

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

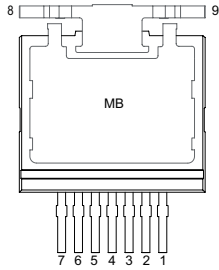
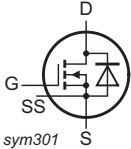
Table 1. Quick reference data

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Symbol	Parameter	Conditions	Notes	Values			Unit
Absolute maximum rating							
V _{DS}	drain-source voltage	25 °C ≤ T _j ≤ 175 °C		1200			V
I _D	drain current	V _{GS} = 18 V; T _{mb} = 25 °C		42.6			A
P _{tot}	total power dissipation	T _{mb} = 25 °C, T _j = 175 °C		228			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 V; I _D = 20 A; T _j = 25 °C		-	75	-	mΩ
		V _{GS} = 18 V; I _D = 20 A; T _j = 25 °C		-	65	90	mΩ
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 20 A; V _{DS} = 800 V; V _{GS} = -4 V/18 V; T _j = 25 °C		-	62	-	nC
Q _{GD}	gate-drain charge			-	10	-	nC
Source-drain diode							
Q _r	recovered charge	I _{SD} = 20 A; di/dt = 500 A/μs; V _{DS} = 400 V; T _j = 25 °C		-	52	-	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
WNSC2M75120TB-A	TSPAK	WNSC2M75120TB-A6J	Reel	600	TSPAKH	06-Dec-2024

7. Marking

Table 4. Marking codes

Type number	Marking codes
WNSC2M75120TB-A	WNSC2M 75120TB-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	$T_{mb} = 25\text{ °C}$; $T_j = 175\text{ °C}$		228	W
I_D	drain current	$V_{GS} = 18\text{ V}$; $T_{mb} = 25\text{ °C}$		42.6	A
		$V_{GS} = 18\text{ V}$; $T_{mb} = 100\text{ °C}$		30.1	A
I_{DM}	peak drain current	pulse width t_p limited by T_{jmax}	Fig.17	85	A
I_S	continuous diode current	$V_{GS} = -4\text{ V}$; $T_{mb} = 25\text{ °C}$		38.3	A
I_{SM}	pulse diode current	$V_{GS} = -4\text{ V}$; pulse width t_p limited by T_{jmax}		85	A
E_{as}	single pulse drain-to-source avalanche	$I_{AS} = 15\text{ A}$; $L = 1\text{ mH}$; $V_{DD} = 100\text{ V}$; $T_j = 25\text{ °C}$		113	mJ
T_{stg}	storage temperature			-55 to 175	°C
T_j	junction temperature			-55 to 175	°C
$T_{sld(M)}$	peak soldering temperature			245	°C

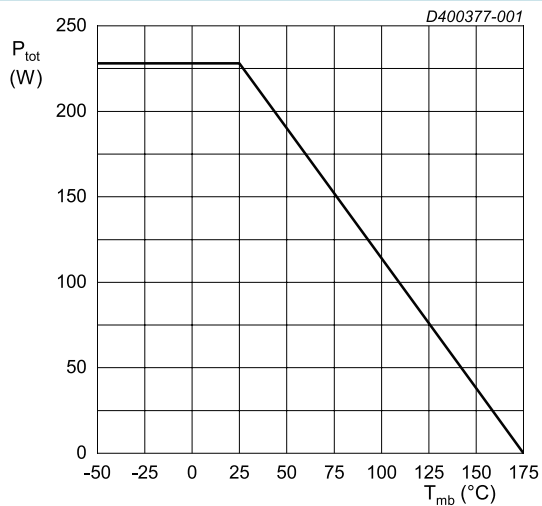


Fig. 1. Total power dissipation as a function of mounting base temperature; maximum values

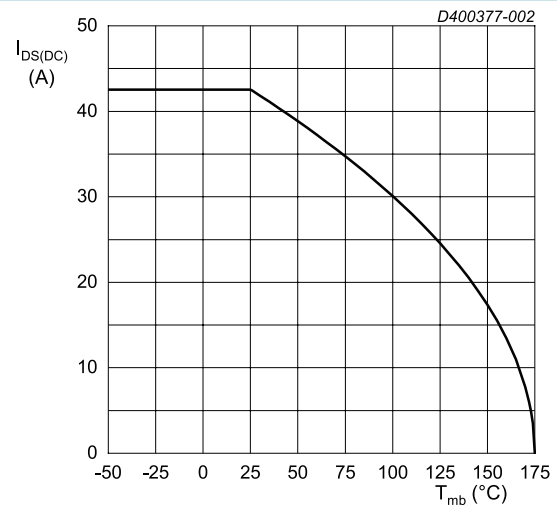


Fig. 2. Continuous Drain Current as a function of mounting base temperature

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			-	0.66	-	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.

