

## 1. General description

WeEnPACK-B1 module with WeEn 1200V Gen2 SiC MOSFET and Pressfit type. Integrated with NTC temperature sensor.



## 2. Features and benefits

- H Bridge topology
- Press-fit 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

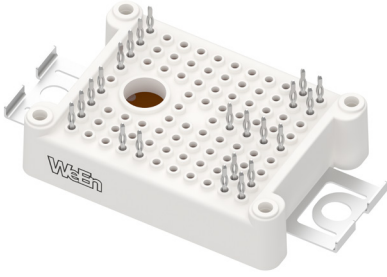
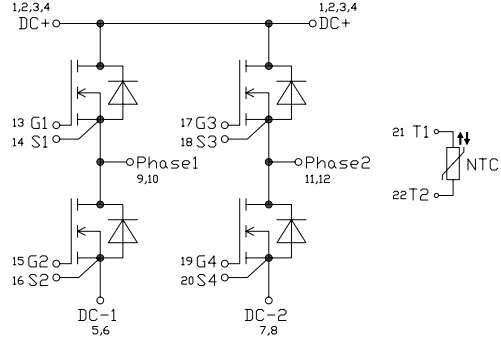
## 4. Quick reference data

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	$V_{GS} = 18\text{ V}; T_h = 25\text{ °C}$			38		A
$P_{tot}$	total power dissipation	$T_h = 25\text{ °C}$			74		W
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15\text{ V}; I_D = 33\text{ A}; T_j = 25\text{ °C}$		-	40	-	mΩ
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$I_D = 33\text{ A}; V_{DS} = 800\text{ V}; V_{GS} = -4\text{ V}/18\text{ V}; T_j = 25\text{ °C}$		-	115	-	nC
$Q_{GD}$	gate-drain charge			-	18	-	nC
<b>Source-drain diode</b>							
$Q_r$	recovered charge	$I_{SD} = 33\text{ A}; V_{GS} = -4\text{ V}/18\text{ V}; V_R = 600\text{ V}; di/dt = 3400\text{ A}/\mu\text{s}; R_{G(ext)} = 5.1\text{ }\Omega; T_j = 25\text{ °C}$		-	465	-	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
WMSC040F12B1P	WeEnPACK-B1	WMSC040F12B1P6T	Tray	16	WeEnPACK-B1PFB-A	28-Jun-2024

## 7. Marking

Table 4. Marking codes

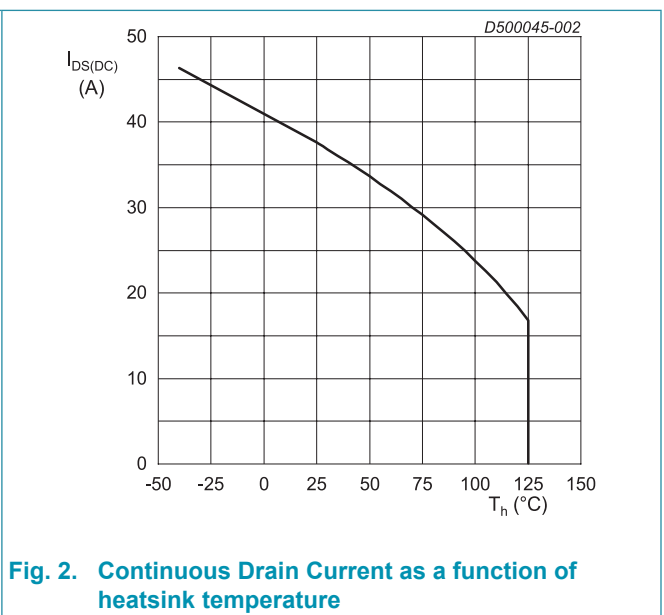
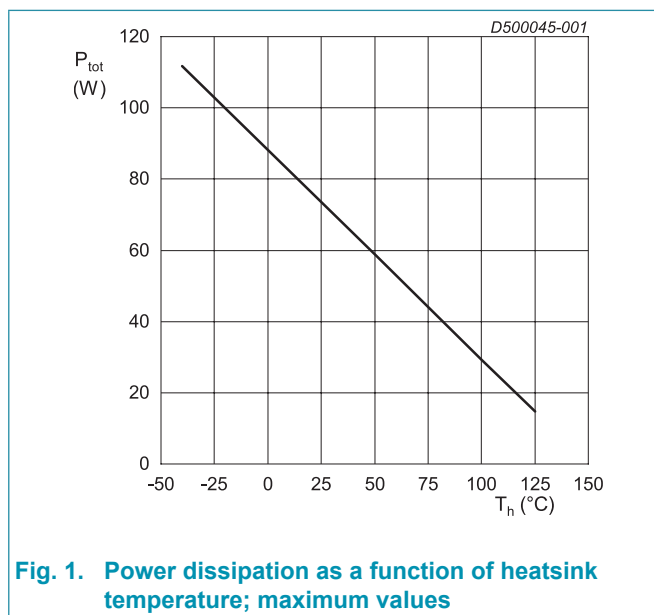
Type number	Marking codes
WMSC040F12B1P	WMSC040F12B1P

