

## 1. General description

Silicon Carbide MOSFET in a TO263-7L plastic package, designed for high frequency, high efficiency systems.



## 2. Features and benefits

- Low on-resistance
- Fast switching speed
- 0V turn-off gate voltage for simple gate drive
- 100% UIS Tested
- Easy to parallel
- Controllable dV/dt for optimized EMI
- Reduced cooling requirements
- RoHS compliant

## 3. Applications

- Switch Mode Power Supplies
- UPS
- Solar string inverter and solar optimizer
- EV Charger
- Motor Drives

## 4. Quick reference data

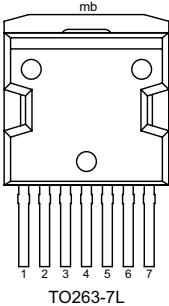
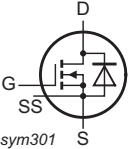
Table 1. Quick reference data

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Symbol	Parameter	Conditions	Notes	Values			Unit
Absolute maximum rating							
V <sub>DS</sub>	drain-source voltage	25 °C ≤ T <sub>j</sub> ≤ 175 °C		1200			V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 18 V; T <sub>mb</sub> = 25 °C		58			A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C, T <sub>j</sub> = 175 °C		375			W
T <sub>j</sub>	junction temperature			-55 to 175			°C
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
R <sub>DS(on)</sub>	drain-source on-state resistance	V <sub>GS</sub> = 15 V; I <sub>D</sub> = 25 A; T <sub>j</sub> = 25 °C		-	60	-	mΩ
Dynamic characteristics							
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 25 A; V <sub>DS</sub> = 800 V; V <sub>GS</sub> = -4 V/18 V; T <sub>j</sub> = 25 °C		-	83	-	nC
Q <sub>GD</sub>	gate-drain charge			-	15	-	nC
Source-drain diode							
Q <sub>r</sub>	recovered charge	I <sub>SD</sub> = 25 A; di/dt = 500 A/μs; V <sub>DS</sub> = 400 V; T <sub>j</sub> = 25 °C		-	64	-	nC

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	SS	source sense		
3-7	S	source		
mb	D	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
WNSC2M60120B7	TO263-7L	WNSC2M60120B76J	Reel	800	TO263P-7L	12-Jun-2023

7. Marking

Table 4. Marking codes

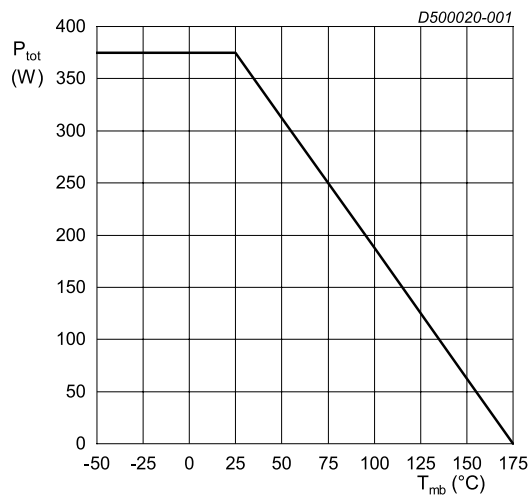
Type number	Marking codes
WNSC2M60120B7	WNSC2M 60120B7

## 8. Limiting values

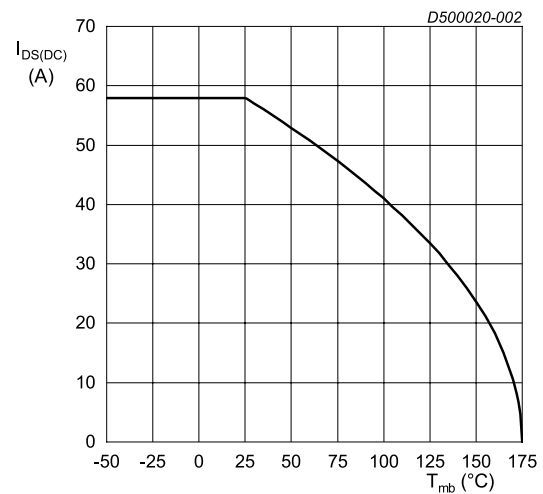
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Notes	Values	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$		1200	V
$V_{GS,max}$	gate-source voltage			-12 to 24	V
$V_{GS,op}$	gate-source voltage			-4 to 18	V
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}, T_j = 175\text{ °C}$		375	W
$I_D$	drain current	$V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$		58	A
		$V_{GS} = 18\text{ V}; T_{mb} = 100\text{ °C}$		41	A
$I_{DM}$	peak drain current	pulse width $t_p$ limited by $T_{jmax}$	Fig.17	116	A
$I_S$	continuous diode current	$V_{GS} = -4\text{ V}; T_{mb} = 25\text{ °C}$		48.6	A
$I_{SM}$	pulse diode current	$V_{GS} = -4\text{ V}$ ; pulse width $t_p$ limited by $T_{jmax}$		116	A
$E_{as}$	single pulse drain-to-source avalanche	$I_{AS} = 15\text{ A}; L = 1\text{ mH}; V_{DD} = 100\text{ V}; T_j = 25\text{ °C}$		112.5	mJ
$T_{stg}$	storage temperature			-55 to 175	°C
$T_j$	junction temperature			-55 to 175	°C
$T_{sld(M)}$	peak soldering temperature			260	°C



