

## 1. General description

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



AEC - Q101 Qualified



## 2. Features and benefits

- Kelvin source configuration
- Low specific on-resistance
- Optimized dynamic performance
- 0V turn-off  $V_{GS}$  for simple gate driving
- 100% UIS Tested
- Easy to parallel
- RoHS compliant
- Automotive Qualified (AEC-Q101)

## 3. Applications

- Automotive on board chargers
- Automotive DC-DC converters
- Automotive electric compressor motor drives
- HV battery management systems

## 4. Quick reference data

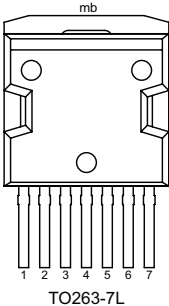
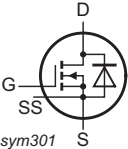
Table 1. Quick reference data

Table 17: Quick reference data

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		93			A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C, T <sub>j</sub> = 175 °C		417			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> = 40 A; T <sub>j</sub> = 25 °C		-	30	-	mΩ
		V <sub>GS</sub> = 18 V; I <sub>D</sub> = 40 A; T <sub>j</sub> = 25 °C		-	24	40	mΩ
Dynamic characteristics							
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = 40 A; V <sub>DS</sub> = 800 V; V <sub>GS</sub> = -4 V/18 V; T <sub>j</sub> = 25 °C		-	151	-	nC
Q <sub>GD</sub>	gate-drain charge			-	21	-	nC
Source-drain diode							
Q <sub>r</sub>	recovered charge	I <sub>SD</sub> = 40 A; di/dt = 500 A/μs; V <sub>DS</sub> = 400 V; T <sub>j</sub> = 25 °C		-	129	-	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
WNSC2M30120B7-A	TO263-7L	WNSC2M30120B7-A6J	Reel	800	TO263P-7L	05-Mar-2024

7. Marking

Table 4. Marking codes

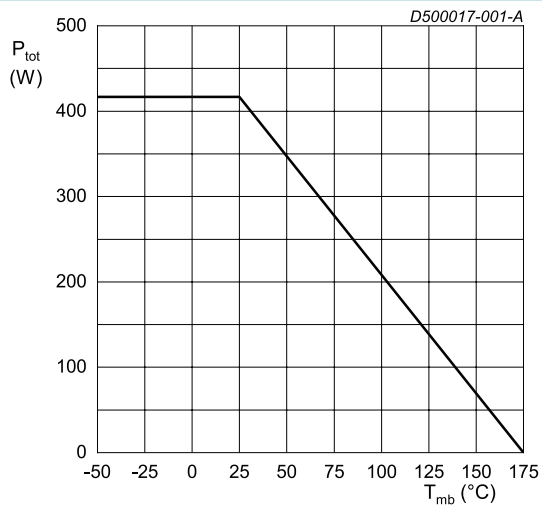
Type number	Marking codes
WNSC2M30120B7-A	WNSC2M 30120B7-A

## 8. Limiting values

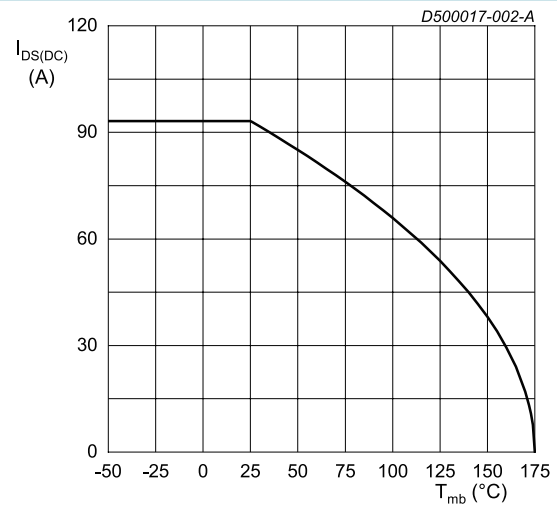
**Table 5. Limiting values**

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	Absolute maximum values		-10 to 22	V
$V_{GS,op}$	gate-source voltage	Recommended operational values		-4 to 18	V
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; $T_j = 175\text{ °C}$		417	W
$I_D$	drain current	$V_{GS} = 18\text{ V}$ ; $T_{mb} = 25\text{ °C}$		93	A
		$V_{GS} = 18\text{ V}$ ; $T_{mb} = 100\text{ °C}$		65	A
$I_{DM}$	peak drain current	pulse width $t_p$ limited by $T_{jmax}$	Fig.17	186	A
$I_S$	continuous diode current	$V_{GS} = -4\text{ V}$ ; $T_{mb} = 25\text{ °C}$		70	A
$I_{SM}$	pulse diode current	$V_{GS} = -4\text{ V}$ ; pulse width $t_p$ limited by $T_{jmax}$		186	A
$E_{as}$	single pulse drain-to-source avalanche	$I_{AS} = 20\text{ A}$ ; $L = 1\text{ mH}$ ; $V_{DD} = 100\text{ V}$ ; $T_j = 25\text{ °C}$		200	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			-	0.36	-	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	40	-	K/W

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.

