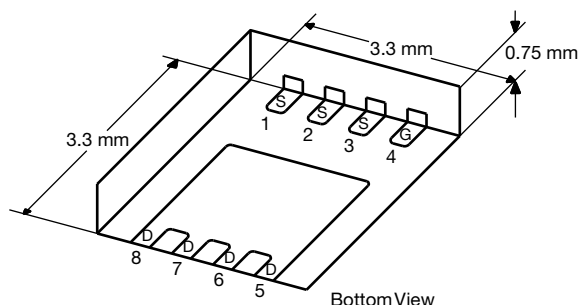


## P-Channel 20 V (D-S) MOSFET

### 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                | 0.0045 at V <sub>GS</sub> = - 4.5 V | - 50 <sup>e</sup>  | 93 nC                 |
|                     | 0.0063 at V <sub>GS</sub> = - 2.5 V | - 50 <sup>e</sup>  |                       |
|                     | 0.0115 at V <sub>GS</sub> = - 1.8 V | - 50 <sup>e</sup>  |                       |

PowerPAK 1212-8S



#### Ordering Information:

SiSS23DN-T1-GE3 (Lead (Pb)-free and Halogen-free)

### FEATURES

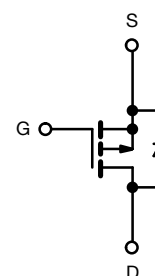
- TrenchFET® Power MOSFET
- Low Thermal Resistance PowerPAK® Package with Small Size and Low 0.75 mm Profile
- 100 % R<sub>g</sub> and UIS Tested
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- Smart Phones, Tablet PCs, Mobile Computing
  - Battery Switch
  - Load Switch
  - Power Management
  - Battery Management



P-Channel MOSFET

### 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)           | I <sub>D</sub>                    | T <sub>C</sub> = 25 °C | A    |
|                                                              |                                   | T <sub>C</sub> = 70 °C |      |
|                                                              |                                   | T <sub>A</sub> = 25 °C |      |
|                                                              |                                   | T <sub>A</sub> = 70 °C |      |
| Pulsed Drain Current (t = 100 μs)                            | I <sub>DM</sub>                   | - 200                  | A    |
| Continuous Source-Drain Diode Current                        | I <sub>S</sub>                    | T <sub>C</sub> = 25 °C |      |
|                                                              |                                   | T <sub>A</sub> = 25 °C |      |
| Avalanche Current                                            | I <sub>AS</sub>                   | - 23                   |      |
| Single-Pulse Avalanche Energy                                | E <sub>AS</sub>                   | 26                     | mJ   |
| Maximum Power Dissipation                                    | P <sub>D</sub>                    | T <sub>C</sub> = 25 °C | W    |
|                                                              |                                   | T <sub>C</sub> = 70 °C |      |
|                                                              |                                   | T <sub>A</sub> = 25 °C |      |
|                                                              |                                   | T <sub>A</sub> = 70 °C |      |
| Operating Junction and Storage Temperature Range             | T <sub>J</sub> , T <sub>stg</sub> | - 50 to 150            | °C   |
| Soldering Recommendations (Peak Temperature) <sup>c, d</sup> |                                   | 260                    |      |

#### Notes:

- Surface mounted on 1" x 1" FR4 board.
- t = 10 s.
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The PowerPAK 1212-8S is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.
- Package limited.

**THERMAL RESISTANCE RATINGS**

| Parameter                                   |               | Symbol     | Typical | Maximum | Unit |
|---------------------------------------------|---------------|------------|---------|---------|------|
| Maximum Junction-to-Ambient <sup>a, b</sup> | $t \leq 10$ s | $R_{thJA}$ | 21      | 26      | °C/W |
| Maximum Junction-to-Case (Drain)            | Steady State  | $R_{thJC}$ | 1.7     | 2.2     |      |

Notes:

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

b. Maximum under steady state conditions is 63 °C/W.

