

## 7.8 mΩ, 9 A Load Switch with Discharge and Reverse Current Blocking

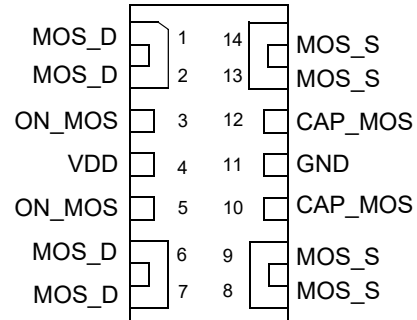
### General Description

The SLG59M1600V is designed for load switching application. The part comes with one 9 A rated MOSFET switched on by an ON control pin. MOSFET turn on time is independently adjusted by an external capacitor.

### Features

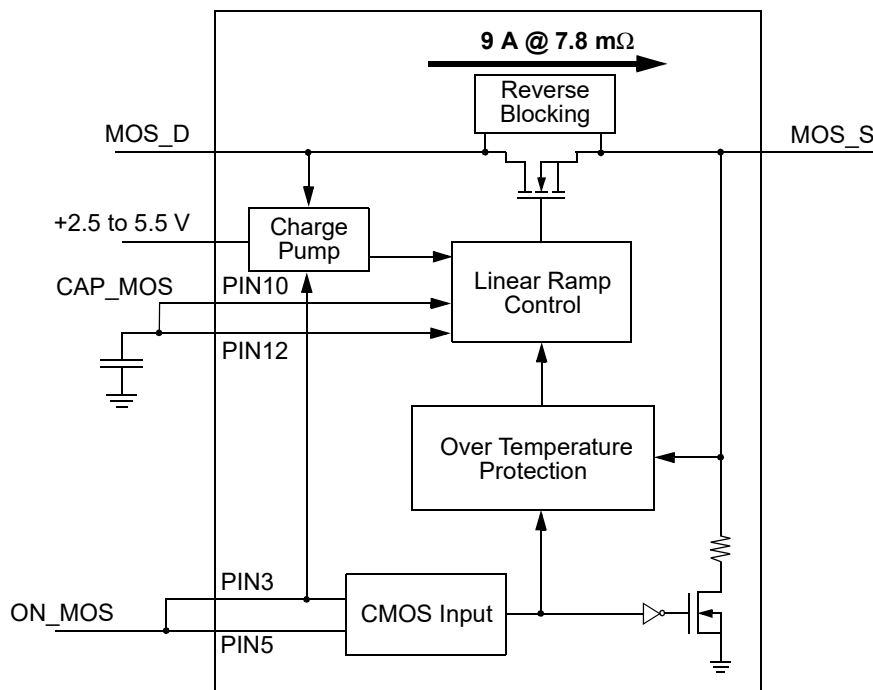
- One 9 A independent MOSFET with reverse current blocking
- Integrated VGS Charge Pump
- Internal discharge for gate and source
- Ramp Control
- Protected by thermal shutdown
- Pb-Free / RoHS Compliant
- Halogen-Free
- STDFN 14L, 1 x 3 x 0.55 mm

### Pin Configuration



**14-pin STDFN**  
(Top View)

### Block Diagram



## Pin Description

| Pin # | Pin Name | Type   | Pin Description   |
|-------|----------|--------|---|
| 1     | MOS_D    | MOSFET | Drain of MOSFET   |
| 2     | MOS_D    | MOSFET | Drain of MOSFET   |
| 3     | ON_MOS   | Input  | Turns on MOS (4 MΩ pull down resistor). Tied to Pin 5 on PCB. |
| 4     | VDD      | VDD    | +5VDD Power   |
| 5     | ON_MOS   | Input  | Turns on MOS (4 MΩ pull down resistor). Tied to Pin 3 on PCB. |
| 6     | MOS_D    | MOSFET | Drain of MOSFET   |
| 7     | MOS_D    | MOSFET | Drain of MOSFET   |
| 8     | MOS_S    | MOSFET | Source of MOSFET  |
| 9     | MOS_S    | MOSFET | Source of MOSFET  |
| 10    | CAP_MOS  | Input  | Sets ramp and turn on time for MOSFET. Tied to Pin 12 on PCB. |
| 11    | GND      | GND    | Ground  |
| 12    | CAP_MOS  | Input  | Sets ramp and turn on time for MOSFET. Tied to Pin 10 on PCB. |
| 13    | MOS_S    | MOSFET | Source of MOSFET  |
| 14    | MOS_S    | MOSFET | Source of MOSFET  |

