

### Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)MAX}$ | $I_D$ | $V_{(BR)DSS}$ | $R_{DS(on)MAX}$ | $I_D$  |
|---------------|-----------------|-------|---------------|-----------------|--------|
| 60V           | 1.15Ω@10V       | 0.32A | -60V          | 3.5Ω@-10V       | -0.19A |
|               | 1.35Ω@4.5V      |       |               | 4.3Ω@-4.5V      |        |

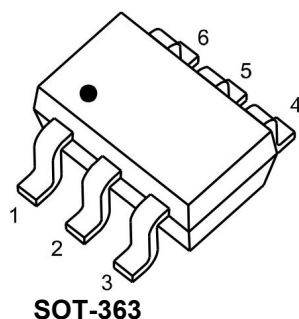
### Feature

- Voltage controlled small signal switch
- Low  $R_{DS(ON)}$
- Low Gate Charge
- Suffix "-Q1" for AEC-Q101

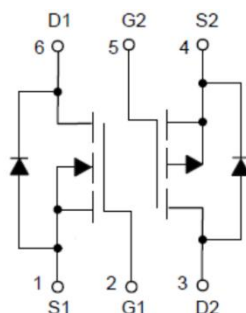
### Application

- Video monitor
- Power management

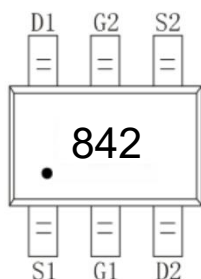
### Package



### Circuit diagram



### Marking



### Absolute maximum ratings (Ta=25°C unless otherwise noted)

| Parameter                                                        | Symbol                   | N-Channel  | p-Channel  | Unit |
|------------------------------------------------------------------|--------------------------|------------|------------|------|
| Drain-Source Voltage                                             | $V_{DS}$                 | 60         | -60        | V    |
| Gate-Source Voltage                                              | $V_{GS}$                 | $\pm 20$   | $\pm 20$   | V    |
| Continuous Drain Current <sup>1,2)</sup>                         | $I_D$                    | 0.32       | -0.19      | A    |
| Continuous Drain Current <sup>1,2)</sup> (T <sub>A</sub> =100°C) | $I_D(100^\circ\text{C})$ | 0.2        | -0.12      | A    |
| Pulsed Drain Current (t <sub>p</sub> ≤10us)                      | $I_{DM}$                 | 2          | -1         | A    |
| Power Dissipation <sup>1,2)</sup>                                | $P_D$                    | 0.25       | 0.25       | W    |
| Thermal Resistance, Junction-to-Ambient <sup>2)</sup>            | $R_{\theta JA}$          | 500        | 500        | °C/W |
| Junction Temperature                                             | $T_J$                    | 150        | 150        | °C   |
| Storage Temperature                                              | $T_{STG}$                | -55 ~ +150 | -55 ~ +150 | °C   |

### N-CH Electrical characteristics (T<sub>J</sub>=25°C, unless otherwise noted)

| Parameter                             | Symbol               | Test Condition                                                                          | Min. | Typ. | Max. | Unit |
|---------------------------------------|----------------------|-----------------------------------------------------------------------------------------|------|------|------|------|
| Static Characteristics                |                      |                                                                                         |      |      |      |      |
| Drain-source breakdown voltage        | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0V, I <sub>D</sub> =250μA                                             | 60   |      |      | V    |
| Zero gate voltage drain current       | I <sub>DSS</sub>     | V <sub>DS</sub> =60V,V <sub>GS</sub> = 0V                                               |      |      | 1    | μA   |
|                                       |                      | V <sub>DS</sub> =60V,V <sub>GS</sub> = 0V,T <sub>J</sub> =150°C                         |      |      | 100  |      |
| Gate-body leakage current             | I <sub>GSS</sub>     | V <sub>GS</sub> =±20V, V <sub>DS</sub> = 0V                                             |      |      | ±100 | nA   |
| Gate threshold voltage                | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 1.1  | 1.6  | 2.1  | V    |
| Drain-source on-resistance            | R <sub>DS(on)</sub>  | V <sub>GS</sub> =10V, I <sub>D</sub> =0.3A                                              |      | 0.87 | 1.15 | Ω    |
|                                       |                      | V <sub>GS</sub> =4.5V, I <sub>D</sub> =0.2A                                             |      | 1    | 1.35 |      |
| Dynamic characteristics <sup>3)</sup> |                      |                                                                                         |      |      |      |      |
| Input Capacitance                     | C <sub>iSS</sub>     | V <sub>DS</sub> =30V,V <sub>GS</sub> =0V,f =1MHz                                        |      | 35.6 |      | pF   |
| Output Capacitance                    | C <sub>oSS</sub>     |                                                                                         |      | 3.4  |      |      |
| Reverse Transfer Capacitance          | C <sub>rSS</sub>     |                                                                                         |      | 2.1  |      |      |
| Total Gate Charge                     | Q <sub>g</sub>       | V <sub>DS</sub> =30V,V <sub>GS</sub> =10V, I <sub>D</sub> =0.3A                         |      | 1.24 |      | nC   |
| Gtae-Source Charge                    | Q <sub>gs</sub>      |                                                                                         |      | 0.24 |      |      |
| Gtae-Drain Charge                     | Q <sub>gd</sub>      |                                                                                         |      | 0.36 |      |      |
| Gate Resistance                       | R <sub>g</sub>       | f=1MHz                                                                                  |      | 5.3  |      | Ω    |
| Turn-on delay time                    | t <sub>d(on)</sub>   | V <sub>DS</sub> =30V,V <sub>GS</sub> =10V,<br>I <sub>D</sub> =0.3A,R <sub>GEN</sub> =3Ω |      | 2.7  |      | nS   |
| Turn-on rise time                     | t <sub>r</sub>       |                                                                                         |      | 2.8  |      |      |
| Turn-off delay time                   | t <sub>d(off)</sub>  |                                                                                         |      | 5.4  |      |      |
| Turn-off fall time                    | t <sub>f</sub>       |                                                                                         |      | 73   |      |      |
| Source-Drain Diode characteristics    |                      |                                                                                         |      |      |      |      |
| Diode Forward Current                 | I <sub>S</sub>       | T <sub>A</sub> =25°C                                                                    |      |      | 0.3  | A    |
| Diode Forward voltage                 | V <sub>SD</sub>      | V <sub>GS</sub> =0V, I <sub>S</sub> =0.3A                                               |      |      | 1.2  | V    |
| Reverse Recovery Charge               | Q <sub>rr</sub>      | V <sub>GS</sub> =0V, I <sub>F</sub> =0.3A,<br>V <sub>R</sub> =30V, di/dt =100A/us       |      | 4    |      | nC   |
| Reverse Recovery Time                 | t <sub>rr</sub>      |                                                                                         |      | 10.6 |      | nS   |

