# FAN8100N/FAN8100MTC

## Low Voltage/Low Saturation 2-CH DC Motor Driver

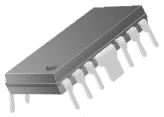
## Features

- Two channel H-bridge drivers with built-in NPN and vertical-PNP power transistors
- Four functions for each channel - Forward/Reserve/Stop/ Brake functions
- Special output pin for an RC car application - for a Turbo function for Ch.A (five-function RF receiver chip RX-2 interface)
- Low stand-by current (typ. 0.1uA)
- Wide supply voltage range (PVCC=1.8V ~ 9.0V) suitable for battery operated applications
- 3.3V and 5V micro-controller interface
- Low output saturation voltage (upper and lower total : typ. 0.15V@ 0.2A)
- High current outputs (max. 1.5A/Ch.)
- Parallel connection (Max Current : 3A)
- High thermal capability for high continuous output currents
- Built-in spark killing diodes
- Built-in a thermal shutdown(TSD) function with hysteresis
- Short circuit protected
- Temperature independent internal voltage reference

## Description

The FAN8100N/FAN8100MTC is a monolithic two channel dc motor drive IC designed for low voltage operated systems. It has dual H-bridge drivers, using NPN and vertical-PNP power transistors with a low saturation voltage. Power packages with heat sinks endure high continuous output current. The high current and low saturation voltage feature make this device suitable for dc motor applications such as toy cars. It has also a built-in thermal shutdown protection circuit with hysteresis.

**12-DIPH-300**




**14-TSSOP**

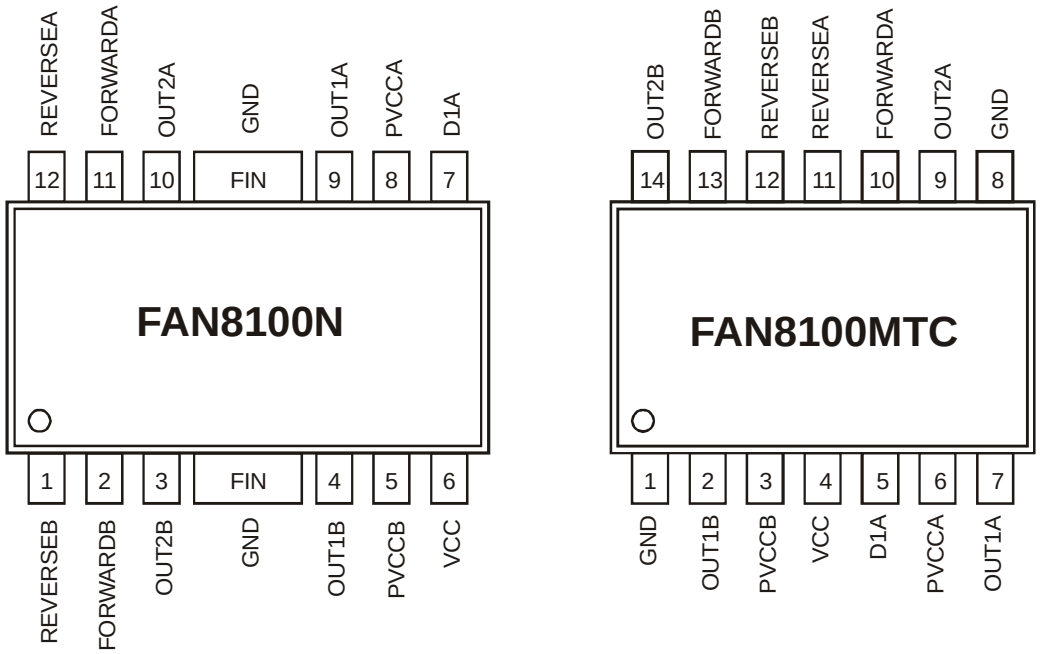

## Typical Application

- General purpose dc motor driver
- Electronic toys - robots, RC cars
- Digital still camera(DSC) and film camera
- Home appliances and office equipment
- Precision instruments

## Ordering Information

| Device | Package | Operating Temp. |
|---|---|---|
| FAN8100N | 12-DIPH-300 | –20 ~ +75°C |
| FAN8100MTC | 14-TSSOP | –20 ~ +75°C |
| FAN8100MTCX | 14-TSSOP | –20 ~ +75°C |

