

1. General description

WeEnPACK-B1 module with WeEn 1200V Gen2 SiC MOSFET and Integrated NTC temperature sensor, configured with Pressfit pin and pre-applied thermal paste.



2. Features and benefits

- H Bridge topology
- Press-fit pin type
- Pre-applied thermal interface material
- Low Switching Losses
- Low Q_g and C_{rss}
- Low Inductive Design
- Low $R_{DS(on)}$

3. Applications

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

4. Quick reference data

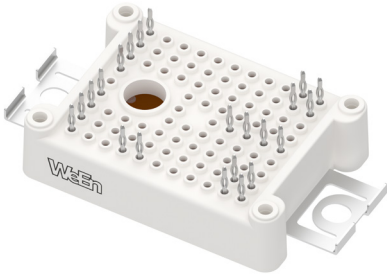
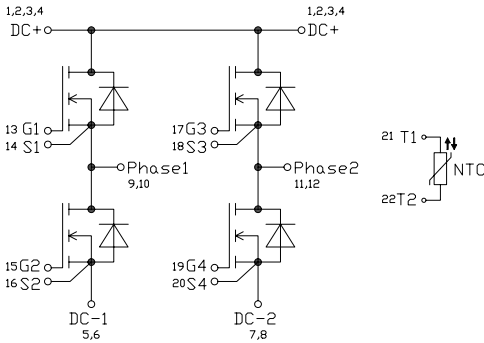
Table 1. Quick reference data

Table 17. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
Absolute maximum rating							
V _{DS}	drain-source voltage	T _J = 25 °C		1200			V
I _D	drain current	V _{GS} = 18 V; T _h = 25 °C		47			A
P _{tot}	total power dissipation	T _h = 25 °C		114			W
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
R _{DS(on)}	drain-source on-state resistance	V _{GS} = 15 V; I _D = 33 A; T _J = 25 °C		-	40	-	mΩ
		V _{GS} = 18 V; I _D = 33 A; T _J = 25 °C		-	33	45	mΩ
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 33 A; V _{DS} = 800 V; V _{GS} = -4 V/18 V; T _J = 25 °C		-	115	-	nC
Q _{GD}	gate-drain charge			-	17.5	-	nC
Source-drain diode							
Q _r	recovered charge	I _{SD} = 33 A; V _{GS} = -4 V/18 V; V _R = 600 V; di/dt = 3400 A/μs; R _{G(ext)} = 5.1 Ω; T _J = 25 °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
WMSC040F12B1L-B	WeEnPACK-B1	WMSC040F12B1L-B6T	Tray	24	WeEnPACK-B1PFB-B	20-Mar-2024

7. Marking

Table 4. Marking codes

Type number	Marking codes
WMSC040F12B1L-B	WMSC040F12B1L-B

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
MOSFET					
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	$T_h = 25\text{ °C}$		114	W
I_D	drain current	$V_{GS} = 18\text{ V}$; $T_h = 25\text{ °C}$		47	A
		$V_{GS} = 18\text{ V}$; $T_h = 100\text{ °C}$		30	A
I_{DM}	peak drain current	pulse width t_p limited by $T_{j,max}$		100	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
Body Diode					
I_{SD}	DC body diode forward current	$T_h = 25\text{ °C}$; $V_{GS} = -4\text{ V}$		30	A
$I_{SD,pulse}$	Pulse body diode current	verified by design, t_p limited by $T_{j,max}$		100	A

