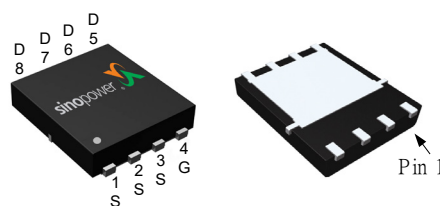


## N-Channel Enhancement Mode MOSFET

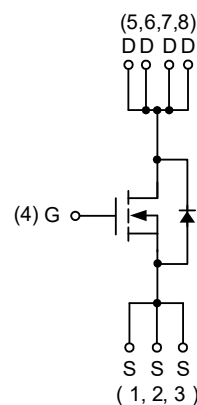
## Features

- 30V/30A<sup>a</sup>
  - $R_{DS(ON)} = 6.4\text{m}\Omega(\text{max.}) @ V_{GS} = 10\text{V}$
  - $R_{DS(ON)} = 8.7\text{m}\Omega(\text{max.}) @ V_{GS} = 4.5\text{V}$
- 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

- Power Management in Desktop Computer or DC/DC Converters.

## Ordering and Marking Information

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>SM4377NB <span style="border: 1px solid black; padding: 2px;">  </span><span style="border: 1px solid black; padding: 2px;">  </span><span style="border: 1px solid black; padding: 2px;">  </span>-<span style="border: 1px solid black; padding: 2px;">  </span><span style="border: 1px solid black; padding: 2px;">  </span><span style="border: 1px solid black; padding: 2px;">  </span></p> <div style="margin-left: 100px;"> <div style="border-left: 1px solid black; height: 60px; margin-bottom: 2px;"></div> <div style="border-left: 1px solid black; height: 60px; margin-bottom: 2px;"></div> <div style="border-left: 1px solid black; height: 60px; margin-bottom: 2px;"></div> <div style="border-left: 1px solid black; height: 60px;"></div> </div> <div style="margin-left: 150px;"> <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>SM4377NB KP :</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">  <p>4377NB<br/>XXXXX</p> </div> <p>XXXXX - Lot Code</p> </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                   |                       | 30              | 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  | 30 <sup>a</sup> | A    |
| I <sub>D</sub>                | Continuous Drain Current               | T <sub>C</sub> =25°C  | 30 <sup>a</sup> | A    |
|                               |                                        | T <sub>C</sub> =100°C | 30 <sup>a</sup> |      |
| I <sub>DM</sub> <sup>b</sup>  | Pulsed Drain Current                   | T <sub>C</sub> =25°C  | 120             |      |
| 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    | Steady State          | 2.3             | °C/W |
| I <sub>D</sub>                | Continuous Drain Current               | T <sub>A</sub> =25°C  | 15              | A    |
|                               |                                        | T <sub>A</sub> =70°C  | 12              |      |
| I <sub>DM</sub> <sup>b</sup>  | Pulsed Drain Current                   | T <sub>A</sub> =25°C  | 60              |      |
| 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> <sup>c</sup> | Thermal Resistance-Junction to Ambient | t ≤ 10s               | 23              | °C/W |
|                               |                                        | Steady State          | 55              |      |
| I <sub>AS</sub> <sup>d</sup>  | Avalanche Current, Single pulse        | L=0.1mH               | 25              | A    |
| E <sub>AS</sub> <sup>d</sup>  | Avalanche Energy, Single pulse         | L=0.1mH               | 31.3            | mJ   |

Note a : Maximum continuous current is limited by bonding wire.

Note b : Pulse width limited by maximum junction temperature.

Note c : Surface mounted on  $1\text{in}^2$  pad area, steady state  $t = 999\text{s}$ .