## Ordering Information

| Part Number   | Type                      | Production Flow             |
|---------------|---------------------------|-----------------------------|
| SLG59M1600V   | STDFN 14L                 | Industrial, -40 °C to 85 °C |
| SLG59M1600VTR | STDFN 14L (Tape and Reel) | Industrial, -40 °C to 85 °C |

## Absolute Maximum Ratings

| Parameter           | Description                                     | Conditions   | Min. | Typ. | Max. | Unit |
|---------------------|---|--|------|------|------|------|
| $V_D$               | Power Supply                                    |  | --   | --   | 6    | V    |
| $T_S$               | Storage Temperature                             |  | -65  | --   | 150  | °C   |
| ESD <sub>HBM</sub>  | ESD Protection                                  | Human Body Model   | 2000 | --   | --   | V    |
| ESD <sub>CDM</sub>  | ESD Protection                                  | Charged Device Model   | 1000 | --   | --   | V    |
| MSL                 | Moisture Sensitivity Level                      |  | 1    |      |      |      |
| $\theta_{JA}$       | Package Thermal Resistance, Junction-to-Ambient | 1mm x 3mm 14L STDFN; Determined using 1 in <sup>2</sup> , 1.2 oz. copper pads under VIN and VOUT on FR4 pcb material | --   | 71   | --   | °C/W |
| $W_{DIS}$           | Package Power Dissipation                       |  | --   | --   | 1.2  | W    |
| $I_{D_{MAX}}$       | Max Operating Current                           |  |      |      | 9    | A    |
| MOSFET $I_{D_{PK}}$ | Peak Current from Drain to Source               | For no more than 10 continuous seconds out of every 100 seconds  | --   | --   | 12   | A    |

Note: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## Electrical Characteristics

$T_A = -40\text{ °C to }85\text{ °C}$  (unless otherwise stated)

| Parameter            | Description  | Conditions  | Min.                      | Typ. | Max.     | Unit |
|----------------------|--|---|---------------------------|------|----------|------|
| $V_{DD}$             | Power Supply Voltage                                     |   | 2.5                       | --   | 5.5      | V    |
| $I_{DD}$             | Power Supply Current when OFF                            |   | --                        | 0.1  | 1        | μA   |
|                      | Power Supply Current, ON_MOS_1 & ON_MOS_2 (Steady State) |   | --                        | 40   | 70       | μA   |
| $R_{DS_{ON}}$        | ON Resistance  | $T_A$ 25°C MOSFET @100 mA   | --                        | 7.8  | 10.5     | mΩ   |
|                      |  | $T_A$ 70°C MOSFET @100 mA   | --                        | 8.4  | 12.1     | mΩ   |
|                      |  | $T_A$ 85°C MOSFET @100 mA   | --                        | 9.0  | 12.7     | mΩ   |
| MOSFET $I_{DS}$      | Current from Drain to Source for each MOSFET             | Continuous  | --                        | --   | 9        | A    |
| $I_{DS_{LKG}}$       | $I_{DS}$ Leakage (Reverse Blocking enabled)              | $V_S = 1.0\text{ V to }5.0\text{ V}$ , $V_{DD} = V_D = 0\text{ V}$ , ON_MOS = LOW, Full temp range                            | --                        | 0.5  | 5.0      | μA   |
| $V_D$                | Drain Voltage  |   | 0.85                      | 5.0  | $V_{DD}$ | V    |
| $T_{ON\_Delay}$      | ON pin Delay Time  | 50% ON to Ramp Begin, $R_L = 20\ \Omega$ , no $C_L$   | 0                         | 270  | 500      | μs   |
| $T_{Total\_ON}$      | Total Turn On Time                                       | 50% ON to 90% $V_S$   | Configurable <sup>1</sup> |      |          | ms   |
|                      |  | Example: CAP (Pin 10 & 12) share a single 4nF capacitor, $V_{DD} = V_D = 5\text{ V}$ , Source_Cap = 10 μF, $R_L = 20\ \Omega$ | --                        | 1.1  | --       | ms   |
| $T_{SLEWRATE}$       | Slew Rate  | 10% $V_S$ to 90% $V_S$  | Configurable <sup>1</sup> |      |          | V/ms |
|                      |  | Example: CAP (Pin 10 & 12) share a single 4nF capacitor, $V_{DD} = V_D = 5\text{ V}$ , Source_Cap = 10 μF, $R_L = 20\ \Omega$ | --                        | 6.0  | --       | V/ms |
| $CAP_{SOURCE}$       | Source Cap   | Source to GND   | --                        | --   | 1000     | μF   |
| $R_{DIS}$            | Discharge Resistance                                     |   | 50                        | 113  | 150      | Ω    |
| ON_ $V_{IH}$         | High Input Voltage on ON pin                             |   | 0.85                      | --   | $V_{DD}$ | V    |
| ON_ $V_{IL}$         | Low Input Voltage on ON pin                              |   | -0.3                      | 0    | 0.3      | V    |
| THERM <sub>ON</sub>  | Thermal shutoff turn-on temperature                      |   | --                        | 125  | --       | °C   |
| THERM <sub>OFF</sub> | Thermal shutoff turn-off temperature                     |   | --                        | 100  | --       | °C   |

