

1. General description

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



AEC - Q101 Qualified



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

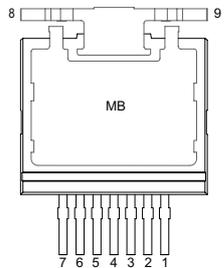
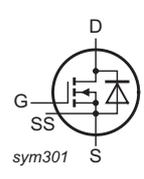
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
Absolute maximum rating							
V_{DS}	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$		1200			V
I_D	drain current	$V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$		24.6			A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}, T_j = 175\text{ °C}$		169			W
T_j	junction temperature			-55 to 175			°C
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15\text{ V}; I_D = 10\text{ A}; T_j = 25\text{ °C}$		-	150	-	mΩ
		$V_{GS} = 18\text{ V}; I_D = 10\text{ A}; T_j = 25\text{ °C}$		-	120	150	mΩ
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$I_D = 10\text{ A}; V_{DS} = 800\text{ V}; V_{GS} = -4\text{ V}/18\text{ V}; T_j = 25\text{ °C}$		-	40	-	nC
Q_{GD}	gate-drain charge			-	9.8	-	nC
Source-drain diode							
Q_r	recovered charge	$I_{SD} = 10\text{ A}; di/dt = 500\text{ A}/\mu\text{s}; V_{DS} = 400\text{ V}; T_j = 25\text{ °C}$		-	26	-	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
WNSC2M150120TB-A	TSPAK	WNSC2M150120TB-A6J	Reel	600	TSPAKH	06-Dec-2024

7. Marking

Table 4. Marking codes

Type number	Marking codes
WNSC2M150120TB-A	WNSC2M 150120TB-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	$T_{mb} = 25\text{ °C}, T_j = 175\text{ °C}$		169	W
I_D	drain current	$V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$		24.6	A
		$V_{GS} = 18\text{ V}; T_{mb} = 100\text{ °C}$		17.4	A
I_{DM}	peak drain current	pulse width t_p limited by T_{jmax}	Fig.17	50	A
I_S	continuous diode current	$V_{GS} = -4\text{ V}; T_{mb} = 25\text{ °C}$		22.5	A
I_{SM}	pulse diode current	$V_{GS} = -4\text{ V};$ pulse width t_p limited by T_{jmax}		50	A
E_{as}	single pulse drain-to-source avalanche	$I_{AS} = 7\text{ A}; L = 1\text{ mH}; V_{DD} = 100\text{ V}; T_j = 25\text{ °C}$		24.5	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

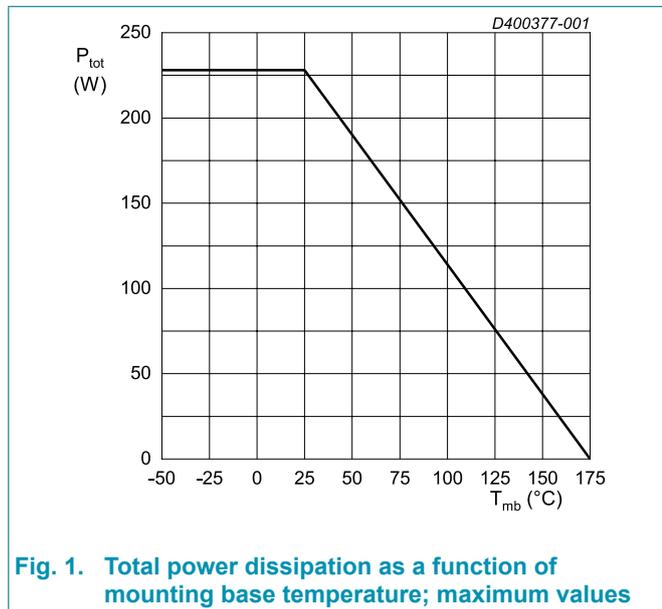


Fig. 1. Total power dissipation as a function of mounting base temperature; maximum values

