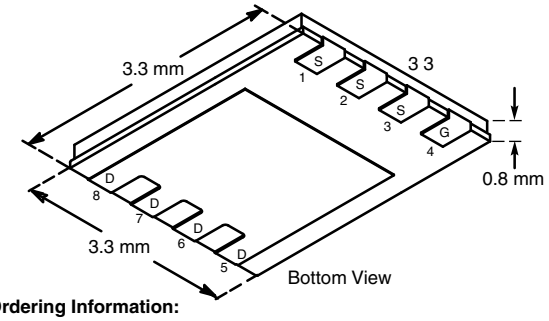
# P-Channel 20-V (D-S) MOSFET

| PRODUCT SUMMARY | | | |
|---|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) Max. | $I_D$ (A)[a] | $Q_g$ (Typ.) |
| - 20 | 0.0054 at $V_{GS}$ = - 4.5V | - 30[a] | 57 nC |
| | 0.0060 at $V_{GS}$ = - 3.7 V | - 30[a] | |
| | 0.0083 at $V_{GS}$ = - 2.5 V | - 30[a] | |
| | 0.0140 at $V_{GS}$ = - 1.8 V | - 30[a] | |

Thin PowerPAK® 1212-8




**Ordering Information:**
SiS435DNT-T1-GE3 (Lead (Pb)-free and Halogen-free)

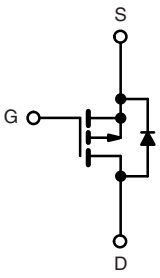
## FEATURES

- TrenchFET® Gen III P-Channel Power MOSFET
- Thin 0.8 mm max. height
- 100 % $R_g$ and UIS Tested
- Material categorization:
  For definitions of compliance please see
  www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE

## APPLICATIONS

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




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 | | $V_{GS}$ | ± 8 | |
| Continuous Drain Current ($T_J$ = 150 °C) | $T_C$ = 25 °C | $I_D$ | - 30[a] | A |
| | $T_C$ = 70 °C | | - 30[a] | |
| | $T_A$ = 25 °C | | - 22[b, c] | |
| | $T_A$ = 70 °C | | - 17[b, c] | |
| Pulsed Drain Current (t = 300 µs) | | $I_{DM}$ | - 80 | |
| Continuous Source-Drain Diode Current | $T_C$ = 25 °C | $I_S$ | - 30[a] | |
| | $T_A$ = 25 °C | | - 3.1[b, c] | |
| Avalanche Current | L = 0.1 mH | $I_{AS}$ | - 20 | |
| Single Pulse Avalanche Energy | | $E_{AS}$ | 20 | mJ |
| Maximum Power Dissipation | $T_C$ = 25 °C | $P_D$ | 39 | W |
| | $T_C$ = 70 °C | | 25 | |
| | $T_A$ = 25 °C | | 3.7[b, c] | |
| | $T_A$ = 70 °C | | 2.4[b, c] | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 150 | °C |
| Soldering Recommendations (Peak Temperature)[d, e] | | | 260 | |

| THERMAL RESISTANCE RATINGS | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Typical** | **Maximum** | **Unit** |
| Maximum Junction-to-Ambient[b, f] | t ≤ 10 s | $R_{thJA}$ | 24 | 33 | °C/W |
| Maximum Junction-to-Case (Drain) | Steady State | $R_{thJC}$ | 2.4 | 3.2 | |

Notes:
a. Package limited.
b. Surface mounted on 1" x 1" FR4 board.
c. t = 10 s.
d. See solder profile (*www.vishay.com/doc?73257*). The Thin PowerPAK 1212-8 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.
f. Maximum under steady state conditions is 81 °C/W.

