

## EMIPAK 1B PressFit Power Module

### 650 V PFC and Full Bridge MOSFET, 25 A



**EMIPAK 1B**  
(package example)

#### PRIMARY CHARACTERISTICS

| QB1 - QB2 PFC MOSFET                  |                                                       |
|---------------------------------------|-------------------------------------------------------|
| $V_{DS}$                              | 650 V                                                 |
| $R_{DS(on)}$ typical at $I_C = 25$ A  | 59 m $\Omega$                                         |
| $I_D$ at $T_{SINK} = 65$ °C           | 25 A                                                  |
| Q1 to Q4 FULL BRIDGE MOSFET           |                                                       |
| $V_{DS}$                              | 650 V                                                 |
| $R_{DS(on)}$ typical at $I_C = 25$ A  | 59 m $\Omega$                                         |
| $I_D$ at $T_{SINK} = 65$ °C           | 25 A                                                  |
| DB1 - DB2 SILICON CARBIDE CLAMP DIODE |                                                       |
| $V_{RRM}$                             | 650 V                                                 |
| $V_{FM}$ typical at 12 A              | 1.52 V                                                |
| $I_F$ at $T_{SINK} = 69$ °C           | 12 A                                                  |
| Package                               | EMIPAK 1B                                             |
| Circuit configuration                 | MOSFET dual boost PFC and MOSFET full bridge inverter |
| Type                                  | Modules - MOSFET                                      |

#### FEATURES

- E series power MOSFET with fast body diode
- SiC diode technology
- Exposed  $Al_2O_3$  substrate with low thermal resistance
- Low input capacitance
- Low switching and conduction losses
- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Ultra low gate charge  $Q_g$
- Low internal inductances
- Qualified using AQG324 guideline as reference
- PressFit pins locking technology  
PATENT(S): [www.vishay.com/patents](http://www.vishay.com/patents)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

#### DESCRIPTION

The EMIPAK 1B package is easy to use thanks to the PressFit pins. The exposed substrate provides improved thermal performance.

The optimized layout also helps to minimize stray parameters, allowing for better EMI performance.

#### ABSOLUTE MAXIMUM RATINGS ( $T_J = 25$ °C unless otherwise noted)

| PARAMETER                          | SYMBOL     | TEST CONDITIONS                                              | MAX.        | UNITS |
|------------------------------------|------------|--------------------------------------------------------------|-------------|-------|
| Operating junction temperature     | $T_J$      |                                                              | 150         | °C    |
| Storage temperature range          | $T_{Stg}$  |                                                              | -40 to +150 |       |
| RMS isolation voltage              | $V_{ISOL}$ | $T_J = 25$ °C, all terminals shorted, $f = 50$ Hz, $t = 1$ s | 3500        | V     |
| QB1 - QB2 PFC MOSFET               |            |                                                              |             |       |
| Drain to source voltage            | $V_{DS}$   |                                                              | 650         | V     |
| Gate to source voltage             | $V_{GS}$   |                                                              | $\pm 20$    |       |
| Pulsed drain current               | $I_{DM}$   |                                                              | 49          | A     |
| Continuous drain current           | $I_D$      | $T_{SINK} = 25$ °C                                           | 29          | A     |
|                                    |            | $T_{SINK} = 80$ °C                                           | 22          |       |
| Power dissipation                  | $P_D$      | $T_{SINK} = 25$ °C                                           | 139         | W     |
|                                    |            | $T_{SINK} = 80$ °C                                           | 78          |       |
| Single pulse avalanche energy      | $E_{AS}$   | $L = 10$ mH, $I_{AS} = 16$ A, $T_J = 25$ °C                  | 1280        | mJ    |
| Pulsed source current (body diode) | $I_{SM}$   |                                                              | 225         | A     |

**PATENT(S):** [www.vishay.com/patents](http://www.vishay.com/patents)

This Vishay product is protected by one or more United States and International patents.

**ABSOLUTE MAXIMUM RATINGS** ( $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

| <b>Q1 to Q4 FULL BRIDGE MOSFET</b>           |           |                                                                                  |          |    |
|----------------------------------------------|-----------|----------------------------------------------------------------------------------|----------|----|
| Drain to source voltage                      | $V_{DSS}$ |                                                                                  | 650      | V  |
| Gate to source voltage                       | $V_{GS}$  |                                                                                  | $\pm 20$ |    |
| Pulsed drain current                         | $I_{DM}$  | $V_{GS} = 10\text{ V}$                                                           | 49       | A  |
| Continuous drain current                     | $I_D$     | $T_{SINK} = 25\text{ }^{\circ}\text{C}$                                          | 29       | A  |
|                                              |           | $T_{SINK} = 80\text{ }^{\circ}\text{C}$                                          | 22       |    |
| Power dissipation                            | $P_D$     | $T_{SINK} = 25\text{ }^{\circ}\text{C}$                                          | 139      | W  |
|                                              |           | $T_{SINK} = 80\text{ }^{\circ}\text{C}$                                          | 78       |    |
| Single pulse avalanche energy                | $E_{AS}$  | $L = 10\text{ mH}$ , $I_{AS} = 16\text{ A}$ , $T_J = 25\text{ }^{\circ}\text{C}$ | 1280     | mJ |
| Pulsed source current (body diode)           | $I_{SM}$  |                                                                                  | 225      | A  |
| <b>DB1 - DB2 SILICON CARBIDE CLAMP DIODE</b> |           |                                                                                  |          |    |
| Cathode to anode voltage                     | $V_{RRM}$ |                                                                                  | 650      | V  |
| Single pulse forward current                 | $I_{FSM}$ | 10 ms sine or 6 ms rectangular pulse, $T_J = 25\text{ }^{\circ}\text{C}$         | 85       | A  |
| Diode continuous forward current             | $I_F$     | $T_{SINK} = 25\text{ }^{\circ}\text{C}$                                          | 15       | A  |
|                                              |           | $T_{SINK} = 80\text{ }^{\circ}\text{C}$                                          | 11       |    |
| Power dissipation                            | $P_D$     | $T_{SINK} = 25\text{ }^{\circ}\text{C}$                                          | 44       | W  |
|                                              |           | $T_{SINK} = 80\text{ }^{\circ}\text{C}$                                          | 25       |    |

