

N-channel 200 V, 0.019 Ω, 83 A, TO-247  
low gate charge STripFET™ Power MOSFET

## Features

Type	$V_{DSS}$	$R_{DS(on)}$ max	$I_D$
STW90NF20	200 V	< 0.023 Ω	83 A

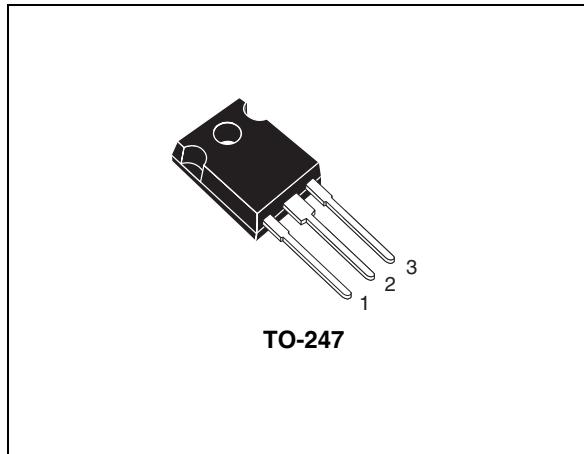
- Exceptional dv/dt capability
- Low gate charge
- 100% Avalanche tested

## Application

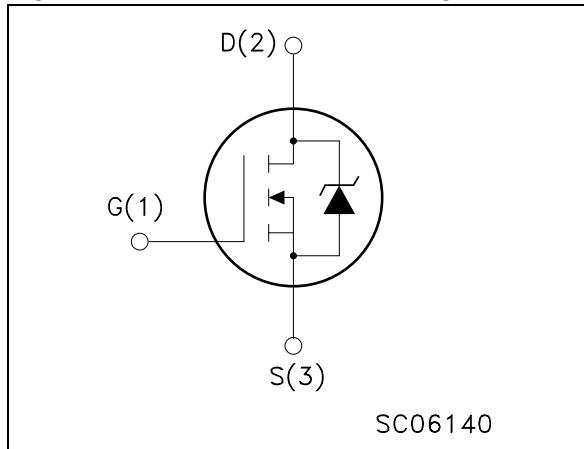
- Switching applications

## Description

This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

Order code	Marking	Package	Packaging
STW90NF20	90NF20	TO-247	Tube

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	200	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	83	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	52	A
$I_{DM}^{(1)}$	Drain current (pulsed)	332	A
	Derating factor	2.4	W/ $^\circ\text{C}$
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	300	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	-50 to 150	$^\circ\text{C}$

1. Pulse width limited by safe operating area
2.  $I_{SD} \leq 83 \text{ A}$ ,  $di/dt \leq 400 \text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 80\% V_{(BR)DSS}$

**Table 2. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.42	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	$^\circ\text{C}/\text{W}$
$T_I$	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

**Table 3. Avalanche characteristics**

Symbol	Parameter	Max value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_J$ max)	83	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50 \text{ V}$ )	400	mJ

## 2 Electrical characteristics

( $T_{CASE} = 25^\circ\text{C}$  unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1 \text{ mA}, V_{GS} = 0$	200			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}, V_{DS} = \text{Max rating } @ 125^\circ\text{C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{DS} = \pm 20 \text{ V}$			$\pm 100$	nA
$V_{GS(\text{th})}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	2	3	4	V
$R_{DS(\text{on})}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}, I_D = 45 \text{ A}$		0.018	0.023	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15 \text{ V}, I_D = 45 \text{ A}$		40		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse Transfer Capacitance	$V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0$		5736 1126 196		pF pF pF
$C_{oss \text{ eq.}}^{(2)}$	Equivalent output capacitance	$V_{DS} = 0 \text{ to } 160 \text{ V}, V_{GS} = 0$		687		pF
$R_G$	Intrinsic gate resistance	$f = 1 \text{ MHz open drain}$		1.7		$\Omega$
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 160 \text{ V}, I_D = 83 \text{ A}, V_{GS} = 10 \text{ V}$		164 46 72		nC nC nC

1. Pulsed: pulse duration = 300 $\mu\text{s}$ , duty cycle 1.5%
2.  $C_{oss \text{ eq.}}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 100 \text{ V}$ , $I_D = 41.5 \text{ A}$		24		ns
$t_r$	Rise time			138		ns
$t_{d(off)}$	Turn-off delay time	$R_G = 4.7 \Omega$ , $V_{GS} = 10 \text{ V}$ ,		148		ns
$t_f$	Fall time			142		ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current			83		A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)			332		A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 83 \text{ A}$ , $V_{GS} = 0$		1.6		V
$t_{rr}$	Reverse recovery time	$I_{SD} = 83 \text{ A}$ , $V_{DD} = 100 \text{ V}$	200			ns
$Q_{rr}$	Reverse recovery charge	$dI/dt = 100 \text{ A}/\mu\text{s}$	1.6			$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		16			A
$t_{rr}$	Reverse recovery time	$I_{SD} = 83 \text{ A}$ , $V_{DD} = 100 \text{ V}$	235			ns
$Q_{rr}$	Reverse recovery charge	$dI/dt = 100 \text{ A}/\mu\text{s}$	2.2			$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	$T_j = 150^\circ\text{C}$	18			A

