

RoHS Compliant Product  
A suffix of "-C" specifies halogen & lead-free

## DESCRIPTION

The SSPRD6560-C is the highest performance trench N-Ch and P-Ch MOSFETs with extreme high cell density, which provide excellent  $R_{DS(ON)}$  and gate charge for most of the synchronous buck converter applications.

The SSPRD6560-C meet the RoHS and Green Product requirement with full function reliability approved.

## FEATURES

- Advanced High Cell Density Trench Technology
- Super Low Gate Charge
- Green Device Available

## MARKING



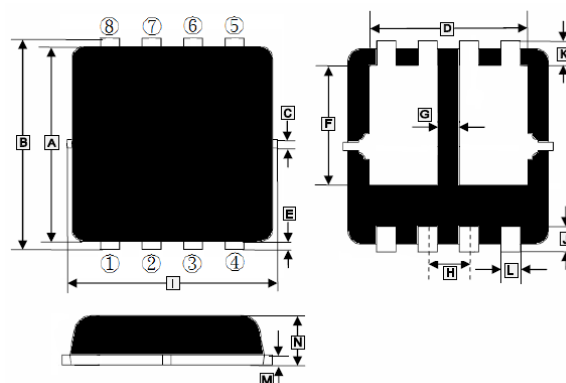
## PACKAGE INFORMATION

| Package   | MPQ | Leader Size |
|-----------|-----|-------------|
| DFN3x3-8D | 3K  | 13 inch     |

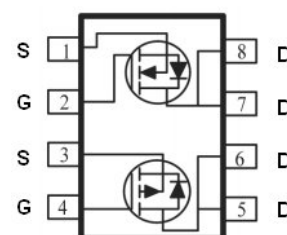
## ORDER INFORMATION

| Part Number | Type                            |
|-------------|---------------------------------|
| SSPRD6560-C | Lead (Pb)-free and Halogen-free |

**DFN3x3-8D**



| REF. | Millimeter |      | REF. | Millimeter |      |
|------|------------|------|------|------------|------|
|      | Min.       | Max. |      | Min.       | Max. |
| A    | 3          | 3.2  | H    | 0.65       | BSC  |
| B    | 3.25       | 3.45 | I    | 3.2        | 3.4  |
| C    | 0.13       | BSC  | J    | 0.3        | 0.5  |
| D    | 2.39       | 2.59 | K    | 0.3        | 0.5  |
| E    | 0.13       | BSC  | L    | 0.25       | 0.35 |
| F    | 1.78       | 1.98 | M    | 0.1        | 0.25 |
| G    | 0.3        | BSC  | N    | 0.7        | 0.8  |



## ABSOLUTE MAXIMUM RATINGS

| Parameter                                             |                    | Symbol          | Ratings  |      | Unit          |
|-------------------------------------------------------|--------------------|-----------------|----------|------|---------------|
|                                                       |                    |                 | N-Ch     | P-Ch |               |
| Drain-Source Voltage                                  |                    | $V_{DS}$        | 60       | -60  | V             |
| Gate-Source Voltage                                   |                    | $V_{GS}$        | $\pm 20$ |      | V             |
| Continuous Drain Current, @ $V_{GS}=10V$ <sup>1</sup> | $T_C=25^{\circ}C$  | $I_D$           | 6.8      | -5.1 | A             |
|                                                       | $T_C=100^{\circ}C$ |                 | 4.2      | -3.2 |               |
|                                                       | $T_A=25^{\circ}C$  |                 | 4.3      | -3.2 |               |
|                                                       | $T_A=70^{\circ}C$  |                 | 2.8      | -2   |               |
| Pulsed Drain Current <sup>3</sup>                     |                    | $I_{DM}$        | 20       | -20  | A             |
| Total Power Dissipation                               | $T_C=25^{\circ}C$  | $P_D$           | 3.78     |      | W             |
| Operating Junction and Storage Temperature Range      |                    | $T_J, T_{STG}$  | -55~150  |      | $^{\circ}C$   |
| Thermal Data                                          |                    |                 |          |      |               |
| Thermal Resistance Junction-Ambient <sup>1</sup>      |                    | $R_{\theta JA}$ | 84       |      | $^{\circ}C/W$ |
| Thermal Resistance Junction-Ambient <sup>2</sup>      |                    |                 | 135      |      |               |
| Thermal Resistance Junction-Case <sup>1</sup>         |                    | $R_{\theta JC}$ | 33       |      |               |