## 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; $f = 50\text{ Hz}$ ; $t = 1\text{ s}$		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	$T_h = 25\text{ °C}$		74	W
$I_D$	drain current	$V_{GS} = 18\text{ V}$ ; $T_h = 25\text{ °C}$		38	A
		$V_{GS} = 18\text{ V}$ ; $T_h = 100\text{ °C}$		24	A
$I_{DM}$	peak drain current	pulse width $t_p$ limited by $T_{j,max}$		80	A
$E_{as}$	single pulse drain-to-source avalanche	$I_{AS} = 24\text{ A}$ ; $L = 1\text{ mH}$ ; $V_{DD} = 100\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; per MOSFET		288	mJ
<b>Body Diode</b>					
$I_{SD}$	DC body diode forward current	$T_h = 25\text{ °C}$ ; $V_{GS} = -4\text{ V}$		18	A
$I_{SD,pulse}$	Pulse body diode current	verified by design, $t_p$ limited by $T_{j,max}$		80	A



### 9. Thermal & Mechanical characteristics

Table 6. Thermal & Mechanical characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	per MOSFET		-	0.75	-	K/W
$R_{th(j-h)}$	thermal resistance from junction to heatsink	per MOSFET, $\lambda_{grease} = 3 \text{ W/(m}\cdot\text{K)}$ $thick_{grease} = 50 \text{ }\mu\text{m}$		-	1.7	-	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			20	-	50	N
G	Approximate Weight			-	20	-	g

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

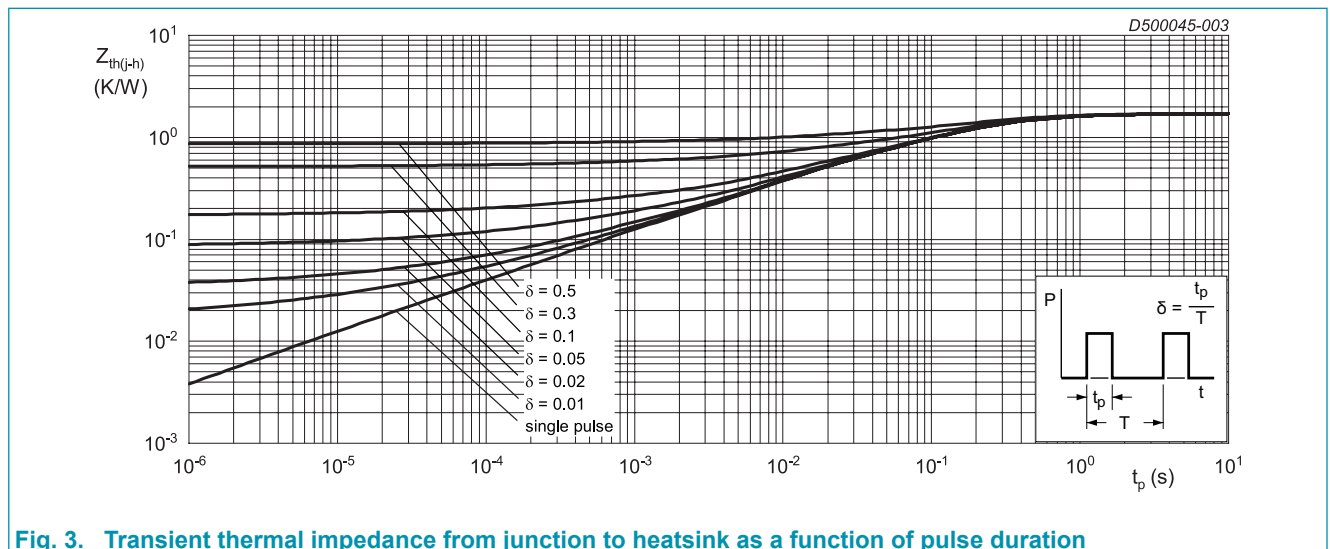


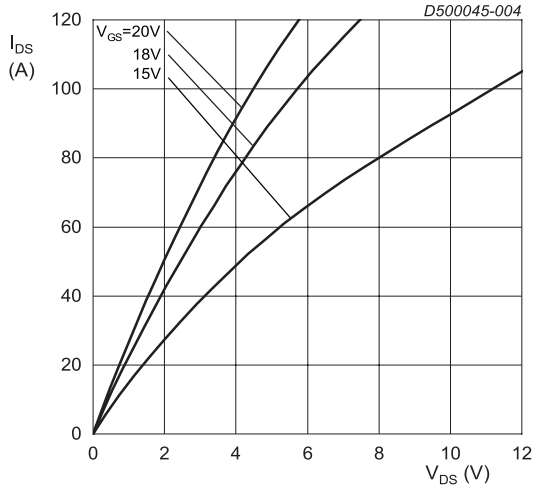
Fig. 3. Transient thermal impedance from junction to heatsink as a function of pulse duration

