

ASSP

BIPOLAR

1A Motor Drive IC for Motor Applications

MB3853

■ DESCRIPTION

The FUJITSU MB3853 is a motor drive IC with two power driver channels capable of sink/source operation, for use in two-channel independent operation or H-type drive operation.

The control system and output system have independent power supplies, allowing the control system to be set to low-voltage operation to conserve power.

Protective circuits are provided for temperature, overvoltage, and overload current, with an open collector type monitoring terminal.

The MB3853 is designed for use with motors in AV products, office automation products, or cameras, and is also an ideal IC for use in automated vending equipment and other unmanned operating devices.

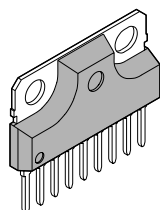
■ FEATURES

- Circuit configuration
 - Two sets of built-in control circuits and power circuits
 - Built-in fly-back diode
- Functions
 - Can drive two motors independently or in H-type drive configurations
 - Built-in inhibitor function

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■ PACKAGE

Plastic SIP, 9 pins



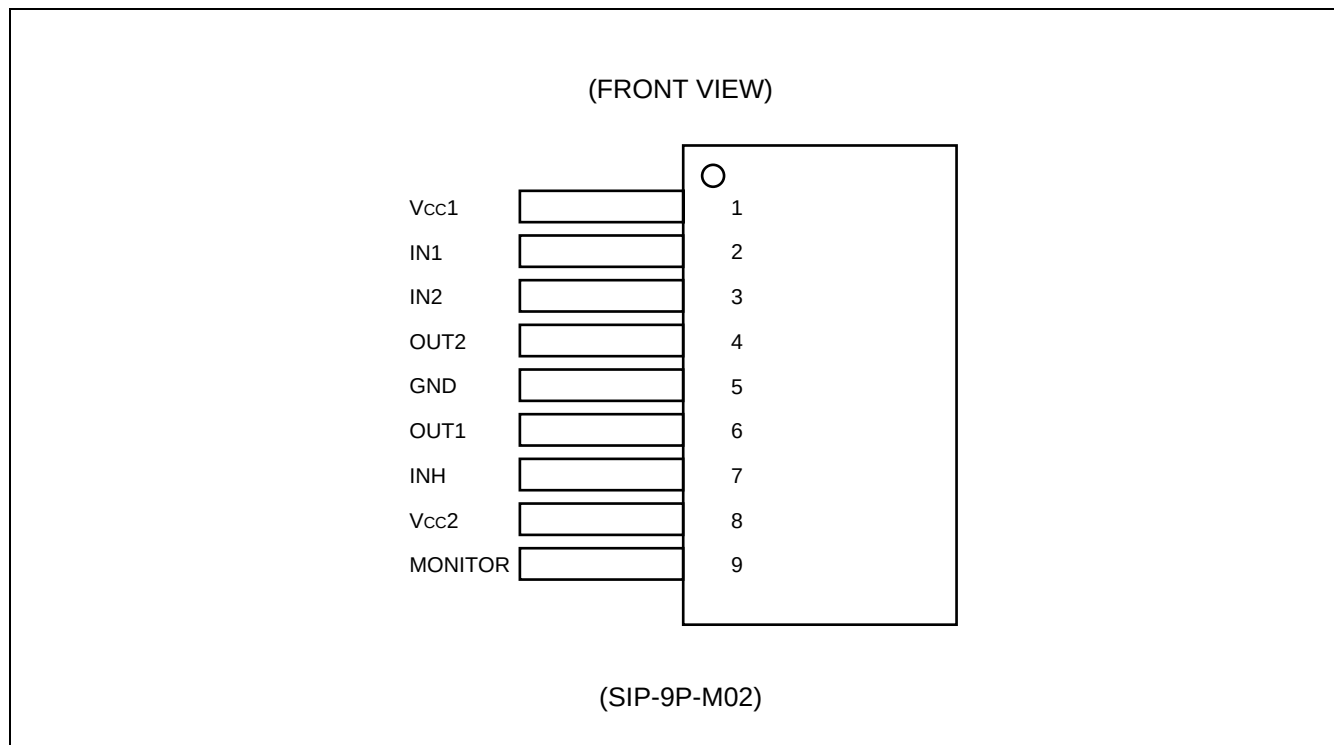
(SIP-9P-M02)

MB3853

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- Input/output terminals
Power supply terminals : Independent control system supply terminal and output system supply terminal
Control terminals : TTL level/CMOS level compatible
Monitor terminal : Open collector type
- Space-saving package (SIP9)