Note d : 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)

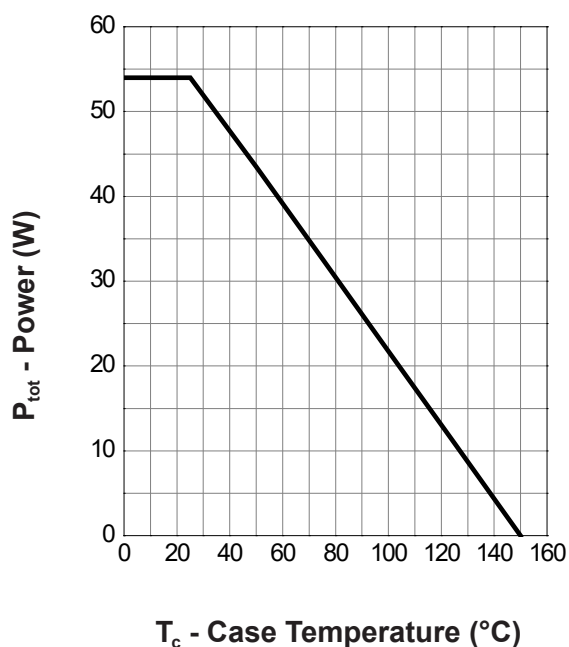
| Symbol                                   | Parameter                        | Test Conditions                                                                                                 | Min. | Typ.       | Max.     | Unit |
|------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------|------|------------|----------|------|
| Static Characteristics                   |                                  |                                                                                                                 |      |            |          |      |
| BV <sub>DSS</sub>                        | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA                                                                     | 30   | -          | -        | V    |
| I <sub>DSS</sub>                         | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =24V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =85°C                                               | -    | -          | 1<br>30  | μA   |
| V <sub>GS(th)</sub>                      | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA                                                       | 1.5  | 1.8        | 2.5      | 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>e</sup>         | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =30A<br>T <sub>J</sub> =125°C                                             | -    | 5.3<br>8.3 | 6.4<br>- | mΩ   |
|                                          |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =15A                                                                     | -    | 6.7        | 8.7      |      |
| Gfs                                      | Forward Transconductance         | V <sub>DS</sub> =5V, I <sub>DS</sub> =30A                                                                       | -    | 22         | -        | S    |
| Diode Characteristics                    |                                  |                                                                                                                 |      |            |          |      |
| V <sub>SD</sub> <sup>e</sup>             | Diode Forward Voltage            | I <sub>SD</sub> =15A, V <sub>GS</sub> =0V                                                                       | -    | 0.8        | 1.1      | V    |
| t <sub>rr</sub>                          | Reverse Recovery Time            | I <sub>SD</sub> =30A, dI <sub>SD</sub> /dt=100A/μs                                                              | -    | 16.7       | -        | ns   |
| t <sub>a</sub>                           | Charge Time                      |                                                                                                                 | -    | 9.1        | -        |      |
| t <sub>b</sub>                           | Discharge Time                   |                                                                                                                 | -    | 7.6        | -        |      |
| Q <sub>rr</sub>                          | Reverse Recovery Charge          |                                                                                                                 | -    | 5.5        | -        | nC   |
| Dynamic Characteristics <sup>f</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> =15V,<br>Frequency=1.0MHz                                               | -    | 1440       | 1872     | pF   |
| C <sub>oss</sub>                         | Output Capacitance               |                                                                                                                 | -    | 185        | -        |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance     |                                                                                                                 | -    | 108        | -        |      |
| t <sub>d(ON)</sub>                       | Turn-on Delay Time               | V <sub>DD</sub> =15V, R <sub>L</sub> =15Ω,<br>I <sub>DS</sub> =1A, V <sub>GEN</sub> =10V,<br>R <sub>G</sub> =6Ω | -    | 13.4       | 25       | ns   |
| t <sub>r</sub>                           | Turn-on Rise Time                |                                                                                                                 | -    | 9.7        | 18       |      |
| t <sub>d(OFF)</sub>                      | Turn-off Delay Time              |                                                                                                                 | -    | 33         | 60       |      |
| t <sub>f</sub>                           | Turn-off Fall Time               |                                                                                                                 | -    | 8.7        | 16       |      |
| Gate Charge Characteristics <sup>f</sup> |                                  |                                                                                                                 |      |            |          |      |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =15V, V <sub>GS</sub> =10V,<br>I <sub>DS</sub> =30A                                             | -    | 26         | 39       | nC   |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V,<br>I <sub>DS</sub> =30A                                            | -    | 12.7       | 19       |      |
| Q <sub>gth</sub>                         | Threshold Gate Charge            |                                                                                                                 | -    | 2.7        | -        |      |
| Q <sub>gs</sub>                          | Gate-Source Charge               |                                                                                                                 | -    | 4.7        | -        |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge                |                                                                                                                 | -    | 4.9        | -        |      |

