

## Dual P-Channel 2.5-V (G-S) MOSFET

### PRODUCT SUMMARY

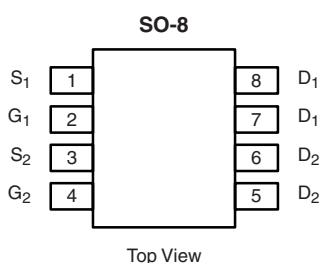
| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )  | $I_D$ (A) |
|--------------|----------------------------|-----------|
| - 20         | 0.06 at $V_{GS} = - 4.5$ V | - 4.7     |
|              | 0.10 at $V_{GS} = - 2.5$ V | - 3.7     |

### FEATURES

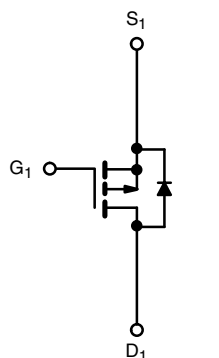
- Halogen-free According to IEC 61249-2-21 Definition
- Compliant to RoHS Directive 2002/95/EC



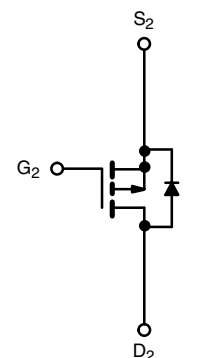
**RoHS**  
COMPLIANT  
**HALOGEN**  
**FREE**  
Available



Ordering Information: Si9933BDY-T1-E3 (Lead (Pb)-free)  
Si9933BDY-T1-GE3 (Lead (Pb)-free and Halogen-free)



P-Channel MOSFET



P-Channel MOSFET

### ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

| Parameter                                                 | Symbol         | 10 s        | Steady State | Unit |
|-----------------------------------------------------------|----------------|-------------|--------------|------|
| Drain-Source Voltage                                      | $V_{DS}$       | - 20        |              | V    |
| Gate-Source Voltage                                       | $V_{GS}$       | $\pm 12$    |              |      |
| Continuous Drain Current ( $T_J = 150$ °C) <sup>a</sup>   | $I_D$          | - 4.7       | - 3.6        | A    |
|                                                           |                | - 3.8       | - 2.8        |      |
| Pulsed Drain Current                                      | $I_{DM}$       | - 20        |              |      |
| Continuous Source Current (Diode Conduction) <sup>a</sup> | $I_S$          | - 1.7       | - 0.9        | W    |
| Maximum Power Dissipation <sup>a</sup>                    | $P_D$          | 2.0         | 1.1          |      |
|                                                           |                | 1.3         | 0.7          |      |
| Operating Junction and Storage Temperature Range          | $T_J, T_{stg}$ | - 55 to 150 |              | °C   |

### THERMAL RESISTANCE RATINGS

| Parameter                                | Symbol     | Typical | Maximum | Unit |
|------------------------------------------|------------|---------|---------|------|
| Maximum Junction-to-Ambient <sup>a</sup> | $R_{thJA}$ | 55      | 62.5    | °C/W |
|                                          |            | 90      | 110     |      |
| Maximum Junction-to-Foot (Drain)         | $R_{thJF}$ | 33      | 40      |      |

Notes:

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

For SPICE model information via the Worldwide Web: [www.vishay.com/www/product/spice.htm](http://www.vishay.com/www/product/spice.htm)

