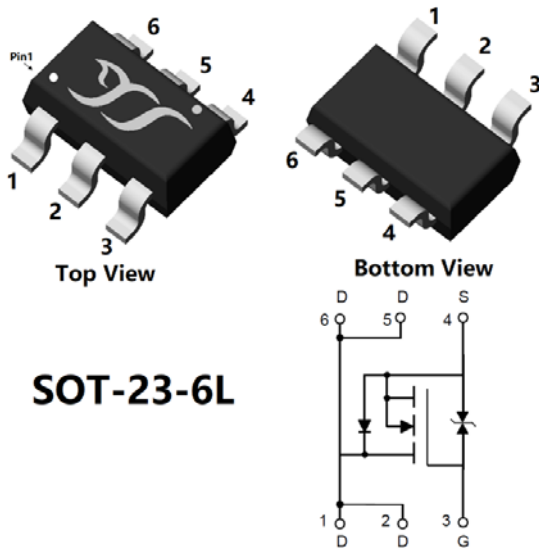


## N-Channel Enhancement Mode Field Effect Transistor



### Product Summary

- $V_{DS}$  40V
- $I_D$  5.2A
- $R_{DS(ON)}$  (at  $V_{GS}=10V$ )  $<30m\Omega$
- $R_{DS(ON)}$  (at  $V_{GS}=4.5V$ )  $<39m\Omega$
- ESD Protected Up to 2KV (HBM)

### General Description

- Low  $R_{DS(ON)}$  & FOM
- Extremely low switching loss
- Moisture Sensitivity Level 1
- Epoxy Meets UL 94 V-0 Flammability Rating
- Halogen Free
- Part no. with suffix "Q" means AEC-Q101 qualified

### Applications

- Relay driver
- High-speed line driver
- Low-side load switch
- Switching circuits

### Limiting Values

| Parameter                              | Conditions                                |                                            | Symbol                            | Min | Max  | Unit |
|----------------------------------------|-------------------------------------------|--------------------------------------------|-----------------------------------|-----|------|------|
| Drain-source Voltage                   |                                           |                                            | V <sub>DS</sub>                   | -   | 40   | V    |
| Gate-source Voltage                    |                                           |                                            | V <sub>GS</sub>                   | -20 | 20   |      |
| Continuous Drain Current (Note 1,2)    | Steady-State                              | T <sub>A</sub> =25°C,V <sub>GS</sub> =10V  | I <sub>D</sub>                    | -   | 5.2  | A    |
|                                        |                                           | T <sub>A</sub> =100°C,V <sub>GS</sub> =10V |                                   | -   | 3.6  |      |
| Pulsed Drain Current                   | T <sub>A</sub> =25°C,t <sub>p</sub> ≤10μs |                                            | I <sub>DM</sub>                   | -   | 20.8 |      |
| Maximum Body-Diode Continuous Current  | T <sub>A</sub> =25°C                      |                                            | I <sub>S</sub>                    |     | 1.3  |      |
| Total Power Dissipation (Note 1,2)     | Steady-State                              | T <sub>A</sub> =25°C                       | P <sub>D</sub>                    | -   | 1.63 | W    |
|                                        |                                           | T <sub>A</sub> =100°C                      |                                   | -   | 0.81 |      |
| Junction and Storage Temperature Range |                                           |                                            | T <sub>J</sub> , T <sub>STG</sub> | -55 | 175  | °C   |

### Thermal Resistance

| Parameter                                       |              | Symbol          | Typ | Max | Units        |
|-------------------------------------------------|--------------|-----------------|-----|-----|--------------|
| Thermal Resistance Junction-to-Ambient (Note 2) | Steady-State | $R_{\theta JA}$ | -   | 92  | $^\circ C/W$ |



