

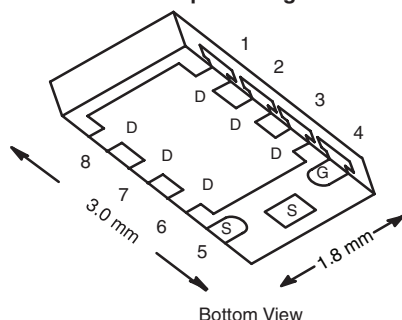


## P-Channel 20-V (D-S) MOSFET

### PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) <sup>a</sup> | $Q_g$ (Typ.) |
|--------------|-----------------------------|------------------------|--------------|
| - 20         | 0.052 at $V_{GS} = - 4.5$ V | - 8 <sup>e</sup>       | 8            |
|              | 0.082 at $V_{GS} = - 2.5$ V | - 7.5                  |              |

PowerPAK® ChipFET Single



Bottom View

Ordering Information: Si5459DU-T1-GE3 (Lead (Pb)-free and Halogen-free)

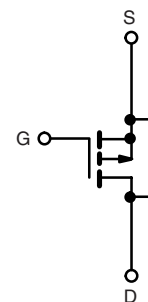
### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC


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

### APPLICATIONS

- Load Switch
- HDD DC/DC



P-Channel MOSFET

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

| Parameter                                                    | Symbol         | Limit         | Unit |
|--------------------------------------------------------------|----------------|---------------|------|
| Drain-Source Voltage                                         | $V_{DS}$       | - 20          | V    |
| Gate-Source Voltage                                          | $V_{GS}$       | $\pm 12$      |      |
| Continuous Drain Current ( $T_J = 150$ °C)                   | $I_D$          | $T_C = 25$ °C | A    |
|                                                              |                | $T_C = 70$ °C |      |
|                                                              |                | $T_A = 25$ °C |      |
|                                                              |                | $T_A = 70$ °C |      |
| Pulsed Drain Current (10 $\mu$ s Pulse Width)                | $I_{DM}$       | - 20          | A    |
| Source-Drain Current Diode Current                           | $I_S$          | $T_C = 25$ °C |      |
|                                                              |                | $T_A = 25$ °C |      |
| Maximum Power Dissipation                                    | $P_D$          | $T_C = 25$ °C | W    |
|                                                              |                | $T_C = 70$ °C |      |
|                                                              |                | $T_A = 25$ °C |      |
|                                                              |                | $T_A = 70$ °C |      |
| Operating Junction and Storage Temperature Range             | $T_J, T_{stg}$ | - 50 to 150   | °C   |
| Soldering Recommendations (Peak Temperature) <sup>d, e</sup> |                | 260           |      |

### THERMAL RESISTANCE RATINGS

| Parameter                                   | Symbol     | Limit   |         | Unit |
|---------------------------------------------|------------|---------|---------|------|
|                                             |            | Typical | Maximum |      |
| Maximum Junction-to-Ambient <sup>b, d</sup> | $R_{thJA}$ | 30      | 36      | °C/W |
| Maximum Junction-to-Case (Drain)            | $R_{thJC}$ | 9.5     | 11.5    |      |

Notes:

a. Based on  $T_C = 25$  °C.

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

c.  $t = 10$  s.

d. Maximum under Steady State conditions is 72 °C/W.

e. Package Limited.

d. See Solder Profile ([www.vishay.com/ppg273257](http://www.vishay.com/ppg273257)). The PowerPAK ChipFET 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.

e. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.