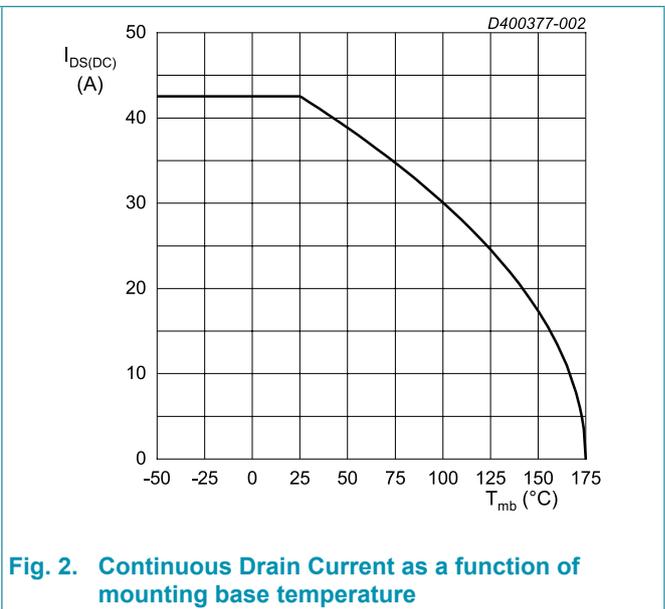


Fig. 2. Continuous Drain Current as a function of mounting base temperature

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			-	0.89	-	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.

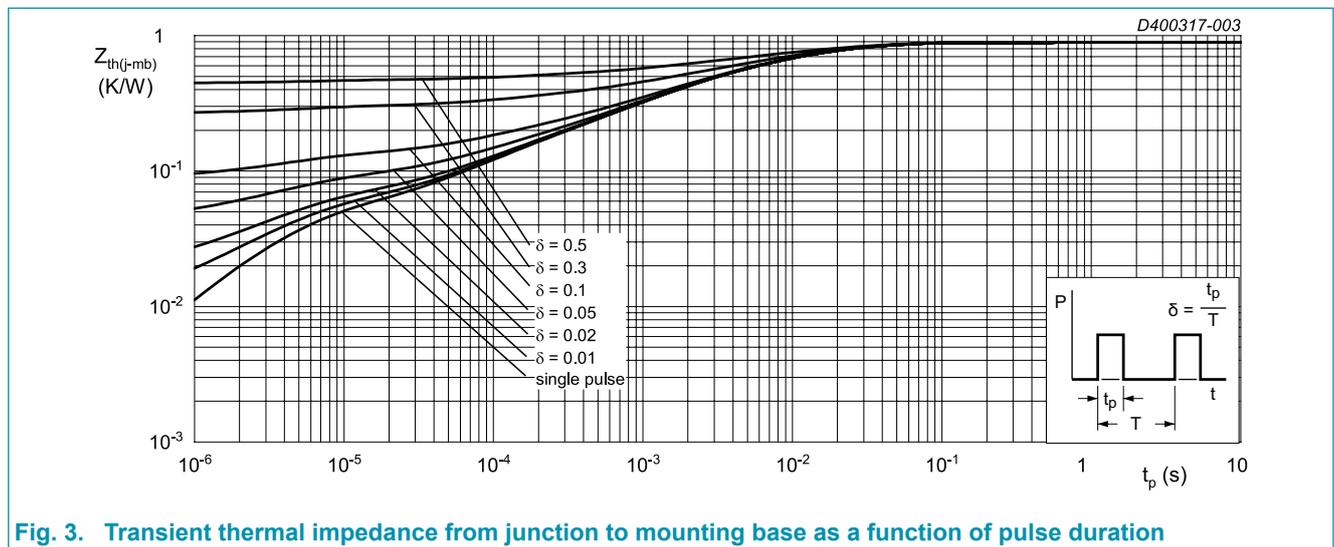
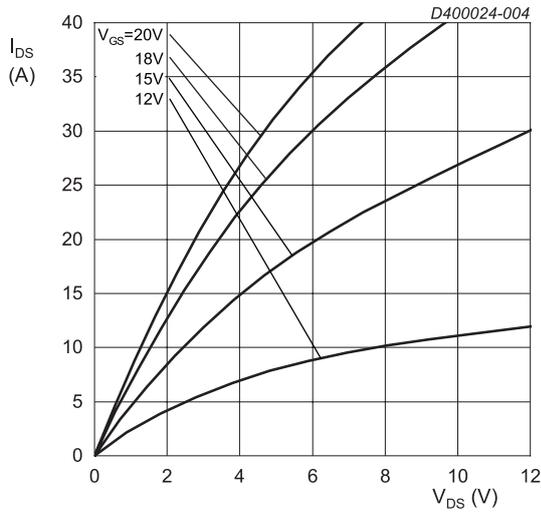