## 10. Characteristics

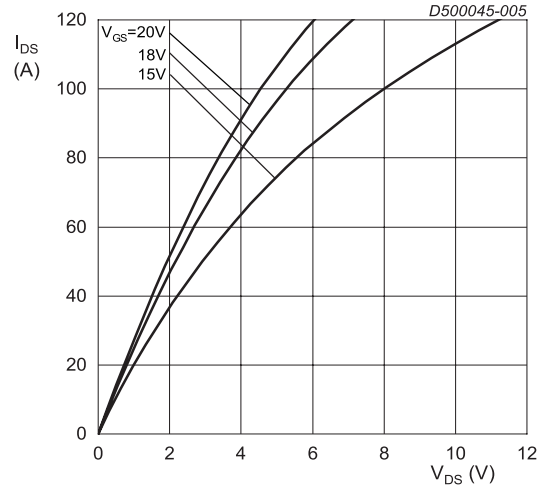
Table 7. Characteristics

MOSFET							
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 100 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$		1200	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 10 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$		1.9	2.6	3.5	V
		$I_D = 10 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C$		-	1.9	-	V
$I_{DSS}$	drain leakage current	$V_{DS} = 1200 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$		-	0.2	100	$\mu A$
$I_{GSS}$	gate leakage current (absolute value)	$V_{GS} = 24 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$		-	10	100	nA
		$V_{GS} = -12 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$		-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15 \text{ V}; I_D = 33 \text{ A}; T_j = 25 \text{ }^\circ C$		-	40	-	m $\Omega$
		$V_{GS} = 18 \text{ V}; I_D = 33 \text{ A}; T_j = 25 \text{ }^\circ C$		-	33	45	m $\Omega$
		$V_{GS} = 18 \text{ V}; I_D = 33 \text{ A}; T_j = 125 \text{ }^\circ C$		-	46	-	m $\Omega$
		$V_{GS} = 18 \text{ V}; I_D = 33 \text{ A}; T_j = 150 \text{ }^\circ C$		-	51	-	m $\Omega$
		$V_{GS} = 18 \text{ V}; I_D = 33 \text{ A}; T_j = 175 \text{ }^\circ C$		-	54	-	m $\Omega$
$R_G$	gate resistance	$f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C; \text{ per MOSFET}$		-	1	-	$\Omega$
$g_{fs}$	transconductance	$V_{DS} = 20 \text{ V}; I_D = 33 \text{ A}; T_j = 25 \text{ }^\circ C$		-	20	-	S
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$I_D = 33 \text{ A}; V_{DS} = 800 \text{ V}; V_{GS} = -4 \text{ V}/18 \text{ V}; T_j = 25 \text{ }^\circ C$		-	115	-	nC
$Q_{GS}$	gate-source charge			-	47	-	nC
$Q_{GD}$	gate-drain charge			-	18	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 1000 \text{ V}; V_{GS} = 0 \text{ V}; f = 100 \text{ KHz}; T_j = 25 \text{ }^\circ C$		-	2.45	-	nF
$C_{oss}$	output capacitance			-	108	-	pF
$C_{riss}$	reverse transfer capacitance			-	11	-	pF
$E_{oss}$	Coss stored energy			-	54	-	$\mu J$
$t_{d(on)}$	turn-on delay time		$V_{DS} = 800 \text{ V}; V_{GS} = -4 \text{ V}/18 \text{ V}; R_{G(ext)} = 5.1 \text{ } \Omega; I_D = 33 \text{ A}; L = 300 \text{ } \mu H; T_j = 25 \text{ }^\circ C$		-	27	-
$t_r$	rise time			-	30	-	ns
$t_{d(off)}$	turn-off delay time			-	42	-	ns
$t_f$	fall time			-	11	-	ns
$E_{on}$	turn-on energy			-	612	-	$\mu J$
$E_{off}$	turn-off energy			-	90	-	$\mu J$

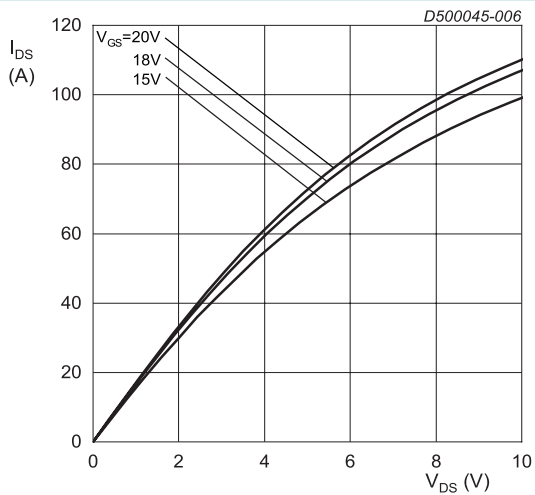
Body diode							
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
V <sub>SD</sub>	source-drain voltage	V <sub>GS</sub> = -4 V; I <sub>SD</sub> = 33 A; T <sub>j</sub> = 25 °C		-	5.5	-	V
		V <sub>GS</sub> = -4 V; I <sub>SD</sub> = 33 A; T <sub>j</sub> = 150 °C		-	5.0	-	V
<b>Dynamic characteristics</b>							
I <sub>rrm</sub>	reverse recovery current	I <sub>SD</sub> = 33 A; V <sub>GS</sub> = -4 V/18 V; V <sub>R</sub> = 600 V; di/dt = 3400 A/μs; R <sub>G(ext)</sub> = 5.1 Ω; T <sub>j</sub> = 25 °C		-	44	-	A
t <sub>rr</sub>	reverse recovery time			-	19	-	ns
Q <sub>r</sub>	recovered charge			-	465	-	nC
E <sub>rec</sub>	reverse recovery energy			-	117	-	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	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15K))]$			3380		K
	Maximum operating temperature			-	200	-	°C
	Dissipation costant			-	2	-	mW/K
	Thermal time constant			-	≤10	-	s



