

1. General description

Silicon Carbide MOSFET in a TO247-4L plastic package, designed for high frequency, high efficiency systems.



2. Features and benefits

- Separate driver source pin
- 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

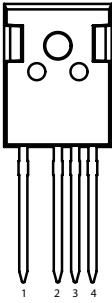
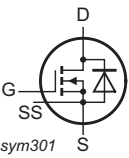
Table 1. Quick reference data

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Symbol	Parameter	Conditions	Notes	Values			Unit
Absolute maximum rating							
V _{DS}	drain-source voltage	25 °C ≤ T _j ≤ 175 °C			1200		V
I _D	drain current	V _{GS} = 18 V; T _{mb} = 25 °C			73		A
P _{tot}	total power dissipation	T _{mb} = 25 °C			405		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 = 35 A; T _j = 25 °C		-	40	55	mΩ
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 35 A; V _{DS} = 800 V; V _{GS} = -4 V/18 V; T _j = 25 °C		-	116	-	nC
Q _{GD}	gate-drain charge			-	19	-	nC
Source-drain diode							
Q _r	recovered charge	I _{SD} = 35 A; di/dt = 500 A/μs; V _{DS} = 400 V; T _j = 25 °C		-	174	-	nC

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain		 sym301
2	S	source		
3	SS	source sense		
4	G	gate		
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
WNSC2M40120R	TO247-4L	WNSC2M40120R6Q	Tube	30	TO247N-4L	17-Dec-2021

7. Marking

Table 4. Marking codes

Type number	Marking codes
WNSC2M40120R	WNSC2M 40120R

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 22	V
$V_{GS,op}$	gate-source voltage			-4 to 18	V
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$		405	W
I_D	drain current	$V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$		73	A
		$V_{GS} = 18\text{ V}; T_{mb} = 100\text{ °C}$		52	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$		100	A
E_{as}	single pulse drain-to-source avalanche	$I_{AS} = 24\text{ A}; L = 1\text{ mH}; V_{DD} = 100\text{ V}; T_J = 25\text{ °C}$		288	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

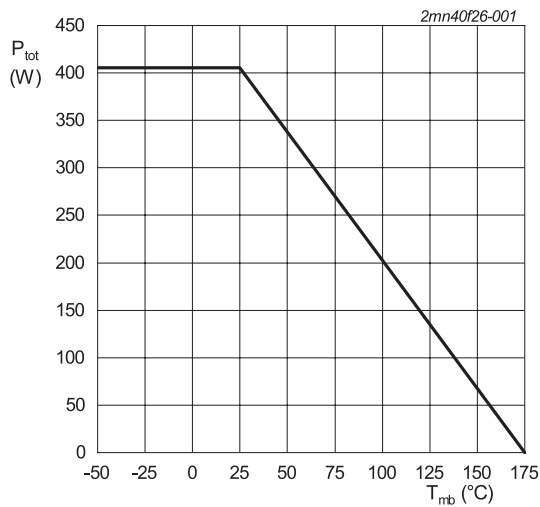


Fig. 1. Total power dissipation as a function of mounting base temperature; maximum values

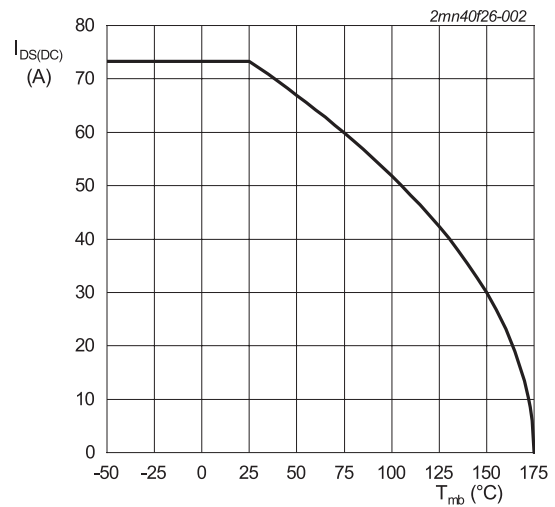


Fig. 2. Continuous Drain Current as a function of mounting base temperature

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			-	-	0.37	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.

