TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

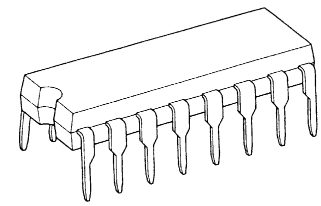
TA8083P, TA8083F

Dual DC Motor Driver

The TA8083P and TA8083F each contain two motor driver circuits with a current capacity of 0.5 A for directly driving bidirectional DC motors. Inputs DI1 A/B and DI2 A/B are combined to select one of forward, reverse, stop, and brake modes. Since the inputs are TTL-compatible, this IC can be controlled directly from a CPU or other control system.

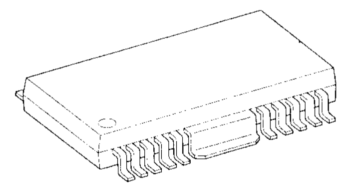
In addition, the IC also has a low standby current function, a self-diagnostic function, and various detection functions.

TA8083P



DIP16-P-300-2.54A

TA8083F



HSOP20-P-450-1.00

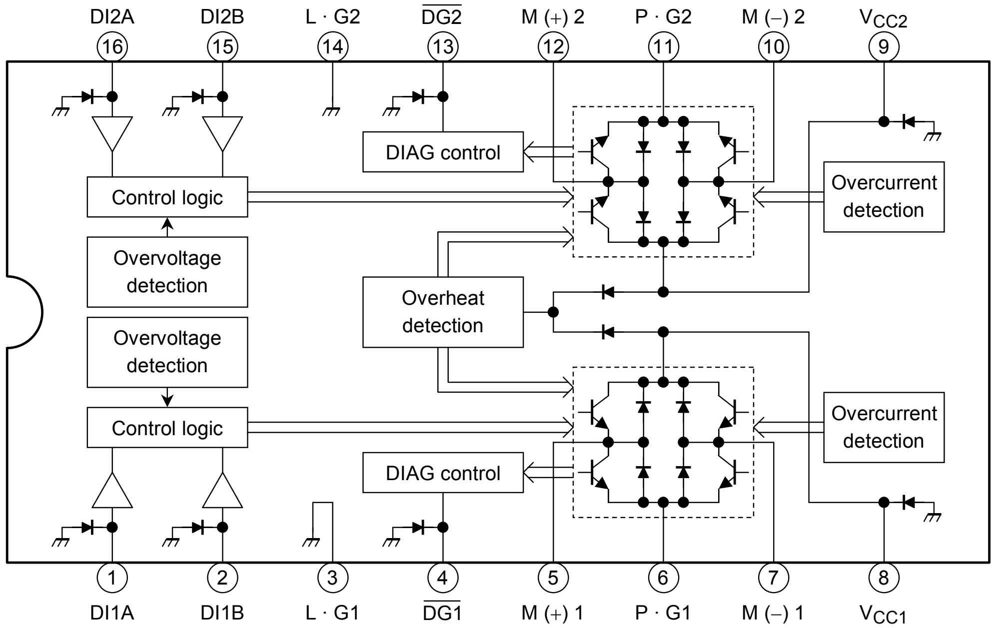
Weight
DIP16-P-300-2.54A: 1.0 g (typ.)
HSOP20-P-450-1.00: 0.79 g (typ.)