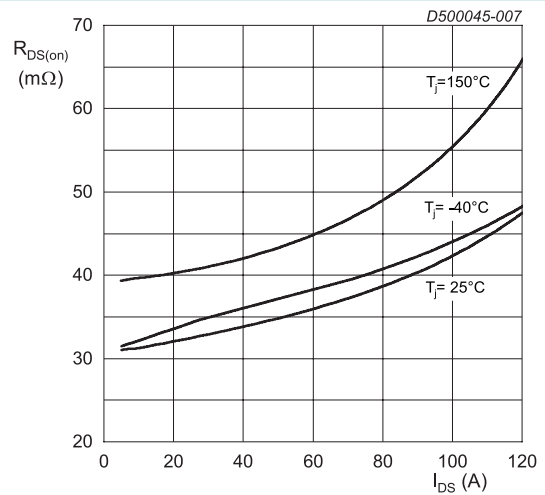
**Fig. 4.** Output characteristics; drain current as a function of drain-source voltage; typical values  
 $T_j = -40\text{ °C}; t_p < 200\ \mu\text{s}$



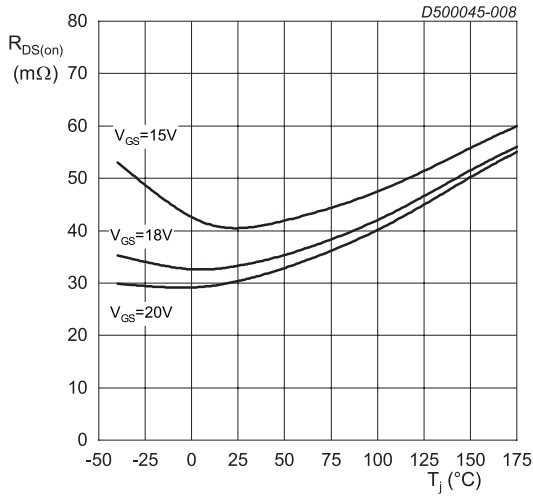
**Fig. 5.** Output characteristics; drain current as a function of drain-source voltage; typical values  
 $T_j = 25\text{ °C}; t_p < 200\ \mu\text{s}$



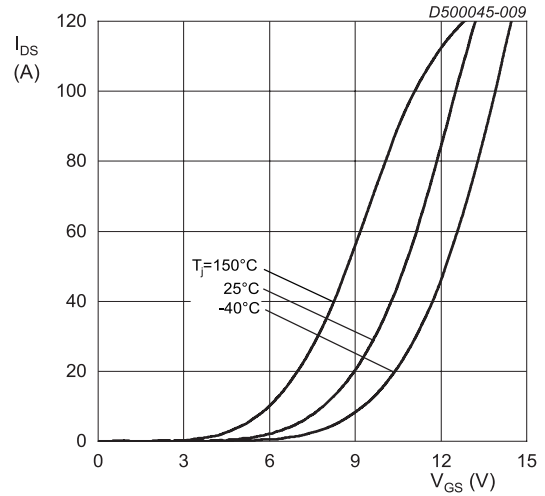
**Fig. 6.** Output characteristics; drain current as a function of drain-source voltage; typical values  
 $T_j = 150\text{ °C}; t_p < 200\ \mu\text{s}$



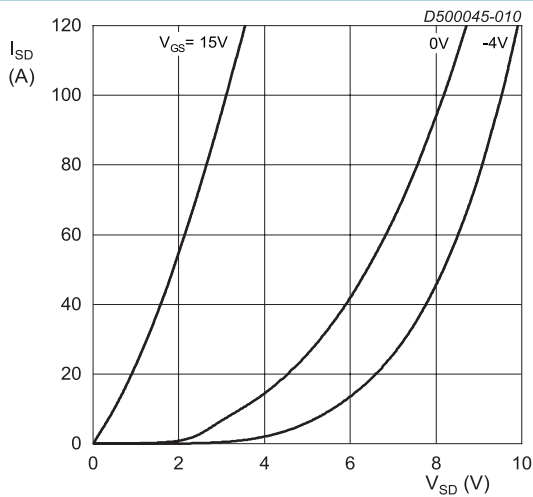
**Fig. 7.** Drain-source on-state resistance as a function of drain current; typical values  
 $V_{GS} = 18\text{ V}; t_p < 200\ \mu\text{s}$



