

1. General description

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



2. Features and benefits

- Kelvin source configuration
- Low on-resistance
- Fast switching speed
- 0V turn-off V_{GS} for simple gate driving
- 100% UIS Tested
- Easy to parallel
- Reverse paralleling Si diode for protection

3. Applications

- PV MPPT circuit
- Energy storage systems

4. Quick reference data

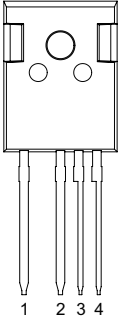
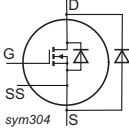
Table 1. Quick reference data

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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		75			A
P _{tot}	total power dissipation	T _{mb} = 25 °C, T _j = 175 °C		652			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 = 33 A; T _j = 25 °C		-	40	-	mΩ
		V _{GS} = 18 V; I _D = 33 A; T _j = 25 °C		-	33	45	mΩ
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 33 A; V _{DS} = 800 V; V _{GS} = -4 V/18 V; T _j = 25 °C		-	115	-	nC
Q _{GD}	gate-drain charge			-	18	-	nC
Source-drain diode							
Q _r	recovered charge	I _{SD} = 5 A; di/dt = 100 A/μs; V _{DS} = 400 V; T _j = 25 °C		-	23447	-	nC

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain		
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
WNSC2M40120RS-D	TO247-4L NL	WNSC2M40120RS-D6Q	Tube	30	TO247N-4L NL	10-Jun-2025

7. Marking

Table 4. Marking codes

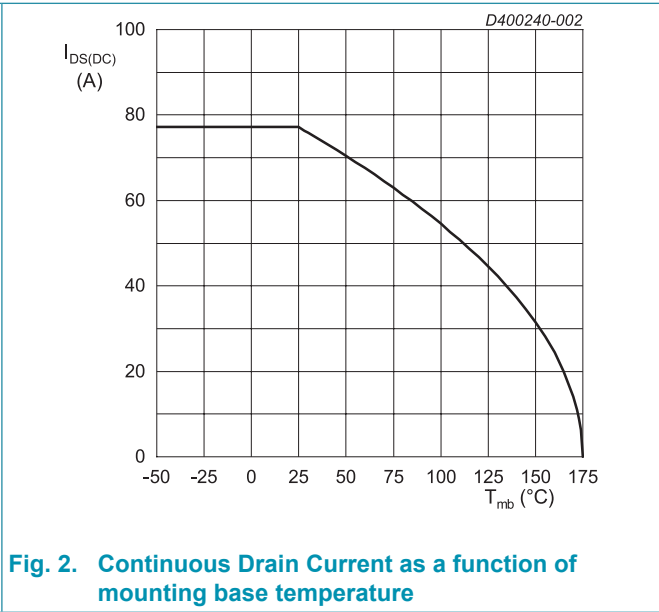
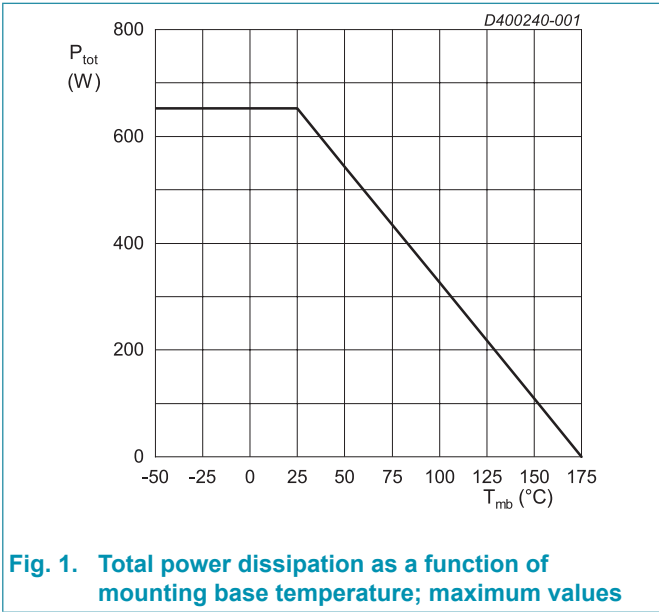
Type number	Marking codes
WNSC2M40120RS-D	WNSC2M 40120RS-D

