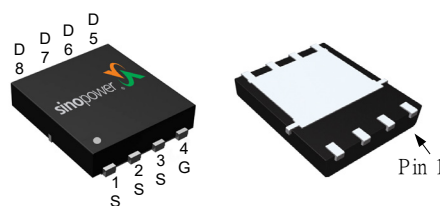


## N-Channel Enhancement Mode MOSFET

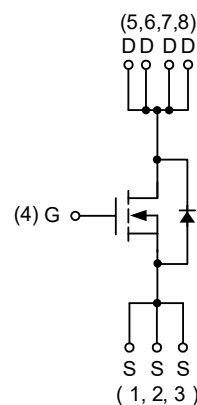
## Features

- 60V/51A  
 $R_{DS(ON)} = 11.3\text{m}\Omega(\text{max.}) @ V_{GS} = 10\text{V}$   
 $R_{DS(ON)} = 16.2\text{m}\Omega(\text{max.}) @ V_{GS} = 4.5\text{V}$
- 100% UIS +  $R_g$  Tested
- Reliable and Rugged
- Lead Free and Green Devices Available  
(RoHS Compliant)

## Pin Description



DFN5x6A-8\_EP



N-Channel MOSFET

## Applications

- Secondary Side Synchronous Rectification.
- DC-DC Converter.
- Motor Control.
- Load Switching.

## Ordering and Marking Information

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>SM6175NH <span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span>-<span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span><span style="border: 1px solid black; padding: 0 2px;"> </span></p> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="border-left: 1px solid black; border-bottom: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border-left: 1px solid black; border-bottom: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border-left: 1px solid black; border-bottom: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border-left: 1px solid black; border-bottom: 1px solid black; width: 20px; height: 20px;"></div> </div> <div style="margin-left: 25px;"> <p>Assembly Material</p> <p>Handling Code</p> <p>Temperature Range</p> <p>Package Code</p> </div> | <p>Package Code<br/>           KP : DFN5x6A-8_EP</p> <p>Operating Junction Temperature Range<br/>           C : -55 to 150 °C</p> <p>Handling Code<br/>           TR : Tape &amp; Reel</p> <p>Assembly Material<br/>           G : Halogen and Lead Free Device</p>                                                                   |
| <p>SM6175NH KP :</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px; text-align: center;"> <br/> <b>6175NH</b><br/>           XXXXX         </div> <div> <p>XXXXX - Lot Code</p> </div> </div> |

Note : SINOPOWER lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. SINOPOWER lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020D for MSL classification at lead-free peak reflow temperature. SINOPOWER defines "Green" to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

**Absolute Maximum Ratings** ( $T_A=25^{\circ}\text{C}$  Unless Otherwise Noted)

| Symbol                       | Parameter                              |                       | Rating     | Unit |
|------------------------------|----------------------------------------|-----------------------|------------|------|
| Common Ratings               |                                        |                       |            |      |
| V <sub>DSS</sub>             | Drain-Source Voltage                   |                       | 60         | V    |
| V <sub>GSS</sub>             | Gate-Source Voltage                    |                       | ±20        |      |
| T <sub>J</sub>               | Maximum Junction Temperature           |                       | 150        | °C   |
| T <sub>STG</sub>             | Storage Temperature Range              |                       | -55 to 150 |      |
| I <sub>S</sub>               | Diode Continuous Forward Current       | T <sub>C</sub> =25°C  | 26         | A    |
| I <sub>D</sub>               | Continuous Drain Current               | T <sub>C</sub> =25°C  | 51         | A    |
|                              |                                        | T <sub>C</sub> =100°C | 32         |      |
| I <sub>DM</sub> <sup>a</sup> | Pulsed Drain Current                   | T <sub>C</sub> =25°C  | 204        |      |
| P <sub>D</sub>               | Maximum Power Dissipation              | T <sub>C</sub> =25°C  | 54         | W    |
|                              |                                        | T <sub>C</sub> =100°C | 22         |      |
| R <sub>θJC</sub>             | Thermal Resistance-Junction to Case    |                       | 2.3        | °C/W |
| I <sub>D</sub>               | Continuous Drain Current               | T <sub>A</sub> =25°C  | 10         | A    |
|                              |                                        | T <sub>A</sub> =70°C  | 8          |      |
| P <sub>D</sub>               | Maximum Power Dissipation              | T <sub>A</sub> =25°C  | 2.3        | W    |
|                              |                                        | T <sub>A</sub> =70°C  | 1.5        |      |
| R <sub>θJA</sub>             | Thermal Resistance-Junction to Ambient |                       | 55         | °C/W |
| I <sub>AS</sub> <sup>b</sup> | Avalanche Current, Single pulse        | L=0.5mH               | 14         | A    |
| E <sub>AS</sub> <sup>b</sup> | Avalanche Energy, Single pulse         | L=0.5mH               | 49         | mJ   |

Note a : Pulse width limited by maximum junction temperature.

