

MONOLITHIC H BRIDGE DRIVER

DESCRIPTION

This IC is a monolithic H bridge driver employing a horizontal N-channel power MOS FET for its driver stage.

It is provided with forward/reverse and brake functions and is ideal as a driver circuit for a motor that winds or unwinds the film in a camera, or a motor for moving a lens.

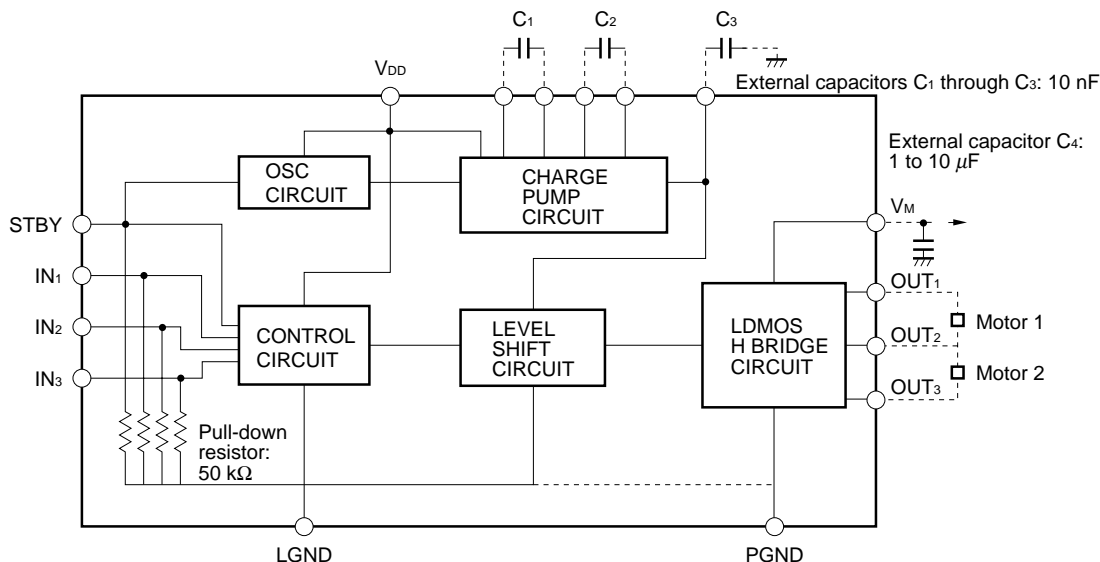
FEATURES

- High drive current
  - $I_{DR1} = 0.5 \text{ A (DC)}$
  - $I_{DR2} = 1 \text{ A: at } PW \leq 200 \text{ ms, duty cycle } \leq 50\%$
  - $I_{DR3} = 3 \text{ A: at } PW \leq 200 \text{ ms, single pulse}$
- 1.5ch H bridge circuits
- Low ON resistance (sum of ON resistance of top and bottom FETs)
  - $R_{ON} = 0.6 \Omega \text{ TYP. at } I_{DR} = 0.5 \text{ A}$
- Standby function that turns OFF charge pump circuit
- Low-voltage drive (2.5 V MIN.)
- Surface-mount mini-mold package: 20-pin plastic SOP (300 mil)

ORDERING INFORMATION

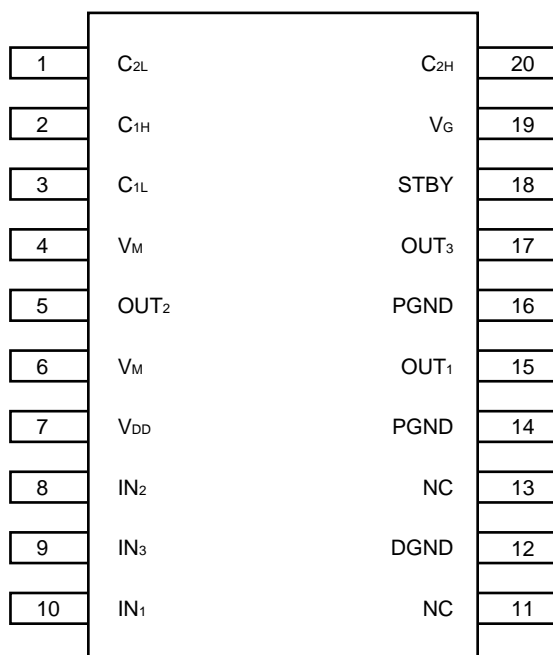
| Part Number     | Package                      |
|-----------------|------------------------------|
| $\mu$ PD16823GS | 20-pin plastic SOP (300 mil) |