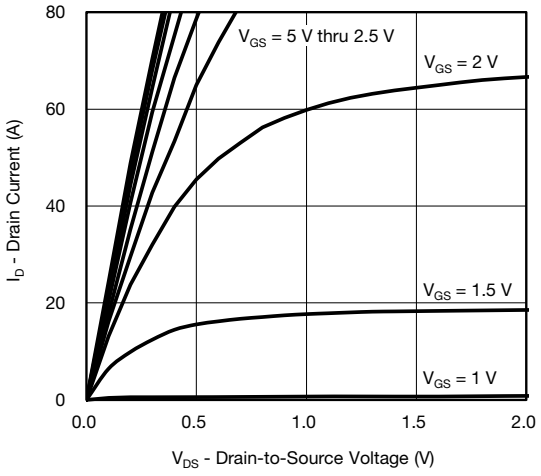
| **SPECIFICATIONS** ($T_J$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Min.** | **Typ.** | **Max.** | **Unit** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = - 250 µA | - 20 | | | V |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS}/T_J$ | $I_D$ = - 250 µA | | - 16 | | mV/°C |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | | | 2.9 | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = - 250 µA | - 0.4 | | - 0.9 | V |
| Gate-Source Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 8 V | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = - 20 V, $V_{GS}$ = 0 V | | | - 1 | µA |
| | | $V_{DS}$ = - 20 V, $V_{GS}$ = 0 V, $T_J$ = 55 °C | | | - 10 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS} \leq$ - 5 V, $V_{GS}$ = - 4.5 V | - 20 | | | A |
| Drain-Source On-State Resistance[a] | $R_{DS(on)}$ | $V_{GS}$ = - 4.5 V, $I_D$ = - 13 A | | 0.0044 | 0.0054 | Ω |
| | | $V_{GS}$ = - 3.7 V, $I_D$ = - 10 A | | 0.0048 | 0.0060 | |
| | | $V_{GS}$ = - 2.5 V, $I_D$ = - 10 A | | 0.0065 | 0.0083 | |
| | | $V_{GS}$ = - 1.8 V, $I_D$ = - 5 A | | 0.0110 | 0.0140 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = - 10 V, $I_D$ = - 13 A | | 55 | | S |
| **Dynamic[b]** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = - 10 V, $V_{GS}$ = 0 V, f = 1 MHz | | 5700 | | pF |
| Output Capacitance | $C_{oss}$ | | | 620 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 585 | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = - 10 V, $V_{GS}$ = - 8 V, $I_D$ = - 20 A | | 98 | 180 | nC |
| | | $V_{DS}$ = - 10 V, $V_{GS}$ = - 4.5 V, $I_D$ = - 20 A | | 57 | 86 | |
| Gate-Source Charge | $Q_{gs}$ | | | 7.4 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 13.1 | | |
| Gate Resistance | $R_g$ | f = 1 MHz | 0.8 | 3.8 | 7.6 | Ω |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = - 10 V, $R_L$ = 1 Ω<br>$I_D \cong$ - 10 A, $V_{GEN}$ = - 4.5 V, $R_g$ = 1 Ω | | 40 | 80 | ns |
| Rise Time | $t_r$ | | | 30 | 60 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 100 | 200 | |
| Fall Time | $t_f$ | | | 30 | 60 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = - 10 V, $R_L$ = 1 Ω<br>$I_D \cong$ - 10 A, $V_{GEN}$ = - 8 V, $R_g$ = 1 Ω | | 15 | 30 | |
| Rise Time | $t_r$ | | | 10 | 20 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 110 | 220 | |
| Fall Time | $t_f$ | | | 25 | 50 | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous Source-Drain Diode Current | $I_S$ | $T_C$ = 25 °C | | | - 30 | A |
| Pulse Diode Forward Current | $I_{SM}$ | | | | - 80 | |
| Body Diode Voltage | $V_{SD}$ | $I_S$ = - 10 A, $V_{GS}$ = 0 V | | - 0.8 | - 1.2 | V |
| Body Diode Reverse Recovery Time | $t_{rr}$ | $I_F$ = - 10 A, dI/dt = 100 A/µs, $T_J$ = 25 °C | | 19 | 40 | ns |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | | 10 | 20 | nC |
| Reverse Recovery Fall Time | $t_a$ | | | 9 | | ns |
| Reverse Recovery Rise Time | $t_b$ | | | 10 | | |

Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

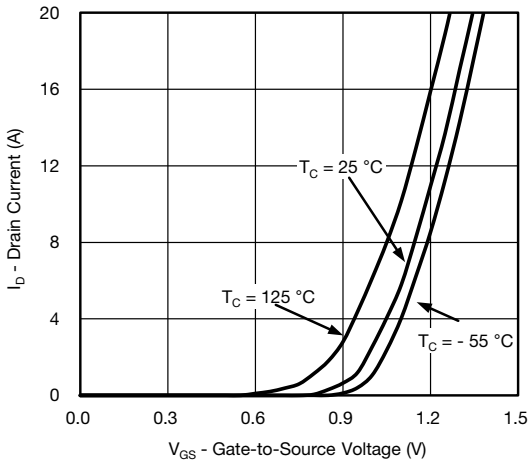
*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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


For technical questions, contact: pmostechsupport@vishay.com
Document Number: 63264
S13-0465-Rev. A, 04-Mar-13

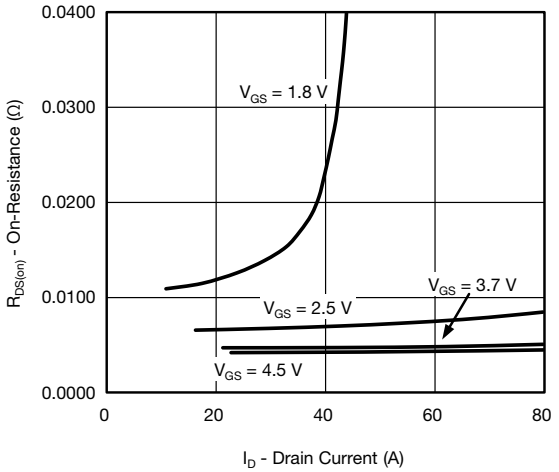
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