## Electrical Characteristics (continued)

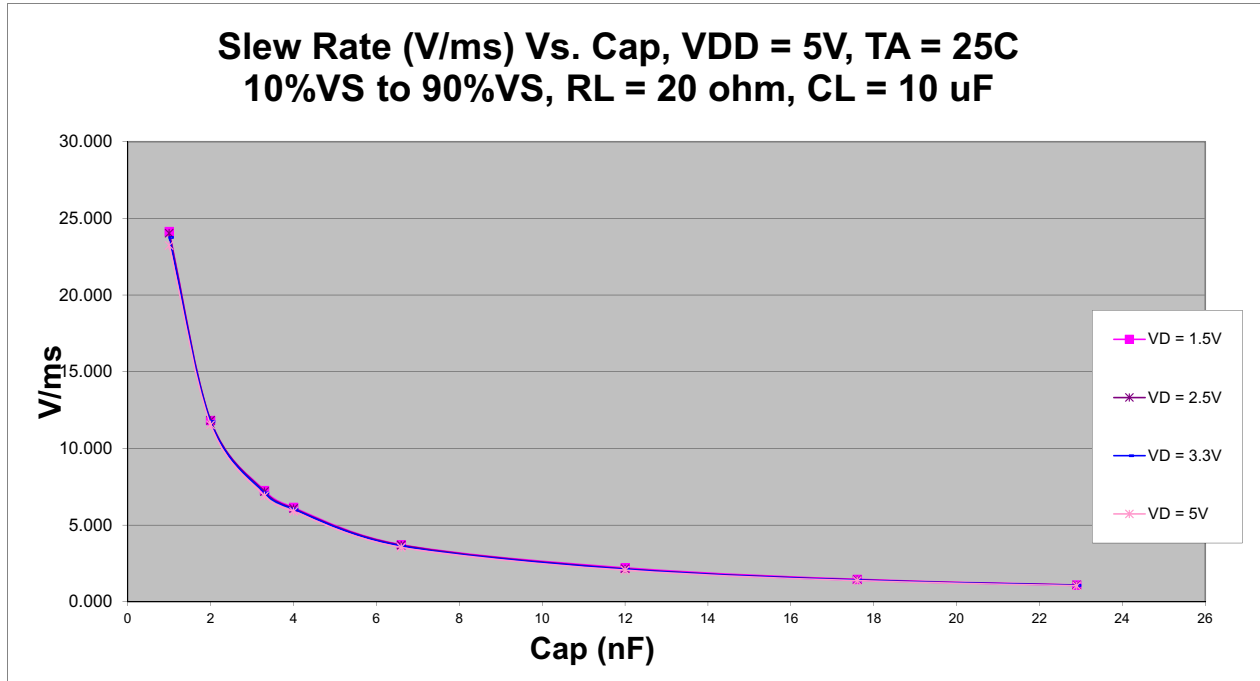
T<sub>A</sub> = -40 °C to 85 °C (unless otherwise stated)