**SPECIFICATIONS**  $T_A = 25\text{ }^{\circ}\text{C}$  unless otherwise noted

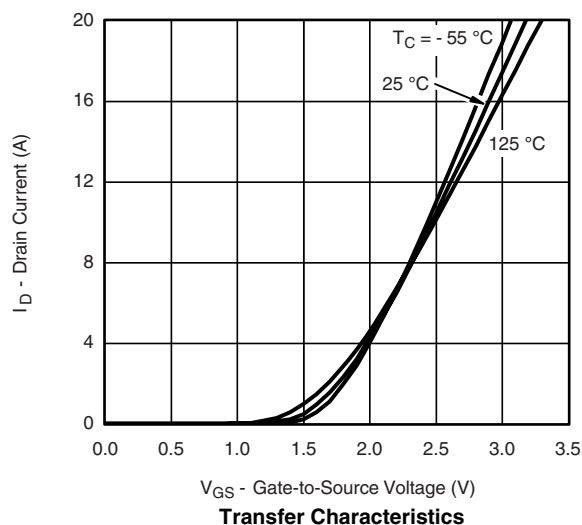
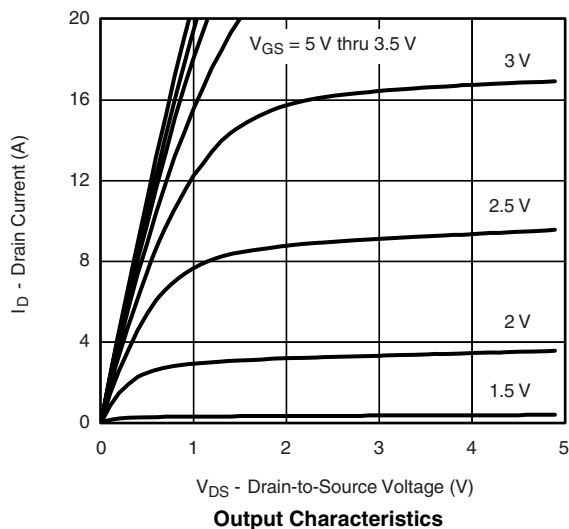
| Parameter                                     | Symbol       | Test Conditions                                                                                                                      | Min. | Typ.  | Max.      | Unit          |
|-----------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------|------|-------|-----------|---------------|
| <b>Static</b>                                 |              |                                                                                                                                      |      |       |           |               |
| Gate Threshold Voltage                        | $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$                                                                                  | -0.6 |       | -1.4      | V             |
| Gate-Body Leakage                             | $I_{GSS}$    | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 12\text{ V}$                                                                                   |      |       | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current               | $I_{DSS}$    | $V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                      |      |       | -1        | $\mu\text{A}$ |
|                                               |              | $V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 55\text{ }^{\circ}\text{C}$                                                 |      |       | -5        |               |
| On-State Drain Current <sup>a</sup>           | $I_{D(on)}$  | $V_{DS} \leq -5\text{ V}$ , $V_{GS} = -4.5\text{ V}$                                                                                 | -20  |       |           | A             |
| Drain-Source On-State Resistance <sup>a</sup> | $R_{DS(on)}$ | $V_{GS} = -4.5\text{ V}$ , $I_D = -4.7\text{ A}$                                                                                     |      | 0.048 | 0.06      | $\Omega$      |
|                                               |              | $V_{GS} = -2.5\text{ V}$ , $I_D = -1\text{ A}$                                                                                       |      | 0.08  | 0.10      |               |
| Forward Transconductance <sup>a</sup>         | $g_{fs}$     | $V_{DS} = -10\text{ V}$ , $I_D = -4.7\text{ A}$                                                                                      |      | 11    |           | S             |
| Diode Forward Voltage <sup>a</sup>            | $V_{SD}$     | $I_S = -1.7\text{ A}$ , $V_{GS} = 0\text{ V}$                                                                                        |      | -0.75 | -1.2      | V             |
| <b>Dynamic<sup>b</sup></b>                    |              |                                                                                                                                      |      |       |           |               |
| Total Gate Charge                             | $Q_g$        | $V_{DS} = -10\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -4.7\text{ A}$                                                           |      | 6     | 9         | nC            |
| Gate-Source Charge                            | $Q_{gs}$     |                                                                                                                                      |      | 1.4   |           |               |
| Gate-Drain Charge                             | $Q_{gd}$     |                                                                                                                                      |      | 1.9   |           |               |
| Gate Resistance                               | $R_g$        | $f = 1\text{ MHz}$                                                                                                                   |      | 9.5   |           | $\Omega$      |
| Turn-On Delay Time                            | $t_{d(on)}$  | $V_{DD} = -10\text{ V}$ , $R_L = 10\text{ }\Omega$<br>$I_D \equiv -1\text{ A}$ , $V_{GEN} = -4.5\text{ V}$ , $R_g = 6\text{ }\Omega$ |      | 22    | 35        | ns            |
| Rise Time                                     | $t_r$        |                                                                                                                                      |      | 35    | 55        |               |
| Turn-Off Delay Time                           | $t_{d(off)}$ |                                                                                                                                      |      | 45    | 70        |               |
| Fall Time                                     | $t_f$        |                                                                                                                                      |      | 25    | 40        |               |
| Source-Drain Reverse Recovery Time            | $t_{rr}$     | $I_F = -1.7\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}$                                                                           |      | 25    | 50        |               |

Notes:

