

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

| PRODUCT SUMMARY     |                                   |                    |
|---------------------|-----------------------------------|--------------------|
| V <sub>DS</sub> (V) | R <sub>DS(on)</sub> (Ω)           | I <sub>D</sub> (A) |
| 20                  | 0.0045 at V <sub>GS</sub> = 10 V  | 21                 |
|                     | 0.0068 at V <sub>GS</sub> = 4.5 V | 17                 |

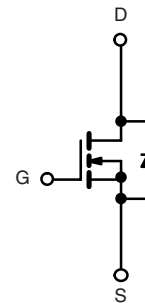
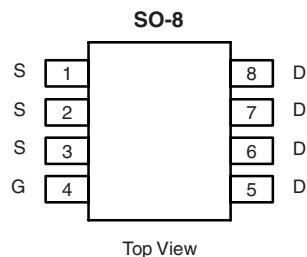
### FEATURES

- Halogen-free According to IEC 61249-2-21 Available
- TrenchFET® Power MOSFET
- PWM Optimized for Fast Switching
- Low Switching Losses
- Low Gate Drive Losses
- 100 % R<sub>G</sub> Tested



### APPLICATIONS

- Self-Driven Synchronous Rectification



N-Channel MOSFET

**Ordering Information:** Si4408DY-T1-E3 (Lead (Pb)-free)  
Si4408DY-T1-GE3 (Lead (Pb)-free and Halogen-free)

| ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted |                                   |                        |              |      |     |
|---|-----------------------------------|------------------------|--------------|------|-----|
| Parameter   | Symbol                            | 10 s                   | Steady State | Unit |     |
| Drain-Source Voltage  | V <sub>DS</sub>                   | 20                     |              | V    |     |
| Gate-Source Voltage   | V <sub>GS</sub>                   | ± 20                   |              |      |     |
| Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>         | I <sub>D</sub>                    | T <sub>A</sub> = 25 °C | 21           | 14   | A   |
|   |                                   | T <sub>A</sub> = 70 °C | 17           | 11   |     |
| Pulsed Drain Current (10 μs Pulse Width)                                | I <sub>DM</sub>                   | 60                     |              |      |     |
| Continuous Source Current (Diode Conduction) <sup>a</sup>               | I <sub>S</sub>                    | 2.9                    | 1.3          | W    |     |
| Maximum Power Dissipation <sup>a</sup>                                  | P <sub>D</sub>                    | T <sub>A</sub> = 25 °C | 3.5          |      | 1.6 |
|   |                                   | T <sub>A</sub> = 70 °C | 2.2          |      | 1   |
| 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> | R <sub>thJA</sub> | t ≤ 10 s     | 29      | 35   | °C/W |
|  |                   | Steady State | 67      | 80   |      |
| Maximum Junction-to-Foot (Drain)         | R <sub>thJF</sub> | 13           | 16      |      |      |

Notes:

a. Surface Mounted on 1" x 1" FR4 board.

