

## 1. General description

WeEnPACK-B2 module with WeEn 1200V Gen2 SiC MOSFET and Solderpin type. Integrated with NTC temperature sensor.



## 2. Features and benefits

- H Bridge topology
- Solder pin type
- Low  $R_{DS(on)}$
- Low Switching Losses
- Low  $Q_g$  and  $C_{rss}$
- Low Inductive Design

## 3. Applications

- Power inverters
- AC-DC converters
- Active power factor correctors
- Motor drives

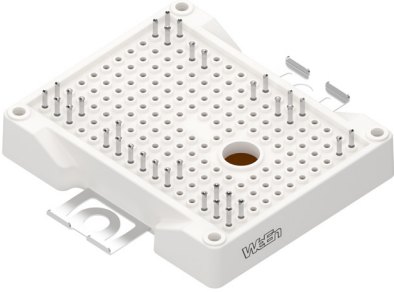
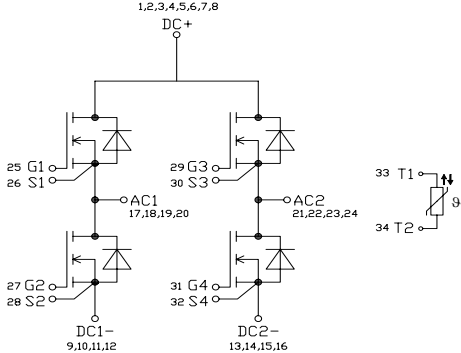
## 4. Quick reference data

Table 1. Quick reference data

| Symbol                         | Parameter                        | Conditions                                                                                                               | Notes | Values     |     |     | Unit |
|--------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------|------------|-----|-----|------|
| <b>Absolute maximum rating</b> |                                  |                                                                                                                          |       |            |     |     |      |
| $V_{DS}$                       | drain-source voltage             | $T_j = 25\text{ °C}$                                                                                                     |       | 1200       |     |     | V    |
| $I_D$                          | drain current                    | $V_{GS} = 18\text{ V}; T_h = 25\text{ °C}$                                                                               |       | 104        |     |     | A    |
| $P_{tot}$                      | total power dissipation          | $T_h = 25\text{ °C}$                                                                                                     |       | 142        |     |     | W    |
| $T_j$                          | junction temperature             |                                                                                                                          |       | -40 to 150 |     |     | °C   |
| Symbol                         | Parameter                        | Conditions                                                                                                               | Notes | Min        | Typ | Max | Unit |
| <b>Static characteristics</b>  |                                  |                                                                                                                          |       |            |     |     |      |
| $R_{DS(on)}$                   | drain-source on-state resistance | $V_{GS} = 15\text{ V}; I_D = 100\text{ A}; T_j = 25\text{ °C}$                                                           |       | -          | 11  | -   | mΩ   |
|                                |                                  | $V_{GS} = 18\text{ V}; I_D = 100\text{ A}; T_j = 25\text{ °C}$                                                           |       | -          | 8.3 | -   | mΩ   |
| <b>Dynamic characteristics</b> |                                  |                                                                                                                          |       |            |     |     |      |
| $Q_{G(tot)}$                   | total gate charge                | $I_D = 100\text{ A}; V_{DS} = 800\text{ V}; V_{GS} = -4\text{ V}/18\text{ V}; T_j = 25\text{ °C}$                        |       | -          | 402 | -   | nC   |
| $Q_{GD}$                       | gate-drain charge                |                                                                                                                          |       | -          | 62  | -   | nC   |
| <b>Source-drain diode</b>      |                                  |                                                                                                                          |       |            |     |     |      |
| $Q_r$                          | recovered charge                 | $I_{SD} = 100\text{ A}; V_{GS} = -4\text{ V}; di/dt = 6500\text{ A}/\mu\text{s}; V_R = 600\text{ V}; T_j = 25\text{ °C}$ |       | -          | 950 | -   | nC   |

## 5. Pinning information

Table 2. Pinning information

| Simplified outline                                                                                                                                               | Circuit diagram                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  <p>* Please refer to the package outline description for actual pin order.</p> |  |

## 6. Ordering information

Table 3. Ordering information

| Type number   | Package Name | Orderable part number | Packing method | Small packing quantity | Package version  | Package issue date |
|---------------|--------------|-----------------------|----------------|------------------------|------------------|--------------------|
| WMSC011F12B2S | WeEnPACK-B2  | WMSC011F12B2S6T       | Tray           | 12                     | WeEnPACK-B2PFB-A | 28-Jun-2024        |

## 7. Marking

Table 4. Marking codes

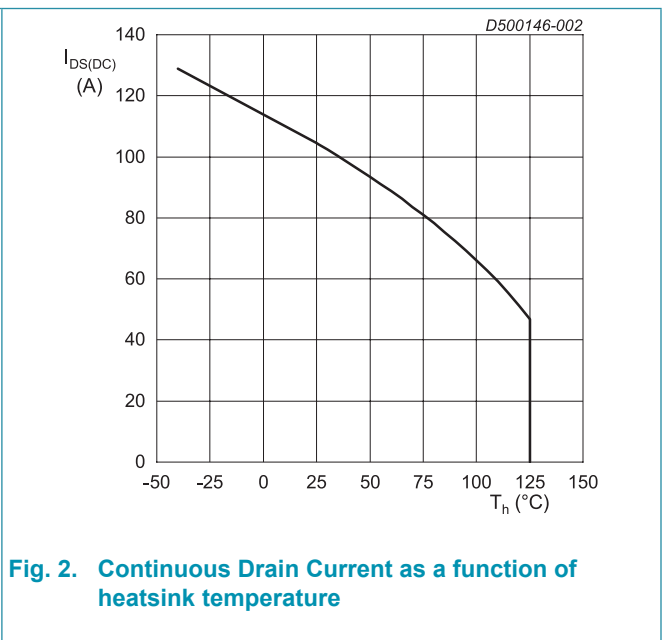
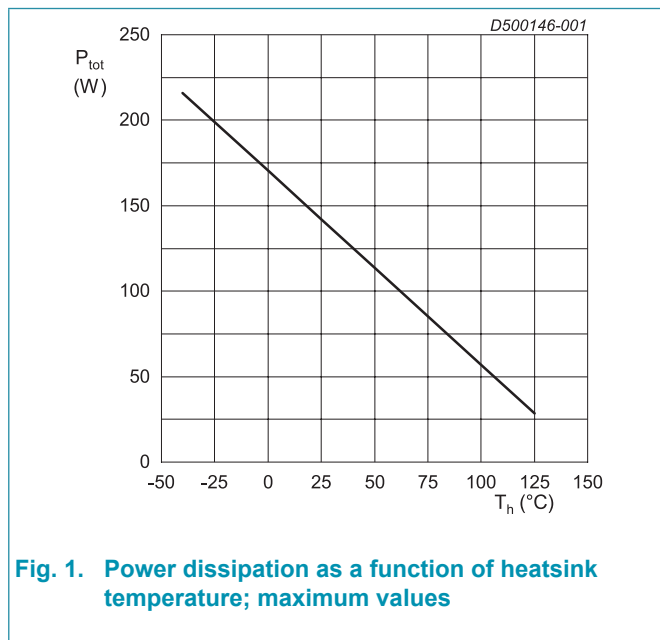
| Type number   | Marking codes |
|---------------|---------------|
| WMSC011F12B2S | WMSC011F12B2S |