**ELECTRICAL SPECIFICATIONS** ( $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

| PARAMETER                                     | SYMBOL                         | TEST CONDITIONS                                                                                                      | MIN. | TYP.  | MAX.      | UNITS                  |
|-----------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------|------|-------|-----------|------------------------|
| <b>QB1 - QB2 PFC MOSFET</b>                   |                                |                                                                                                                      |      |       |           |                        |
| Drain to source breakdown voltage             | $BV_{DSS}$                     | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                               | 650  | -     | -         | m $\Omega$             |
| Drain to source on resistance                 | $R_{DS(on)}$                   | $V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$                                                                         | -    | 59    | 80        |                        |
|                                               |                                | $V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$ , $T_J = 150\text{ }^{\circ}\text{C}$                                   | -    | 132   | -         |                        |
| Gate threshold voltage                        | $V_{GS(th)}$                   | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                   | 1.8  | 2.9   | 4.4       | V                      |
| Temperature coefficient of threshold voltage  | $\Delta V_{GS(th)}/\Delta T_J$ | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$ ( $25\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$ ) | -    | -10.8 | -         | mV/ $^{\circ}\text{C}$ |
| Forward transconductance                      | $g_{fs}$                       | $V_{DS} = 20\text{ V}$ , $I_D = 25\text{ A}$                                                                         | -    | 31    | -         | S                      |
| Transfer characteristics                      | $V_{GS}$                       | $V_{DS} = 20\text{ V}$ , $I_D = 25\text{ A}$                                                                         | -    | 4.76  | -         | V                      |
| Zero gate voltage drain current               | $I_{DSS}$                      | $V_{GS} = 0\text{ V}$ , $V_{DS} = 650\text{ V}$                                                                      | -    | 2     | 100       | $\mu\text{A}$          |
|                                               |                                | $V_{GS} = 0\text{ V}$ , $V_{DS} = 650\text{ V}$ , $T_J = 150\text{ }^{\circ}\text{C}$                                | -    | 700   | -         |                        |
| Gate to source leakage current                | $I_{GSS}$                      | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$                                                                   | -    | -     | $\pm 150$ | nA                     |
| <b>QB1 - QB2 PFC MOSFET BODY DIODE</b>        |                                |                                                                                                                      |      |       |           |                        |
| Source-to-drain voltage drop                  | $V_{SD}$                       | $I_{SD} = 25\text{ A}$ , $V_{GS} = 0\text{ V}$                                                                       | -    | 0.95  | 1.32      | V                      |
| <b>Q1 to Q4 FULL BRIDGE MOSFET</b>            |                                |                                                                                                                      |      |       |           |                        |
| Drain to source breakdown voltage             | $BV_{DSS}$                     | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                               | 650  | -     | -         | m $\Omega$             |
| Drain to source on resistance                 | $R_{DS(on)}$                   | $V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$                                                                         | -    | 59    | 80        |                        |
|                                               |                                | $V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$ , $T_J = 150\text{ }^{\circ}\text{C}$                                   | -    | 132   | -         |                        |
| Gate threshold voltage                        | $V_{GS(th)}$                   | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                   | 1.8  | 2.9   | 4.4       | V                      |
| Temperature coefficient of threshold voltage  | $\Delta V_{GS(th)}/\Delta T_J$ | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$ ( $25\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$ ) | -    | -10.8 | -         | mV/ $^{\circ}\text{C}$ |
| Forward transconductance                      | $g_{fs}$                       | $V_{DS} = 20\text{ V}$ , $I_D = 25\text{ A}$                                                                         | -    | 31    | -         | S                      |
| Transfer characteristics                      | $V_{GS}$                       | $V_{DS} = 20\text{ V}$ , $I_D = 25\text{ A}$                                                                         | -    | 4.76  | -         | V                      |
| Zero gate voltage drain current               | $I_{DSS}$                      | $V_{GS} = 0\text{ V}$ , $V_{DS} = 650\text{ V}$                                                                      | -    | 2     | 100       | $\mu\text{A}$          |
|                                               |                                | $V_{GS} = 0\text{ V}$ , $V_{DS} = 650\text{ V}$ , $T_J = 150\text{ }^{\circ}\text{C}$                                | -    | 700   | -         |                        |
| Gate to source leakage current                | $I_{GSS}$                      | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$                                                                   | -    | -     | $\pm 150$ | nA                     |
| <b>Q1 to Q4 FULL BRIDGE MOSFET BODY DIODE</b> |                                |                                                                                                                      |      |       |           |                        |
| Source-to-drain voltage drop                  | $V_{SD}$                       | $I_{SD} = 25\text{ A}$ , $V_{GS} = 0\text{ V}$                                                                       | -    | 0.95  | 1.32      | V                      |
| <b>DB1 - DB2 SILICON CARBIDE CLAMP DIODE</b>  |                                |                                                                                                                      |      |       |           |                        |
| Forward voltage drop                          | $V_{FM}$                       | $I_F = 12\text{ A}$                                                                                                  | -    | 1.52  | 2.00      | V                      |
|                                               |                                | $I_F = 12\text{ A}$ , $T_J = 150\text{ }^{\circ}\text{C}$                                                            | -    | 1.92  | -         |                        |
| Breakdown voltage                             | $V_{BR}$                       | $I_R = 500\text{ }\mu\text{A}$                                                                                       | 650  | -     | -         | V                      |
| Reverse leakage current                       | $I_{RM}$                       | $V_R = 650\text{ V}$                                                                                                 | -    | 1.8   | 100       | $\mu\text{A}$          |
|                                               |                                | $V_R = 650\text{ V}$ , $T_J = 150\text{ }^{\circ}\text{C}$                                                           | -    | 600   | -         |                        |



| SWITCHING CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise noted) |                     |                                                                                                                                                            |      |      |      |       |
|---------------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|
| PARAMETER                                                                 | SYMBOL              | TEST CONDITIONS                                                                                                                                            | MIN. | TYP. | MAX. | UNITS |
| QB1 - QB2 PFC MOSFET                                                      |                     |                                                                                                                                                            |      |      |      |       |
| Total gate charge (turn-on)                                               | Q <sub>g</sub>      | I <sub>D</sub> = 24 A,<br>V <sub>DS</sub> = 480 V,<br>V <sub>GS</sub> = 10 V                                                                               | -    | 190  | -    | nC    |
| Gate to source charge (turn-on)                                           | Q <sub>gs</sub>     |                                                                                                                                                            | -    | 41   | -    |       |
| Gate to drain charge (turn-on)                                            | Q <sub>gd</sub>     |                                                                                                                                                            | -    | 67   | -    |       |
| Turn-on switching loss                                                    | E <sub>ON</sub>     | I <sub>D</sub> = 25 A, V <sub>DD</sub> = 325 V,<br>V <sub>GS</sub> = +10 V / -10 V,<br>R <sub>g</sub> = 4.7 Ω, L = 500 μH                                  | -    | 0.11 | -    | mJ    |
| Turn-on delay time                                                        | t <sub>d(on)</sub>  |                                                                                                                                                            | -    | 14   | -    | ns    |
| Rise time                                                                 | t <sub>r</sub>      |                                                                                                                                                            | -    | 9    | -    |       |
| Turn-off switching loss                                                   | E <sub>OFF</sub>    |                                                                                                                                                            | -    | 0.06 | -    | mJ    |
| Turn-off delay time                                                       | t <sub>d(off)</sub> |                                                                                                                                                            | -    | 78   | -    | ns    |
| Fall time                                                                 | t <sub>f</sub>      |                                                                                                                                                            | -    | 7    | -    |       |
| Turn-on switching loss                                                    | E <sub>ON</sub>     | I <sub>D</sub> = 25 A, V <sub>DD</sub> = 325 V,<br>V <sub>GS</sub> = +10 V / -10 V,<br>R <sub>g</sub> = 4.7 Ω, L = 500 μH, T <sub>J</sub> = 125 °C         | -    | 0.12 | -    | mJ    |
| Turn-on delay time                                                        | t <sub>d(on)</sub>  |                                                                                                                                                            | -    | 12   | -    | ns    |
| Rise time                                                                 | t <sub>r</sub>      |                                                                                                                                                            | -    | 9    | -    |       |
| Turn-off switching loss                                                   | E <sub>OFF</sub>    |                                                                                                                                                            | -    | 0.06 | -    | mJ    |
| Turn-off delay time                                                       | t <sub>d(off)</sub> |                                                                                                                                                            | -    | 82   | -    | ns    |
| Fall time                                                                 | t <sub>f</sub>      |                                                                                                                                                            | -    | 7    | -    |       |
| Input capacitance                                                         | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 100 V,<br>f = 1 MHz                                                                                            | -    | 5900 | -    | pF    |
| Output capacitance                                                        | C <sub>oss</sub>    |                                                                                                                                                            | -    | 260  | -    |       |
| Reverse transfer capacitance                                              | C <sub>rss</sub>    |                                                                                                                                                            | -    | 5    | -    |       |
| Reverse bias safe operating area                                          | RBSOA               | T <sub>J</sub> = 150 °C, I <sub>D</sub> = 120 A, V <sub>DD</sub> = 400 V,<br>V <sub>P</sub> = 600 V, R <sub>g</sub> = 4.7 Ω, V <sub>GS</sub> = +10 V / 0 V |      |      |      |       |
| QB1 - QB2 PFC MOSFET BODY DIODE                                           |                     |                                                                                                                                                            |      |      |      |       |
| Diode reverse recovery time                                               | t <sub>rr</sub>     | V <sub>R</sub> = 400 V, T <sub>J</sub> = 25 °C,<br>I <sub>S</sub> = 22 A,<br>di/dt = 100 A/μs                                                              | -    | 203  | -    | ns    |
| Diode reverse recovery current                                            | I <sub>rr</sub>     |                                                                                                                                                            | -    | 16   | -    | A     |
| Diode reverse recovery charge                                             | Q <sub>rr</sub>     |                                                                                                                                                            | -    | 1625 | -    | nC    |
| Q1 to Q4 FULL BRIDGE MOSFET                                               |                     |                                                                                                                                                            |      |      |      |       |
| Total gate charge (turn-on)                                               | Q <sub>g</sub>      | I <sub>D</sub> = 24 A,<br>V <sub>DS</sub> = 480 V,<br>V <sub>GS</sub> = 10 V                                                                               | -    | 190  | -    | nC    |
| Gate-source charge                                                        | Q <sub>gs</sub>     |                                                                                                                                                            | -    | 41   | -    |       |
| Gate-drain charge                                                         | Q <sub>gd</sub>     |                                                                                                                                                            | -    | 67   | -    |       |
| Turn-off switching loss                                                   | E <sub>OFF</sub>    | I <sub>D</sub> = 25 A, V <sub>DD</sub> = 325 V,<br>V <sub>GS</sub> = +10 V / -10 V,<br>R <sub>g</sub> = 4.7 Ω, L = 500 μH                                  | -    | 0.05 | -    | mJ    |
| Turn-off delay time                                                       | t <sub>d(off)</sub> |                                                                                                                                                            | -    | 76   | -    | ns    |
| Fall time                                                                 | t <sub>f</sub>      |                                                                                                                                                            | -    | 7    | -    |       |
| Turn-off switching loss                                                   | E <sub>OFF</sub>    | I <sub>D</sub> = 25 A, V <sub>DD</sub> = 325 V,<br>V <sub>GS</sub> = +10 V / -10 V,<br>R <sub>g</sub> = 4.7 Ω, L = 500 μH, T <sub>J</sub> = 125 °C         | -    | 0.05 | -    | mJ    |
| Turn-off delay time                                                       | t <sub>d(off)</sub> |                                                                                                                                                            | -    | 79   | -    | ns    |
| Fall time                                                                 | t <sub>f</sub>      |                                                                                                                                                            | -    | 7    | -    |       |
| Input capacitance                                                         | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 100 V,<br>f = 1 MHz                                                                                            | -    | 5900 | -    | pF    |
| Output capacitance                                                        | C <sub>oss</sub>    |                                                                                                                                                            | -    | 260  | -    |       |
| Reverse transfer capacitance                                              | C <sub>rss</sub>    |                                                                                                                                                            | -    | 5    | -    |       |
| Reverse bias safe operating area                                          | RBSOA               | T <sub>J</sub> = 150 °C, I <sub>D</sub> = 50 A, V <sub>DD</sub> = 400 V,<br>V <sub>P</sub> = 600 V, R <sub>g</sub> = 4.7 Ω, V <sub>GS</sub> = +10 V / 0 V  |      |      |      |       |
| Q1 to Q4 FULL BRIDGE MOSFET BODY DIODE                                    |                     |                                                                                                                                                            |      |      |      |       |
| Diode reverse recovery time                                               | t <sub>rr</sub>     | V <sub>R</sub> = 400 V, T <sub>J</sub> = 25 °C,<br>I <sub>S</sub> = 22 A,<br>di/dt = 100 A/μs                                                              | -    | 203  | -    | ns    |
| Diode reverse recovery current                                            | I <sub>rr</sub>     |                                                                                                                                                            | -    | 16   | -    | A     |
| Diode reverse recovery charge                                             | Q <sub>rr</sub>     |                                                                                                                                                            | -    | 1625 | -    | nC    |
| DB1 - DB2 SILICON CARBIDE CLAMP DIODE                                     |                     |                                                                                                                                                            |      |      |      |       |
| Total capacitive charge                                                   | Q <sub>C</sub>      | V <sub>R</sub> = 400 V, I <sub>F</sub> = 12 A, di/dt = 500 A/μs                                                                                            | -    | 29   | -    | nC    |

