

Unipolar Driver ICs

SI-7300A and SI-7330A

■ Ratings

(Ta = 25°C)

| Type No. | Supply voltage (V) | | Output current (A) | Junction temperature (°C) | Operating ambient temperature (°C) | Storage temperature (°C) |
|----------|-----------------------|------|--------------------------|---------------------------------|--|--------------------------------|
| | Vcc1 | Vcc2 | Io | Tj | Top | Tstg |
| SI-7300A | 48 | 8 | 1.7 | +125 | -20 to +80 | -30 to +100 |
| SI-7330A | 42 | 8 | 3.2 | +125 | -20 to +80 | -30 to +100 |

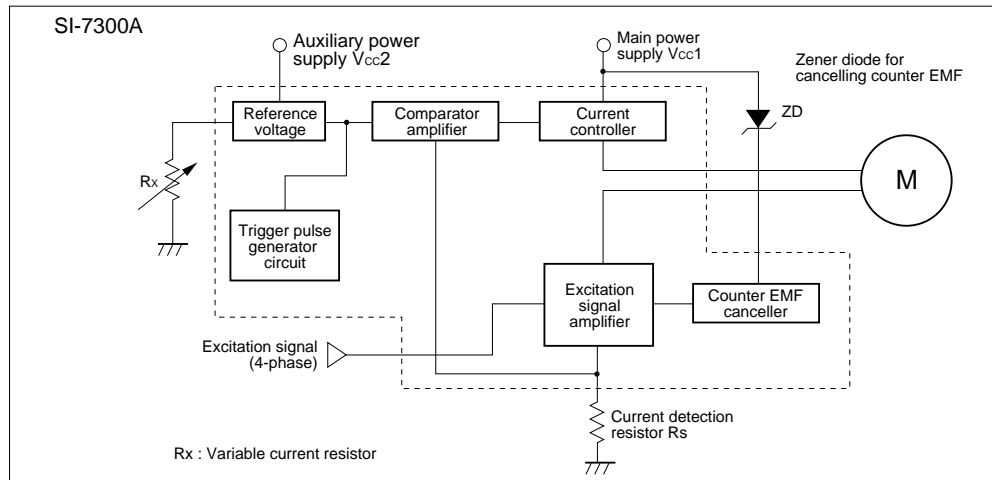
■ Characteristics

(Ta = 25°C)

