Unipolar Driver ICs

SI-7115B

■ Characteristics

(Ta = 25°C)

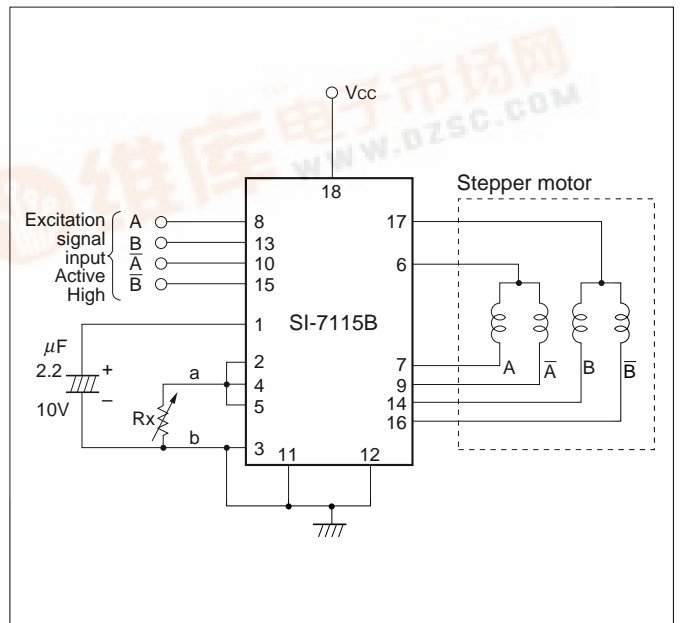| Parameter	Absolute maximum rating					Electrical characteristics									Phase switching signal input			
	Applied voltage	Output current	Junction temperature	Operating ambient temperature	Storage temperature	Supply voltage Vcc(V)			Output current Io(A)		Input current Iin(mA)		Oscillation frequency f (kHz)		ON			OFF
Type No.	Vsurge(V)	Io(A/ø)	Tj(°C)	Top(°C)	Tstg(°C)	min	typ	max	min	max	min	max	min	max	Output current (A/ø)	Input voltage (V)min	Input current (mA)min	Input voltage (V)max
SI-7115B	40	1.7	125	−20 to +80	−30 to +100	20	24	30	0.2	1.5		5.0	19	24	0.2	2.7	1.0	0.8
															0.5	3.1	1.2	
															1.0	3.6	1.4	
															1.5	4.5	2.0	

■ Block diagram
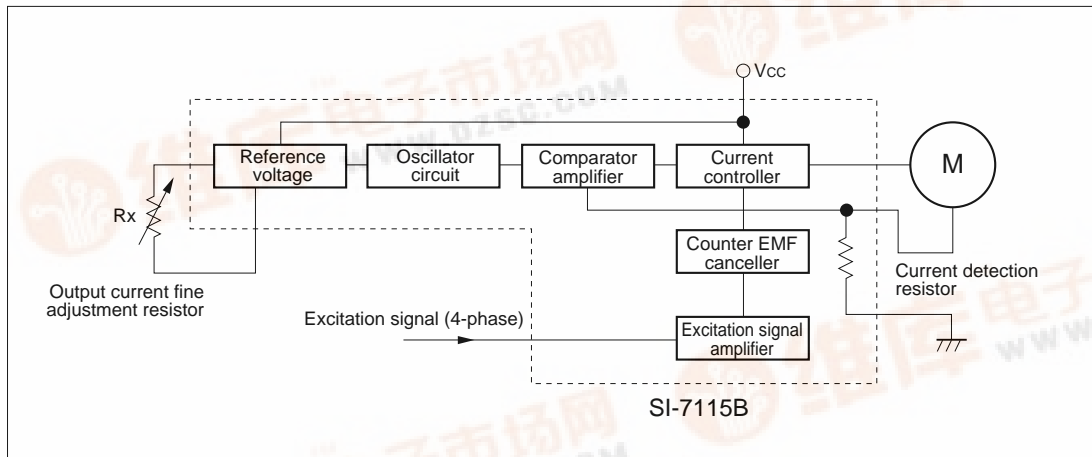
■ Equivalent circuit diagram
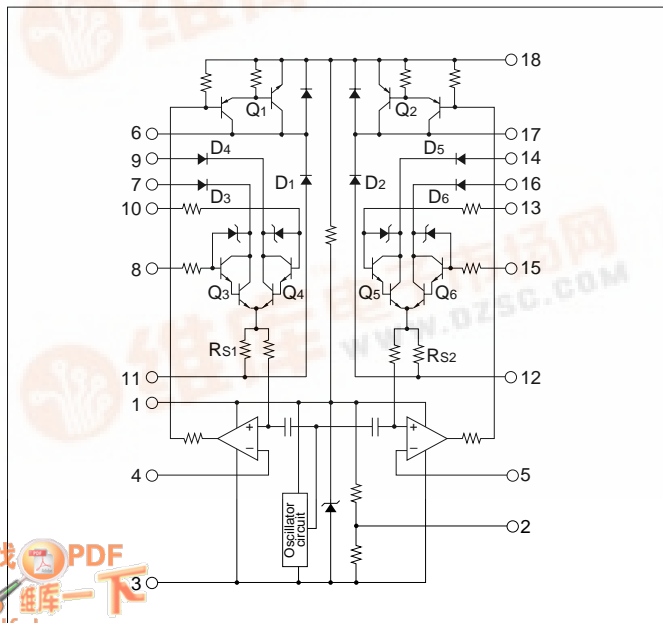
■ External connection diagram