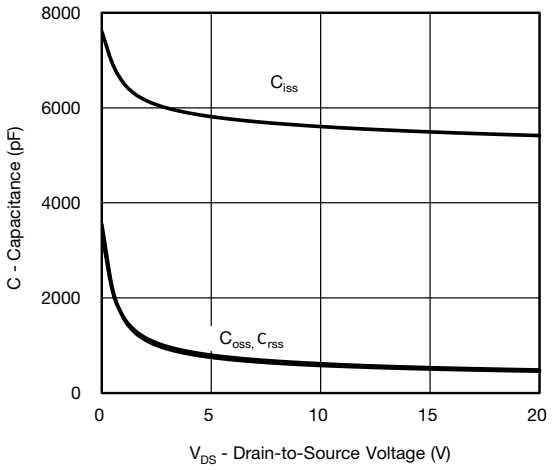

**Output Characteristics**



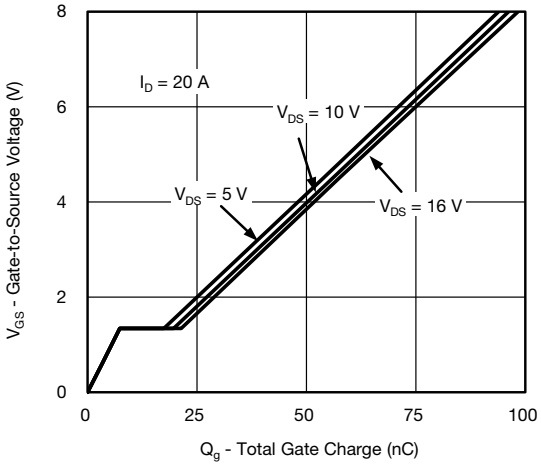

**Transfer Characteristics**



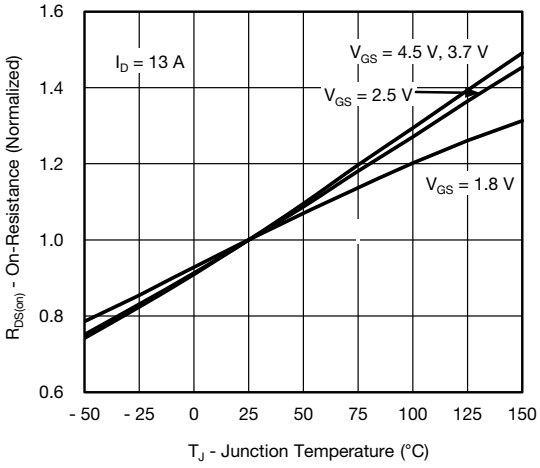

**On-Resistance vs. Drain Current and Gate Voltage**




**Capacitance**

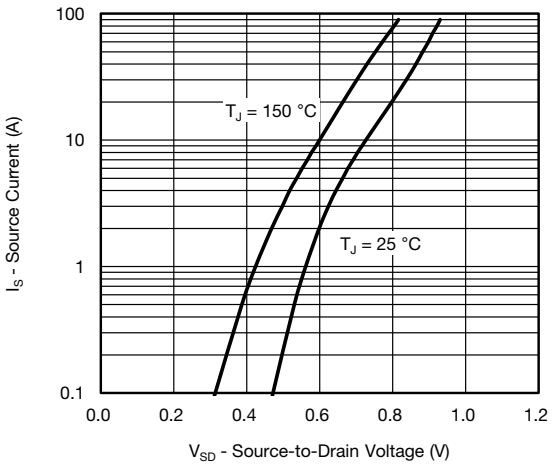



**Gate Charge**

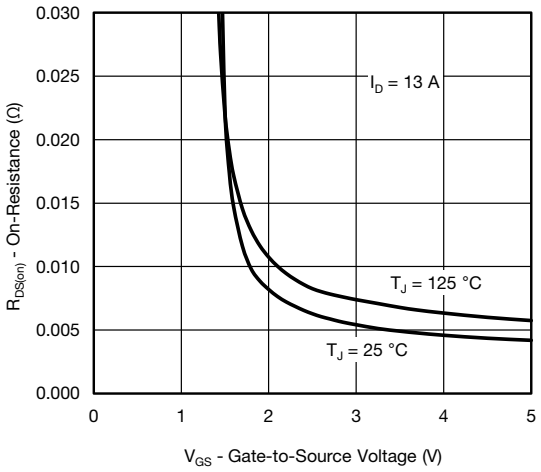



**On-Resistance vs. Junction Temperature**

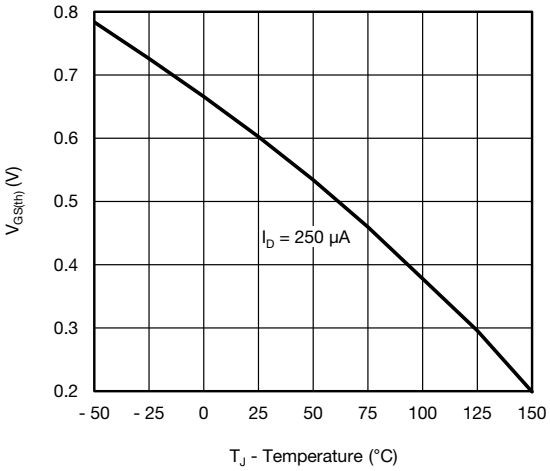
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