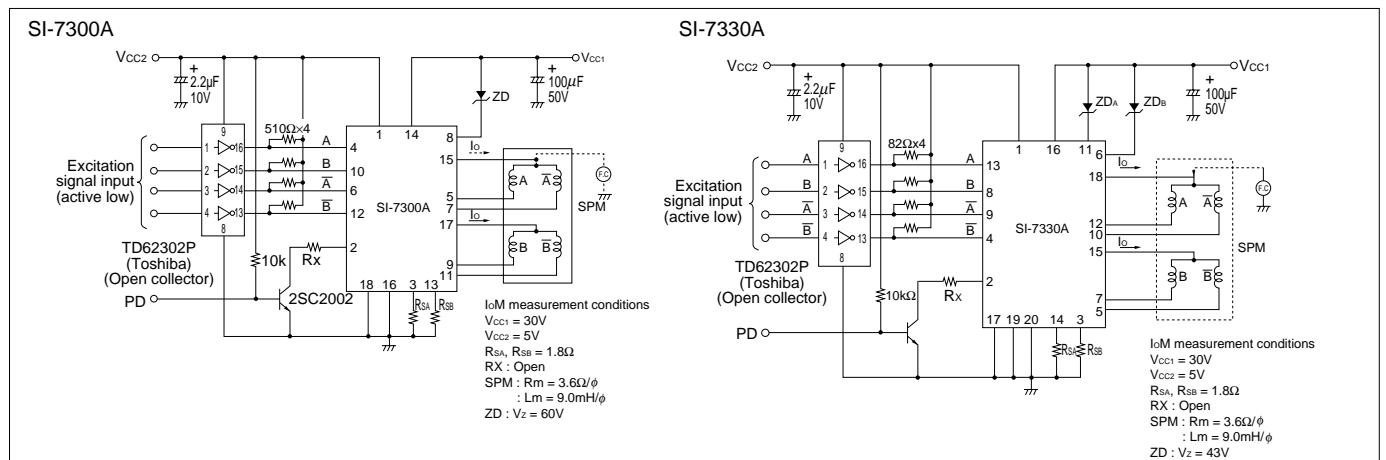
| Electrical charac- teristics | Supply voltage | | | | | | Output current | | | | | | Vcc2 input current | | | Oscillation frequency | | | External zener diode breakdown voltage | | Input excitation signal (active high) | | | | | | | | | | | |
|------------------------------------|----------------|-----|-----|------|-----|-----|----------------|------|------|-----|-----|-----|-----------------------|-----|-----|--------------------------|-----|-----|---|-----|---------------------------------------|-----------------------|---------------|-----|---------------|-----|-------------------------------|-----|---------------|--|--|--|
| | | | | | | | | | | | | | | | | | | | | | Input voltage (V) | | | | | | High level input current (mA) | | | | | |
| | (V) | | | | | | (mA/ø) | | | | | | (mA) | | | (kHz) | | | (V) | | Low level (OFF) | High level (ON) | Io= 0.5A/ø | | Io= 1.0A/ø | | Io= 1.5A/ø | | Io= 3.0A/ø | | | |
| | Vcc1 | | | Vcc2 | | | Io | | Iom* | | | | Icc2 | | | F | | | Vz | | VIL | VIH | IIH | | IIH | | IIH | | IIH | | | |
| Type No. | min | typ | max | min | typ | max | min | max | min | typ | max | max | min | typ | max | min | max | max | typ | min | max | min | max | min | max | min | max | min | max | | | |
| SI-7300A | 15 | 30 | 42 | 4.5 | 5 | 5.5 | 200 | 1500 | 535 | 580 | 625 | 45 | 19 | 21 | 25 | Vcc1 +5 | 70 | 0.8 | 2.8 | 2.2 | 10.0 | 3.0 | 10.0 | 4.9 | 10.0 | | | | | | | |
| SI-7330A | 15 | 30 | 35 | 4.5 | 5 | 5.5 | 200 | 3000 | 535 | 580 | 625 | 45 | 19 | 21 | 25 | Vcc1 | 43 | 0.3 | 1.8 | 5 | 100 | | | 15 | 100 | 40 | 100 | | | | | |

* Measurement conditions are as shown in the external connection diagram.