**P-CH Electrical characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)**

| Parameter                             | Symbol               | Test Condition                                                                             | Min. | Typ. | Max.  | Unit |
|---------------------------------------|----------------------|--------------------------------------------------------------------------------------------|------|------|-------|------|
| Static Characteristics                |                      |                                                                                            |      |      |       |      |
| Drain-source breakdown voltage        | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0V, I <sub>D</sub> =-250μA                                               | -60  |      |       | V    |
| Zero gate voltage drain current       | I <sub>DSS</sub>     | V <sub>DS</sub> =-60V,V <sub>GS</sub> = 0V                                                 |      |      | -1    | μA   |
|                                       |                      | V <sub>DS</sub> =-60V,V <sub>GS</sub> = 0V,T <sub>J</sub> =150°C                           |      |      | -100  |      |
| Gate-body leakage current             | I <sub>GSS</sub>     | V <sub>GS</sub> =±20V, V <sub>DS</sub> = 0V                                                |      |      | ±100  | nA   |
| Gate threshold voltage                | V <sub>GS(th)</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                                  | -0.9 | -1.4 | -1.9  | V    |
| Drain-source on-resistance            | R <sub>DS(on)</sub>  | V <sub>GS</sub> =-10V, I <sub>D</sub> =-0.1A                                               |      | 2.7  | 3.5   | Ω    |
|                                       |                      | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-0.1A                                              |      | 3.2  | 4.3   |      |
| Dynamic characteristics <sup>3)</sup> |                      |                                                                                            |      |      |       |      |
| Input Capacitance                     | C <sub>iss</sub>     | V <sub>DS</sub> =-30V,V <sub>GS</sub> =0V,f =1MHz                                          |      | 22.6 |       | pF   |
| Output Capacitance                    | C <sub>oss</sub>     |                                                                                            |      | 3.2  |       |      |
| Reverse Transfer Capacitance          | C <sub>rss</sub>     |                                                                                            |      | 1.5  |       |      |
| Total Gate Charge                     | Q <sub>g</sub>       | V <sub>DS</sub> =-30V,V <sub>GS</sub> =-10V,<br>I <sub>D</sub> =-0.1A                      |      | 2.45 |       | nC   |
| Gtae-Source Charge                    | Q <sub>gs</sub>      |                                                                                            |      | 0.45 |       |      |
| Gtae-Drain Charge                     | Q <sub>gd</sub>      |                                                                                            |      | 0.78 |       |      |
| Gate Resistance                       | R <sub>g</sub>       | f=1MHz                                                                                     |      | 31   |       | Ω    |
| Turn-on delay time                    | t <sub>d(on)</sub>   | V <sub>DS</sub> =-30V,V <sub>GS</sub> =-10V,<br>I <sub>D</sub> =-0.1A,R <sub>GEN</sub> =3Ω |      | 0.4  |       | nS   |
| Turn-on rise time                     | t <sub>r</sub>       |                                                                                            |      | 2.3  |       |      |
| Turn-off delay time                   | t <sub>d(off)</sub>  |                                                                                            |      | 4    |       |      |
| Turn-off fall time                    | t <sub>f</sub>       |                                                                                            |      | 60.6 |       |      |
| Source-Drain Diode characteristics    |                      |                                                                                            |      |      |       |      |
| Diode Forward Current                 | I <sub>S</sub>       | T <sub>A</sub> =25°C                                                                       |      |      | -0.19 | A    |
| Diode Forward voltage                 | V <sub>SD</sub>      | V <sub>GS</sub> =0V, I <sub>S</sub> =-0.19A                                                |      |      | -1.2  | V    |
| Reverse Recovery Charge               | Q <sub>rr</sub>      | V <sub>GS</sub> =0V, I <sub>F</sub> =-0.1A,                                                |      | 2.65 |       | nC   |
| Reverse Recovery Time                 | t <sub>rr</sub>      | V <sub>R</sub> =-30V, di/dt =100A/us                                                       |      | 9.8  |       | nS   |

**Notes:**

- 1) The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
- 2) The value of R<sub>θJA</sub> is measured with the device mounted on the 40mm\*40mm\*1.1mm single layer FR-4 PCB board with 1 in2 pad of 2oz. Copper, in the still air environment with T<sub>A</sub> = 25°C. The maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design.
- 3) Guaranteed by design, not subject to production testing.

