

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

| PRODUCT SUMMARY     |                                  |                    |                       |
|---------------------|----------------------------------|--------------------|-----------------------|
| V <sub>DS</sub> (V) | R <sub>DS(on)</sub> (Ω) Max.     | I <sub>D</sub> (A) | Q <sub>g</sub> (Typ.) |
| 20                  | 0.420 at V <sub>GS</sub> = 4.5 V | 0.5                | 1 nC                  |
|                     | 0.492 at V <sub>GS</sub> = 2.5 V | 0.2                |                       |
|                     | 0.597 at V <sub>GS</sub> = 1.8 V | 0.2                |                       |
|                     | 0.762 at V <sub>GS</sub> = 1.5 V | 0.05               |                       |

### FEATURES

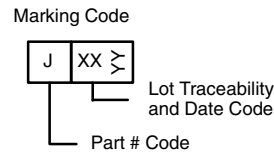
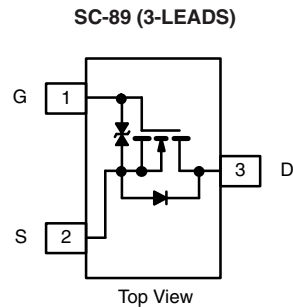
- TrenchFET<sup>®</sup> Power MOSFET
- Gate-Source ESD Protected: 1000 V
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- Load/Power Switching for Portable Devices
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories
- Battery Operated Systems
- Power Supply Converter Circuits



Ordering Information: Si1062X-T1-GE3 (Lead (Pb)-free and Halogen-free)

| ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted) |                                   |                      |                      |   |
|---|-----------------------------------|----------------------|----------------------|---|
| Parameter   | Symbol                            | Limit                | 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            | 0.53 <sup>a, b</sup> | A                    |   |
|   | T <sub>A</sub> = 70 °C            | 0.43 <sup>a, b</sup> |                      |   |
| Pulsed Drain Current (t = 300 μs)   | I <sub>DM</sub>                   | 2                    |                      |   |
| Continuous Source-Drain Diode Current                                     | T <sub>A</sub> = 25 °C            | I <sub>S</sub>       | 0.18 <sup>a, b</sup> | A |
| Maximum Power Dissipation <sup>a</sup>                                    | T <sub>A</sub> = 25 °C            | P <sub>D</sub>       | 0.22 <sup>a, b</sup> | W |
|   | T <sub>A</sub> = 70 °C            |                      | 0.14 <sup>a, b</sup> |   |
| Operating Junction and Storage Temperature Range                          | T <sub>J</sub> , T <sub>stg</sub> | - 55 to 150          | °C                   |   |

| THERMAL RESISTANCE RATINGS               |                   |              |      |      |      |
|--|-------------------|--------------|------|------|------|
| Parameter                                | Symbol            | Typ.         | Max. | Unit |      |
| Maximum Junction-to-Ambient <sup>b</sup> | R <sub>thJA</sub> | t ≤ 5 s      | 440  | 530  | °C/W |
|  |                   | Steady State | 540  | 650  |      |

Notes:

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

b. t = 5 s.

| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                         |   |  |       |          |                      |    |
|---|-------------------------|---|--|-------|----------|----------------------|----|
| Parameter   | Symbol                  | Test Conditions   | Min.   | Typ.  | Max.     | Unit                 |    |
| <b>Static</b>   |                         |   |  |       |          |                      |    |
| Drain-Source Breakdown Voltage  | $V_{DS}$                | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                            | 20   |       |          | V                    |    |
| $V_{DS}$ Temperature Coefficient  | $\Delta V_{DS}/T_J$     | $I_D = 250\text{ }\mu\text{A}$  |  | 11    |          | mV/ $^\circ\text{C}$ |    |
| $V_{GS(th)}$ Temperature Coefficient  | $\Delta V_{GS(th)}/T_J$ |   |  | - 1.8 |          |                      |    |
| Gate-Source Threshold Voltage   | $V_{GS(th)}$            | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                | 0.4  |       | 1        | V                    |    |
| Gate-Source Leakage   | $I_{GSS}$               | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 8\text{ V}$                                 |  |       | $\pm 30$ | $\mu\text{A}$        |    |
|   |                         | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 4.5\text{ V}$                               |  |       | $\pm 1$  |                      |    |
| Zero Gate Voltage Drain Current   | $I_{DSS}$               | $V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$                                    |  |       | 1        |                      |    |
|   |                         | $V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 85\text{ }^\circ\text{C}$ |  |       | 10       |                      |    |
| On-State Drain Current <sup>a</sup>   | $I_{D(on)}$             | $V_{DS} \geq 5\text{ V}$ , $V_{GS} = 4.5\text{ V}$                                | 2  |       |          | A                    |    |
| Drain-Source On-State Resistance <sup>a</sup>                               | $R_{DS(on)}$            | $V_{GS} = 4.5\text{ V}$ , $I_D = 0.5\text{ A}$                                    |  | 0.350 | 0.420    | $\Omega$             |    |
|   |                         | $V_{GS} = 2.5\text{ V}$ , $I_D = 0.2\text{ A}$                                    |  | 0.410 | 0.492    |                      |    |
|   |                         | $V_{GS} = 1.8\text{ V}$ , $I_D = 0.2\text{ A}$                                    |  | 0.459 | 0.597    |                      |    |
|   |                         | $V_{GS} = 1.5\text{ V}$ , $I_D = 0.05\text{ A}$                                   |  | 0.510 | 0.762    |                      |    |
| Forward Transconductance  | $g_{fs}$                | $V_{DS} = 10\text{ V}$ , $I_D = 0.5\text{ A}$                                     |  | 7.5   |          | S                    |    |
| <b>Dynamic<sup>b</sup></b>  |                         |   |  |       |          |                      |    |
| Input Capacitance   | $C_{iss}$               | $V_{DS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$               |  | 43    |          | pF                   |    |
| Output Capacitance  | $C_{oss}$               |   |  | 14    |          |                      |    |
| Reverse Transfer Capacitance  | $C_{rss}$               |   |  | 8     |          |                      |    |
| Total Gate Charge   | $Q_g$                   | $V_{DS} = 10\text{ V}$ , $V_{GS} = 8\text{ V}$ , $I_D = 0.5\text{ A}$             |  | 1.8   | 2.7      | nC                   |    |
| Gate-Source Charge  | $Q_{gs}$                | $V_{DS} = 10\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 0.5\text{ A}$           |  | 1     | 2        |                      |    |
| Gate-Drain Charge   | $Q_{gd}$                |   |  | 0.16  |          |                      |    |
| Gate Resistance   | $R_g$                   |   |  | 0.13  |          |                      |    |
| Turn-On Delay Time  | $t_{d(on)}$             | $f = 1\text{ MHz}$  |  | 12.2  |          | $\Omega$             |    |
| Rise Time   | $t_r$                   |   | $V_{DD} = 10\text{ V}$ , $R_L = 20\text{ }\Omega$<br>$I_D \cong 0.4\text{ A}$ , $V_{GEN} = 4.5\text{ V}$ , $R_g = 1\text{ }\Omega$ |       | 2        | 4                    | ns |
| Turn-Off Delay Time   | $t_{d(off)}$            |   |  |       | 14       | 24                   |    |
| Fall Time   | $t_f$                   |   |  |       | 16       | 30                   |    |
|   |                         |   |  |       | 11       | 20                   |    |
| <b>Drain-Source Body Diode Characteristics</b>                              |                         |   |  |       |          |                      |    |
| Pulse Diode Forward Current <sup>a</sup>                                    | $I_{SM}$                |   |  |       | 2        | A                    |    |
| Body Diode Voltage  | $V_{SD}$                | $I_S = 0.4\text{ A}$  |  | 0.8   | 1.2      | V                    |    |
| Body Diode Reverse Recovery Time  | $t_{rr}$                | $I_F = 0.4\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}$                         |  | 10    | 15       | ns                   |    |
| Body Diode Reverse Recovery Charge  | $Q_{rr}$                |   |  | 2     | 4        | nC                   |    |
| Reverse Recovery Fall Time  | $t_a$                   |   |  | 5     |          | ns                   |    |
| Reverse Recovery Rise Time  | $t_b$                   |   |  | 5     |          |                      |    |

