## Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- Green Device Available
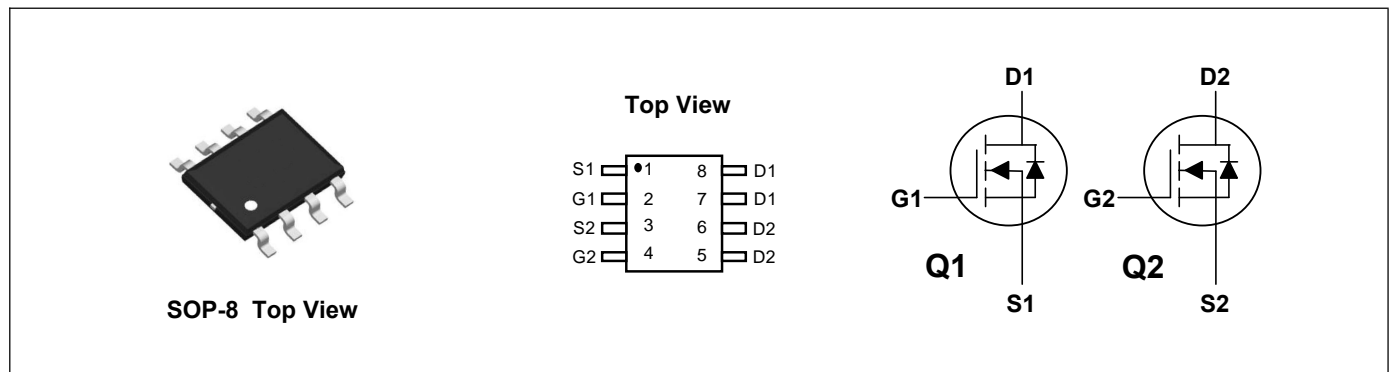
## Applications

- High Frequency Point-of-Load,Synchronous Buck Converter
- Networking DC-DC Power System
- Load Switch

## Product Summary

| | **Q1** | **Q2** | |
|---|---|---|---|
| $V_{DS}$ | 40 | 40 | V |
| $I_D$ | 8 | 12 | A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | 18 | 14 | mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$=4.5V) | 28 | 20 | mΩ |

RoHS

**Top View**

| | | |
|---|---|---|
| S1 | 1 | D1 |
| G1 | 2 | D1 |
| S2 | 3 | D2 |
| G2 | 4 | D2 |

**SOP-8  Top View**

D1    D2

G1  **Q1**  G2  **Q2**

S1    S2

## Absolute Maximum Ratings($T_A$=25℃, unless otherwise noted)

| Parameter | Symbol | Q1 | Q2 | Units |
|---|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 40 | 40 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | ±20 | V |
| Continuous Drain Current[1] | $I_D$@$T_C$=25℃ | 8 | 12 | A |
| Continuous Drain Current[1] | $I_D$@$T_C$=100℃ | 5.7 | 8.5 | A |
| Pulsed Drain Current[2] | $I_{DM}$ | 32 | 60 | A |
| Total Power Dissipation[3] | $P_D$@$T_C$=25℃ | 2 | 2.5 | W |
| Storage Temperature Range | $T_{STG}$ | -55 to 150 | | ℃ |
| Operating Junction Temperature Range | $T_J$ | -55 to 150 | | ℃ |

## Thermal Characteristics

| Parameter | Symbol | Typ | Max | Unit |
|---|---|---|---|---|
| Thermal Resistance Junction-Ambient[1]    (Q1) | $R_{\theta JA}$ | 62.5 | 85 | ℃/W |
| Thermal Resistance Junction-Ambient[1]    (Q2) | $R_{\theta JA}$ | 50 | 75 | ℃/W |

## Q1 Electrical Characteristics ($T_J$=25℃, unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V , $I_D$=250uA | 40 | --- | --- | V |
| Static Drain-Source On-Resistance[2] | $R_{DS(ON)}$ | $V_{GS}$=10V , $I_D$=8A | --- | 15.8 | 18 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=4A | --- | 22 | 28 | mΩ |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.0 | 1.5 | 2.0 | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=40V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| Forward Transconductance | gfs | $V_{DS}$=5V , $I_D$=8A | 33 | --- | --- | S |
| Total Gate Charge | $Q_g$ | $V_{DS}$=20V , $V_{GS}$=10V , $I_D$=8A | --- | 23 | --- | nC |
| Gate-Source Charge | $Q_{gs}$ | | --- | 3.5 | --- | |
| Gate-Drain Charge | $Q_{gd}$ | | --- | 5.3 | --- | |
| Turn-On Delay Time | $T_{d(on)}$ | $V_{DD}$=20V , $V_{GS}$=10V , $R_G$=3Ω, $R_L$=2.5Ω | --- | 5.5 | --- | ns |
| Rise Time | $T_r$ | | --- | 14 | --- | |
| Turn-Off Delay Time | $T_{d(off)}$ | | --- | 24 | --- | |
| Fall Time | $T_f$ | | --- | 12 | --- | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=20V , $V_{GS}$=0V , f=1MHz | --- | 964 | --- | pF |
| Output Capacitance | $C_{oss}$ | | --- | 109 | --- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | --- | 96 | --- | |

## Drain-Source Diode Characteristics

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Diode Forward Voltage[2] | $V_{SD}$ | $V_{GS}$=0V , $I_S$=8A , $T_J$=25℃ | --- | 0.8 | 1.2 | V |

**Note:**

1.The data tested by surface mounted on a 1 inch[2] FR-4 board with 2OZ copper.

