

## 1. General description

Silicon Carbide MOSFET in a TSPAK plastic package with top side cooling structure, designed for high frequency, high efficiency systems.



## 2. Features and benefits

- Automotive Qualified (AEC-Q101)
- Reduced cooling requirements
- Low on-resistance
- Fast switching speed
- 0V turn-off gate voltage for simple gate driver
- 100% UIS Tested
- Easy to parallel
- Controllable dV/dt for optimized EMI
- RoHS compliant



## 3. Applications

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

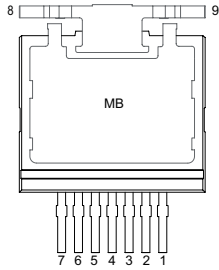
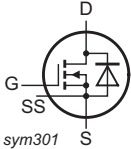
## 4. Quick reference data

Table 1. Quick reference data

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		96.8			A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C, T <sub>j</sub> = 175 °C		540			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>i</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		
8-9 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
WNSC2M30120TB-A	TSPAK	WNSC2M30120TB-A6J	Reel	600	TSPAKH	06-Dec-2024

7. Marking

Table 4. Marking codes

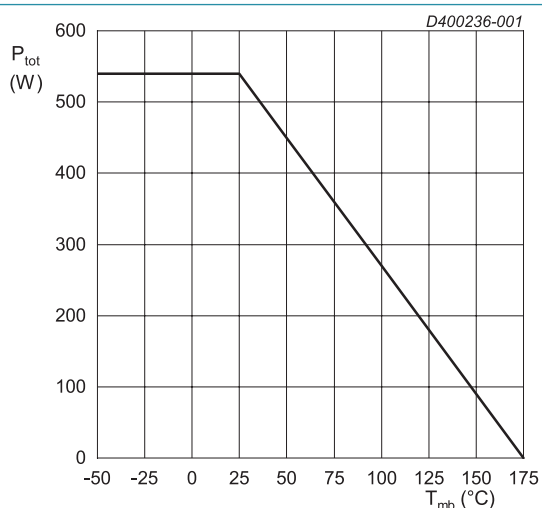
Type number	Marking codes
WNSC2M30120TB-A	WNSC2M 30120TB-A

## 8. Limiting values

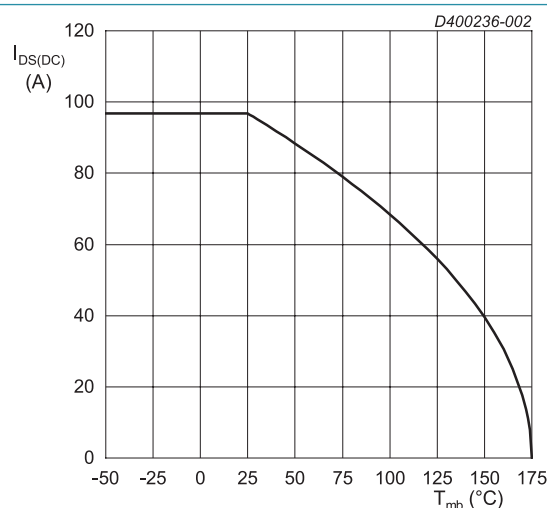
**Table 5. Limiting values**

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	$T_{mb} = 25\text{ °C}$ ; $T_j = 175\text{ °C}$		540	W
$I_D$	drain current	$V_{GS} = 18\text{ V}$ ; $T_{mb} = 25\text{ °C}$		96.8	A
		$V_{GS} = 18\text{ V}$ ; $T_{mb} = 100\text{ °C}$		68.4	A
$I_{DM}$	peak drain current	pulse width $t_p$ limited by $T_{jmax}$	Fig.17	190	A
$I_S$	continuous diode current	$V_{GS} = -4\text{ V}$ ; $T_{mb} = 25\text{ °C}$		73.1	A
$I_{SM}$	pulse diode current	$V_{GS} = -4\text{ V}$ ; pulse width $t_p$ limited by $T_{jmax}$		190	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			-	0.28	-	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	40	-	K/W