**Fig. 1. Total power dissipation as a function of mounting base temperature; maximum values**



**Fig. 2. Continuous Drain Current as a function of mounting base temperature**

9. Thermal & Mechanical characteristics

Table 6. Thermal & Mechanical characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base			-	0.4	-	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	40	-	K/W
$M_d$	Mounting torque	M3 or 6 - 32 screw		-	-	0.6	Nm

Note: It is recommended that a metal washer is inserted between screw head and mounting tab.  
Do not use self-tapping screws.  
Device is ESD sensitive. Handling precautions are recommended.

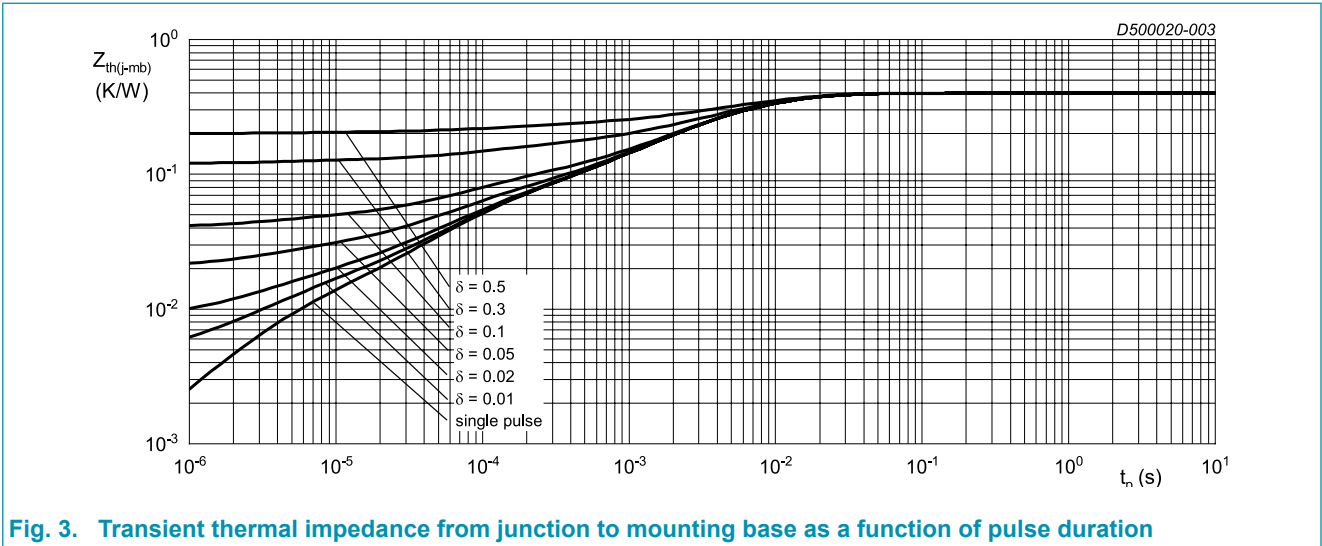
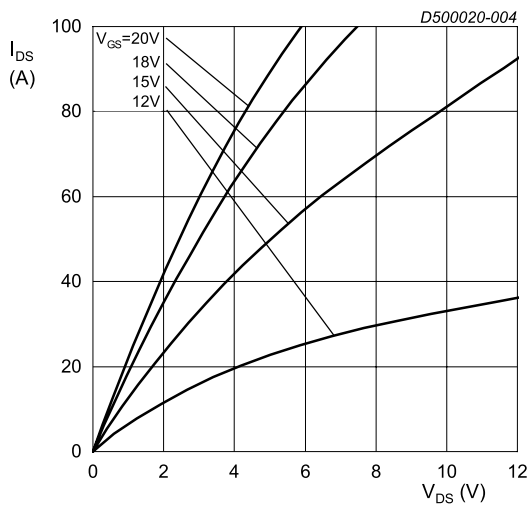