| Parameter              | Description          | Conditions   | Min. | Typ. | Max. | Unit |
|------------------------|----------------------|--|------|------|------|------|
| THERM <sub>TIME</sub>  | Thermal shutoff time |  | --   | --   | 1    | ms   |
| T <sub>OFF_Delay</sub> | OFF Delay Time       | 50% ON to V <sub>S</sub> Fall, V <sub>DD</sub> = V <sub>D</sub> = 5 V,<br>R <sub>L</sub> = 20 Ω, no C <sub>L</sub> | --   | 1.7  | 3    | μs   |

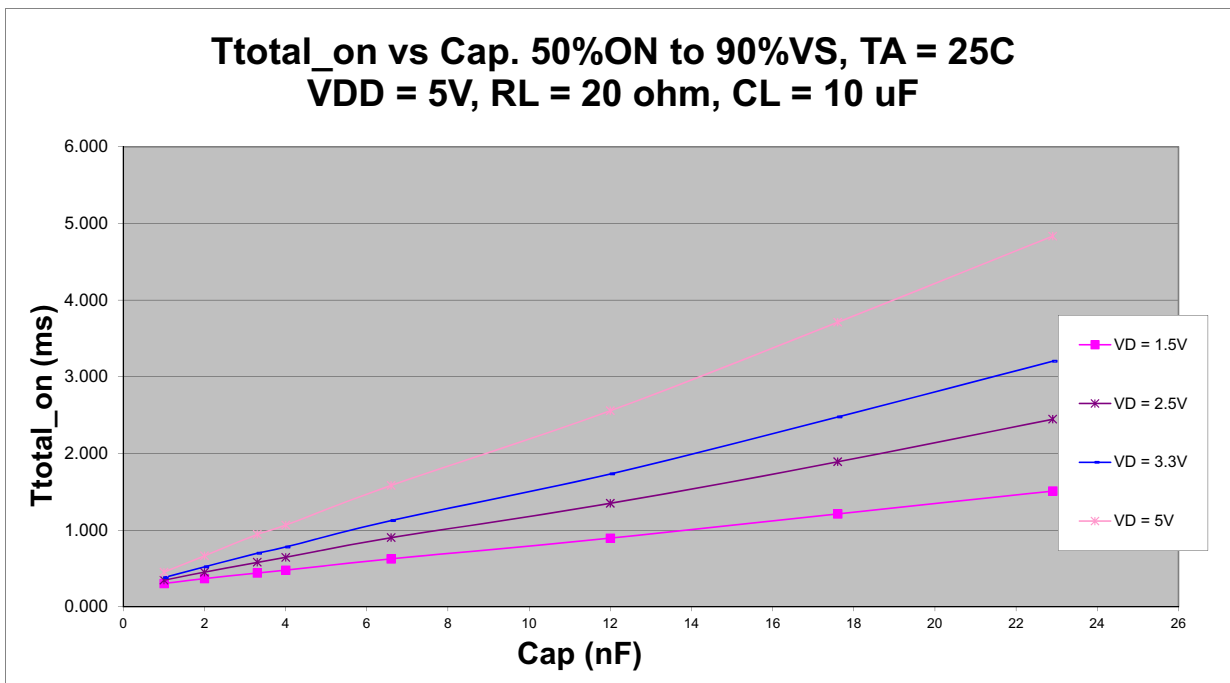
Notes:

