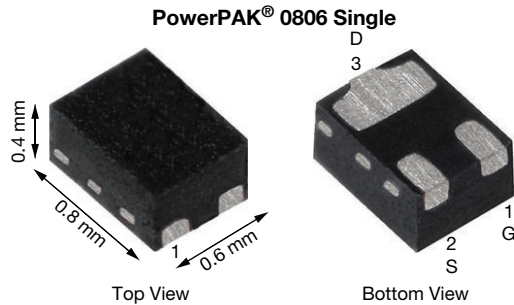


## N-Channel 12 V (D-S) MOSFET



### FEATURES

- TrenchFET® power MOSFET
- Ultra small 0.8 mm x 0.6 mm outline
- Ultra thin 0.4 mm max. height
- Typical ESD protection 1500 V (HBM)
- 1.2 V rated  $R_{DS(on)}$
- 100 %  $R_g$  tested
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

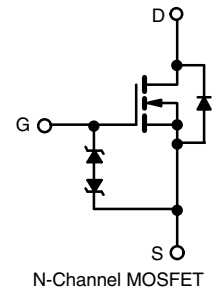


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

| PRODUCT SUMMARY                                    |                     |
|--|---------------------|
| $V_{DS}$ (V)                                       | 12                  |
| $R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 4.5$ V | 0.34                |
| $R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 2.5$ V | 0.4                 |
| $R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 1.8$ V | 0.55                |
| $R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 1.5$ V | 1.2                 |
| $R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 1.2$ V | 2.5                 |
| $Q_g$ typ. (nC)                                    | 0.47                |
| $I_D$ (A)  | 0.5 <sup>a, f</sup> |
| Configuration                                      | Single              |

### APPLICATIONS

- Load switch
- High speed switching
- DC/DC converters
- Battery-operated and mobile devices



| ORDERING INFORMATION            |                  |
|---------------------------------|------------------|
| Package                         | PowerPAK 0806    |
| Lead (Pb)-free and halogen-free | SiUD412ED-T1-GE3 |

#### Note

- The lead finish is NiPdAu and classed as E4 finish

| ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted) |                |               |                     |   |
|---|----------------|---------------|---------------------|---|
| PARAMETER   | SYMBOL         | LIMIT         | UNIT                |   |
| Drain-source voltage  | $V_{DS}$       | 12            | V                   |   |
| Gate-source voltage   | $V_{GS}$       | $\pm 5$       | V                   |   |
| Continuous drain current / $T_J = 150$ °C)                        | $I_D$          | $T_A = 25$ °C | 0.5 <sup>a, f</sup> | A |
|   |                | $T_A = 70$ °C | 0.5 <sup>a, f</sup> |   |
|   |                | $T_A = 25$ °C | 0.5 <sup>b</sup>    |   |
|   |                | $T_A = 70$ °C | 0.5 <sup>b</sup>    |   |
| Pulsed drain current ( $t = 100$ $\mu$ s)                         | $I_{DM}$       | 1.5           | A                   |   |
| Continuous source-drain diode current                             | $I_S$          | $T_A = 25$ °C | 0.5 <sup>a, f</sup> | A |
|   |                | $T_A = 70$ °C | 0.37 <sup>b</sup>   |   |
| Maximum power dissipation   | $P_D$          | $T_A = 25$ °C | 1.25 <sup>a</sup>   | W |
|   |                | $T_A = 70$ °C | 0.8 <sup>a</sup>    |   |
|   |                | $T_A = 25$ °C | 0.37 <sup>b</sup>   |   |
|   |                | $T_A = 70$ °C | 0.24 <sup>b</sup>   |   |
| Operating junction and storage temperature range                  | $T_J, T_{stg}$ | -55 to +150   | °C                  |   |
| Soldering recommendations (peak temperature) <sup>c</sup>         |                | 260           | °C                  |   |

| THERMAL RESISTANCE RATINGS                  |            |         |         |      |
|---|------------|---------|---------|------|
| PARAMETER                                   | SYMBOL     | TYPICAL | MAXIMUM | UNIT |
| Maximum junction-to-ambient <sup>a, d</sup> | $R_{thJA}$ | 80      | 100     | °C/W |
| Maximum junction-to-ambient <sup>b, e</sup> | $R_{thJA}$ | 265     | 335     |      |