## 8. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol            | Parameter                              | Conditions                                                                                                          | Notes  | Values     | Unit |
|-------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------|------------|------|
| $T_{stg}$         | storage temperature                    |                                                                                                                     |        | -40 to 125 | °C   |
| $T_{j,op}$        | operating junction temperature         |                                                                                                                     |        | -40 to 150 | °C   |
| $T_{j,max}$       | maximum junction temperature           | Intermittent condition with shortened lifetime                                                                      |        | -40 to 175 | °C   |
| $V_{ISOL}$        | RMS isolation voltage                  | $T_j = 25\text{ °C}$ ; all terminals shorted;<br>$f = 50\text{ Hz}$ ; $t = 1\text{ s}$                              |        | 3500       | V    |
| <b>MOSFET</b>     |                                        |                                                                                                                     |        |            |      |
| $V_{DS}$          | drain-source voltage                   | $T_j = 25\text{ °C}$                                                                                                |        | 1200       | V    |
| $V_{GS,max}$      | gate-source voltage                    | Absolute maximum values                                                                                             |        | -12 to 24  | V    |
| $V_{GS,op}$       | gate-source voltage                    | Recommended operational values                                                                                      |        | -4 to 18   | V    |
| $P_{tot}$         | total power dissipation                | $T_h = 25\text{ °C}$                                                                                                |        | 142        | W    |
| $I_D$             | drain current                          | $V_{GS} = 18\text{ V}$ ; $T_h = 25\text{ °C}$                                                                       |        | 104        | A    |
|                   |                                        | $V_{GS} = 18\text{ V}$ ; $T_h = 100\text{ °C}$                                                                      |        | 66         | A    |
| $I_{DM}$          | peak drain current                     | pulse width $t_p$ limited by $T_{j,max}$                                                                            | Fig.17 | 208        | A    |
| $E_{as}$          | single pulse drain-to-source avalanche | $I_{AS} = 30\text{ A}$ ; $L = 1\text{ mH}$ ; $V_{DD} = 100\text{ V}$ ;<br>$T_{j(init)} = 25\text{ °C}$ ; per MOSFET |        | 450        | mJ   |
| <b>Body Diode</b> |                                        |                                                                                                                     |        |            |      |
| $I_{SD}$          | DC body diode forward current          | $V_{GS} = -4\text{ V}$ ; $T_h = 25\text{ °C}$                                                                       |        | 36         | A    |
| $I_{SD,pulse}$    | Pulse body diode current               | verified by design, $t_p$ limited by $T_{j,max}$                                                                    |        | 208        | A    |



### 9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol                    | Parameter                                    | Conditions                                                                                                 | Notes | Min                            | Typ  | Max | Unit |
|---------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------|-------|--------------------------------|------|-----|------|
| $R_{th(j-c)}$             | thermal resistance from junction to case     | per MOSFET                                                                                                 |       | -                              | 0.26 | -   | K/W  |
| $R_{th(j-h)}$             | thermal resistance from junction to heatsink | per MOSFET, $\lambda_{grease} = 1 \text{ W/(m}\cdot\text{K)}$<br>$thick_{grease} = 50 \text{ }\mu\text{m}$ |       | -                              | 0.88 | -   | K/W  |
| <b>Internal Isolation</b> |                                              | basic insulation (class 1, IEC 61140)                                                                      |       | Al <sub>2</sub> O <sub>3</sub> |      |     |      |
| $d_{Creep}$               | Creepage distance                            | terminal to heatsink                                                                                       |       | -                              | 11.5 | -   | mm   |
|                           |                                              | terminal to terminal                                                                                       |       | -                              | 6.3  | -   | mm   |
| $d_{Clear}$               | Clearance                                    | terminal to heatsink                                                                                       |       | -                              | 10   | -   | mm   |
|                           |                                              | terminal to terminal                                                                                       |       | -                              | 5    | -   | mm   |
| CTI                       | Comperative tracking index                   |                                                                                                            |       | >200                           |      |     |      |
| F                         | Mounting force per clamp                     |                                                                                                            |       | 40                             | -    | 80  | N    |
| G                         | Approximate Weight                           |                                                                                                            |       | -                              | 36   | -   | g    |

Note: Module is ESD sensitive. Handling precautions are recommended.