**SPECIFICATIONS** ( $T_J = 25$  °C, unless otherwise noted)

| Parameter                                     | Symbol                               | Test Conditions                                                                                                             | Min.  | Typ.   | Max.   | Unit      |  |
|-----------------------------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------|--------|--------|-----------|--|
| Static                                        |                                      |                                                                                                                             |       |        |        |           |  |
| Drain-Source Breakdown Voltage                | V <sub>DS</sub>                      | V <sub>GS</sub> = 0 V, I <sub>D</sub> = - 250 μA                                                                            | - 20  |        |        | V         |  |
| V <sub>DS</sub> Temperature Coefficient       | ΔV <sub>DS</sub> /T <sub>J</sub>     | I <sub>D</sub> = - 250 μA                                                                                                   |       | - 12   |        | mV/<br>°C |  |
| V <sub>GS(th)</sub> Temperature Coefficient   | ΔV <sub>GS(th)</sub> /T <sub>J</sub> |                                                                                                                             |       | 3.4    |        |           |  |
| Gate-Source Threshold Voltage                 | V <sub>GS(th)</sub>                  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA                                                               | - 0.4 |        | - 0.9  | V         |  |
| Gate-Source 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> = 55 °C                                                     |       |        | - 10   |           |  |
| On-State Drain Current <sup>a</sup>           | I <sub>D(on)</sub>                   | V <sub>DS</sub> ≤ - 5 V, V <sub>GS</sub> = - 4.5 V                                                                          | - 20  |        |        | A         |  |
| Drain-Source On-State Resistance <sup>a</sup> | R <sub>DS(on)</sub>                  | V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 20 A                                                                          |       | 0.0035 | 0.0045 | Ω         |  |
|                                               |                                      | V <sub>GS</sub> = - 2.5 V, I <sub>D</sub> = - 10 A                                                                          |       | 0.0051 | 0.0063 |           |  |
|                                               |                                      | V <sub>GS</sub> = - 1.8 V, I <sub>D</sub> = - 10 A                                                                          |       | 0.0081 | 0.0115 |           |  |
| Forward Transconductance <sup>a</sup>         | g <sub>fs</sub>                      | V <sub>DS</sub> = - 10 V, I <sub>D</sub> = - 20 A                                                                           |       | 44     |        | S         |  |
| Dynamic <sup>b</sup>                          |                                      |                                                                                                                             |       |        |        |           |  |
| Input Capacitance                             | C <sub>iss</sub>                     | V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz                                                                  |       | 8840   |        | pF        |  |
| Output Capacitance                            | C <sub>oss</sub>                     |                                                                                                                             |       | 835    |        |           |  |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>                     |                                                                                                                             |       | 900    |        |           |  |
| Total Gate Charge                             | Q <sub>g</sub>                       | V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 20 A                                                 |       | 195    | 300    | nC        |  |
|                                               |                                      | V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 20 A                                                |       | 93     | 140    |           |  |
|                                               |                                      |                                                                                                                             |       |        | 12     |           |  |
|                                               |                                      |                                                                                                                             |       |        | 21     |           |  |
| Gate-Source Charge                            | Q <sub>gs</sub>                      |                                                                                                                             |       |        |        |           |  |
| Gate-Drain Charge                             | Q <sub>gd</sub>                      |                                                                                                                             |       |        |        |           |  |
| Gate Resistance                               | R <sub>g</sub>                       | f = 1 MHz                                                                                                                   | 0.5   | 2.6    | 5.2    | Ω         |  |
| Turn-On Delay Time                            | t <sub>d(on)</sub>                   | V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 1 Ω<br>I <sub>D</sub> ≅ - 10 A, V <sub>GEN</sub> = - 4.5 V, R <sub>g</sub> = 1 Ω |       | 45     | 90     | ns        |  |
| Rise Time                                     | t <sub>r</sub>                       |                                                                                                                             |       | 50     | 100    |           |  |
| Turn-Off DelayTime                            | t <sub>d(off)</sub>                  |                                                                                                                             |       | 140    | 280    |           |  |
| Fall Time                                     | t <sub>f</sub>                       |                                                                                                                             |       | 50     | 100    |           |  |
| Turn-On Delay Time                            | t <sub>d(on)</sub>                   | V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 1 Ω<br>I <sub>D</sub> ≅ - 10 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω  |       | 15     | 30     |           |  |
| Rise Time                                     | t <sub>r</sub>                       |                                                                                                                             |       | 5      | 10     |           |  |
| Turn-Off DelayTime                            | t <sub>d(off)</sub>                  |                                                                                                                             |       | 150    | 300    |           |  |
| Fall Time                                     | t <sub>f</sub>                       |                                                                                                                             |       | 40     | 80     |           |  |
| Drain-Source Body Diode Characteristics       |                                      |                                                                                                                             |       |        |        |           |  |
| Continuous Source-Drain Diode Current         | I <sub>S</sub>                       | T <sub>C</sub> = 25 °C                                                                                                      |       |        | - 50°  | A         |  |
| Pulse Diode Forward Current <sup>d</sup>      | I <sub>SM</sub>                      |                                                                                                                             |       |        | - 200  |           |  |
| Body Diode Voltage                            | V <sub>SD</sub>                      | I <sub>F</sub> = - 10 A                                                                                                     |       | - 0.8  | - 1.2  | V         |  |
| Body Diode Reverse Recovery Time              | t <sub>rr</sub>                      | I <sub>F</sub> = - 10 A, dl/dt = 100 A/μs, T <sub>J</sub> = 25 °C                                                           |       | 30     | 60     | ns        |  |
| Body Diode Reverse Recovery Charge            | Q <sub>rr</sub>                      |                                                                                                                             |       | 15     | 30     | nC        |  |
| Reverse Recovery Fall Time                    | t <sub>a</sub>                       |                                                                                                                             |       | 16     |        | ns        |  |
| Reverse Recovery Rise Time                    | t <sub>b</sub>                       |                                                                                                                             |       | 14     |        |           |  |