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

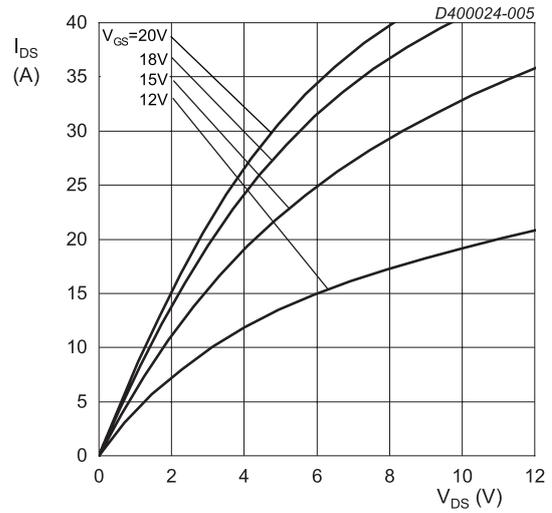
Table 7. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 100 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$		1200	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 2.5 \text{ mA}; V_{DS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C$		1.9	2.6	3.5	V
		$I_D = 2.5 \text{ mA}; V_{DS} = 10 \text{ V}; T_j = 175 \text{ }^\circ C$		-	1.9	-	V
I_{DSS}	drain leakage current	$V_{DS} = 1200 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$		-	0.2	100	μA
		$V_{DS} = 1200 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ C$		-	2	-	μA
I_{GSS}	gate leakage current	$V_{GS} = 22 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$		-	10	100	nA
		$V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$		-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15 \text{ V}; I_D = 10 \text{ A}; T_j = 25 \text{ }^\circ C$		-	150	-	m Ω
		$V_{GS} = 18 \text{ V}; I_D = 10 \text{ A}; T_j = 25 \text{ }^\circ C$		-	120	150	m Ω
		$V_{GS} = 18 \text{ V}; I_D = 10 \text{ A}; T_j = 175 \text{ }^\circ C$		-	233	-	m Ω
R_G	gate resistance	$f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$		-	3	-	Ω
g_{fs}	transconductance	$V_{DS} = 20 \text{ V}; I_D = 10 \text{ A}; T_j = 25 \text{ }^\circ C$		-	5.1	-	S
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$I_D = 10 \text{ A}; V_{DS} = 800 \text{ V}; V_{GS} = -4 \text{ V}/18 \text{ V}; T_j = 25 \text{ }^\circ C$		-	40	-	nC
Q_{GS}	gate-source charge			-	14.5	-	nC
Q_{GD}	gate-drain charge			-	9.8	-	nC
C_{iss}	input capacitance	$V_{DS} = 1000 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$		-	741	-	pF
C_{oss}	output capacitance			-	36	-	pF
C_{rss}	reverse transfer capacitance			-	3.4	-	pF
E_{oss}	Coss stored energy			-	18	-	μJ
$t_{d(on)}$	turn-on delay time	$V_{DS} = 800 \text{ V}; V_{GS} = -4 \text{ V}/18 \text{ V}; R_{G(ext)} = 5.1 \text{ } \Omega; I_D = 10 \text{ A}; L = 330 \text{ } \mu H; T_j = 25 \text{ }^\circ C$		-	17	-	ns
t_r	rise time			-	18	-	ns
$t_{d(off)}$	turn-off delay time			-	26	-	ns
t_f	fall time			-	20	-	ns
E_{on}	turn-on energy (Sic Diode FWD)		Fig.20	-	163	-	μJ
E_{off}	turn-off energy (Sic Diode FWD)		Fig.20	-	15	-	μJ
E_{on}	turn-on energy (Body Diode FWD)		Fig.20	-	158	-	μJ
E_{off}	turn-off energy (Body Diode FWD)		Fig.20	-	18	-	μJ
Source-drain diode							
V_{SD}	source-drain voltage	$V_{GS} = 0 \text{ V}; I_{SD} = 5 \text{ A}; T_j = 25 \text{ }^\circ C$		-	3.2	-	V
		$V_{GS} = -4 \text{ V}; I_{SD} = 5 \text{ A}; T_j = 25 \text{ }^\circ C$		-	4.8	-	V
		$V_{GS} = -4 \text{ V}; I_{SD} = 5 \text{ A}; T_j = 175 \text{ }^\circ C$		-	4.2	-	V
t_{rr}	reverse recovery time	$I_{SD} = 10 \text{ A}; di/dt = 500 \text{ A}/\mu s; V_{DS} = 400 \text{ V}; T_j = 25 \text{ }^\circ C$		-	17	-	ns
Q_r	recovered charge			-	26	-	nC
I_{rrm}	reverse recovery current			-	2.7	-	A



