

### Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)MAX}$ | $I_D$ |
|---------------|-----------------|-------|
| 60V           | 44mΩ@10V        | 5A    |
|               | 49mΩ@4.5V       |       |

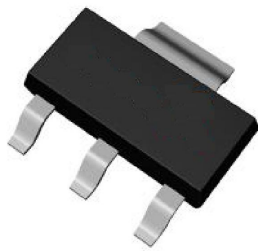
### Feature

- Trench power MV MOSFET technology
- High density cell design for low  $R_{DS(on)}$
- Suffix "-Q1" for AEC-Q101

### Application

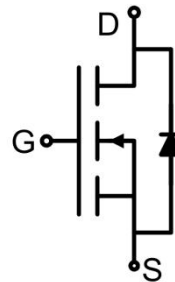
- PWM application
- Load switch
- Battery protection

### Package

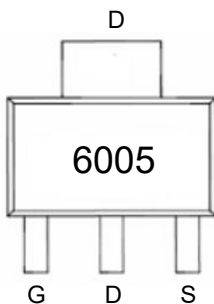


SOT-223

### Circuit diagram



### Marking



### Absolute maximum ratings( $T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter  | Symbol                  | Value      | Unit                      |
|--|-------------------------|------------|---------------------------|
| Drain-Source Voltage                                 | $V_{DS}$                | 60         | V                         |
| Gate-Source Voltage                                  | $V_{GS}$                | $\pm 20$   | V                         |
| Continuous Drain Current                             | $I_D$                   | 5          | A                         |
| Continuous Drain Current ( $T_A=70^\circ\text{C}$ )  | $I_D(70^\circ\text{C})$ | 4          | A                         |
| Pulsed Drain Current <sup>1)</sup>                   | $I_{DM}$                | 25         | A                         |
| Power Dissipation                                    | $P_D$                   | 2.5        | W                         |
| Thermal Resistance Junction to Ambient <sup>2)</sup> | $R_{\theta JA}$         | 50         | $^\circ\text{C}/\text{W}$ |
| Operating Junction Temperature                       | $T_J$                   | -55 ~ +150 | $^\circ\text{C}$          |
| Storage Temperature                                  | $T_{STG}$               | -55 ~ +150 | $^\circ\text{C}$          |

### Electrical characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)

| Parameter                                   | Symbol        | Test Condition   | Min. | Typ. | Max.      | Unit          |
|---|---------------|--|------|------|-----------|---------------|
| <b>Static Characteristics</b>               |               |  |      |      |           |               |
| Drain-source breakdown voltage              | $V_{(BR)DSS}$ | $V_{GS}=0\text{V}, I_D=250\mu\text{A}$                                 | 60   |      |           | V             |
| Zero gate voltage drain current             | $I_{DSS}$     | $V_{DS}=60\text{V}, V_{GS}=0\text{V}$                                  |      |      | 1         | $\mu\text{A}$ |
| Gate-body leakage current                   | $I_{GSS}$     | $V_{DS}=0\text{V}, V_{GS}=\pm 20\text{V}$                              |      |      | $\pm 100$ | nA            |
| Gate threshold voltage                      | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=250\mu\text{A}$                                    | 1    | 1.5  | 2.5       | V             |
| Drain-source on-resistance                  | $R_{DS(on)}$  | $V_{GS}=10\text{V}, I_D=5.0\text{A}$                                   |      | 35   | 44        | m $\Omega$    |
|   |               | $V_{GS}=4.5\text{V}, I_D=4.0\text{A}$                                  |      | 39   | 49        |               |
| <b>Dynamic characteristics<sup>3)</sup></b> |               |  |      |      |           |               |
| Input Capacitance                           | $C_{iss}$     | $V_{DS}=30\text{V}, V_{GS}=0\text{V}, f=1\text{MHz}$                   |      | 1018 |           | pF            |
| Output Capacitance                          | $C_{oss}$     |  | 70   |      |           |               |
| Reverse Transfer Capacitance                | $C_{rss}$     |  | 62   |      |           |               |
| Total Gate Charge                           | $Q_g$         | $V_{DS}=30\text{V}, V_{GS}=10\text{V}, I_D=10\text{A}$                 |      | 26   |           | nC            |
| Gate-Source Charge                          | $Q_{gs}$      |  | 5.4  |      |           |               |
| Gate-Drain Charge                           | $Q_{gd}$      |  | 6.5  |      |           |               |
| Turn-on delay time                          | $t_{d(on)}$   | $V_{DS}=30\text{V}, V_{GS}=10\text{V}, I_D=2\text{A}$<br>$R_G=3\Omega$ |      | 10   |           | nS            |
| Turn-on rise time                           | $t_r$         |  | 20   |      |           |               |
| Turn-off delay time                         | $t_{d(off)}$  |  | 29   |      |           |               |
| Turn-off fall time                          | $t_f$         |  | 21   |      |           |               |
| <b>Source-Drain Diode characteristics</b>   |               |  |      |      |           |               |
| Diode Continuous Current                    | $I_S$         |  |      |      | 5         | A             |
| Diode Forward voltage                       | $V_{SD}$      | $V_{GS}=0\text{V}, I_S=5\text{A}$                                      |      |      | 1.2       | V             |
| Reverse recover time                        | $T_{rr}$      | $I_S=20\text{A}, di/dt=-500\text{A}/\mu\text{s}$                       |      | 23   |           | nS            |
| Reverse recovery charge                     | $Q_{rr}$      |  | 11.7 |      | nC        |               |

