

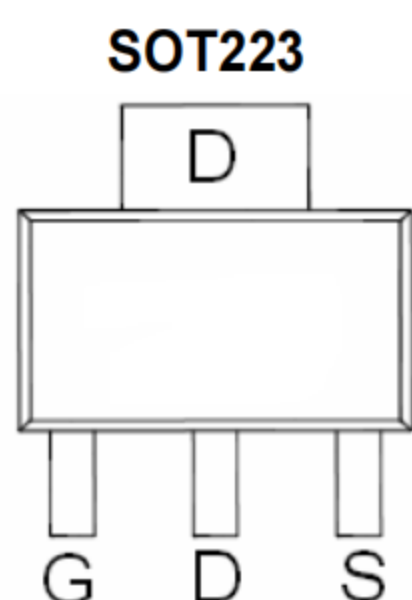
### GENERAL FEATURES

- 60V, 4A,  $R_{DS(ON)} = 85m\Omega$  @  $V_{GS} = 10V$ .  
 $R_{DS(ON)} = 100m\Omega$  @  $V_{GS} = 4.5V$ .
- High dense cell design for extremely low  $R_{DS(ON)}$ .
- Rugged and reliable.
- Lead free product is acquired.
- SOT-223 package.

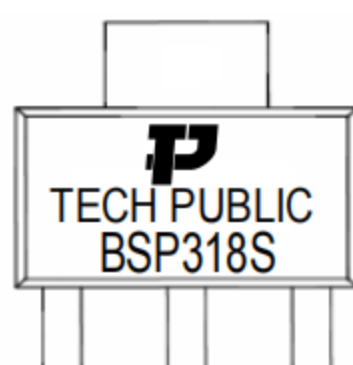
### Application

- Load/Power Switching
- Interfacing Switching
- Logic Level Shift

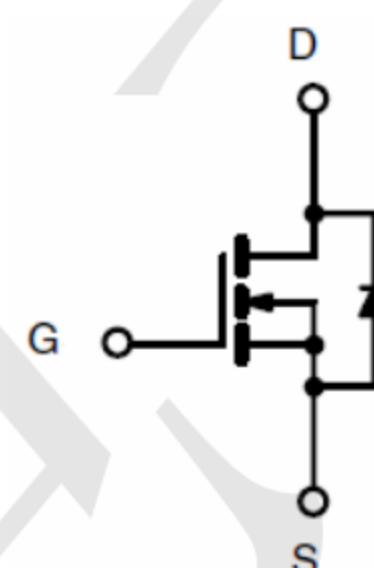
### Package and Pin Configuration



Marking:



### Circuit diagram



### ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ C$ unless otherwise noted

| Parameter                             | Symbol         | Limit      | Units      |
|---------------------------------------|----------------|------------|------------|
| Drain-Source Voltage                  | $V_{DS}$       | 60         | V          |
| Gate-Source Voltage                   | $V_{GS}$       | $\pm 20$   | V          |
| Drain Current-Continuous              | $I_D$          | 4          | A          |
| Drain Current-Pulsed <sup>a</sup>     | $I_{DM}$       | 20         | A          |
| Maximum Power Dissipation             | $P_D$          | 3          | W          |
| Operating and Store Temperature Range | $T_J, T_{stg}$ | -55 to 150 | $^\circ C$ |