SI-7115B

■ External dimensions

(Unit: mm)

Plastic package

Dimensions of SI-7115B pins

11.5±1

4

0.4

4.0

71.7±0.5

60.3±0.4

39.6±0.5

Type No.

Lot No.

φ3.4

8.0

11.5±1

0.5

43.2

P=2.54

1 2 3 · · · · · · · · · 18

9.0±0.6

Aluminum plate
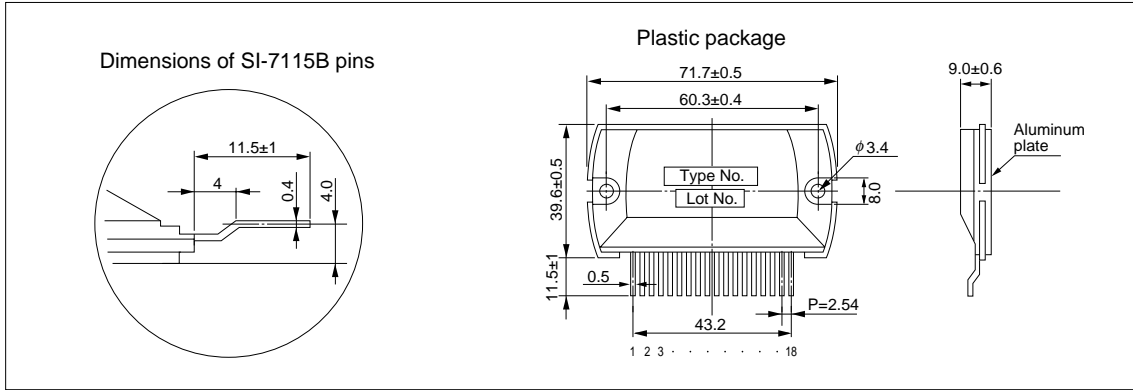
Application Note

■ Determining the output current Io (motor coil current)

The output current Io can be set to any value by connecting an external resistor Rx across pin 3 and all of pins 2, 4 and 5. Fig. A, B and C show the relationship between the external resistor and the output current, the supply voltage and the output current, and the output current and the temperature, respectively.

Output current Io

Output current Io	Rx
0.31 to 0.39 (A/ø)	200 (Ω)
0.95 to 1.05 (A/ø)	1.4 (kΩ)

Condition Vcc = 24V, Ta = 25°C
2-phase excitation
Holding mode
Motor: 23PM-C109
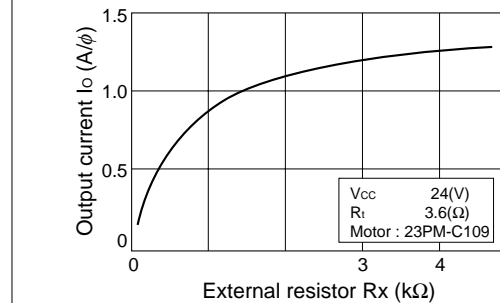
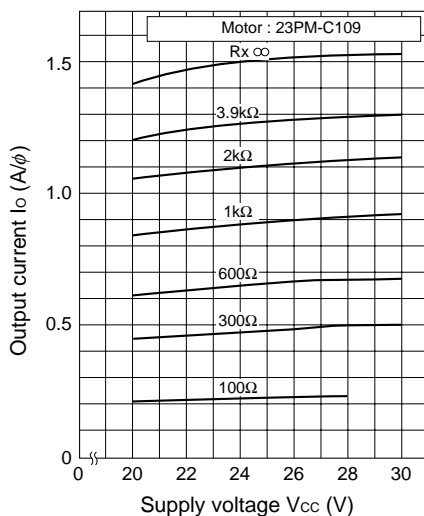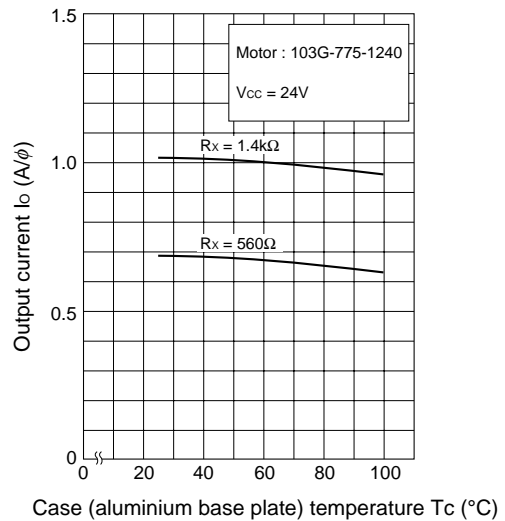Fig. A SI-7115B External resistor vs. Output current