## N- Channel Typical Characteristics

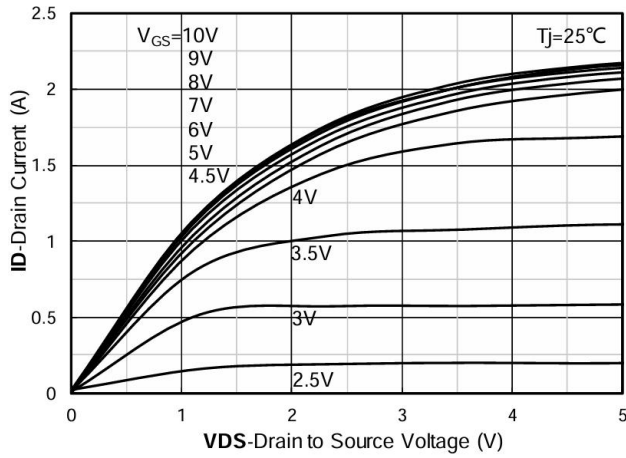


Figure 1. Output Characteristics

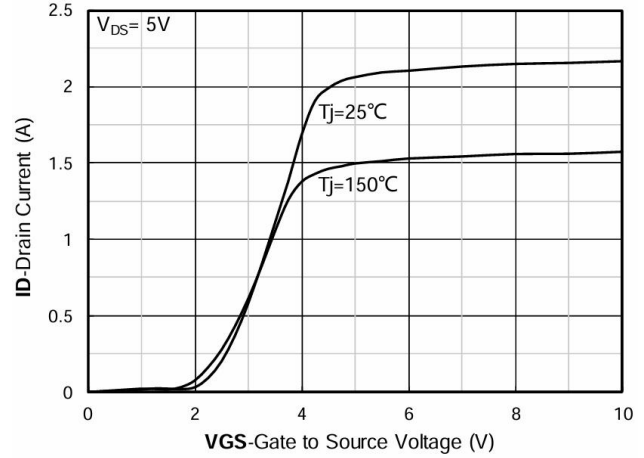


Figure 2. Transfer Characteristics

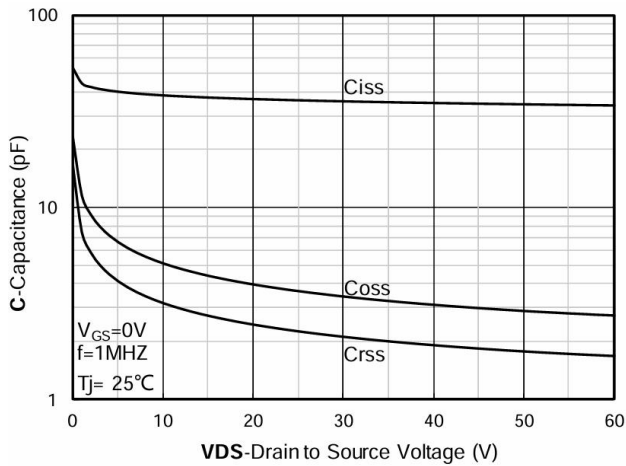


Figure 3. Capacitance Characteristics

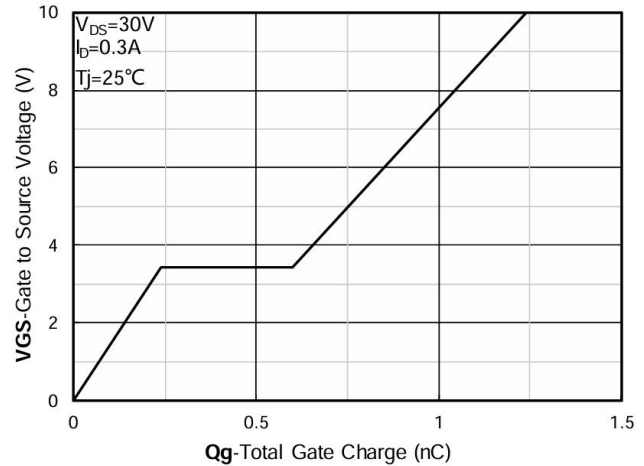


Figure 4. Gate Charge

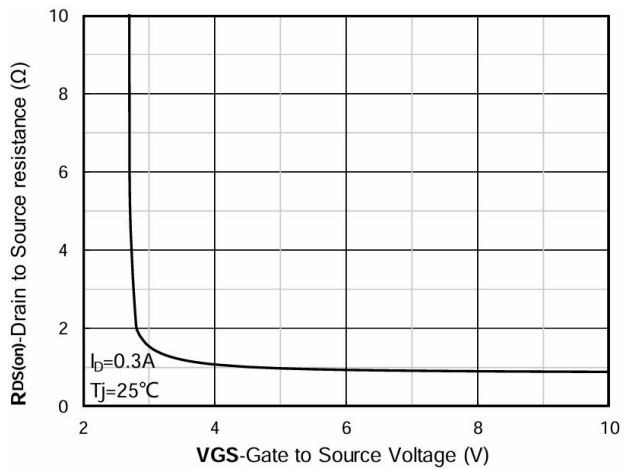


Figure 5. On-Resistance vs. Gate to Source Voltage

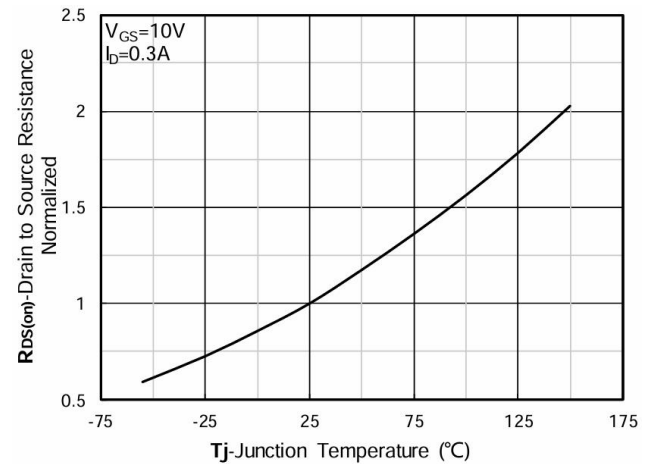


Figure 6. Normalized On-Resistance

## N-Channel Typical Characteristics

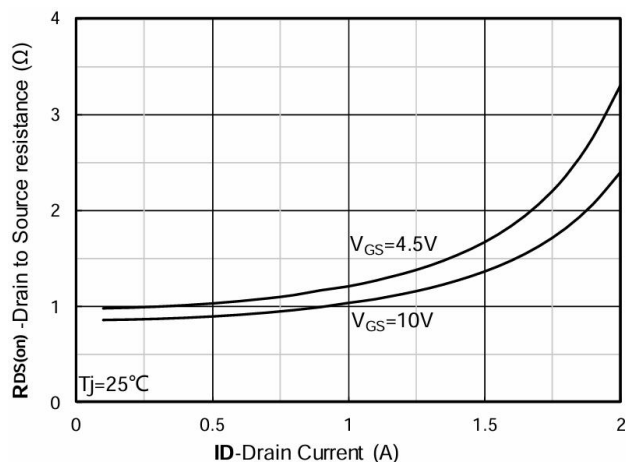