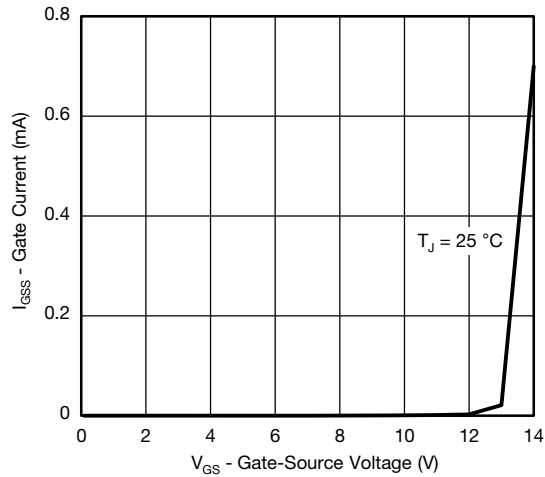
## Notes:

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

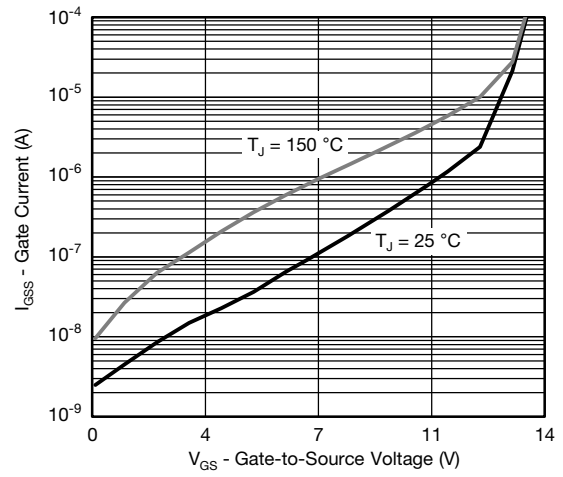
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



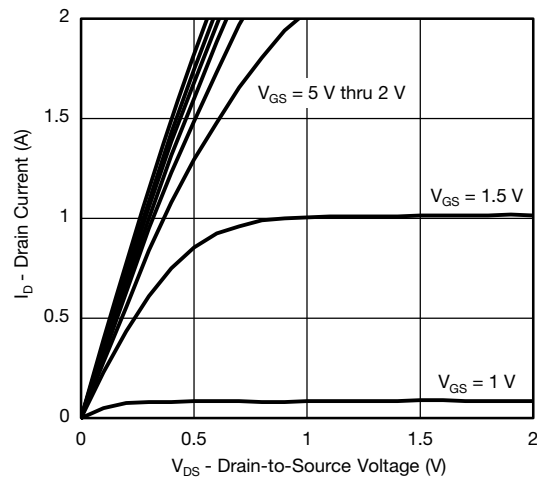
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



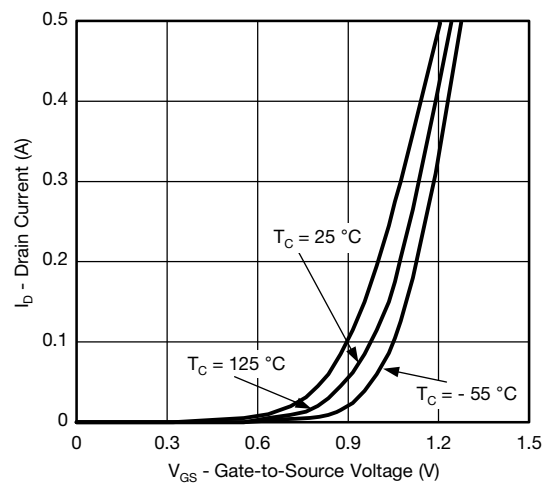
**Gate Current vs. Gate-Source Voltage**



