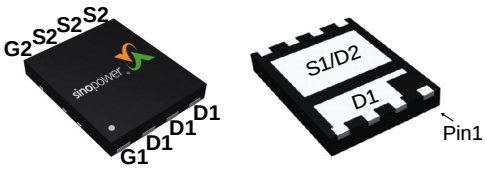
# SM7360EKQG

**Dual N-Channel Enhancement Mode MOSFET**

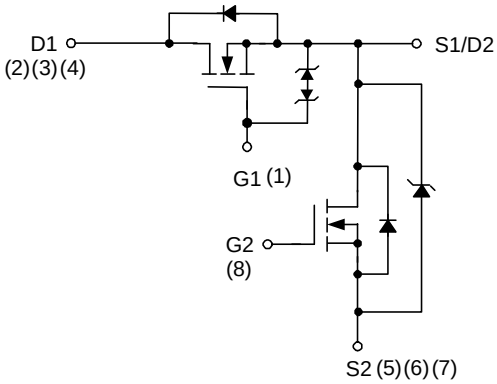
## Features

- **Channel 1 (ESD Protection)**
  30V/83A,
  $R_{DS(ON)}$ = 3mΩ (max.) @ $V_{GS}$ = 10V
  $R_{DS(ON)}$ = 5.6mΩ (max.) @ $V_{GS}$ = 4.5V
- **Channel 2 (Integrated Schottky diode)**
  30V/85A,
  $R_{DS(ON)}$ = 1.3mΩ (max.) @ $V_{GS}$ =10V
  $R_{DS(ON)}$ = 2.0mΩ (max.) @ $V_{GS}$ =4.5V
- 100% UIS + $R_g$ Tested
- Dual Dies Package and Minimize Board Space
- Lower $Q_g$ and $Q_{gd}$ for High-Speed Switching
- Lower $R_{DS(ON)}$ to Minimize Conduction Losses
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

## Pin Description




DFN5x6-8 (Dual -Saw-EP)




N-Channel MOSFET

## Applications

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

## Ordering and Marking Information

| | |
|---|---|
| SM7360EK □□□-□□ □<br>Assembly Material<br>Handling Code<br>Temperature Range<br>Package Code | Package Code<br>QG : DFN5x6-8 (Dual-Saw-EP)<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 |
| SM7360EK QG : SM7360EK XXXXX | 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 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).

**SINOPOWER reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.**

## Absolute Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | | Channel 1 | Channel 2 | Unit |
|---|---|---|---|---|---|
| **Common Ratings** | | | | | |
| $V_{DSS}$ | Drain-Source Voltage | | 30 | | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±20 | | V |
| $T_J$ | Maximum Junction Temperature | | 150 | | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to 150 | | °C |
| $I_S$ | Diode Continuous Forward Current | | 30 | 75 | A |
| $I_D$ | Continuous Drain Current | $T_C$=25°C | 83 | 85[a] | A |
| | | $T_C$=100°C | 52 | 85[a] | |
| $I_{DM}$[b] | Pulse Drain Current Tested | $T_C$=25°C | 200 | 300 | A |
| $P_D$ | Maximum Power Dissipation | $T_C$=25°C | 35 | 83 | W |
| | | $T_C$=100°C | 14 | 33 | |
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | Steady State | 3.5 | 1.5 | °C/W |
| $I_D$ | Continuous Drain Current | $T_A$=25°C | 17 | 25 | A |
| | | $T_A$=70°C | 13.6 | 20 | |
| $P_D$ | Maximum Power Dissipation | $T_A$=25°C | 1.38 | 1.38 | W |
| | | $T_A$=70°C | 0.88 | 0.88 | |
| $R_{\theta JA}$[c] | Thermal Resistance-Junction to Ambient | t ≤ 10s | 45 | 41 | °C/W |
| | | Steady State | 90 | 90 | |
| $I_{AS}$[d] | Avalanche Current, Single pulse (L=0.1mH) | | 30 | 50 | A |
| $E_{AS}$[d] | Avalanche Energy, Single pulse (L=0.1mH) | | 45 | 125 | mJ |

Note a: Package is limited to 85A.
Note b: Pulse width is limited by max. junction temperature.
Note c: Surface mounted on 1in$^2$ pad area, steady state t=999s.
Note d: UIS tested and pulse width are limited by maximum junction temperature 150°C (initial temperature $T_j$=25°C).

## Channel 1 Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | Channel 1 | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| **Static Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_{DS}$=250μA | 30 | - | - | V |
| $BV_{DSSt}$ | Drain-Source Breakdown Voltage (transient) | $V_{GS}$=0V, $I_{D(aval)}$=30A<br>$T_{case}$=25°C, $t_{transient}$=100ns | 34 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=24V, $V_{GS}$=0V | - | - | 1 | μA |
| | | $T_J$=85°C | - | - | 30 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_{DS}$=250μA | 1.4 | 1.7 | 2.5 | V |
| $I_{GSS}$ | Gate Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | - | - | ±10 | μA |
| $R_{DS(ON)}$ [e] | Drain-Source On-state Resistance | $V_{GS}$=10V, $I_{DS}$=13A | - | 2.5 | 3 | mΩ |
| | | $T_J$=125°C | - | 3.6 | - | |
| | | $V_{GS}$=4.5V, $I_{DS}$=11A | - | 4.2 | 5.6 | |
| Gfs | Forward Transconductance | $V_{DS}$=5V, $I_{DS}$=11A | - | 22 | - | S |
| **Diode Characteristics** | | | | | | |
| $V_{SD}$ [e] | Diode Forward Voltage | $I_{SD}$=13A, $V_{GS}$=0V | - | 0.8 | 1.1 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{DS}$=13A, $dI_{SD}/dt$=100A/μs<br>$V_{DD}$=15V | - | 33 | - | ns |
| $t_a$ | Charge Time | | - | 16 | - | |
| $t_b$ | Discharge Time | | - | 17 | - | |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 19 | - | nC |
| **Dynamic Characteristics** [f] | | | | | | |
| $R_G$ | Gate Resistance | $V_{GS}$=0V,$V_{DS}$=0V,F=1MHz | - | 0.9 | 1.8 | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V,<br>$V_{DS}$=15V,<br>Frequency=1.0MHz | - | 1200 | 1560 | pF |
| $C_{oss}$ | Output Capacitance | | - | 770 | - | |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 60 | - | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{DD}$=15V, $R_L$=15Ω,<br>$I_{DS}$=1A, $V_{GEN}$=10V,<br>$R_G$=1Ω | - | 8.8 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 10.6 | - | |
| $t_{d(OFF)}$ | Turn-off Delay Time | | - | 22 | - | |
| $t_f$ | Turn-off Fall Time | | - | 29 | - | |
| **Gate Charge Characteristics** [f] | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=15V, $V_{GS}$=4.5V,<br>$I_{DS}$=13A | - | 9.3 | - | nC |
| $Q_g$ | Total Gate Charge | $V_{DS}$=15V, $V_{GS}$=10V,<br>$I_{DS}$=13A | - | 19 | - | |
| $Q_{gth}$ | Threshold Gate Charge | | - | 1.3 | - | |
| $Q_{gs}$ | Gate-Source Charge | | - | 2 | - | |
| $Q_{gd}$ | Gate-Drain Charge | | - | 4.3 | - | |

Note e: Pulse test ; pulse width≤300μs, duty cycle≤2%.
Note f: Guaranteed by design, not subject to production testing.

