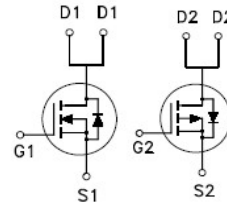


**PRODUCT SUMMARY**

|    | $V_{(BR)DSS}$ | $R_{DS(ON)}$  | $I_D$ |
|----|---------------|---------------|-------|
| Q2 | -30V          | 24m $\Omega$  | -25A  |
| Q1 | 30V           | 9.9m $\Omega$ | 48A   |

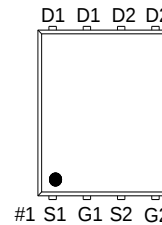


**Features**

- Pb-Free, Halogen Free and RoHS compliant.
- Low  $R_{DS(on)}$  to Minimize Conduction Losses.
- Ohmic Region Good  $R_{DS(on)}$  Ratio.
- Optimized Gate Charge to Minimize Switching Losses.

**Applications**

- Protection Circuits Applications.
- Logic/Load Switch Circuits Applications.
- DC Motor for BLDC Applications.



G. GATE  
D. DRAIN  
S. SOURCE

100% UIS Tested  
100% Rg Tested

**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ }^{\circ}\text{C}$  Unless Otherwise Noted)**

| PARAMETERS/TEST CONDITIONS                     |                                     | SYMBOL         | Q2         | Q1       | UNITS              |
|------------------------------------------------|-------------------------------------|----------------|------------|----------|--------------------|
| Drain-Source Voltage                           |                                     | $V_{DS}$       | -30        | 30       | V                  |
| Gate-Source Voltage                            |                                     | $V_{GS}$       | $\pm 25$   | $\pm 20$ | V                  |
| Continuous Drain Current                       | $T_C = 25\text{ }^{\circ}\text{C}$  | $I_D$          | -25        | 48       | A                  |
|                                                | $T_C = 100\text{ }^{\circ}\text{C}$ |                | -16        | 30       |                    |
| Pulsed Drain Current <sup>1</sup>              |                                     | $I_{DM}$       | -100       | 130      |                    |
| Continuous Drain Current <sup>3</sup>          | $T_A = 25\text{ }^{\circ}\text{C}$  | $I_D$          | -8         | 12       |                    |
|                                                | $T_A = 70\text{ }^{\circ}\text{C}$  |                | -6.4       | 10       |                    |
| Avalanche Current                              |                                     | $I_{AS}$       | -24        | 22       |                    |
| Avalanche Energy                               | $L = 0.1\text{mH}$                  | $E_{AS}$       | 29         | 24       | mJ                 |
| Power Dissipation                              | $T_C = 25\text{ }^{\circ}\text{C}$  | $P_D$          | 26         | 42       | W                  |
|                                                | $T_C = 100\text{ }^{\circ}\text{C}$ |                | 10         | 17       |                    |
| Power Dissipation <sup>3</sup>                 | $T_A = 25\text{ }^{\circ}\text{C}$  | $P_D$          | 2.7        | 2.8      | W                  |
|                                                | $T_A = 70\text{ }^{\circ}\text{C}$  |                | 1.7        | 1.8      |                    |
| Operating Junction & Storage Temperature Range |                                     | $T_j, T_{stg}$ | -55 to 150 |          | $^{\circ}\text{C}$ |

**THERMAL RESISTANCE RATINGS**

| THERMAL RESISTANCE               |              | SYMBOL          |    | TYPICAL | MAXIMUM | UNITS  |
|----------------------------------|--------------|-----------------|----|---------|---------|--------|
| Junction-to-Ambient <sup>2</sup> | $t \leq 10s$ | $R_{\theta JA}$ | Q2 |         | 47      | °C / W |
|                                  |              |                 | Q1 |         | 44      |        |
| Junction-to-Ambient <sup>2</sup> | Steady-State | $R_{\theta JA}$ | Q2 |         | 75      |        |
|                                  |              |                 | Q1 |         | 72      |        |
| Junction-to-Case                 |              | $R_{\theta JC}$ | Q2 |         | 4.9     |        |
|                                  |              |                 | Q1 |         | 3       |        |

<sup>1</sup>Pulse width limited by maximum junction temperature  $T_{J(MAX)}=150^{\circ}C$ .

<sup>2</sup>The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^{\circ}C$ . The value in any given application depends on the user's specific board design.

<sup>3</sup>The Power dissipation is based on  $R_{\theta JA} t \leq 10s$  value.

