# ST1153A

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## *Low-saturation, Low-voltage*

## *Bi-directional Multi-Channels Motor Driver*

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# ST1153A

## Low-saturation, Low-voltage
## Bi-directional Multi-channels Motor Driver

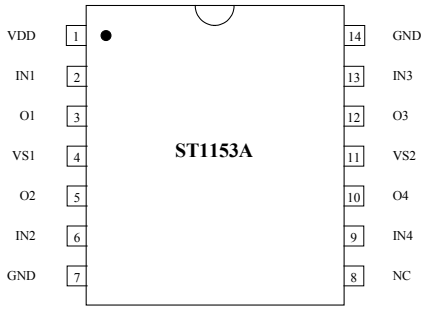
## General Specifications

The device is a multi-channels low-saturation bi-directional motor driver IC. This IC supports the maximum of 3 channel motor operating and supports control of forward, reverse, standby and braking operation for each motor. The design is optimal for stepper-motor applications, such as cameras, printers, FDDs, or other portable devices

## Features and Benefits

- Low voltage operation ( VDD min = VS1 min = VS2 min = 1.5V )
- Low saturation voltage ( Upper transistor + low transistor residual voltage; 0.3V typ. at 400mA )
- Maximal 3 channel bi-directional drivers
- Low input current drain
- Low current drain in standby mode
- Separate control logic power supply and motor driver power supply
- Brake function
- High output sinking and driving capability
- Thin, highly reliable package (SOP-14)

## Pin Assignment




| PIN NO. | PIN NAME | DESCRIPTION |
|---|---|---|
| 1 | VDD | Power supply pin for controller. |
| 2 | IN1 | Input pin that determines driving mode. |
| 3 | O1 | Output sinking / driving pin. |
| 4 | VS1 | Power supply pin for output driver O1/ O2. |
| 5 | O2 | Output sinking / driving pin. |
| 6 | IN2 | Input pin that determines driving mode. |
| 7 | GND | Ground pin |
| 8 | NC | No connecting |
| 9 | IN4 | Input pin that determines driving mode. |
| 10 | O4 | Output sinking / driving pin. |
| 11 | VS2 | Power supply pin for output driver O3/ O4. |
| 12 | O3 | Output sinking / driving pin. |
| 13 | IN3 | Input pin that determines driving mode. |
| 14 | GND | Ground pin |

## Absolute Maximum Ratings *( Unless otherwise noted, $T_A$= 25℃ )*

| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 5.5 | V |
| | $V_S$ | 3.5 | V |
| Input Voltage | $V_{IN}$ | $V_{DD}$+0.4 | V |
| GND pin Current | $I_{GND}$ | 1.5 | A |
| $I_{ODC}$ Current (per connection) | $I_{ODC}$ | 0.75 | A |
| Power Dissipation | $P_D$ | 800 | mW |
| Operating Temperature Range | $T_{OPR}$ | -40 ~ 125 | °C |
| Storage Temperature Range | $T_{STG}$ | -65 ~ 150 | °C |

## Electrical Characteristic

*(Unless otherwise noted, $T_A$= 25℃ & $V_{DD}$ = $V_S$ = 3V )*

| Characteristic | Sym. | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Supply Voltage | $V_{DD}$ | | 1.5 | 3 | 5.5 | V |
| | $V_S$ | | 1.5 | 3 | 3.5 | V |
| Supply Current ( $I_{DD}$ + $I_S$ ) | $I_{DD0}$ | $V_{IN1, IN2, IN3, IN4}$ = 0V | | 0.1 | 10 | μA |
| | $I_{DD1}$ | $V_{IN1}$=3V, $V_{IN2, IN3, IN4}$=0V | | 0.1 | 2 | mA |
| | $I_{DD2}$ | $V_{IN1, IN2}$=3V, $V_{IN3, IN4}$=0V | | 0.5 | 10 | μA |
| IN1 / IN2 / IN3 / IN4 Input Terminal ( $T_J$ = 25℃) | | | | | | |
| Input Voltage “H” | $V_{IH}$ | - | 0.8*$V_{DD}$ | - | $V_{DD}$+0.4 | V |
| Input Voltage “L” | $V_{IL}$ | - | -0.4 | - | 0.2*$V_{DD}$ | V |
| Input Current “H” | $I_{IH}$ | $V_{IN}$ = $V_{DD}$ | - | - | ±5 | μA |
| Input Current “L” | $I_{IL}$ | $V_{IN}$ = 0 V | - | - | ±5 | μA |
| O1 / O2 / O3 / O4 Output Terminal ( $T_J$ = 25℃) | | | | | | |
| Output Voltage (upper + lower) | $V_{OUT1}$ | $I_{OUT}$ = 200 mA | - | 0.2 | 0.3 | V |
| | $V_{OUT2}$ | $I_{OUT}$ = 400 mA | - | 0.3 | 0.6 | V |
| | $V_{OUT3}$ | $I_{OUT}$ = 400 mA ( parallel connection ) | - | 0.2 | 0.4 | V |
| | $V_{OUT4}$ | $I_{OUT}$ = 800 mA ( parallel connection ) | - | 0.4 | 0.7 | V |
| Output Sustaining Voltage | $V_{O(SUS)}$ | $I_{OUT}$ = 400 mA | - | - | $V_S$ | V |