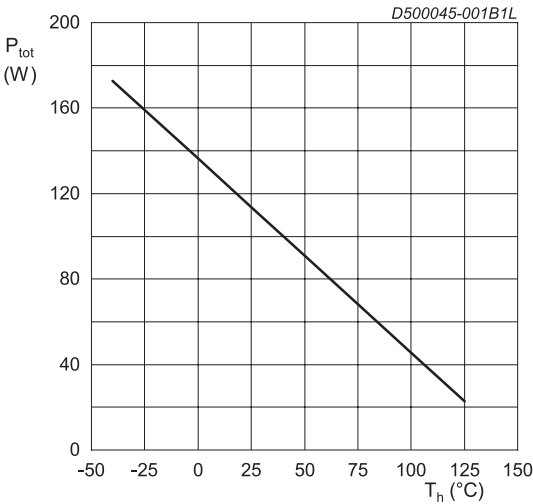


Fig. 1. Power dissipation as a function of heatsink temperature; maximum values

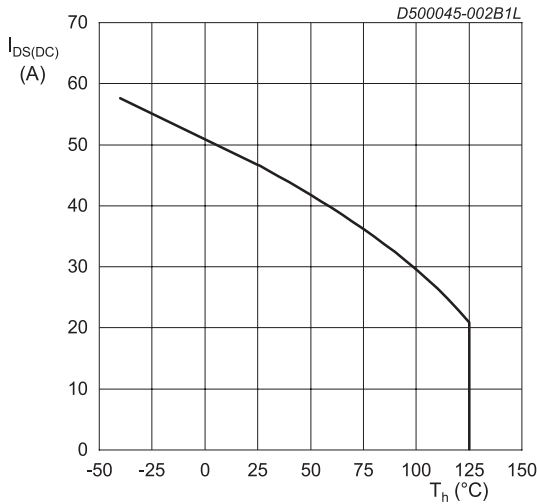


Fig. 2. Continuous Drain Current as a function of heatsink temperature

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, valid with pre-applied thermal interface material, $\lambda_{grease} = 4 \text{ W/(m}\cdot\text{K)}$, $thick_{grease} = 50 \text{ }\mu\text{m}$		-	1.1	-	K/W
Internal Isolation		basic insulation (class 1, IEC 61140)		Al_2O_3			
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.