## Pin Assignments

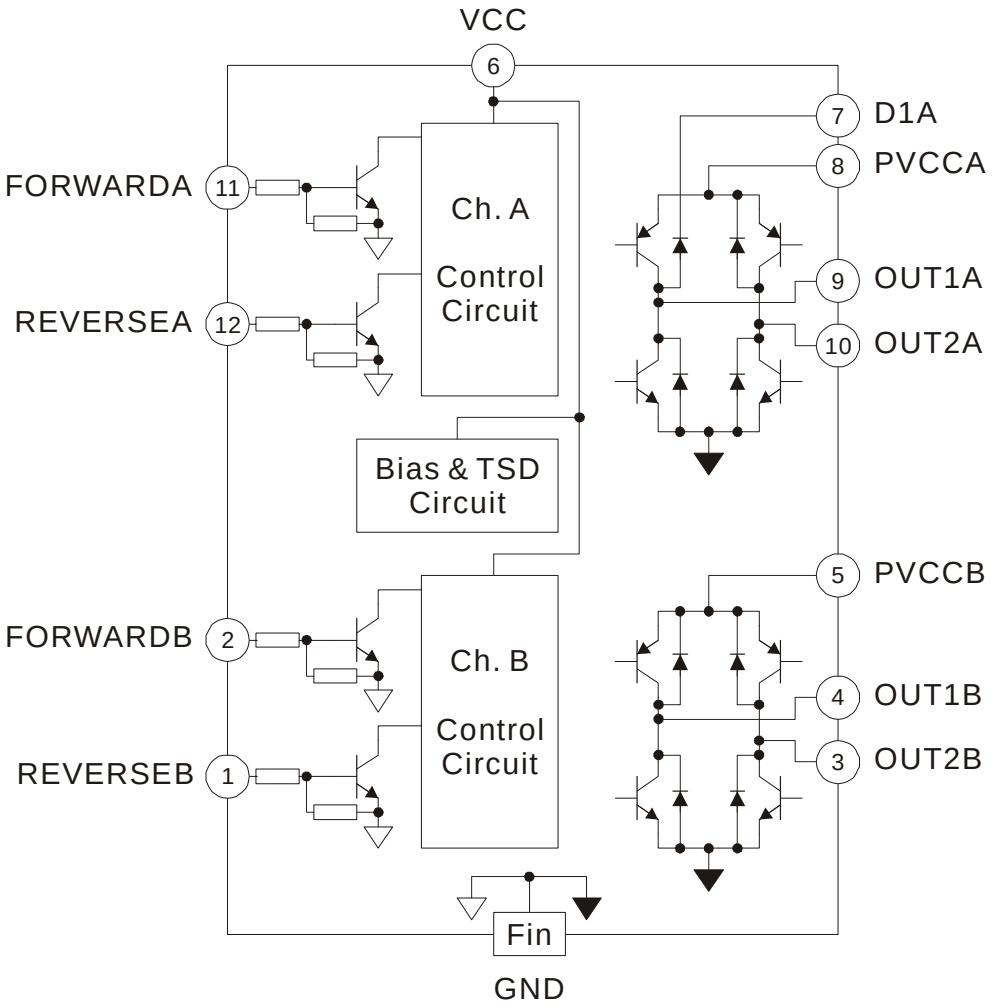



## Pin Definitions

| Pin Number | Pin Name | I/O | Pin Function Description |
|---|---|---|---|
| 1(12) | REVERSEB | I | Reverse logic input for channel B |
| 2(13) | FORWARDB | I | Forward logic input for channel B |
| 3(14) | OUT2B | O | Output2 of channel B |
| FIN(1) | GND | - | Ground |
| 4(2) | OUT1B | O | Output1 of channel B |
| 5(3) | PVCCB | - | Supply voltage for channel B output |
| 6(4) | VCC | - | Logic and control circuit supply voltage |
| 7(5) | D1A | O | Cathode of OUT1A upper diode |
| 8(6) | PVCCA | - | Supply voltage for channel A output |
| 9(7) | OUT1A | O | Output1 of channel A |
| FIN(8) | GND | - | Ground |
| 10(9) | OUT2A | I | Output2 of channel A |
| 11(10) | FORWARDA | I | Forward logic input for channel A |
| 12(11) | REVERSEA | I | Reverse logic input for channel A |

**Note**: ( ) FAN8100MTC

## Internal Block Diagram




**Note**: FAN8100N pin number

## Absolute Maximum Ratings (Ta = 25°C)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Maximum logic and control supply voltage | $VCC_{(MAX)}$ | 10.5 | V |
| Maximum output supply voltage | $PVCC_{(MAX)}$ | 10.5 | V |
| Maximum output applied voltage | $VOUT_{(MAX)}$ | PVCC + VD | V |
| Maximum applied input voltage | $VIN_{(MAX)}$ | 10.0 | V |
| Maximum D1A Voltage | $VD1A_{(MAX)}$ | PVCCA + 4.5 | V |
| Peak output current per channel | $IOUT_{(PEAK)}$ | 1.5(1.2) | A |

**Note**: ( ) FAN8100MTC

## Recommended Operating Conditions (Ta = 25°C)

| Parameter | Symbol | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Logic and control circuit supply voltage | VCC | 2.2 | - | 9.0 | V |
| Output supply voltage | PVCC | 1.8 | - | 9.0 | V |
| D1A Voltage | VD1A | PVCCA | - | PVCCA +3.0 | V |