**ELECTRICAL CHARACTERISTICS ( $T_J = 25^{\circ}C$ , Unless Otherwise Noted)**

| PARAMETER                                     | SYMBOL        | TEST CONDITIONS                                 | LIMITS |      |      | UNIT      |
|-----------------------------------------------|---------------|-------------------------------------------------|--------|------|------|-----------|
|                                               |               |                                                 | MIN    | TYP  | MAX  |           |
| STATIC                                        |               |                                                 |        |      |      |           |
| Drain-Source Breakdown Voltage                | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = -250\mu A$                  | Q2     | -30  |      | V         |
|                                               |               | $V_{GS} = 0V, I_D = 250\mu A$                   | Q1     | 30   |      |           |
| Gate Threshold Voltage                        | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = -250\mu A$              | Q2     | -1.3 | -1.7 | -2.3      |
|                                               |               | $V_{DS} = V_{GS}, I_D = 250\mu A$               | Q1     | 1.47 | 1.8  | 2.35      |
| Gate-Body Leakage                             | $I_{GSS}$     | $V_{DS} = 0V, V_{GS} = \pm 20V$                 | Q2     |      |      | $\pm 100$ |
|                                               |               | $V_{DS} = 0V, V_{GS} = \pm 20V$                 | Q1     |      |      | $\pm 100$ |
| Zero Gate Voltage Drain Current               | $I_{DSS}$     | $V_{DS} = -30V, V_{GS} = 0V$                    | Q2     |      |      | -1        |
|                                               |               | $V_{DS} = 30V, V_{GS} = 0V$                     | Q1     |      |      | 1         |
|                                               |               | $V_{DS} = -30V, V_{GS} = 0V, T_J = 55^{\circ}C$ | Q2     |      |      | -10       |
|                                               |               | $V_{DS} = 30V, V_{GS} = 0V, T_J = 55^{\circ}C$  | Q1     |      |      | 10        |
| Drain-Source On-State Resistance <sup>1</sup> | $R_{DS(ON)}$  | $V_{GS} = -4.5V, I_D = -7A$                     | Q2     |      | 28.1 | 40        |
|                                               |               | $V_{GS} = 4.5V, I_D = 13A$                      | Q1     |      | 10.1 | 14        |
|                                               |               | $V_{GS} = -10V, I_D = -7A$                      | Q2     |      | 18.7 | 24        |
|                                               |               | $V_{GS} = 10V, I_D = 13A$                       | Q1     |      | 7.6  | 9.9       |
| Forward Transconductance <sup>1</sup>         | $g_{fs}$      | $V_{DS} = -5V, I_D = -7A$                       | Q2     |      | 50   | S         |
|                                               |               | $V_{DS} = 5V, I_D = 13A$                        | Q1     |      | 28   |           |

| DYNAMIC                                                                 |                     |                        |                                                                                                                                                            |    |     |      |      |    |  |
|-------------------------------------------------------------------------|---------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|------|------|----|--|
| Input Capacitance <sup>6</sup>                                          | C <sub>iss</sub>    |                        | Q2<br>V <sub>GS</sub> = 0V, V <sub>DS</sub> = -15V f = 1MHz<br>Q1<br>V <sub>GS</sub> = 0V, V <sub>DS</sub> = 15V f = 1MHz                                  | Q2 | 801 | 1002 | 1202 | pF |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 | 672 | 840  | 1008 |    |  |
| Output Capacitance <sup>6</sup>                                         | C <sub>oss</sub>    |                        |                                                                                                                                                            | Q2 | 133 | 167  | 200  |    |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 | 120 | 150  | 180  |    |  |
| Reverse Transfer Capacitance <sup>6</sup>                               | C <sub>rss</sub>    |                        |                                                                                                                                                            | Q2 | 75  | 125  | 175  |    |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 | 65  | 109  | 152  |    |  |
| Gate Resistance <sup>6</sup>                                            | R <sub>g</sub>      |                        | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V, f = 1MHz                                                                                                       | Q2 | 0.2 | 7.5  | 10   | Ω  |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 | 0.2 | 0.65 | 3    |    |  |
| Total Gate Charge <sup>5,6</sup>                                        | Q <sub>g</sub>      | V <sub>GS</sub> = 10V  | Q2<br>V <sub>DS</sub> = -15V V <sub>GS</sub> = -10V,<br>I <sub>D</sub> = -7A<br>Q1<br>V <sub>DS</sub> = 15V V <sub>GS</sub> = 10V,<br>I <sub>D</sub> = 13A | Q2 | 12  | 20   | 28   | nC |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 | 10  | 18   | 25   |    |  |
|                                                                         |                     | V <sub>GS</sub> = 4.5V |                                                                                                                                                            | Q2 | 6   | 10   | 14   |    |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 | 5.9 | 9.9  | 13.8 |    |  |
| Gate-Source Charge <sup>5,6</sup>                                       | Q <sub>gs</sub>     |                        |                                                                                                                                                            | Q2 | 1.4 | 2.4  | 3.4  |    |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 | 1.3 | 2.1  | 2.9  |    |  |
| Gate-Drain Charge <sup>5,6</sup>                                        | Q <sub>gd</sub>     |                        |                                                                                                                                                            | Q2 | 2.8 | 4.6  | 6.4  |    |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 | 3.2 | 5.3  | 7.4  |    |  |
| Turn-On Delay Time <sup>5</sup>                                         | t <sub>d(on)</sub>  |                        | Q2 , V <sub>DS</sub> = -15V<br>I <sub>D</sub> ≅ -7A V <sub>GS</sub> = -10V,<br>R <sub>GEN</sub> =6Ω                                                        | Q2 |     | 7.4  |      | nS |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 |     | 9    |      |    |  |
| Rise Time <sup>5</sup>                                                  | t <sub>r</sub>      |                        |                                                                                                                                                            | Q2 |     | 40   |      |    |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 |     | 73   |      |    |  |
| Turn-Off Delay Time <sup>5</sup>                                        | t <sub>d(off)</sub> |                        | Q2                                                                                                                                                         |    | 47  |      |      |    |  |
|                                                                         |                     |                        | Q1                                                                                                                                                         |    | 24  |      |      |    |  |
| Fall Time <sup>5</sup>                                                  | t <sub>f</sub>      |                        | Q2                                                                                                                                                         |    | 63  |      |      |    |  |
|                                                                         |                     |                        | Q1                                                                                                                                                         |    | 105 |      |      |    |  |
| SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (T <sub>J</sub> = 25 °C) |                     |                        |                                                                                                                                                            |    |     |      |      |    |  |
| Continuous Current                                                      | I <sub>S</sub>      |                        |                                                                                                                                                            | Q2 |     |      | -20  | A  |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 |     |      | 35   |    |  |
| Forward Voltage <sup>4</sup>                                            | V <sub>SD</sub>     |                        | I <sub>F</sub> = -7A V <sub>GS</sub> = 0V                                                                                                                  | Q2 |     |      | -1.3 | V  |  |
|                                                                         |                     |                        | I <sub>F</sub> = 13A, V <sub>GS</sub> = 0V                                                                                                                 | Q1 |     |      | 1.2  |    |  |
| Reverse Recovery Time                                                   | t <sub>rr</sub>     |                        | Q2<br>I <sub>F</sub> = -7A dI <sub>F</sub> /dt = 100A / μS                                                                                                 | Q2 |     | 8.6  |      | nS |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 |     | 7.7  |      |    |  |
| Reverse Recovery Charge                                                 | Q <sub>rr</sub>     |                        | Q1<br>I <sub>F</sub> = 13A, dI <sub>F</sub> /dt = 100A / μS                                                                                                | Q2 |     | 2.1  |      | nC |  |
|                                                                         |                     |                        |                                                                                                                                                            | Q1 |     | 1.6  |      |    |  |

