

## Dual N-Channel Enhancement Mode MOSFET

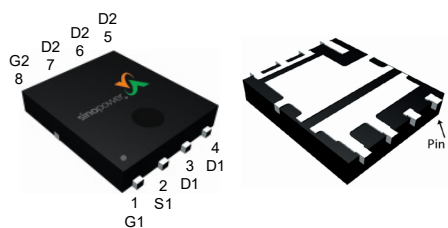
## Features

- Channel 1**  
 30V/90A  
 $R_{DS(ON)} = 4.1m\Omega(max.) @ V_{GS} = 10V$   
 $R_{DS(ON)} = 6m\Omega(max.) @ V_{GS} = 4.5V$
- Channel 2**  
 30V/198A  
 $R_{DS(ON)} = 1.4m\Omega(max.) @ V_{GS} = 10V$   
 $R_{DS(ON)} = 2.2m\Omega(max.) @ V_{GS} = 4.5V$
- 100% UIS +  $R_g$  Tested
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)
- Moisture Sensitivity Level MSL1 (per JEDEC J-STD-020D)

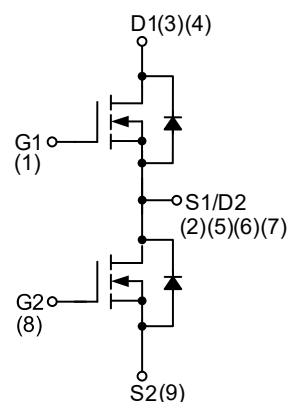
## Applications

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

## Pin Description



TDFN5x6J-8\_EP2



N-Channel MOSFET

## Ordering and Marking Information

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SM7346EQ <span style="border: 1px solid black; padding: 2px;">XX</span> <span style="border: 1px solid black; padding: 2px;">XX</span> <span style="border: 1px solid black; padding: 2px;">XX</span><br><div style="display: flex; align-items: center; margin-top: 10px;"> <div style="flex: 1; border-left: 1px solid black; border-right: 1px solid black; height: 20px; margin: 0 5px;"></div> <div style="flex: 1; border-left: 1px solid black; border-right: 1px solid black; height: 20px; margin: 0 5px;"></div> <div style="flex: 1; border-left: 1px solid black; border-right: 1px solid black; height: 20px; margin: 0 5px;"></div> <div style="flex: 1; border-left: 1px solid black; border-right: 1px solid black; height: 20px; margin: 0 5px;"></div> <div style="flex: 1; border-left: 1px solid black; border-right: 1px solid black; height: 20px; margin: 0 5px;"></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div>Assembly Material</div> <div>Handling Code</div> <div>Temperature Range</div> <div>Package Code</div> </div> | Package Code<br>KQ : TDFN5x6J-8_EP2<br>Operating Junction Temperature Range<br>C : -55 to 150 °C<br>Handling Code<br>TR : Tape & Reel<br>Assembly Material<br>G : Halogen and Lead Free Device |
| SM7346EQ KQ : <span style="border: 1px solid black; padding: 2px; display: inline-block; text-align: center;">7346EQ<br/>XXXXX</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | XXXXX - Lot Code                                                                                                                                                                               |

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 leadfree 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                              |                       | Channel 1  |     | Channel 2 | Unit |
|-------------------------------|----------------------------------------|-----------------------|------------|-----|-----------|------|
| Common Ratings                |                                        |                       |            |     |           |      |
| V <sub>DSS</sub>              | Drain-Source Voltage                   |                       | 30         |     |           | V    |
| V <sub>GSS</sub>              | Gate-Source Voltage                    |                       | ±20        | ±20 |           | V    |
| T <sub>J</sub>                | Maximum Junction Temperature           |                       | 150        |     |           | °C   |
| T <sub>STG</sub>              | Storage Temperature Range              |                       | -55 to 150 |     |           | °C   |
| I <sub>S</sub>                | Diode Continuous Forward Current       | T <sub>C</sub> =25°C  | 45         | 81  |           | A    |
| I <sub>D</sub>                | Continuous Drain Current               | T <sub>C</sub> =25°C  | 90         | 198 |           | A    |
|                               |                                        | T <sub>C</sub> =100°C | 57         | 125 |           |      |
| I <sub>DM</sub> <sup>a</sup>  | Pulse Drain Current                    | T <sub>C</sub> =25°C  | 358        | 400 |           | A    |
| P <sub>D</sub>                | Maximum Power Dissipation              | T <sub>C</sub> =25°C  | 54         | 89  |           | W    |
|                               |                                        | T <sub>C</sub> =100°C | 22         | 36  |           |      |
| R <sub>θJC</sub>              | Thermal Resistance-Junction to Case    | Steady State          | 2.3        | 1.4 |           | °C/W |
| I <sub>D</sub>                | Continuous Drain Current               | T <sub>A</sub> =25°C  | 16         | 29  |           | A    |
|                               |                                        | T <sub>A</sub> =70°C  | 13         | 23  |           |      |
| I <sub>DM</sub> <sup>a</sup>  | Pulse Drain Current                    | T <sub>A</sub> =25°C  | 63         | 115 |           | A    |
| P <sub>D</sub>                | Maximum Power Dissipation              | T <sub>A</sub> =25°C  | 1.7        | 1.9 |           | W    |
|                               |                                        | T <sub>A</sub> =70°C  | 1.1        | 1.2 |           |      |
| R <sub>θJA</sub> <sup>b</sup> | Thermal Resistance-Junction to Ambient | t ≤10s                | 35         | 30  |           | °C/W |
|                               |                                        | Steady State          | 75         | 66  |           |      |
| I <sub>AS</sub> <sup>c</sup>  | Avalanche Current, Single pulse        | L=0.1mH               | 22         | 40  |           | A    |
| E <sub>AS</sub> <sup>c</sup>  | Avalanche Energy, Single pulse         | L=0.1mH               | 24         | 80  |           | mJ   |