#### Notes

- Surface mounted on 1" x 1" FR4 board with full copper,  $t = 5$  s
- Surface mounted on 1" x 1" FR4 board with minimum copper,  $t = 5$  s
- Refer to IPC / JEDEC® (J-STD-020), no manual or hand soldering
- Maximum under steady state conditions is 135 °C/W
- Maximum under steady state conditions is 400 °C/W
- Package limited



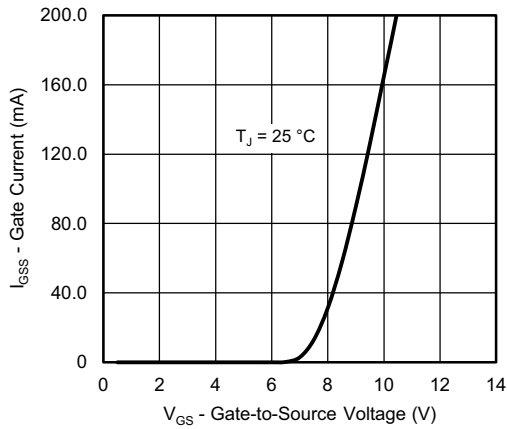
| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                         |   |      |      |                  |                      |
|---|-------------------------|---|------|------|------------------|----------------------|
| PARAMETER   | SYMBOL                  | TEST CONDITIONS   | MIN. | TYP. | MAX.             | UNIT                 |
| <b>Static</b>   |                         |   |      |      |                  |                      |
| Drain-source breakdown voltage  | $V_{DS}$                | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$   | 12   | -    | -                | V                    |
| $V_{DS}$ temperature coefficient  | $\Delta V_{DS}/T_J$     | $I_D = 250\text{ }\mu\text{A}$  | -    | 9    | -                | mV/ $^\circ\text{C}$ |
| $V_{GS(th)}$ temperature coefficient  | $\Delta V_{GS(th)}/T_J$ |   | -    | -1   | -                |                      |
| Gate-source threshold voltage   | $V_{GS(th)}$            | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$   | 0.35 | -    | 0.9              | V                    |
| Gate-source leakage   | $I_{GSS}$               | $V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$  | -    | -    | $\pm 10$         | $\mu\text{A}$        |
| Zero gate voltage drain current   | $I_{DSS}$               | $V_{DS} = 12\text{ V}, V_{GS} = 0\text{ V}$   | -    | -    | 1                |                      |
|   |                         | $V_{DS} = 12\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$   | -    | -    | 10               |                      |
| On-state drain current <sup>a</sup>   | $I_{D(on)}$             | $V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$   | 1    | -    | -                | A                    |
| Drain-source on-state resistance <sup>a</sup>                               | $R_{DS(on)}$            | $V_{GS} = 4.5\text{ V}, I_D = 0.5\text{ A}$   | -    | 0.27 | 0.34             | $\Omega$             |
|   |                         | $V_{GS} = 2.5\text{ V}, I_D = 0.2\text{ A}$   | -    | 0.31 | 0.4              |                      |
|   |                         | $V_{GS} = 1.8\text{ V}, I_D = 0.1\text{ A}$   | -    | 0.37 | 0.55             |                      |
|   |                         | $V_{GS} = 1.5\text{ V}, I_D = 0.1\text{ A}$   | -    | 0.42 | 1.2              |                      |
|   |                         | $V_{GS} = 1.2\text{ V}, I_D = 0.05\text{ A}$  | -    | 0.55 | 2.5              |                      |
| Forward transconductance <sup>a</sup>                                       | $g_{fs}$                | $V_{DS} = 6\text{ V}, I_D = 0.5\text{ A}$   | -    | 1.6  | -                | S                    |
| <b>Dynamic <sup>b</sup></b>   |                         |   |      |      |                  |                      |
| Input capacitance   | $C_{iss}$               | $V_{DS} = 6\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$  | -    | 21   | -                | $\mu\text{F}$        |
| Output capacitance  | $C_{oss}$               |   | -    | 13   | -                |                      |
| Reverse transfer capacitance  | $C_{rss}$               |   | -    | 7    | -                |                      |
| Total gate charge   | $Q_g$                   | $V_{DS} = 6\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 0.5\text{ A}$  | -    | 0.47 | 0.71             | nC                   |
| Gate-source charge  | $Q_{gs}$                | $V_{DS} = 6\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 0.5\text{ A}$  | -    | 0.04 | -                |                      |
| Gate-drain charge   | $Q_{gd}$                |   | -    | 0.09 | -                |                      |
| Gate resistance   | $R_g$                   | $f = 1\text{ MHz}$  | 3    | 15   | 30               | $\Omega$             |
| Turn-on delay time  | $t_{d(on)}$             | $V_{DD} = 6\text{ V}, R_L = 12\text{ }\Omega, I_D \cong 0.5\text{ A},$<br>$V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$ | -    | 2    | 5                | ns                   |
| Rise time   | $t_r$                   |   | -    | 20   | 40               |                      |
| Turn-off delay time   | $t_{d(off)}$            |   | -    | 17   | 35               |                      |
| Fall time   | $t_f$                   |   | -    | 10   | 20               |                      |
| <b>Drain-Source Body Diode Characteristics</b>                              |                         |   |      |      |                  |                      |
| Continuous source-drain diode current                                       | $I_S$                   | $T_A = 25\text{ }^\circ\text{C}$  | -    | -    | 0.5 <sup>c</sup> | A                    |
| Pulse diode forward current   | $I_{SM}$                |   | -    | -    | 1.5              |                      |
| Body diode voltage  | $V_{SD}$                | $I_S = 0.5\text{ A}, V_{GS} = 0\text{ V}$   | -    | 0.7  | 1.2              | V                    |
| Body diode reverse recovery time  | $t_{rr}$                | $I_F = 0.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s},$<br>$T_J = 25\text{ }^\circ\text{C}$                               | -    | 15   | 30               | ns                   |
| Body diode reverse recovery charge  | $Q_{rr}$                |   | -    | 3    | 6                | nC                   |
| Reverse recovery fall time  | $t_a$                   |   | -    | 12.5 | -                | ns                   |
| Reverse recovery rise time  | $t_b$                   |   | -    | 2.5  | -                |                      |

