

Fan Speed PWM Controller

Features

- Constant Fan Speed Control
- PWM control for stable operation
- Build-in MOSFET switch
- SMBus interface
- Internal short-circuit protection
- On/Off control provided

Applications

- Notebook PC
- Industrial PC
- LAN Switch
- Servers
- Telecom equipment
- Industrial Control

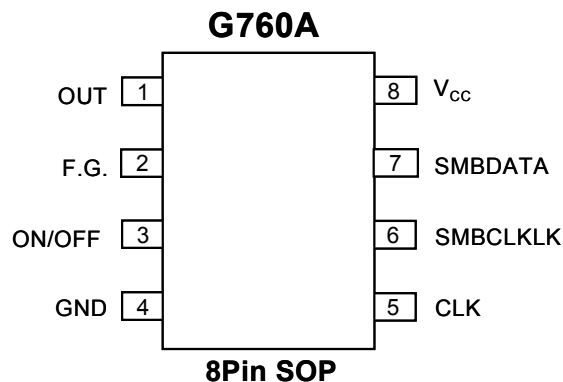
General Description

G760 is a single chip solution for fan speed control, packaged in a space saving SO-8 package. It connects directly to the fan and performs closed-loop control of the fan speed. The only external component required is a 10 μ F capacitor. It determines the current fan speed based on the fan rotation pulses and an externally supplied clock. It uses pulse width modulation (PWM) method and an on-chip MOSFET to control the fan speed to $\pm 2\%$ of the programmed speed. The desired fan speed is programmed via the SMBus. The actual fan speed and fan status can be read via the SMBus. Short-circuit protection is implemented to prevent damages to the fan and this IC itself. An On/Off control pin is also provided.

Ordering Information

| PART* | TEMP. RANGE | PIN-PACKAGE |
|-------|--------------|-------------|
| G760A | 0°C to +70°C | 8-SOP |

Pin configuration



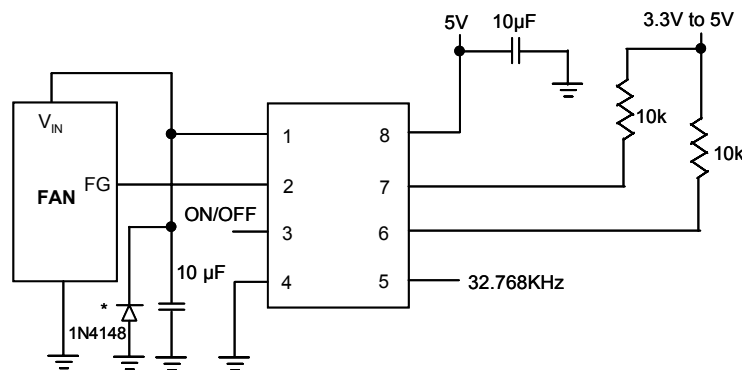
Absolute Maximum Ratings

| PARAMETER | SYMBOL | MAXIMUM | UNITS |
|---|-----------|-------------|-------|
| Supply Voltage | V_{CC} | -0.3 to +7 | V |
| Operating Temperature Range | T_A | 0 to +70 | °C |
| Junction Temperature Range | T_J | 0 to +125 | °C |
| Storage Temperature Range | T_{STG} | -65 to +150 | °C |
| Lead Temperature (soldering) 10 seconds | T_L | 300 | °C |

Electrical Characteristics (Unless specified: $V_{CC} = 5V$, $T_A = 25^\circ C$)