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

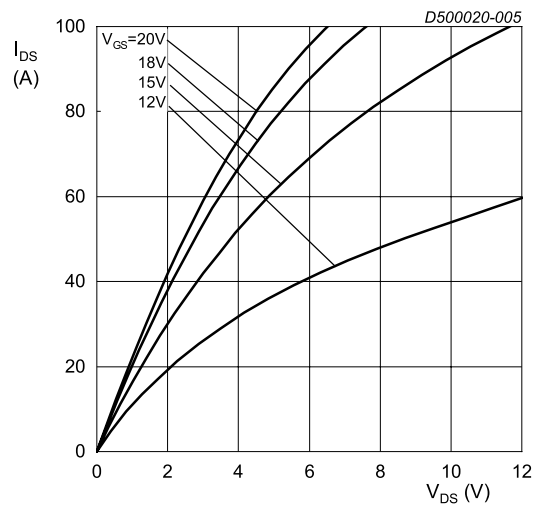
## 10. Characteristics

Table 7. Characteristics

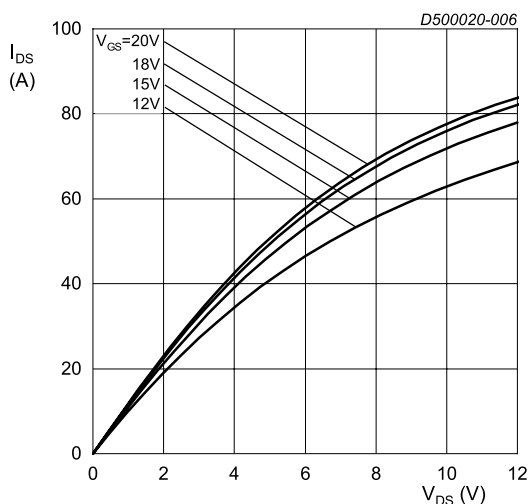
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 100 \mu A$ ; $V_{GS} = 0 V$ ; $T_J = 25^\circ C$		1200	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 6 mA$ ; $V_{DS} = 10 V$ ; $T_J = 25^\circ C$		1.9	2.6	3.5	V
		$I_D = 6 mA$ ; $V_{DS} = 10 V$ ; $T_J = 175^\circ C$		-	1.9	-	V
$I_{DSS}$	drain leakage current	$V_{DS} = 1200 V$ ; $V_{GS} = 0 V$ ; $T_J = 25^\circ C$		-	0.2	100	$\mu A$
		$V_{DS} = 1200 V$ ; $V_{GS} = 0 V$ ; $T_J = 175^\circ C$		-	2	-	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 24 V$ ; $V_{DS} = 0 V$ ; $T_J = 25^\circ C$		-	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	$V_{GS} = 15 V$ ; $I_D = 25 A$ ; $T_J = 25^\circ C$		-	60	-	m $\Omega$
		$V_{GS} = 18 V$ ; $I_D = 25 A$ ; $T_J = 25^\circ C$		-	49	68	m $\Omega$
		$V_{GS} = 18 V$ ; $I_D = 25 A$ ; $T_J = 175^\circ C$		-	93	-	m $\Omega$
$R_G$	gate resistance	$f = 1 MHz$ ; $T_J = 25^\circ C$		-	2.2	-	$\Omega$
$g_{fs}$	transconductance	$V_{DS} = 20 V$ ; $I_D = 25 A$ ; $T_J = 25^\circ C$		-	14	-	S
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$I_D = 25 A$ ; $V_{DS} = 800 V$ ; $V_{GS} = -4 V/18 V$ ; $T_J = 25^\circ C$		-	83	-	nC
$Q_{GS}$	gate-source charge			-	31	-	nC
$Q_{GD}$	gate-drain charge			-	15	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 1000 V$ ; $V_{GS} = 0 V$ ; $f = 1 MHz$ ; $T_J = 25^\circ C$		-	1731	-	pF
$C_{oss}$	output capacitance			-	71	-	pF
$C_{rss}$	reverse transfer capacitance			-	7	-	pF
$E_{oss}$	Coss stored energy			-	35.5	-	$\mu J$
$t_{d(on)}$	turn-on delay time	$V_{DS} = 800 V$ ; $V_{GS} = -4 V/18 V$ ; $R_{G(ext)} = 5.1 \Omega$ ; $I_D = 25 A$ ; $L = 330 \mu H$ ; $T_J = 25^\circ C$		-	12	-	ns
$t_r$	rise time			-	23	-	ns
$t_{d(off)}$	turn-off delay time			-	21	-	ns
$t_f$	fall time			-	55	-	ns
$E_{on}$	turn-on energy (Body Diode FWD)		Fig.20	-	150	-	$\mu J$
$E_{off}$	turn-off energy (Body Diode FWD)		Fig.20	-	62	-	$\mu J$
<b>Source-drain diode</b>							
$V_{SD}$	source-drain voltage	$V_{GS} = 0 V$ ; $I_{SD} = 12.5 A$ ; $T_J = 25^\circ C$		-	3.4	-	V
		$V_{GS} = -4 V$ ; $I_{SD} = 12.5 A$ ; $T_J = 25^\circ C$		-	5.1	-	V
		$V_{GS} = -4 V$ ; $I_{SD} = 12.5 A$ ; $T_J = 175^\circ C$		-	4.4	-	V
$t_{rr}$	reverse recovery time	$I_{SD} = 25 A$ ; $di/dt = 500 A/\mu s$ ; $V_{DS} = 400 V$ ; $T_J = 25^\circ C$		-	23.8	-	ns
$Q_r$	recovered charge			-	64	-	nC
$I_{rrm}$	reverse recovery current			-	4.7	-	A