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

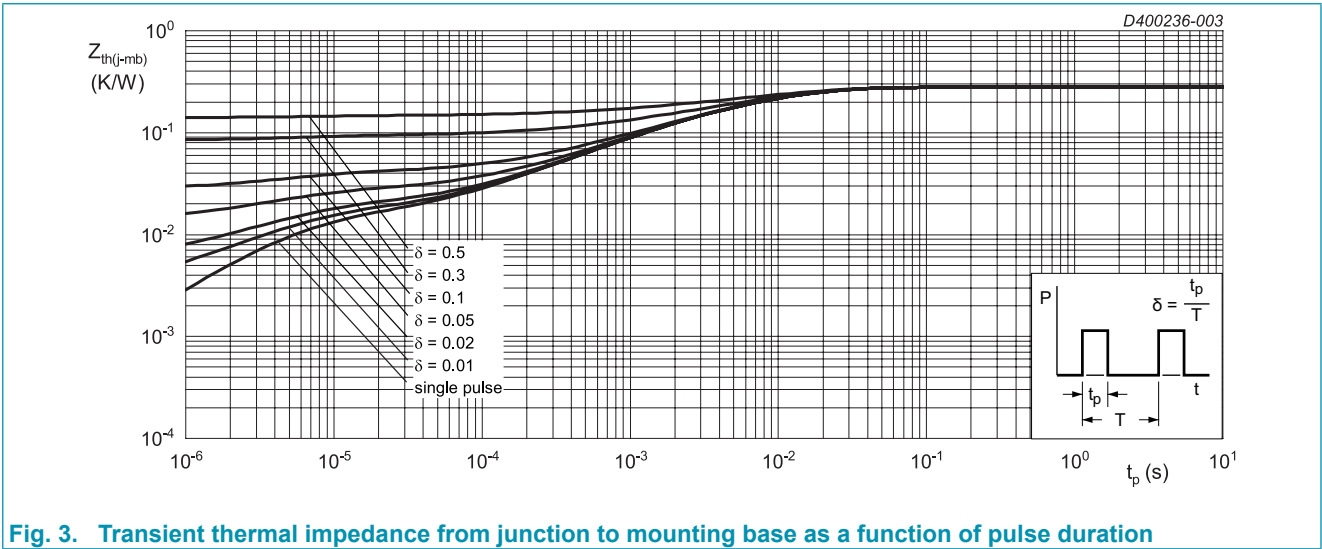
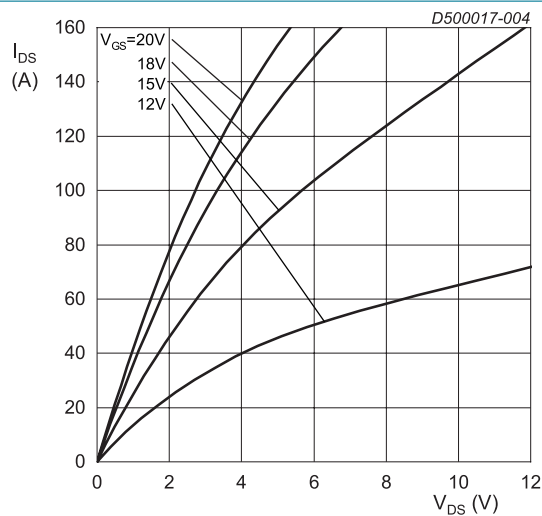