Features

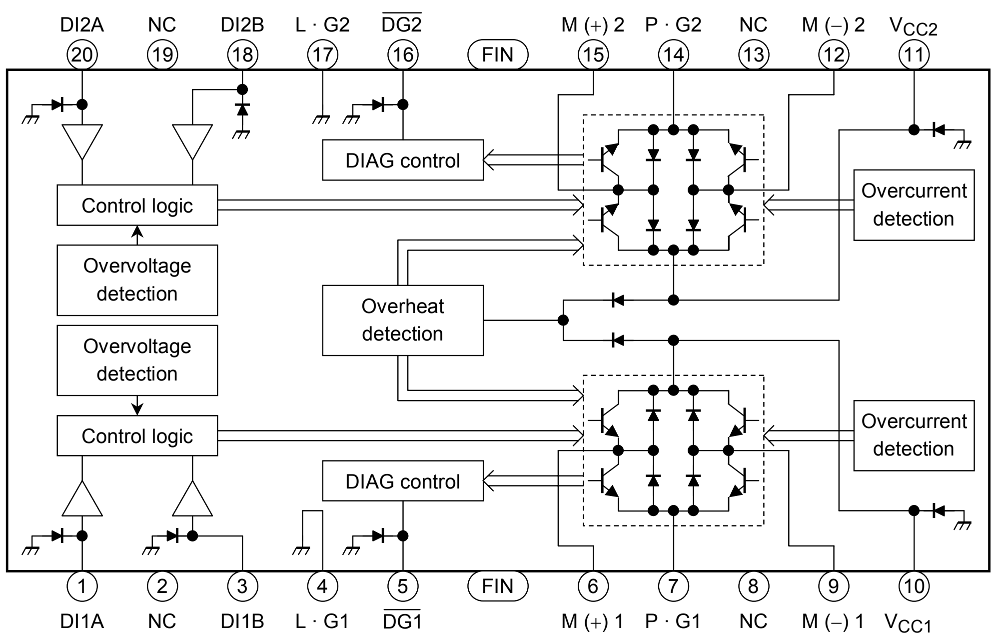
- Bidirectional DC motor driver.
- 0.5 current capacity
- Two circuits contained (power supply, self-diagnostic, and detection functions provide for each channel)
- Low standby current: 0.1 mA (max)
- Self-diagnostic output: Short-circuit mode (1 A typ.)
- Operating supply voltage range: V_{CC} = 8 V to 16 V
- Detection functions: Thermal-shutdown, short-circuit detection, and overvoltage detection
- Built-in counter electromotive force absorption diodes.
- DIP 16-pin plastic package (TA8083P)
  HSOP 20-pin power flat package (TA8083F)

Block Diagram and Pin Layout

TA8083P



TA8083F



Note 1: The TA8083P and TA8083F are the same chip; only the packages are different.

Note 2: Some of the functional blocks, circuits, or constants in the block diagram are omitted or simplified to clarify the descriptions of the relevant features.

Pin Description

Pin No.				Symbol		Description
TA8083P		TA8083F				
CH1	CH2	CH1	CH2	CH1	CH2	
1 2	16 15	1 3	20 18	DI1A DI1B	DI2A DI2B	Input pin. The signal from this pin controls the output state. (See Truth Table 1.)
3	14	4	17	L · G1	L · G2	Ground pin for Logic portion.
4	13	5	16	DG1	DG2	Self-diagnosis output pins. (See Table 2, Truth Table & Timing Chart.) NPN transistor open-collector output. When output becomes overcurrent, set to on; duty 97% on (low). At normal operation or at the time of STOP, set to open (high).
5	12	6	15	M (+) 1	M (+) 2	Connects to the DC motor. Both the sink and the source have a current capacity of 0.5 A. Features overcurrent detection function to temporarily protect IC from instantaneous destruction at load short, ground fault, or direct connection to high power. (See section on Multiple Detections below.) Features diodes for absorbing counter electromotive force built into both V_{CC} and Gnd sides.
6	11	7	14	P · G1	P · G2	Ground pin for output portion.
7	10	9	12	M (–) 1	M (–) 2	A motor is connected between this pin and the M (+) pin. This pin has a function equivalent to that of the M (+) pin, and is controlled by input to the DIA and DIB pins.
8	9	10	11	V_{CC1}	V_{CC2}	Power supply pin. This pin has a function to turn off the output when the applied voltage exceeds 30 V.
—		2, 8, 13, 19		NC		Not connected. (Electrically, this pin is completely open.)