Notes:

- 1) Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
- 2)  $R_{\theta JA}$  is the sum of the junction-to-lead and lead-to-ambient thermal resistance, where the lead thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JL}$  is guaranteed by design, while  $R_{\theta JA}$  is determined by the board design. The maximum rating presented here is based on mounting on a 1 in 2 pad of 2oz copper.
- 3) Guaranteed by design, not subject to production testing.

## Typical Characteristics

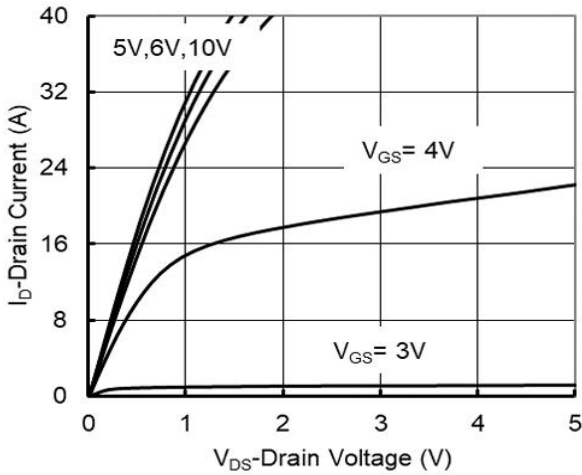


Figure 1. Output Characteristics

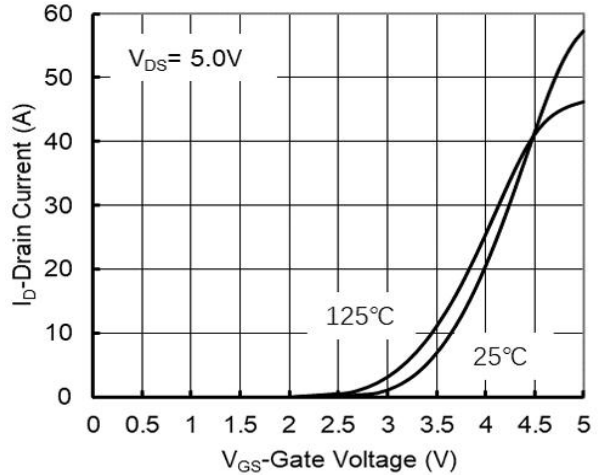


Figure 2. Transfer Characteristics

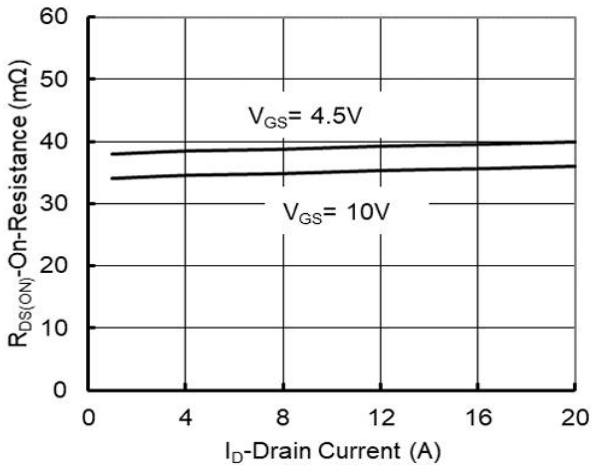


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

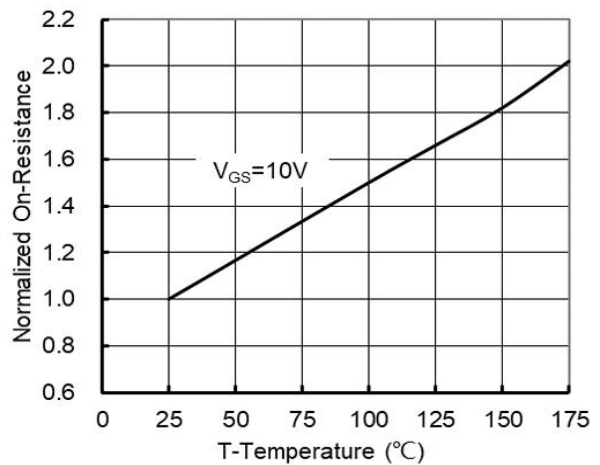


Figure 4. On-Resistance vs. Junction Temperature