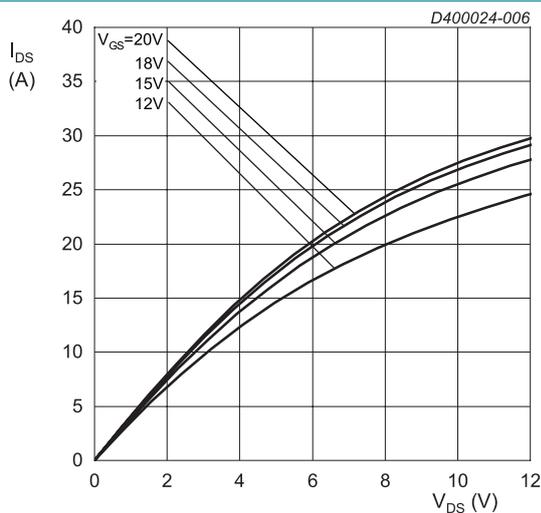
$T_j = -55\text{ °C}; t_p < 200\ \mu\text{s}$

Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values



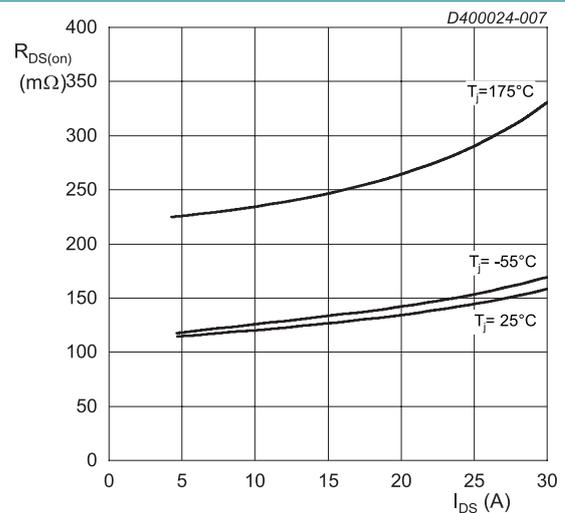
$T_j = 25\text{ °C}; t_p < 200\ \mu\text{s}$

Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values



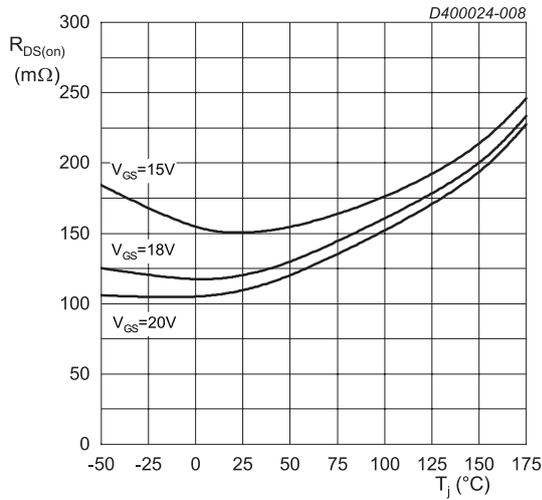
$T_j = 175\text{ °C}; t_p < 200\ \mu\text{s}$

Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

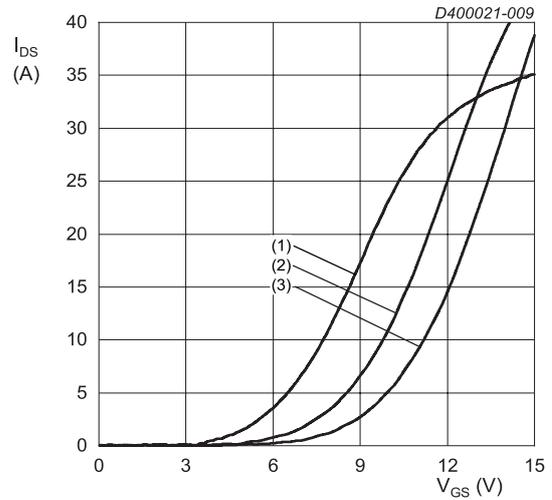


$V_{GS} = 18\text{ V}; t_p < 200\ \mu\text{s}$

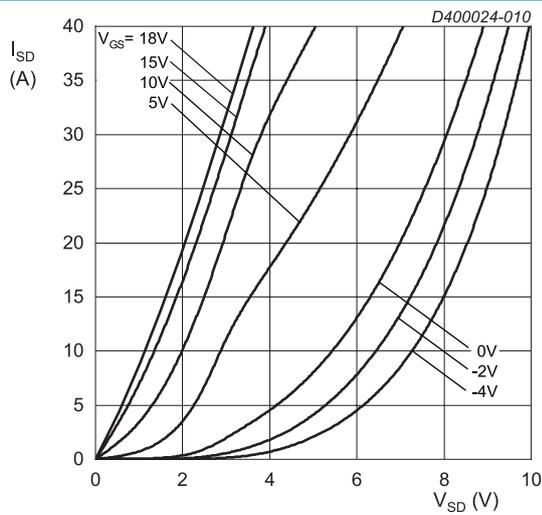
Fig. 7. Drain-source on-state resistance as a function of drain current; typical values