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Notes	Values	Unit
SiC MOSFET					
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		-12 to 24	V
$V_{GS,op}$	gate-source voltage	Recommended operational values		-4 to 18	V
I_D	drain current	$V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$		75	A
		$V_{GS} = 18\text{ V}; T_{mb} = 100\text{ °C}$		55	A
I_{DM}	peak drain current	pulse width t_p limited by T_{Jmax}		150	A
Si diode					
V_R	Reverse voltage	$25\text{ °C} \leq T_J \leq 150\text{ °C}$		1600	V
T_J	junction temperature			-55 to 150	°C
Source-drain diode					
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}, T_J = 175\text{ °C}$		652	W
E_{as}	single pulse drain-to-source avalanche	$I_{AS} = 4.5\text{ A}; L = 5\text{ mH}; V_{DD} = 50\text{ V}; T_J = 25\text{ °C}$		50	mJ
I_F	average forward current	DC, $T_{mb} \leq 125\text{ °C}$, square-wave pulse		97	A
		DC, $T_{mb} \leq 25\text{ °C}$, square-wave pulse		195	A
I_{FRM}	repetitive peak forward current	$\delta = 0.5; t_p = 25\text{ }\mu\text{s}; T_{mb} = 125\text{ °C}$; square-wave pulse		152	A
I_{FSM}	non-repetitive peak forward current	$t_p = 10\text{ ms}; T_{J(init)} = 25\text{ °C}$; sine-wave pulse		610	A
		$t_p = 100\text{ }\mu\text{s}; T_{J(init)} = 25\text{ °C}$; square-wave pulse		2800	A
T_{stg}	storage temperature			-55 to 150	°C
$T_{J,max}$	maximum junction temperature	Intermittent condition with shorted lifetime		-55 to 175	°C
$T_{sld(M)}$	peak soldering temperature			260	°C
M_d	monting torque	M3 or 6 - 32 screw		0.6	Nm

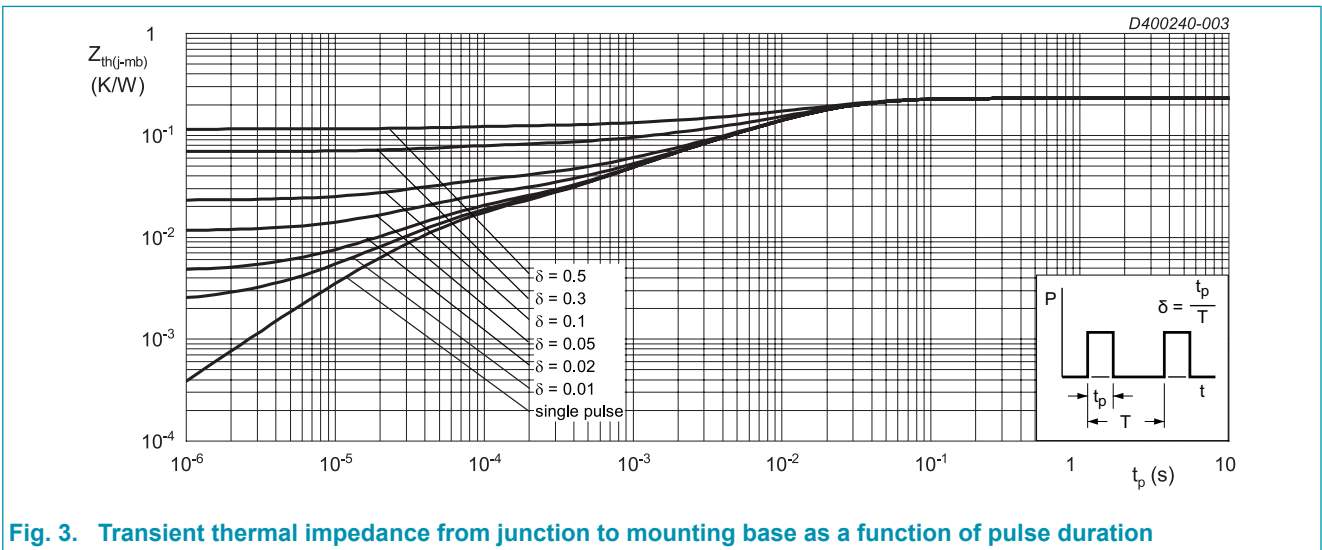


9. Thermal & Mechanical characteristics

Table 6. Thermal & Mechanical characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-c)}$	thermal resistance from junction to case			-	0.23	-	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	40	-	K/W

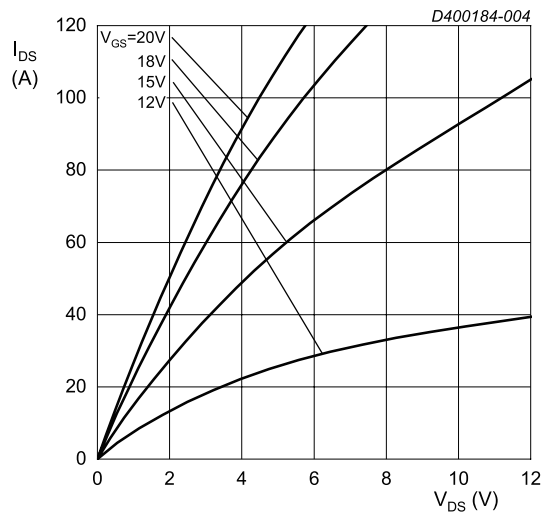
Note: It is recommended that a metal washer is inserted between screw head and mounting tab.
Do not use self-tapping screws.
Device is ESD sensitive. Handling precautions are recommended.