**Notes**

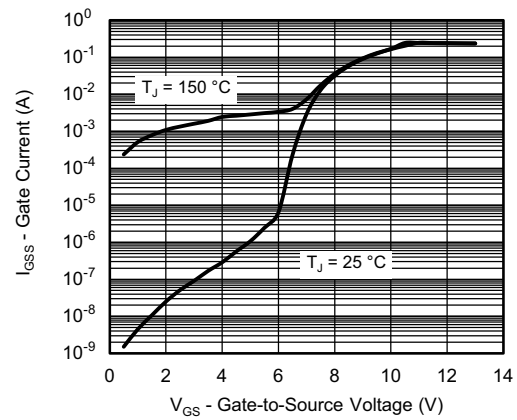
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$
- Guaranteed by design, not subject to production testing
- Surface mounted on 1" x 1" FR4 board with full copper,  $t = 5\text{ s}$

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.

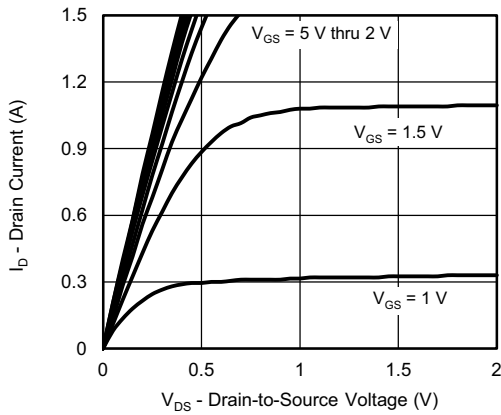
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



