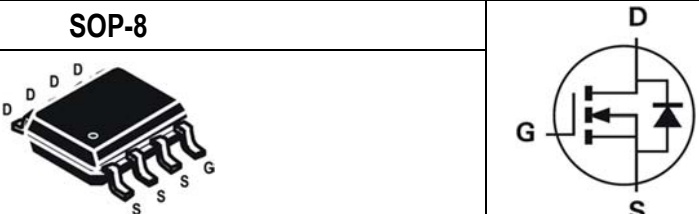


|   |              |  |
|---|--------------|--|
| <b>V<sub>DSS</sub> , 40V</b><br><b>R<sub>DS(ON)</sub> , 6.0mΩ (max.) @ V<sub>GS</sub>=10V</b><br><b>R<sub>DS(ON)</sub> , 7.4mΩ (max.) @ V<sub>GS</sub>=4.5V</b><br><b>I<sub>D</sub> , 17A</b> | <b>SOP-8</b> |  |
|   |              |  |

| Description  | Features  |
|--|---|
| The SG40N05S uses advanced Trench technology and designs to provide excellent R <sub>DS(ON)</sub> with low gate charge. This device is suitable for use in PWM, load switching and general purpose applications. | <ul style="list-style-type: none"> <li>• Low On-Resistance</li> <li>• Low Input Capacitance</li> <li>• Low Miller Charge</li> <li>• Low Input / Output Leakage</li> <li>• Pb-free lead plating; RoHS compliant</li> </ul> |
|  | <b>Applications</b> <ul style="list-style-type: none"> <li>• Motor / Body Load Control</li> <li>• Automotive Systems</li> <li>• Load Switch</li> <li>• DC-DC converters and Off-line UPS</li> </ul>                       |

## Ordering Information

| Ordering Code | RoHS Status  | Package | Package Code | Packing     | Quantity |
|---------------|--------------|---------|--------------|-------------|----------|
| SG40N05S      | Halogen-Free | SOP-8   | S            | Tape & Reel | 3,000    |

## Absolute Maximum Ratings (T<sub>A</sub>=25°C unless otherwise noted)

**Absolute Maximum Ratings** (TA = 25 °C unless otherwise noted)

| Parameter                                  | Symbol           | Value                | Unit |   |
|--|------------------|----------------------|------|---|
| Drain-Source Voltage                       | V <sub>DS</sub>  | 40                   | V    |   |
| Gate-Source Voltage                        | V <sub>GS</sub>  | ±20                  | V    |   |
| Drain Current-Continuous                   | I <sub>D</sub>   | T <sub>A</sub> =25°C | 17   | A |
|  |                  | T <sub>A</sub> =70°C | 14   | A |
| Drain Current-Pulsed <small>Note 1</small> | I <sub>DM</sub>  | 68                   | A    |   |
| Avalanche Current                          | I <sub>AS</sub>  | 30                   | A    |   |
| Avalanche Energy, L=0.1mH                  | E <sub>AS</sub>  | 45                   | mJ   |   |
| Maximum Power Dissipation                  | P <sub>D</sub>   | T <sub>C</sub> =25°C | 3.1  | W |
|  |                  | T <sub>C</sub> =70°C | 2    | W |
| Storage Temperature Range                  | T <sub>STG</sub> | -55 to +150          | °C   |   |
| Operating Junction Temperature Range       | T <sub>J</sub>   | -55 to +150          | °C   |   |

## Thermal Resistance Ratings

| Parameter                   | Symbol           | Conditions   | Min. | Typ. | Max. | Unit |
|-----------------------------|------------------|--------------|------|------|------|------|
| Maximum Junction-to-Ambient | R <sub>θJA</sub> | Steady State | -    | -    | 75   | °C/W |
| Maximum Junction-to-Ambient | R <sub>θJA</sub> | t ≤ 10s      | -    | -    | 40   | °C/W |
| Maximum Junction-to-Case    | R <sub>θJC</sub> | Steady State | -    | -    | 24   | °C/W |

## Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

| OFF CHARACTERISTICS             |                   |   |      |      |      |      |
|---------------------------------|-------------------|---|------|------|------|------|
| Parameter                       | Symbol            | Conditions                                  | Min. | Typ. | Max. | Unit |
| Drain-Source Breakdown Voltage  | BV <sub>DSS</sub> | V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA | 40   | -    | -    | V    |
| Zero Gate Voltage Drain Current | I <sub>DSS</sub>  | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V   | -    | -    | 1    | μA   |
| Gate-Body Leakage               | I <sub>GSS</sub>  | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V  | -    | -    | ±100 | nA   |

| ON CHARACTERISTICS                         |                     |   |      |      |      |      |
|--|---------------------|---|------|------|------|------|
| Parameter                                  | Symbol              | Conditions  | Min. | Typ. | Max. | Unit |
| Gate Threshold Voltage                     | V <sub>GS(TH)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA | 1    | -    | 2.5  | V    |
| Drain-Source On-State Resistance           | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>DS</sub> =10A                | -    | -    | 6.0  | mΩ   |
| Drain-Source On-State Resistance           |                     | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =7A                | -    | -    | 7.4  | mΩ   |
| Forward Transconductance <sup>Note 1</sup> | g <sub>fs</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =17A                  | -    | 25   | -    | S    |

| DYNAMIC CHARACTERISTICS      |                  |   |      |      |      |      |
|------------------------------|------------------|---|------|------|------|------|
| Parameter                    | Symbol           | Conditions  | Min. | Typ. | Max. | Unit |
| Input Capacitance            | C <sub>iss</sub> | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz | -    | 3018 | -    | pF   |
| Output Capacitance           | C <sub>oss</sub> |   | -    | 247  | -    |      |
| Reverse Transfer Capacitance | C <sub>rss</sub> |   | -    | 183  | -    |      |
| Gate Resistance              | R <sub>g</sub>   | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz  | -    | 1.5  | -    | Ω    |

| SWITCHING CHARACTERISTICS     |                     |   |      |      |      |      |
|-------------------------------|---------------------|---|------|------|------|------|
| Parameter                     | Symbol              | Conditions  | Min. | Typ. | Max. | Unit |
| Turn-On Delay Time            | T <sub>d(on)</sub>  | V <sub>DD</sub> =15V, I <sub>D</sub> =17A, V <sub>GS</sub> =10V, R <sub>g</sub> =3.3Ω | -    | 18.2 | -    | ns   |
| Rise Time                     | t <sub>r</sub>      |   | -    | 9.8  | -    |      |
| Turn-Off Delay Time           | T <sub>d(off)</sub> |   | -    | 82.5 | -    |      |
| Fall Time                     | t <sub>f</sub>      |   | -    | 6.5  | -    |      |
| Total Gate Charge             | Q <sub>g</sub>      | V <sub>DS</sub> =20V, I <sub>DS</sub> =15A, V <sub>GS</sub> =4.5V                     | -    | 25   | -    | nC   |
| Gate to Source Gate Charge    | Q <sub>gs</sub>     |   | -    | 7    | -    |      |
| Gate to Drain "Miller" Charge | Q <sub>gd</sub>     |   | -    | 11   | -    |      |