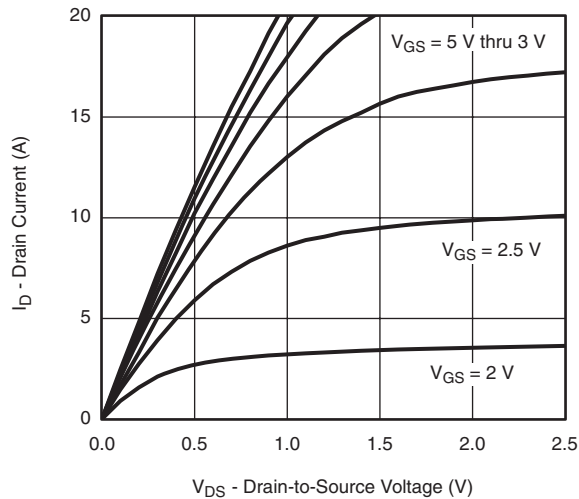
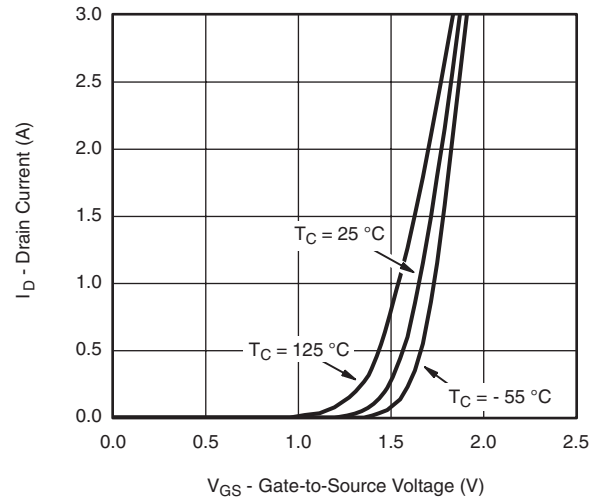
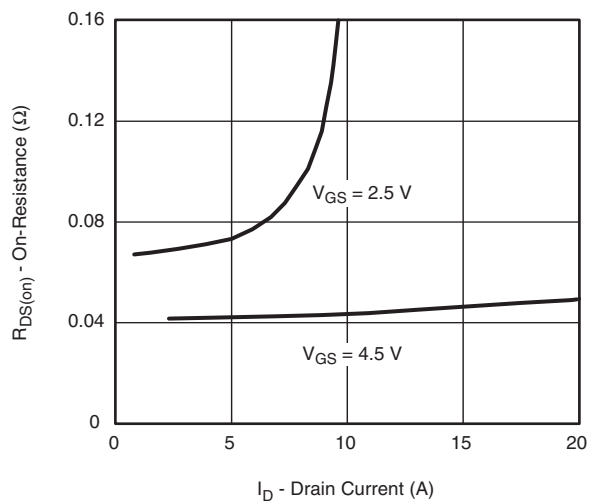
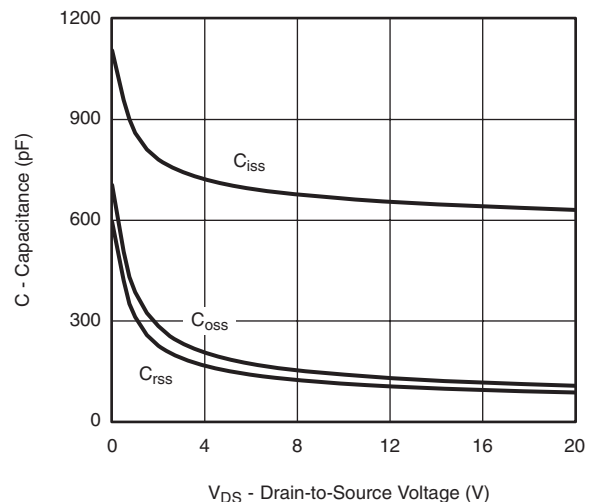
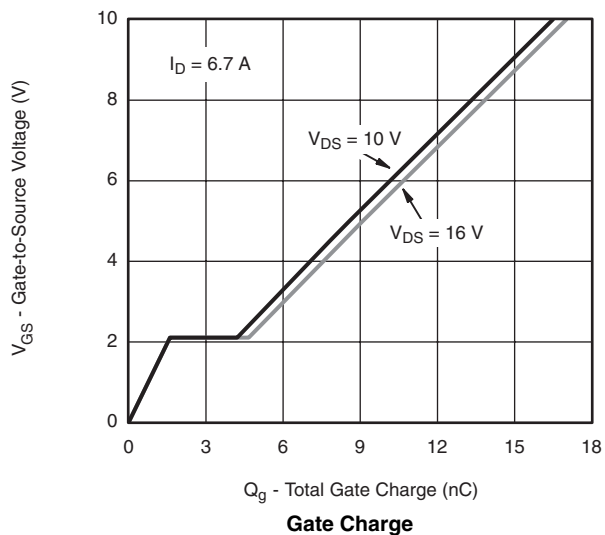
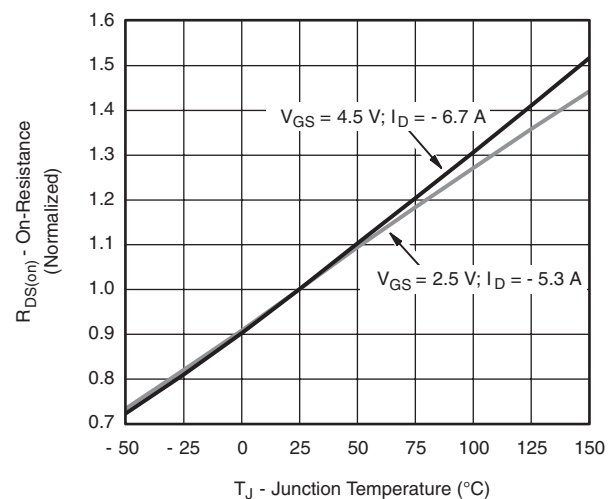
| SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted |                                      |                                                                                                                                |       |                   |       |       |  |
|---------------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------|-------------------|-------|-------|--|
| Parameter                                                     | Symbol                               | Test Conditions                                                                                                                | Min.  | Typ. <sup>a</sup> | 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                                                                                                      |       | - 19              |       | mV/°C |  |
| V <sub>GS(th)</sub> Temperature Coefficient                   | ΔV <sub>GS(th)</sub> /T <sub>J</sub> |                                                                                                                                |       | 3.1               |       |       |  |
| Gate Threshold Voltage                                        | V <sub>GS(th)</sub>                  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA                                                                  | - 0.6 |                   | - 1.4 | V     |  |
| Gate-Body Leakage                                             | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 12 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>b</sup>                           | I <sub>D(on)</sub>                   | V <sub>DS</sub> = ≤ - 5 V, V <sub>GS</sub> = - 10 V                                                                            | - 20  |                   |       | A     |  |
| Drain-Source On-State Resistance <sup>b</sup>                 | R <sub>DS(on)</sub>                  | V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 6.7 A                                                                            |       | 0.043             | 0.052 | Ω     |  |
|                                                               |                                      | V <sub>GS</sub> = - 2.5 V, I <sub>D</sub> = - 1 A                                                                              |       | 0.068             | 0.082 |       |  |
| Forward Transconductance <sup>b</sup>                         | g <sub>fs</sub>                      | V <sub>DS</sub> = - 10 V, I <sub>D</sub> = - 6.7 A                                                                             |       | 11                |       | S     |  |
| Dynamic <sup>a</sup>                                          |                                      |                                                                                                                                |       |                   |       |       |  |