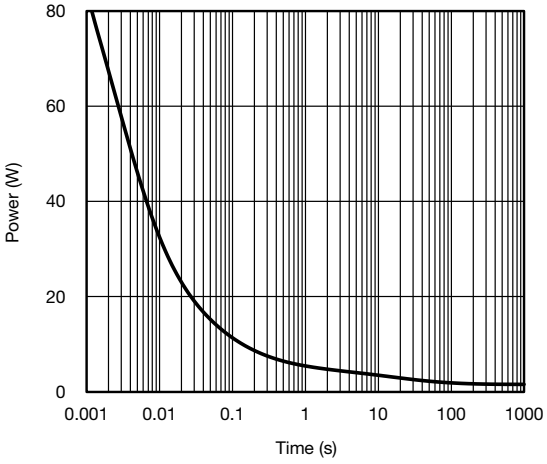

**Soure-Drain Diode Forward Voltage**



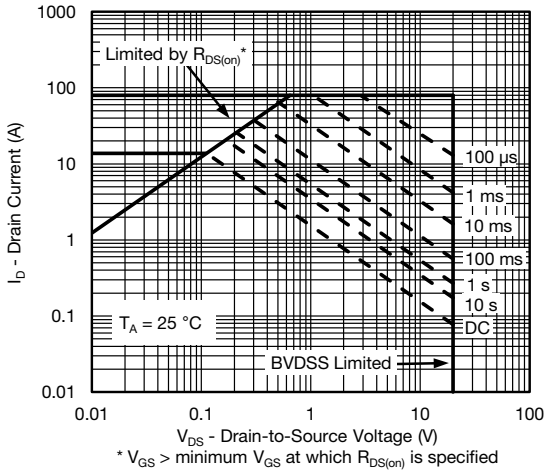

**On-Resistance vs. Gate-to-Source Voltage**




**Threshold Voltage**




**Single Pulse Power, Junction-to-Ambient**

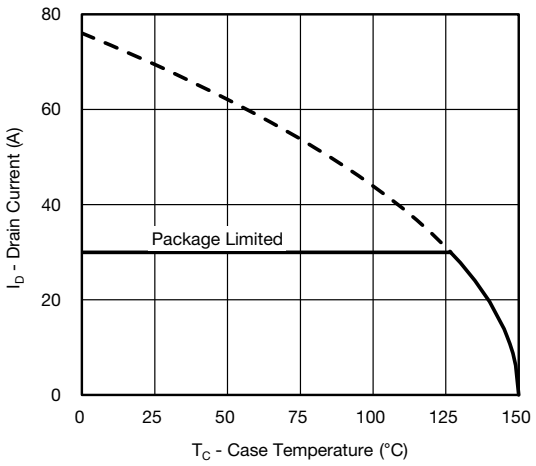



**Safe Operating Area, Junction-to-Ambient**

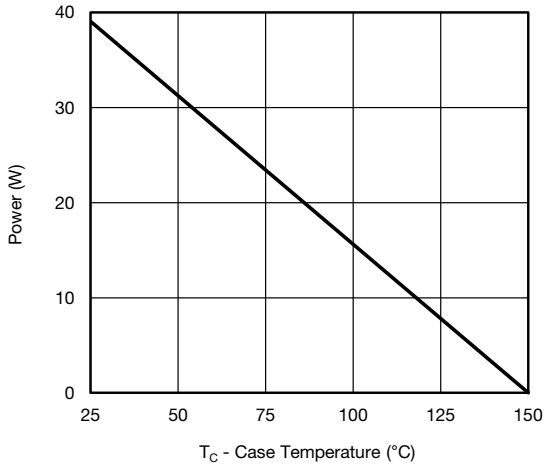

