

1. General description

WeEnPACK-B1 module with WeEn 1200V Gen2 SiC MOSFET and PressFit pin type. Intergrated with NTC temperature sensor.



2. Features and benefits

- Half bridge topology
- PressFit pins technology
- Low $R_{DS(on)}$
- Low Switching Losses
- Low Q_g and C_{rss}
- Low Inductive Design

3. Applications

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

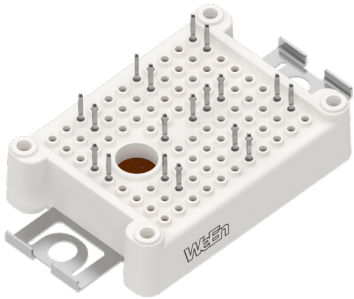
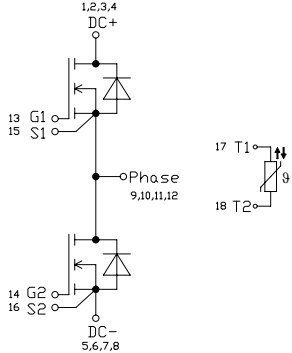
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
Absolute maximum rating							
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$		1200			V
I_D	drain current	$V_{GS} = 18\text{ V}; T_h = 25\text{ °C}$		70			A
P_{tot}	total power dissipation	$T_h = 25\text{ °C}$		118			W
$T_{j,op}$	junction temperature			-40 to 150			°C
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15\text{ V}; I_D = 50\text{ A}; T_j = 25\text{ °C}$		-	20	-	mΩ
		$V_{GS} = 18\text{ V}; I_D = 50\text{ A}; T_j = 25\text{ °C}$		-	15.9	29	mΩ
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$I_D = 50\text{ A}; V_{DS} = 800\text{ V}; V_{GS} = -4\text{ V}/18\text{ V}; T_j = 25\text{ °C}$		-	232	-	nC
Q_{GD}	gate-drain charge			-	44	-	nC
Source-drain diode							
Q_r	recovered charge	$I_{SD} = 50\text{ A}; V_{GS} = -4\text{ V}; di/dt = 8500\text{ A}/\mu\text{s}; V_R = 600\text{ V}; T_j = 25\text{ °C}$		-	810	-	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
WMSC020H12B1P	WeEnPACK-B1	WMSC020H12B1P6T	Tray	24	WeEnPACK-B1PHB-A	14-Dec-2023

7. Marking

Table 4. Marking codes

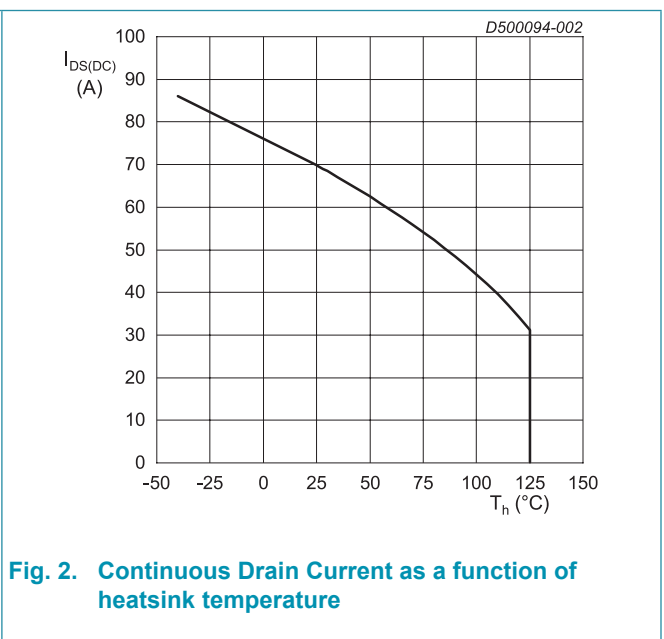
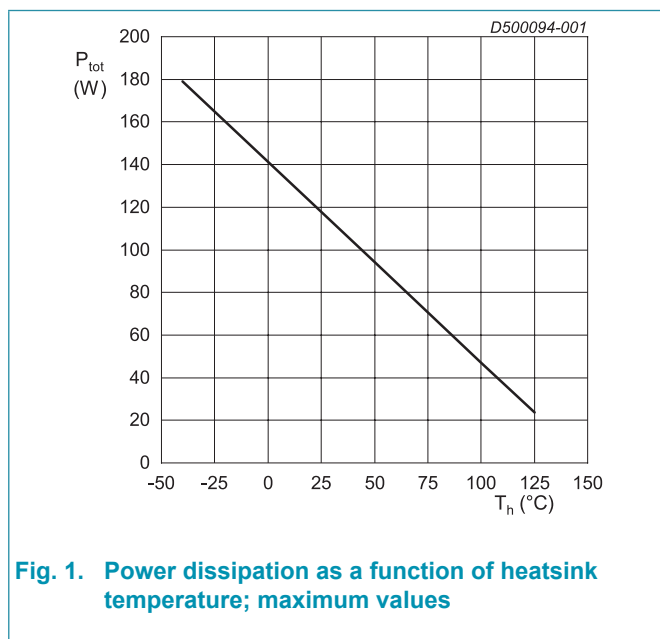
Type number	Marking codes
WMSC020H12B1P	WMSC020H12B1P