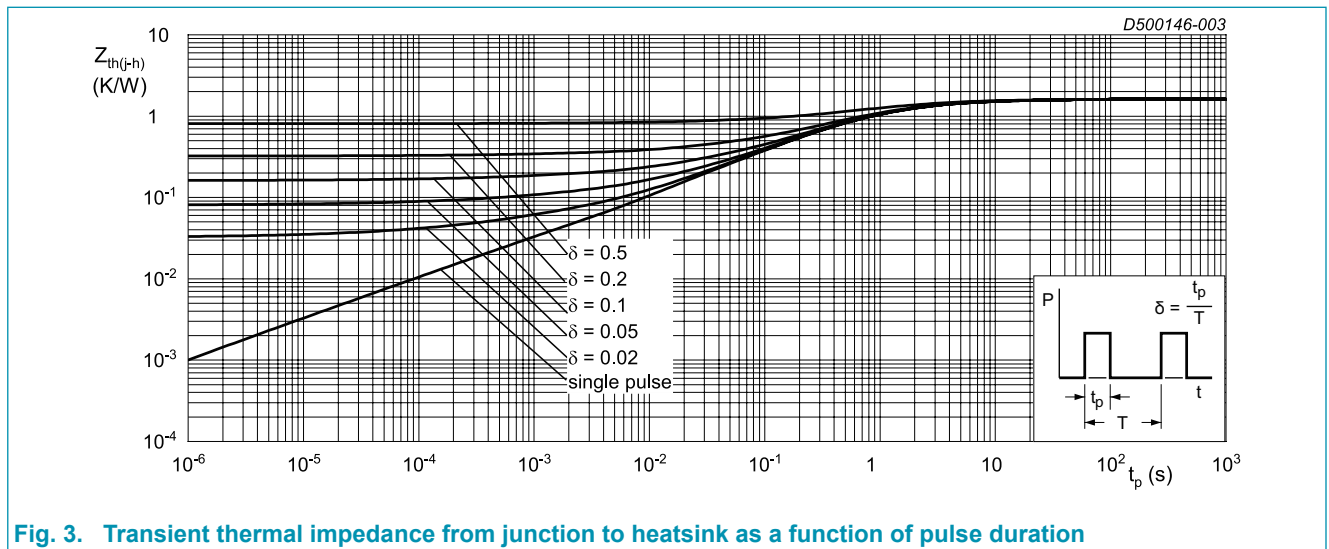


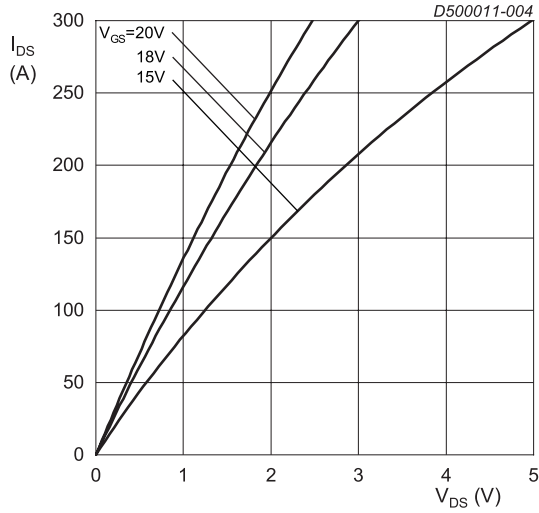
Fig. 3. Transient thermal impedance from junction to heatsink as a function of pulse duration

## 10. Characteristics

Table 7. Characteristics

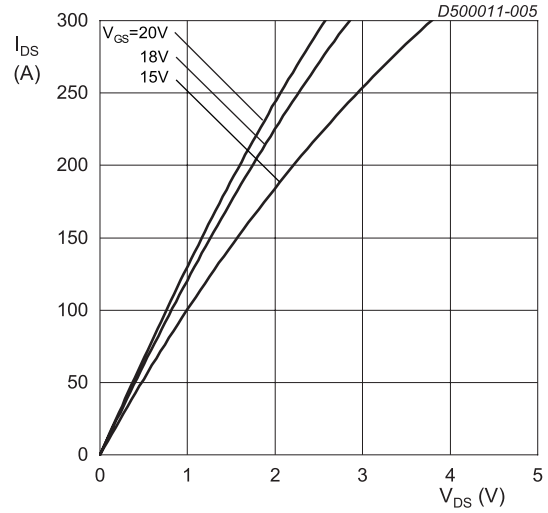
| MOSFET                         |                                       |                                                                                                               |                                                                                                                                                       |      |      |     |            |    |
|--------------------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----|------------|----|
| Symbol                         | Parameter                             | Conditions                                                                                                    | Notes                                                                                                                                                 | Min  | Typ  | Max | Unit       |    |
| <b>Static characteristics</b>  |                                       |                                                                                                               |                                                                                                                                                       |      |      |     |            |    |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage        | $I_D = 200 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$                                              |                                                                                                                                                       | 1200 | -    | -   | V          |    |
| $V_{GS(th)}$                   | gate-source threshold voltage         | $I_D = 40 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$                                       |                                                                                                                                                       | 1.9  | 2.5  | 3.5 | V          |    |
|                                |                                       | $I_D = 40 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 175 \text{ }^\circ C$                                      |                                                                                                                                                       | -    | 1.9  | -   | V          |    |
| $I_{DSS}$                      | drain leakage current                 | $V_{DS} = 1200 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$                                              |                                                                                                                                                       | -    | 0.4  | 200 | $\mu A$    |    |
| $I_{GSS}$                      | gate leakage current (absolute value) | $V_{GS} = 24 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$                                                |                                                                                                                                                       | -    | 20   | 200 | nA         |    |
|                                |                                       | $V_{GS} = -12 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$                                               |                                                                                                                                                       | -    | 20   | 200 | nA         |    |
| $R_{DS(on)}$                   | drain-source on-state resistance      | $V_{GS} = 15 V$ ; $I_D = 100 A$ ; $T_j = 25 \text{ }^\circ C$                                                 |                                                                                                                                                       | -    | 11   | -   | m $\Omega$ |    |
|                                |                                       | $V_{GS} = 18 V$ ; $I_D = 100 A$ ; $T_j = 25 \text{ }^\circ C$                                                 |                                                                                                                                                       | -    | 8.3  | 14  | m $\Omega$ |    |
|                                |                                       | $V_{GS} = 18 V$ ; $I_D = 100 A$ ; $T_j = 125 \text{ }^\circ C$                                                |                                                                                                                                                       | -    | 11.7 | -   | m $\Omega$ |    |
|                                |                                       | $V_{GS} = 18 V$ ; $I_D = 100 A$ ; $T_j = 150 \text{ }^\circ C$                                                |                                                                                                                                                       | -    | 13.2 | -   | m $\Omega$ |    |
|                                |                                       | $V_{GS} = 18 V$ ; $I_D = 100 A$ ; $T_j = 175 \text{ }^\circ C$                                                |                                                                                                                                                       | -    | 13.9 | -   | m $\Omega$ |    |
| $R_G$                          | gate resistance, each side            | $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ C$ , each die with $4.7 \text{ } \Omega$ $R_{G,ext}$ in series |                                                                                                                                                       | -    | 2.85 | -   | $\Omega$   |    |
| $g_{fs}$                       | transconductance                      | $V_{DS} = 20 V$ ; $I_D = 100 A$ ; $T_j = 25 \text{ }^\circ C$                                                 |                                                                                                                                                       | -    | 56   | -   | S          |    |
| <b>Dynamic characteristics</b> |                                       |                                                                                                               |                                                                                                                                                       |      |      |     |            |    |
| $Q_{G(tot)}$                   | total gate charge                     | $I_D = 100 A$ ; $V_{DS} = 800 V$ ; $V_{GS} = -4 V/18 V$ ; $T_j = 25 \text{ }^\circ C$                         |                                                                                                                                                       | -    | 402  | -   | nC         |    |
| $Q_{GS}$                       | gate-source charge                    |                                                                                                               |                                                                                                                                                       | -    | 170  | -   | nC         |    |
| $Q_{GD}$                       | gate-drain charge                     |                                                                                                               |                                                                                                                                                       | -    | 62   | -   | nC         |    |
| $C_{iss}$                      | input capacitance                     | $V_{DS} = 1000 V$ ; $V_{GS} = 0 V$ ; $f = 100 \text{ KHz}$ ; $T_j = 25 \text{ }^\circ C$                      |                                                                                                                                                       | -    | 9    | -   | nF         |    |
| $C_{oss}$                      | output capacitance                    |                                                                                                               |                                                                                                                                                       | -    | 405  | -   | pF         |    |
| $C_{rss}$                      | reverse transfer capacitance          |                                                                                                               |                                                                                                                                                       | -    | 26   | -   | pF         |    |
| $E_{oss}$                      | Coss stored energy                    |                                                                                                               |                                                                                                                                                       | -    | 203  | -   | $\mu J$    |    |
| $t_{d(on)}$                    | turn-on delay time                    |                                                                                                               | $V_{DS} = 800 V$ ; $V_{GS} = -4 V/18 V$ ; $R_{G(ext)} = 1.0 \text{ } \Omega$ ; $I_D = 100 A$ ; $L = 130 \text{ } \mu H$ ; $T_j = 25 \text{ }^\circ C$ |      | -    | 29  | -          | ns |
| $t_r$                          | rise time                             |                                                                                                               |                                                                                                                                                       |      | -    | 13  | -          | ns |
| $t_{d(off)}$                   | turn-off delay time                   |                                                                                                               |                                                                                                                                                       |      | -    | 84  | -          | ns |
| $t_f$                          | fall time                             |                                                                                                               |                                                                                                                                                       | -    | 40   | -   | ns         |    |
| $E_{on}$                       | turn-on energy                        |                                                                                                               |                                                                                                                                                       | -    | 2.3  | -   | mJ         |    |
| $E_{off}$                      | turn-off energy                       |                                                                                                               |                                                                                                                                                       | -    | 0.82 | -   | mJ         |    |