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

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

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

**Channel 1 Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| Symbol                                   | Parameter                        | Test Conditions                                                                                                 | Channel 1 |      |      | Unit |
|------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------|------|------|------|
|                                          |                                  |                                                                                                                 | Min.      | Typ. | Max. |      |
| 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                                                                       | -         | -    | 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       | 1.6  | 2    | 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>d</sup>         | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =15A                                                                      | -         | 3.4  | 4.1  | mΩ   |
|                                          |                                  | T <sub>J</sub> =125°C                                                                                           | -         | 4.8  | -    |      |
|                                          |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =12A                                                                     | -         | 4.6  | 6    |      |
| Gfs                                      | Forward Transconductance         | V <sub>DS</sub> =5V, I <sub>DS</sub> =8A                                                                        | -         | 25   | -    | S    |
| Diode Characteristics                    |                                  |                                                                                                                 |           |      |      |      |
| V <sub>SD</sub> <sup>d</sup>             | Diode Forward Voltage            | I <sub>SD</sub> =8A, V <sub>GS</sub> =0V                                                                        | -         | 0.75 | 1.1  | V    |
| t <sub>rr</sub>                          | Reverse Recovery Time            | I <sub>SD</sub> =15A, dI <sub>SD</sub> /dt=100A/μs                                                              | -         | 25   | -    | ns   |
| t <sub>a</sub>                           | Charge Time                      |                                                                                                                 | -         | 12   | -    |      |
| t <sub>b</sub>                           | Discharge Time                   |                                                                                                                 | -         | 13   | -    |      |
| Q <sub>rr</sub>                          | Reverse Recovery Charge          |                                                                                                                 | -         | 11   | -    | nC   |
| Dynamic Characteristics <sup>e</sup>     |                                  |                                                                                                                 |           |      |      |      |
| R <sub>G</sub>                           | Gate Resistance                  | V <sub>GS</sub> =0V,V <sub>DS</sub> =0V,F=1MHz                                                                  | -         | 1.7  | -    | Ω    |
| C <sub>iss</sub>                         | Input Capacitance                | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =15V,<br>Frequency=1.0MHz                                               | -         | 930  | 1209 | pF   |
| C <sub>oss</sub>                         | Output Capacitance               |                                                                                                                 | -         | 430  | -    |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance     |                                                                                                                 | -         | 35   | -    |      |
| 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 | -         | 12   | 22   | ns   |
| t <sub>r</sub>                           | Turn-on Rise Time                |                                                                                                                 | -         | 11   | 20   |      |
| t <sub>d(OFF)</sub>                      | Turn-off Delay Time              |                                                                                                                 | -         | 24   | 44   |      |
| t <sub>f</sub>                           | Turn-off Fall Time               |                                                                                                                 | -         | 18   | 33   |      |
| Gate Charge Characteristics <sup>e</sup> |                                  |                                                                                                                 |           |      |      |      |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =15V, V <sub>GS</sub> =10V,<br>I <sub>DS</sub> =15A                                             | -         | 13   | 18   | nC   |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V,<br>I <sub>DS</sub> =15A                                            | -         | 5.8  | -    |      |
| Q <sub>gth</sub>                         | Threshold Gate Charge            |                                                                                                                 | -         | 1.4  | -    |      |
| Q <sub>gs</sub>                          | Gate-Source Charge               |                                                                                                                 | -         | 2.7  | -    |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge                |                                                                                                                 | -         | 1.1  | -    |      |

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

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

**Channel 2 Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

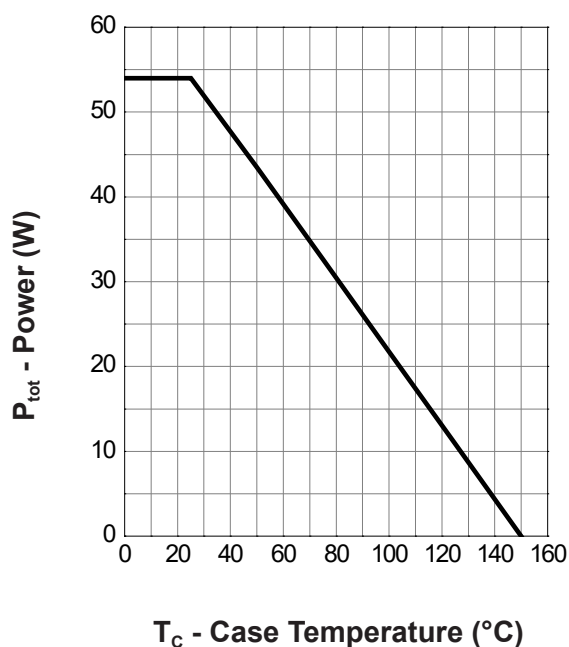
| Symbol                                   | Parameter                        | Test Conditions                                                                                           | Channel 2 |      |      | Unit |
|------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------|-----------|------|------|------|
|                                          |                                  |                                                                                                           | Min.      | Typ. | Max. |      |
| 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                                                                 | -         | -    | 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       | 1.6  | 2    | 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>d</sup>         | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =25A                                                                | -         | 1.2  | 1.4  | mΩ   |
|                                          |                                  | T <sub>J</sub> =125°C                                                                                     | -         | 1.7  | -    |      |
|                                          |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =20A                                                               | -         | 1.7  | 2.2  |      |
| Gfs                                      | Forward Transconductance         | V <sub>DS</sub> =5V, I <sub>DS</sub> =20A                                                                 | -         | 60   | -    | S    |
| Diode Characteristics                    |                                  |                                                                                                           |           |      |      |      |
| V <sub>SD</sub> <sup>d</sup>             | Diode Forward Voltage            | I <sub>SD</sub> =13A, V <sub>GS</sub> =0V                                                                 | -         | 0.75 | 1.1  | V    |
| t <sub>rr</sub>                          | Reverse Recovery Time            | I <sub>SD</sub> =25A, dI <sub>SD</sub> /dt=100A/μs                                                        | -         | 38   | -    | ns   |
| t <sub>a</sub>                           | Charge Time                      |                                                                                                           | -         | 20   | -    |      |
| t <sub>b</sub>                           | Discharge Time                   |                                                                                                           | -         | 18   | -    |      |
| Q <sub>rr</sub>                          | Reverse Recovery Charge          |                                                                                                           | -         | 23   | -    | nC   |
| Dynamic Characteristics <sup>e</sup>     |                                  |                                                                                                           |           |      |      |      |
| R <sub>G</sub>                           | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz                                                          | -         | 1.2  | -    | Ω    |
| C <sub>iss</sub>                         | Input Capacitance                | V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, Frequency=1.0MHz                                               | -         | 2550 | 3315 | pF   |
| C <sub>oss</sub>                         | Output Capacitance               |                                                                                                           | -         | 1120 | -    |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance     |                                                                                                           | -         | 70   | -    |      |
| t <sub>d(ON)</sub>                       | Turn-on Delay Time               | V <sub>DD</sub> =15V, R <sub>L</sub> =15Ω, I <sub>DS</sub> =1A, V <sub>GEN</sub> =10V, R <sub>G</sub> =6Ω | -         | 17   | 31   | ns   |
| t <sub>r</sub>                           | Turn-on Rise Time                |                                                                                                           | -         | 10   | 18   |      |
| t <sub>d(OFF)</sub>                      | Turn-off Delay Time              |                                                                                                           | -         | 47   | 85   |      |
| t <sub>f</sub>                           | Turn-off Fall Time               |                                                                                                           | -         | 51   | 92   |      |
| Gate Charge Characteristics <sup>e</sup> |                                  |                                                                                                           |           |      |      |      |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =15V, V <sub>GS</sub> =10V, I <sub>DS</sub> =25A                                          | -         | 31   | 43.4 | nC   |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V, I <sub>DS</sub> =25A                                         | -         | 14   | -    |      |
| Q <sub>gth</sub>                         | Threshold Gate Charge            |                                                                                                           | -         | 3.1  | -    |      |
| Q <sub>gs</sub>                          | Gate-Source Charge               |                                                                                                           | -         | 5.2  | -    |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge                |                                                                                                           | -         | 3    | -    |      |

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

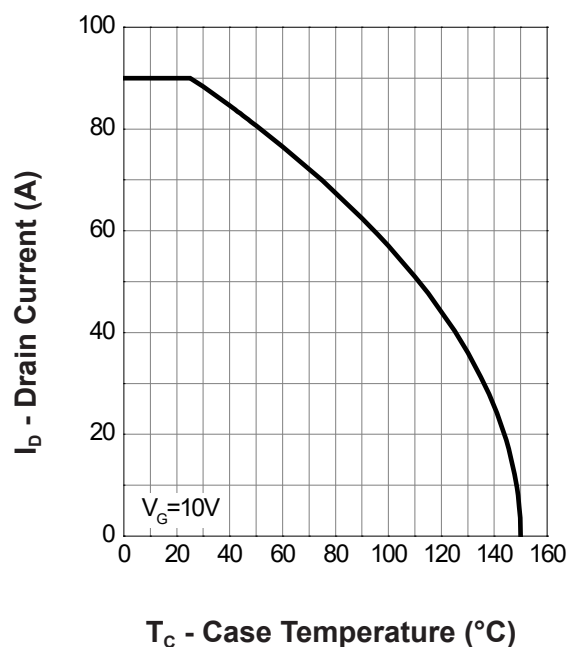
Note e : Guaranteed by design, not subject to production testing.