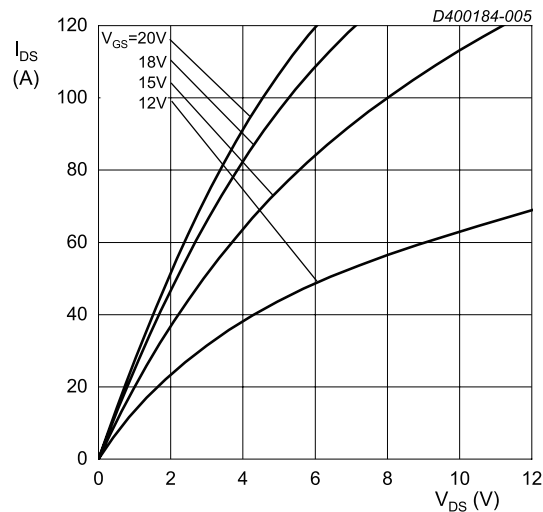
10. Characteristics

Table 7. Characteristics

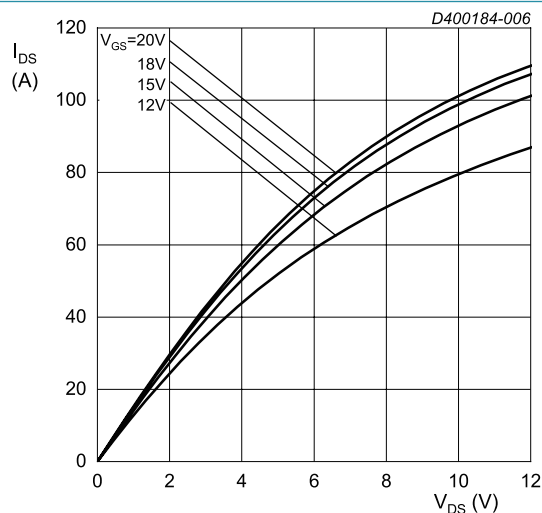
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 100 \mu A$; $V_{GS} = 0 V$; $T_J = 25^\circ C$		1200	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 10 mA$; $V_{DS} = 10 V$; $T_J = 25^\circ C$		1.9	2.6	3.5	V
		$I_D = 10 mA$; $V_{DS} = 10 V$; $T_J = 175^\circ C$		-	1.9	-	V
I_{DSS}	drain leakage current	$V_{DS} = 1200 V$; $V_{GS} = 0 V$; $T_J = 25^\circ C$		-	0.2	100	μA
		$V_{DS} = 1200 V$; $V_{GS} = 0 V$; $T_J = 175^\circ C$		-	1	-	mA
I_{GSS}	gate leakage current	$V_{GS} = 24 V$; $V_{DS} = 0 V$; $T_J = 25^\circ C$		-	10	100	nA
		$V_{GS} = -12 V$; $V_{DS} = 0 V$; $T_J = 25^\circ C$		-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15 V$; $I_D = 33 A$; $T_J = 25^\circ C$		-	40	-	m Ω
		$V_{GS} = 18 V$; $I_D = 33 A$; $T_J = 25^\circ C$		-	33	45	m Ω
		$V_{GS} = 18 V$; $I_D = 33 A$; $T_J = 175^\circ C$		-	56	-	m Ω
R_G	gate resistance	$f = 1 MHz$; $T_J = 25^\circ C$		-	1	-	Ω
g_{fs}	transconductance	$V_{DS} = 20 V$; $I_D = 33 A$; $T_J = 25^\circ C$		-	20	-	S
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$I_D = 33 A$; $V_{DS} = 800 V$; $V_{GS} = -4 V/18 V$; $T_J = 25^\circ C$		-	115	-	nC
Q_{GS}	gate-source charge			-	47	-	nC
Q_{GD}	gate-drain charge			-	18	-	nC
C_{iss}	input capacitance	$V_{DS} = 1000 V$; $V_{GS} = 0 V$; $f = 1 MHz$; $T_J = 25^\circ C$		-	2400	-	pF
C_{oss}	output capacitance			-	120	-	pF
C_{rss}	reverse transfer capacitance			-	10	-	pF
E_{oss}	Coss stored energy			-	60	-	μJ
$t_{d(on)}$	turn-on delay time	$V_{DS} = 800 V$; $V_{GS} = -4 V/18 V$; $R_{G(ext)} = 5.1 \Omega$; $I_D = 33 A$; $L = 300 \mu H$; $T_J = 25^\circ C$		-	14	-	ns
t_r	rise time			-	27	-	ns
$t_{d(off)}$	turn-off delay time			-	34	-	ns
t_f	fall time			-	11	-	ns
E_{on}	turn-on energy (SiC Diode FWD)		Fig.20	-	413	-	μJ
E_{off}	turn-off energy (SiC Diode FWD)		Fig.20	-	81	-	μJ
E_{on}	turn-on energy (Body Diode FWD)		Fig.20	-	8591	-	μJ
E_{off}	turn-off energy (Body Diode FWD)		Fig.20	-	97	-	μJ
Source-drain diode							
V_{SD}	source-drain voltage	$V_{GS} = -4 V$; $I_{SD} = 33 A$; $T_J = 25^\circ C$		-	1.1	-	V
		$V_{GS} = -4 V$; $I_{SD} = 33 A$; $T_J = 175^\circ C$		-	1.0	-	V
		$V_{GS} = -4 V$; $I_{SD} = 40 A$; $T_J = 25^\circ C$		-	1.15	-	V
		$V_{GS} = -4 V$; $I_{SD} = 50 A$; $T_J = 25^\circ C$		-	1.2	-	V
t_{rr}	reverse recovery time	$I_{SD} = 5 A$; $di/dt = 100 A/\mu s$; $V_{DS} = 400 V$; $T_J = 25^\circ C$		-	950	-	ns
Q_r	recovered charge			-	23447	-	nC
I_{rrm}	reverse recovery current			-	43	-	A