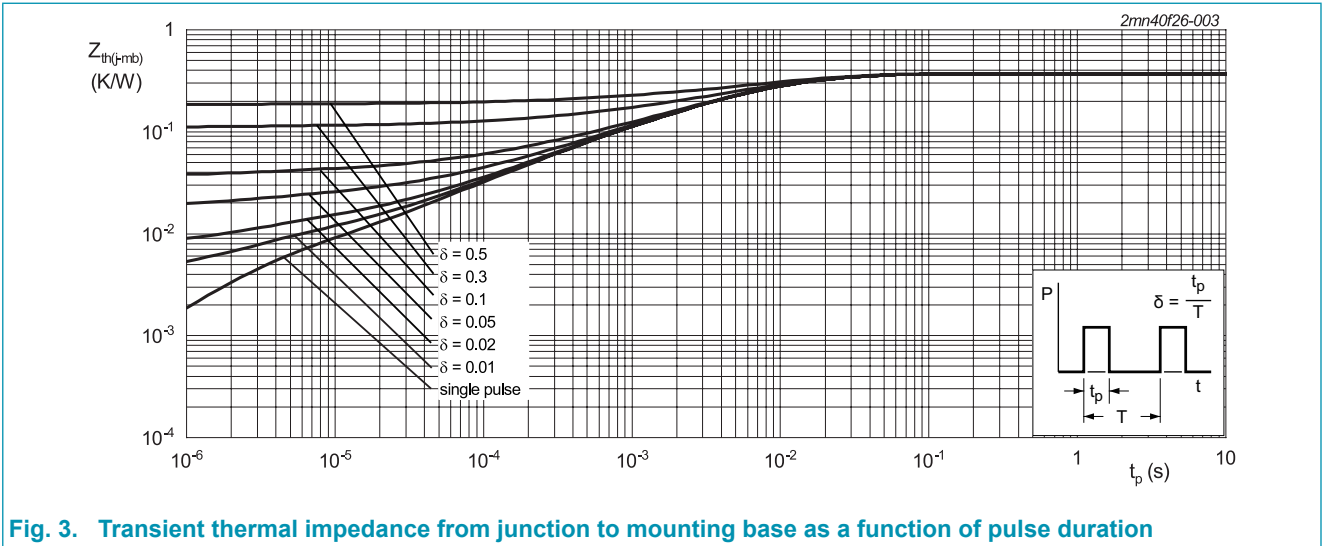
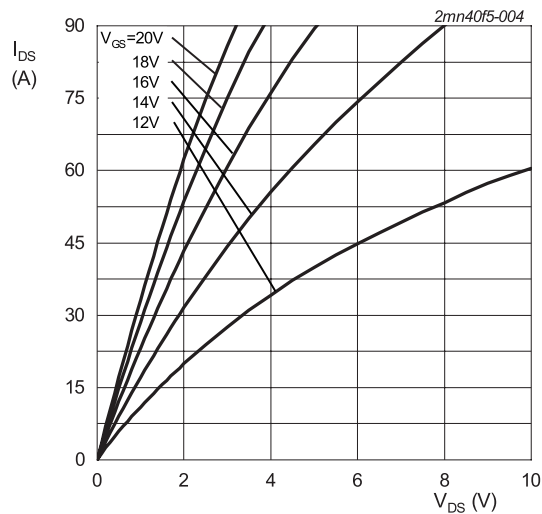