Truth Table 1: Input/Output

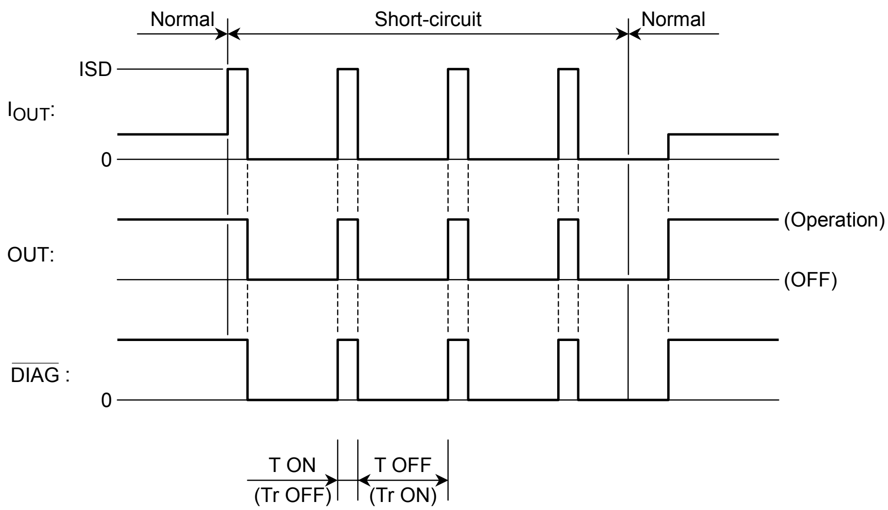
Input		Output		Operation Mode
DI1/2A	DI1/2B	M (+) 1/2	M (–) 1/2	
H	H	L	L	Brake
L	H	L	H	Reverse (CCW)
H	L	H	L	Forward (CW)
L	L	OFF (high impedance)		Stop (standby)

Truth Table 2: Self-diagnosis

Input		Output		$\overline{\text{DIAG}}$
DI1/2A	DI1/2B	Mode	Load	
H	H	Brake	Normal	H
			Short	L*
L/H	H/L	CCW/CW	Normal	H
			Short	L*
L	L	Stop	—	H

*: See timing chart.

Self-diagnosis Timing Chart



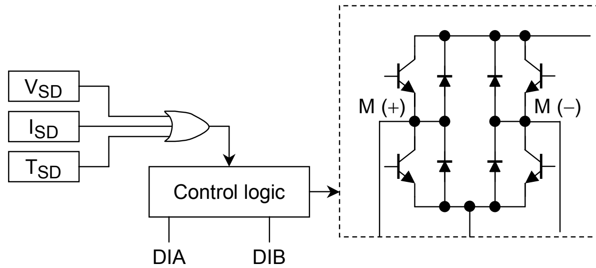
$$\frac{\text{T ON}}{\text{T ON} + \text{T OFF}} = 3\%$$

Note: Timing charts may be simplified to clarify the descriptions of features and operations.

Description of Multi-detection Operation

The TA8083P and TA8083F has functions for detecting overvoltage (V_{SD}), overcurrent (I_{SD}), and overheating (T_{SD}). These functions temporarily protect the IC (and the motor load in some cases) from deterioration or destruction due to power-related overstress.

The three functions work independently and each function is explained below.



Note 1: These functions are intended to protect the IC from instantaneous faults, including output short circuits, and are not designed to protect the IC from all types of faults.

Note 2: If the IC is used beyond the maximum ratings, it may be damaged before the detection circuits are activated.

Note 3: These functions are not activated if the operating voltage is less than 8 V. In this range, short-circuiting the output can cause damage to the IC.

1. Overvoltage detection (V_{SD})

- Basic operation

  When the voltage supplied to the V_{CC} pin is up to the V_{SD} detection voltage, the output is controlled by the input signals. However, when the V_{CC} voltage exceeds the detection voltage, the output enters high-impedance state regardless of the input signals.

- Detailed explanation

  The V_{SD} voltage is detected by an internal zener diode. If the input voltage is higher than the zener voltage, a signal to turn off the output transistors is sent to the control logic. If it is lower than the zener voltage, the logic is controlled by the input signals from DIA and DIB.

2. Overheat detection (T_{SD})

- Basic operation

  When the junction (chip) temperature is up to the T_{SD} detection temperature, the output is controlled by the input signals. When it exceeds the T_{SD} detection temperature, the output enters high-impedance state regardless of the input signals.

- Detailed explanation

  The temperature is detected by monitoring the V_F of a diode on the chip. When the diode V_F is lower than the internal reference voltage, a signal to turn off the output transistors is sent to the control logic. When it is higher than the internal reference voltage, the logic is controlled by the input signals from DIA and DIB.