| Body diode                     |                               |                                                                                                                        |       |     |        |     |      |
|--------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------|-------|-----|--------|-----|------|
| Symbol                         | Parameter                     | Conditions                                                                                                             | Notes | Min | Typ    | Max | Unit |
| <b>Static characteristics</b>  |                               |                                                                                                                        |       |     |        |     |      |
| V <sub>SD</sub>                | source-drain voltage          | V <sub>GS</sub> = -4 V; I <sub>SD</sub> = 100 A; T <sub>j</sub> = 25 °C                                                |       | -   | 5.5    | -   | V    |
|                                |                               | V <sub>GS</sub> = -4 V; I <sub>SD</sub> = 100 A; T <sub>j</sub> = 150 °C                                               |       | -   | 5.0    | -   | V    |
| <b>Dynamic characteristics</b> |                               |                                                                                                                        |       |     |        |     |      |
| t <sub>rr</sub>                | reverse recovery time         | I <sub>SD</sub> = 100 A; V <sub>GS</sub> = -4 V; di/dt = 6500 A/μs;<br>V <sub>R</sub> = 600 V; T <sub>j</sub> = 25 °C  |       | -   | 23     | -   | ns   |
| Q <sub>r</sub>                 | recovered charge              |                                                                                                                        |       | -   | 950    | -   | nC   |
| I <sub>rrm</sub>               | reverse recovery current      |                                                                                                                        |       | -   | 72     | -   | A    |
| E <sub>rec</sub>               | reverse recovery energy       |                                                                                                                        |       | -   | 370    | -   | μJ   |
| t <sub>rr</sub>                | reverse recovery time         | I <sub>SD</sub> = 100 A; V <sub>GS</sub> = -4 V; di/dt = 8000 A/μs;<br>V <sub>R</sub> = 600 V; T <sub>j</sub> = 150 °C |       | -   | 30     | -   | ns   |
| Q <sub>r</sub>                 | recovered charge              |                                                                                                                        |       | -   | 2436   | -   | nC   |
| I <sub>rrm</sub>               | reverse recovery current      |                                                                                                                        |       | -   | 125    | -   | A    |
| E <sub>rec</sub>               | reverse recovery energy       |                                                                                                                        |       | -   | 1210   | -   | μJ   |
| <b>NTC thermistor</b>          |                               |                                                                                                                        |       |     |        |     |      |
| Symbol                         | Parameter                     | Conditions                                                                                                             | Notes | Min | Typ    | Max | Unit |
| R <sub>25</sub>                | Rated resistance              | T <sub>NTC</sub> = 25 °C                                                                                               |       | -   | 5000   | -   | Ω    |
| R <sub>100</sub>               |                               | T <sub>NTC</sub> = 100 °C                                                                                              |       |     | 465±5% |     | Ω    |
| B <sub>25/50</sub>             | B-value                       | B <sub>2</sub> = R <sub>25</sub> exp[B <sub>25/50</sub> (1/T <sub>2</sub> - 1/(298.15K))]                              |       |     | 3380   |     | K    |
|                                | Maximum operating temperature |                                                                                                                        |       | -   | 200    | -   | °C   |
|                                | Dissipation constant          |                                                                                                                        |       | -   | 2      | -   | mW/K |
|                                | Thermal time constant         |                                                                                                                        |       | -   | ≤10    | -   | s    |