## Channel 1 Typical Operating Characteristics

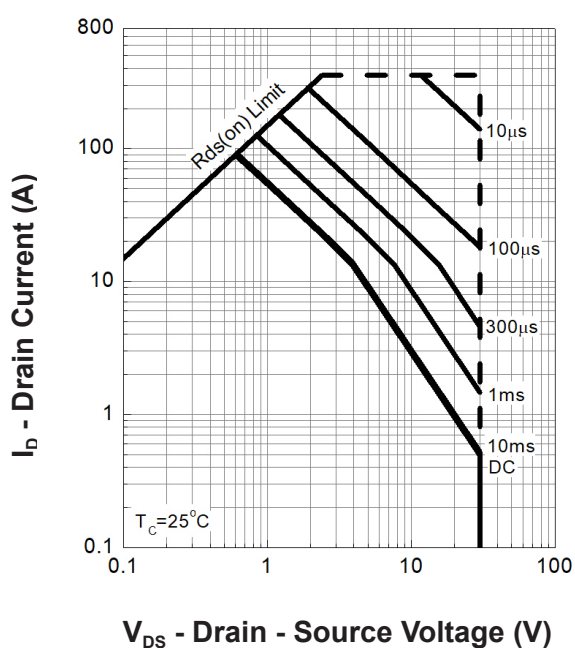
Power Dissipation



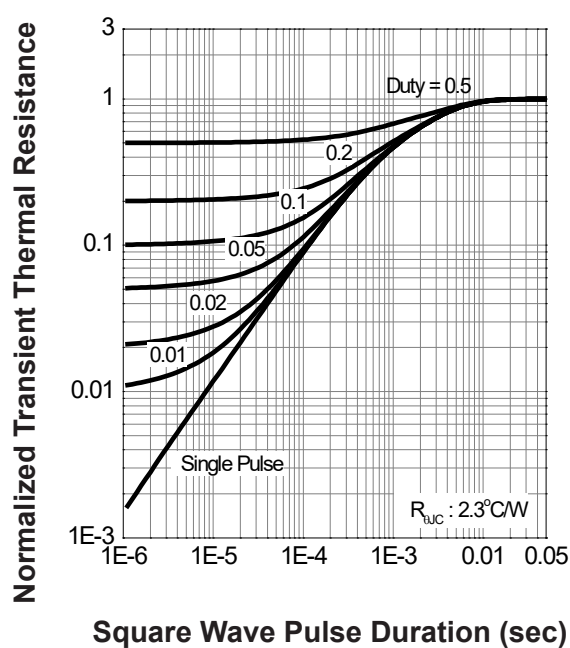
Drain Current



Safe Operation Area

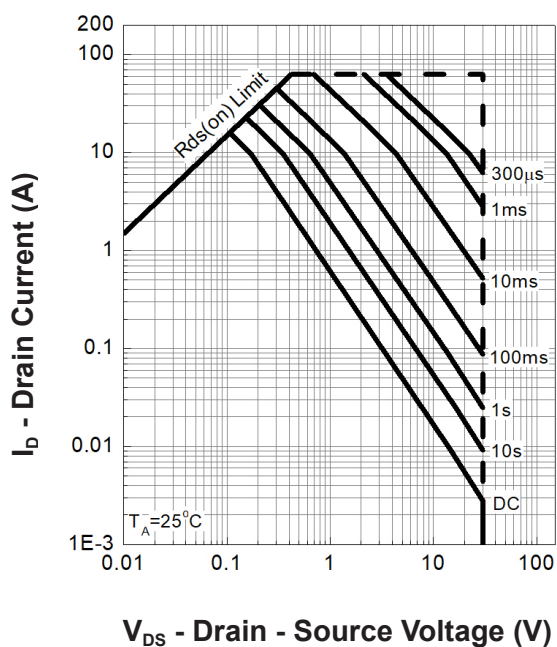


Thermal Transient Impedance

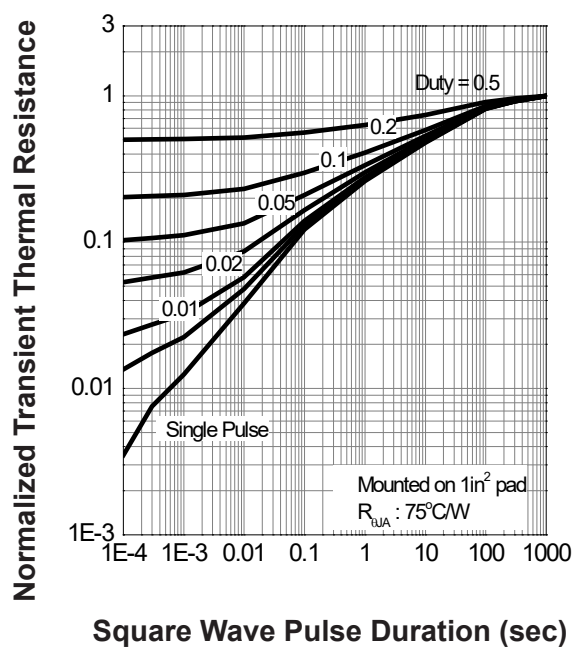


## Channel 1 Typical Operating Characteristics(Cont.)

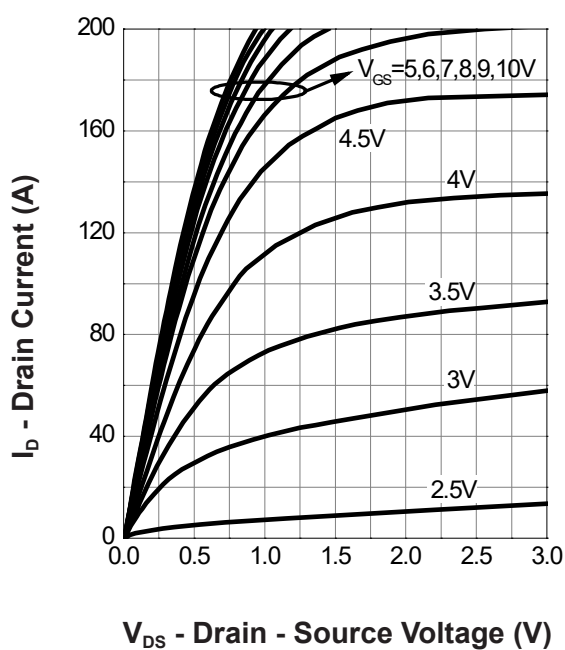
Safe Operation Area



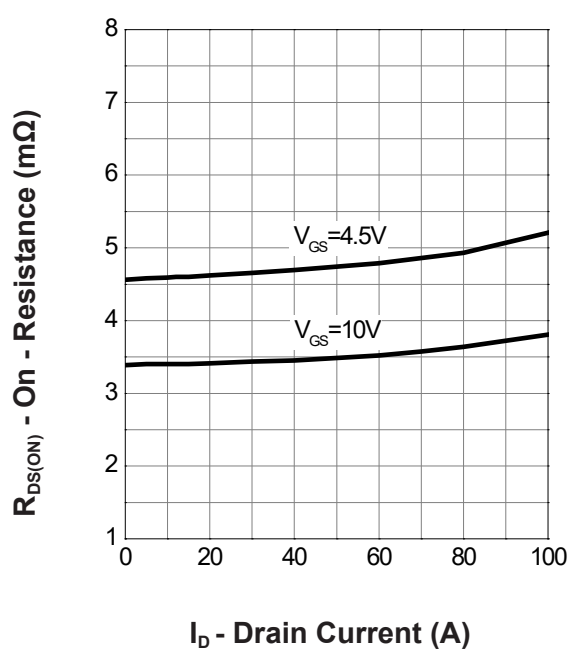