BLOCK DIAGRAM

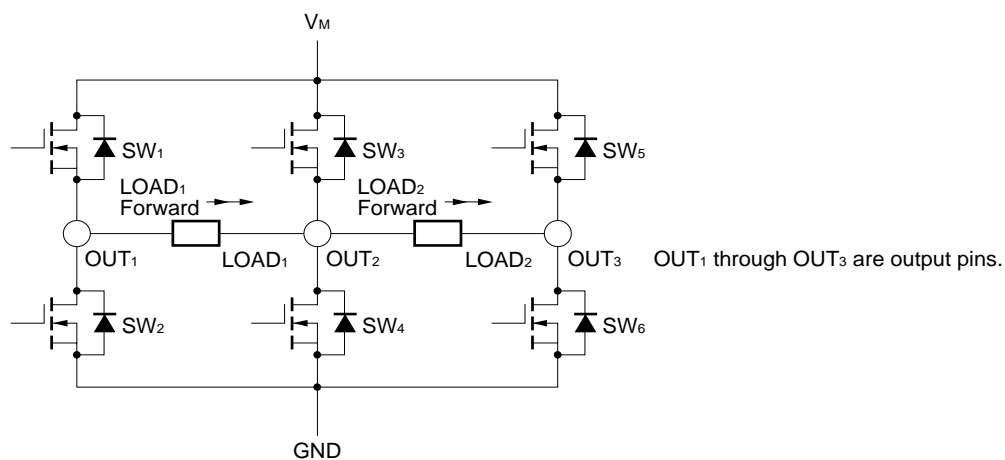


The information in this document is subject to change without notice.

PIN CONFIGURATION



INTERNAL CONNECTION



FUNCTION TABLE

| Input Signal    |                 |                 |      | Circuit Operation | Current Path   |
|-----------------|-----------------|-----------------|------|-------------------|--|
| IN <sub>1</sub> | IN <sub>2</sub> | IN <sub>3</sub> | STBY |                   |  |
| L               | H               | L               | H    | 1 CH forward mode | SW <sub>1</sub> →LOAD <sub>1</sub> →SW <sub>4</sub>                    |
| L               | L               | H               | H    | 1 CH reverse mode | SW <sub>3</sub> →LOAD <sub>1</sub> →SW <sub>2</sub>                    |
| L               | H               | H               | H    | 1 CH brake mode   | SW <sub>2</sub> (Di <sub>2</sub> ) →LOAD <sub>1</sub> →SW <sub>4</sub> |
| H               | H               | L               | H    | 2 CH forward mode | SW <sub>3</sub> →LOAD <sub>2</sub> →SW <sub>6</sub>                    |
| H               | L               | H               | H    | 2 CH reverse mode | SW <sub>5</sub> →LOAD <sub>2</sub> →SW <sub>4</sub>                    |
| H               | H               | H               | H    | 2 CH brake mode   | SW <sub>4</sub> (Di <sub>4</sub> ) →LOAD <sub>2</sub> →SW <sub>6</sub> |
| ×               | L               | L               | H    | Stop mode         |  |
| ×               | ×               | ×               | L    | Standby mode      | Charge pump ON/OFF   |

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

| Parameter  | Symbol               | Condition                         | Ratings                       | Unit |
|--|----------------------|-----------------------------------|-------------------------------|------|
| (Positive) supply voltage  | V <sub>DD</sub>      | When charge pump operates         | -0.5 to +6.5                  | V    |
|  |                      | When charge pump does not operate | -0.5 to +8.0                  | V    |
|  | V <sub>M</sub>       |                                   | -0.5 to +8.0                  | V    |
| Gate drive voltage   | V <sub>G</sub>       |                                   | 15                            | V    |
| Input voltage  | V <sub>IN</sub>      |                                   | -0.5 to V <sub>DD</sub> + 0.5 | V    |
| H bridge drive current<br>Positive: MOS output stage forward current<br>Negative: Output stage diode current | I <sub>DR</sub>      | DC                                | ±0.5                          | A    |
|  |                      | PW ≤ 200 ms, duty cycle ≤ 50%     | ±1.0                          | A    |
|  |                      | PW ≤ 200 ms, single pulse         | ±3.0                          | A    |
| Power dissipation  | P <sub>D</sub>       |                                   | 1.0                           | W    |
| Operating temperature  | T <sub>A</sub>       |                                   | -30 to +60                    | °C   |
| Junction temperature   | T <sub>j(peak)</sub> |                                   | 150                           | °C   |
| Storage temperature  | T <sub>stg</sub>     |                                   | -55 to +150                   | °C   |