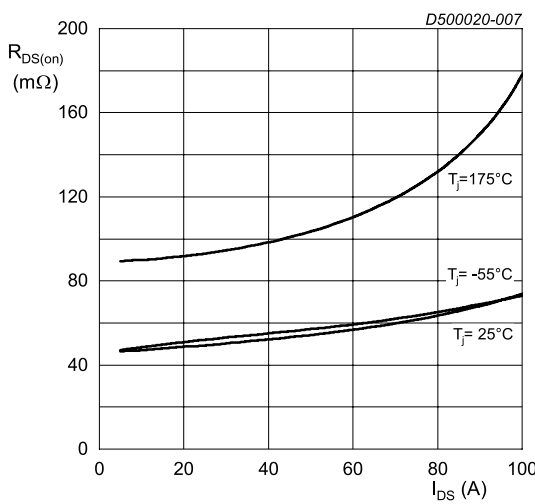
$T_j = -55^\circ\text{C}$ ;  $t_p < 200\ \mu\text{s}$   
**Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values**



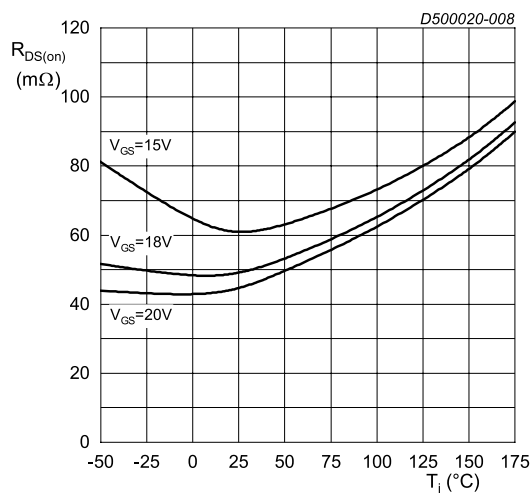
$T_j = 25^\circ\text{C}$ ;  $t_p < 200\ \mu\text{s}$   
**Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values**



$T_j = 175^\circ\text{C}$ ;  $t_p < 200\ \mu\text{s}$   
**Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values**

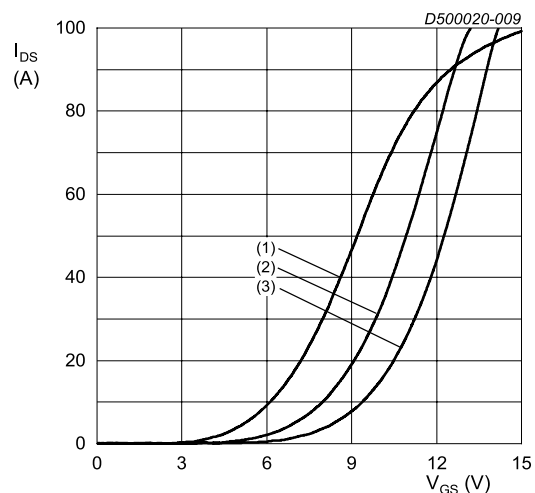


$V_{GS} = 18\text{ V}$ ;  $t_p < 200\ \mu\text{s}$   
**Fig. 7. Drain-source on-state resistance as a function of drain current; typical values**