Note b : UIS tested and pulse width limited by maximum junction temperature (initial temperature  $T_J=25^{\circ}\text{C}$ ).

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

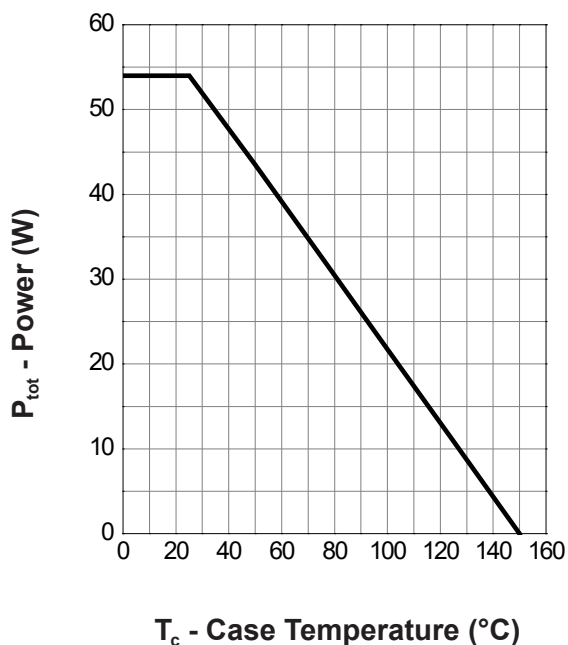
| Symbol                                   | Parameter                        | Test Conditions                                                                                                 | Min. | Typ. | Max. | Unit |
|------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics                   |                                  |                                                                                                                 |      |      |      |      |
| BV <sub>DSS</sub>                        | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA                                                                     | 60   | -    | -    | V    |
| I <sub>DSS</sub>                         | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =48V, V <sub>GS</sub> =0V                                                                       | -    | -    | 1    | μA   |
|                                          |                                  | T <sub>J</sub> =85°C                                                                                            | -    | -    | 30   |      |
| V <sub>GS(th)</sub>                      | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA                                                       | 1    | 2    | 3    | V    |
| I <sub>GSS</sub>                         | Gate Leakage Current             | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                                                      | -    | -    | ±100 | nA   |
| R <sub>DS(ON)</sub> <sup>c</sup>         | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =20A                                                                      | -    | 9.4  | 11.3 | mΩ   |
|                                          |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =12A                                                                     | -    | 12.5 | 16.2 | mΩ   |
| Diode Characteristics                    |                                  |                                                                                                                 |      |      |      |      |
| V <sub>SD</sub> <sup>c</sup>             | Diode Forward Voltage            | I <sub>SD</sub> =10A, V <sub>GS</sub> =0V                                                                       | -    | 0.8  | 1.1  | V    |
| t <sub>rr</sub> <sup>d</sup>             | Reverse Recovery Time            | I <sub>SD</sub> =20A, dI <sub>SD</sub> /dt=100A/μs                                                              | -    | 25   | -    | ns   |
| Q <sub>rr</sub> <sup>d</sup>             | Reverse Recovery Charge          |                                                                                                                 | -    | 17   | -    | nC   |
| Dynamic Characteristics <sup>d</sup>     |                                  |                                                                                                                 |      |      |      |      |
| R <sub>G</sub>                           | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz                                                                | -    | 1    | -    | Ω    |
| C <sub>iss</sub>                         | Input Capacitance                | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =30V,<br>Frequency=1.0MHz                                               | -    | 1029 | 1338 | pF   |
| C <sub>oss</sub>                         | Output Capacitance               |                                                                                                                 | -    | 196  | -    |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance     |                                                                                                                 | -    | 26   | -    |      |
| t <sub>d(ON)</sub>                       | Turn-on Delay Time               | V <sub>DD</sub> =30V, R <sub>L</sub> =30Ω,<br>I <sub>DS</sub> =1A, V <sub>GEN</sub> =10V,<br>R <sub>G</sub> =6Ω | -    | 13   | 23   | ns   |
| t <sub>r</sub>                           | Turn-on Rise Time                |                                                                                                                 | -    | 6    | 11   |      |
| t <sub>d(OFF)</sub>                      | Turn-off Delay Time              |                                                                                                                 | -    | 26   | 47   |      |
| t <sub>f</sub>                           | Turn-off Fall Time               |                                                                                                                 | -    | 21   | 38   |      |
| Gate Charge Characteristics <sup>d</sup> |                                  |                                                                                                                 |      |      |      |      |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =30V, V <sub>GS</sub> =10V,<br>I <sub>DS</sub> =20A                                             | -    | 16   | 24   | nC   |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =30V, V <sub>GS</sub> =4.5V,<br>I <sub>DS</sub> =20A                                            |      | 7.7  | -    |      |
| Q <sub>gs</sub>                          | Gate-Source Charge               |                                                                                                                 | -    | 3.7  | -    |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge                |                                                                                                                 | -    | 2.8  | -    |      |

Note c : Pulse test ; pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ .

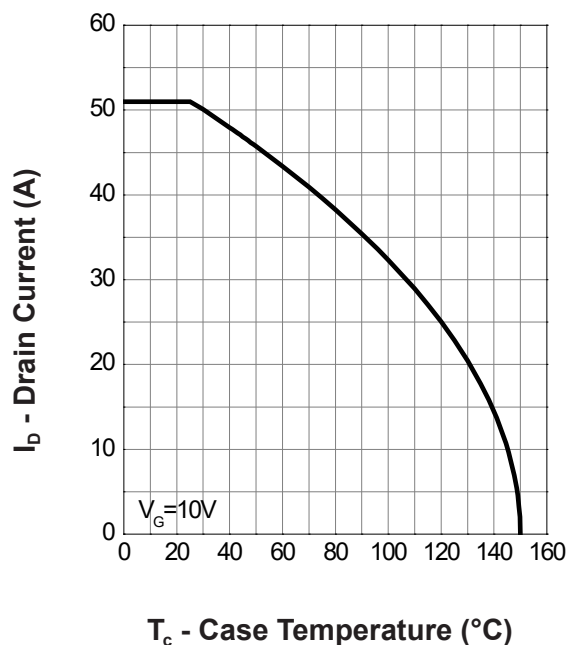
Note d : Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

