

### General Description:

The LWD6001A4 uses trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications. The package form is TO-252-4L, which accords with the ROHS standard and Halogen Free standard.

### Features:

- Fast Switching
- Low Gate Charge and  $R_{DS(ON)}$
- Low Reverse transfer capacitances

### Applications:

- DC-DC Converter
- Portable Equipment
- Power Management

**100% DVDS Tested**

**100% Avalanche Tested**



### Package Marking and Ordering Information:

| Marking           | Part Number | Package   | Packing | Qty.     |
|-------------------|-------------|-----------|---------|----------|
| D6001A/LW A4/D.C. | LWD6001A4   | TO-252-4L | Reel    | 2500 Pcs |

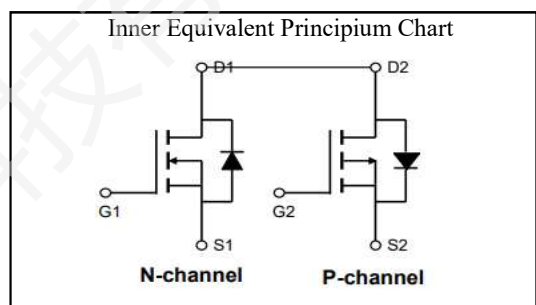
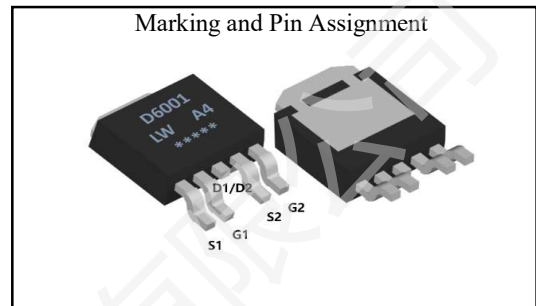
### Absolute Maximum Ratings:

| Symbol         | Parameter                                        |                    | Value           |          | Units       |
|----------------|--------------------------------------------------|--------------------|-----------------|----------|-------------|
|                |                                                  |                    | N-Ch            | P-Ch     |             |
| $V_{DSS}$      | Drain-to-Source Voltage                          |                    | 60              | -60      | V           |
| $I_D$          | Continuous Drain Current                         | $T_C=25^{\circ}C$  | 16              | -16      | A           |
|                | Continuous Drain Current                         | $T_C=100^{\circ}C$ | 10              | -10      | A           |
| $I_{DM}^{a1}$  | Pulsed Drain Current                             |                    | 64              | -64      | A           |
| $E_{AS}^{a2}$  | Single pulse avalanche energy                    |                    | 39              | 34       | mJ          |
| $V_{GS}$       | Gate-to-Source Voltage                           |                    | $\pm 20$        | $\pm 20$ | V           |
| $P_D$          | Power Dissipation                                |                    | 30              | 32       | W           |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range |                    | 150, -55 to 150 |          | $^{\circ}C$ |
| $T_L$          | Maximum Temperature for Soldering                |                    | 260             |          | $^{\circ}C$ |

### Thermal Characteristics:

| Symbol          | Parameter                            |  | Value |      | Units         |
|-----------------|--------------------------------------|--|-------|------|---------------|
|                 |                                      |  | N-Ch  | P-Ch |               |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case |  | 4.16  | 3.9  | $^{\circ}C/W$ |

| Symbol                    | N-Ch | P-Ch | Units      |
|---------------------------|------|------|------------|
| $V_{DSS}$                 | 60   | -60  | V          |
| $I_D$                     | 16   | -16  | A          |
| $R_{DS(ON) \text{ TYPE}}$ | 33.7 | 55   | m $\Omega$ |



**N-Channel Electrical Characteristic** ( $T_C = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified):

| Static Characteristics |                                   |                               |       |      |      |           |
|------------------------|-----------------------------------|-------------------------------|-------|------|------|-----------|
| Symbol                 | Parameter                         | Test Conditions               | Value |      |      | Units     |
|                        |                                   |                               | Min.  | Typ. | Max. |           |
| $V_{DSS}$              | Drain to Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$     | 60    | --   | --   | V         |
| $I_{DSS}$              | Drain to Source Leakage Current   | $V_{DS}=60V, V_{GS}=0V$       | --    | --   | 1.0  | $\mu A$   |
| $I_{GSS(F)}$           | Gate to Source Forward Leakage    | $V_{GS}=+20V, V_{DS}=0V$      | --    | --   | 100  | nA        |
| $I_{GSS(R)}$           | Gate to Source Reverse Leakage    | $V_{GS}=-20V, V_{DS}=0V$      | --    | --   | -100 | nA        |
| $V_{GS(TH)}$           | Gate Threshold Voltage            | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1.1   | 1.6  | 2.1  | V         |
| $R_{DS(ON)1}$          | Drain-to-Source On-Resistance     | $V_{GS}=10V, I_D=8.0A$        | --    | 33.7 | 45   | $m\Omega$ |
| $R_{DS(ON)2}$          | Drain-to-Source On-Resistance     | $V_{GS}=4.5V, I_D=3.0A$       | --    | 37   | 55   | $m\Omega$ |