For technical questions, contact: pmostechsupport@vishay.com

Document Number: 63264
S13-0465-Rev. A, 04-Mar-13

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



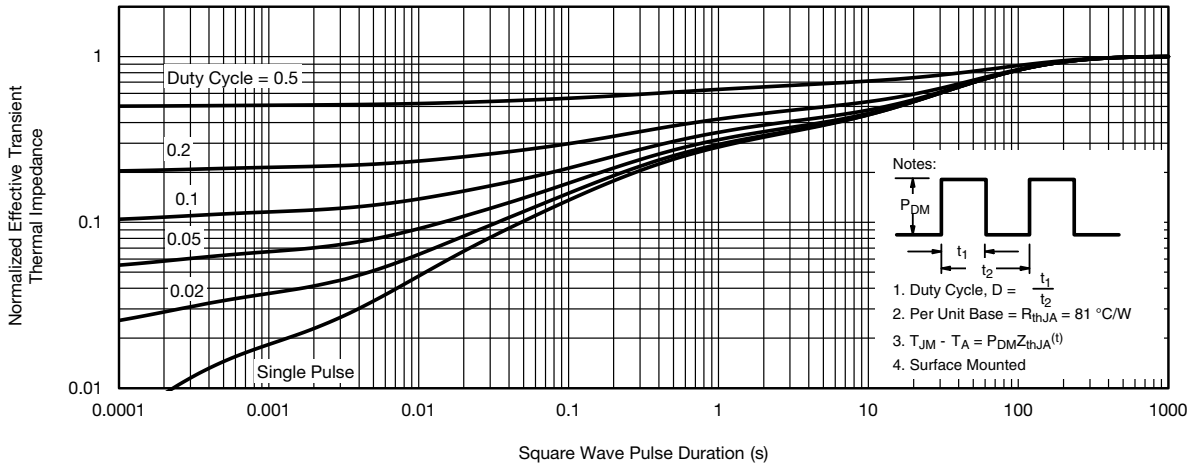

**Current Derating***



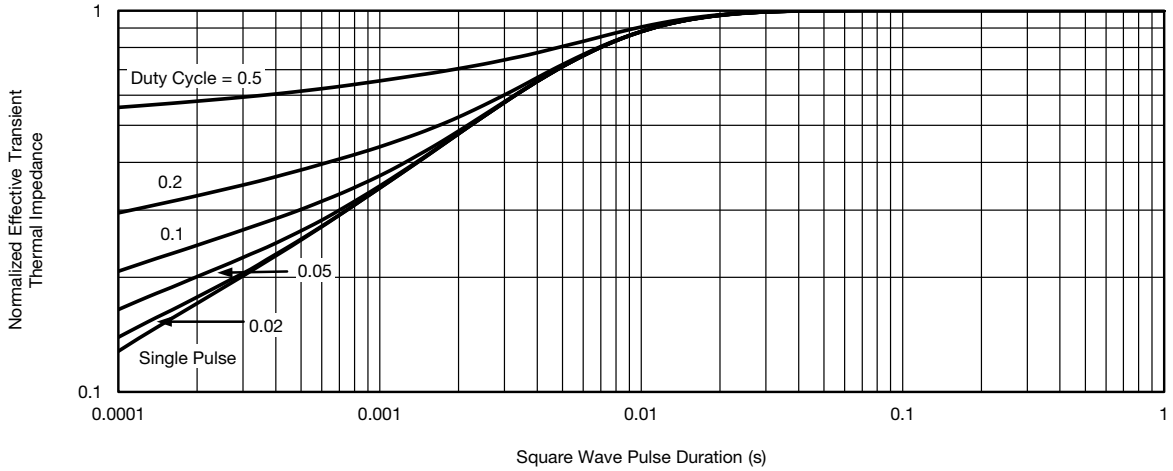

**Power Derating, Junction-to-Case**

* 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.