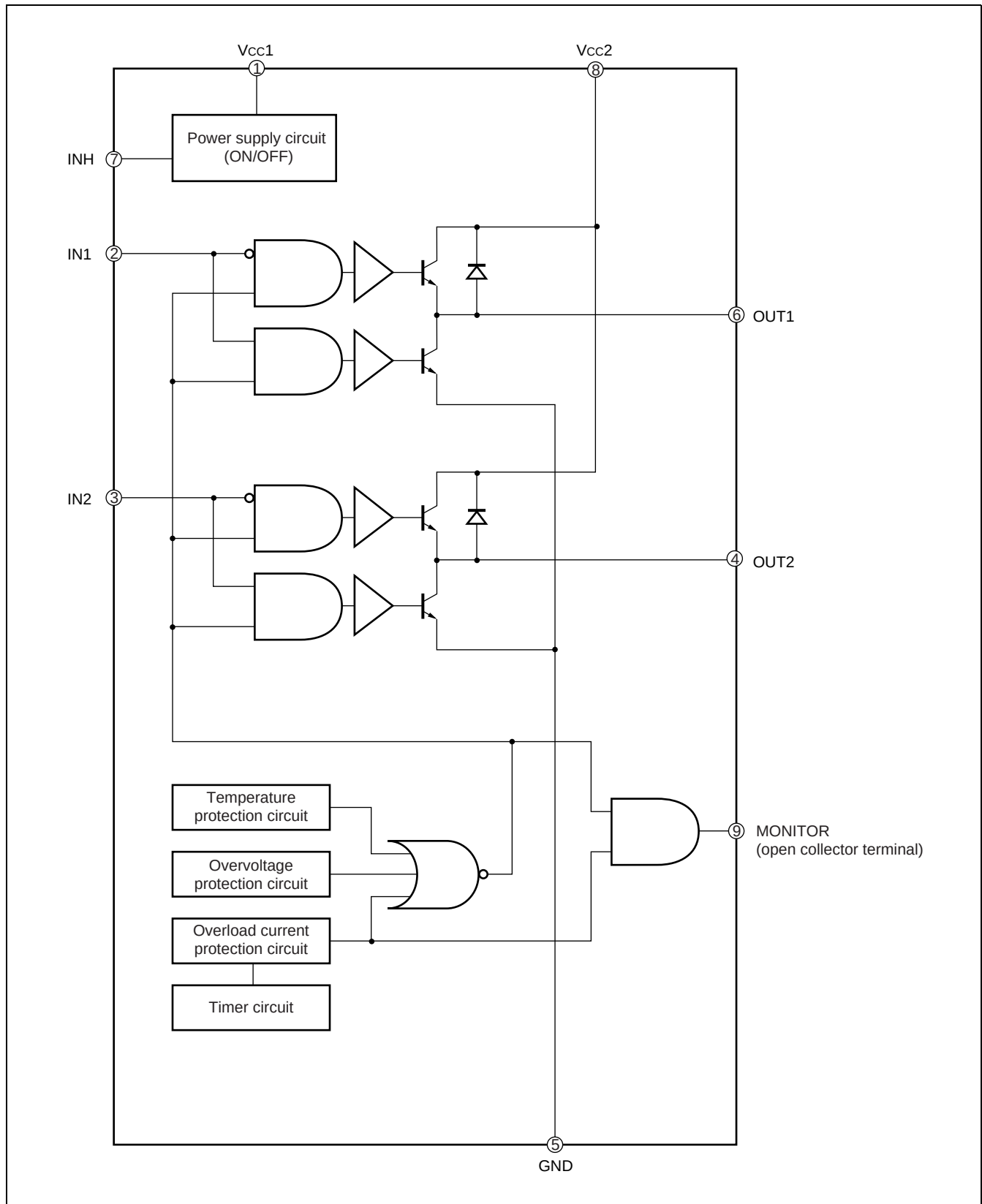
■ PIN ASSIGNMENT



■ PIN DESCRIPTION

Pin no.	Symbol	I/O	Description
1	Vcc1	—	Control system power supply terminal
2	IN1	I	Load control signal input terminal 1
3	IN2	I	Load control signal input terminal 2
4	OUT2	O	Load control output terminal 2
5	GND	—	Ground terminal
6	OUT1	O	Load control output terminal 1
7	INH	I	Inhibitor signal input terminal
8	Vcc2	—	Output system power supply terminal
9	MONITOR	O	Protective circuit motor signal output terminal (open collector type terminal)