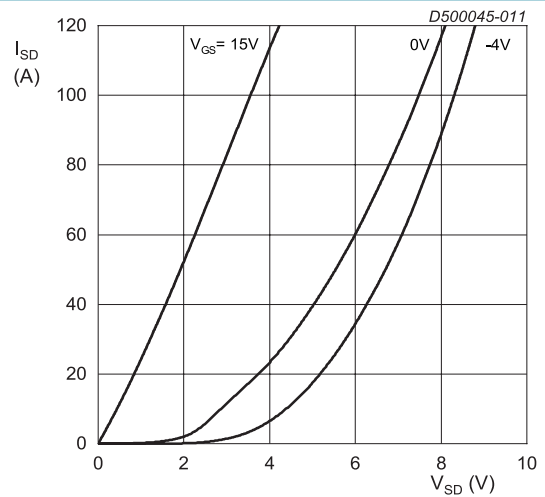
$I_{DS} = 33 A; t_p < 200 \mu s$   
**Fig. 8. Drain-source on-state resistance as a function of junction temperature**



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

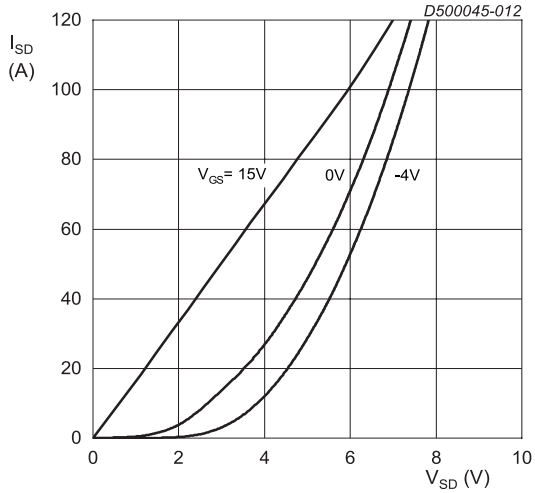


$T_j = -40^{\circ}C; t_p < 200 \mu s$   
**Fig. 10. Body diode forward characteristics; typical values**

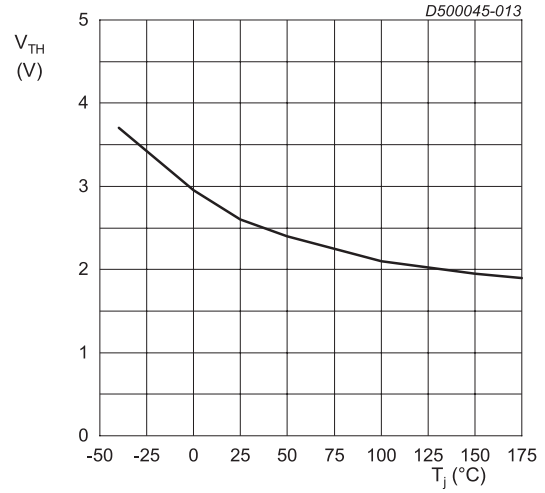


$T_j = 25^{\circ}C; t_p < 200 \mu s$   
**Fig. 11. Body diode forward characteristics; typical values**

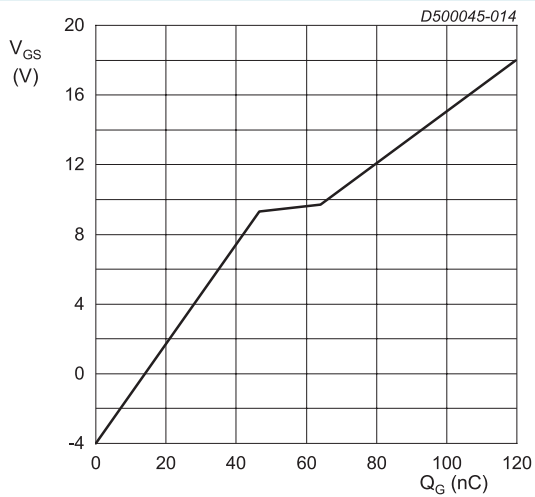




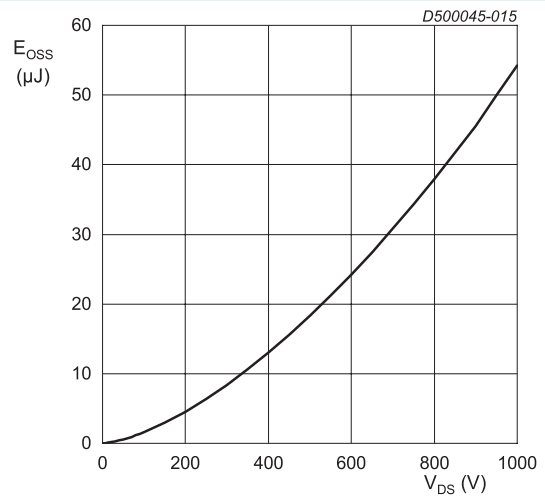
$T_j = 150\text{ }^\circ\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 12. Body diode forward characteristics; typical values**



