

## 1. General description

Silicon Carbide MOSFET in a TO263-7L plastic package, designed for high frequency, high efficiency systems.



## 2. Features and benefits

- Low on-resistance
- Fast switching speed
- 0V turn-off gate voltage for simple gate drive
- Easy to parallel
- 100% UIS Tested
- 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

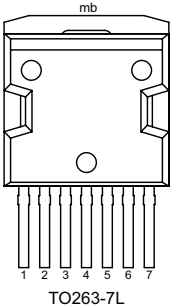
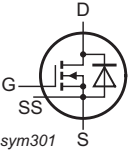
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
<b>Absolute maximum rating</b>							
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$		1700			V
$I_D$	drain current	$V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$		7.5			A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$		91			W
$T_j$	junction temperature			-55 to 175			°C
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15\text{ V}; I_D = 1\text{ A}; T_j = 25\text{ °C}$		-	1000	-	mΩ
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$I_D = 2\text{ A}; V_{DS} = 1200\text{ V}; V_{GS} = 0\text{ V}/18\text{ V}; T_j = 25\text{ °C}$		-	12	-	nC
$Q_{GD}$	gate-drain charge			-	5	-	nC
<b>Source-drain diode</b>							
$Q_r$	recovered charge	$I_{SD} = 1\text{ A}; di/dt = 500\text{ A}/\mu\text{s}; V_{DS} = 400\text{ V}; T_j = 25\text{ °C}$		-	38	-	nC

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p style="text-align: center;">TO263-7L</p>	 <p style="text-align: center;"><i>sym301</i></p>
2	SS	source sense		
3-7	S	source		
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
WNSC2M1K0170B7	TO263-7L		Reel	800	TO263P-7L	12-Jun-2023

## 7. Marking

Table 4. Marking codes

Type number	Marking codes
WNSC2M1K0170B7	WNSC2M 1K0170B7

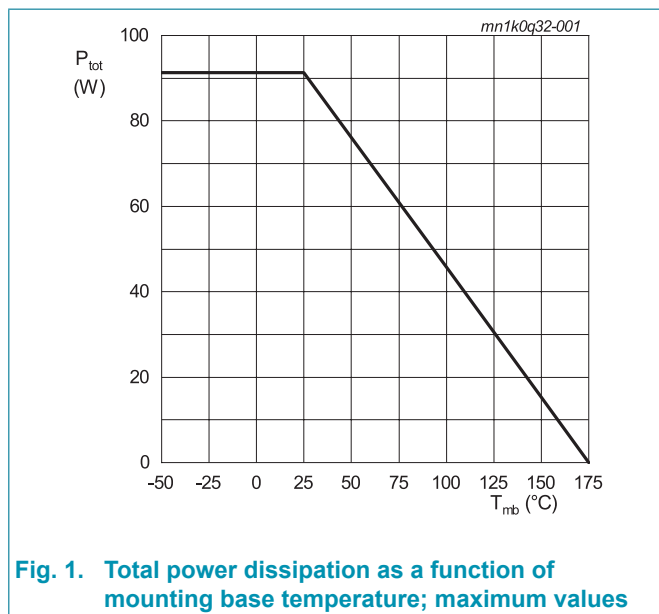
## 8. Limiting values

**Table 5. Limiting values**

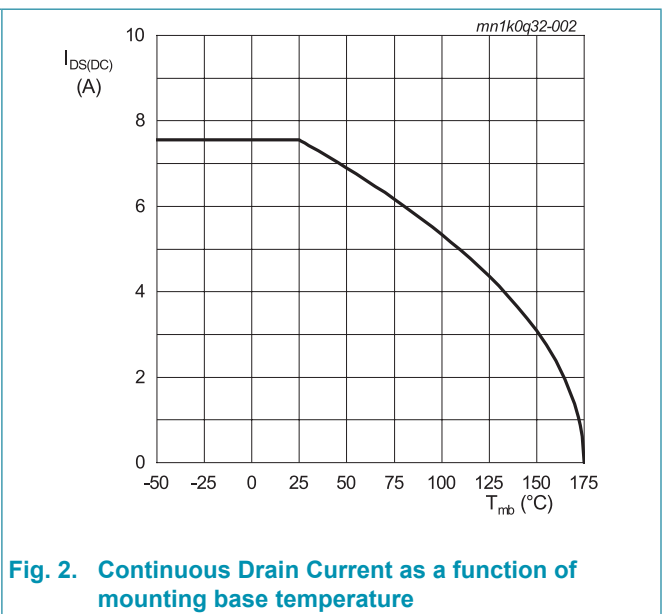
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Notes	Vaules	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$		1700	V
$V_{GS,max}$	gate-source voltage			-10 to 22	V
$V_{GS,op}$	gate-source voltage			-5 to 18	V
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$		91	W
$I_D$	drain current	$V_{GS} = 18\text{ V}; T_{mb} = 25\text{ °C}$		7.5	A
		$V_{GS} = 18\text{ V}; T_{mb} = 100\text{ °C}$		5.3	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$		20	A
$E_{as}$	single pulse drain-to-source avalanche	$I_{AS} = 7\text{ A}; L = 1\text{ mH}; V_{DD} = 100\text{ V}; T_{j(init)} = 25\text{ °C}$		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