**RECOMMENDED OPERATING CONDITIONS (T<sub>A</sub> = 25 °C)**

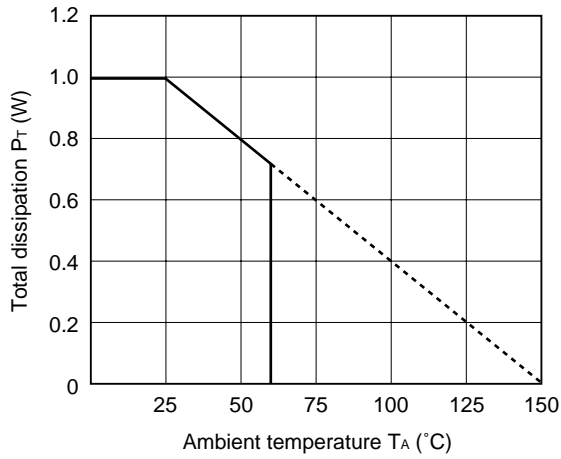
| Parameter                 | Symbol               | Condition                         | Ratings      | Unit |
|---------------------------|----------------------|-----------------------------------|--------------|------|
| (Positive) supply voltage | V <sub>DD</sub>      | When charge pump operates         | 2.5 to 6.0   | V    |
|                           |                      | When charge pump does not operate | 2.5 to 7.5   | V    |
|                           | V <sub>M</sub>       |                                   | -0.5 to +7.5 | V    |
| Gate drive voltage        | V <sub>G</sub>       |                                   | 11 to 14     | V    |
| Junction temperature      | T <sub>j(peak)</sub> |                                   | 125          | °C   |

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = -30 °C to +60 °C)**

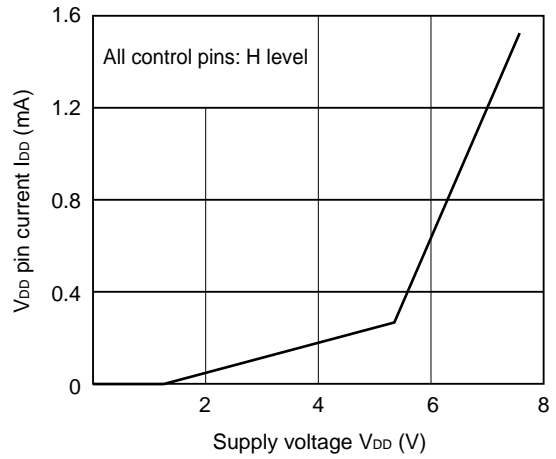
| Parameter                              | Symbol            | Condition   | MIN.                  | TYP. | MAX.                  | Unit |
|--|-------------------|---|-----------------------|------|-----------------------|------|
| V <sub>DD</sub> pin current            | I <sub>DD1</sub>  | V <sub>DD</sub> = 5 V, with all control pins at high level                              |                       |      | 2.0                   | mA   |
|  | I <sub>DD2</sub>  | V <sub>DD</sub> = 5 V, with all control pins at low level                               |                       |      | 10                    | μA   |
| V <sub>M</sub> pin current             | I <sub>M</sub>    | T <sub>A</sub> = 25 °C, with all control pins at low level                              |                       |      | 1.0                   | μA   |
|  |                   | With all control pins at low level  |                       |      | 10                    | μA   |
| H bridge ON resistance                 | R <sub>ON</sub>   | I <sub>DR</sub> = 0.5 A, V <sub>DD</sub> = V <sub>M</sub> = 5 V, T <sub>A</sub> = 25 °C |                       | 0.6  | 0.8                   | Ω    |
| Control pin high-level input voltage   | V <sub>IH</sub>   |   | V <sub>DD</sub> × 0.6 |      |                       | V    |
| Control pin low-level input voltage    | V <sub>IL</sub>   |   |                       |      | V <sub>DD</sub> × 0.2 | V    |
| Charge pump circuit turn-off time      | t <sub>ONC</sub>  | V <sub>DD</sub> = V <sub>M</sub> = 5 V  |                       |      | 1.0                   | ms   |
| H bridge circuit turn-ON time          | t <sub>ONH</sub>  | C <sub>1</sub> = C <sub>2</sub> = C <sub>3</sub> = 10 nF<br>I <sub>DR</sub> = 0.5 A     |                       |      | 10                    | μs   |
| H bridge circuit turn-OFF time         | t <sub>OFFH</sub> |   |                       |      | 5.0                   | μs   |
| Regenerative diode voltage drop        | V <sub>F</sub>    | I <sub>F</sub> = 0.5 A  |                       | 1.0  |                       | V    |
| Control pin input pull-down resistance | R <sub>IN</sub>   |   | 25                    | 50   | 75                    | kΩ   |