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

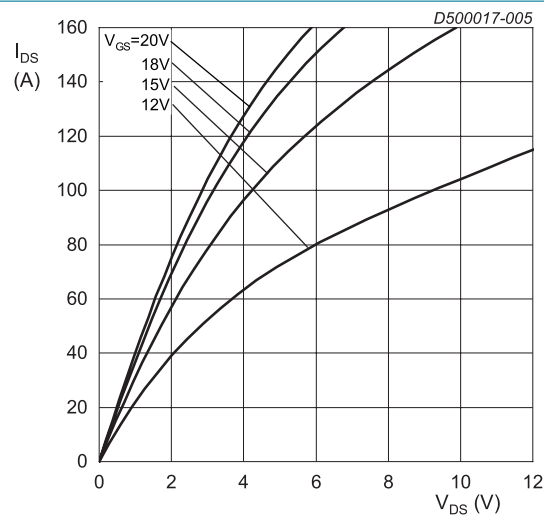
## 10. Characteristics

Table 7. Characteristics

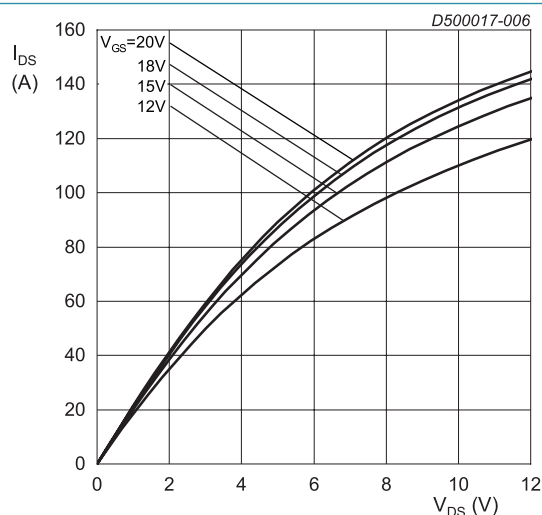
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 100 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C		1200	-	-	V
V <sub>GS(th)</sub>	gate-source threshold voltage	I <sub>D</sub> = 12 mA; V <sub>DS</sub> = 10 V; T <sub>J</sub> = 25 °C		1.9	2.6	3.5	V
		I <sub>D</sub> = 12 mA; V <sub>DS</sub> = 10 V; T <sub>J</sub> = 175 °C		-	1.9	-	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 1200 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C		-	0.2	100	μA
		V <sub>DS</sub> = 1200 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 175 °C		-	2	-	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 22 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C		-	10	100	nA
		V <sub>GS</sub> = -10 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C		-	10	100	nA
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
		V <sub>GS</sub> = 18 V; I <sub>D</sub> = 40 A; T <sub>J</sub> = 175 °C		-	48	-	mΩ
R <sub>G</sub>	gate resistance	f = 1 MHz; T <sub>J</sub> = 25 °C		-	0.8	-	Ω
g <sub>fs</sub>	transconductance	V <sub>DS</sub> = 20 V; I <sub>D</sub> = 40 A; T <sub>J</sub> = 25 °C		-	27	-	S
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>GS</sub>	gate-source charge			-	63	-	nC
Q <sub>GD</sub>	gate-drain charge			-	21	-	nC
C <sub>iss</sub>	input capacitance	V <sub>DS</sub> = 1000 V; V <sub>GS</sub> = 0 V; f = 1 MHz; T <sub>J</sub> = 25 °C		-	3305	-	pF
C <sub>oss</sub>	output capacitance			-	139	-	pF
C <sub>rss</sub>	reverse transfer capacitance			-	12	-	pF
E <sub>oss</sub>	Coss stored energy			-	69.5	-	μJ
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 800 V; V <sub>GS</sub> = -4 V/18 V; R <sub>G(ext)</sub> = 5.1 Ω; I <sub>D</sub> = 40 A; L = 100 μH; T <sub>J</sub> = 25 °C		-	27	-	ns
t <sub>r</sub>	rise time			-	34	-	ns
t <sub>d(off)</sub>	turn-off delay time			-	51	-	ns
t <sub>f</sub>	fall time			-	14	-	ns
E <sub>on</sub>	turn-on energy <sup>(Sic Diode FWD)</sup>		Fig.20	-	552	-	μJ
E <sub>off</sub>	turn-off energy <sup>(Sic Diode FWD)</sup>		Fig.20	-	162	-	μJ
E <sub>on</sub>	turn-on energy <sup>(Body Diode FWD)</sup>		Fig.20	-	671	-	μJ
E <sub>off</sub>	turn-off energy <sup>(Body Diode FWD)</sup>		Fig.20	-	154	-	μJ
Source-drain diode							
V <sub>SD</sub>	source-drain voltage	V <sub>GS</sub> = 0 V; I <sub>SD</sub> = 20 A; T <sub>J</sub> = 25 °C		-	3.2	-	V
		V <sub>GS</sub> = -4 V; I <sub>SD</sub> = 20 A; T <sub>J</sub> = 25 °C		-	4.8	-	V
		V <sub>GS</sub> = -4 V; I <sub>SD</sub> = 20 A; T <sub>J</sub> = 175 °C		-	4.2	-	V
t <sub>rr</sub>	reverse recovery time	I <sub>SD</sub> = 40 A; di/dt = 500 A/μs; V <sub>DS</sub> = 400 V; T <sub>J</sub> = 25 °C		-	33.4	-	ns
Q <sub>r</sub>	recovered charge			-	129	-	nC
I <sub>rrm</sub>	reverse recovery current			-	6.9	-	A