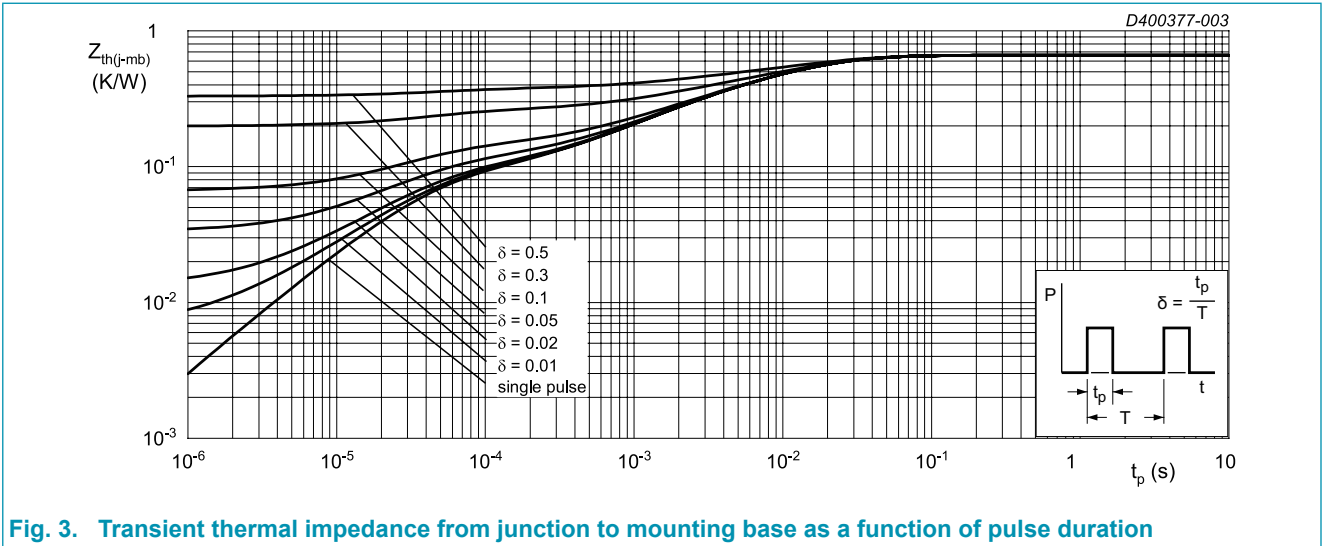
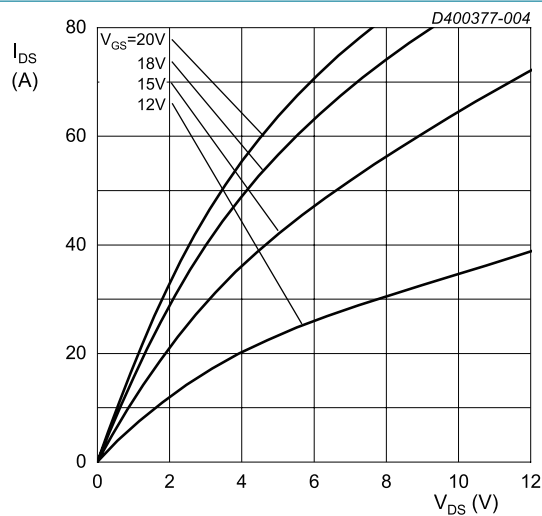