Figure 7.  $R_{DS(on)}$  vs. Drain Current

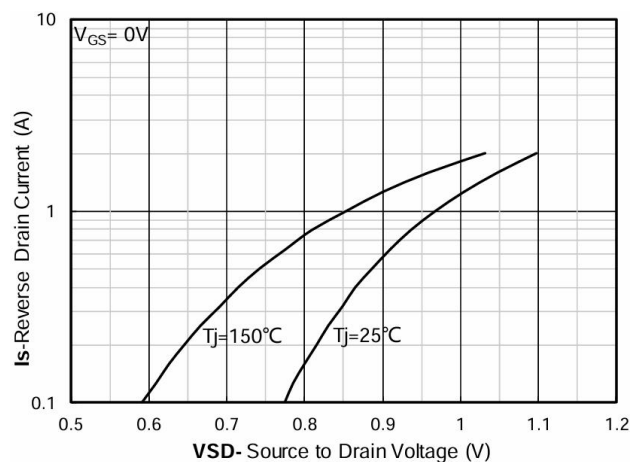


Figure 8. Forward characteristics of reverse diode

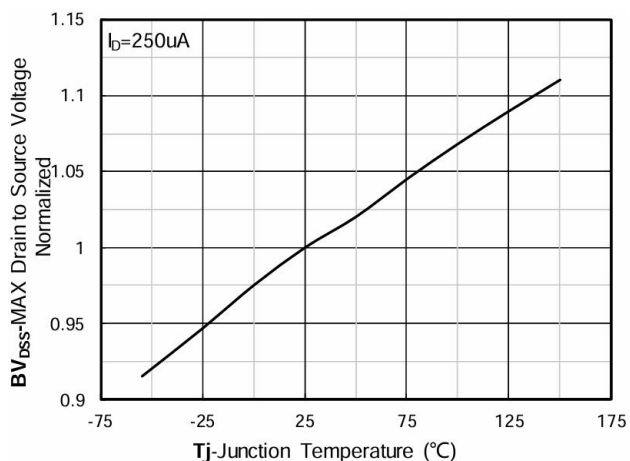


Figure 9. Normalized breakdown voltage

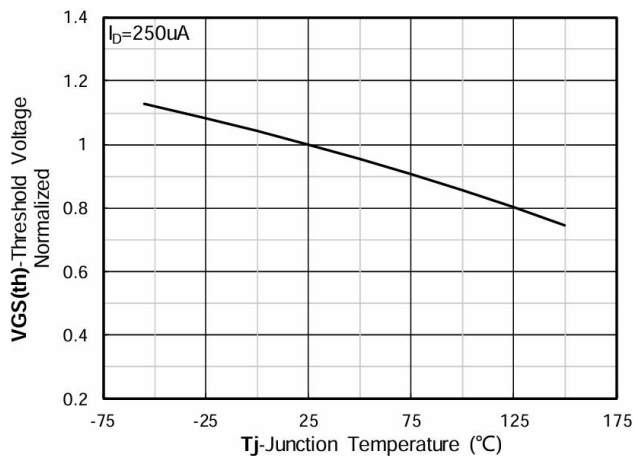


Figure 10. Normalized Threshold voltage

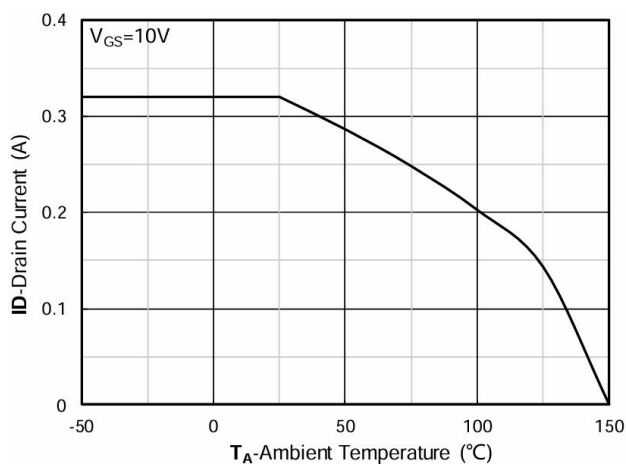


Figure 11. Current dissipation

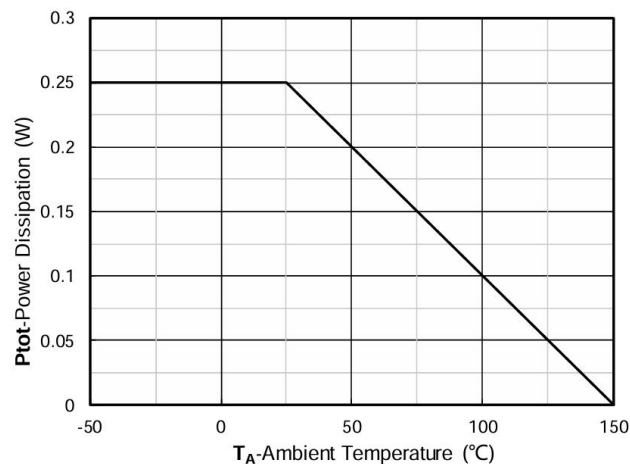


Figure 12. Power dissipation

## N- Channel Typical Characteristics

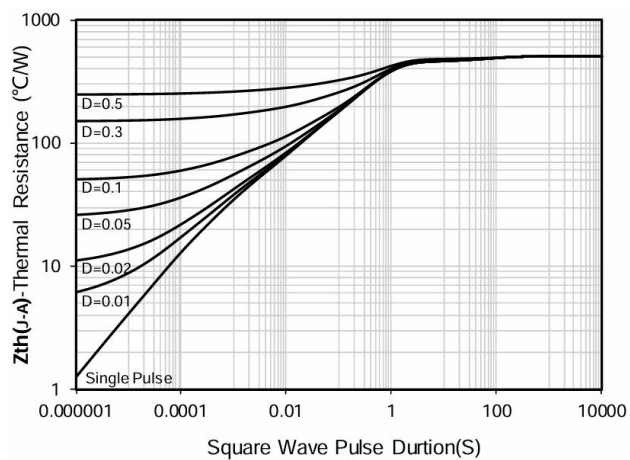


Figure 13. Maximum Transient Thermal Impedance

