

## Dual N-Channel Enhancement Mode MOSFET

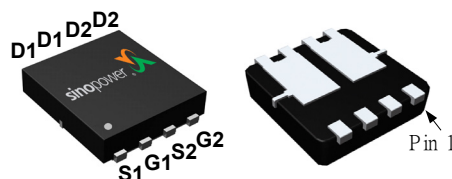
## Features

- 100V/27A  
 $R_{DS(ON)} = 19.3\text{m}\Omega(\text{max.})@V_{GS}=10\text{V}$   
 $R_{DS(ON)} = 26\text{m}\Omega(\text{max.})@V_{GS}=4.5\text{V}$
- 100% UIS +  $R_g$  Tested
- ESD Protection
- Reliable and Rugged
- Lead Free and Green Devices Available  
(RoHS Compliant)

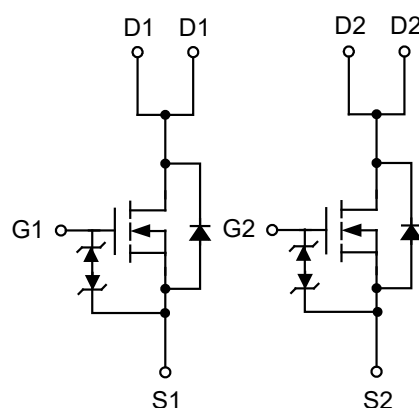
## Applications

- Power Management in Notebook Computer, Portable Equipment and Battery Powered Systems.

## Pin Description



DFN5x6C-8\_EP2



N-Channel MOSFET

## Ordering and Marking Information

|                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>SM7311DH <span style="border: 1px solid black; padding: 2px;">□□□-□□□</span></p> <div style="display: flex; align-items: center;"> <div style="border-left: 1px solid black; height: 100px; margin-right: 5px;"></div> <div> <p>Assembly Material</p> <p>Handling Code</p> <p>Temperature Range</p> <p>Package Code</p> </div> </div> | <p>Package Code<br/>           KP : DFN5x6C-8_EP2</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>SM7311DH KP :</p>                                                                                                                                                                                                                                                                                                                     | <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; text-align: center; margin-right: 20px;"> <br/>           7311DH<br/>           XXXXX         </div> <p>XXXXXX - 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                 |
|-------------------|----------------------------------------|---------------------------|--------------|----------------------|
| $V_{DSS}$         | Drain-Source Voltage                   |                           | 100          | V                    |
| $V_{GSS}$         | Gate-Source Voltage                    |                           | $\pm 20$     |                      |
| $T_J$             | Maximum Junction Temperature           |                           | 150          | C                    |
| $T_{STG}$         | Storage Temperature Range              |                           | -55 to 150   |                      |
| $I_S$             | Diode Continuous Forward Current       | $T_C=25^{\circ}\text{C}$  | 13           | A                    |
| $I_D$             | Continuous Drain Current               | $T_C=25^{\circ}\text{C}$  | 27           |                      |
|                   |                                        | $T_C=100^{\circ}\text{C}$ | 16.4         |                      |
| $I_{DM}^a$        | Pulse Drain Current                    | $T_C=25^{\circ}\text{C}$  | 100          | A                    |
| $P_D$             | Maximum Power Dissipation              | $T_C=25^{\circ}\text{C}$  | 30           | W                    |
|                   |                                        | $T_C=100^{\circ}\text{C}$ | 11           |                      |
| $R_{\theta JC}$   | Thermal Resistance-Junction to Case    |                           | 4.2          | $^{\circ}\text{C/W}$ |
| $I_D$             | Continuous Drain Current               | $T_A=25^{\circ}\text{C}$  | 5.8          | A                    |
|                   |                                        | $T_A=70^{\circ}\text{C}$  | 4.6          |                      |
| $P_D$             | Maximum Power Dissipation              | $T_A=25^{\circ}\text{C}$  | 1.39         | W                    |
|                   |                                        | $T_A=70^{\circ}\text{C}$  | 0.89         |                      |
| $R_{\theta JA}^c$ | Thermal Resistance-Junction to Ambient |                           | Steady State | $^{\circ}\text{C/W}$ |
| $I_{AS}^b$        | Avalanche Current, Single pulse        | $L=0.5\text{mH}$          | 15           | A                    |
| $E_{AS}^b$        | Avalanche Energy, Single pulse         | $L=0.5\text{mH}$          | 56           | mJ                   |

Note a : Pulse width is limited by max. junction temperature.