■ Block diagram

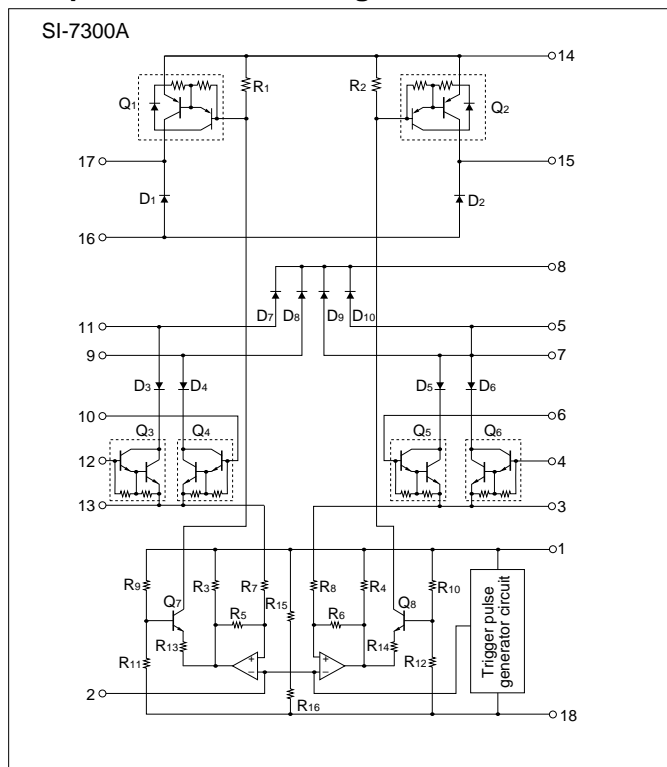


■ External connection diagram

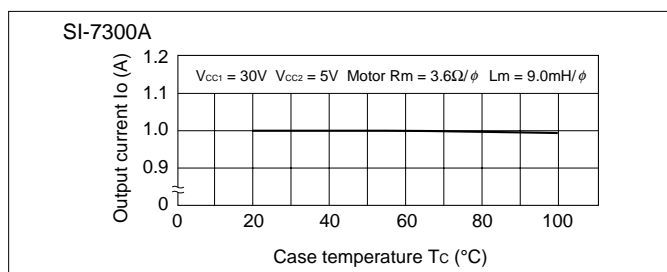


SI-7300 and SI-7330A

■ Equivalent circuit diagram

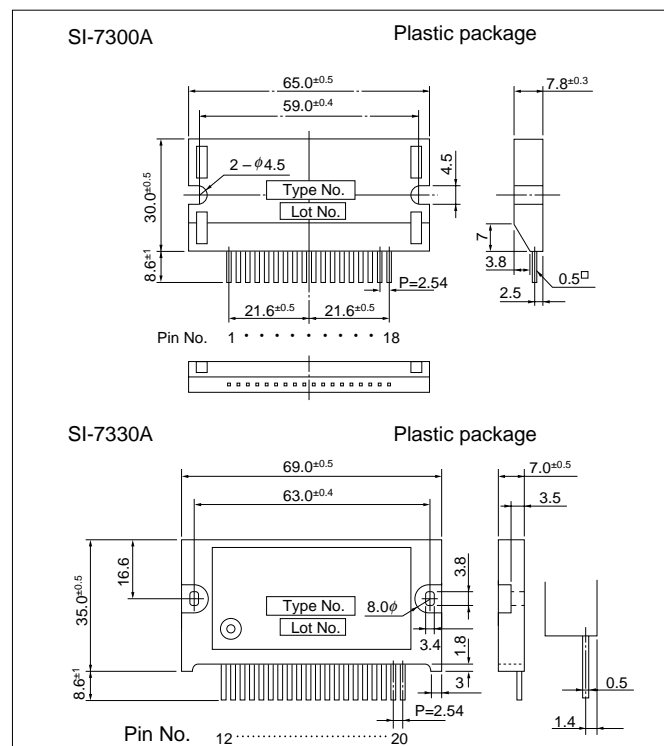


■ Case temperature vs. Output current

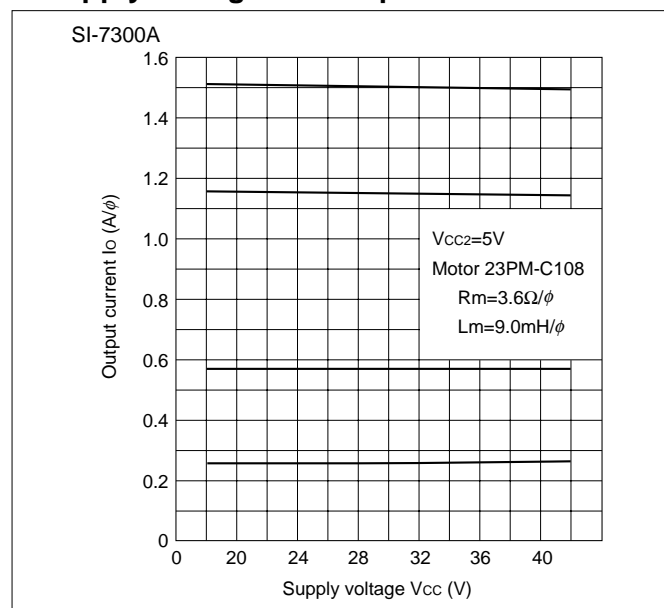


■ External dimensions

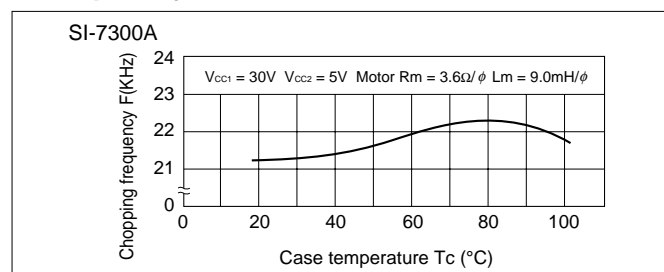
(Unit: mm)