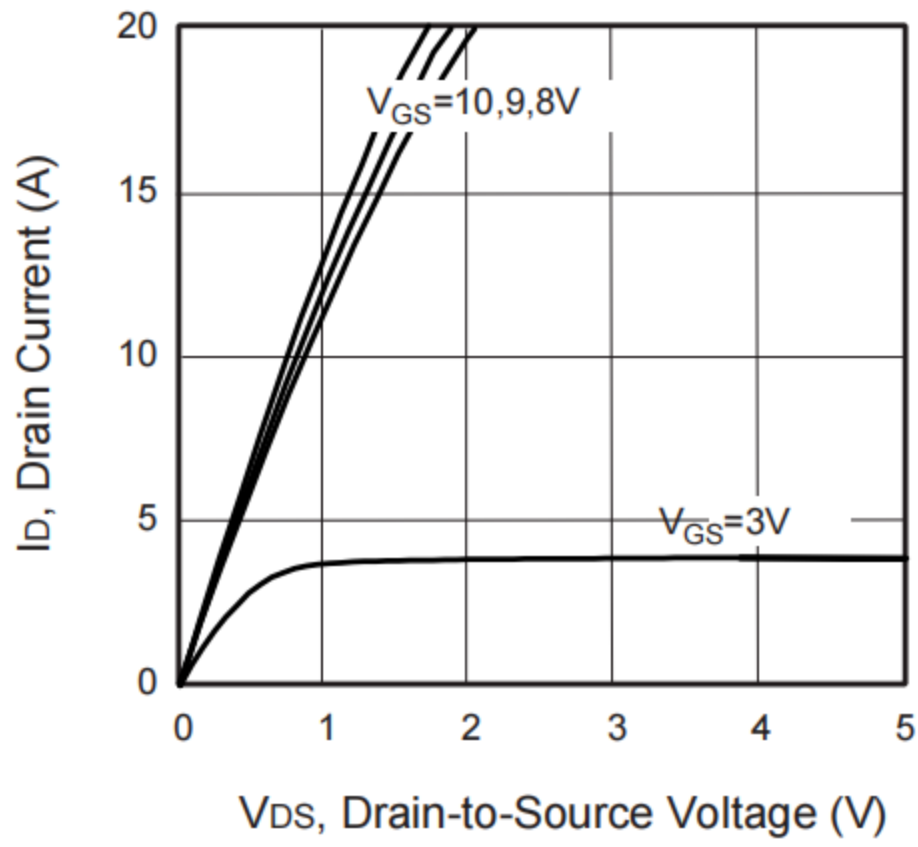
### Thermal Characteristics

| Parameter  | Symbol          | Limit | Units        |
|--|-----------------|-------|--------------|
| Thermal Resistance, Junction-to-Ambient <sup>b</sup> | $R_{\theta JA}$ | 42    | $^\circ C/W$ |

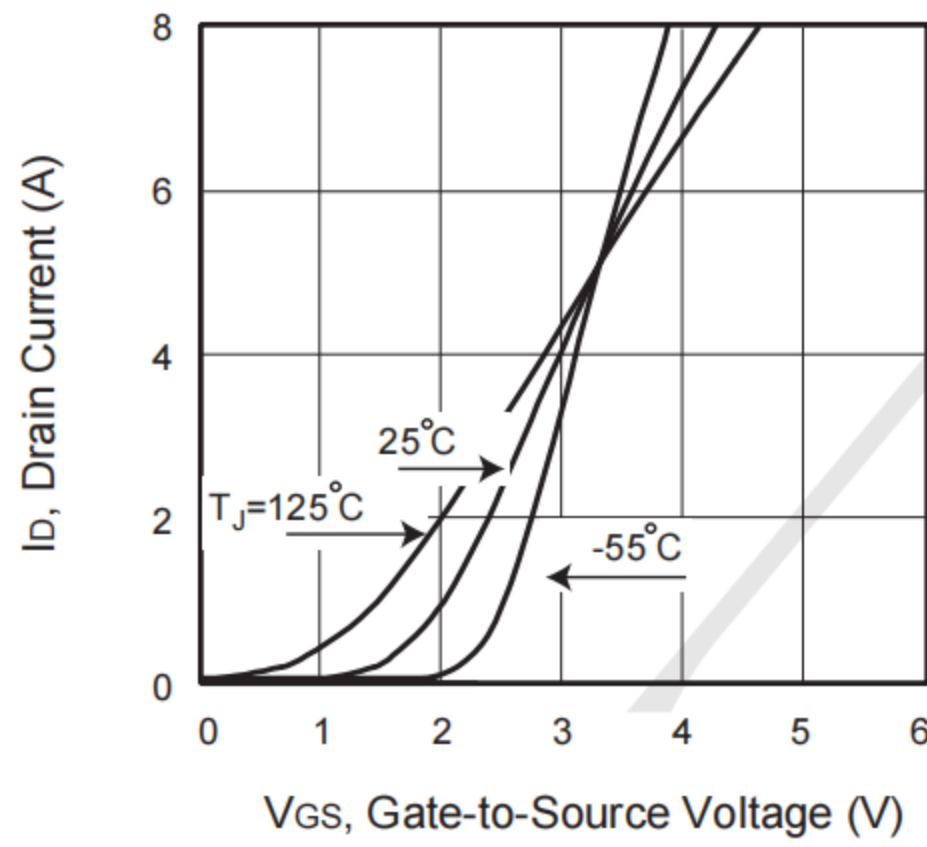
### Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