Thermal Transient Impedance



Output Characteristics

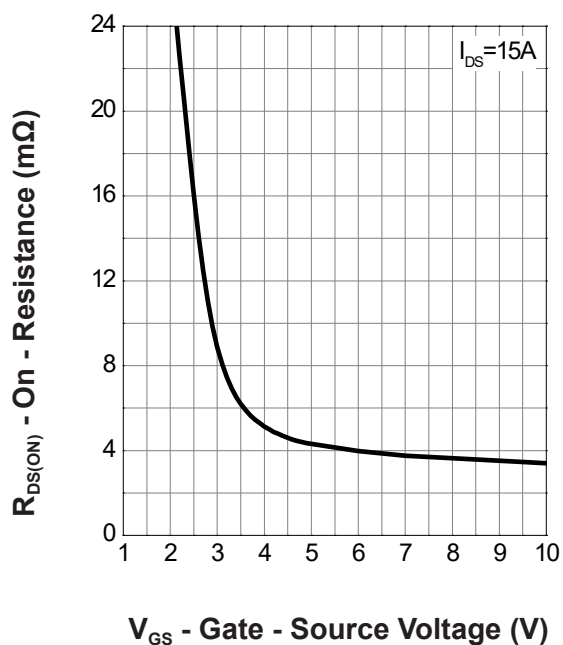


Drain-Source On Resistance

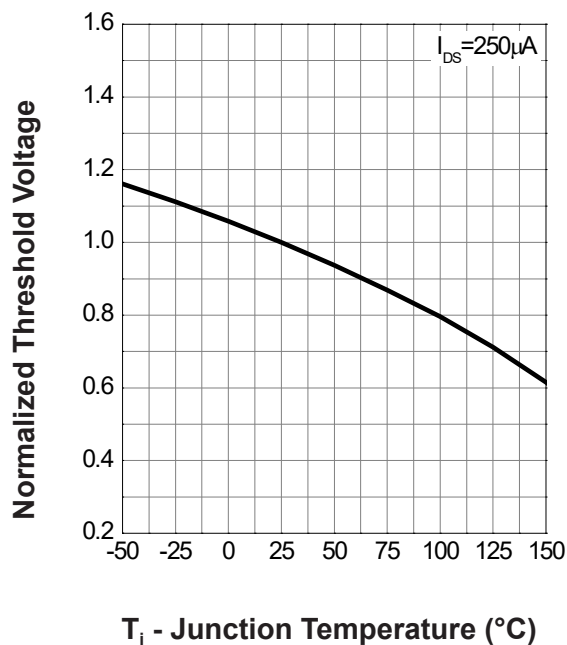


## Channel 1 Typical Operating Characteristics(Cont.)

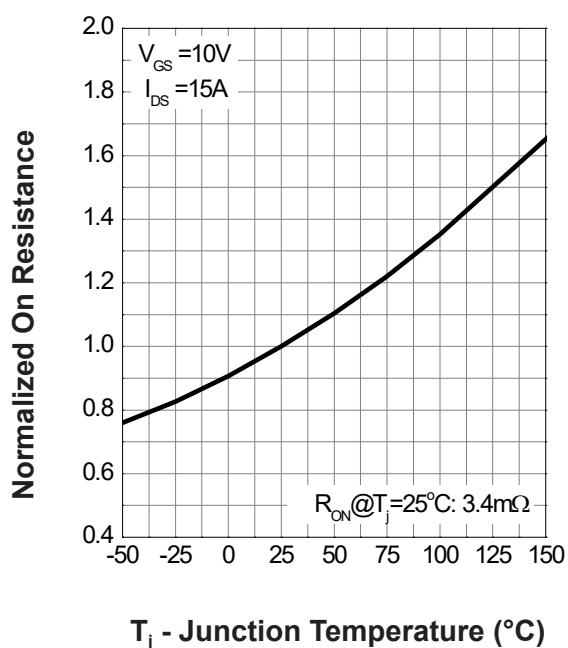
Gate-Source On Resistance



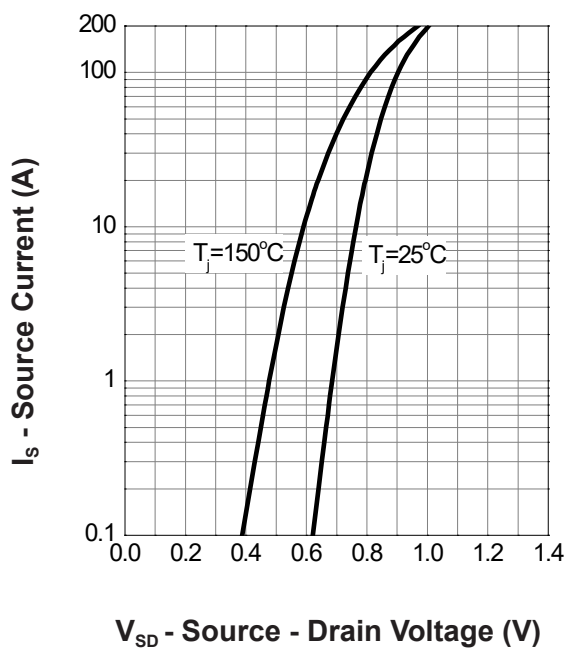
Gate Threshold Voltage



Drain-Source On Resistance

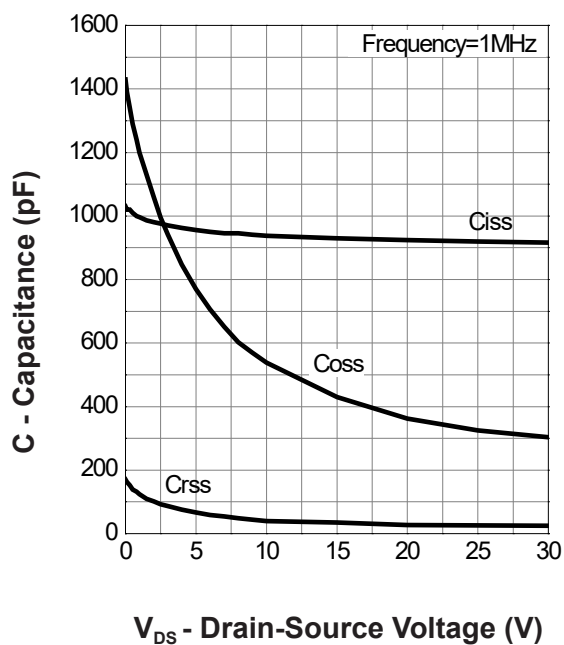


Source-Drain Diode Forward

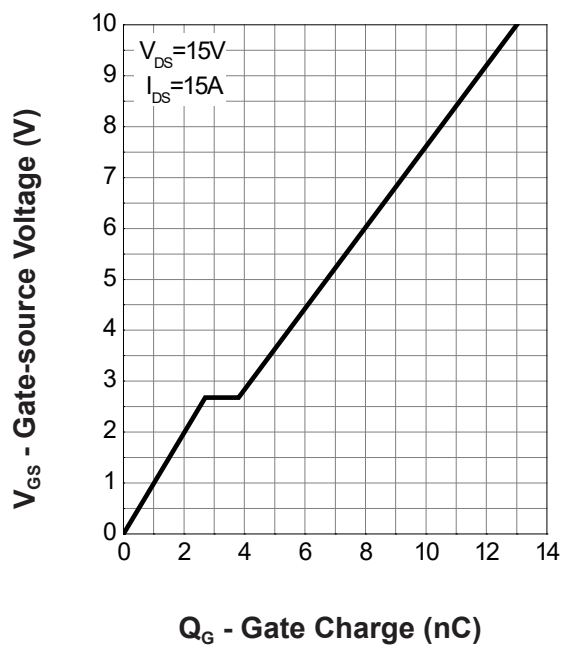