Note b : UIS tested and pulse width limited by maximum junction temperature  $150^{\circ}\text{C}$  (initial temperature  $T_J=25^{\circ}\text{C}$ ).

Note c : Surface Mounted on  $1\text{in}^2$  pad area.

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

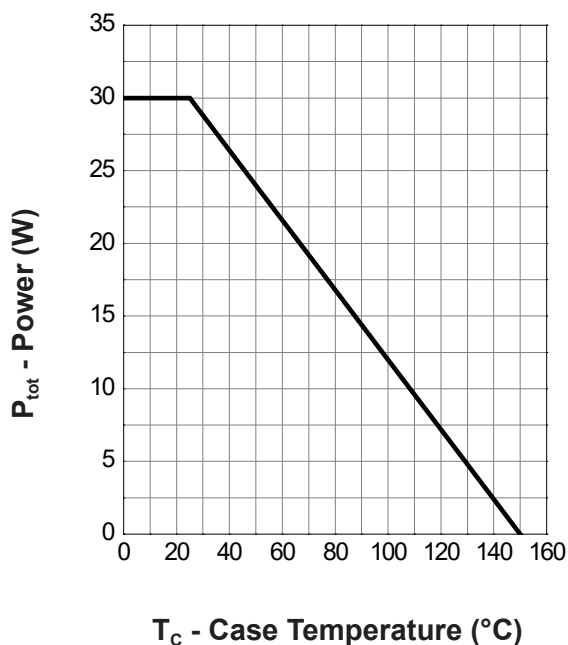
| Symbol                                   | Parameter                        | Test Conditions                                                                                                 | Min. | Typ.       | Max.       | Unit |
|------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------|------|------------|------------|------|
| Static Characteristics                   |                                  |                                                                                                                 |      |            |            |      |
| BV <sub>DSS</sub>                        | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA                                                                     | 100  | -          | -          | V    |
| I <sub>DSS</sub>                         | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =80V, 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    | 2          | 3          | V    |
| I <sub>GSS</sub>                         | Gate Leakage Current             | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                                                      | -    | -          | ±10        | μA   |
| R <sub>DS(ON)</sub> <sup>d</sup>         | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =11A<br>V <sub>GS</sub> =4.5V, I <sub>DS</sub> =7A                        | -    | 16.1<br>20 | 19.3<br>26 | mΩ   |
| Diode Characteristics                    |                                  |                                                                                                                 |      |            |            |      |
| V <sub>SD</sub> <sup>d</sup>             | Diode Forward Voltage            | I <sub>SD</sub> =5A, V <sub>GS</sub> =0V                                                                        | -    | 0.8        | 1.3        | V    |
| t <sub>rr</sub>                          | Reverse Recovery Time            | I <sub>SD</sub> =11A, dI <sub>SD</sub> /dt=100A/μs                                                              | -    | 38         | -          | ns   |
| Q <sub>rr</sub>                          | Reverse Recovery Charge          |                                                                                                                 | -    | 58         | -          | nC   |
| Dynamic Characteristics <sup>e</sup>     |                                  |                                                                                                                 |      |            |            |      |
| R <sub>G</sub>                           | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz                                                                | -    | 2          | -          | Ω    |
| C <sub>iss</sub>                         | Input Capacitance                | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =50V,<br>Frequency=1.0MHz                                               | -    | 1150       | 1500       | pF   |
| C <sub>oss</sub>                         | Output Capacitance               |                                                                                                                 | -    | 180        | -          |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance     |                                                                                                                 | -    | 28         | -          |      |
| 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 | -    | 14         | 26         | ns   |
| t <sub>r</sub>                           | Turn-on Rise Time                |                                                                                                                 | -    | 7          | 13         |      |
| t <sub>d(OFF)</sub>                      | Turn-off Delay Time              |                                                                                                                 | -    | 32         | 58         |      |
| t <sub>f</sub>                           | Turn-off Fall Time               |                                                                                                                 | -    | 31         | 56         |      |
| Gate Charge Characteristics <sup>e</sup> |                                  |                                                                                                                 |      |            |            |      |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =50V, V <sub>GS</sub> =10V,<br>I <sub>DS</sub> =11A                                             | -    | 24         | 34         | nC   |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =50V, V <sub>GS</sub> =4.5V,<br>I <sub>DS</sub> =11A                                            | -    | 12         | -          |      |
| Q <sub>gs</sub>                          | Gate-Source Charge               |                                                                                                                 | -    | 4.3        | -          |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge                |                                                                                                                 | -    | 5.4        | -          |      |