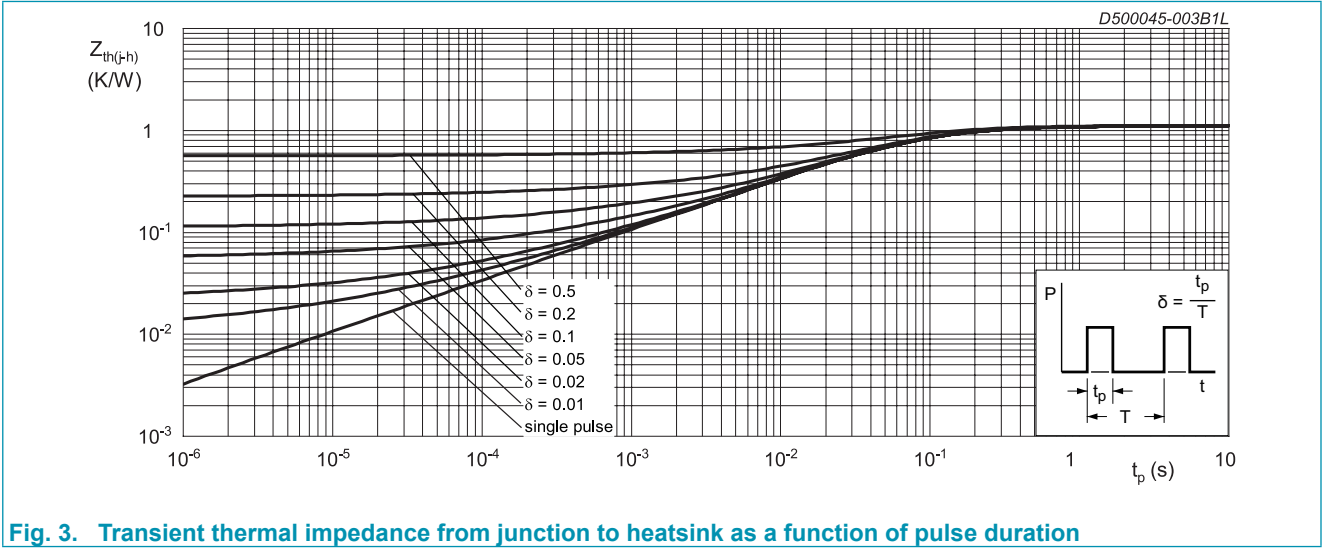


Fig. 3. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Characteristics

Table 7. Characteristics

MOSFET							
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 100 \mu A$; $V_{GS} = 0 V$; $T_j = 25^\circ C$		1200	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 10 mA$; $V_{DS} = V_{GS}$; $T_j = 25^\circ C$		1.9	2.6	3.5	V
		$I_D = 10 mA$; $V_{DS} = V_{GS}$; $T_j = 175^\circ C$		-	1.9	-	V
I_{DSS}	drain leakage current	$V_{DS} = 1200 V$; $V_{GS} = 0 V$; $T_j = 25^\circ C$		-	0.2	100	μA
I_{GSS}	gate leakage current (absolute value)	$V_{GS} = 24 V$; $V_{DS} = 0 V$; $T_j = 25^\circ C$		-	10	100	nA
		$V_{GS} = -12 V$; $V_{DS} = 0 V$; $T_j = 25^\circ C$		-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15 V$; $I_D = 33 A$; $T_j = 25^\circ C$		-	40	-	m Ω
		$V_{GS} = 18 V$; $I_D = 33 A$; $T_j = 25^\circ C$		-	33	45	m Ω
		$V_{GS} = 18 V$; $I_D = 33 A$; $T_j = 125^\circ C$		-	46	-	m Ω
		$V_{GS} = 18 V$; $I_D = 33 A$; $T_j = 150^\circ C$		-	51	-	m Ω
		$V_{GS} = 18 V$; $I_D = 33 A$; $T_j = 175^\circ C$		-	54	-	m Ω
R_G	gate resistance	$f = 1 MHz$; $T_j = 25^\circ C$; per MOSFET		-	1	-	Ω
g_{fs}	transconductance	$V_{DS} = 20 V$; $I_D = 33 A$; $T_j = 25^\circ C$		-	20	-	S
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$I_D = 33 A$; $V_{DS} = 800 V$; $V_{GS} = -4 V/18 V$; $T_j = 25^\circ C$		-	115	-	nC
Q_{GS}	gate-source charge			-	47	-	nC
Q_{GD}	gate-drain charge			-	17.5	-	nC
C_{iss}	input capacitance	$V_{DS} = 1000 V$; $V_{GS} = 0 V$; $f = 100 KHz$; $T_j = 25^\circ C$		-	2.45	-	nF
C_{oss}	output capacitance			-	108	-	pF
C_{rss}	reverse transfer capacitance			-	11	-	pF
E_{oss}	Coss stored energy			-	54	-	μJ
$t_{d(on)}$	turn-on delay time	$V_{DS} = 800 V$; $V_{GS} = -4 V/18 V$; $R_{G(ext)} = 5.1 \Omega$; $I_D = 33 A$; $L = 300 \mu H$; $T_j = 25^\circ C$		-	27	-	ns
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	-	μJ
E_{off}	turn-off energy			-	90	-	μJ

Body diode							
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V _{SD}	source-drain voltage	V _{GS} = -4 V; I _{SD} = 33 A; T _j = 25 °C		-	5.5	-	V
		V _{GS} = -4 V; I _{SD} = 33 A; T _j = 150 °C		-	5.0	-	V
Dynamic characteristics							
I _{rrm}	reverse recovery current	I _{SD} = 33 A; V _{GS} = -4 V/18 V; V _R = 600 V; di/dt = 3400 A/μs; R _{G(ext)} = 5.1 Ω; T _j = 25 °C		-	44	-	A
t _{rr}	reverse recovery time			-	19	-	ns
Q _r	recovered charge			-	465	-	nC
E _{rec}	reverse recovery energy			-	117	-	μJ
NTC thermistor							
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
R ₂₅	Rated resistance	T _{NTC} = 25 °C		-	5000	-	Ω
R ₁₀₀		T _{NTC} = 100 °C		465±5%			Ω
B _{25/50}	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

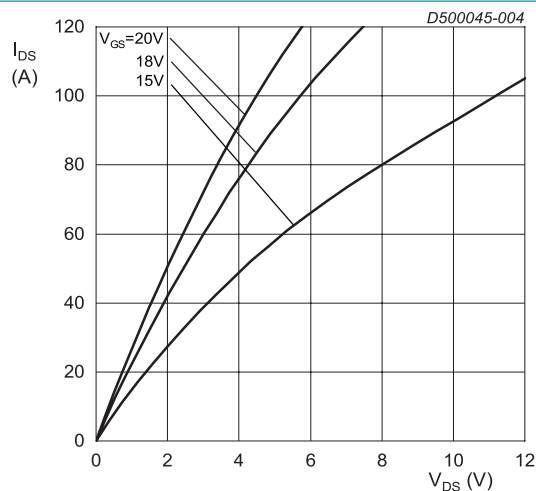


Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values
 $T_j = -40\text{ }^{\circ}\text{C}; t_p < 200\text{ }\mu\text{s}$

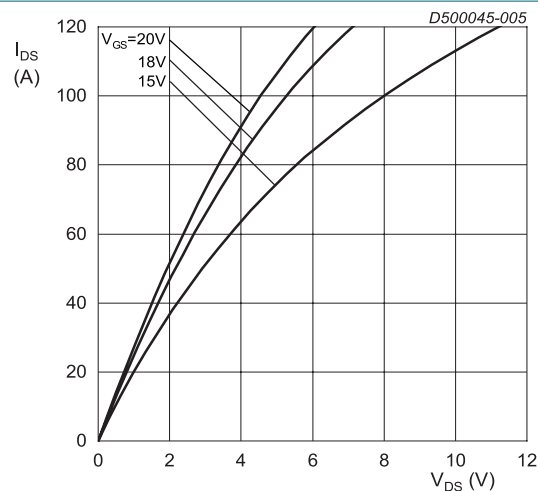


Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values
 $T_j = 25\text{ }^{\circ}\text{C}; t_p < 200\text{ }\mu\text{s}$