TYPICAL CHARACTERISTICS ( $T_A = 25\text{ }^\circ\text{C}$ )

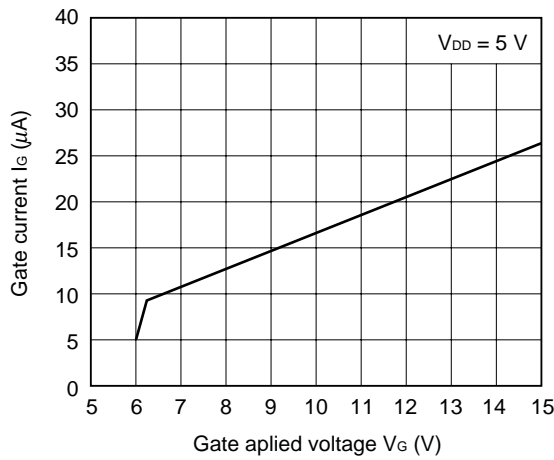
$P_T$  vs.  $T_A$  Characteristics



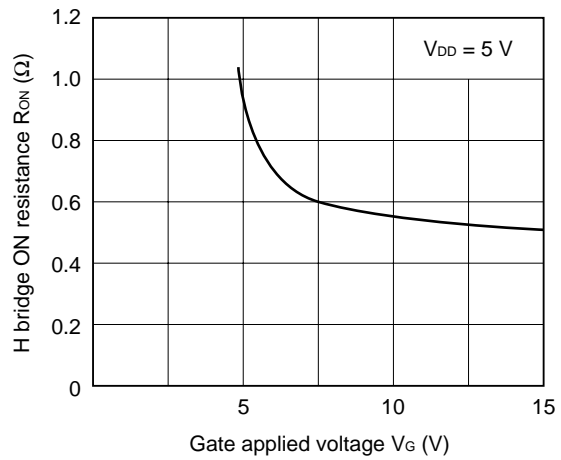
$I_{DD}$  vs.  $V_{DD}$  Characteristics