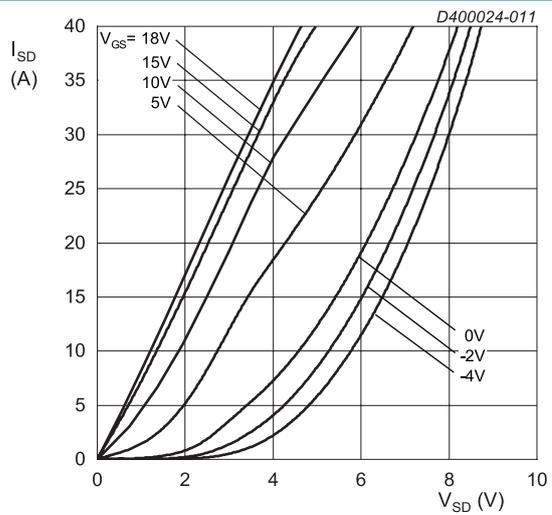
$I_{DS} = 10 A; t_p < 200 \mu s$
Fig. 8. Drain-source on-state resistance as a function of junction temperature



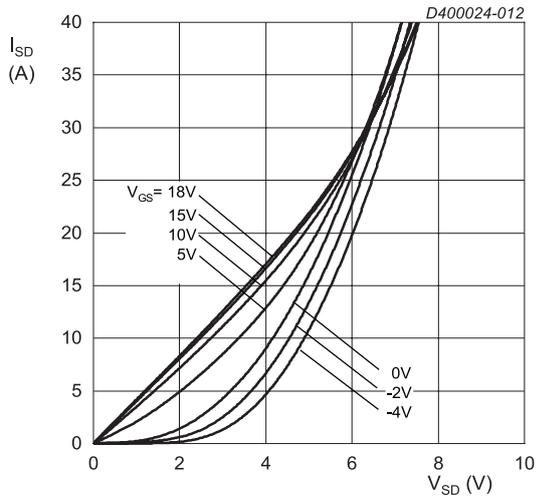
$V_{DS} = 20 V; t_p < 200 \mu s$
 (1) $T_j = 175^{\circ}C$
 (2) $T_j = 25^{\circ}C$
 (3) $T_j = -55^{\circ}C$
Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values



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

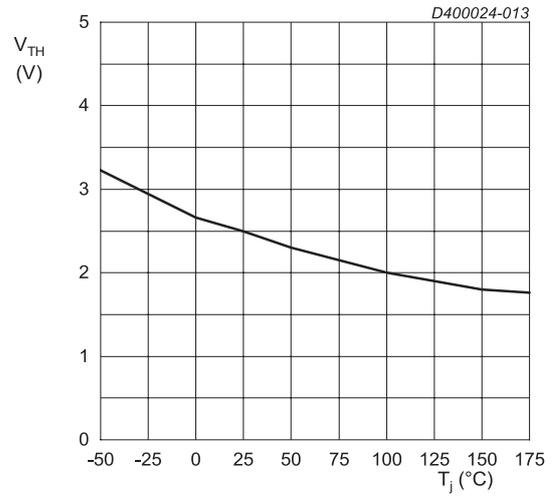


$T_j = 25^{\circ}C; t_p < 200 \mu s$
Fig. 11. Body diode forward characteristics; typical values



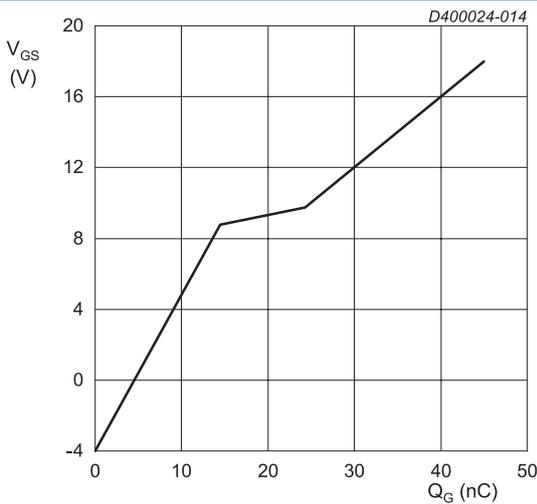
$T_j = 175\text{ }^\circ\text{C}$; $t_p < 200\text{ }\mu\text{s}$