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

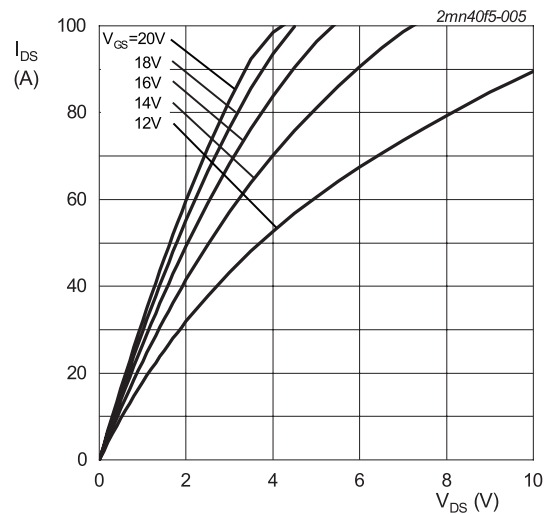
10. Characteristics

Table 7. Characteristics

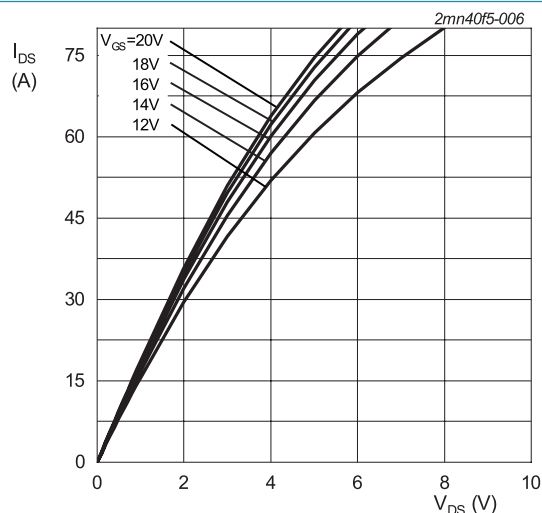
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 100 μA; V _{GS} = 0 V; T _J = 25 °C		1200	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 10 mA; V _{DS} = 10 V; T _J = 25 °C		1.9	2.6	3.5	V
		I _D = 10 mA; V _{DS} = 10 V; T _J = 175 °C		-	1.9	-	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} = -8 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 = 35 A; T _J = 25 °C		-	40	55	mΩ
		V _{GS} = 18 V; I _D = 35 A; T _J = 25 °C		-	35	46	mΩ
		V _{GS} = 18 V; I _D = 35 A; T _J = 175 °C		-	58	-	mΩ
R _G	gate resistance	f = 1 MHz; T _J = 25 °C		-	1	-	Ω
g _{fs}	transconductance	V _{DS} = 20 V; I _D = 35 A; T _J = 25 °C		-	24	-	S
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 35 A; V _{DS} = 800 V; V _{GS} = -4 V/18 V; T _J = 25 °C		-	116	-	nC
Q _{GS}	gate-source charge			-	42	-	nC
Q _{GD}	gate-drain charge			-	19	-	nC
C _{iss}	input capacitance	V _{DS} = 1000 V; V _{GS} = 0 V; f = 1 MHz; T _J = 25 °C		-	2450	-	pF
C _{oss}	output capacitance			-	108	-	pF
C _{rss}	reverse transfer capacitance			-	11	-	pF
E _{oss}	Coss stored energy			-	54	-	μJ
t _{d(on)}	turn-on delay time	V _{DS} = 800 V; V _{GS} = -3 V/18 V; R _{G(ext)} = 2.4 Ω; I _D = 35 A; L = 100 μH; T _J = 25 °C		-	10	-	ns
t _r	rise time			-	15	-	ns
t _{d(off)}	turn-off delay time			-	26	-	ns
t _f	fall time			-	9	-	ns
E _{on}	turn-on energy (SiC Diode FWD)			-	351	-	μJ
E _{off}	turn-off energy (SiC Diode FWD)			-	157	-	μJ
E _{on}	turn-on energy (Body Diode FWD)			-	273	-	μJ
E _{off}	turn-off energy (Body Diode FWD)			-	150	-	μJ
Source-drain diode							
V _{SD}	source-drain voltage	V _{GS} = -4 V; I _F = 17.5 A; T _J = 25 °C		-	4.8	-	V
		V _{GS} = -4 V; I _F = 17.5 A; T _J = 175 °C		-	4.2	-	V
t _{rr}	reverse recovery time	I _{SD} = 35 A; di/dt = 500 A/μs; V _{DS} = 400 V; T _J = 25 °C		-	52	-	ns
Q _r	recovered charge			-	174	-	nC
I _{rrm}	reverse recovery current			-	6.8	-	A