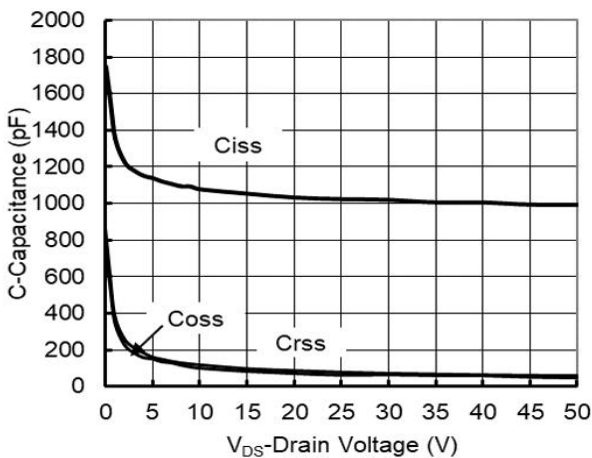


Figure 5. Capacitance Characteristics

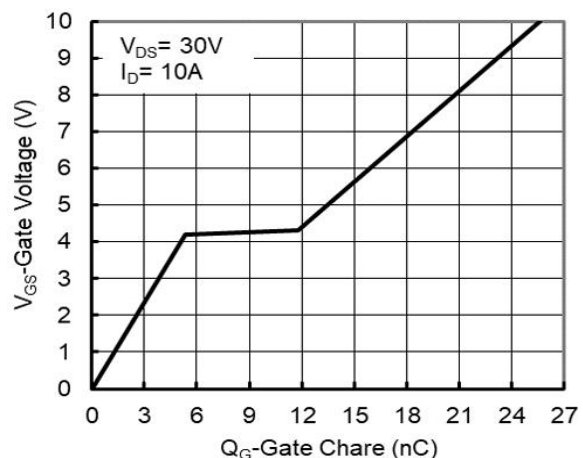


Figure 6. Gate Charge

## Typical Characteristics

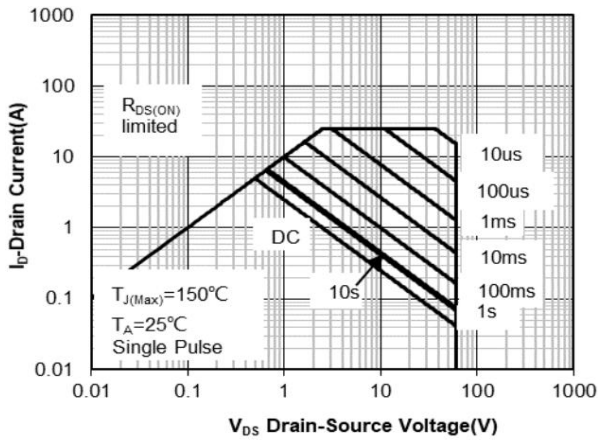


Figure 7. Safe Operation Area

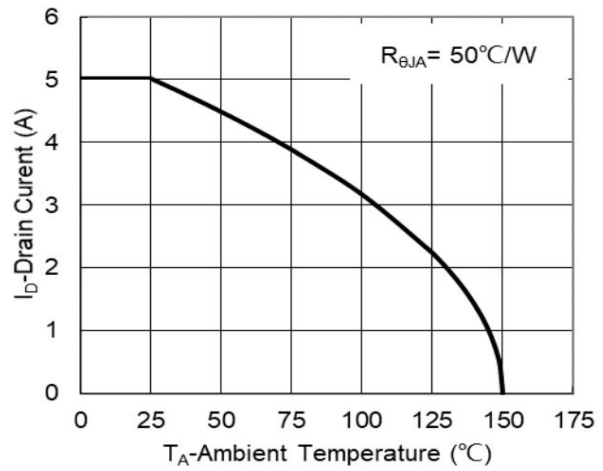


Figure 8. Maximum Continuous Drain Current vs Ambient Temperature

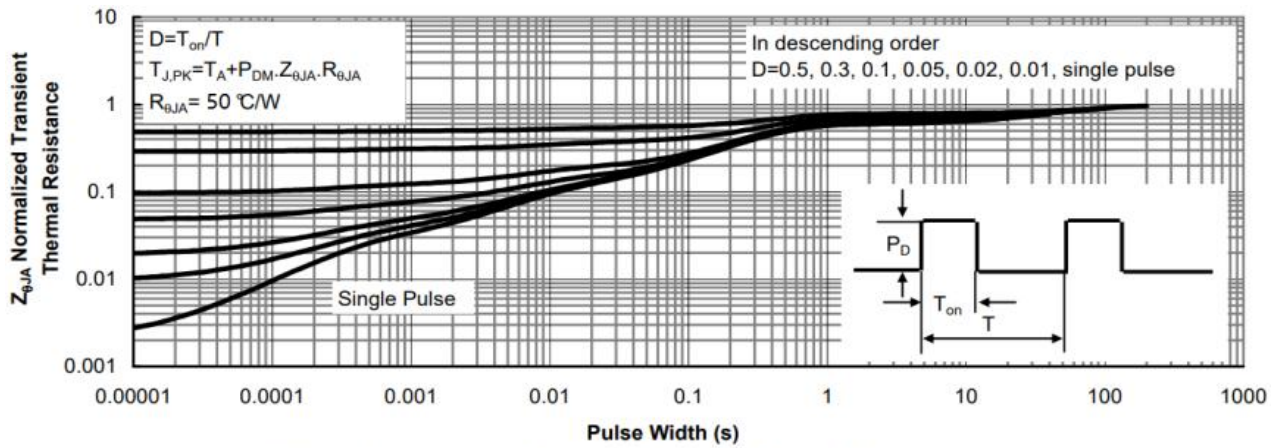
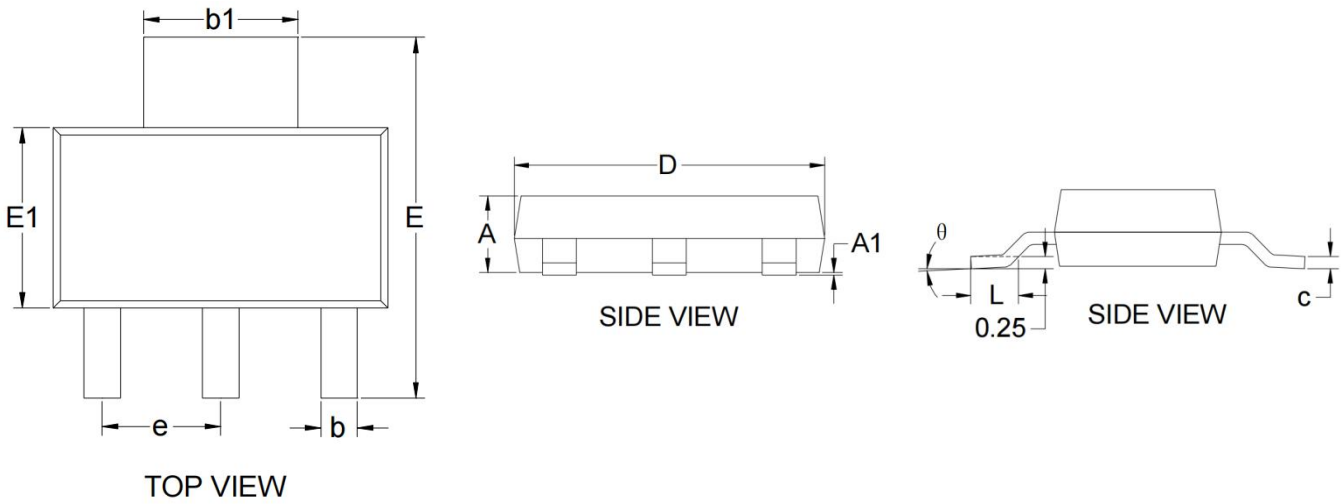