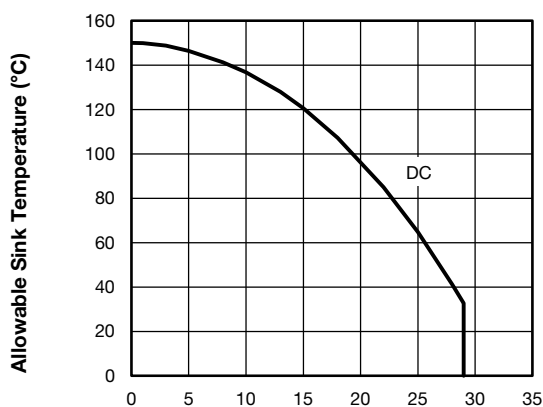
| INTERNAL NTC - THERMISTOR SPECIFICATIONS |             |                                                                |                |                        |
|------------------------------------------|-------------|----------------------------------------------------------------|----------------|------------------------|
| PARAMETER                                | SYMBOL      | TEST CONDITIONS                                                | VALUE          | UNITS                  |
| Resistance                               | $R_{25}$    | $T_C = 25\text{ }^{\circ}\text{C}$                             | 5000           | $\Omega$               |
|                                          | $R_{100}$   | $T_C = 100\text{ }^{\circ}\text{C}$                            | $493 \pm 5\%$  |                        |
| B-value                                  | $B_{25/50}$ | $R_2 = R_{25} \exp. [B_{25/50} (1/T_2 - 1/(298.15\text{ K}))]$ | $3375 \pm 5\%$ | K                      |
| Maximum operating temperature            |             |                                                                | 220            | $^{\circ}\text{C}$     |
| Dissipation constant                     |             |                                                                | 2              | mW/ $^{\circ}\text{C}$ |
| Thermal time constant                    |             |                                                                | 8              | s                      |

**THERMAL AND MECHANICAL SPECIFICATIONS**

| PARAMETER                                                                                              | SYMBOL     | MIN. | TYP. | MAX. | UNITS |
|--------------------------------------------------------------------------------------------------------|------------|------|------|------|-------|
| QB1 - QB2 PFC MOSFET - Junction to sink thermal resistance (per switch) <sup>(1)</sup>                 | $R_{thJS}$ | -    | 0.75 | -    | °C/W  |
| Q1 to Q4 FULL BRIDGE MOSFET - Junction to sink thermal resistance (per switch) <sup>(1)</sup>          |            | -    | 0.75 | -    |       |
| DB1 - DB2 SILICON CARBIDE CLAMP DIODE - Junction to sink thermal resistance (per diode) <sup>(1)</sup> |            | -    | 2.35 | -    |       |
| Case to sink thermal resistance (per module) <sup>(1)</sup>                                            |            | -    | 0.1  | -    |       |
| Mounting torque (M4)                                                                                   |            | 2    | -    | 3    | Nm    |
| Weight                                                                                                 |            | -    | 28   | -    | g     |

**Note**

<sup>(1)</sup> Mounting surface flat, smooth, and greased,  $\lambda_{grease} = 0.67 \text{ W/mK}$



$I_D$  - Continuous Drain Current (A)

Fig. 1 - Maximum MOSFET Continuous Drain Current vs. Sink Temperature

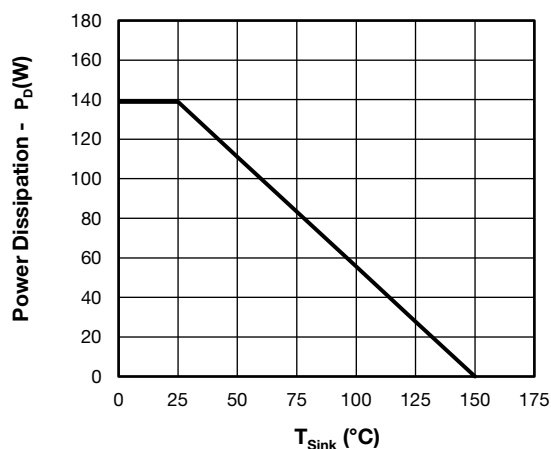


Fig. 2 - MOSFET Power Dissipation Curve

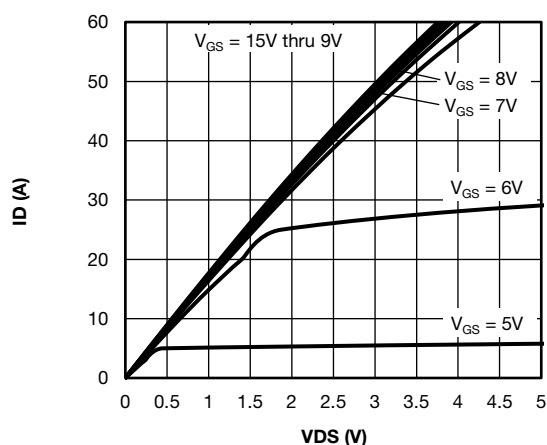


Fig. 3 - Typical MOSFET Drain-to-Source Current Output Characteristics at  $T_J = 25^\circ\text{C}$