Output current Io (A/ø)

1.5

1.0

0.5

0

0   3   4

External resistor Rx (kΩ)

Vcc   24(V)
Rt   3.6(Ω)
Motor : 23PM-C109

Fig. B SI-711B Supply voltage vs. Output current

Motor : 23PM-C109

Rx ∞

3.9kΩ

2kΩ

1kΩ

600Ω

300Ω

100Ω

Output current Io (A/ø)

1.5

1.0

0.5

0

0   20   22   24   26   28   30

Supply voltage Vcc (V)

Fig. C SI-7511B Output current vs. Temperature

Motor : 103G-775-1240

Vcc = 24V

Rx = 1.4kΩ

Rx = 560Ω

Output current Io (A/ø)

1.5

1.0

0.5

0

0   20   40   60   80   100

Case (aluminium base plate) temperature Tc (°C)
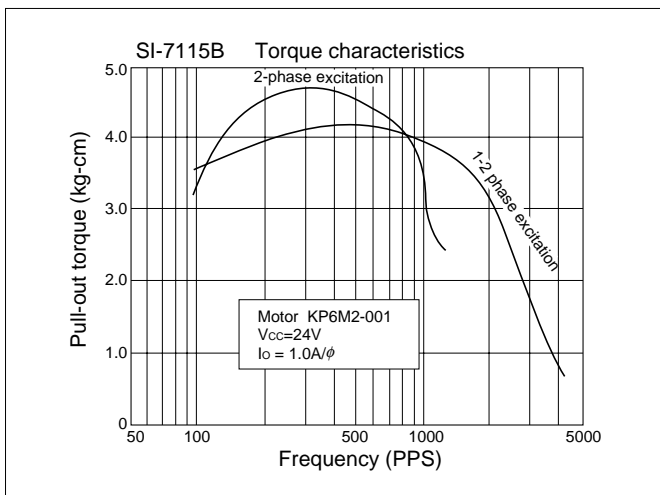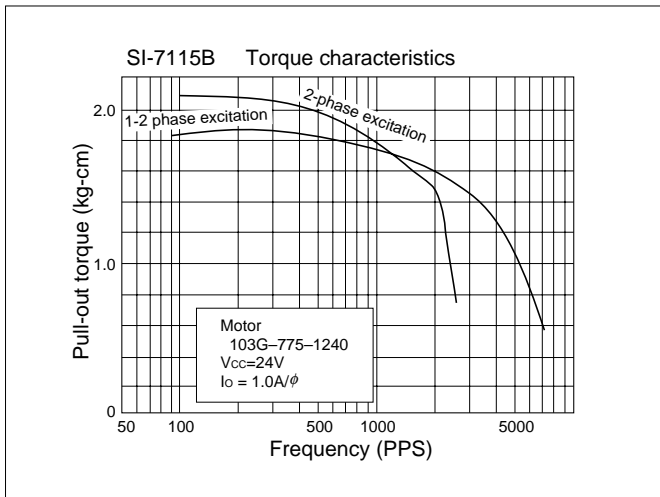
Application Note

■ **Power down mode**

The SI-7115B can be operated in power down mode. The circuit is shown below.

As shown in the figure, when the power down transistor is switched on, (Ry is power down resistor) R_X/R_Y becomes a current fixing resistance and the current during power down mode can be obtained by substituting this resistance to R_X in the previous Fig. A.

Power down circuit

Power down Transistor T_R
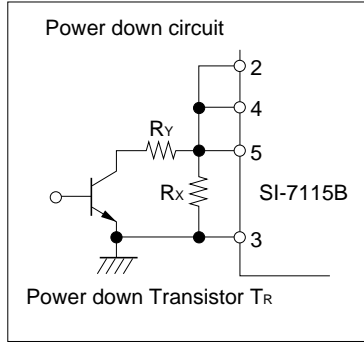
■ **Example of Frequency vs. Torque characteristics**

The following two graphs show the relationship between frequency (pps) and pull-out torque (kg - cm) of SI-7115B when used with two types of motor.