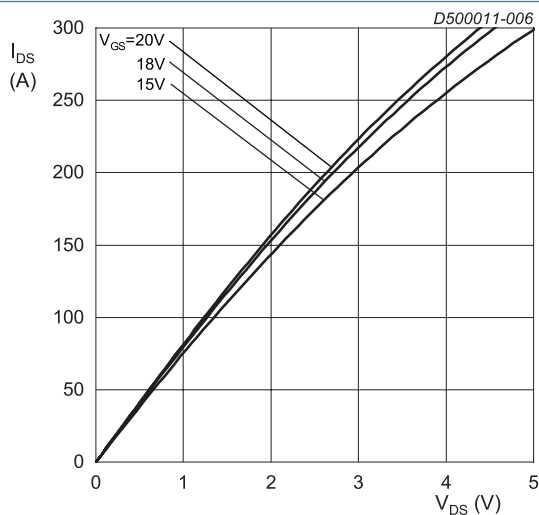
$T_j = -40\text{ °C}; t_p < 200\ \mu\text{s}$

**Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values**



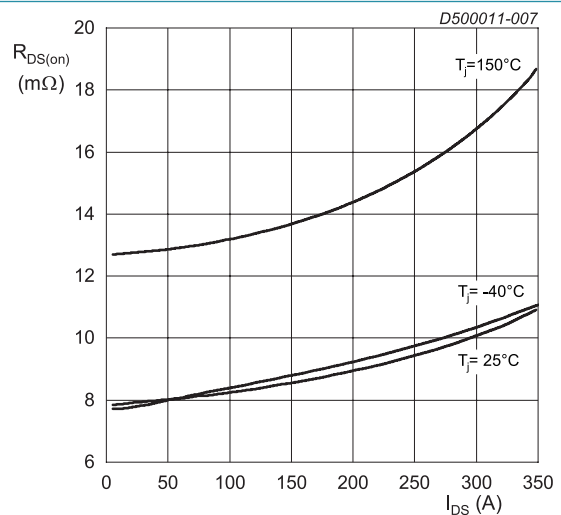
$T_j = 25\text{ °C}; t_p < 200\ \mu\text{s}$

**Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values**



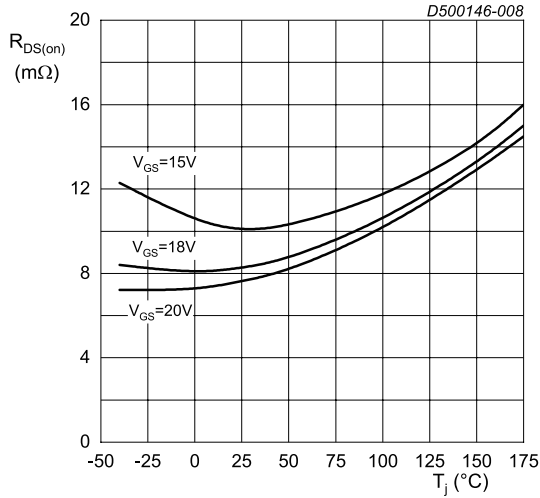
$T_j = 150\text{ °C}; t_p < 200\ \mu\text{s}$

**Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values**

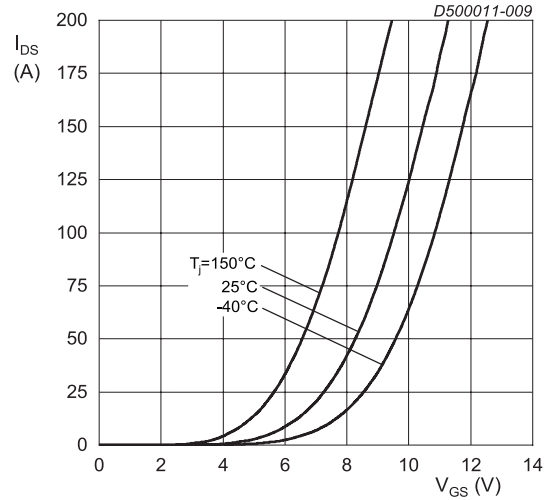


$V_{GS} = 18\text{ V}; t_p < 200\ \mu\text{s}$

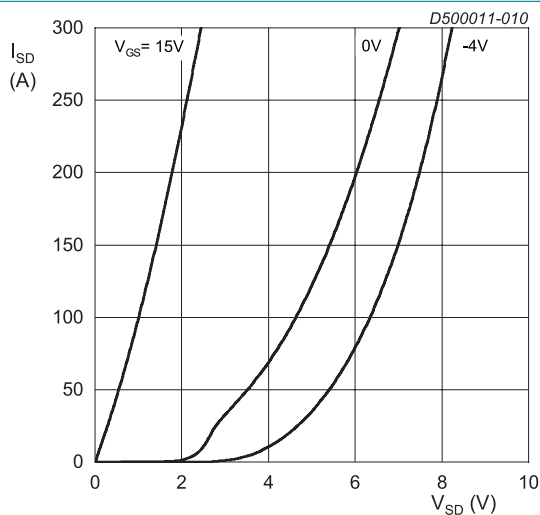
**Fig. 7. Drain-source on-state resistance as a function of drain current; typical values**



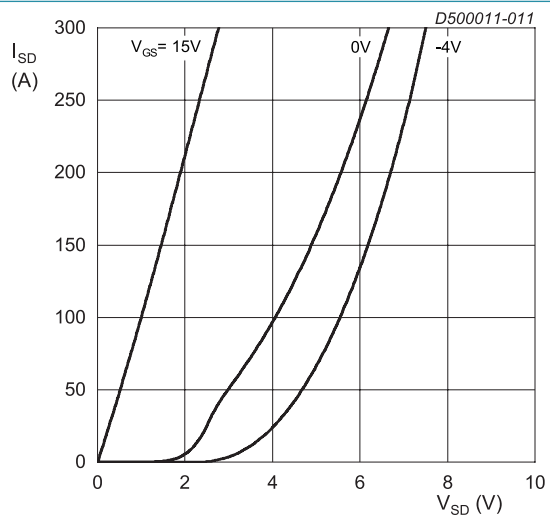
$I_{DS} = 100 A; t_p < 200 \mu s$   
**Fig. 8. Drain-source on-state resistance as a function of junction temperature**



$V_{DS} = 20 V; t_p < 200 \mu s$   
**Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values**

