

## 20V N-Channel Enhancement Mode MOSFET

### Description

The AP2302EI uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a Battery protection or in other Switching application.

### General Features

$V_{DS} = 20V$   $I_D = 2.1A$

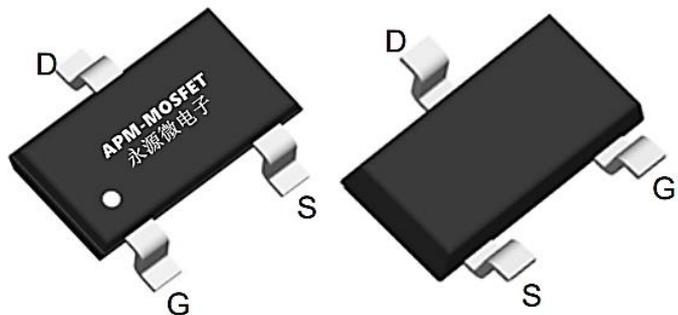
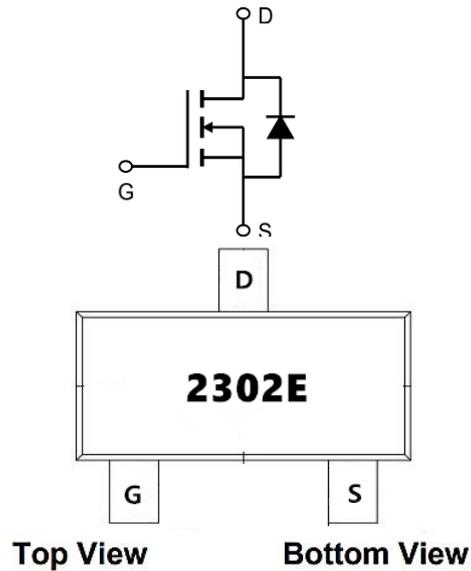
$R_{DS(ON)} < 65m\Omega$  @  $V_{GS}=10V$  (Type: **55mΩ**)

### Application

Battery protection

Load switch

Uninterruptible power supply



### Package Marking and Ordering Information

| Product ID | Pack   | Marking | Qty(PCS) |
|------------|--------|---------|----------|
| AP2302EI   | SOT23L | 2302E   | 3000     |

### Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ unless otherwise noted)

| Symbol                     | Parameter  | Rating     | Units              |
|----------------------------|--|------------|--------------------|
| $V_{DS}$                   | Drain-Source Voltage                             | 20         | V                  |
| $V_{GS}$                   | Gate-Source Voltage                              | $\pm 12$   | V                  |
| $I_D@T_A=25^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 4.5V^1$      | 2.1        | A                  |
| $I_D@T_A=70^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 4.5V^1$      | 1.0        | A                  |
| $I_{DM}$                   | Pulsed Drain Current <sup>2</sup>                | 16         | A                  |
| $P_D@T_A=25^\circ\text{C}$ | Total Power Dissipation <sup>3</sup>             | 0.35       | W                  |
| TSTG                       | Storage Temperature Range                        | -55 to 150 | $^\circ\text{C}$   |
| $T_J$                      | Operating Junction Temperature Range             | -55 to 150 | $^\circ\text{C}$   |
| $R_{\theta JA}$            | Thermal Resistance Junction-ambient <sup>1</sup> | 125        | $^\circ\text{C/W}$ |
| $R_{\theta JC}$            | Thermal Resistance Junction-Case <sup>1</sup>    | 100        | $^\circ\text{C/W}$ |