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	$T_h = 25\text{ °C}$		118	W
I_D	drain current	$V_{GS} = 18\text{ V}$; $T_h = 25\text{ °C}$		70	A
		$V_{GS} = 18\text{ V}$; $T_h = 100\text{ °C}$		44	A
I_{DM}	peak drain current	pulse width t_p limited by $T_{j,max}$	Fig.17	140	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	$V_{GS} = -4\text{ V}$; $T_h = 25\text{ °C}$		28	A
$I_{SD,pulse}$	Pulse body diode current	verified by design, t_p limited by $T_{j,max}$		140	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		-	0.38	-	K/W
$R_{th(j-h)}$	thermal resistance from junction to heatsink	per MOSFET, $\lambda_{grease} = 1 \text{ W/(m}\cdot\text{K)}$		-	1.06	-	K/W
Internal Isolation		basic insulation (class 1, IEC 61140)		Al ₂ O 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.

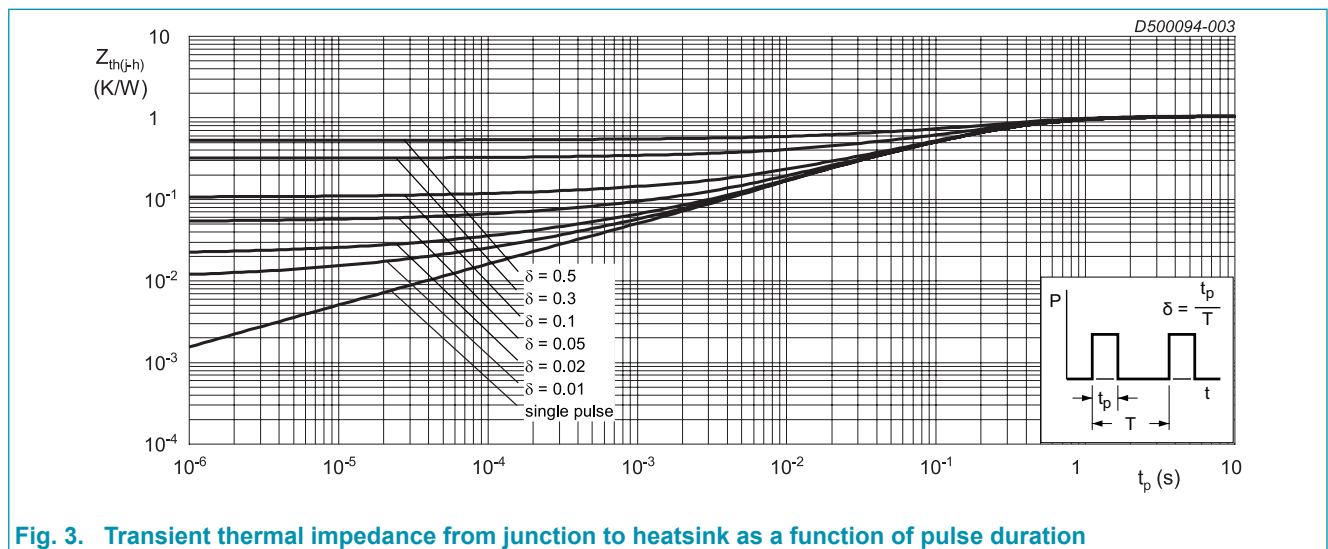


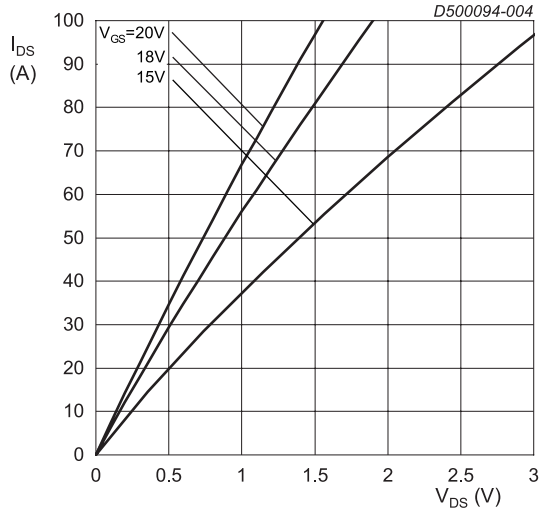
Fig. 3. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Characteristics