Notes:

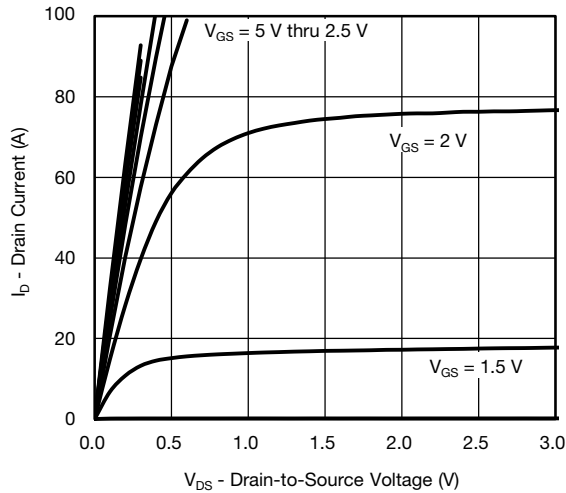
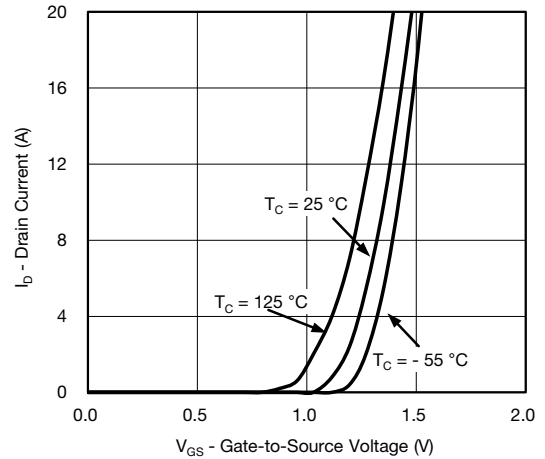
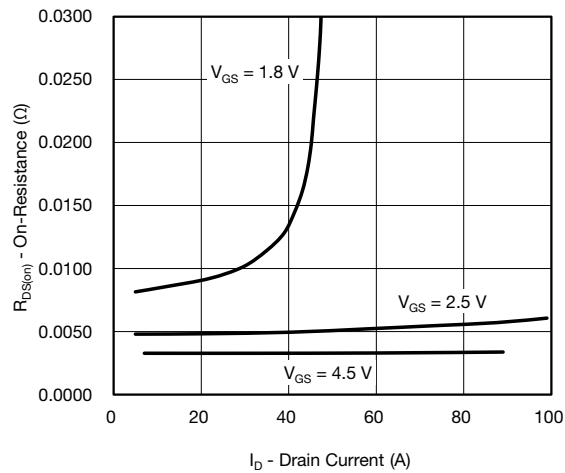
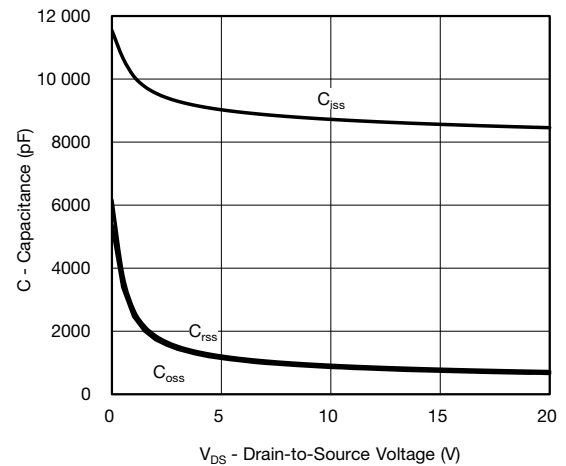
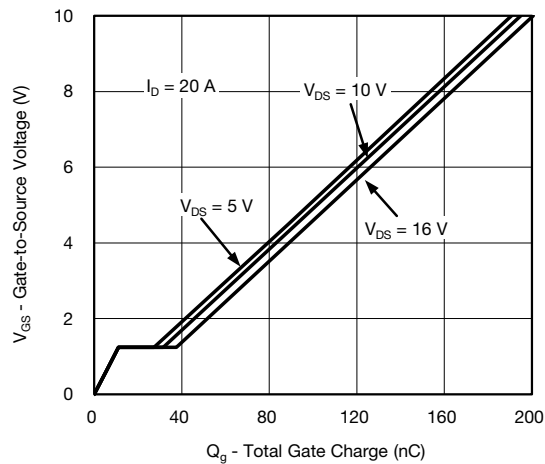
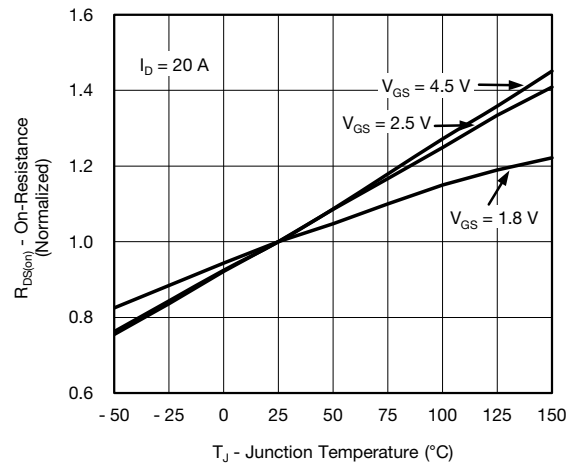
a. Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.

