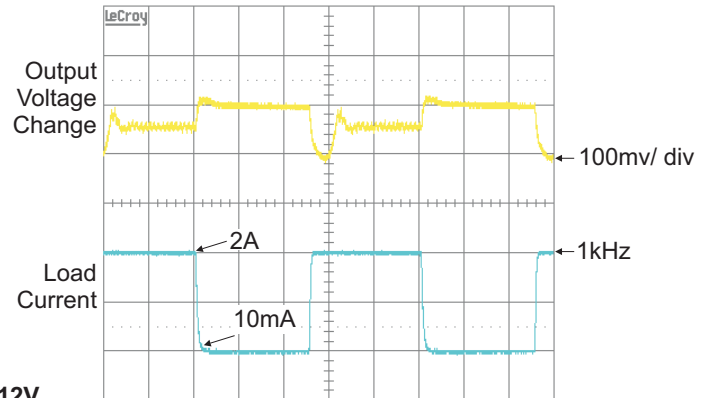


Figure 14. GL2575 -3.3

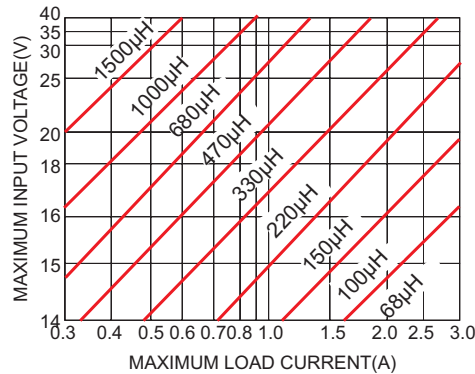


Figure 15. GL2575 - 12

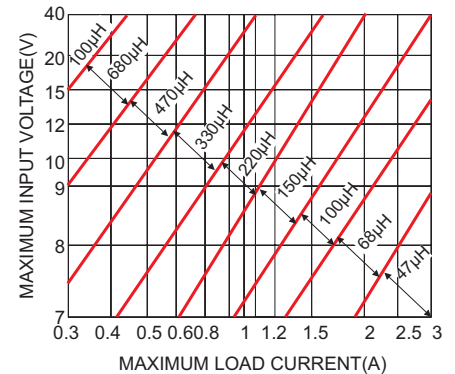


Figure 16. GL2575 -5.0

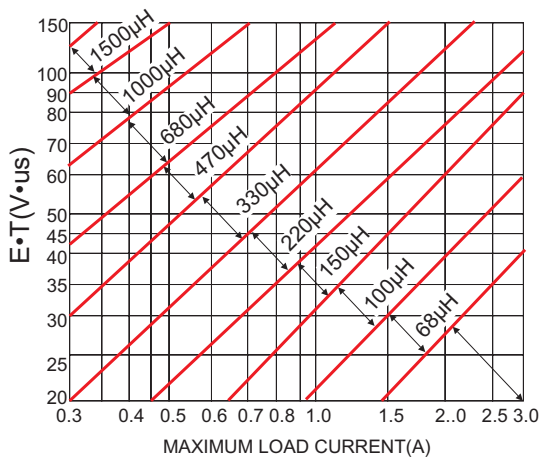


Figure 17. GL2575- ADJ

$$E T = (V_{IN} - V_{OUT}) \frac{V_{OUT}}{V_{IN}} \frac{1,000}{F(\text{in kHz})}$$

PROCEDURE(Adjustable Output Voltage Versions)

Given:

V_{OUT} = Regulated Output Voltage
 $V_{IN}(\text{Max})$ = Maximum Input Voltage
 $I_{LOAD}(\text{Max})$ = Maximum Load Current
 F = Switching Frequency (Fixed at 52 kHz)

1. Programming Output Voltage(Selecting R1 and R2, as shown in Figure 12. And Figure 13.

Use the following formula to select the appropriate resistor values.

$$V_{OUT} = V_{REF} \left(1 + \frac{R2}{R1} \right) \quad \text{where } V_{REF} = 1.23V$$

$R1$ can be between 1k and 5k. (For best temperature coefficient and stability with time, use 1% metal film resistors)

$$R2 = R1 \left(\frac{V_{OUT}}{V_{REF}} - 1 \right)$$

EXAMPLE (Adjustable Output Voltage Versions)

Given:

$V_{OUT} = 10V$
 $V_{IN}(\text{Max}) = 25V$
 $I_{LOAD}(\text{Max}) = 2A$
 $F = 52kHz$

1. Programming Output Voltage (Selecting R1 and R2)

$$V_{OUT} = 1.23 \left(1 + \frac{R2}{R1} \right) \quad \text{Select } R1 = 1k$$

$$R2 = R1 \left(\frac{V_{OUT}}{V_{REF}} - 1 \right) = 1k \left(\frac{10V}{1.23V} - 1 \right)$$