Fig. 12. Body diode forward characteristics; typical values



$V_{DS} = 10\text{ V}$; $I_{DS} = 2.5\text{ mA}$

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



$I_{DS} = 10\text{ A}$; $I_{GS} = 0.1\text{ mA}$; $V_{DS} = 800\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$

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

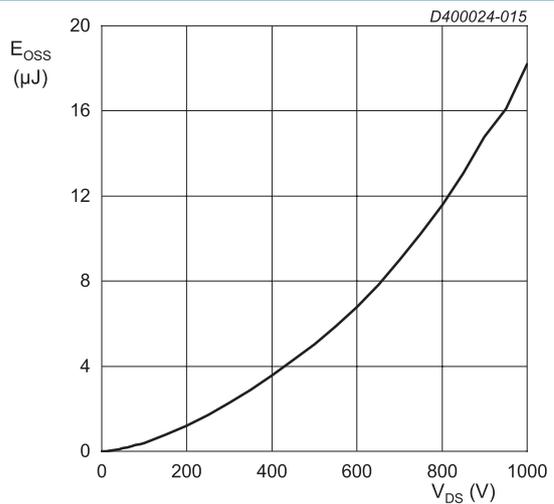
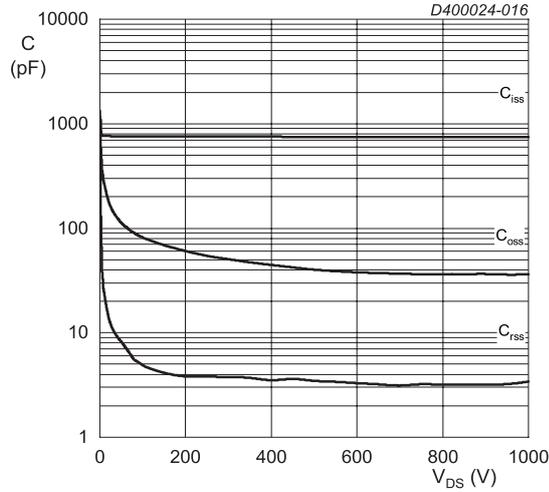
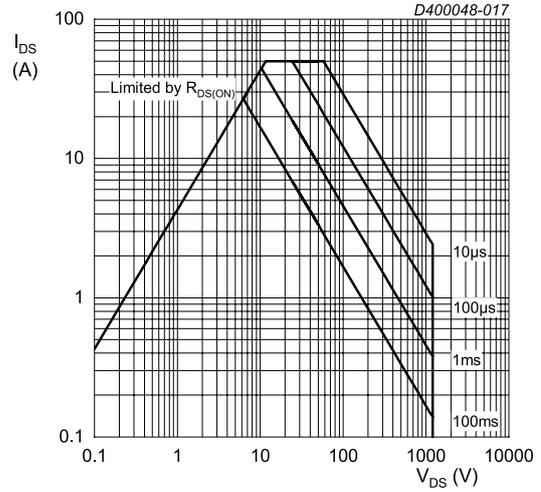


Fig. 15. Output capacitor stored energy as a function of drain-source voltage



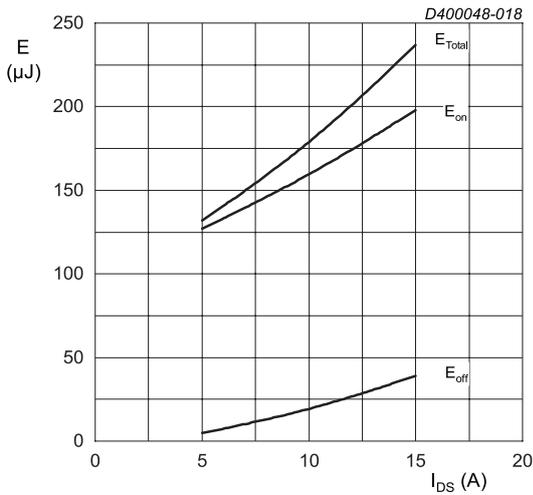
V_{DS} = 0 - 1000 V
 T_j = 25 °C; V_{AC} = 25 mV; f = 1 MHz