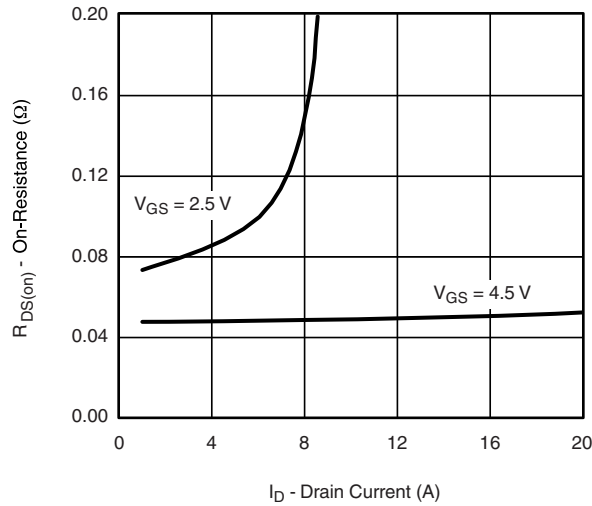
a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

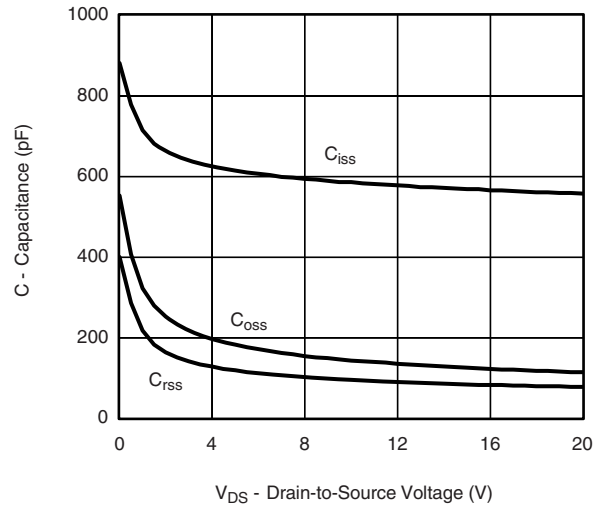
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

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

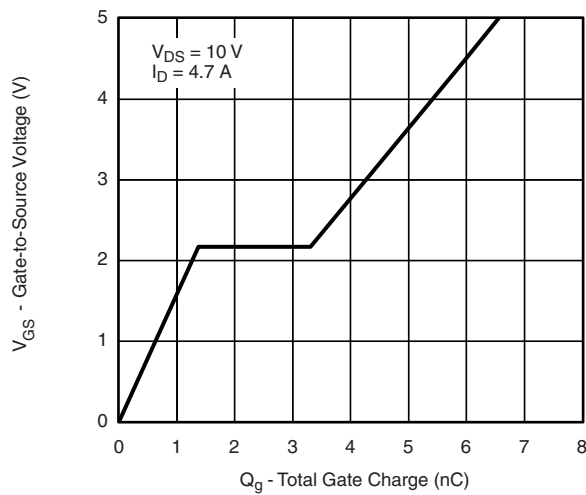
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