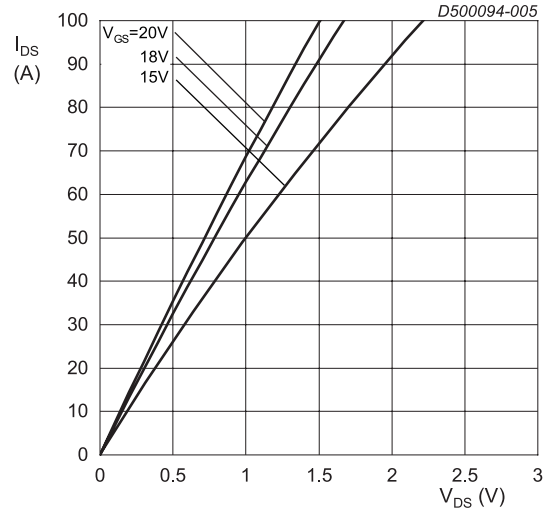
Table 7. Characteristics

MOSFET								
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit	
Static characteristics								
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 200 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$		1200	-	-	V	
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 20 \text{ mA}; V_{DS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C$		1.9	2.5	3.5	V	
		$I_D = 20 \text{ mA}; V_{DS} = 10 \text{ V}; T_j = 175 \text{ }^\circ C$		-	1.9	-	V	
I_{DSS}	drain leakage current	$V_{DS} = 1200 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$		-	0.4	200	μA	
I_{GSS}	gate leakage current (absolute value)	$V_{GS} = 24 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$		-	20	200	nA	
		$V_{GS} = -12 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$		-	20	200	nA	
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15 \text{ V}; I_D = 50 \text{ A}; T_j = 25 \text{ }^\circ C$		-	20	-	m Ω	
		$V_{GS} = 18 \text{ V}; I_D = 50 \text{ A}; T_j = 25 \text{ }^\circ C$		-	15.9	29	m Ω	
		$V_{GS} = 18 \text{ V}; I_D = 50 \text{ A}; T_j = 125 \text{ }^\circ C$		-	21.7	-	m Ω	
		$V_{GS} = 18 \text{ V}; I_D = 50 \text{ A}; T_j = 150 \text{ }^\circ C$		-	24.1	-	m Ω	
		$V_{GS} = 18 \text{ V}; I_D = 50 \text{ A}; T_j = 175 \text{ }^\circ C$		-	25.3	-	m Ω	
R_G	gate resistance, each side	$f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$, each die with 4.7 Ω $R_{G(ext)}$ in series		-	2.9	-	Ω	
g_{fs}	transconductance	$V_{DS} = 20 \text{ V}; I_D = 50 \text{ A}; T_j = 25 \text{ }^\circ C$		-	35	-	S	
Dynamic characteristics								
$Q_{G(tot)}$	total gate charge	$I_D = 50 \text{ A}; V_{DS} = 800 \text{ V}; V_{GS} = -4 \text{ V}/18 \text{ V}; T_j = 25 \text{ }^\circ C$		-	232	-	nC	
Q_{GS}	gate-source charge			-	86	-	nC	
Q_{GD}	gate-drain charge			-	44	-	nC	
C_{iss}	input capacitance	$V_{DS} = 1000 \text{ V}; V_{GS} = 0 \text{ V}; f = 100 \text{ KHz}; T_j = 25 \text{ }^\circ C$		-	4.8	-	nF	
C_{oss}	output capacitance			-	237	-	pF	
C_{rss}	reverse transfer capacitance			-	21.3	-	pF	
E_{oss}	Coss stored energy			-	118	-	μJ	
$t_{d(on)}$	turn-on delay time		$V_{DS} = 800 \text{ V}; V_{GS} = -4 \text{ V}/18 \text{ V}; R_{G(off)} = 2.4 \text{ } \Omega; R_{G(on)} = 2.4 \text{ } \Omega; I_D = 50 \text{ A}; L = 100 \text{ } \mu H; T_j = 25 \text{ }^\circ C$		-	22	-	ns
t_r	rise time				-	42	-	ns
$t_{d(off)}$	turn-off delay time				-	68	-	ns
t_f	fall time			-	39	-	ns	
E_{on}	turn-on energy			-	0.84	-	mJ	
E_{off}	turn-off energy			-	0.4	-	mJ	