## Channel 1 Typical Operating Characteristics(Cont.)

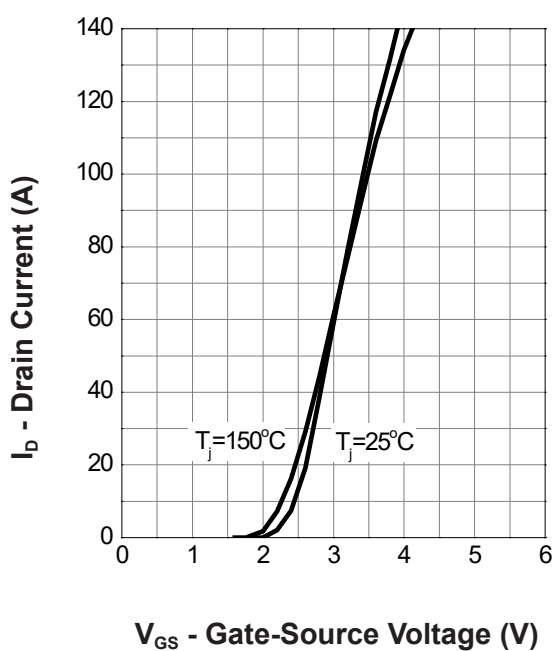
Capacitance



Gate Charge

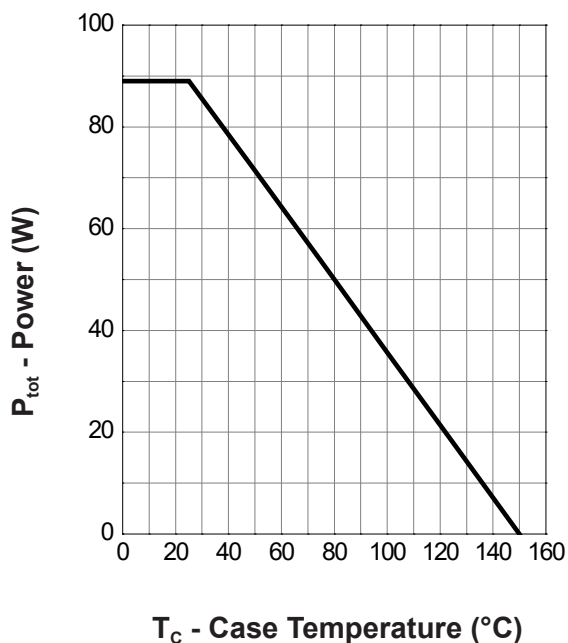


Transfer Characteristics

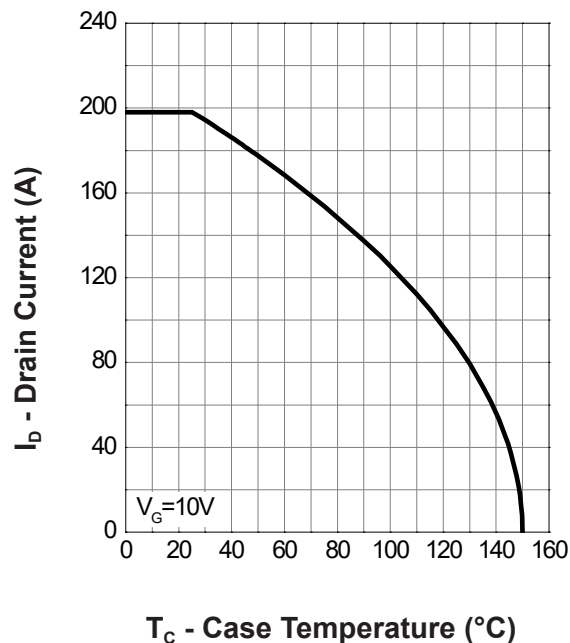


## Channel 2 Typical Operating Characteristics

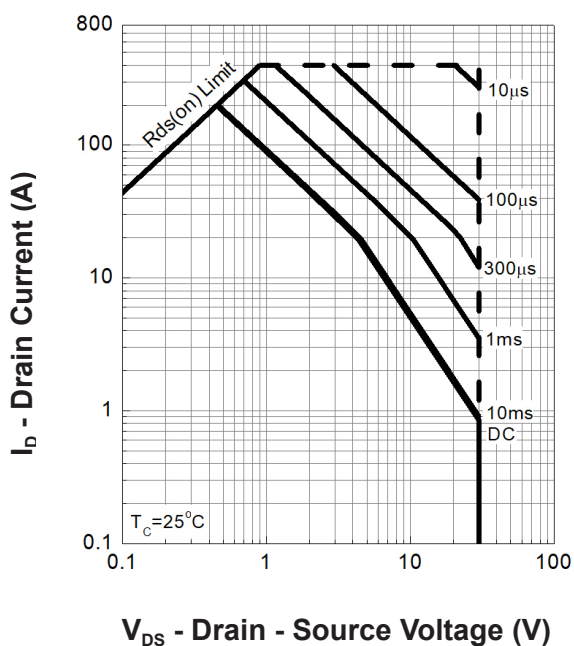
Power Dissipation



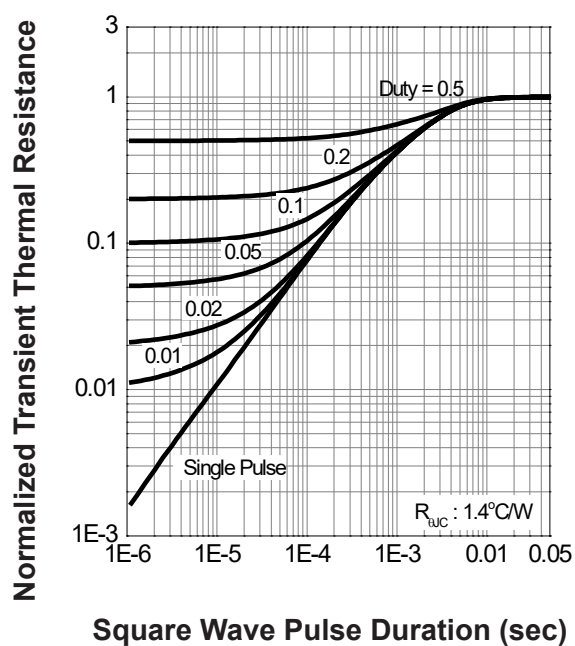
Drain Current



Safe Operation Area

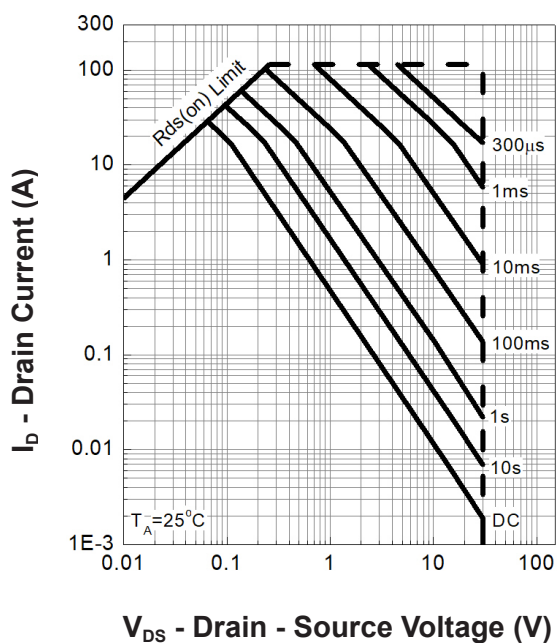