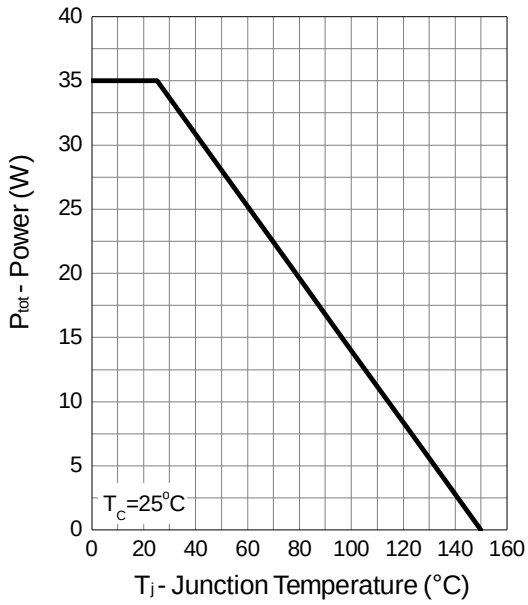
## Channel 2 Electrical Characteristics ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | Channel 2 | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| **Static Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_{DS}$=250μA | 30 | - | - | V |
| $BV_{DSSt}$ | Drain-Source Breakdown Voltage (transient) | $V_{GS}$=0V, $I_{D(aval)}$=50A<br>$T_{case}$=25°C, $t_{transient}$=100ns | 34 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=24V, $V_{GS}$=0V | - | - | 500 | μA |
| | | $T_J$=85°C | - | - | 5 | mA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_{DS}$=250μA | 1.4 | 1.7 | 2.5 | V |
| $I_{GSS}$ | Gate Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | - | - | ±100 | nA |
| $R_{DS(ON)}$ [e] | Drain-Source On-state Resistance | $V_{GS}$=10V, $I_{DS}$=25A | - | 1 | 1.3 | mΩ |
| | | $T_J$=125°C | - | 1.5 | - | |
| | | $V_{GS}$=4.5V, $I_{DS}$=20A | - | 1.5 | 2.0 | |
| Gfs | Forward Transconductance | $V_{DS}$=5V, $I_{DS}$=20A | - | 50 | - | S |
| **Diode Characteristics** | | | | | | |
| $V_{SD}$ [e] | Diode Forward Voltage | $I_{SD}$=2A, $V_{GS}$=0V | - | 0.45 | 0.7 | V |
| | | $I_{SD}$=25A, $V_{GS}$=0V | - | 0.75 | 1.1 | |
| $t_{rr}$ | Reverse Recovery Time | $I_{DS}$=5A, $dI_{SD}/dt$=100A/μs<br>$V_{DD}$=18V | - | 55 | - | ns |
| $t_a$ | Charge Time | | - | 30 | - | |
| $t_b$ | Discharge Time | | - | 25 | - | |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 64 | - | nC |
| **Dynamic Characteristics** [f] | | | | | | |
| $R_G$ | Gate Resistance | $V_{GS}$=0V,$V_{DS}$=0V,F=1MHz | - | 0.7 | 1.5 | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V,<br>$V_{DS}$=15V,<br>Frequency=1.0MHz | - | 4450 | - | pF |
| $C_{oss}$ | Output Capacitance | | - | 2050 | - | |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 210 | - | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{DD}$=15V, $R_L$=15Ω,<br>$I_{DS}$=1A, $V_{GEN}$=10V,<br>$R_G$=1Ω | - | 20 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 12.2 | - | |
| $t_{d(OFF)}$ | Turn-off Delay Time | | - | 42 | - | |
| $t_f$ | Turn-off Fall Time | | - | 30 | - | |
| **Gate Charge Characteristics** [f] | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=15V, $V_{GS}$=4.5V,<br>$I_{DS}$=25A | - | 29 | - | nC |
| $Q_g$ | Total Gate Charge | $V_{DS}$=15V, $V_{GS}$=10V,<br>$I_{DS}$=25A | - | 63 | - | |
| $Q_{gth}$ | Threshold Gate Charge | | - | 7 | - | |
| $Q_{gs}$ | Gate-Source Charge | | - | 12.3 | - | |
| $Q_{gd}$ | Gate-Drain Charge | | - | 6.1 | - | |

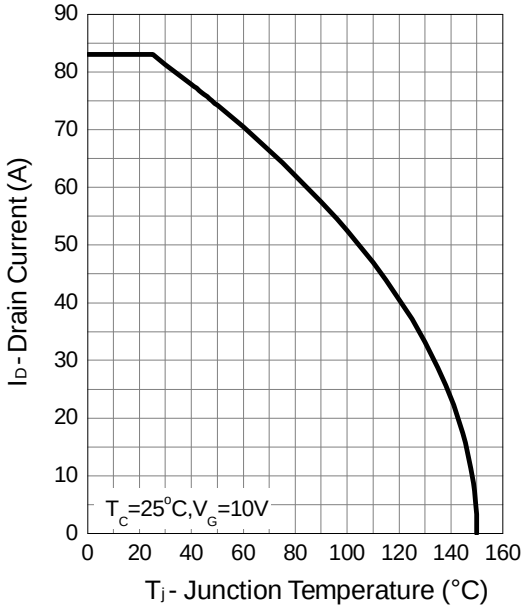
Note e: Pulse test ; pulse width≤300μs, duty cycle≤2%.
Note f: Guaranteed by design, not subject to production testing.