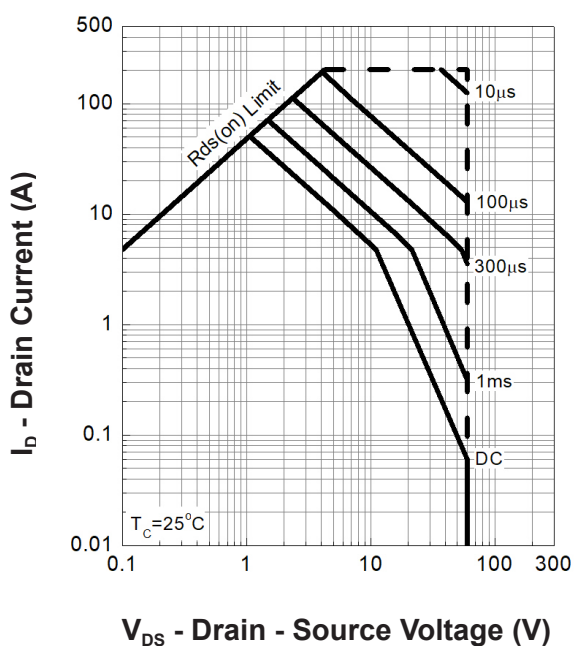
**Power Dissipation**



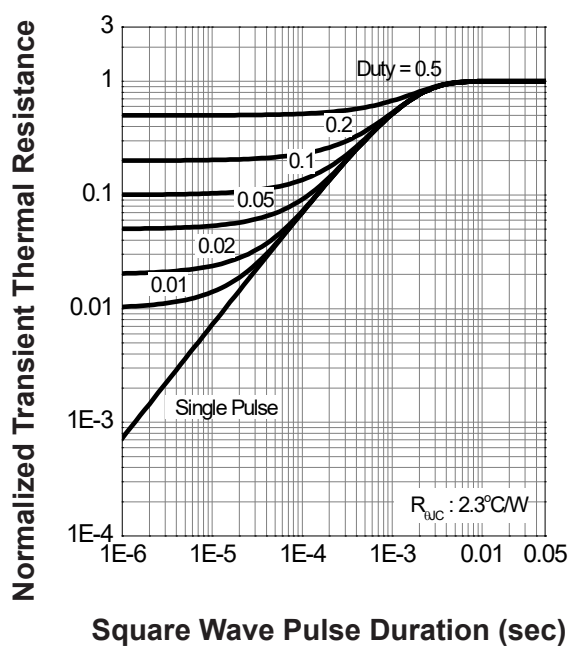
**Drain Current**



**Safe Operation Area**

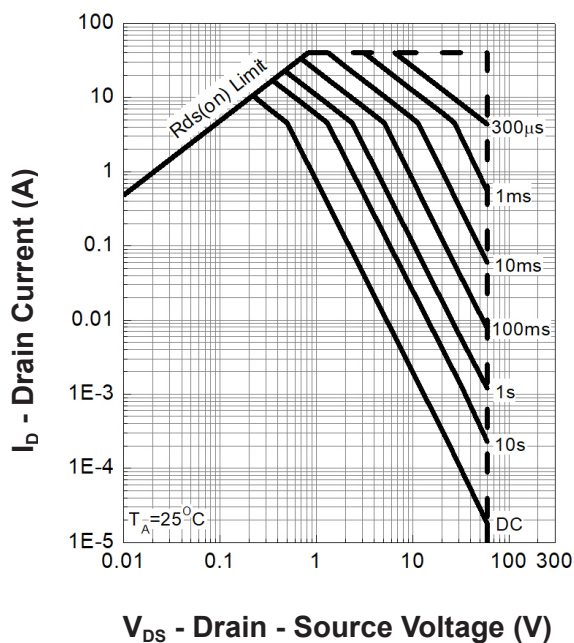


**Thermal Transient Impedance**

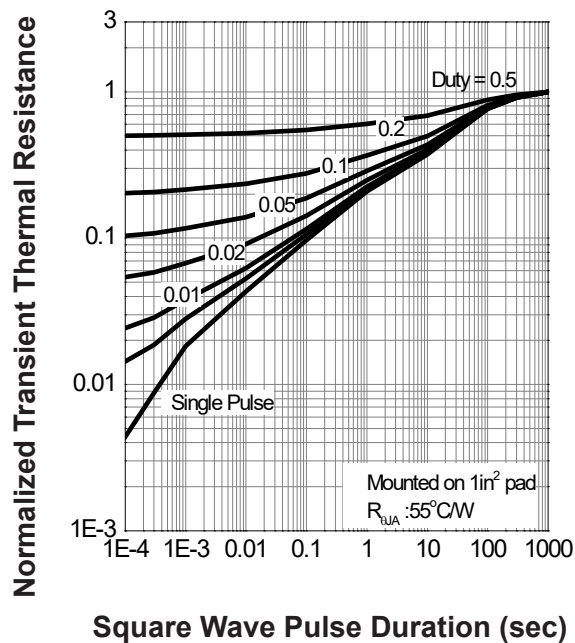


## Typical Operating Characteristics(Cont.)

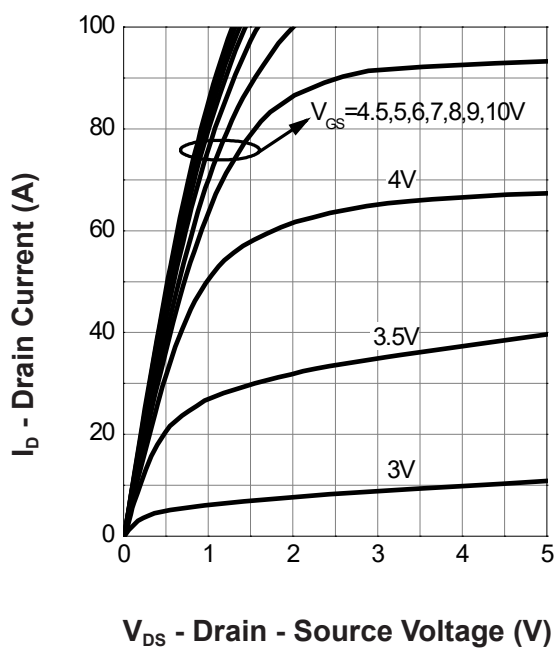
**Safe Operation Area**



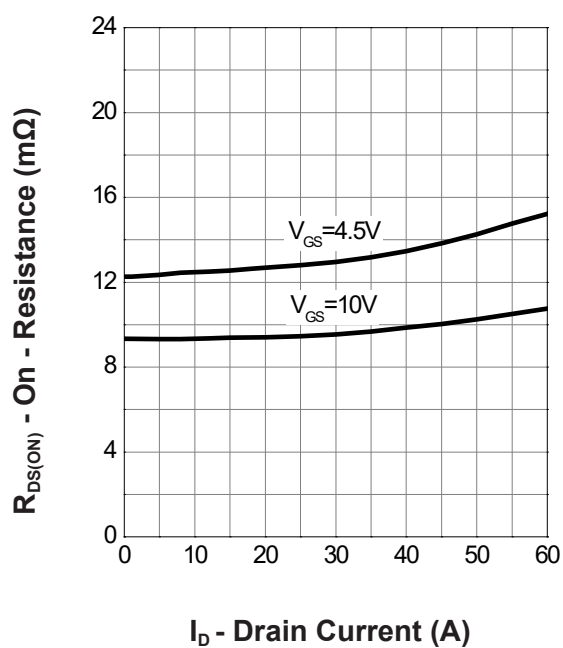