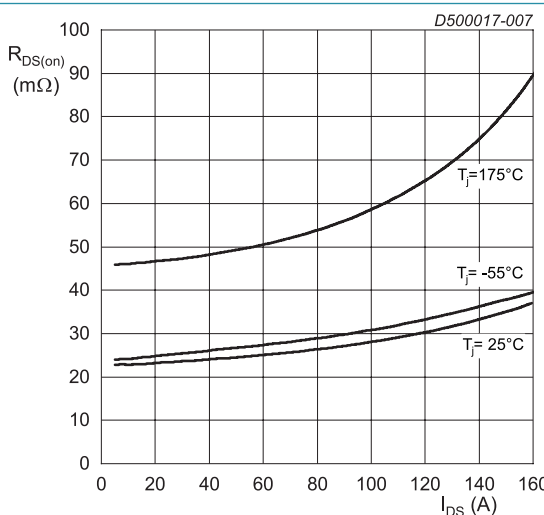
$T_j = -55\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values**



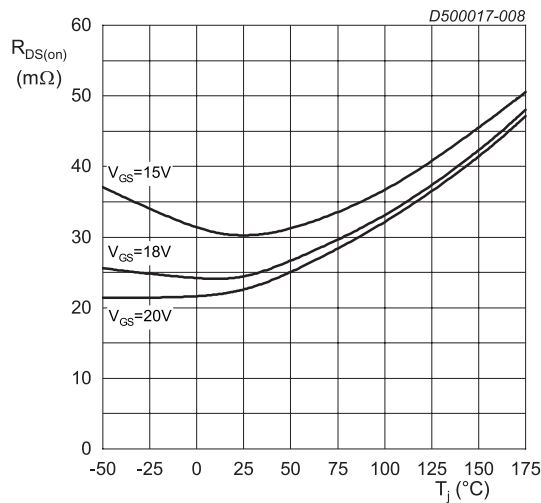
$T_j = 25\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values**



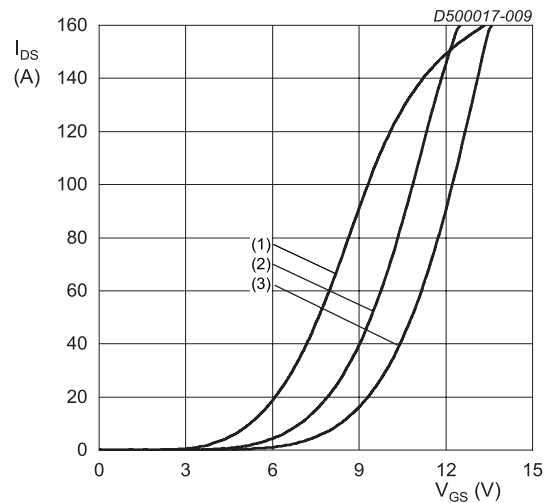
$T_j = 175\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values**



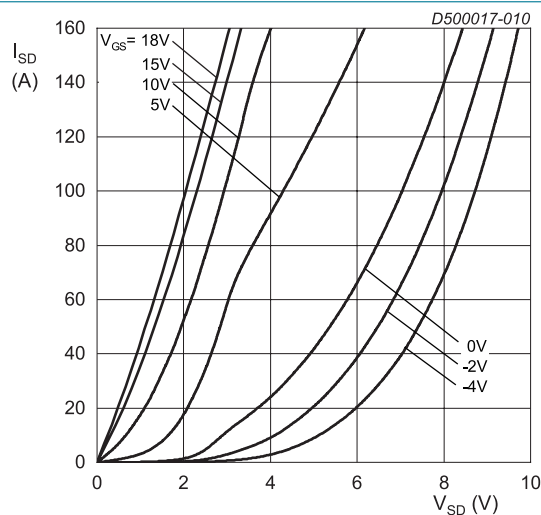
$V_{GS} = 18\text{ V}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 7. Drain-source on-state resistance as a function of drain current; typical values**



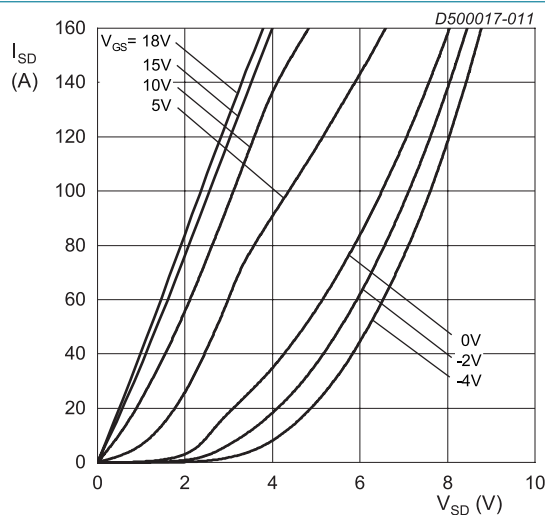
$I_{DS} = 40\text{ A}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 8. Drain-source on-state resistance as a function of junction temperature**