1. Refer to table for configuration details.

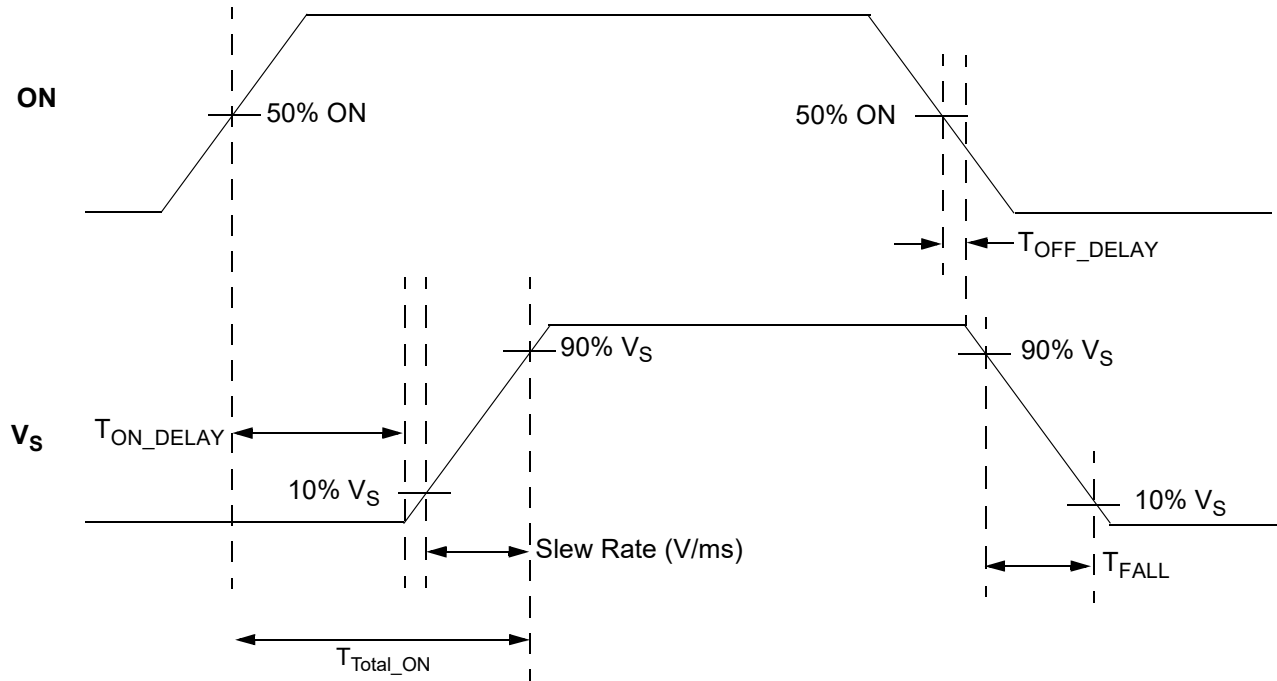
T<sub>SLEW</sub> vs. CAP



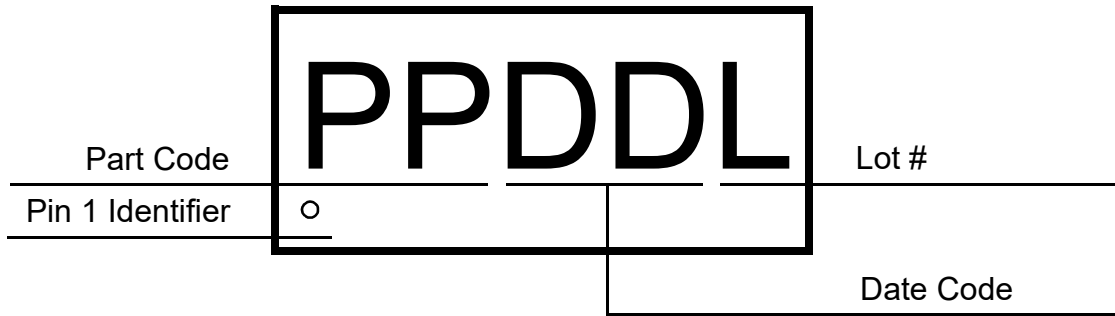
T<sub>TOTAL\_ON</sub> vs. CAP



$T_{Total\_ON}$ ,  $T_{ON\_Delay}$  and Slew Rate Measurement

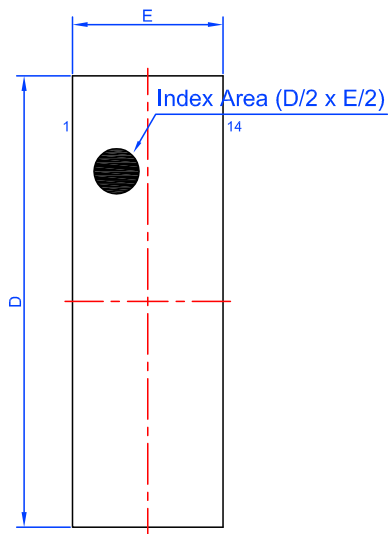


Package Top Marking System Definition

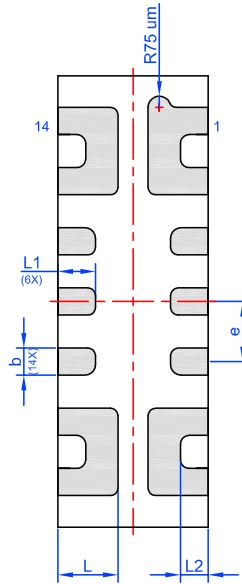


Package Drawing and Dimensions

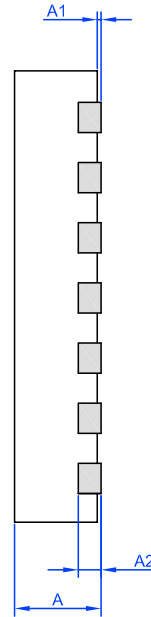
14 Lead STDFN Package 1 mm x 3 mm (Fused Lead)



Top View



BTM View



SIDE View

Unit: mm

| Symbol | Min      | Nom. | Max   | Symbol | Min  | Nom. | Max  |
|--------|----------|------|-------|--------|------|------|------|
| A      | 0.50     | 0.55 | 0.60  | D      | 2.95 | 3.00 | 3.05 |
| A1     | 0.005    | -    | 0.050 | E      | 0.95 | 1.00 | 1.05 |
| A2     | 0.10     | 0.15 | 0.20  | L      | 0.35 | 0.40 | 0.45 |
| b      | 0.13     | 0.18 | 0.23  | L1     | 0.20 | 0.25 | 0.30 |