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

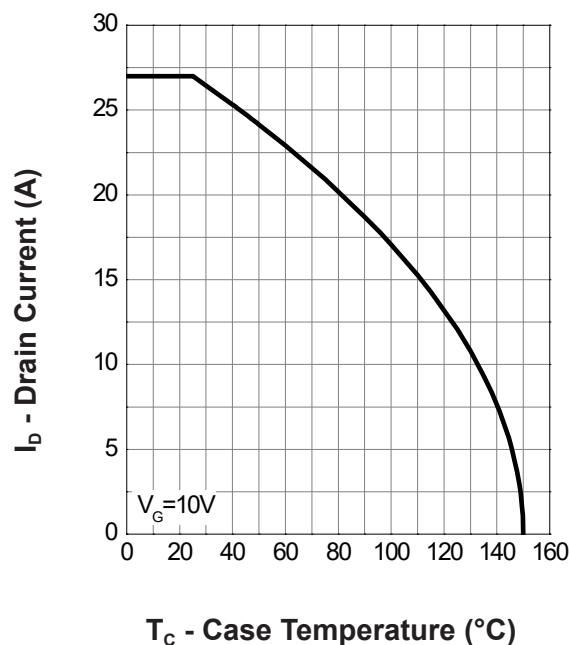
Note e : Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