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



**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 characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base			-	-	1.64	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	40	-	K/W

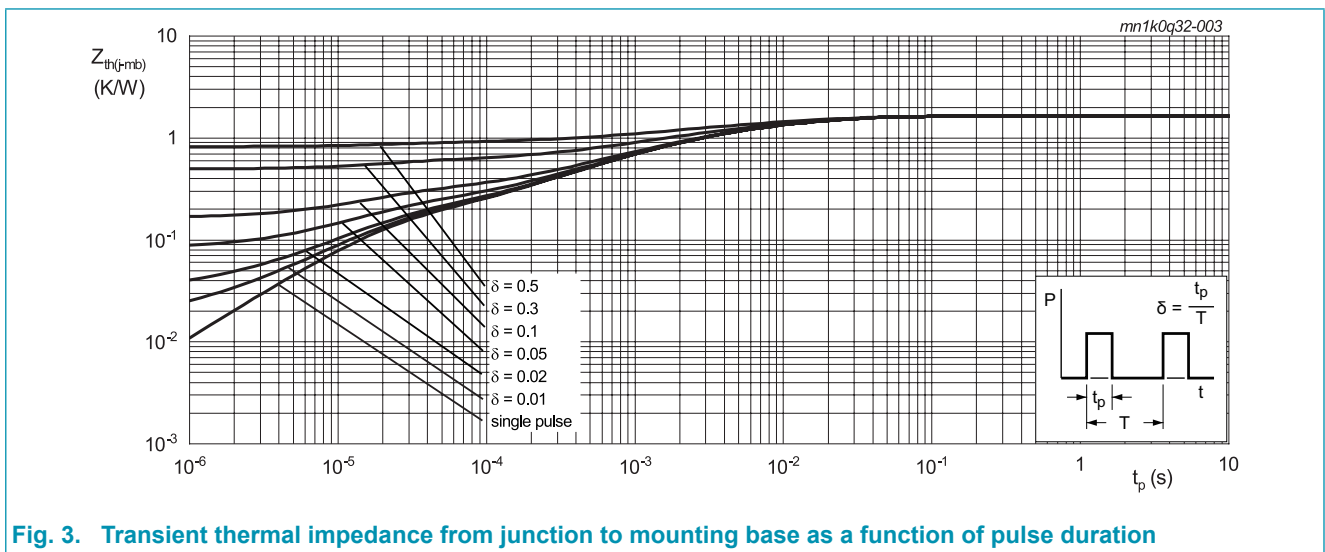
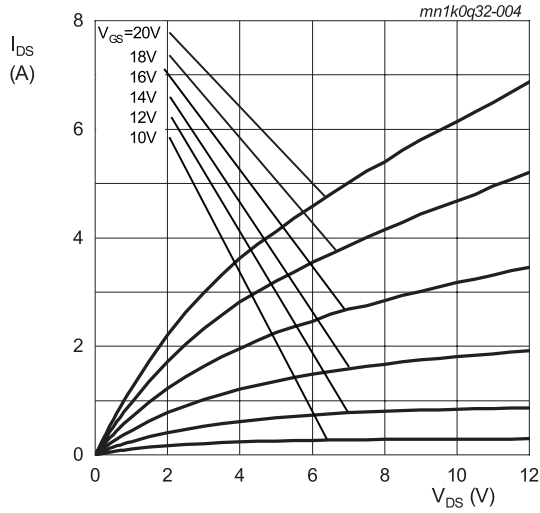