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

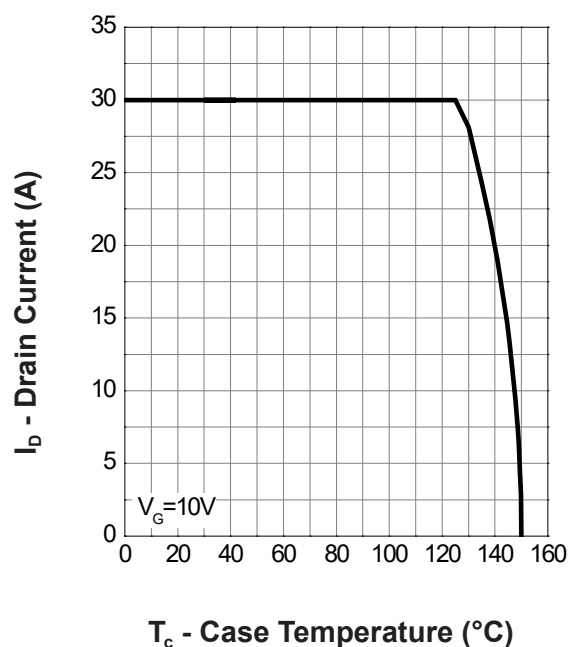
Note f : Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