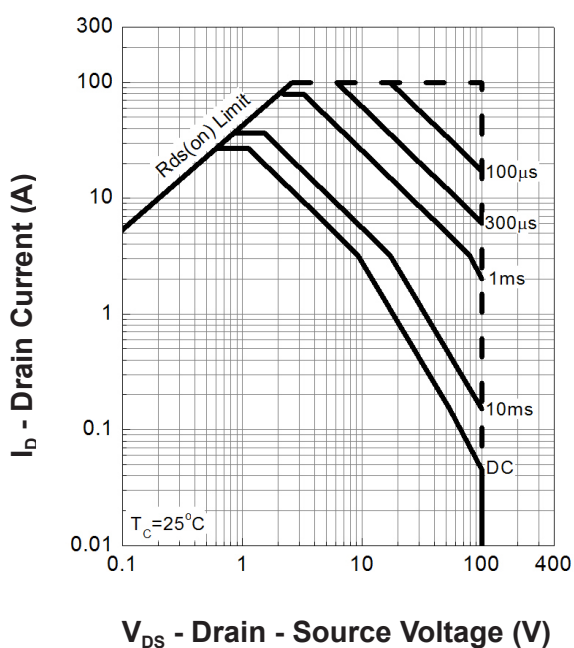
**Power Dissipation**



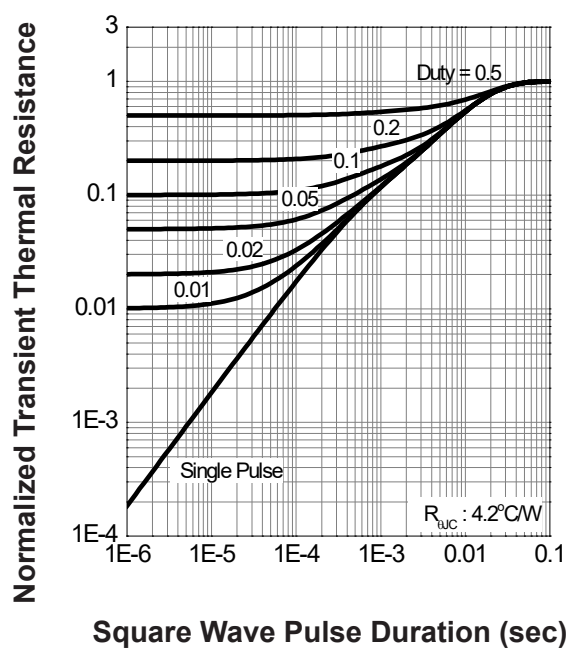
**Drain Current**



**Safe Operation Area**

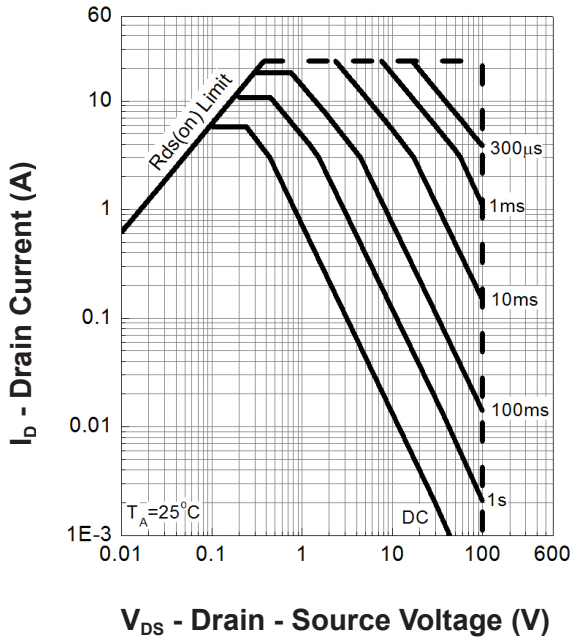


**Thermal Transient Impedance**

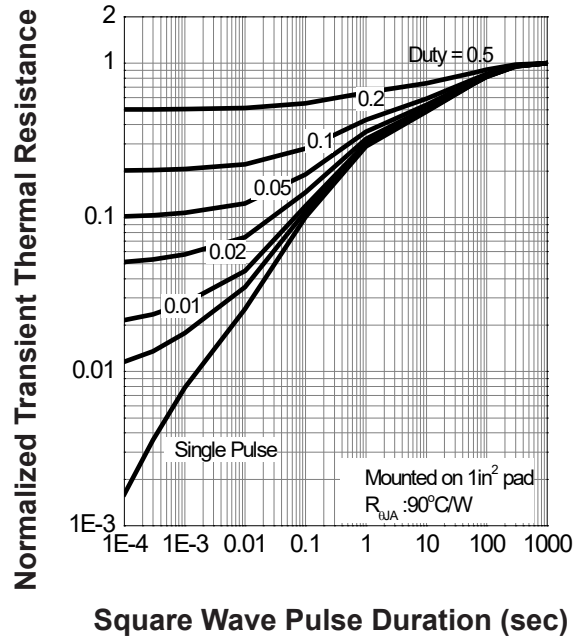


## Typical Operating Characteristics(Cont.)

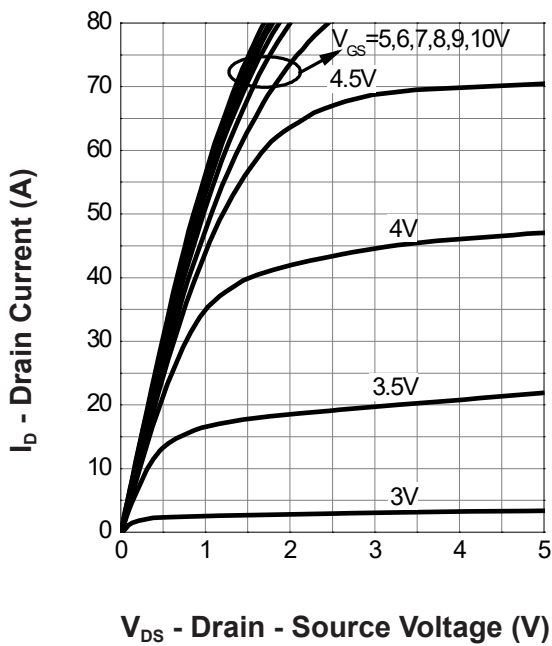