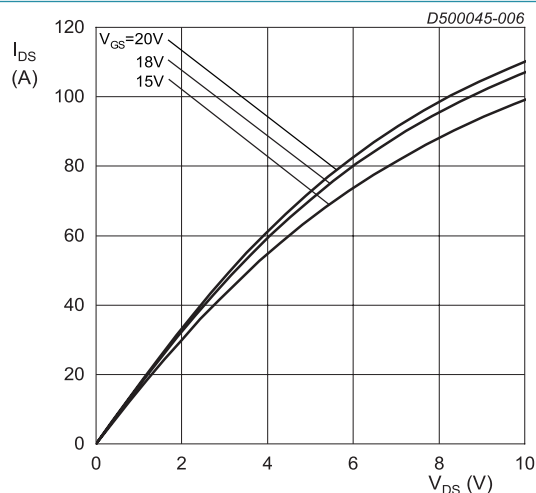


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values
 $T_j = 150\text{ }^{\circ}\text{C}; t_p < 200\text{ }\mu\text{s}$

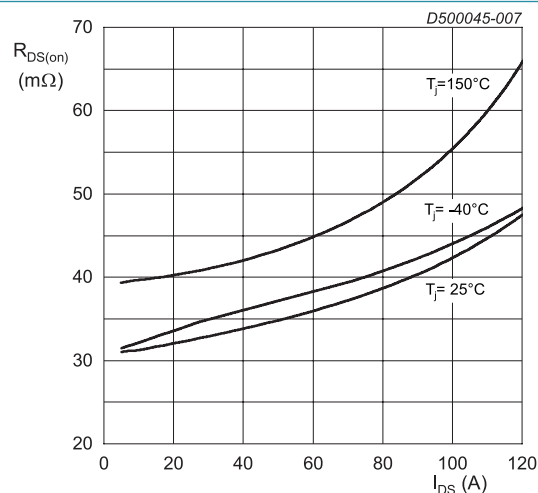
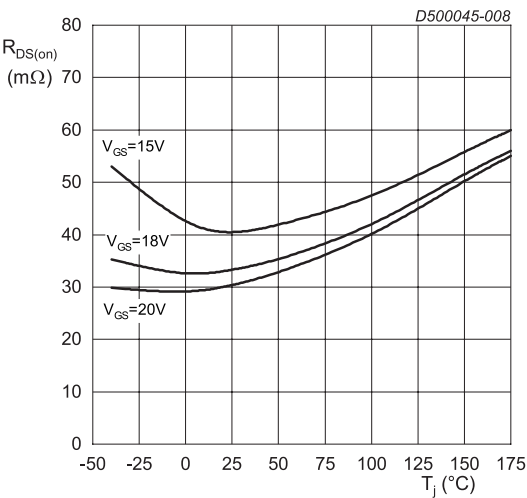
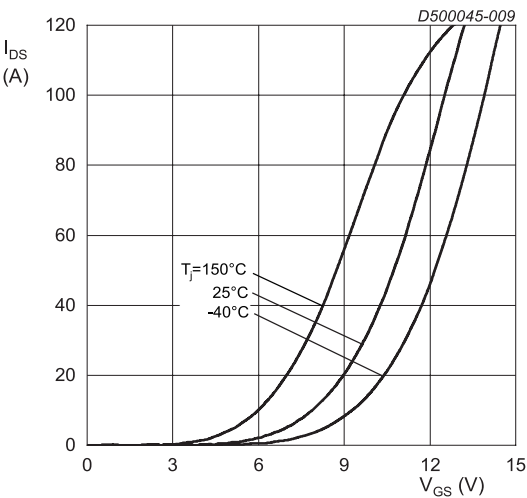


Fig. 7. Drain-source on-state resistance as a function of drain current; typical values
 $V_{GS} = 18\text{ V}; t_p < 200\text{ }\mu\text{s}$



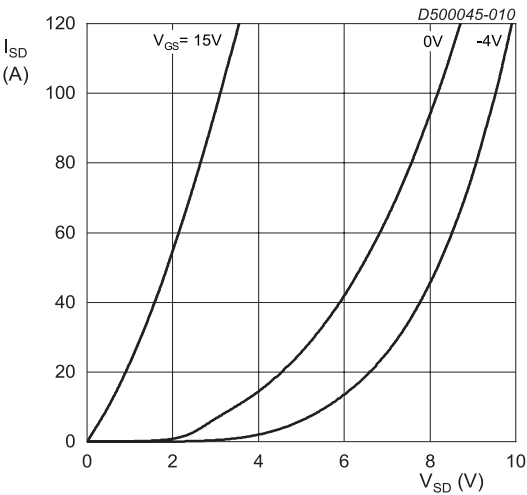
$I_{DS} = 33\text{ A}; t_p < 200\text{ }\mu\text{s}$