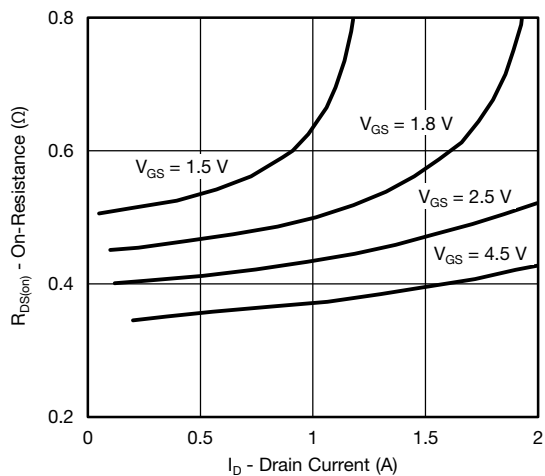
**Gate Current vs. Gate-Source Voltage**



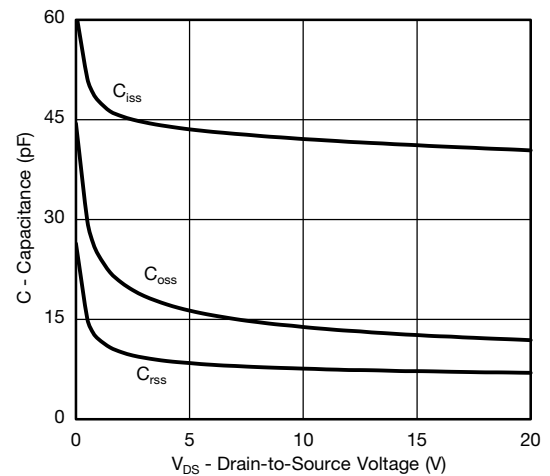
**Output Characteristics**



**Transfer Characteristics**



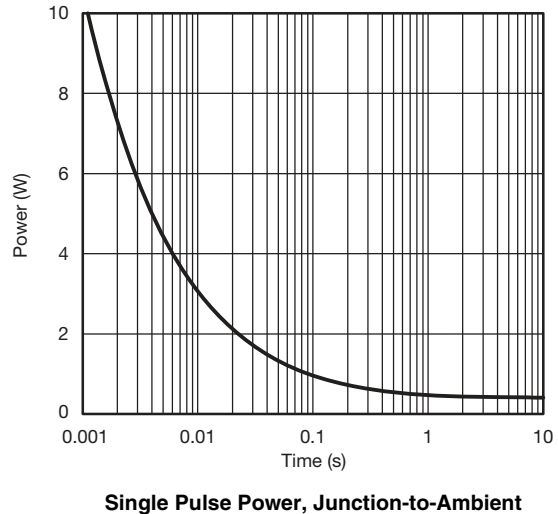
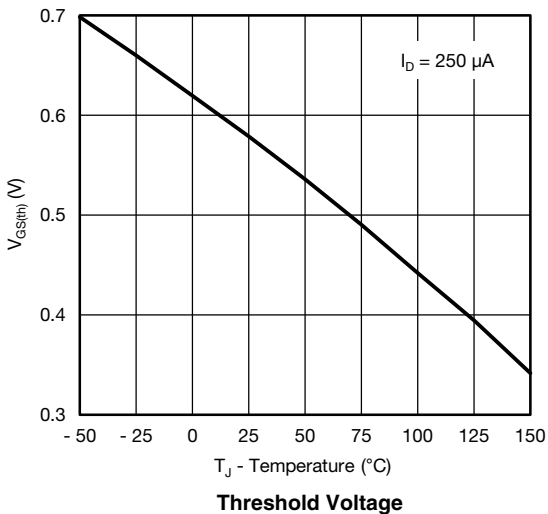