Fig. 3. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Characteristics

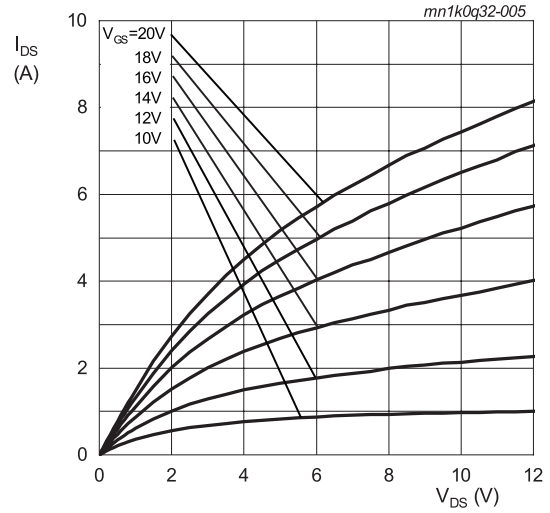
**Table 7. Characteristics**

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 100 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$		1700	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 0.8 \text{ mA}$ ; $V_{DS} = 10 V$ ; $T_j = 25 \text{ }^\circ C$		2.3	3.2	4.2	V
		$I_D = 0.8 \text{ mA}$ ; $V_{DS} = 10 V$ ; $T_j = 150 \text{ }^\circ C$		-	2.4	-	V
$I_{DSS}$	drain leakage current	$V_{DS} = 1700 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$		-	0.1	10	$\mu A$
		$V_{DS} = 1700 V$ ; $V_{GS} = 0 V$ ; $T_j = 150 \text{ }^\circ C$		-	1	-	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 18 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$		-	10	100	nA
		$V_{GS} = -10 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$		-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 15 V$ ; $I_D = 1 A$ ; $T_j = 25 \text{ }^\circ C$		-	1000	-	m $\Omega$
		$V_{GS} = 18 V$ ; $I_D = 1 A$ ; $T_j = 25 \text{ }^\circ C$		-	750	1000	m $\Omega$
		$V_{GS} = 18 V$ ; $I_D = 1 A$ ; $T_j = 150 \text{ }^\circ C$		-	1050	-	m $\Omega$
$R_G$	gate resistance	$f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ C$		-	16	-	$\Omega$
$g_{fs}$	transconductance	$V_{DS} = 10 V$ ; $I_D = 1 A$ ; $T_j = 25 \text{ }^\circ C$		-	0.5	-	S
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$I_D = 2 A$ ; $V_{DS} = 1200 V$ ; $V_{GS} = 0 V/18 V$ ; $T_j = 25 \text{ }^\circ C$		-	12	-	nC
$Q_{GS}$	gate-source charge			-	3.8	-	nC
$Q_{GD}$	gate-drain charge			-	5	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 1000 V$ ; $V_{GS} = 0 V$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ C$		-	225	-	pF
$C_{oss}$	output capacitance			-	15	-	pF
$C_{rss}$	reverse transfer capacitance			-	2.8	-	pF
$E_{oss}$	Coss stored energy			-	7.5	-	$\mu J$
$t_{d(on)}$	turn-on delay time	$V_{DS} = 1000 V$ ; $V_{GS} = -3 V/18 V$ ; $R_{G(ext)} = 5.1 \Omega$ ; $I_D = 2 A$ ; $L = 1.4 \text{ mH}$ ; $T_j = 25 \text{ }^\circ C$		-	15	-	ns
$t_r$	rise time			-	21	-	ns
$t_{d(off)}$	turn-off delay time			-	19	-	ns
$t_f$	fall time			-	10	-	ns
$E_{on}$	turn-on energy (Body Diode FWD)			-	23	-	$\mu J$
$E_{off}$	turn-off energy (Body Diode FWD)			-	3	-	$\mu J$
<b>Source-drain diode</b>							
$V_{SD}$	source-drain voltage	$V_{GS} = 0 V$ ; $I_F = 1 A$ ; $T_j = 25 \text{ }^\circ C$		-	3.9	-	V
		$V_{GS} = 0 V$ ; $I_F = 1 A$ ; $T_j = 150 \text{ }^\circ C$		-	3.4	-	V
$t_{rr}$	reverse recovery time	$I_{SD} = 1 A$ ; $di/dt = 500 A/\mu s$ ; $V_{DS} = 400 V$ ; $T_j = 25 \text{ }^\circ C$		-	36	-	ns
$Q_r$	recovered charge			-	38	-	nC
$I_{rrm}$	reverse recovery current			-	1.8	-	A