## ■ Electrical Characteristics

| Parameter                         | Symbol              | Conditions                                                                                                 | Min | Typ  | Max | Units |
|-----------------------------------|---------------------|------------------------------------------------------------------------------------------------------------|-----|------|-----|-------|
| Static Parameter                  |                     |                                                                                                            |     |      |     |       |
| Drain-Source Breakdown Voltage    | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA, T <sub>j</sub> =25°C                                           | 40  | -    | -   | V     |
| Zero Gate Voltage Drain Current   | I <sub>DSS</sub>    | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V, T <sub>j</sub> =25°C                                            | -   | -    | 1   | μA    |
|                                   |                     | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V, T <sub>j</sub> =125°C                                           | -   | -    | 100 |       |
| Gate-Source Leakage Current       | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V, T <sub>j</sub> =25°C                                           | -   | -    | ±10 | μA    |
| Gate Threshold Voltage            | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA, T <sub>j</sub> =25°C                             | 1.3 | 1.7  | 2.3 | V     |
| Static Drain-Source On-Resistance | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =5A, T <sub>j</sub> =25°C                                             | -   | 21   | 30  | mΩ    |
|                                   |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =2.5A, T <sub>j</sub> =25°C                                          | -   | 28   | 39  | mΩ    |
| Diode Forward Voltage             | V <sub>SD</sub>     | I <sub>S</sub> =5A, V <sub>GS</sub> =0V, T <sub>j</sub> =25°C                                              | -   | 0.85 | 1.2 | V     |
| Gate Resistance                   | R <sub>G</sub>      | f=1MHz, T <sub>j</sub> =25°C                                                                               | -   | 1.5  | -   | Ω     |
| Dynamic Parameters                |                     |                                                                                                            |     |      |     |       |
| Input Capacitance                 | C <sub>iss</sub>    | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, f=1MHz, T <sub>j</sub> =25°C                                    | -   | 692  | -   | pF    |
| Output Capacitance                | C <sub>oss</sub>    |                                                                                                            | -   | 56   | -   |       |
| Reverse Transfer Capacitance      | C <sub>rss</sub>    |                                                                                                            | -   | 47   | -   |       |
| Switching Parameters              |                     |                                                                                                            |     |      |     |       |
| Total Gate Charge                 | Q <sub>g</sub>      | V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, I <sub>D</sub> =5A, T <sub>j</sub> =25°C                       | -   | 14.5 | -   | nC    |
| Gate-Source Charge                | Q <sub>gs</sub>     |                                                                                                            | -   | 2.1  | -   |       |
| Gate-Drain Charge                 | Q <sub>gd</sub>     |                                                                                                            | -   | 3.3  | -   |       |
| Reverse Recovery Charge           | Q <sub>rr</sub>     | I <sub>F</sub> =5A, di/dt=100A/μs, V <sub>GS</sub> =0V, V <sub>R</sub> =20V, T <sub>j</sub> =25°C          | -   | 9    | -   | nC    |
| Reverse Recovery Time             | t <sub>rr</sub>     |                                                                                                            | -   | 13.9 | -   | ns    |
| Turn-on Delay Time                | t <sub>D(on)</sub>  | V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, I <sub>D</sub> =5A, R <sub>GEN</sub> =3Ω, T <sub>j</sub> =25°C | -   | 7    | -   | ns    |
| Turn-on Rise Time                 | t <sub>r</sub>      |                                                                                                            | -   | 2.9  | -   |       |
| Turn-off Delay Time               | t <sub>D(off)</sub> |                                                                                                            | -   | 19.7 | -   |       |
| Turn-off Fall Time                | t <sub>f</sub>      |                                                                                                            | -   | 3.3  | -   |       |

Note:

- The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
- The value of  $R_{\theta JA}$  is measured with the device mounted on the 40mm\*40mm\*1.1mm single layer FR-4 PCB board with 1 in<sup>2</sup> pad of 2oz. Copper, in the still air environment with  $T_A=25^\circ C$ . The maximum allowed junction temperature of  $175^\circ C$ . The value in any given application depends on the user's specific board design.