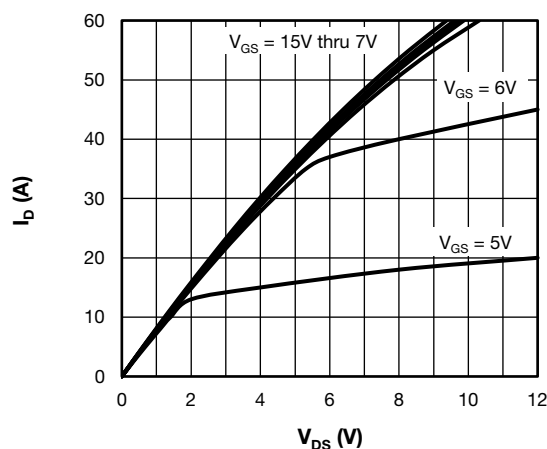


Fig. 4 - Typical MOSFET Drain-to-Source Current Output Characteristics at  $T_J = 150^\circ\text{C}$

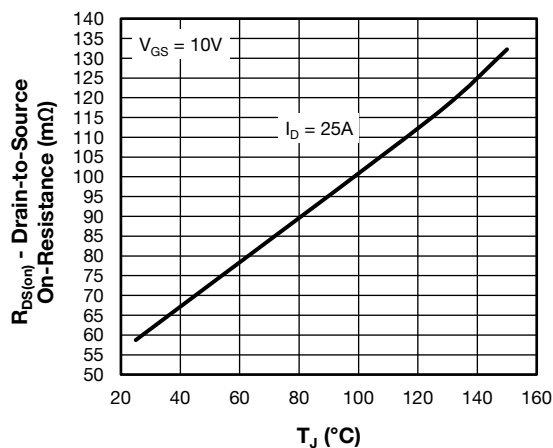


Fig. 5 - Typical MOSFET  
Drain-to-Source On-Resistance vs. Temperature

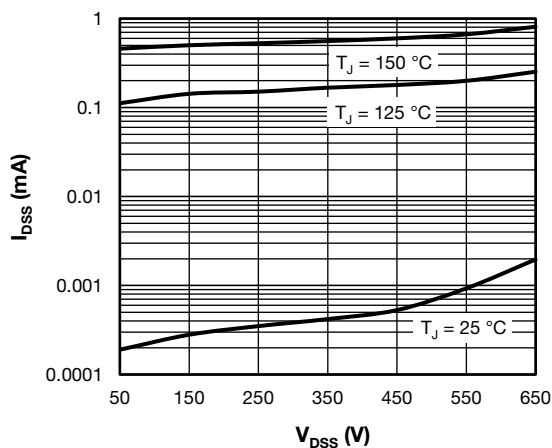


Fig. 8 - Typical MOSFET Zero Gate Voltage Drain Current

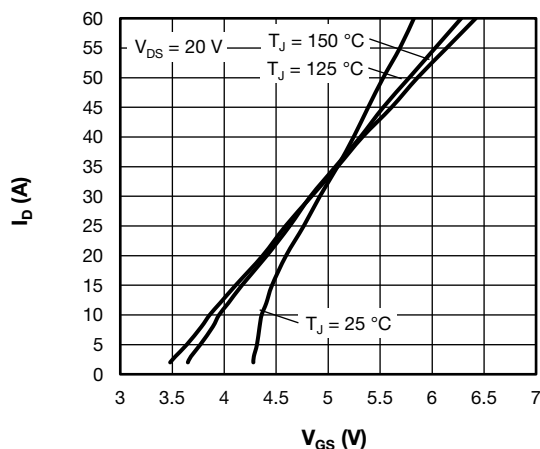


Fig. 6 - Typical MOSFET Transfer Characteristics

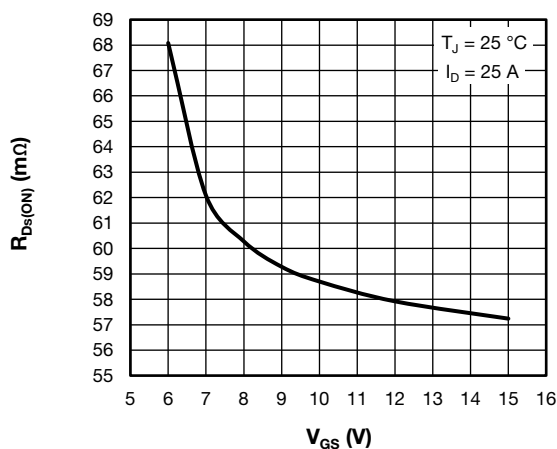


Fig. 9 - Typical MOSFET  
Drain - State Resistance vs. Gate-to-Source Voltage

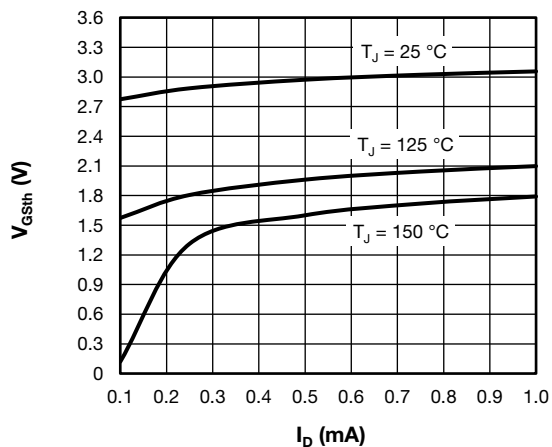


Fig. 7 - Typical MOSFET Gate Threshold Voltage Characteristics

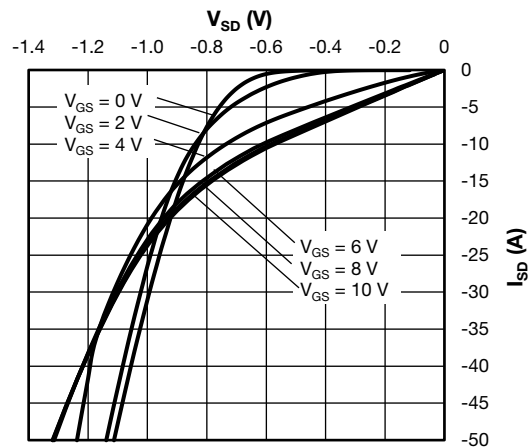


Fig. 10 - Typical MOSFET Source-to-Drain Current Characteristics  
at  $T_J = 25\text{ }^{\circ}\text{C}$

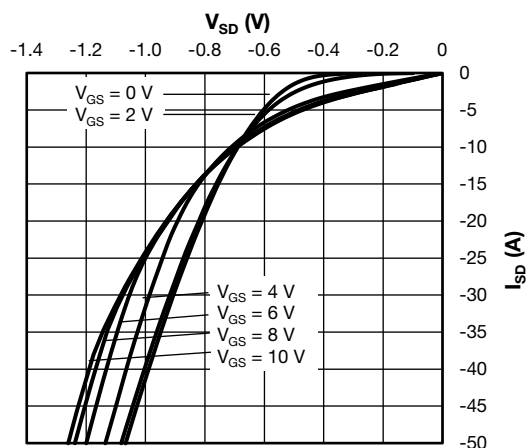


Fig. 11 - Typical MOSFET Source-to-Drain Current Characteristics at  $T_J = 125\text{ }^{\circ}\text{C}$