## Channel 1 Typical Operating Characteristics

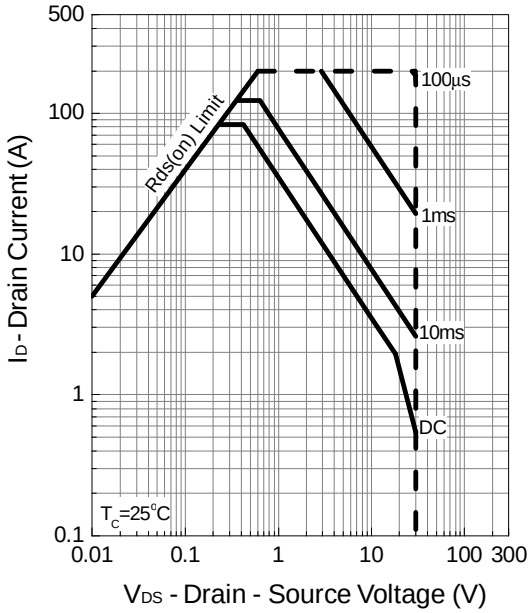
**Power Dissipation**



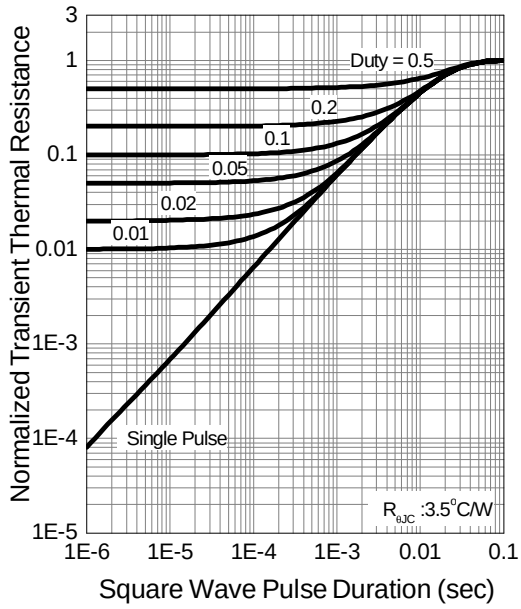

**Drain Current**




**Safe Operation Area**

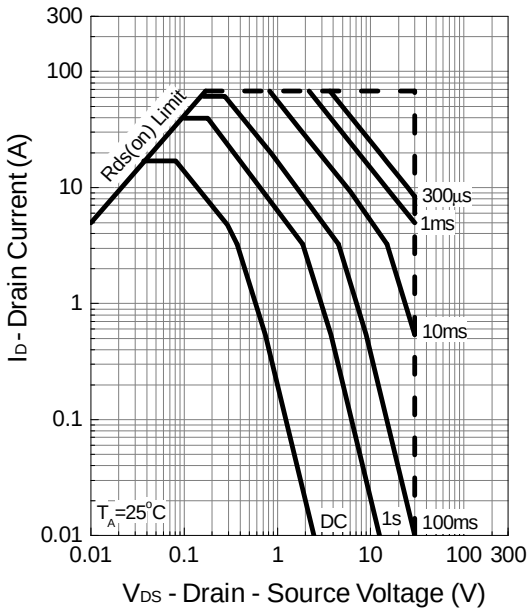



**Thermal Transient Impedance**

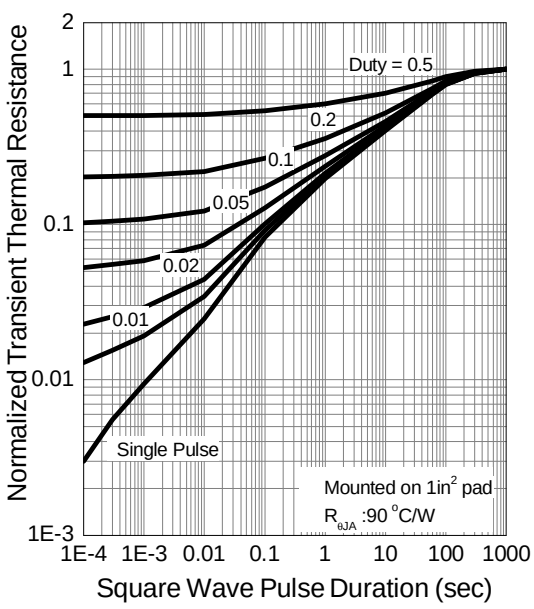


## Channel 1 Typical Operating Characteristics (Cont.)

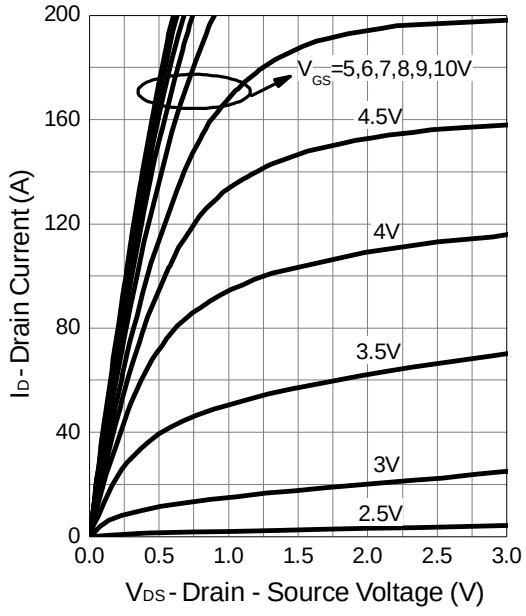
### Safe Operation Area



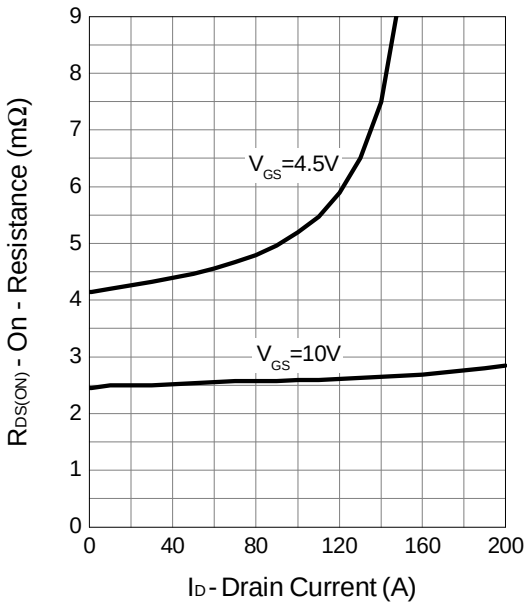

### Thermal Transient Impedance




### Output Characteristics

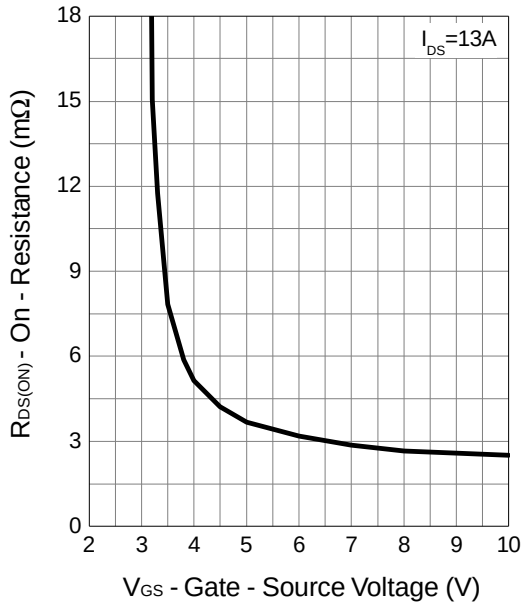



### Drain-Source On Resistance

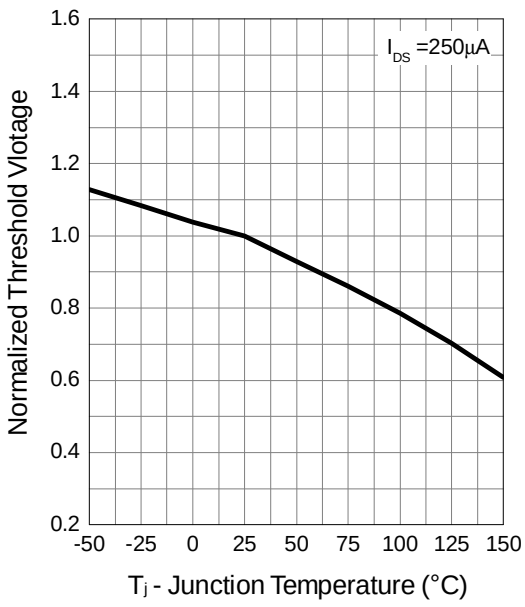