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

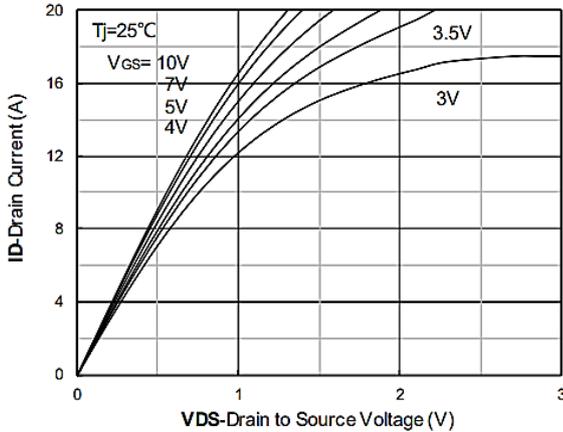
| Symbol   | Parameter  | Test Condition                                     | Min. | Typ. | Max.      | Units      |
|----------|--|--|------|------|-----------|------------|
| V(BR)DSS | Drain-Source Breakdown Voltage                           | $V_{GS}=0V, I_D=250\mu A$                          | 20   | 22   | -         | V          |
| IDSS     | Zero Gate Voltage Drain Current                          | $V_{DS}=20V, V_{GS}=0V,$                           | -    | -    | 1.0       | $\mu A$    |
| IGSS     | Gate to Body Leakage Current                             | $V_{DS}=0V, V_{GS}=\pm 12V$                        | -    | -    | $\pm 100$ | nA         |
| VGS(th)  | Gate Threshold Voltage                                   | $V_{DS}=V_{GS}, I_D=250\mu A$                      | 0.5  | 0.65 | 1.2       | V          |
| RDS(on)  | Static Drain-Source on-Resistance note2                  | $V_{GS}=4.5V, I_D=3A$                              | -    | 55   | 65        | m $\Omega$ |
|          |  | $V_{GS}=2.5V, I_D=2A$                              | -    | 75   | 98        |            |
| Ciss     | Input Capacitance  | $V_{DS}=10V, V_{GS}=0V, f=1.0\text{MHz}$           | -    | 150  | -         | pF         |
| Coss     | Output Capacitance                                       |  | -    | 34   | -         | pF         |
| Crss     | Reverse Transfer Capacitance                             |  | -    | 26   | -         | pF         |
| Qg       | Total Gate Charge  | $V_{DS}=10V, I_D=3A, V_{GS}=4.5V$                  | -    | 2.4  | -         | nC         |
| Qgs      | Gate-Source Charge                                       |  | -    | 0.88 | -         | nC         |
| Qgd      | Gate-Drain("Miller") Charge                              |  | -    | 0.77 | -         | nC         |
| td(on)   | Turn-on Delay Time                                       | $V_{DS}=10V, I_D=3A, R_{GEN}=3\Omega, V_{GS}=4.5V$ | -    | 6.8  | -         | ns         |
| tr       | Turn-on Rise Time  |  | -    | 57   | -         | ns         |
| td(off)  | Turn-off Delay Time                                      |  | -    | 14   | -         | ns         |
| tr       | Turn-off Fall Time                                       |  | -    | 53   | -         | ns         |
| IS       | Maximum Continuous Drain to Source Diode Forward Current |  | -    | -    | 2.3       | A          |
| ISM      | Maximum Pulsed Drain to Source Diode Forward Current     |  | -    | -    | 6.8       | A          |
| VSD      | Drain to Source Diode Forward Voltage                    | $V_{GS}=0V, I_S=3A$                                | -    | -    | 1.3       | V          |

#### Note :

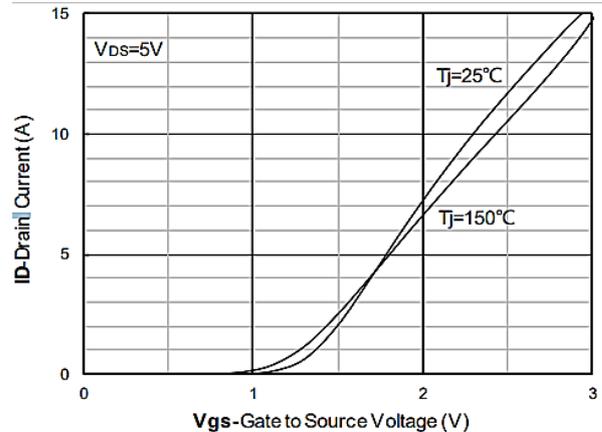
- 1、The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2、The data tested by pulsed , pulse width  $\cong 300\mu s$  , duty cycle  $\cong 2\%$
- 3、The power dissipation is limited by 150 $^{\circ}\text{C}$  junction temperature
- 4、The data is theoretically the same as  $I_D$  and  $I_{DM}$  , in real applications , should be limited by total power dissipation.