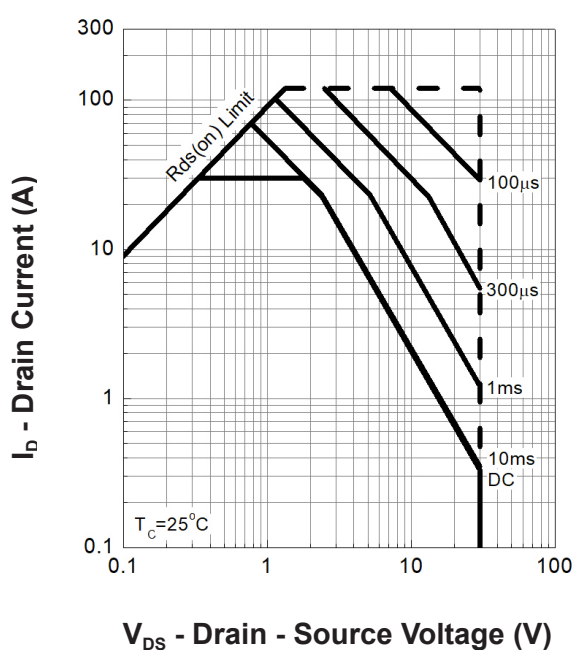
Power Dissipation



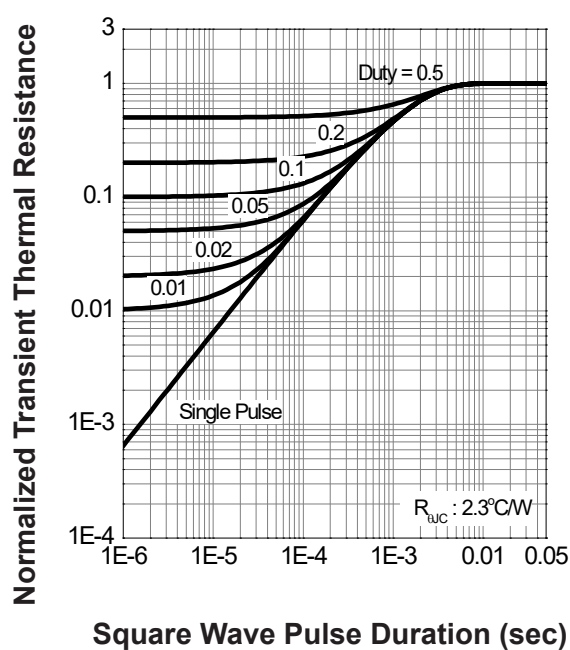
Drain Current



Safe Operation Area

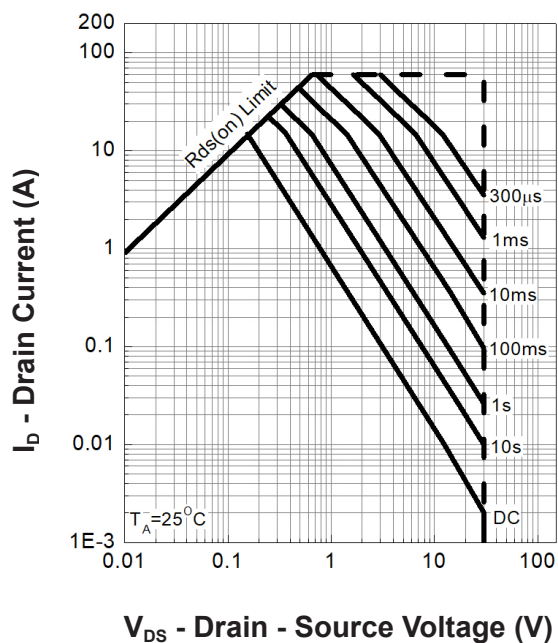


Thermal Transient Impedance

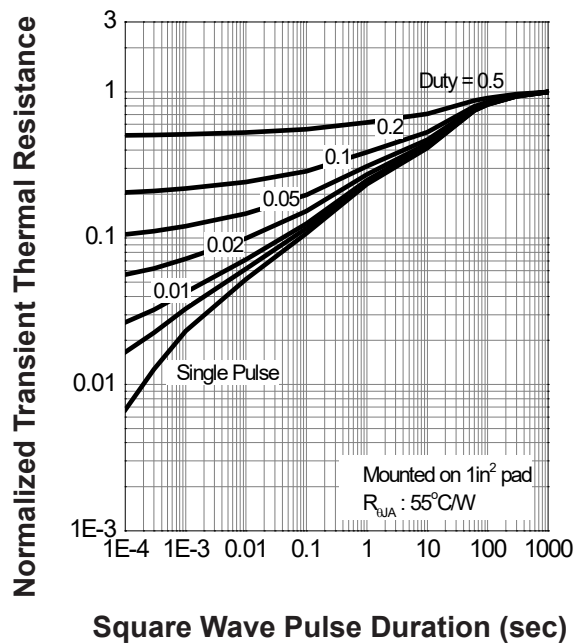


## Typical Operating Characteristics(Cont.)

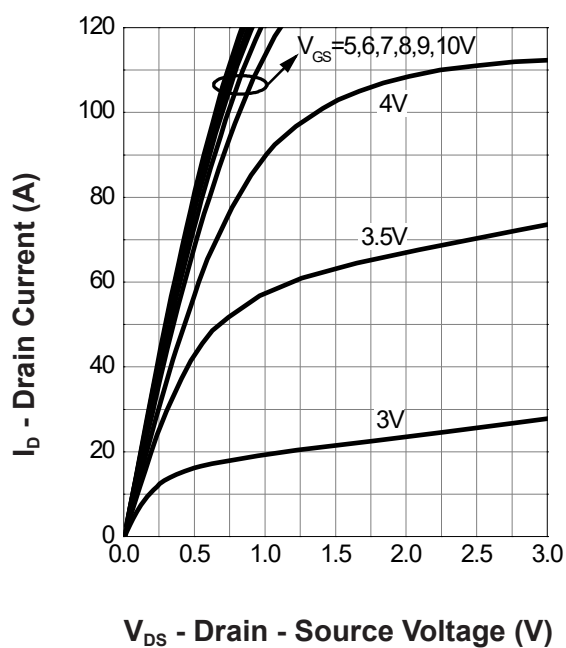