3. Overcurrent detection (I_{SD})

- Basic operation

  When the output current (M (+) or M (–), Isink or Isource) is up to the I_{SD} detection current, the output is controlled by the input signals. When it exceeds the detection current, the output assumes a switching waveform as shown in Figure 1.

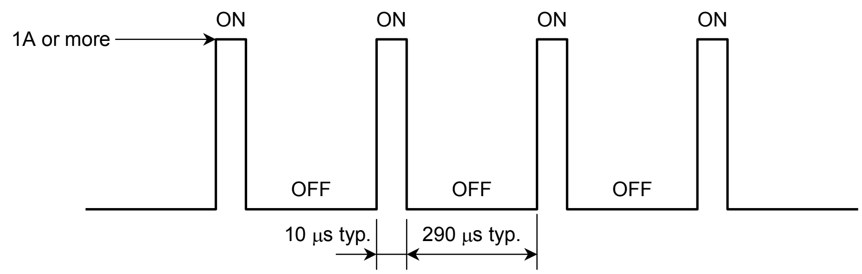


Figure 1: Basic operation

- Detailed explanation

  The output current is detected by monitoring the sense resistance. One detection circuit connects to one of the circuits (CH1 or CH2) and leads to the short-circuit detection circuit. When a current exceeding the I_{SD} detection current flows through one of the four output transistors, the short-circuit detection circuit is activated. This circuit contains a timer. When an overcurrent condition continues for 10 μs (typically), the detection circuit places the output in high-impedance mode and, 290 μs (typically) later, returns the IC to ON mode. The switching-waveform output is repeated until the overcurrent condition is no longer present.

- Caution for application

  The overcurrent detection is intended to protect the IC temporarily from overcurrent conditions due to short circuits. If an overcurrent condition continues after the output transistors move to switching mode, damage can occur due to overstress. To prevent this, a system must be configured so that the IC is switched into standby mode immediately after an overcurrent condition is detected by the DIAG output. In this case, the time that it takes to detect an overcurrent fault caused by short circuit to output (or to supply or ground) and to place the IC to the standby mode should be within one second.

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CC}	30	V
	V_{CC}	60 (1 s)	
Input voltage	V_{IN}	−0.3 to V_{CC} + 0.3	V
Output current	I_O · AVE	0.5	A
Power dissipation	P_D	1.4/2	W
Operating temperature	T_{opr}	−40 to 110	°C
Storage temperature	T_{stg}	−55 to 50	°C

Note 1: The absolute maximum ratings of a semiconductor device are a set of specified parameter values which must not be exceeded during operation, even for an instant.

If any of these levels is exceeded during operation, the device's electrical characteristics may be irreparably altered and the reliability and lifetime of the device can no longer be guaranteed, possibly causing damage to any other equipment with which it is used. Applications using the device should be designed such that the maximum ratings will never be exceeded in any operating conditions.

Ensuring that the parameter values remain within these specified ranges during device operation will help to ensure that the integrity of the device is not compromised.

Note 2: P_D: TA8083P/TA8083F
TA8083F: On board condition. (50 × 50 × 1.6 mm 50% Cu)

HSOP20-P-450-1.00 Thermal Resistance Data (Ta = 25°C)