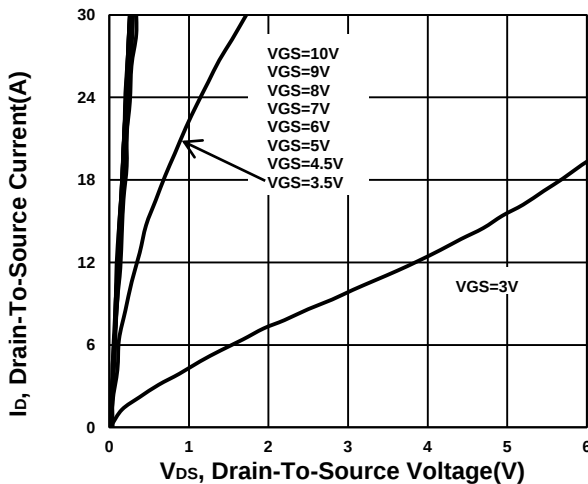
<sup>4</sup>Pulse test : Pulse Width  $\leq 300 \mu sec$ , Duty Cycle  $\leq 2\%$ .

<sup>5</sup>Independent of operating temperature.

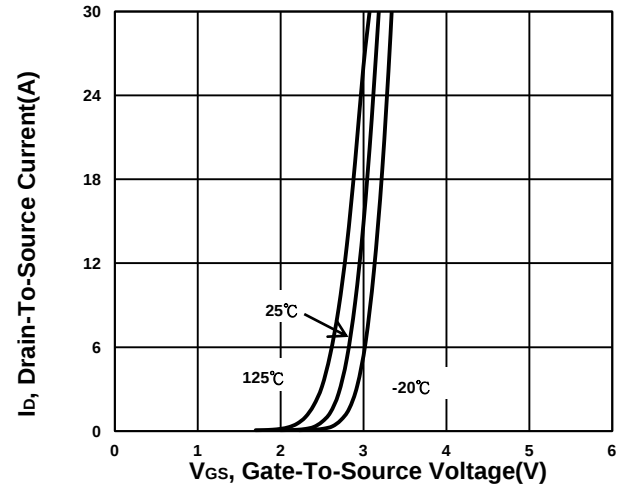
<sup>6</sup>Guaranteed by design, not subject to production testing.