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

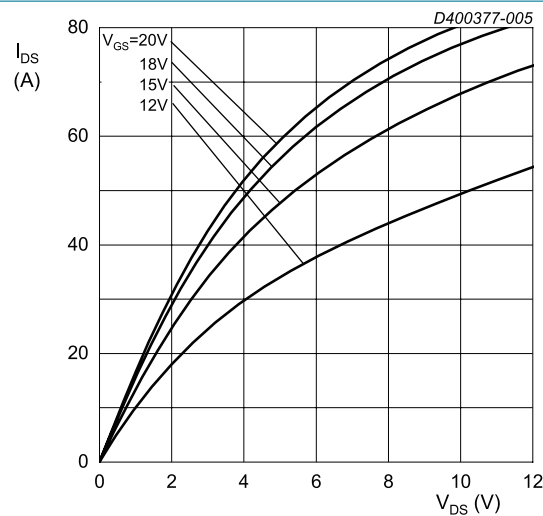
Table 7. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 100 μA; V _{GS} = 0 V; T _J = 25 °C		1200	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 5 mA; V _{DS} = 10 V; T _J = 25 °C		1.9	2.2	3.5	V
		I _D = 5 mA; V _{DS} = 10 V; T _J = 175 °C		-	1.5	-	V
I _{DSS}	drain leakage current	V _{DS} = 1200 V; V _{GS} = 0 V; T _J = 25 °C		-	0.2	100	μA
		V _{DS} = 1200 V; V _{GS} = 0 V; T _J = 175 °C		-	2	-	μA
I _{GSS}	gate leakage current	V _{GS} = 22 V; V _{DS} = 0 V; T _J = 25 °C		-	10	100	nA
		V _{GS} = -10 V; V _{DS} = 0 V; T _J = 25 °C		-	10	100	nA
R _{DS(on)}	drain-source on-state resistance	V _{GS} = 15 V; I _D = 20 A; T _J = 25 °C		-	75	-	mΩ
		V _{GS} = 18 V; I _D = 20 A; T _J = 25 °C		-	65	90	mΩ
		V _{GS} = 18 V; I _D = 20 A; T _J = 175 °C		-	122	-	mΩ
R _G	gate resistance	f = 1 MHz; T _J = 25 °C		-	2.8	-	Ω
g _{fs}	transconductance	V _{DS} = 20 V; I _D = 20 A; T _J = 25 °C		-	10	-	S
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 20 A; V _{DS} = 800 V; V _{GS} = -4 V/18 V; T _J = 25 °C		-	62	-	nC
Q _{GS}	gate-source charge			-	25	-	nC
Q _{GD}	gate-drain charge			-	10	-	nC
C _{iss}	input capacitance	V _{DS} = 1000 V; V _{GS} = 0 V; f = 1 MHz; T _J = 25 °C		-	1317	-	pF
C _{oss}	output capacitance			-	58	-	pF
C _{rss}	reverse transfer capacitance			-	6.7	-	pF
E _{oss}	Coss stored energy			-	29	-	μJ
t _{d(on)}	turn-on delay time	V _{DS} = 800 V; V _{GS} = -4 V/18 V; R _{G(ext)} = 5.1 Ω; I _D = 20 A; L = 330 μH; T _J = 25 °C		-	20	-	ns
t _r	rise time			-	24	-	ns
t _{d(off)}	turn-off delay time			-	33	-	ns
t _f	fall time			-	14	-	ns
E _{on}	turn-on energy ^(Sic Diode FWD)		Fig.20	-	250	-	μJ
E _{off}	turn-off energy ^(Sic Diode FWD)		Fig.20	-	61	-	μJ
E _{on}	turn-on energy ^(Body Diode FWD)		Fig.20	-	275	-	μJ
E _{off}	turn-off energy ^(Body Diode FWD)		Fig.20	-	68	-	μJ
Source-drain diode							
V _{SD}	source-drain voltage	V _{GS} = 0 V; I _{SD} = 10 A; T _J = 25 °C		-	3.2	-	V
		V _{GS} = -4 V; I _{SD} = 10 A; T _J = 25 °C		-	4.8	-	V
		V _{GS} = -4 V; I _{SD} = 10 A; T _J = 175 °C		-	4.2	-	V
t _{rr}	reverse recovery time	I _{SD} = 20 A; di/dt = 500 A/μs; V _{DS} = 400 V; T _J = 25 °C		-	21	-	ns
Q _r	recovered charge			-	52	-	nC
I _{rrm}	reverse recovery current			-	4.3	-	A



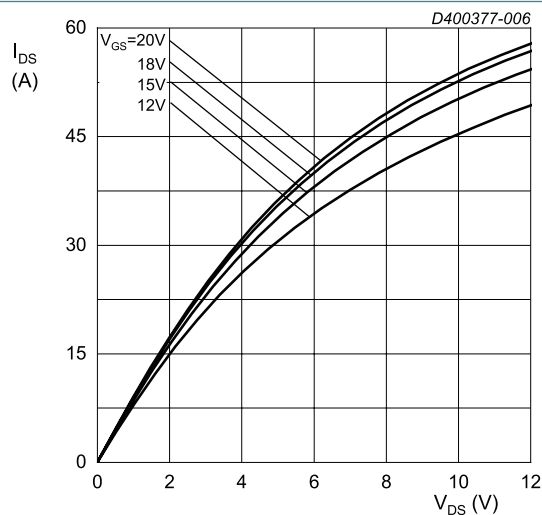
$T_j = -55^{\circ}\text{C}$; $t_p < 200\ \mu\text{s}$