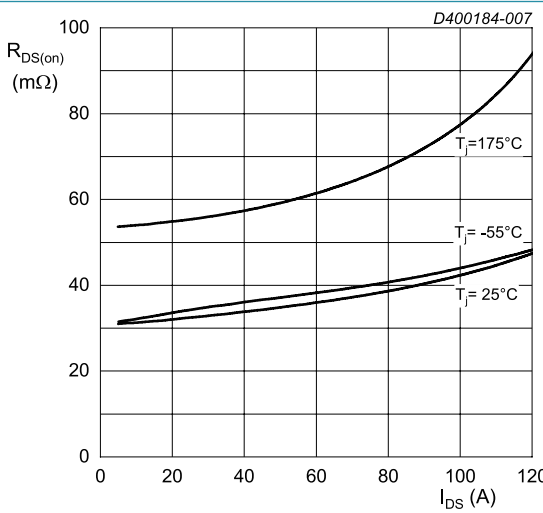
$T_j = -55\text{ }^{\circ}\text{C}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 4. Output characteristics; drain current as a function of drain-source voltage; typical values



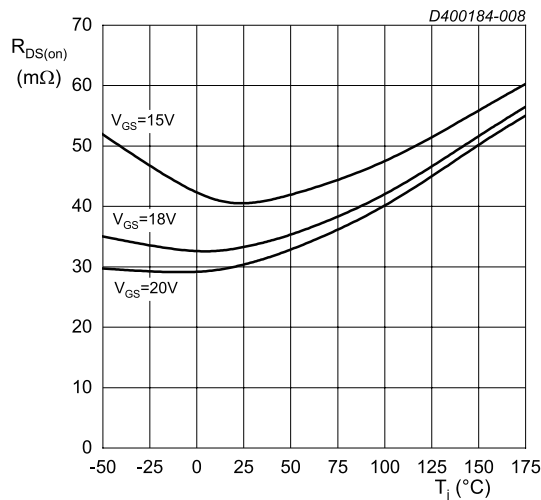
$T_j = 25\text{ }^{\circ}\text{C}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values



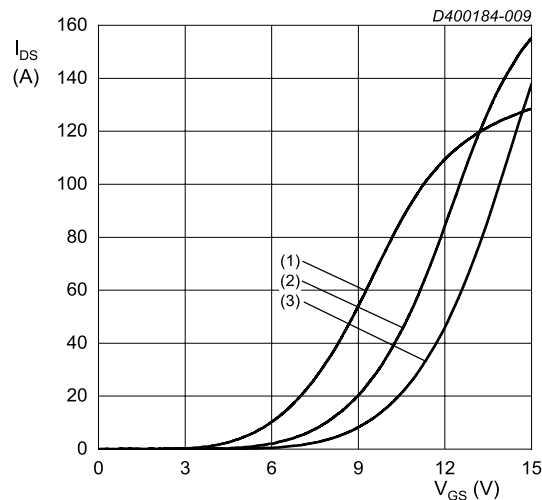
$T_j = 175\text{ }^{\circ}\text{C}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values