2.The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3.The power dissipation is limited by 150℃ junction temperature

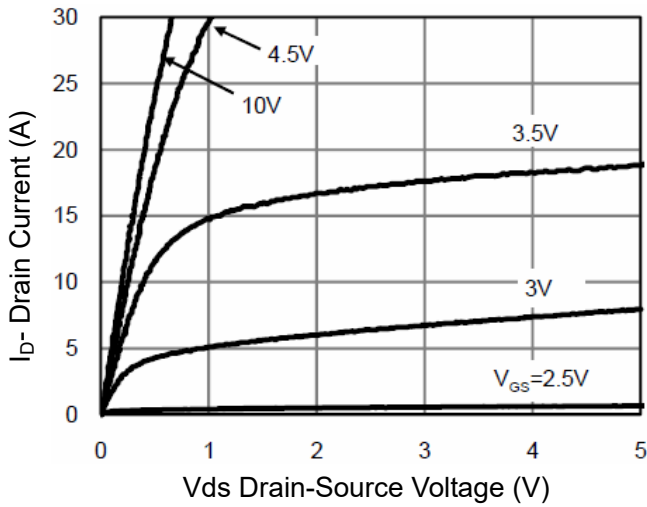www.atcsemi.com

## Q1  Typical Characteristics


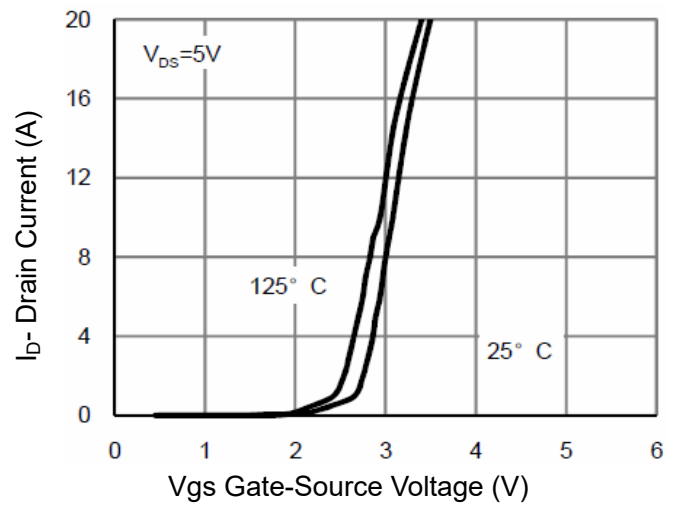**Figure 1 Output Characteristics**


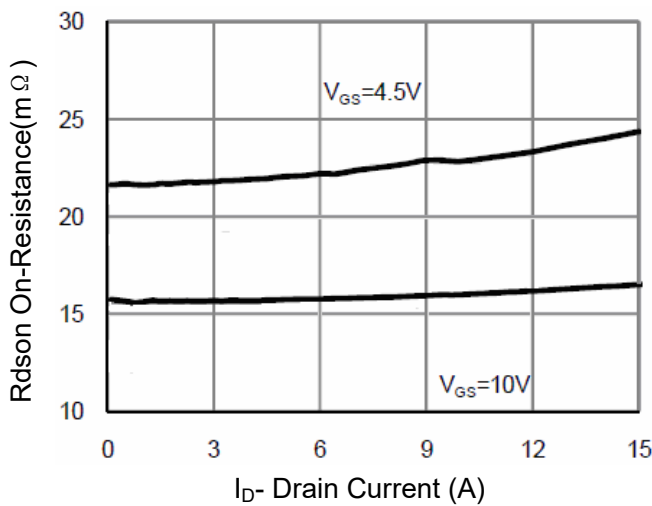**Figure 2 Transfer Characteristics**
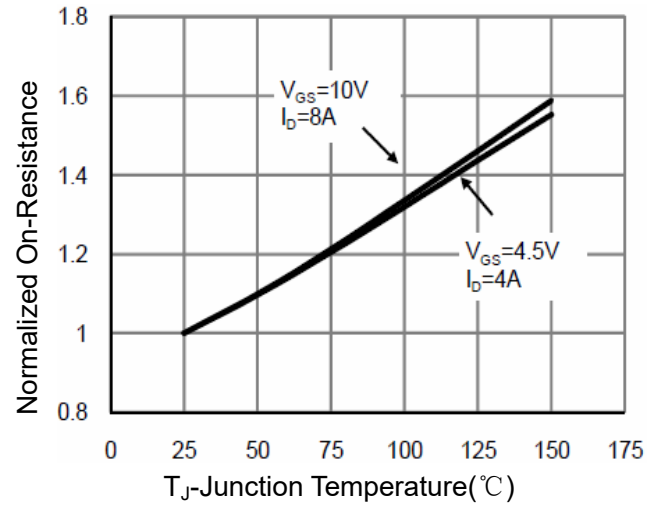

