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# LA6681MC

**Monolithic Linear IC**

# Single-phase Full-wave Fan Motor IC

ON Semiconductor®

http://onsemi.com

## Overview

The LA6681MC drives the single-phase bipolar fan motor, through low-saturation BTL output linear drive, silently and at high efficiency with suppressed reactive power while saving power.
This product is the most suitable for the CPU cooler fan motor operating on 5V power for notebook PC, which is required to be compactness and low noise.

## Functions

- Single-phase full-wave linear drive by BTL output.
  : Linear drive for further silence and the most suitable for fan motor for the notebook PC.
- Operable at low voltage and over a wide operation voltage range (2.0 to 7.0V)
- Low saturation output (Upper + lower saturation voltages: $V_O$sat (total) = 0.32V typ, $I_O$ = 400mA)
  : High coil efficiency and small current drain. Small heat generation from IC itself
- FG output (Rotation detection output: Open collector output)
- High impedance of Hall input pin
- Heat protection circuit
  : The heat protection circuit suppresses the drive current to prevent burn or damage of IC when the large current flows due to output short-circuit and the IC chip temperature exceeds 180°C.
- Small package with high heat capacity

## Specifications

### Absolute Maximum Ratings at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ max | | 8 | V |
| Output current | $I_{OUT}$ max | | 1.0 | A |
| Output withstand voltage | $V_{OUT}$ max | | 8 | V |
| FG output withstand voltage | $V_{FG}$ max | | 8 | V |
| FG output current | $I_{FG}$ max | | 5 | mA |
| Allowable dissipation | Pd max | Mounted on a specified board. *1 | 750 | mW |
| Operating temperature | Topr | *2 | -30 to +110 | °C |
| Storage temperature | Tstg | | -55 to +150 | °C |

*1: Mounted on a specified board: 114.3×76.1×1.6 $mm^3$, glass epoxy board.
*2: Tjmax = 150°C max must not be exceeded.
Caution 1) Absolute maximum ratings represent the value which cannot be exceeded for any length of time.
Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details.

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**Recommended Operating Conditions** at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | | 2.0 to 7.0 | V |
| Common-phase input voltage range of Hall input | $V_I$CM | | 0.3 to $V_{CC}$–1.5 | V |

**Electrical Characteristics** at Ta = 25°C, $V_{CC}$ = 5V, unless otherwise specified.

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Circuit current | $I_{CC}$ | IN-=1.0V, IN+=2.0V, RL=∞ | | 14 | 19 | mA |
| OUT saturation voltage L | $V_O$satL | $I_O$ = 400mA | | 0.17 | 0.25 | V |
| OUT saturation voltage H | $V_O$satH | $I_O$ = 400mA | | 0.21 | 0.30 | V |
| Input offset voltage | VOFST | Zero peak value | | 0 | 5 | mV |
| Hall bias voltage | VHB | $I_{HB}$ = 5mA | 1.3 | 1.4 | 1.5 | V |
| Hall amplifier gain | Vg | | 42 | 46 | 47 | dB |
| Hall amplifier input current | VINR | | -10 | -2 | 10 | μA |
| FG output L voltage | VFG | $I_{FG}$ = 3mA | | 0.2 | 0.3 | V |
| FG output leakage current | IFGL | $V_{FG}$ = 7V | | | 30 | μA |
| Overheat protection circuit | Th | * Design guarantee | 150 | 180 | 210 | °C |

## Truth Table

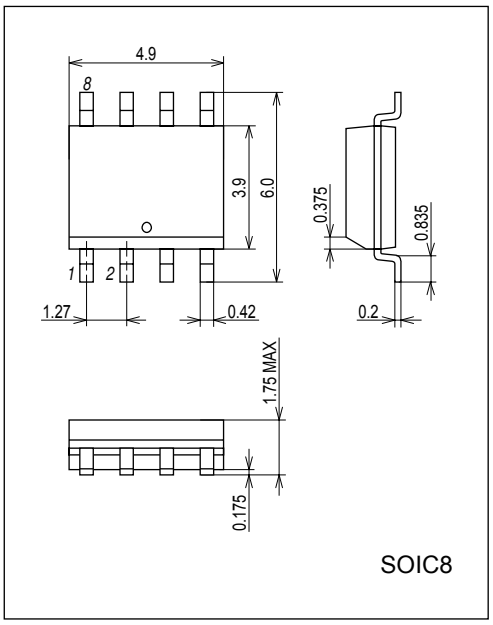
| $IN^-$ | $IN^+$ | OUT1 | OUT2 | FG | Mode |
|---|---|---|---|---|---|
| H | L | H | L | L | During rotation |
| L | H | L | H | OFF | |
| - | - | OFF | OFF | - | Overheat protected |