## TYPICAL PERFORMANCE CHARACTERISTICS N-CHANNEL

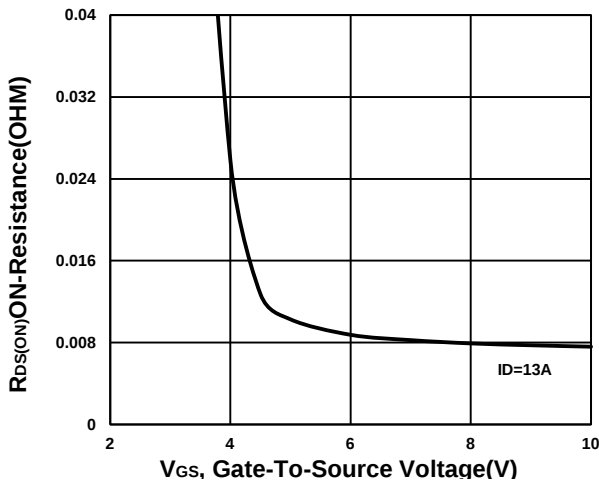
Output Characteristics



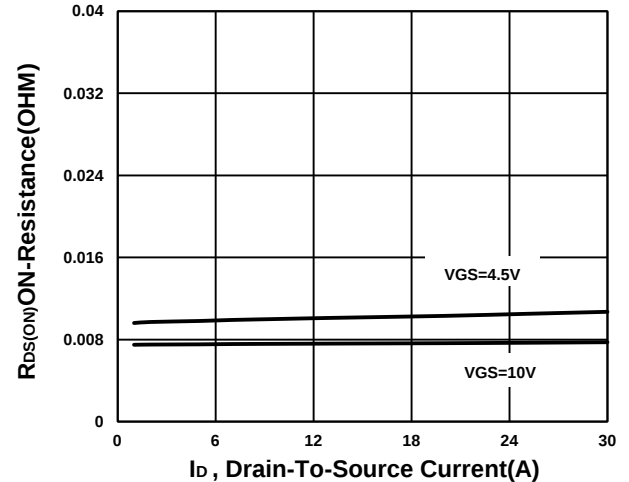
Transfer Characteristics



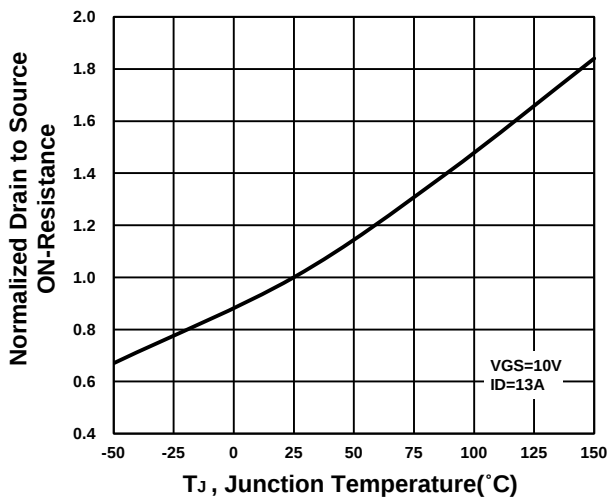
On-Resistance VS Gate-To-Source Voltage



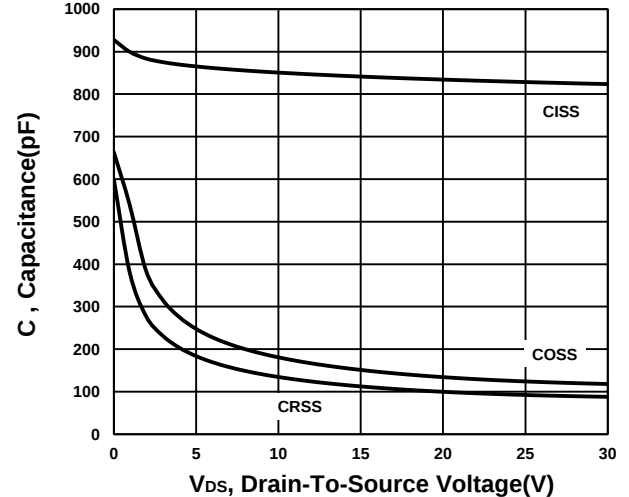
On-Resistance VS Drain Current



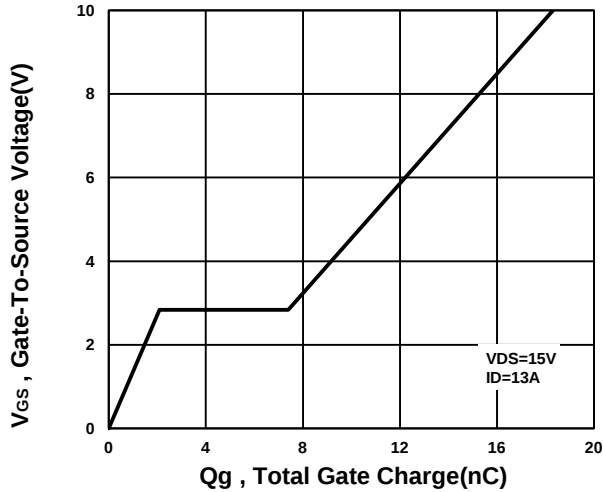