## ■ Typical Electrical and Thermal Characteristics Diagrams

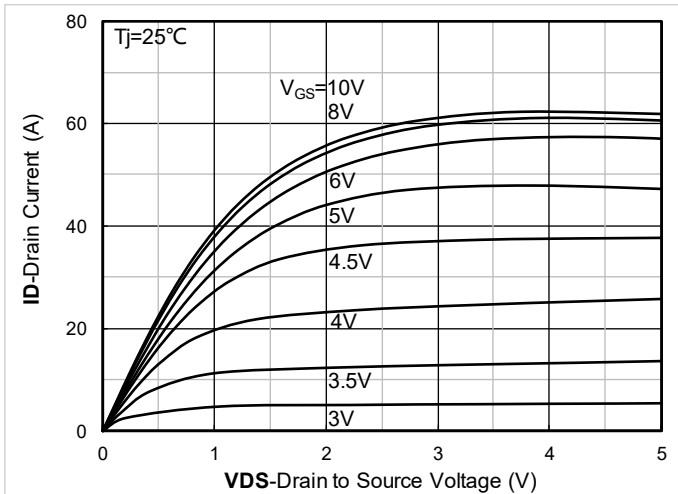


Figure 1. Output Characteristics; typical values

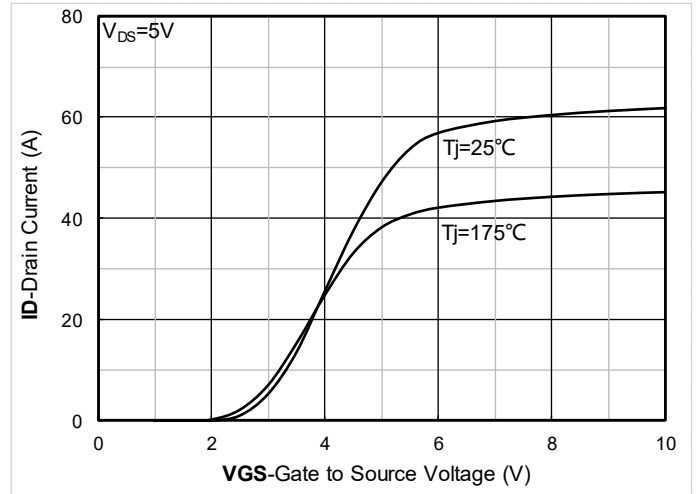


Figure 2. Transfer Characteristics; typical values

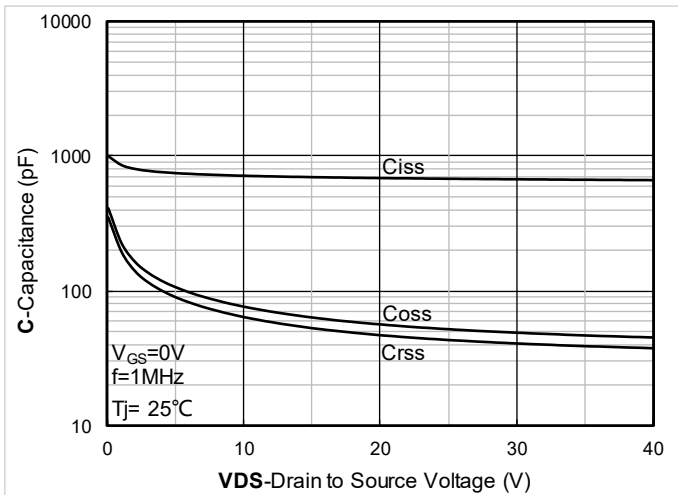


Figure 3. Capacitance Characteristics; typical values

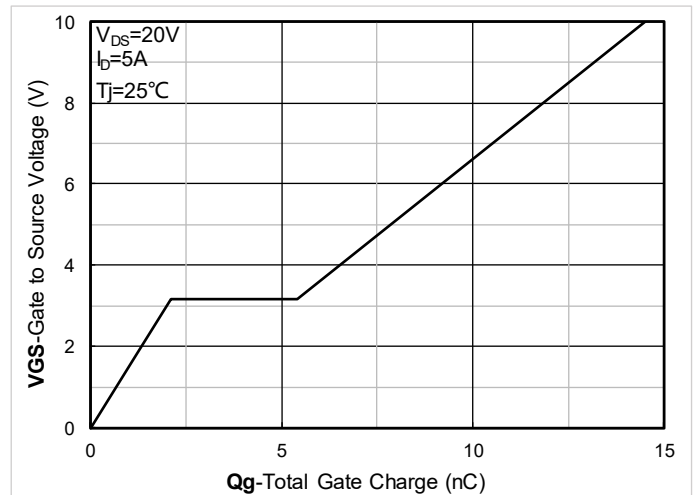


Figure 4. Gate Charge; typical values

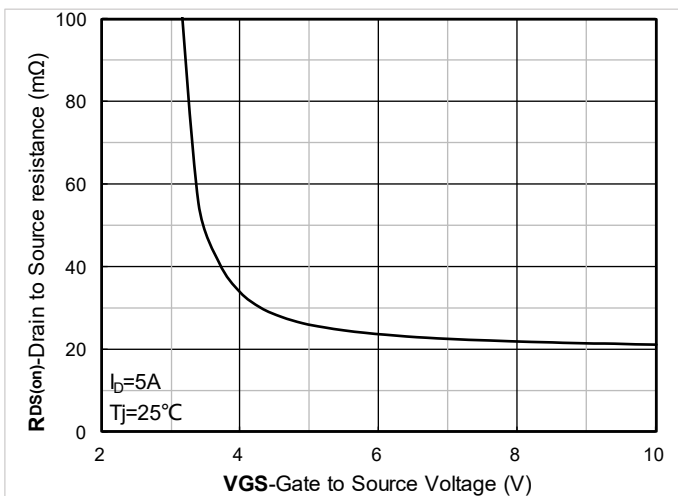


Figure 5. On-Resistance vs. Gate to Source Voltage; typical values

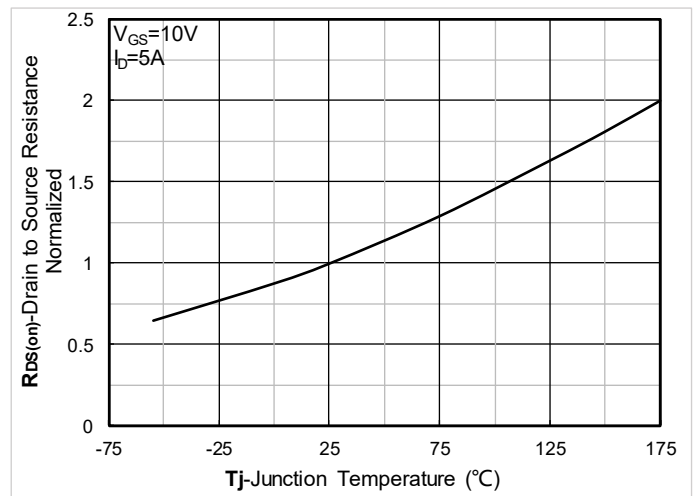


Figure 6. Normalized On-Resistance

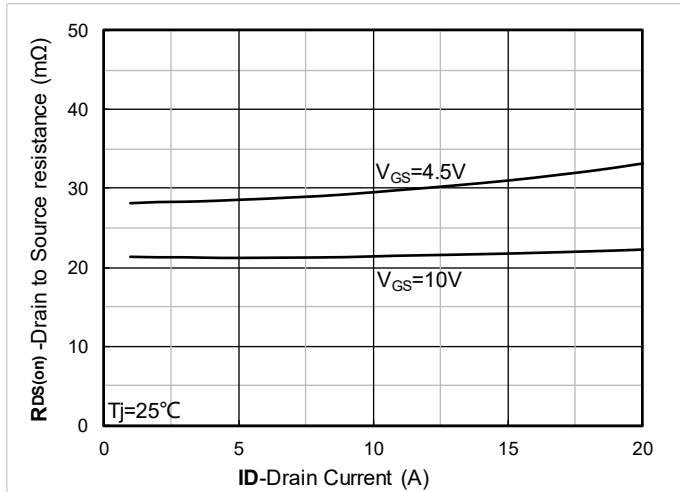


Figure 7.  $R_{DS(on)}$  vs. Drain Current; typical values

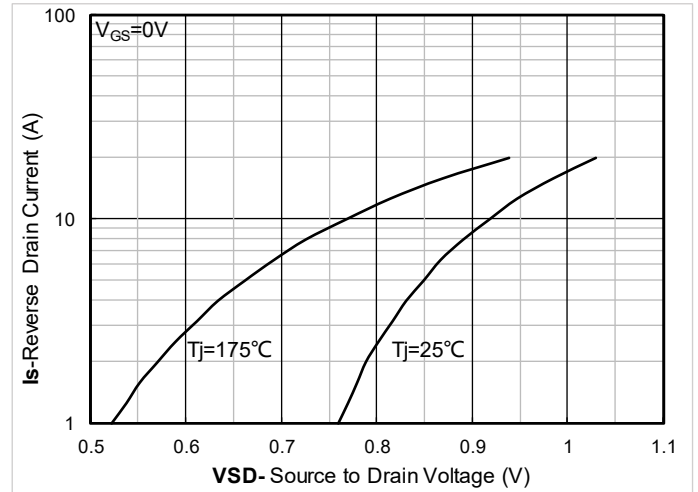


Figure 8. Forward characteristics of reverse diode; typical values

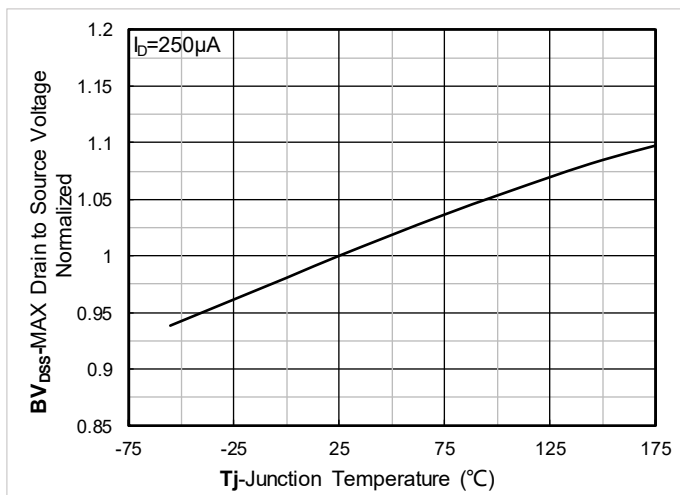


Figure 9. Normalized breakdown voltage

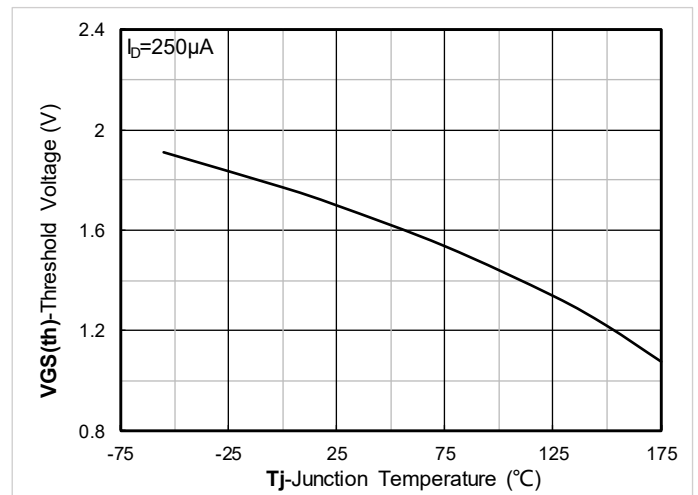


Figure 10. Gate Threshold voltage; typical values