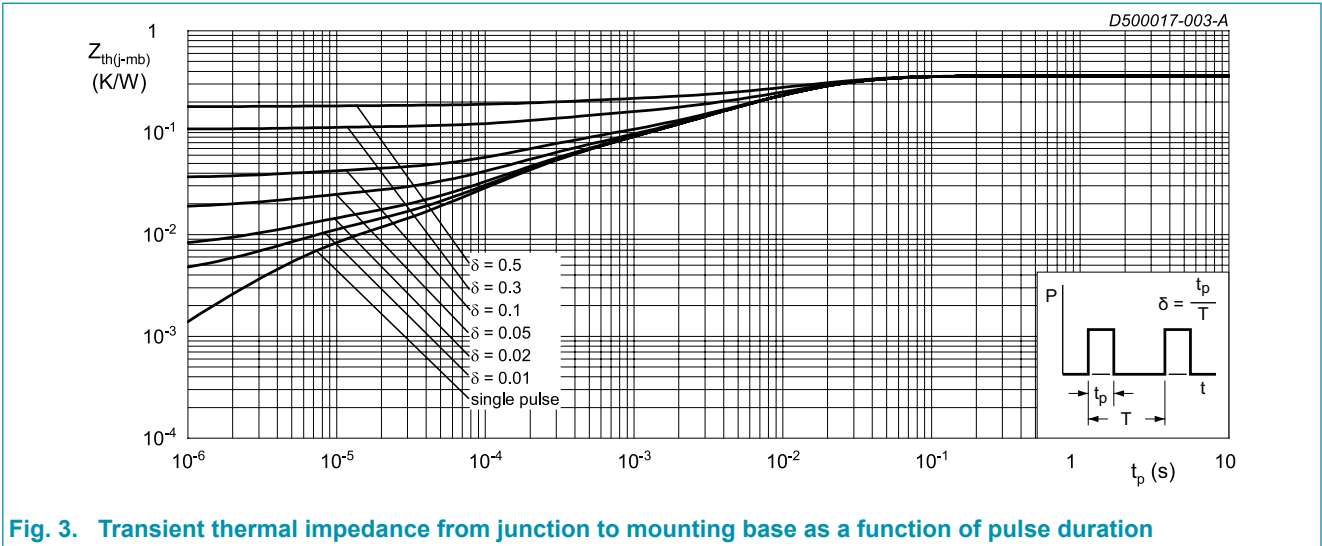
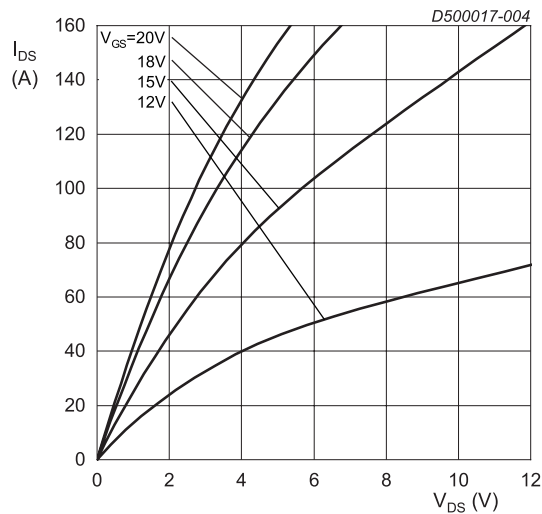


