



## Ultra-small 40 mΩ / 1.0 A Dual Integrated Power Switch

### General Description

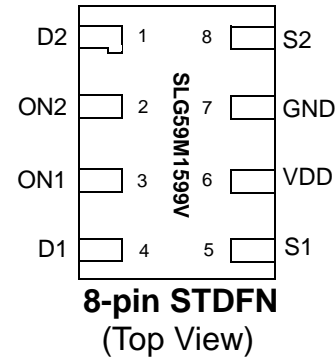
The SLG59M1599V is designed for load switching applications. The part comes with two 40 mΩ 1.0 A rated MOSFETs, each controlled by an ON control pin. Each MOSFET's ramp rate is adjustable depending on the input current level of the ON pin.

The product is packaged in an ultra-small 1.6 x 1.0 mm package.

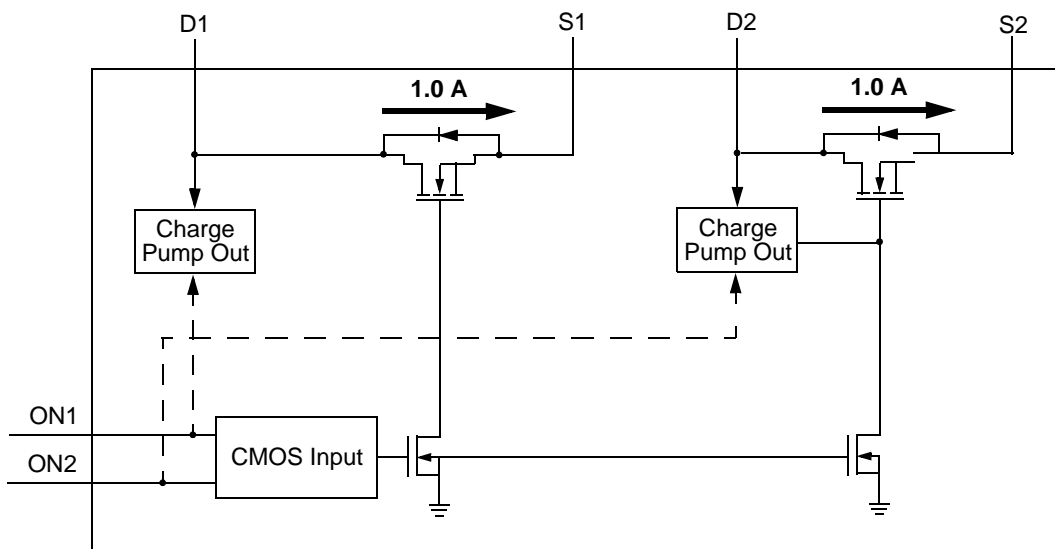
### Features

- Two 40 mΩ 1.0 A MOSFETs
- Two integrated VGS Charge Pumps
- User selectable ramp rate with external resistor
- Protected by thermal shutdown
- Pb-Free / Halogen-Free / RoHS compliant
- STDFN 8L, 1.6 x 1.0 mm