| Input Capacitance                                             | C <sub>iss</sub>                     | V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz                                                                     |       | 665               |       | pF    |  |
| Output Capacitance                                            | C <sub>oss</sub>                     |                                                                                                                                |       | 140               |       |       |  |
| Reverse Transfer Capacitance                                  | C <sub>rss</sub>                     |                                                                                                                                |       | 115               |       |       |  |
| Total Gate Charge                                             | Q <sub>g</sub>                       | V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 6.7 A                                                   |       | 17                | 26    | nC    |  |
|                                                               |                                      | V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 6.7 A                                                  |       | 8                 | 12    |       |  |
| Q <sub>gs</sub>                                               |                                      |                                                                                                                                | 2     |                   |       |       |  |
| Q <sub>gd</sub>                                               |                                      |                                                                                                                                | 3     |                   |       |       |  |
| Gate Resistance                                               | R <sub>g</sub>                       | f = 1 MHz                                                                                                                      | 1.2   | 6                 | 12    | Ω     |  |
| Turn-On Delay Time                                            | t <sub>d(on)</sub>                   | V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 1.9 Ω<br>I <sub>D</sub> ≅ - 5.3 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω  |       | 6                 | 12    | ns    |  |
| Rise Time                                                     | t <sub>r</sub>                       |                                                                                                                                |       | 15                | 23    |       |  |
| Turn-Off Delay Time                                           | t <sub>d(off)</sub>                  |                                                                                                                                |       | 26                | 39    |       |  |
| Fall Time                                                     | t <sub>f</sub>                       |                                                                                                                                |       | 9                 | 18    |       |  |