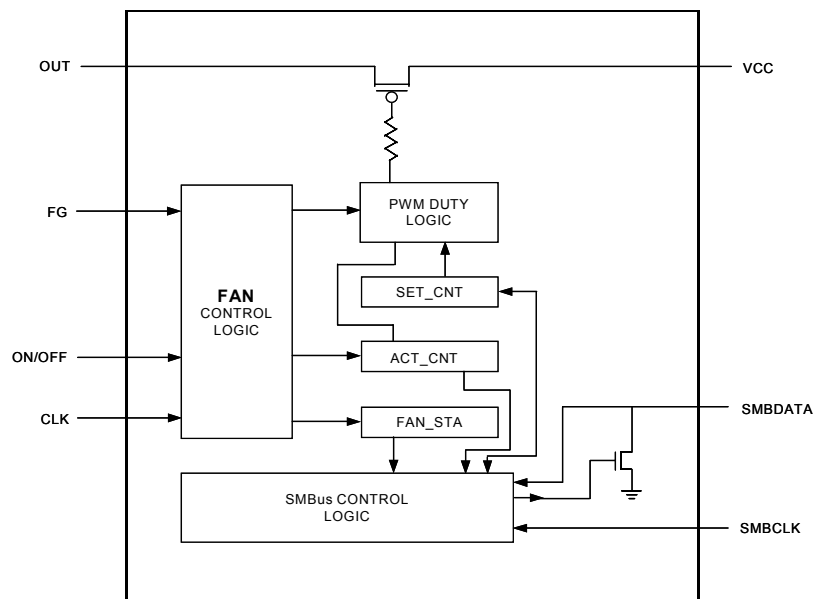
| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|-------------|-----|-----|------|----------|
| Supply voltage | V_{CC} | 4.5 | 5 | 5.5 | V |
| Shutdown current | On/Off = 0V | | 2 | 5 | μA |
| MOSFET on resistance | | | 0.2 | 0.25 | Ω |
| Short-circuit current limit | | | 0.5 | | A |
| Input logic low | V_{IL} | | | 0.8 | V |
| Input logic high | V_{IH} | 2.4 | | | V |
| Average Output current | | | | 350 | mA |
| FG input Positive-going threshold voltage | $V_{CC}=5V$ | | 1.8 | | V |
| FG input Negative-going threshold voltage | $V_{CC}=5V$ | | 0.7 | | V |
| FG input Hysteresis voltage | $V_{CC}=5V$ | | 1.1 | | V |

Application Circuit



Diode 1N4148 is optional

Block Diagram



Pin Description

| PIN NO. | PIN NAME | PIN FUNCTION |
|---------|-----------------|---------------------------------------|
| 1 | OUT | PWM output, connect to fan |
| 2 | F.G. | FAN pulse Input |
| 3 | ON/OFF | ON/OFF control pin, 0V means shutdown |
| 4 | GND | Ground |
| 5 | CLK | Clock input for fan speed measurement |
| 6 | SMBCLK | SMBus clock line |
| 7 | SMBDATA | SMBus data line |
| 8 | V _{CC} | Supply voltage |

Description

The fan speed is measured by counting the number of the CLK pin period between the rising edges of two fan speed pulses on FG pin. In this way, we are actually measuring the period of the fan speed. To avoid the cost of doing division to obtain the speed, this count number, N, is used in the PWM control algorithm, thus, the desired fan speed should be programmed by writing the corresponding count number. The count number is given by:

$$N = (\text{CLK} \times 30) / (\text{rpm} \times P)$$

N : Count Number

P : FG pulses number per revolution of fan.

For CLK = 32768Hz, P = 2

$$\Rightarrow N = 491520 / \text{rpm}$$

For CLK = 16384Hz, P = 2

$$\Rightarrow N = 245762 / \text{rpm}$$

Some selected count numbers are shown below

Table 1. Count numbers for P=2

| rpm | CLK=32768Hz | CLK=16384Hz |
|-------|-------------|-------------|
| 968 | --- | 254 |
| 1935 | 254 | 127 |
| 2000 | 246 | 123 |
| 3000 | 164 | 82 |
| 4000 | 123 | 61 |
| 5000 | 98 | 49 |
| 6000 | 82 | 41 |
| 7000 | 70 | 35 |
| 8000 | 61 | 31 |
| 9000 | 55 | 27 |
| 10000 | 49 | 25 |
| 20000 | 25 | 12 |
| 30000 | 16 | 8 |

When pin 3 (On/Off) is a logical 1, the fan speed will be controlled according to the setting in the programmed fan speed register. There are two ways to stop the fan, (1) setting pin 3 (On/Off) to 0V, (2) program the fan speed register to 255. These also makes the fan controller into power saving mode.

Controlling Fan at Lower Speed

For stably controlling fans at lower rotation speed, three schemes are recommended as below:

1. Use larger decoupling capacitors between FAN_OUT and GND.
2. Shunt a capacitor of 1μF-2μF on FG pin to GND.
3. Use fans with open-collector FG outputs.

When controlling fans under lower rotation speed, the output voltage of FAN_OUT would be too low for fan to generate recognizable FG signals.

Using decouple capacitors on FAN_OUT and FG is to increase the SNR on FG pins. While using fans with open_collector FG outputs can thoroughly solve the problem, because the logic high level of FG would be fixed to 5V.

Internal Registers

This IC provides 3 SMBus registers.