### Pin Configuration



### Block Diagram





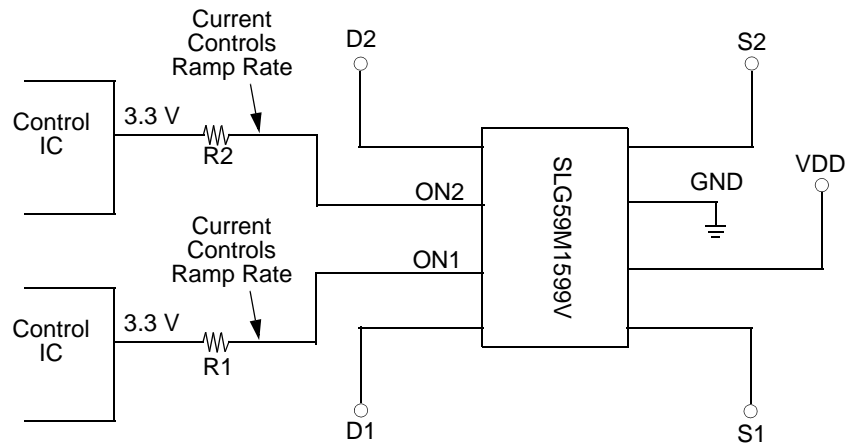
### Pin Description

| Pin # | Pin Name | Type   | Pin Description  |
|-------|----------|--------|--|
| 1     | D2       | MOSFET | Drain of Power MOSFET1   |
| 2     | ON2      | Input  | Turns on MOSFET1. Configurable slew rate control depending on input current. |
| 3     | ON1      | Input  | Turns on MOSFET2. Configurable slew rate control depending on input current. |
| 4     | D1       | MOSFET | Drain of Power MOSFET2   |
| 5     | S1       | MOSFET | Source of Power MOSFET2  |
| 6     | VDD      | PWR    | Power Supply   |
| 7     | GND      | GND    | Ground   |
| 8     | S2       | MOSFET | Source of Power MOSFET1  |

### Ordering Information

| Part Number   | Type                     | Production Flow             |
|---------------|--------------------------|-----------------------------|
| SLG59M1599V   | STDFN 8L                 | Industrial, -40 °C to 85 °C |
| SLG59M1599VTR | STDFN 8L (Tape and Reel) | Industrial, -40 °C to 85 °C |

### Application Diagram





## Absolute Maximum Ratings

| Parameter                | Description                       | Conditions   | Min. | Typ. | Max. | Unit |
|--------------------------|-----------------------------------|--|------|------|------|------|
| V <sub>DD</sub>          | Power Supply                      |  | --   | --   | 6    | V    |
| T <sub>S</sub>           | 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    |      |      |      |
| θ <sub>JA</sub>          | Thermal Resistance,               | 1 x 1.6mm STDFN; Determined using 1 in <sup>2</sup> , 1 oz. copper pads under each Dx and Sx terminal and FR4 pcb material | --   | 72   | --   | °C/W |
| W <sub>DIS</sub>         | Package Power Dissipation         |  | --   | --   | 0.4  | W    |
| MOSFET IDS <sub>PK</sub> | Peak Current from Drain to Source | For no more than 1 ms with 1% duty cycle   | --   | --   | 1.5  | 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<sub>A</sub> = -40 °C to 85 °C (unless otherwise stated)

| Parameter              | Description                           | Conditions   | Min.                      | Typ. | Max.            | Unit |
|------------------------|---------------------------------------|--|---------------------------|------|-----------------|------|
| V <sub>DD</sub>        | Power Supply                          | Pin 6  | 2.5                       | --   | 5.5             | V    |
| V <sub>D1</sub>        | Drain Voltage of MOS1                 | Pin 4  | 0.85                      | --   | V <sub>DD</sub> | V    |
| V <sub>D2</sub>        | Drain Voltage of MOS2                 | Pin 1  | 0.85                      | --   | V <sub>DD</sub> | V    |
| I <sub>DD</sub>        | Power Supply Current (PIN 6)          | when OFF   | --                        | 0.1  | 1               | μA   |
|                        |                                       | when ON, No load   | --                        | 35   | 50              | μA   |
| RDS <sub>ON</sub>      | Static Drain to Source ON Resistance  | T <sub>A</sub> 25°C MOSFET[1:2]  | --                        | 40   | 50              | mΩ   |
|                        |                                       | T <sub>A</sub> 70°C MOSFET[1:2]  | --                        | 50   | 55              | mΩ   |
|                        |                                       | T <sub>A</sub> 85°C MOSFET[1:2]  | --                        | 55   | 65              | mΩ   |
| IDS                    | Operating Current                     | V <sub>D</sub> = 2.5 V to 5.5 V  | --                        | --   | 1.0             | A    |
| T <sub>Delay_ON</sub>  | ON pin Delay Time                     | 50% ON to Ramp Begin<br>Input Current (PIN2, PIN3) = 20 μA,<br>V <sub>DD</sub> = V <sub>D</sub> = 5 V, Source_Cap = 10 μF, R <sub>L</sub> = 20 Ω | --                        | 2.4  | 4.0             | ms   |
| T <sub>Total_ON</sub>  | Total Turn On Time                    | 50% ON to 90% V <sub>S</sub>   | Configurable <sup>1</sup> |      |                 | ms   |
|                        |                                       | Example: Input Current (PIN2, PIN3) = 20 μA, V <sub>DD</sub> = V <sub>D</sub> = 5 V, Source_Cap = 10 μF, R <sub>L</sub> = 20 Ω                   | --                        | 11.7 | --              | ms   |
| T <sub>SLEWRATE</sub>  | Slew Rate                             | 10% V <sub>S</sub> to 90% V <sub>S</sub>   | Configurable <sup>1</sup> |      |                 | V/ms |
|                        |                                       | Example: Input Current (PIN2, PIN3) = 20 μA, V <sub>DD</sub> = V <sub>D</sub> = 5 V, Source_Cap = 10 μF, R <sub>L</sub> = 20 Ω                   | --                        | 0.56 | --              | V/ms |
| ON_V <sub>REF</sub>    | ON Pin Reference Voltage <sup>2</sup> |  | 0.99                      | 1.05 | 1.10            | V    |
| ON_V <sub>IH_INI</sub> | Initial Turn On Voltage               | Internal Charge Pump ON  | 1.2                       | --   | V <sub>DD</sub> | V    |
| ON_V <sub>IL</sub>     | Low Input Voltage on ON pin           | Internal Charge Pump OFF   | -0.3                      | 0    | 0.3             | V    |
| ON_R                   | Input Impedance on ON pin             |  | 100                       | --   | --              | MΩ   |
| THERM <sub>ON</sub>    | Thermal shutoff turn-on temperature   |  | --                        | 125  | --              | °C   |
| THERM <sub>OFF</sub>   | Thermal shutoff turn-off temperature  |  | --                        | 100  | --              | °C   |
| THERM <sub>TIME</sub>  | Thermal shutoff time                  |  | --                        | --   | 1               | ms   |