**Safe Operation Area**



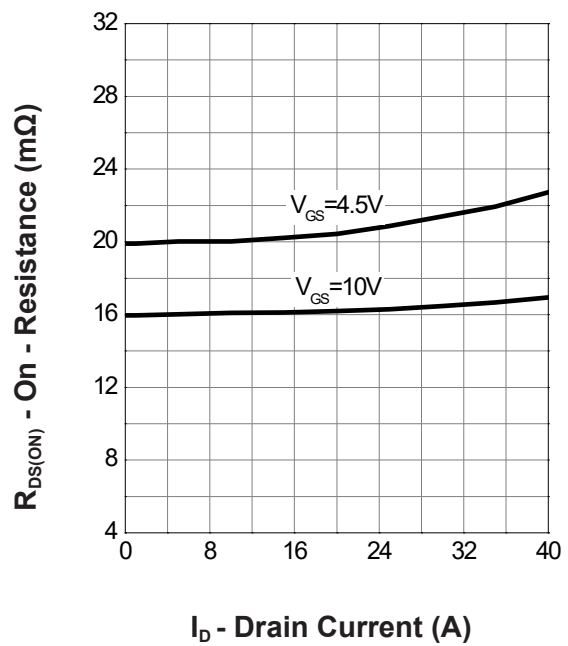
**Thermal Transient Impedance**



**Output Characteristics**

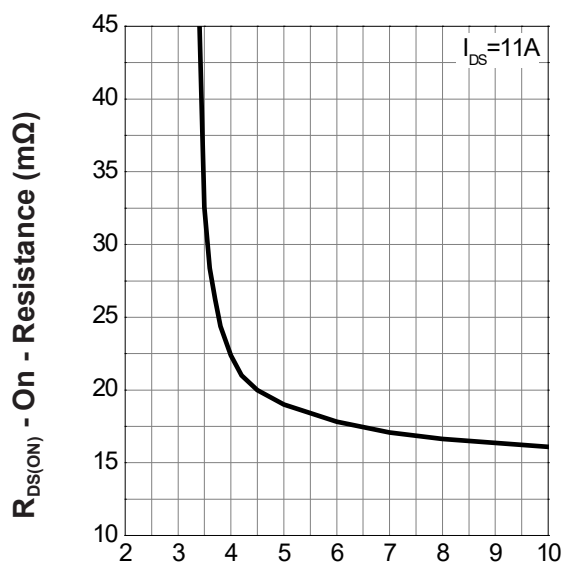


**Drain-Source On Resistance**

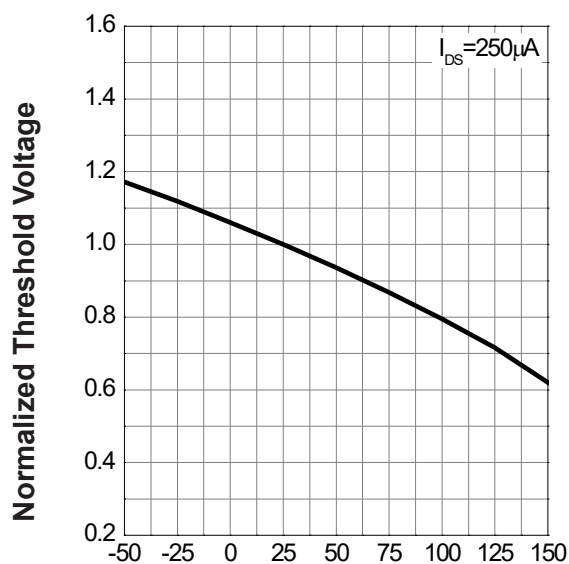


## Typical Operating Characteristics(Cont.)

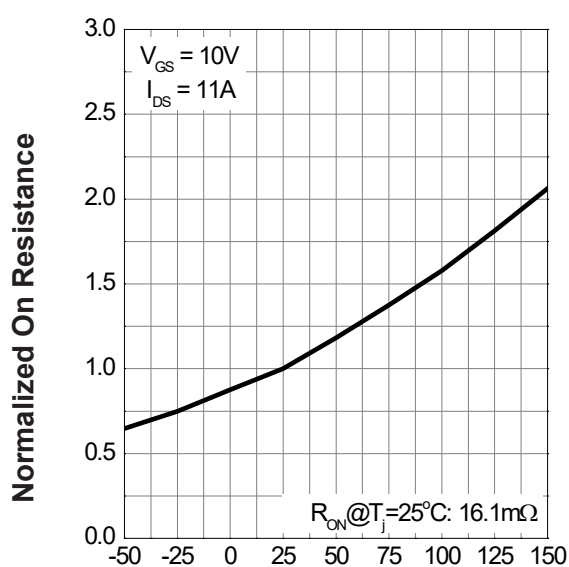
Gate-Source On Resistance