## Channel 1 Typical Operating Characteristics (Cont.)

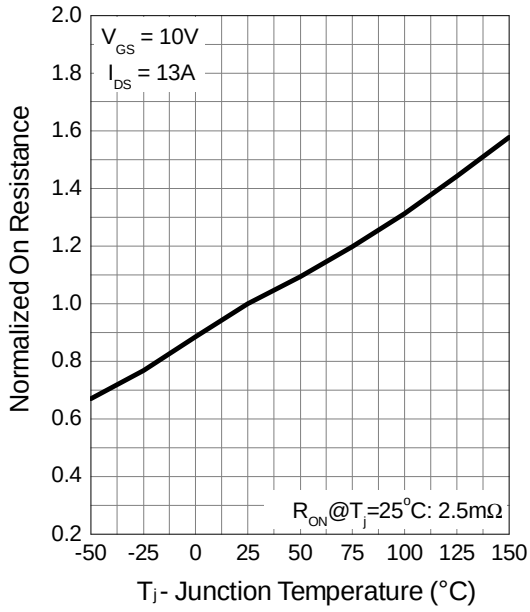
**Gate-Source On Resistance**



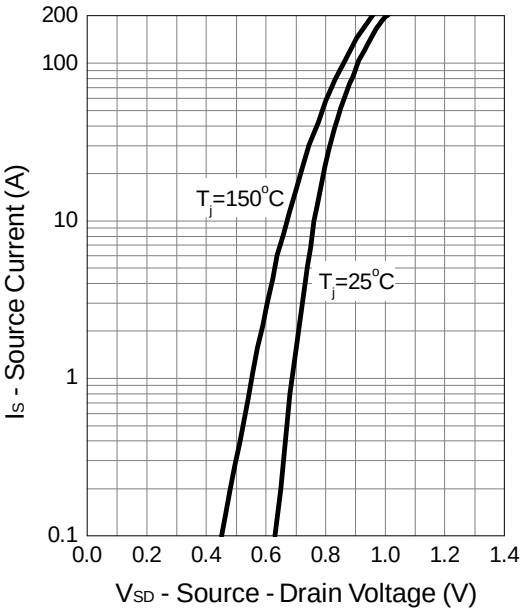

**Gate Threshold Voltage**




**Drain-Source On Resistance**

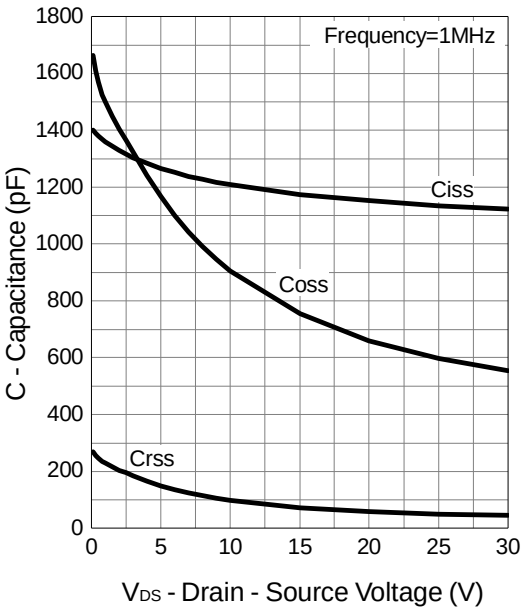



**Source-Drain Diode Forward**

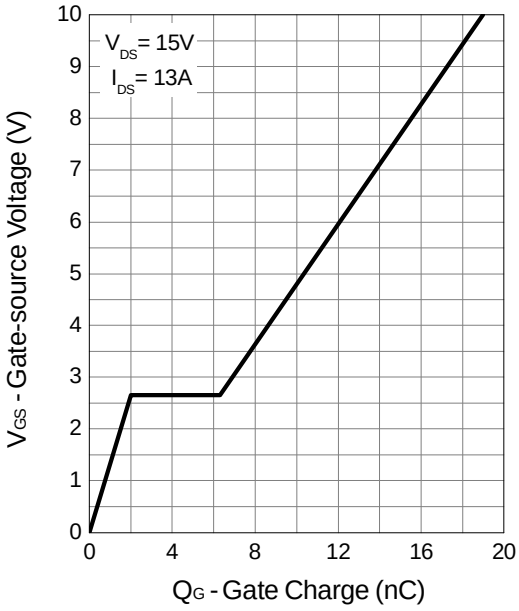


## Channel 1 Typical Operating Characteristics (Cont.)

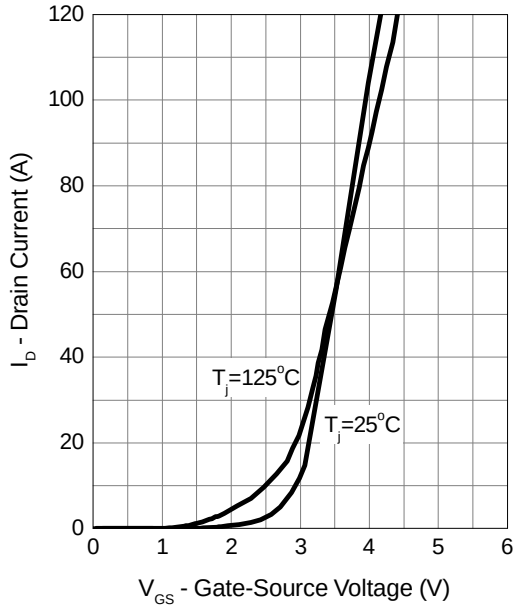
**Capacitance**




**Gate Charge**

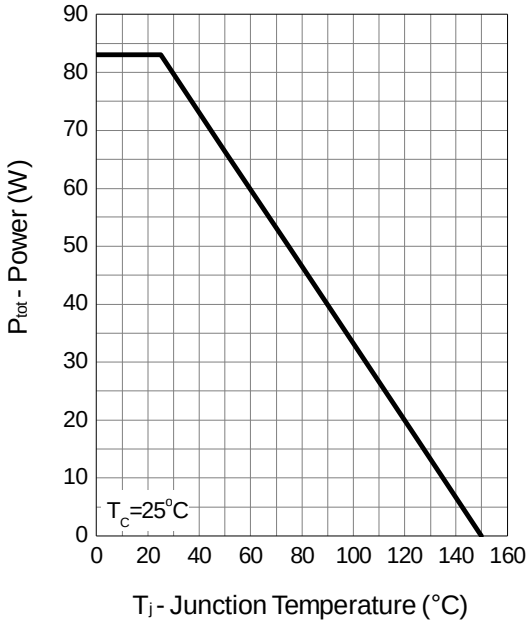



**Transfer Characteristics**

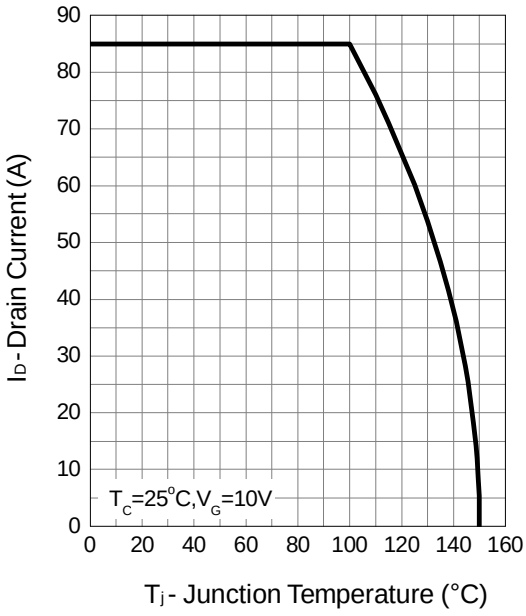