1. Pulse with limited by maximum temperature
2. Pulsed: pulse duration = 300 $\mu$ s, duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

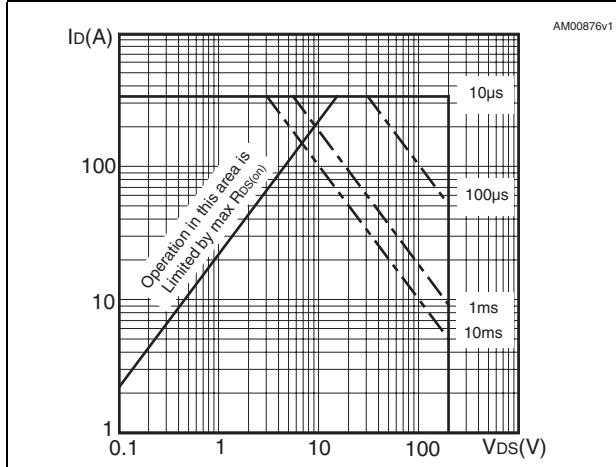


Figure 3. Thermal impedance

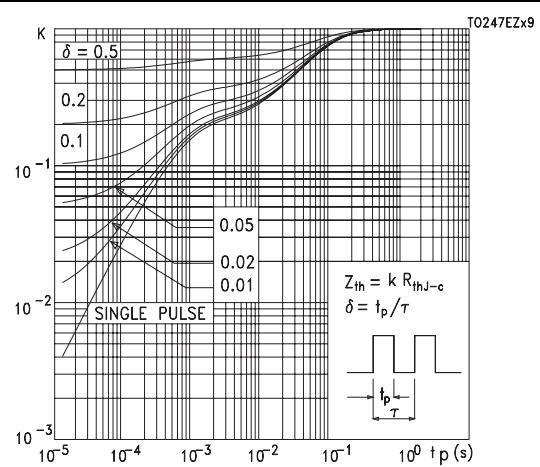


Figure 4. Output characteristics

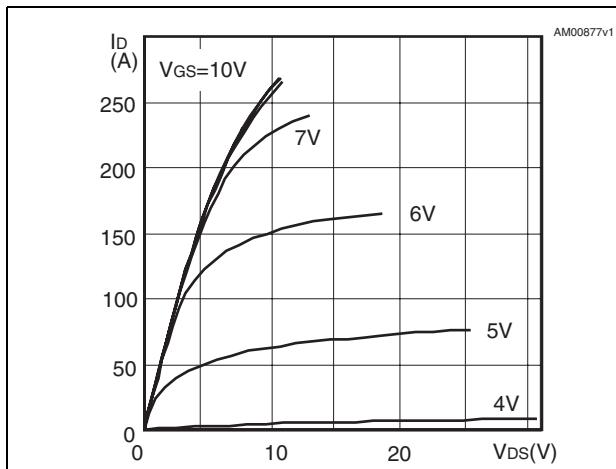


Figure 5. Transfer characteristics

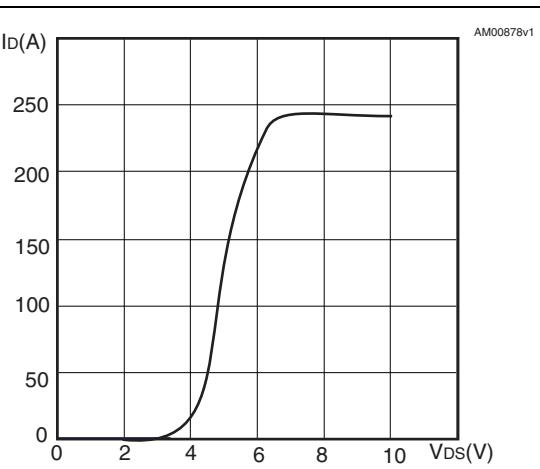
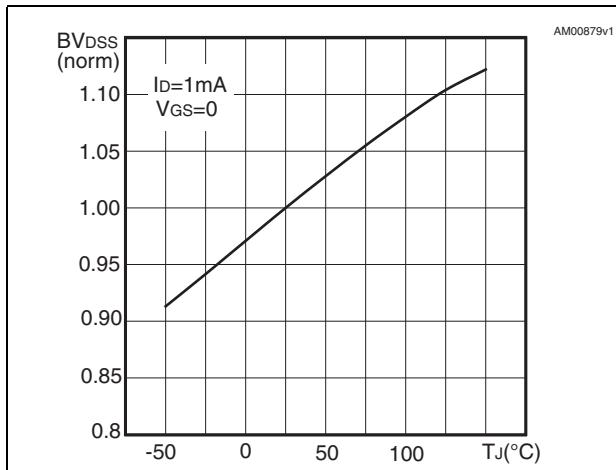
Figure 6. Normalized  $BV_{DSS}$  vs temperature

Figure 7. Static drain-source on resistance