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

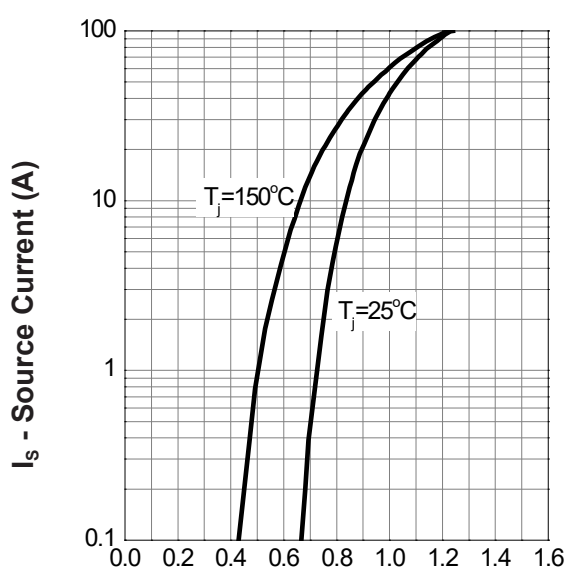
Gate Threshold Voltage

 $T_J$  - Junction Temperature (°C)

Drain-Source On Resistance

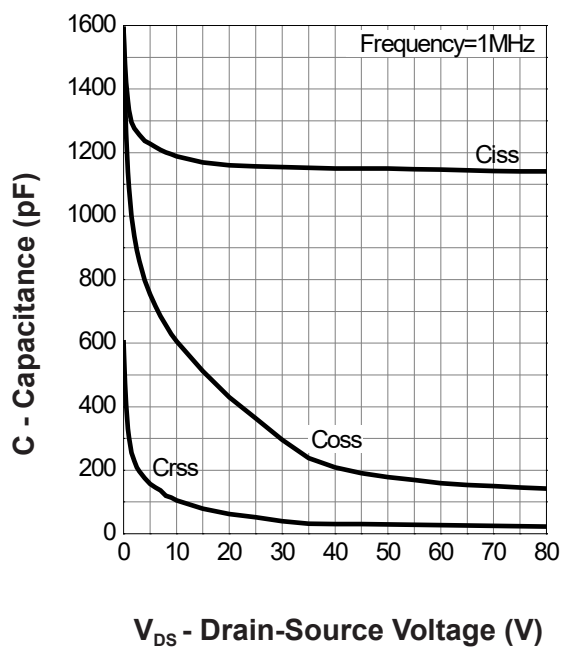
 $T_J$  - Junction Temperature (°C)

Source-Drain Diode Forward

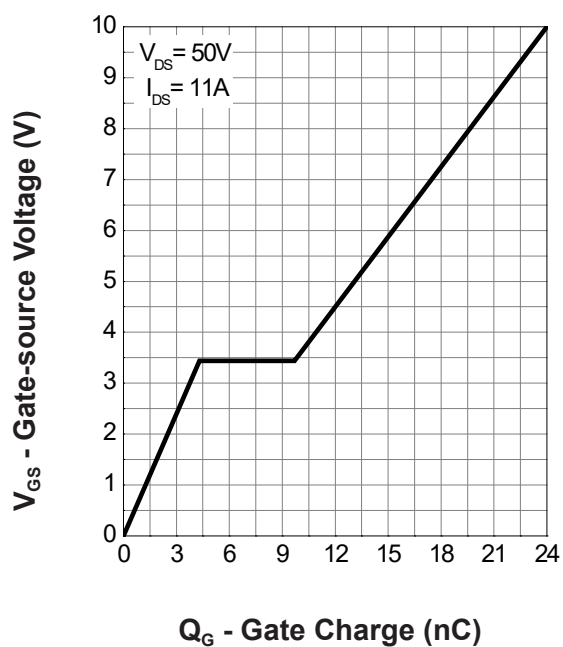
 $V_{SD}$  - Source - Drain Voltage (V)

