



## N-Channel 20-V (D-S) MOSFET

### PRODUCT SUMMARY

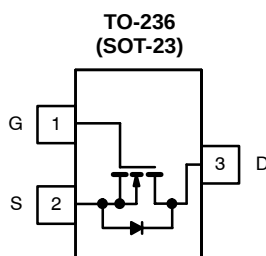
| $V_{DS}$ (V) | $r_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) | $Q_g$ (Typ) |
|--------------|---------------------------|-----------|-------------|
| 20           | 0.033 @ $V_{GS} = 4.5$ V  | 4.9       | 11.2        |
|              | 0.040 @ $V_{GS} = 2.5$ V  | 4.4       |             |
|              | 0.051 @ $V_{GS} = 1.8$ V  | 3.9       |             |

### FEATURES

- 1.8-V Rated
- RoHS Compliant



Pb-free  
Available



Top View  
Si2312DS (C2)\*  
\*Marking Code

Ordering Information: Si2312DS-T1  
Si2312DS-T1—E3 (Lead (Pb)-Free)

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)

| Parameter                                                      |                       | Symbol                            | 5 sec      | Steady State | Unit |
|----------------------------------------------------------------|-----------------------|-----------------------------------|------------|--------------|------|
| Drain-Source Voltage                                           |                       | V <sub>DS</sub>                   | 20         |              | V    |
| Gate-Source Voltage                                            |                       | V <sub>GS</sub>                   | ±8         |              |      |
| Continuous Drain Current (T <sub>J</sub> = 150°C) <sup>a</sup> | T <sub>A</sub> = 25°C | I <sub>D</sub>                    | 4.9        | 3.77         | A    |
|                                                                | T <sub>A</sub> = 70°C |                                   | 3.9        | 3.0          |      |
| Pulsed Drain Current <sup>b</sup>                              |                       | I <sub>DM</sub>                   | 15         |              |      |
| Avalanche Current <sup>b</sup>                                 | L = 0.1 mH            | I <sub>AS</sub>                   | 15         |              |      |
| Single Avalanche Energy                                        |                       | E <sub>AS</sub>                   | 11.25      |              | mJ   |
| Continuous Source Current (Diode Conduction) <sup>a</sup>      |                       | I <sub>S</sub>                    | 1.0        |              | A    |
| Power Dissipation <sup>a</sup>                                 | T <sub>A</sub> = 25°C | P <sub>D</sub>                    | 1.25       | 0.75         | W    |
|                                                                | T <sub>A</sub> = 70°C |                                   | 0.80       | 0.48         |      |
| Operating Junction and Storage Temperature Range               |                       | T <sub>J</sub> , T <sub>stg</sub> | −55 to 150 |              | °C   |

### THERMAL RESISTANCE RATINGS

| Parameter                                |                | Symbol     | Typical | Maximum | Unit               |
|------------------------------------------|----------------|------------|---------|---------|--------------------|
| Maximum Junction-to-Ambient <sup>a</sup> | $t \leq 5$ sec | $R_{thJA}$ | 75      | 100     | $^\circ\text{C/W}$ |
|                                          | Steady State   |            | 120     | 166     |                    |
| Maximum Junction-to-Foot                 | Steady State   | $R_{thJF}$ | 40      | 50      |                    |