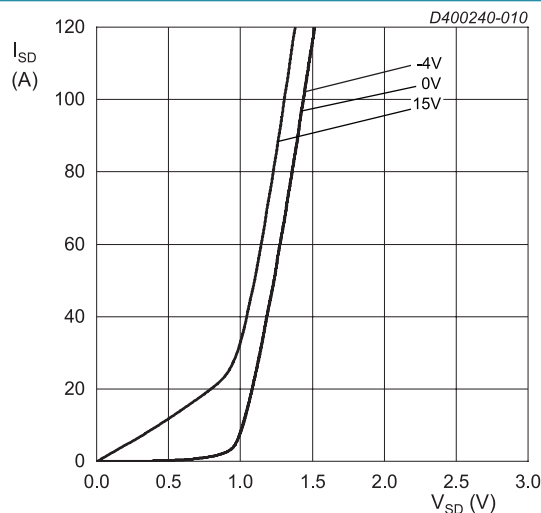
$V_{GS} = 18\text{ V}$; $t_p < 200\text{ }\mu\text{s}$
Fig. 7. Drain-source on-state resistance as a function of drain current; typical values



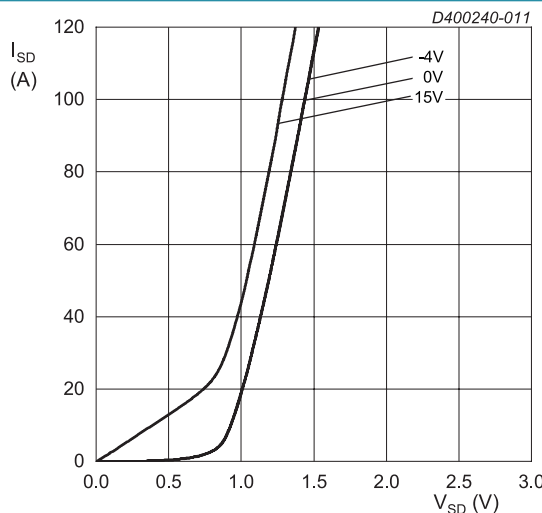
$I_{DS} = 33\text{ A}$; $t_p < 200\text{ }\mu s$
Fig. 8. Drain-source on-state resistance as a function of junction temperature



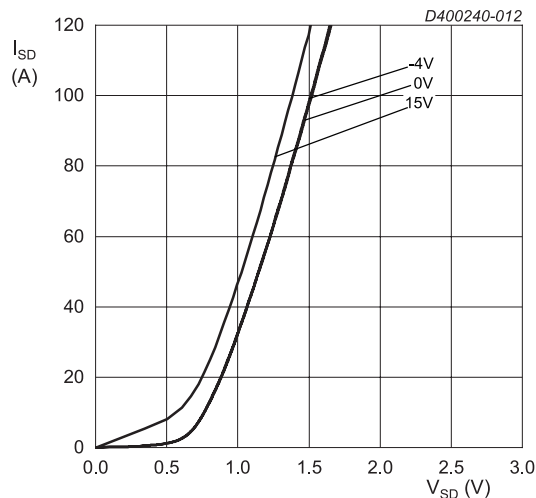
$V_{DS} = 20\text{ V}$; $t_p < 200\text{ }\mu s$
(1) $T_j = 175^{\circ}C$
(2) $T_j = 25^{\circ}C$
(3) $T_j = -55^{\circ}C$
Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values



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

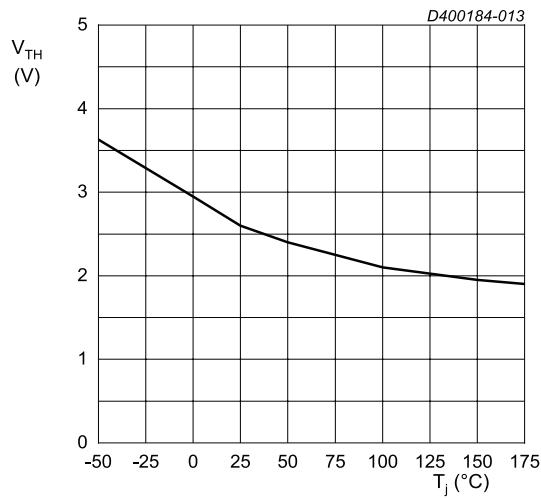


$T_j = 25^{\circ}C$; $t_p < 200\text{ }\mu s$
Fig. 11. Body diode forward characteristics; typical values



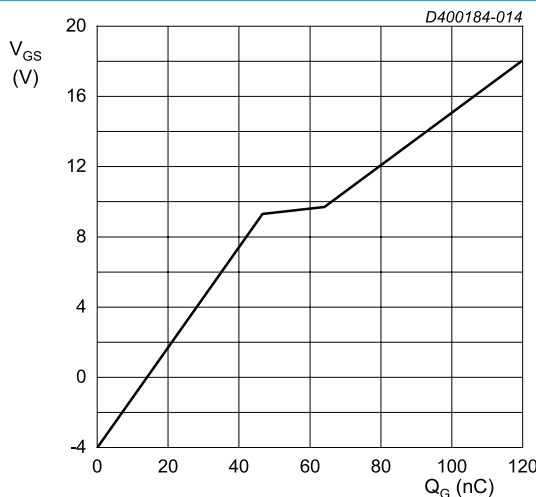
$T_j = 175\text{ }^{\circ}\text{C}$; $t_p < 200\text{ }\mu\text{s}$