**Figure 3 Drain-Source On-Resistance**


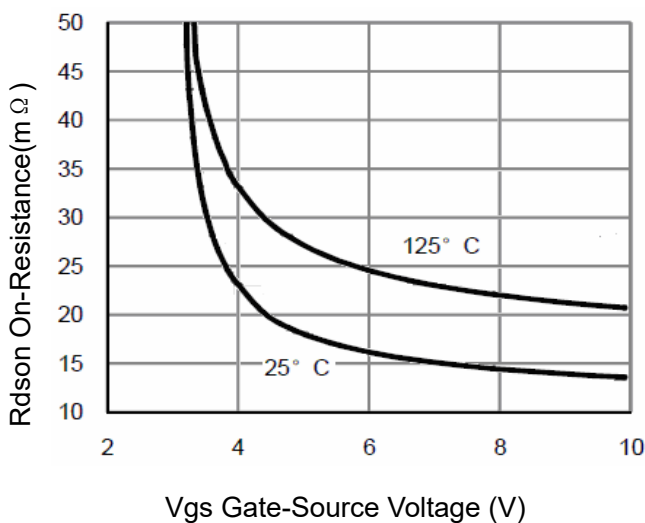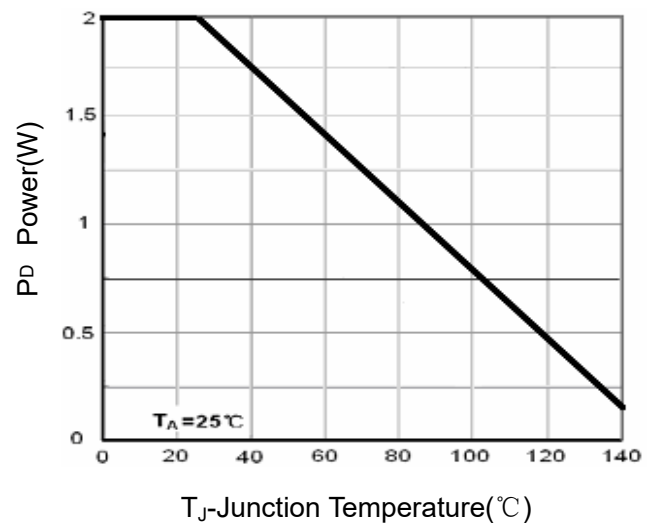**Figure 4 Drain-Source On-Resistance**
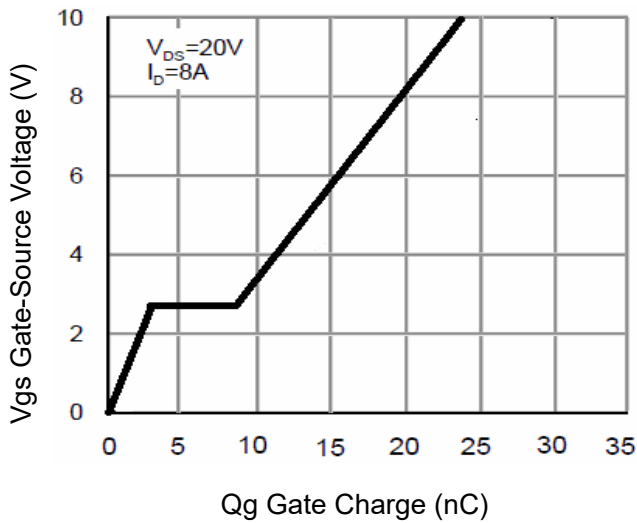