## Typical Operating Characteristics(Cont.)

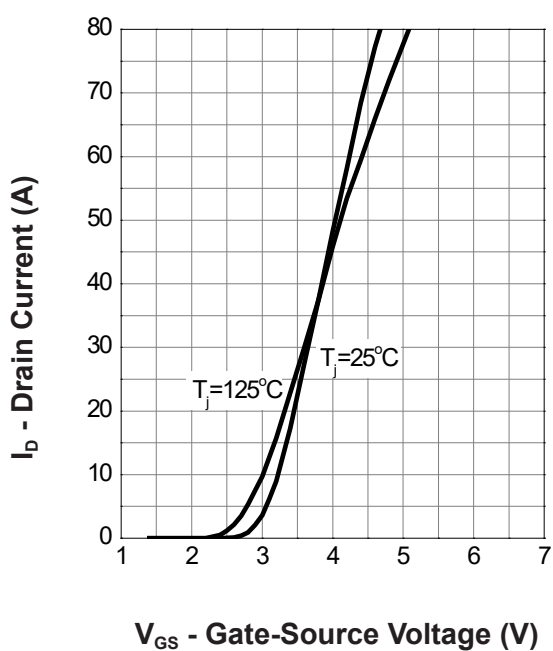
### Capacitance



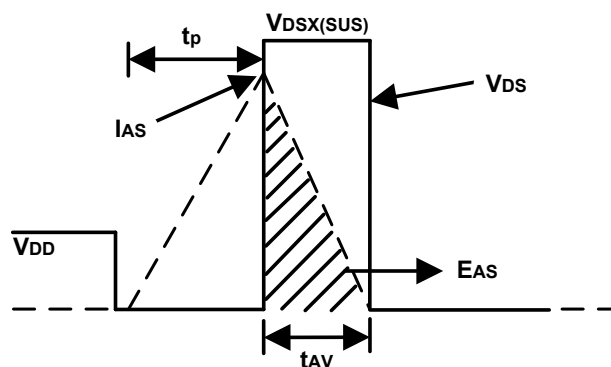
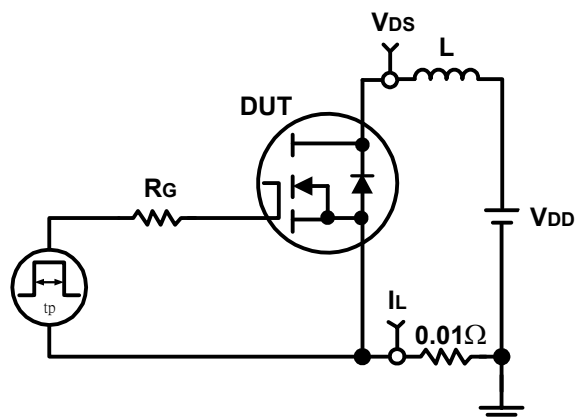
### Gate Charge



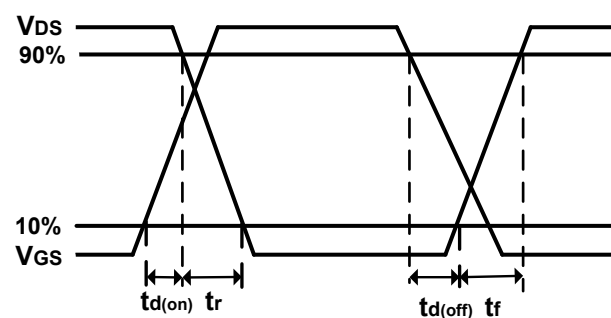
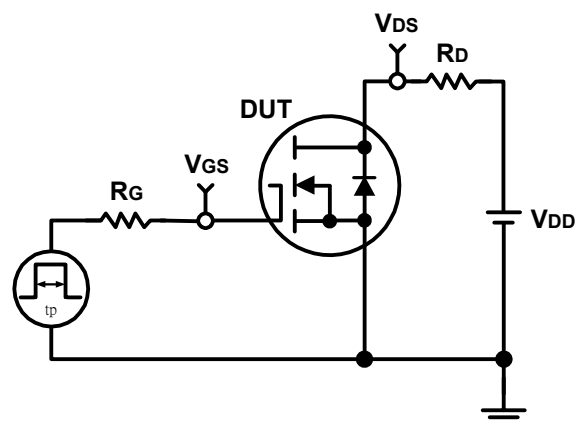
### Transfer Characteristics