**Thermal Transient Impedance**



**Output Characteristics**

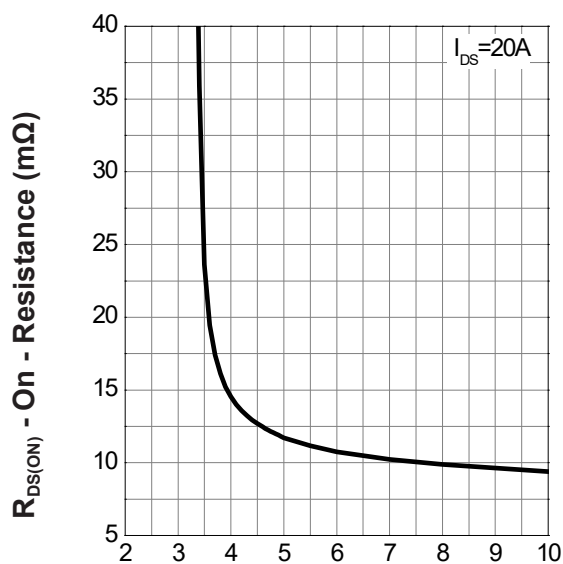


**Drain-Source On Resistance**

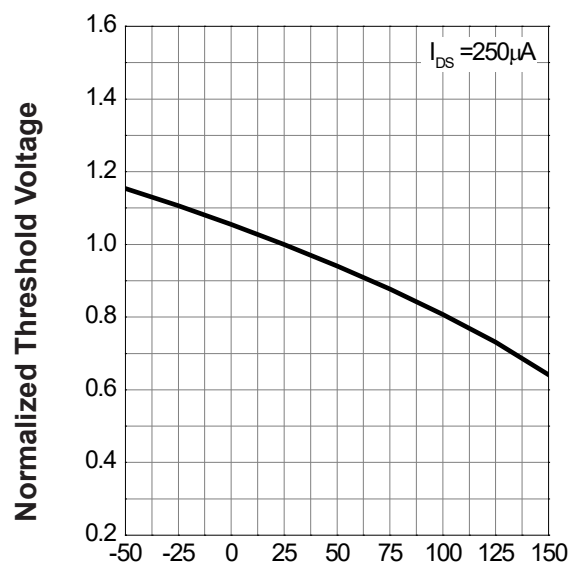


## Typical Operating Characteristics(Cont.)

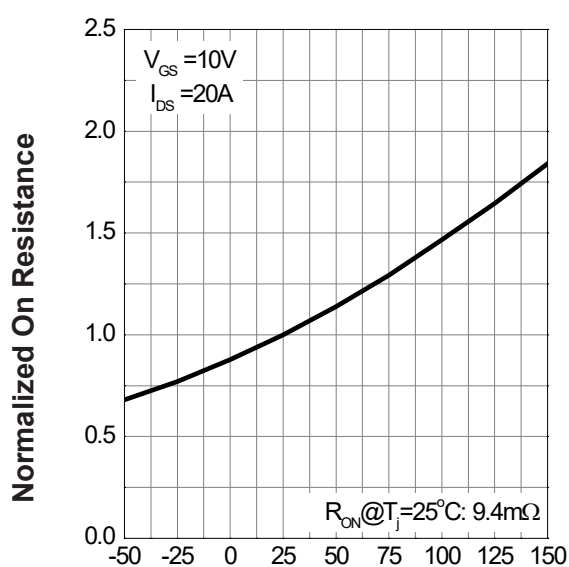
Gate-Source On Resistance

 $V_{GS}$  - Gate - Source Voltage (V)

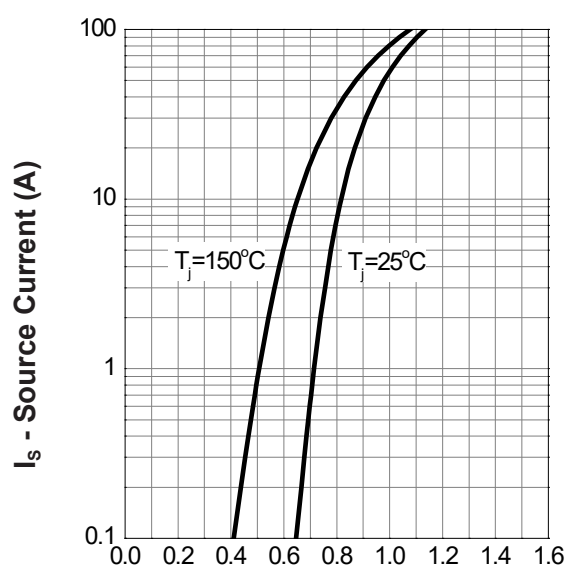
Gate Threshold Voltage

 $T_J$  - Junction Temperature (°C)