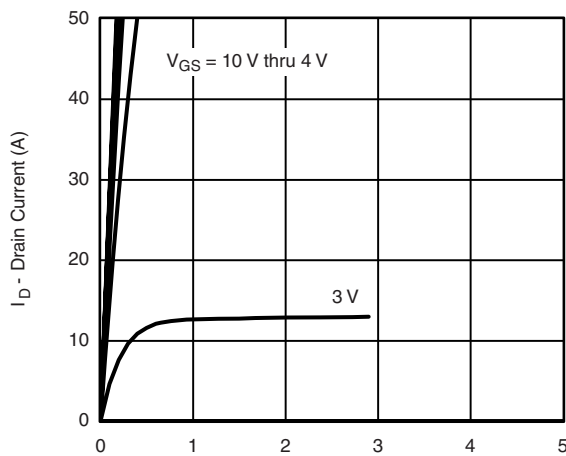
| <b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted |              |   |      |        |           |               |
|---|--------------|---|------|--------|-----------|---------------|
| Parameter   | Symbol       | Test Conditions   | Min. | Typ.   | Max.      | Unit          |
| <b>Static</b>   |              |   |      |        |           |               |
| Gate Threshold Voltage  | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$   | 1.0  |        |           | V             |
| Gate-Body Leakage   | $I_{GSS}$    | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$   |      |        | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current   | $I_{DSS}$    | $V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}$   |      |        | 1         | $\mu\text{A}$ |
|   |              | $V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$   |      |        | 5         |               |
| On-State Drain Current <sup>a</sup>   | $I_{D(on)}$  | $V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$  | 30   |        |           | A             |
| Drain-Source On-State Resistance <sup>a</sup>                                   | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 21\text{ A}$   |      | 0.0035 | 0.0045    | $\Omega$      |
|   |              | $V_{GS} = 4.5\text{ V}, I_D = 17\text{ A}$  |      | 0.0054 | 0.0068    |               |
| Forward Transconductance <sup>a</sup>   | $g_{fs}$     | $V_{DS} = 6\text{ V}, I_D = 21\text{ A}$  |      | 60     |           | S             |
| Diode Forward Voltage <sup>a</sup>  | $V_{SD}$     | $I_S = 2.9\text{ A}, V_{GS} = 0\text{ V}$   |      | 0.75   | 1.1       | V             |
| <b>Dynamic<sup>b</sup></b>  |              |   |      |        |           |               |
| Total Gate Charge   | $Q_g$        | $V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 21\text{ A}$  |      | 21     | 32        | nC            |
| Gate-Source Charge  | $Q_{gs}$     |   | 8.9  |        |           |               |
| Gate-Drain Charge   | $Q_{gd}$     |   | 6.4  |        |           |               |
| Gate Resistance   | $R_g$        |   | 0.5  | 1.40   | 2.4       | $\Omega$      |
| Turn-On Delay Time  | $t_{d(on)}$  | $V_{DD} = 10\text{ V}, R_L = 10\text{ }\Omega$<br>$I_D \cong 1\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 6\text{ }\Omega$ |      | 42     | 65        | ns            |
| Rise Time   | $t_r$        |   | 42   | 65     |           |               |
| Turn-Off Delay Time   | $t_{d(off)}$ |   | 60   | 90     |           |               |
| Fall Time   | $t_f$        |   | 26   | 40     |           |               |
| Source-Drain Reverse Recovery Time  | $t_{rr}$     | $I_F = 2.9\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$  |      | 55     | 80        |               |

Notes:

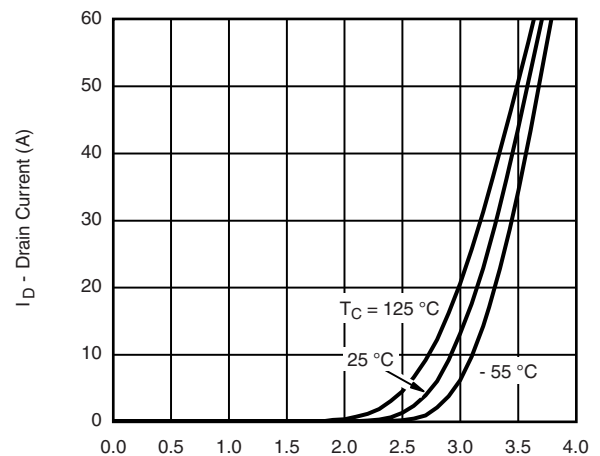
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- b. Guaranteed by design, not subject to production testing.

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 $25\text{ }^\circ\text{C}$ , unless otherwise noted

