



LV8402GP

Bi-CMOS IC 2ch Forward/Reverse Motor Driver

ON Semiconductor®

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Overview

LV8402GP is a 2ch forward/reverse motor driver IC using D-MOS FET for output stage. As MOS circuit is used, it supports the PWM input. Its features are that the on resistance (0.75Ω typ) and current dissipation are low. It also provides protection functions such as heat protection circuit and reduced voltage detection and is optimal for the motors that need high-current.

Functions

- 2ch forward/reverse motor driver.
- Low power consumption.
- Low ON resistance 0.75Ω.
- Built-in EXTRA mode for PWM port reduction when a motor drives by two phase excitation.
- Built-in low voltage reset and thermal shutdown circuit.
- 4 mode function forward/reverse, brake and standby.
- Built-in charge pump.

Specifications

Maximum Ratings at Ta = 25°C, SGND = PGND = 0V

| Parameter | Symbol | Conditions | Ratings | Unit |
|------------------------------------|---------------------|-------------------------------|------------------------------|------|
| Power supply voltage (for load) | VM max | | -0.5 to 16.0 | V |
| Power supply voltage (for control) | V _{CC} max | | -0.5 to 6.0 | V |
| Output current | I _O max | | 1.4 | A |
| Output peak current | I _O peak | t ≤ 10ms | 2.5 | A |
| Input voltage | V _{IN} max | | -0.5 to V _{CC} +0.5 | V |
| Allowable power dissipation | Pd max | Mounted on a specified board* | 1050 | mW |
| Operating temperature | T _{opr} | | -30 to +85 | °C |
| Storage temperature | T _{stg} | | -55 to +150 | °C |

* Specified board: 40.0mm × 50.0mm × 0.8mm, 4 Layer glass epoxy board.

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.

Allowable Operating Conditions at Ta = 25°C, SGND = PGND = 0V

| Parameter | Symbol | Conditions | Ratings | Unit |
|--|-----------------|--|----------------------|------|
| Power supply voltage (VM pin) | VM | Case except the start operation of the charge pump circuit | 1.5 to 15.0 | V |
| Power supply voltage (VM pin) | VM | | 1.8 to 15.0 | V |
| Power supply voltage (V _{CC} pin) | V _{CC} | | 2.8 to 5.5 | V |
| Input signal voltage | V _{IN} | | 0 to V _{CC} | V |
| Input signal frequency | f max | | 200 | kHz |

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

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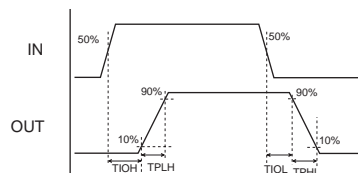
Electrical Characteristics $T_a = 25^\circ\text{C}$, $V_{CC} = 3.0\text{V}$, $V_M = 6.0\text{V}$, $SGND = PGND = 0\text{V}$, unless otherwise specified.