Drain-Source On Resistance

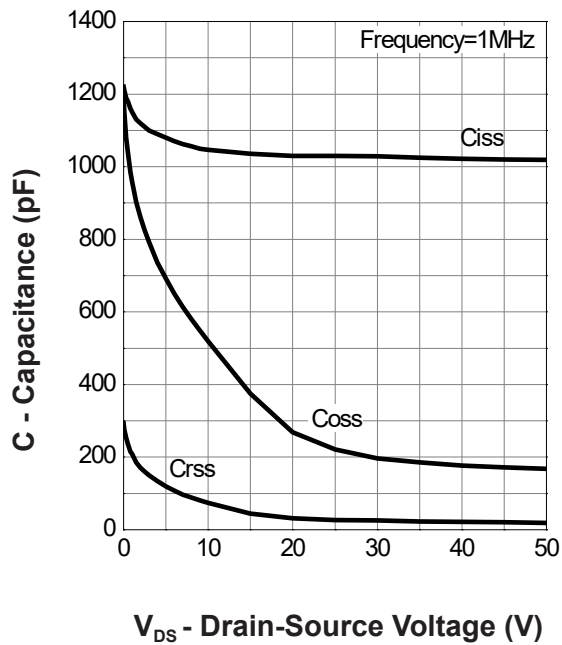
 $T_J$  - Junction Temperature (°C)

Source-Drain Diode Forward

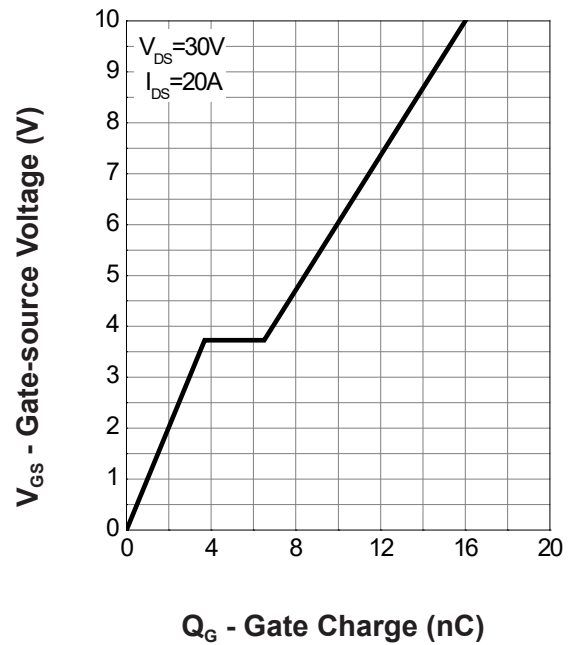
 $V_{SD}$  - Source - Drain Voltage (V)