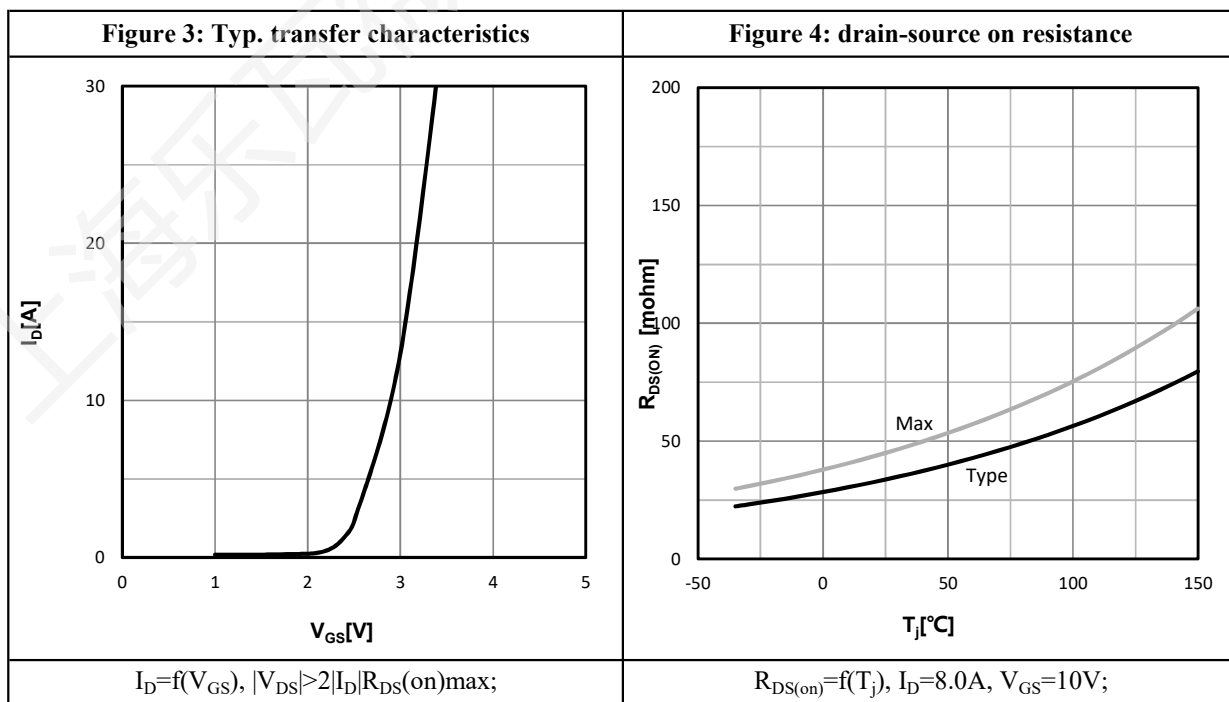
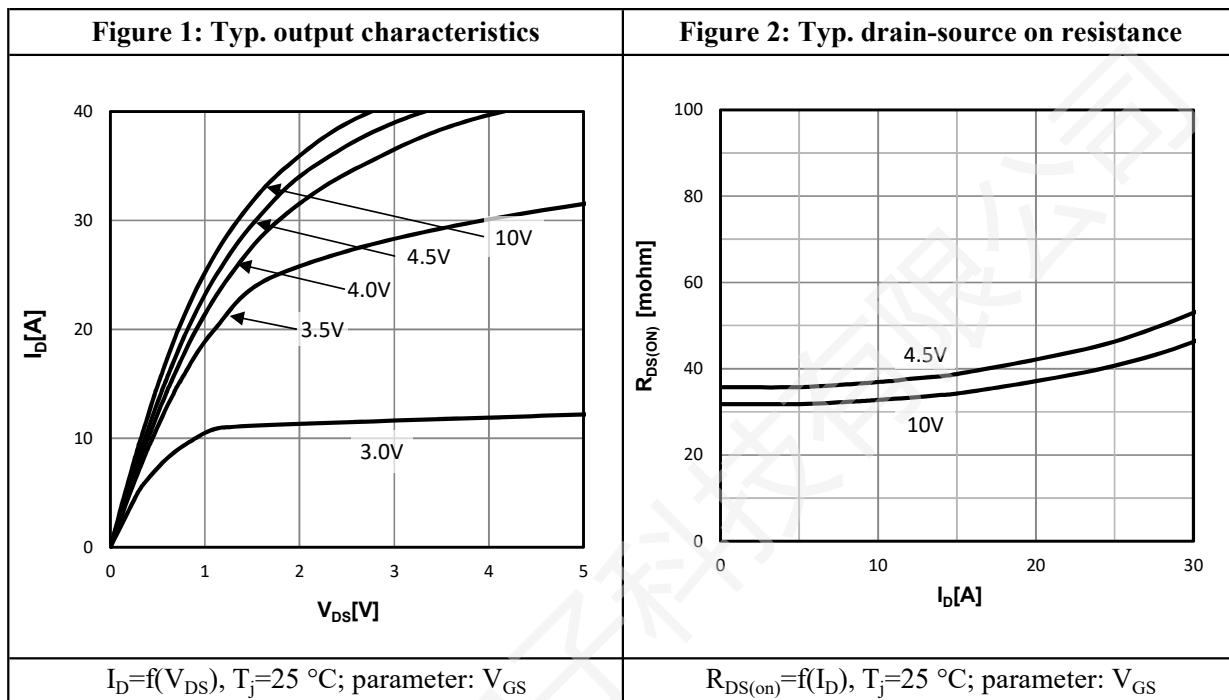
| Dynamic Characteristics |                              |                                  |       |      |      |          |
|-------------------------|------------------------------|----------------------------------|-------|------|------|----------|
| Symbol                  | Parameter                    | Test Conditions                  | Value |      |      | Units    |
|                         |                              |                                  | Min.  | Typ. | Max. |          |
| $C_{iss}$               | Input Capacitance            | $V_{GS} = 0V$                    | --    | 990  | --   | pF       |
| $C_{oss}$               | Output Capacitance           | $V_{DS} = 30V$                   | --    | 42   | --   |          |
| $C_{rss}$               | Reverse Transfer Capacitance | $f = 1.0MHz$                     | --    | 38   | --   |          |
| $R_G$                   | Gate resistance              | $V_{GS}=0V, V_{DS}=0V, f=1.0MHz$ | --    | 1.4  | --   | $\Omega$ |

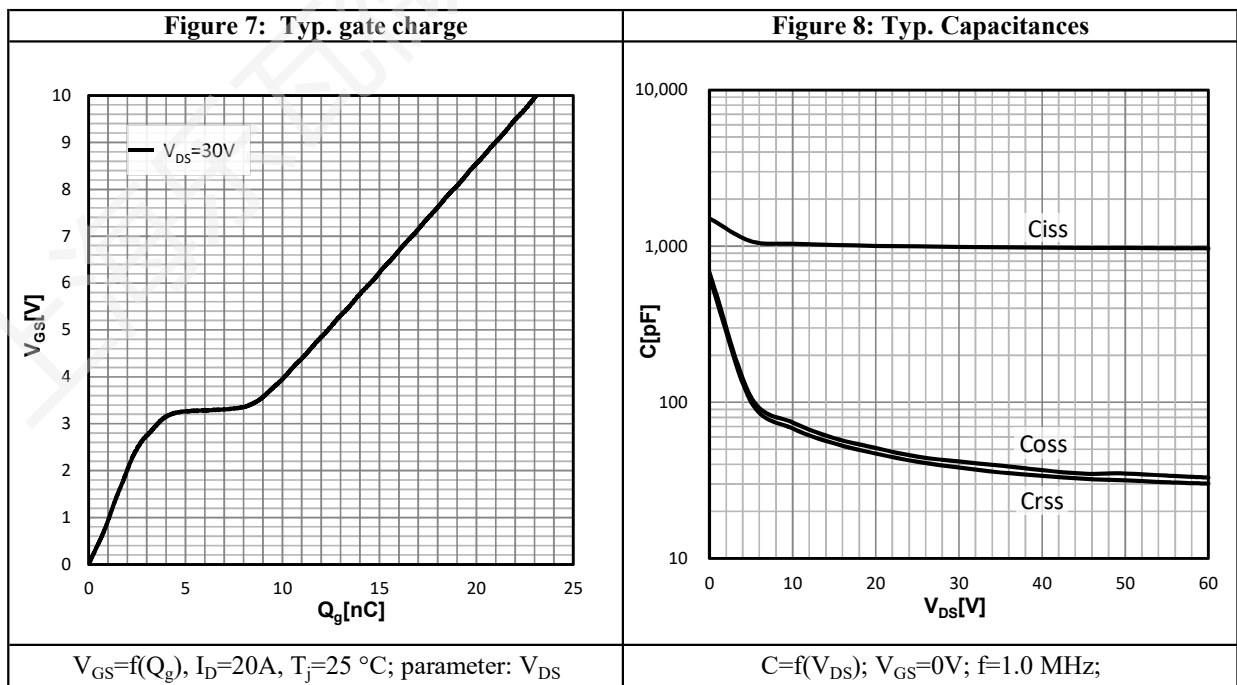
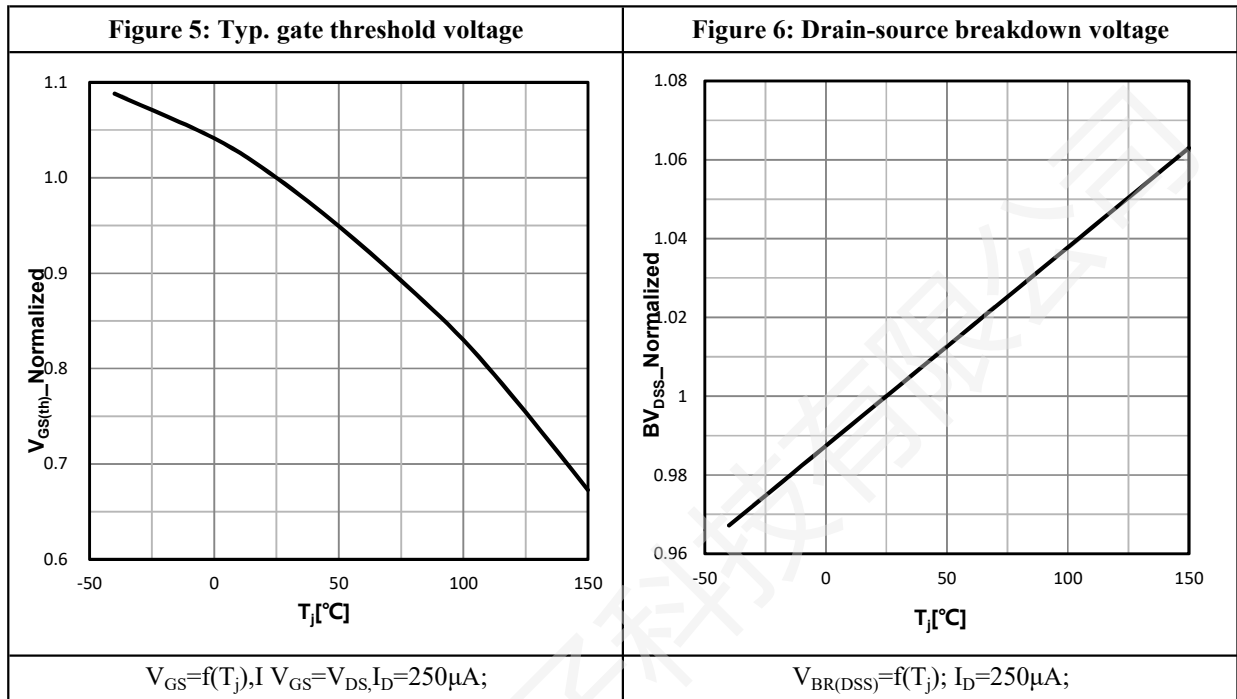
| Resistive Switching Characteristics |                     |                   |       |      |      |       |
|-------------------------------------|---------------------|-------------------|-------|------|------|-------|
| Symbol                              | Parameter           | Test Conditions   | Value |      |      | Units |
|                                     |                     |                   | Min.  | Typ. | Max. |       |
| $t_{d(ON)}$                         | Turn-on Delay Time  | $I_D = 8.0A$      | --    | 4.2  | --   | ns    |
| $t_r$                               | Rise Time           | $V_{DS} = 30V$    | --    | 3.4  | --   |       |
| $t_{d(OFF)}$                        | Turn-Off Delay Time | $V_{GS} = 10V$    | --    | 16   | --   |       |
| $t_f$                               | Fall Time           | $R_G = 3.0\Omega$ | --    | 2.0  | --   |       |
| $Q_g$                               | Total Gate Charge   | $V_{GS} = 10V$    | --    | 22   | --   | nC    |
| $Q_{gs}$                            | Gate Source Charge  | $V_{DS} = 30V$    | --    | 3.4  | --   |       |
| $Q_{gd}$                            | Gate Drain Charge   | $I_D = 20A$       | --    | 4.7  | --   |       |