### Safe Operation Area



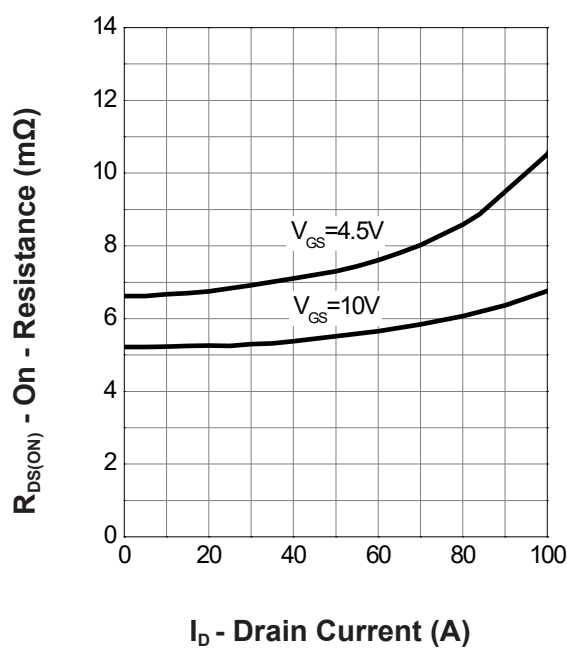
### Thermal Transient Impedance



### Output Characteristics

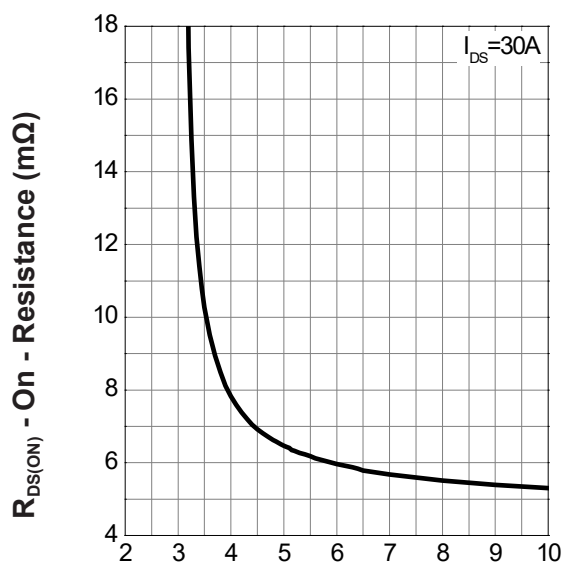


### Drain-Source On Resistance

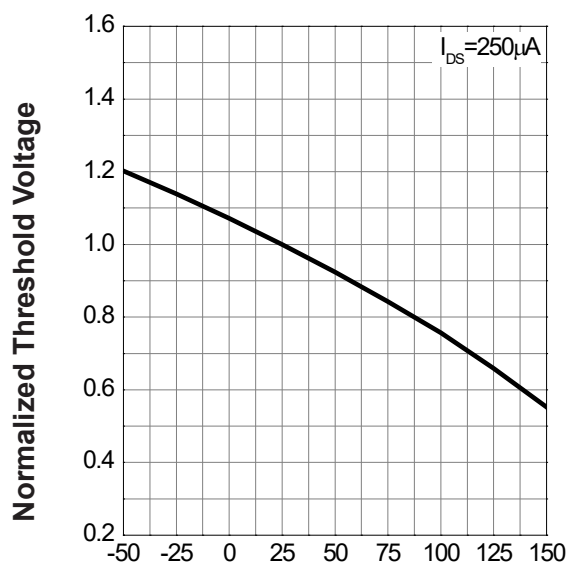


## Typical Operating Characteristics(Cont.)

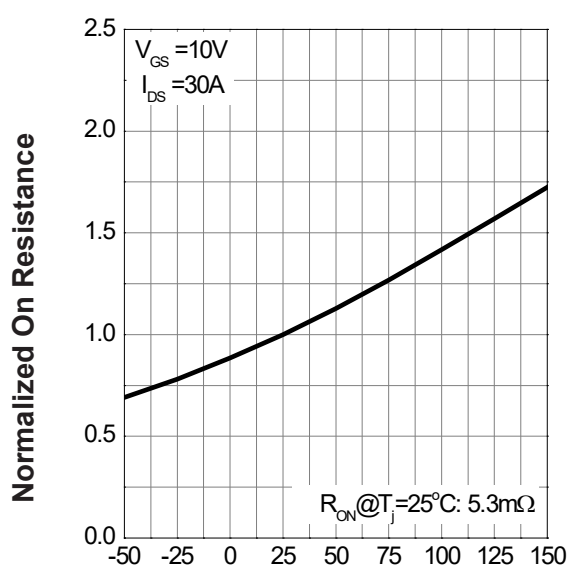
Gate-Source On Resistance