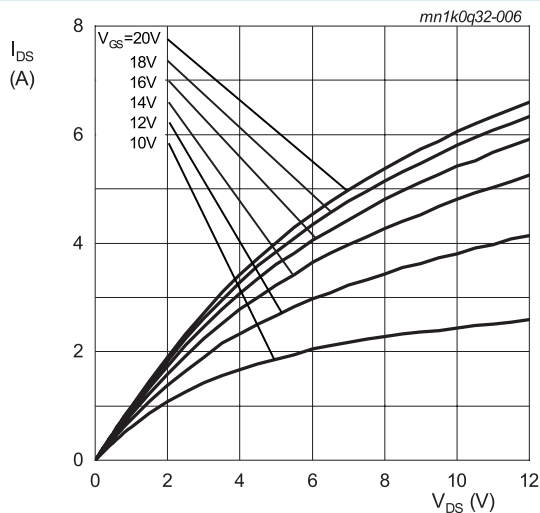
$T_j = -55\text{ }^\circ\text{C}; t_p < 200\text{ }\mu\text{s}$

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



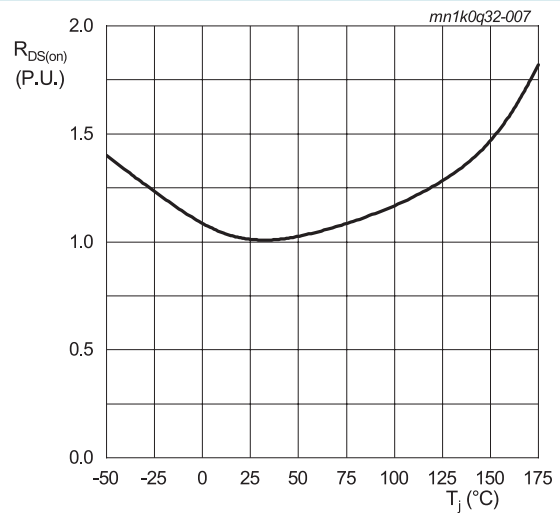
$T_j = 25\text{ }^\circ\text{C}; t_p < 200\text{ }\mu\text{s}$

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



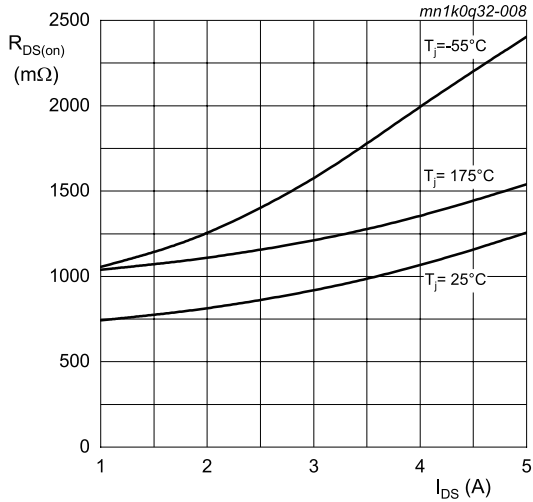
$T_j = 150\text{ }^\circ\text{C}; t_p < 200\text{ }\mu\text{s}$

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

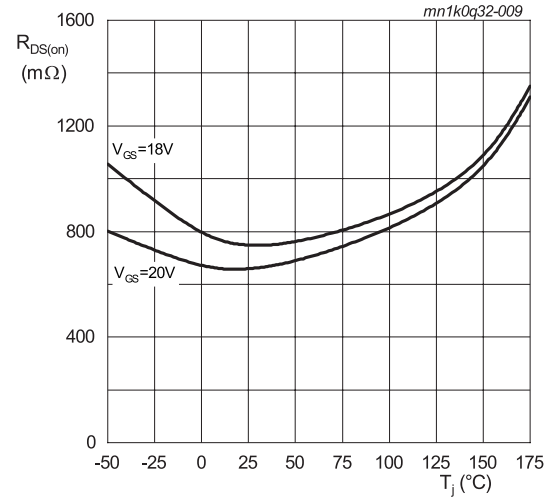


$I_{DS} = 1\text{ A}; V_{GS} = 18\text{ V}; t_p < 200\text{ }\mu\text{s}$

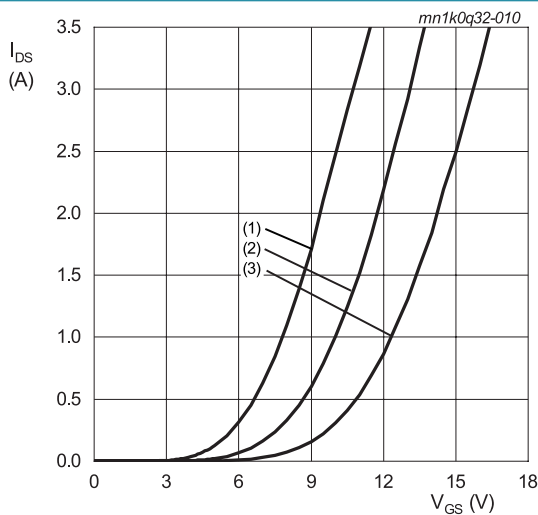
**Fig. 7. Normalized drain-source on-state resistance as a function of junction temperature**