| e      | 0.40 BSC |      |       | L2     | 0.06 | 0.11 | 0.16 |

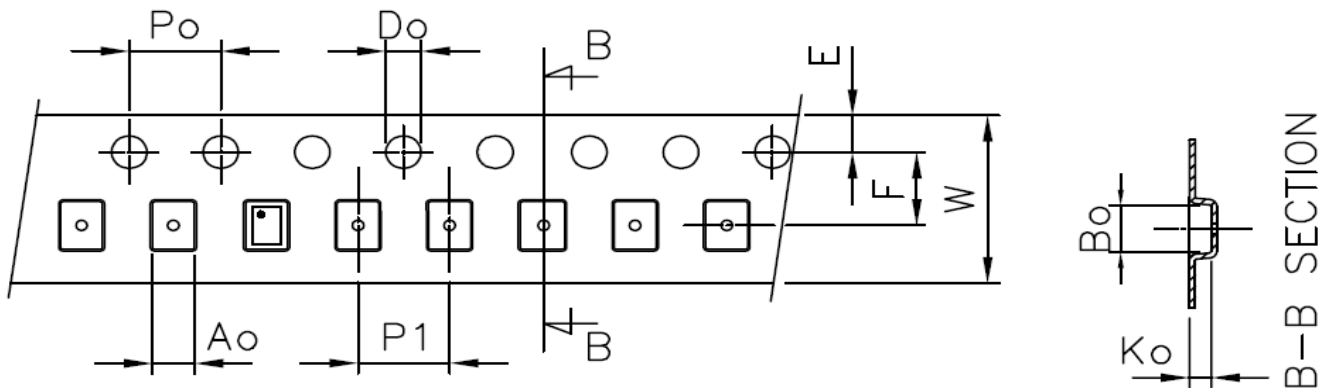


## Tape and Reel Specifications

| Package Type                  | # of Pins | Nominal Package Size | Units per Reel | Max Units per Box | Reel & Hub Size (mm) | Trailer A |             | Leader B |             | Pocket Tape (mm) |       |
|-------------------------------|-----------|----------------------|----------------|-------------------|----------------------|-----------|-------------|----------|-------------|------------------|-------|
|                               |           |                      |                |                   |                      | Pockets   | Length (mm) | Pockets  | Length (mm) | Width            | Pitch |
| STDFN 14L<br>1x3mm<br>0.4P FC | 14        | 1x3x0.55mm           | 3000           | 3000              | 178/60               | 100       | 400         | 100      | 400         | 8                | 4     |