**Figure5 Rdson vs Vgs**


**Figure 6 Power Dissipation**

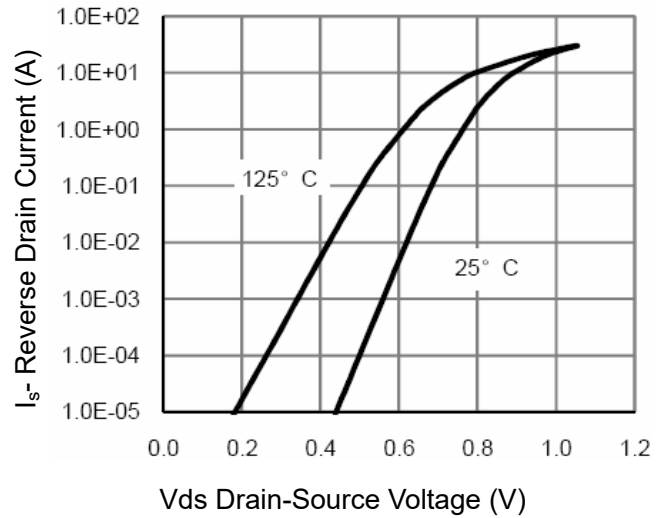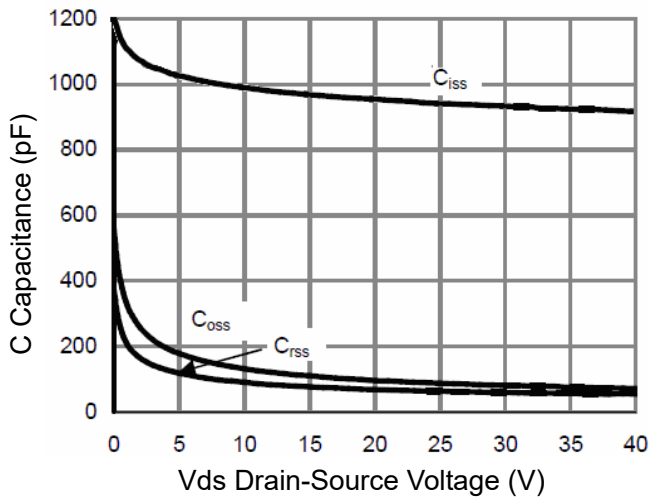Figure **7** Gate Charge

Figure **8** Source- Drain Diode Forward
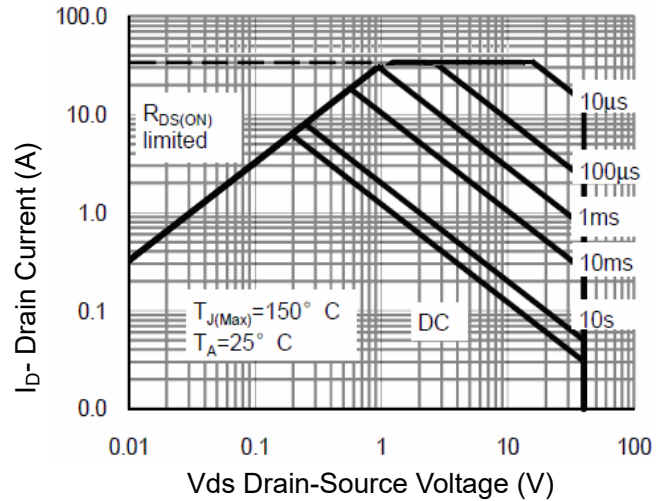
Figure **9** Capacitance vs Vds