| Turn-On Delay Time                                            | t <sub>d(on)</sub>                   | V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 1.9 Ω<br>I <sub>D</sub> ≅ - 5.3 A, V <sub>GEN</sub> = - 4.5 V, R <sub>g</sub> = 1 Ω |       | 21                | 32    |       |  |
| Rise Time                                                     | t <sub>r</sub>                       |                                                                                                                                |       | 50                | 75    |       |  |
| Turn-Off Delay Time                                           | t <sub>d(off)</sub>                  |                                                                                                                                |       | 29                | 44    |       |  |
| Fall Time                                                     | t <sub>f</sub>                       |                                                                                                                                |       | 13                | 20    |       |  |
| Drain-Source Body Diode Characteristics                       |                                      |                                                                                                                                |       |                   |       |       |  |
| Continuous Source-Drain Diode Current                         | I <sub>S</sub>                       | T <sub>C</sub> = 25 °C                                                                                                         |       |                   | - 8   | A     |  |
| Pulse Diode Forward Current <sup>a</sup>                      | I <sub>SM</sub>                      |                                                                                                                                |       |                   | - 20  |       |  |
| Body Diode Voltage                                            | V <sub>SD</sub>                      | I <sub>S</sub> = - 5.3 A                                                                                                       |       | - 0.77            | - 1.2 | V     |  |
| Body Diode Reverse Recovery Time                              | t <sub>rr</sub>                      | I <sub>F</sub> = - 5.3 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C                                                             |       | 30                | 45    | ns    |  |
| Body Diode Reverse Recovery Charge                            | Q <sub>rr</sub>                      |                                                                                                                                |       | 17                | 26    | nC    |  |
| Reverse Recovery Fall Time                                    | t <sub>a</sub>                       |                                                                                                                                |       | 16                |       | ns    |  |
| Reverse Recovery Rise Time                                    | t <sub>b</sub>                       |                                                                                                                                |       | 14                |       |       |  |