1. Programmed fan speed register: (SET_CNT, address: 00b)

This register is a read/write register, it contains the count number of the desired fan speed. Power up default is FFh.

2. Actual fan speed register: (ACT_CNT, address: 01b)

This register is read only. It contains the count number of

the actual fan speed. Power up default is FFh.

3. Fan status register: (FAN_STA, address: 10b)

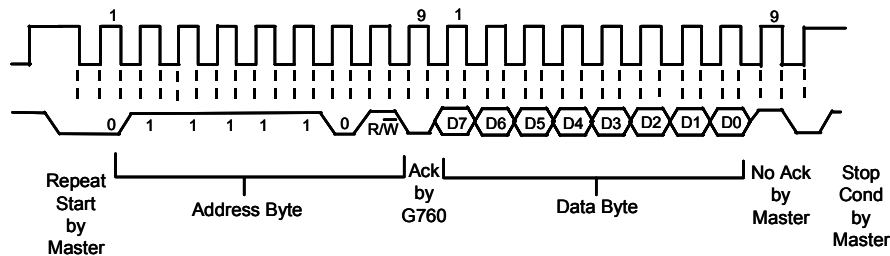
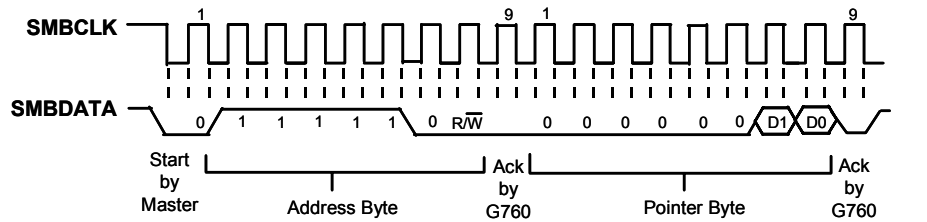
This register is read only. Its bit 0 is set to 1 when the actual fan speed is $\pm 20\%$ outside the desired speed. Its bit 1 is set to 1 when fan speed is below

1920 rpm. Power up default is 10b.

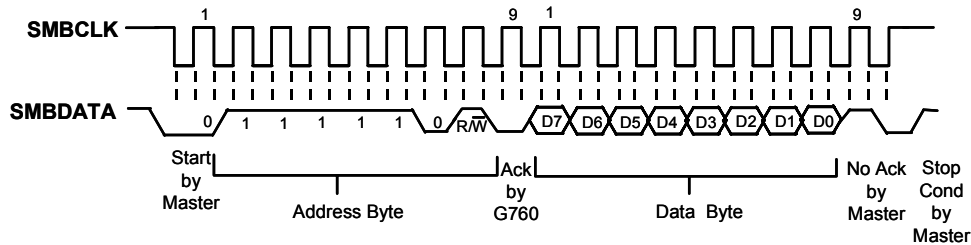
SMBus Address

The SMBus address of this chip is fixed to 7Ch (01111100b) for write and 7Dh(01111101b) for read.

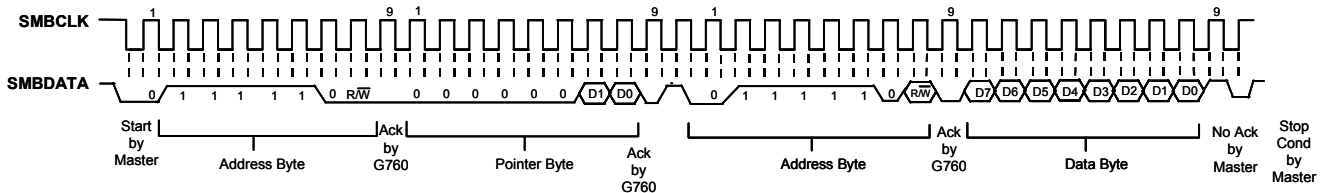
SMBus Timing



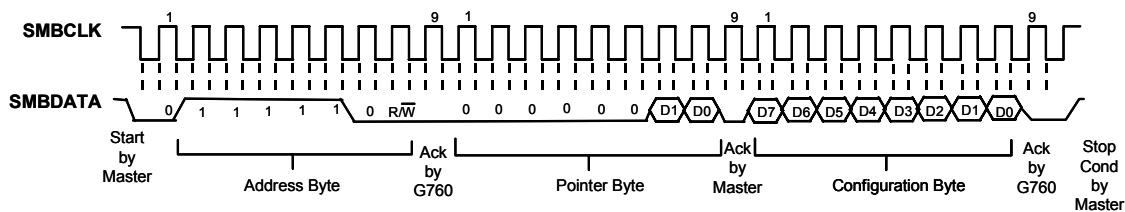
(a) Typical Pointer Set Followed by Immediate Read