# **N-CHANNEL ELECTRICAL CHARACTERISTICS** ( $T_J=25^\circ\text{C}$ unless otherwise specified)

| Parameter                                      |                   | Symbol       | Min. | Typ. | Max.      | Unit       | Test Conditions                                             |
|------------------------------------------------|-------------------|--------------|------|------|-----------|------------|-------------------------------------------------------------|
| Drain-Source Breakdown Voltage                 |                   | $BV_{DSS}$   | 60   | -    | -         | V          | $V_{GS}=0$ , $I_D=250\mu A$                                 |
| Gate Threshold Voltage                         |                   | $V_{GS(th)}$ | 1    | -    | 2.5       | V          | $V_{DS}=V_{GS}$ , $I_D=250\mu A$                            |
| Forward Transfer Conductance                   |                   | $g_{fs}$     | -    | 25.3 | -         | S          | $V_{DS}=5V$ , $I_D=4.3A$                                    |
| Gate-Source Leakage Current                    |                   | $I_{GSS}$    | -    | -    | $\pm 100$ | nA         | $V_{GS}= \pm 20V$                                           |
| Drain-Source Leakage Current                   | $T_J=25^{\circ}C$ | $I_{DSS}$    | -    | -    | 1         | $\mu A$    | $V_{DS}=48V$ , $V_{GS}=0$                                   |
|                                                | $T_J=55^{\circ}C$ |              | -    | -    | 5         |            |                                                             |
| Static Drain-Source On-Resistance <sup>4</sup> |                   | $R_{DS(ON)}$ | -    | -    | 45        | m $\Omega$ | $V_{GS}=10V$ , $I_D=4.3A$                                   |
|                                                |                   |              | -    | -    | 55        |            | $V_{GS}=4.5V$ , $I_D=4A$                                    |
| Total Gate Charge                              |                   | $Q_g$        | -    | 19   | -         | nC         | $I_D=4.3A$<br>$V_{DS}=48V$<br>$V_{GS}=10V$                  |
| Gate-Source Charge                             |                   | $Q_{gs}$     | -    | 2.5  | -         |            |                                                             |
| Gate-Drain (“Miller”) Charge                   |                   | $Q_{gd}$     | -    | 5    | -         |            |                                                             |
| Turn-on Delay Time                             |                   | $T_{d(on)}$  | -    | 2.8  | -         | nS         | $V_{DS}=30V$<br>$I_D=1A$<br>$V_{GS}=10V$<br>$R_G=3.3\Omega$ |
| Rise Time                                      |                   | $T_r$        | -    | 16.6 | -         |            |                                                             |
| Turn-off Delay Time                            |                   | $T_{d(off)}$ | -    | 21.2 | -         |            |                                                             |
| Fall Time                                      |                   | $T_f$        | -    | 5.6  | -         |            |                                                             |
| Input Capacitance                              |                   | $C_{iss}$    | -    | 1027 | -         | pF         | $V_{GS}=0$<br>$V_{DS}=15V$<br>$f=1MHz$                      |
| Output Capacitance                             |                   | $C_{oss}$    | -    | 65   | -         |            |                                                             |
| Reverse Transfer Capacitance                   |                   | $C_{rss}$    | -    | 46   | -         |            |                                                             |
| Source-Drain Diode                             |                   |              |      |      |           |            |                                                             |
| Continuous Source Current <sup>1</sup>         |                   | $I_S$        | -    | -    | 4.3       | A          |                                                             |
| Pulsed Source Current <sup>3</sup>             |                   | $I_{SM}$     | -    | -    | 20        |            |                                                             |
| Forward on Voltage <sup>4</sup>                |                   | $V_{SD}$     | -    | -    | 1.2       | V          | $V_{GS}=0$ , $I_S=1A$ , $T_J=25^{\circ}C$                   |