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

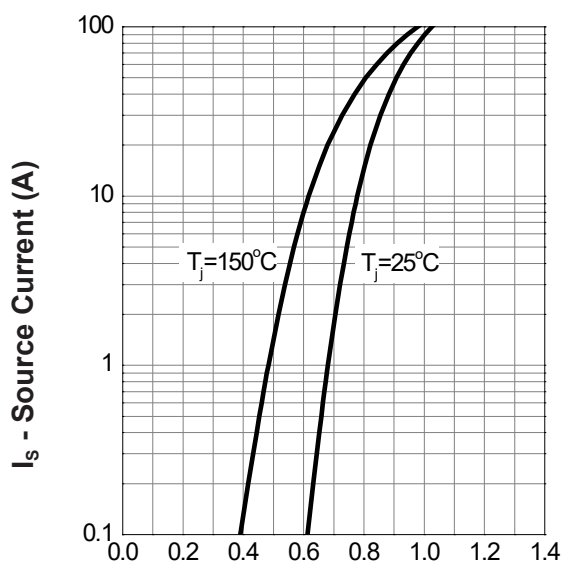
Gate Threshold Voltage

 $T_J$  - Junction Temperature (°C)

Drain-Source On Resistance

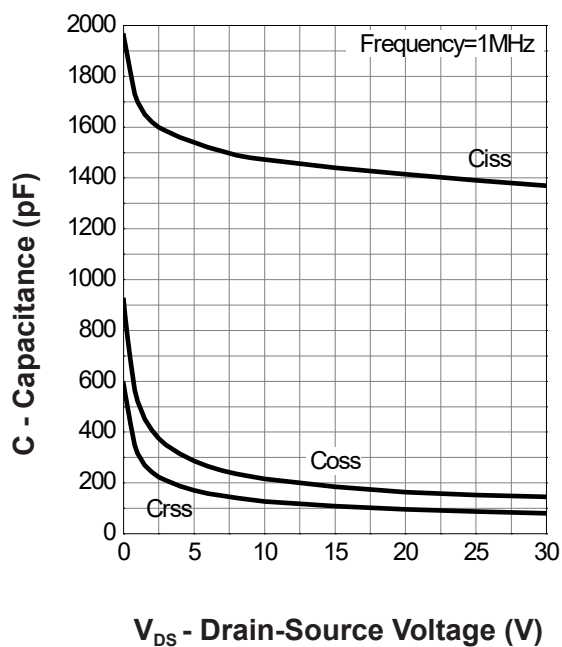
 $T_J$  - Junction Temperature (°C)

Source-Drain Diode Forward

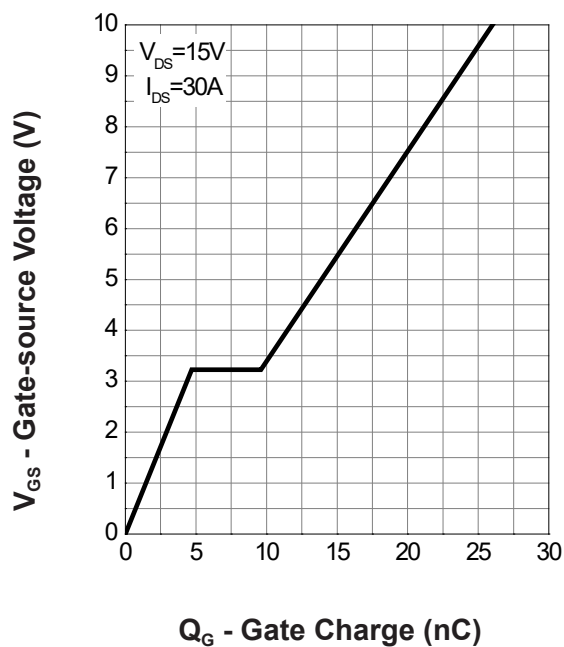
 $V_{SD}$  - Source - Drain Voltage (V)