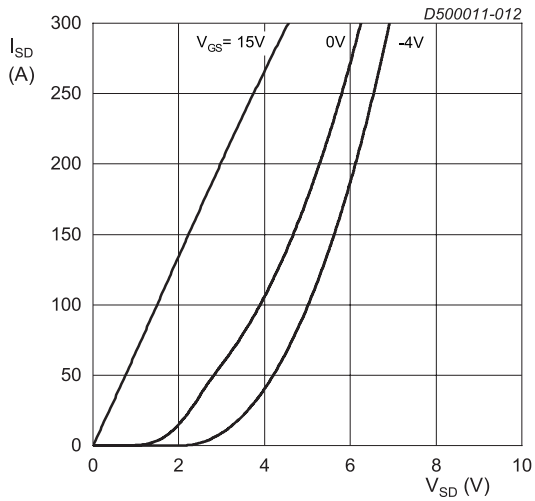


$T_j = -40^{\circ}C; t_p < 200 \mu s$   
**Fig. 10. Body diode forward characteristics; typical values**



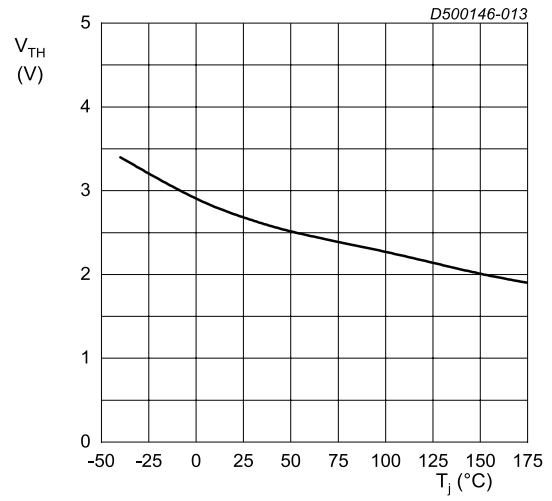
$T_j = 25^{\circ}C; t_p < 200 \mu s$   
**Fig. 11. Body diode forward characteristics; typical values**





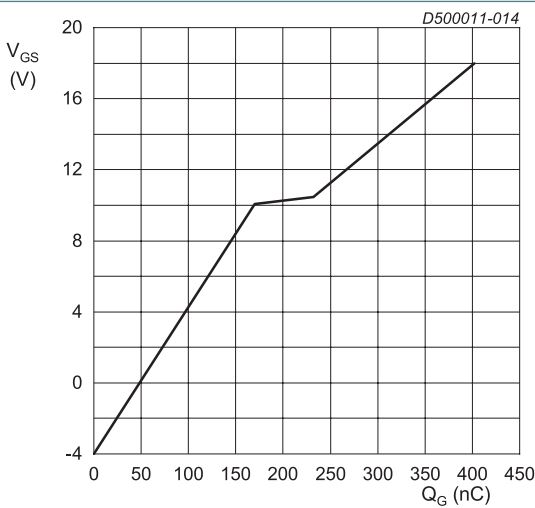
$T_j = 150\text{ }^\circ\text{C}; t_p < 200\text{ }\mu\text{s}$

**Fig. 12. Body diode forward characteristics; typical values**



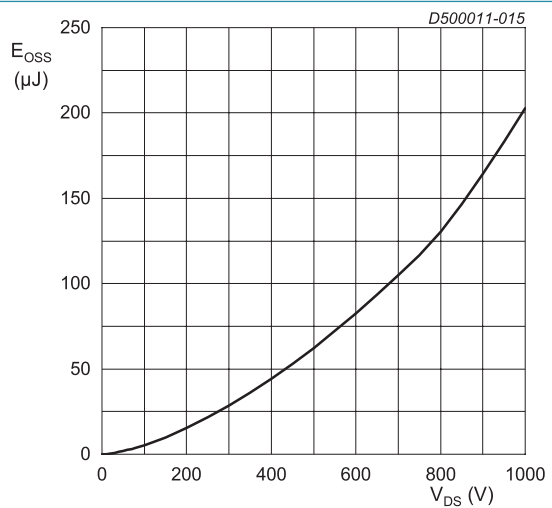
$V_{DS} = V_{GS}; I_{DS} = 40\text{ mA}$

**Fig. 13. Threshold voltage as a function of junction temperature**

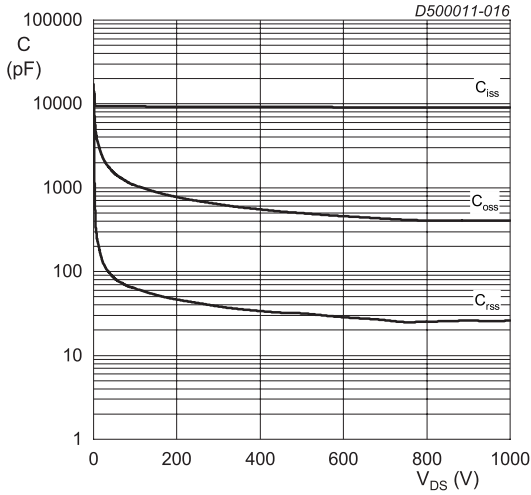


$I_{DS} = 100\text{ A}; I_{GS} = 1\text{ mA}; V_{DS} = 800\text{ V}; T_j = 25\text{ }^\circ\text{C}$