## Channel 2 Typical Operating Characteristics

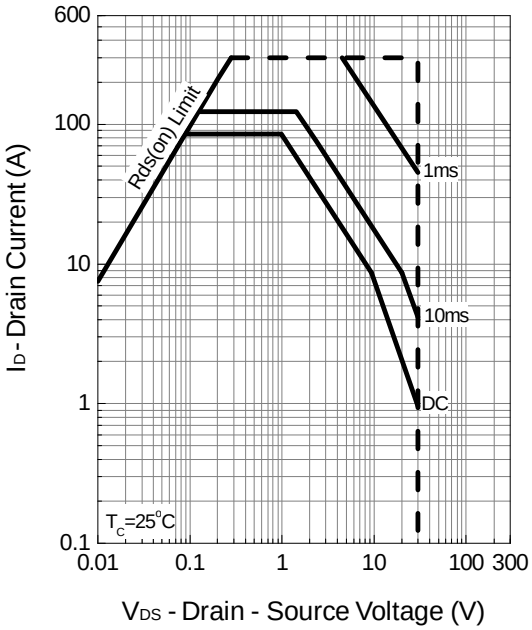
**Power Dissipation**



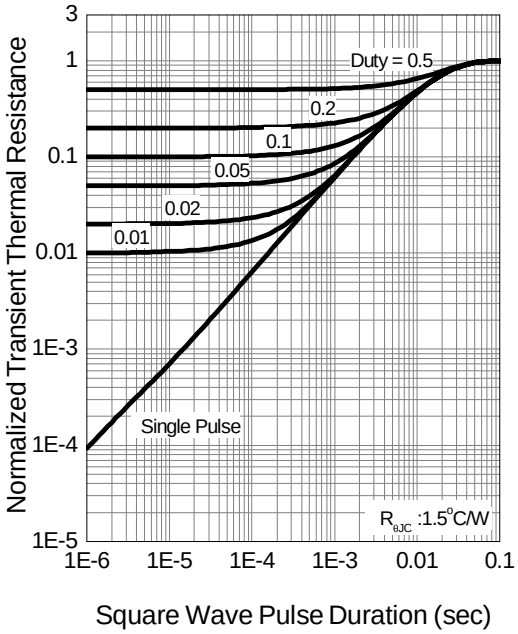

**Drain Current**




**Safe Operation Area**

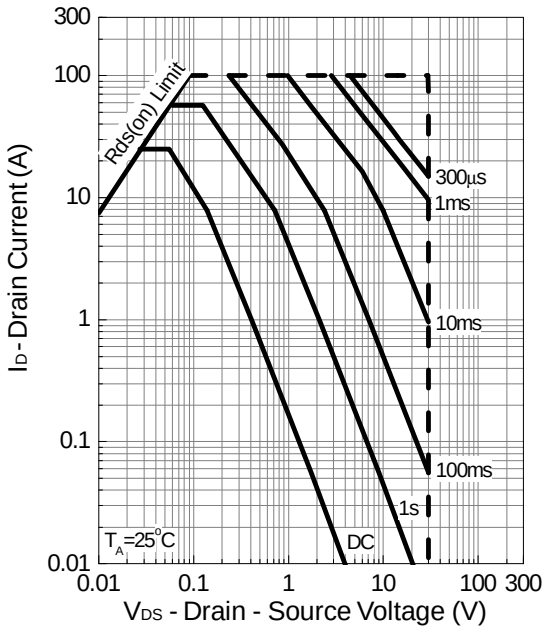



**Thermal Transient Impedance**

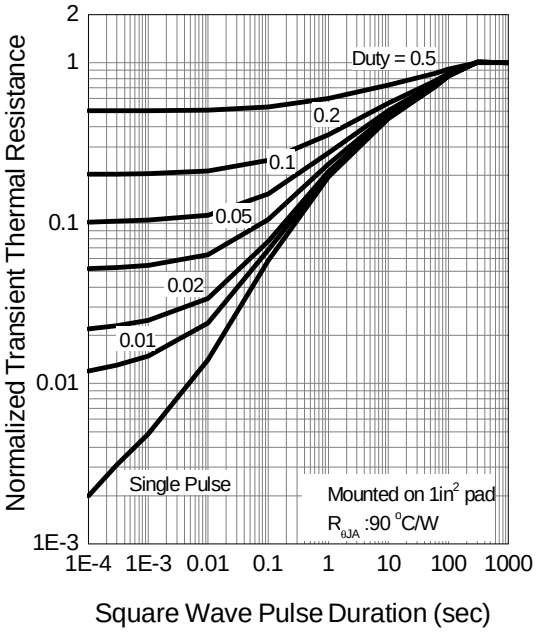


## Channel 2 Typical Operating Characteristics (Cont.)

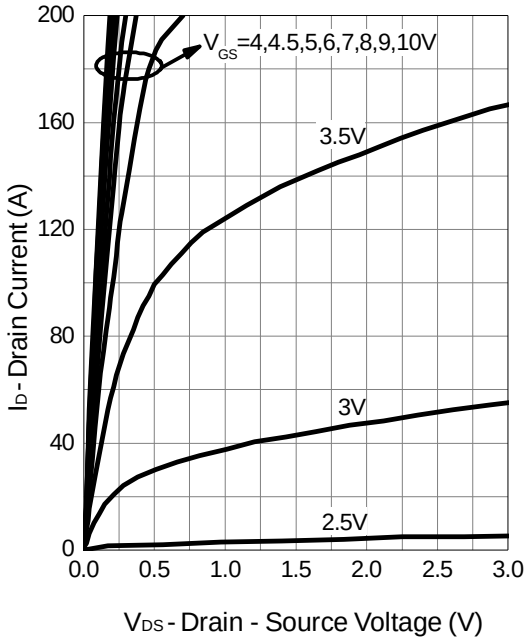
**Safe Operation Area**



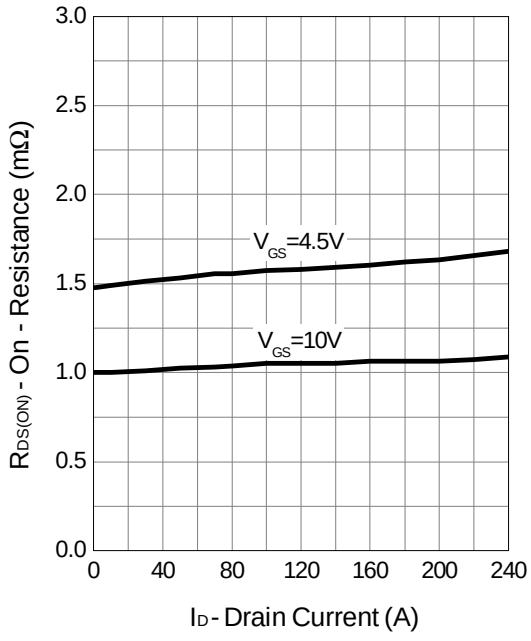

**Thermal Transient Impedance**




**Output Characteristics**

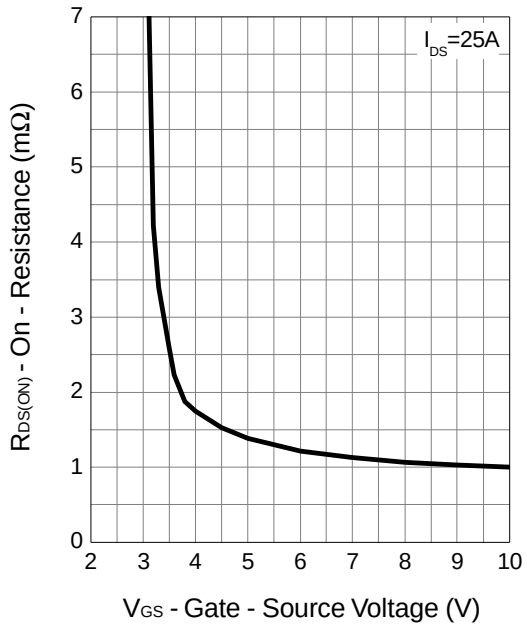



**Drain-Source On Resistance**

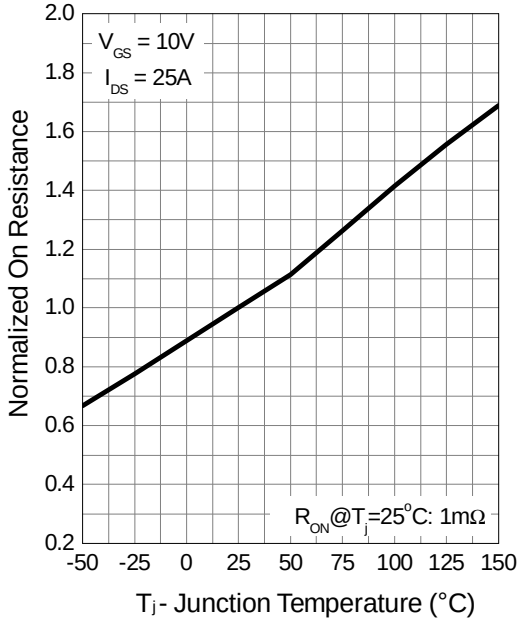