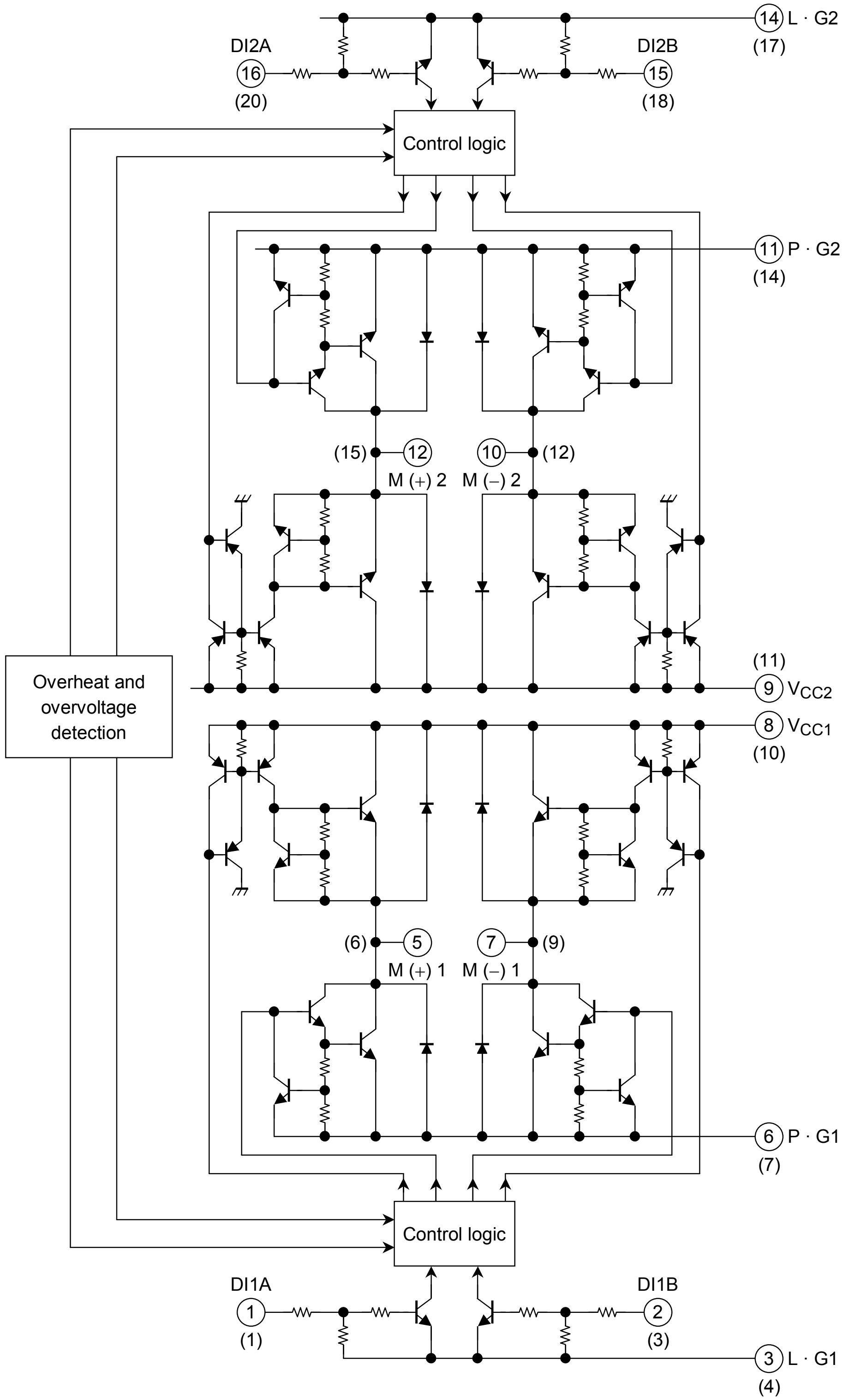
Characteristics	Test Condition	Rating	Unit
Rθ j-a	—	125	°C/W
Rθ j-c	—	13	°C/W
PD1	Infinite radiation board	9.6	W
PD2	50 × 50 × 1.0 mm iron board mounted	3.2	W
PD3	50 × 50 × 1.6 mm 50% Cu mounted	2.0	W
PD4	No radiation board	1.0	W

Electrical Characteristics (V_{CC} = 8 to 16 V, Tc = −40 to 110°C)