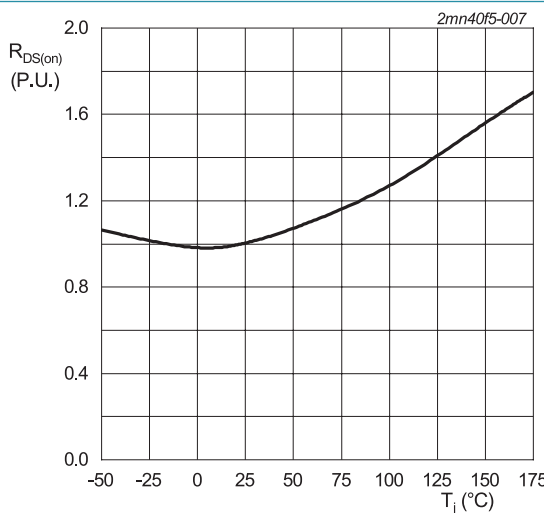
$T_j = -55\text{ }^{\circ}\text{C}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values



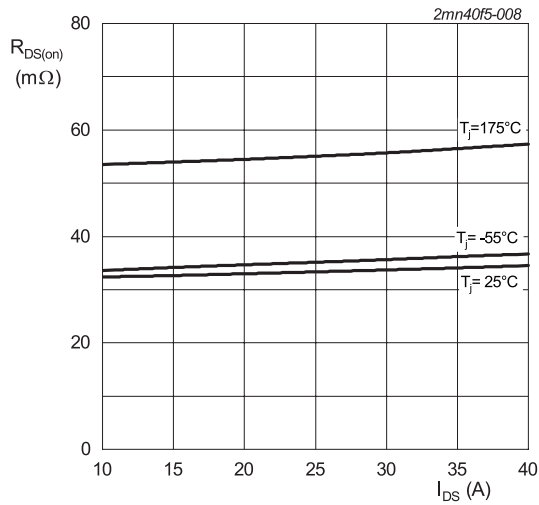
$T_j = 25\text{ }^{\circ}\text{C}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values



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

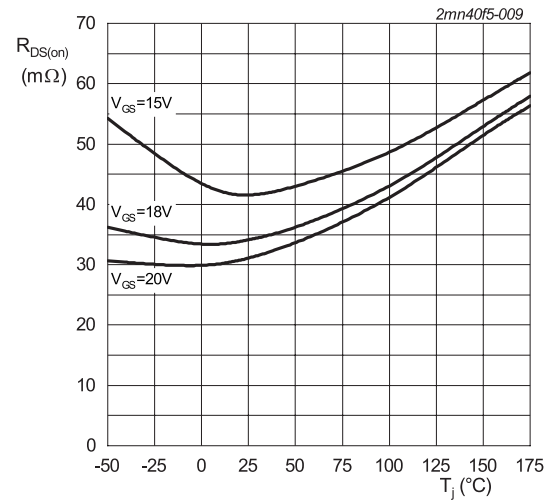


$I_{DS} = 35\text{ A}$; $V_{GS} = 18\text{ V}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 7. Normalized drain-source on-state resistance as a function of junction temperature



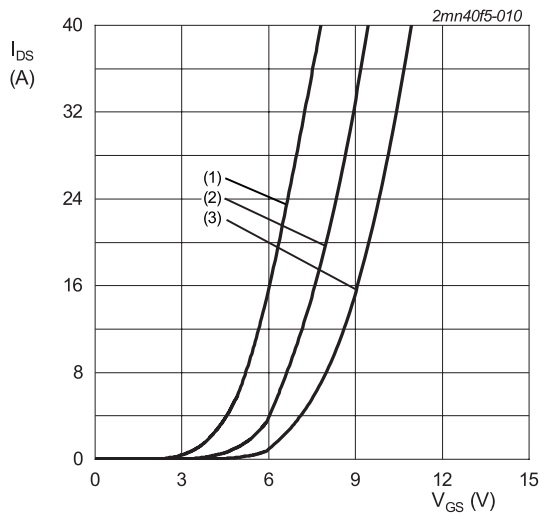
$V_{GS} = 18\text{ V}$; $t_p < 200\text{ }\mu\text{s}$