SI-7115B   Torque characteristics

Motor
103G–775–1240
Vcc=24V
Io = 1.0A/ϕ

SI-7115B   Torque characteristics

Motor KP6M2-001
Vcc=24V
Io = 1.0A/ϕ

■ **Thermal design**

In SI-7115B, the avalanche diode of the phase-switching transistor is operated in breakdown condition and the energy built up in the inductance of the motor coil is dissipated as heat of the transistor. Hence, when the motor rotates, the internal heat dissipation increases compared with when the motor is stopped.

Therefore, the internal heat dissipation of 7115B can be computed from the data taken with actual load through the following procedures.
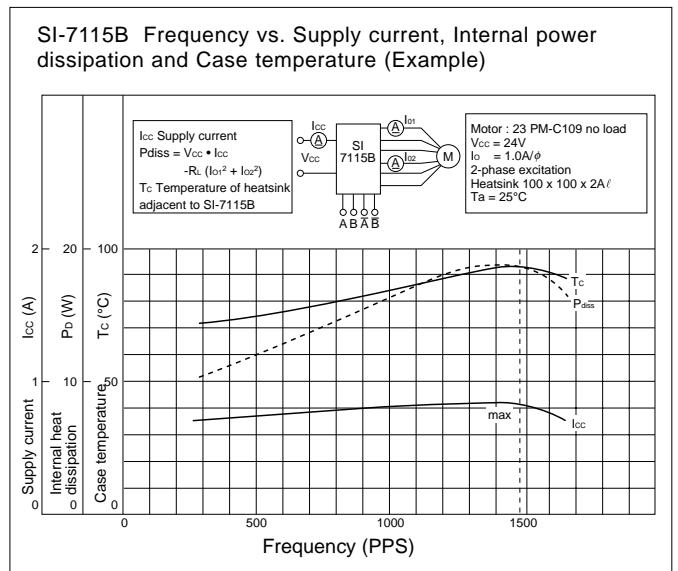
(1) Vary the rotation speed of the motor within the actual operating range in a circuit under actual load conditions and measure the supply current Icc and the corresponding output current I_{o1} and I_{o2}.

Method for measuring current
(circuit under actual load conditions)
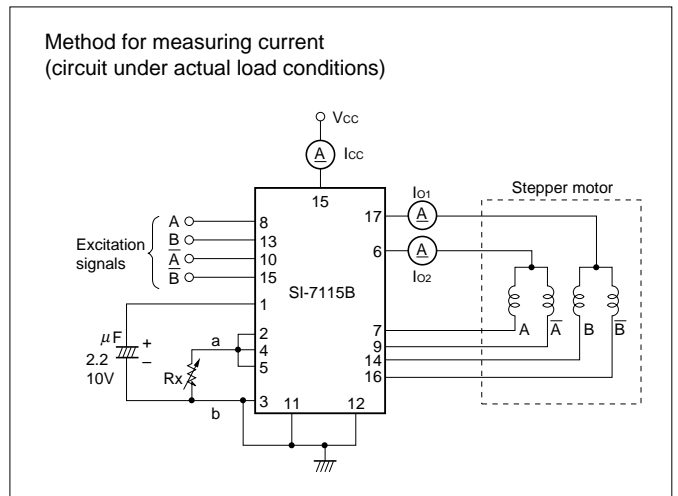
(2) Obtain the internal power dissipation Pdiss (4-phase) of 7115B through the following formula.

$$\text{Pdiss} = \text{Vcc} \cdot \text{Icc} - (I_{o1}^2 + I_{o2}^2) \cdot R_L$$

The figure below shows the relationship between frequency (PPS) and Icc, Pdiss, and case temperature Tc.

SI-7115B Frequency vs. Supply current, Internal power dissipation and Case temperature (Example)

Icc Supply current
Pdiss = Vcc • Icc
  -RL (Io1² + Io2²)
Tc Temperature of heatsink
adjacent to SI-7115B

Motor : 23 PM-C109 no load
Vcc = 24V
Io = 1.0A/ϕ
2-phase excitation
Heatsink 100 x 100 x 2Aℓ
Ta = 25°C

Application Note

SI-7115B Derating curve

SI-7115B
Aluminum heatsink
Using silicone grease
Unit : mm

Internal power dissipation P$_D$ (W) (2-phase)

100×200×2(3.4°C/W)

100×150×2(3.75°C/W)

100×100×2(4.7°C/W)

No heatsink

Ambient temperature Ta (°C)

(3) Obtain the heatsink area corresponding to the ambient temperature Ta from the derating curve.

(4) Verify that the temperature of the aluminum base plate of 7115B or adjacent heatsinks is below 85°C (equivalent to max. ambient temperature) when operating under actual load conditions.

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.