Characteristics	Symbol	Pin	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Power supply current	I_{CC1}	V_{CC1}/V_{CC2}	—	CH1 + CH 2: Stop	—	—	0.1	mA
	I_{CC2}		—	CH1 or CH 2: CW or CCW	—	20	30	
	I_{CC3}		—	CH1 + CH 2: CW or CCW	—	40	60	
	I_{CC4}		—	CH1 + CH 2: Brake	—	20	32	
Input voltage	V_{IL}	DI1A/B/ DI2A/B	—		—	—	0.8	V
	V_{IH}		—		2.0	—	—	
Input current	V_{IL}	DI1A/B/ DI2A/B	—	V_{IN} = 0.4 V	—	10	20	μA
	V_{IH}		—	V_{IN} = 5 V	—	300	600	
Output saturation voltage	$V_{SAT\ (total)}$	M (+)/(−) 1/ M (+)/(−) 2	—	I_O = 0.4 A, Tc = 25°C	—	1.8	2.5	V
			—	I_O = 0.4 A, Tc = 110°C	—	1.7	2.4	
Output leakage current	I_{LEAK-U}	M (+)/(−) 1/ M (+)/(−) 2	—	V_{OUT} = 0 V	−10	—	—	μA
	I_{LEAK-L}		—	$V_{OUT} = V_{CC}$	—	—	10	
Diode forward voltage	V_{F-U}	M (+)/(−) 1/ M (+)/(−) 2	—	I_F = 0.4 A	—	1.5	—	V
	V_{F-L}		—		—	1.5	—	
Output voltage	V_{OL}	$\overline{DIAG}$ 1/ 2	—	I_{OL} = 3 mA	—	—	0.5	V
Output leakage current	I_{LEAK}	$\overline{DIAG}$ 1/ 2	—	$V_{OUT} = V_{CC}$	—	—	10	μA
Overcurrent detection	I_{SD}		—		—	1.0	—	A
Shutdown temperature	T_{SD}		—		—	150	—	°C
Overvoltage detection	V_{SD}		—		—	30	—	V
Transfer delay time	t_{pLH}		—		—	1	10	μs
	t_{pHL}		—		—	1	10	

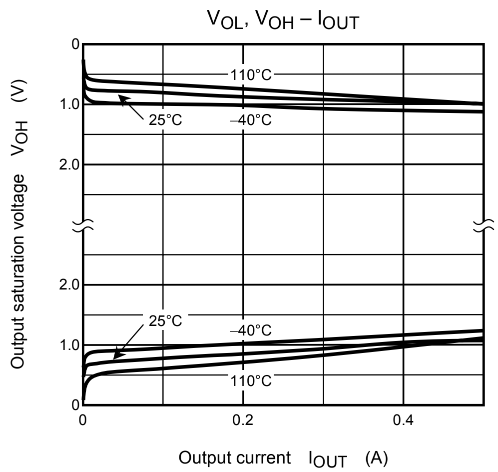
Note: The parameter values above are guaranteed in the operating voltage range of 8 V to 16 V. If the guaranteed range is exceeded, the performance of the IC must be tested thoroughly in its application. It is the customer’s responsibility to evaluate the use of the IC.

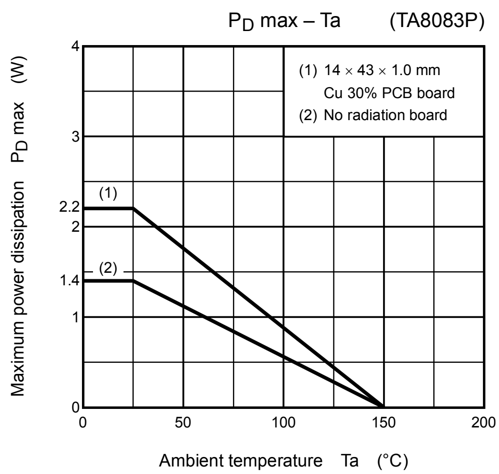
I/O Equivalent Circuit (numbers in ○ show the pin number of the TA8083P, those in ( ) show the pin number of the TA8083F.)

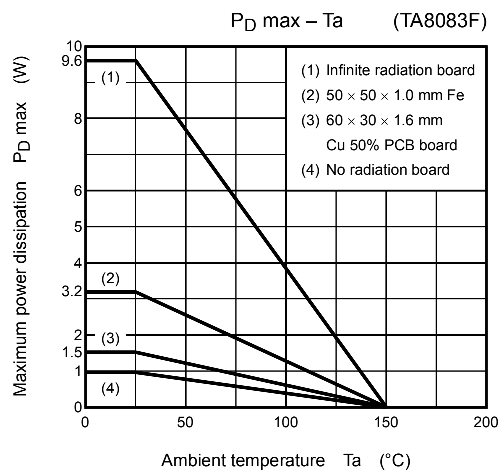


Note: The equivalent circuit diagrams may be simplified or some parts of them may be omitted for explanatory purposes.