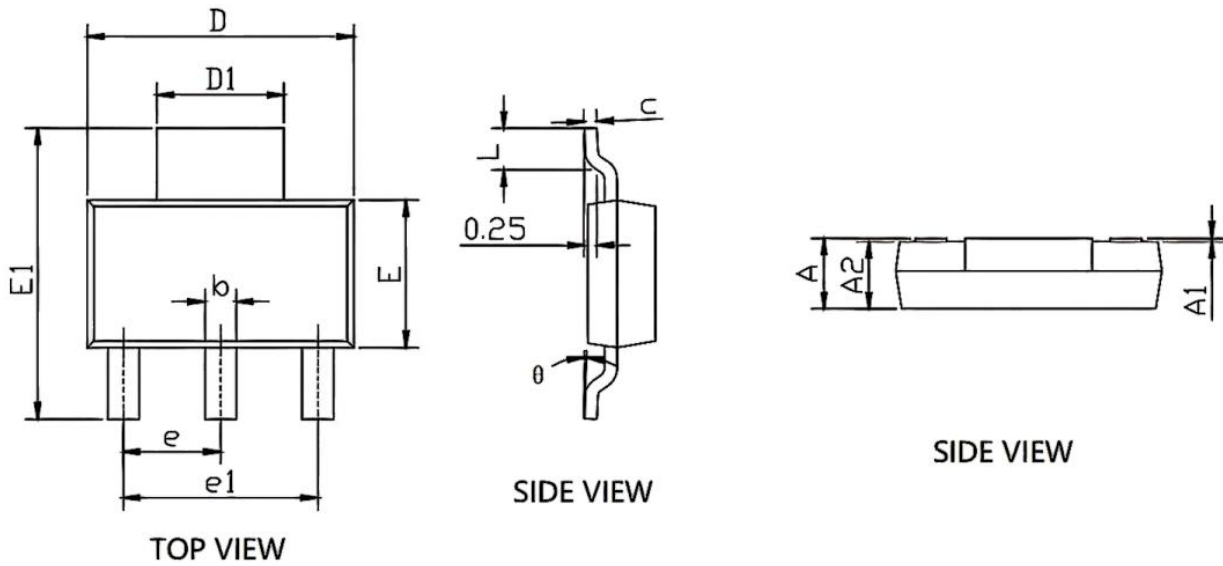
Figure 9. Normalized Maximum Transient Thermal Impedance

### SOT-223 Type A Package Information



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min.                      | Max.  | Min.                 | Max.  |
| A        | 1.500                     | 1.700 | 0.059                | 0.067 |
| A1       | 0.020                     | 0.100 | 0.000                | 0.004 |
| b        | 0.660                     | 0.840 | 0.026                | 0.033 |
| b1       | 2.900                     | 3.100 | 0.114                | 0.122 |
| c        | 0.230                     | 0.350 | 0.009                | 0.014 |
| D        | 6.300                     | 6.700 | 0.248                | 0.264 |
| E        | 6.700                     | 7.300 | 0.264                | 0.287 |
| E1       | 3.300                     | 3.700 | 0.130                | 0.146 |
| e        | 2.200                     | 2.400 | 0.087                | 0.094 |
| L        | 0.750                     | 1.250 | 0.030                | 0.049 |
| $\theta$ | 0°                        | 10°   | 0°                   | 10°   |

### SOT-223 Type B 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°   |