Thermal Transient Impedance

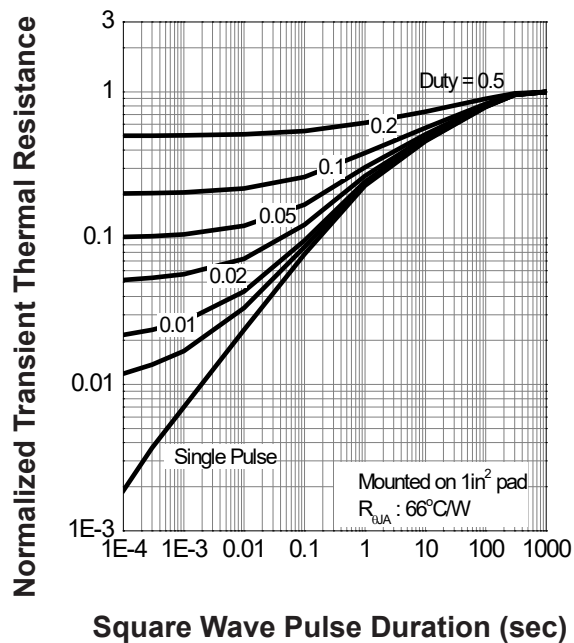


## Channel 2 Typical Operating Characteristics(Cont.)

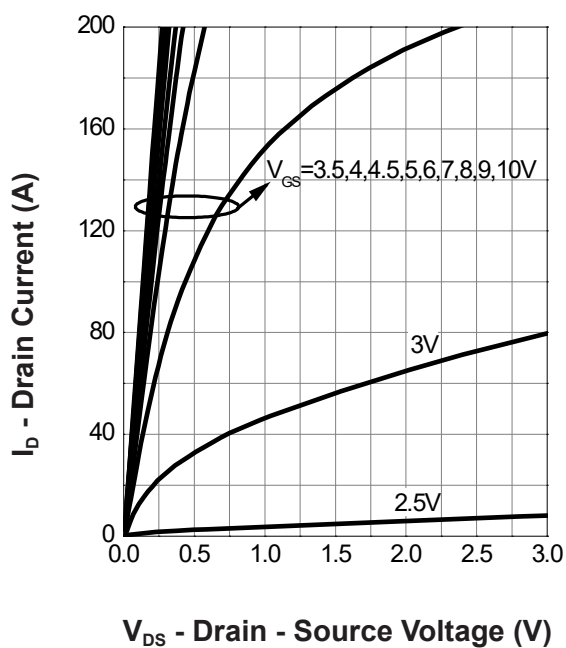
Safe Operation Area



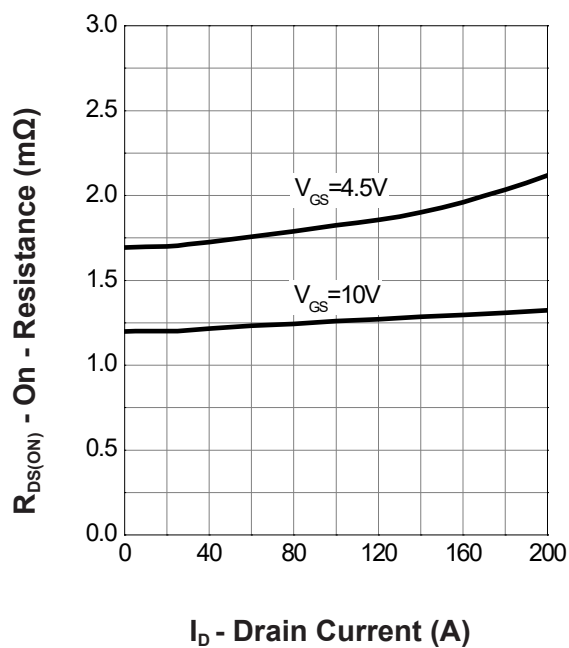
Thermal Transient Impedance



Output Characteristics

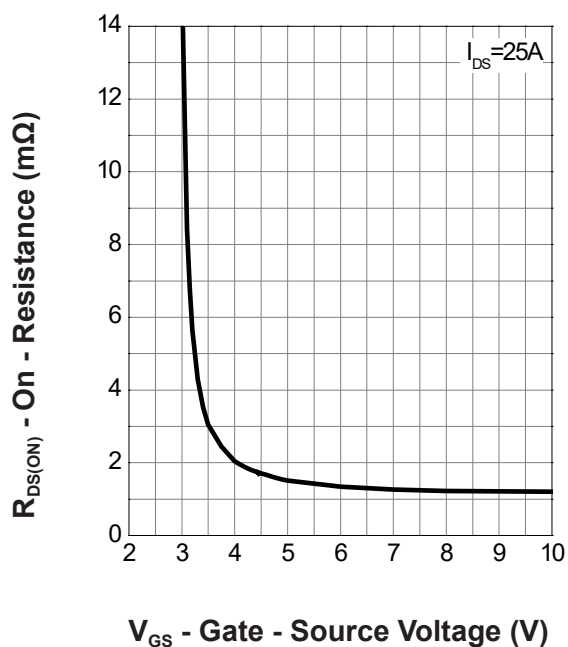


Drain-Source On Resistance

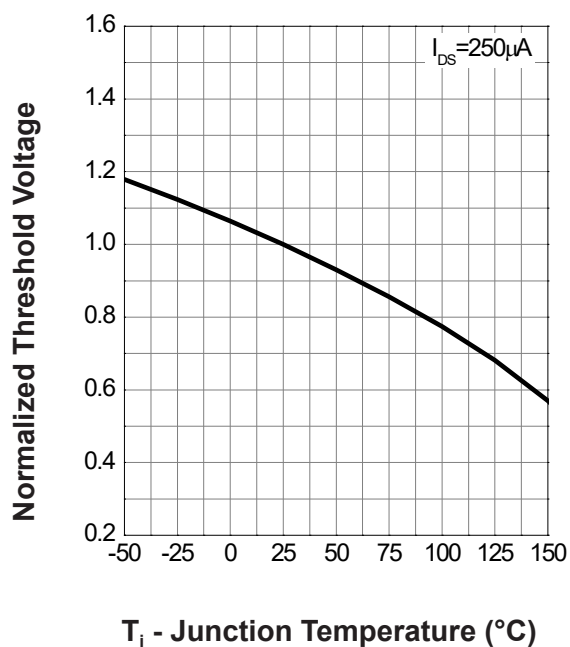


## Channel 2 Typical Operating Characteristics(Cont.)

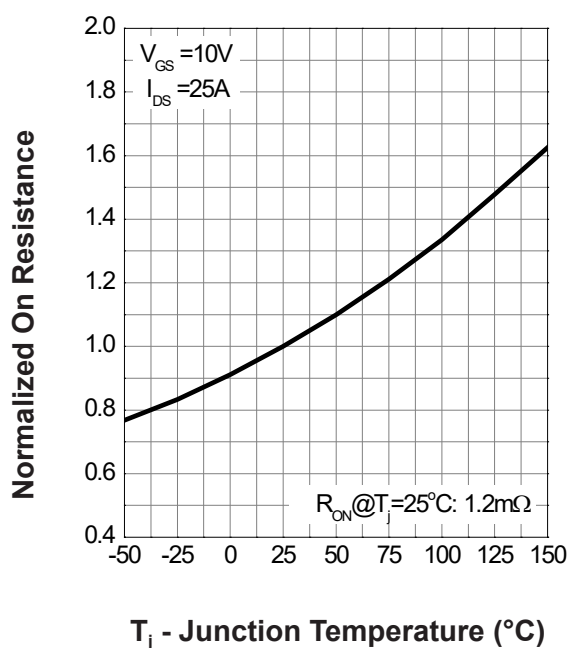
