

MONOLITHIC DUAL H BRIDGE DRIVER CIRCUIT

DESCRIPTION

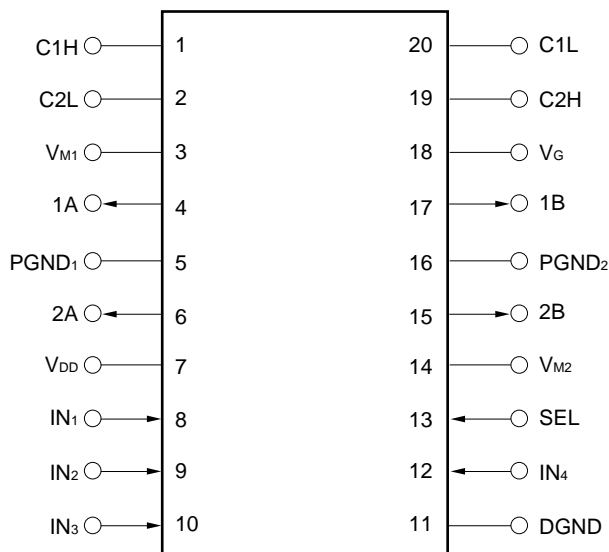
The  $\mu$ PD16808 is a monolithic dual H bridge driver circuit which employing N-channel power MOS FETs for its driver stage. By using the power MOS FETs for the output stage, saturation voltage and power consumption are substantially improved as compared with conventional driver circuits that use bipolar transistors.

Because the dual H bridge driver circuits at the output stage are independent of each other, this IC is ideal as the driver circuit for a 1- to 2-phase excitation bipolar driving stepping motor for the head actuator of an FDD.

FEATURES

- Low ON resistance (sum of ON resistors of top and bottom FETs)  
 $R_{ON1} = 1.0 \Omega$  TYP. ( $V_M = 5.0$  V)  
 $R_{ON2} = 1.5 \Omega$  TYP. ( $V_M = 12.0$  V)
- Low current consumption:  $I_{DD} = 0.4$  mA TYP.
- Four input modes independently controlling dual H bridge drivers (with 1- to 2-phase excitation selected)
- Motor voltage 12 V/5 V compatible
- Compact surface mount package: 20-pin plastic SOP (300 mil)

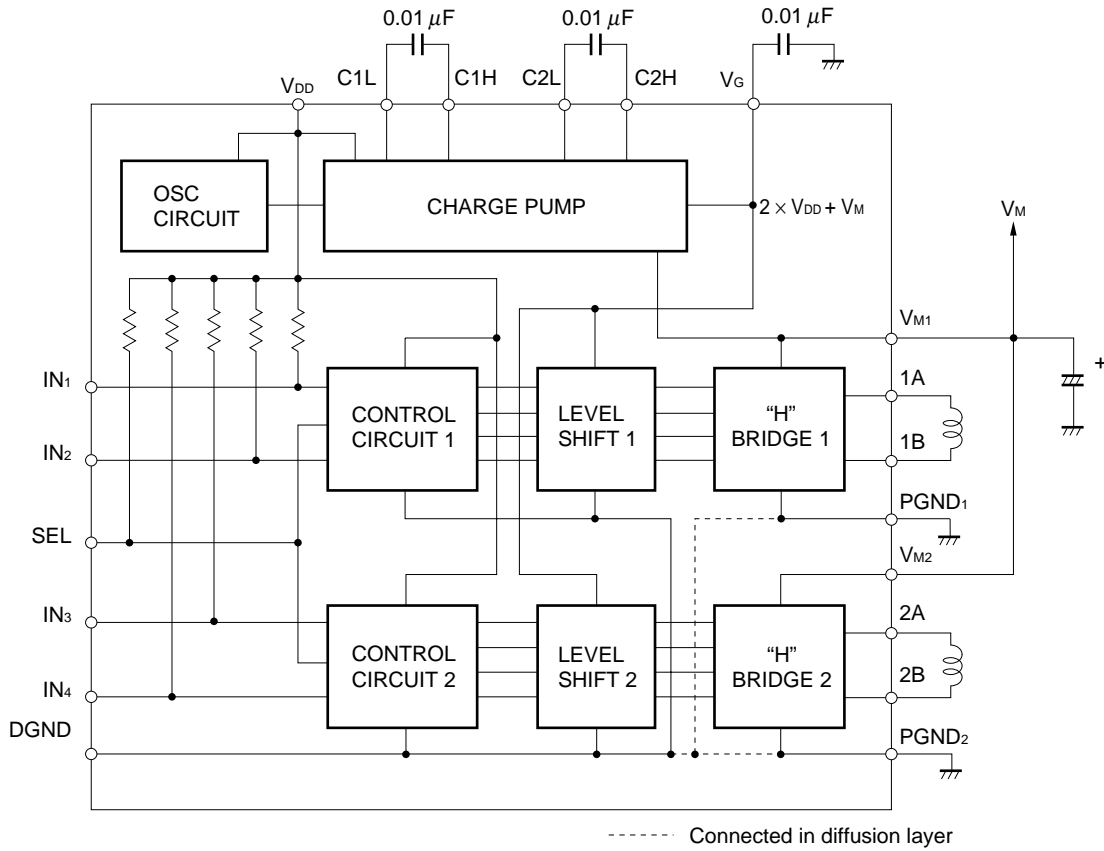
PIN CONFIGURATION (Top View)