Notes:

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

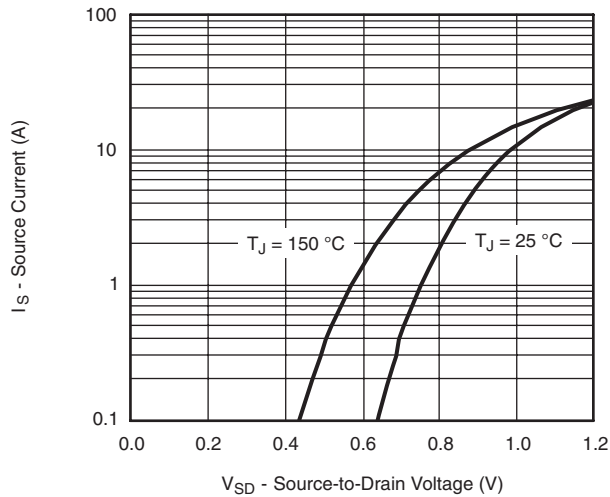
b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

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.

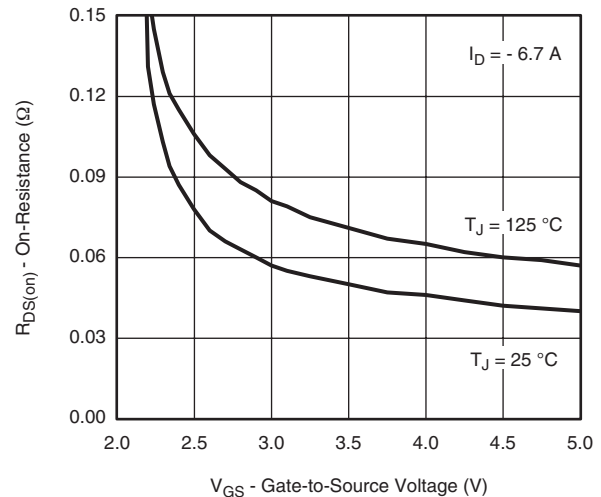

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Output Characteristics**

**Transfer Characteristics**

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

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

## Si5459DU

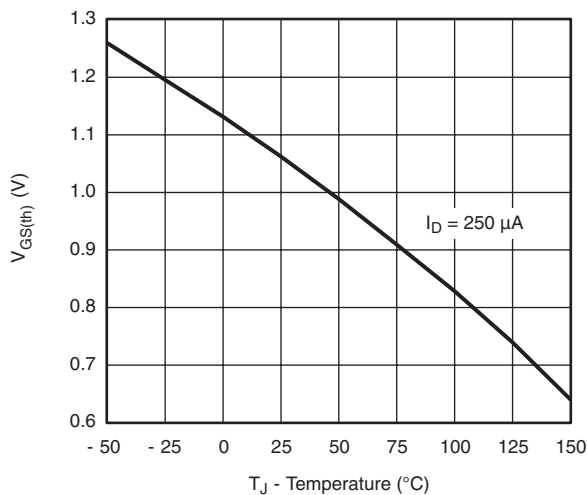
Vishay Siliconix

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

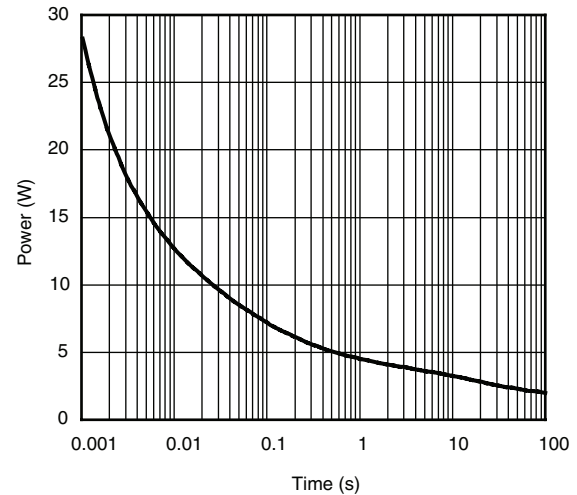
Source-Drain Diode Forward Voltage



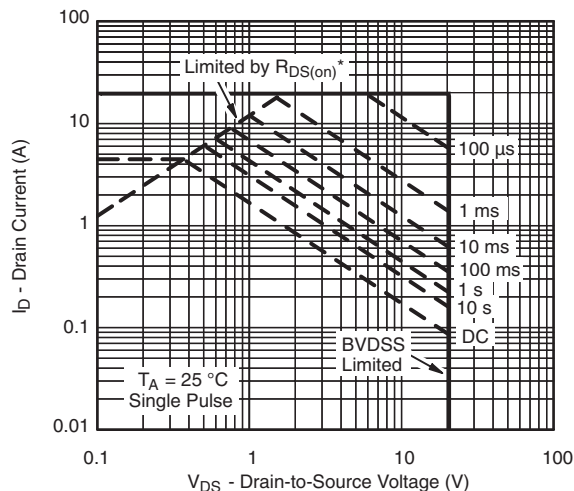
On-Resistance vs. Gate-to-Source Voltage