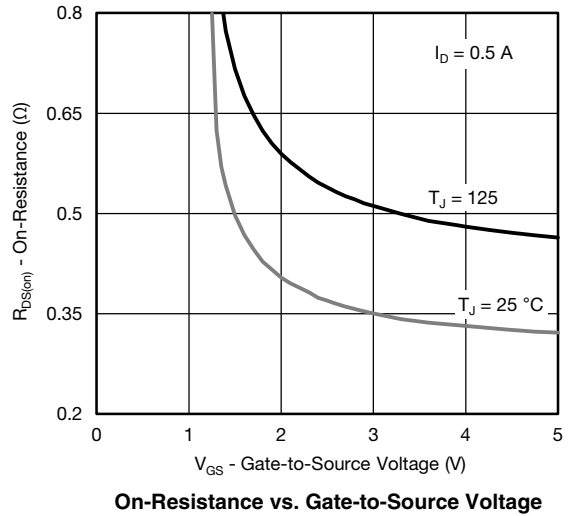
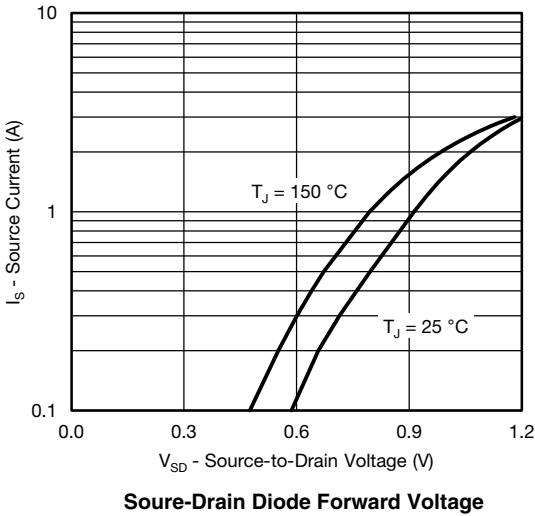
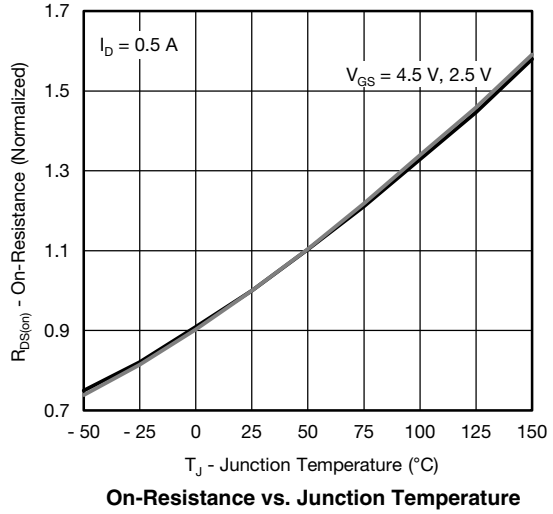
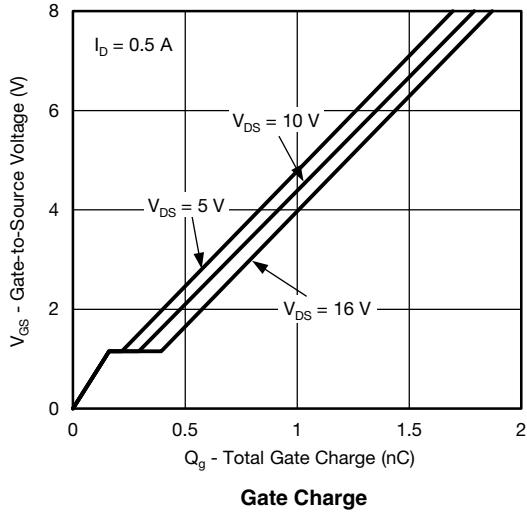
**On-Resistance vs. Drain Current**



**Capacitance**

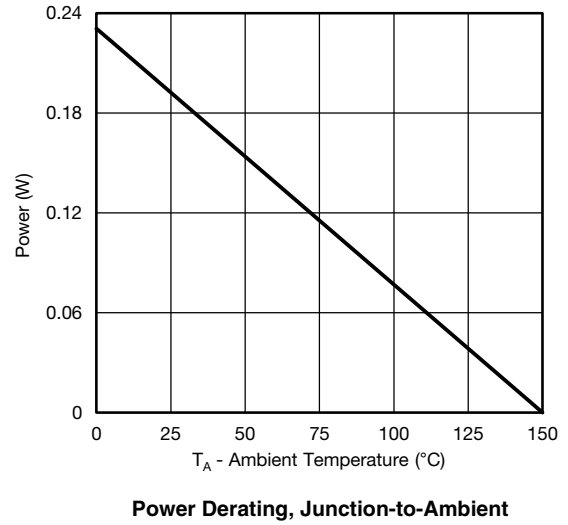
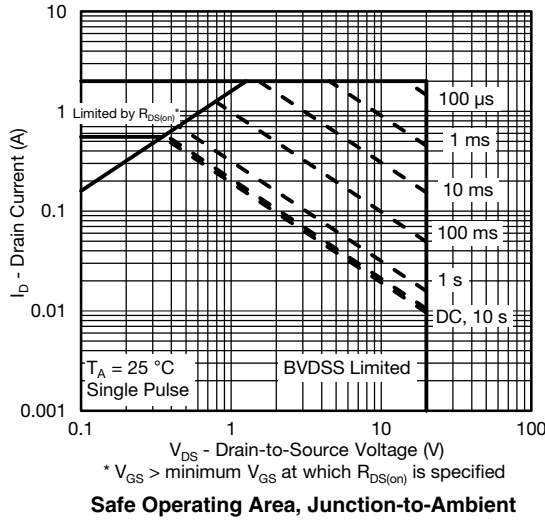