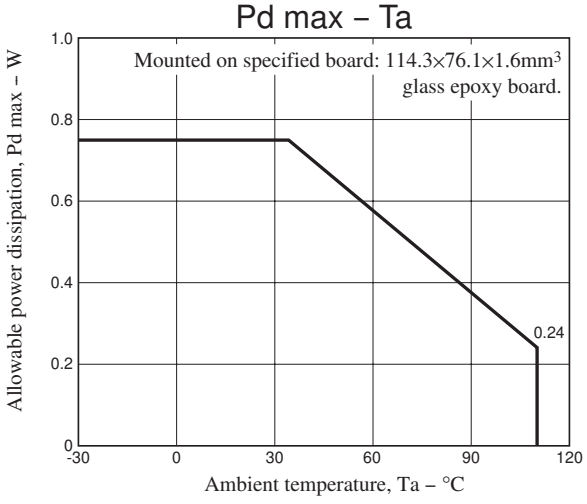
-:Don't care.

## Package Dimensions

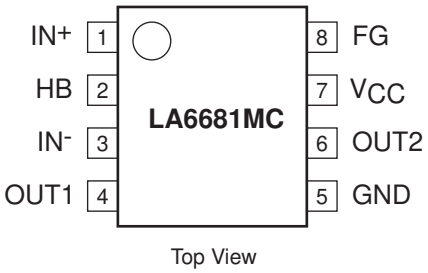
unit : mm (typ)