**Fig. 14. Gate-source voltage as a function of gate charge; typical values**

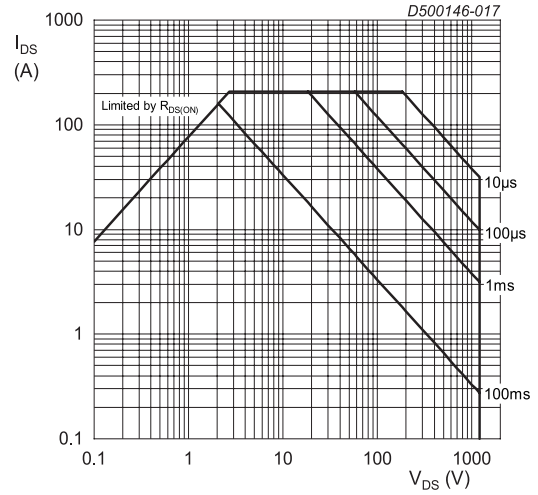


**Fig. 15. Output capacitor stored energy as a function of drain-source voltage**



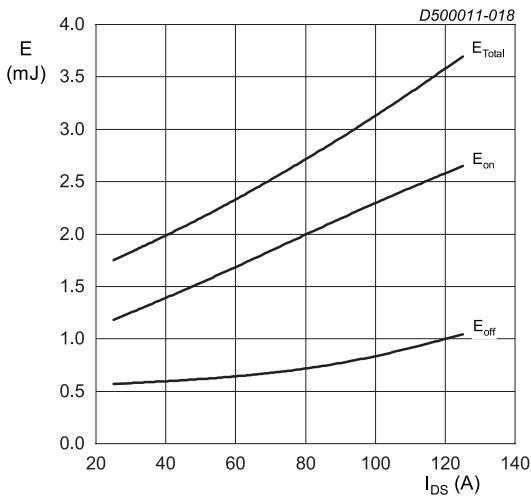
$V_{DS} = 0 - 1000 \text{ V}$   
 $T_j = 25 \text{ }^\circ\text{C}; V_{AC} = 25 \text{ mV}; f = 100 \text{ KHz}$

**Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



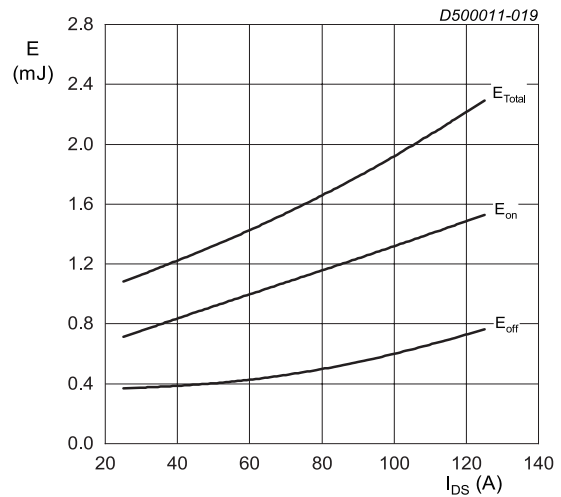
$T_j = 25 \text{ }^\circ\text{C}; D = 0$   
 Parameter:  $t_p$

**Fig. 17. Forward bias safe operating area**



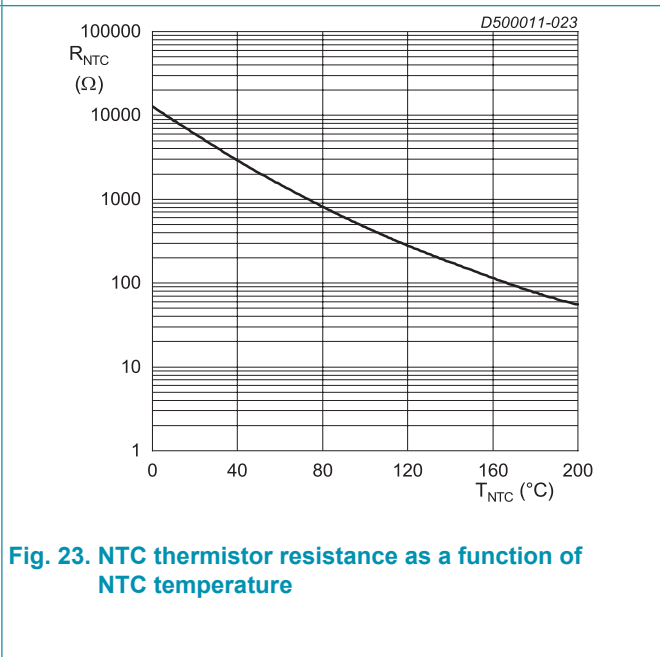
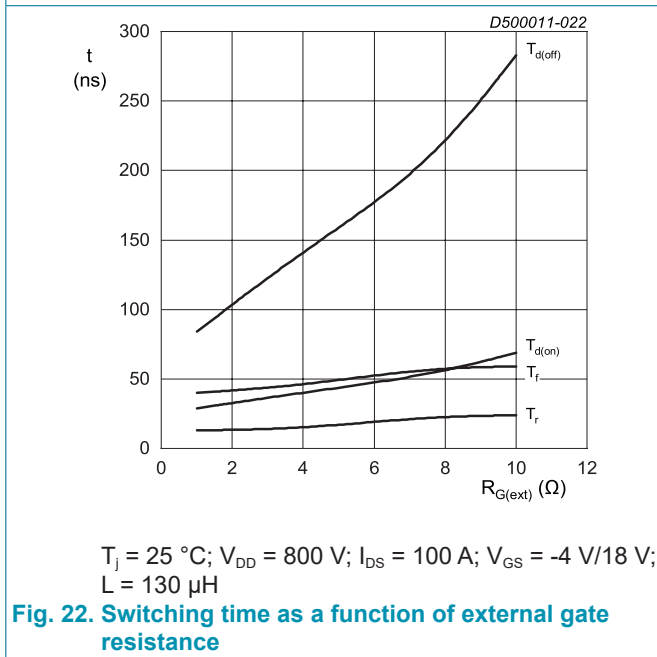
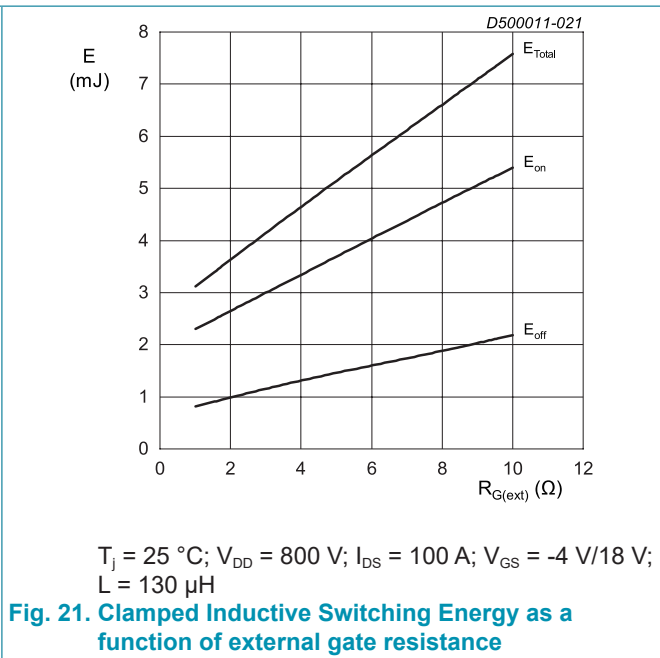
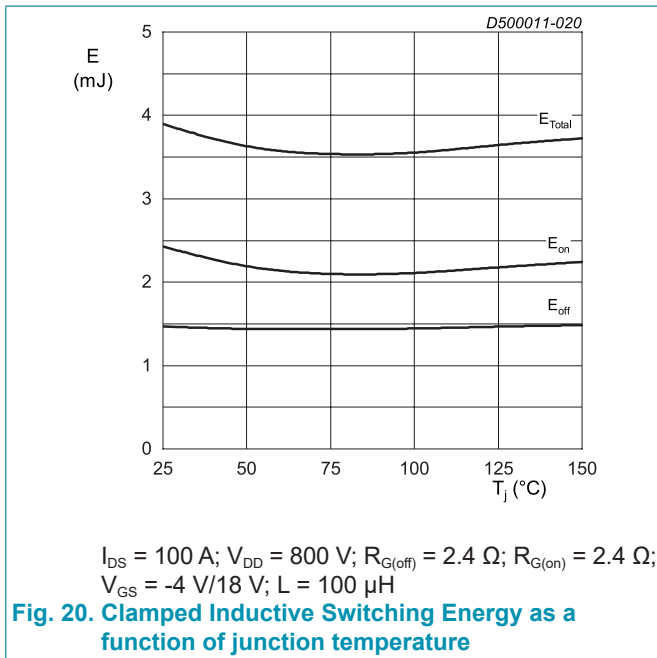
$T_j = 25 \text{ }^\circ\text{C}; V_{DD} = 800 \text{ V}; R_{G(ext)} = 1.0 \text{ } \Omega; R_{G(on)} = 1.0 \text{ } \Omega;$   
 $V_{GS} = -4 \text{ V}/18 \text{ V}; L = 130 \text{ } \mu\text{H}$