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



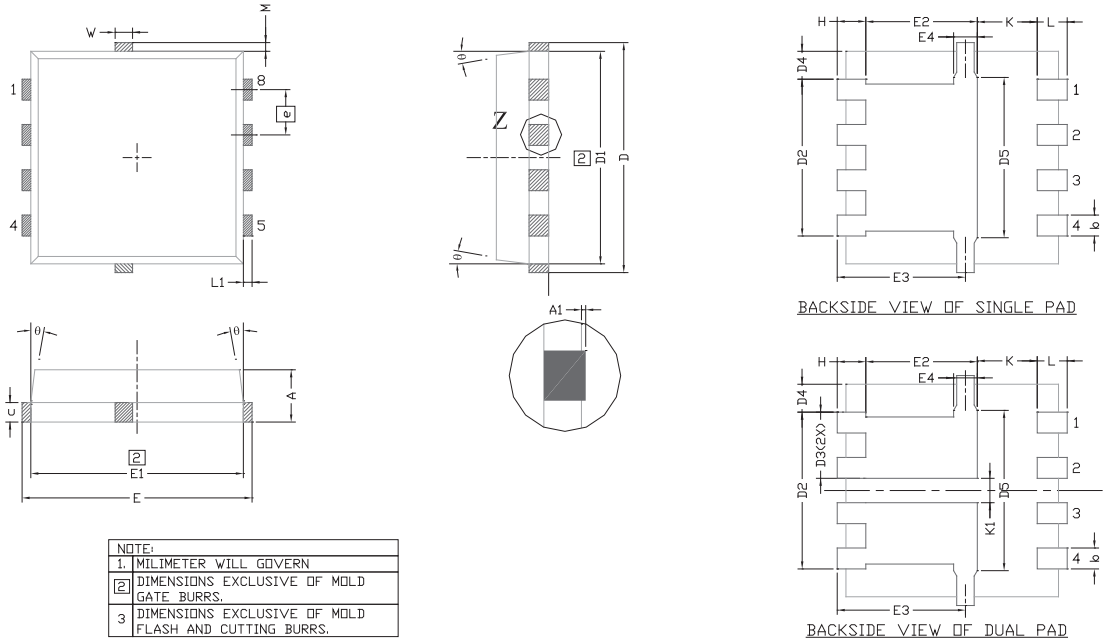

**Normalized Thermal Transient Impedance, Junction-to-Ambient**




**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?63264.*

# PowerPAK® 1212-8T

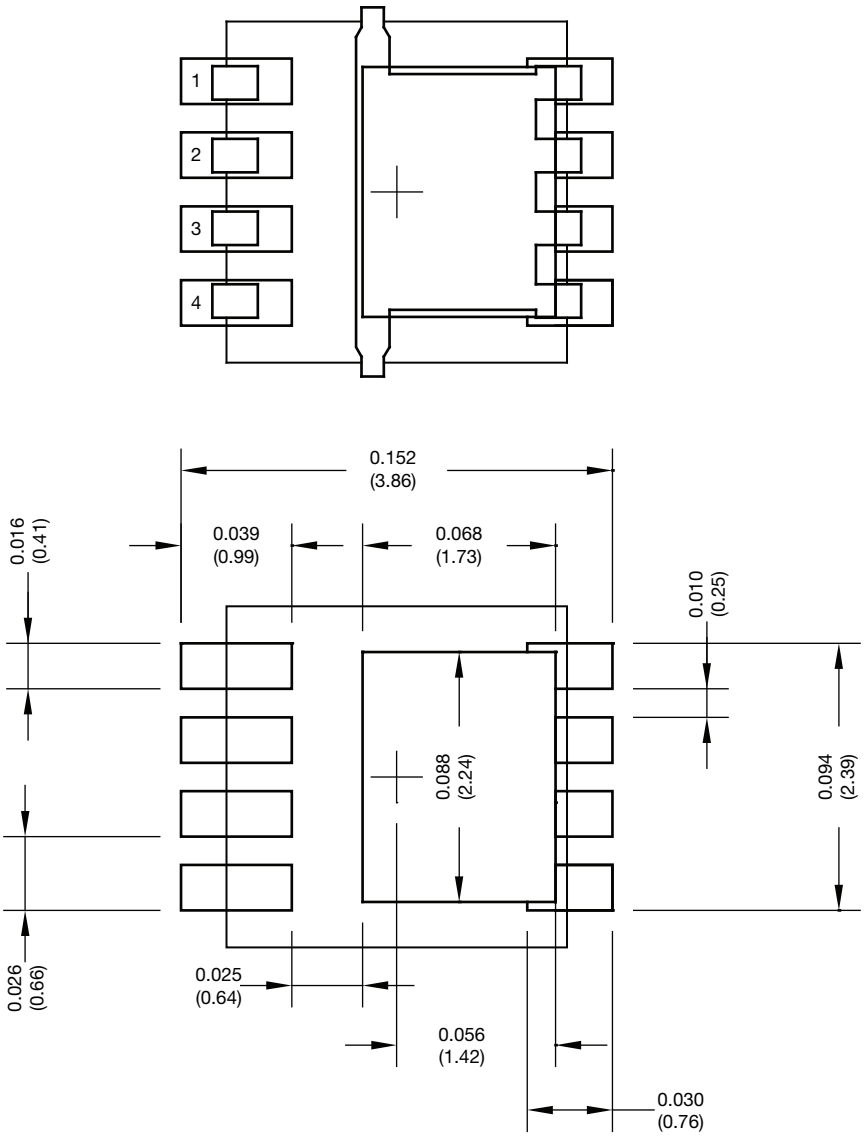



| NOTE: | |
|---|---|
| 1. | MILIMETER WILL GOVERN |
| 2 | DIMENSIONS EXCLUSIVE OF MOLD GATE BURRS. |
| 3 | DIMENSIONS EXCLUSIVE OF MOLD FLASH AND CUTTING BURRS. |