Gate-Source On Resistance



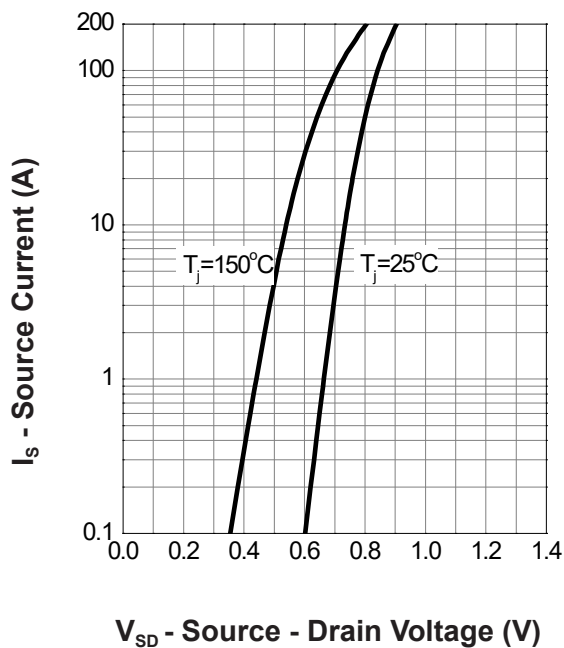
Gate Threshold Voltage



Drain-Source On Resistance

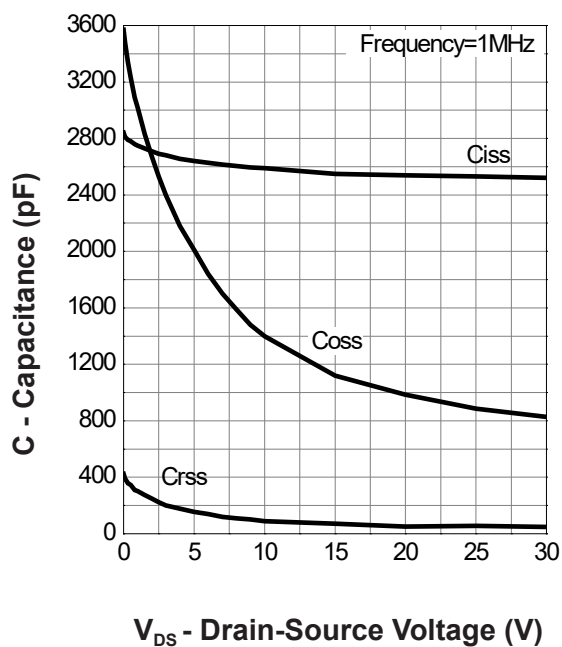


Source-Drain Diode Forward

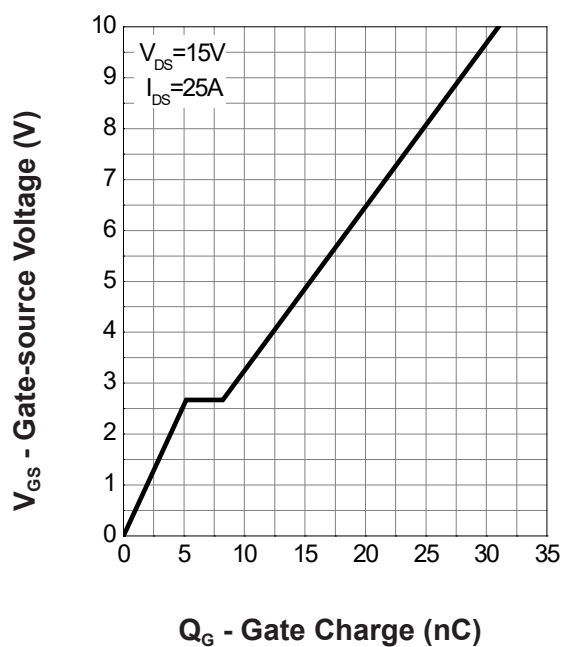


## Channel 2 Typical Operating Characteristics(Cont.)

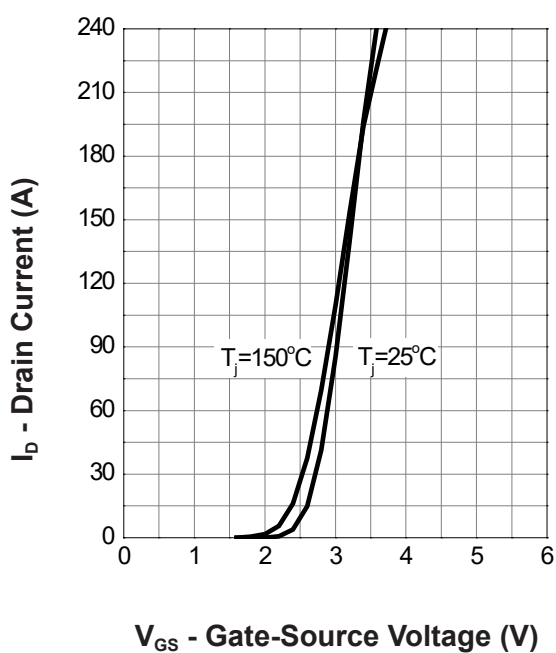
Capacitance



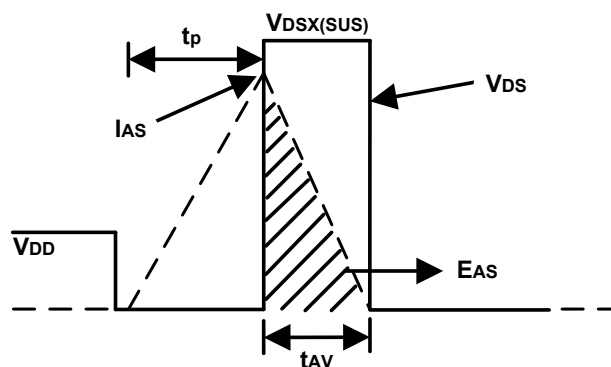
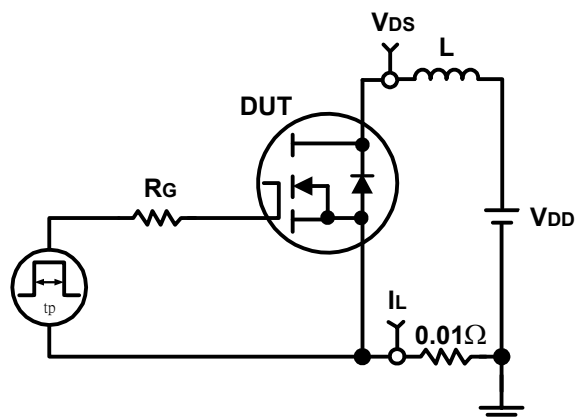
Gate Charge