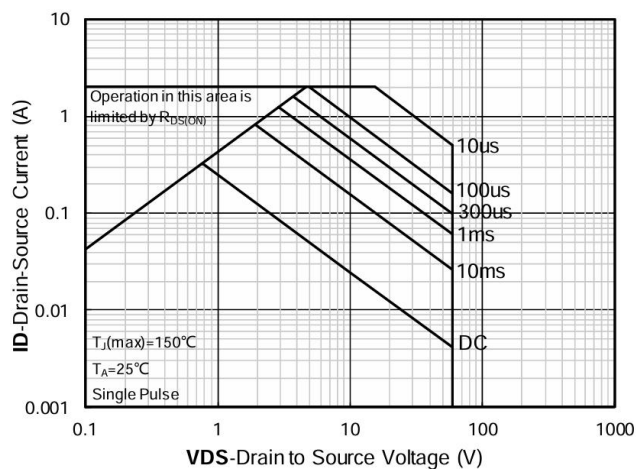


Figure 14. Safe Operation Area

## P- Channel Typical Characteristics

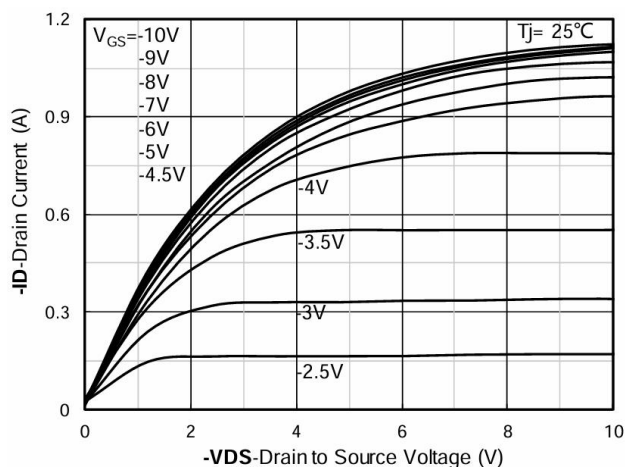


Figure 1. Output Characteristics

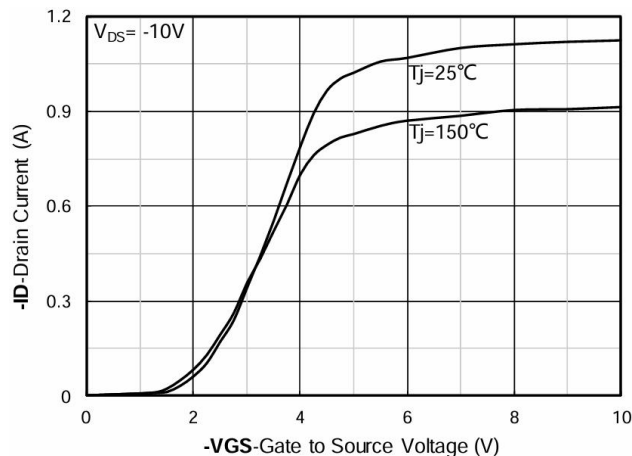


Figure 2. Transfer Characteristics

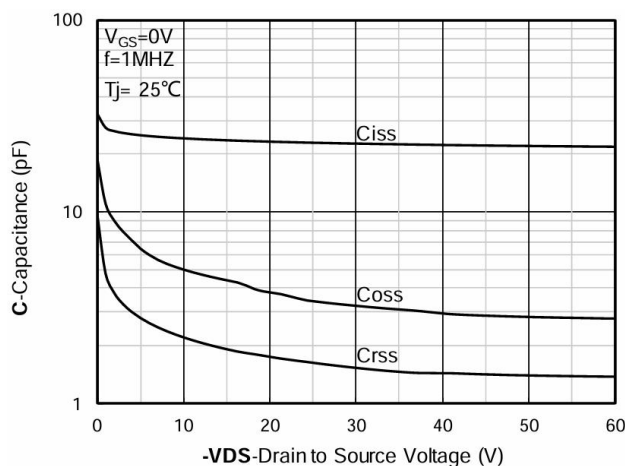


Figure 3. Capacitance Characteristics

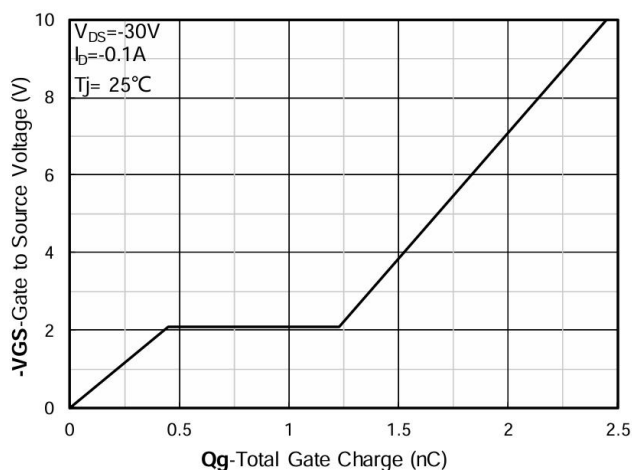


Figure 4. Gate Charge

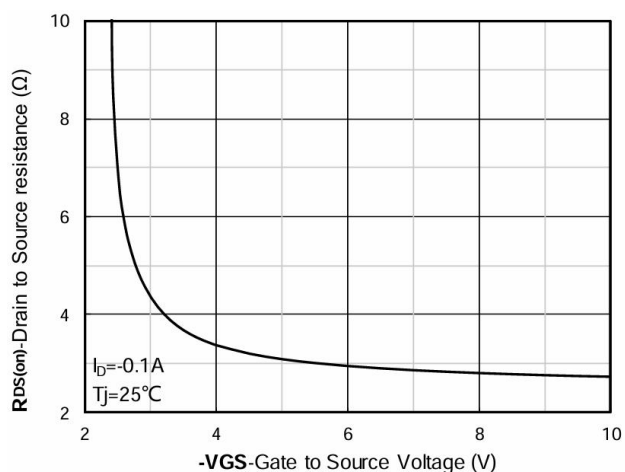


Figure 5. On-Resistance vs. Gate to Source Voltage

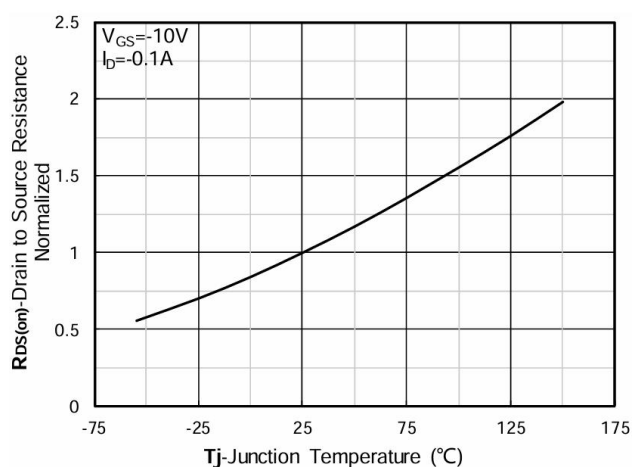


Figure 6. Normalized On-Resistance