### Electrical Characteristics (continued)

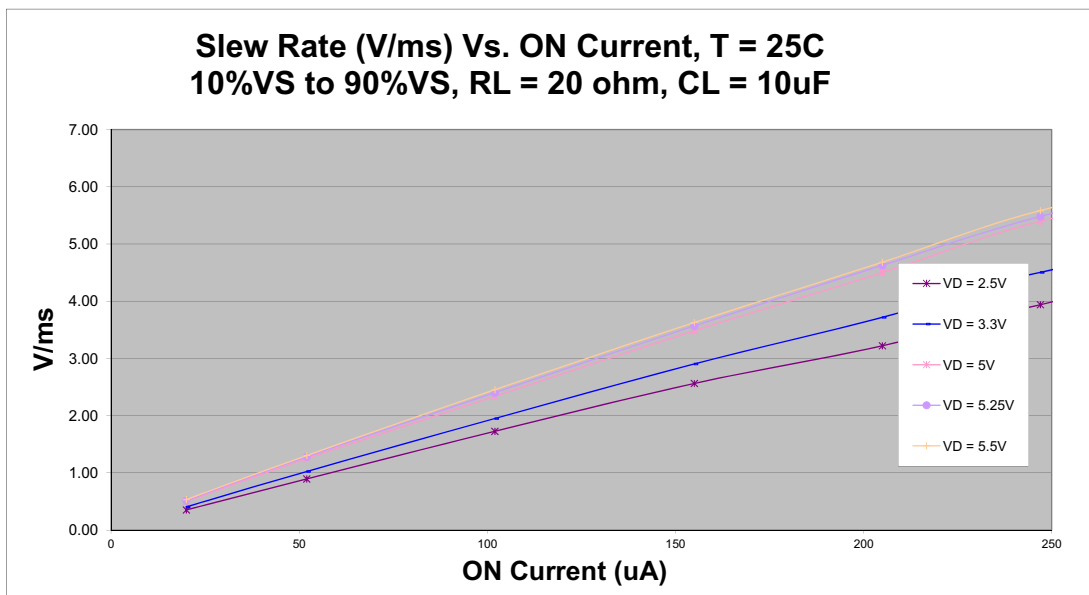
T<sub>A</sub> = -40 °C to 85 °C (unless otherwise stated)