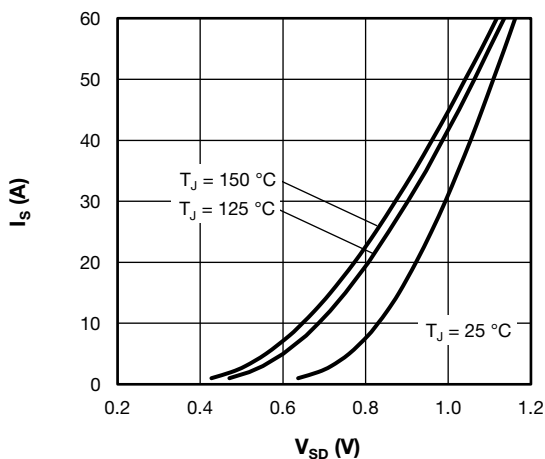


Fig. 12 - Typical MOSFET Body Diode Source-to-Drain Current Characteristics

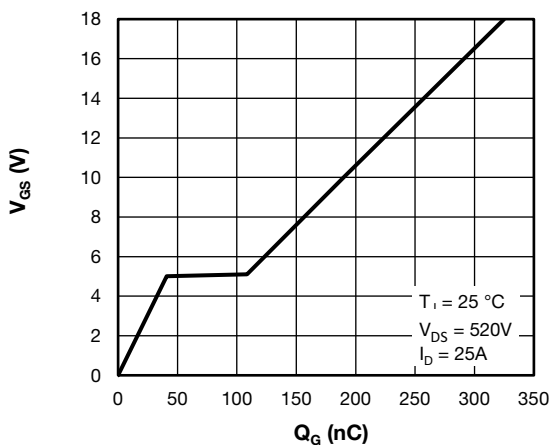


Fig. 13 - Typical MOSFET Gate charge vs. Gate-to-Source Voltage

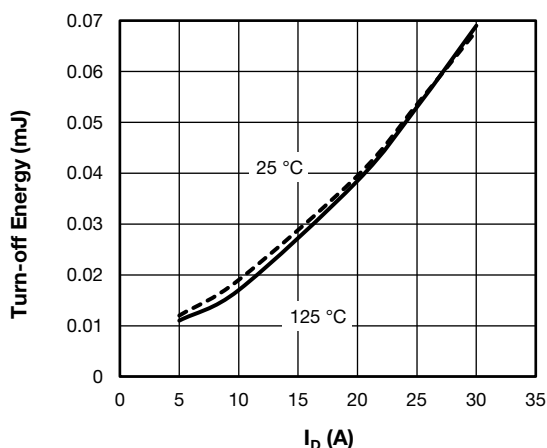


Fig. 14 - Typical Q1 to Q4 Turn-off Energy Loss vs.  $I_D$   
 $V_{DD} = 325\text{ V}$ ,  $R_g = 4.7\text{ }\Omega$ ,  $V_{GS} = \pm 10\text{ V}$ ,  $L = 500\text{ }\mu\text{H}$

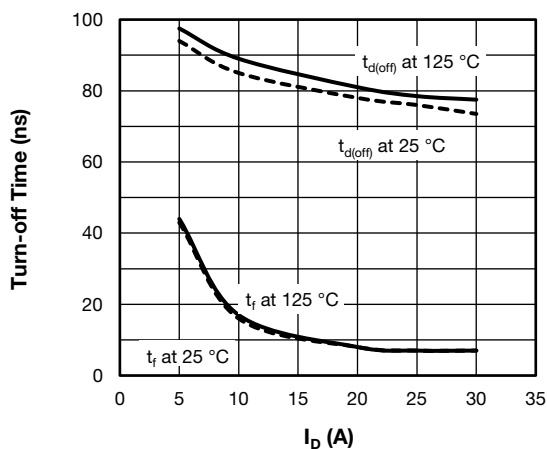


Fig. 15 - Typical Q1 to Q4 Turn-off Switching Time vs.  $I_D$   
 $V_{DD} = 325\text{ V}$ ,  $R_g = 4.7\text{ }\Omega$ ,  $V_{GS} = \pm 10\text{ V}$ ,  $L = 500\text{ }\mu\text{H}$

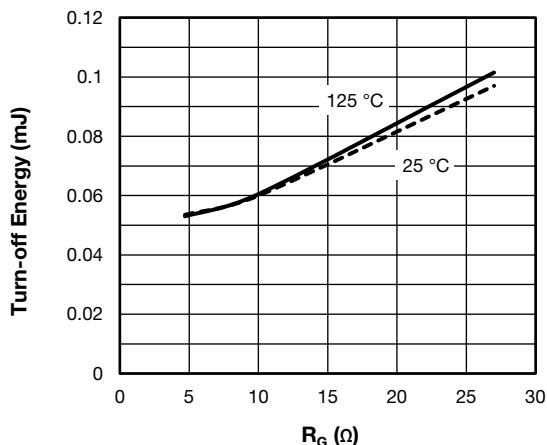


Fig. 16 - Typical Q1 to Q4 Turn-off Energy Loss vs.  $R_g$   
 $V_{DD} = 325\text{ V}$ ,  $I_D = 25\text{ A}$ ,  $V_{GS} = \pm 10\text{ V}$ ,  $L = 500\text{ }\mu\text{H}$

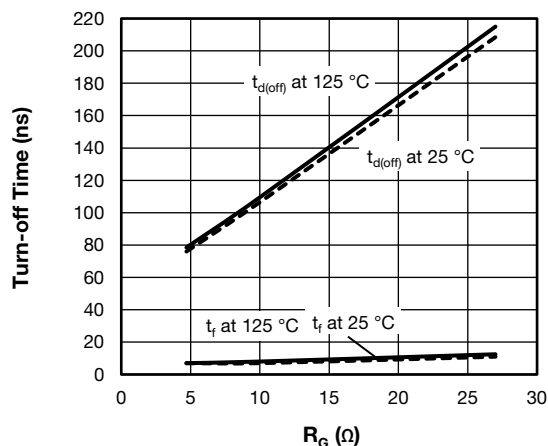


Fig. 17 - Typical Q1 to Q4 Turn-off Switching Time vs.  $R_g$   
 $V_{DD} = 325 \text{ V}$ ,  $I_D = 25 \text{ A}$ ,  $V_{GS} = \pm 10 \text{ V}$ ,  $L = 500 \text{ } \mu\text{H}$

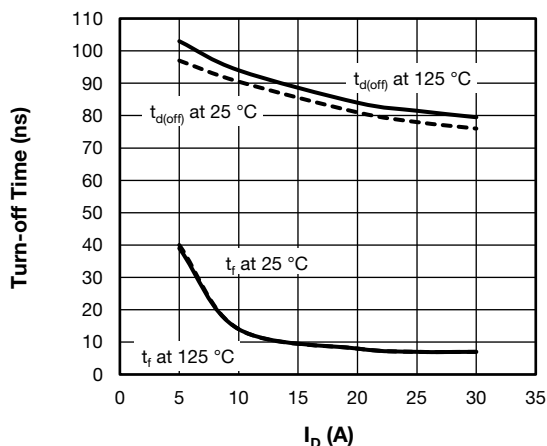


Fig. 20 - Typical QB1 to QB2 Turn-off Switching Time vs.  $I_D$   
 $V_{DD} = 325 \text{ V}$ ,  $R_g = 4.7 \text{ } \Omega$ ,  $V_{GS} = \pm 10 \text{ V}$ ,  $L = 500 \text{ } \mu\text{H}$

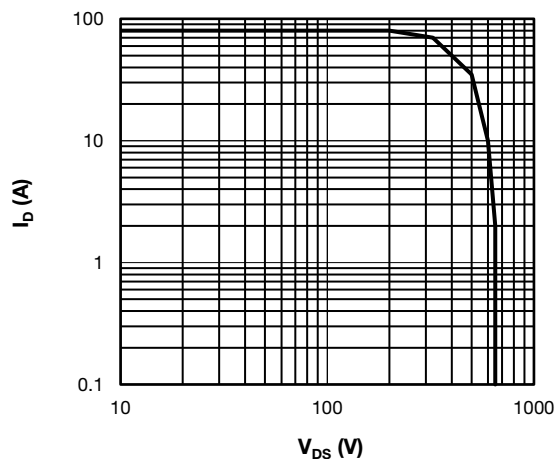


Fig. 18 - Q1 to Q4 Reverse BIAS SOA  $T_J = 150 \text{ } ^\circ\text{C}$ ,  $V_{GS} = 10 \text{ V}$