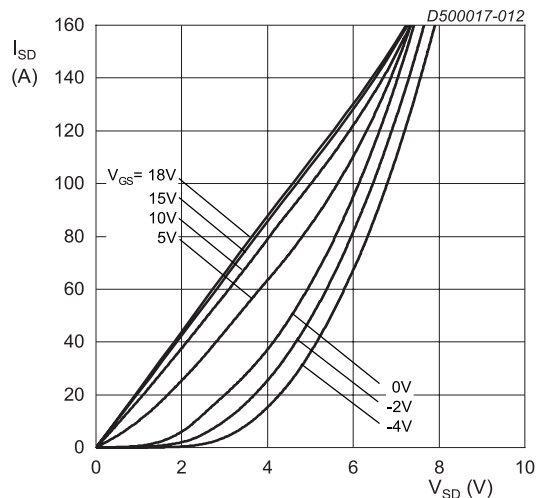
$V_{DS} = 20\text{ V}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values**



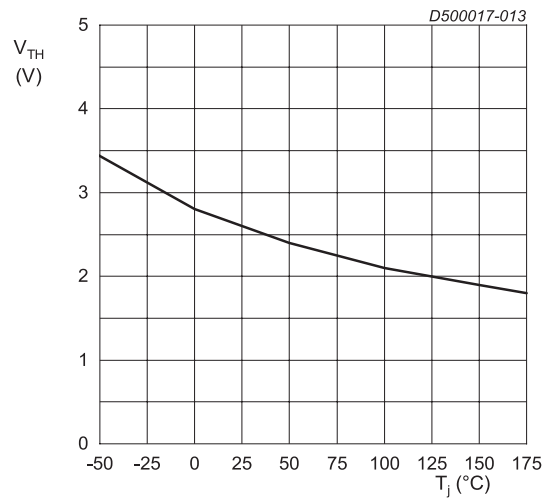
$T_j = -55\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 10. Body diode forward characteristics; typical values**



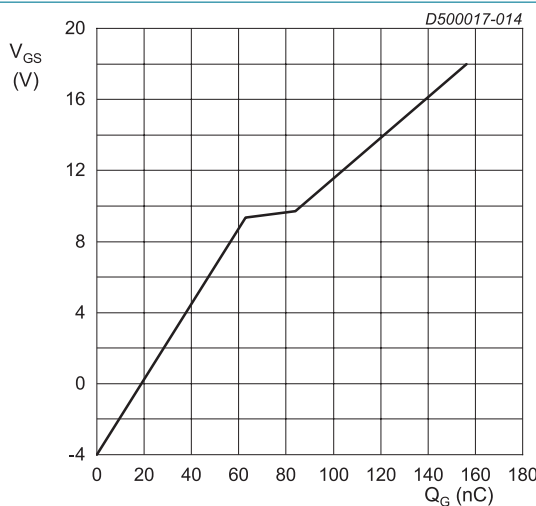
$T_j = 25\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 11. Body diode forward characteristics; typical values**



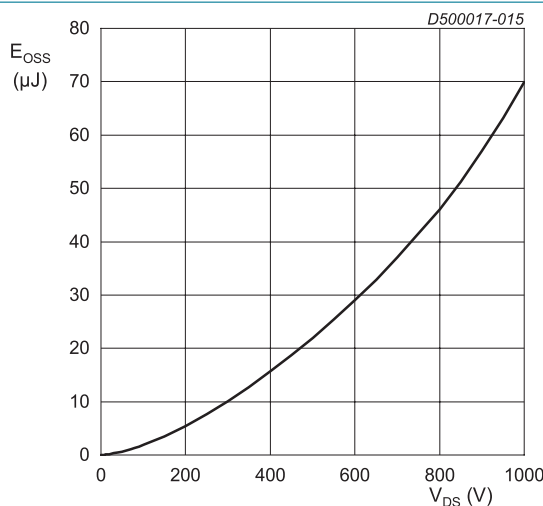
$T_j = 175\text{ }^{\circ}\text{C}$ ;  $t_p < 200\text{ }\mu\text{s}$   
**Fig. 12. Body diode forward characteristics; typical values**



$V_{DS} = 10\text{ V}$ ;  $I_{DS} = 12\text{ mA}$   
**Fig. 13. Threshold voltage as a function of junction temperature**