$I_{DS} = 25 \text{ A}$ ;  $t_p < 200 \mu\text{s}$

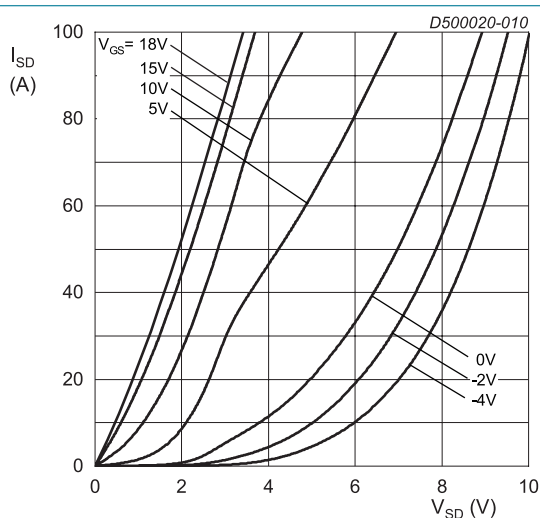
**Fig. 8. Drain-source on-state resistance as a function of junction temperature**



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

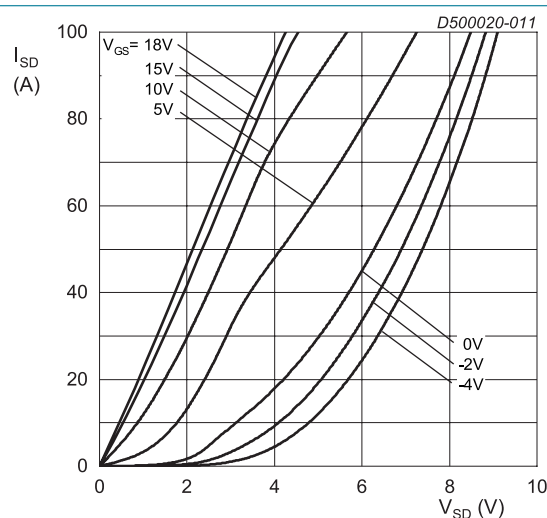
- (1)  $T_J = 175 \text{ °C}$
- (2)  $T_J = 25 \text{ °C}$
- (3)  $T_J = -55 \text{ °C}$

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



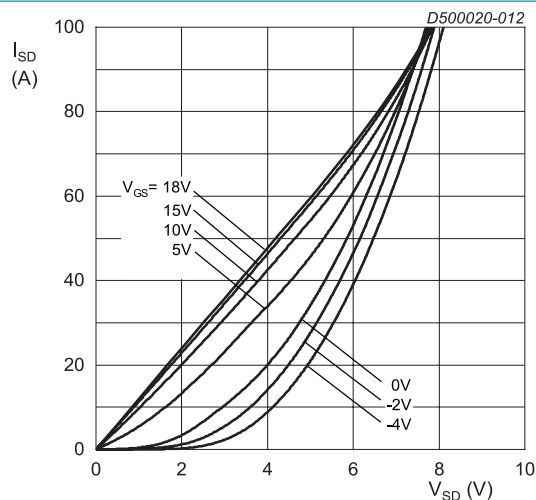
$T_J = -55 \text{ °C}$ ;  $t_p < 200 \mu\text{s}$

**Fig. 10. Body diode forward characteristics; typical values**

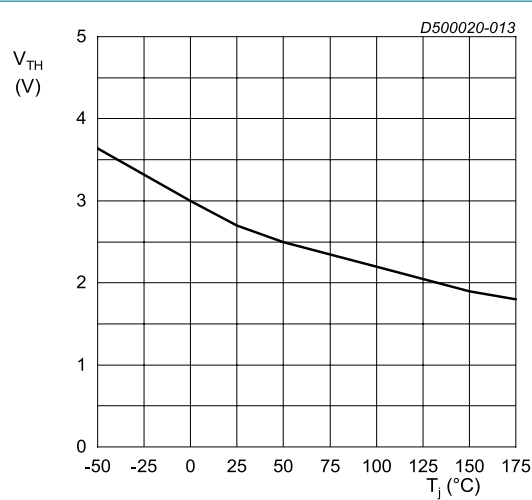


$T_J = 25 \text{ °C}$ ;  $t_p < 200 \mu\text{s}$

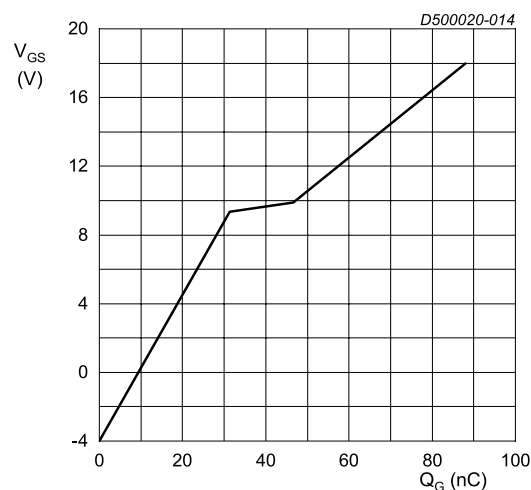
**Fig. 11. Body diode forward characteristics; typical values**