On-Resistance VS Temperature



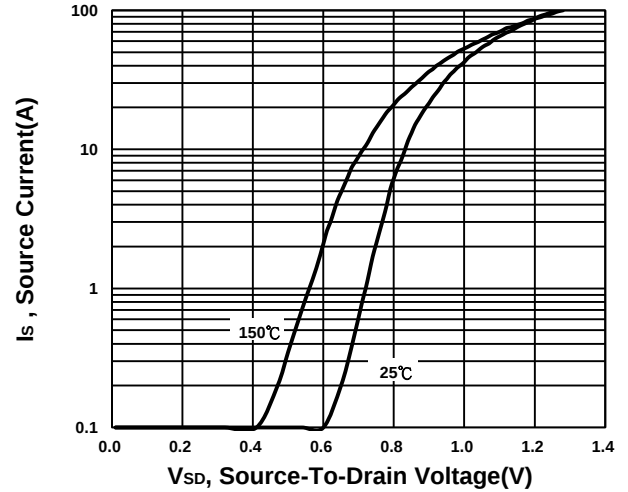
Capacitance Characteristic



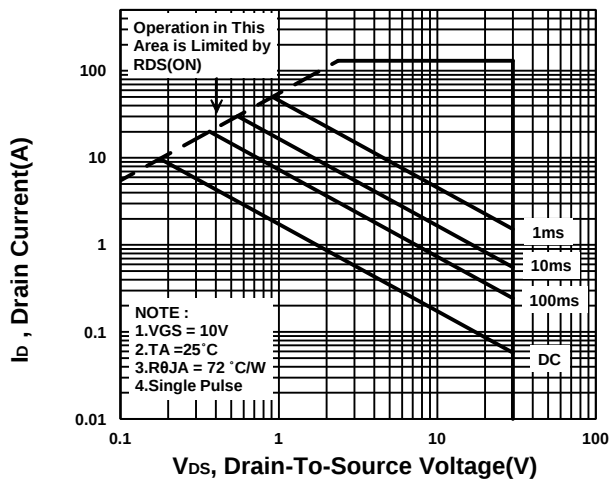
Gate charge Characteristics



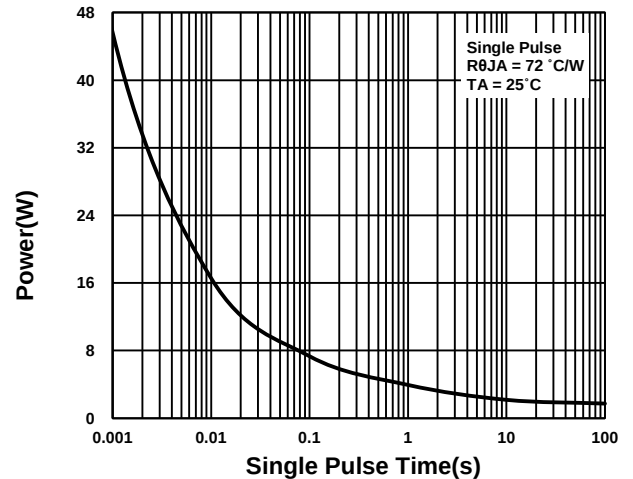
Source-Drain Diode Forward Voltage



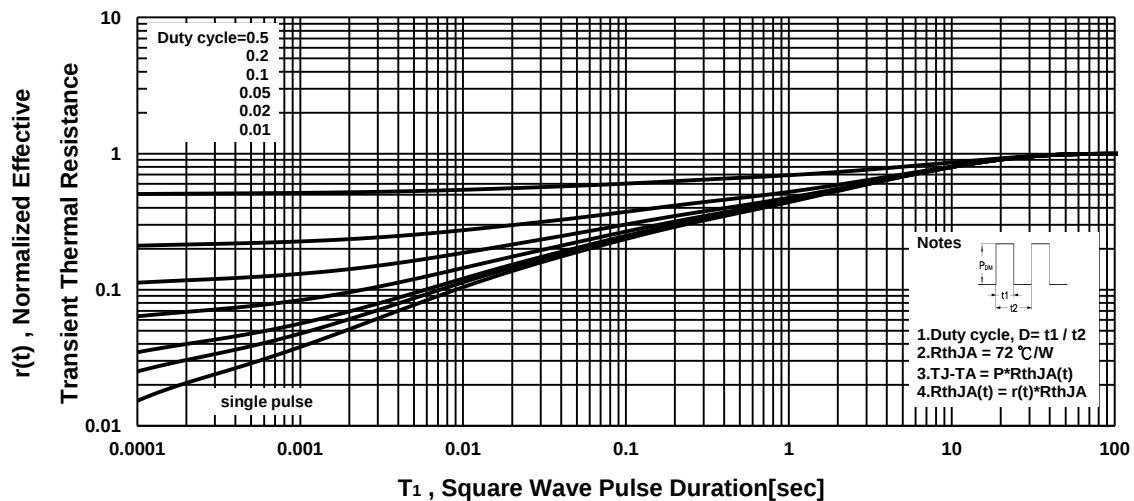
Safe Operating Area



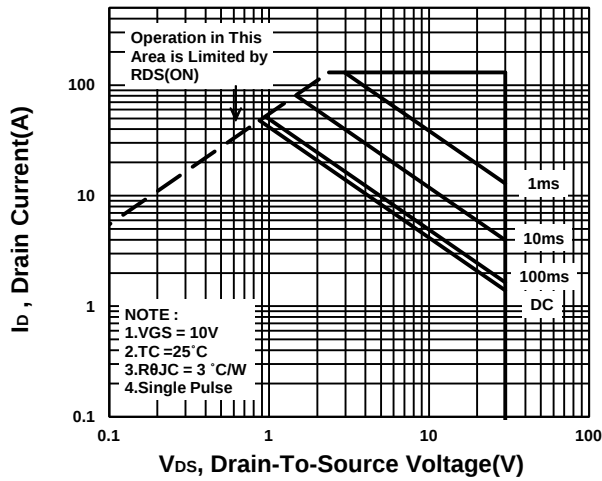
Single Pulse Maximum Power Dissipation