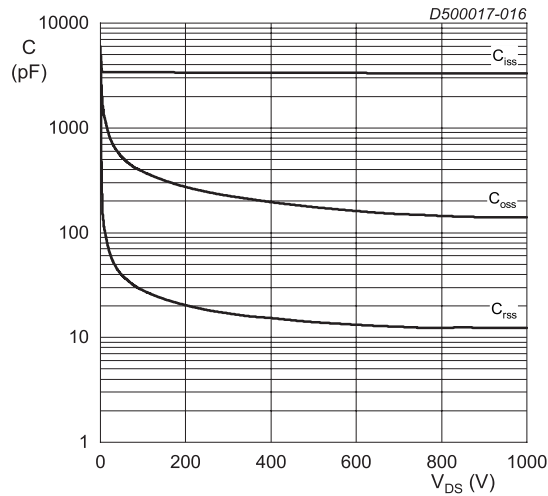


$I_{DS} = 40\text{ A}$ ;  $I_{GS} = 0.1\text{ mA}$ ;  $V_{DS} = 800\text{ V}$ ;  $T_j = 25\text{ }^{\circ}\text{C}$   
**Fig. 14. Gate-source voltage as a function of gate charge; typical values**



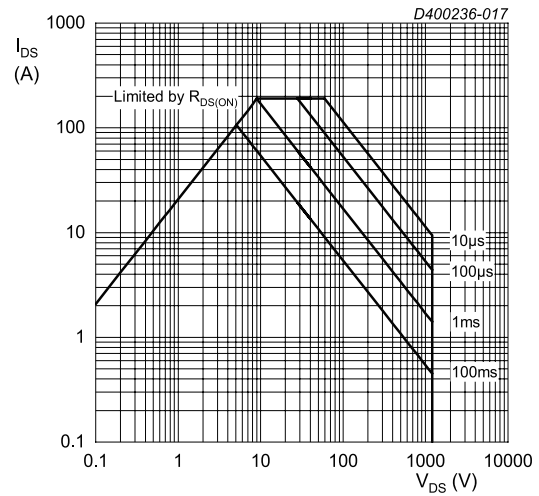
**Fig. 15. Output capacitor stored energy as a function of drain-source voltage**





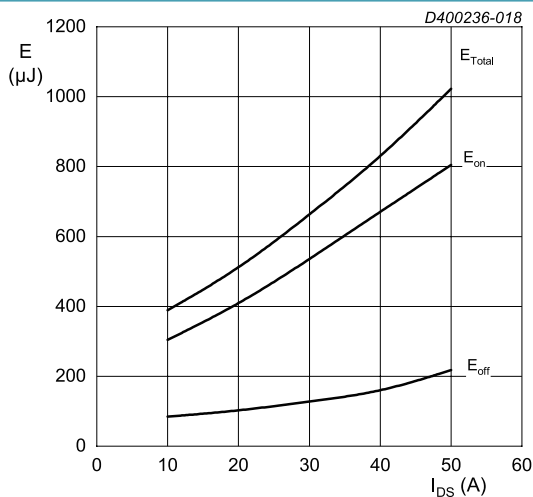
$V_{DS} = 0 - 1000 \text{ V}$   
 $T_j = 25^\circ\text{C}$ ;  $V_{AC} = 25 \text{ mV}$ ;  $f = 1 \text{ MHz}$

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



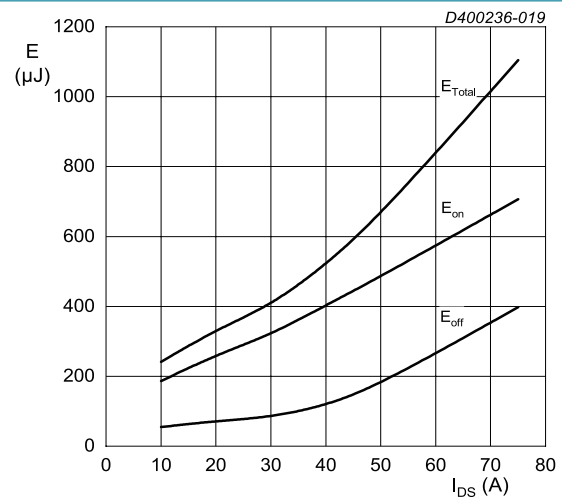
$T_j = 25^\circ\text{C}$ ;  $D = 0$   
 Parameter:  $t_p$