**Note**: See the characteristics graphs.

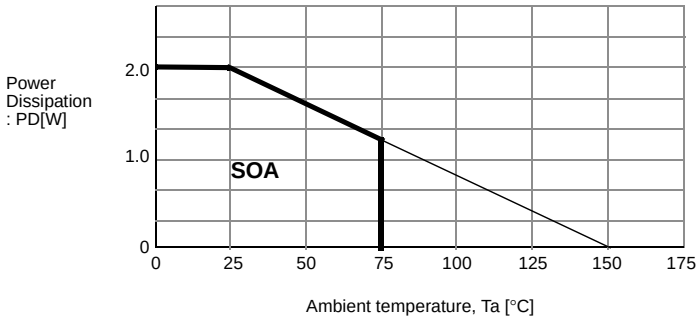
## Typical Thermal Characteristics

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Power dissipation | PD[note1] | FAN8100N: 2.0<br>FAN8100MTC: 1.0 | W |
| Operating temperature | TA | –20 ~ 75 | °C |
| Storage temperature | TSTG | –40 ~ 125 | °C |
| Junction temperature | TJ | 150 | °C |
| Thermal shutdown temperature | TSD[note2] | 150 | °C |
| Thermal shutdown hysteresis temperature | ΔTSD[note2] | 50 | °C |

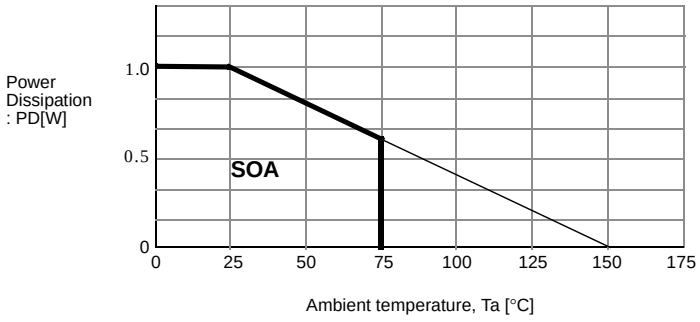
**Notes**:
1. When mounted on JEDEC 76.2mm × 114mm × 1.57mm PCB (FR-4 glass epoxy material).
2. On the junction. These values are design specifications.

## Power Dissipation Curve

FAN8100N




FAN8100MTC




**Notes**:
1. When mounted on JEDEC 76.2mm × 114mm × 1.57mm PCB (FR-4 glass epoxy material).
2. Power dissipation reduces 16mW/°C (FAN8100N) and 32mW/°C (FAN8100MTC) for using above Ta=25°C.
3. Do not exceed PD and SOA(Safe Operating Area).

## Electrical Characteristics

(Ta=25°C, VCC=3V, PVCCA=PVCCB=3V, unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Stand-by current ($I_{VCC}+I_{PVCCA}+I_{PVCCB}$) | ICC0 | All input pins=0V, with output pins open | - | 0.1 | 10 | uA |
| VCC supply current 1 ($I_{VCC}$) | ICC1 | Forward or Reverse (single channel) | - | 4 | 6 | mA |
| VCC supply current 2 ($I_{VCC}$) | ICC2 | Brake (single channel) | - | 5.5 | 8 | mA |
| Total supply current 1 ($I_{VCC}+I_{PVCCA}+I_{PVCCB}$) | ICC3 | Forward or Reverse (single channel) with output pins open | - | 30(20) | 40(27) | mA |
| Total supply current 2 ($I_{VCC}+I_{PVCCA}+I_{PVCCB}$) | ICC4 | Brake (single channel) with output pins open | - | 55(35) | 65(45) | mA |
| Saturation voltage 1 (upper + lower output transistors total) | VSAT1 | FORWARDA=3V, other input pins=0V, IOUT=0.2A | - | 0.15 | 0.25 | V |
| Saturation voltage 2 (upper + lower output transistors total) | VSAT2 | FORWARDA=3V, other input pins=0V, IOUT=0.4A | - | 0.35 | 0.55 | V |
| Input high level voltage | VINH | - | 1.8 | - | VCC | V |
| Input low level voltage | VINL | - | –0.3 | - | 0.7 | V |
| Input current | IIN | VIN=3V, per each input pin | - | 100 | 200 | uA |
| Spark-killing diode leakage current | ILEAK | VCC=9V, PVCC=9V | - | - | 30 | uA |
| Spark-killing diode voltage drop | VD | IOUT=0.4A | - | - | 1.7 | V |

**Note**: ( ) FAN8100MTC

## Timing Characteristics

(Ta=25°C, VCC=3V, PVCCA=PVCCB=3V, unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output rising time | tR | input rising time = 20ns output voltage 10% to 90% | - | 0.3 | - | us |
| Output falling time | tF | input falling time = 20ns output voltage 90% to 10% | - | 0.3 | - | us |
| Input to output propagation delay | tPLH | input rising time = 20ns input 50% to output 50% | - | 1 | - | us |
| | tPHL | input falling time = 20ns input 50% to output 50% | - | 1 | - | us |