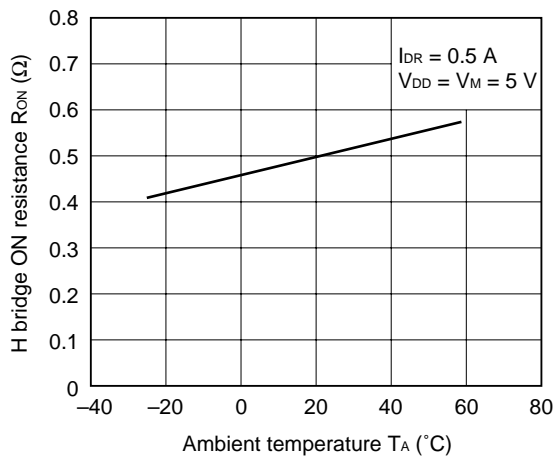
$I_G$  vs.  $V_G$  Characteristics

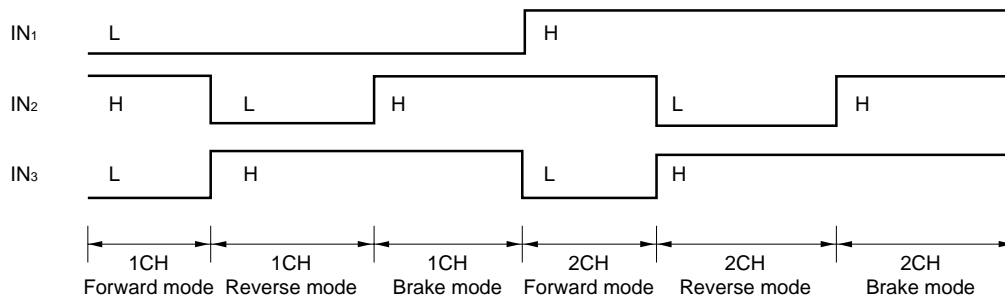
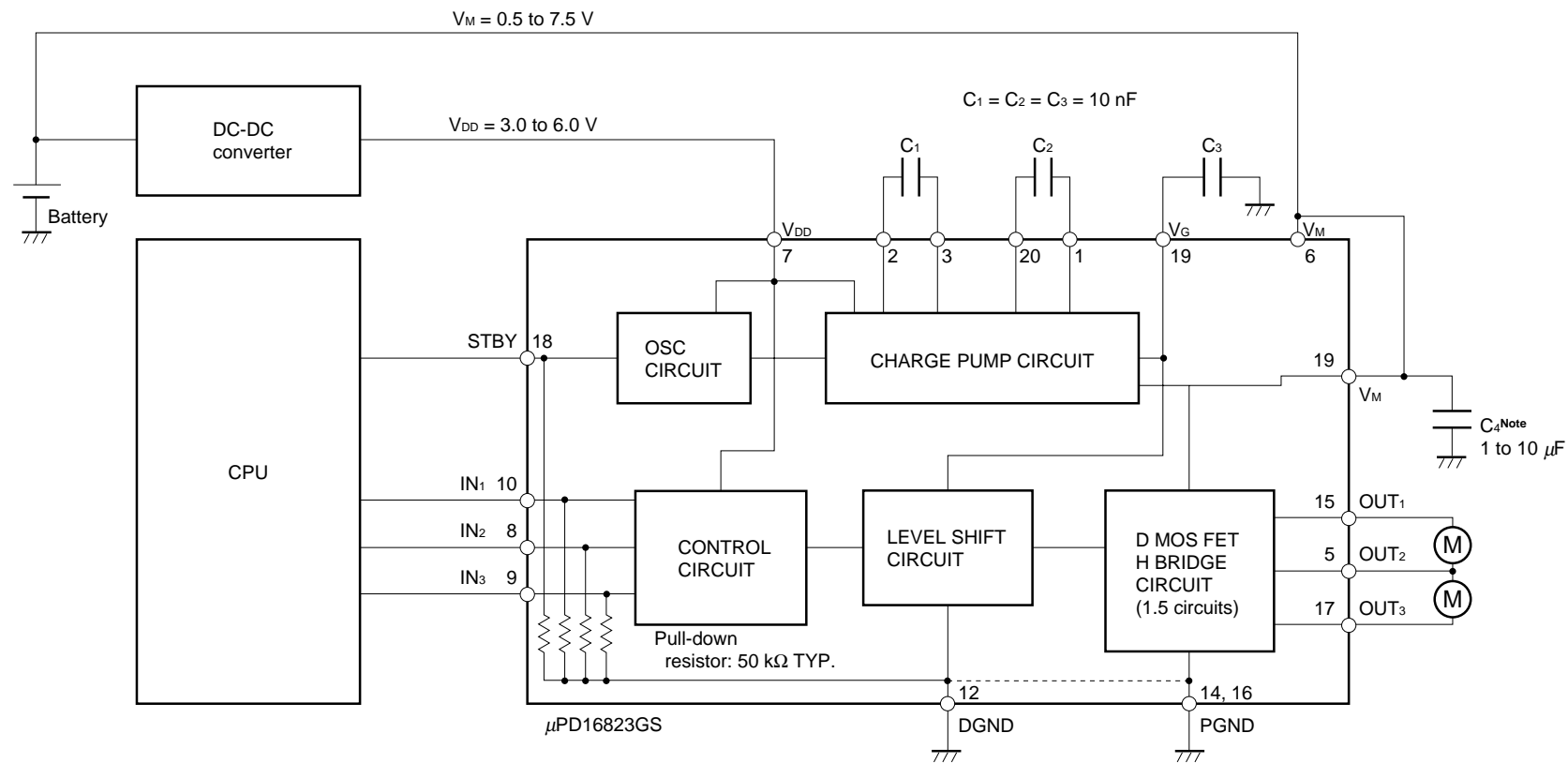