| Parameter              | Description              | Conditions   | Min. | Typ. | Max. | Unit |
|------------------------|--------------------------|--|------|------|------|------|
| T <sub>OFF_Delay</sub> | OFF Delay Time           | 50% ON to V <sub>S</sub> Fall, V <sub>D</sub> = 5 V, R <sub>L</sub> = 20 Ω             | --   | 55   | 70   | μs   |
| T <sub>FALL</sub>      | V <sub>S</sub> Fall Time | 90% V <sub>S</sub> to 10% V <sub>S</sub> , V <sub>D</sub> = 5 V, R <sub>L</sub> = 20 Ω | --   | 32   | --   | μs   |

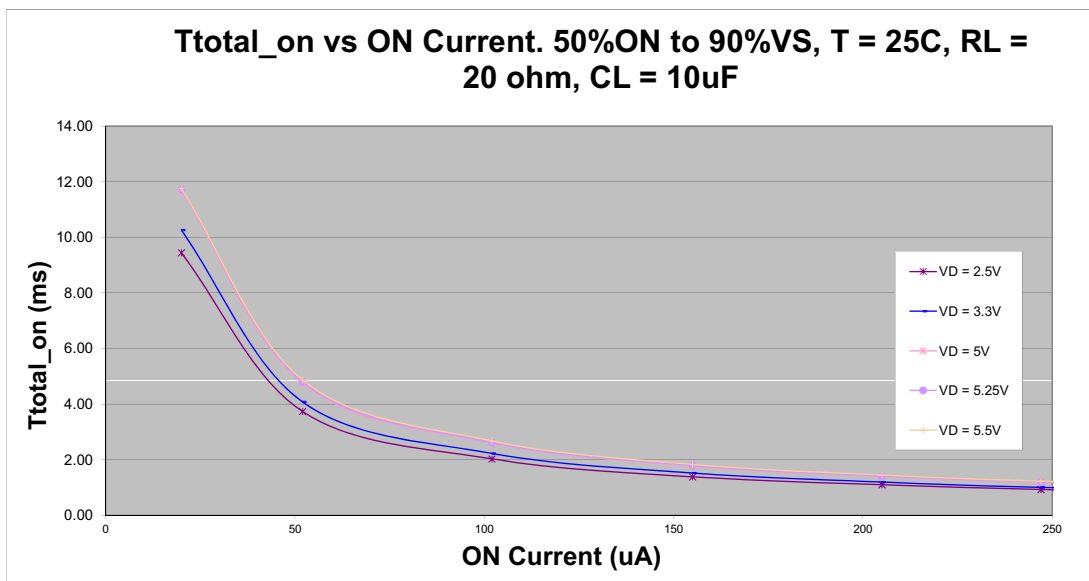
Notes:

1. Refer to table for configuration details.
2. Voltage before ON pin resistor needs to be higher than 1.2 V to generate required I<sub>ON</sub>