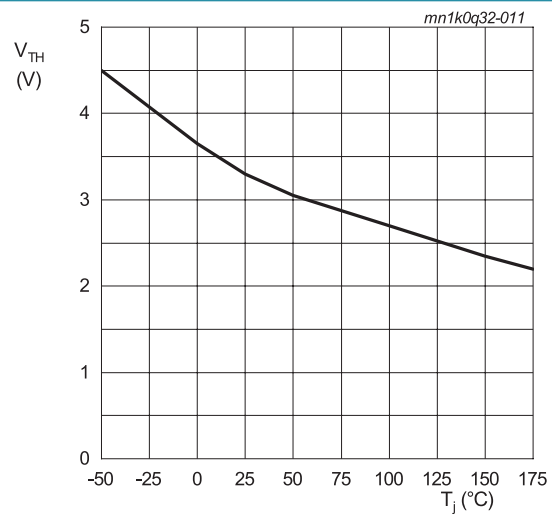
$V_{GS} = 18\text{ V}; t_p < 200\ \mu\text{s}$   
**Fig. 8. Drain-source on-state resistance as a function of drain current; typical values**



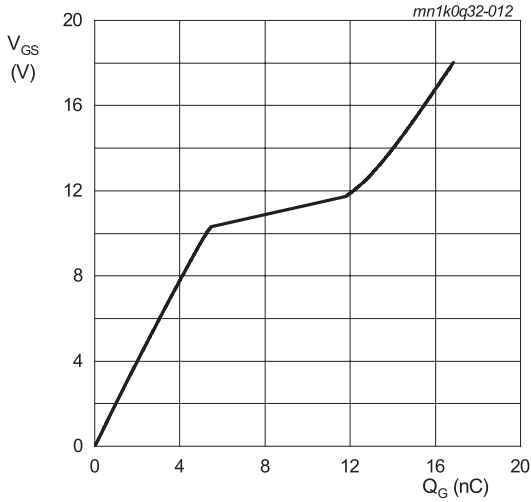
$I_{DS} = 1\text{ A}; t_p < 200\ \mu\text{s}$   
**Fig. 9. Drain-source on-state resistance as a function of junction temperature**



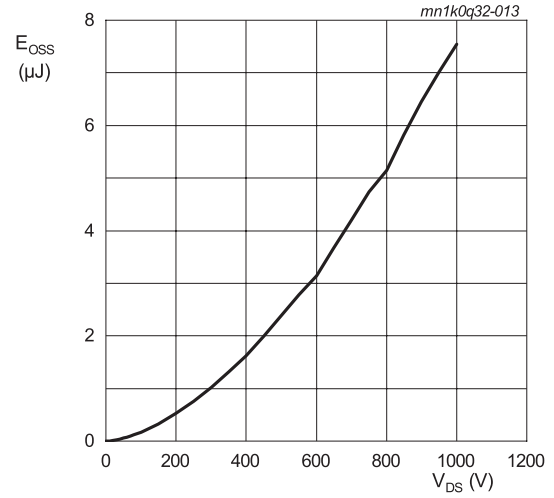
$V_{DS} = 10\text{ V}; t_p < 200\ \mu\text{s}$   
 (1)  $T_J = 150^\circ\text{C}$   
 (2)  $T_J = 25^\circ\text{C}$   
 (3)  $T_J = -55^\circ\text{C}$   
**Fig. 10. Transfer characteristics; drain current as a function of gate-source voltage; typical values**



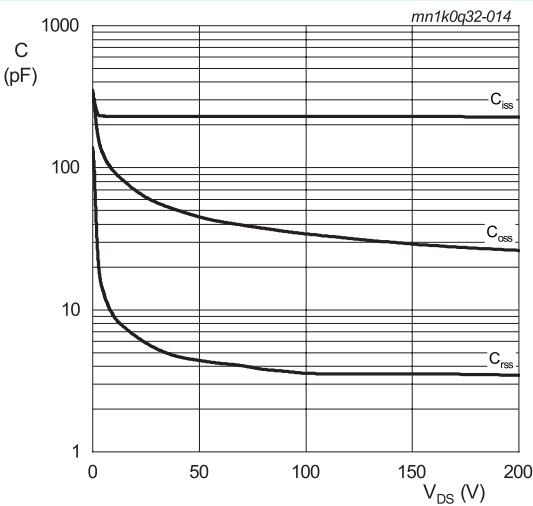
$V_{DS} = 10\text{ V}; I_{DS} = 0.8\text{ mA}$   
**Fig. 11. Threshold voltage as a function of junction temperature**