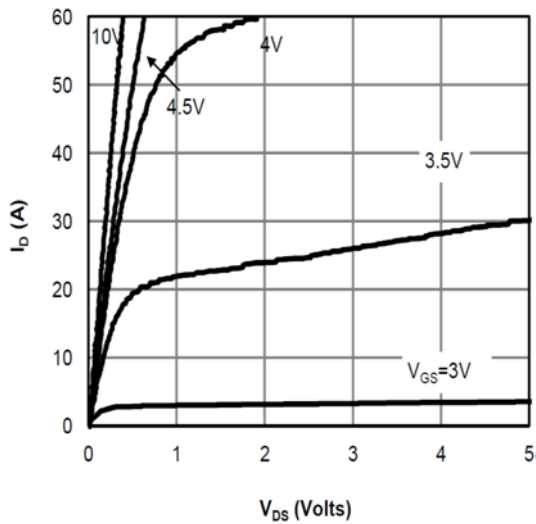
| DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS |                 |   |      |      |      |      |
|--|-----------------|---|------|------|------|------|
| Parameter  | Symbol          | Conditions  | Min. | Typ. | Max. | Unit |
| Maximum Body-Diode Continuous Current                  | I <sub>S</sub>  | V <sub>G</sub> =V <sub>D</sub> =0V, Force Current | -    | -    | 17   | A    |
| Pulsed Source Current                                  | I <sub>SM</sub> | V <sub>G</sub> =V <sub>D</sub> =0V, Force Current | -    | -    | 68   | A    |
| Drain-Source Diode Forward Voltage                     | V <sub>SD</sub> | V <sub>GS</sub> =0V, I <sub>S</sub> =17A          | -    | -    | 1.2  | V    |

### Notes:

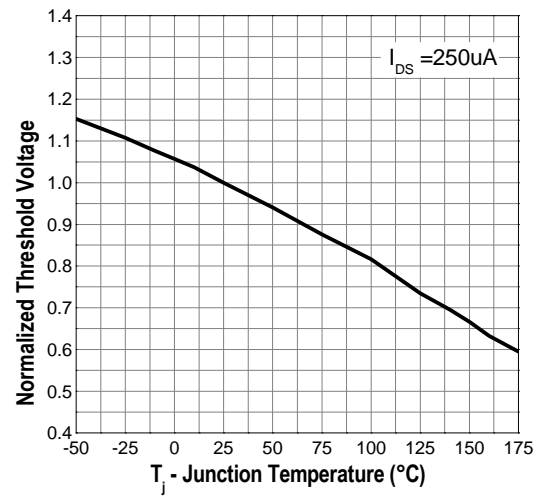
1. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
2. R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R<sub>θJC</sub> is guaranteed by design while R<sub>θJA</sub> is determined by the user's board design. R<sub>θJA</sub> shown below for single device operation on FR-4 in still air.