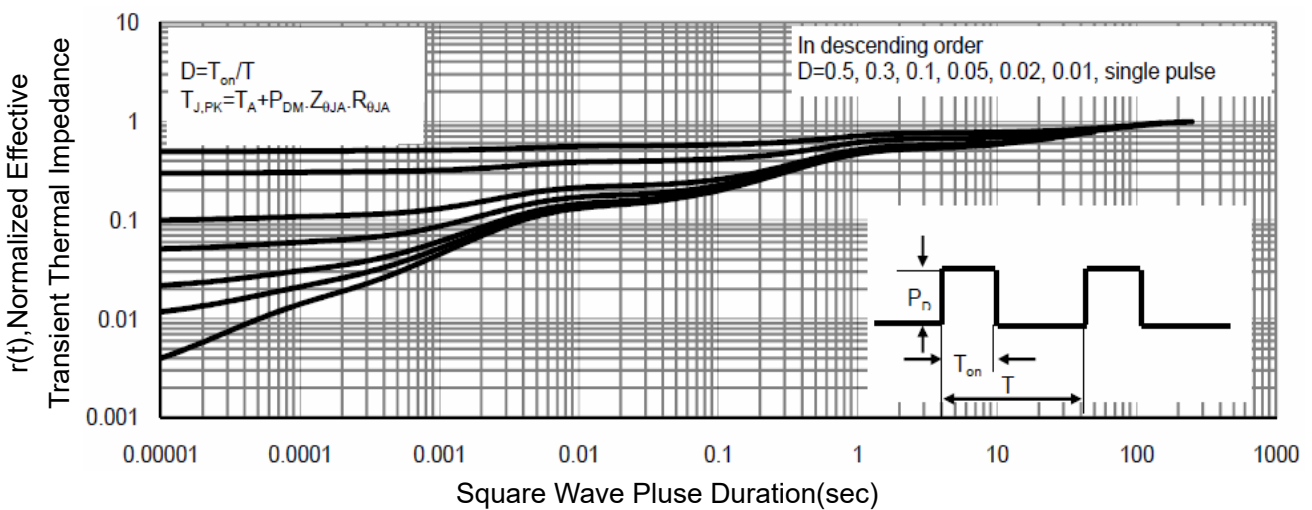Figure **10** Safe Operation Area

Figure **11** Normalized Maximum Transient Thermal Impedance

## Q2 Electrical Characteristics ($T_J$=25℃, unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V , $I_D$=250uA | 40 | --- | --- | V |
| Static Drain-Source On-Resistance[2] | $R_{DS(ON)}$ | $V_{GS}$=10V , $I_D$=10A | --- | 11.7 | 14 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=8A | --- | 15.6 | 20 | mΩ |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.2 | 1.6 | 2.5 | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=40V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| Forward Transconductance | gfs | $V_{DS}$=5V , $I_D$=10A | --- | 75 | --- | S |
| Total Gate Charge | $Q_g$ | $V_{DS}$=20V , $V_{GS}$=10V , $I_D$=10A | --- | 38 | --- | nC |
| Gate-Source Charge | $Q_{gs}$ | | --- | 5.6 | --- | |
| Gate-Drain Charge | $Q_{gd}$ | | --- | 7.4 | --- | |
| Turn-On Delay Time | $T_{d(on)}$ | $V_{DD}$=20V , $V_{GS}$=10V , $R_G$=3Ω, $R_L$=2Ω | --- | 6.4 | --- | ns |
| Rise Time | $T_r$ | | --- | 17.2 | --- | |
| Turn-Off Delay Time | $T_{d(off)}$ | | --- | 29.6 | --- | |
| Fall Time | $T_f$ | | --- | 16.8 | --- | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=20V , $V_{GS}$=0V , f=1MHz | --- | 1780 | --- | pF |
| Output Capacitance | $C_{oss}$ | | --- | 209 | --- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | --- | 160 | --- | |

## Drain-Source Diode Characteristics

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Continuous Source Current[1] | $I_S$ | | --- | --- | 12 | A |
| Diode Forward Voltage[2] | $V_{SD}$ | $V_{GS}$=0V , $I_S$=10A , $T_J$=25℃ | --- | --- | 1.2 | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$=10A , di/dt=100A/μs，$T_J$=25℃ | --- | 29 | --- | nS |
| Reverse Recovery Charge | $Q_{rr}$ | | --- | 26 | --- | nC |

**Note:**

1.The data tested by surface mounted on a 1 inch[2] FR-4 board with 2OZ copper.

2.The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3.The power dissipation is limited by 150℃ junction temperature
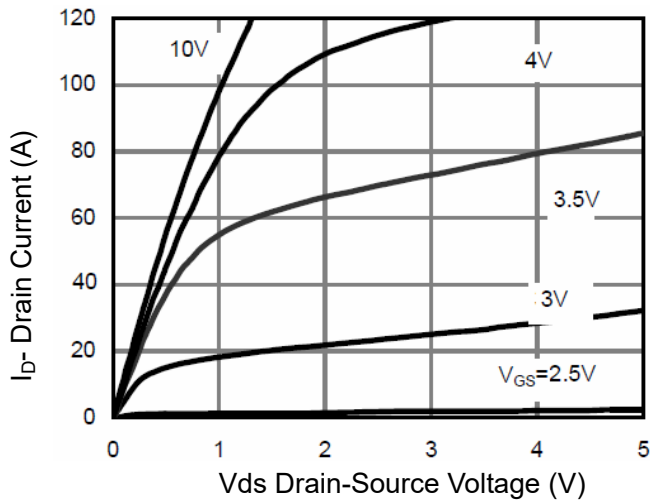
## Q2  Typical Characteristics



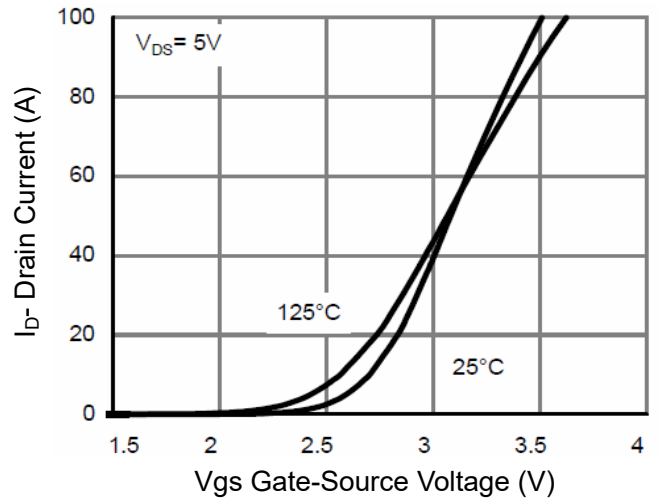**Figure 1 Output Characteristics**
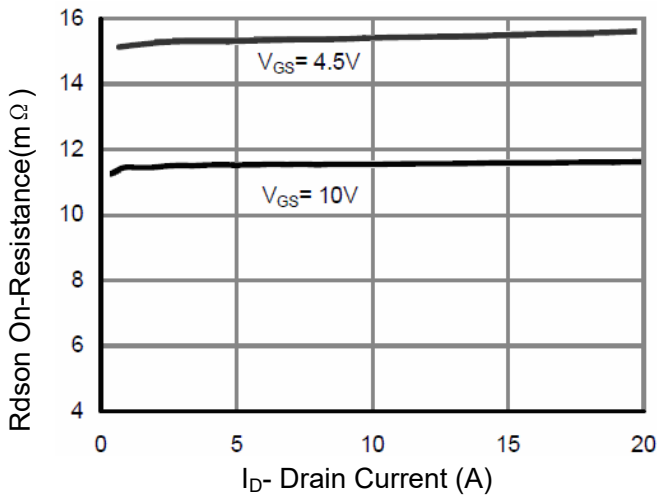