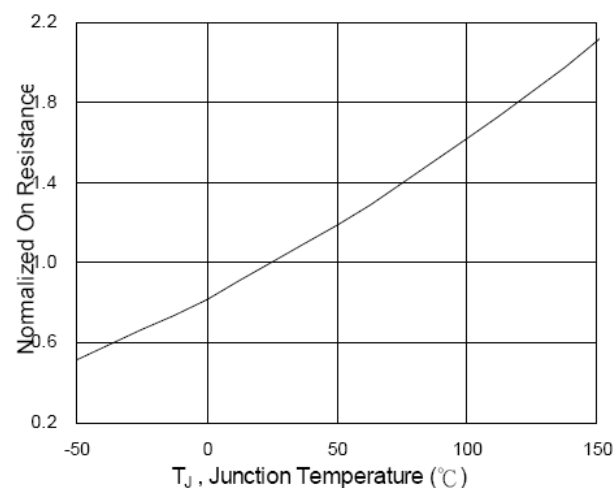
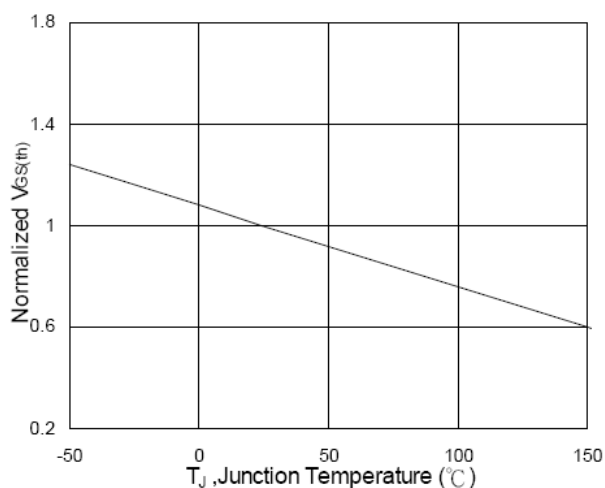
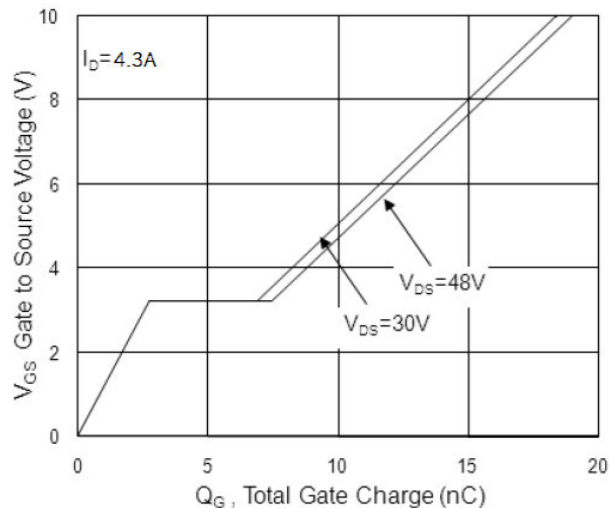
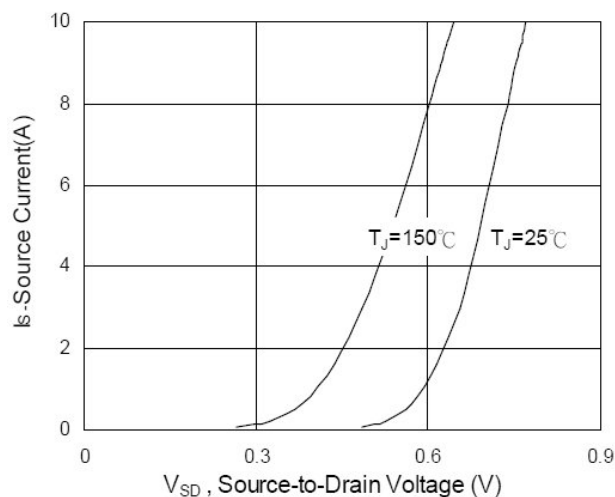
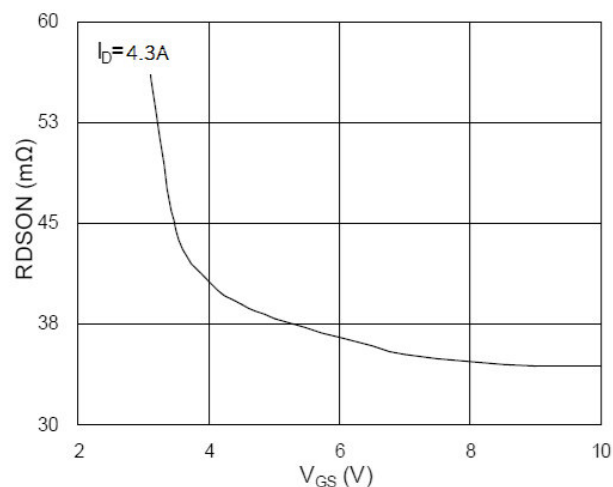
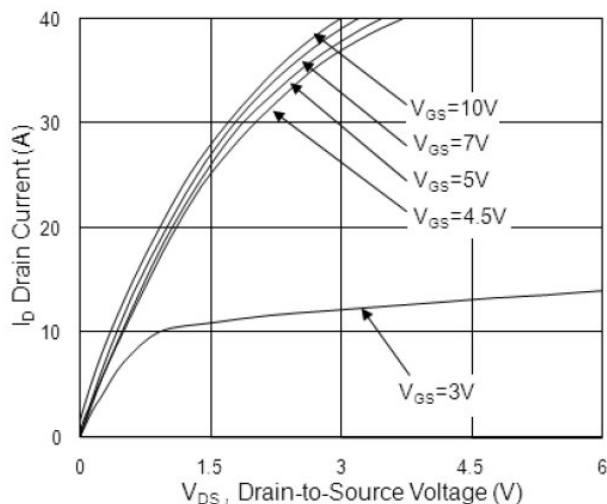
**P-CHANNEL ELECTRICAL CHARACTERISTICS** ( $T_J=25^\circ\text{C}$  unless otherwise specified)