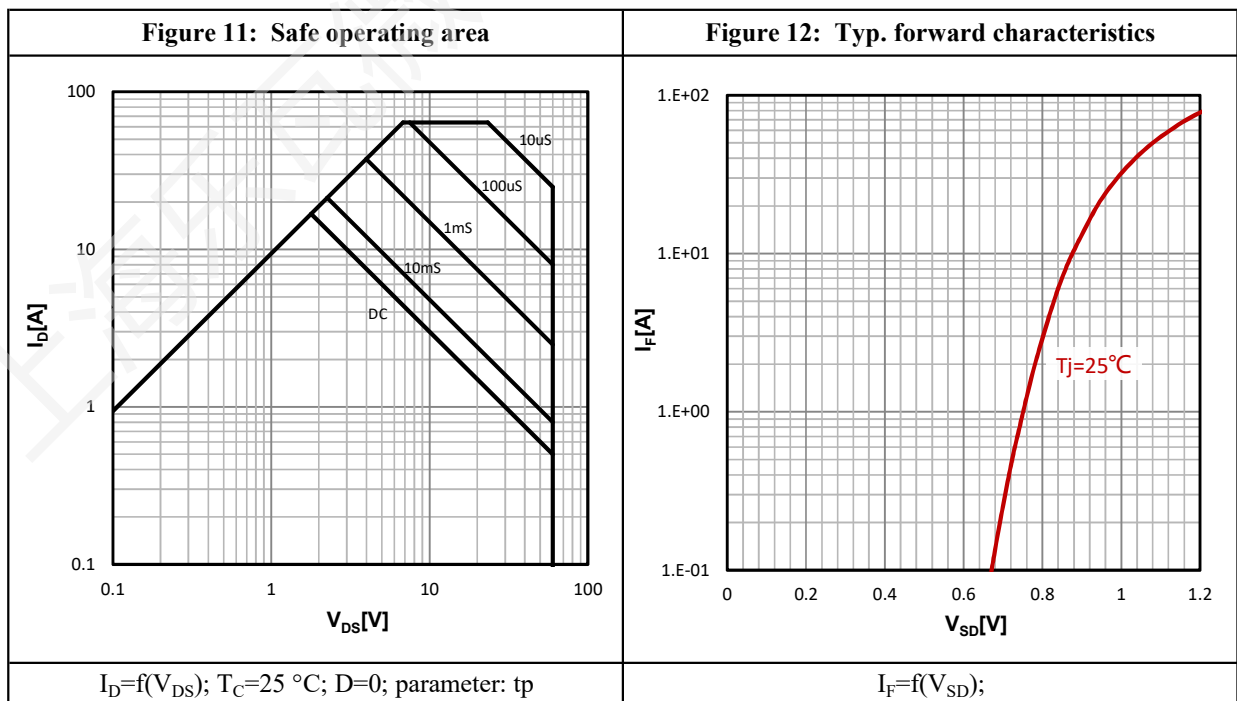
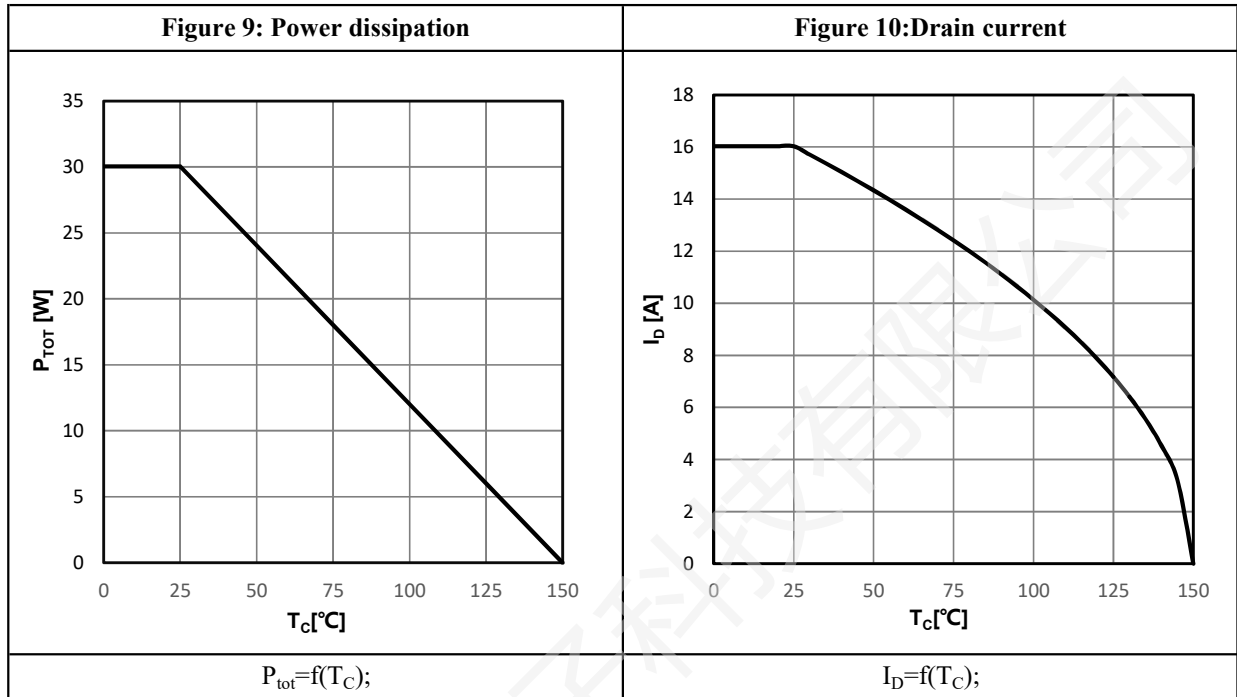
| Source-Drain Diode Characteristics |                       |                                    |       |      |      |       |
|------------------------------------|-----------------------|------------------------------------|-------|------|------|-------|
| Symbol                             | Parameter             | Test Conditions                    | Value |      |      | Units |
|                                    |                       |                                    | Min.  | Typ. | Max. |       |
| $I_S$                              | Diode Forward Current | $T_C = 25\text{ }^{\circ}\text{C}$ | --    | --   | 16   | A     |
| $V_{SD}$                           | Diode Forward Voltage | $I_S=8.0A, V_{GS}=0V$              | --    | --   | 1.2  | V     |