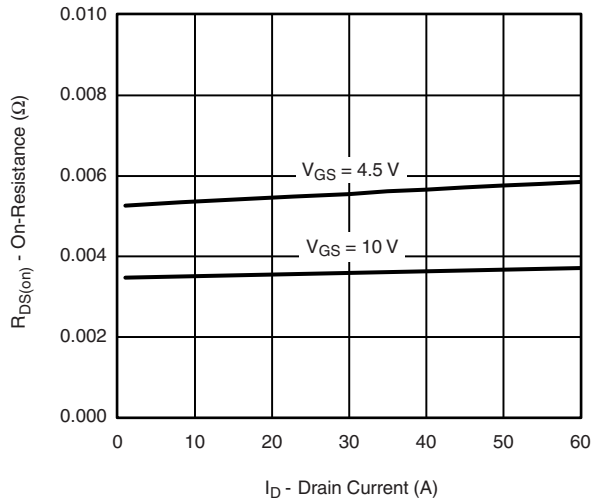


**Output Characteristics**

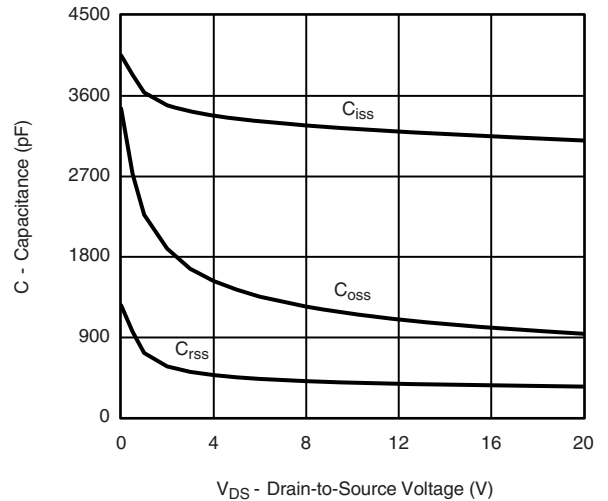


**Transfer Characteristics**

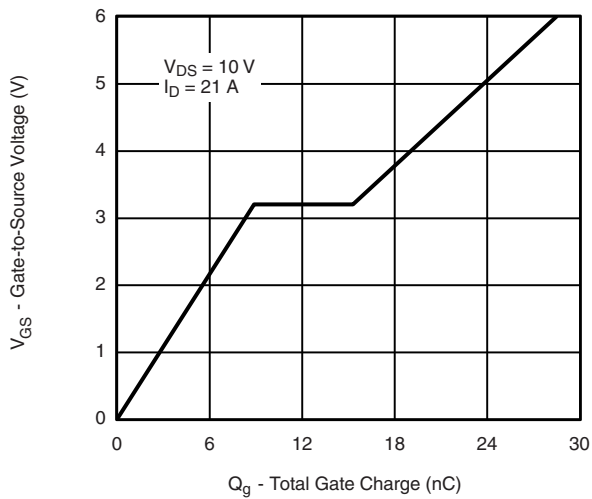
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