| Parameter                                      |                      | Symbol              | Min. | Typ. | Max. | Unit | Test Conditions                                                                                  |
|------------------------------------------------|----------------------|---------------------|------|------|------|------|--------------------------------------------------------------------------------------------------|
| Drain-Source Breakdown Voltage                 |                      | BV <sub>DSS</sub>   | -60  | -    | -    | V    | V <sub>GS</sub> =0, I <sub>D</sub> = -250μA                                                      |
| Gate Threshold Voltage                         |                      | V <sub>GS(th)</sub> | -1   | -    | -2.5 | V    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA                                       |
| Forward Transfer Conductance                   |                      | g <sub>fs</sub>     | -    | 8.7  | -    | S    | V <sub>DS</sub> = -5V, I <sub>D</sub> = -3.2A                                                    |
| Gate-Source Leakage Current                    |                      | I <sub>GSS</sub>    | -    | -    | ±100 | nA   | V <sub>GS</sub> = ±20V                                                                           |
| Drain-Source Leakage Current                   | T <sub>J</sub> =25°C | I <sub>DSS</sub>    | -    | -    | -1   | μA   | V <sub>DS</sub> = -48V, V <sub>GS</sub> =0                                                       |
|                                                | T <sub>J</sub> =55°C |                     | -    | -    | -5   |      |                                                                                                  |
| Static Drain-Source On-Resistance <sup>4</sup> |                      | R <sub>DS(ON)</sub> | -    | -    | 82   | mΩ   | V <sub>GS</sub> = -10V, I <sub>D</sub> = -3.2A                                                   |
|                                                |                      |                     | -    | -    | 102  |      | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A                                                    |
| Total Gate Charge                              |                      | Q <sub>g</sub>      | -    | 11.8 | -    | nC   | I <sub>D</sub> = -3.2A<br>V <sub>DS</sub> = -20V<br>V <sub>GS</sub> = -4.5V                      |
| Gate-Source Charge                             |                      | Q <sub>gs</sub>     | -    | 1.9  | -    |      |                                                                                                  |
| Gate-Drain (“Miller”) Charge                   |                      | Q <sub>gd</sub>     | -    | 6.5  | -    |      |                                                                                                  |
| Turn-on Delay Time                             |                      | T <sub>d(on)</sub>  | -    | 8.8  | -    | nS   | V <sub>DS</sub> = -15V<br>I <sub>D</sub> = -1A<br>V <sub>GS</sub> = -10V<br>R <sub>G</sub> =3.3Ω |
| Rise Time                                      |                      | T <sub>r</sub>      | -    | 19.6 | -    |      |                                                                                                  |
| Turn-off Delay Time                            |                      | T <sub>d(off)</sub> | -    | 47.2 | -    |      |                                                                                                  |
| Fall Time                                      |                      | T <sub>f</sub>      | -    | 9.6  | -    |      |                                                                                                  |
| Input Capacitance                              |                      | C <sub>iss</sub>    | -    | 1080 | -    | pF   | V <sub>GS</sub> =0<br>V <sub>DS</sub> = -15V<br>f=1MHz                                           |
| Output Capacitance                             |                      | C <sub>oss</sub>    | -    | 97   | -    |      |                                                                                                  |
| Reverse Transfer Capacitance                   |                      | C <sub>rss</sub>    | -    | 50   | -    |      |                                                                                                  |
| Source-Drain Diode                             |                      |                     |      |      |      |      |                                                                                                  |
| Continuous Source Current <sup>1</sup>         |                      | I <sub>S</sub>      | -    | -    | -3.2 | A    |                                                                                                  |
| Pulsed Source Current <sup>3</sup>             |                      | I <sub>SM</sub>     | -    | -    | -20  |      |                                                                                                  |
| Forward on Voltage <sup>4</sup>                |                      | V <sub>SD</sub>     | -    | -    | -1.2 | V    | V <sub>GS</sub> =0, I <sub>S</sub> = -1A, T <sub>J</sub> =25°C                                   |

Notes:

1. Surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
2. When mounted on Min. copper pad.
3. Pulse width limited by maximum junction temperature, pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
4. Pulse Test: pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .

## N-CHANNEL CHARACTERISTIC CURVE



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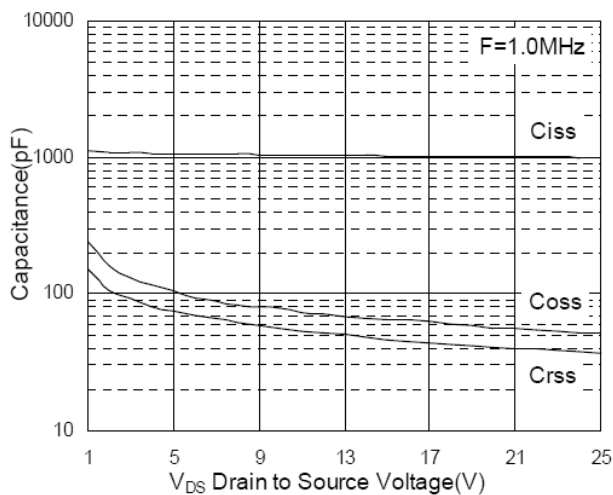


Fig.7 Capacitance

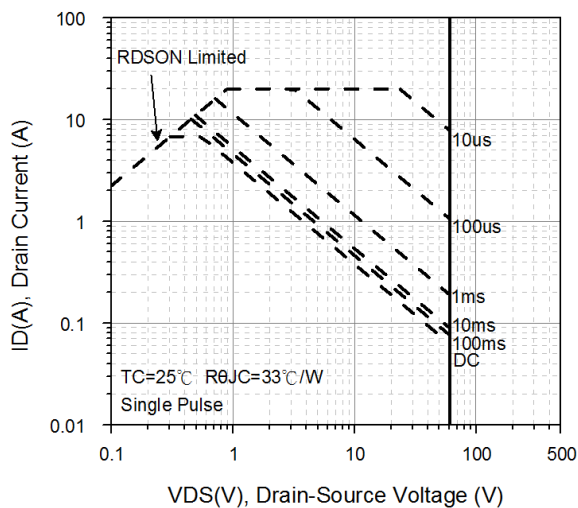


Fig.8 Safe Operating Area

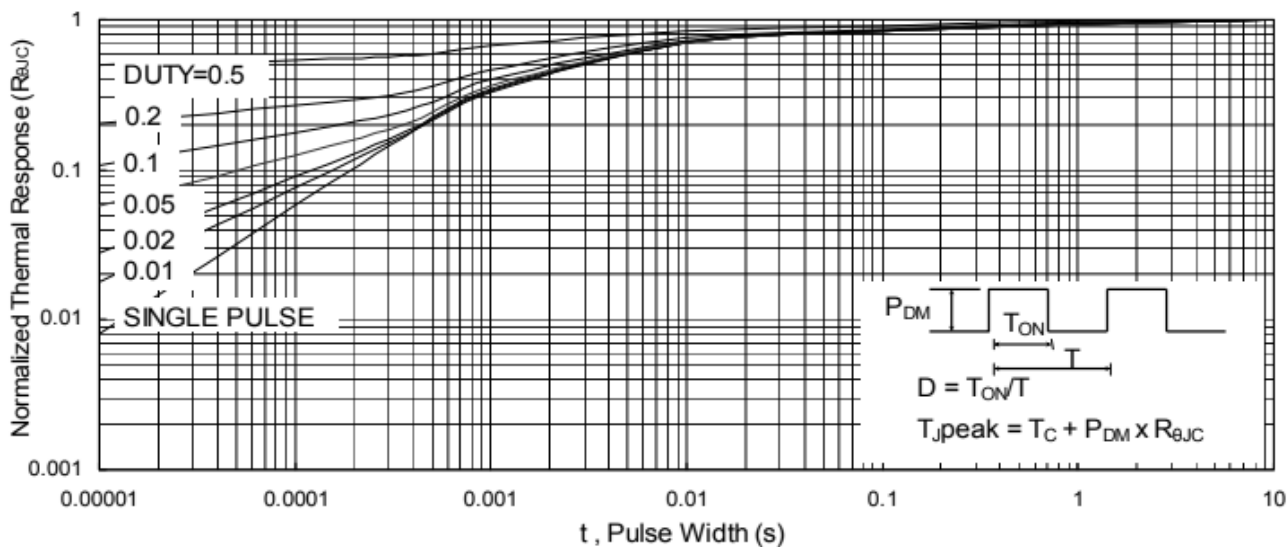


Fig.9 Normalized Maximum Transient Thermal Impedance

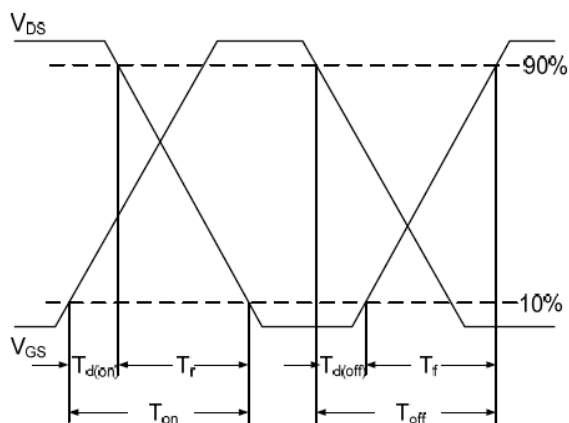


Fig.10 Switching Time Waveform

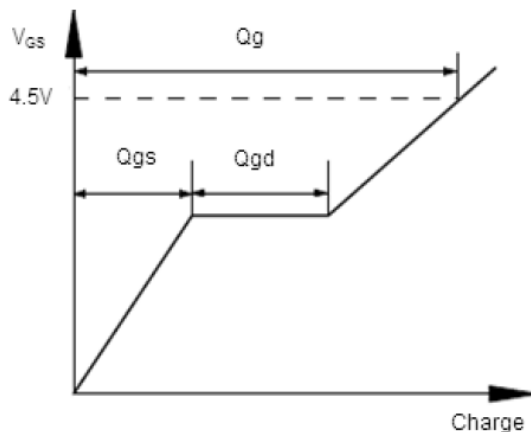


Fig.11 Gate Charge Waveform

## P-CHANNEL CHARACTERISTIC CURVE

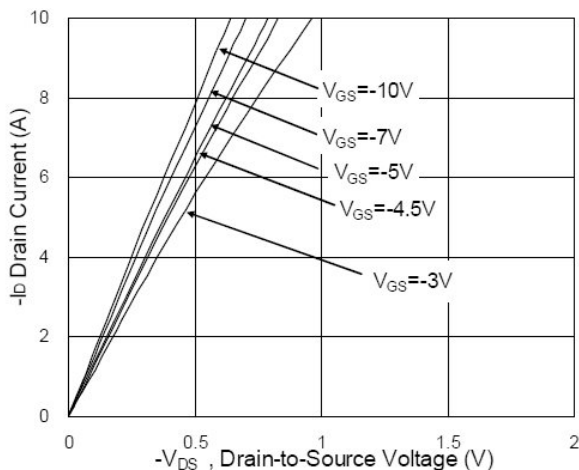


Fig.1 Typical Output Characteristics

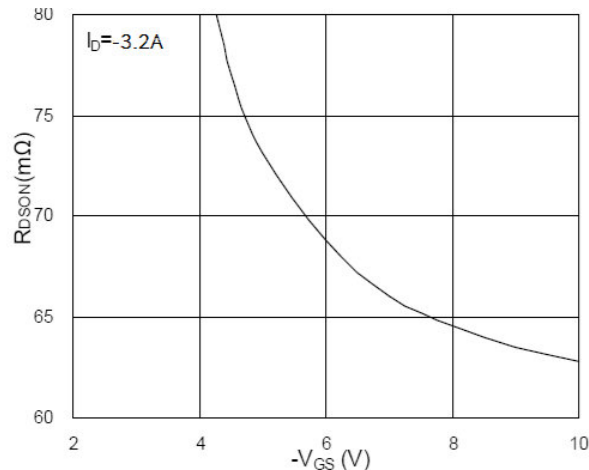


Fig.2 On-Resistance v.s Gate-Source

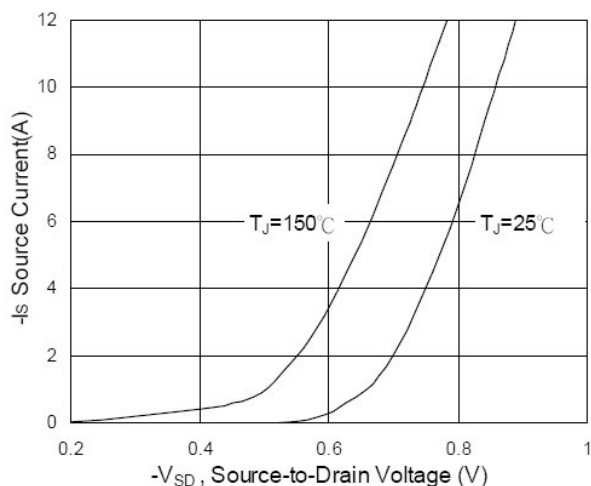


Fig.3 Forward Characteristics of Reverse

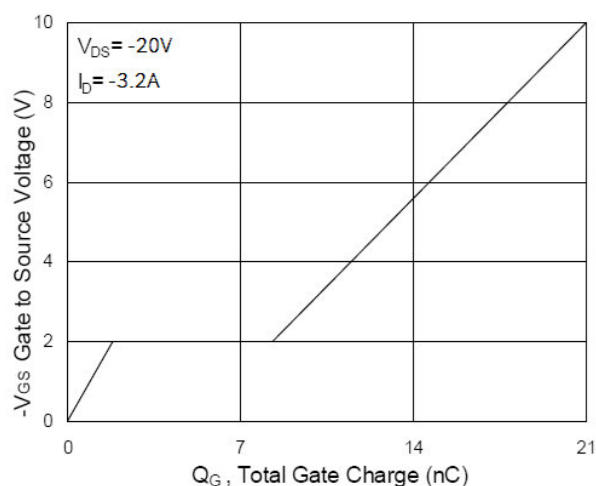


Fig.4 Gate-Charge Characteristics

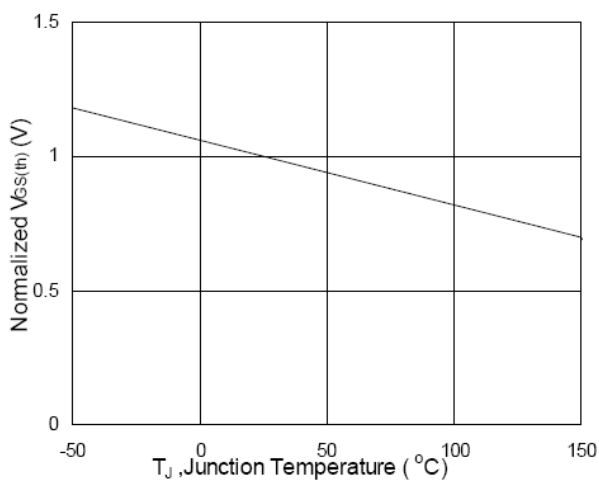


Fig.5 Normalized  $V_{GS(th)}$  v.s  $T_J$

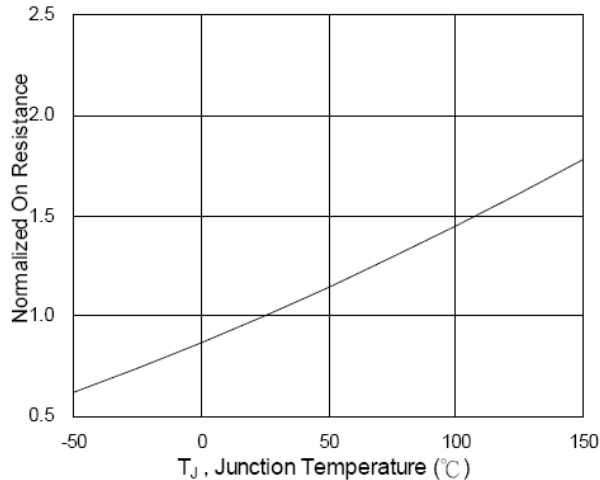


Fig.6 Normalized  $R_{DS(ON)}$  v.s  $T_J$

## P-CHANNEL CHARACTERISTIC CURVE

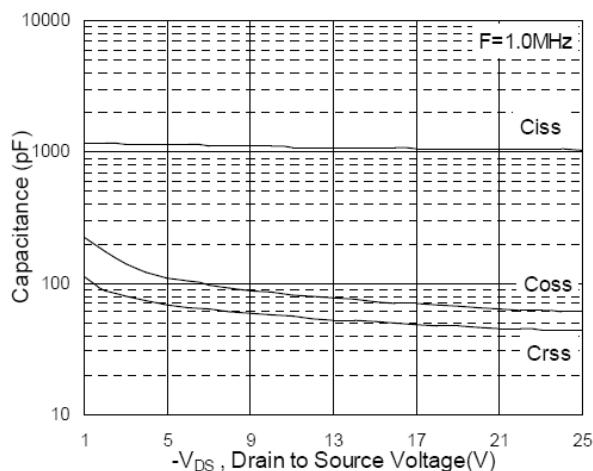