Fig. 8. Drain-source on-state resistance as a function of drain current; typical values



$I_{DS} = 35\text{ A}$; $t_p < 200\text{ }\mu\text{s}$

Fig. 9. Drain-source on-state resistance as a function of junction temperature



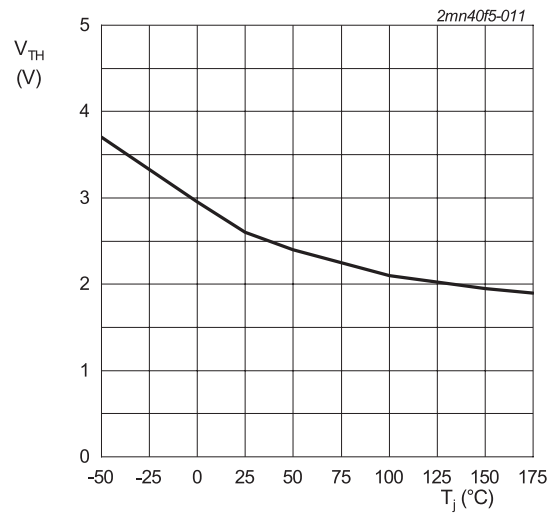
$V_{DS} = 10\text{ V}$; $t_p < 200\text{ }\mu\text{s}$

(1) $T_J = 175^\circ\text{C}$

(2) $T_J = 25^\circ\text{C}$

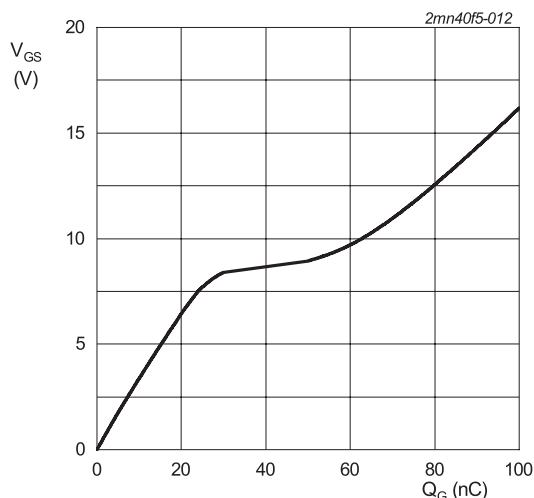
(3) $T_J = -55^\circ\text{C}$

Fig. 10. Transfer characteristics; drain current as a function of gate-source voltage; typical values



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

Fig. 11. Threshold voltage as a function of junction temperature



$I_{DS} = 35 \text{ A}$; $I_{GS} = 0.1 \text{ mA}$; $V_{DS} = 800 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$
Fig. 12. Gate-source voltage as a function of gate charge; typical values