## Truth Table

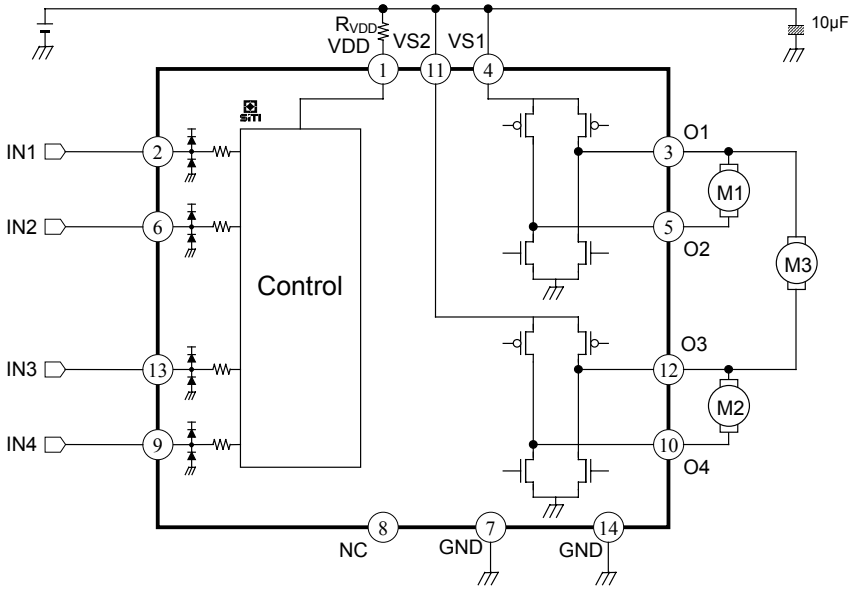
Functions of each Motor

| IN1 | IN2 | O1/O3 (O1) | O2 / O4 (O3) | Mode |
|---|---|---|---|---|
| H | L | H | L | Forward |
| L | H | L | H | Reverse |
| H | H | H | H | Brake |
| L | L | OFF | OFF | Standby |

Selection of Motor

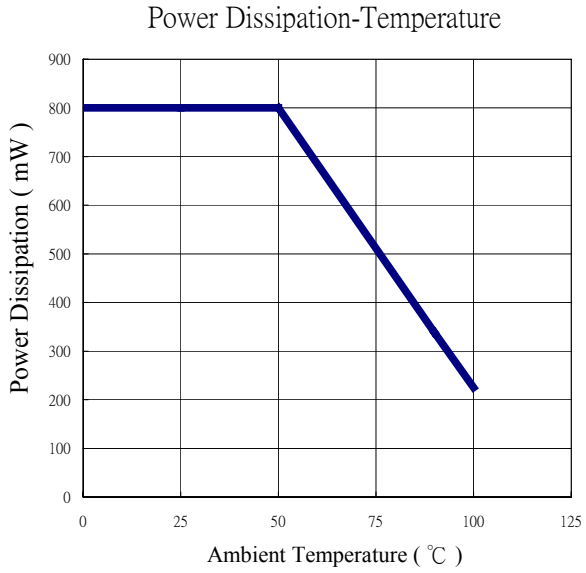
| IN3 | IN4 | Motor Selection |
|---|---|---|
| H | H | Motor 1 |
| H | L | Motor 2 |
| L | H | Motor 3 |
| L | L | Motor 1 & Motor 2 (parallel connection) |

## Block Diagram & Application Circuit



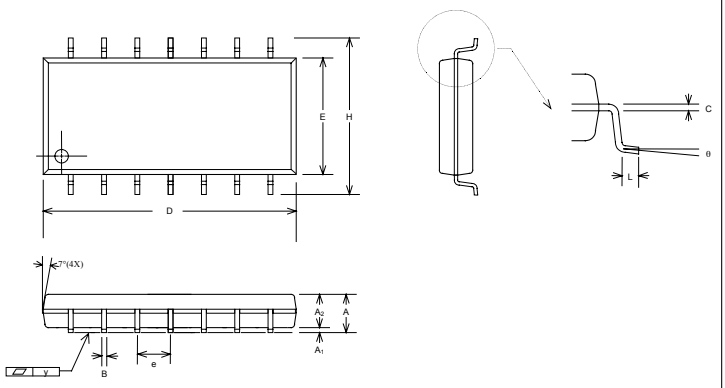
## Application Notes

- To increase system stability, it is suggestion to connect a resistor $R_{VDD}$ about 470Ω between battery power and driver's VDD pin as shown on application circuit.
- The IC supports 3 channels operating separately or the parallel connection of two channels. For 3th motor application, the power supply for 3th motor is from both VS1 and VS2 pins.
- In multiple power supply application, although power supply of control logic and motor driver are separated, the voltage of VDD pin must be lager than or equal to the voltage of VS1 and VS2 pin.
- The power dissipated by the IC varies widely with the supply voltage, the output current, and loading. It is important to ensure the application does not exceed the allowable power dissipation of the IC package. The recommended motor driver power dissipation versus temperature is depicted as follows:



## Package Specifications(SOP-14)

(14-pin SOP )




| SYMBOL | Dimensions in Millimeter | | | Dimensions in Inches | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.35 | — | 1.75 | 0.0532 | — | 0.0688 |
| $A_1$ | 0.10 | — | 0.25 | 0.0040 | — | 0.0098 |
| $A_2$ | — | — | — | — | — | — |
| B | 0.33 | — | 0.51 | 0.013 | — | 0.020 |
| C | 0.19 | — | 0.25 | 0.0075 | — | 0.0098 |
| D | 8.55 | — | 8.75 | 0.3367 | — | 0.3444 |
| E | 3.8 | — | 4.0 | 0.1497 | — | 0.1574 |
| e | — | 1.27 | — | — | 0.050 | — |
| H | 5.8 | — | 6.2 | 0.2264 | — | 0.2440 |
| L | 0.40 | — | 1.27 | 0.016 | — | 0.050 |
| Y | — | — | 0.10 | — | — | 0.004 |
| θ | 0° | — | 8° | 0° | — | 8° |
| | | | | | | |