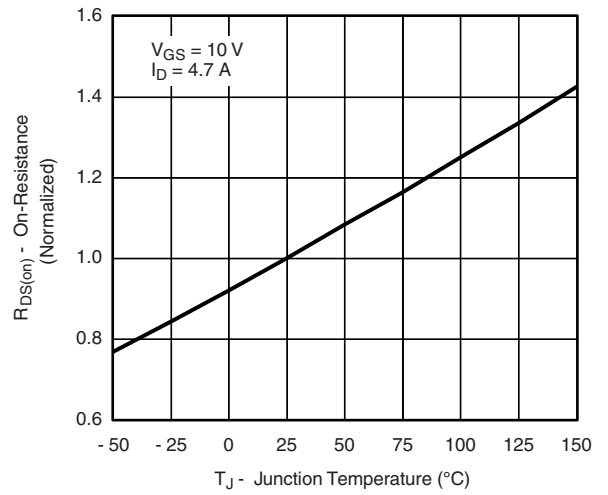
On-Resistance vs. Drain Current



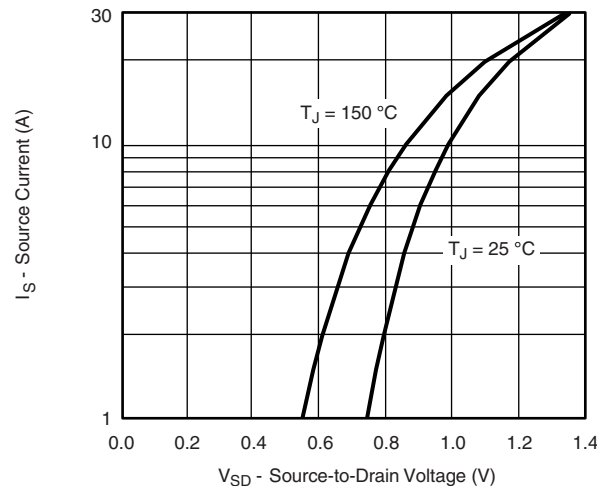
Capacitance



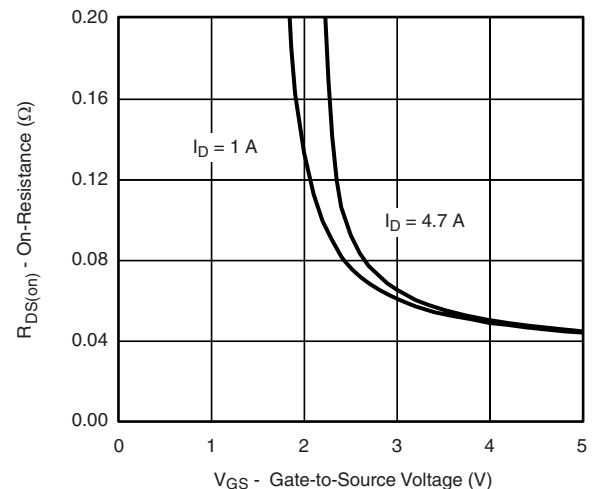
Gate Charge



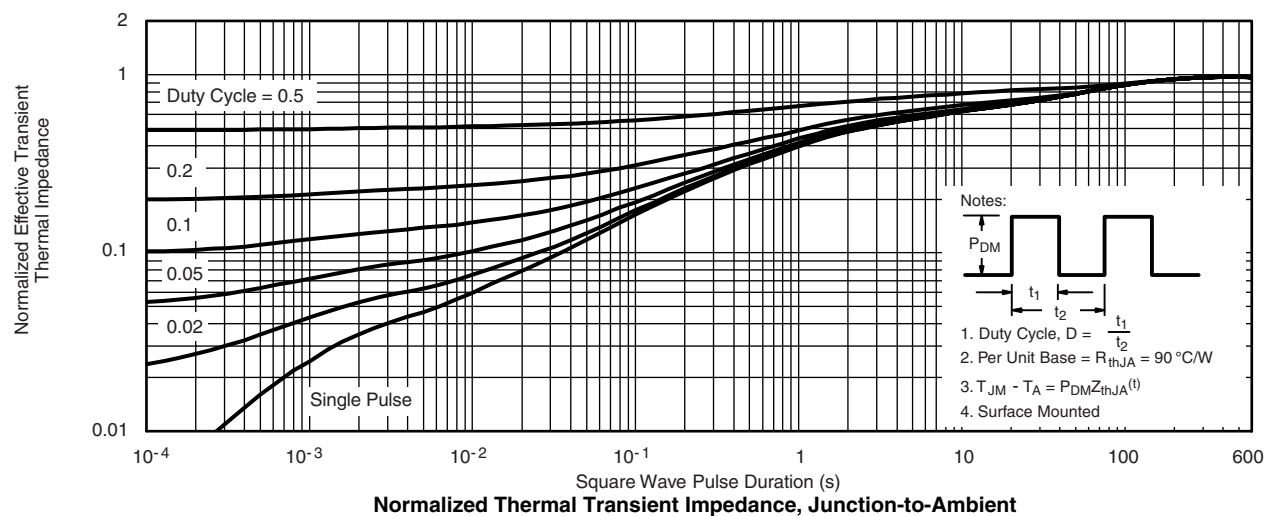
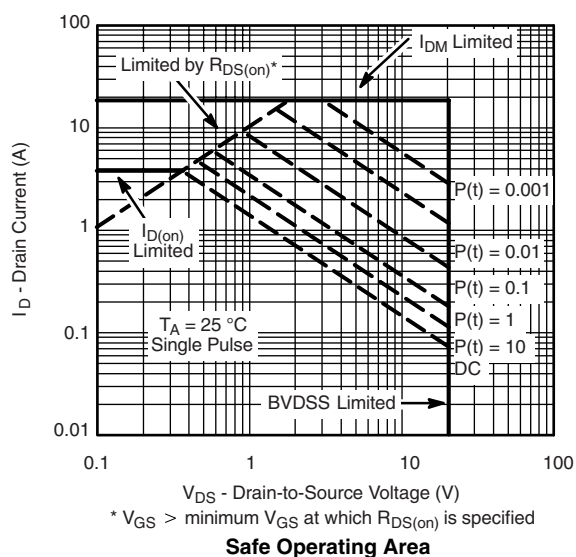
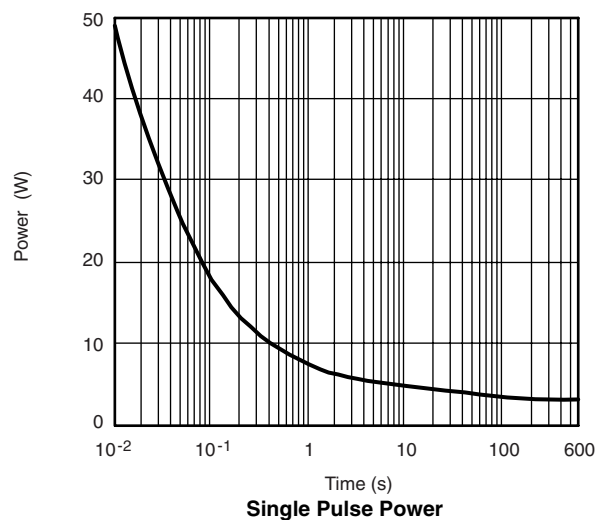
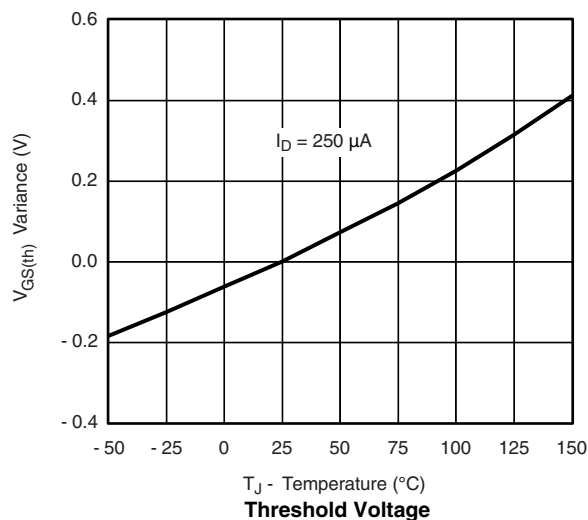
On-Resistance vs. Junction Temperature