■ BLOCK DIAGRAM

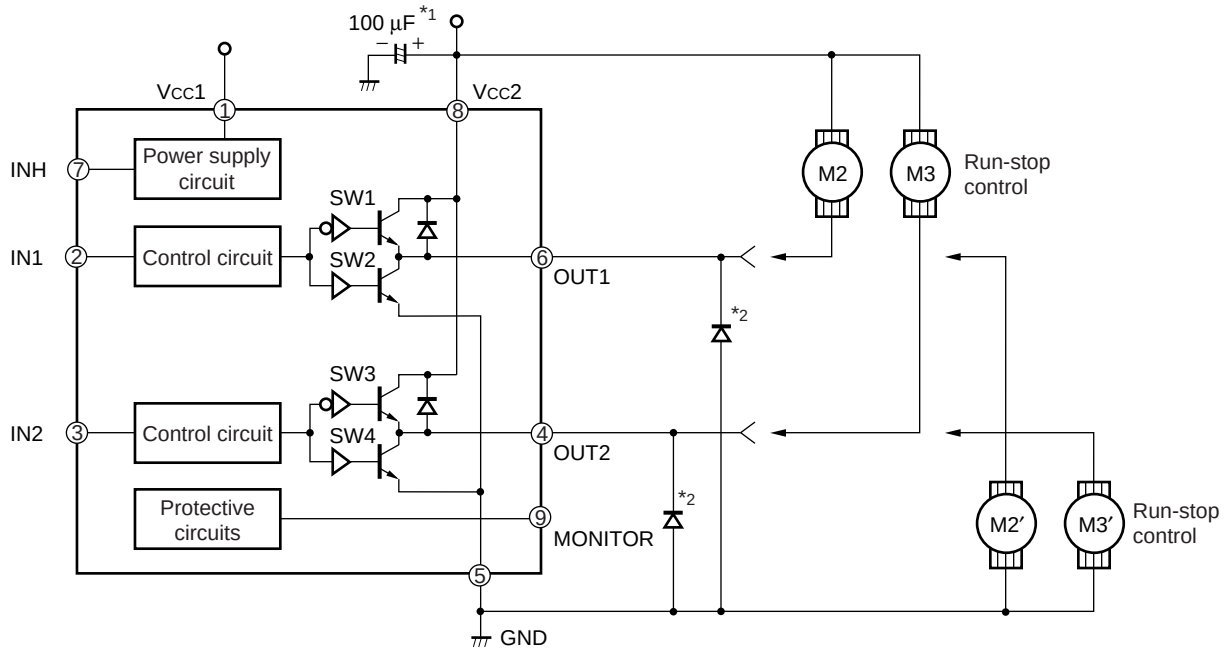


FUNCTIONAL DESCRIPTION

The MB3853 provides two methods for controlling motors. The IC can be connected to two motors and drive each motor independently, or connected to one motor in an H-type connection and drive the motor in forward and reverse directions.

1. Sample connection to 2 motors for run-stop control.

(1) Connection diagram



*1 : The capacitor should be placed close to the IC terminal.

*2 : When using the M2' and M3' terminals, ensure that the OUT1 terminal (pin 6) voltage and OUT2 terminal (pin 4) voltage do not fall below -0.3 V by connecting the OUT1 and OUT2 terminals to ground through a Schottky barrier diode.