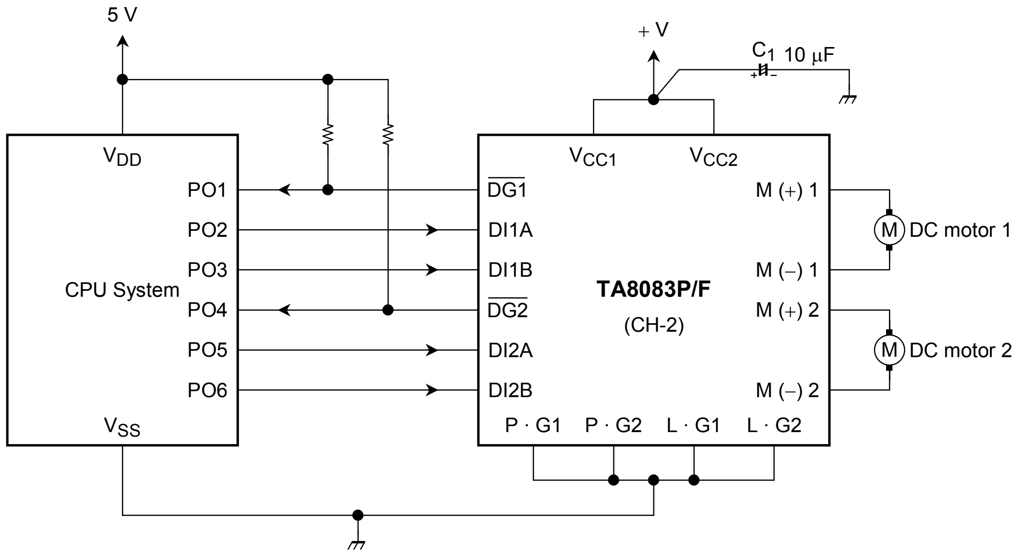
Reference Characteristics







Application Circuit



Caution for Wiring

Note 1: The capacitors C1 are for absorbing disturbance noise, etc.

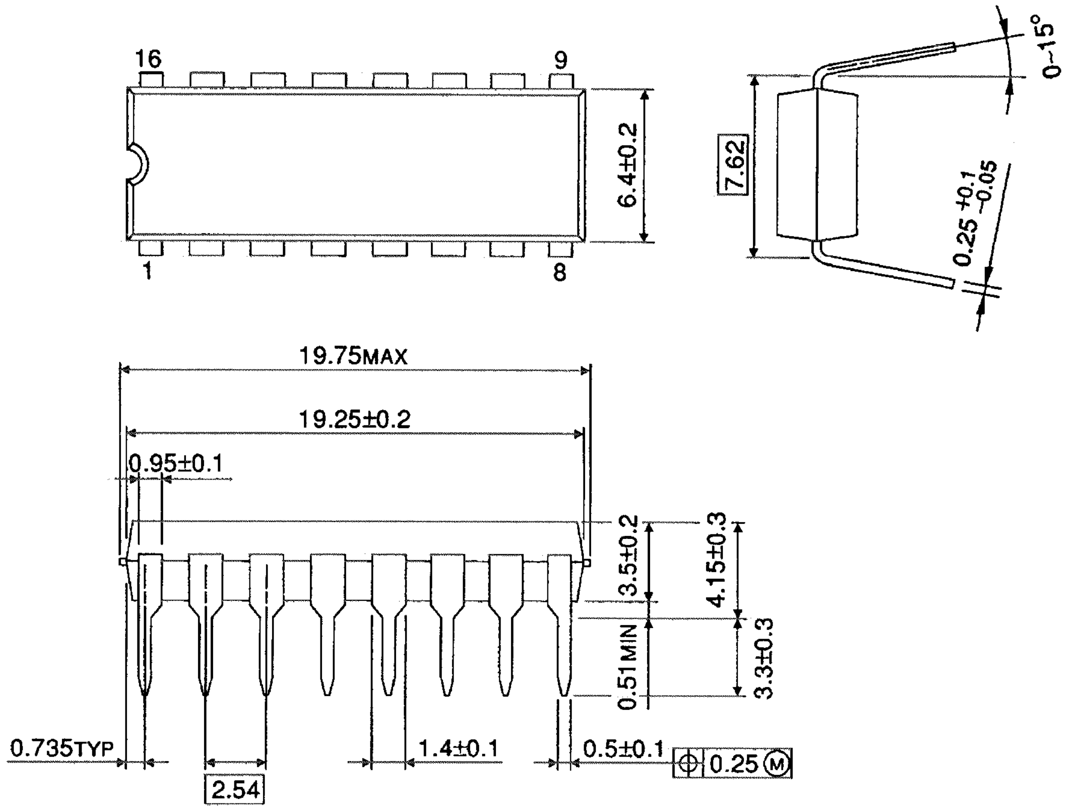
Note 2: Connect each capacitor as close to the IC as possible.