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

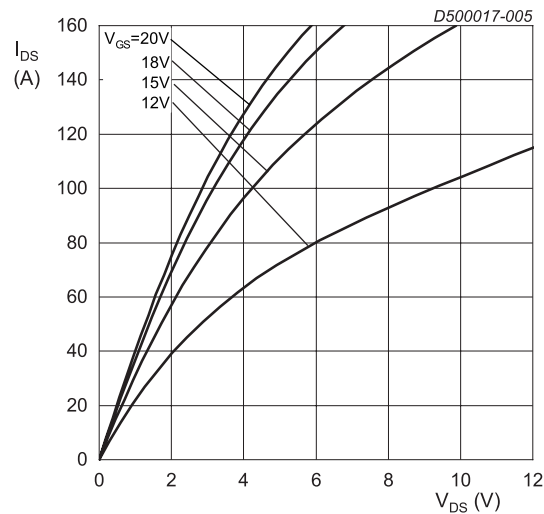
## 10. Characteristics

Table 7. Characteristics

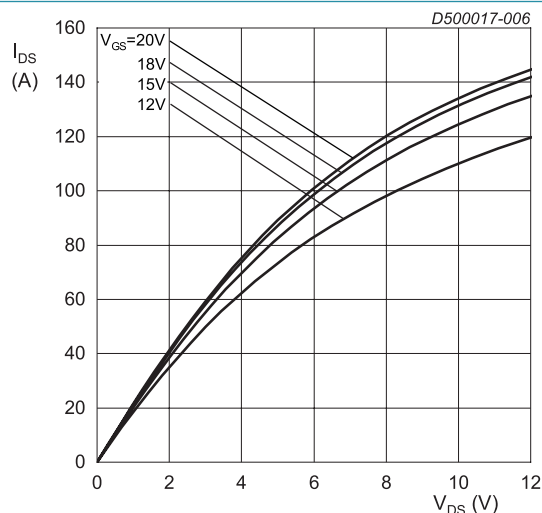
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 100 \mu A$ ; $V_{GS} = 0 V$ ; $T_J = 25^\circ C$		1200	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 12 mA$ ; $V_{DS} = 10 V$ ; $T_J = 25^\circ C$		1.9	2.6	3.5	V
		$I_D = 12 mA$ ; $V_{DS} = 10 V$ ; $T_J = 175^\circ C$		-	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	$V_{GS} = 22 V$ ; $V_{DS} = 0 V$ ; $T_J = 25^\circ C$		-	10	100	nA
		$V_{GS} = -10 V$ ; $V_{DS} = 0 V$ ; $T_J = 25^\circ C$		-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15 V$ ; $I_D = 40 A$ ; $T_J = 25^\circ C$		-	30	-	m $\Omega$
		$V_{GS} = 18 V$ ; $I_D = 40 A$ ; $T_J = 25^\circ C$		-	24	40	m $\Omega$
		$V_{GS} = 18 V$ ; $I_D = 40 A$ ; $T_J = 175^\circ C$		-	48	-	m $\Omega$
$R_G$	gate resistance	$f = 1 MHz$ ; $T_J = 25^\circ C$		-	0.8	-	$\Omega$
$g_{fs}$	transconductance	$V_{DS} = 20 V$ ; $I_D = 40 A$ ; $T_J = 25^\circ C$		-	27	-	S
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$I_D = 40 A$ ; $V_{DS} = 800 V$ ; $V_{GS} = -4 V/18 V$ ; $T_J = 25^\circ C$		-	151	-	nC
$Q_{GS}$	gate-source charge			-	63	-	nC
$Q_{GD}$	gate-drain charge			-	21	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 1000 V$ ; $V_{GS} = 0 V$ ; $f = 1 MHz$ ; $T_J = 25^\circ C$		-	3305	-	pF
$C_{oss}$	output capacitance			-	139	-	pF
$C_{rss}$	reverse transfer capacitance			-	12	-	pF
$E_{oss}$	Coss stored energy			-	70	-	$\mu J$
$t_{d(on)}$	turn-on delay time	$V_{DS} = 800 V$ ; $V_{GS} = -4 V/18 V$ ; $R_{G(ext)} = 3.6 \Omega$ ; $I_D = 40 A$ ; $L = 330 \mu H$ ; $T_J = 25^\circ C$		-	14	-	ns
$t_r$	rise time			-	27	-	ns
$t_{d(off)}$	turn-off delay time			-	43	-	ns
$t_f$	fall time			-	50	-	ns
$E_{on}$	turn-on energy (Body Diode FWD)		Fig.20	-	260	-	$\mu J$
$E_{off}$	turn-off energy (Body Diode FWD)		Fig.20	-	156	-	$\mu J$
<b>Source-drain diode</b>							
$V_{SD}$	source-drain voltage	$V_{GS} = 0 V$ ; $I_{SD} = 20 A$ ; $T_J = 25^\circ C$		-	3.2	-	V
		$V_{GS} = -4 V$ ; $I_{SD} = 20 A$ ; $T_J = 25^\circ C$		-	4.8	-	V
		$V_{GS} = -4 V$ ; $I_{SD} = 20 A$ ; $T_J = 175^\circ C$		-	4.2	-	V
$t_{rr}$	reverse recovery time	$I_{SD} = 40 A$ ; $di/dt = 500 A/\mu s$ ; $V_{DS} = 400 V$ ; $T_J = 25^\circ C$		-	34	-	ns
$Q_r$	recovered charge			-	129	-	nC
$I_{rrm}$	reverse recovery current			-	6.9	-	A