Fig. 8. Drain-source on-state resistance as a function of junction temperature



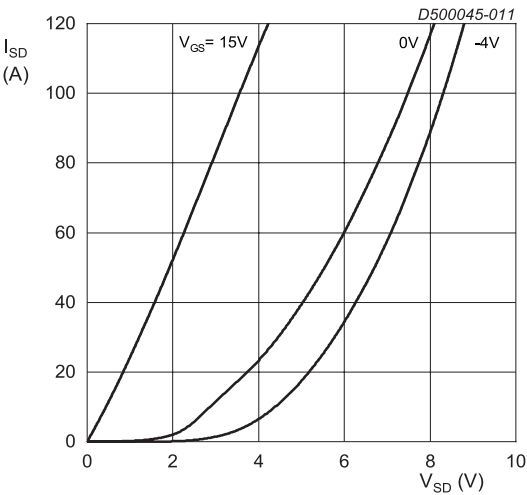
$V_{DS} = 20\text{ V}; t_p < 200\text{ }\mu\text{s}$

Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values



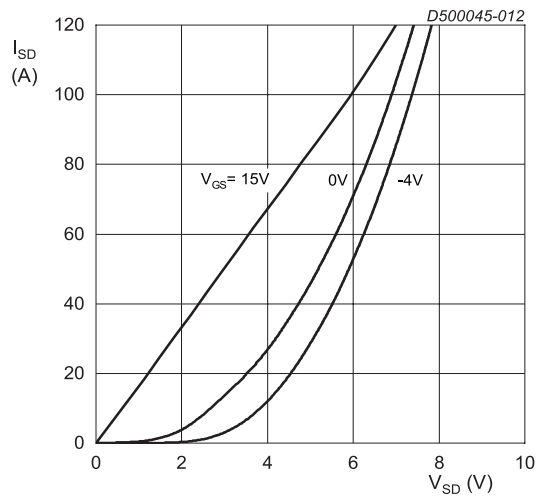
$T_j = -40\text{ }^\circ\text{C}; t_p < 200\text{ }\mu\text{s}$

Fig. 10. Body diode forward characteristics; typical values

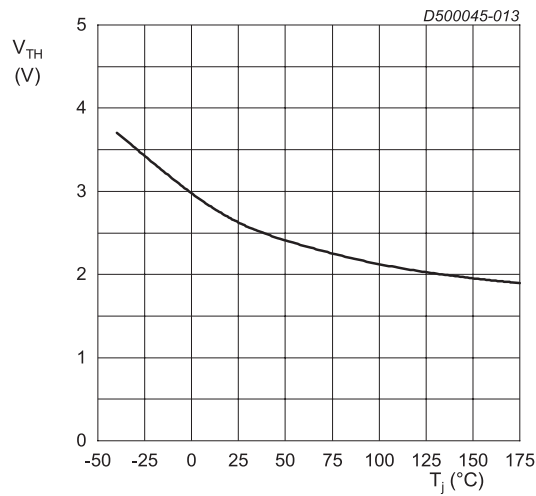


$T_j = 25\text{ }^\circ\text{C}; t_p < 200\text{ }\mu\text{s}$

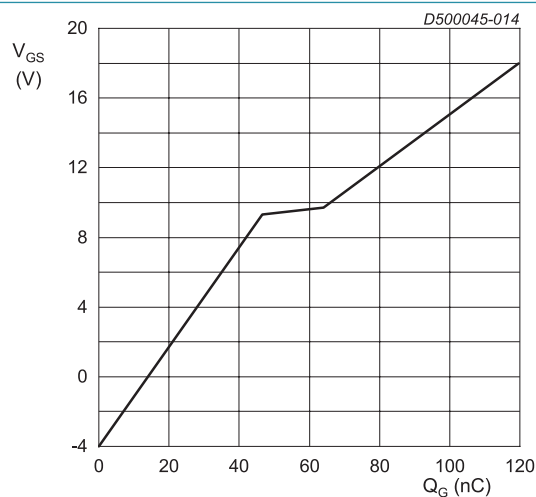
Fig. 11. Body diode forward characteristics; typical values