| Parameter   | Symbol       | Test Condition  | Min | Typ | Max  | Units     |
|---|--------------|---|-----|-----|------|-----------|
| <b>Off Characteristics</b>                                    |              |   |     |     |      |           |
| Drain-Source Breakdown Voltage                                | $BV_{DSS}$   | $V_{GS} = 0V, I_D = 250\mu A$                             | 60  |     |      | V         |
| Zero Gate Voltage Drain Current                               | $I_{DSS}$    | $V_{DS} = 60V, V_{GS} = 0V$                               |     |     | 1    | $\mu A$   |
| Gate Body Leakage Current, Forward                            | $I_{GSSF}$   | $V_{GS} = 20V, V_{DS} = 0V$                               |     |     | 100  | nA        |
| Gate Body Leakage Current, Reverse                            | $I_{GSSR}$   | $V_{GS} = -20V, V_{DS} = 0V$                              |     |     | -100 | nA        |
| <b>On Characteristics</b>                                     |              |   |     |     |      |           |
| Gate Threshold Voltage  | $V_{GS(th)}$ | $V_{GS} = V_{DS}, I_D = 250\mu A$                         | 1   |     | 3    | V         |
| Static Drain-Source On-Resistance                             | $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 2A$                                  |     |     | 85   | $m\Omega$ |
|   |              | $V_{GS} = 4.5V, I_D = 1.5A$                               |     |     | 100  | $m\Omega$ |
| <b>Dynamic Characteristics<sup>d</sup></b>                    |              |   |     |     |      |           |
| Input Capacitance   | $C_{iss}$    | $V_{DS} = 25V, V_{GS} = 0V, f = 1.0\text{ MHz}$           |     | 530 |      | pF        |
| Output Capacitance  | $C_{oss}$    |   |     | 70  |      | pF        |
| Reverse Transfer Capacitance                                  | $C_{rss}$    |   |     | 50  |      | pF        |
| <b>Switching Characteristics<sup>d</sup></b>                  |              |   |     |     |      |           |
| Turn-On Delay Time  | $t_{d(on)}$  | $V_{DD} = 30V, I_D = 1A, V_{GS} = 10V, R_{GEN} = 6\Omega$ |     | 9   | 18   | ns        |
| Turn-On Rise Time   | $t_r$        |   |     | 4   | 8    | ns        |
| Turn-Off Delay Time   | $t_{d(off)}$ |   |     | 28  | 56   | ns        |
| Turn-Off Fall Time  | $t_f$        |   |     | 3   | 6    | ns        |
| Total Gate Charge   | $Q_g$        | $V_{DS} = 30V, I_D = 4.5A, V_{GS} = 10V$                  |     | 13  | 17   | nC        |
| Gate-Source Charge  | $Q_{gs}$     |   |     | 1   |      | nC        |
| Gate-Drain Charge   | $Q_{gd}$     |   |     | 4   |      | nC        |
| <b>Drain-Source Diode Characteristics and Maximun Ratings</b> |              |   |     |     |      |           |
| Drain-Source Diode Forward Current <sup>b</sup>               | $I_S$        |   |     |     | 2.5  | A         |
| Drain-Source Diode Forward Voltage <sup>c</sup>               | $V_{SD}$     | $V_{GS} = 0V, I_S = 2.5A$                                 |     |     | 1.1  | V         |

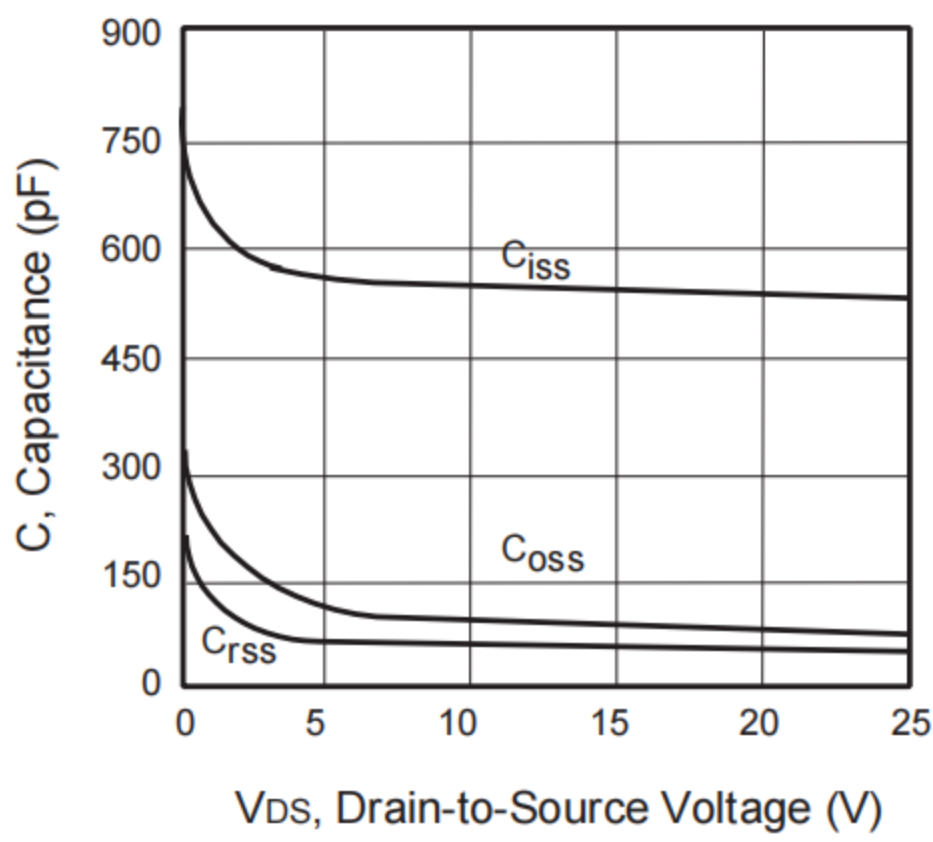
**Typical Electrical and Thermal Characteristics**