#### Notes

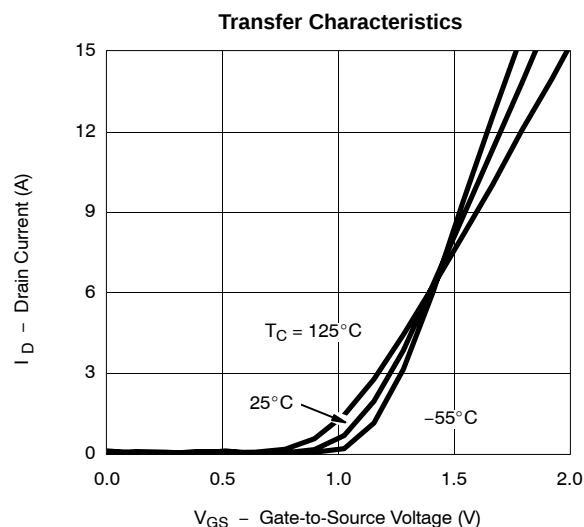
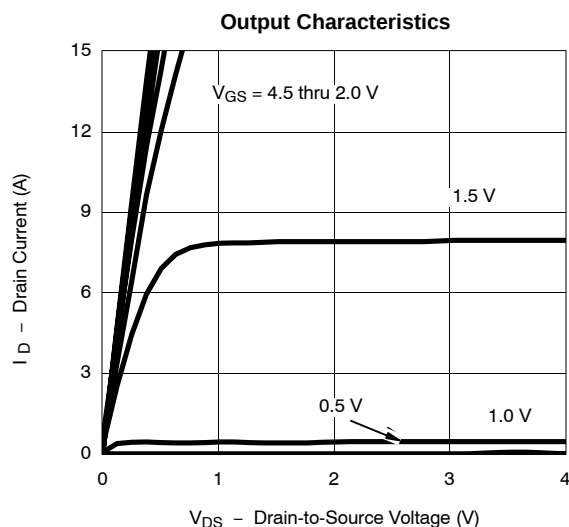
- a. Surface Mounted on 1" x 1" FR4 Board.  
b. Pulse width limited by maximum junction temperature

| SPECIFICATIONS (T <sub>A</sub> = 25° C UNLESS OTHERWISE NOTED) |                      |                                                                                                                         |        |       |       |      |
|----------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------|--------|-------|-------|------|
| Parameter                                                      | Symbol               | Test Conditions                                                                                                         | Limits |       |       | Unit |
|                                                                |                      |                                                                                                                         | Min    | Typ   | Max   |      |
| Static                                                         |                      |                                                                                                                         |        |       |       |      |
| Drain-Source Breakdown Voltage                                 | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                                          | 20     |       |       | V    |
| Gate-Threshold Voltage                                         | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                             | 0.45   | 0.65  | 0.85  |      |
| Gate-Body Leakage                                              | I <sub>GSS</sub>     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 8 V                                                                          |        |       | ± 100 | nA   |
| Zero Gate Voltage Drain Current                                | I <sub>DSS</sub>     | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V                                                                           |        |       | 1     | μA   |
|                                                                |                      | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 70°C                                                    |        |       | 75    |      |
| On-State Drain Current <sup>a</sup>                            | I <sub>D(on)</sub>   | V <sub>DS</sub> ≥ 10 V, V <sub>GS</sub> = 4.5 V                                                                         | 15     |       |       | A    |
| Drain-Source On-Resistance <sup>a</sup>                        | r <sub>DS(on)</sub>  | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 5.0 A                                                                         |        | 0.027 | 0.033 | Ω    |
|                                                                |                      | V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 4.5 A                                                                         |        | 0.033 | 0.040 |      |
|                                                                |                      | V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 4.0 A                                                                         |        | 0.042 | 0.051 |      |
| Forward Transconductance <sup>a</sup>                          | g <sub>fs</sub>      | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 5.0 A                                                                          |        | 40    |       | S    |
| Diode Forward Voltage                                          | V <sub>SD</sub>      | I <sub>S</sub> = 1.0 A, V <sub>GS</sub> = 0 V                                                                           |        | 0.8   | 1.2   | V    |
| Dynamic <sup>b</sup>                                           |                      |                                                                                                                         |        |       |       |      |
| Total Gate Charge                                              | Q <sub>g</sub>       | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 5.0 A                                                 |        | 11.2  | 14.0  | nC   |
| Gate-Source Charge                                             | Q <sub>gs</sub>      |                                                                                                                         |        | 1.4   |       |      |
| Gate-Drain Charge                                              | Q <sub>gd</sub>      |                                                                                                                         |        | 2.2   |       |      |
| Switching                                                      |                      |                                                                                                                         |        |       |       |      |
| Turn-On Delay Time                                             | t <sub>d(on)</sub>   | V <sub>DD</sub> = 10 V, R <sub>L</sub> = 10 Ω<br>I <sub>D</sub> ≅ 1.0 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 6 Ω |        | 15    | 25    | ns   |
| Rise Time                                                      | t <sub>r</sub>       |                                                                                                                         |        | 40    | 60    |      |
| Turn-Off Delay Time                                            | t <sub>d(off)</sub>  |                                                                                                                         |        | 48    | 70    |      |
| Fall-Time                                                      | t <sub>f</sub>       |                                                                                                                         |        | 31    | 45    |      |
| Source-Drain Reverse Recovery Time                             | t <sub>rr</sub>      | I <sub>F</sub> = 1.0 A, di/dt = 100 A/μs                                                                                |        | 13    | 25    |      |