| Parameter | Symbol | Conditions | Remarks | Ratings | | | Unit | | |
|--|---------------|---|--|---------------------|------|---------------------|------------------|---------------|---------------|
| | | | | min | typ | max | | | |
| Standby load current drain | IMO | EN1=EN2=0V, EXTRA=3V | 1 | | | 1.0 | μA | | |
| Standby control current drain | ICO | EN1=EN2=IN1=IN2=IN3=IN4=0V | 2 | | | 1.0 | μA | | |
| Operating control current drain | IC1 | EN=3V, with no load | 3 | | 0.85 | 1.2 | mA | | |
| High-level input voltage | V_{IH} | $2.7 \leq V_{CC} \leq 5.5\text{V}$ | | $0.6 \times V_{CC}$ | | V_{CC} | V | | |
| Low-level input voltage | V_{IL} | $2.7 \leq V_{CC} \leq 5.5\text{V}$ | | 0 | | $0.2 \times V_{CC}$ | V | | |
| High-level input current (IN1, IN2, IN3, IN4, EN1, EN2) | I_{IH} | $V_{IN} = 3\text{V}$ | 4 | | 15 | 25 | μA | | |
| Low-level input current (IN1, IN2, IN3, IN4, EN1, EN2) | I_{IL} | $V_{IN} = 0\text{V}$ | 4 | -1.0 | | | μA | | |
| Pull-down resistance value | RDN | IN1, IN2, IN3, IN4, EN1, EN2 | 4 | 100 | 200 | 400 | k Ω | | |
| High-level input current 2 (IN1, IN2, IN3, IN4, EN1, EN2) | I_{IH2} | $V_{IN} = 3\text{V}$ | 5 | | | 1.0 | μA | | |
| Low-level input current 2 (IN1, IN2, IN3, IN4, EN1, EN2) | I_{IL2} | $V_{IN} = 0\text{V}$ | 5 | -25 | -15 | | μA | | |
| Pull-up resistance value | RUP | EXTRA | 5 | 100 | 200 | 400 | k Ω | | |
| Charge pump voltage | VG | $V_{CC} + V_M$ | | 8.5 | 9.0 | 9.5 | V | | |
| Output ON resistance 1 | RON1 | Sum of top and bottom sides ON resistance. | 6 | | 0.75 | 1.2 | Ω | | |
| Output ON resistance 2 | RON2 | Sum of top and bottom sides ON resistance. $V_{CC} = 2.8\text{V}$ | 6 | | 1.0 | 1.5 | Ω | | |
| Low-voltage detection voltage | VCS | V_{CC} pin voltage is monitored | 7 | 2.15 | 2.30 | 2.45 | V | | |
| Thermal shutdown temperature | Tth | Design guarantee value * | 8 | 150 | 180 | 210 | $^\circ\text{C}$ | | |
| Output block | Turn-on time | TPLH | When no load. Design guarantee value * | 9 | | 0.3 | 0.5 | μS | |
| | | | | | | | 100 | 200 | nS |
| | Turn-off time | TPHL | When no load. Design guarantee value * | 9 | | | 0.35 | 0.6 | μS |
| | | | | | | | | 100 | 200 |

* : Design guarantee value and no measurement is performed.

Remarks

1. Current consumption when output at the VM pin is off.
2. Current consumption at the V_{CC} for standby mode.
3. EN1=3V (IC starts) shows the current consumption of the V_{CC} pin.
4. Pins IN 1, 2, 3, 4, EN1, and EN2 are all pulled down according to resistance.
5. EXTRA pin is pulled up according to resistance.
6. Sum of upper and lower saturation voltages of OUT pin divided by the current.
7. All power transistors are turned off if a low V_{CC} condition is detected.
8. All output transistors are turned off if the thermal protection circuit is activated. They are turned on again as the temperature goes down.
9. Rising time from 10% to 90% and falling time from 90% to 10% are specified.
10. The change of the voltage of the input pin provides for time until the voltage of the terminal OUT changes by 10% at the time of 50% of V_{CC} .

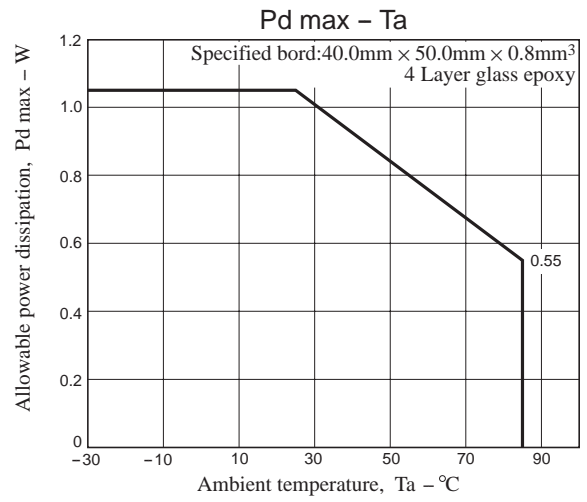
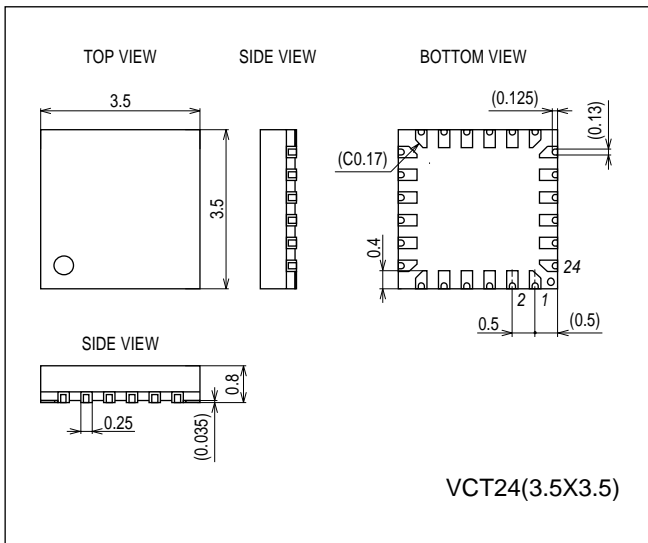