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



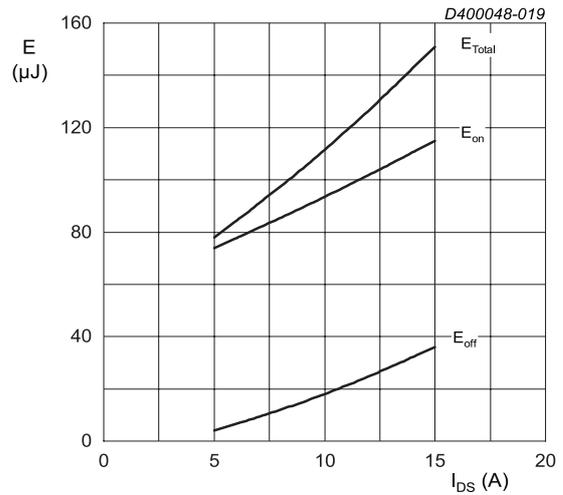
T_j = 25 °C; D = 0
 Parameter: t_p

Fig. 17. Forward bias safe operating area



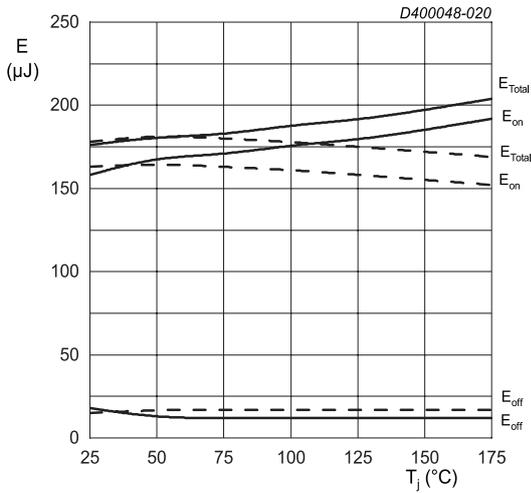
T_j = 25 °C; V_{DD} = 800 V; R_{G(ext)} = 5.1 Ω;
 V_{GS} = -4 V/18 V; L = 330 μH
 FWD = WNSC2M150120TB-A

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



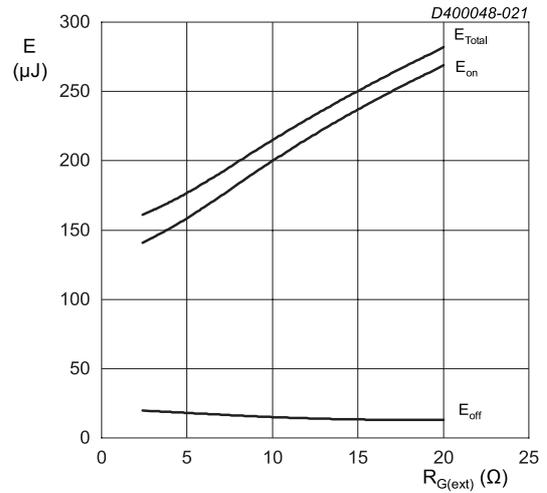
T_j = 25 °C; V_{DD} = 600 V; R_{G(ext)} = 5.1 Ω;
 V_{GS} = -4 V/18 V; L = 330 μH
 FWD = WNSC2M150120TB-A

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



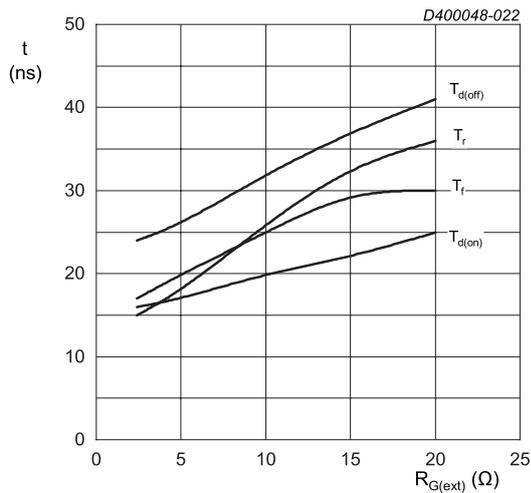
$I_{DS} = 10 \text{ A}$; $V_{DD} = 800 \text{ V}$; $R_{G(ext)} = 5.1 \text{ } \Omega$;
 $V_{GS} = -4 \text{ V}/18 \text{ V}$; $L = 330 \text{ } \mu\text{H}$
 FWD = WNSC2M150120TB-A
 FWD = WNSC2D201200TB(---)

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



$T_j = 25 \text{ } ^\circ\text{C}$; $V_{DD} = 800 \text{ V}$; $I_{DS} = 10 \text{ A}$; $V_{GS} = -4 \text{ V}/18 \text{ V}$
 FWD = WNSC2M150120TB-A; $L = 330 \text{ } \mu\text{H}$

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



$T_j = 25 \text{ } ^\circ\text{C}$; $V_{DD} = 800 \text{ V}$; $I_{DS} = 10 \text{ A}$; $V_{GS} = -4 \text{ V}/18 \text{ V}$
 FWD = WNSC2M150120TB-A; $L = 330 \text{ } \mu\text{H}$