■ Supply voltage vs. Output current



■ Case temperature vs. Chopping frequency



SI-7300 and SI-7330A

Application Note

■ Determining the output current I_o (motor coil current)

The output current, I_o is fixed by the following circuit elements:

- R_s : Current detection resistor
- V_{CC2} : Supply voltage
- R_x : Variable current resistor

To operate a motor at maximum current level, set $R_x =$ infinity (open). Based on the specifications of SI-7300A, its output current I_o can be seen as:

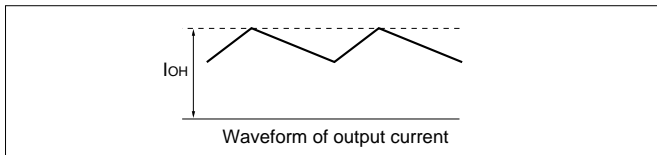
I_o (rms value): 535 to 625 mA

To compute I_o when different values are used for R_s and V_{CC2} , use the approximation formula below. The maximum ripple value I_{OH} of the output current waveform can be computed as follows:

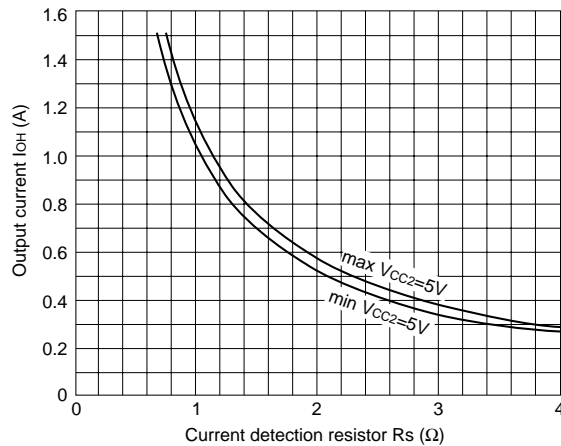
$$I_{OH(max)} \approx \frac{1}{R_s} (0.233 \cdot V_{CC2} - 0.026) \text{ [A]}$$

$$I_{OH(min)} \approx \frac{1}{R_s} (0.214 \cdot V_{CC2} - 0.021) \text{ [A]}$$

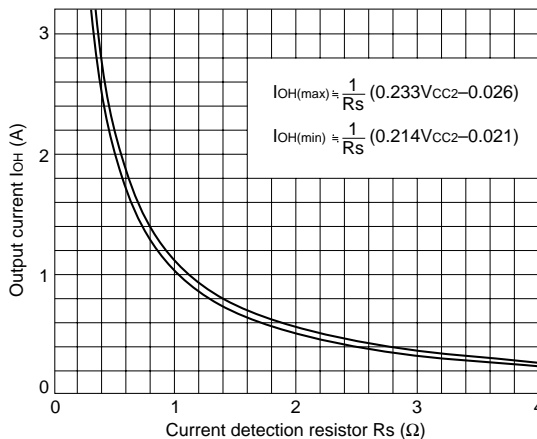
The graph of this equation is shown below.