**Figure 2 Transfer Characteristics**



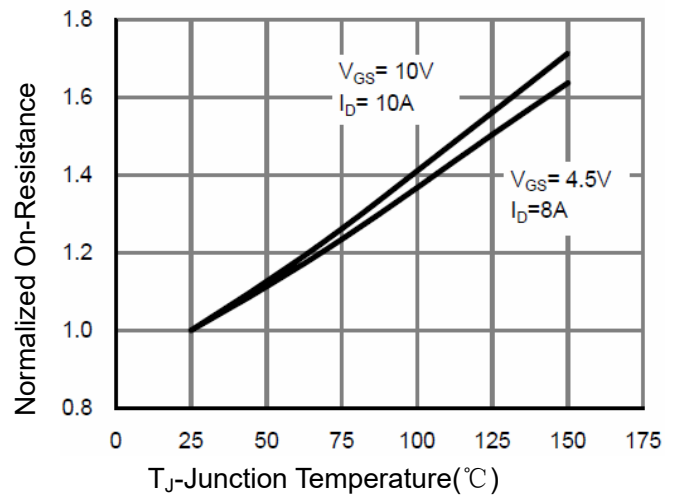**Figure 3 Rdson- Drain Current**
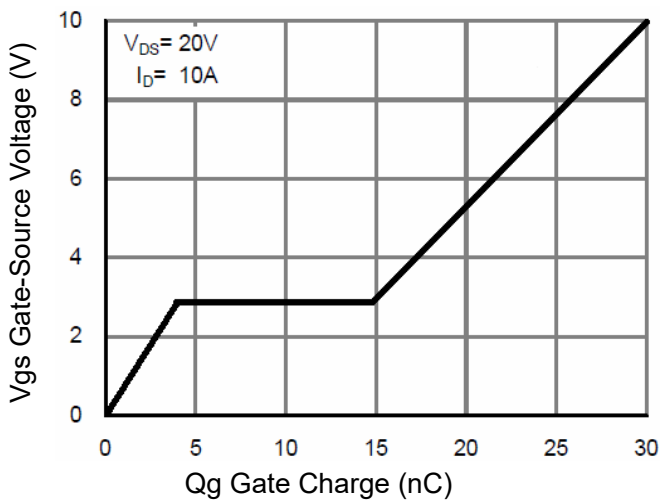