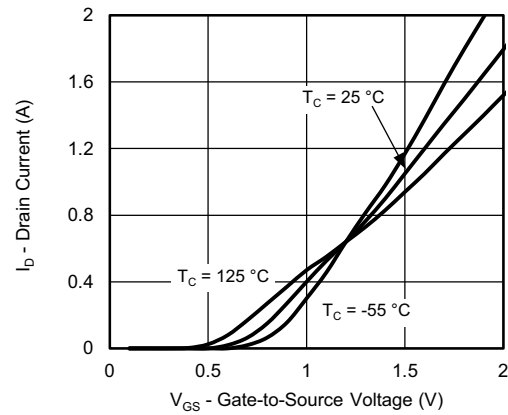
**Gate-Current vs. Gate-Source Voltage**



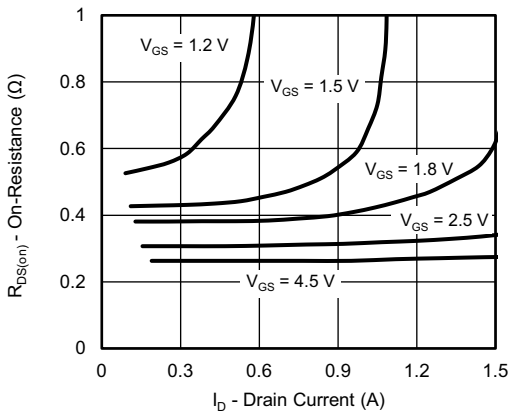
**Gate-Current vs. Gate-Source Voltage**