ORDERING INFORMATION

| Part Number | Package                      |
|-------------|------------------------------|
| μPD16808GS  | 20-pin plastic SOP (300 mil) |

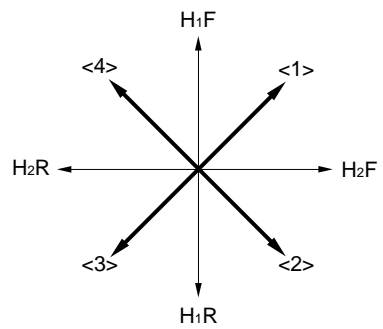
BLOCK DIAGRAM



**FUNCTION TABLE**

- With 1- to 2-phase excitation selected (SEL = High)

| Excitation Direction | IN <sub>1</sub> | IN <sub>2</sub> | IN <sub>3</sub> | IN <sub>4</sub> | H <sub>1</sub> | H <sub>2</sub> |
|----------------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|
| —                    | L               | L               | L               | L               | S              | S              |
| H <sub>2</sub> R     | L               | L               | L               | H               | S              | R              |
| H <sub>2</sub> F     | L               | L               | H               | L               | S              | F              |
| —                    | L               | L               | H               | H               | S              | S              |
| H <sub>1</sub> R     | L               | H               | L               | L               | R              | S              |
| <3>                  | L               | H               | L               | H               | R              | R              |
| <2>                  | L               | H               | H               | L               | R              | F              |
| H <sub>1</sub> R     | L               | H               | H               | H               | R              | S              |
| H <sub>1</sub> F     | H               | L               | L               | L               | F              | S              |
| <4>                  | H               | L               | L               | H               | F              | R              |
| <1>                  | H               | L               | H               | L               | F              | F              |
| H <sub>1</sub> F     | H               | L               | H               | H               | F              | S              |
| —                    | H               | H               | L               | L               | S              | S              |
| H <sub>2</sub> R     | H               | H               | L               | H               | S              | R              |
| H <sub>2</sub> F     | H               | H               | H               | L               | S              | F              |
| —                    | H               | H               | H               | H               | S              | S              |

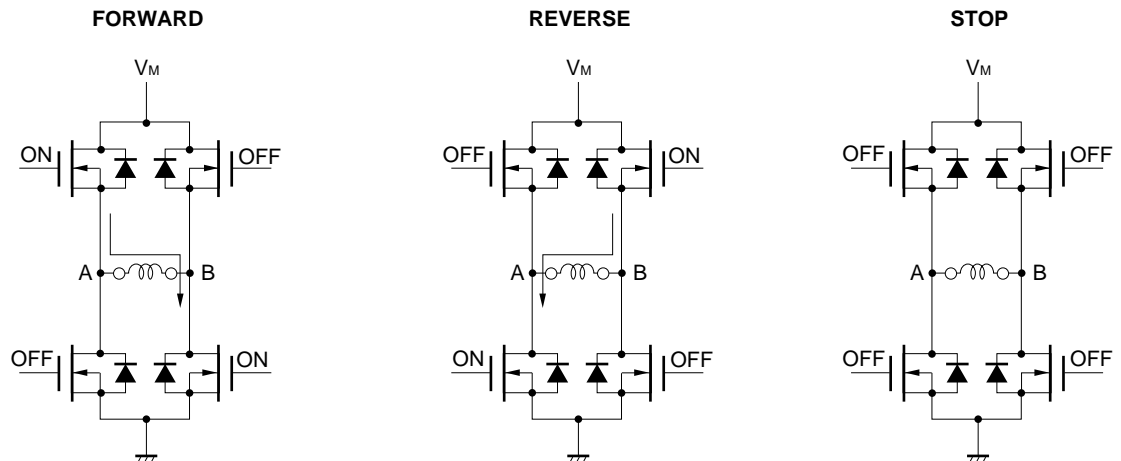


- With 2-phase excitation selected (SEL = Low)

| Excitation Direction | IN <sub>1</sub> | IN <sub>3</sub> | IN <sub>4</sub> | IN <sub>2</sub> | H <sub>1</sub> | H <sub>2</sub> |
|----------------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|
| <1>                  | H               | H               | ×               | H               | F              | F              |
| <2>                  | L               | H               | ×               | H               | R              | F              |
| <3>                  | L               | L               | ×               | H               | R              | R              |
| <4>                  | H               | L               | ×               | H               | F              | R              |
| —                    | ×               | ×               | ×               | L               | Stop           |                |

F: Forward    R: Reverse    S: Stop    ×: Don't care

For the excitation waveform timing chart, refer to **APPLICATION CIRCUIT EXAMPLE**.



**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C)**

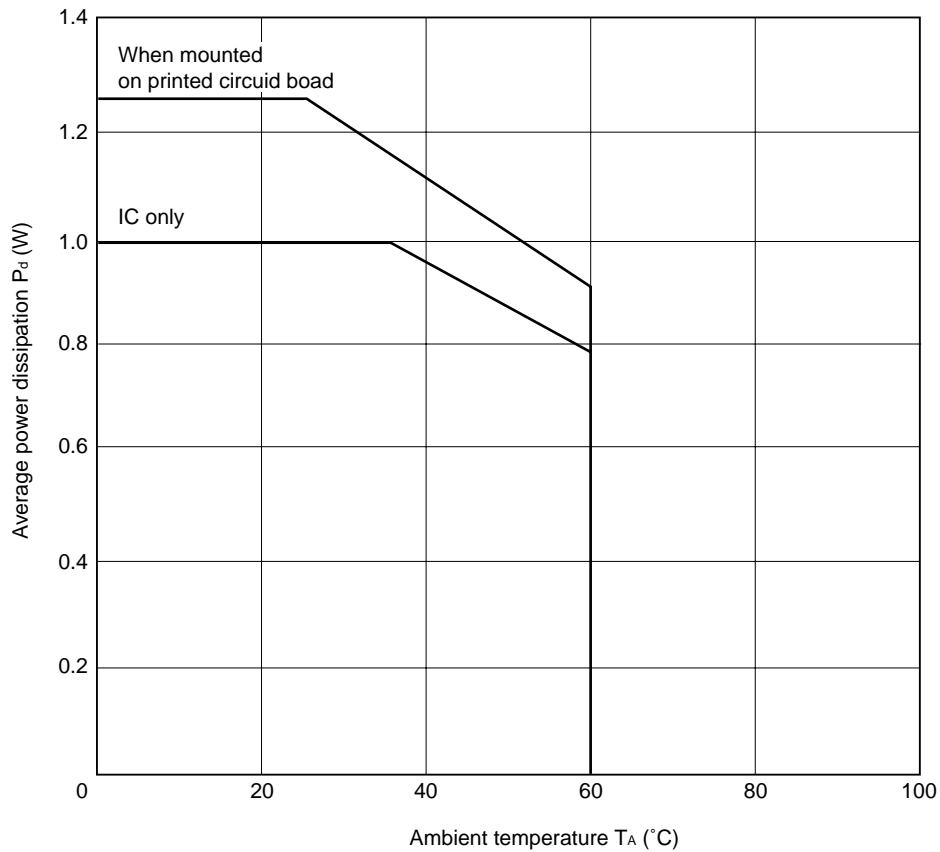
| Parameter                             | Symbol                 | Rating                        | Unit |
|---------------------------------------|------------------------|-------------------------------|------|
| Supply voltage (motor block)          | V <sub>M</sub>         | -0.5 to +15                   | V    |
| Supply voltage (control block)        | V <sub>DD</sub>        | -0.5 to +7                    | V    |
| Power dissipation                     | P <sub>d1</sub>        | 1.0 <sup>Note 1</sup>         | W    |
|                                       | P <sub>d2</sub>        | 1.25 <sup>Note 2</sup>        |      |
| Instantaneous H bridge driver current | I <sub>b</sub> (pulse) | ±1.0 <sup>Note 2, 3</sup>     | A    |
| Input voltage                         | V <sub>IN</sub>        | -0.5 to V <sub>DD</sub> + 0.5 | V    |
| Operating temperature range           | T <sub>A</sub>         | 0 to 60                       | °C   |
| Operation junction temperature        | T <sub>JMAX.</sub>     | 150                           | °C   |
| Storage temperature range             | T <sub>stg</sub>       | -55 to +125                   | °C   |

**Notes 1.** IC only

**2.** When mounted on a printed circuit board (100 × 100 × 1 mm, glass epoxy)

**3.** t ≤ 5 ms, Duty ≤ 40 %

**P<sub>d</sub> – T<sub>A</sub> Characteristics**



**RECOMMENDED OPERATING CONDITIONS**

| Parameter  | Symbol                | MIN.     | TYP. | MAX. | Unit |
|--|-----------------------|----------|------|------|------|
| Supply voltage (motor block)                             | $V_M$                 | 4.0      | 5.0  | 13.2 | V    |
| Supply voltage (control block)                           | $V_{DD}$              | 4.0      | 5.0  | 6.0  | V    |
| H bridge driver current <sup>Note</sup><br>$V_M = 5.0$ V | 1-/2-phase excitation | $I_{DR}$ |      | ±600 | mA   |
|  | 2-phase excitation    |          |      | ±450 |      |
| Charge pump capacitance                                  | $C_1$ to $C_3$        | 5        |      | 20   | nF   |
| Operating temperature                                    | $T_A$                 | 0        |      | 60   | °C   |

**Note** When mounted on a printed circuit board (100 × 100 × 1 mm, glass epoxy)

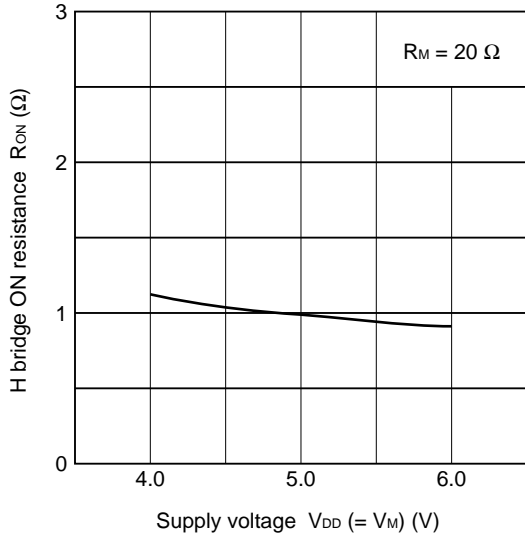
**ELECTRICAL SPECIFICATIONS (Within recommended operating conditions unless otherwise specified)**

| Parameter  | Symbol           | Conditions   | MIN. | TYP. | MAX.           | Unit |
|--|------------------|--|------|------|----------------|------|
| OFF $V_M$ pin current                            | $I_M$            | $V_M = 6.0$ V, $V_{DD} = 6.0$ V <sup>Note 1</sup>  |      |      | 1.0            | μA   |
|  |                  | $V_M = 13.2$ V, $V_{DD} = 6.0$ V <sup>Note 1</sup> |      |      | 1.0            | mA   |
| $V_{DD}$ pin current                             | $I_{DD}$         | <b>Note 2</b>                                      |      | 0.4  | 1.0            | mA   |
| Control pin high-level input current             | $I_{IH}$         | $T_A = 25$ °C, $V_{IN} = V_{DD}$                   |      |      | 1.0            | μA   |
|  |                  | $0 \leq T_A \leq 60$ °C, $V_{IN} = V_{DD}$         |      |      | 2.0            |      |
| Control pin low-level input current              | $I_{IL}$         | $T_A = 25$ °C, $V_{IN} = 0$ V                      |      |      | -0.18          | mA   |
|  |                  | $0 \leq T_A \leq 60$ °C, $V_{IN} = 0$ V            |      |      | -0.25          |      |
| Control pin input pull-up resistance             | $R_{IN}$         | $T_A = 25$ °C                                      | 35   | 50   | 65             | kΩ   |
|  |                  | $0 \leq T_A \leq 60$ °C                            | 25   |      | 75             |      |
| Control pin high-level input voltage             | $V_{IH}$         |  | 3.0  |      | $V_{DD} + 0.3$ | V    |
| Control pin low-level input voltage              | $V_{IL}$         |  | -0.3 |      | 0.8            | V    |
| H bridge circuit ON resistance <sup>Note 3</sup> | $R_{ON1}$        | $V_{DD} = 5$ V, $V_M = 5$ V                        |      | 1.0  | 2.0            | Ω    |
|  | $R_{ON2}$        | $V_{DD} = 5$ V, $V_M = 12$ V                       |      | 1.5  | 3.0            | Ω    |
| $R_{ON}$ relative accuracy                       | $\Delta R_{ON1}$ | Excitation direction <2>, <4> <sup>Note 4</sup>    |      |      | ±5             | %    |
|  | $\Delta R_{ON2}$ | Excitation direction <1>, <3>                      |      |      | ±10            |      |
| Charge pump circuit ( $V_G$ ) turn-ON time       | $T_{ONG}$        | $V_{DD} = 5$ V, $V_M = 5$ V                        |      | 0.2  | 1.0            | ms   |
| H bridge circuit turn-ON time                    | $T_{ONH}$        | $C_1 = C_2 = C_3 = 10$ nF                          |      |      | 5              | μs   |
| H bridge circuit turn-OFF time                   | $T_{OFFH}$       | $R_M = 20$ Ω                                       |      |      | 5              | μs   |

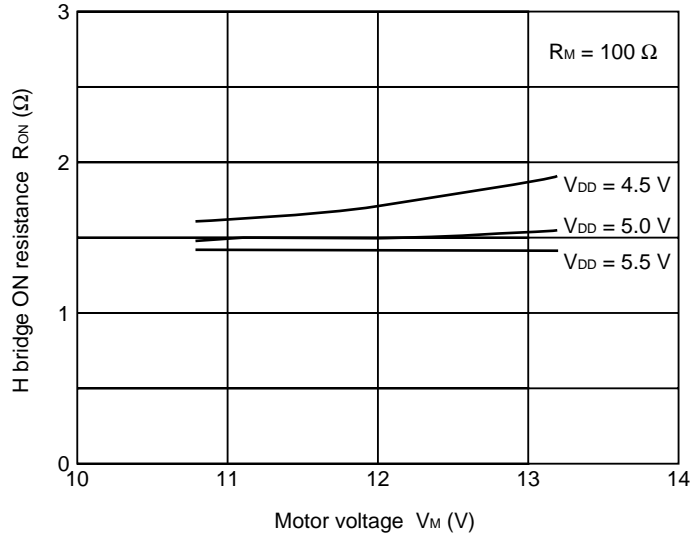
- Notes**
- Control pins (IN<sub>1</sub>, IN<sub>2</sub>, IN<sub>3</sub>, IN<sub>4</sub>): low
  - Control pins (IN<sub>1</sub>, IN<sub>2</sub>, IN<sub>3</sub>, IN<sub>4</sub>): high
  - Sum of ON resistances of top and bottom transistors
  - For the excitation direction, refer to **FUNCTION TABLE**.

CHARACTERISTIC CURVES

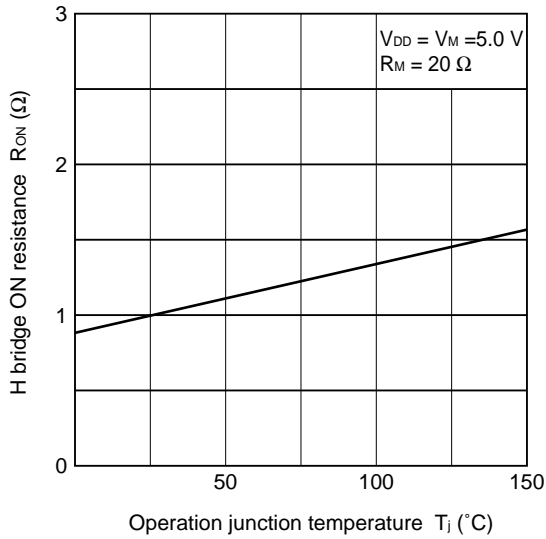
**R<sub>ON</sub> vs. V<sub>DD</sub> (= V<sub>M</sub>) Characteristics**



**R<sub>ON</sub> vs. V<sub>M</sub> Characteristics**



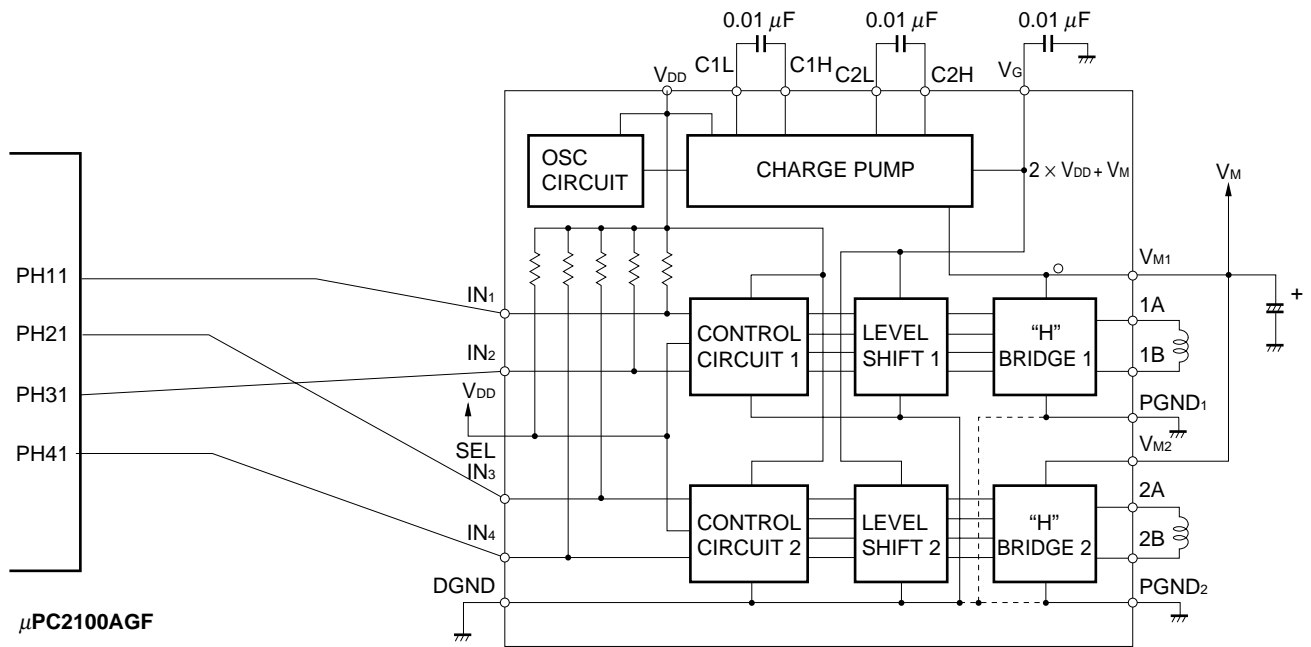
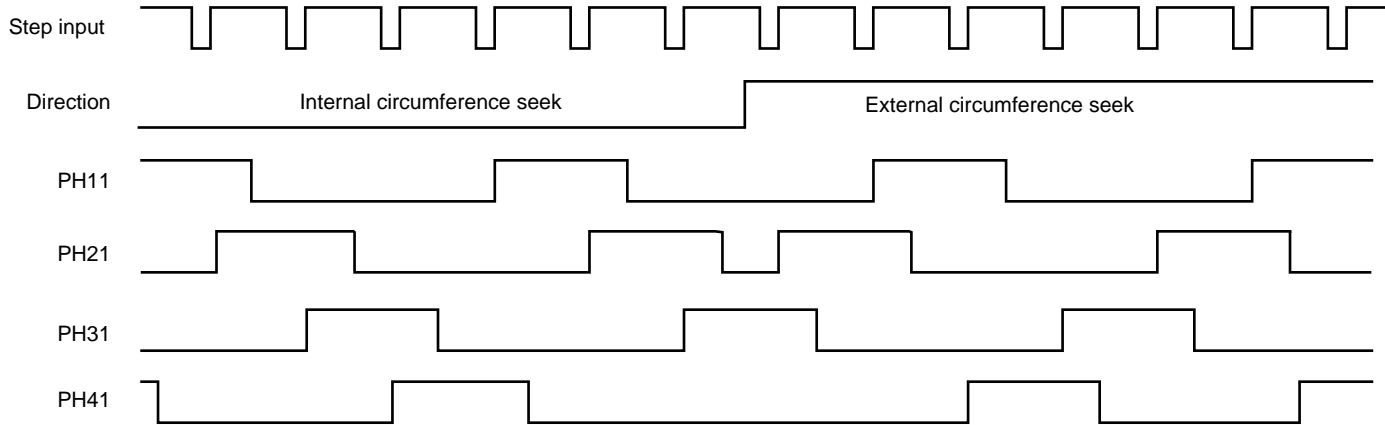
**R<sub>ON</sub> vs. T<sub>j</sub> Characteristics**



APPLICATION CIRCUIT EXAMPLE

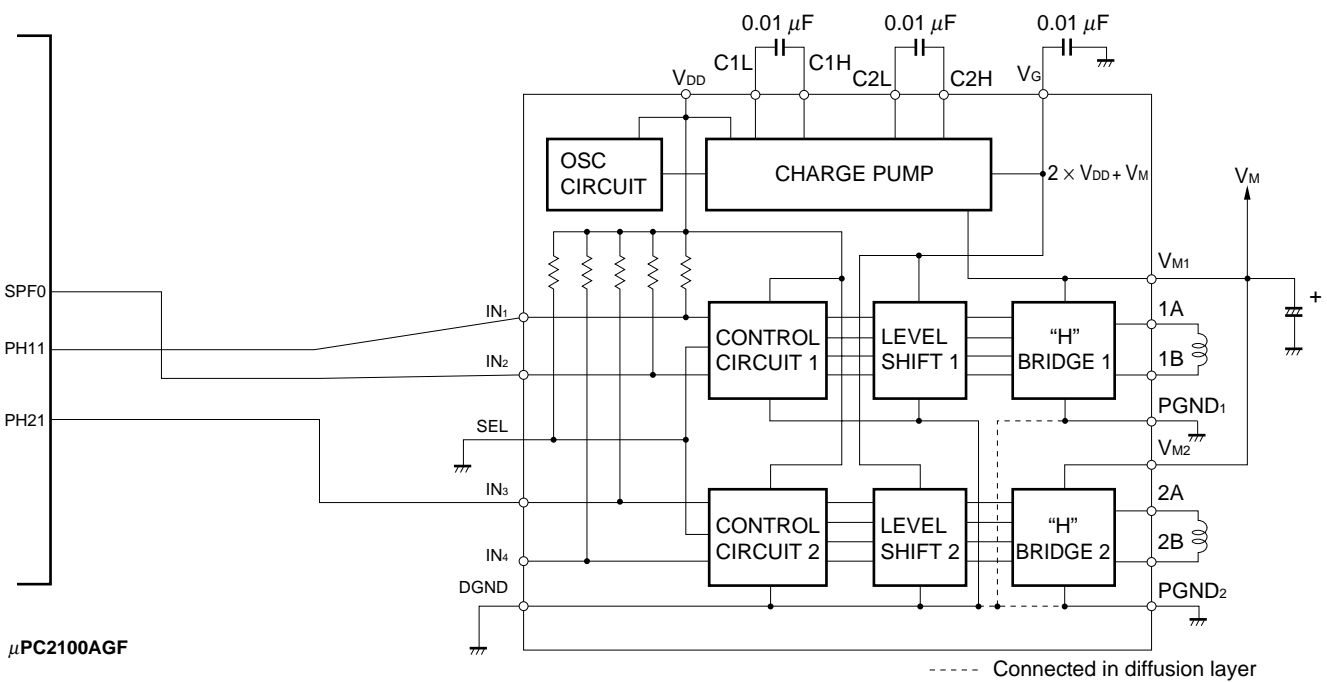
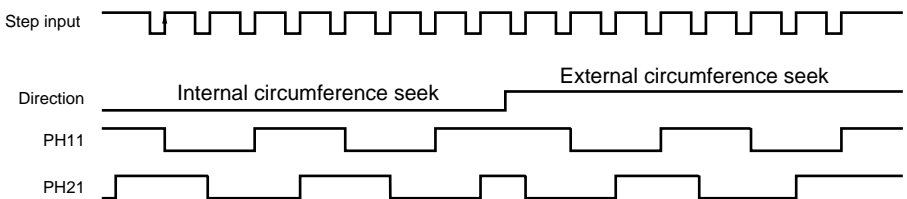
- Connection with 1-chip FDD LSI μPC2100AGF (With 1- to 2-phase excitation selected)

μPC2100AGF Stepping Motor Excitation Timing Chart



- Connection with 1-chip FDD LSI μPC2100AGF (With 2-phase excitation selected)