## P- Channel Typical Characteristics

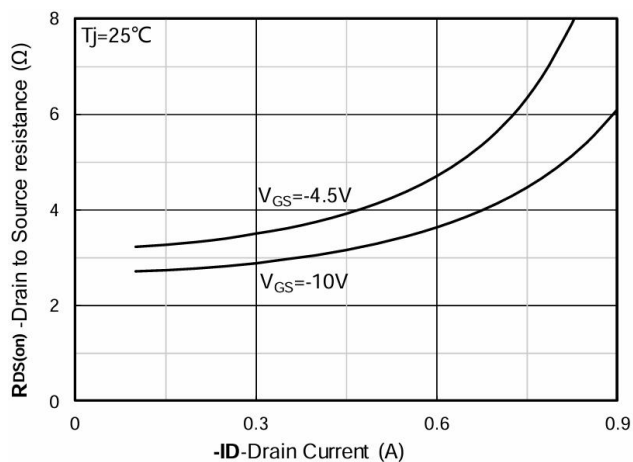


Figure 7. RDS(on) vs. Drain Current

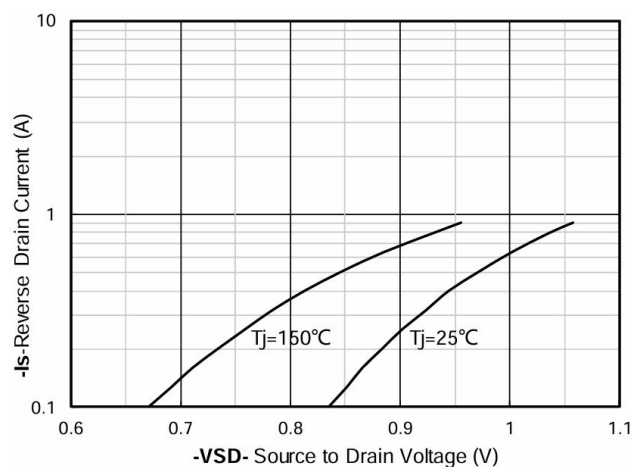


Figure 8. Forward characteristics of reverse diode

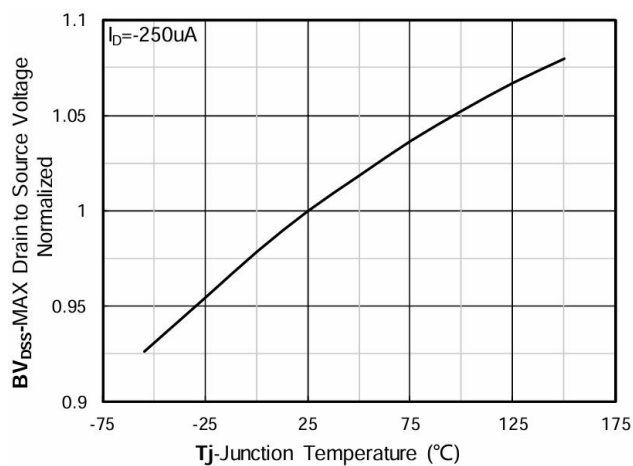


Figure 9. Normalized breakdown voltage

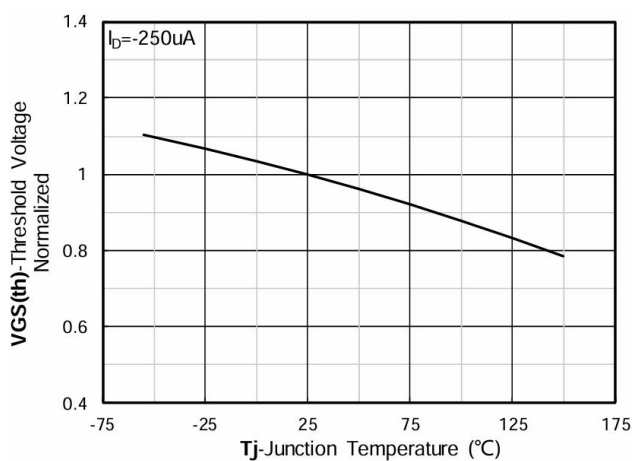


Figure 10. Normalized Threshold voltage

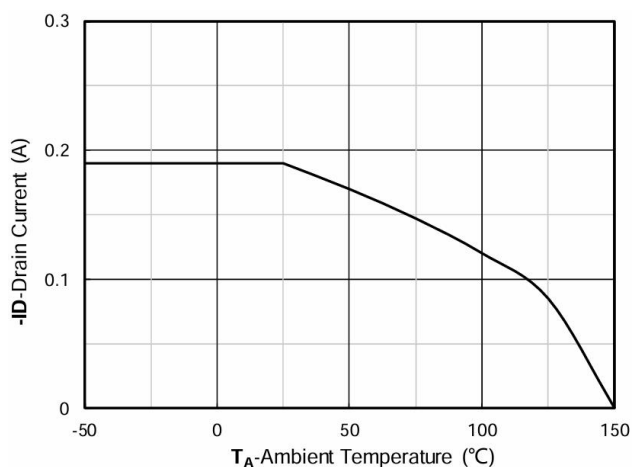


Figure 11. Current dissipation

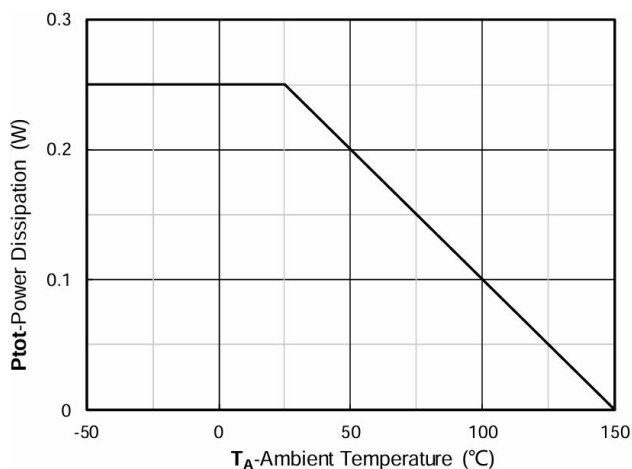


Figure 12. Power dissipation



## P- Channel Typical Characteristics

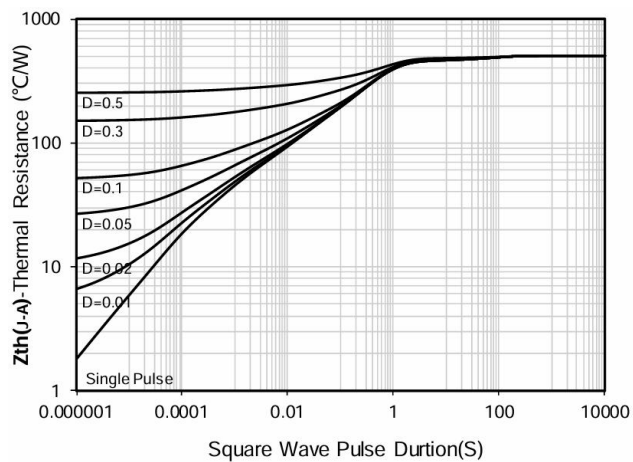