Fig. 12. Body diode forward characteristics; typical values



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

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



$I_{DS} = 33\text{ A}$; $I_{GS} = 0.1\text{ mA}$; $V_{DS} = 800\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$

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

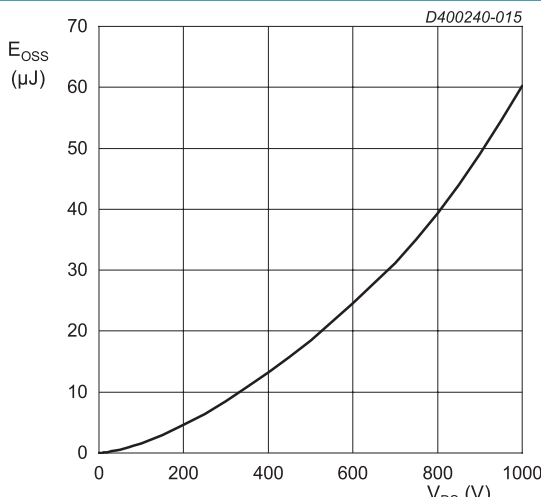
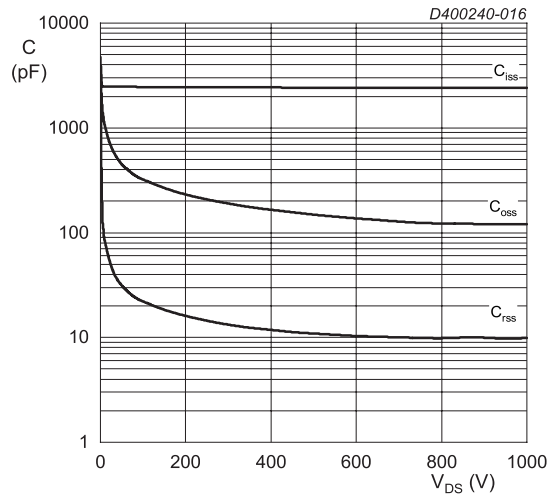
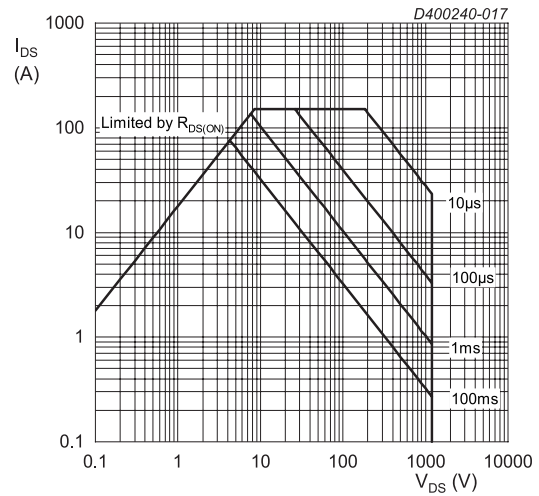


Fig. 15. Output capacitor stored energy as a function of drain-source voltage



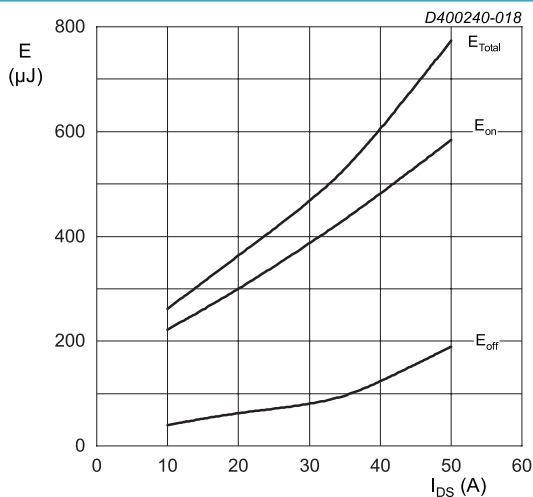
$V_{DS} = 0 - 1000 \text{ V}$
 $T_j = 25^\circ\text{C}$; $V_{AC} = 25 \text{ mV}$; $f = 1 \text{ MHz}$