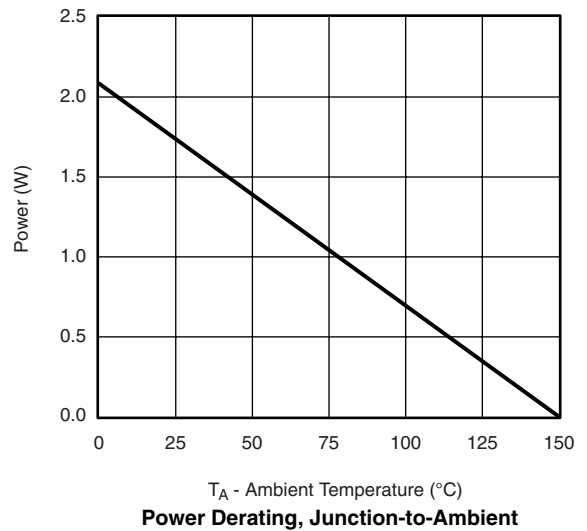
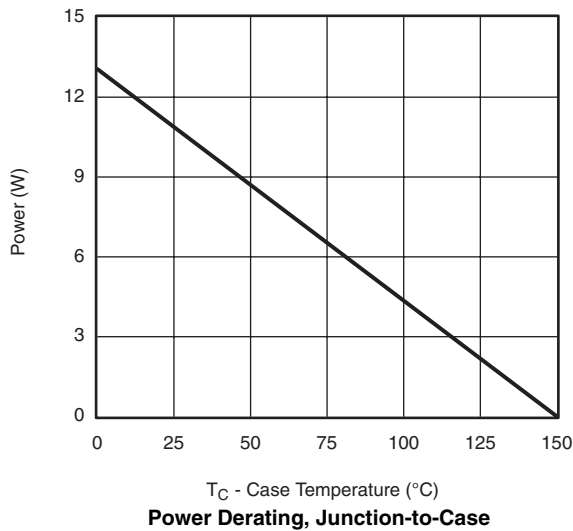
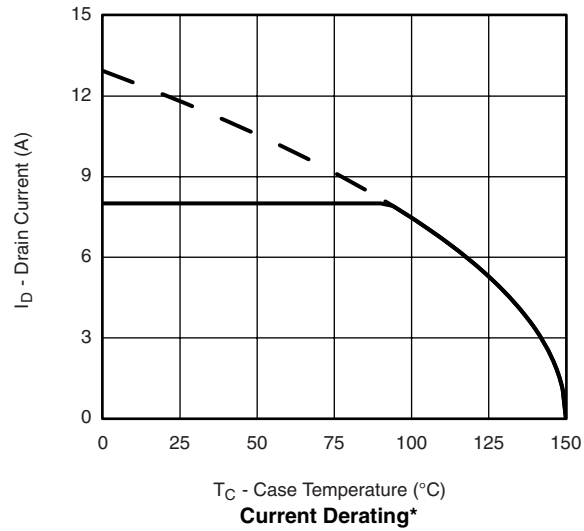
Threshold Voltage