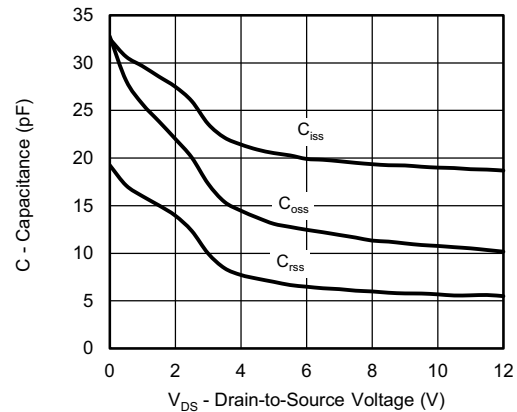
**Output Characteristics**



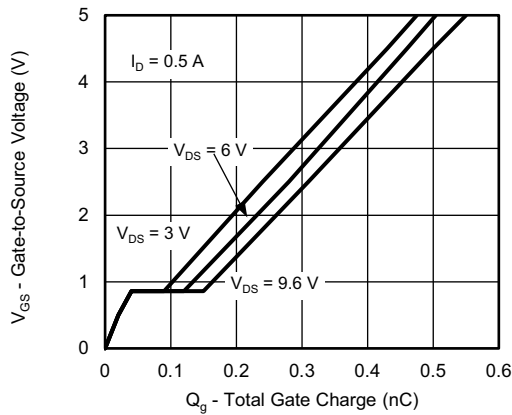
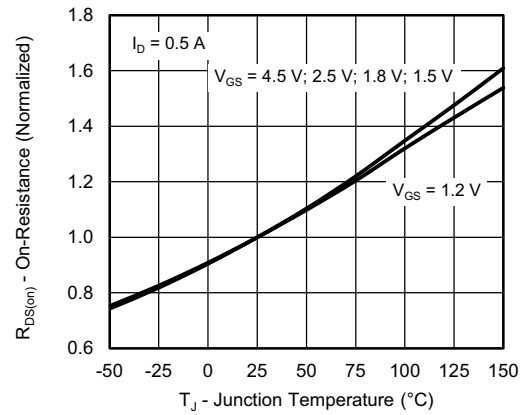
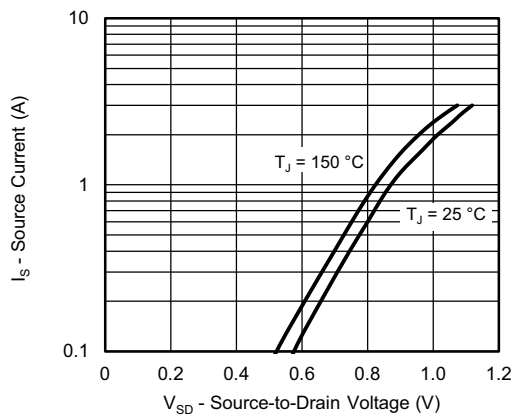
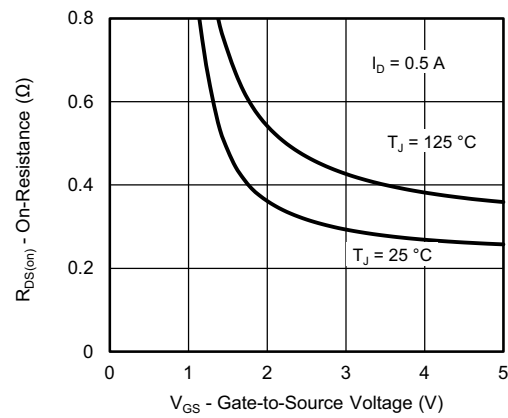
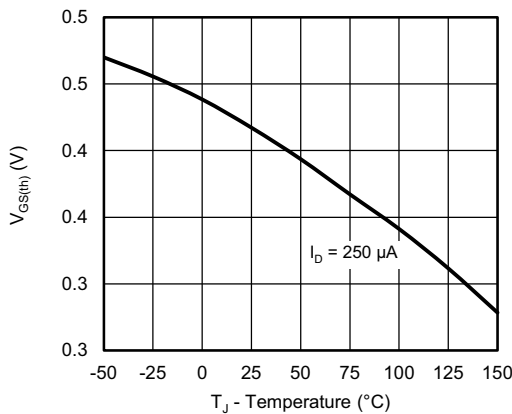
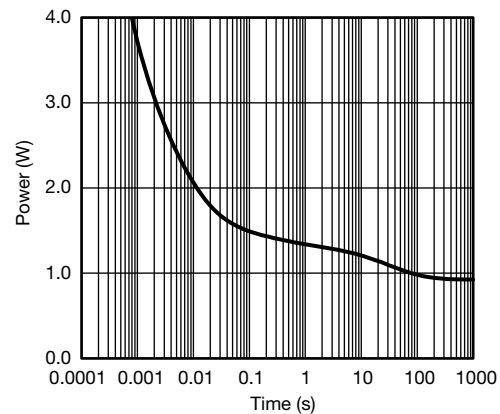
**Transfer Characteristics**



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

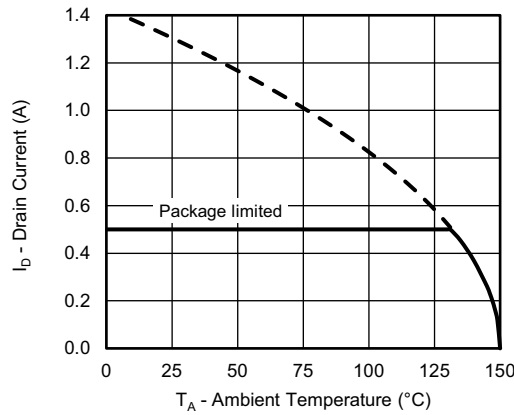


**Capacitance**

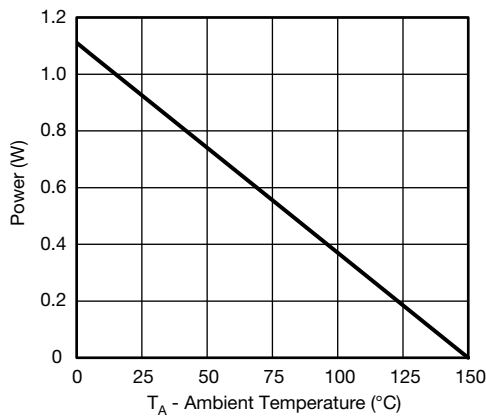
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**Source-Drain Diode Forward Voltage**