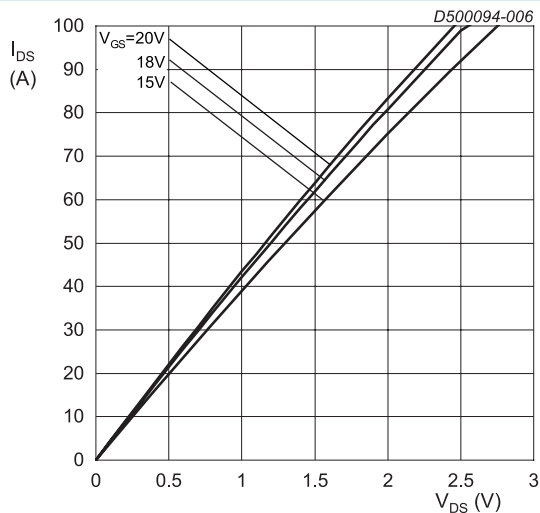
Body diode							
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V _{SD}	source-drain voltage	V _{GS} = -4 V; I _{SD} = 50 A; T _j = 25 °C		-	5.5	-	V
		V _{GS} = -4 V; I _{SD} = 50 A; T _j = 150 °C		-	4.9	-	V
Dynamic characteristics							
t _{rr}	reverse recovery time	I _{SD} = 50 A; V _{GS} = -4 V; di/dt = 8500 A/μs; V _R = 600 V; T _j = 25 °C		-	19	-	ns
Q _r	recovered charge			-	810	-	nC
I _{rrm}	reverse recovery current			-	71	-	A
E _{rec}	reverse recovery energy			-	345	-	μJ
t _{rr}	reverse recovery time	I _{SD} = 50 A; V _{GS} = -4 V; di/dt = 11000 A/μs; V _R = 600 V; T _j = 150 °C		-	22	-	ns
Q _r	recovered charge			-	1670	-	nC
I _{rrm}	reverse recovery current			-	120	-	A
E _{rec}	reverse recovery energy			-	1135	-	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 constant			-	2	-	mW/K
	Thermal time constant			-	≤10	-	s



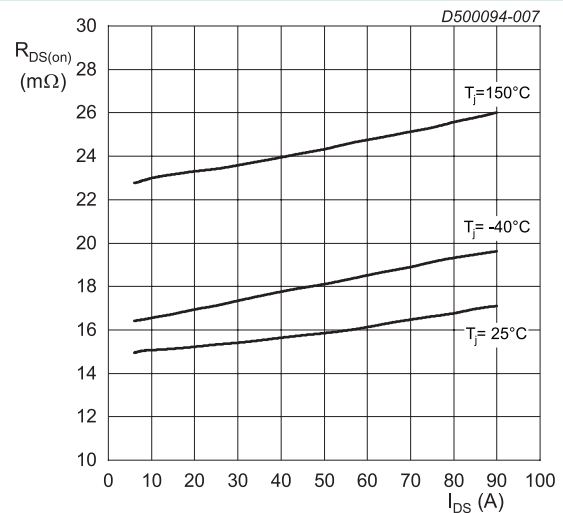
$T_j = -40\text{ °C}; t_p < 200\ \mu\text{s}$
Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values



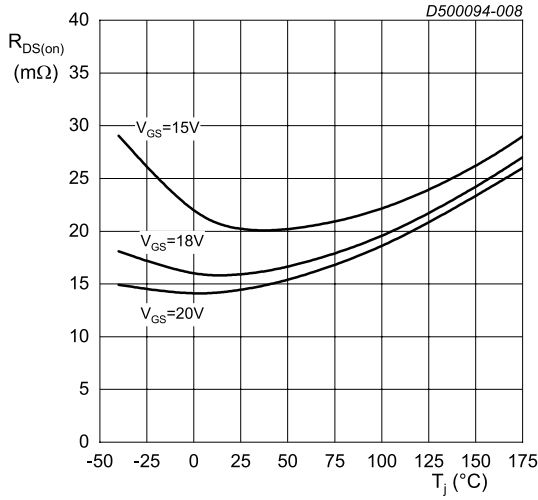
$T_j = 25\text{ °C}; t_p < 200\ \mu\text{s}$
Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values