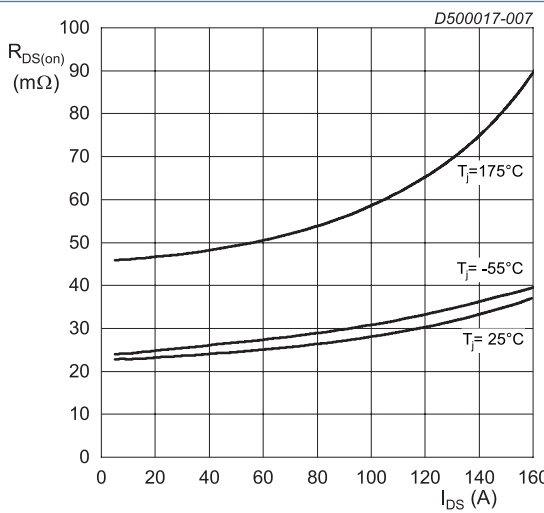
$T_j = -55\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values**



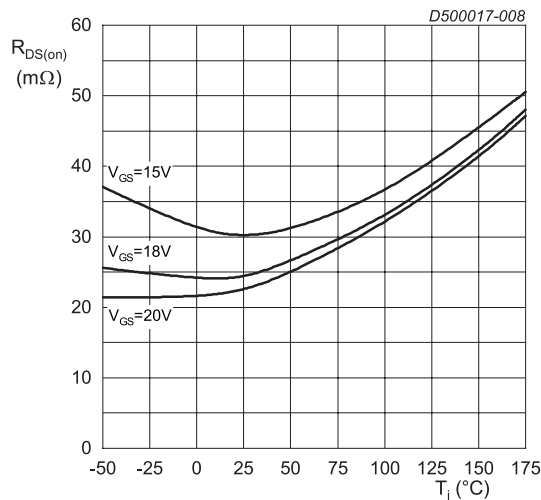
$T_j = 25\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values**



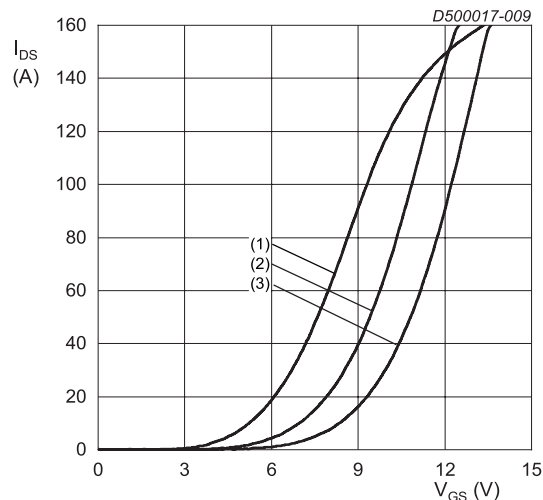
$T_j = 175\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values**



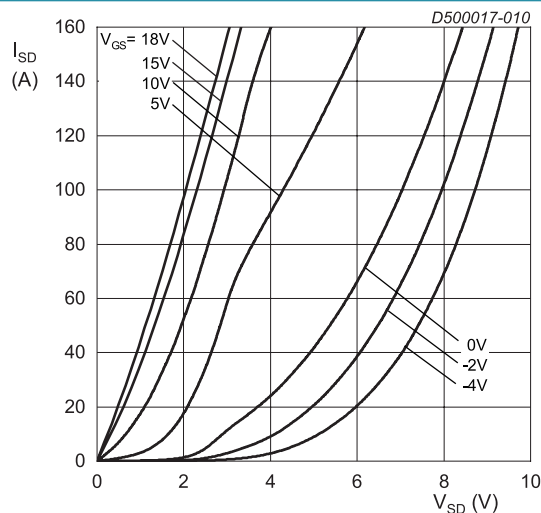
$V_{GS} = 18\text{ V}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 7. Drain-source on-state resistance as a function of drain current; typical values**