**Figure 4 Rdson-JunctionTemperature**
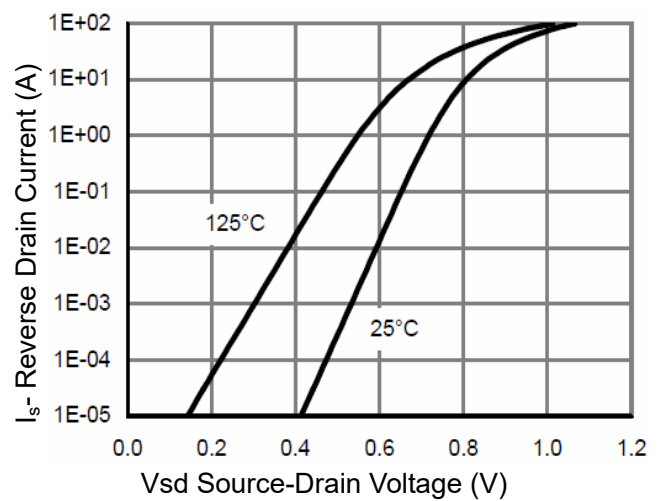


**Figure 5 Gate Charge**



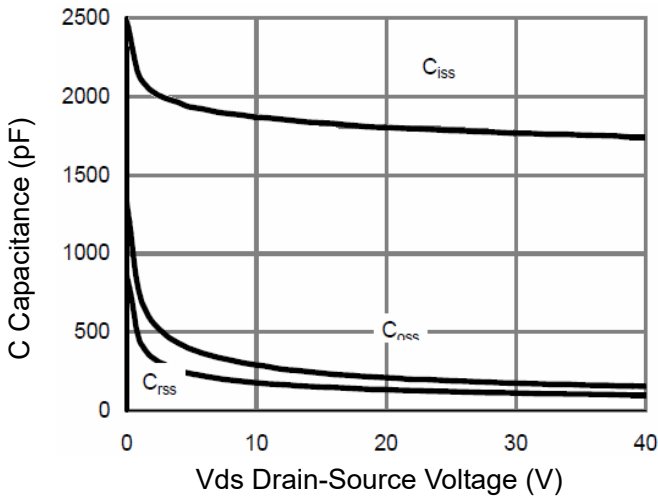**Figure 6 Source- Drain Diode Forward**
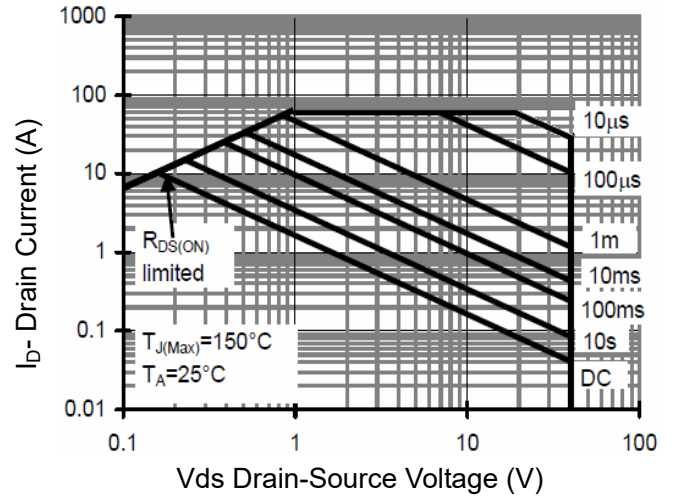
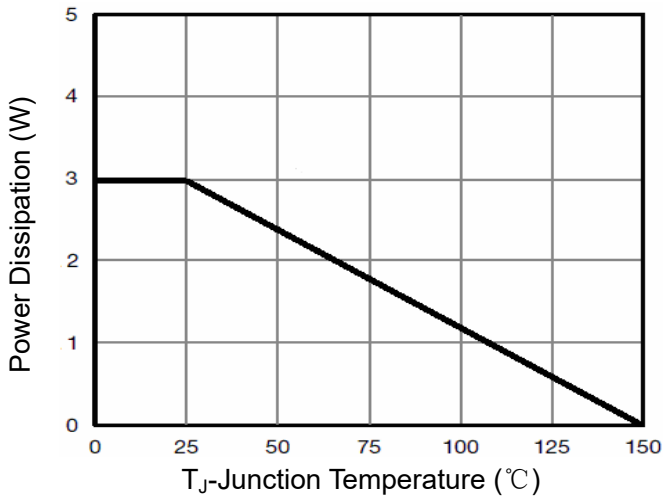**Figure 7 Capacitance vs Vds**