Single Pulse Power, Junction-to-Ambient



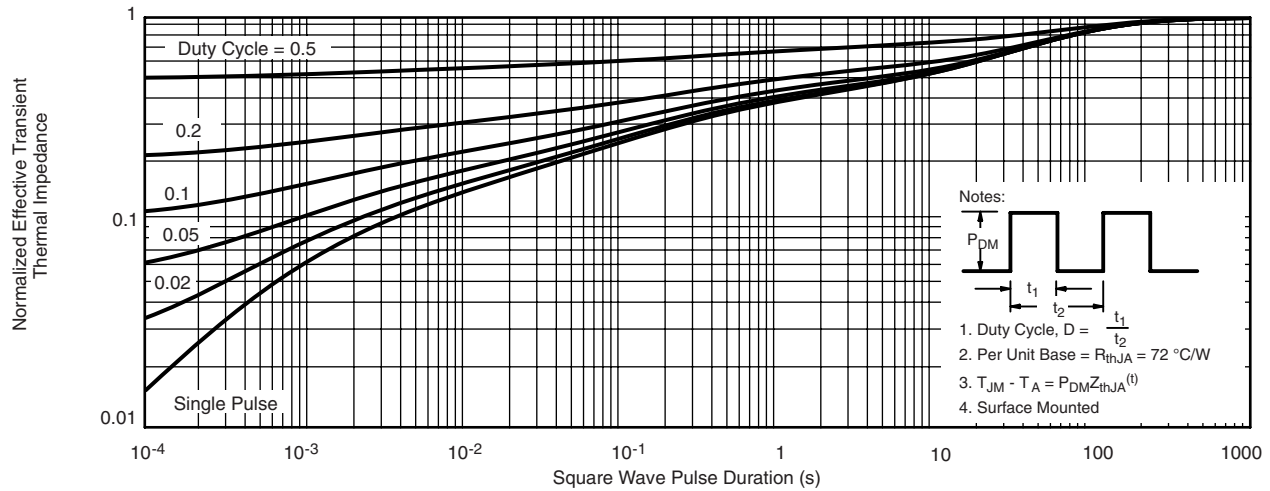
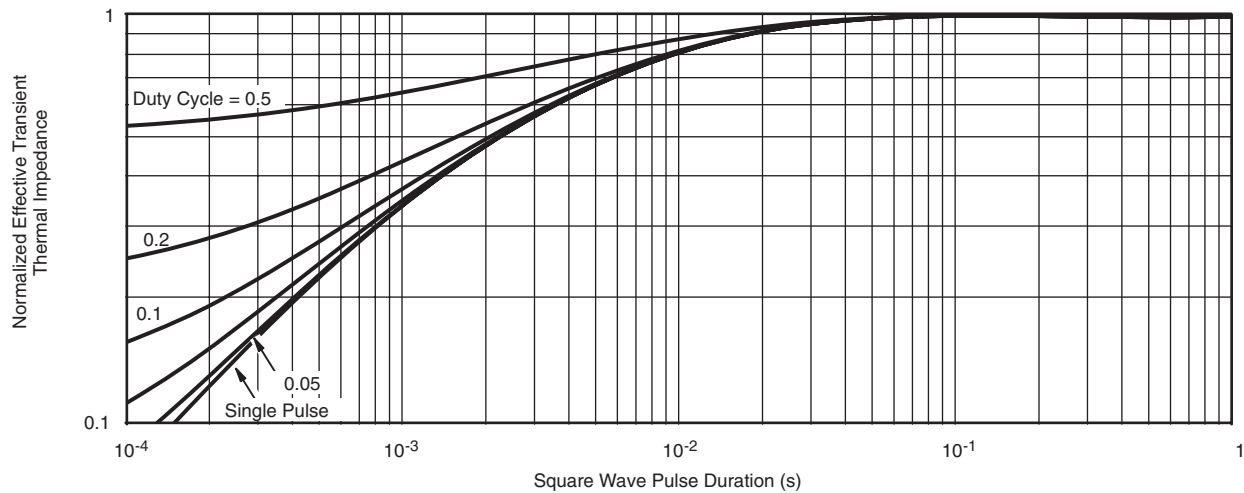
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified  
**Safe Operating Area, Junction-to-Ambient**