### Slew Rate vs. ON Current

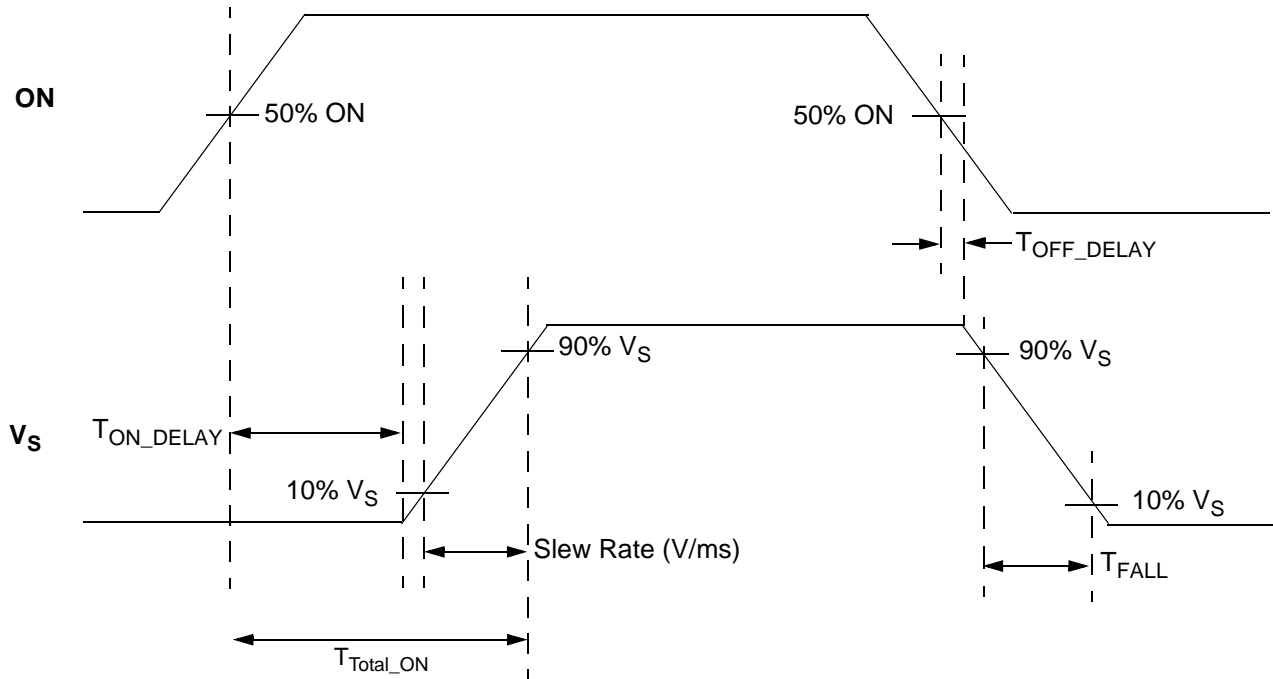


### T<sub>Total\_ON</sub> vs. On Current





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



### Adjustable Ramp Rate vs. ON Pin Current (5.5 V, 25 °C)

| $I_{ON}$    | $T_{SLEW}$ (typ) |
|-------------|------------------|
| 20 $\mu A$  | 0.56 V/ms        |
| 50 $\mu A$  | 1.34 V/ms        |
| 100 $\mu A$ | 2.53 V/ms        |
| 150 $\mu A$ | 3.71 V/ms        |
| 200 $\mu A$ | 4.68 V/ms        |
| 250 $\mu A$ | 5.63 V/ms        |

### Adjustable Slew Rate (ON2 Pin 2 and ON1 Pin3)

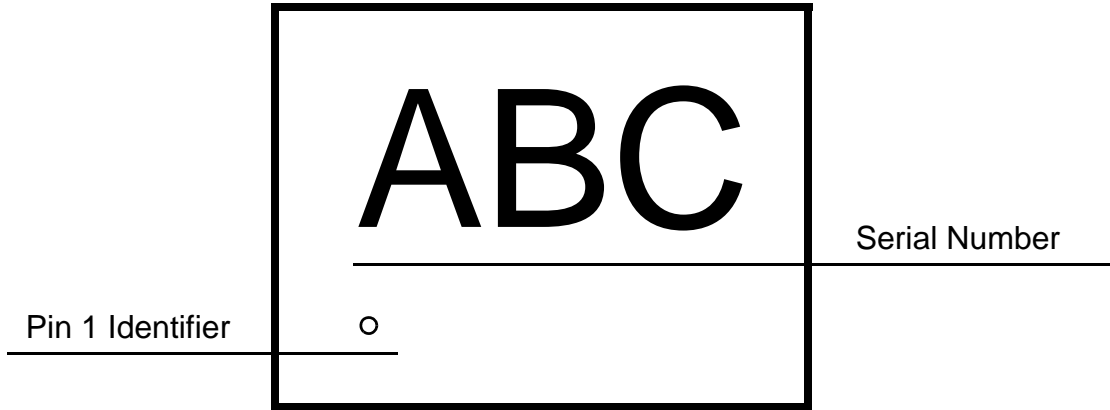
SLG59M1599V has a built in configurable slew control feature. The configurable slew control uses current detection method on ON1/ON2. When ON voltage rise above  $ON\_VIH\_INI$  (1.2 V typical), the slew control circuit will measure the current flowing into ON1/ON2. Based on the current flowing into ON1/ON2, different slew rates will be selected by the internal control circuit. See  $I_{ON}$  vs.  $T_{slew}$  table. The slew rate is configurable by selecting a different R1/R2 resistor value as shown on application diagram. Calculating the R1/R2 value depends on both the desired slew rate, and the  $VOH$  level of the device driving the ON1/ON2 pin.