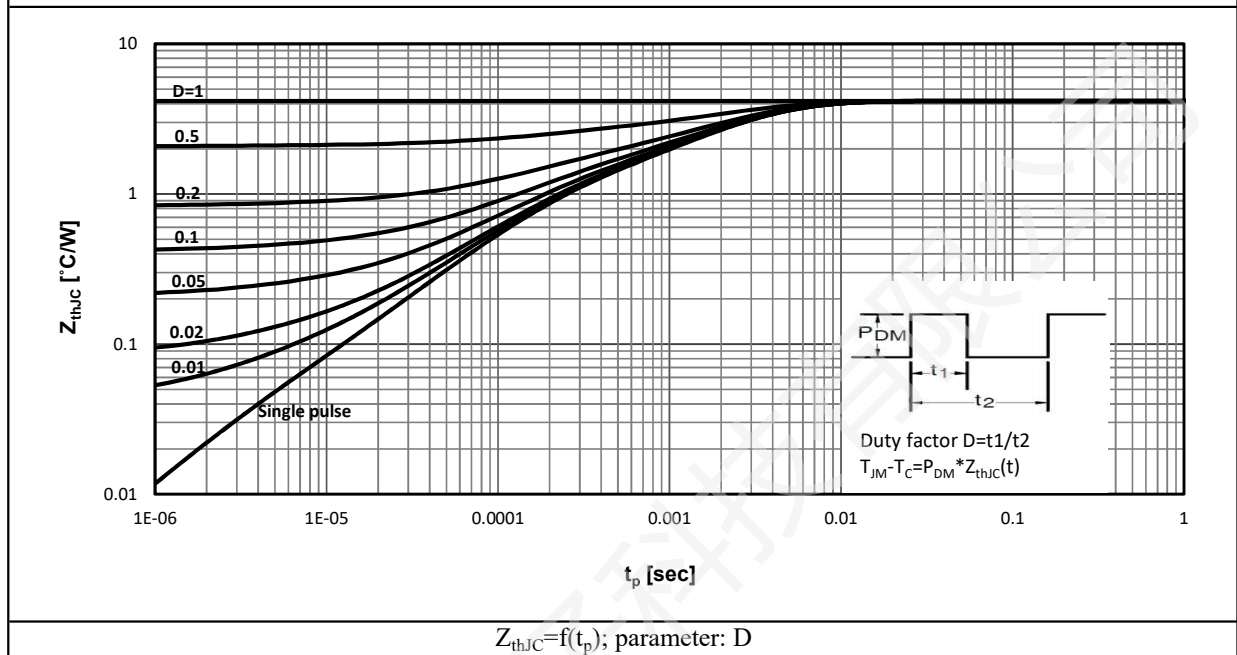
a1: Repetitive rating; pulse width limited by maximum junction temperature

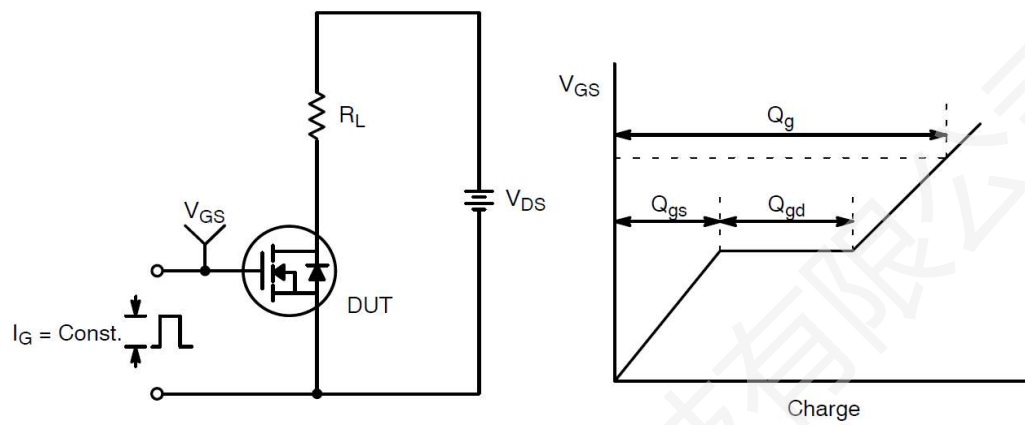
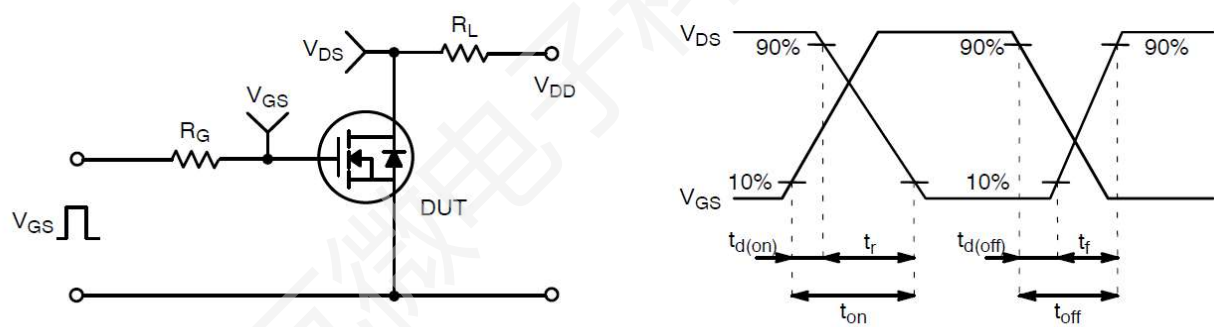
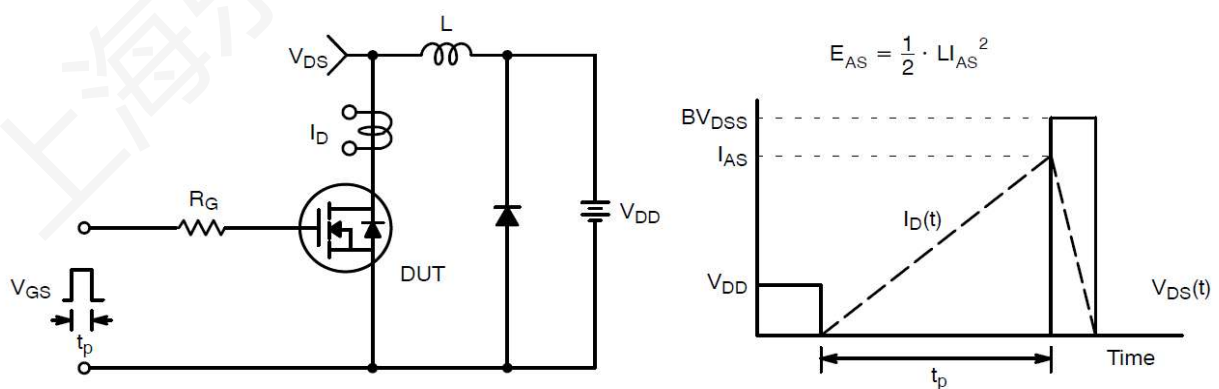
a2:  $V_{DD}=30V, L=0.5mH, R_G=25\Omega$ , Starting  $T_J=25\text{ }^{\circ}\text{C}$