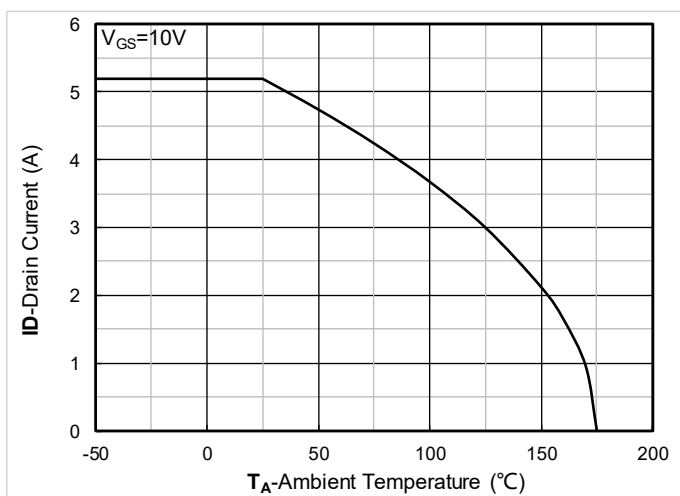


Figure 11. Current dissipation

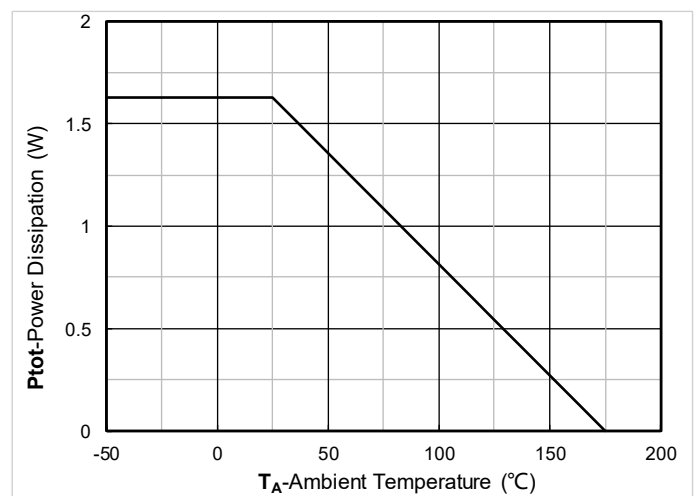


Figure 12. Power dissipation

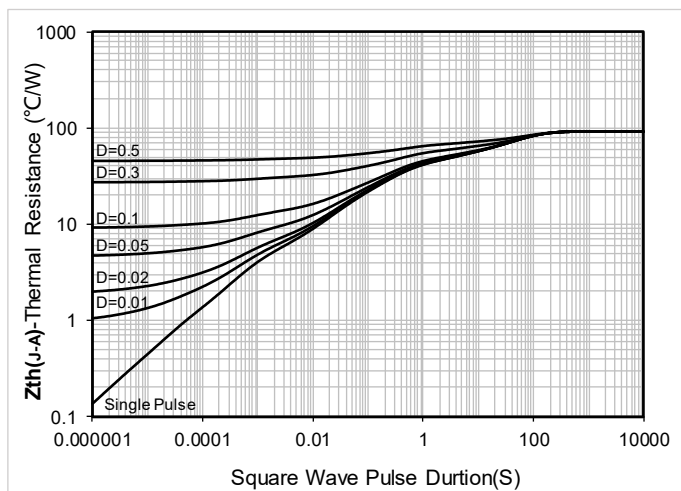


Figure 13. Maximum Transient Thermal Impedance

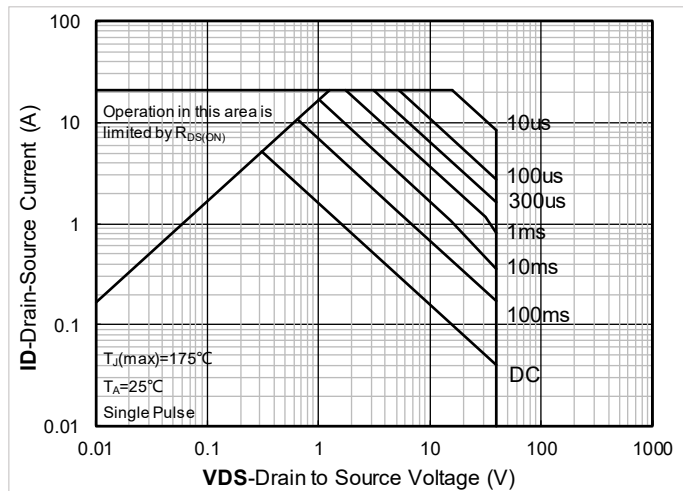


Figure 14. Safe Operation Area

## ■ Test Circuits & Waveforms

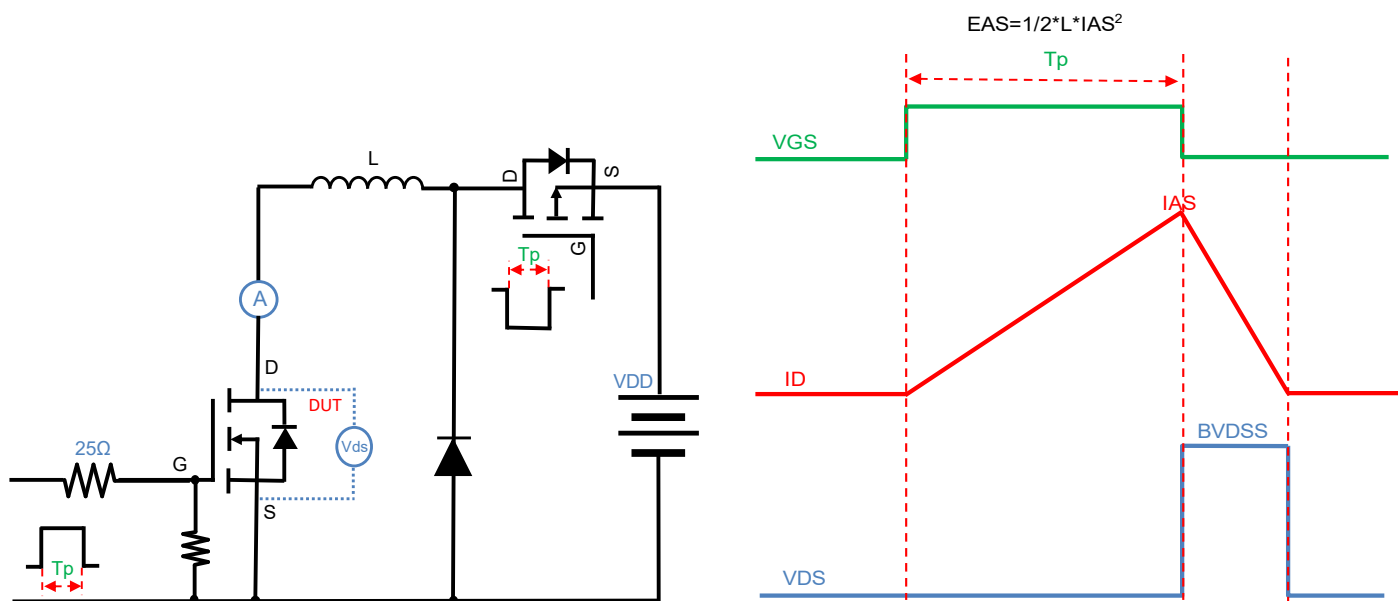


Figure A. Unclamped Inductive Switching (UIS) Test Circuit & Waveform

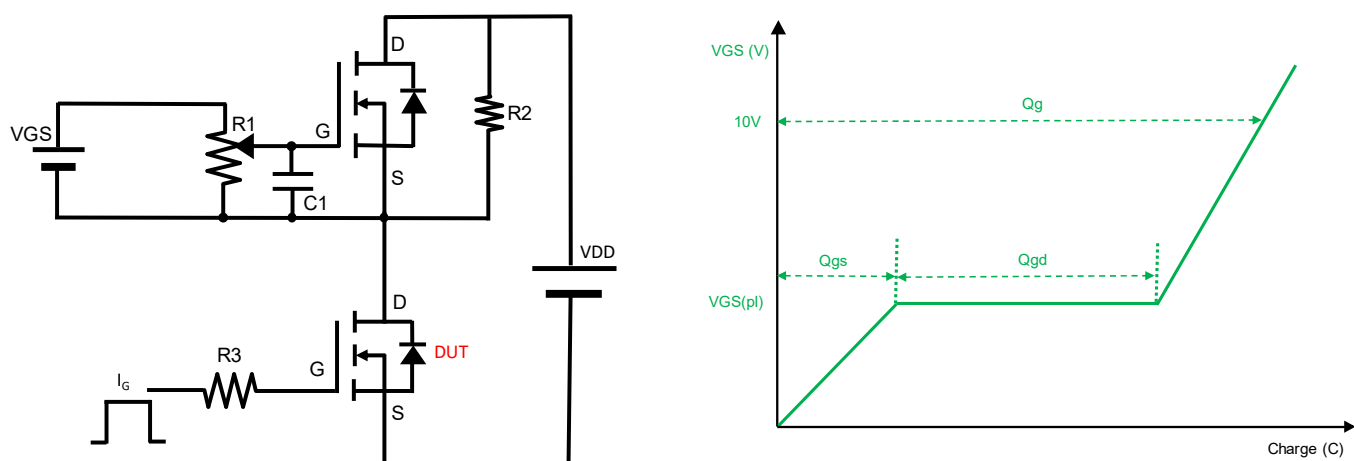


Figure B. Gate Charge Test Circuit & Waveform