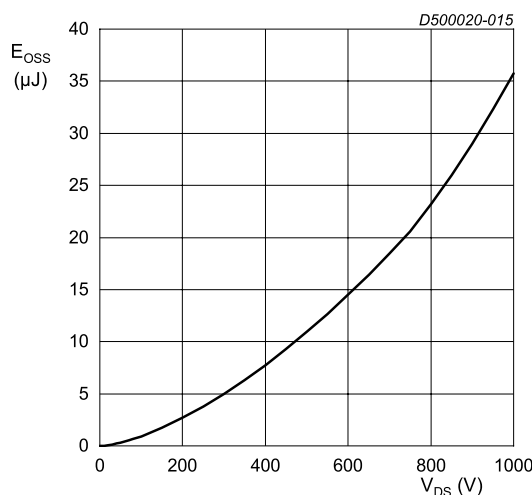
$T_j = 175\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 12. Body diode forward characteristics; typical values**



$V_{DS} = 10\text{ V}$ ;  $I_{DS} = 6\text{ mA}$   
**Fig. 13. Threshold voltage as a function of junction temperature**

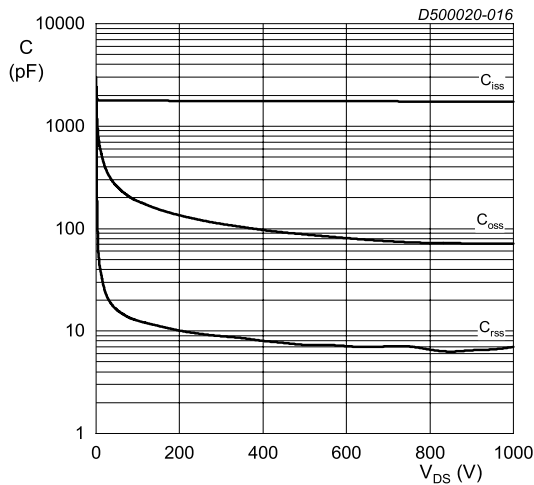


$I_{DS} = 25\text{ A}$ ;  $I_{GS} = 0.1\text{ mA}$ ;  $V_{DS} = 800\text{ V}$ ;  $T_j = 25\text{ }^{\circ}\text{C}$   
**Fig. 14. Gate-source voltage as a function of gate charge; typical values**



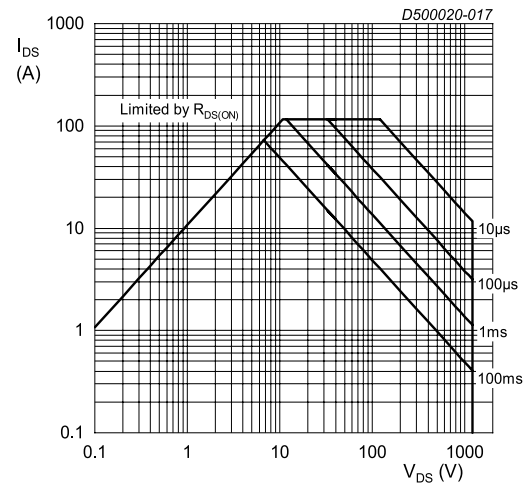
**Fig. 15. Output capacitor stored energy as a function of drain-source voltage**





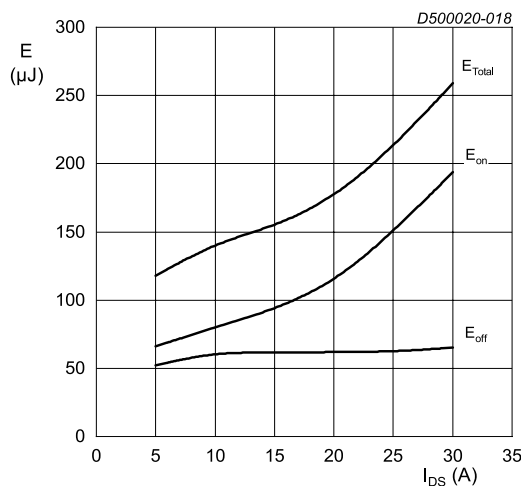
$V_{DS} = 0 - 1000$  V  
 $T_j = 25$  °C;  $V_{AC} = 25$  mV;  $f = 1$  MHz