$$ON\_Current = (GPIO\_VOH - ON\_VREF (1.05 V typical)) / R$$



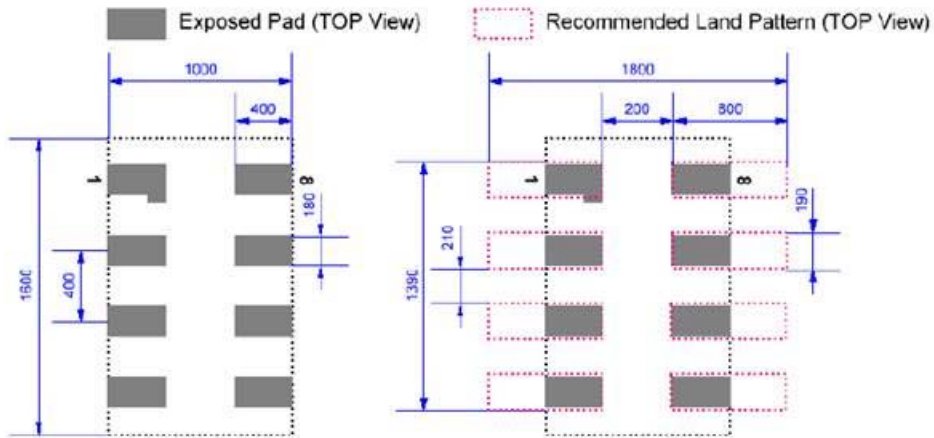
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Package Top Marking System Definition