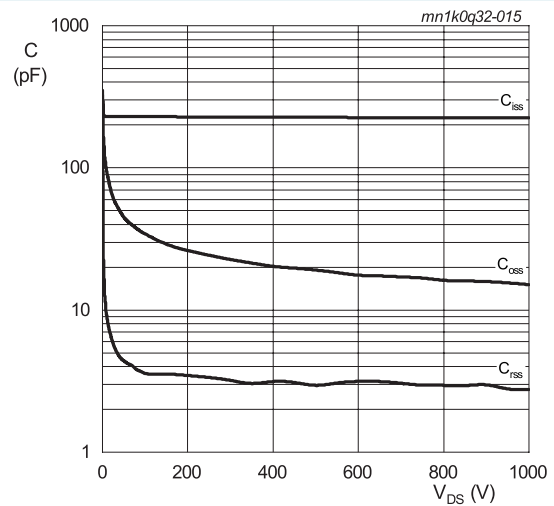
$I_{DS} = 2\text{ A}; I_{GS} = 0.1\text{ mA}; V_{DS} = 1200\text{ V}; T_j = 25\text{ }^\circ\text{C}$   
**Fig. 12. Gate-source voltage as a function of gate charge; typical values**



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

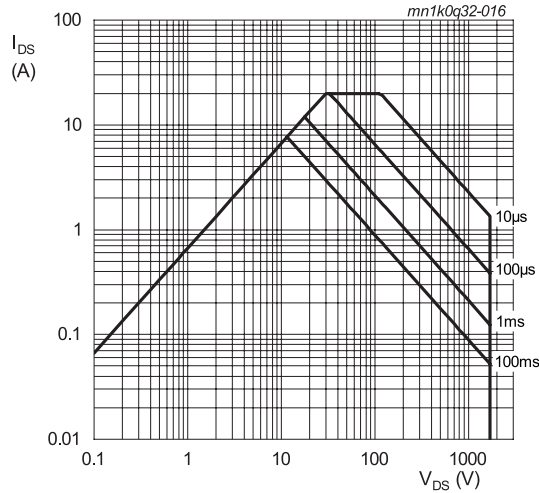


$V_{DS} = 0 - 200\text{ V}$   
 $T_j = 25\text{ }^\circ\text{C}; V_{AC} = 25\text{ mV}; f = 1\text{ MHz}$   
**Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



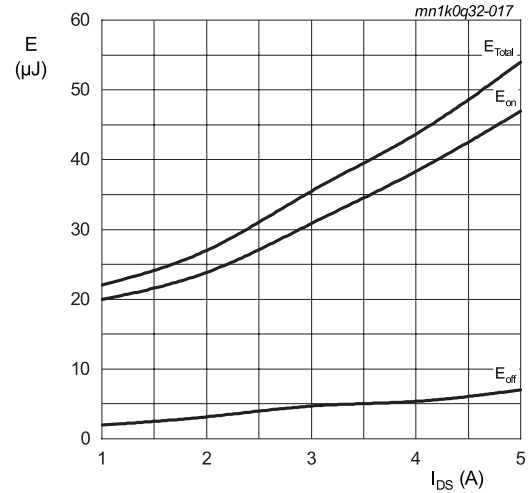
$V_{DS} = 0 - 1000\text{ V}$   
 $T_j = 25\text{ }^\circ\text{C}; V_{AC} = 25\text{ mV}; f = 1\text{ MHz}$   
**Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**





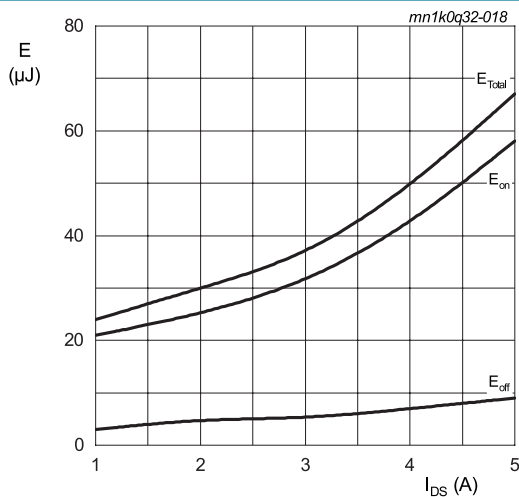
$T_j = 25\text{ }^\circ\text{C}$ ;  $D = 0$   
 Parameter:  $t_p$