**Note**: with 1nF Capacitor Loads

# Function Descriptions

## Logical Truth Table

### Channel A

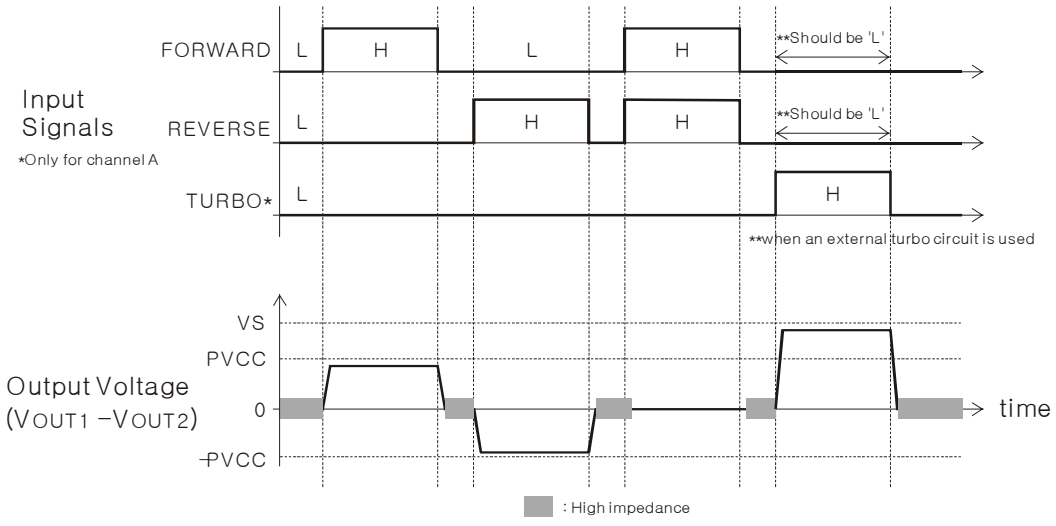
| FORWARDA | REVERSEA | OUT1A | OUT2A | Function |
|---|---|---|---|---|
| L | L | Z | Z | Stand-by (Stop) |
| H | L | H | L | Forward |
| L | H | L | H | Reverse |
| H | H | L | L | Brake |

### Channel B

| FORWARDB | REVERSEB | OUT1B | OUT2B | Function |
|---|---|---|---|---|
| L | L | Z | Z | Stand-by (Stop) |
| H | L | H | L | Forward |
| L | H | L | H | Reverse |
| H | H | L | L | Brake |

Z: high-impedance

# Time Domain Waveforms




**Notes**: **See typical application circuits.

# Application Information

## 1. Thermal Shutdown (TSD)

Thermal Shutdown Circuit turns OFF all outputs when the junction temperature typically reaches 150°C. It is intended to protect the device from failures due to excessive junction temperature.
The Thermal Shutdown has the hysteresis of 40°C approximately.

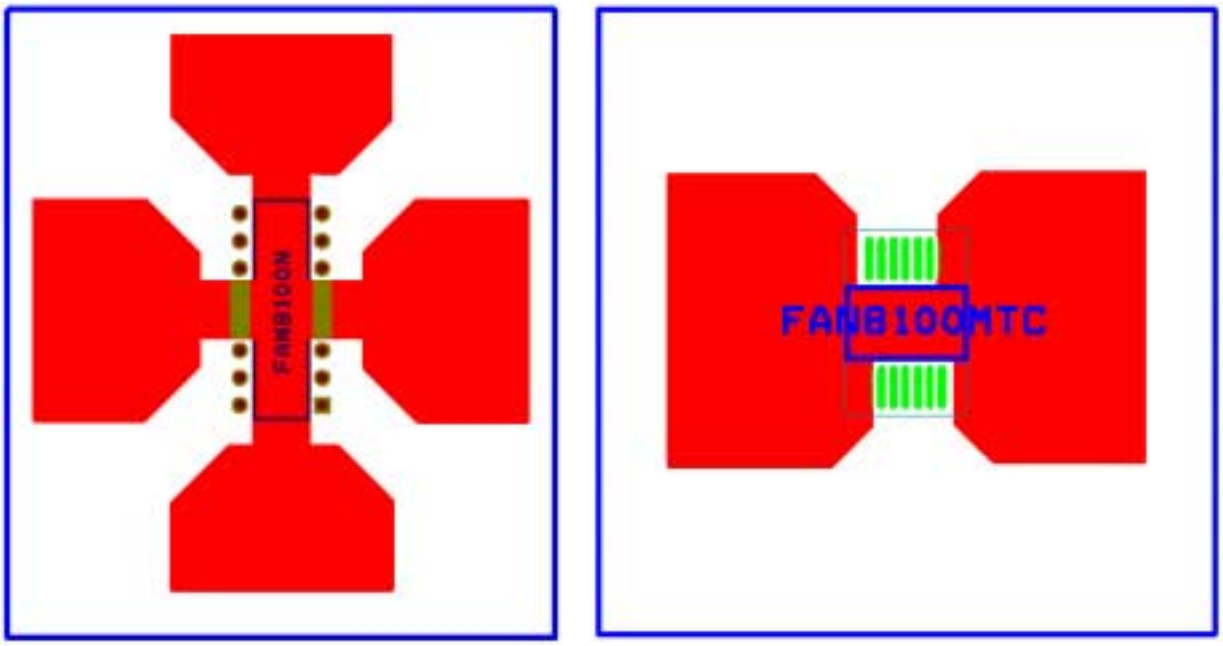
## 2. Printed Circuit Board (PCB) Layout

If high current flows on the power supply(PVCC) and GND line, it can be misoperated due to the line oscillation.
The following points should be kept in mind regarding as the pattern layout to prevent it.