## Typical Operating Characteristics(Cont.)

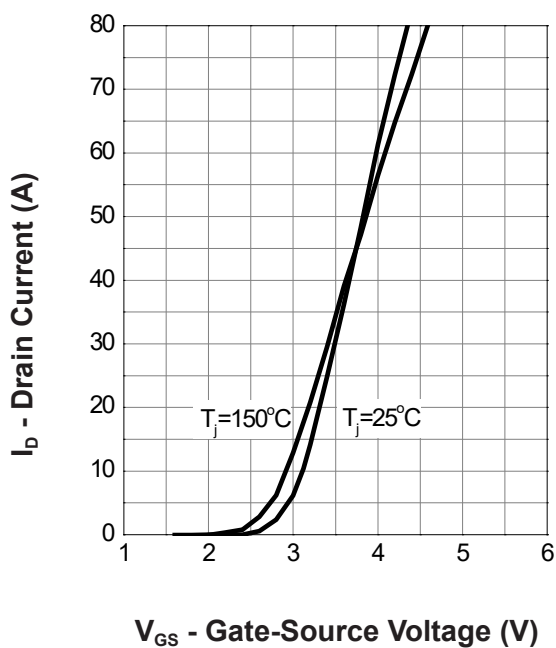
**Capacitance**



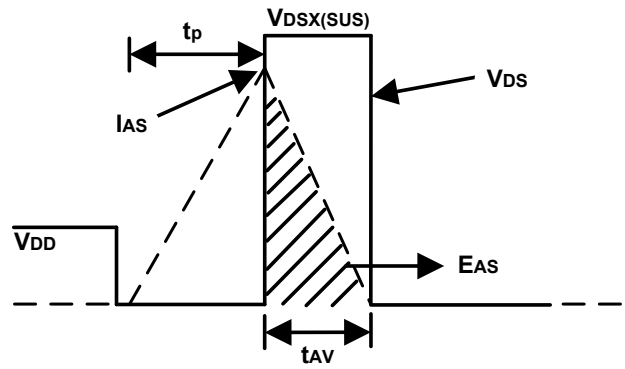
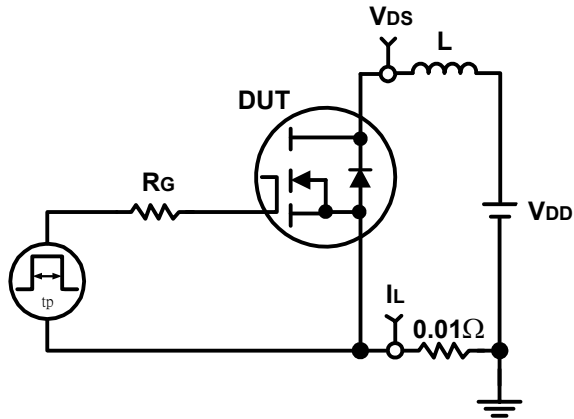
**Gate Charge**



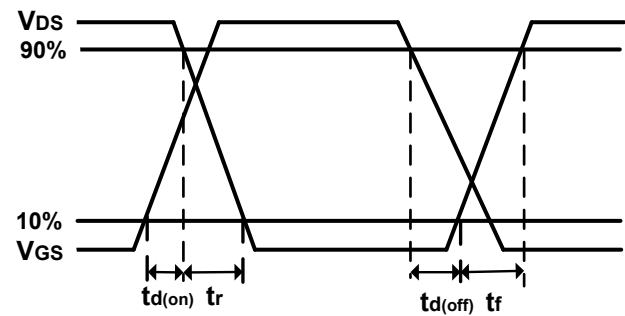
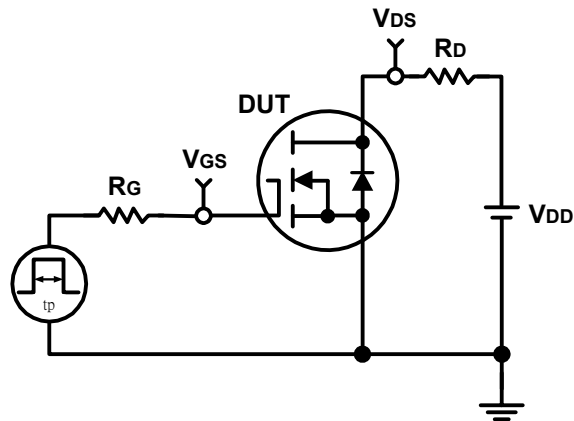
**Transfer Characteristics**