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



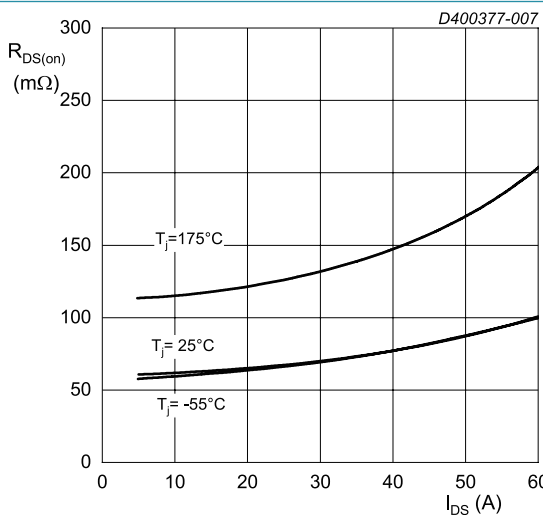
$T_j = 25^{\circ}\text{C}$; $t_p < 200\ \mu\text{s}$

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



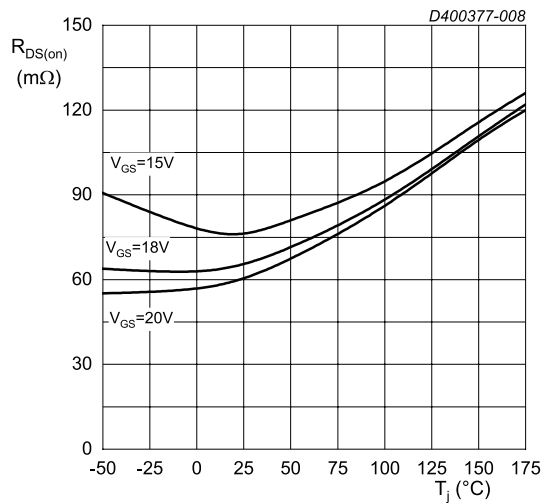
$T_j = 175^{\circ}\text{C}$; $t_p < 200\ \mu\text{s}$

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

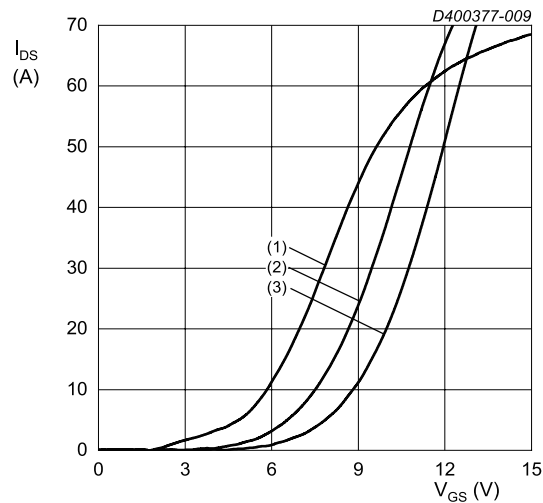


$V_{GS} = 18\text{ V}$; $t_p < 200\ \mu\text{s}$

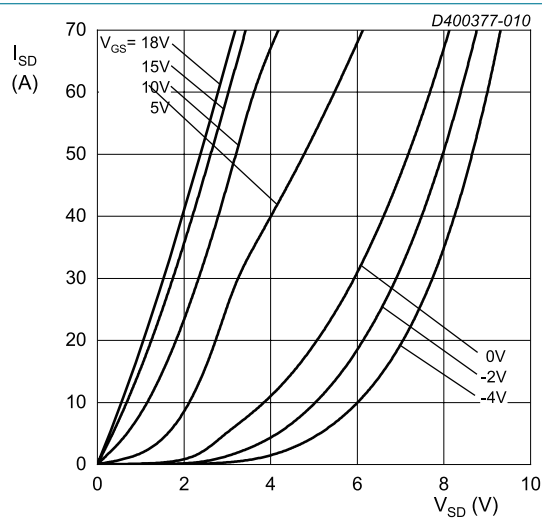
Fig. 7. Drain-source on-state resistance as a function of drain current; typical values



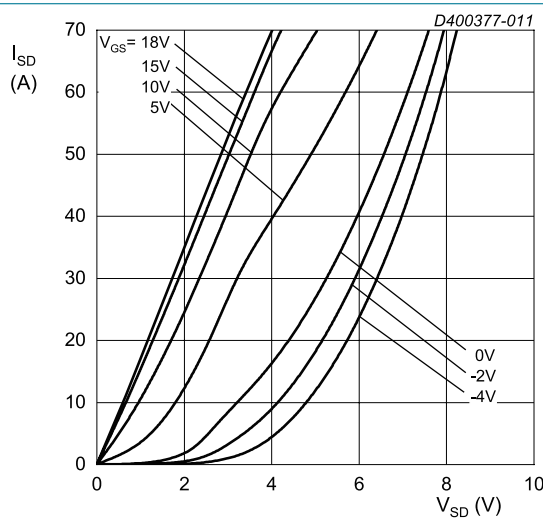
$I_{DS} = 20\text{ A}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 8. Drain-source on-state resistance as a function of junction temperature