- Making the wiring lines thick and short, especially between power supply (PVCC) and GND.
- Putting a passthrough capacitor near the IC

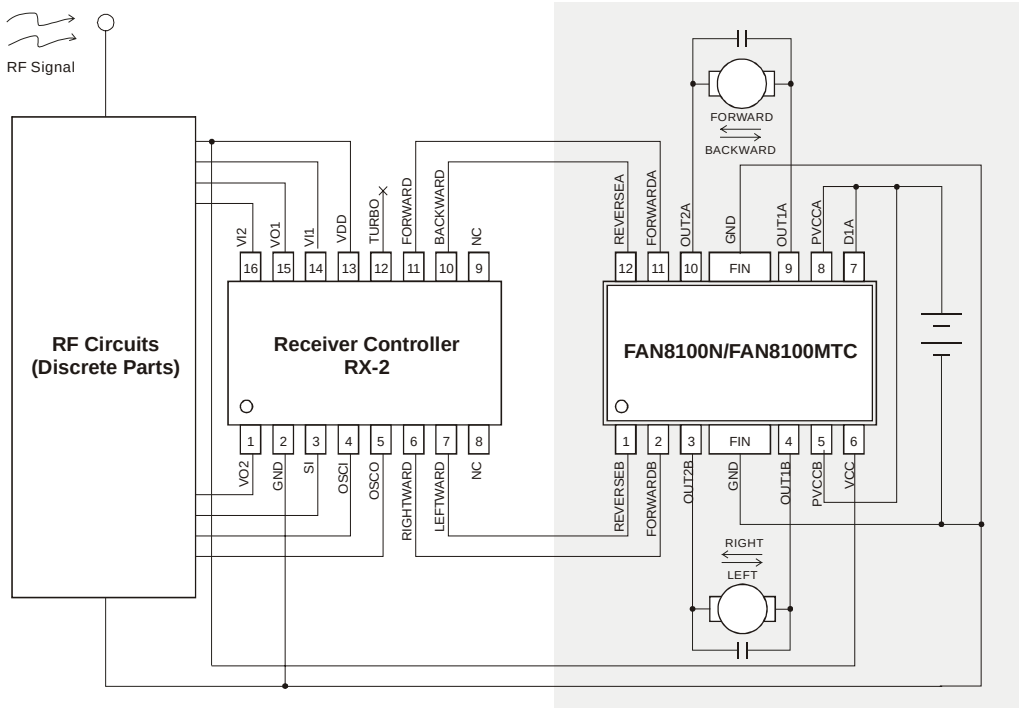
The $R_{th\text{-}ja}$ of the FAN8100N/MTC can be reduced by soldering the GND pins to a suitable copper area of the printed circuit board as shown in following figure. It is recommended the copper area is as large as possible.