Note 3: Ensure that the IC is mounted correctly. Failing to do so may result in the IC or target equipment being damaged.

Note 4: The application circuit shown above is not intended to guarantee mass production. A thorough evaluation is required when designing an application circuit for mass production.

Package Dimensions

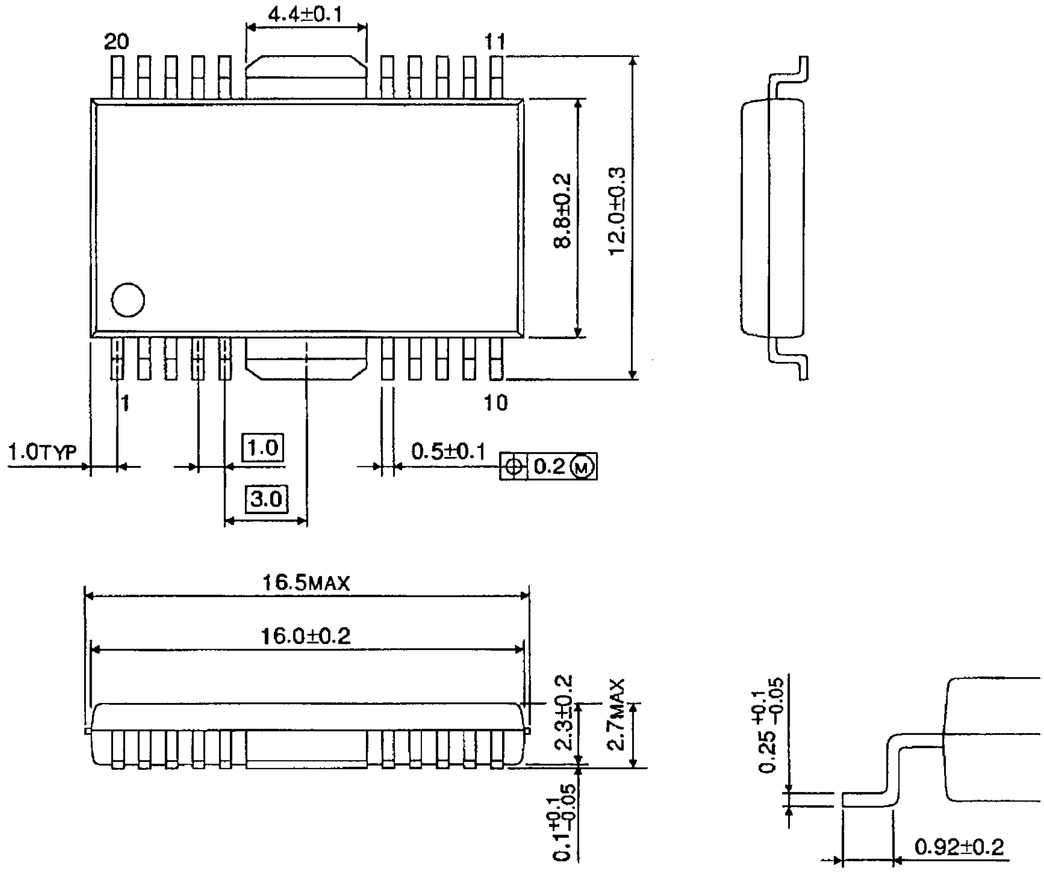
DIP16-P-300-2.54A Unit : mm



Weight: 1.0 g (typ.)

Package Dimensions

HSOP20-P-450-1.00 Unit : mm



Weight: 0.79 g (typ.)

RESTRICTIONS ON PRODUCT USE