## Typical Operating Characteristics

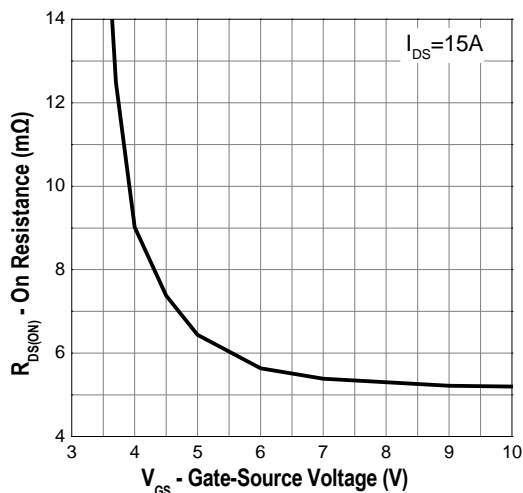
### Output Characteristics



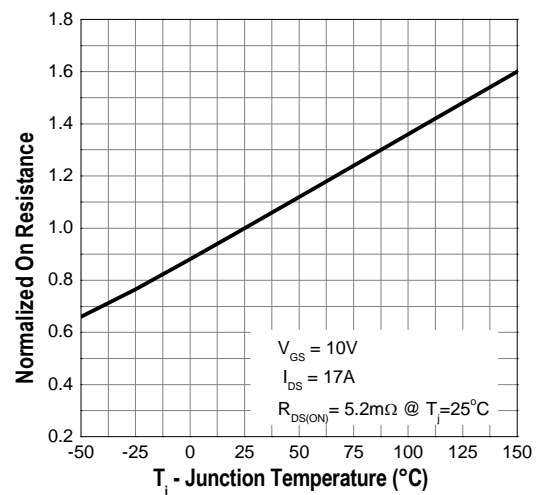
### Gate Threshold Voltage



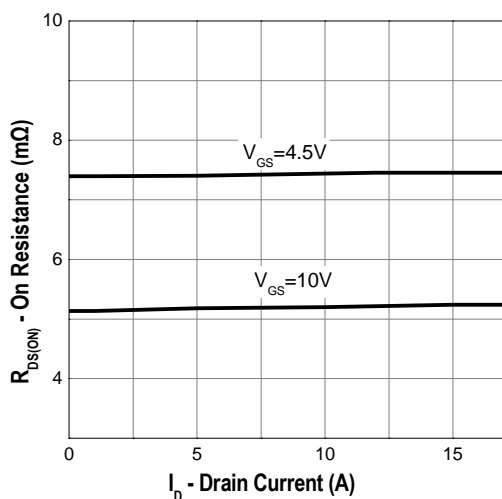
### Gate-Source On Resistance



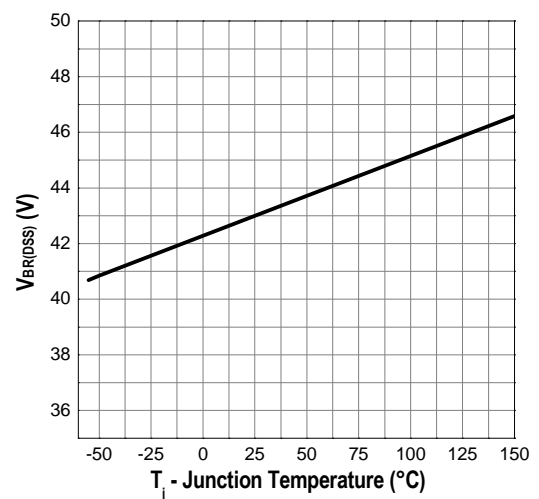
### Drain-Source On Resistance



### Drain-Source On Resistance

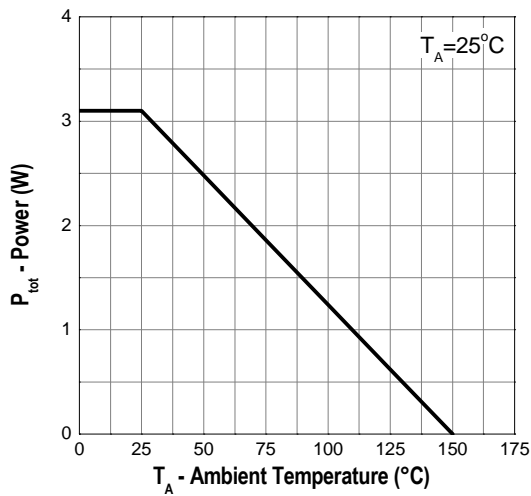


### Drain-source Breakdown Voltage

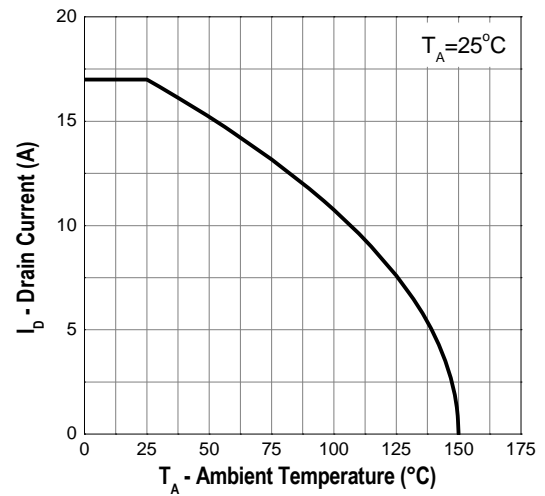


Typical Operating Characteristics (Cont.)