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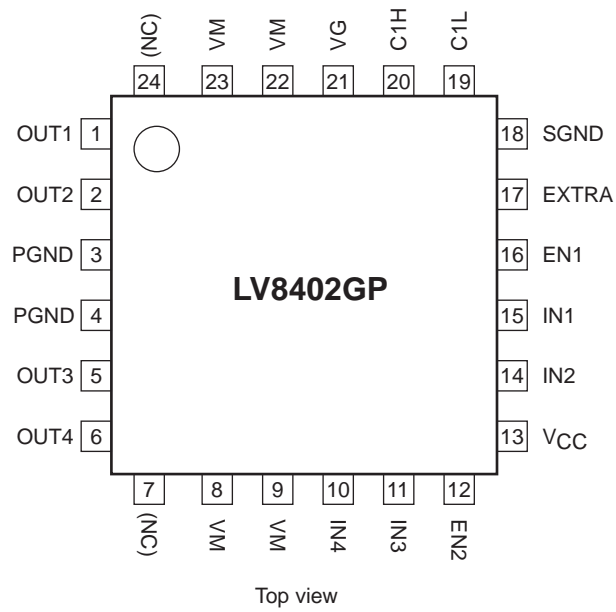
Package Dimensions

unit : mm (typ)

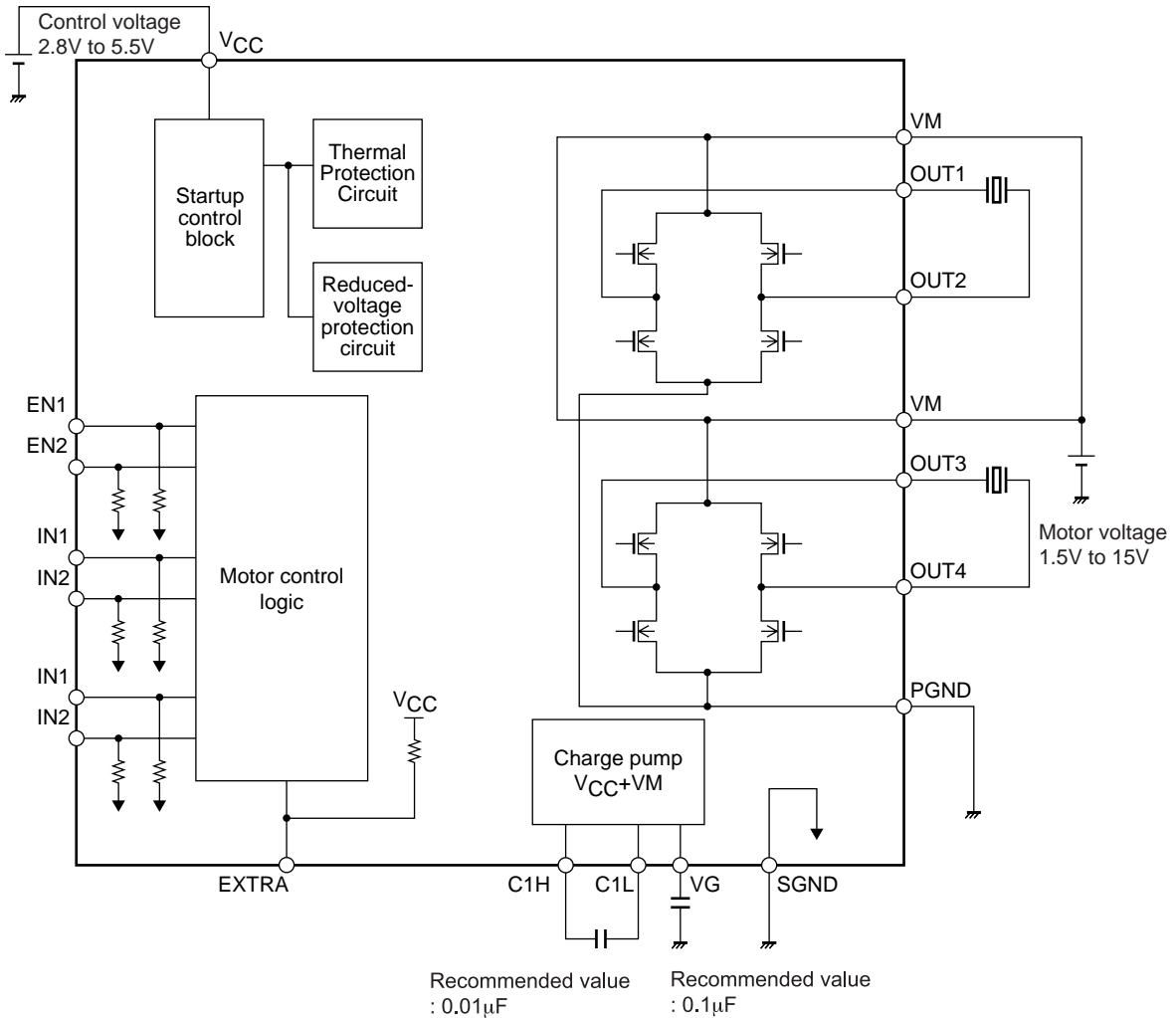
3322A



Pin Assignment



Block Diagram



Assumption: 0.0047µF to 0.1µF Assumption: 0.047µF to 1µF

* Connect a kickback absorption capacitor as near as possible to the IC. Coil kickback may cause increase in VM line voltage, and a voltage exceeding the maximum rating may be applied momentarily to the IC, which results in deterioration or damage of the IC

Truth Table

| EXTRA | EN1 (EN2) | IN1 (IN3) | IN2 (IN4) | OUT1 (OUT3) | OUT2 (OUT4) | Charge pump | Mode |
|-------|-----------|-----------|-----------|-------------|-------------|-------------|----------|
| H | H | H | H | Z | Z | ON | Stand-by |
| | | H | L | L | H | | Reverse |
| | | L | H | H | L | | Forward |
| | | L | L | L | L | | Brake |
| | L | - | - | L | L | OFF | Stand-by |
| L | H | H | - | L | H | ON | Reverse |
| | | L | - | H | L | | Forward |
| | | L | - | L | L | | Brake |

- : denotes a don't care value. Z: High-Impedance

- In the standby mode, current consumption vanishes.