$R_{ON}$  vs.  $V_G$  Characteristics



$R_{ON}$  vs.  $T_A$  Characteristics

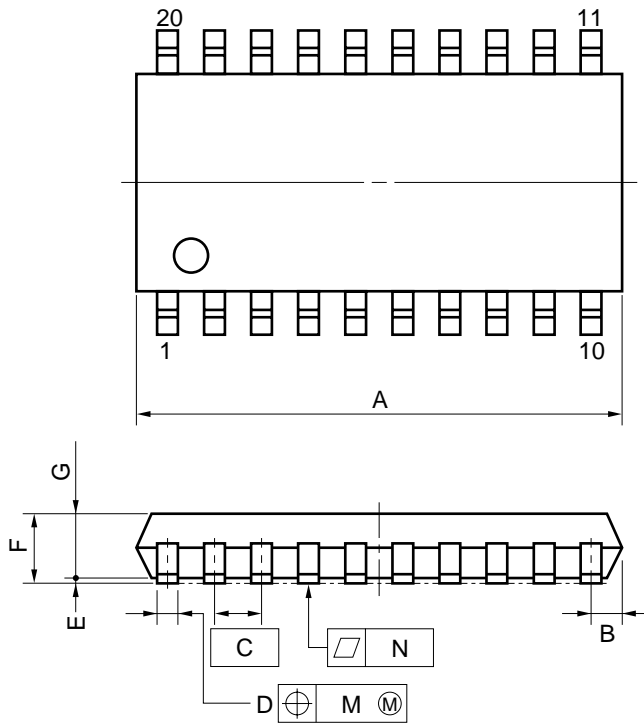




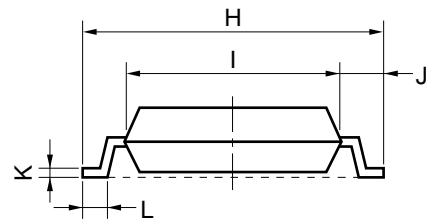
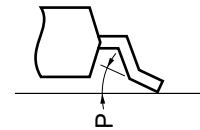
**Note** It is recommended to connect an external capacitor of 1 to 10  $\mu\text{F}$  between  $V_M$  and GND to protect the gate of the D MOS FET from voltage surge.

PACKAGE DIMENSION

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°+7°<br>-3°                           | 3°+7°<br>-3°                              |

P20GM-50-300B, C-4

**RECOMMENDED SOLDERING CONDITIONS**

It is recommended to solder this product under the conditions shown below.

For soldering methods and conditions other than those listed below, consult NEC.

For details of the recommended soldering conditions, refer to Information Document “**Semiconductor Device Mounting Technology Manual**” (C10535E).

| Soldering Method | Soldering Condition   | Symbol of Recommended Soldering |
|------------------|---|---------------------------------|
| Infrared reflow  | Package peak temperature: 235 °C, Time: 30 seconds MAX. (210 °C MIN.)<br>Number of times: 2 MAX., Number of days: None <sup>Note</sup> , Flux: Rosin-based flux with little chlorine component (chlorine: 0.2 Wt% MAX.) | IR35-00-2                       |
| VPS              | Package peak temperature: 215 °C, Time: 40 seconds MAX. (200 °C MIN.)<br>Number of times: 2 MAX., Number of days: None <sup>Note</sup> , Flux: Rosin-based flux with little chlorine component (chlorine: 0.2 Wt% MAX.) | VP15-00-2                       |
| Wave soldering   | Package peak temperature: 260 °C, Time: 10 seconds MAX.,<br>Preheating temperature: 120 °C MAX., Number of times: 1, Flux:<br>Rosin-based flux with little chlorine component (chlorine: 0.2 Wt% MAX.)                  | WS60-00-1                       |

**Note** The number of days during which the product can be stored at 25 °C 65% RH MAX. after the dry pack was opened.

**Caution** Do not use two or more soldering methods in combination.

**REFERENCE DOCUMENTS**

| Document Name   | Document No. |
|---|--------------|
| NEC Semiconductor Device Reliability/Quality Control System | C11745E      |
| Guide to Quality Assurance for Semiconductor Devices        | MEI-1202     |
| Safe Operating Area of Power MOS FET                        | TEA-1037     |

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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Anti-radioactive design is not implemented in this product.