Fig. 16. Forward bias safe operating area



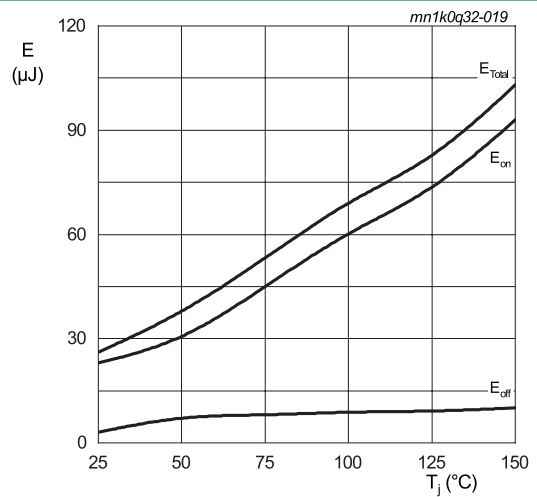
$T_j = 25\text{ }^\circ\text{C}$ ;  $V_{DD} = 1000\text{ V}$ ;  $R_{G(ext)} = 5.1\text{ }\Omega$ ;  
 $V_{GS} = -3\text{ V}/18\text{ V}$ ; FWD = WNSC2M1K0170B7  
 $L = 1.4\text{ mH}$

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



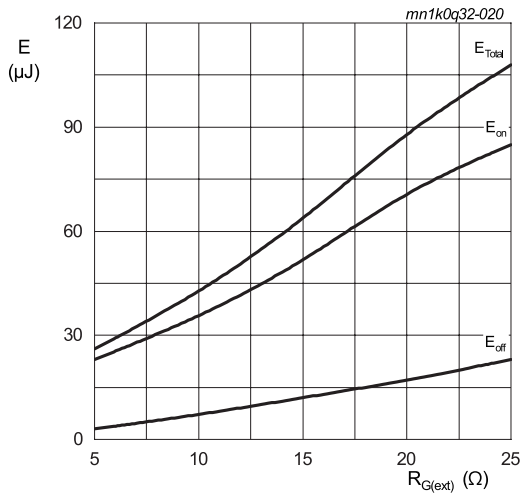
$T_j = 25\text{ }^\circ\text{C}$ ;  $V_{DD} = 1200\text{ V}$ ;  $R_{G(ext)} = 5.1\text{ }\Omega$ ;  
 $V_{GS} = -3\text{ V}/18\text{ V}$ ; FWD = WNSC2M1K0170B7  
 $L = 1.4\text{ mH}$

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



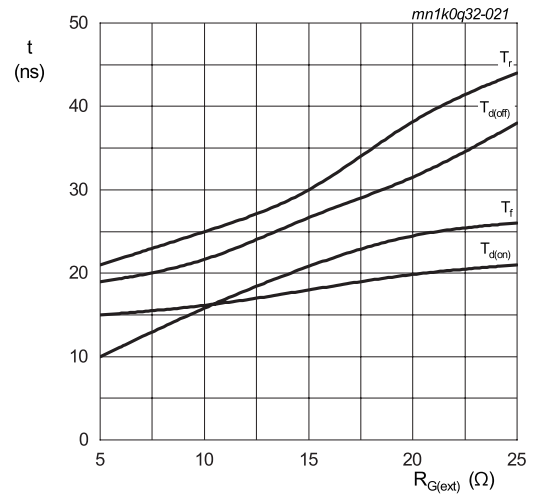
$I_{DS} = 2\text{ A}$ ;  $V_{DD} = 1000\text{ V}$ ;  $R_{G(ext)} = 5.1\text{ }\Omega$ ;  
 $V_{GS} = -3\text{ V}/18\text{ V}$ ; FWD = WNSC2M1K0170B7  
 $L = 1.4\text{ mH}$

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



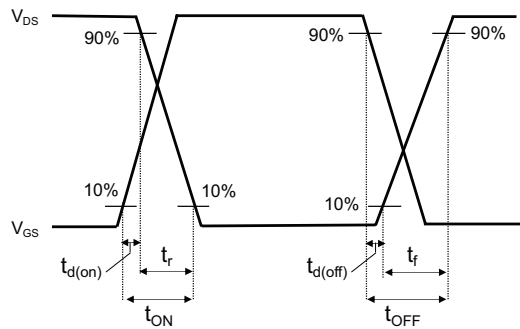
$T_j = 25\text{ }^\circ\text{C}$ ;  $V_{DD} = 1000\text{ V}$ ;  $I_{DS} = 2\text{ A}$ ;  $V_{GS} = -3\text{ V}/18\text{ V}$   
FWD = WNSC2M1K0170B7;  $L = 1.4\text{ mH}$