**N-Channel Characteristics Curve:**






**Figure 13: Max. Transient Thermal Impedance**


**Test Circuit & Waveform:**

**Figure 14: Gate Charge Test Circuit & Waveform**

**Figure 15: Resistive Switching Test Circuit & Waveforms**

**Figure 16: Unclamped Inductive Switching Test Circuit & Waveforms**

**P-Channel Electrical Characteristic** ( $T_C = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified):

| Static Characteristics |                                   |                                |       |       |      |           |
|------------------------|-----------------------------------|--------------------------------|-------|-------|------|-----------|
| Symbol                 | Parameter                         | Test Conditions                | Value |       |      | Units     |
|                        |                                   |                                | Min.  | Typ.  | Max. |           |
| $V_{DSS}$              | Drain to Source Breakdown Voltage | $V_{GS}=0V, I_D=-250\mu A$     | -60   | --    | --   | V         |
| $I_{DSS}$              | Drain to Source Leakage Current   | $V_{DS}=-60V, V_{GS}=0V$       | --    | --    | 1.0  | $\mu A$   |
| $I_{GSS(F)}$           | Gate to Source Forward Leakage    | $V_{GS}=-20V, V_{DS}=0V$       | --    | --    | -100 | nA        |
| $I_{GSS(R)}$           | Gate to Source Reverse Leakage    | $V_{GS}=+20V, V_{DS}=0V$       | --    | --    | 100  | nA        |
| $V_{GS(TH)}$           | Gate Threshold Voltage            | $V_{DS}=V_{GS}, I_D=-250\mu A$ | -1.3  | -1.65 | -2.5 | V         |
| $R_{DS(ON)1}$          | Drain-to-Source On-Resistance     | $V_{GS}=-10V, I_D=-5.0A$       | --    | 55    | 80   | $m\Omega$ |
| $R_{DS(ON)2}$          | Drain-to-Source On-Resistance     | $V_{GS}=-4.5V, I_D=-4.0A$      | --    | 69    | 120  | $m\Omega$ |

| Dynamic Characteristics |                              |                                  |       |      |      |          |
|-------------------------|------------------------------|----------------------------------|-------|------|------|----------|
| Symbol                  | Parameter                    | Test Conditions                  | Value |      |      | Units    |
|                         |                              |                                  | Min.  | Typ. | Max. |          |
| $C_{iss}$               | Input Capacitance            | $V_{GS} = 0V$                    | --    | 490  | --   | pF       |
| $C_{oss}$               | Output Capacitance           | $V_{DS} = -30V$                  | --    | 87   | --   |          |
| $C_{rss}$               | Reverse Transfer Capacitance | $f = 1.0MHz$                     | --    | 5.8  | --   |          |
| $R_G$                   | Gate resistance              | $V_{GS}=0V, V_{DS}=0V, f=1.0MHz$ | --    | 3.0  | --   | $\Omega$ |

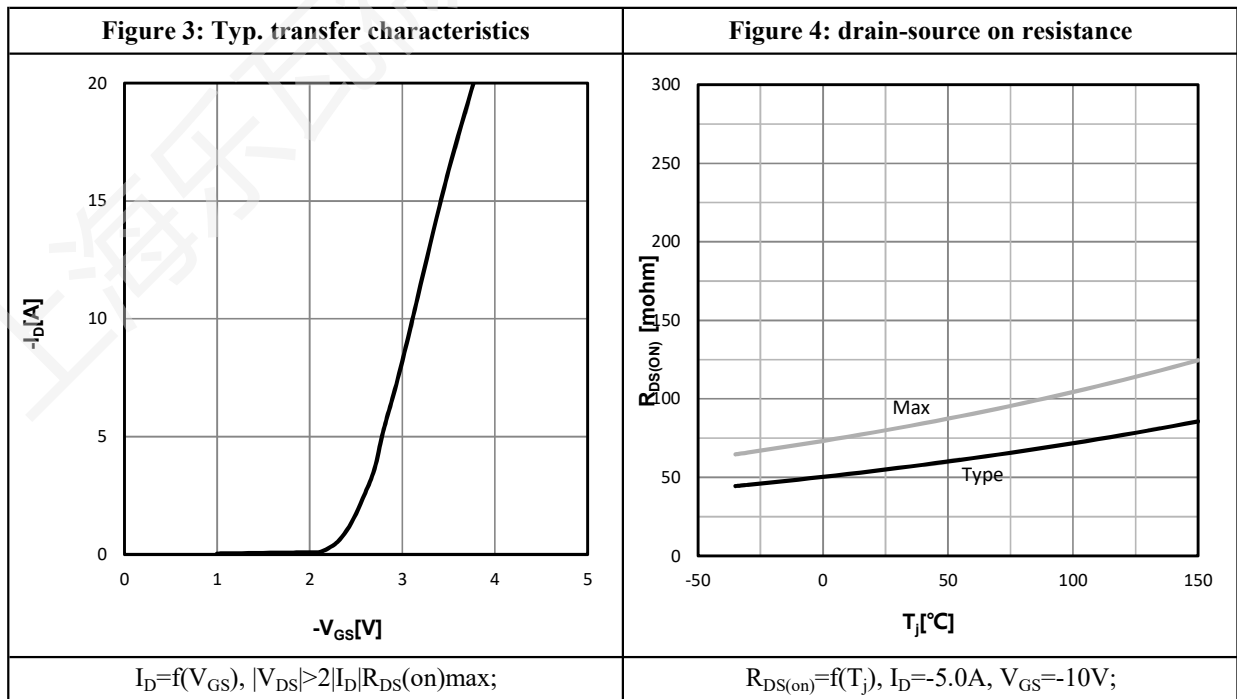
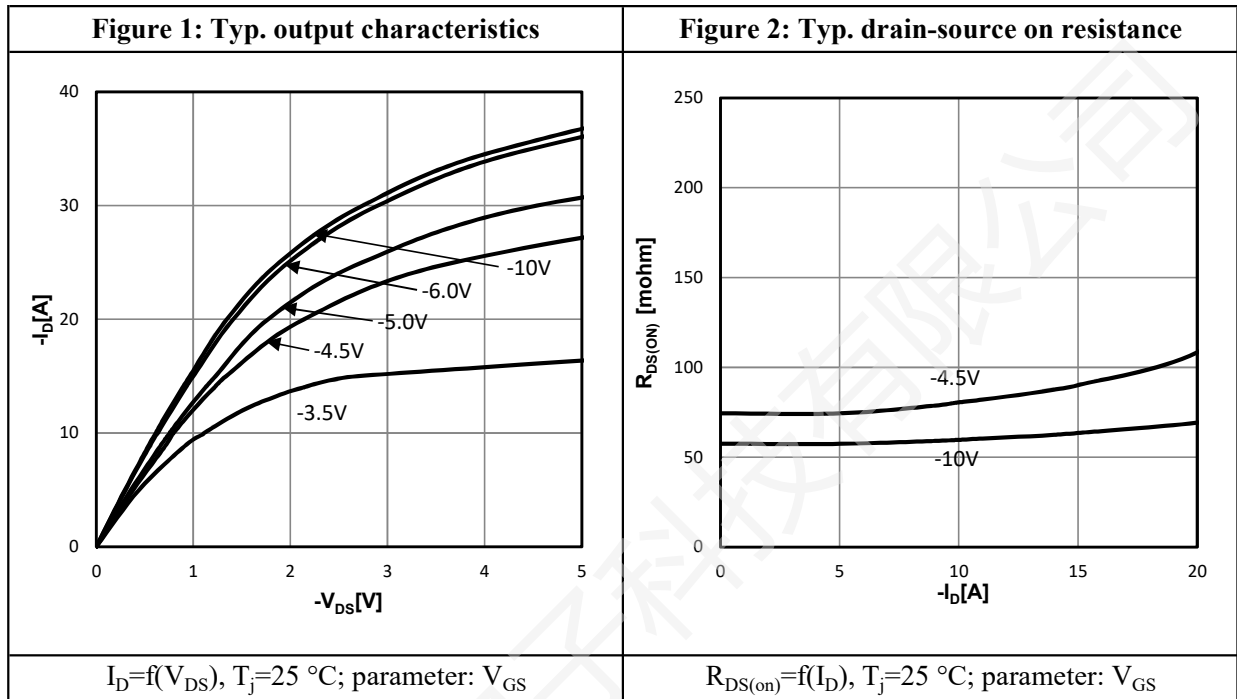
| Resistive Switching Characteristics |                       |                   |       |      |      |       |
|-------------------------------------|-----------------------|-------------------|-------|------|------|-------|
| Symbol                              | Parameter             | Test Conditions   | Value |      |      | Units |
|                                     |                       |                   | Min.  | Typ. | Max. |       |
| $t_{d(ON)}$                         | Turn-on Delay Time    | $I_D = -5.0A$     | --    | 9.0  | --   | ns    |
| $t_r$                               | Rise Time             | $V_{DS} = -30V$   | --    | 10   | --   |       |
| $t_{d(OFF)}$                        | Turn-Off Delay Time   | $V_{GS} = -10V$   | --    | 25   | --   |       |
| $t_f$                               | Fall Time             | $R_G = 3.0\Omega$ | --    | 11   | --   |       |
| $Q_g$                               | Total Gate Charge     | $V_{GS} = -10V$   | --    | 8.0  | --   | nC    |
| $Q_{gs}$                            | Gate to Source Charge | $V_{DS} = -30V$   | --    | 1.8  | --   |       |
| $Q_{gd}$                            | Gate to Drain Charge  | $I_D = -10A$      | --    | 1.1  | --   |       |