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

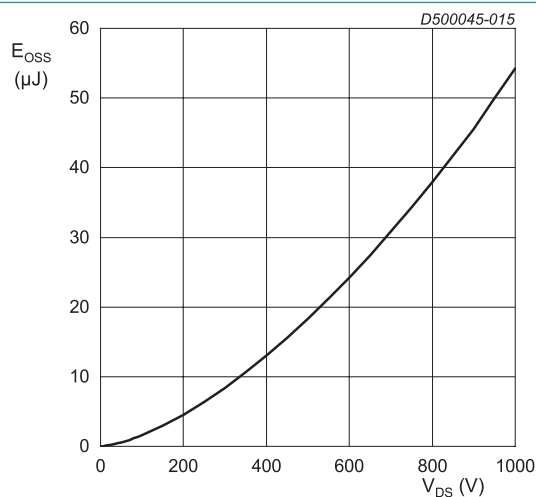
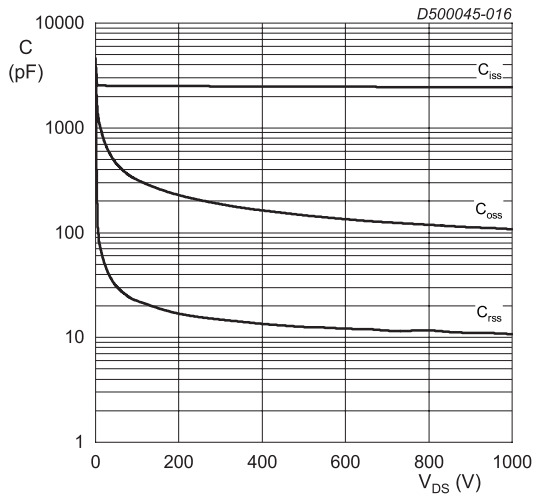
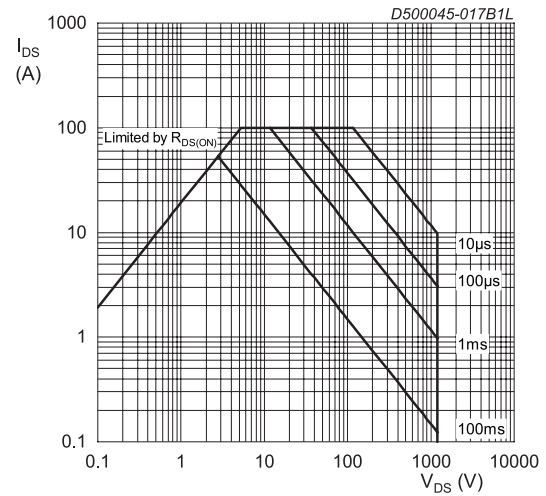


Fig. 15. Output capacitor stored energy as a function of drain-source voltage



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

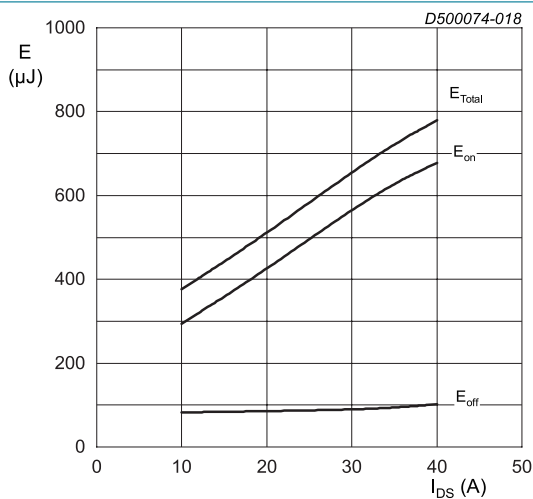
Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$T_h = 25^\circ\text{C}$; $D = 0$