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

**Threshold Voltage**

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



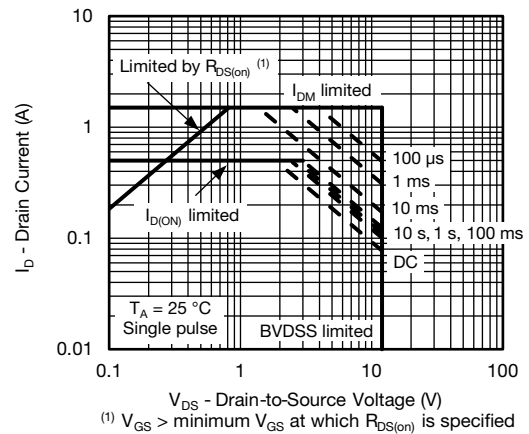
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating <sup>a</sup>



Power, Junction-to-Ambient



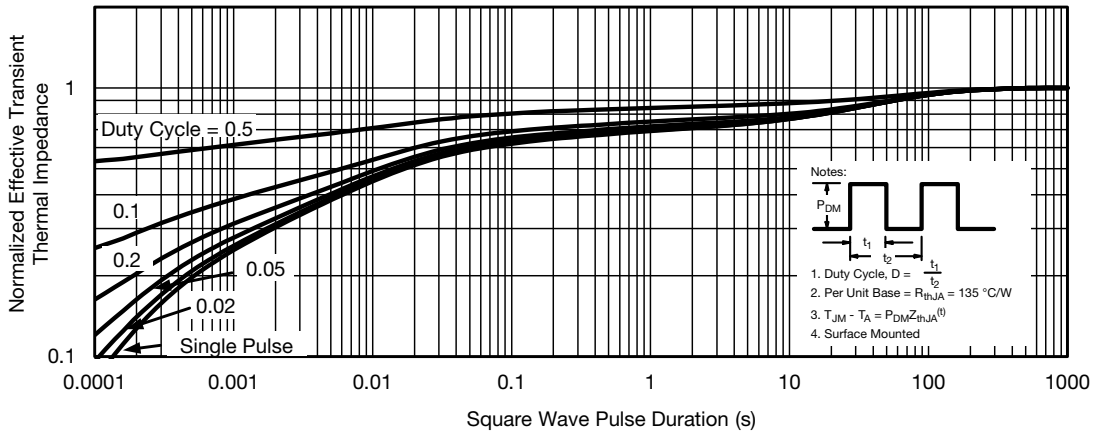
Safe Operating Area, Junction-to-Ambient

Note

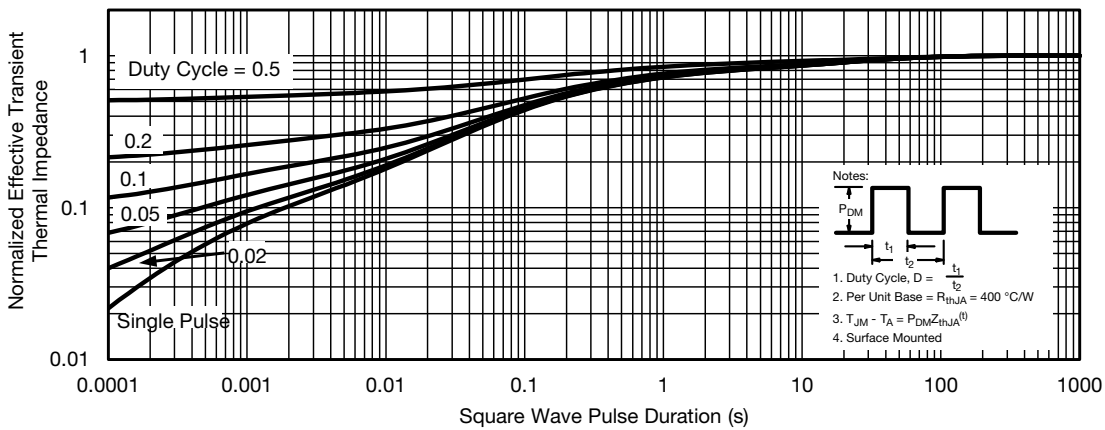
- a. The power dissipation P<sub>D</sub> is based on T<sub>J</sub> max. = 25 °C, using junction-to-ambient thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient (on 1" x 1" FR4 board with maximum copper)