## Channel 2 Typical Operating Characteristics (Cont.)

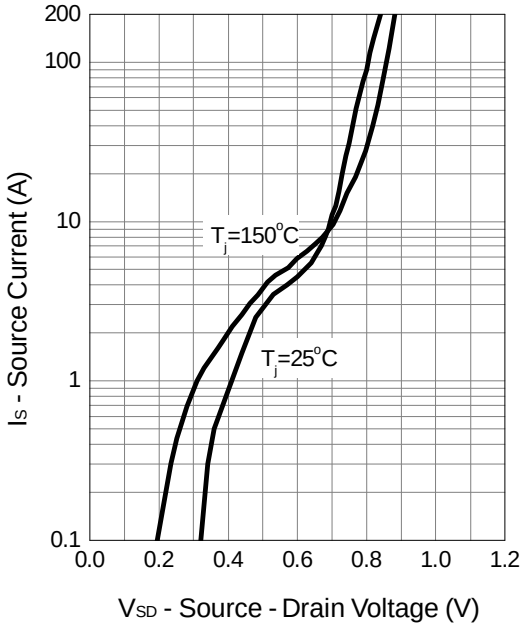
**Gate-Source On Resistance**



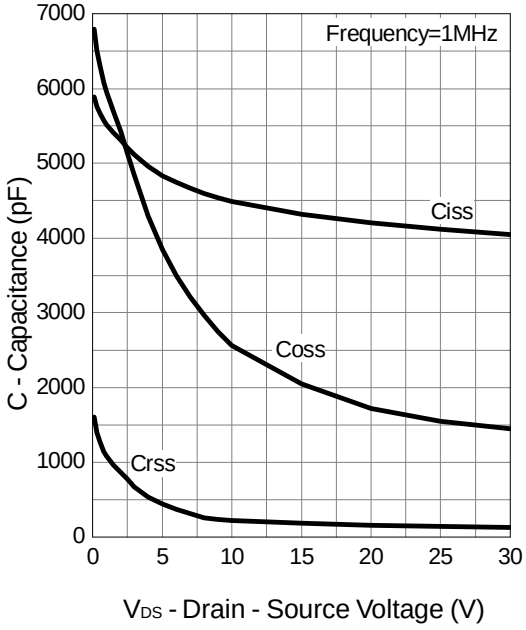

**Drain-Source On Resistance**




**Source-Drain Diode Forward**

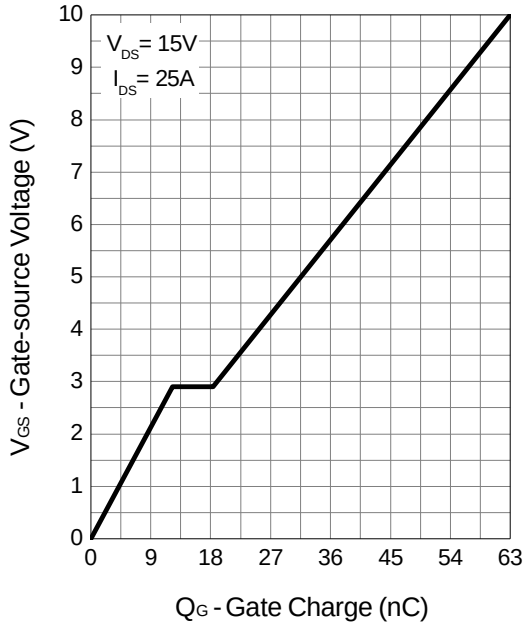



**Capacitance**

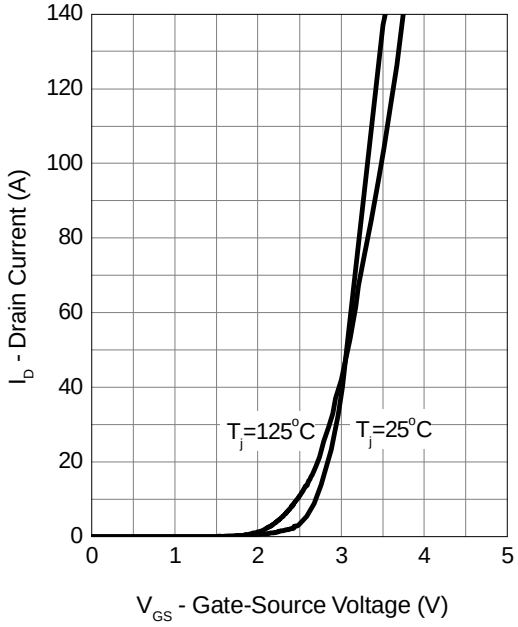


## Channel 2 Typical Operating Characteristics (Cont.)

**Gate Charge**

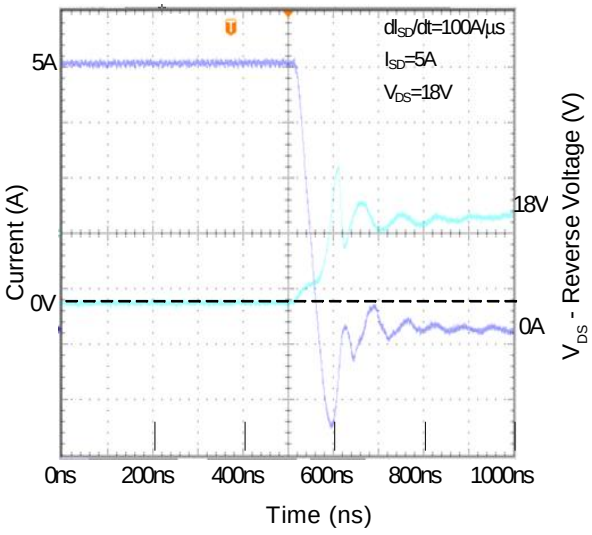



**Transfer Characteristics**

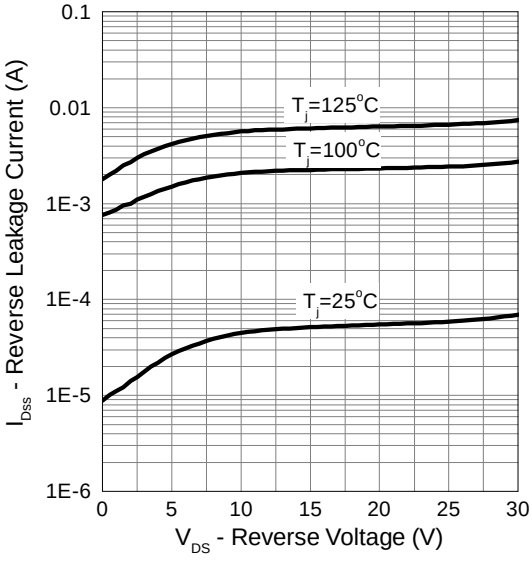



## Channel 2 Schottky Body Diode Characteristics

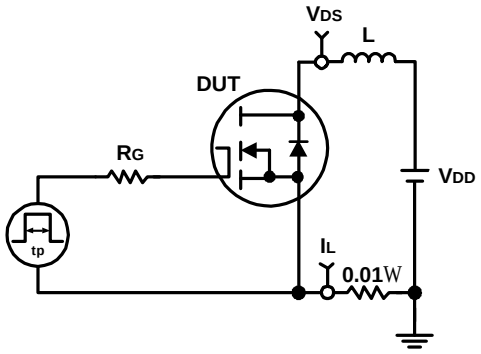
**Body Diode Reverse Recovery Diode Characteristics**