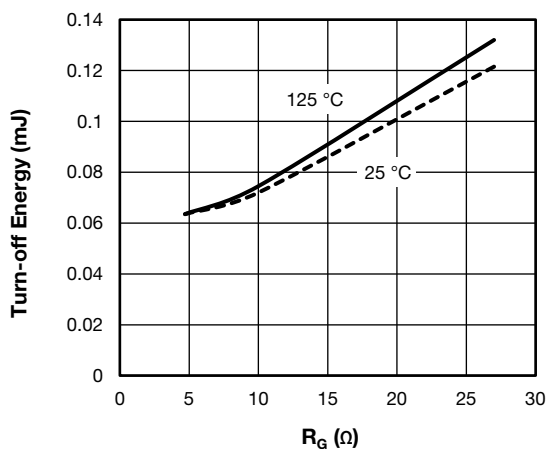


Fig. 21 - Typical QB1 - QB2 Turn-off Energy Loss vs.  $R_g$

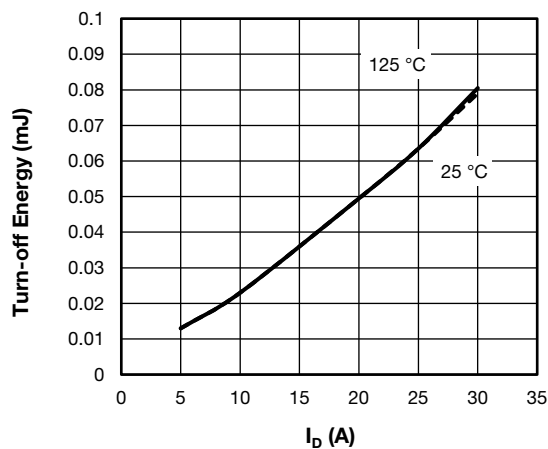


Fig. 19 - Typical QB1 - QB2 Turn-off Energy Loss vs.  $I_D$   
 $V_{DD} = 325 \text{ V}$ ,  $R_g = 4.7 \text{ } \Omega$ ,  $V_{GS} = \pm 10 \text{ V}$ ,  $L = 500 \text{ } \mu\text{H}$

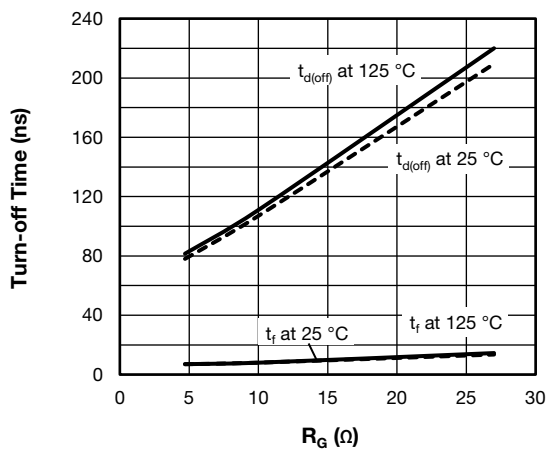


Fig. 22 - Typical QB1 - QB2 Turn-off Switching Time vs.  $R_g$

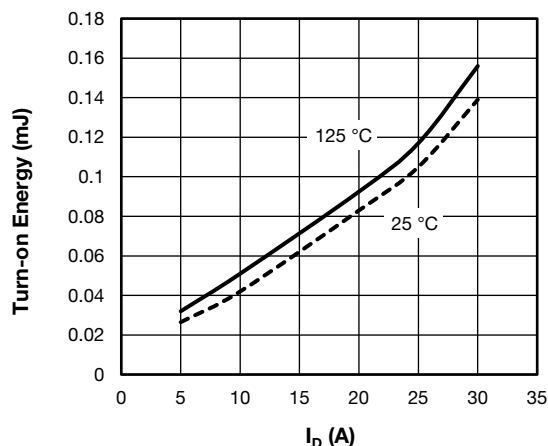


Fig. 23 - Typical QB1 - QB2 Turn-on Energy Loss vs.  $I_D$   
 $V_{DD} = 325 \text{ V}$ ,  $R_g = 4.7 \text{ } \Omega$ ,  $V_{GS} = \pm 10 \text{ V}$ ,  $L = 500 \text{ } \mu\text{H}$

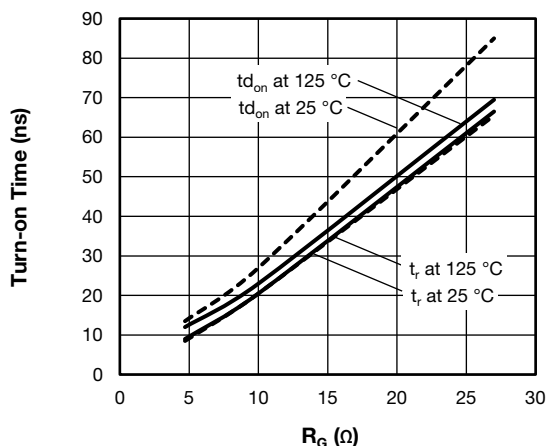


Fig. 26 - Typical QB1 - QB2 Turn-on Switching Time vs.  $R_g$   
 $V_{DD} = 325 \text{ V}$ ,  $I_D = 25 \text{ A}$ ,  $V_{GS} = \pm 10 \text{ V}$ ,  $L = 500 \text{ } \mu\text{H}$

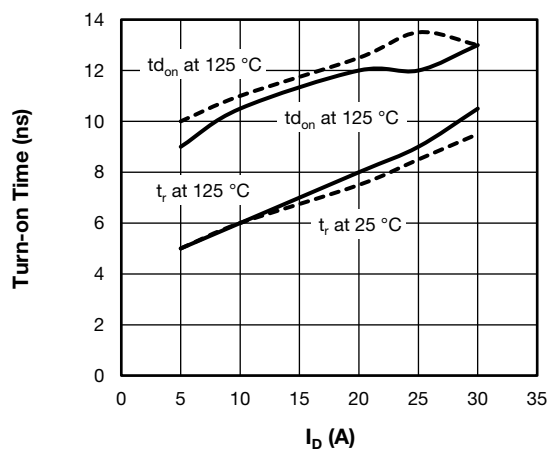


Fig. 24 - Typical QB1 - QB2 Turn-on Switching Time vs.  $I_D$   
 $V_{DD} = 325 \text{ V}$ ,  $R_g = 4.7 \text{ } \Omega$ ,  $V_{GS} = \pm 10 \text{ V}$ ,  $L = 500 \text{ } \mu\text{H}$

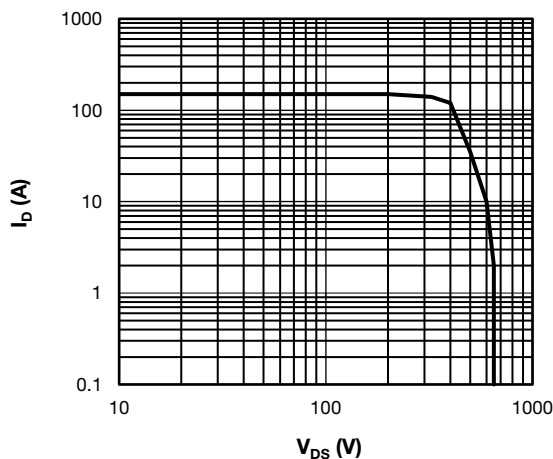


Fig. 27 - QB1 - QB2 Reverse BIAS SOA  
 $T_J = 150 \text{ } ^\circ\text{C}$ ,  $V_{GS} = 10 \text{ V}$

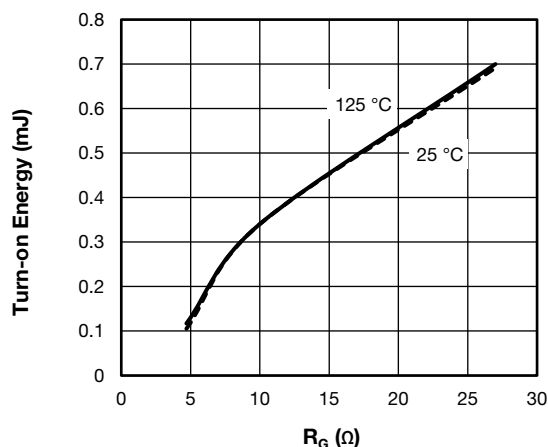


Fig. 25 - Typical QB1 - QB2 Turn-on Energy Loss vs.  $R_g$   
 $V_{DD} = 325 \text{ V}$ ,  $I_D = 25 \text{ A}$ ,  $V_{GS} = \pm 10 \text{ V}$ ,  $L = 500 \text{ } \mu\text{H}$