**20V N-Channel Enhancement Mode MOSFET**

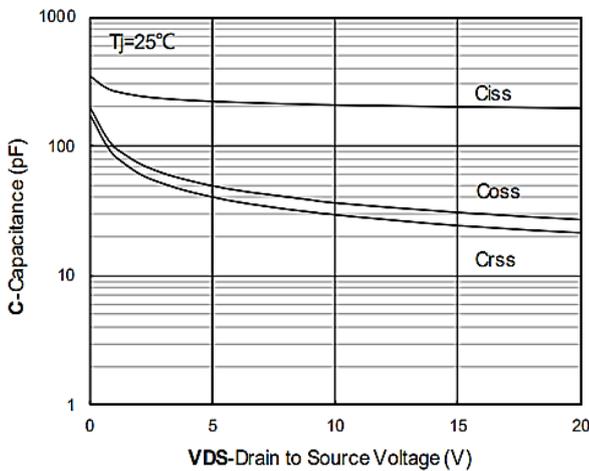
**Typical Characteristics**



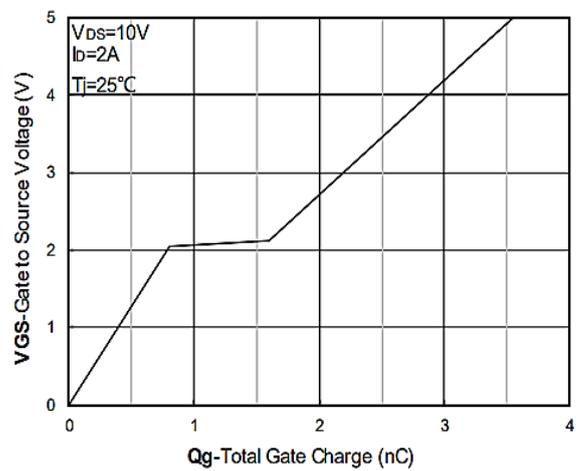
**Figure1. Output Characteristics**



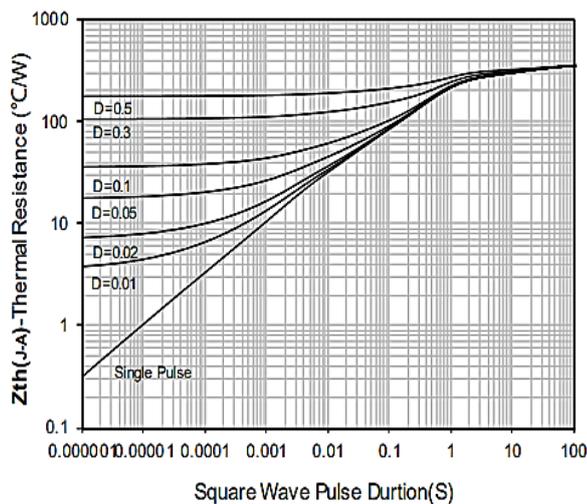
**Figure2. Transfer Characteristics**



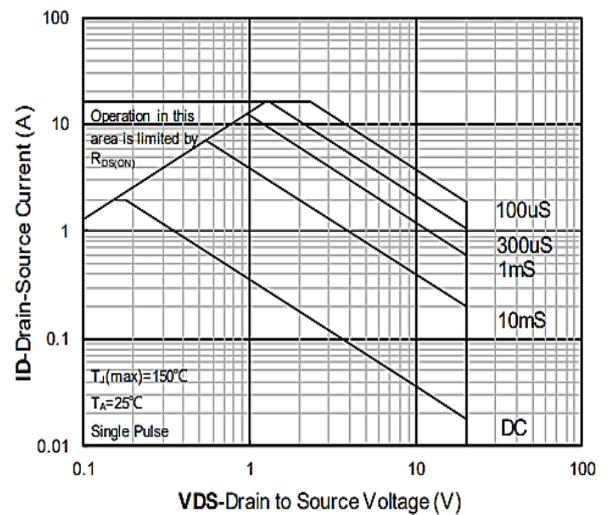
**Figure3. Capacitance Characteristics**



**Figure4. Gate Charge**

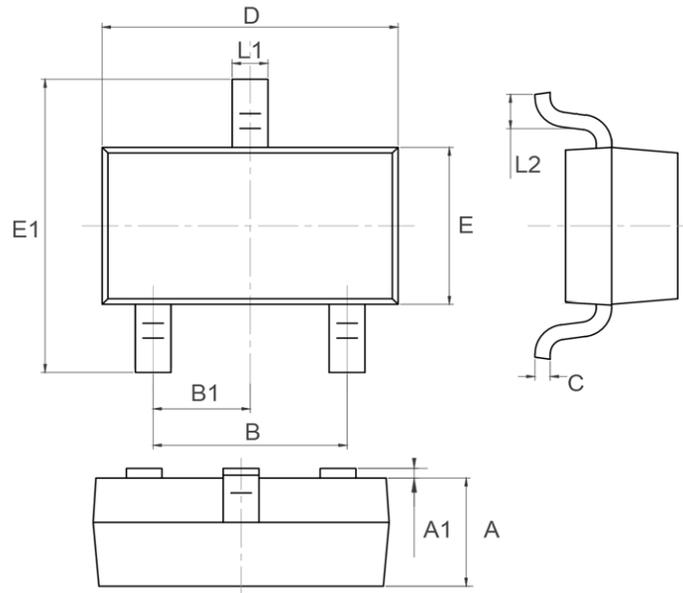


**Figure5. Maximum Transient Thermal Impedance**



**Figure6. Safe Operation Area**

Package Mechanical Data-SOT23L



| Symbol | Dim in mm |       |      |
|--------|-----------|-------|------|
|        | Min       | Typ   | Max  |
| A      | 0.9       | 1     | 1.1  |
| A1     | 0         | 0.05  | 0.1  |
| B      | 1.8       | 1.9   | 2    |
| B1     | 0.95TYP   |       |      |
| C      | 0.08      | 0.115 | 0.15 |
| D      | 2.8       | 2.9   | 3    |
| E      | 1.2       | 1.3   | 1.4  |
| E1     | 2.25      | 2.4   | 2.55 |
| L1     | 0.3       | 0.4   | 0.5  |
| L2     | 0.2       | 0.35  | 0.5  |

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|---------|------------|-----------------|
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