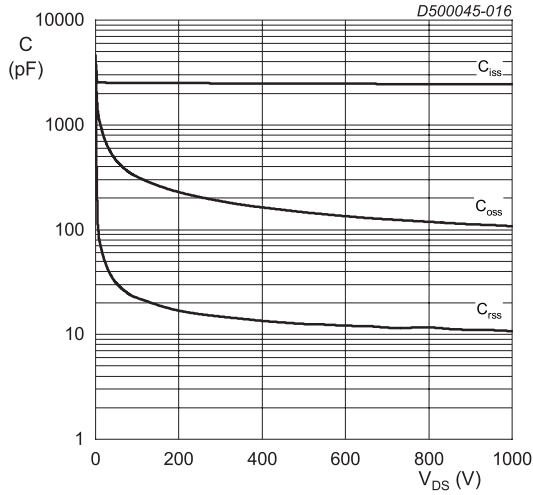
$V_{DS} = 10\text{ V}$ ;  $I_{DS} = 10\text{ mA}$   
**Fig. 13. Threshold voltage as a function of junction temperature**



$I_{DS} = 33\text{ A}$ ;  $I_{GS} = 0.1\text{ mA}$ ;  $V_{DS} = 800\text{ V}$ ;  $T_j = 25\text{ }^\circ\text{C}$   
**Fig. 14. Gate-source voltage as a function of gate charge; typical values**

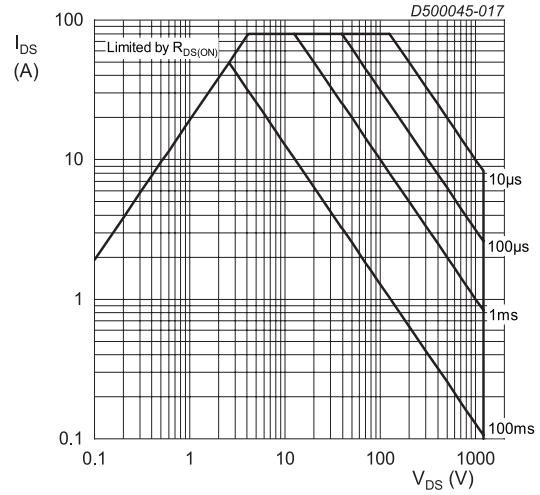


**Fig. 15. Output capacitor stored energy as a function of drain-source voltage**



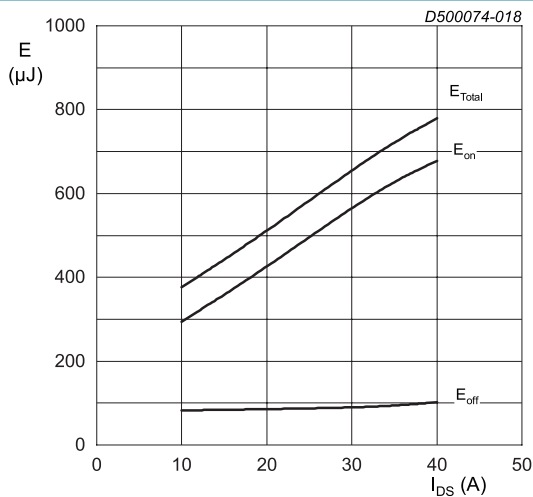
$V_{DS} = 0 - 1000 \text{ V}$   
 $T_j = 25 \text{ }^\circ\text{C}; V_{AC} = 25 \text{ mV}; f = 100 \text{ KHz}$

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



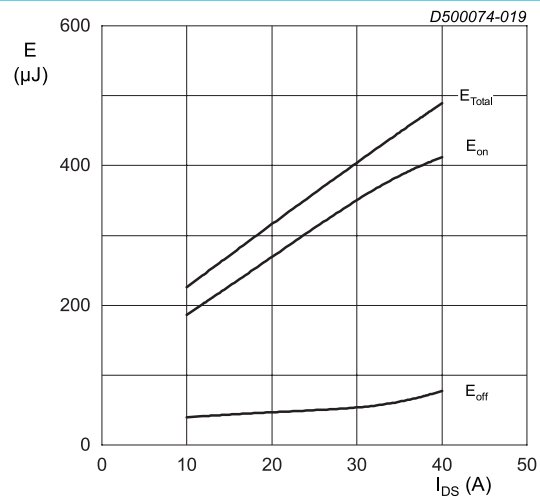
$T_j = 25 \text{ }^\circ\text{C}; D = 0$   
 Parameter:  $t_p$