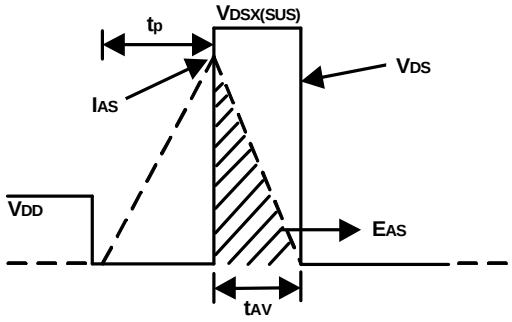



**Body Diode Reverse Leakage Current**

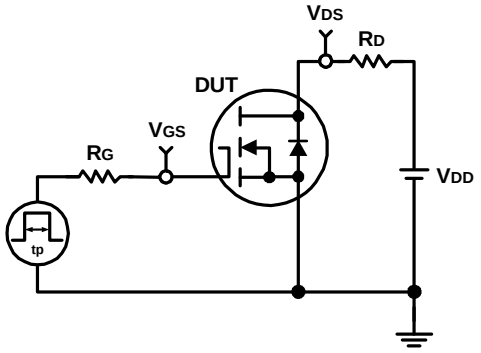


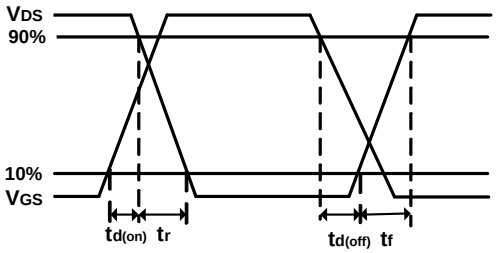
## Avalanche Test Circuit and Waveforms




## Switching Time Test Circuit and Waveforms



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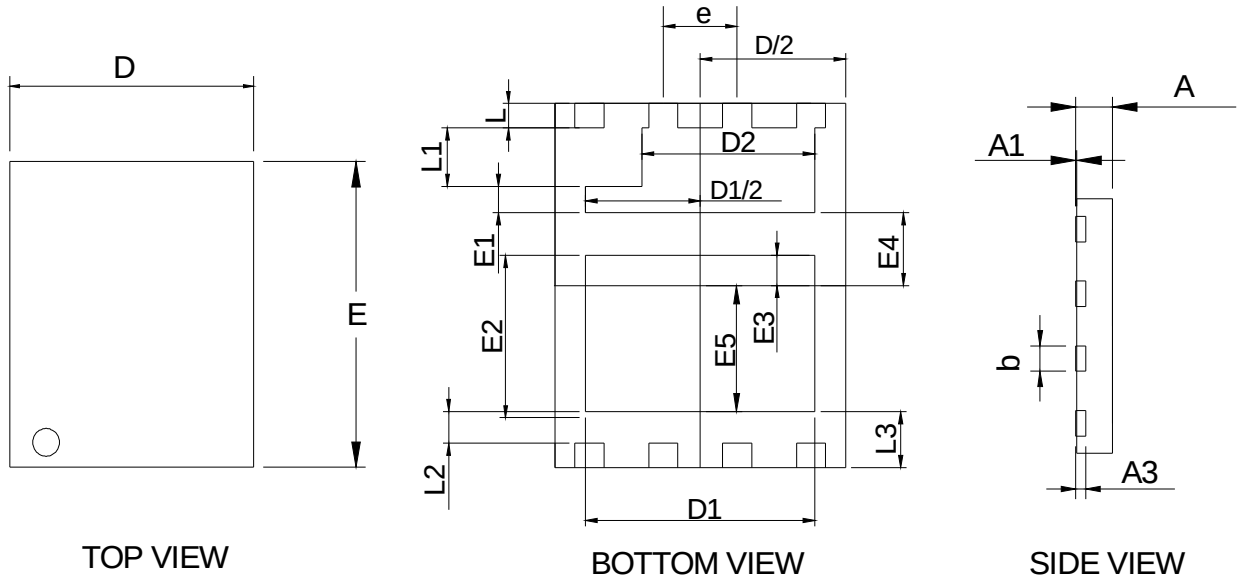
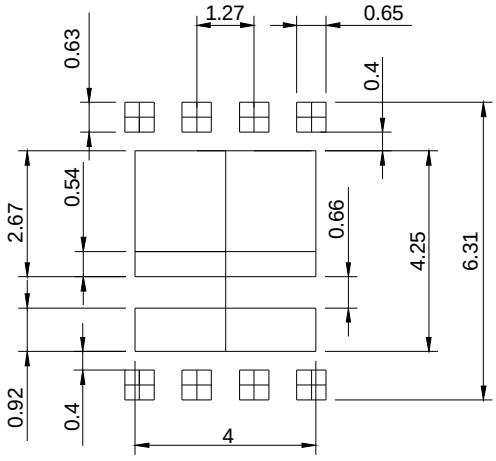
## Package Information



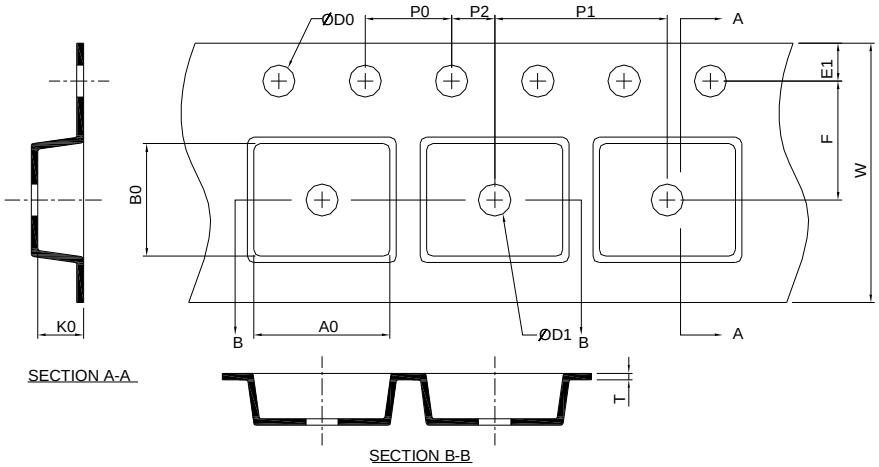

| SYMBOL | DFN5x6D-8_EP2_S | | | |
|---|---|---|---|---|
| | MILLIMETERS | | INCHES | |
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.70 | 0.80 | 0.0276 | 0.0315 |
| A1 | 0.00 | 0.05 | 0.000 | 0.002 |
| A3 | 0.15 | 0.25 | 0.006 | 0.01 |
| b | 0.45 | 0.55 | 0.018 | 0.022 |
| D | 4.90 | 5.10 | 0.193 | 0.201 |
| D1 | 3.80 | 4.05 | 0.078 | 0.088 |
| D2 | 2.85 | 3.13 | 0.110 | 0.123 |
| E | 5.90 | 6.10 | 0.232 | 0.240 |
| E1 | 0.28 | 0.58 | 0.011 | 0.023 |
| E2 | 2.53 | 2.63 | 0.100 | 0.104 |
| E3 | 0.35 | 0.60 | 0.014 | 0.024 |
| E4 | 1.05 | 1.30 | 0.041 | 0.051 |
| E5 | 1.93 | 2.18 | 0.076 | 0.086 |
| e | 1.27 BSC | | 0.050 BSC | |
| L | 0.30 | 0.50 | 0.012 | 0.020 |
| L1 | 0.92 | 1.02 | 0.036 | 0.040 |
| L2 | 0.47 | 0.57 | 0.018 | 0.022 |
| L3 | 0.87 | 0.97 | 0.034 | 0.038 |