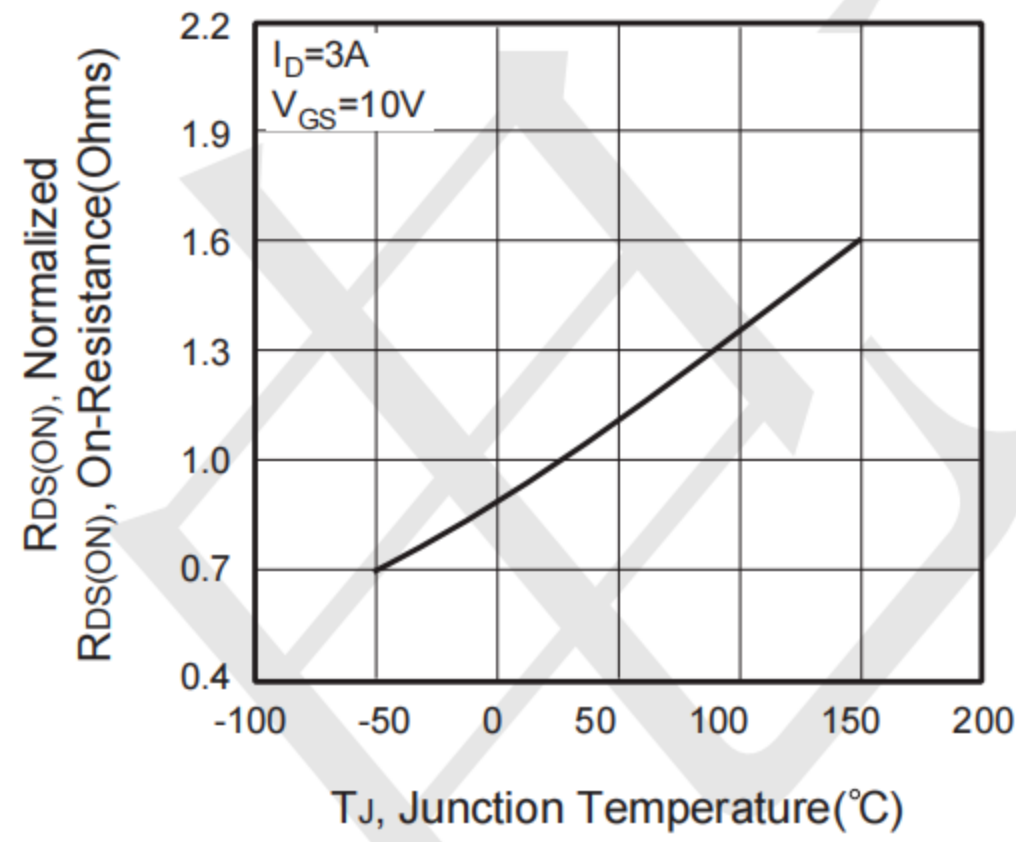
**Figure 1. Output Characteristics**



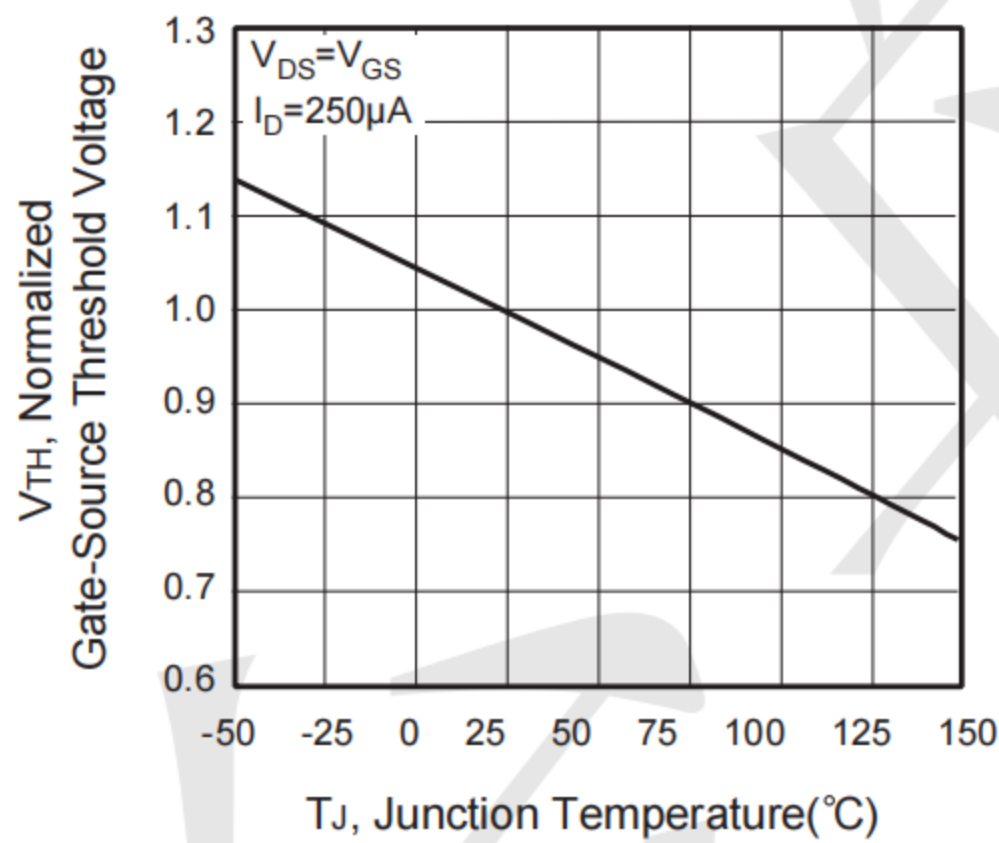
**Figure 2. Transfer Characteristics**



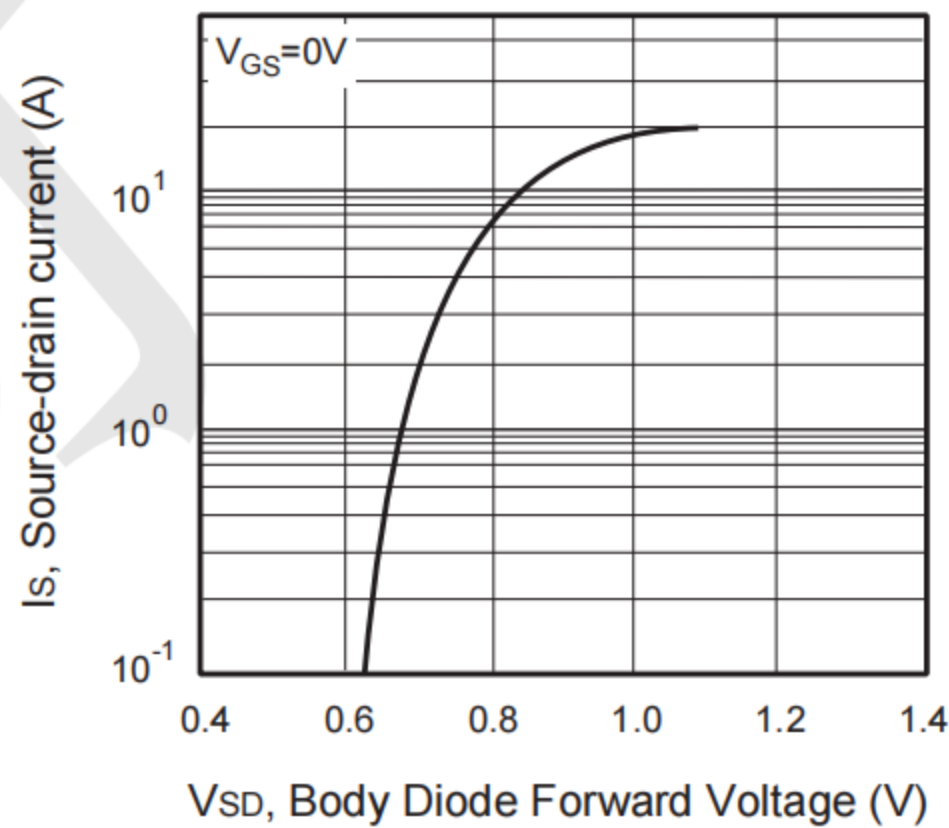
**Figure 3. Capacitance**



**Figure 4. On-Resistance Variation with Temperature**



**Figure 5. Gate Threshold Variation with Temperature**



**Figure 6. Body Diode Forward Voltage Variation with Source Current**

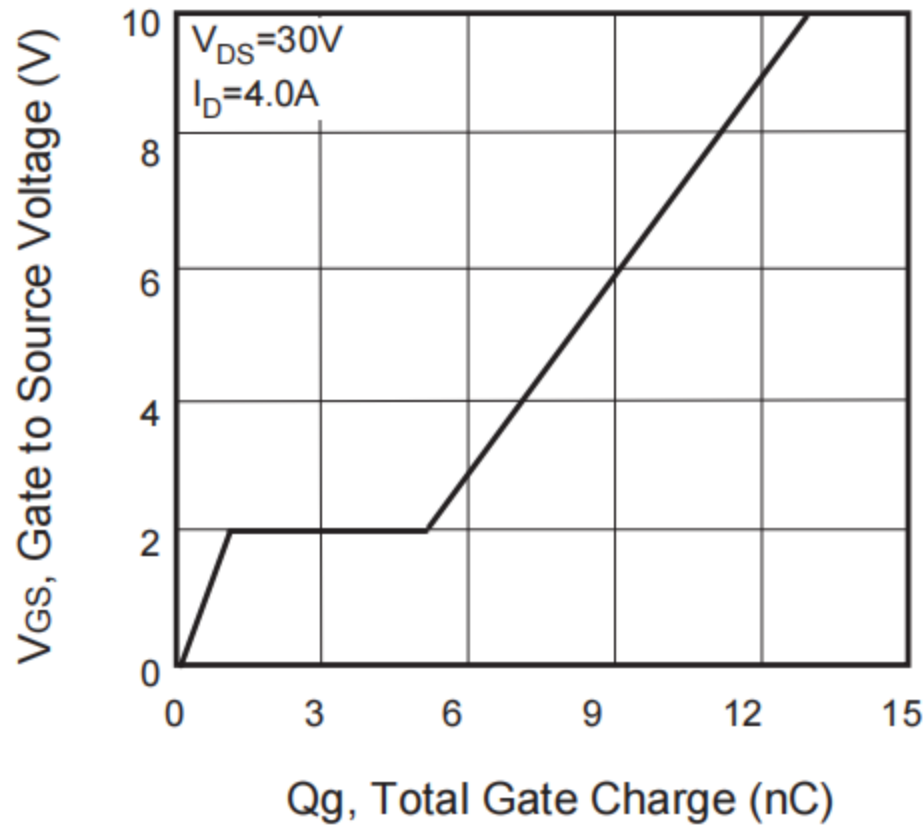