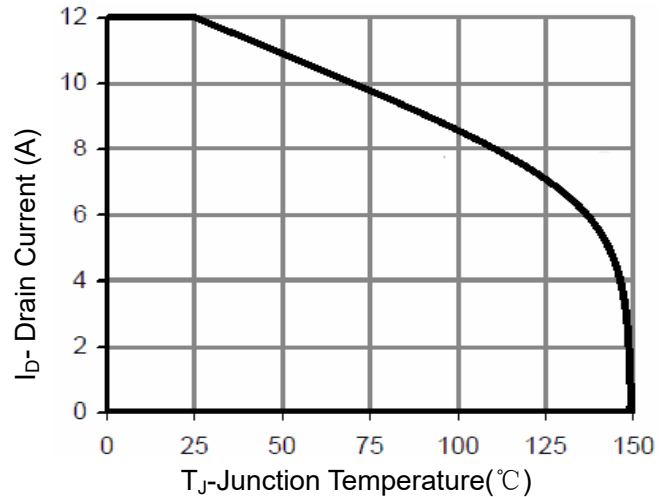**Figure 8 Safe Operation Area**



**Figure 9 Power De-rating**
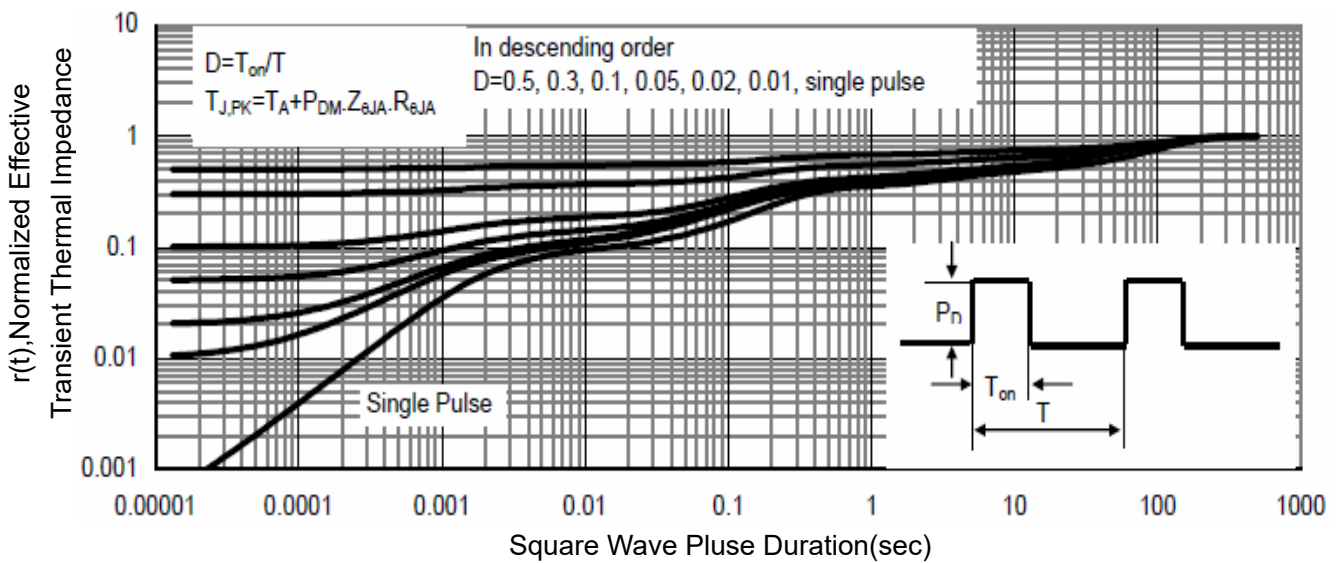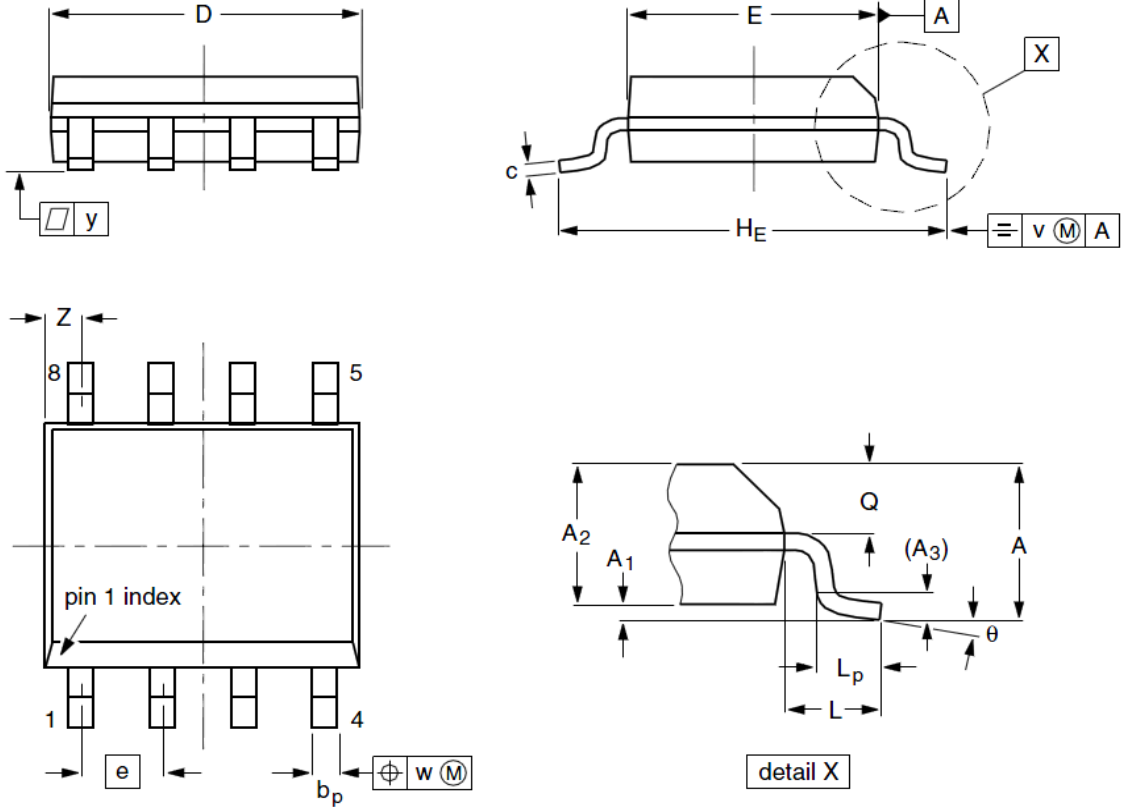


**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

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## SOP-8 Package Outline Dimensions



detail X

| Symbol | Dimensions (unit:mm) | | | Symbol | Dimensions (unit:mm) | | |
|---|---|---|---|---|---|---|---|
| | Min | Typ | Max | | Min | Typ | Max |
| A | 1.35 | 1.55 | 1.75 | $A_1$ | 0.10 | 0.18 | 0.25 |
| $A_2$ | 1.25 | 1.45 | 1.65 | $A_3$ | -- | 0.25 | -- |
| $b_p$ | 0.36 | 0.42 | 0.51 | c | 0.19 | 0.22 | 0.25 |
| D | 4.70 | 4.92 | 5.10 | E | 3.80 | 3.90 | 4.00 |
| e | -- | 1.27 | -- | $H_E$ | 5.80 | 6.00 | 6.20 |
| L | -- | 1.05 | -- | $L_P$ | 0.40 | 0.68 | 1.00 |
| Q | 0.60 | 0.65 | 0.73 | v | -- | 0.25 | -- |
| w | -- | 0.25 | -- | y | -- | 0.10 | -- |
| Z | 0.30 | 0.50 | 0.70 | θ | 0° | | 8° |