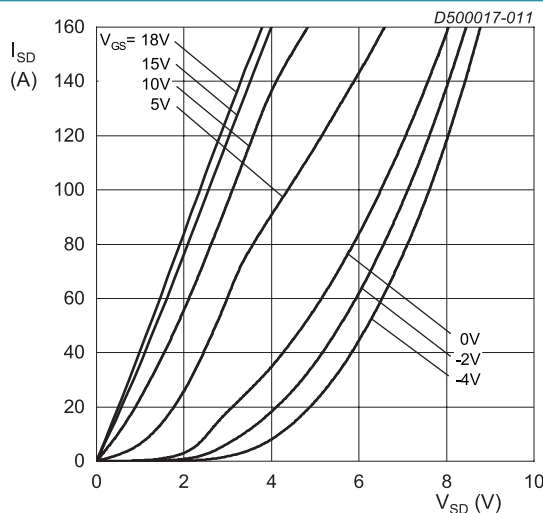
$I_{DS} = 40\text{ A}; t_p < 200\text{ }\mu\text{s}$   
**Fig. 8. Drain-source on-state resistance as a function of junction temperature**



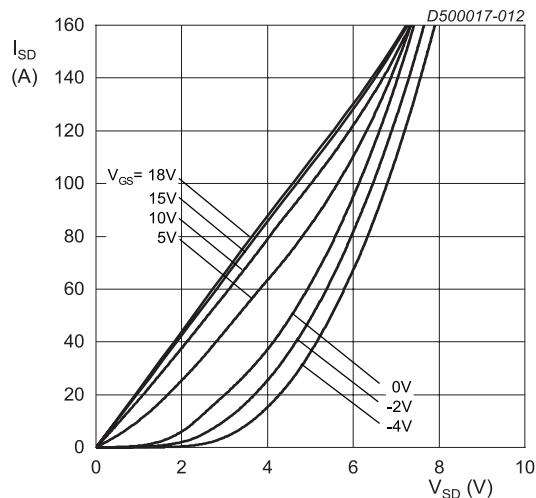
$V_{DS} = 20\text{ V}; t_p < 200\text{ }\mu\text{s}$   
(1)  $T_j = 175\text{ }^\circ\text{C}$   
(2)  $T_j = 25\text{ }^\circ\text{C}$   
(3)  $T_j = -55\text{ }^\circ\text{C}$   
**Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values**



$T_j = -55\text{ }^\circ\text{C}; t_p < 200\text{ }\mu\text{s}$   
**Fig. 10. Body diode forward characteristics; typical values**

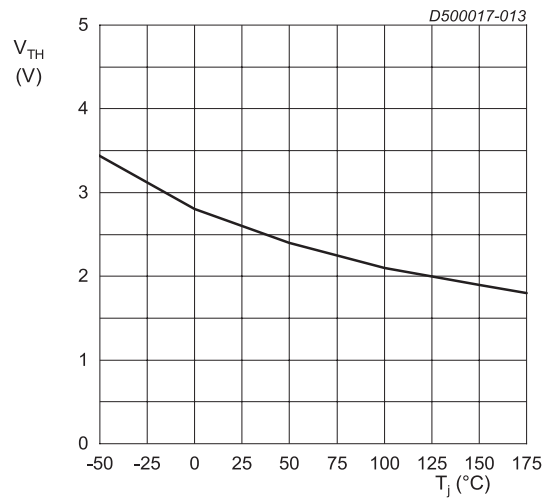


$T_j = 25\text{ }^\circ\text{C}; t_p < 200\text{ }\mu\text{s}$   
**Fig. 11. Body diode forward characteristics; typical values**



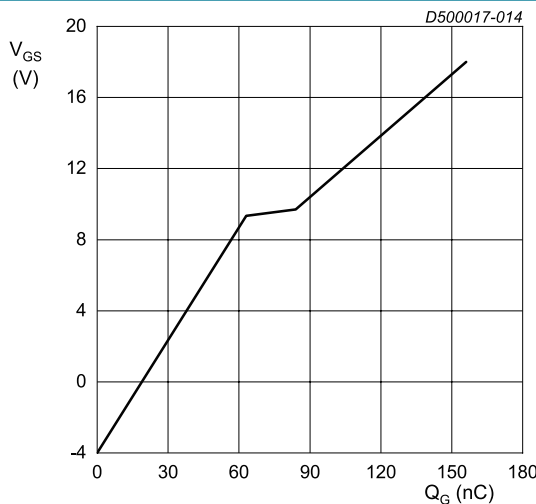
$T_j = 175\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$

Fig. 12. Body diode forward characteristics; typical values



$V_{DS} = 10\text{ V}$ ;  $I_{DS} = 12\text{ mA}$

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



$I_{DS} = 40\text{ A}$ ;  $I_{GS} = 0.1\text{ mA}$ ;  $V_{DS} = 800\text{ V}$ ;  $T_j = 25\text{ }^{\circ}\text{C}$