## Notes

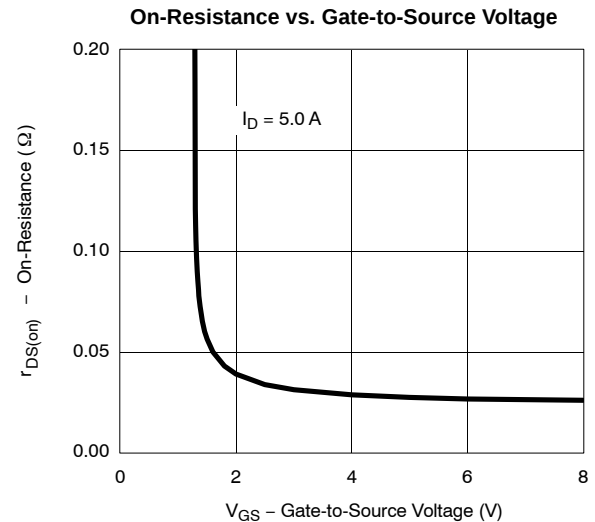
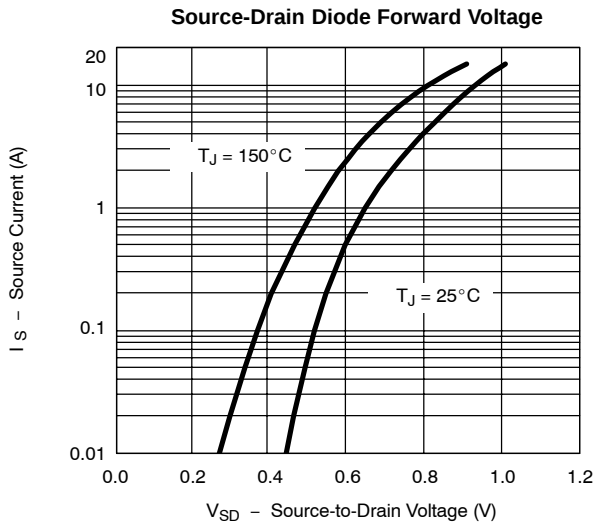
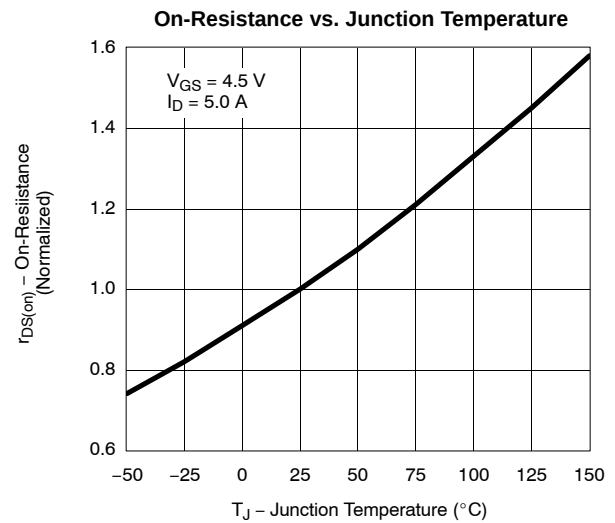
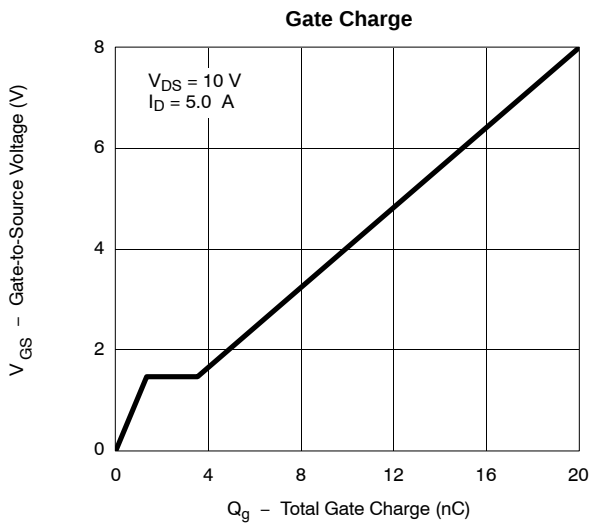
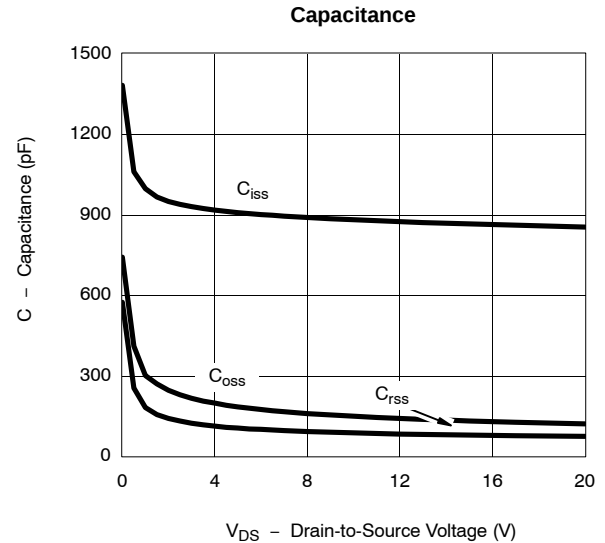
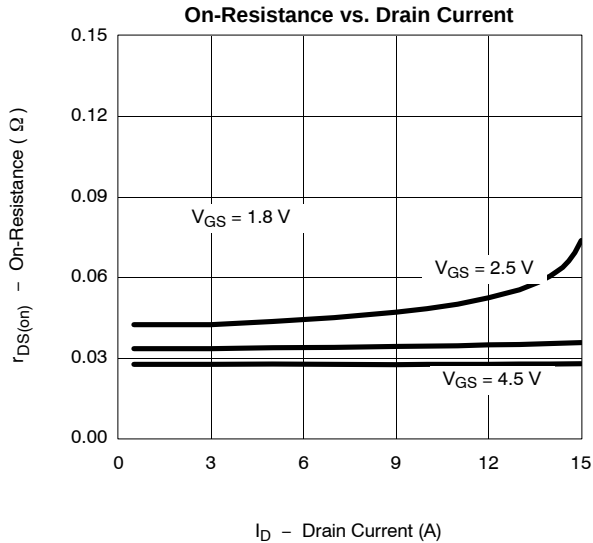
- a. Pulse test:  $PW \leq 300\text{ }\mu\text{s}$  duty cycle  $\leq 2\%$ .  
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