## Avalanche Test Circuit and Waveforms



## Switching Time Test Circuit and Waveforms



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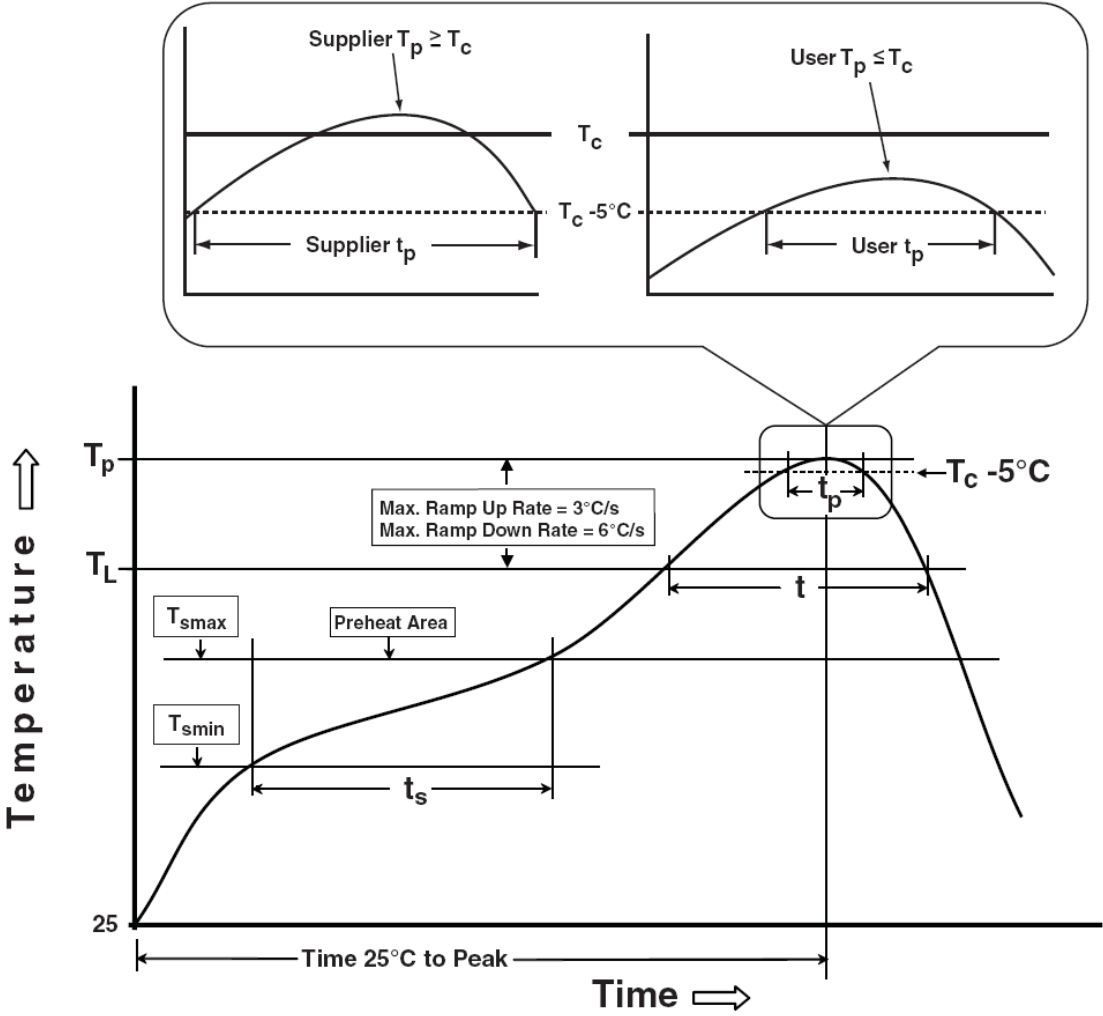
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Classification Profile



## Classification Reflow Profiles

| Profile Feature                                                                                                  | Sn-Pb Eutectic Assembly            | Pb-Free Assembly                   |
|------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|
| <b>Preheat &amp; Soak</b>                                                                                        |                                    |                                    |
| Temperature min ( $T_{smin}$ )                                                                                   | 100 °C                             | 150 °C                             |
| Temperature max ( $T_{smax}$ )                                                                                   | 150 °C                             | 200 °C                             |
| Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )                                                                      | 60-120 seconds                     | 60-120 seconds                     |
| Average ramp-up rate ( $T_{smax}$ to $T_p$ )                                                                     | 3 °C/second max.                   | 3°C/second max.                    |
| Liquidous temperature ( $T_L$ )                                                                                  | 183 °C                             | 217 °C                             |
| Time at liquidous ( $t_L$ )                                                                                      | 60-150 seconds                     | 60-150 seconds                     |
| Peak package body Temperature ( $T_p$ )*                                                                         | See Classification Temp in table 1 | See Classification Temp in table 2 |
| Time ( $t_p$ )** within 5°C of the specified classification temperature ( $T_c$ )                                | 20** seconds                       | 30** seconds                       |
| Average ramp-down rate ( $T_p$ to $T_{smax}$ )                                                                   | 6 °C/second max.                   | 6 °C/second max.                   |
| Time 25°C to peak temperature                                                                                    | 6 minutes max.                     | 8 minutes max.                     |
| * Tolerance for peak profile Temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.          |                                    |                                    |
| ** Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum. |                                    |                                    |

Table 1. SnPb Eutectic Process – Classification Temperatures ( $T_c$ )

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>≥350 |
|-------------------|--------------------------------|--------------------------------|
| <2.5 mm           | 235 °C                         | 220 °C                         |
| ≥2.5 mm           | 220 °C                         | 220 °C                         |

Table 2. Pb-free Process – Classification Temperatures ( $T_c$ )

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>350-2000 | Volume mm <sup>3</sup><br>>2000 |
|-------------------|--------------------------------|------------------------------------|---------------------------------|
| <1.6 mm           | 260 °C                         | 260 °C                             | 260 °C                          |
| 1.6 mm – 2.5 mm   | 260 °C                         | 250 °C                             | 245 °C                          |
| ≥2.5 mm           | 250 °C                         | 245 °C                             | 245 °C                          |

## Customer Service

### Sinopower Semiconductor Inc.

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