Figure 13. Maximum Transient Thermal Impedance

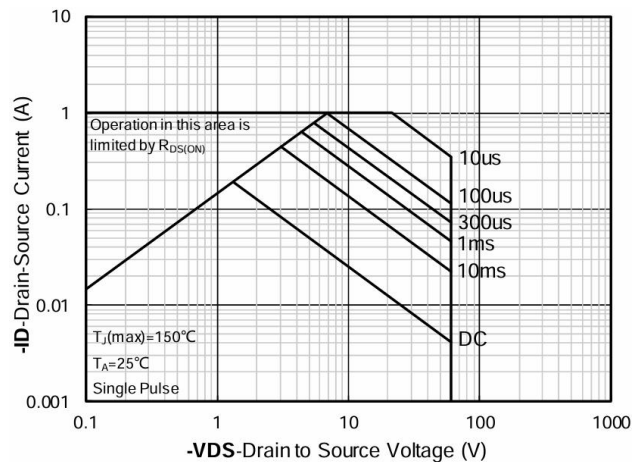
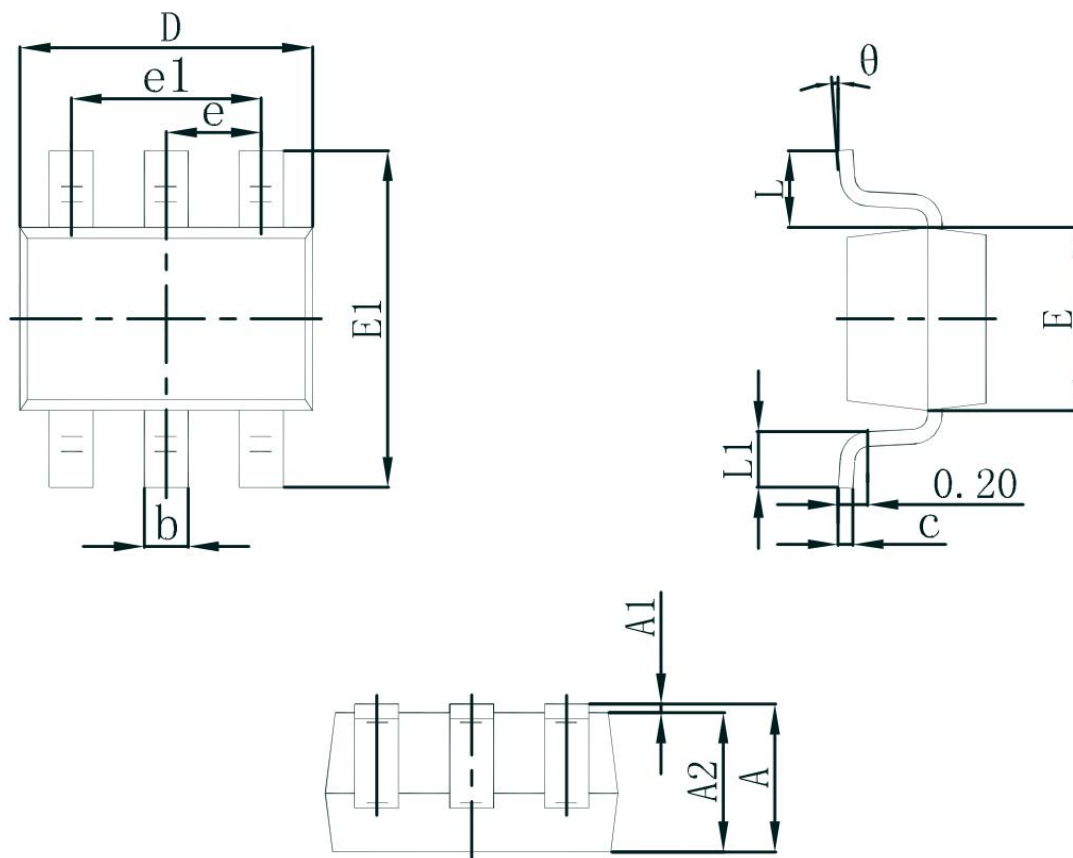


Figure 14. Safe Operation Area

## SOT-363 Package Information



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 0.900                     | 1.100 | 0.035                | 0.043 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 0.900                     | 1.000 | 0.035                | 0.039 |
| b      | 0.150                     | 0.350 | 0.006                | 0.014 |
| c      | 0.100                     | 0.250 | 0.004                | 0.010 |
| D      | 1.800                     | 2.200 | 0.071                | 0.087 |
| E      | 1.150                     | 1.350 | 0.045                | 0.053 |
| E1     | 2.150                     | 2.450 | 0.085                | 0.096 |
| e      | 0.650 TYP.                |       | 0.026 TYP.           |       |
| e1     | 1.200                     | 1.400 | 0.047                | 0.055 |
| L      | 0.525 REF.                |       | 0.021 REF.           |       |
| L1     | 0.260                     | 0.460 | 0.010                | 0.018 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |