

**SuperMOS – SOT-23-3 30V  $V_{DSS}$ , 21m $\Omega$   $R_{DS(ON)}$ , N-channel MOSFET**

**1. Description**

The SI2304DDS-T1-BE3(ES) is N-Channel enhancement MOS Field Effect Transistor. Uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. Device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product SI2304DDS-T1-BE3(ES) is Pb-free.

**2. Features**

- 30V,  $R_{DS(ON)}=21m\Omega(TYP.) @V_{GS}=10V$   
 $R_{DS(ON)}=25m\Omega(TYP.) @V_{GS}=4.5V$
- Use trench MOSFET technology
- High density cell design for low  $R_{DS(on)}$
- Material: Halogen free
- Reliable and rugged
- Avalanche Rated
- Low leakage current

**3. Applications**

- PWM applications
- Load switch
- Power management in portable/desktop PCs
- DC/DC conversion

**4. Ordering Information**

| Part Number          | Package   | Marking | Material     | Packing     | Quantity per reel | Flammability Rating | Reel Size |
|----------------------|-----------|---------|--------------|-------------|-------------------|---------------------|-----------|
| SI2304DDS-T1-BE3(ES) | SOT-23-3L | 3400    | Halogen free | Tape & Reel | 3,000 PCS         | UL 94V-0            | 7 inches  |

Table-1 Ordering information

**5. Pin Configuration and Functions**

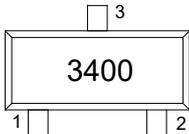
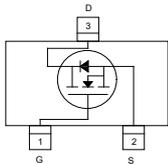
| Pin | Function | Outline   | Circuit Diagram   |
|-----|----------|---|---|
| 1   | Gate     |  |  |
| 2   | Source   |   |   |
| 3   | Drain    |   |   |

Table-2 Pin configuration

## 6. Specification

### Absolute Maximum Rating & Thermal Characteristics

Ratings at 25 °C ambient temperature unless otherwise specified.

| Parameter                              | Symbol                 | Limit      | Unit |
|--|------------------------|------------|------|
| Drain-Source Voltage                   | $BV_{DSS}$             | 30         | V    |
| Gate-Source Voltage                    | $V_{GS}$               | $\pm 12$   | V    |
| Continuous Drain Current <sup>a</sup>  | $T_A=25^\circ\text{C}$ | 5.8        | A    |
|  | $T_A=70^\circ\text{C}$ | 4.6        |      |
| Maximum Power Dissipation <sup>a</sup> | $T_A=25^\circ\text{C}$ | 1.4        | W    |
|  | $T_A=70^\circ\text{C}$ | 0.9        |      |
| Pulsed Drain Current <sup>b</sup>      | $I_{DM}$               | 30         | A    |
| Operating Junction Temperature         | $T_J$                  | 150        | °C   |
| Lead Temperature                       | $T_L$                  | 260        | °C   |
| Storage Temperature Range              | $T_{stg}$              | -55 to 150 | °C   |

### Thermal resistance ratings

| Single Operation                                    |                       |                 |         |         |      |
|---|-----------------------|-----------------|---------|---------|------|
| Parameter   |                       | Symbol          | Typical | Maximum | Unit |
| Junction-to-Ambient Thermal Resistance <sup>a</sup> | $t \leq 10 \text{ s}$ | $R_{\theta JA}$ | 75      | 90      | °C/W |
| Junction-to-Case Thermal Resistance                 | Steady State          | $R_{\theta JC}$ | 43      | 70      |      |

Note:

a; Surface mounted on FR4 Board using 1 square inch pad size, 1oz copper

b: Repetitive rating, pulse width limited by junction temperature,  $tp=10\mu\text{s}$ , Duty Cycle=1%

## Electrical Characteristics

At TA = 25°C unless otherwise specified

| Parameter  | Symbol       | Test Conditions   | Min. | Typ. | Max.      | Unit       |
|--|--------------|---|------|------|-----------|------------|
| <b>OFF CHARACTERISTICS</b>                       |              |   |      |      |           |            |
| Drain-to-Source Breakdown Voltage                | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$                                 | 30   |      |           | V          |
| Zero Gate Voltage Drain Current                  | $I_{DSS}$    | $V_{DS}=24V, V_{GS}=0V$                                   |      |      | 1         | $\mu A$    |
| Gate-to-source Leakage Current                   | $I_{GSS}$    | $V_{DS}=0V, V_{GS}=\pm 12V$                               |      |      | $\pm 100$ | nA         |
| <b>ON CHARACTERISTICS</b>                        |              |   |      |      |           |            |
| Gate Threshold Voltage                           | $V_{GS(TH)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$                             | 0.5  | 1.0  | 1.3       | V          |
| Drain-to-source On-resistance                    | $R_{DS(on)}$ | $V_{GS}=10V, I_D=5.8A$                                    |      | 21.0 | 28.0      | m $\Omega$ |
|  |              | $V_{GS}=4.5V, I_D=5.0A$                                   |      | 25.0 | 33.0      |            |
|  |              | $V_{GS}=2.5V, I_D=4.0A$                                   |      | 33.0 | 52.0      |            |
| Forward Trans conductance                        | $g_{FS}$     | $V_{DS}=5.0V, I_D=5.8A$                                   |      | 7.8  | 15        | S          |
| <b>CHARGES, CAPACITANCES AND GATE RESISTANCE</b> |              |   |      |      |           |            |
| Input Capacitance                                | $C_{ISS}$    | $V_{GS}=0V, f=1MHz,$<br>$V_{DS}=10V$                      |      | 550  |           | pF         |
| Output Capacitance                               | $C_{OSS}$    |   |      | 62   |           |            |
| Reverse Transfer Capacitance                     | $C_{RSS}$    |   |      | 48   |           |            |
| Total Gate Charge                                | $Q_{G(TOT)}$ | $V_{GS}=4.5V, V_{DS}=10V,$<br>$I_D=5.8A$                  |      | 6.7  |           | nC         |
| Threshold Gate Charge                            | $Q_{G(TH)}$  |   |      | 0.75 |           |            |
| Gate-to-Source Charge                            | $Q_{GS}$     |   |      | 1.65 |           |            |
| Gate-to-Drain Charge                             | $Q_{GD}$     |   |      | 1.78 |           |            |
| <b>SWITCHING CHARACTERISTICS</b>                 |              |   |      |      |           |            |
| Turn-On Delay Time                               | $t_{d(ON)}$  | $V_{GS}=4.5V, V_{DS}=10V,$<br>$R_L=10\Omega, R_G=6\Omega$ |      | 3.8  |           | ns         |
| Rise Time  | $t_r$        |   |      | 13.0 |           |            |
| Turn-Off Delay Time                              | $t_{d(OFF)}$ |   |      | 14.2 |           |            |
| Fall Time  | $t_f$        |   |      | 2.0  |           |            |
| <b>BODY DIODE CHARACTERISTICS</b>                |              |   |      |      |           |            |
| Forward Voltage                                  | $V_{SD}$     | $V_{GS}=0V, I_S=1.0A$                                     |      | 0.75 | 1.5       | V          |

7. Typical Characteristic

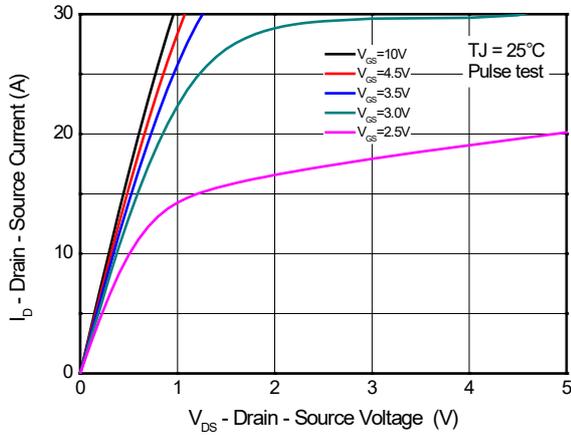


Figure 1. Typ. Output

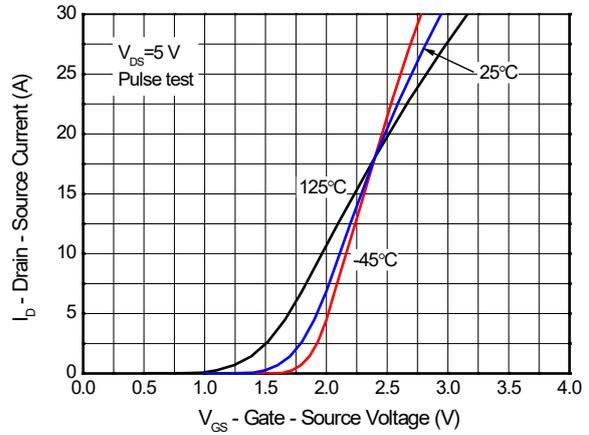


Figure 2. Transfer Characteristics

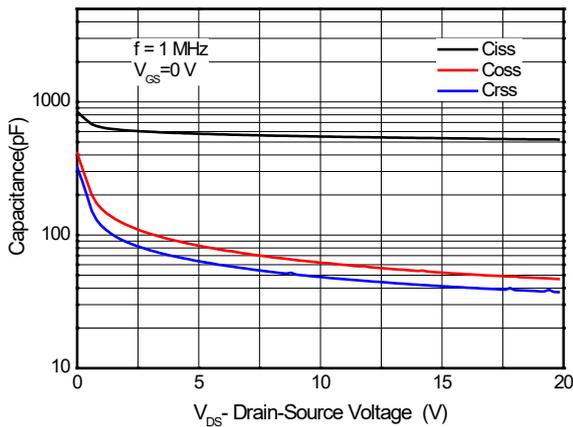


Figure 3. Capacitance Characteristics

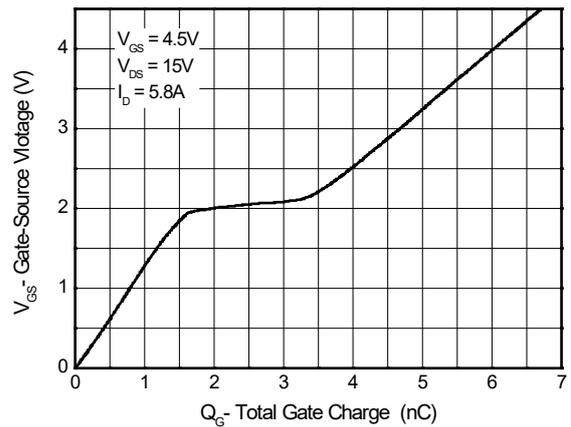


Figure 4. Gate Charge Waveform

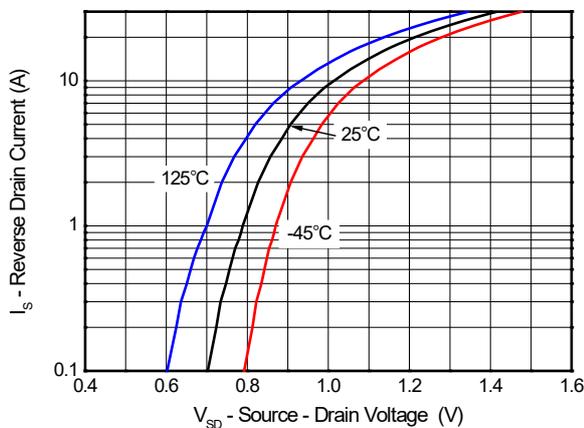


Figure 5. Body-Diode Characteristics

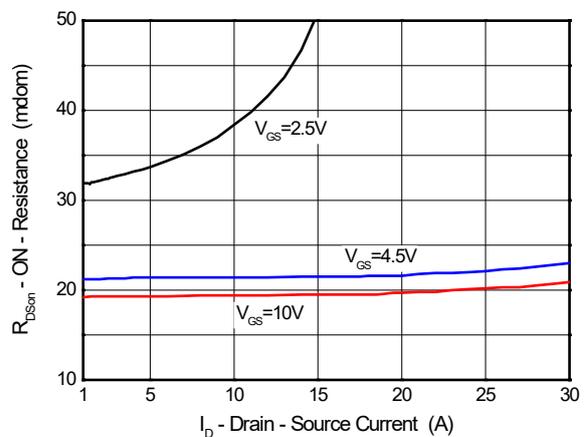


Figure 6.  $R_{DS(on)}$ -Drain Current

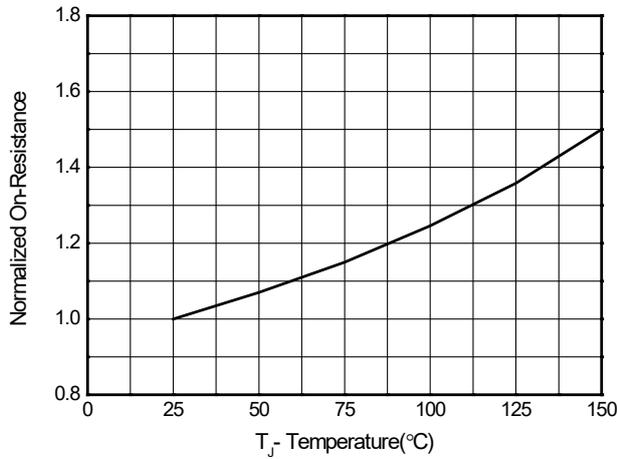


Figure 7. R<sub>ds(on)</sub>-Junction Temperature(°C)

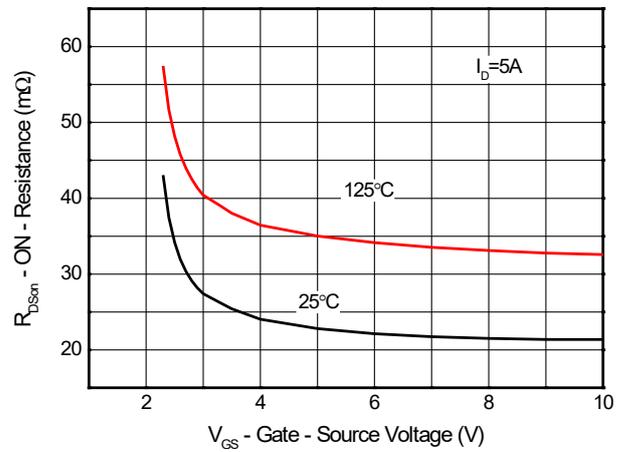


Figure 8: On-Resistance vs. Gate-Source

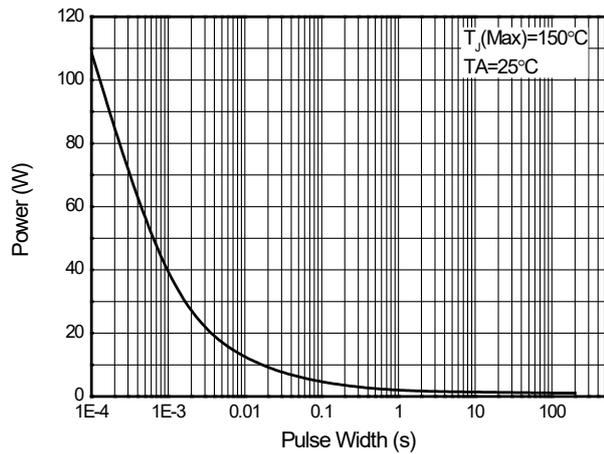


Figure 9: Single Pulse Power Rating Junction-to-Ambient (Note E)

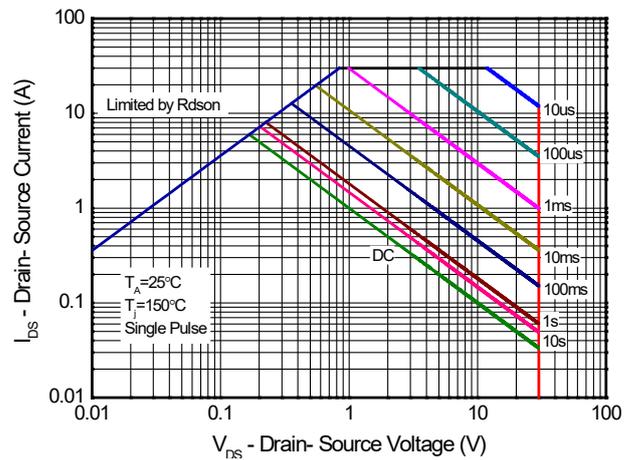
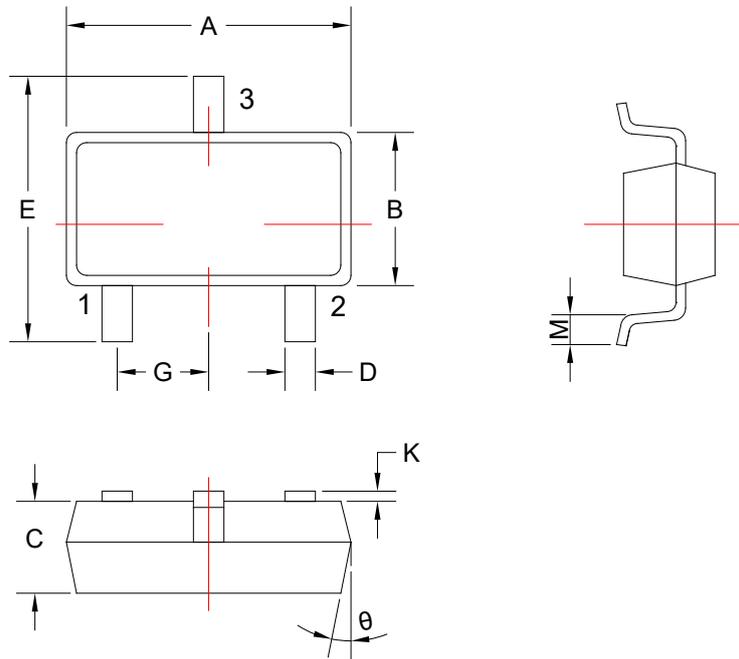


Figure 10. Maximum Safe Operation Area

8. Dimension (SOT-23-3)



| COMMON DIMENSIONS CUNITS MEASURE=MILLIMETER |      |      |          |          |      |
|---|------|------|----------|----------|------|
| SYMBOL                                      | MIN  | MAX  | SYMBOL   | MIN      | MAX  |
| A   | 2.82 | 3.02 | G        | 0.95 TYP |      |
| B   | 1.50 | 1.70 | K        | 0        | 0.10 |
| C   | 1.05 | 1.15 | M        | 0.20     | -    |
| D   | 0.30 | 0.50 | $\theta$ | 7°       | 11°  |
| E   | 2.65 | 2.95 |          |          |      |

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