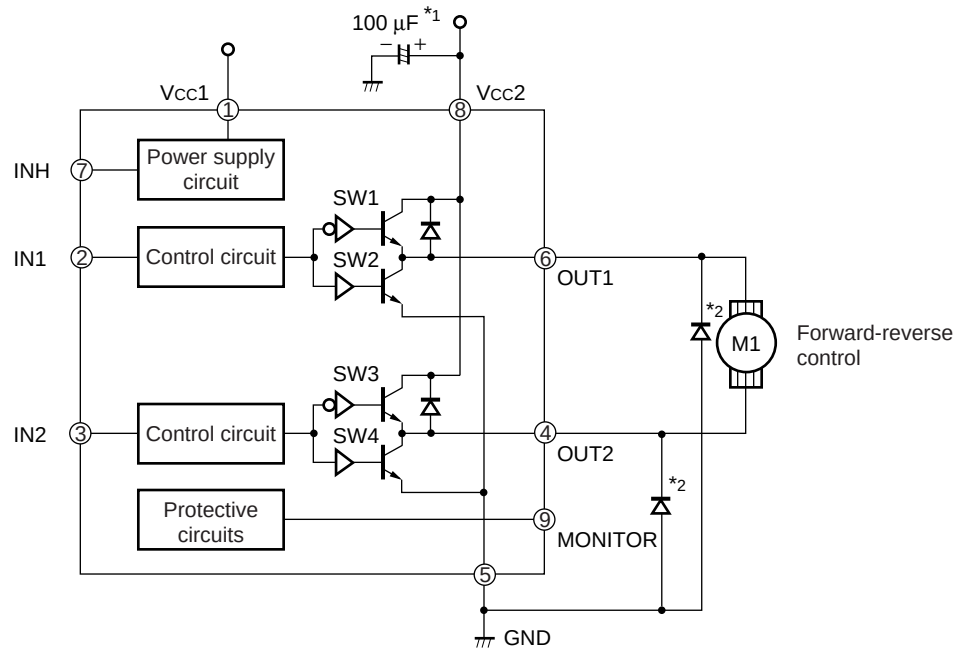
(2) Table of Functions

Mode	Input voltage level			Output terminals		Motor operating mode			
	INH	IN1	IN2	OUT1	OUT2	M2	M3	M2'	M3'
Inhibit mode	"L"	×	×	OFF (high impedance)		Continuous operation			
Mode (1)	"H"	"L"	"L"	"H"	"H"	Brake	Brake	Run	Run
Mode (2)		"L"	"H"	"H"	"L"	Brake	Run	Run	Brake
Mode (3)		"H"	"L"	"L"	"H"	Run	Brake	Brake	Run
Mode (4)		"H"	"H"	"L"	"L"	Run	Run	Brake	Brake

× : May be either "H" or "L" level

2. Sample connection to 1 motor for forward-reverse control

(1) Connection diagram



*1 : The capacitor should be placed close to the IC terminal.

*2 : Ensure that the OUT1 terminal (pin 6) voltage and OUT2 terminal (pin 4) voltage do not fall below -0.3 V by connecting the OUT1 and OUT2 terminals to ground through a Shot key barrier diode.

(2) Table of functions

Mode	Input voltage level			Output terminals		Motor mode
	INH	IN1	IN2	OUT1	OUT2	
Inhibit mode	"L"	×	×	OFF (High impedance)		Continuous operation
Mode (1)	"H"	"L"	"L"	"H"	"H"	Brake
Mode (2)		"L"	"H"	"H"	"L"	Forward (reverse)
Mode (3)		"H"	"L"	"L"	"H"	Reverse (forward)
Mode (4)		"H"	"H"	"L"	"L"	Brake

× : May be either "H" or "L" level

PROTECTIVE CIRCUITS

Circuit name	Operating description	Timing chart
Overvoltage protection circuit	When the Vcc2 supply voltage input exceeds 33 V (Typ.) , the following occurs : (1) All output transistors are turned off, and output is set to high impedance (2) As long as the condition is detected, the monitoring output from the open collector terminal is set to "L" level.	Detection level --- Vcc2 = 33 V (Typ.) Vcc2 Output terminals ON Hi-Z* ON Monitor terminal "H" "L" During detection
Temperature protection circuit	When the chip temperature exceeds $T_J = +180\text{ }^{\circ}\text{C}$, the following occurs : (1) All output transistors are turned off, and output is set to high impedance (2) As long as the condition is detected, the monitoring output from the open collector terminal is set to "L" level.	Detection level --- $T_J = +180\text{ }^{\circ}\text{C}$ (Typ.) Chip temperature Output terminals ON Hi-Z* ON Monitor terminal "H" "L" During detection
Overcurrent protection circuit	Monitors VBE of all output transistors. When any transistor output load current exceeds $I_o = 2.4\text{ A}$ (Typ.) , the following occurs : (1) All output transistors are switched on and off repeatedly (2) As long as the condition is detected, the monitoring output from the open collector terminal is set to "L" level.	Detection level --- $I_o = 2.4\text{ A}$ (Typ.) Load status Output terminals ON Hi-Z* ON Monitor terminal "H" "L" During detection t_1 t_2 t_1 t_2 ($t_1 \cong 5\text{ }\mu\text{s}$, $t_2 \cong 95\text{ }\mu\text{s}$)

* : All output transistors are turned off regardless of logic input voltage.