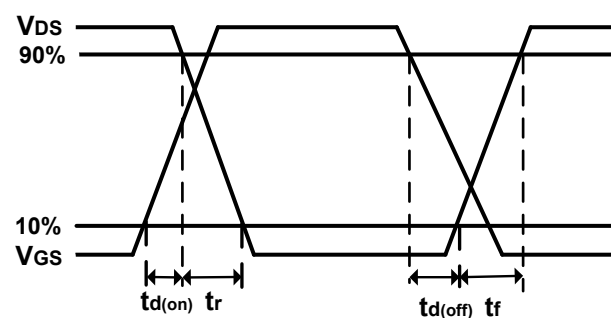
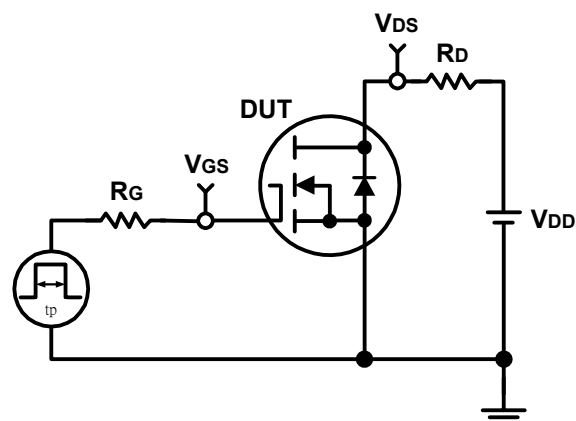
Transfer Characteristics



## Avalanche Test Circuit and Waveforms



## Switching Time Test Circuit and Waveforms



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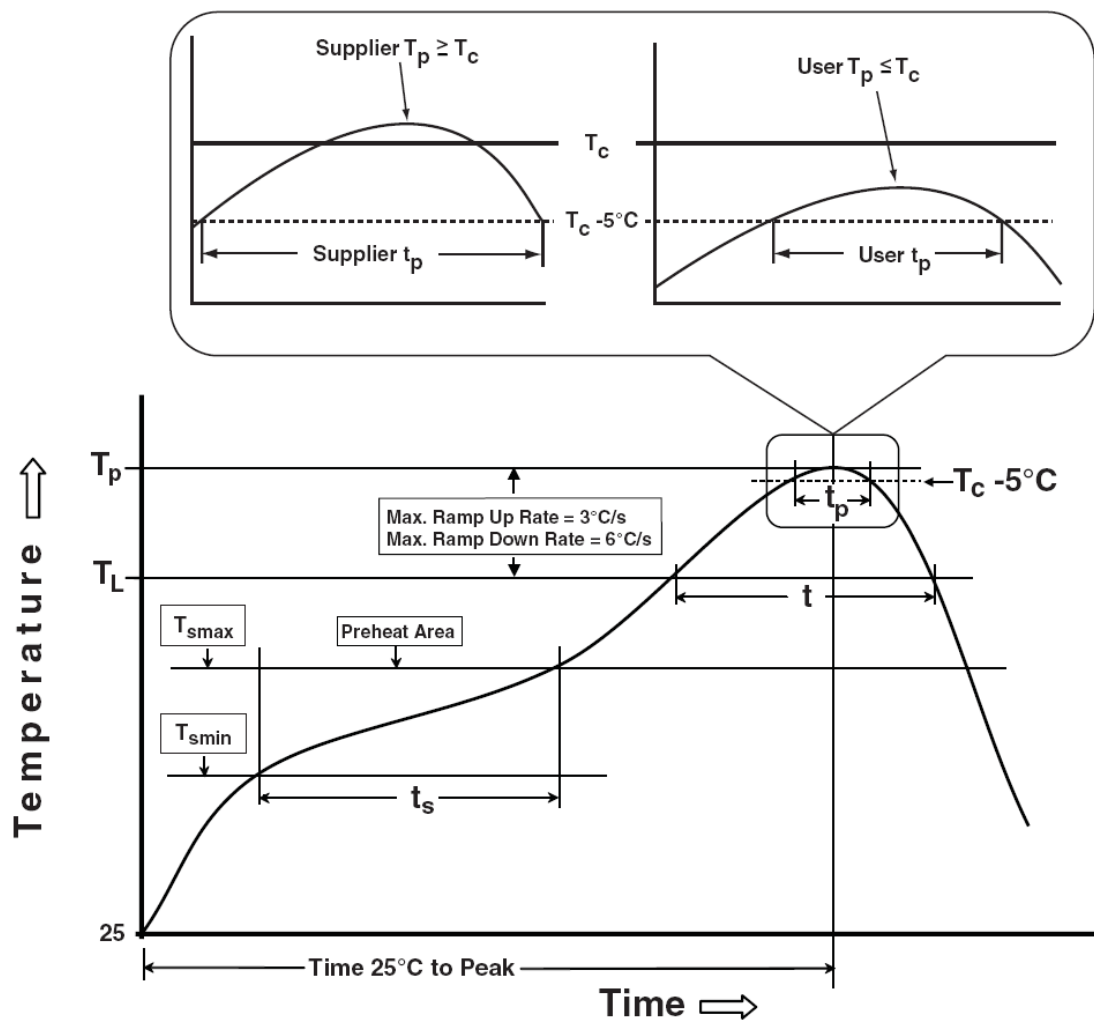
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## Classification Profile



## 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

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