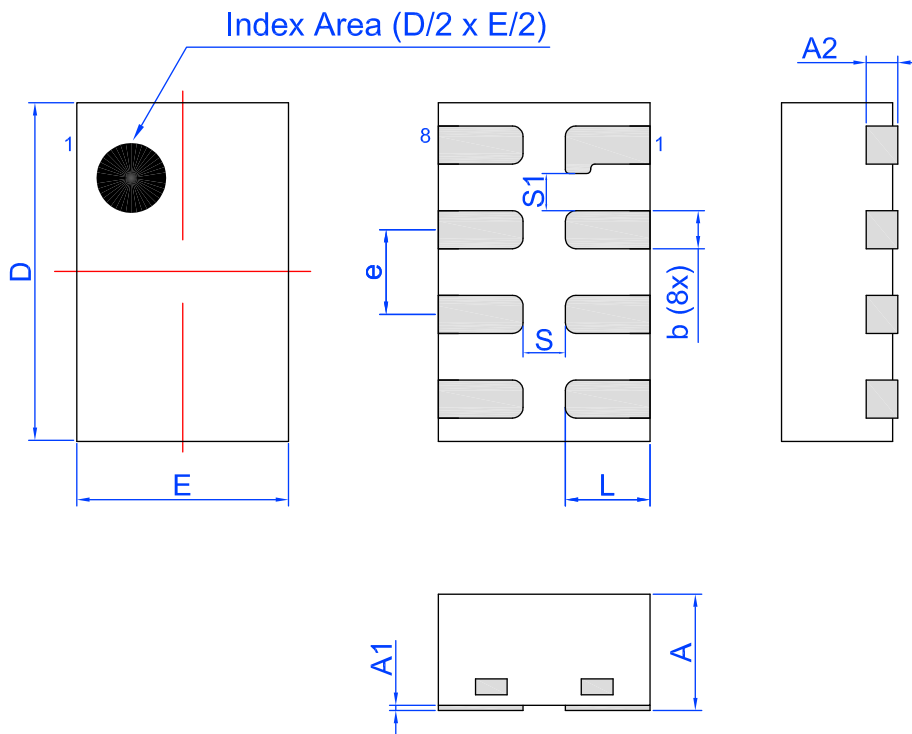


## SLG59M1599V Layout Suggestion



## Package Drawing and Dimensions

8 Lead STDFN Package 1.0 x 1.6 mm



Unit: mm

| Symbol | Min      | Nom. | Max   | Symbol | Min       | Nom. | Max  |
|--------|----------|------|-------|--------|-----------|------|------|
| A      | 0.50     | 0.55 | 0.60  | D      | 1.55      | 1.60 | 1.65 |
| A1     | 0.005    | -    | 0.060 | 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  | S      | 0.2 REF   |      |      |
| e      | 0.40 BSC |      |       | S1     | 0.175 REF |      |      |

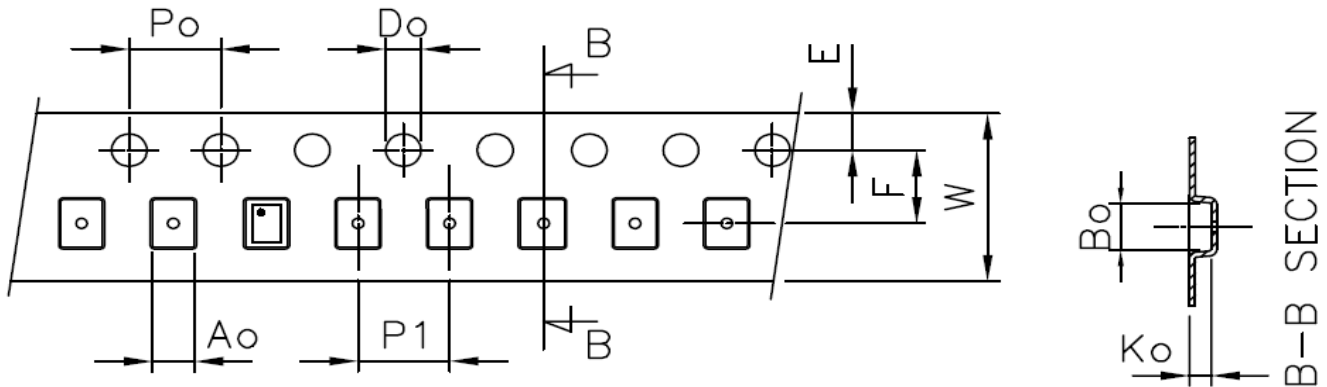


**Tape and Reel Specifications**

| Package Type                         | # of Pins | Nominal Package Size [mm] | Max Units |         | Reel & Hub Size [mm] | Leader (min) |             | Trailer (min) |             | Tape Width [mm] | Part Pitch [mm] |
|--------------------------------------|-----------|---------------------------|-----------|---------|----------------------|--------------|-------------|---------------|-------------|-----------------|-----------------|
|                                      |           |                           | per Reel  | per Box |                      | Pockets      | Length [mm] | Pockets       | Length [mm] |                 |                 |
| STDFN 8L<br>1x1.6mm<br>0.4P<br>Green | 8         | 1.0 x 1.6 x 0.55          | 3,000     | 3,000   | 178 / 60             | 100          | 400         | 100           | 400         | 8               | 4               |

**Carrier Tape Drawing and Dimensions**

| Package Type                      | Pocket BTM Length | Pocket BTM Width | Pocket Depth | Index Hole Pitch | Pocket Pitch | Index Hole Diameter | Index Hole to Tape Edge | Index Hole to Pocket Center | Tape Width |
|-----------------------------------|-------------------|------------------|--------------|------------------|--------------|---------------------|-------------------------|-----------------------------|------------|
|                                   | A0                | B0               | K0           | P0               | P1           | D0                  | E                       | F                           | W          |
| STDFN 8L<br>1x1.6mm<br>0.4P Green | 1.12              | 1.72             | 0.7          | 4                | 4            | 1.55                | 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 0.88 mm<sup>3</sup> (nominal). More information can be found at [www.jedec.org](http://www.jedec.org).





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**Revision History**

| Date       | Version | Change  |
|------------|---------|---|
| 11/20/2015 | 1.03    | Added ESD <sub>CDM</sub> , MSL, and $\theta_{JA}$ specs |

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