**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

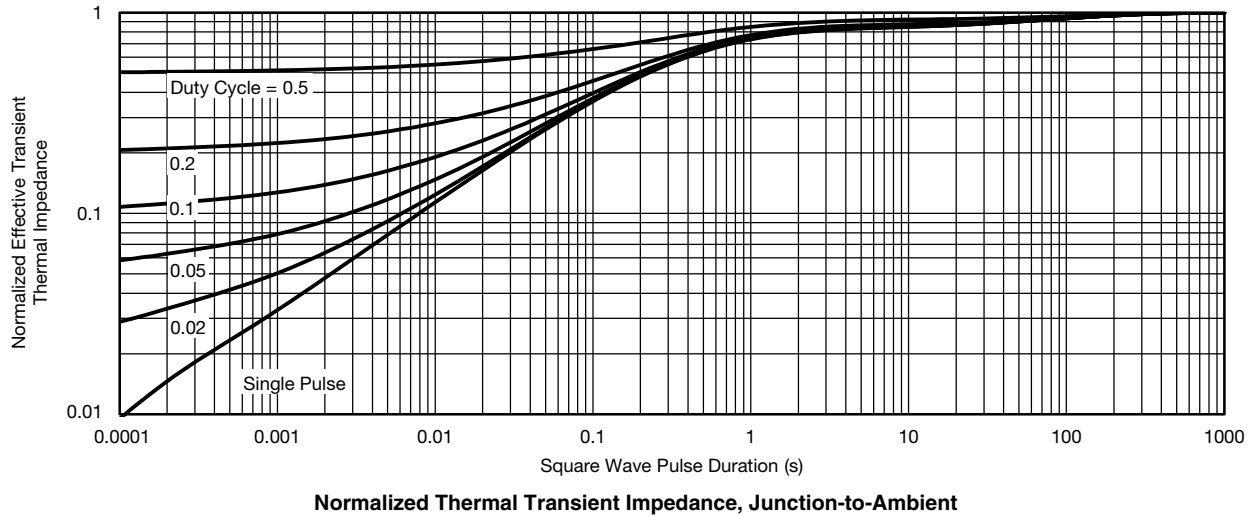




**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?62661](http://www.vishay.com/ppg?62661).



SC89-3



DETAIL X

| Dim                  | MILLIMETERS |      | INCHES    |       |
|----------------------|-------------|------|-----------|-------|
|                      | Min         | Max  | Min       | Max   |
| <b>A</b>             | 0.60        | 0.80 | 0.024     | 0.031 |
| <b>b</b>             | 0.23        | 0.33 | 0.009     | 0.013 |
| <b>C</b>             | 0.10        | 0.20 | 0.004     | 0.008 |
| <b>D</b>             | 1.50        | 1.70 | 0.059     | 0.067 |
| <b>E</b>             | 0.75        | 0.95 | 0.030     | 0.037 |
| <b>e</b>             | 1.00 BSC    |      | 0.040 BSC |       |
| <b>e<sub>1</sub></b> | 0.50 BSC    |      | 0.020 BSC |       |
| <b>H</b>             | 1.50        | 1.70 | 0.059     | 0.067 |
| <b>L</b>             | 0.30        | 0.50 | 0.012     | 0.020 |

ECN: S-03946—Rev. B, 09-Jul-01  
DWG: 5869

## RECOMMENDED MINIMUM PADS FOR SC-89: 3-Lead



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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