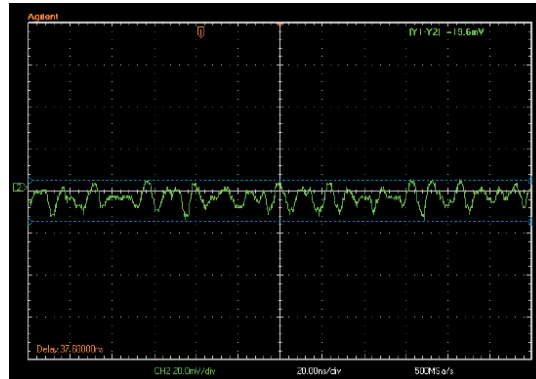
$R2 = 1k (8.13 - 1) = 7.13k$, closest 1% value is 7.15k



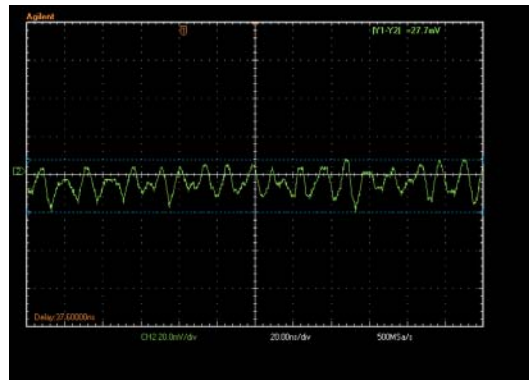
2A STEP-DOWN VOLTAGE SWITCHING REGULATORS

◆ Low Noise Performance Characteristics

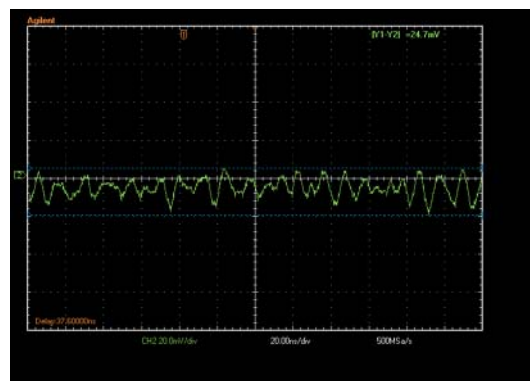
Vin=12Vdc, Vout=5V, Iout=1A



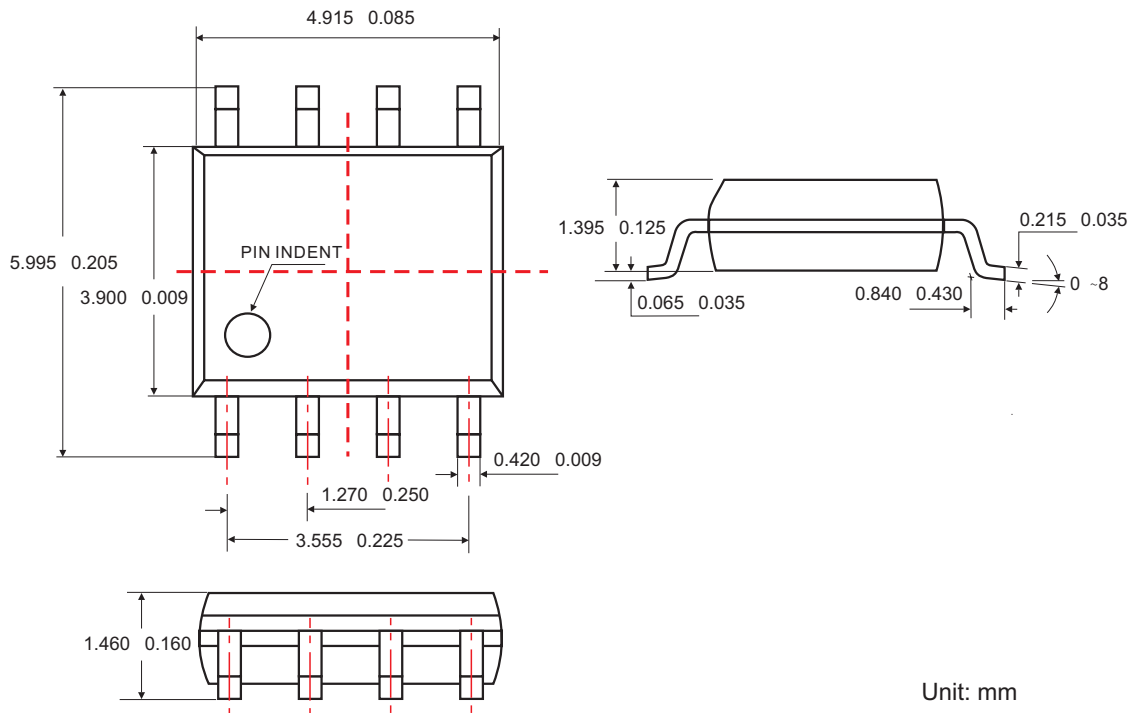
Vin=12Vdc, Vout=5V, Iout=1.5A



Vin=12Vdc, Vout=5V, Iout=2A



◆ SOP-8F PACKAGE OUTLINE DIMENSIONS



◆ ORDERING NUMBER

GL2575 A SF8 R

Circuit Type ←

Output Voltage ←

Shipping
R: Tape & Reel

Package
SF8: SOP-8F