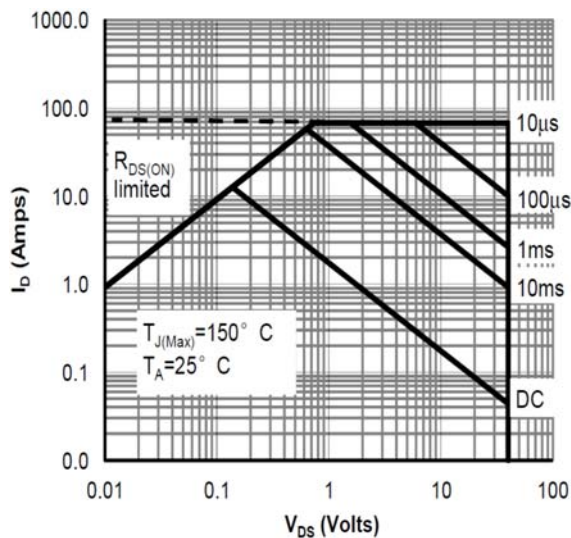
Power Dissipation



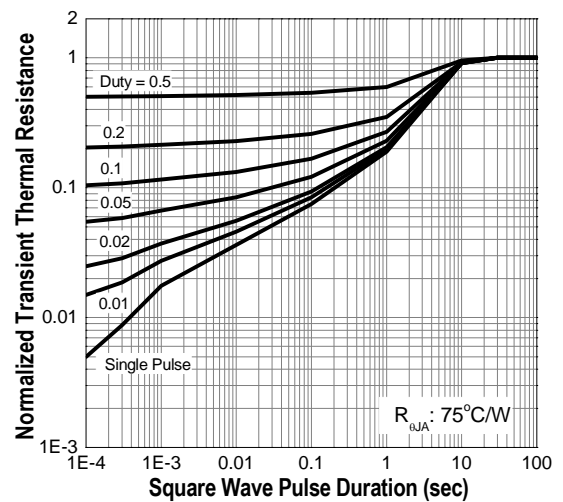
Drain Current



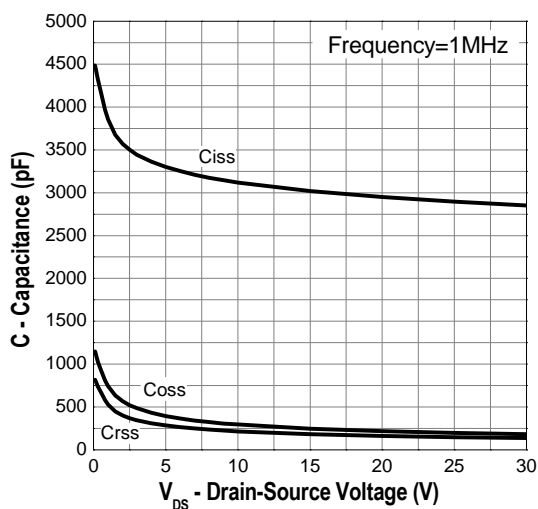
Safe Operation Area



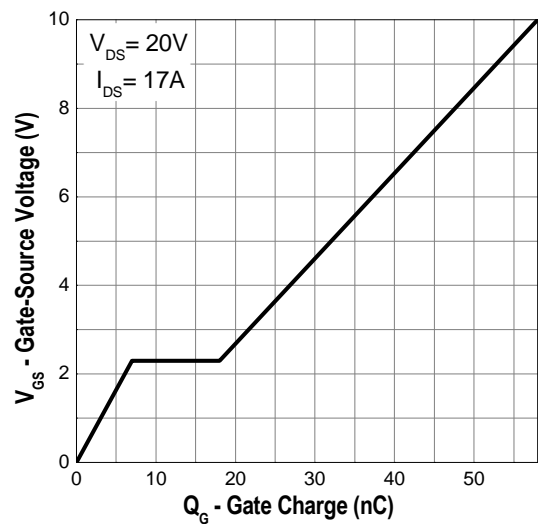
Transient Thermal Impedance




Capacitance



Gate Charge

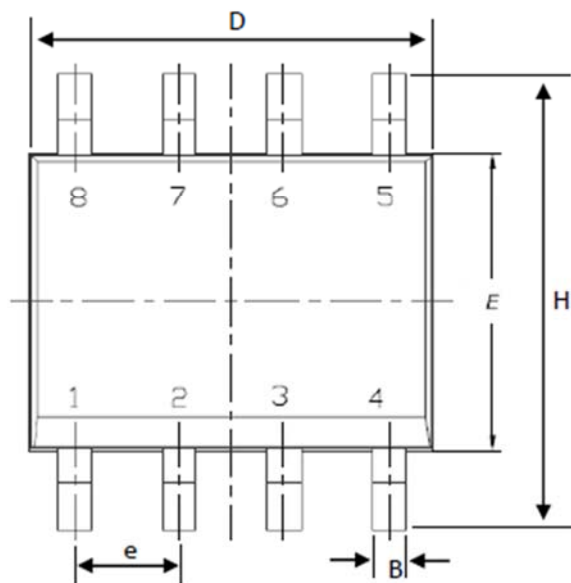


## Marking Information

| SOP-8 (S)  | Marking Rule   |
|--|--|
| <p>Laser Marking</p>  | <p><u>Line 1</u> : Device Name<br/>SG40N05S</p> <p><u>Line 2</u> : Date Code<br/>YYMMXXX</p> <p>YY : Year Code<br/>MM : Month Code<br/>XXX : Serial Number</p> |