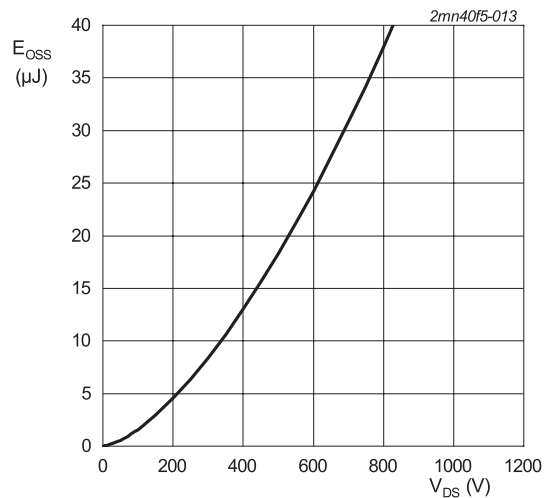
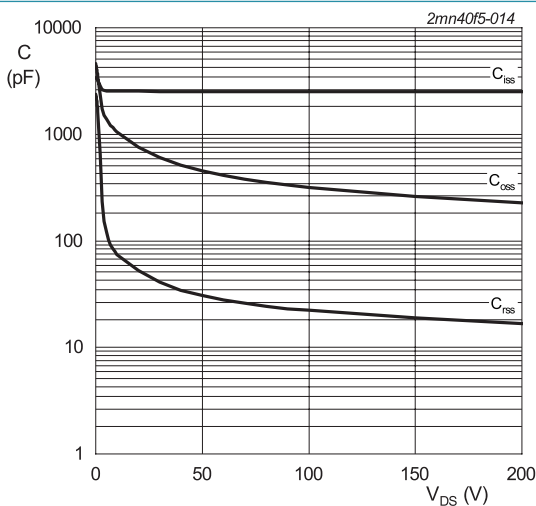
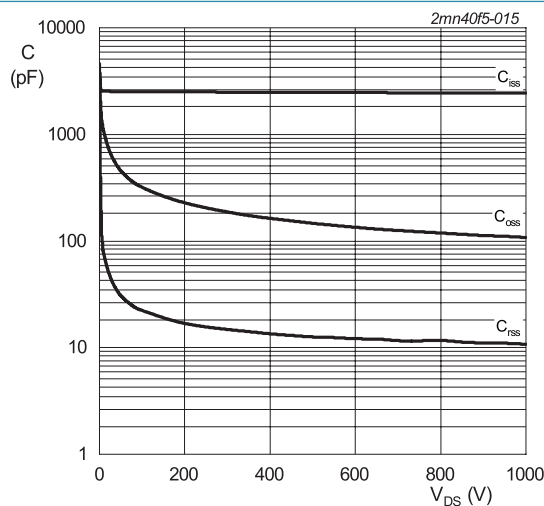


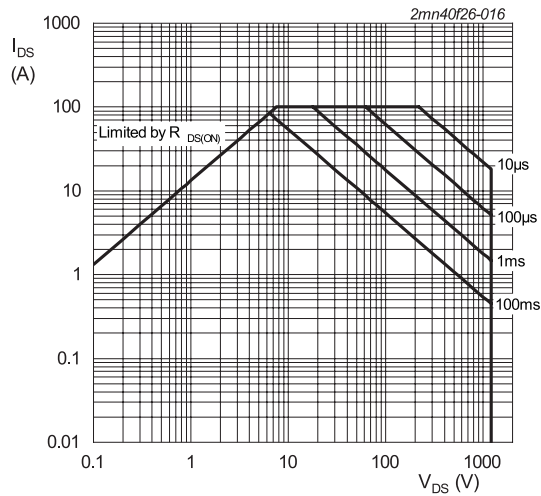
Fig. 13. Output capacitor stored energy as a function of drain-source voltage



$V_{DS} = 0 - 200 \text{ V}$
 $T_j = 25 \text{ }^\circ\text{C}$; $V_{AC} = 25 \text{ mV}$; $f = 1 \text{ MHz}$
Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



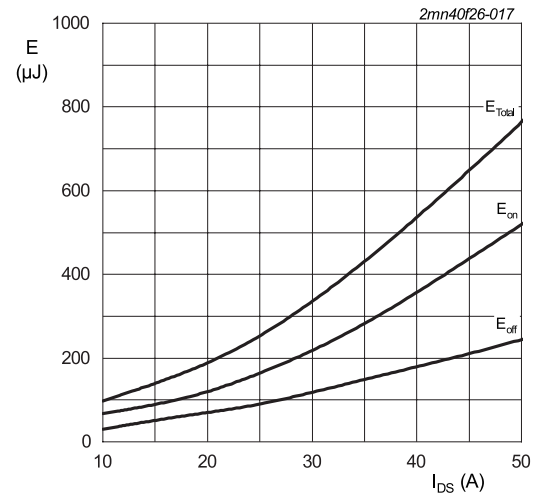
$V_{DS} = 0 - 1000 \text{ V}$
 $T_j = 25 \text{ }^\circ\text{C}$; $V_{AC} = 25 \text{ mV}$; $f = 1 \text{ MHz}$
Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