## Carrier Tape Drawing and Dimensions

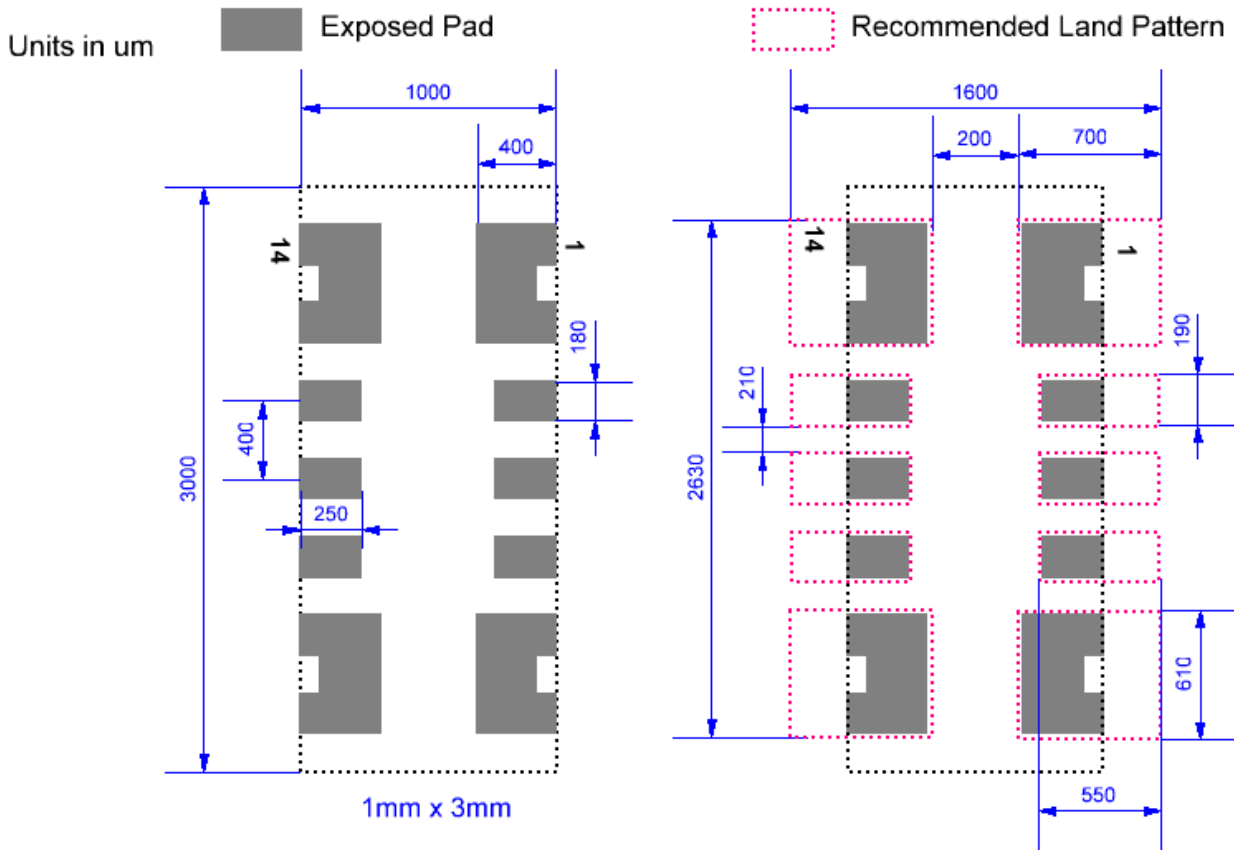
| Package Type                  | Pocket BTM Length [mm] | Pocket BTM Width [mm] | Pocket Depth [mm] | Index Hole Pitch [mm] | Pocket Pitch [mm] | Index Hole Diameter [mm] | Index Hole to Tape Edge [mm] | Index Hole to Pocket Center [mm] | Tape Width [mm] |
|-------------------------------|------------------------|-----------------------|-------------------|-----------------------|-------------------|--------------------------|------------------------------|----------------------------------|-----------------|
|                               | A0                     | B0                    | K0                | P0                    | P1                | D0                       | E                            | F                                | W               |
| STDFN 14L<br>1x3mm 0.4P<br>FC | 1.15                   | 3.15                  | 0.7               | 4                     | 4                 | 1.5                      | 1.75                         | 3.5                              | 8               |