## Typical Operating Characteristics(Cont.)

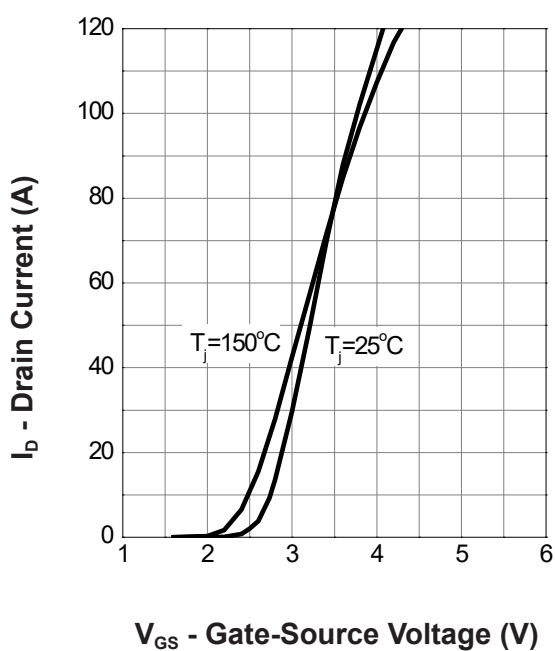
### Capacitance



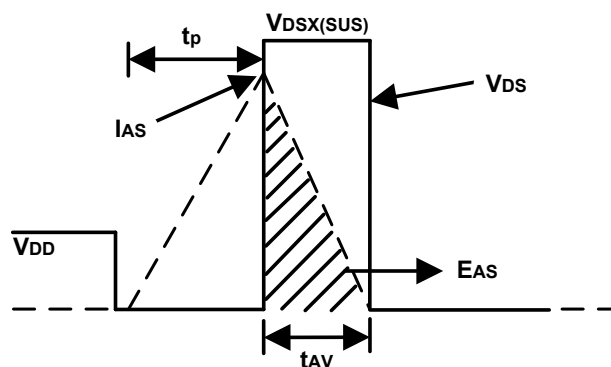
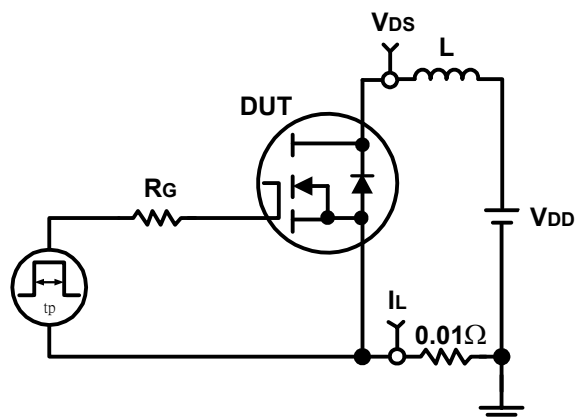
### Gate Charge



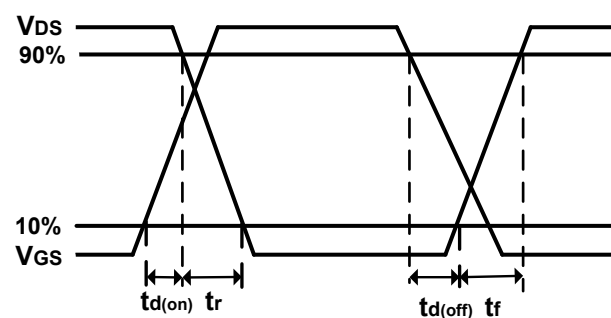
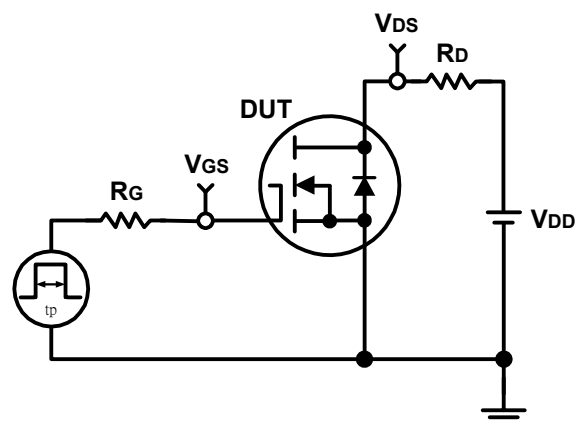
### Transfer Characteristics