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

Parameter: t_p

Fig. 16. Forward bias safe operating area

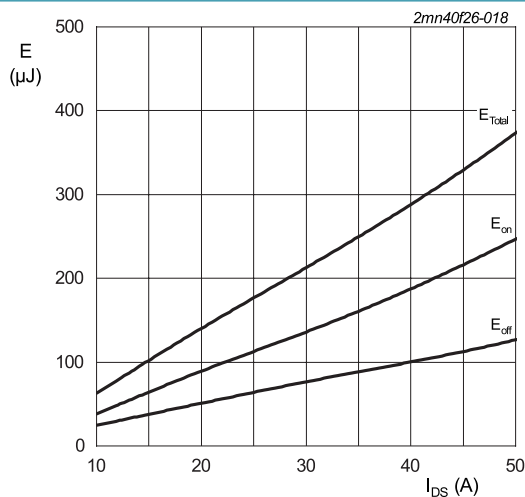


$T_j = 25\text{ }^{\circ}\text{C}$; $V_{DD} = 800\text{ V}$; $R_{G(ext)} = 2.4\text{ }\Omega$;

$V_{GS} = -4\text{ V}/18\text{ V}$; $L = 100\text{ }\mu\text{H}$

FWD = WNSC2D201200W

Fig. 17. Clamped Inductive Switching Energy as a function of drain current

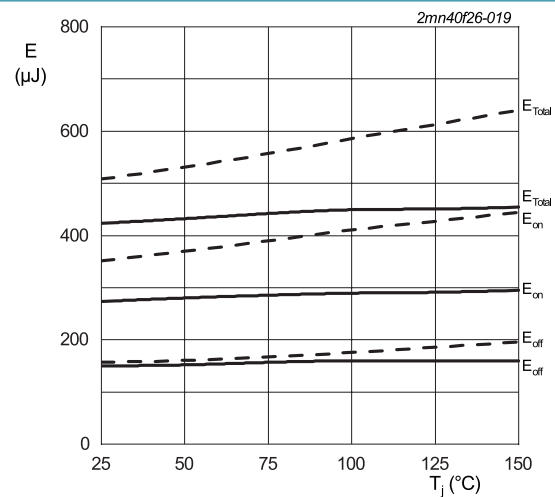


$T_j = 25\text{ }^{\circ}\text{C}$; $V_{DD} = 600\text{ V}$; $R_{G(ext)} = 2.4\text{ }\Omega$;

$V_{GS} = -4\text{ V}/18\text{ V}$; $L = 100\text{ }\mu\text{H}$

FWD = WNSC2D201200W

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



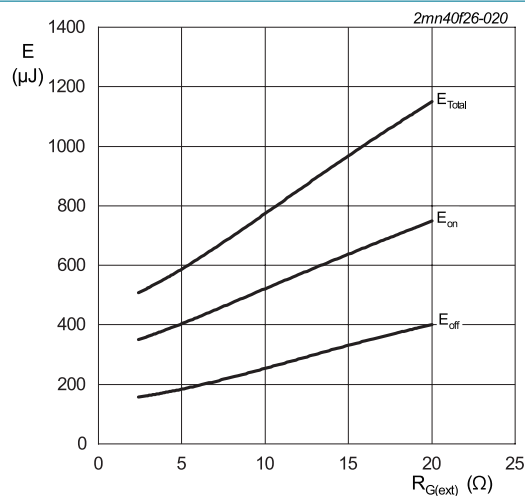
$I_{DS} = 35\text{ A}$; $V_{DD} = 800\text{ V}$; $R_{G(ext)} = 2.4\text{ }\Omega$;

$V_{GS} = -4\text{ V}/18\text{ V}$; $L = 100\text{ }\mu\text{H}$

FWD = WNSC2M40120R

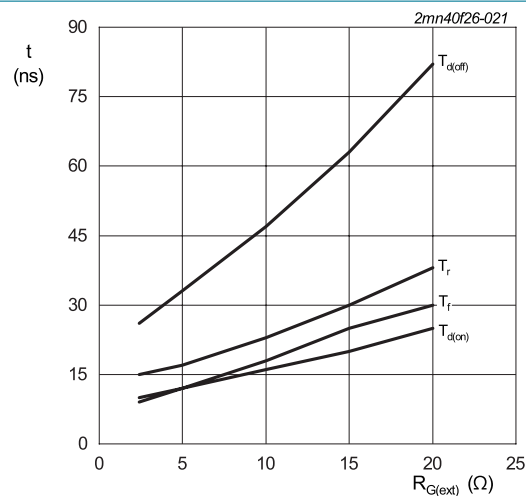
FWD = WNSC2D201200W(- - -)