Fig.7 Capacitance

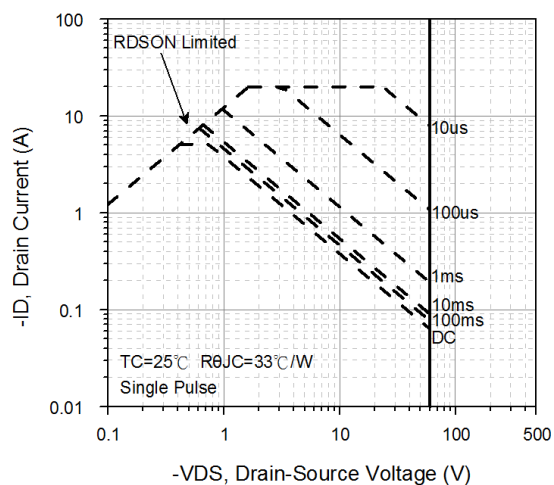


Fig.8 Safe Operating Area

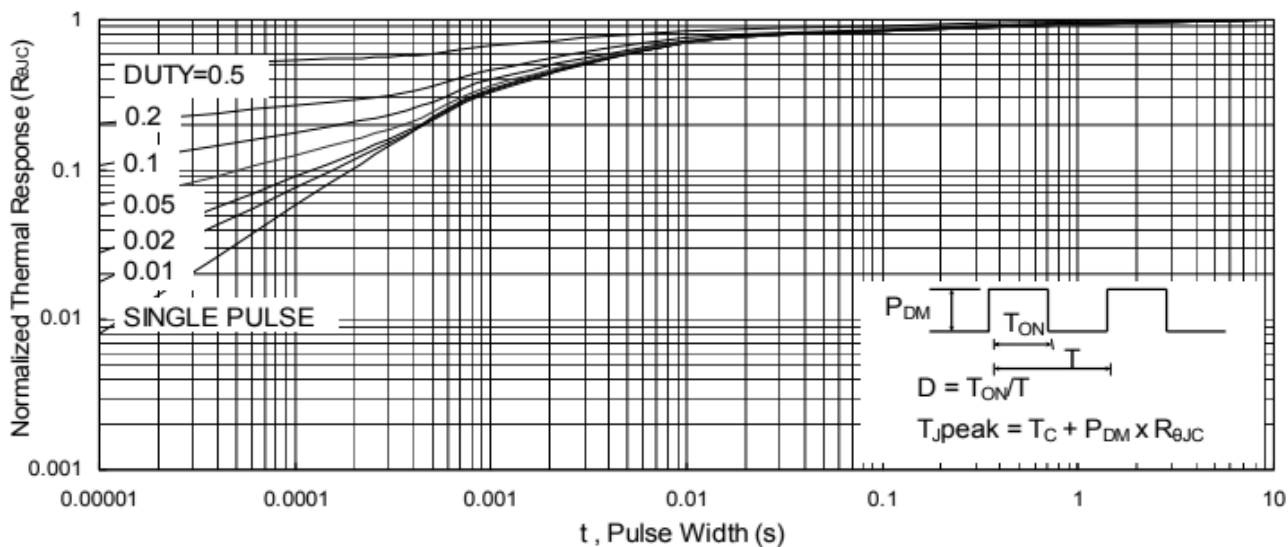


Fig.9 Normalized Maximum Transient Thermal Impedance

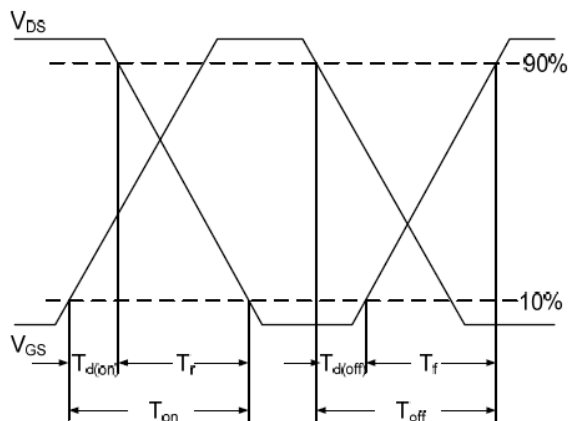


Fig.10 Switching Time Waveform

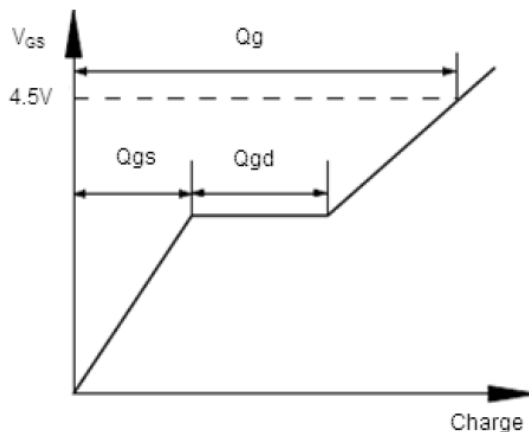


Fig.11 Gate Charge Waveform