Normalized Thermal Transient Impedance, Junction-to-Ambient (on 1" x 1" FR4 board with minimum copper)

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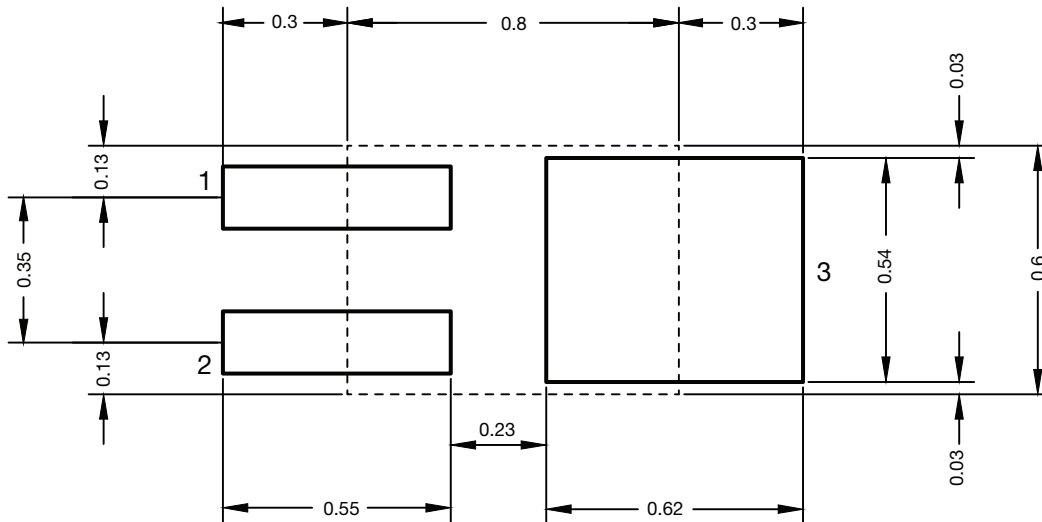
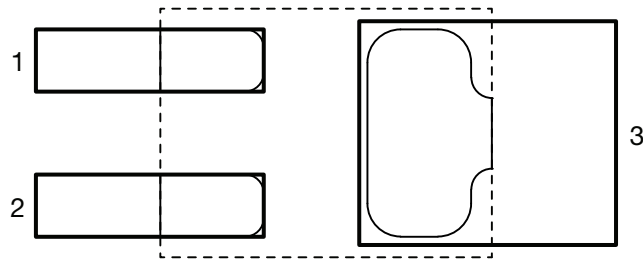
## Case Outline for PowerPAK 0.8 mm x 0.6 mm



| DIM. | MILLIMETERS |       |       | INCHES |        |        |
|------|-------------|-------|-------|--------|--------|--------|
|      | MIN.        | NOM.  | MAX.  | MIN.   | NOM.   | MAX.   |
| A    | 0.350       | 0.380 | 0.400 | 0.0138 | 0.0150 | 0.0157 |
| A1   | 0           | -     | 0.020 | 0      | -      | 0.0008 |
| b    | 0.120       | 0.150 | 0.180 | 0.0047 | 0.0059 | 0.0071 |
| C    | 0.119       | 0.127 | 0.135 | 0.0047 | 0.0050 | 0.0053 |
| D    | 0.750       | 0.800 | 0.850 | 0.0295 | 0.0315 | 0.0335 |
| D1   | 0.200       | 0.250 | 0.300 | 0.0078 | 0.0098 | 0.0118 |
| E    | 0.550       | 0.600 | 0.650 | 0.0217 | 0.0236 | 0.0256 |
| E1   | 0.450       | 0.500 | 0.550 | 0.0177 | 0.0197 | 0.0217 |
| e    | 0.300       | 0.350 | 0.400 | 0.0118 | 0.0138 | 0.0158 |
| K    | 0.150       | 0.250 | 0.350 | 0.0058 | 0.0098 | 0.0138 |
| L    | 0.200       | 0.250 | 0.300 | 0.0078 | 0.0098 | 0.0118 |

ECN: C13-1574-Rev. A, 23-Dec-13  
DWG: 6020

## Recommended Land Pattern PowerPAK® 0806







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