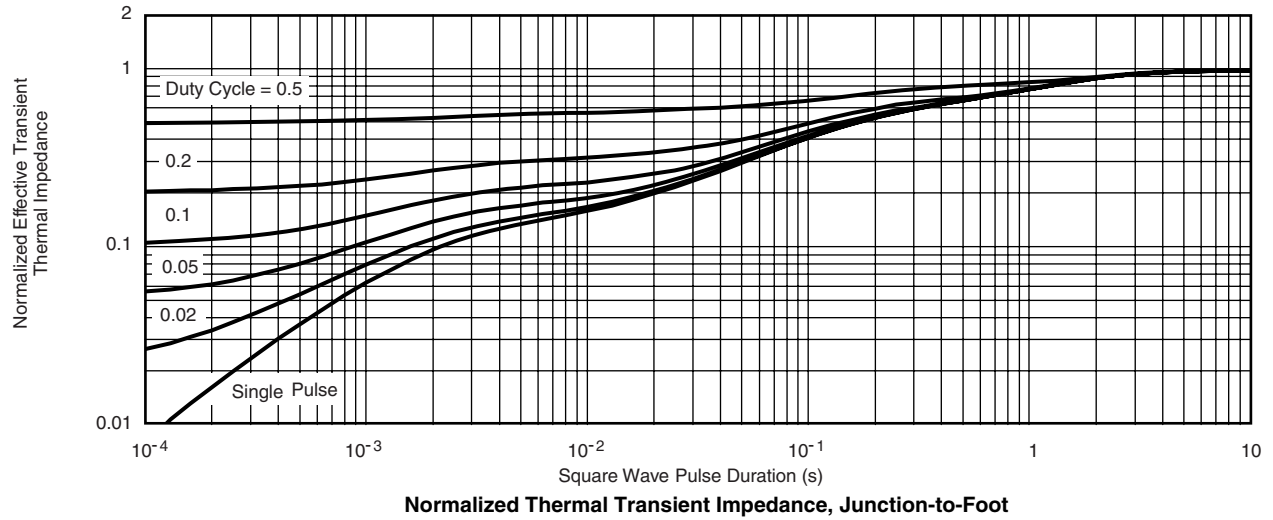
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage

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

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