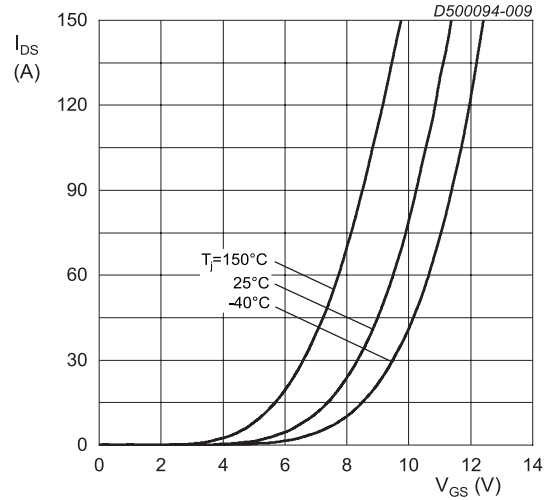
$T_j = 150\text{ °C}; t_p < 200\ \mu\text{s}$
Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values



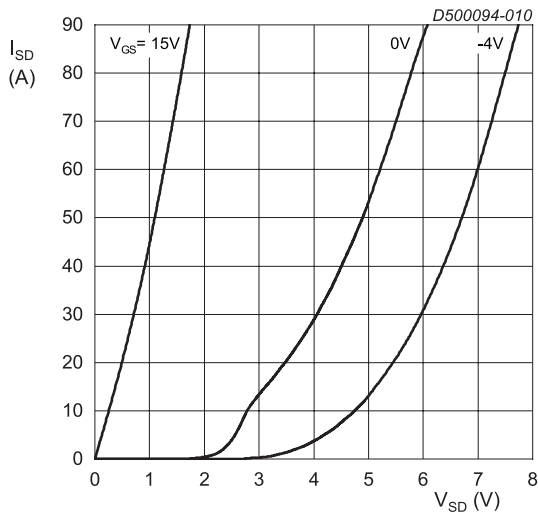
$V_{GS} = 18\text{ V}; t_p < 200\ \mu\text{s}$
Fig. 7. Drain-source on-state resistance as a function of drain current; typical values



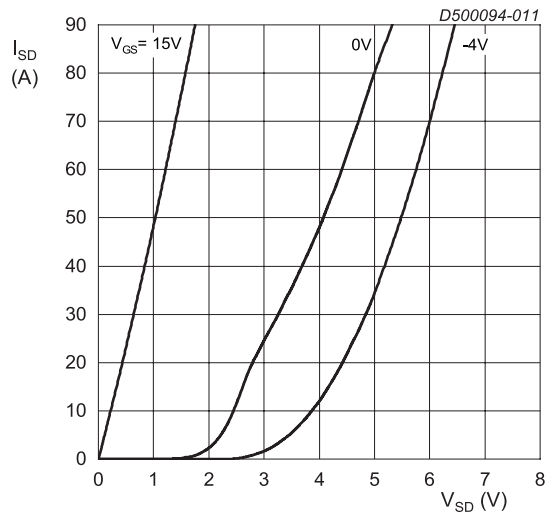
$I_{DS} = 50 A; t_p < 200 \mu s$
Fig. 8. Drain-source on-state resistance as a function of junction temperature



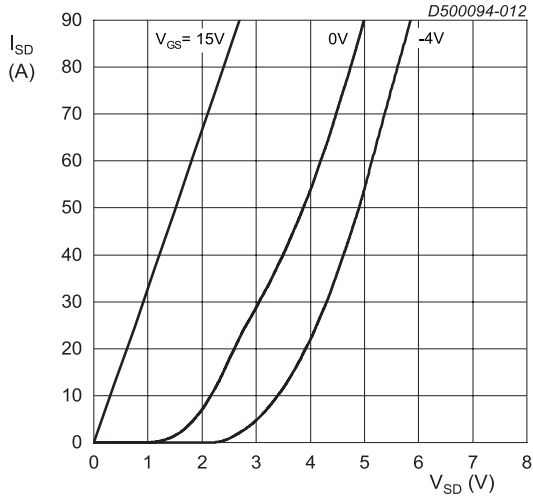
$V_{DS} = 20 V; t_p < 200 \mu s$
Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values