■ ABSOLUTE MAXIMUM RATINGS

(GND = 0 V)

Parameter	Symbol	Condition	Rating		Unit
			Min.	Max.	
Supply voltage	V _{CC1}	—	—	30	V
	V _{CC2}	—	—	30	V
Surge voltage	V _{CC(S)}	t _r ≥ 1 ms, t _s ≤ 200 ms	—	60	V
Output current	I _O	10 ms or less per terminal	—	1.8	A
Power consumption	P _D	T _C ≤ +75 °C	—	18	W
Operating temperature	T _C	—	−40	+85	°C
Storage temperature	T _{stg}	—	−55	+150	°C

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

■ RECOMMENDED OPERATING CONDITIONS

(GND = 0 V)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Supply voltage	V _{CC1}	Control system supply voltage	4.5	5	30	V
	V _{CC2}	Output system supply voltage	—	24	30	V
"H" level input voltage	V _{IH}	IN1, IN2, INH terminals	2.0	—	V _{CC1} + 0.3	V
"L" level input voltage	V _{IL}		−0.3	—	0.8	V
Operating temperature	T _C	—	0	25	70	°C

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.

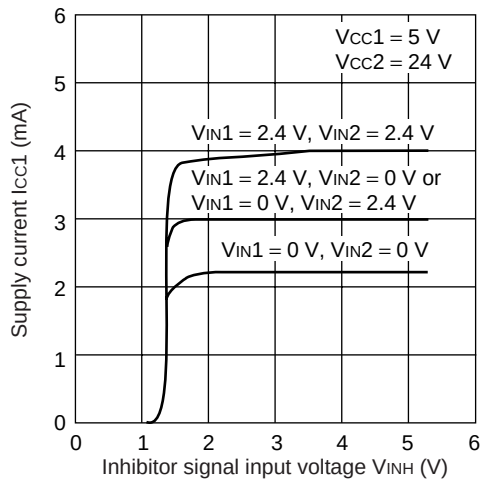
■ ELECTRICAL CHARACTERISTICS

(T_c = +25 °C, GND = 0 V, V_{CC1} = 5 V, V_{CC2} = 24 V)

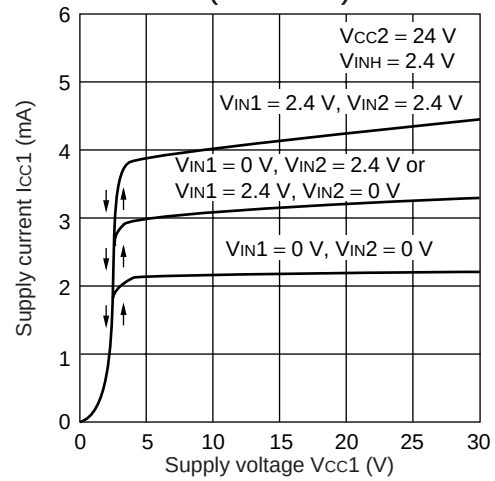
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
"L" level input current	I _{IL}	V _{IL} = 0.4 V	—	—	100	μA
"H" level input current	I _{IH}	V _{IH} = 2.4 V	—	—	100	μA
"L" level output current	V _{OL}	I _O = 1 A	—	1.0	1.4	V
"H" level output current	V _{OH}	I _O = -1 A	22.5	23.0	—	V
Diode forward voltage	V _F	I _O = 1.8 A	—	2.2	—	V
Overcurrent detection current	I _{CS}	—	1.8	2.4	3.5	A
Overcurrent detection voltage	V _{SD}	—	30.5	33.0	35.5	V
"L" level monitoring output voltage	V _{OL}	I _O = 1 mA	—	0.2	0.4	V
"H" level monitoring output current	I _{OH}	V _{OH} = 24 V	—	—	0.01	mA
Supply current	I _{CC1}	IN1 = IN2 = "H"	—	3.7	7.4	mA
		IN1/IN2 = "H/L"	—	2.8	5.6	mA
		IN1 = IN2 = "L"	—	1.9	3.8	mA
	I _{CC2}	IN1 = IN2 = "H"	—	—	1.0	mA
		IN1/IN2 = "H/L"	—	13	20	mA
		IN1 = IN2 = "L"	—	26	40	mA
	I _{CC0}	I _{CC1} + I _{CC2} INH = "L"	—	—	1.0	mA
Package thermal resistance	θ _{J-C}	Infinite heat dissipation	—	4	—	°C/W
Power consumption	OUT1 or OUT2, per terminal	P _D	I _O = 1 A	—	1.2	W
			I _O = 0 mA (braking)	—	300	mW
			I _O = 1 A	—	2.4	W