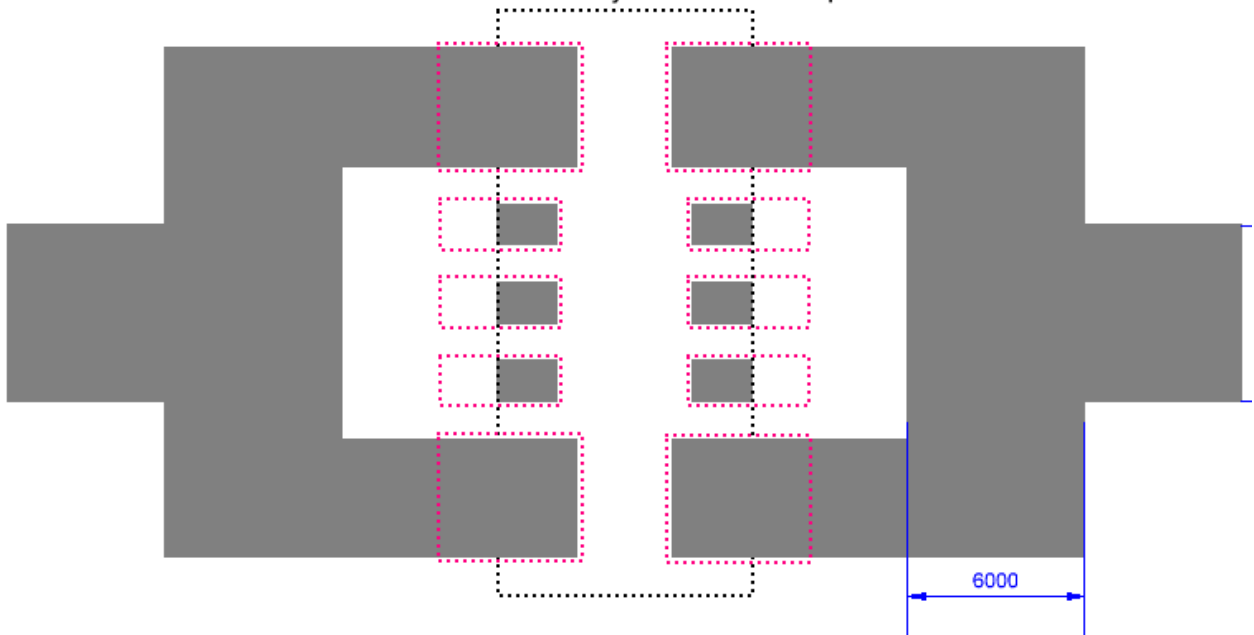
## Recommended Reflow Soldering Profile

Please see IPC/JEDEC J-STD-020: latest revision for reflow profile based on package volume of 1.65 mm<sup>3</sup> (nominal). More information can be found at [www.jedec.org](http://www.jedec.org).

Recommended Land Pattern and PCB Layout



Recommended PCB Layout for external power traces



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## Revision History

| Date       | Version | Change   |
|------------|---------|--|
| 2/10/2022  | 1.04    | Renesas rebranding<br>Fixed typos                      |
| 3/15/2016  | 1.03    | Fixed RDson values                                     |
| 11/30/2015 | 1.02    | Updated Abs. Max and Electrical Characteristics Tables |
| 9/29/2015  | 1.01    | Updated Block Diagram                                  |

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