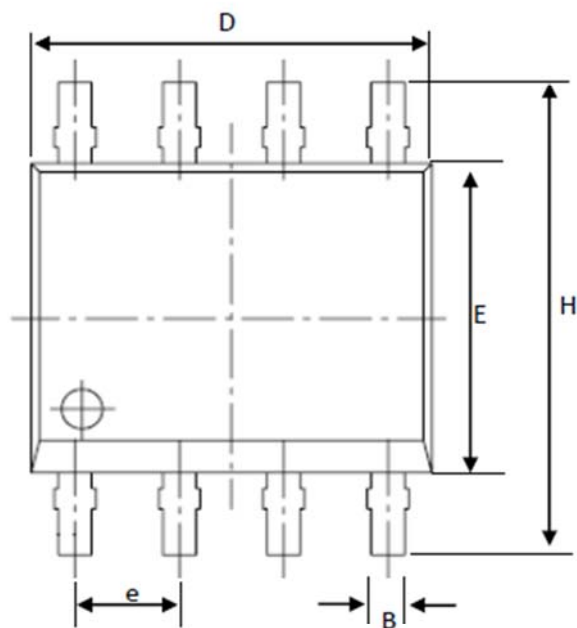
**Package of Dimension**

G-TYPE



| Symbol   | Min  | Nor  | Max  |
|----------|------|------|------|
| A        | 1.35 | 1.55 | 1.75 |
| A1       | 0.10 | 0.18 | 0.25 |
| B        | 0.31 | 0.41 | 0.51 |
| c        | 0.17 | 0.21 | 0.25 |
| D        | 4.80 | 4.90 | 5.00 |
| E        | 3.80 | 3.90 | 4.00 |
| e        | 1.27 | 1.27 | 1.27 |
| H        | 5.80 | 6.00 | 6.20 |
| L        | 0.40 | 0.84 | 1.27 |
| $\alpha$ | 0.00 | 4.00 | 8.00 |