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



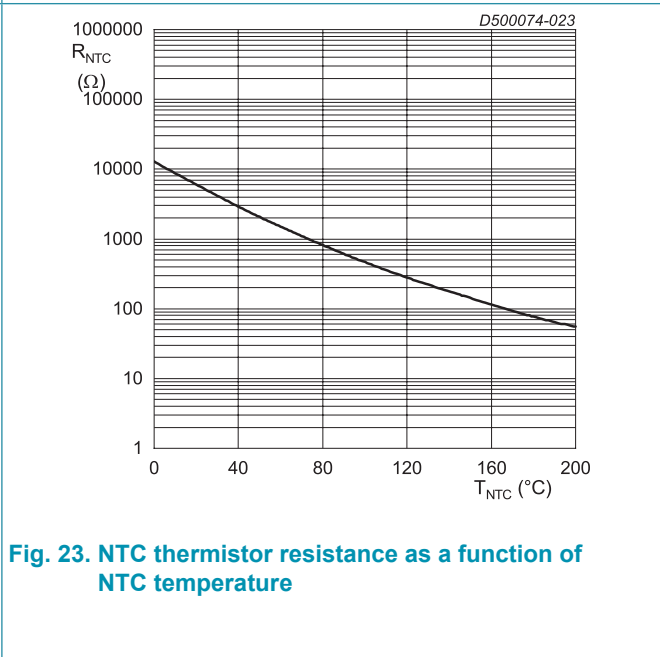
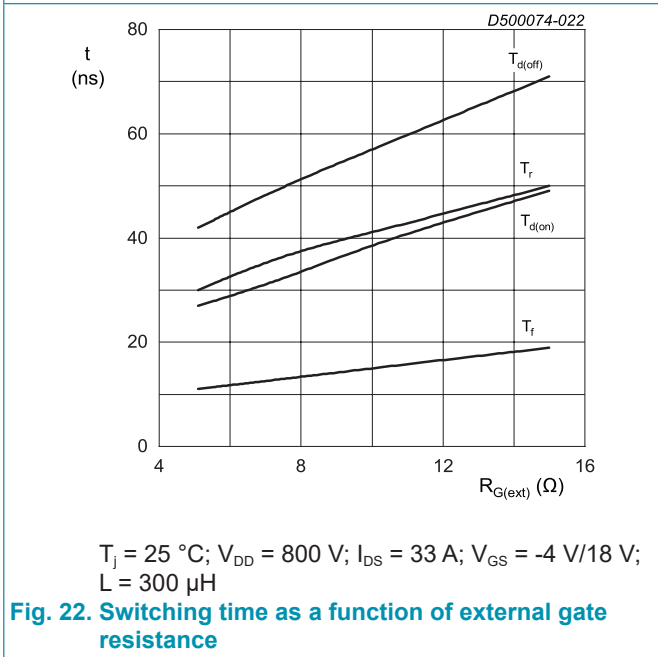
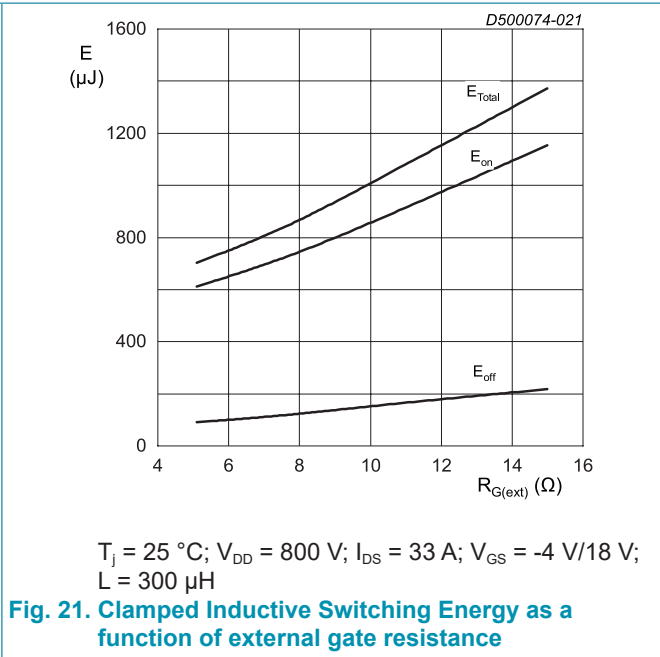
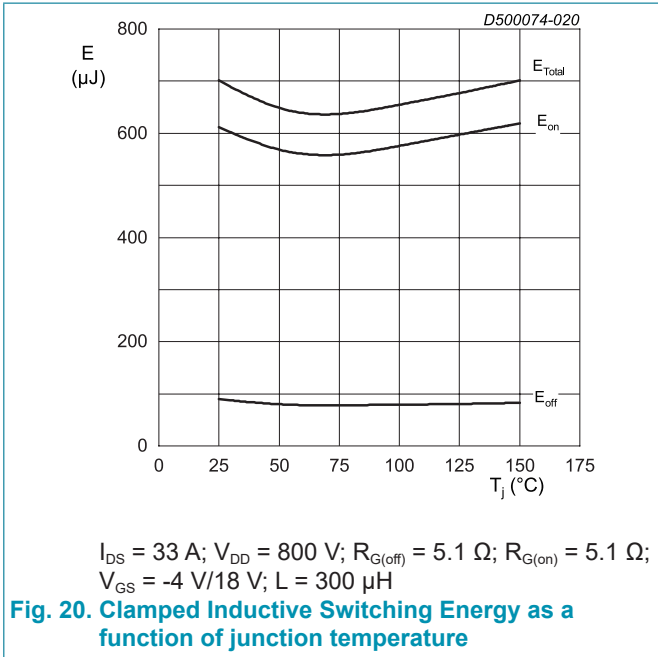
$T_j = 25 \text{ }^\circ\text{C}; V_{DD} = 800 \text{ V}; R_{G(ext)} = 5.1 \text{ } \Omega; R_{G(on)} = 5.1 \text{ } \Omega;$   
 $V_{GS} = -4 \text{ V}/18 \text{ V}; L = 300 \text{ } \mu\text{H}$