**Fig. 18. Clamped Inductive Switching Energy as a function of drain current**



$T_j = 25 \text{ }^\circ\text{C}; V_{DD} = 600 \text{ V}; R_{G(off)} = 1.0 \text{ } \Omega; R_{G(on)} = 1.0 \text{ } \Omega;$   
 $V_{GS} = -4 \text{ V}/18 \text{ V}; L = 130 \text{ } \mu\text{H}$

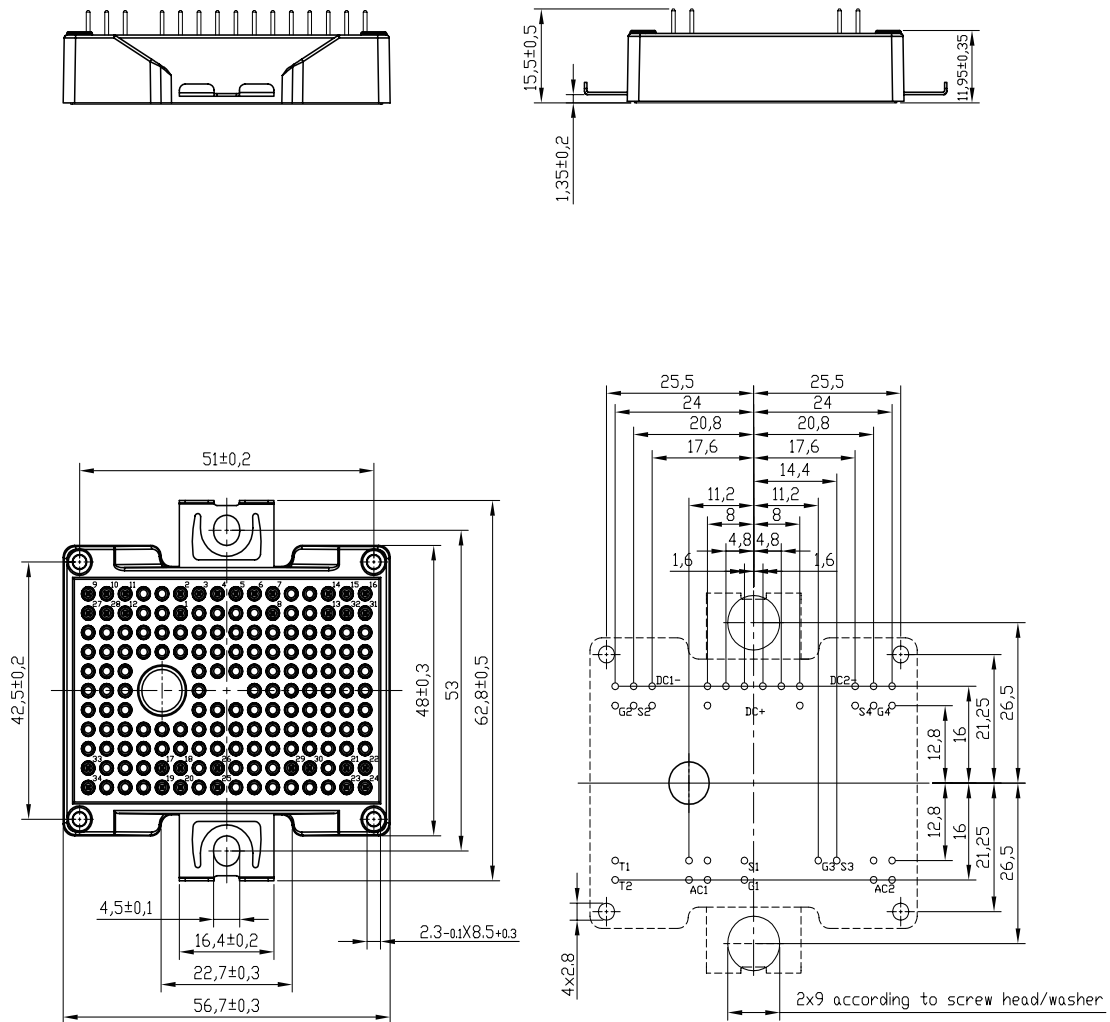
**Fig. 19. Clamped Inductive Switching Energy as a function of drain current**



### 11. Package outline

Package Outline

Dimensions in mm



## 12. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | Definition                                                                            |
|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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