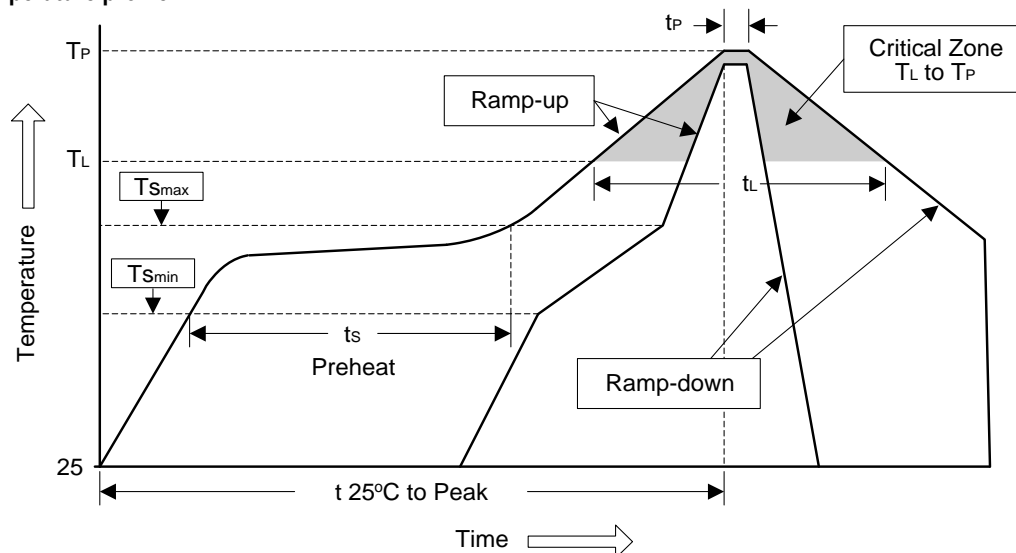
B-TYPE



## Soldering Methods for Silicongear's Products

- Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
- Reflow soldering of surface-mount devices

Figure 1: Temperature profile



| Profile Feature                                      | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|--|-------------------------|------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )              | <3°C/sec                | <3°C/sec         |
| Preheat  |                         |                  |
| - Temperature Min ( $T_{Smin}$ )                     | 100°C                   | 150°C            |
| - Temperature Max ( $T_{Smix}$ )                     | 150°C                   | 200°C            |
| - Time (min to max) ( $t_s$ )                        | 60 to 120 sec           | 60 to 180 sec    |
| $T_{Smix}$ to $T_L$                                  |                         |                  |
| - Ramp-up Rate                                       | <3°C/sec                | <3°C/sec         |
| Time maintained above:                               |                         |                  |
| - Temperature ( $T_L$ )                              | 183°C                   | 217°C            |
| - Time ( $t_L$ )                                     | 60 to 150 sec           | 60 to 150 sec    |
| Peak Temperature ( $T_P$ )                           | 240°C +0/-5°C           | 260°C +0/-5°C    |
| Time within 5°C of actual Peak Temperature ( $t_P$ ) | 10 to 30 sec            | 20 to 40 sec     |
| Ramp-down Rate                                       | <6°C/sec                | <6°C/sec         |
| Time 25°C to Peak Temperature                        | <6 minutes              | <8 minutes       |

### 3. Flow (wave) soldering (solder dipping)

| Products         | Peak Temperature | Dipping Time |
|------------------|------------------|--------------|
| Pb devices.      | 245°C ±5°C       | 5sec ±1sec   |
| Pb-Free devices. | 260°C +0/-5°C    | 5sec ±1sec   |

## **Important Notice**

### **© Silicongear Corporation**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Silicongear cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in an Silicongear product. No circuit patent licenses, copyrights, mask work rights, or other intellectual property rights are implied.

Silicongear Corporation, its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Silicongear"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Silicongear makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Silicongear disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Silicongear's knowledge of typical requirements that are often placed on Silicongear products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Silicongear's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Silicongear products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Silicongear product could result in personal injury or death. Customers using or selling Silicongear products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Silicongear and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Silicongear or its distributor was negligent regarding the design or manufacture of the part. Please contact authorized Silicongear personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Silicongear. Product names and markings noted herein may be trademarks of their respective owners.

Silicongear and the Silicongear logo are trademarks of Silicongear Corporation. All other brand and product names appearing in this document are registered trademarks or trademarks of their respective holders.