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

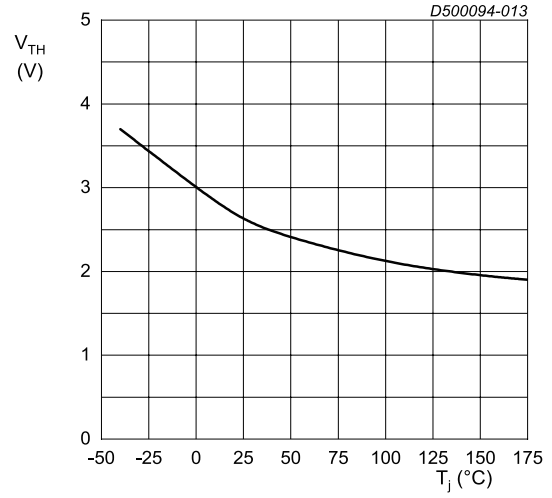


$T_j = 25^{\circ}C; t_p < 200 \mu s$
Fig. 11. Body diode forward characteristics; typical values



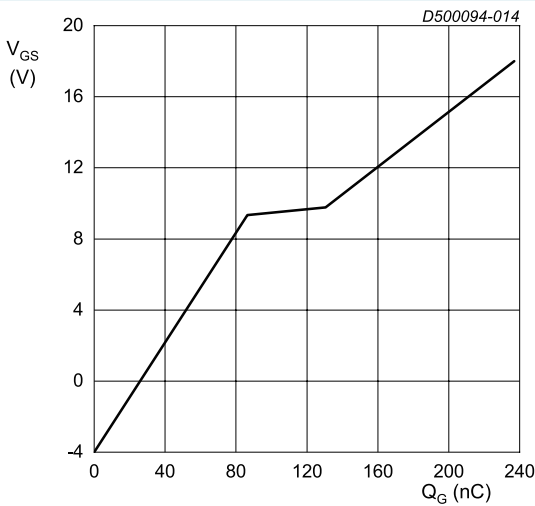
$T_j = 150\text{ }^\circ\text{C}$; $t_p < 200\text{ }\mu\text{s}$

Fig. 12. Body diode forward characteristics; typical values



$V_{DS} = 10\text{ V}$; $I_{DS} = 20\text{ mA}$

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



$I_{DS} = 50\text{ A}$; $I_{GS} = 0.1\text{ mA}$; $V_{DS} = 800\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$

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

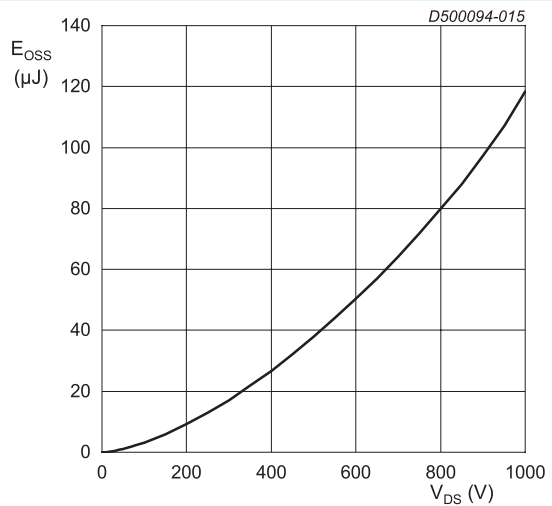
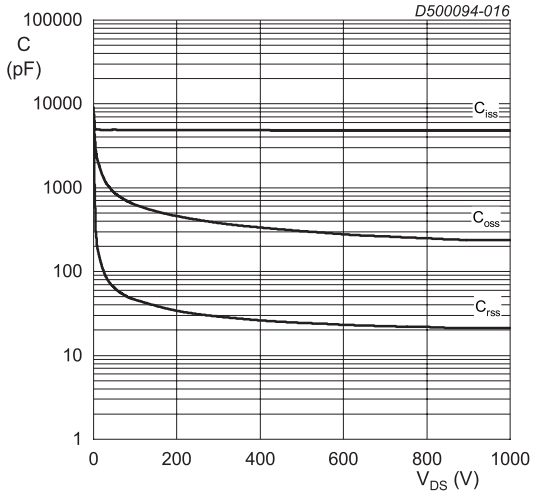
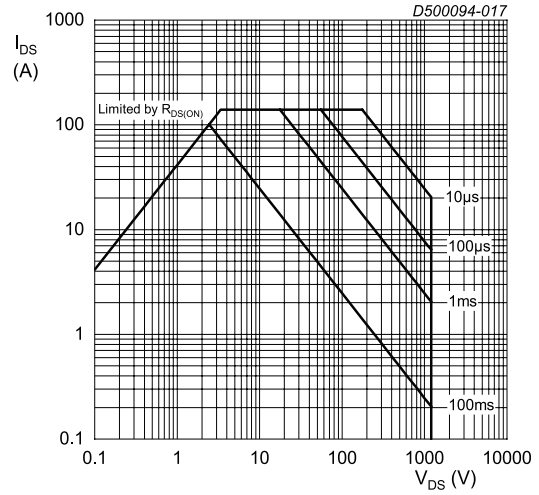