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



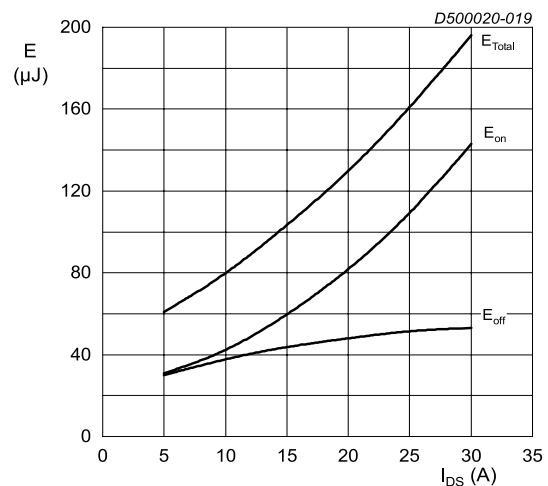
$T_j = 25$  °C;  $D = 0$   
 Parameter:  $t_p$

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



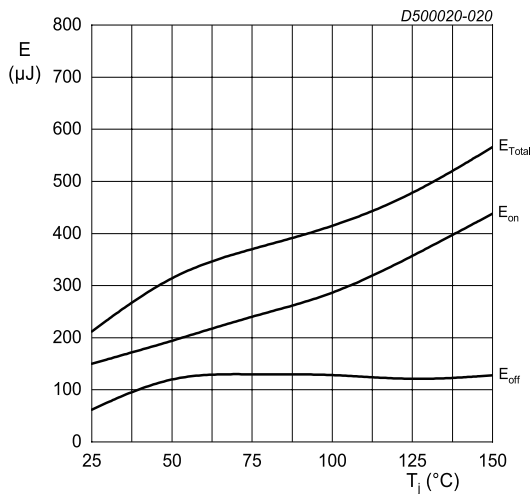
$T_j = 25$  °C;  $V_{DD} = 800$  V;  $R_{G(ext)} = 5.1$  Ω;  
 $V_{GS} = -4$  V/18 V;  $L = 330$  μH  
 FWD = WNSC2M60120B7

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



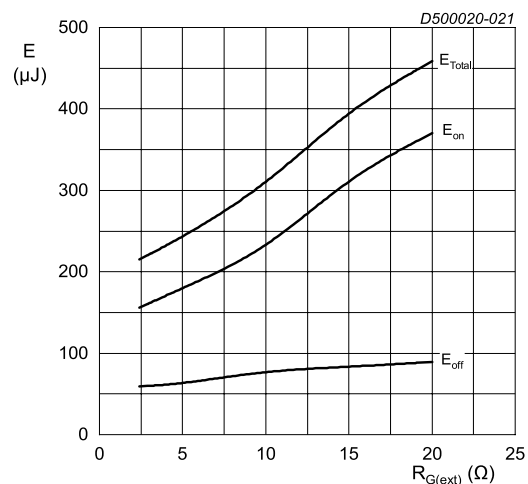
$T_j = 25$  °C;  $V_{DD} = 600$  V;  $R_{G(ext)} = 5.1$  Ω;  
 $V_{GS} = -4$  V/18 V;  $L = 330$  μH  
 FWD = WNSC2M60120B7

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



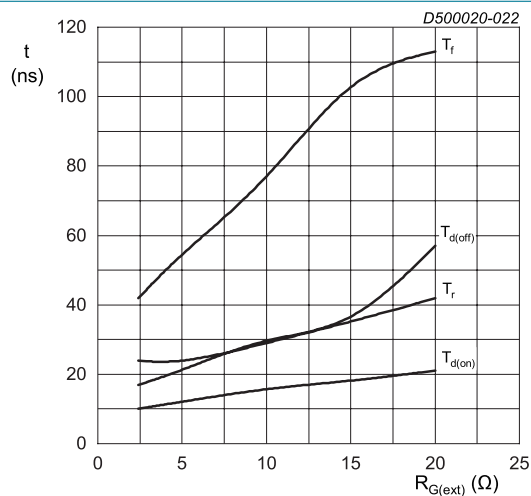
$I_{DS} = 25 \text{ A}$ ;  $V_{DD} = 800 \text{ V}$ ;  $R_{G(ext)} = 5.1 \text{ } \Omega$ ;  
 $V_{GS} = -4 \text{ V}/18 \text{ V}$ ;  $L = 330 \text{ } \mu\text{H}$   
 FWD = WNSC2M60120B7

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



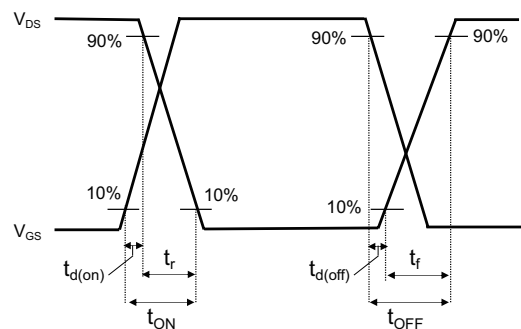
$T_j = 25\text{ }^{\circ}\text{C}$ ;  $V_{DD} = 800\text{ V}$ ;  $I_{DS} = 25\text{ A}$ ;  $V_{GS} = -4\text{ V}/18\text{ V}$   
FWD = WNSC2M60120B7;  $L = 330\text{ }\mu\text{H}$