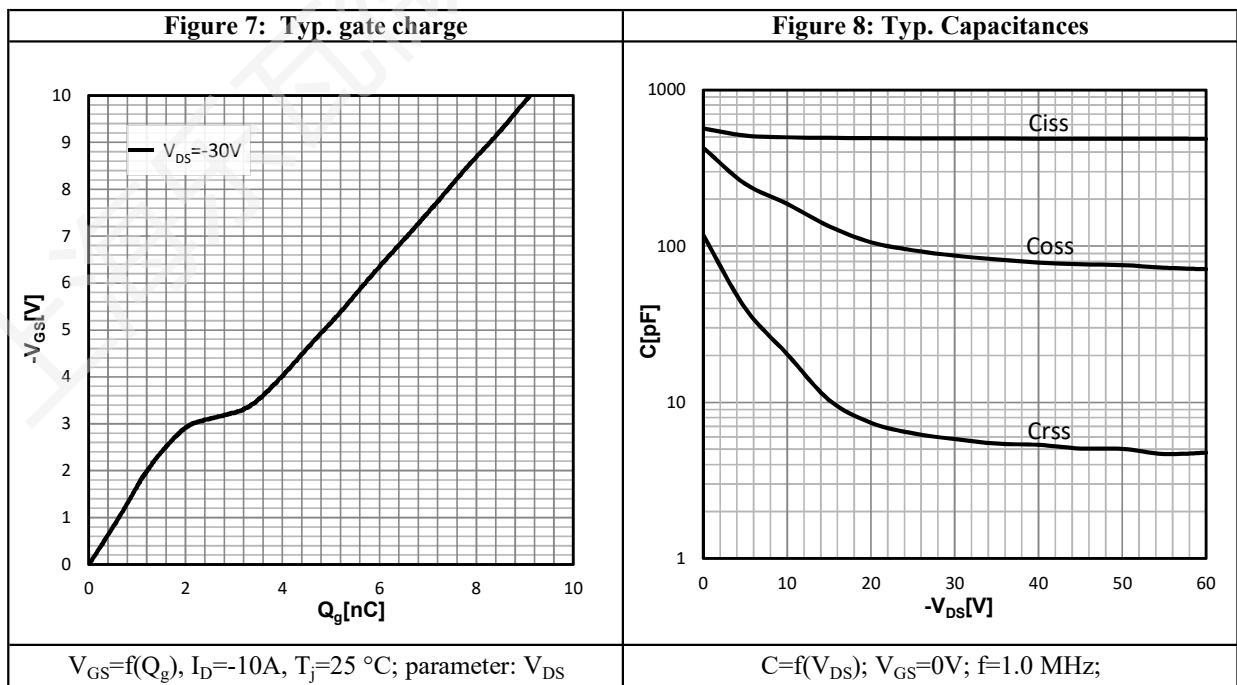
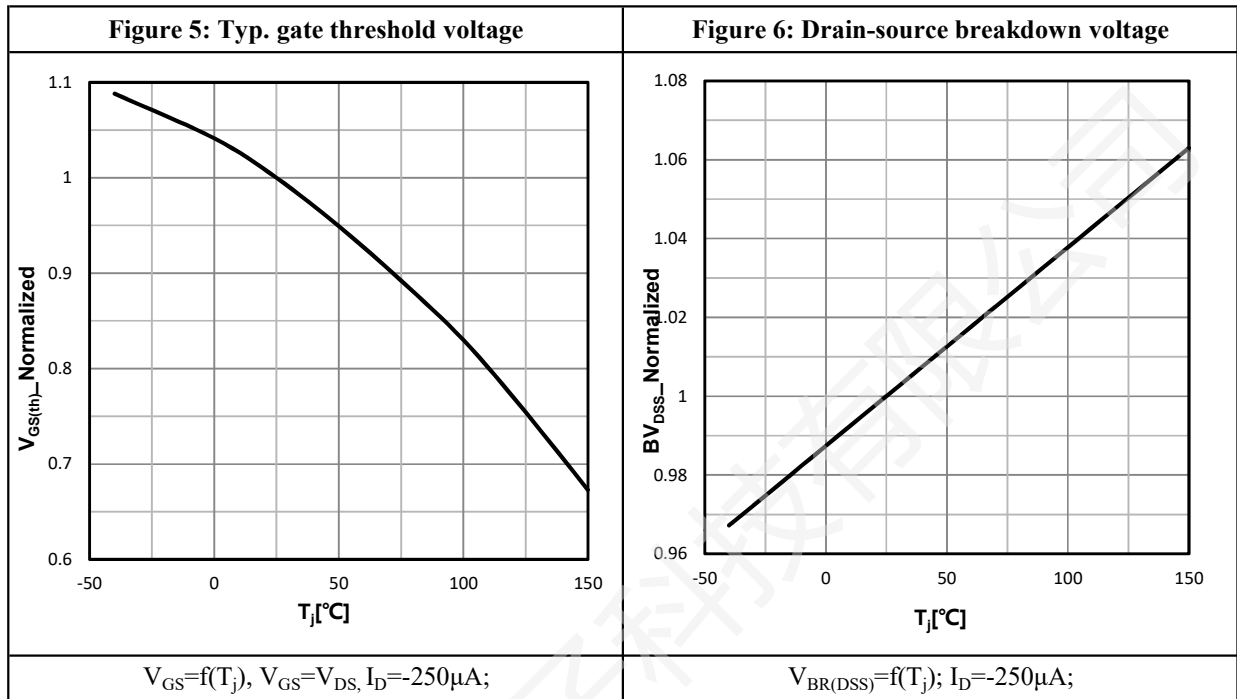
| Source-Drain Diode Characteristics |                       |                                    |       |      |      |       |
|------------------------------------|-----------------------|------------------------------------|-------|------|------|-------|
| Symbol                             | Parameter             | Test Conditions                    | Value |      |      | Units |
|                                    |                       |                                    | Min.  | Typ. | Max. |       |
| $I_S$                              | Diode Forward Current | $T_C = 25\text{ }^{\circ}\text{C}$ | --    | --   | -16  | A     |
| $V_{SD}$                           | Diode Forward Voltage | $I_S = -10A, V_{GS} = 0V$          | --    | --   | -1.2 | V     |