TYPICAL CHARACTERISTIC

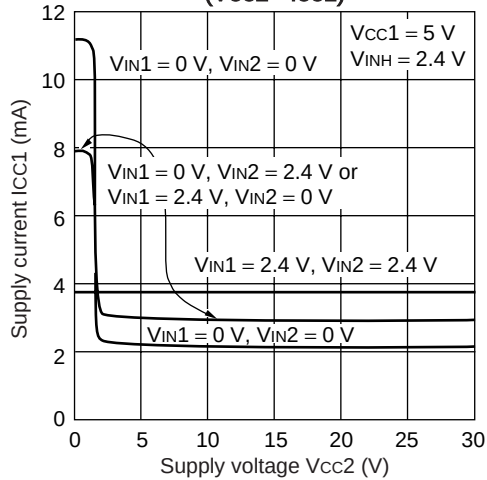
Supply current vs. inhibitor terminal input voltage



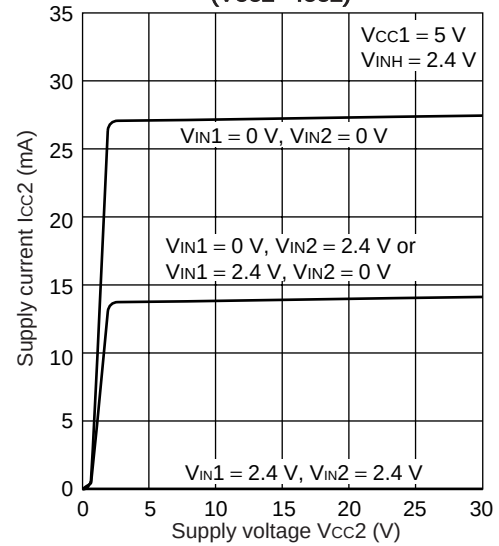
Supply voltage vs. supply current ($V_{CC1} - I_{cc1}$)



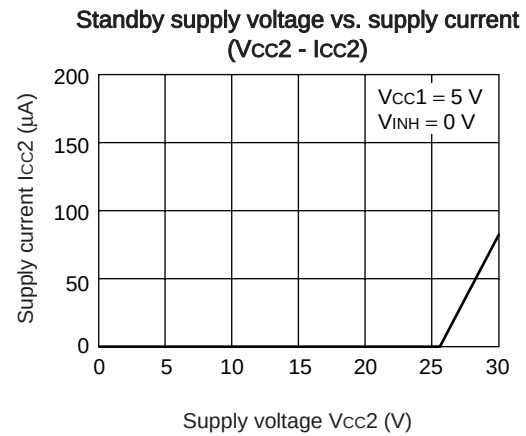
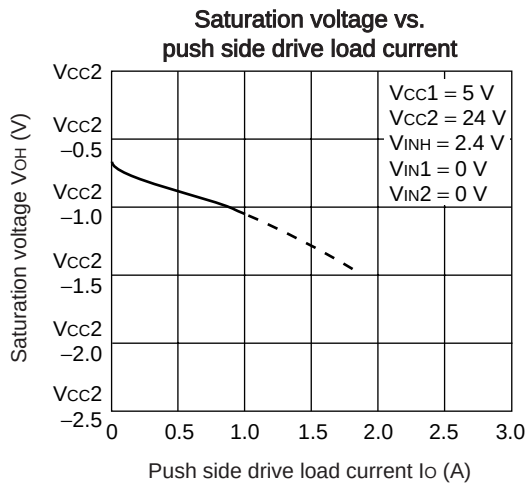
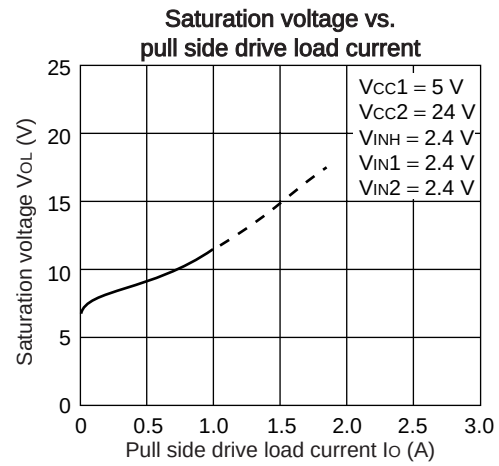
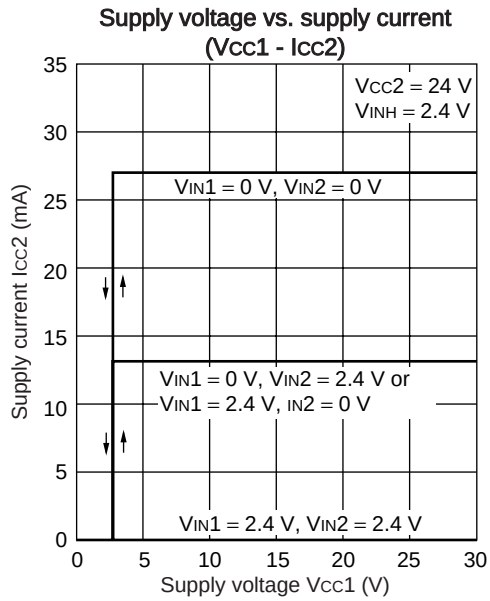
Supply voltage vs. supply current ($V_{CC2} - I_{cc1}$)