### Example of PCB copper area which is used as heatsink

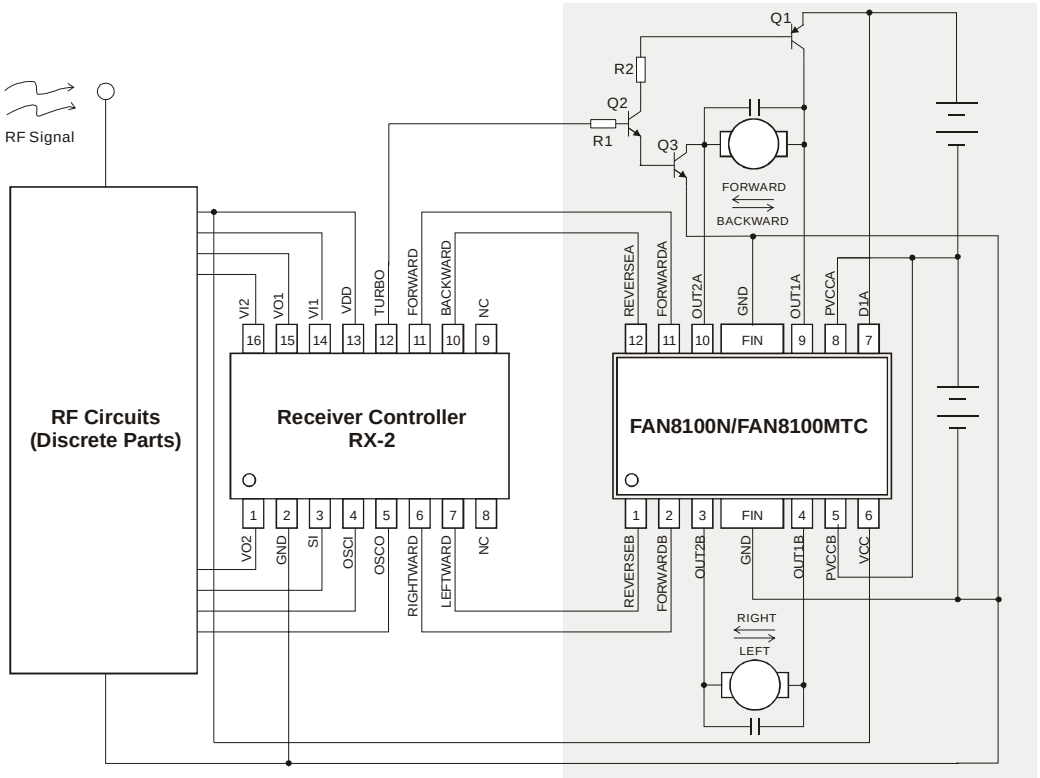


# Typical Application Circuits

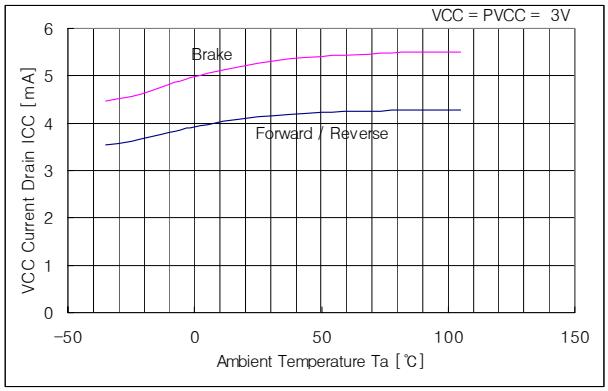
## 1. RF Remote Controlled Car

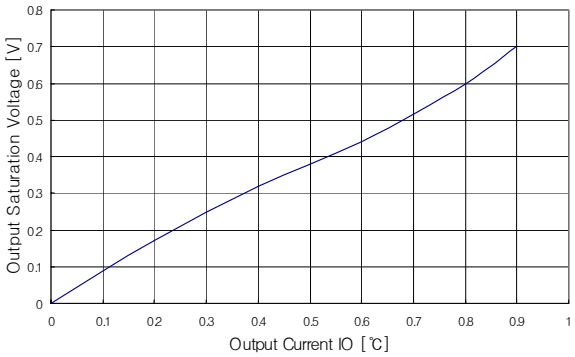


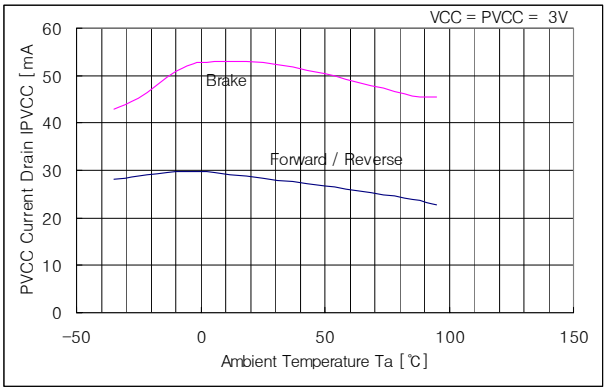

## 2. RF Remote Controlled Car with a Turbo Function

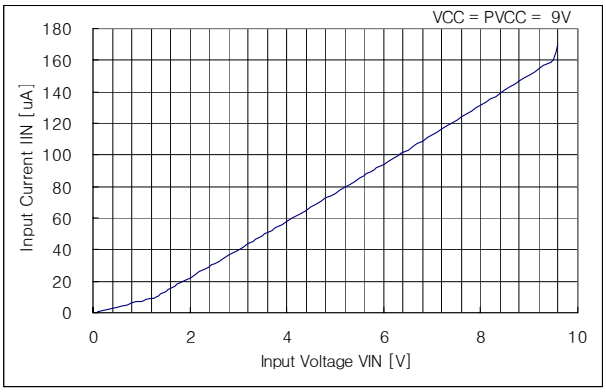


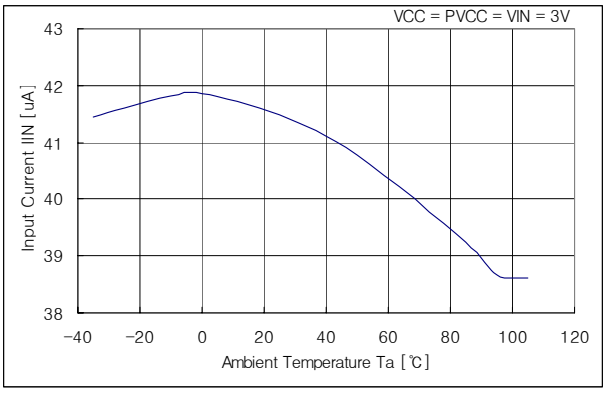
# Typical Performance Characteristics (FAN8100N)