Fig. 19. Clamped Inductive Switching Energy as a function of junction temperature



T_j = 25 °C; V_{DD} = 800 V; I_{DS} = 35 A; V_{GS} = -4 V/18 V
FWD = WNSC2M40120R; L = 100 μH

Fig. 20. Clamped Inductive Switching Energy as a function of external gate resistance



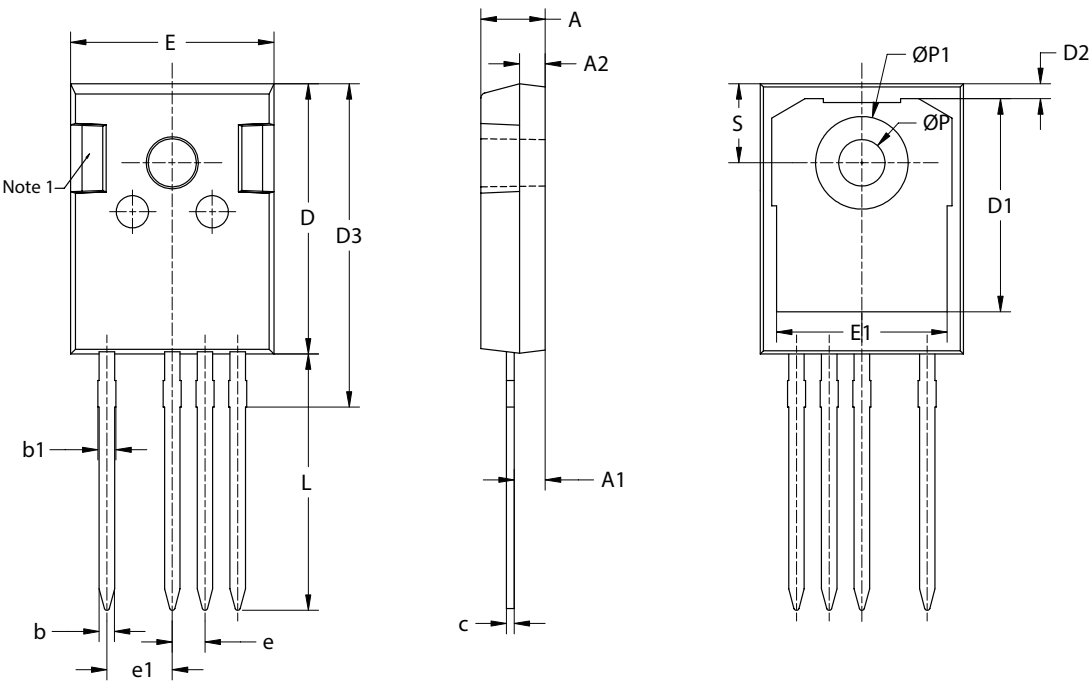
T_j = 25 °C; V_{DD} = 800 V; I_{DS} = 35 A; V_{GS} = -3 V/18 V
FWD = WNSC2M40120R; L = 100 μH

Fig. 21. Switching time as a function of external gate resistance

11. Package outline

Plastic single-ended through-hole package; heatsink mounted;1 mounting hole; 4 leads TO-247

TO247-4L



TOP VIEW

SIDE VIEW

BOTTOM VIEW



SIDE VIEW

UNIT	A	A1	A2	b	b1	c	D	D1	D2	D3	E	E1	e	e1	L	P	P1	S
mm	MAX	5.10	2.51	2.10	1.30	1.80	0.70	21.10	16.85	1.35	25.27	15.90	13.50	2.64	5.18	20.10	3.70	(7.40)
	NOM																	(6.15)
	MIN	4.90	2.31	1.90	1.10	0.50	20.90	16.25	1.05	24.97	15.70	13.10	2.44	4.98	19.80	3.50	-	

- Note:
1. Metal exposed with Sn plating.
 2. All dimensions do not include mold flash & gate remain

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.
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