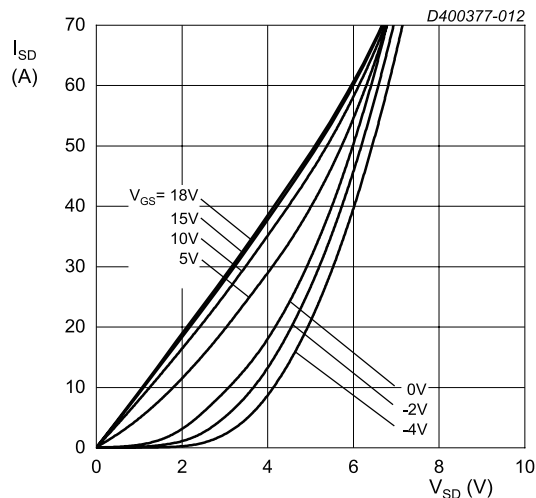
$V_{DS} = 20\text{ V}$; $t_p < 200\text{ }\mu\text{s}$
(1) $T_j = 175\text{ }^\circ\text{C}$
(2) $T_j = 25\text{ }^\circ\text{C}$
(3) $T_j = -55\text{ }^\circ\text{C}$
Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values



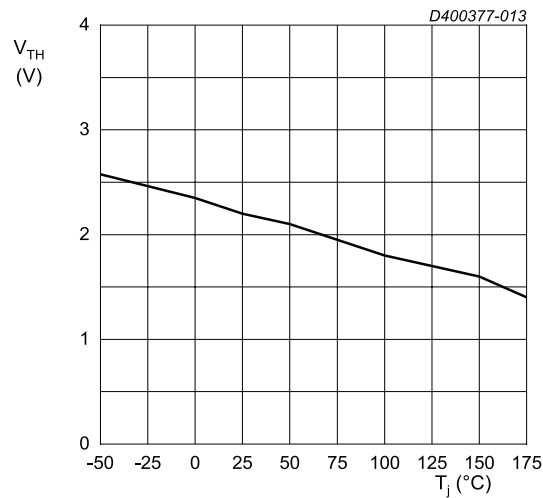
$T_j = -55\text{ }^\circ\text{C}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 10. Body diode forward characteristics; typical values



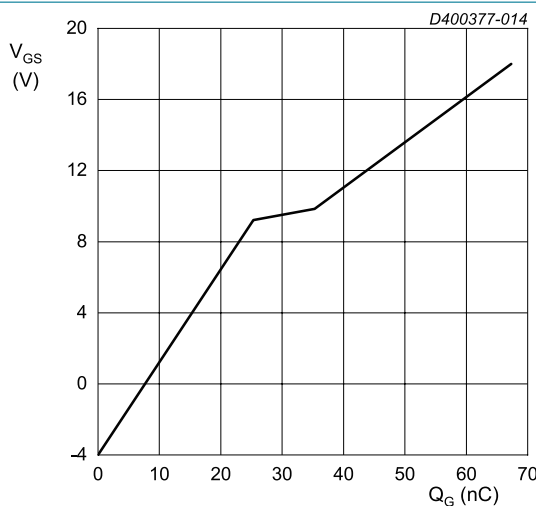
$T_j = 25\text{ }^\circ\text{C}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 11. Body diode forward characteristics; typical values



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



$V_{DS} = 10\text{ V}$; $I_{DS} = 5\text{ mA}$
Fig. 13. Threshold voltage as a function of junction temperature



$I_{DS} = 20\text{ A}$; $I_{GS} = 0.1\text{ mA}$; $V_{DS} = 800\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$
Fig. 14. Gate-source voltage as a function of gate charge; typical values