## Avalanche Test Circuit and Waveforms



## Switching Time Test Circuit and Waveforms



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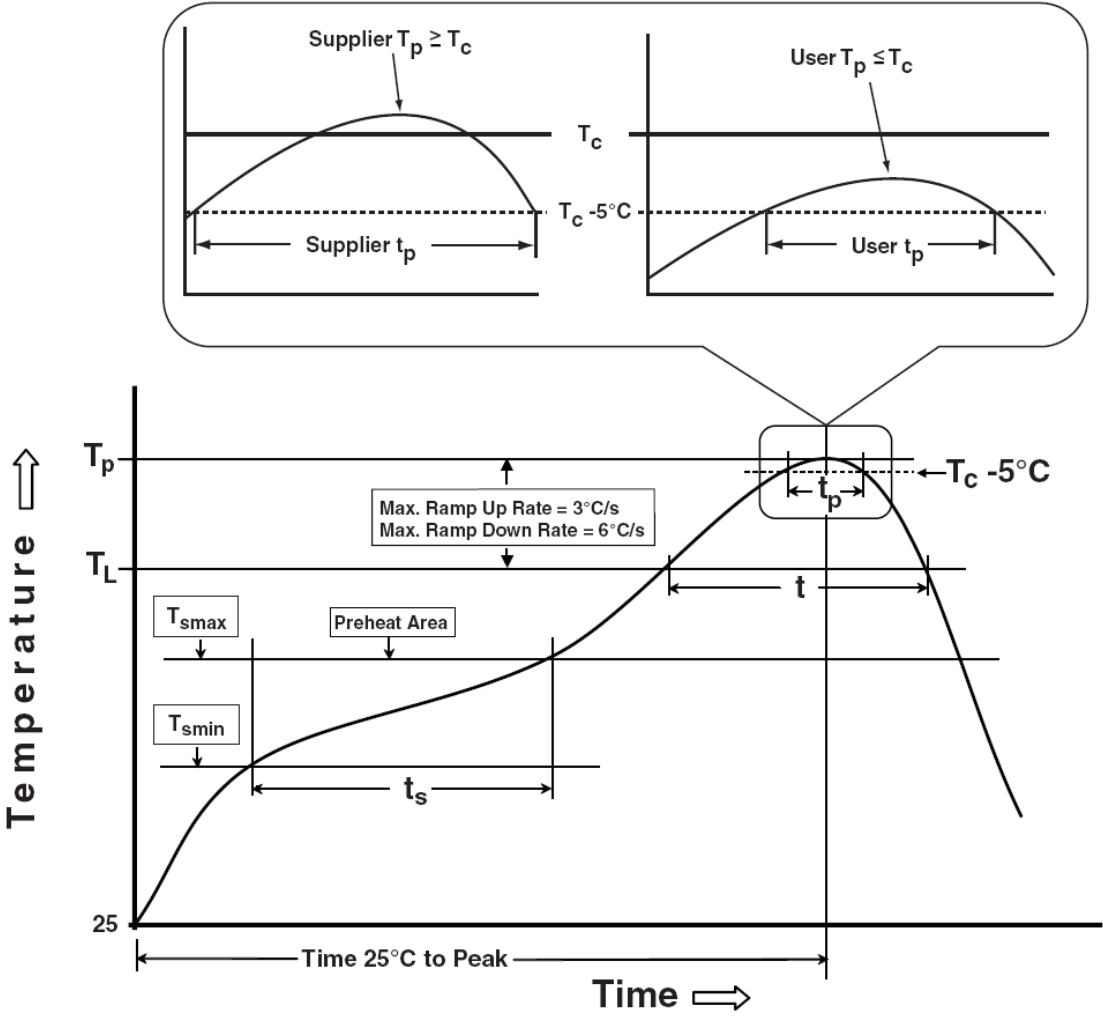
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Classification Profile



## 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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