Figure 7. Gate Charge

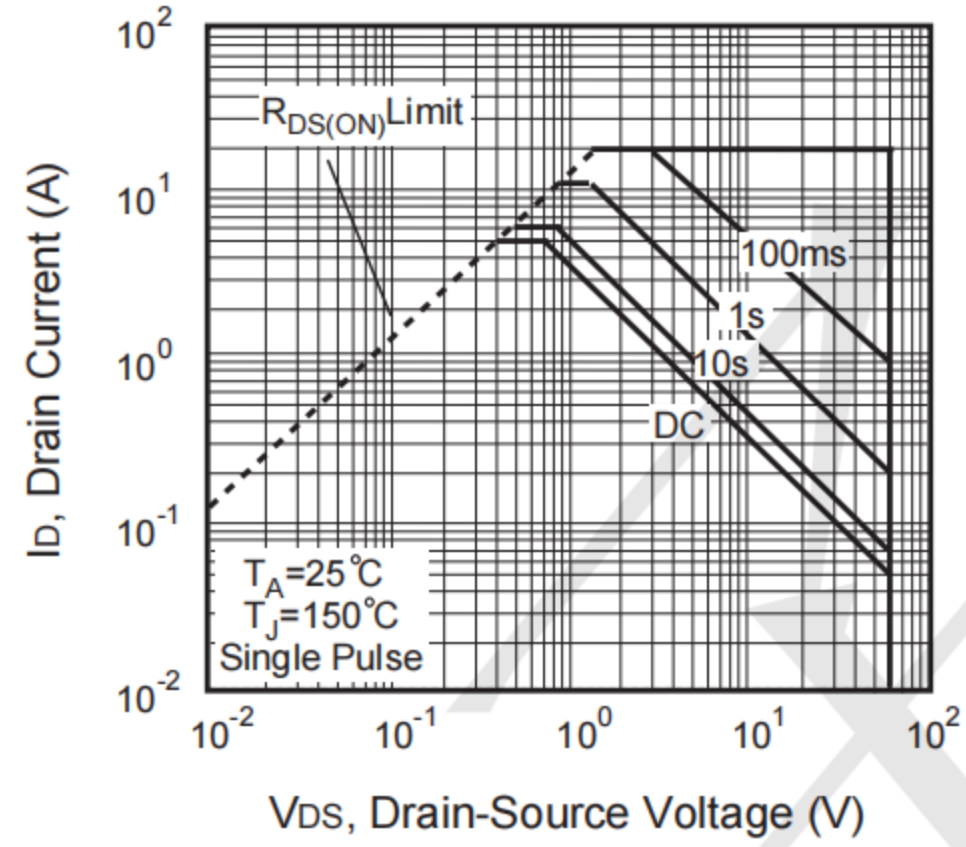


Figure 8. Maximum Safe Operating Area

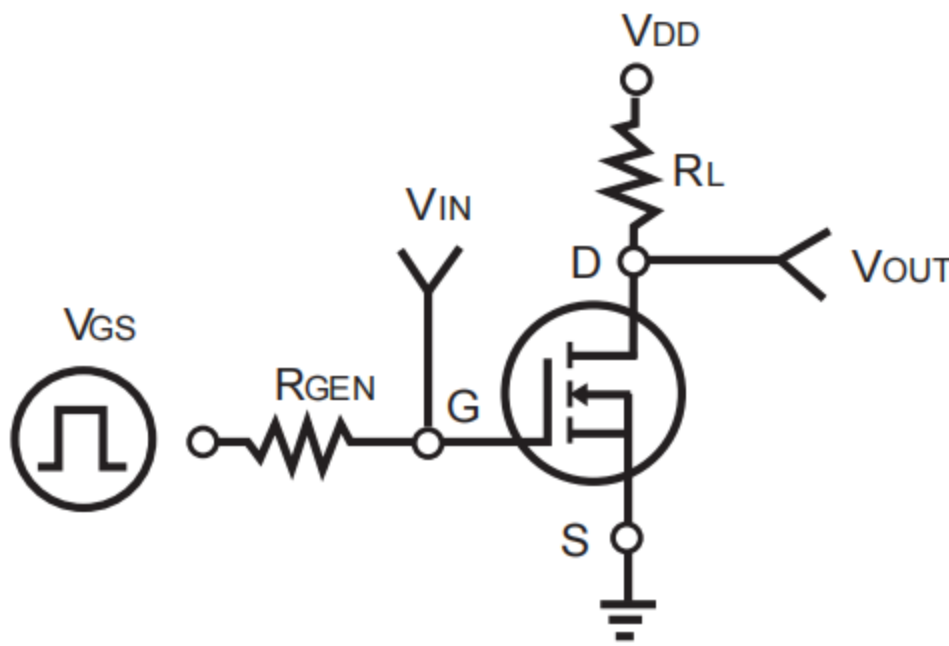


Figure 9. Switching Test Circuit

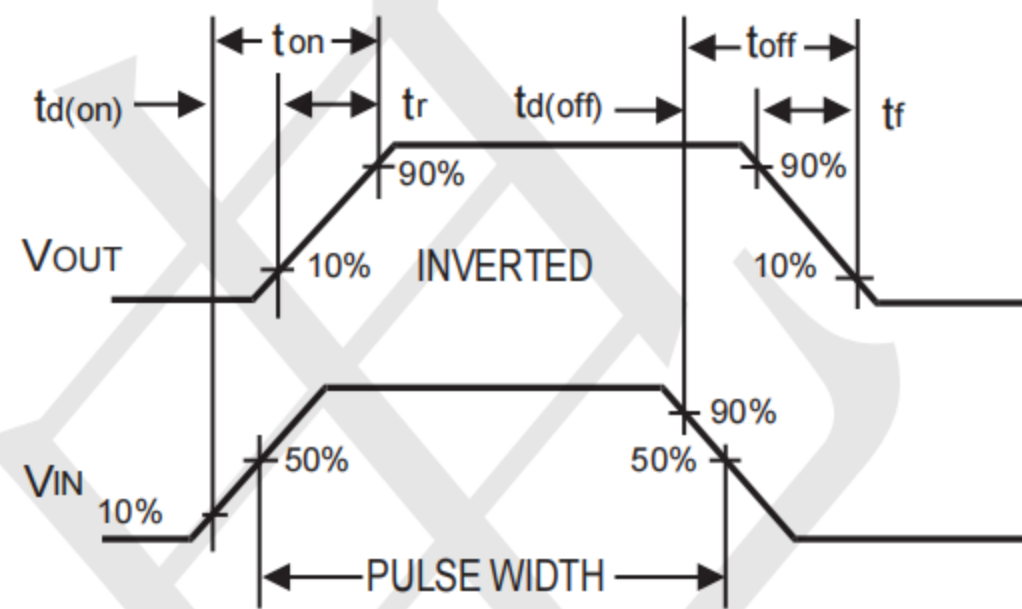


Figure 10. Switching Waveforms

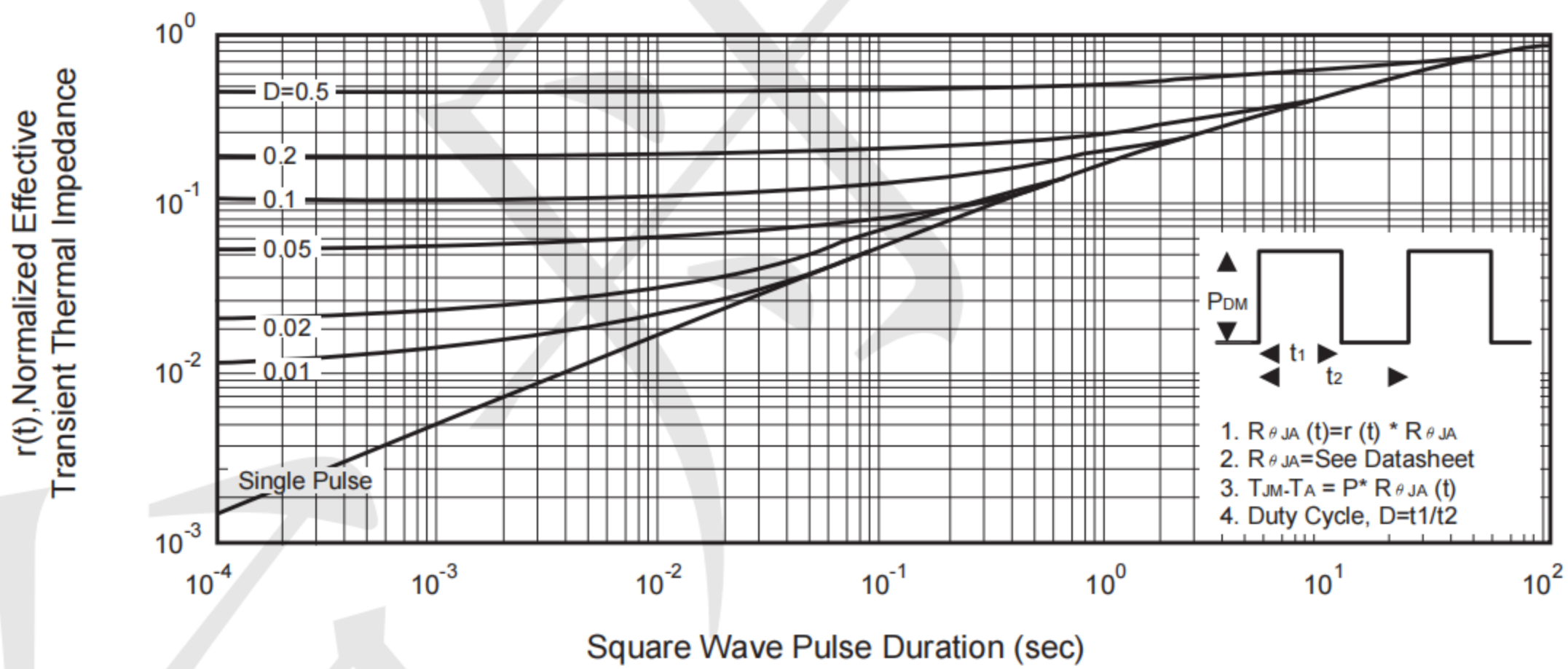
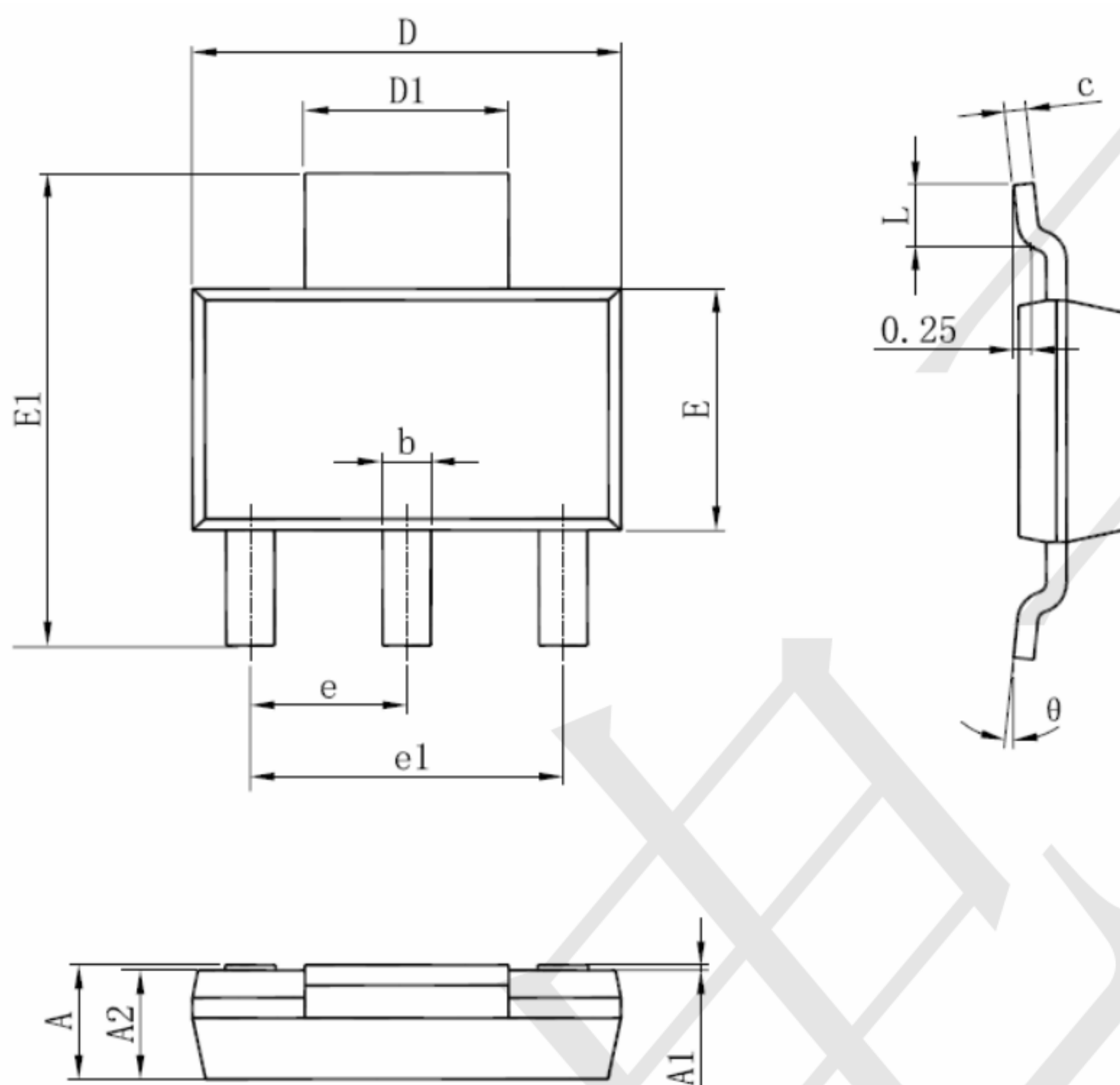


Figure 11. Normalized Thermal Transient Impedance Curve



SOT-223 Package Information



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min                       | Max   | Min                  | Max   |
| A        | 1.520                     | 1.800 | 0.060                | 0.071 |
| A1       | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2       | 1.500                     | 1.700 | 0.059                | 0.067 |
| b        | 0.660                     | 0.820 | 0.026                | 0.032 |
| c        | 0.250                     | 0.350 | 0.010                | 0.014 |
| D        | 6.200                     | 6.400 | 0.244                | 0.252 |
| D1       | 2.900                     | 3.100 | 0.114                | 0.122 |
| E        | 3.300                     | 3.700 | 0.130                | 0.146 |
| E1       | 6.830                     | 7.070 | 0.269                | 0.278 |
| e        | 2.300(BSC)                |       | 0.091(BSC)           |       |
| e1       | 4.500                     | 4.700 | 0.177                | 0.185 |
| L        | 0.900                     | 1.150 | 0.035                | 0.045 |
| $\theta$ | 0°                        | 10°   | 0°                   | 10°   |

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