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

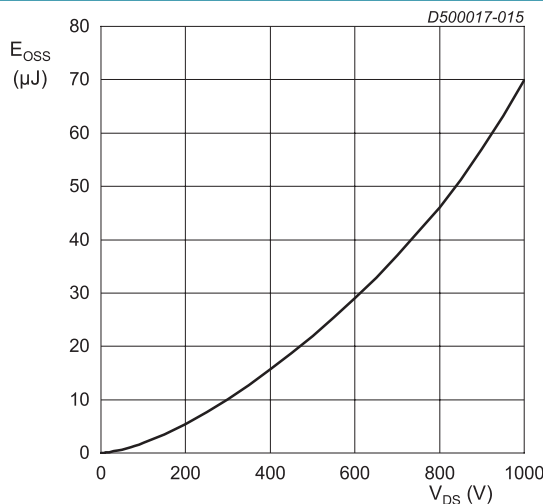
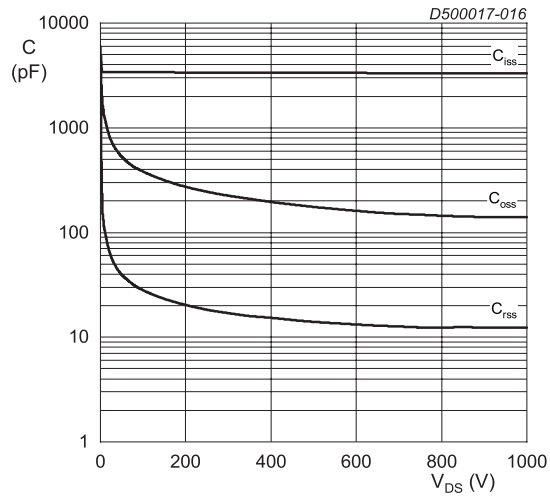


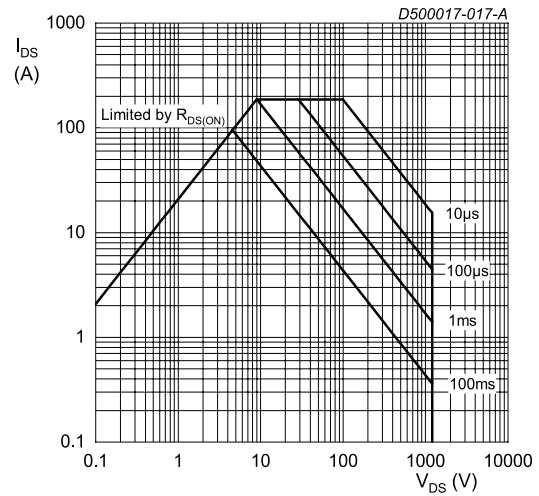
Fig. 15. Output capacitor stored energy as a function of drain-source voltage





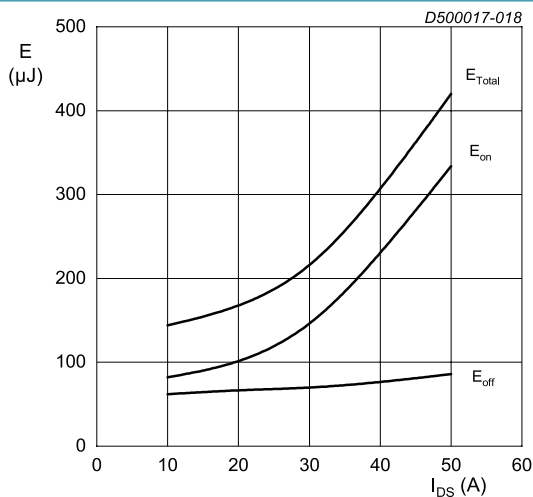
$V_{DS} = 0 - 1000 \text{ V}$   
 $T_j = 25^\circ\text{C}$ ;  $V_{AC} = 25 \text{ mV}$ ;  $f = 1 \text{ MHz}$