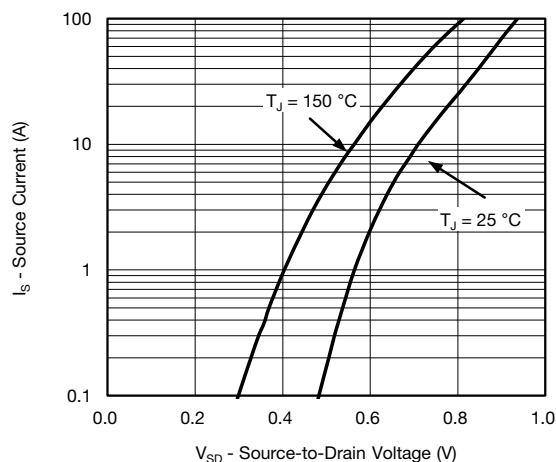
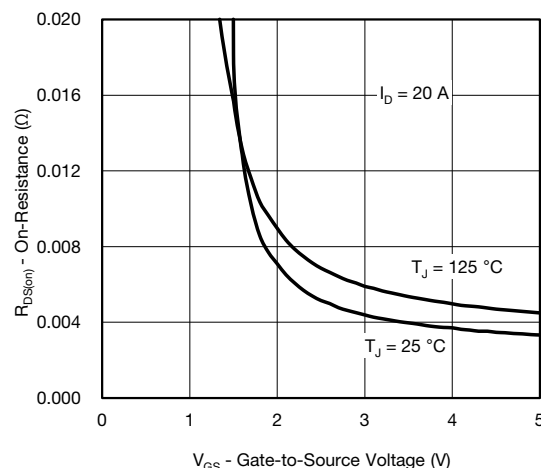
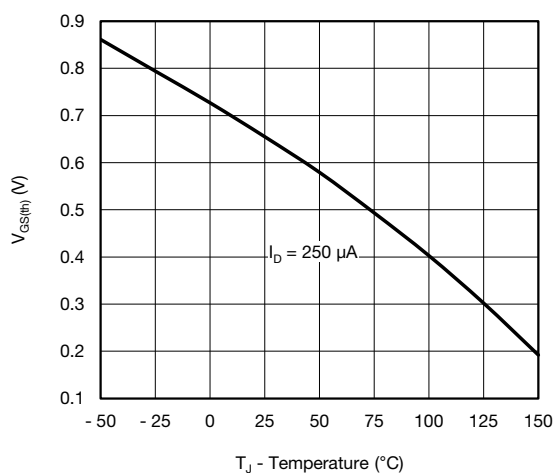
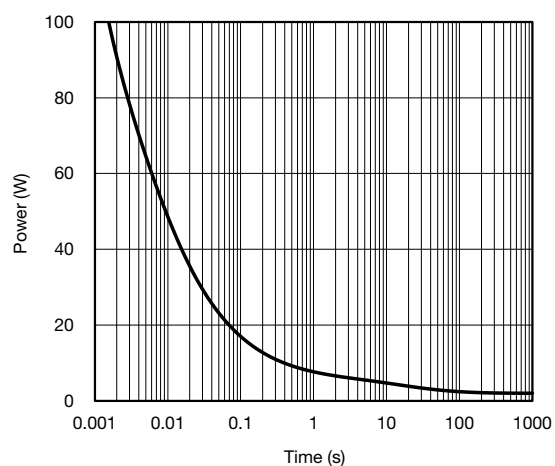
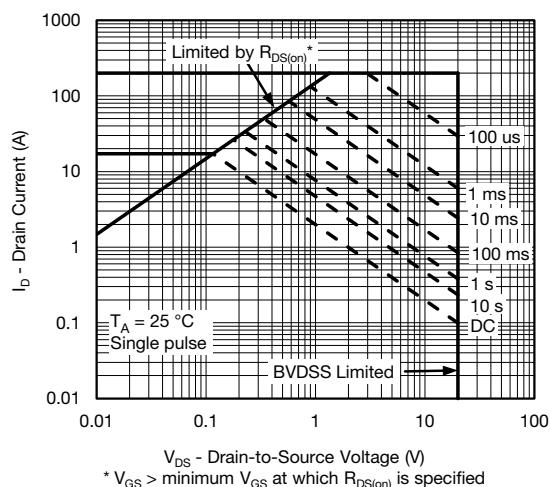
b. Guaranteed by design, not subject to production testing.

c. Package limited.