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



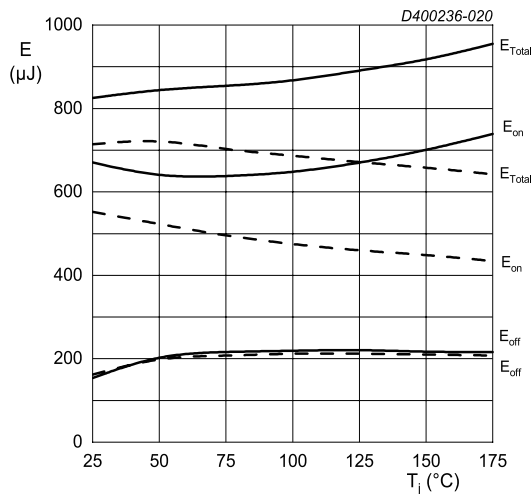
$T_j = 25^\circ\text{C}$ ;  $V_{DD} = 800 \text{ V}$ ;  $R_{G(ext)} = 5.1 \Omega$ ;  
 $V_{GS} = -4 \text{ V}/18 \text{ V}$ ;  $L = 100 \mu\text{H}$   
 FWD = WNSC2M30120TB-A

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



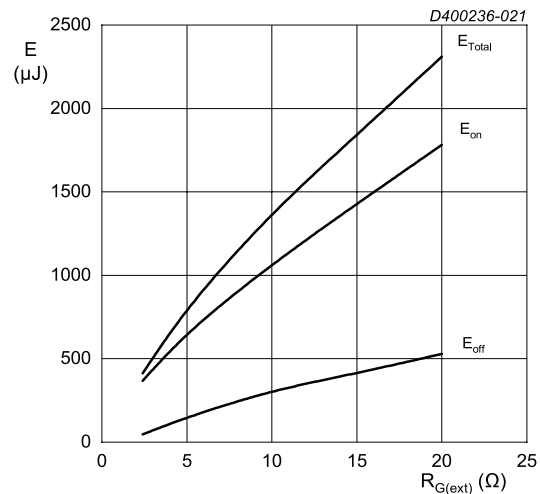
$T_j = 25^\circ\text{C}$ ;  $V_{DD} = 600 \text{ V}$ ;  $R_{G(ext)} = 5.1 \Omega$ ;  
 $V_{GS} = -4 \text{ V}/18 \text{ V}$ ;  $L = 100 \mu\text{H}$   
 FWD = WNSC2M30120TB-A

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



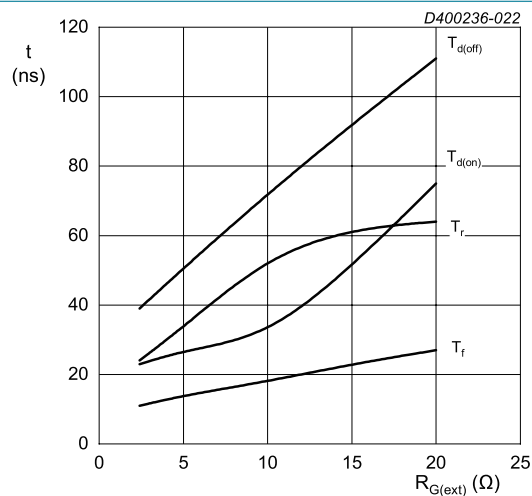
$I_{\text{DS}} = 40 \text{ A}$ ;  $V_{\text{DD}} = 800 \text{ V}$ ;  $R_{\text{G(ext)}} = 5.1 \Omega$ ;  
 $V_{\text{GS}} = -4 \text{ V/18 V}$ ;  $L = 100 \mu\text{H}$   
FWD = WNSC2M30120TB-A

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



$T_j = 25 \text{ }^{\circ}\text{C}$ ;  $V_{\text{DD}} = 800 \text{ V}$ ;  $I_{\text{DS}} = 40 \text{ A}$ ;  $V_{\text{GS}} = -4 \text{ V/18 V}$   
FWD = WNSC2M30120TB-A;  $L = 100 \mu\text{H}$

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



$T_j = 25 \text{ }^{\circ}\text{C}$ ;  $V_{\text{DD}} = 800 \text{ V}$ ;  $I_{\text{DS}} = 40 \text{ A}$ ;  $V_{\text{GS}} = -4 \text{ V/18 V}$   
FWD = WNSC2M30120TB-A;  $L = 100 \mu\text{H}$