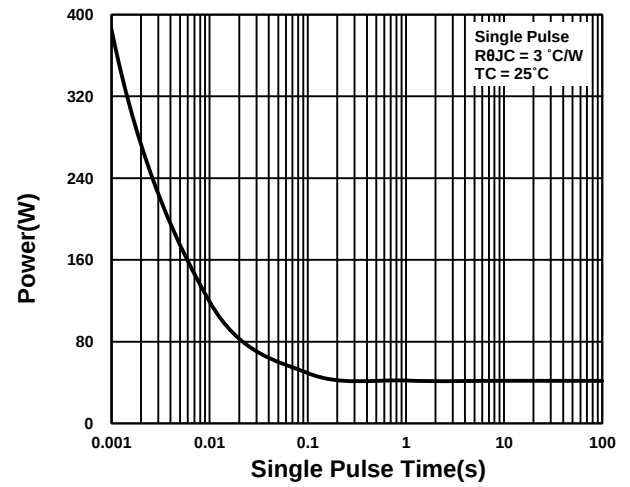
Transient Thermal Response Curve



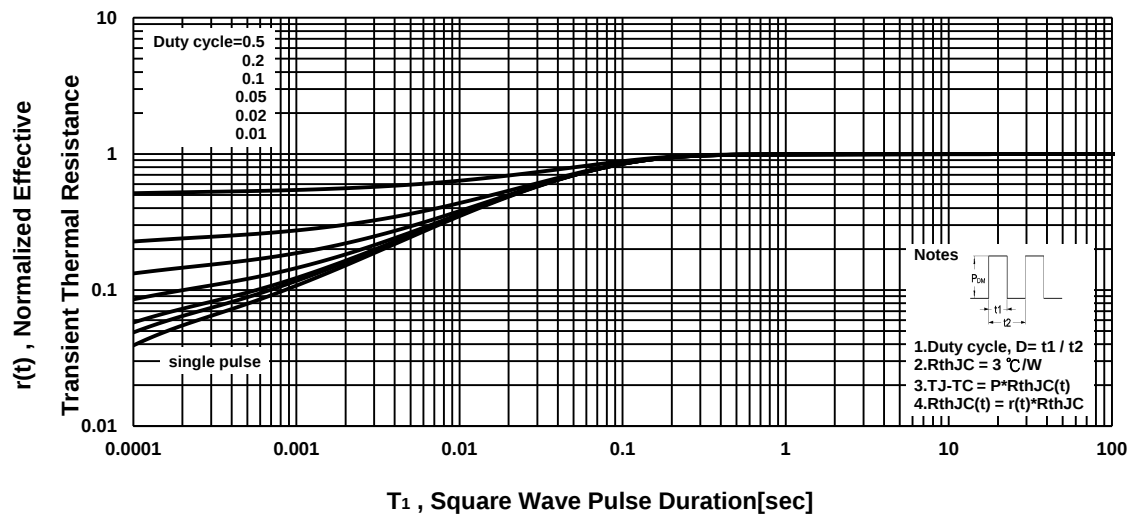
Safe Operating Area



Single Pulse Maximum Power Dissipation

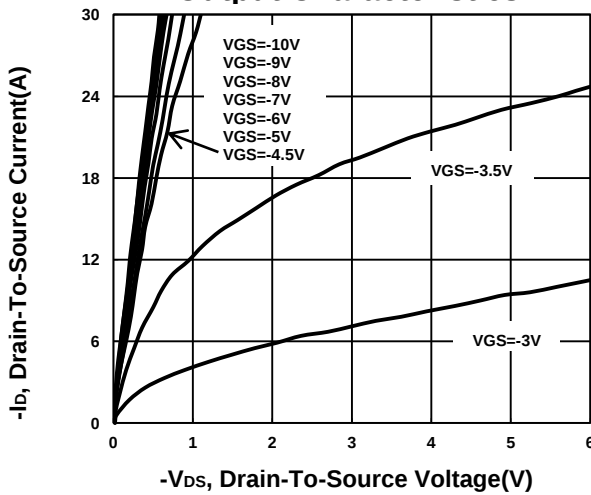


Transient Thermal Response Curve

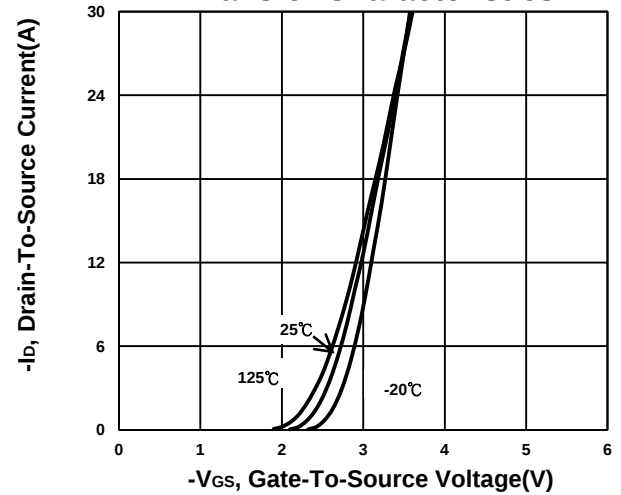


P-CHANNEL

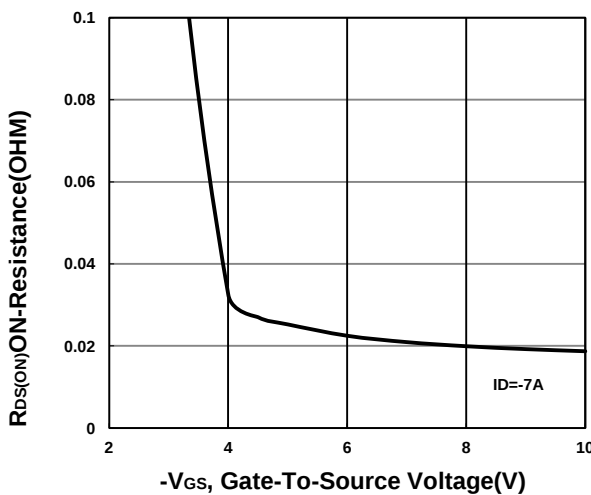
Output Characteristics



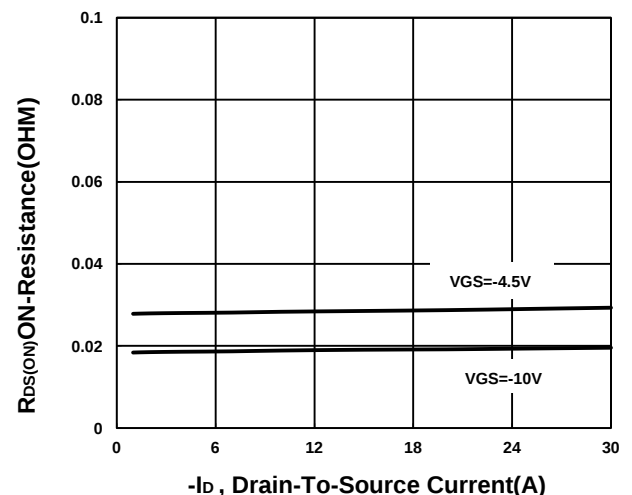