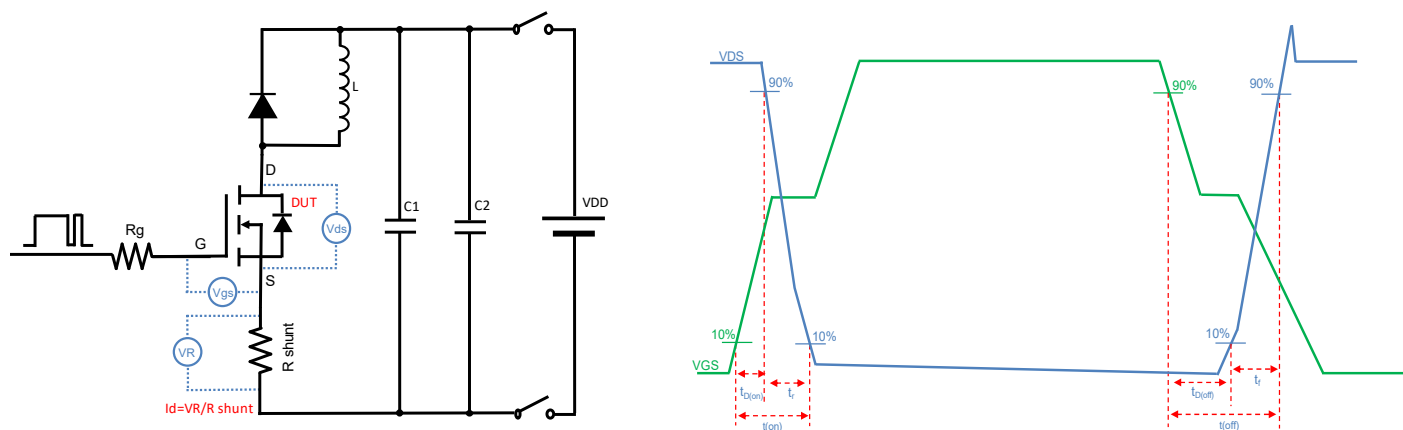


Figure C. Resistive Switching Test Circuit & Waveform

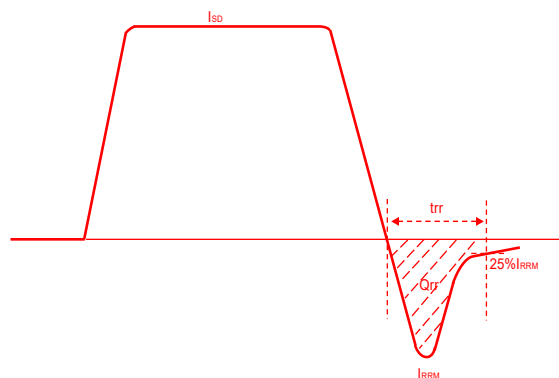
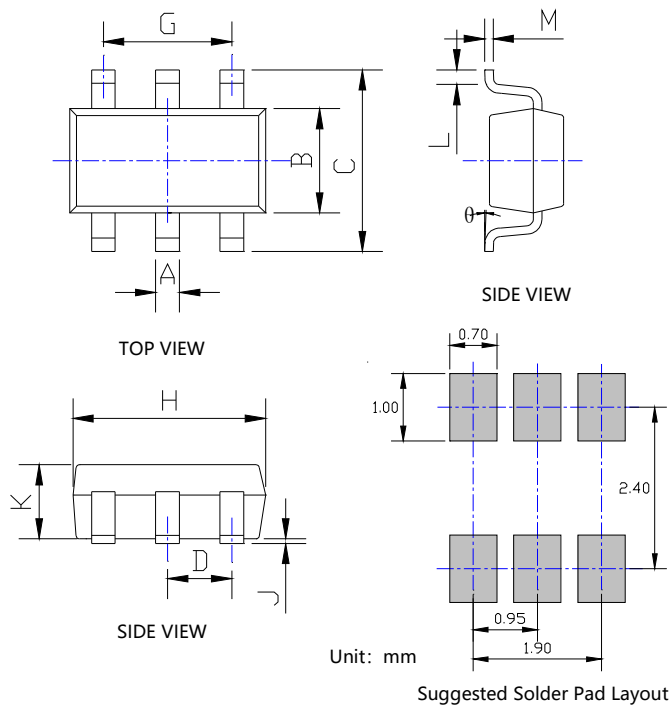


Figure D. Diode Recovery Test Circuit & Waveform



## ■ SOT-23-6L Package information



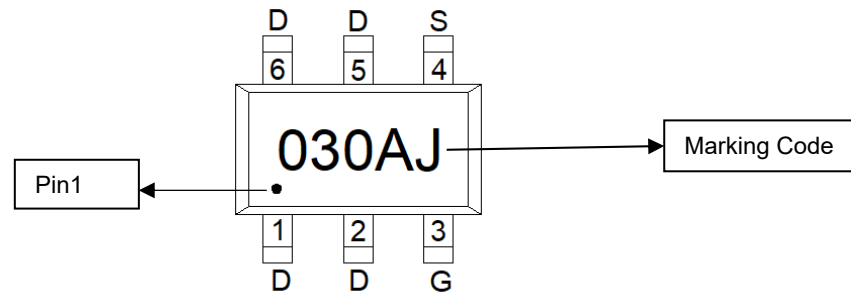
| DIMENSIONS |          |       |            |       |
|------------|----------|-------|------------|-------|
| SYMBOL     | INCHES   |       | Millimeter |       |
|            | MIN.     | MAX.  | MIN.       | MAX.  |
| A          | 0.012    | 0.020 | 0.300      | 0.500 |
| B          | 0.059    | 0.067 | 1.500      | 1.700 |
| C          | 0.104    | 0.116 | 2.650      | 2.950 |
| D          | 0.037BSC |       | 0.950BSC   |       |
| G          | 0.075BSC |       | 1.900BSC   |       |
| H          | 0.111    | 0.119 | 2.820      | 3.020 |
| J          | 0.000    | 0.004 | 0.000      | 0.100 |
| K          | 0.041    | 0.045 | 1.050      | 1.150 |
| L          | 0.012    | 0.024 | 0.300      | 0.600 |
| M          | 0.004    | 0.008 | 0.100      | 0.200 |
| θ          | 0°       | 8°    | 0°         | 8°    |

### Note:

1. Controlling dimension: in millimeters.
2. General tolerance:  $\pm 0.05\text{mm}$ .
3. The pad layout is for reference purposes only.



## ■ Marking Information



### Note:

1. All marking is at middle of the product body
2. All marking is in laser printing
3. 030AJ is marking code
4. Body color: Black



## Disclaimer

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