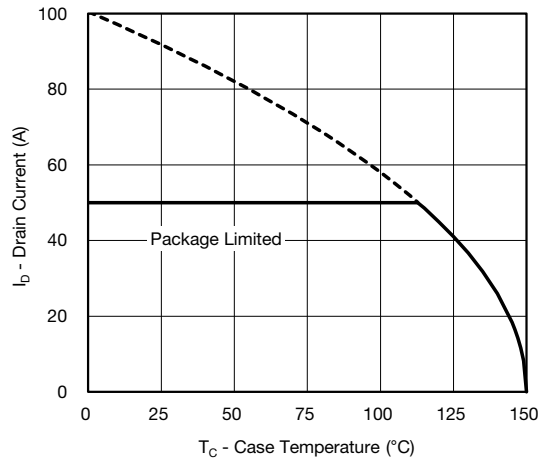
d.  $t = 100$   $\mu$ s.

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.

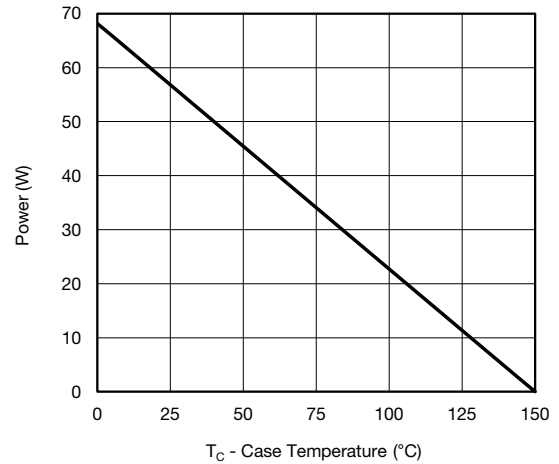
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current and Gate Voltage**

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)**Source-Drain Diode Forward Voltage****On-Resistance vs. Gate-to-Source Voltage****Threshold Voltage****Single Pulse Power, Junction-to-Ambient****Safe Operating Area, Junction-to-Ambient**