Fig. 15. Output capacitor stored energy as a function of drain-source voltage



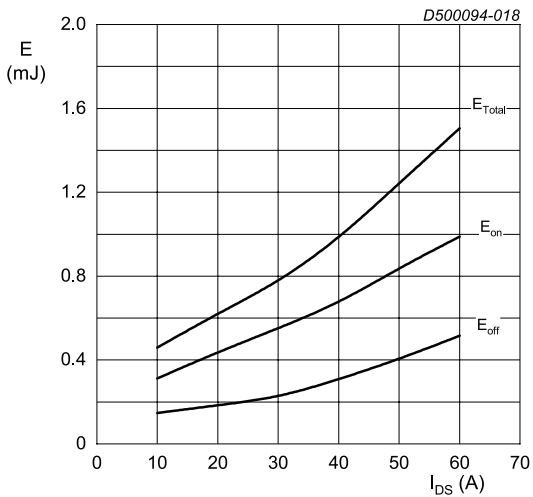
V_{DS} = 0 - 1000 V
 T_j = 25 °C; V_{AC} = 25 mV; f = 100 KHz

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



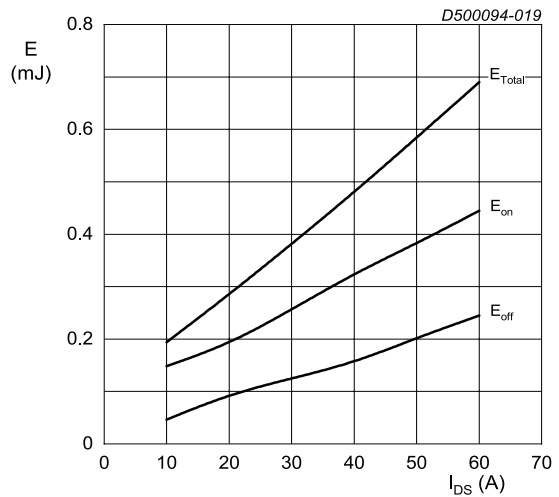
T_j = 25 °C; D = 0
 Parameter: t_p

Fig. 17. Forward bias safe operating area



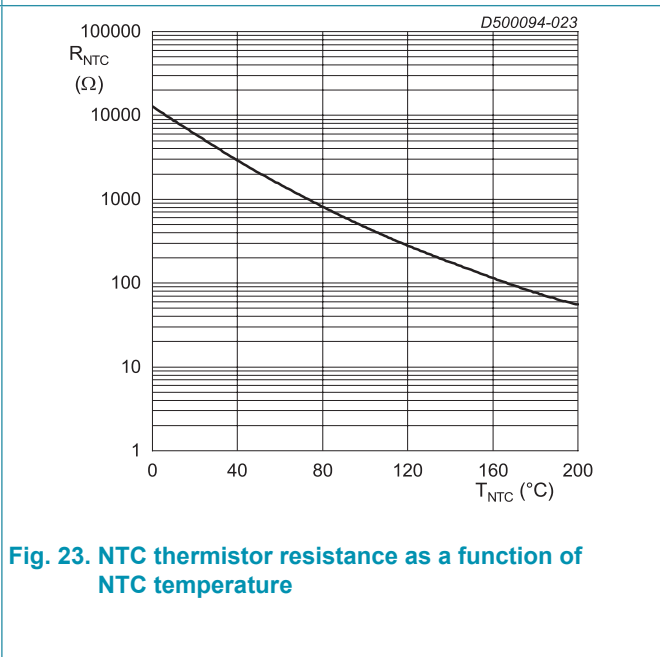
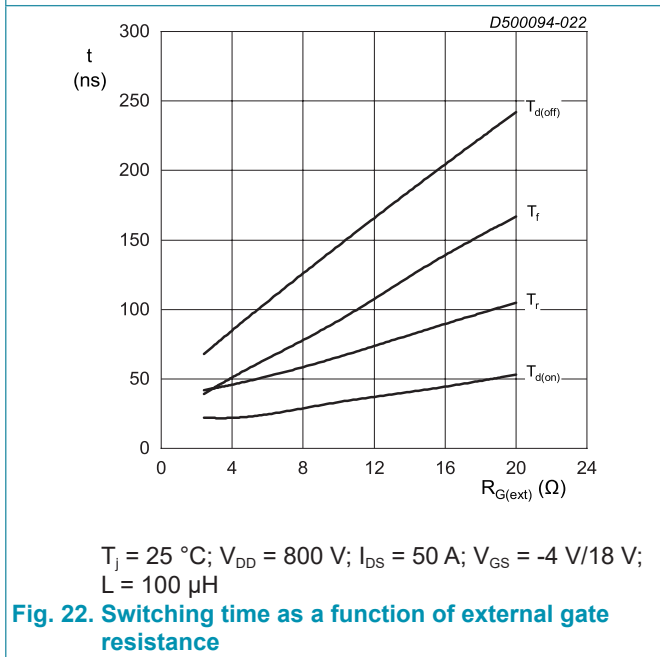
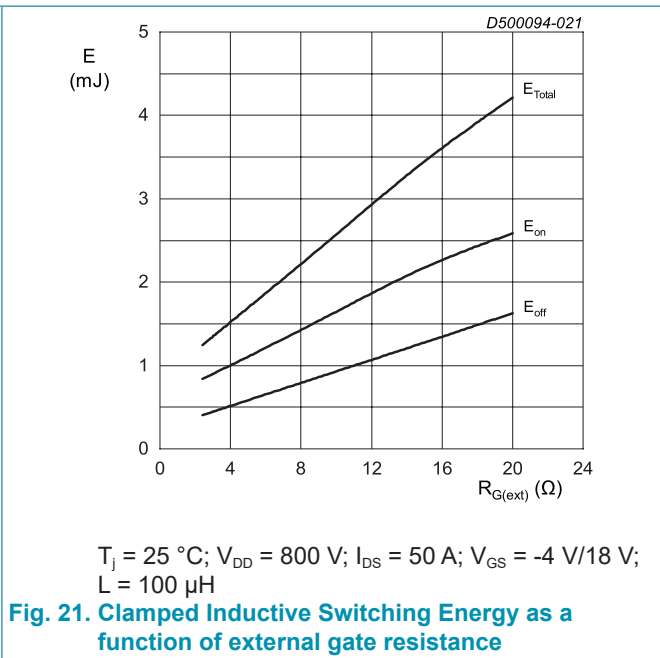