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



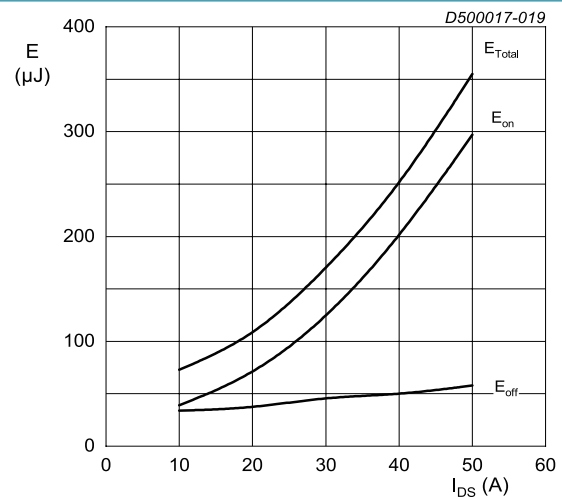
$T_j = 25^\circ\text{C}$ ;  $D = 0$   
 Parameter:  $t_p$

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



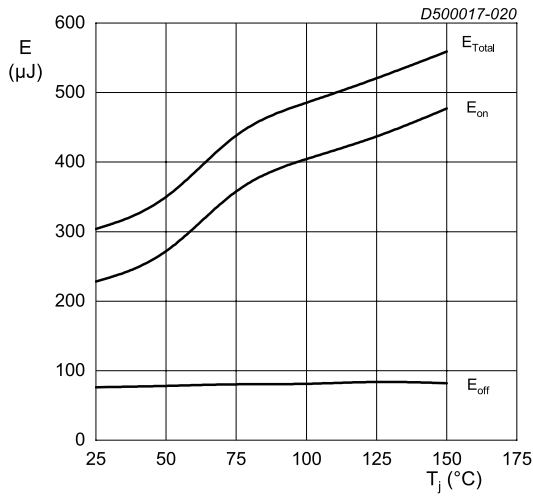
$T_j = 25^\circ\text{C}$ ;  $V_{DD} = 800 \text{ V}$ ;  $R_{G(ext)} = 3.6 \Omega$ ;  
 $V_{GS} = -4 \text{ V}/18 \text{ V}$ ;  $L = 330 \mu\text{H}$   
 FWD = WNSC2M30120B7-A

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



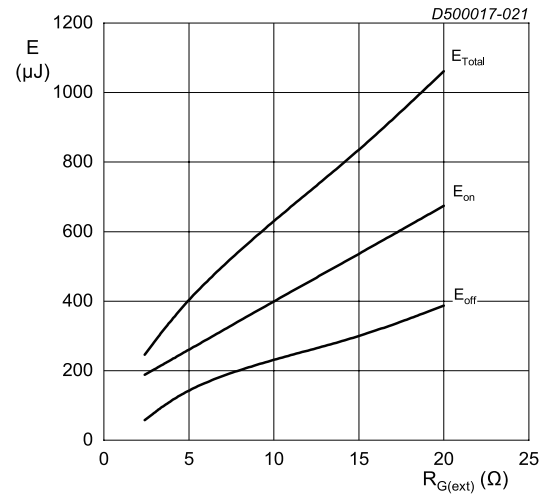
$T_j = 25^\circ\text{C}$ ;  $V_{DD} = 600 \text{ V}$ ;  $R_{G(ext)} = 3.6 \Omega$ ;  
 $V_{GS} = -4 \text{ V}/18 \text{ V}$ ;  $L = 330 \mu\text{H}$   
 FWD = WNSC2M30120B7-A

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



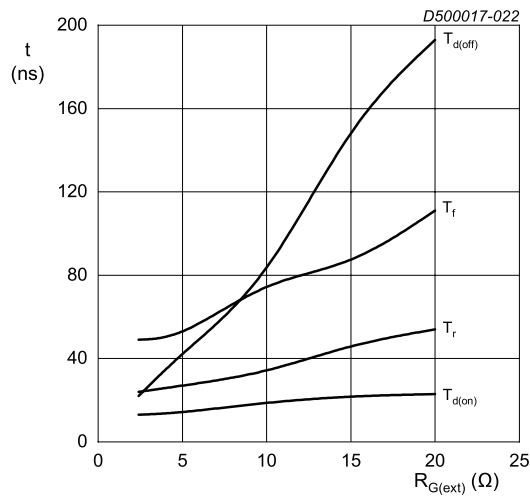
$I_{DS} = 40$  A;  $V_{DD} = 800$  V;  $R_{G(ext)} = 3.6$  Ω;  
 $V_{GS} = -4$  V/18 V;  $L = 330$  μH  
 FWD = WNSC2M30120B7-A