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

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

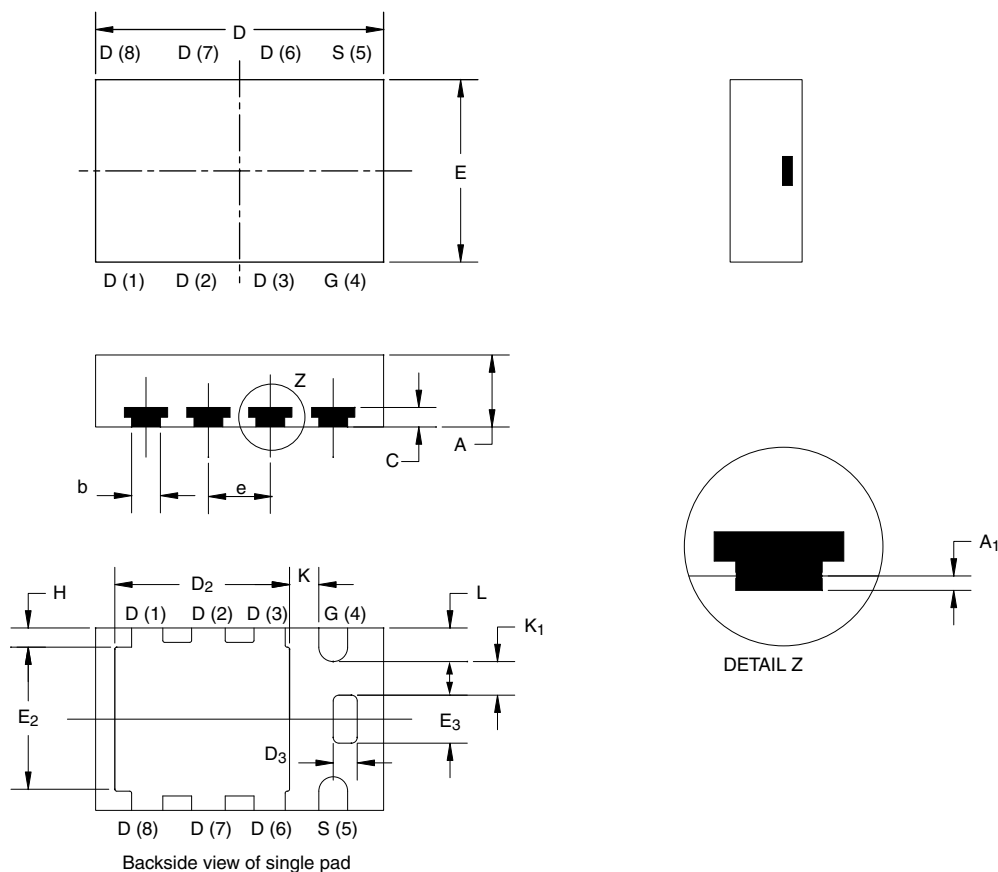
**Si5459DU**

Vishay Siliconix

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Normalized Thermal Transient Impedance, Junction-to-Ambient****Normalized Thermal Transient Impedance, Junction-to-Case**

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?65017](http://www.vishay.com/ppg?65017).

## PowerPAK® ChipFET® SINGLE PAD



| DIM.           | MILLIMETERS |      |      | INCHES    |       |       |
|----------------|-------------|------|------|-----------|-------|-------|
|                | MIN.        | NOM. | MAX. | MIN.      | NOM.  | MAX.  |
| A              | 0.70        | 0.75 | 0.85 | 0.028     | 0.030 | 0.033 |
| A <sub>1</sub> | 0           | -    | 0.05 | 0         | -     | 0.002 |
| b              | 0.25        | 0.30 | 0.35 | 0.010     | 0.012 | 0.014 |
| C              | 0.15        | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| D              | 2.92        | 3.00 | 3.08 | 0.115     | 0.118 | 0.121 |
| D <sub>2</sub> | 1.75        | 1.87 | 2.00 | 0.069     | 0.074 | 0.079 |
| D <sub>3</sub> | 0.20        | 0.25 | 0.30 | 0.008     | 0.010 | 0.012 |
| E              | 1.82        | 1.90 | 1.98 | 0.072     | 0.075 | 0.078 |
| E <sub>2</sub> | 1.38        | 1.50 | 1.63 | 0.054     | 0.059 | 0.064 |
| E <sub>3</sub> | 0.45        | 0.50 | 0.55 | 0.018     | 0.020 | 0.022 |
| e              | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| H              | 0.15        | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| K              | 0.25        | -    | -    | 0.010     | -     | -     |
| K <sub>1</sub> | 0.30        | -    | -    | 0.012     | -     | -     |
| L              | 0.30        | 0.35 | 0.40 | 0.012     | 0.014 | 0.016 |

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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**

## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

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Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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