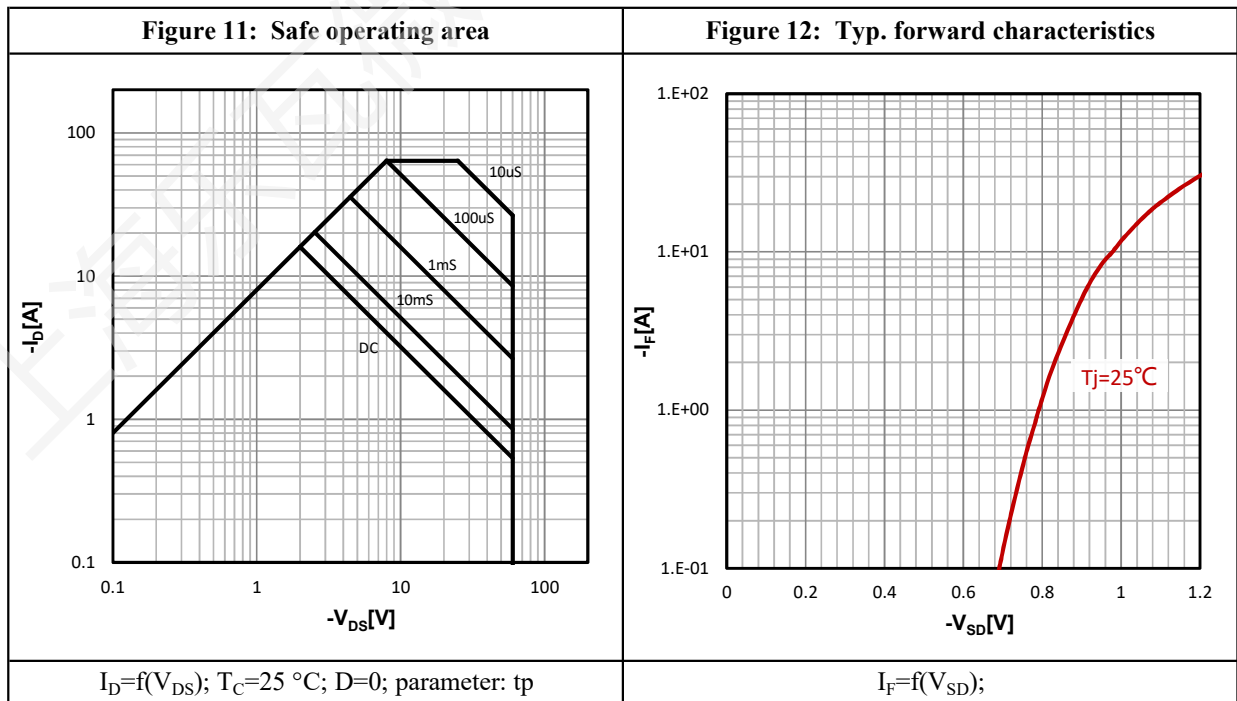
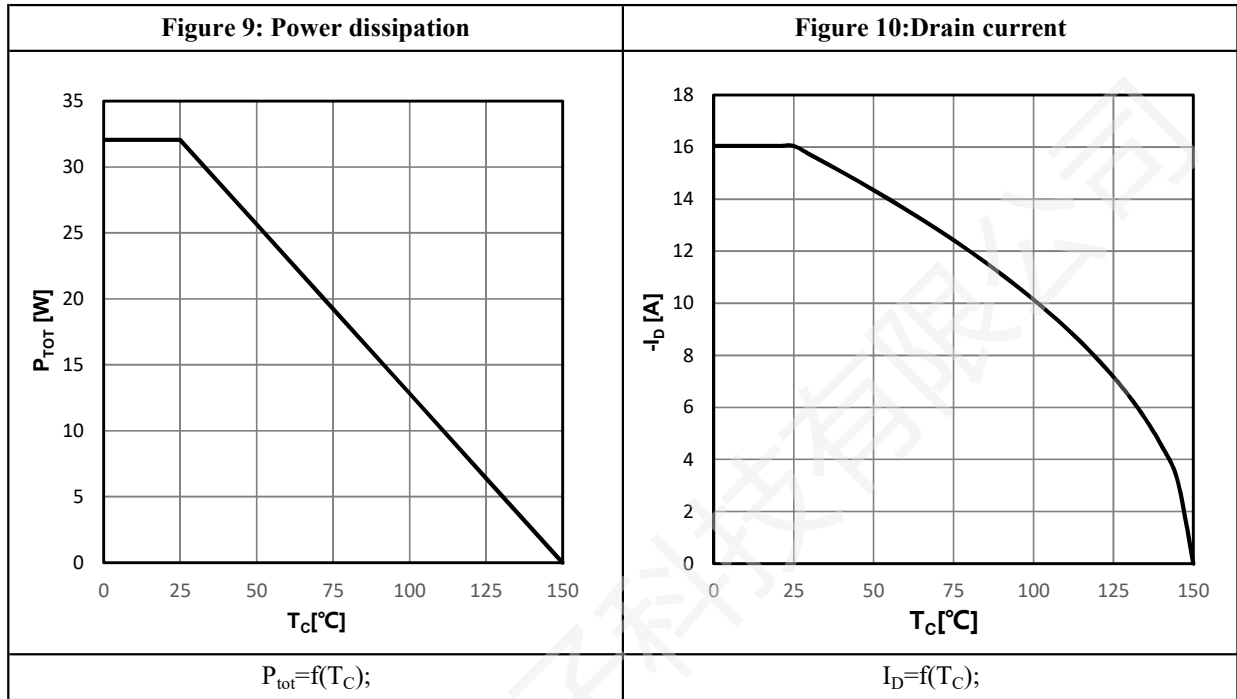
a1: Repetitive rating; pulse width limited by maximum junction temperature

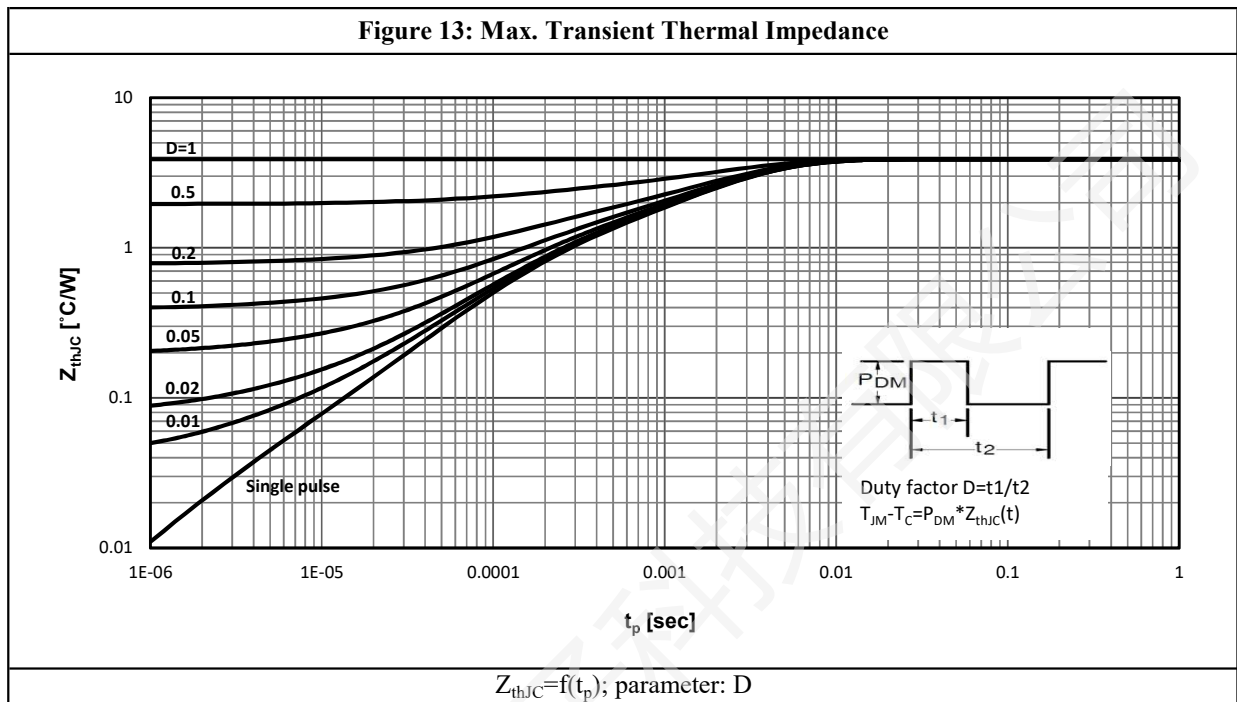
a2:  $V_{DD} = -30V, L = 0.5mH, R_G = 25\Omega$ , Starting  $T_j = 25\text{ }^{\circ}\text{C}$