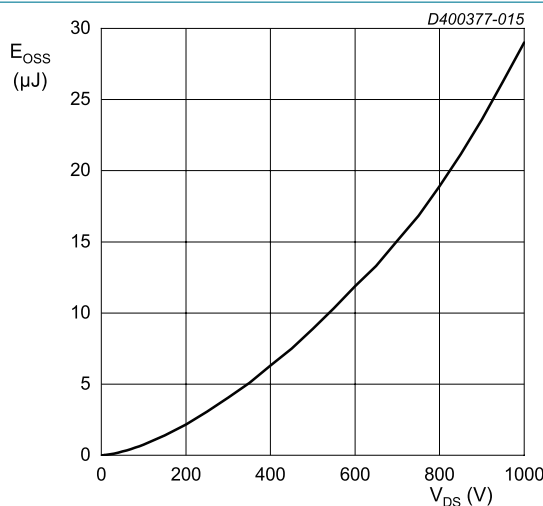
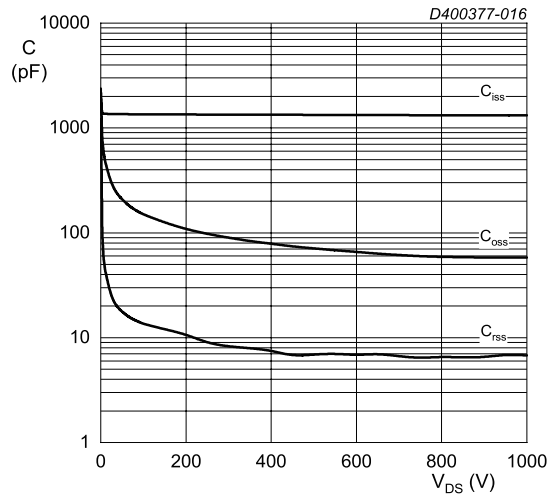
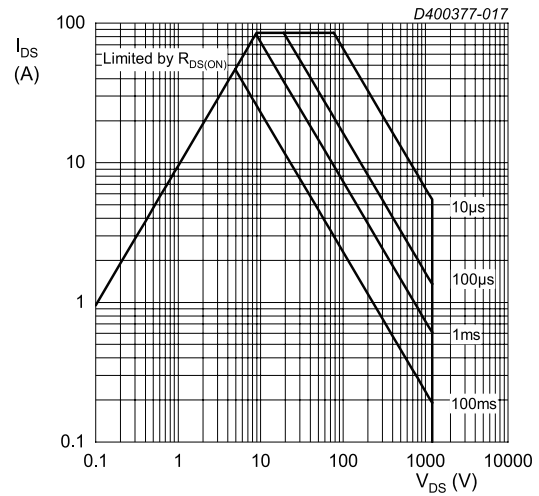


Fig. 15. Output capacitor stored energy as a function of drain-source voltage



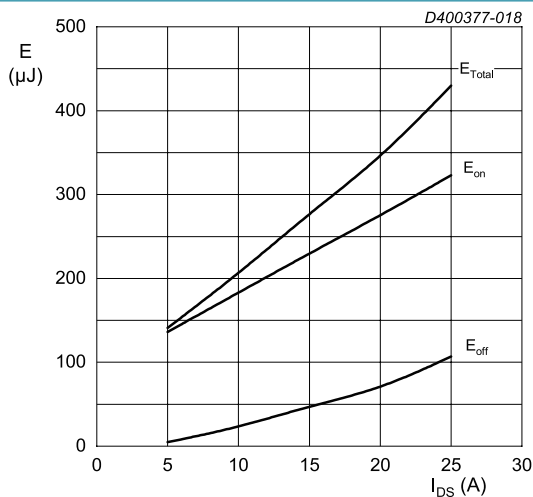
$V_{DS} = 0 - 1000 \text{ V}$
 $T_j = 25^\circ\text{C}$; $V_{AC} = 25 \text{ mV}$; $f = 1 \text{ MHz}$

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



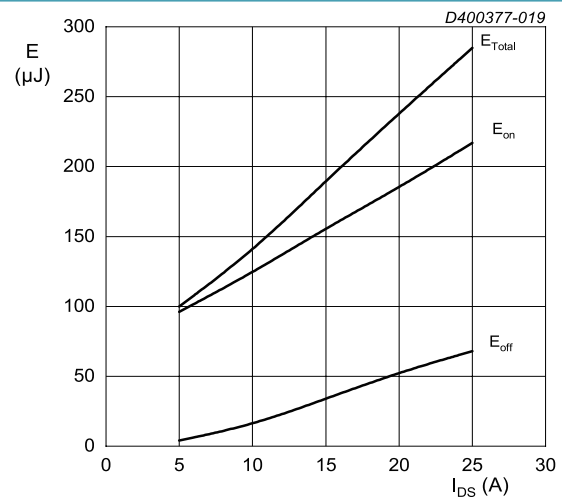
$T_j = 25^\circ\text{C}$; $D = 0$
 Parameter: t_p