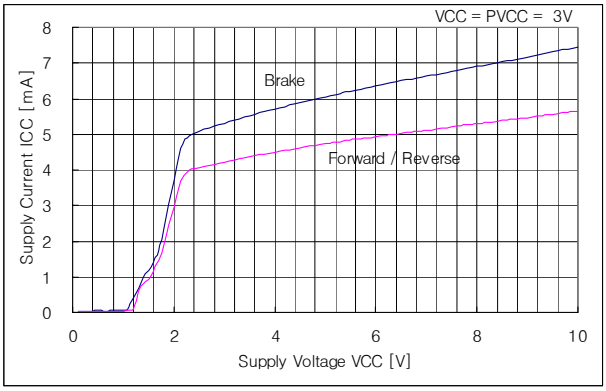


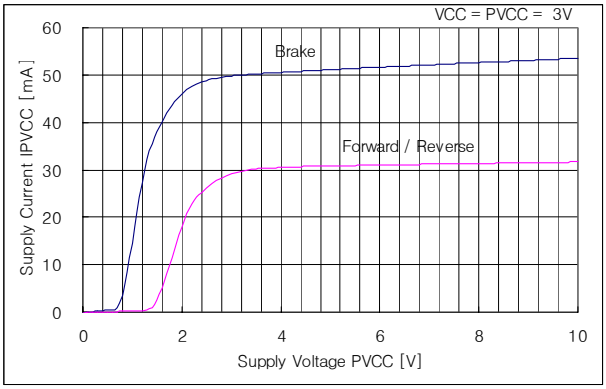



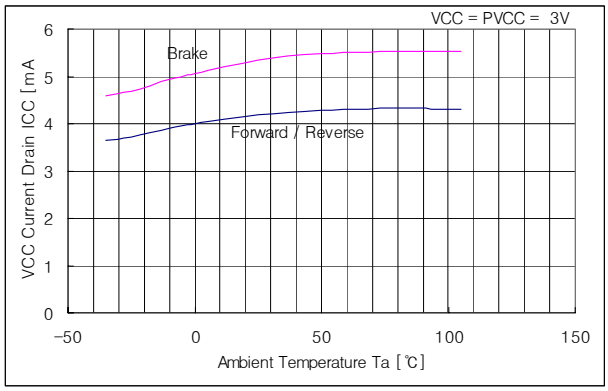



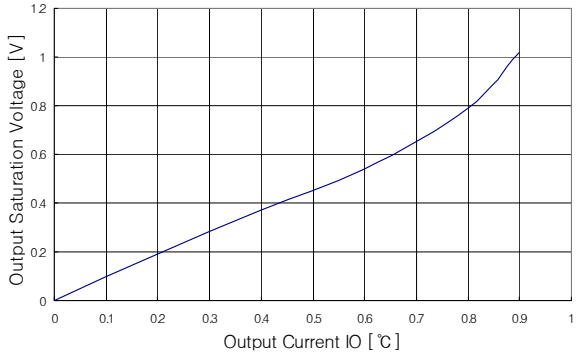



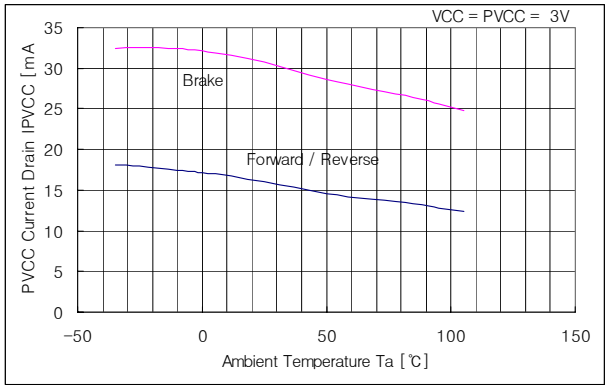



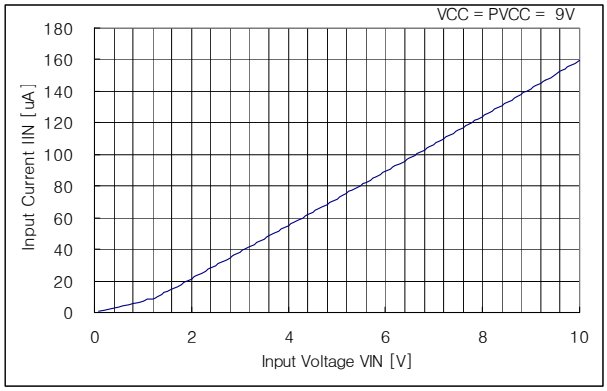



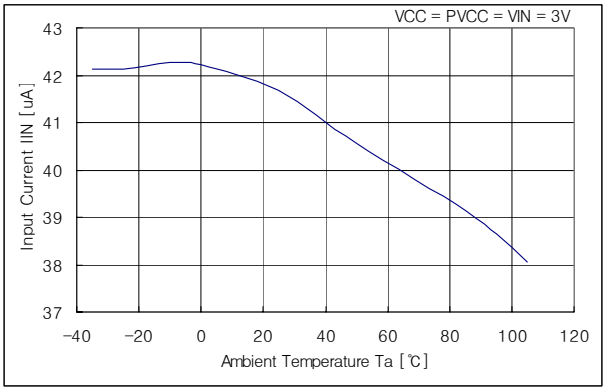
# Typical Performance Characteristics(Continued) (FAN8100MTC)