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



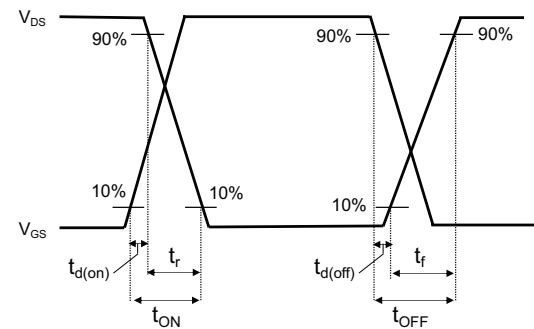
$T_j = 25$  °C;  $V_{DD} = 800$  V;  $I_{DS} = 40$  A;  $V_{GS} = -4$  V/18 V  
 FWD = WNSC2M30120B7-A;  $L = 330$  μH

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



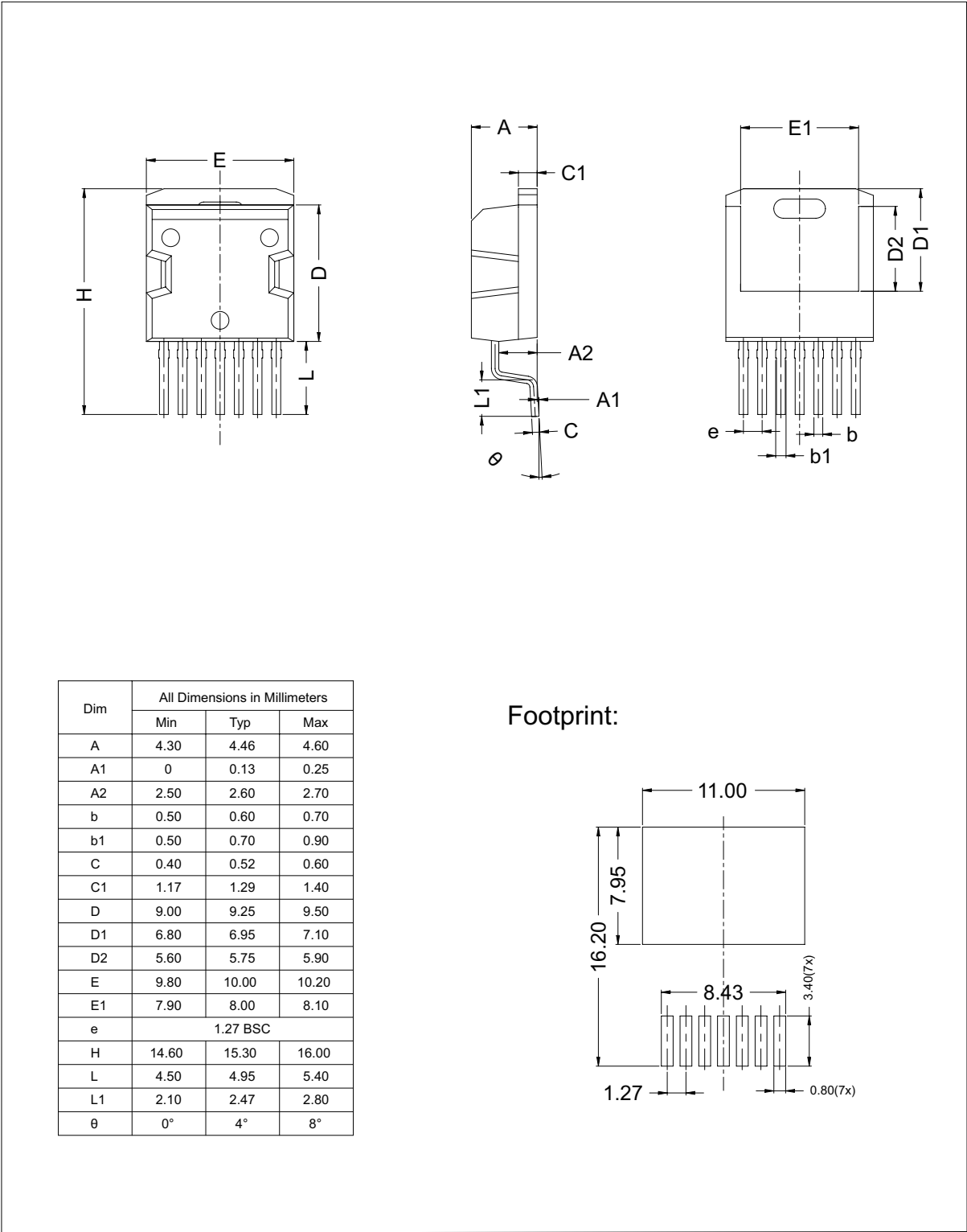
$T_j = 25$  °C;  $V_{DD} = 800$  V;  $I_{DS} = 40$  A;  $V_{GS} = -4$  V/18 V  
 FWD = WNSC2M30120B7-A;  $L = 330$  μH

**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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