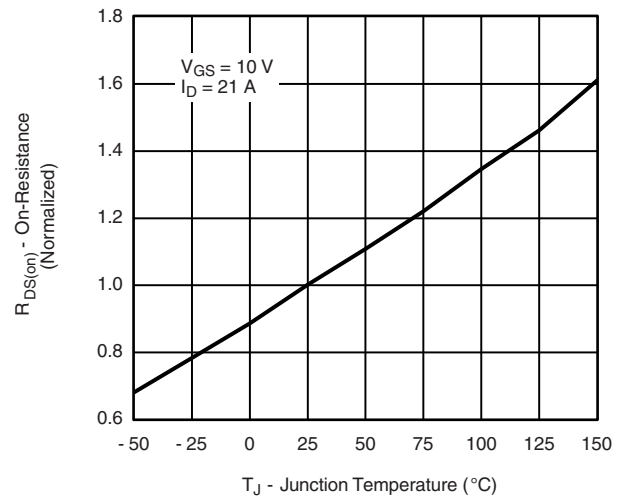
**On-Resistance vs. Drain Current**



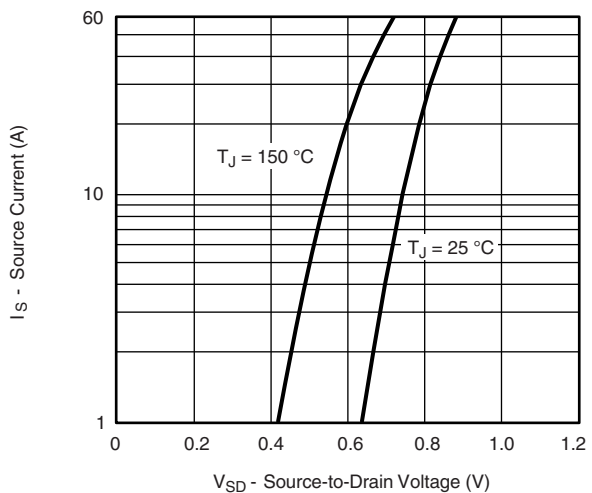
**Capacitance**



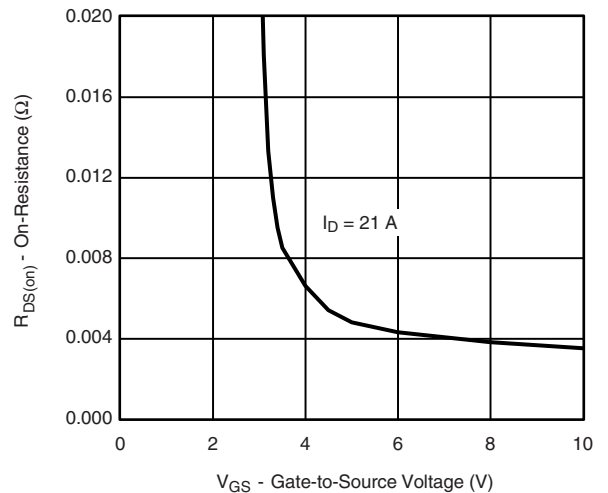
**Gate Charge**



**On-Resistance vs. Junction Temperature**

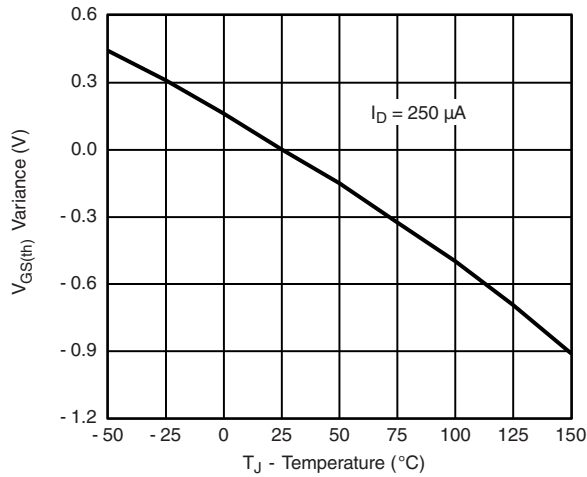


**Source-Drain Diode Forward Voltage**

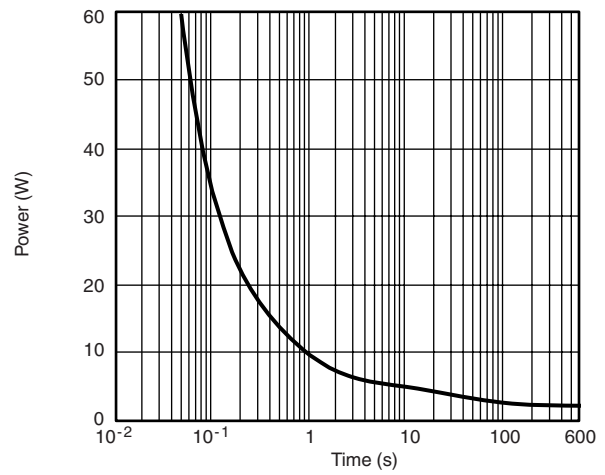


**On-Resistance vs. Gate-to-Source Voltage**

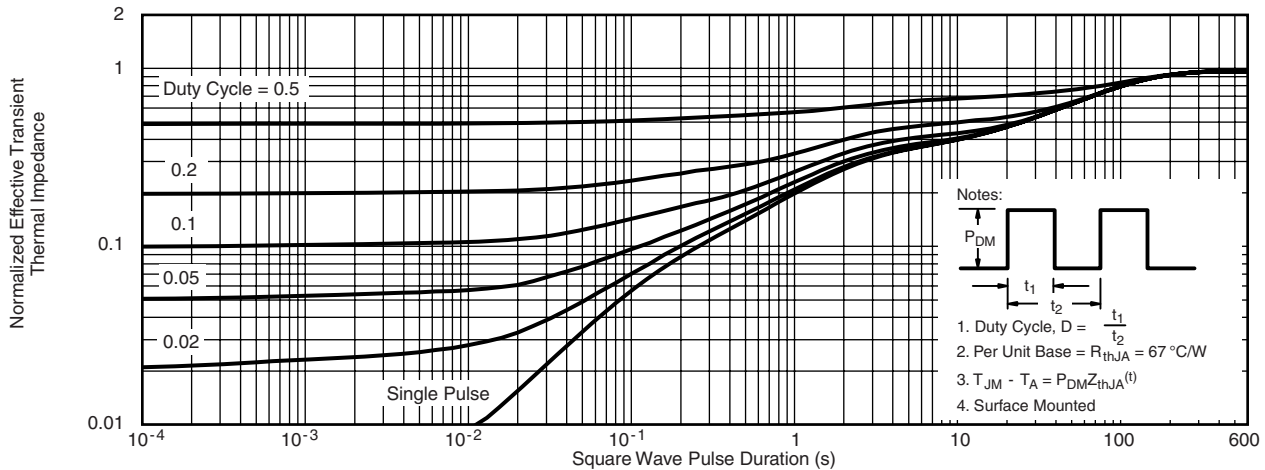
### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