- * All power transistors turn off and the motor stops driving when the IC is detected in low voltage or thermal protection mode.

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Pin Functions

| Pin No. | Pin name | Description | Equivalent circuit |
|----------------------------------|--|--|--------------------|
| 20 21 | C1H VG | Step-up capacitor connection pin. | |
| 17 | EXTRA | Extra logic pin. (Logic switch for PWM) | |
| 16 12 15 14 11 10 | EN1 EN2 IN1 IN2 IN3 IN4 | Driver output switching. Logic enable pin. (Pull-down resistor incorporated) | |
| 1 2 5 6 | OUT1 OUT2 OUT3 OUT4 | Driver output. | |
| 8, 9, 22, 23 | VM | Motor block power supply. | |
| 13 | V _{CC} | Logic block power supply. | |
| 18 | SGND | Control block ground. | |
| 3, 4 | PGND | Driver block ground. | |

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ORDERING INFORMATION

| Device | Package | Shipping (Qty / Packing) |
|-----------------|---|--------------------------|
| LV8402GP-TE-L-H | VCT24 (3.5×3.5) (Pb-Free / Halogen Free) | 2000 / Tape & Reel |
| LV8402GP-H | VCT24 (3.5×3.5) (Pb-Free / Halogen Free) | 490 / Tray JEDEC |

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