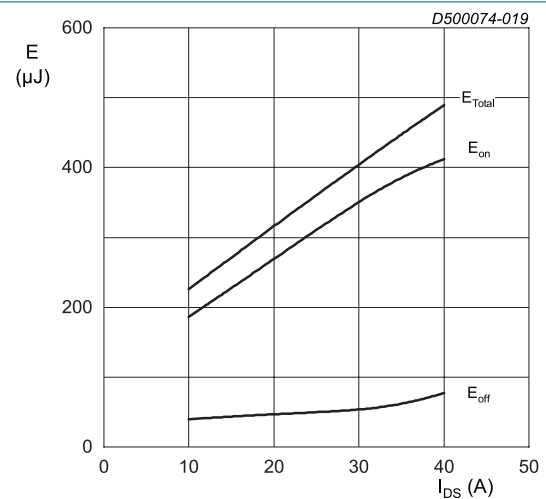
Parameter: t_p

Fig. 17. Forward bias safe operating area



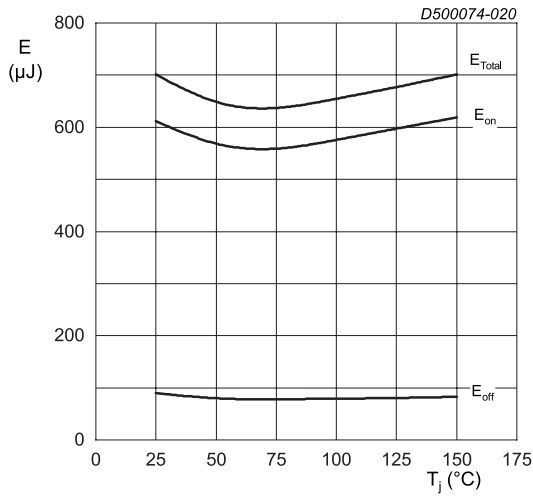
$T_j = 25^\circ\text{C}$; $V_{DD} = 800 \text{ V}$; $R_{G(ext)} = 5.1 \Omega$; $R_{G(on)} = 5.1 \Omega$;
 $V_{GS} = -4 \text{ V/18 V}$; $L = 300 \mu\text{H}$

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



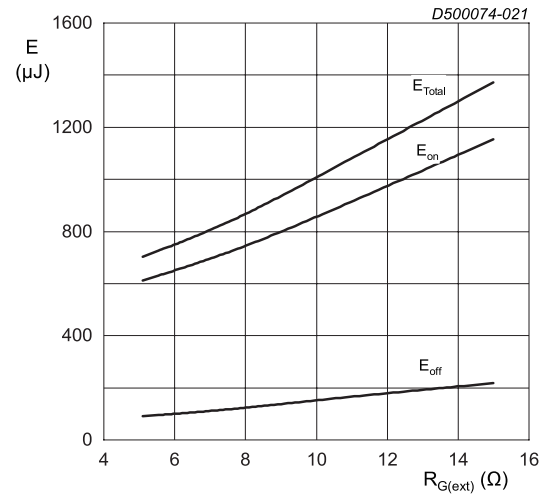
$T_j = 25^\circ\text{C}$; $V_{DD} = 600 \text{ V}$; $R_{G(off)} = 5.1 \Omega$; $R_{G(on)} = 5.1 \Omega$;
 $V_{GS} = -4 \text{ V/18 V}$; $L = 300 \mu\text{H}$

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



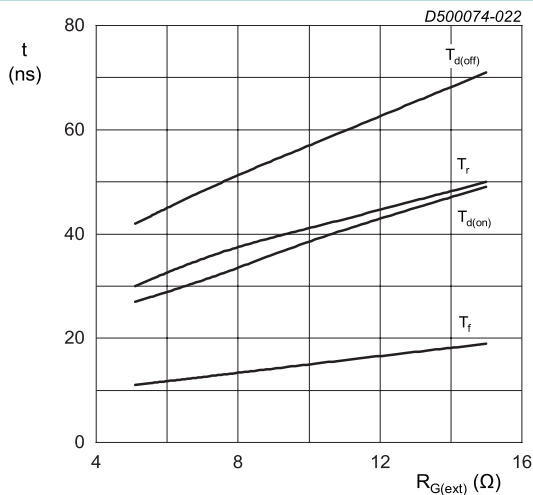
$I_{DS} = 33$ A; $V_{DD} = 800$ V; $R_{G(off)} = 5.1$ Ω; $R_{G(on)} = 5.1$ Ω;
 $V_{GS} = -4$ V/18 V; $L = 300$ μH

Fig. 20. Clamped Inductive Switching Energy as a function of junction temperature



$T_j = 25$ °C; $V_{DD} = 800$ V; $I_{DS} = 33$ A; $V_{GS} = -4$ V/18 V;
 $L = 300$ μH

Fig. 21. Clamped Inductive Switching Energy as a function of external gate resistance