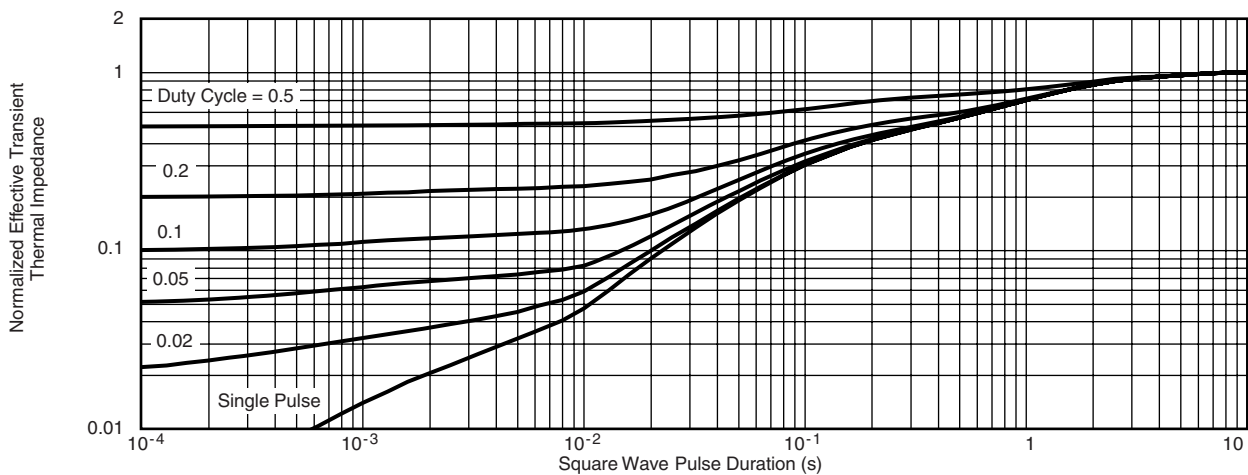
**Threshold Voltage**



**Single Pulse Power**



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**Normalized Thermal Transient Impedance, Junction-to-Foot**

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## SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



| DIM                            | MILLIMETERS |      | INCHES    |       |
|--------------------------------|-------------|------|-----------|-------|
|                                | Min         | Max  | Min       | Max   |
| A                              | 1.35        | 1.75 | 0.053     | 0.069 |
| A <sub>1</sub>                 | 0.10        | 0.20 | 0.004     | 0.008 |
| B                              | 0.35        | 0.51 | 0.014     | 0.020 |
| C                              | 0.19        | 0.25 | 0.0075    | 0.010 |
| D                              | 4.80        | 5.00 | 0.189     | 0.196 |
| E                              | 3.80        | 4.00 | 0.150     | 0.157 |
| e                              | 1.27 BSC    |      | 0.050 BSC |       |
| H                              | 5.80        | 6.20 | 0.228     | 0.244 |
| h                              | 0.25        | 0.50 | 0.010     | 0.020 |
| L                              | 0.50        | 0.93 | 0.020     | 0.037 |
| q                              | 0°          | 8°   | 0°        | 8°    |
| S                              | 0.44        | 0.64 | 0.018     | 0.026 |
| ECN: C-06527-Rev. I, 11-Sep-06 |             |      |           |       |
| DWG: 5498                      |             |      |           |       |

## RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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