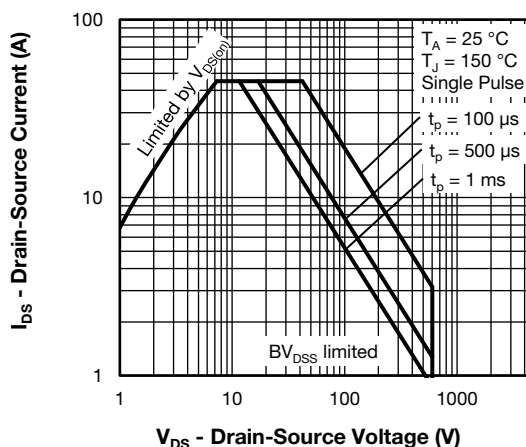


Fig. 28 - MOSFET Safe Operating Area



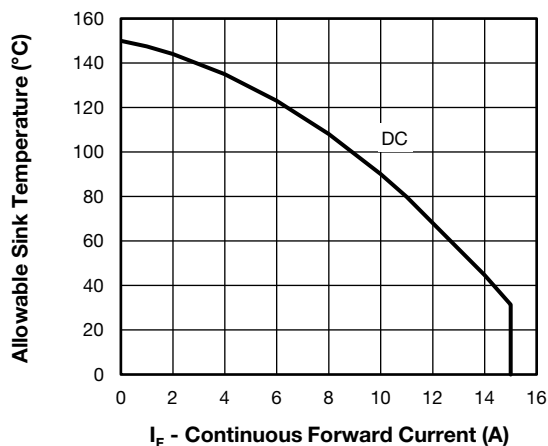


Fig. 29 - Maximum DB1 - DB2  
Continuous Forward Current vs. Sink Temperature

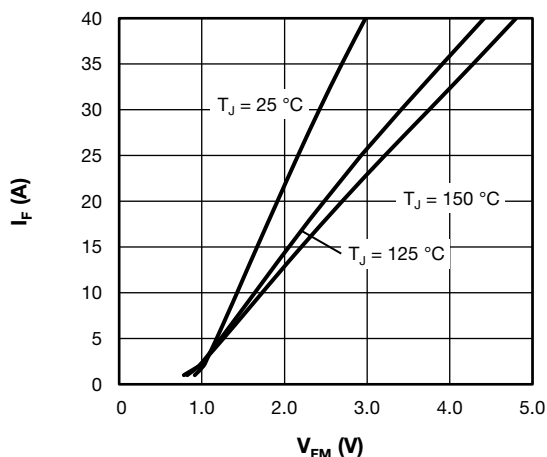


Fig. 30 - Typical DB1 - DB2 Diode Forward Characteristics

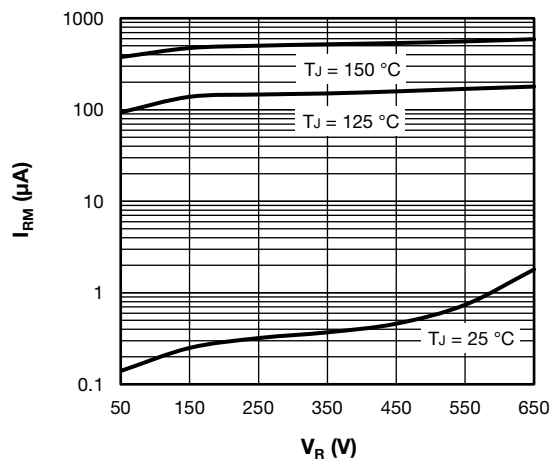


Fig. 31 - Typical DB1 - DB2 Reverse Leakage Current

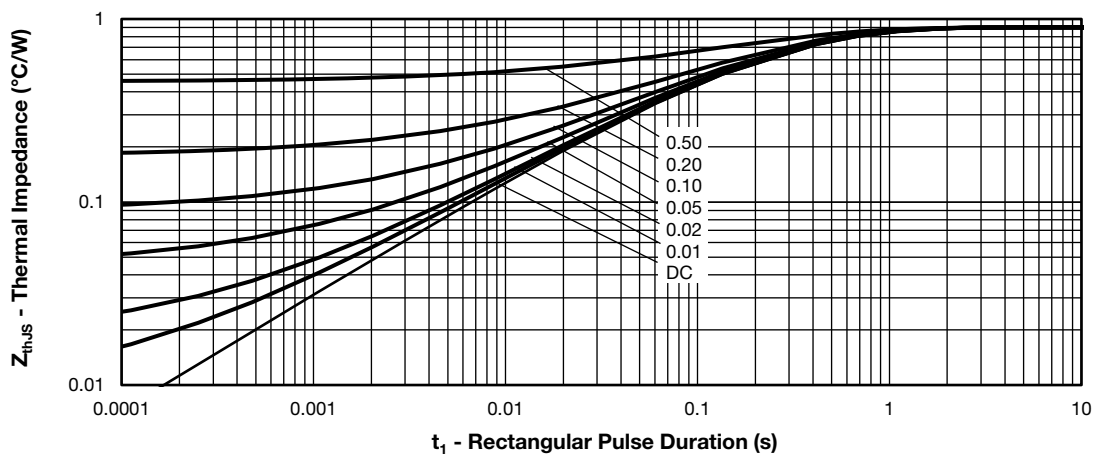


Fig. 32 - Maximum MOSFET  $Z_{thJS}$  Thermal Impedance Characteristics

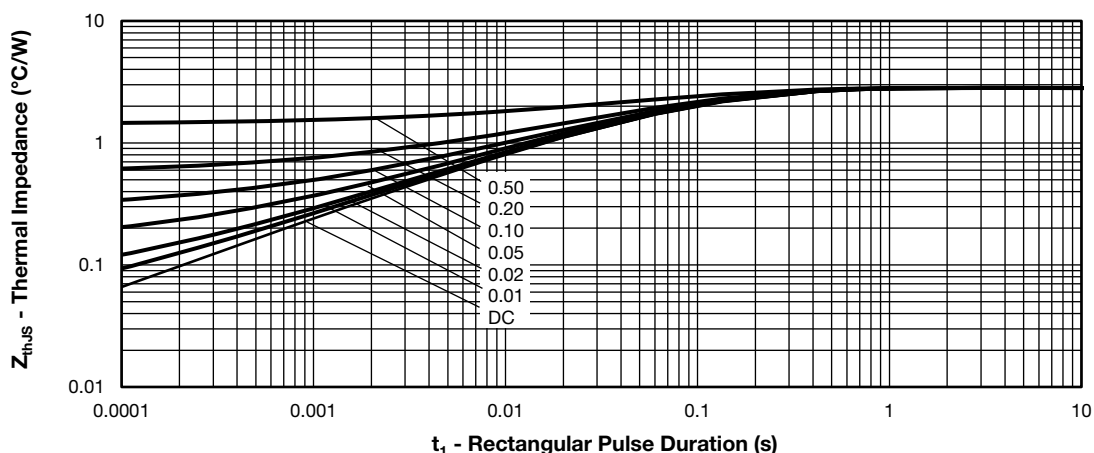


Fig. 33 - Maximum Diode  $Z_{thJS}$  Thermal Impedance Characteristic

## ORDERING INFORMATION TABLE

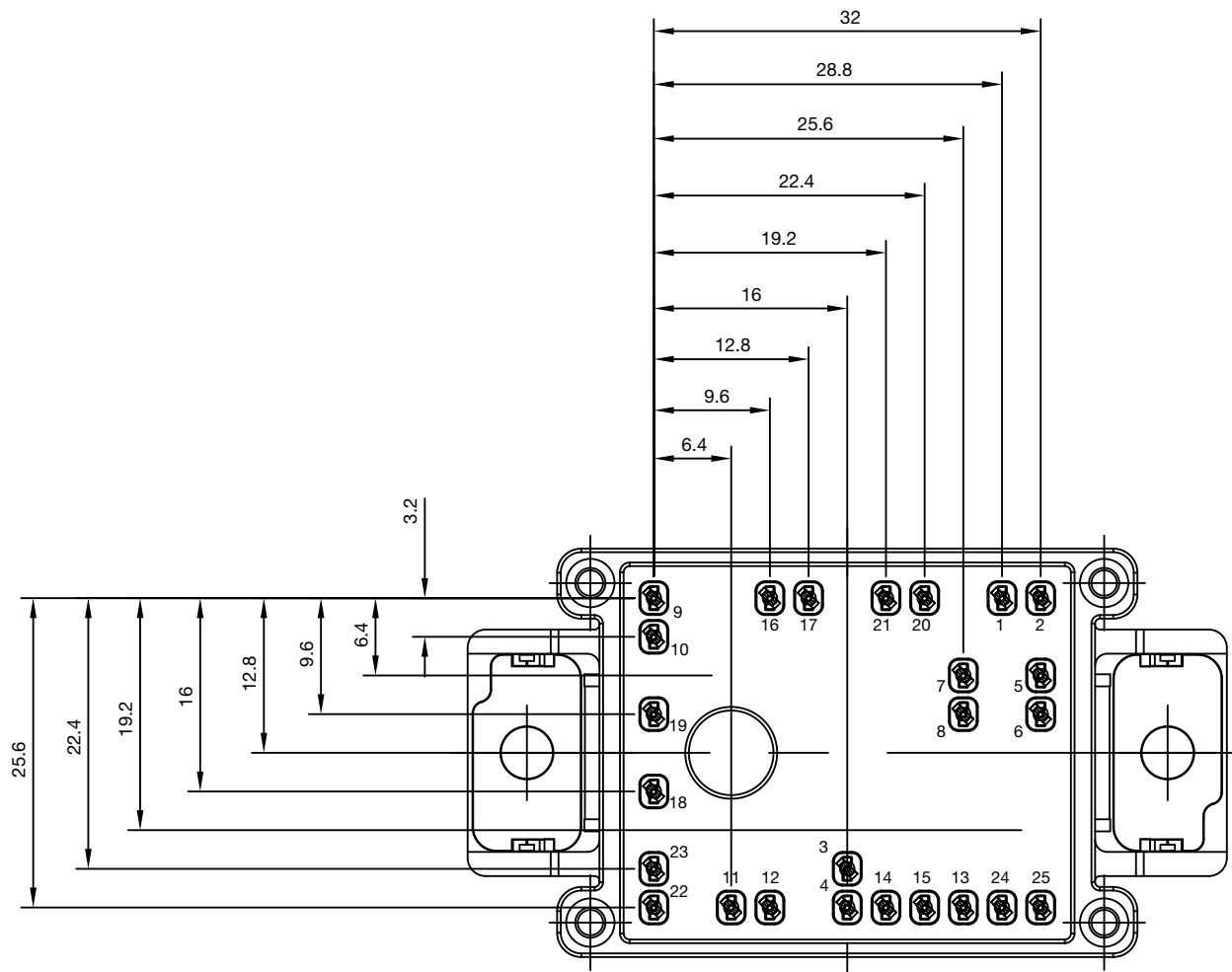
| Device code | VS- | EN | K | 025 | C | 65 | S |
|-------------|-----|----|---|-----|---|----|---|
|             | 1   | 2  | 3 | 4   | 5 | 6  | 7 |

- 1** - Vishay Semiconductors product
- 2** - Package indicator (EN = EMIPAK 1B)
- 3** - Circuit configuration (K = MOSFET dual boost PFC and MOSFET full bridge inverter)
- 4** - Current rating (025 = 25 A)
- 5** - Switch die technology (C = PowerMOS)