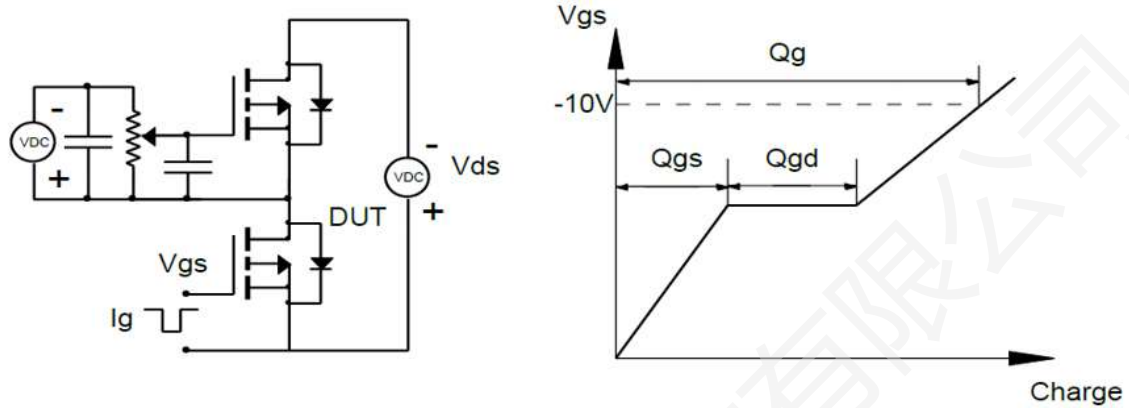
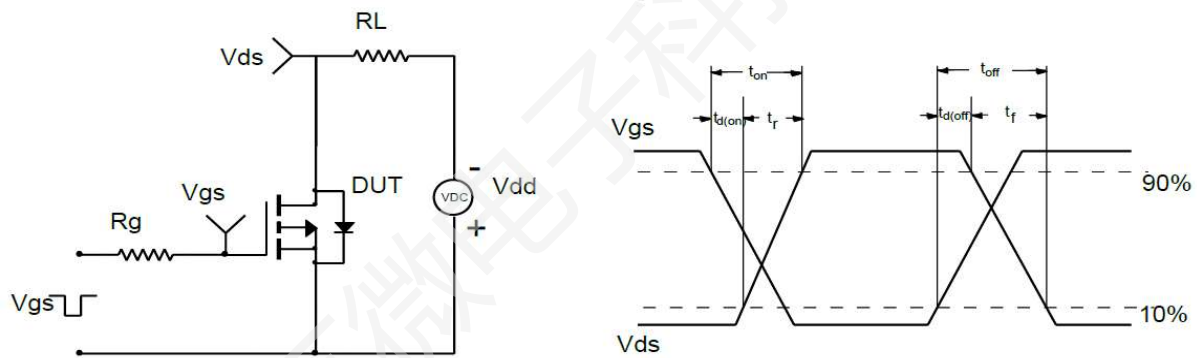
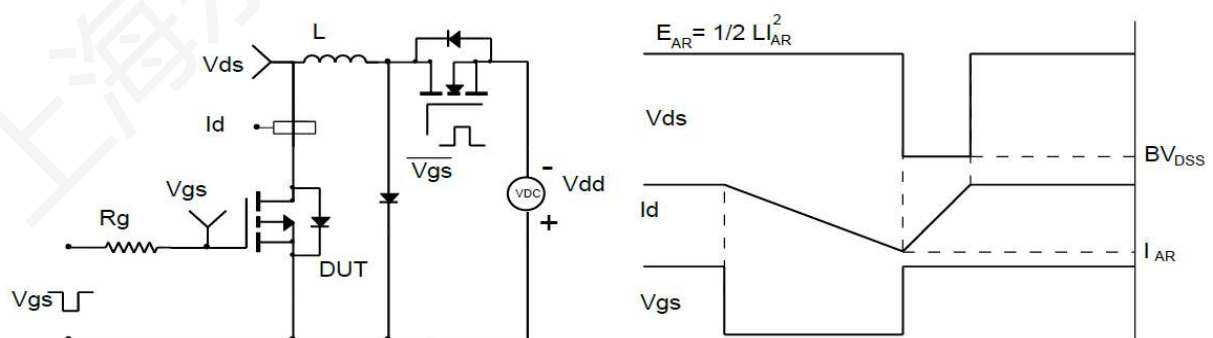


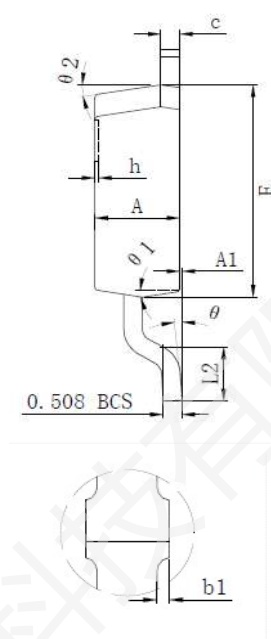
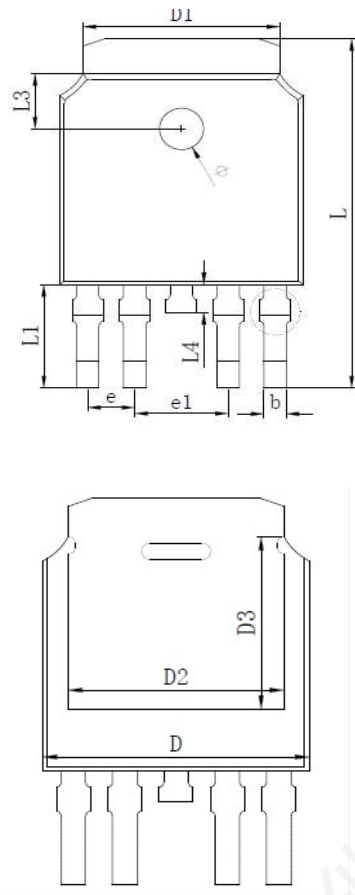
**P-Channel Characteristics Curve:**






**Figure 13: Max. Transient Thermal Impedance**


**P-Channel Test Circuit & Waveform:**

**Figure 14: Gate Charge Test Circuit & Waveform**

**Figure 15: Resistive Switching Test Circuit & Waveforms**

**Figure 16: Unclamped Inductive Switching Test Circuit & Waveforms**

**Package Outline:**


| Symbol | MILLIMETER |        |        |
|--------|------------|--------|--------|
|        | MIN        | TYP    | MAX    |
| A      | 2.200      | 2.300  | 2.400  |
| A1     | 0.000      |        | 0.127  |
| b      | 0.550      | 0.600  | 0.650  |
| b1     | 0.000      |        | 0.120  |
| c(电镀后) | 0.460      | 0.520  | 0.580  |
| D      | 6.500      | 6.600  | 6.700  |
| D1     | 5.334REF   |        |        |
| D2     | 5.346REF   |        |        |
| D3     | 4.490REF   |        |        |
| E      | 6.000      | 6.100  | 6.200  |
| e      | 1.270TYP   |        |        |
| e1     | 2.540TYP   |        |        |
| h      | 0.000      | 0.100  | 0.200  |
| L      | 9.900      | 10.100 | 10.300 |
| L1     | 2.988REF   |        |        |
| L2     | 1.400      | 1.550  | 1.700  |
| L3     | 1.600REF   |        |        |
| L4     | 0.700      | 0.800  | 0.900  |
| φ      | 1.100      | 1.200  | 1.300  |
| θ      | 0°         |        | 8°     |
| θ1     | 9° TYP     |        |        |
| θ2     | 9° TYP     |        |        |

**Revision History:**

| Revision | Date     | Descriptions    |
|----------|----------|-----------------|
| Rev 1.1  | Jun.2025 | Initial Version |

**Disclaimer:**

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