Supply voltage vs. supply current ($V_{CC2} - I_{cc2}$)

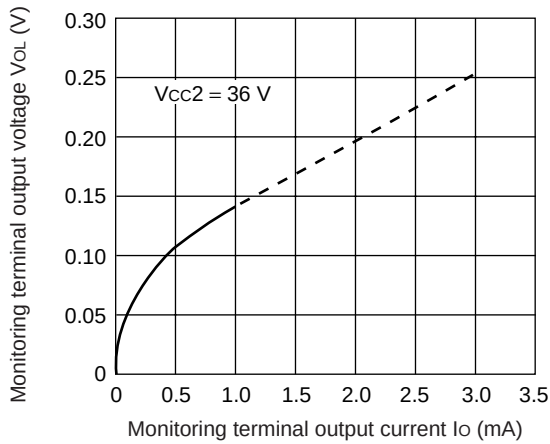


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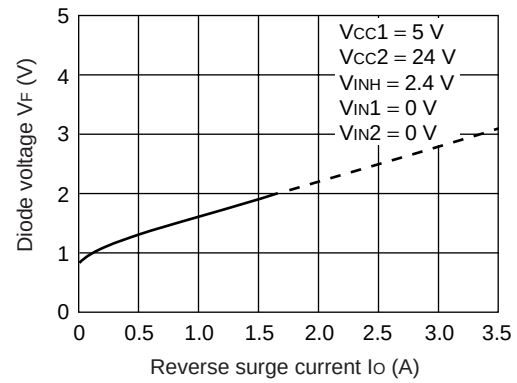


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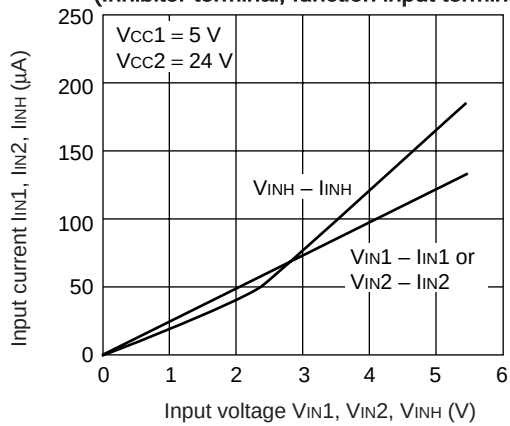
Monitoring terminal output current vs. output voltage



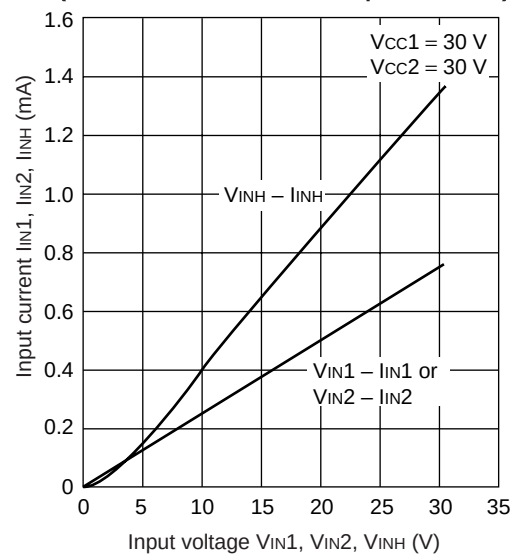
Flyback diode voltage vs. reverse surge current



Input current vs. input voltage
(Inhibitor terminal, function input terminals)