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



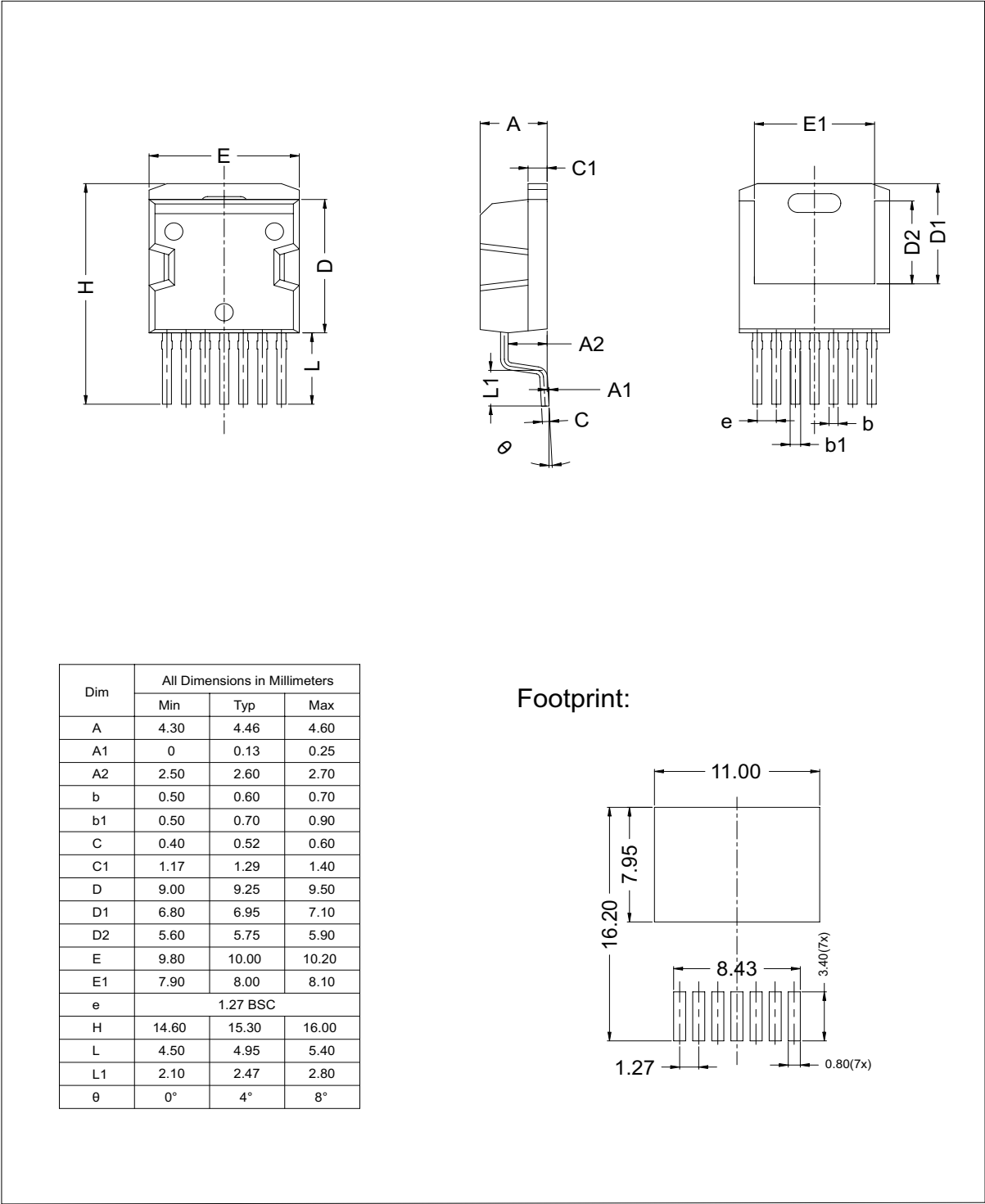
$T_j = 25\text{ }^\circ\text{C}$ ;  $V_{DD} = 800\text{ V}$ ;  $I_{DS} = 25\text{ A}$ ;  $V_{GS} = -4\text{ V}/18\text{ V}$   
FWD = WNSC2M60120B7;  $L = 330\text{ }\mu\text{H}$

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



### Fig. 23. Switching time definition

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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