SI-7300A Output current I_{OH} vs. Current detection resistor R_s

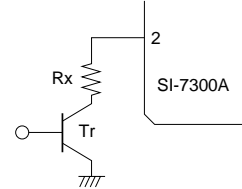


SI-7330A Output current I_{OH} vs. Current detection resistor R_s

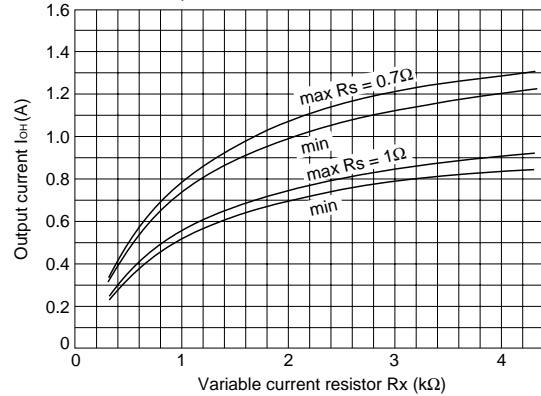


■ Power down mode

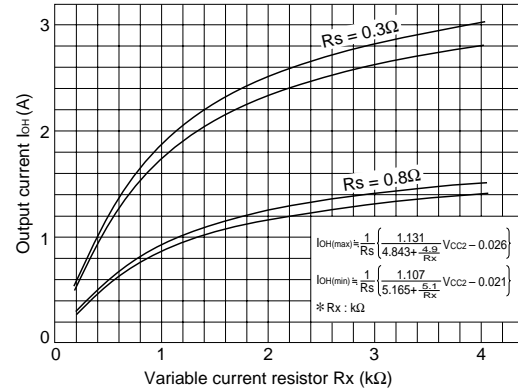
The SI-7300A can be operated in power down mode. The circuit is shown below. When transistor Tr is switched on, the reference voltage drops and the output current can be decreased.



SI-7300A Output current I_{OH} vs. Variable current resistor R_x



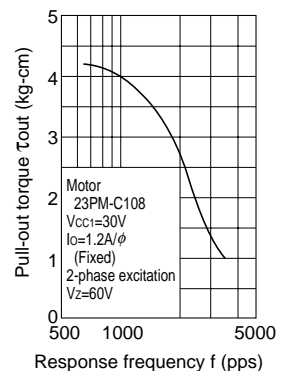
SI-7330A Output current I_{OH} vs. Variable current resistor R_x



■ Example of a Frequency vs. Torque characteristic

The graph shows the relationship between frequency and pull-out torque of SI-7300A.

SI-7300A Pull-out torque T_{out} vs. Response frequency



Application Note

■ Thermal design

The procedures for the thermal design of the SI-7300A are as follows:

- (1) As shown in the right figure, the supply current I_{CC1} and the output current I_o are measured at the maximum level of the supply voltage V_{CC1} . However, the motor is in holding mode at the 2-phase excitation.
- (2) From the above measurements, the internal power dissipation (2 phases) of the hybrid IC can be obtained through the following formula.

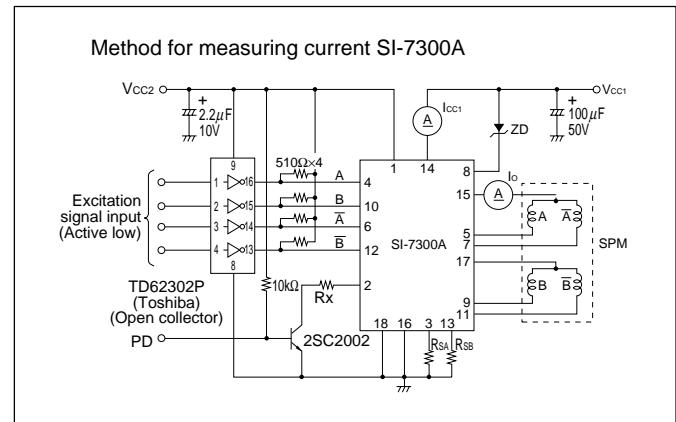
$$P_{diss} = V_{CC1} \cdot I_{CC1} - 2I_o^2(R_L + R_S)$$

Where R_L : coil resistance of the motor per phase

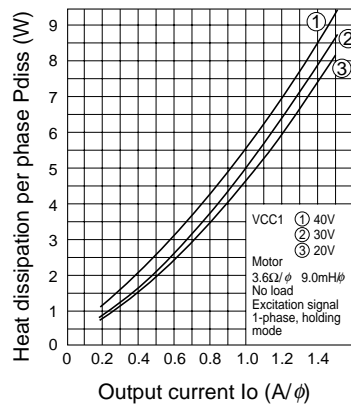
Shown in the lower graphs are sample calculations of P_{diss} vs. I_o .