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

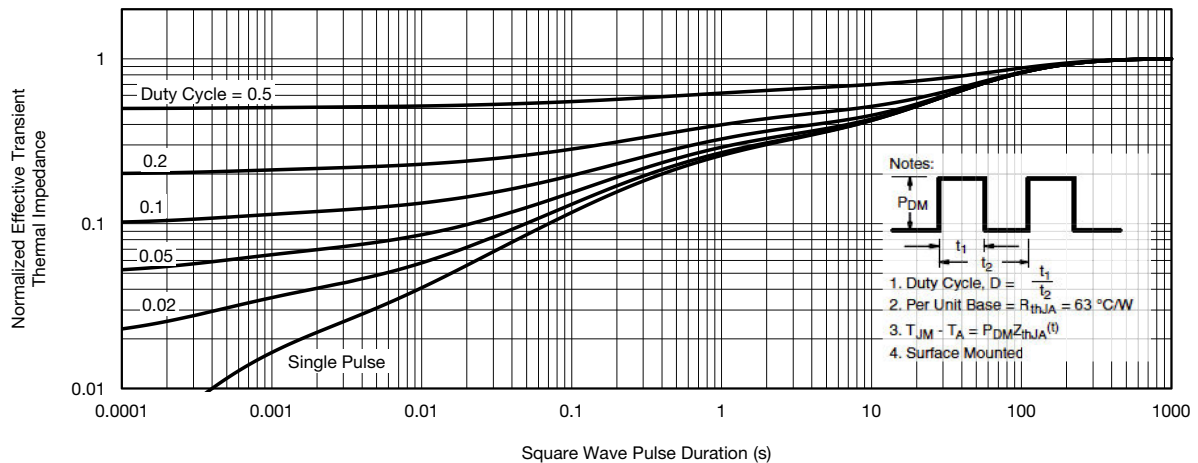


Current Derating\*

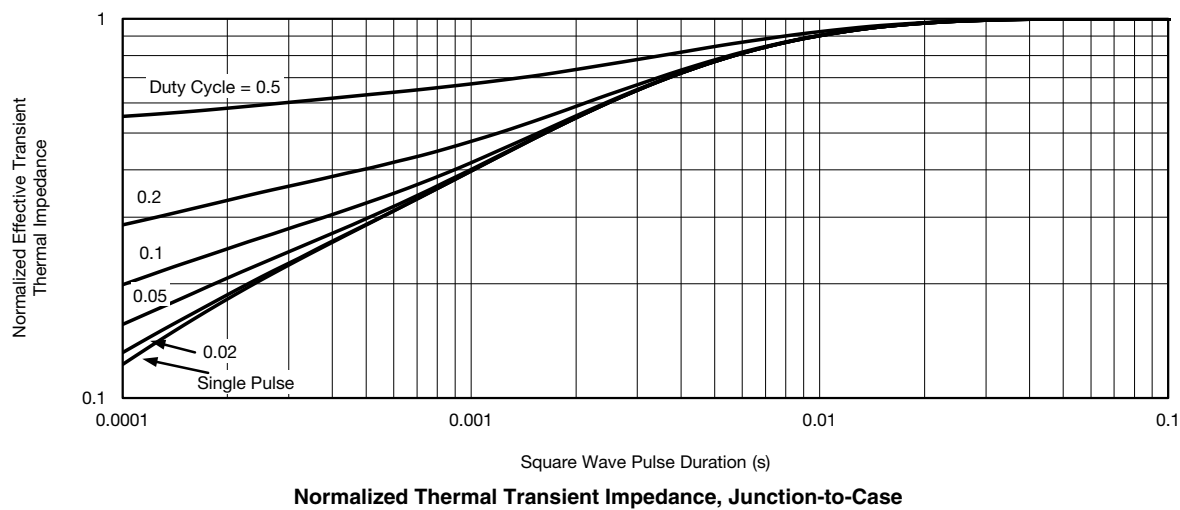


Power, Junction-to-Case

\* The power dissipation  $P_D$  is based on  $T_{J(max.)} = 150\text{ °C}$ , 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.



Normalized Thermal Transient Impedance, Junction-to-Ambient

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

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?62852](http://www.vishay.com/ppg?62852).

## Case Outline for PowerPAK® 1212-8S



| DIM.                                         | MILLIMETERS |      |      | INCHES    |       |       |
|----------------------------------------------|-------------|------|------|-----------|-------|-------|
|                                              | MIN.        | NOM. | MAX. | MIN.      | NOM.  | MAX.  |
| A                                            | 0.67        | 0.75 | 0.83 | 0.027     | 0.030 | 0.033 |
| A1                                           | 0           | -    | 0.05 | 0         | -     | 0.002 |
| A3                                           | 0.20 REF    |      |      | 0.008 REF |       |       |
| b                                            | 0.30 BSC    |      |      | 0.012 BSC |       |       |
| D                                            | 3.30 BSC    |      |      | 0.130 BSC |       |       |
| D1                                           | 2.15        | 2.25 | 2.35 | 0.084     | 0.088 | 0.092 |
| E                                            | 3.30 BSC    |      |      | 0.130 BSC |       |       |
| E1                                           | 1.60        | 1.70 | 1.80 | 0.063     | 0.067 | 0.071 |
| e                                            | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| K                                            | 0.76 TYP    |      |      | 0.030 TYP |       |       |
| K1                                           | 0.41 TYP    |      |      | 0.016 TYP |       |       |
| L                                            | 0.43 BSC    |      |      | 0.017 BSC |       |       |
| z                                            | 0.525 TYP   |      |      | 0.021 TYP |       |       |
| ECN: C12-0200-Rev. A, 12-Mar-12<br>DWG: 6008 |             |      |      |           |       |       |

### Note

- Millimeters will govern.

## RECOMMENDED MINIMUM PADS FOR PowerPAK® 1212-8 Single



Recommended Minimum Pads  
Dimensions in Inches/(mm)

[Return to Index](#)



## Disclaimer

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Электрон  
Связь**

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**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331