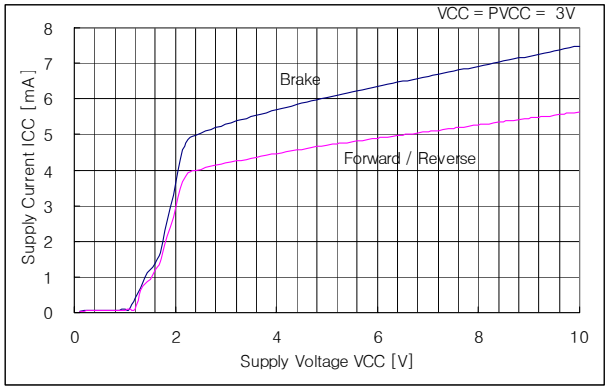


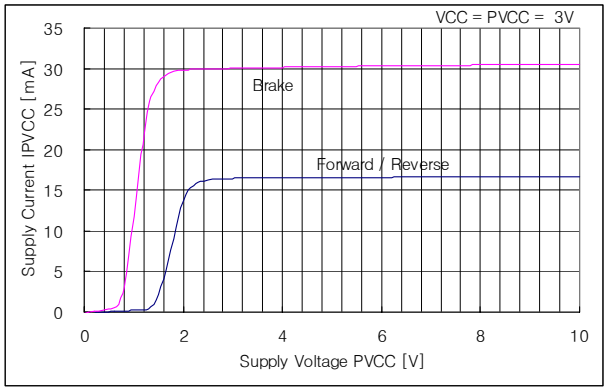



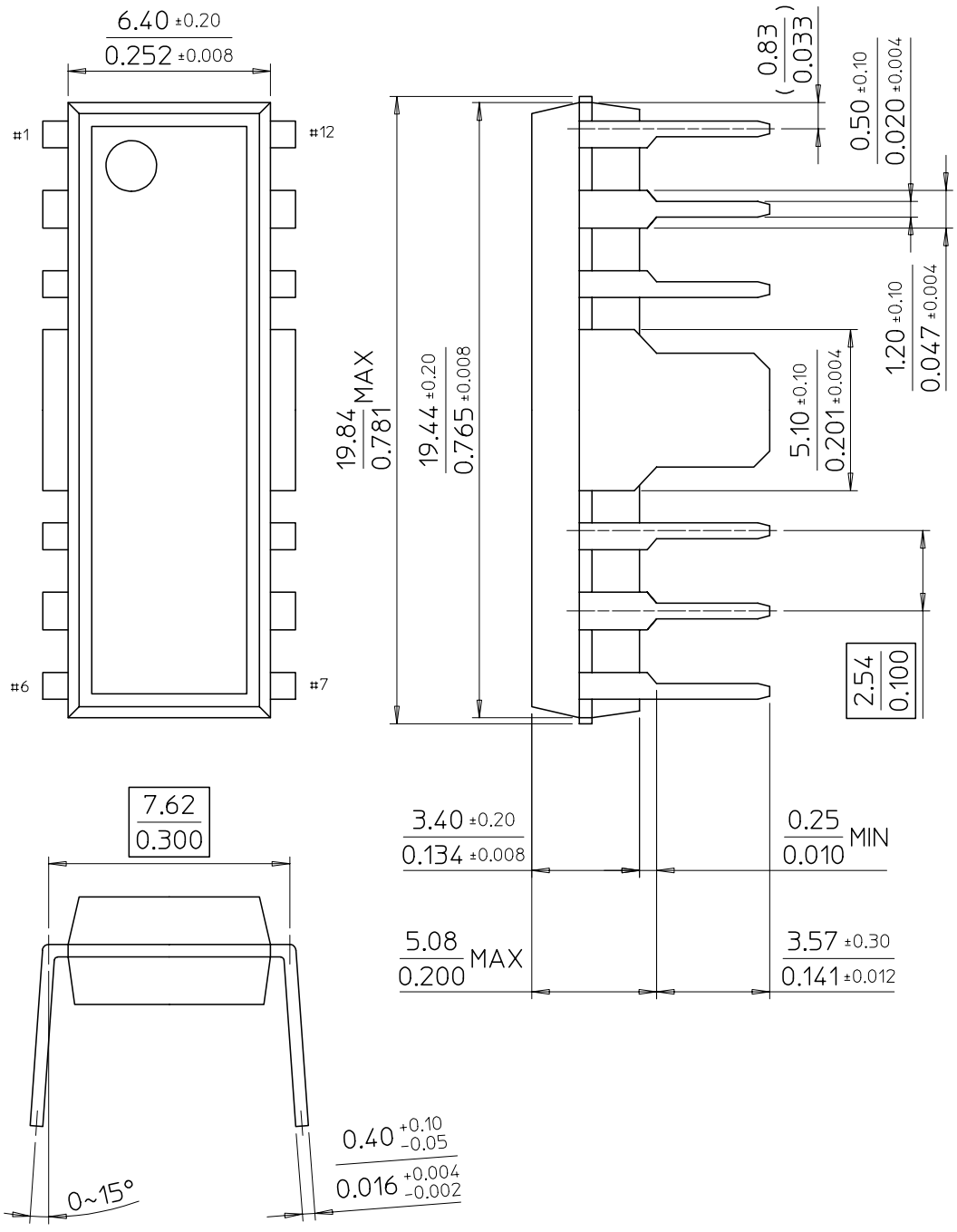



## Mechanical Dimensions (Unit: mm)

### Package Dimension

# 12-DIPH-300



## Mechanical Dimensions (Unit: mm) (Continued)

### Package dimensions

# 14-TSSOP