- (3) The heatsink area corresponding to the ambient temperature can be obtained from the SI-7300A derating curve shown in the lower right.
- (4) Verify that the temperature of the aluminum base plate of the hybrid IC or adjacent heatsinks is below 85°C (equivalent to max. ambient temperature) when operating under actual conditions.

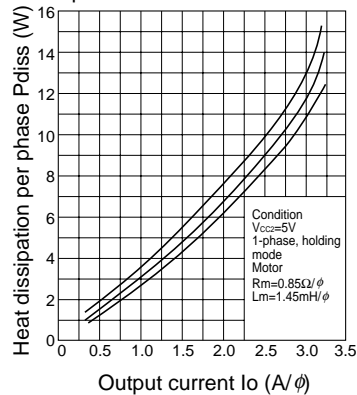
* For details on thermal design, refer to the technical data.



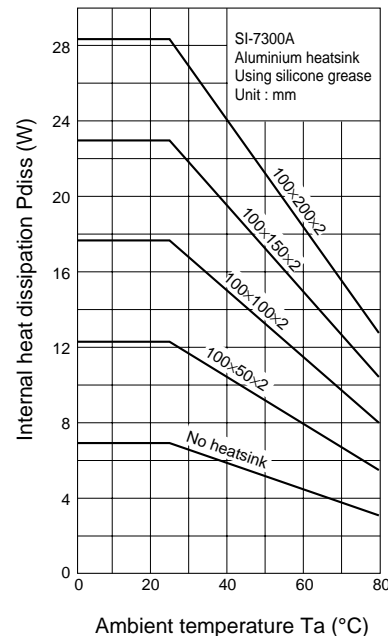
SI-7300A Heat dissipation per phase vs. output current



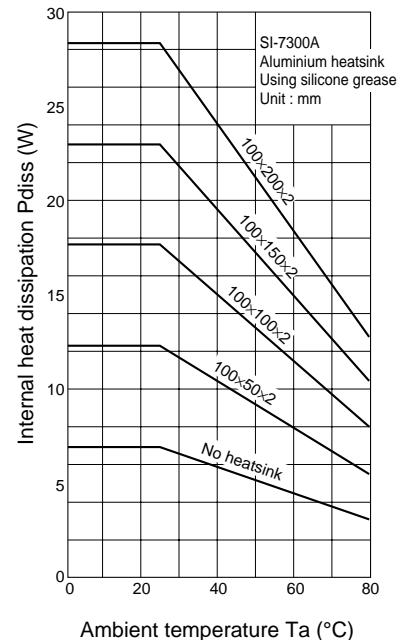
SI-7330A Heat dissipation per phase vs. output current



SI-7300A Derating curve



SI-7330A Derating curve



SI-7200M, SI-7230M, SI-7115B, SI-7300A, SI-7330A, SI-7500A and SI-7502

Handling Precautions

(Note: The SI-7502 is applicable for item (2) only.)

For details, refer to the relevant product specifications.

(1) Tightening torque:

The torque to be applied in tightening screws when mounting the IC on a heatsink should be below 49N•m.

(2) Solvent:

Do not use the following solvents:

| | |
|--------------------------------------|--|
| Substances that dissolve the package | Chlorine-based solvents : Trichloroethylene, Trichloroethane, etc. Aromatic hydrogen compounds: Benzene, Toluene, Xylene, etc. Ketone and Acetone group solvents |
| Substances that weaken the package | Gasoline, Benzine and Kerosene |

(3) Silicone grease:

The silicone grease to be used between the aluminum base plate of the hybrid IC and the heatsink should be any of the following:

- G-746 SHINETSU CHEMICAL INDUSTRIES CO., LTD.
- YG6260 TOSHIBA SILICONE CO., LTD.
- SC102 DOW CORNING TORAY SILICONE CO., LTD.

Please pay sufficient attention in selecting silicone grease since oil in some grease may penetrate the product, which will result in an extremely short product life.

Others

• Resistance against radiation

Resistance against radiation was not considered in the development of these ICs because it is assumed that they will be used in ordinary environment.