- 6** - Voltage rating (65 = 650 V)
- 7** - Clamp diode technology (S = Silicon Carbide diode)

| CIRCUIT CONFIGURATION                                 |                            |                 |
|-------------------------------------------------------|----------------------------|-----------------|
| CIRCUIT                                               | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING |
| MOSFET dual boost PFC and MOSFET full bridge inverter | K                          |                 |



PACKAGE

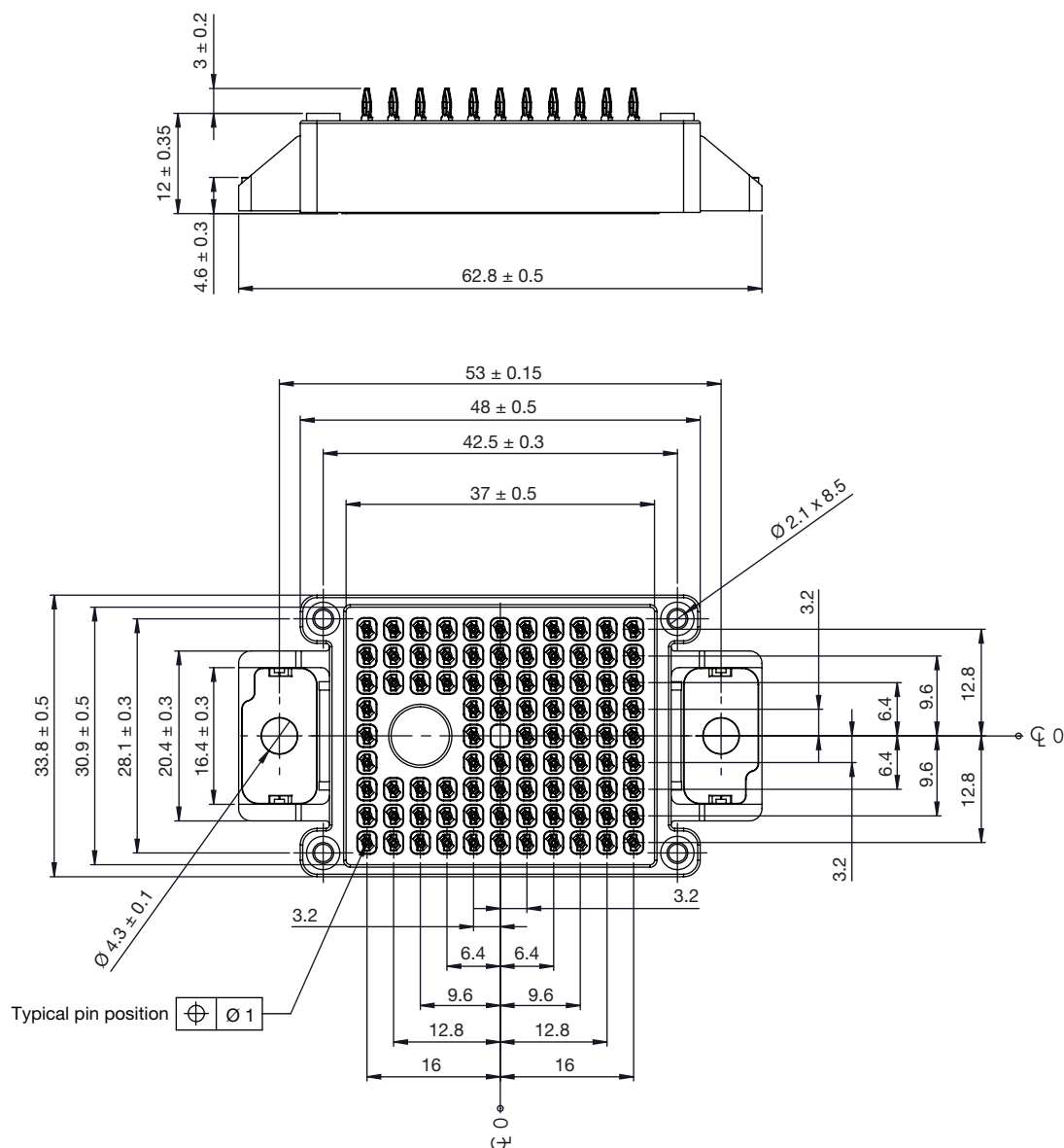


LINKS TO RELATED DOCUMENTS

|                  |                                                                        |
|------------------|------------------------------------------------------------------------|
| Dimensions       | <a href="http://www.vishay.com/doc?95558">www.vishay.com/doc?95558</a> |
| Application Note | <a href="http://www.vishay.com/doc?95580">www.vishay.com/doc?95580</a> |

## EMIPAK-1B PressFit

**DIMENSIONS** in millimeters





## Disclaimer

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