## Avalanche Test Circuit and Waveforms



## Switching Time Test Circuit and Waveforms



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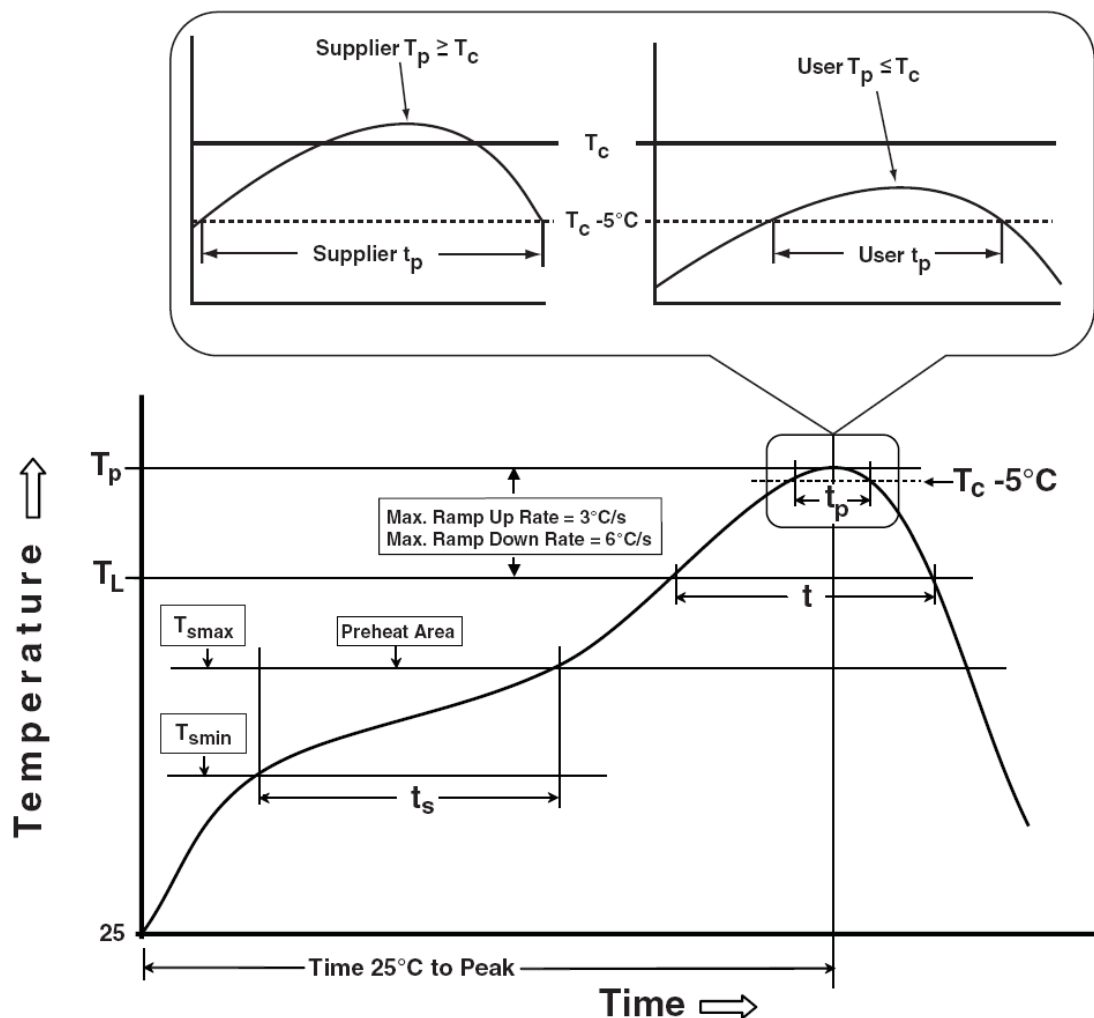
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## Classification Profile



## 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                          |

## Reliability Test Program

| Test item     | Method        | Description                            |
|---------------|---------------|----------------------------------------|
| SOLDERABILITY | JESD-22, B102 | 5 Sec, 245°C                           |
| HTRB          | JESD-22, A108 | 1000 Hrs, 80% of VDS max @ $T_{jmax}$  |
| HTGB          | JESD-22, A108 | 1000 Hrs, 100% of VGS max @ $T_{jmax}$ |
| PCT           | JESD-22, A102 | 168 Hrs, 100%RH, 2atm, 121°C           |
| TCT           | JESD-22, A104 | 500 Cycles, -65°C~150°C                |

## Customer Service

### Sinopower Semiconductor Inc.

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