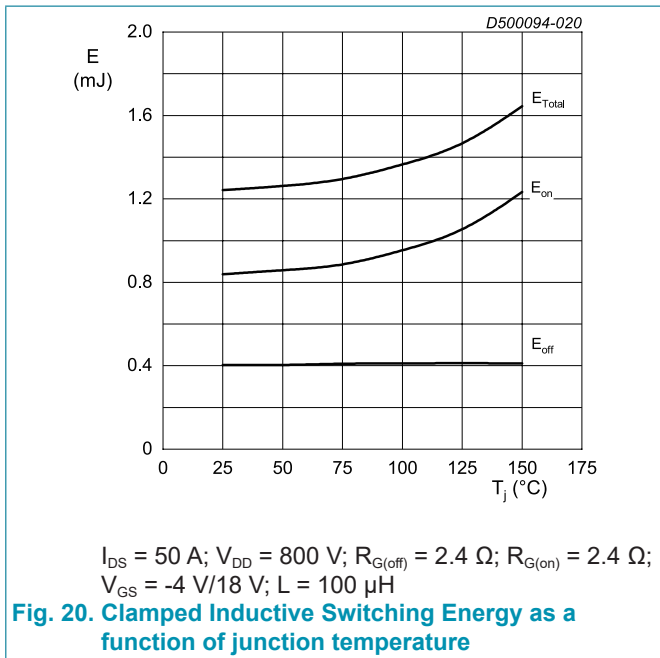
T_j = 25 °C; V_{DD} = 800 V; R_{G(off)} = 2.4 Ω; R_{G(on)} = 2.4 Ω;
 V_{GS} = -4 V/18 V; L = 100 μH

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



T_j = 25 °C; V_{DD} = 600 V; R_{G(off)} = 2.4 Ω; R_{G(on)} = 2.4 Ω;
 V_{GS} = -4 V/18 V; L = 100 μH

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



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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