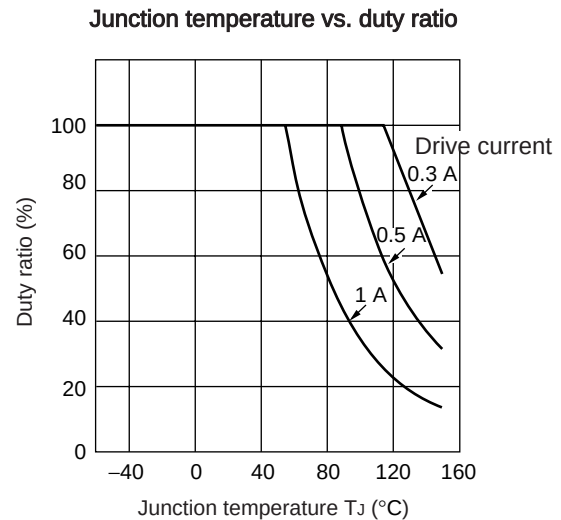
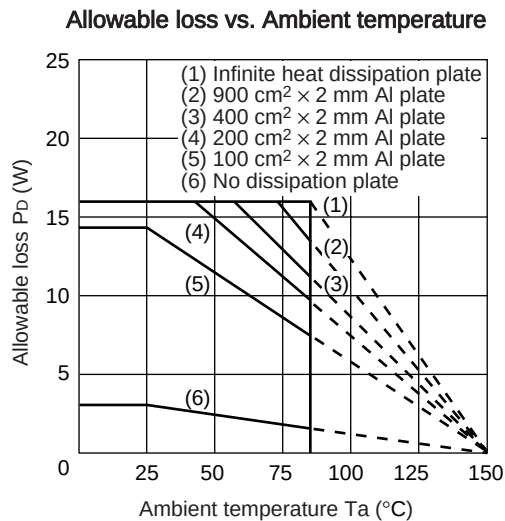


Input current vs. voltage characteristics
at maximum applied voltage
(Inhibitor terminal, function input terminals)



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Notes : • For stable operation over periods of extended usage, the duty ratio should be kept below the characteristic curve.

• Junction temperature should be maintained at $T_j \leq +150$ °C.

(T_j calculation)

$$T_j = T_c + \Delta T$$

$$\Delta T = 4 \text{ (°C/W)} \times P_{DI}$$

$$P_{DI} = V_{CC} \times I_{CC} + \Delta V_o \times I_o$$

$$\Delta V_o = (V_{CC} - V_{OH}) + V_{OL}$$

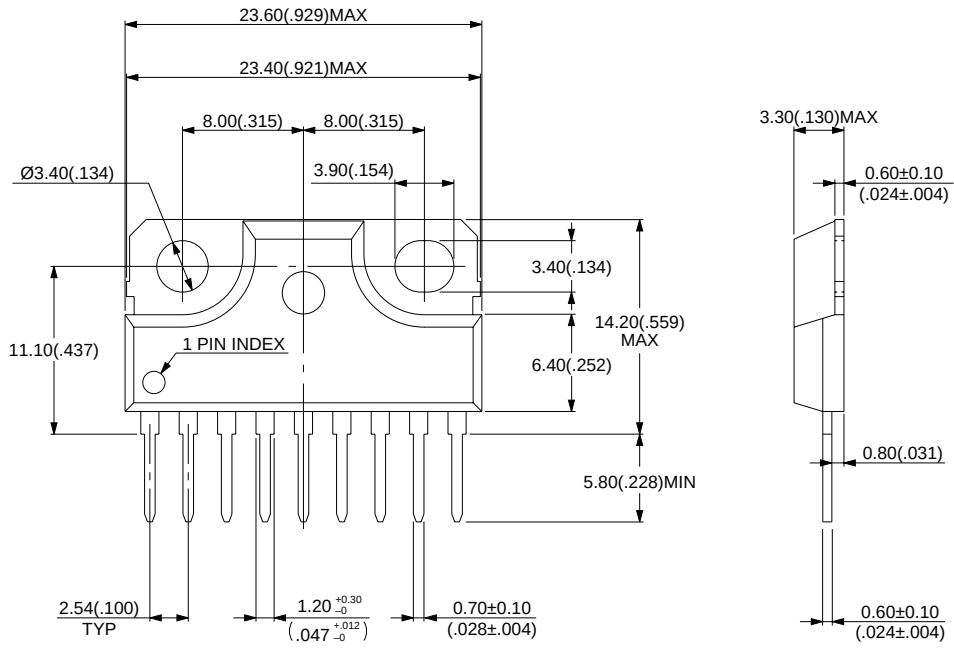
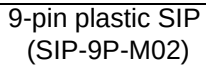
T_c : case temperature, ΔT : difference between case and junction temperature

P_{DI} : IC power consumption (W)

ORDERING INFORMATION

Part Number	Package	Remarks
MB3853PS	Plastic SIP, 9 pins (SIP-9P-M02)	

■ PACKAGE DIMENSION



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Dimensions in mm (inches) .

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