$T_j = 25$ °C; $V_{DD} = 800$ V; $I_{DS} = 33$ A; $V_{GS} = -4$ V/18 V;
 $L = 300$ μH

Fig. 22. Switching time as a function of external gate resistance

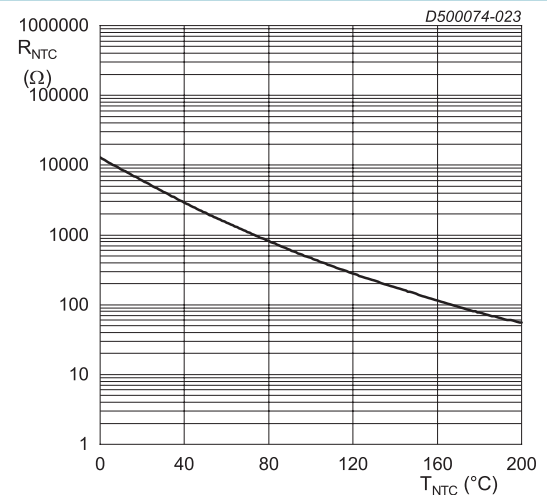
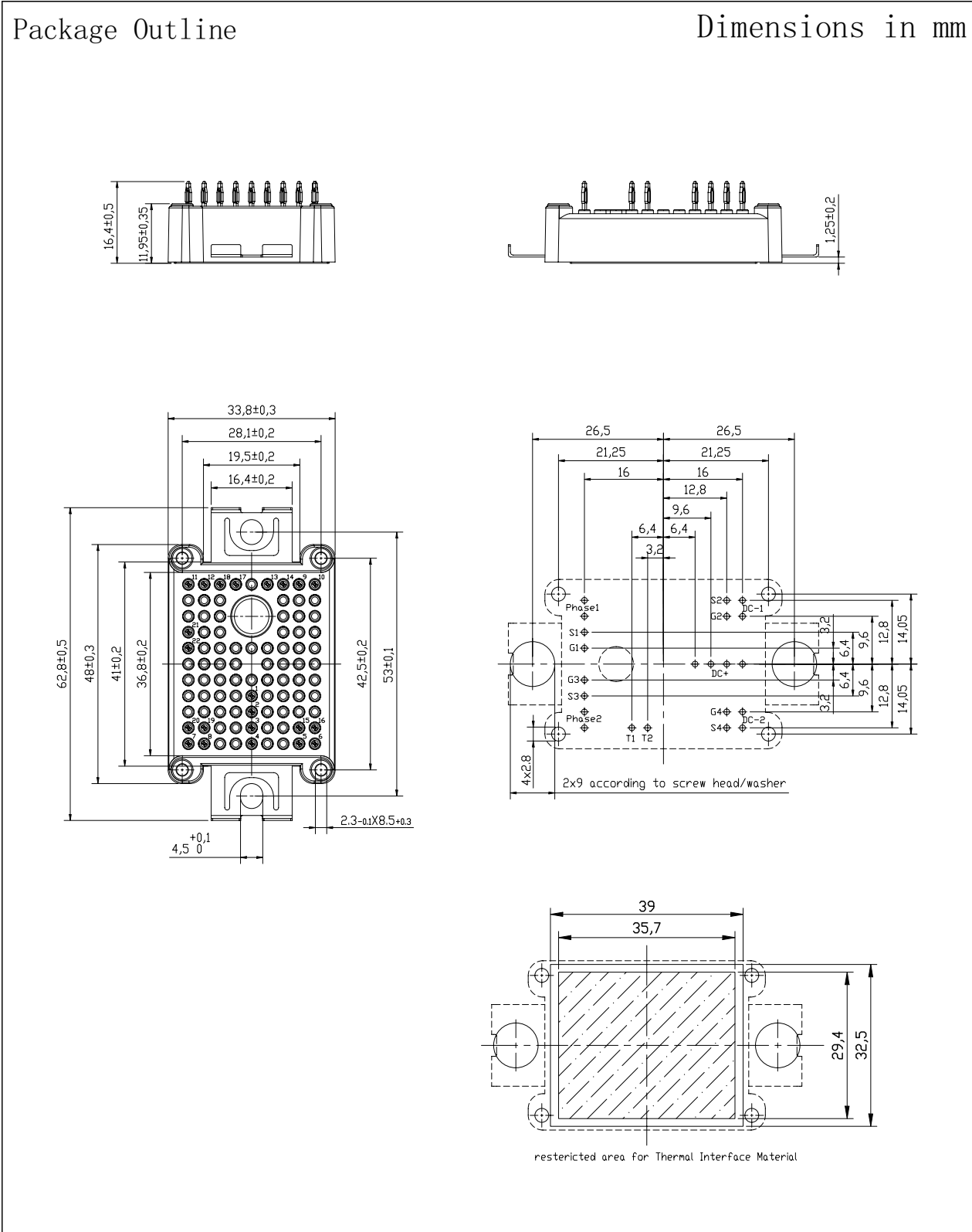


Fig. 23. NTC thermistor resistance as a function of NTC temperature

11. Package outline



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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