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



$T_j = 25 \text{ }^\circ\text{C}; V_{DD} = 600 \text{ V}; R_{G(off)} = 5.1 \text{ } \Omega; R_{G(on)} = 5.1 \text{ } \Omega;$   
 $V_{GS} = -4 \text{ V}/18 \text{ V}; L = 300 \text{ } \mu\text{H}$

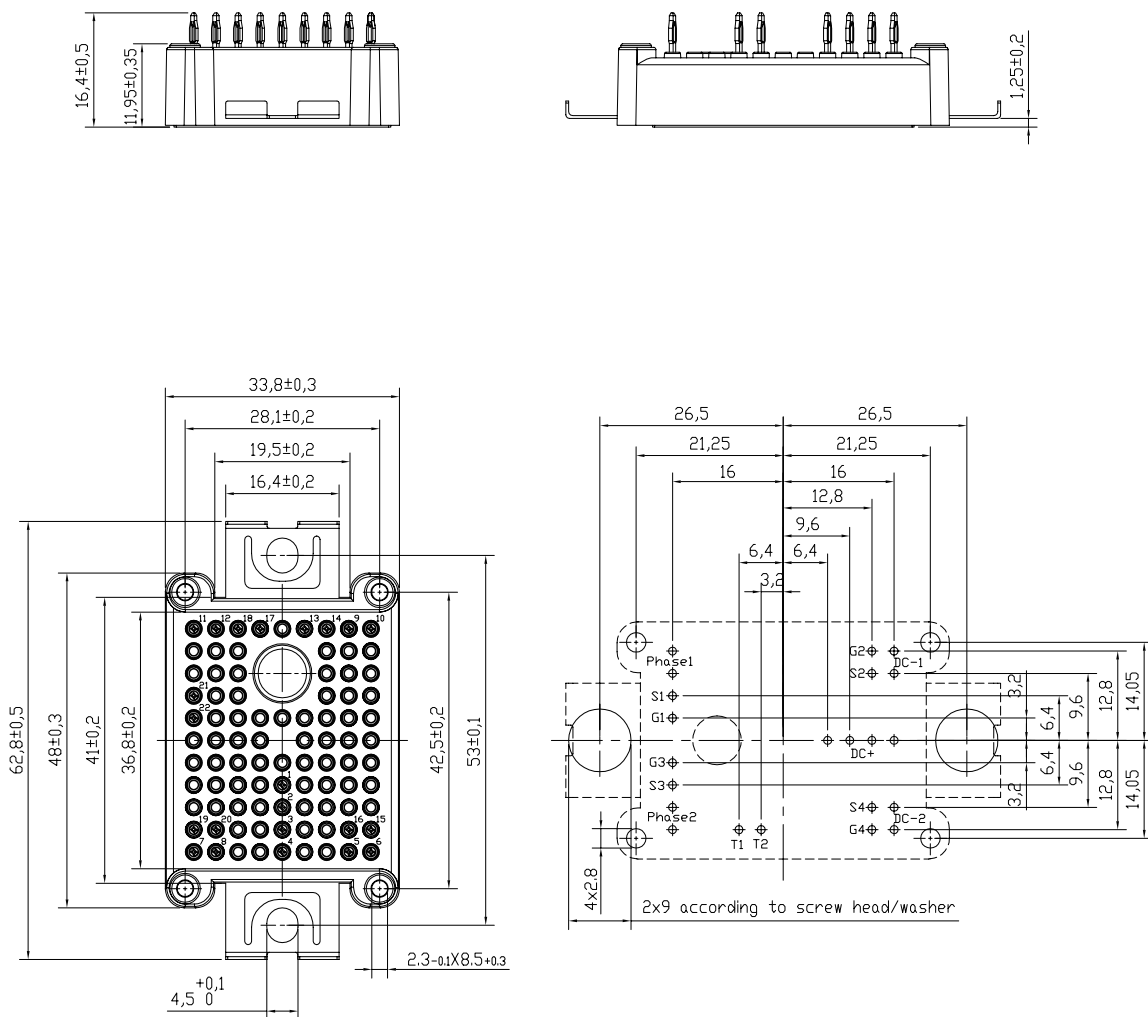
**Fig. 19. Clamped Inductive Switching Energy as a function of drain current**



### 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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