| DIM. | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.70 | 0.75 | 0.80 | 0.028 | 0.030 | 0.031 |
| A1 | 0.00 | - | 0.05 | 0.000 | - | 0.002 |
| b | 0.23 | 0.30 | 0.41 | 0.009 | 0.012 | 0.016 |
| c | 0.23 | 0.28 | 0.33 | 0.009 | 0.011 | 0.013 |
| D | 3.20 | 3.30 | 3.40 | 0.126 | 0.130 | 0.134 |
| D1 | 2.95 | 3.05 | 3.15 | 0.116 | 0.120 | 0.124 |
| D2 | 1.98 | 2.11 | 2.24 | 0.078 | 0.083 | 0.088 |
| D3 | 0.48 | - | 0.89 | 0.019 | - | 0.035 |
| D4 | 0.47 TYP. | | | 0.0185 TYP. | | |
| D5 | 2.3 TYP. | | | 0.090 TYP. | | |
| E | 3.20 | 3.30 | 3.40 | 0.126 | 0.130 | 0.134 |
| E1 | 2.95 | 3.05 | 3.15 | 0.116 | 0.120 | 0.124 |
| E2 | 1.47 | 1.60 | 1.73 | 0.058 | 0.063 | 0.068 |
| E3 | 1.75 | 1.85 | 1.98 | 0.069 | 0.073 | 0.078 |
| E4 | 0.34 TYP. | | | 0.013 TYP. | | |
| e | 0.65 BSC | | | 0.026 BSC | | |
| K | 0.86 TYP. | | | 0.034 TYP. | | |
| K1 | 0.35 | - | - | 0.014 | - | - |
| H | 0.30 | 0.41 | 0.51 | 0.012 | 0.016 | 0.020 |
| L | 0.30 | 0.43 | 0.56 | 0.012 | 0.017 | 0.022 |
| L1 | 0.06 | 0.13 | 0.20 | 0.002 | 0.005 | 0.008 |
| θ | 0° | - | 12° | 0° | - | 12° |
| W | 0.15 | 0.25 | 0.36 | 0.006 | 0.010 | 0.014 |
| M | 0.125 TYP. | | | 0.005 TYP. | | |

ECN: T13-0056-Rev. A, 18-Feb-13
DWG: 6012

# Recommended Minimum PADs for Thin PowerPAK® 1212-8T



# Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

# X-ON Electronics

Largest Supplier of Electrical and Electronic Components

***Click to view similar products for*** MOSFET ***category:***

***Click to view products by*** Vishay ***manufacturer:***

Other Similar products are found below :

614233C 648584F IRFD120 JANTX2N5237 2N7000 FCA20N60_F109 FDZ595PZ 2SK2545(Q,T) 405094E 423220D TPCC8103,L1Q(CM MIC4420CM-TR VN1206L 614234A 715780A NTNS3166NZT5G SSM6J414TU,LF(T 751625C IPS70R2K0CEAKMA1 BUK954R8-60E DMN3404LQ-7 NTE6400 SQJ402EP-T1-GE3 2SK2614(TE16L1,Q) 2N7002KW-FAI DMN1017UCP3-7 EFC2J004NUZTDG ECH8691-TL-W FCAB21350L1 P85W28HP2F-7071 DMN1053UCP4-7 NTE221 NTE2384 NTE2903 NTE2941 NTE2945 NTE2946 NTE2960 NTE2967 NTE2969 NTE2976 NTE455 NTE6400A NTE2910 NTE2916 NTE2956 NTE2911 US6M2GTR TK10A80W,S4X(S SSM6P69NU,LF