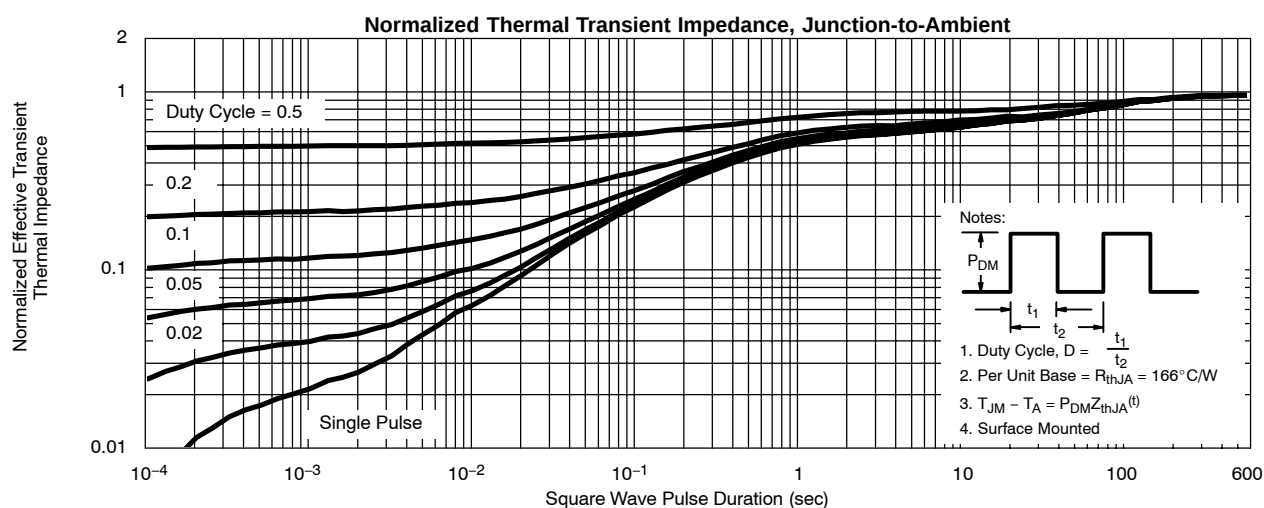
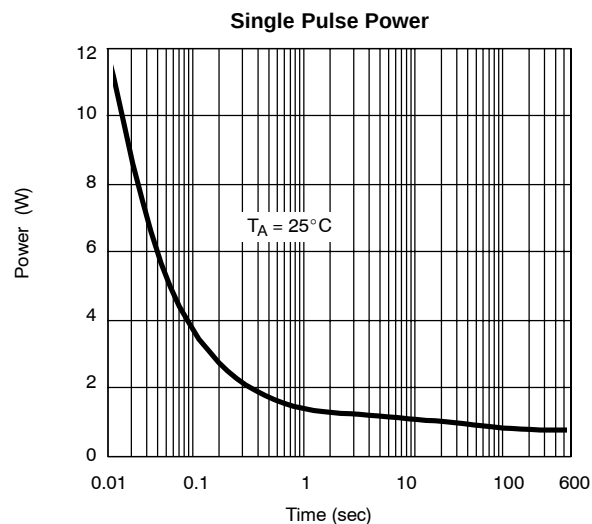
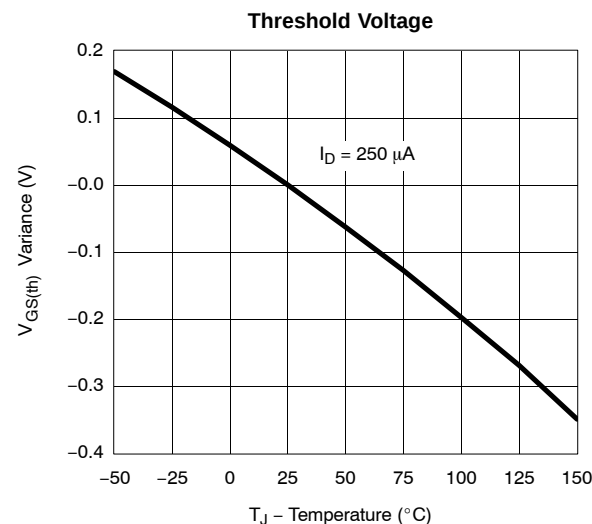
TYPICAL CHARACTERISTICS ( $25^\circ\text{C}$  UNLESS NOTED)



**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**



## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)



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