Transfer Characteristics



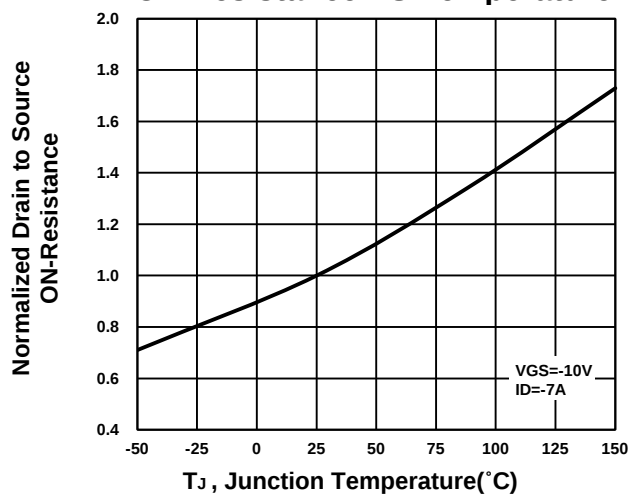
On-Resistance VS Gate-To-Source Voltage



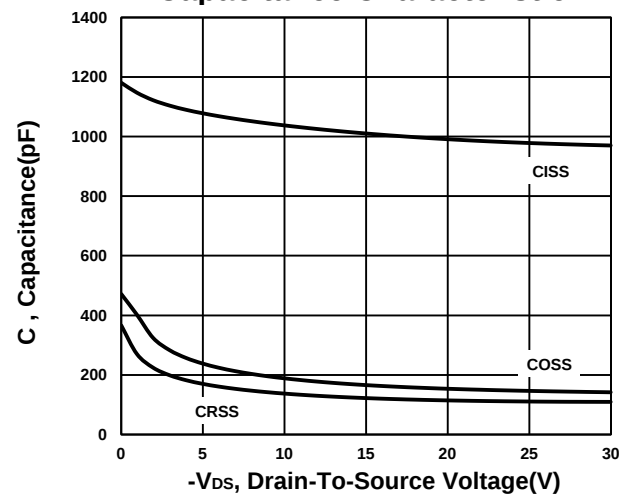
On-Resistance VS Drain Current

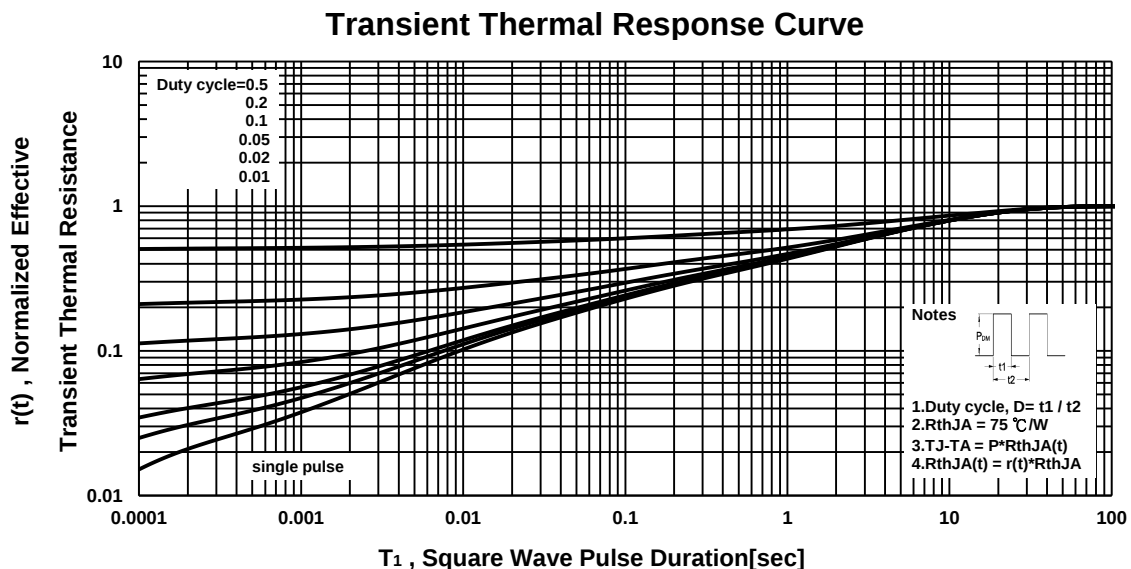
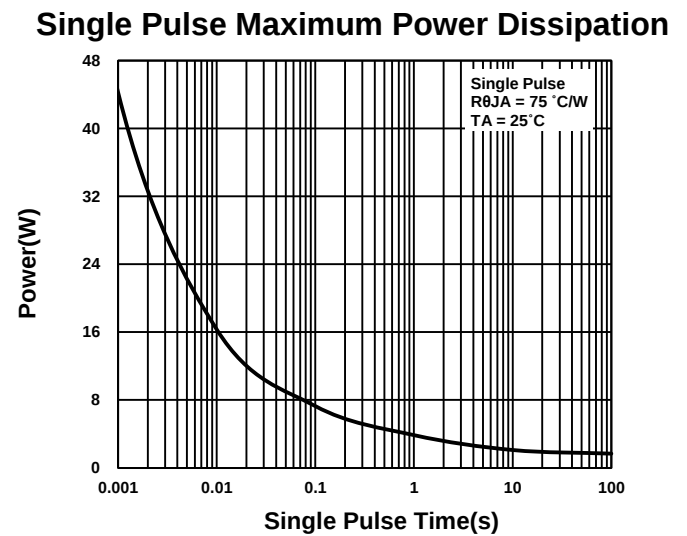
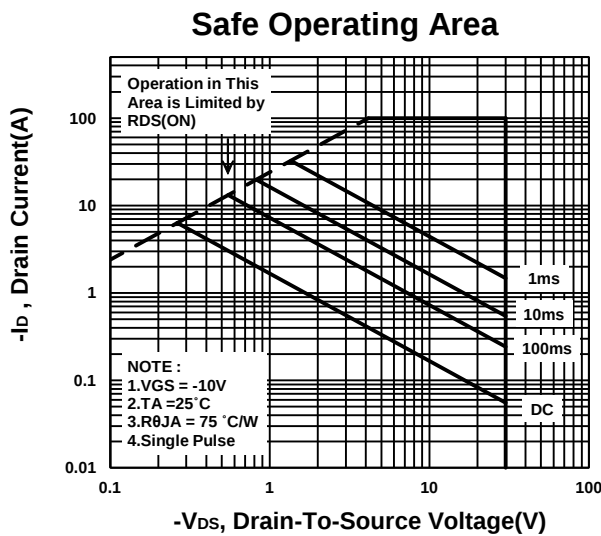
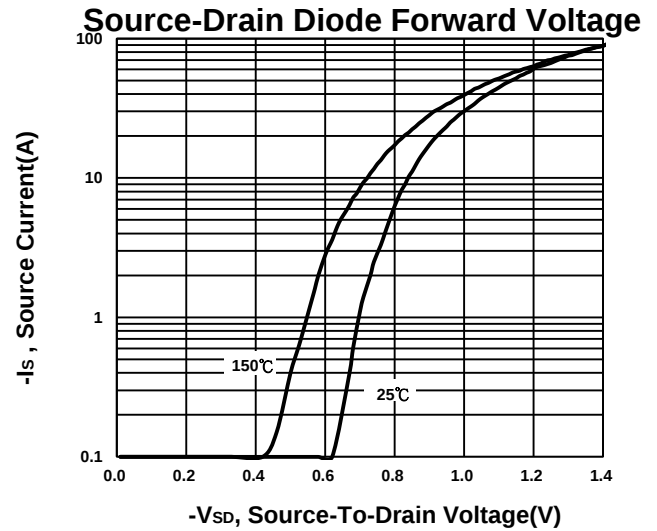
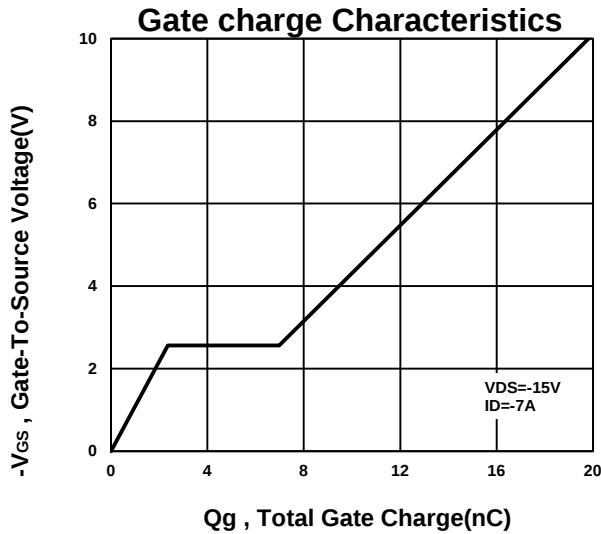