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

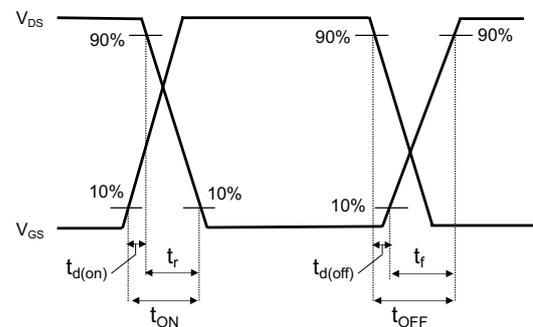
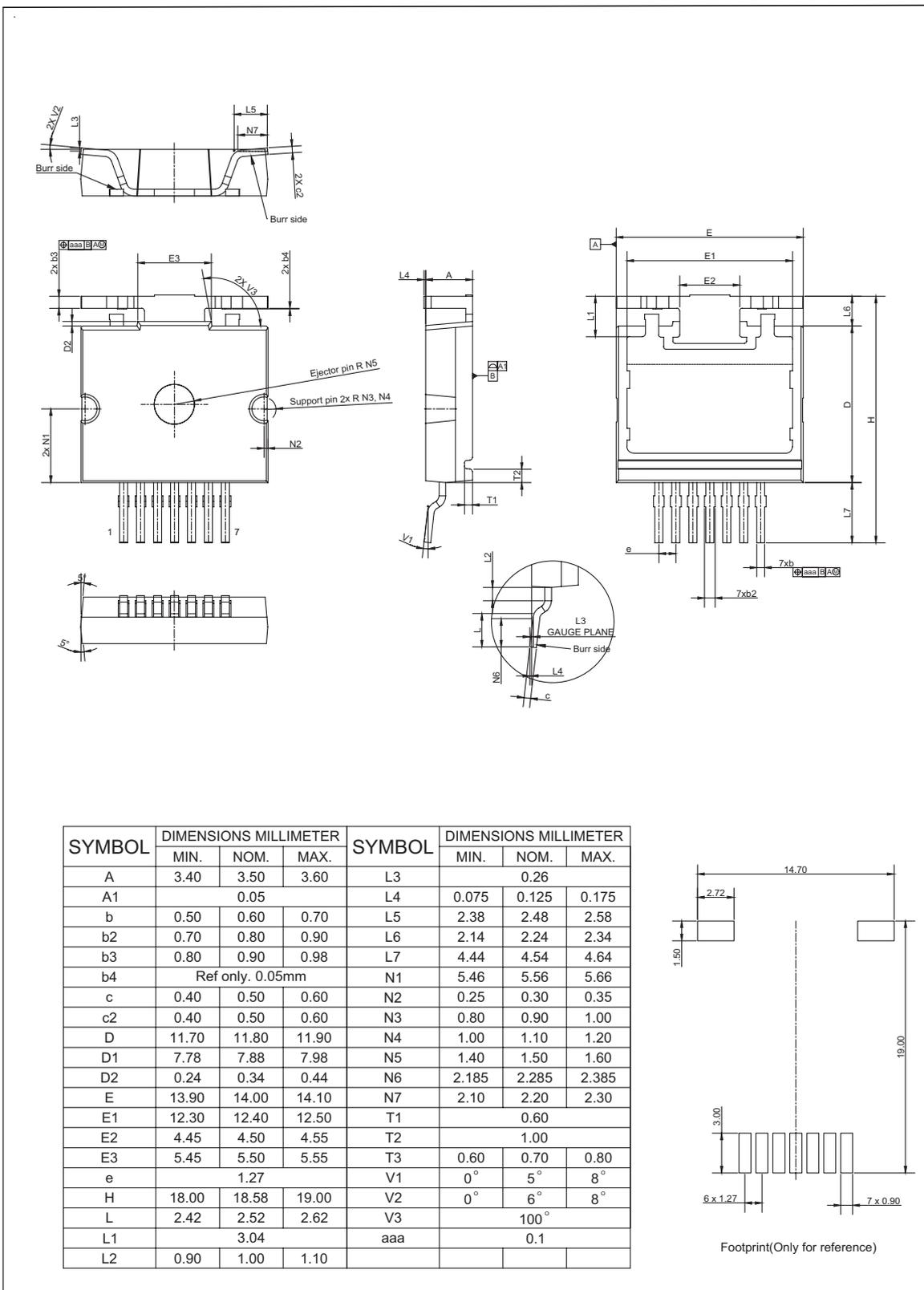


Fig. 23. Switching time definition

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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