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



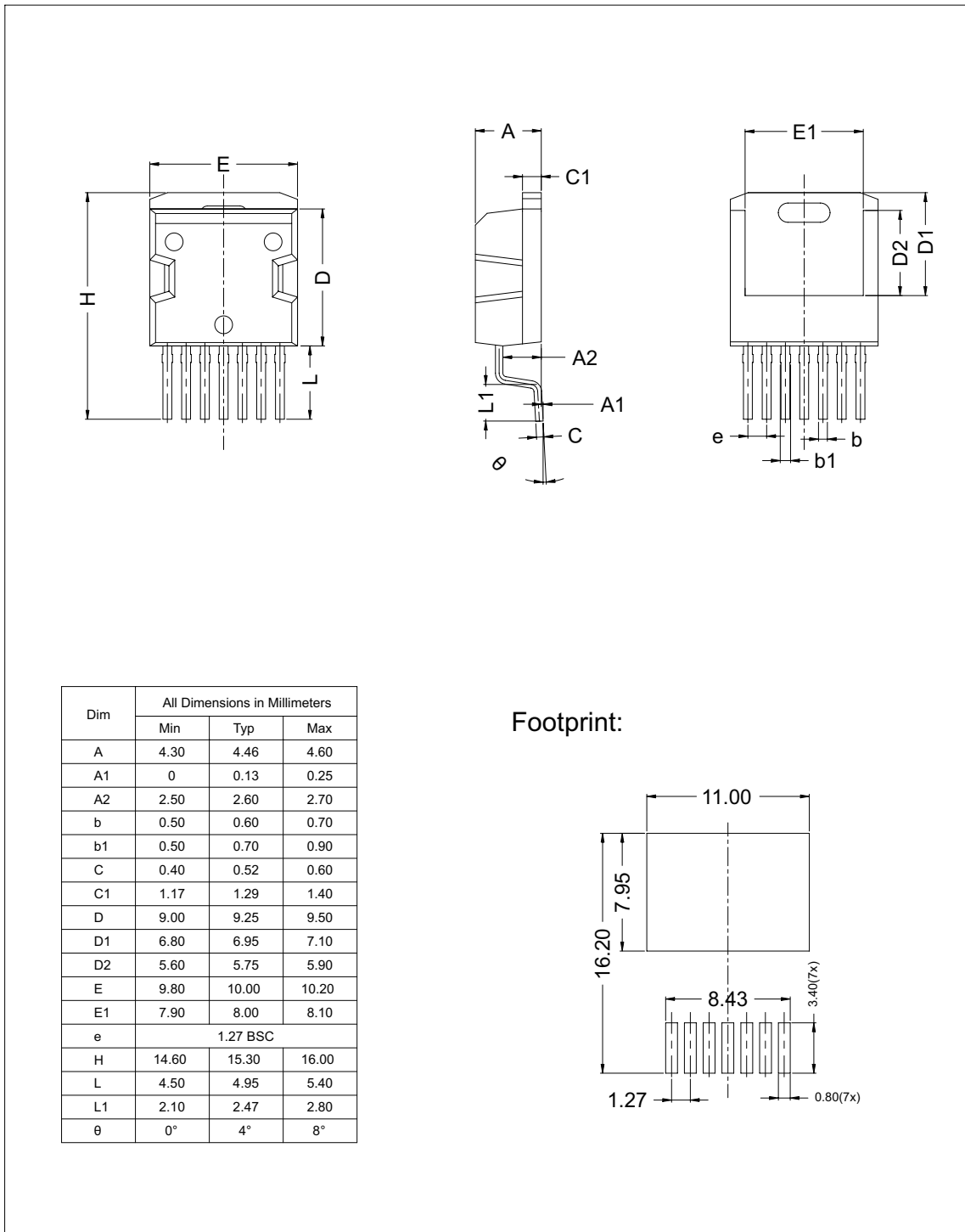
$T_j = 25\text{ }^\circ\text{C}$ ;  $V_{DD} = 1000\text{ V}$ ;  $I_{DS} = 2\text{ A}$ ;  $V_{GS} = -3\text{ V}/18\text{ V}$   
FWD = WNSC2M1K0170B7;  $L = 1.4\text{ mH}$

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



**Fig. 22. 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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