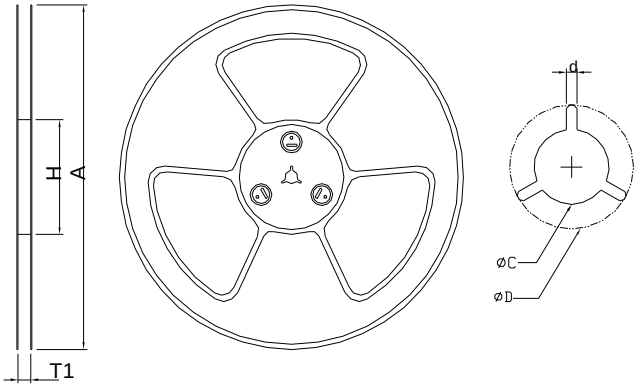
### RECOMMENDED LAND PATTERN




UNIT: mm

## Carrier Tape & Reel Dimensions



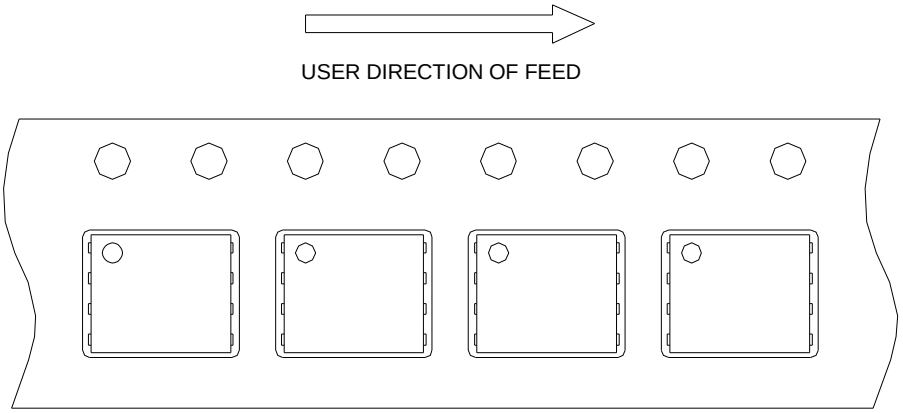




| Application | A | H | T1 | C | d | D | W | E1 | F |
|---|---|---|---|---|---|---|---|---|---|
| DFN5x6D-8_EP2_S | 330.0±2.00 | 50 MIN. | 12.4+2.00 -0.00 | 13.0+0.50 -0.20 | 1.5 MIN. | 20.2 MIN. | 12.0±0.30 | 1.75±0.10 | 5.5±0.10 |
| | **P0** | **P1** | **P2** | **D0** | **D1** | **T** | **A0** | **B0** | **K0** |
| | 4.0±0.10 | 8.0±0.10 | 2.0±0.10 | 1.5+0.10 -0.00 | 1.5 MIN. | 0.3±0.05 | 6.5±0.10 | 5.3±0.10 | 1.4±0.10 |

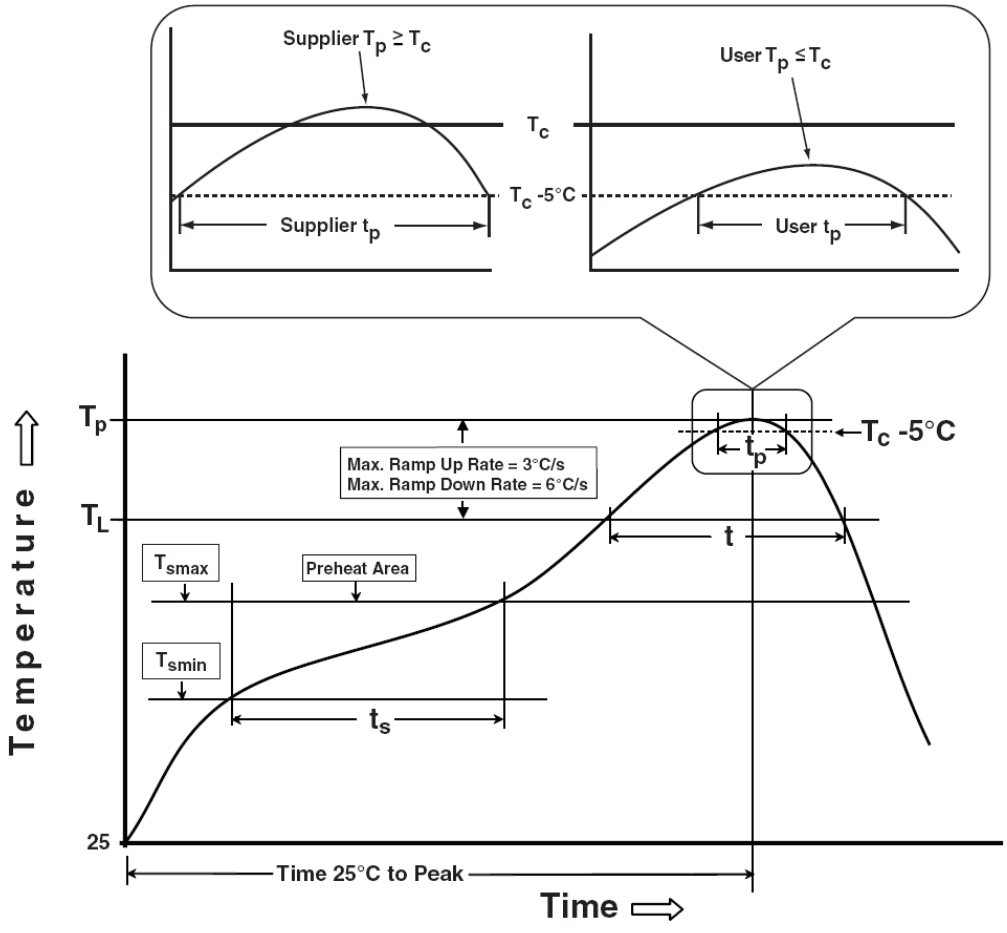
(mm)

## Taping Direction Information

**DFN5x6D-8_EP2_S**




## Classification Profile



## Classification Reflow Profiles

| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|---|---|---|
| **Preheat & Soak**<br>Temperature min ($T_{smin}$)<br>Temperature max ($T_{smax}$)<br>Time ($T_{smin}$ to $T_{smax}$) ($t_s$) | 100 °C<br>150 °C<br>60-120 seconds | 150 °C<br>200 °C<br>60-120 seconds |
| Average ramp-up rate ($T_{smax}$ to $T_P$) | 3 °C/second max. | 3°C/second max. |
| Liquidous temperature ($T_L$)<br>Time at liquidous ($t_L$) | 183 °C<br>60-150 seconds | 217 °C<br>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.<br>** 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 (Tc)

| Package Thickness | Volume $mm^3$ <350 | Volume $mm^3$ ³350 |
|---|---|---|
| <2.5 mm | 235 ℃ | 220 °C |
| ≥2.5 mm | 220 ℃ | 220 °C |

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

| Package Thickness | Volume $mm^3$ <350 | Volume $mm^3$ 350-2000 | Volume $mm^3$ >2000 |
|---|---|---|---|
| <1.6 mm | 260 ℃ | 260 °C | 260 °C |
| 1.6 mm – 2.5 mm | 260 ℃ | 250 °C | 245 °C |
| ≥2.5 mm | 250 ℃ | 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 @ Tjmax |
| HTGB | JESD-22, A108 | 1000 Hrs, 100% of VGS max @ Tjmax |
| PCT | JESD-22, A102 | 168 Hrs, 100%RH, 2atm, 121°C |
| TCT | JESD-22, A104 | 500 Cycles, -65°C~150°C |

## Customer Service

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