3424



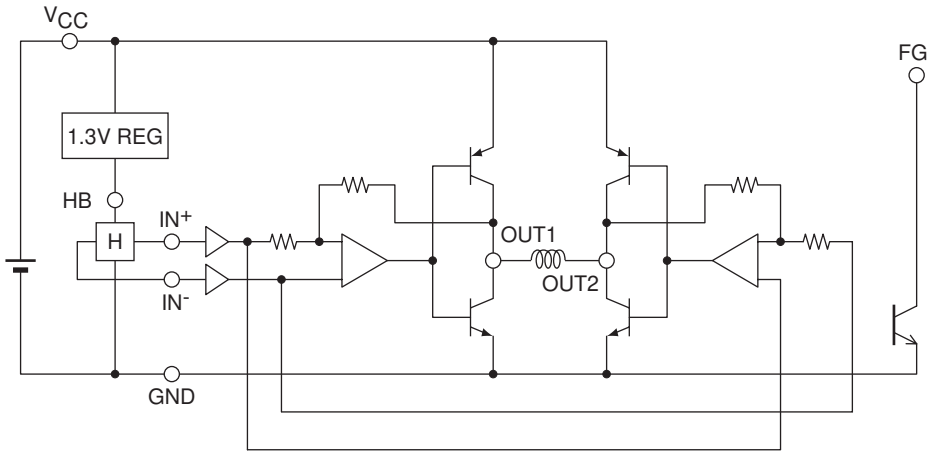



## Pin Assignment

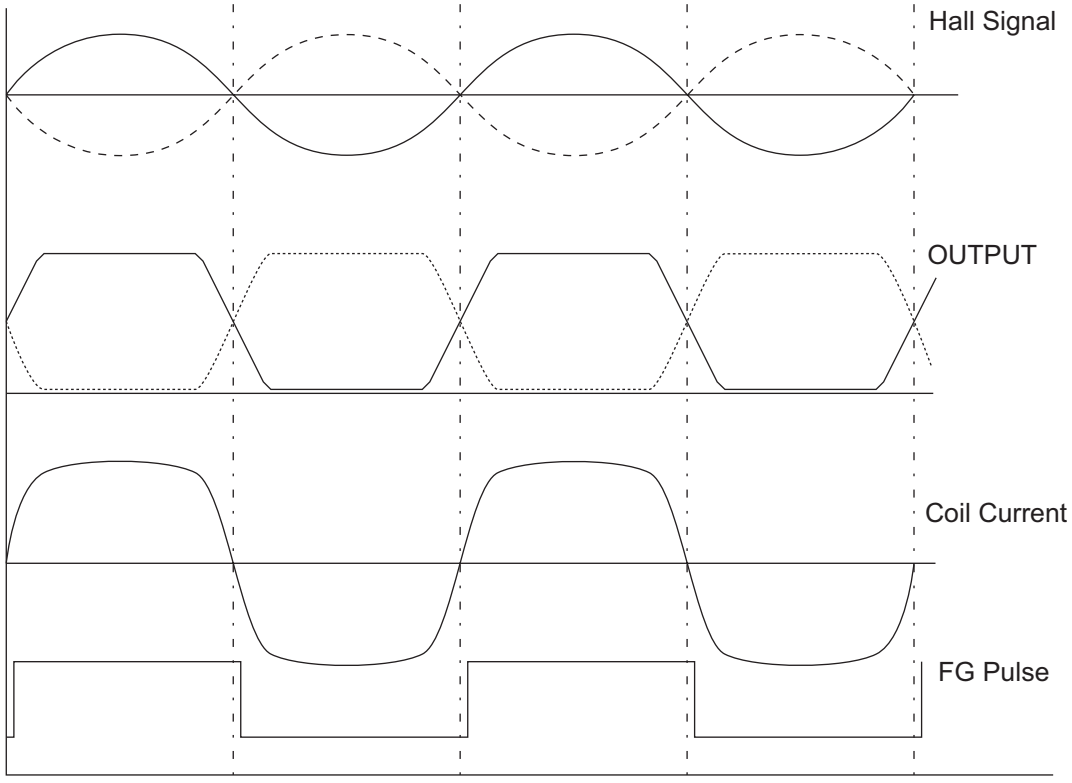



Top View

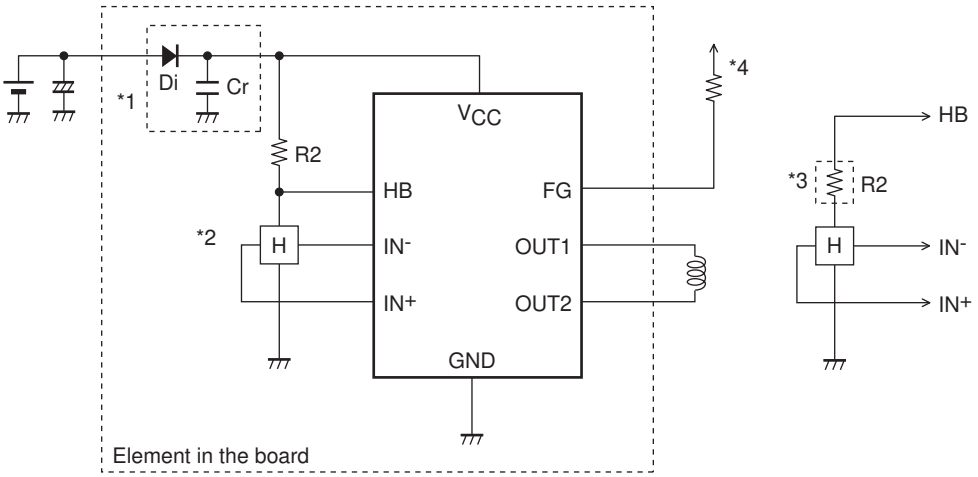
## Block Diagram




## Timing chart



## Application Circuit Examples




*1: When Di to prevent breakdown in case of reverse connection is used, it is necessary to insert a capacitor Cr to secure the regenerative current route. Similarly, Cr is necessary to enhance the reliability when there is no capacitor near the fan power line.

*2: Basically, by taking the bias from HB 1.3V constant-output voltage, stable Hall and coil outputs can be obtained at high temperature. When taking the Hall bias from VCC, insert the limiting resistor R2 on the $V_{CC}$ side as shown in the figure, for biasing. (The use together with HB bias is recommended.)

*3: Linear drive is made by amplifying the Hall output to perform voltage control of the coil. When the Hall element output is high, the starting performance and efficiency are improved. By adjusting (R3) the Hall element, the operation becomes more silent.

*4: Keep this open when not using.