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



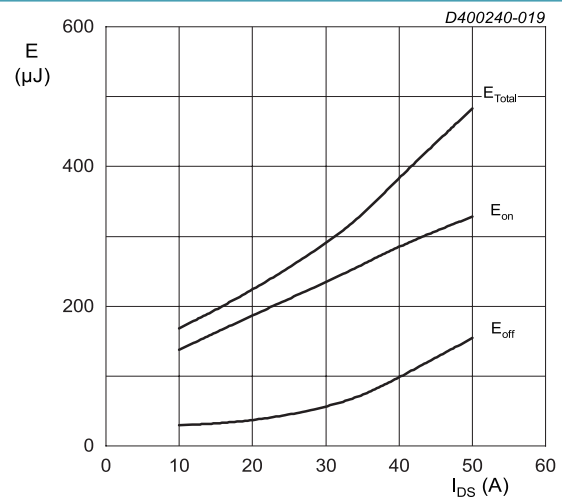
$T_j = 25^\circ\text{C}$; $D = 0$
 Parameter: t_p

Fig. 17. Forward bias safe operating area



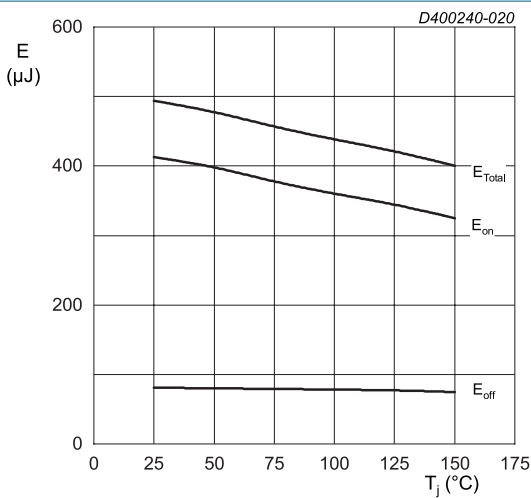
$T_j = 25^\circ\text{C}$; $V_{DD} = 800 \text{ V}$; $R_{G(\text{ext})} = 5.1 \Omega$;
 $V_{GS} = -4 \text{ V}/18 \text{ V}$; $L = 300 \mu\text{H}$
 FWD = WNSC2D401200W

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



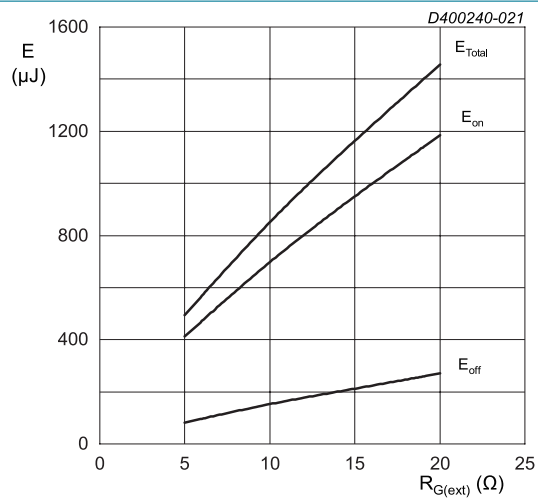
$T_j = 25^\circ\text{C}$; $V_{DD} = 600 \text{ V}$; $R_{G(\text{ext})} = 5.1 \Omega$;
 $V_{GS} = -4 \text{ V}/18 \text{ V}$; $L = 300 \mu\text{H}$
 FWD = WNSC2D401200W

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



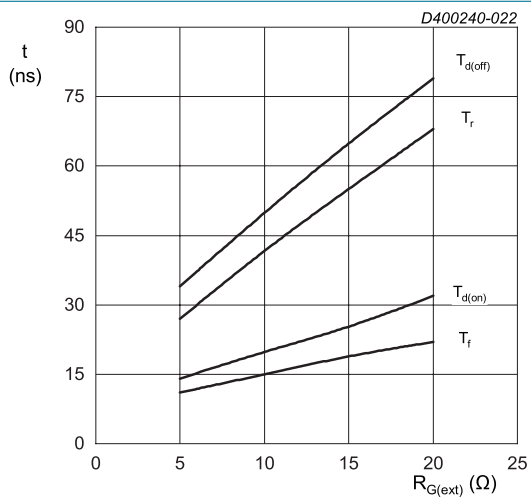
$I_{\text{DS}} = 33 \text{ A}$; $V_{\text{DD}} = 800 \text{ V}$; $R_{\text{G(ext)}} = 5.1 \Omega$;
 $V_{\text{GS}} = -4 \text{ V}/18 \text{ V}$; $L = 300 \mu\text{H}$
FWD = WNSC2D401200W

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



$T_j = 25 \text{ }^{\circ}\text{C}$; $V_{\text{DD}} = 800 \text{ V}$; $I_{\text{DS}} = 33 \text{ A}$;
 $V_{\text{GS}} = -4 \text{ V}/18 \text{ V}$; $L = 300 \mu\text{H}$
FWD = WNSC2D401200W

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



$T_j = 25 \text{ }^{\circ}\text{C}$; $V_{\text{DD}} = 800 \text{ V}$; $I_{\text{DS}} = 33 \text{ A}$; $V_{\text{GS}} = -4 \text{ V}/18 \text{ V}$
FWD = WNSC2D401200W; $L = 300 \mu\text{H}$