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

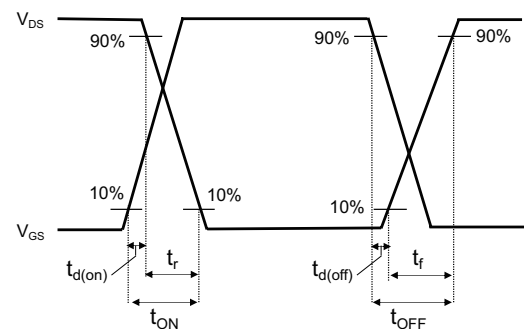
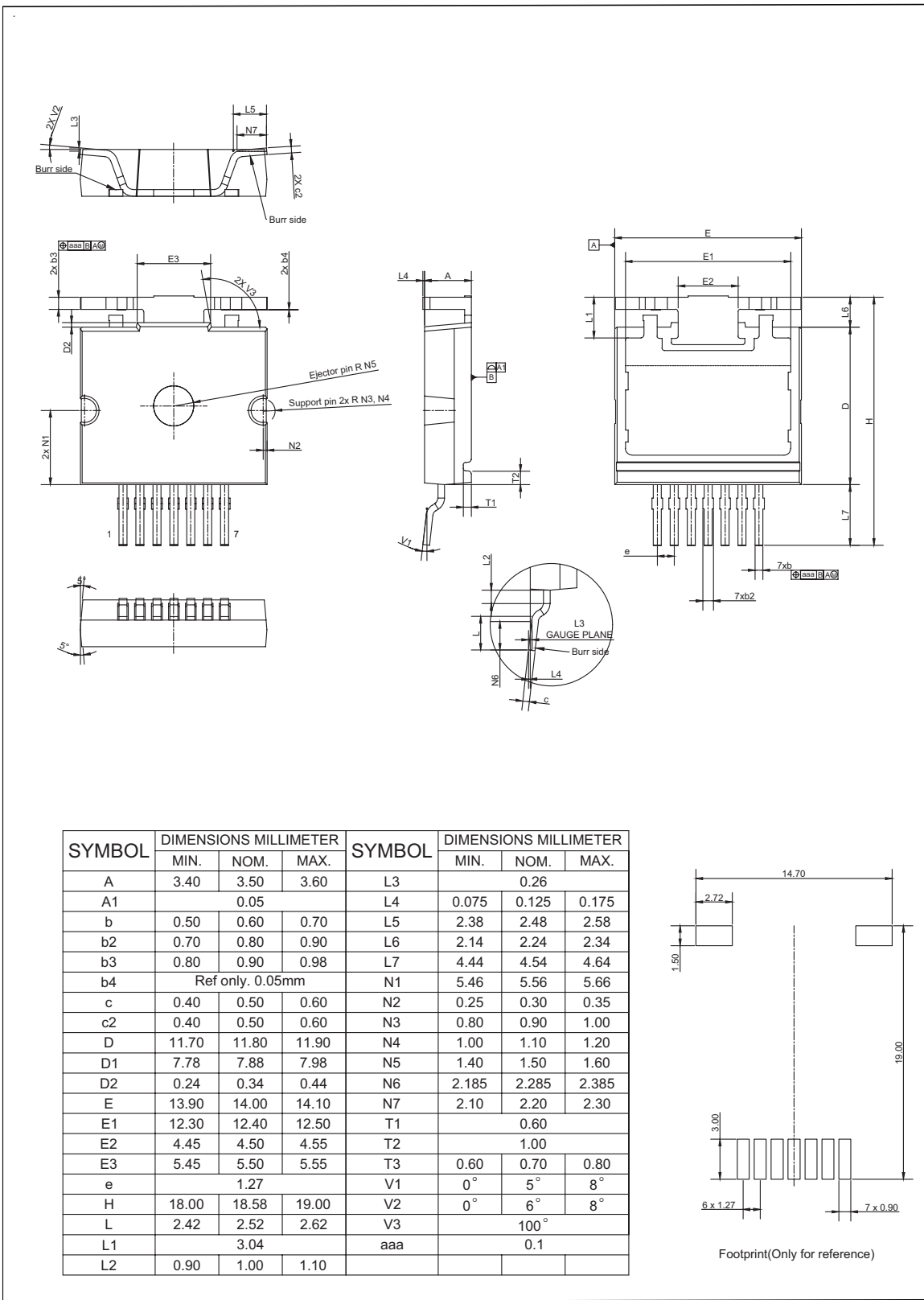


Fig. 23. Switching time definition

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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.ween-semi.com>.

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**Limiting values** — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

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