Fig. 17. Forward bias safe operating area



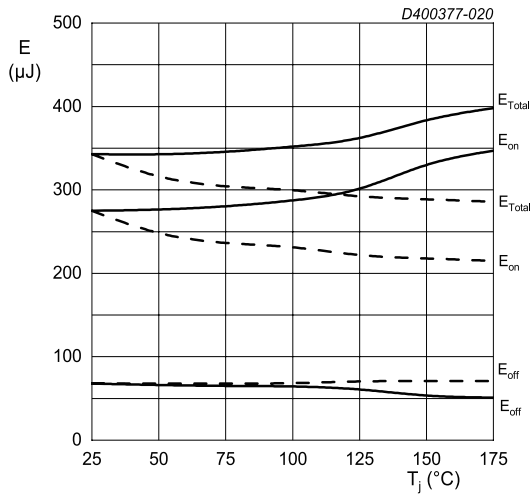
$T_j = 25^\circ\text{C}$; $V_{DD} = 800 \text{ V}$; $R_{G(ext)} = 5.1 \Omega$;
 $V_{GS} = -4 \text{ V}/18 \text{ V}$; $L = 330 \mu\text{H}$
 FWD = WNSC2M75120TB-A

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



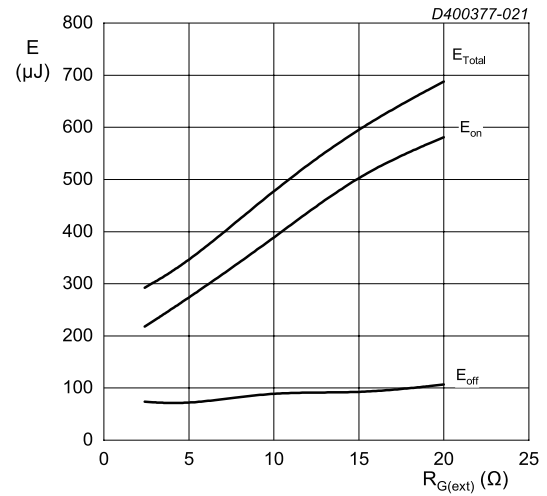
$T_j = 25^\circ\text{C}$; $V_{DD} = 600 \text{ V}$; $R_{G(ext)} = 5.1 \Omega$;
 $V_{GS} = -4 \text{ V}/18 \text{ V}$; $L = 330 \mu\text{H}$
 FWD = WNSC2M75120TB-A

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



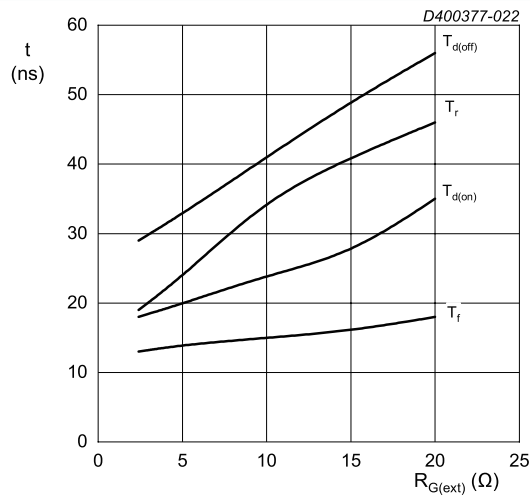
$I_{DS} = 20 \text{ A}$; $V_{DD} = 800 \text{ V}$; $R_{G(ext)} = 5.1 \Omega$;
 $V_{GS} = -4 \text{ V}/18 \text{ V}$; $L = 330 \mu\text{H}$
 FWD = WNSC2M75120TB-A
 FWD = WNSC2D201200TB(---)

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



$T_j = 25 \text{ °C}$; $V_{DD} = 800 \text{ V}$; $I_{DS} = 20 \text{ A}$; $V_{GS} = -4 \text{ V}/18 \text{ V}$
 FWD = WNSC2M75120TB-A; $L = 330 \mu\text{H}$

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



$T_j = 25 \text{ °C}$; $V_{DD} = 800 \text{ V}$; $I_{DS} = 20 \text{ A}$; $V_{GS} = -4 \text{ V}/18 \text{ V}$
 FWD = WNSC2M75120TB-A; $L = 330 \mu\text{H}$