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

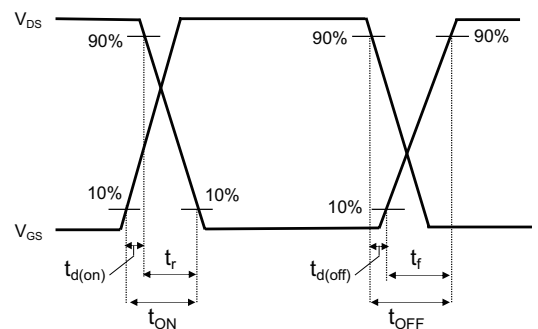
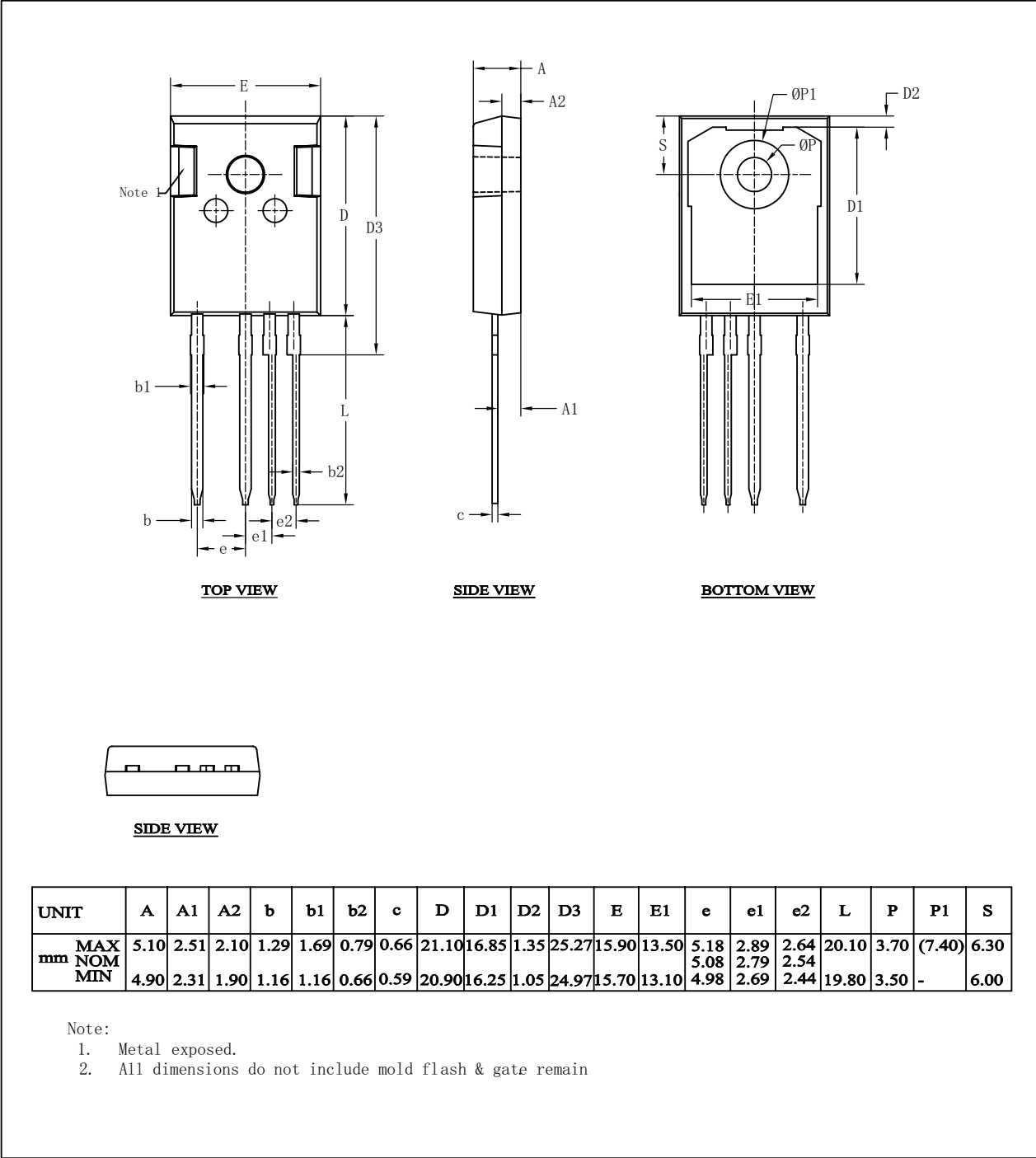


Fig. 23. Switching time definition

11. Package outline

Plastic single-ended through-hole package; headsink mounted; 1 mounting hole; 4 leads TO-247 Narrow Leads

TO247-4L NL



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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