(b) Typical 1-Byte Read with Preset Pointer

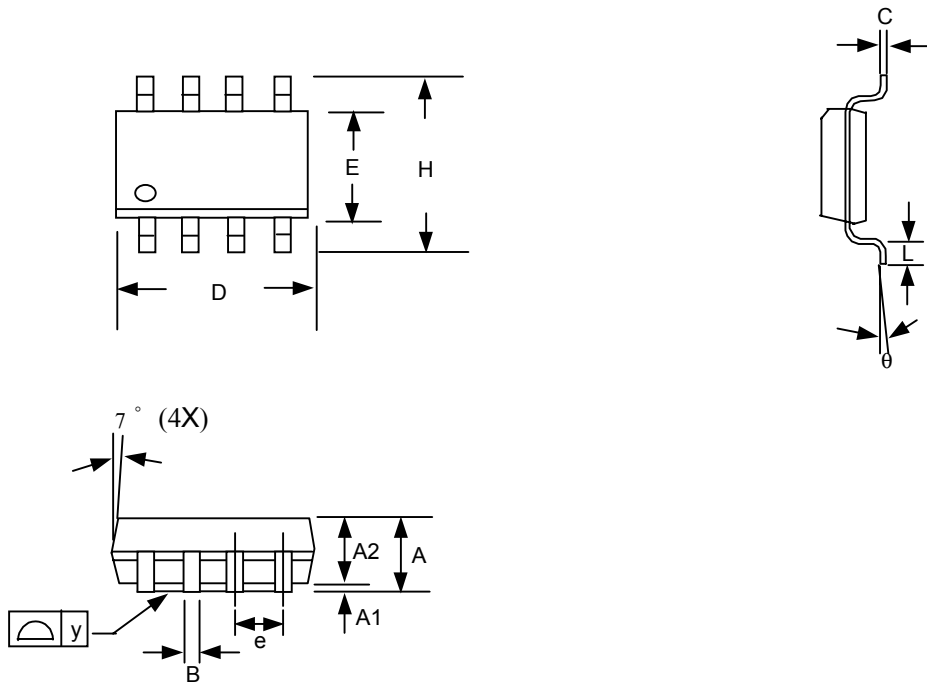


(a) Typical Pointer Set Followed by Immediate Read



(b) Register Write

Package Information

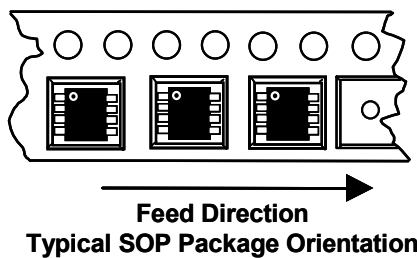


Note:

1. Package body sizes exclude mold flash and gate burrs
2. Dimension L is measured in gage plane
3. Tolerance 0.10mm unless otherwise specified
4. Controlling dimension is millimeter converted inch dimensions are not necessarily exact.

| SYMBOL | DIMENSION IN MM | | | DIMENSION IN INCH | | |
|----------|-----------------|------|------|-------------------|-------|-------|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 1.35 | 1.60 | 1.75 | 0.053 | 0.063 | 0.069 |
| A1 | 0.10 | ---- | 0.25 | 0.004 | ---- | 0.010 |
| A2 | ---- | 1.45 | ---- | ---- | 0.057 | ---- |
| B | 0.33 | ---- | 0.51 | 0.013 | ---- | 0.020 |
| C | 0.19 | ---- | 0.25 | 0.007 | ---- | 0.010 |
| D | 4.80 | ---- | 5.00 | 0.189 | ---- | 0.197 |
| E | 3.80 | ---- | 4.00 | 0.150 | ---- | 0.157 |
| e | ---- | 1.27 | ---- | ---- | 0.050 | ---- |
| H | 5.80 | ---- | 6.20 | 0.228 | ---- | 0.244 |
| L | 0.40 | ---- | 1.27 | 0.016 | ---- | 0.050 |
| y | ---- | ---- | 0.10 | ---- | ---- | 0.004 |
| θ | 0° | ---- | 8° | 0° | ---- | 8° |

Taping Specification



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