On-Resistance VS Temperature

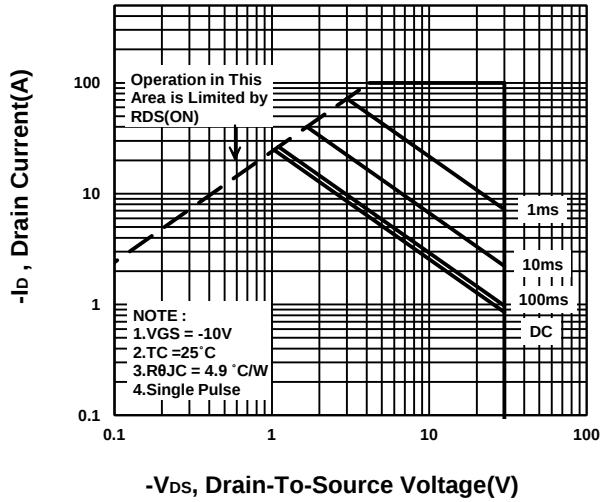


Capacitance Characteristic

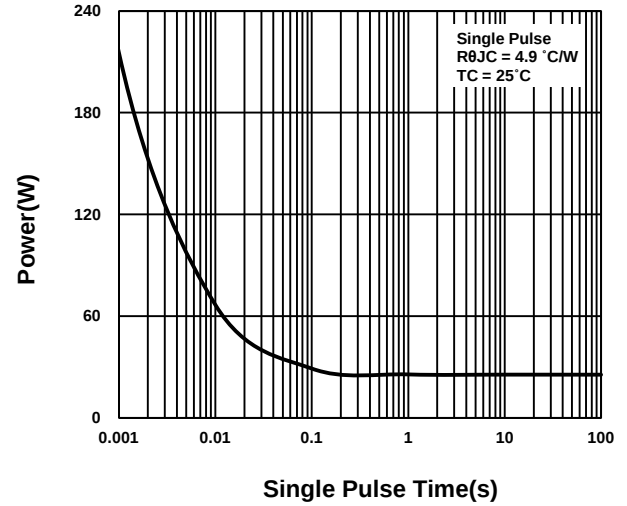




Safe Operating Area



Single Pulse Maximum Power Dissipation



Transient Thermal Response Curve