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

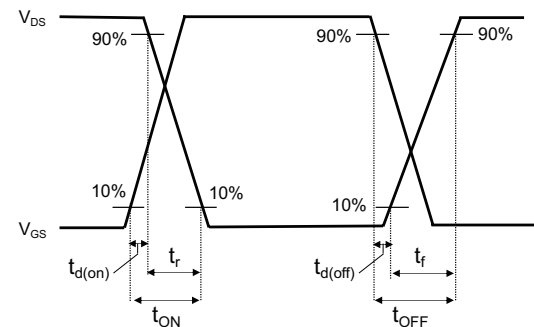
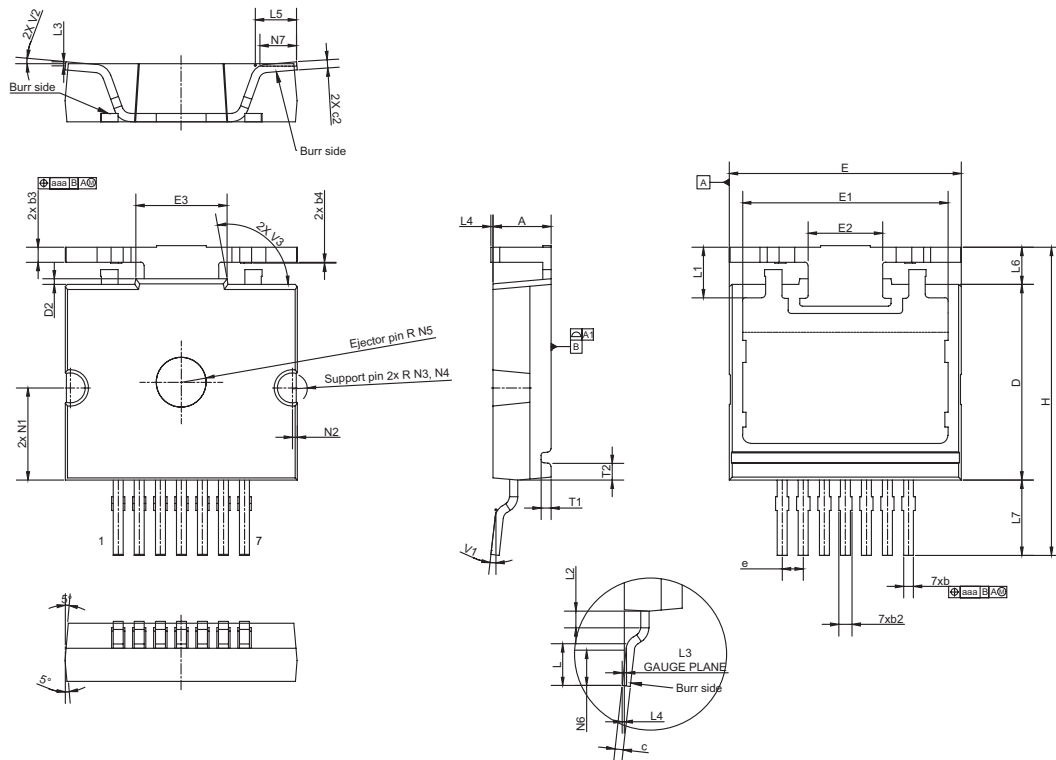
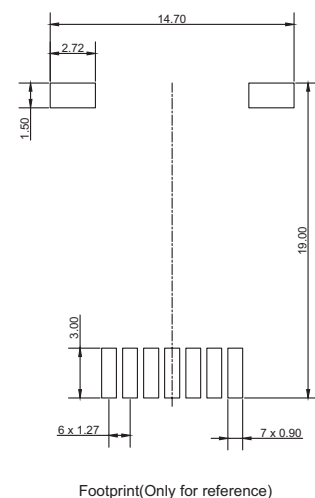


Fig. 23. Switching time definition

11. Package outline



SYMBOL	DIMENSIONS MILLIMETER			SYMBOL	DIMENSIONS MILLIMETER		
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.
A	3.40	3.50	3.60	L3	0.26		
A1	0.05			L4	0.075	0.125	0.175
b	0.50	0.60	0.70	L5	2.38	2.48	2.58
b2	0.70	0.80	0.90	L6	2.14	2.24	2.34
b3	0.80	0.90	0.98	L7	4.44	4.54	4.64
b4	Ref only. 0.05mm			N1	5.46	5.56	5.66
c	0.40	0.50	0.60	N2	0.25	0.30	0.35
c2	0.40	0.50	0.60	N3	0.80	0.90	1.00
D	11.70	11.80	11.90	N4	1.00	1.10	1.20
D1	7.78	7.88	7.98	N5	1.40	1.50	1.60
D2	0.24	0.34	0.44	N6	2.185	2.285	2.385
E	13.90	14.00	14.10	N7	2.10	2.20	2.30
E1	12.30	12.40	12.50	T1	0.60		
E2	4.45	4.50	4.55	T2	1.00		
E3	5.45	5.50	5.55	T3	0.60	0.70	0.80
e	1.27			V1	0°	5°	8°
H	18.00	18.58	19.00	V2	0°	6°	8°
L	2.42	2.52	2.62	V3	100°		
L1	3.04			aaa	0.1		
L2	0.90	1.00	1.10				



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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