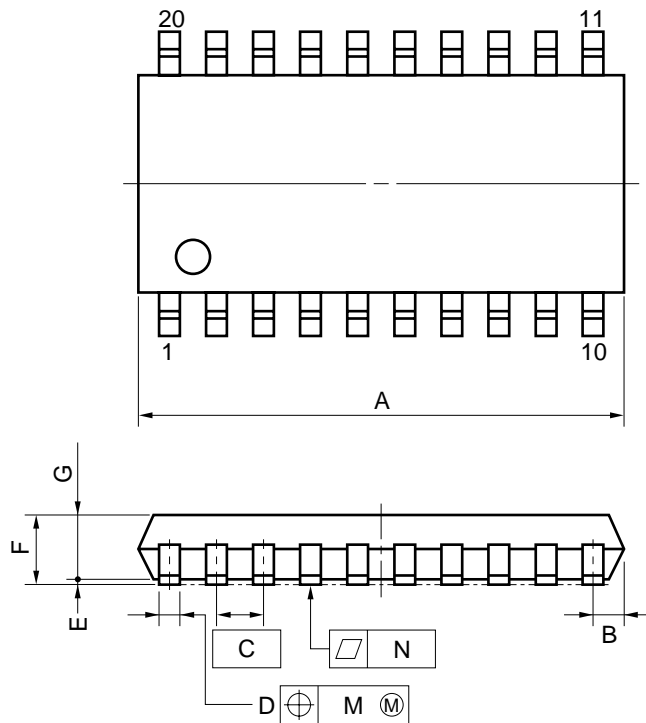
μPC2100AGF Stepping Motor Excitation Timing Chart



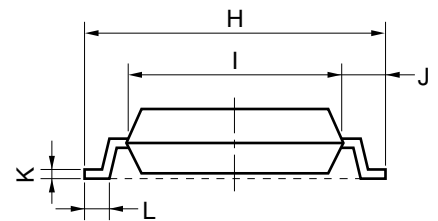
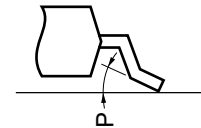
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.



20 PIN PLASTIC SOP (300 mil)



detail of lead end



NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

| ITEM | MILLIMETERS                            | INCHES                                    |
|------|--|---|
| A    | 13.00 MAX.                             | 0.512 MAX.                                |
| B    | 0.78 MAX.                              | 0.031 MAX.                                |
| C    | 1.27 (T.P.)                            | 0.050 (T.P.)                              |
| D    | 0.40 <sup>+0.10</sup> <sub>-0.05</sub> | 0.016 <sup>+0.004</sup> <sub>-0.003</sub> |
| E    | 0.1±0.1                                | 0.004±0.004                               |
| F    | 1.8 MAX.                               | 0.071 MAX.                                |
| G    | 1.55                                   | 0.061                                     |
| H    | 7.7±0.3                                | 0.303±0.012                               |
| I    | 5.6                                    | 0.220                                     |
| J    | 1.1                                    | 0.043                                     |
| K    | 0.20 <sup>+0.10</sup> <sub>-0.05</sub> | 0.008 <sup>+0.004</sup> <sub>-0.002</sub> |
| L    | 0.6±0.2                                | 0.024 <sup>+0.008</sup> <sub>-0.009</sub> |
| M    | 0.12                                   | 0.005                                     |
| N    | 0.10                                   | 0.004                                     |
| P    | 3° <sup>+7°</sup> <sub>-3°</sub>       | 3° <sup>+7°</sup> <sub>-3°</sub>          |

P20GM-50-300B, C-4

**RECOMMENDED SOLDERING CONDITIONS**

It is recommended to solder this product under the conditions described below.  
 For soldering methods and conditions other than those listed below, consult NEC.

**Surface mount type**

For the details of the recommended soldering conditions of this type, refer to **Semiconductor Device Mounting Technology Manual (C10535E)**.

| Soldering Method | Soldering Conditions   | Symbol of Recommended Soldering |
|------------------|--|---------------------------------|
| Infrared reflow  | Peak package temperature: 230 °C, Time: 30 seconds MAX. (210 °C MIN.),<br>Number of times: 1, Number of days: None <sup>Note</sup> | IR30-00                         |
| VPS              | Peak package temperature: 215 °C, Time: 40 seconds MAX. (200 °C MIN.),<br>Number of times: 1, Number of days: None <sup>Note</sup> | VP15-00                         |
| Wave soldering   | Solder bath temperature: 260 °C MAX., Time: 10 seconds MAX.,<br>Number of times: 1, Number of days: None <sup>Note</sup>           | WS60-00                         |
| Partial heating  | Pin temperature: 300 °C MAX., Time: 10 seconds MAX.,<br>Number of days: None <sup>Note</sup>                                       | -                               |

**Note** The number of storage days at 25 °C, 65 % RH after the dry pack has been opened

**Caution** Do not use two or more soldering methods in combination (except partial heating).

[MEMO]

[MEMO]

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