

N-channel clamped 3.5 mΩ - 120 A TO-220
fully protected SAFeFET™ Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STP180NS04ZC	Clamped	< 4.2 mΩ	120 A

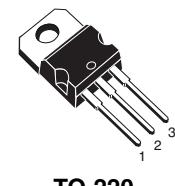
- Low capacitance and gate charge
- 100% avalanche tested
- 175°C maximum junction temperature

Applications

- Switching application

Description

This fully clamped Power MOSFET is produced by using the latest advanced company's mesh OVERLAY process which is based on a novel strip layout. The inherent benefits of the new technology coupled with the extra clamping capabilities make this product particularly suitable for the harshest operation conditions such as those encountered in the automotive environment. Any other application requiring extra ruggedness is also recommended.



TO-220

Figure 1. Internal schematic diagram

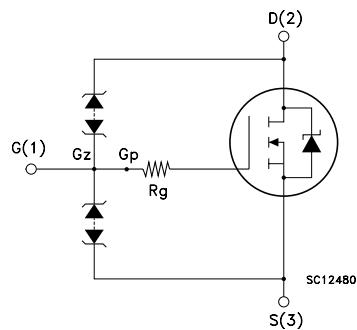


Table 1. Device summary

Order code	Marking	Package	Packaging
STP180NS04ZC	P180NS04ZC	TO-220	Tube

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	33 ⁽¹⁾	V
V_{DG}	Drain-gate voltage	33 ⁽¹⁾	V
V_{GS}	Gate-source voltage	± 20 ⁽¹⁾	V
I_D ⁽²⁾	Drain current (continuous) at $T_C = 25$ °C	120	A
I_D ⁽²⁾	Drain current (continuous) at $T_C=100$ °C	120	A
I_{DG}	Drain gate current (continuous)	± 50	mA
I_{GS}	Gate-source current (continuous)	± 50	mA
I_{DM} ⁽³⁾	Drain current (pulsed)	480	A
P_{TOT}	Total dissipation at $T_C = 25$ °C	300	W
	Derating factor	2	W/°C
$V_{ESD(G-S)}$	Gate-source ESD (HBM-C=100 pF, R=1.5 kΩ)	± 8	kV
$V_{ESD(G-D)}$	Gate-drain ESD (HBM-C=100 pF, R=1.5 kΩ)	± 8	kV
$V_{ESD(D-S)}$	Drain-source ESD (HBM-C=100 pF, R=1.5 kΩ)	± 8	kV
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 175	°C

1. Voltage is limited by zener diodes
2. Current limited by wire bonding
3. Pulse width limited by safe operating area

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.50	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	°C/W
T_I	Maximum lead temperature for soldering purpose	300	°C

Table 4. Avalanche data

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax} $\delta < 1\%$)	80	A
E_{AS}	Single pulse avalanche energy (starting $T_j=25$ °C, $I_D=I_{AS}$, $V_{DD}=21$ V)	1000	mJ

2 Electrical characteristics

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

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DG}$	Clamped voltage	$I_D = 1 \text{ mA}, V_{GS} = 0$ $-40 < T_j < 175^\circ\text{C}$	33		41	V
$V_{DSR(CL)}$	Drain-source clamping voltage (DC)	$I_{GS(CL)} = -2 \text{ mA}, I_D = 1 \text{ A}$		41		V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 16 \text{ V}$ $V_{DS} = 16 \text{ V}, T_j = 150^\circ\text{C}$ $V_{DS} = 16 \text{ V}, T_j = 175^\circ\text{C}$			1 50 100	μA
$I_{GSS}^{(1)}$	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 10 \text{ V}$ $V_{GS} = \pm 10 \text{ V}, T_j = 175^\circ\text{C}$ $V_{GS} = \pm 16 \text{ V}, T_j = 175^\circ\text{C}$			2 50 150	μA
V_{GSS}	Gate-source breakdown voltage	$I_{GS} = \pm 100 \mu\text{A}$	18		25	V
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 1 \text{ mA}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}, I_D = 40 \text{ A}$		3.5	4.2	$\text{m}\Omega$
R_G	Internal gate resistor			14		Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15 \text{ V}, I_D = 40 \text{ A}$		95		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0$		4560 1700 550		pF pF pF
$t_{r(V_{off})}$ t_f t_c	Off voltage rise time Fall time Cross-over time	$V_{CLAMP} = 30 \text{ V}, I_D = 80 \text{ A},$ $V_{GS} = 10 \text{ V}, R_G = 4.7 \Omega$		250 115 290		ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 20 \text{ V}, I_D = 120 \text{ A}$ $V_{GS} = 10 \text{ V}$		110 29 40		nC nC nC

1. Pulsed: pulse duration=300 μs , duty cycle 1.5%

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}^{(1)}$	Source-drain current				120	A
	Source-drain current (pulsed)				480	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=120\text{ A}, V_{GS}=0$			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=120\text{ A}, di/dt = 100\text{ A}/\mu\text{s},$ $V_{DD}=32\text{ V}, T_j=150\text{ }^\circ\text{C}$		56 70 12		ns nC A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

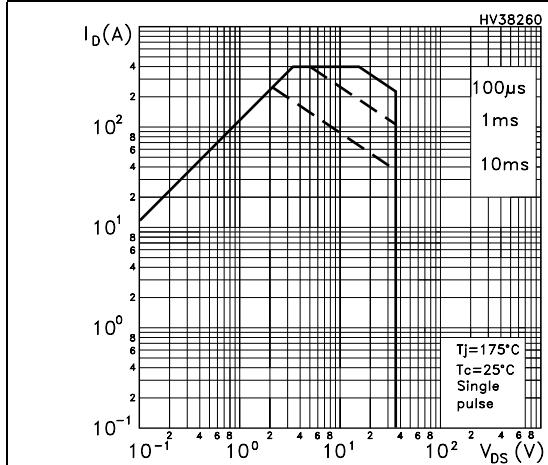


Figure 3. Thermal impedance

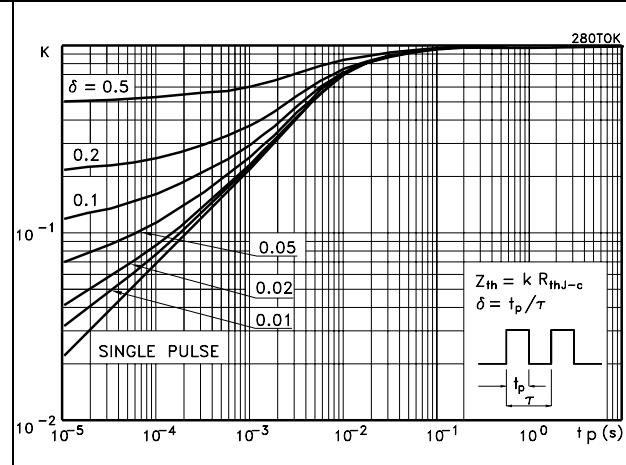


Figure 4. Output characteristics

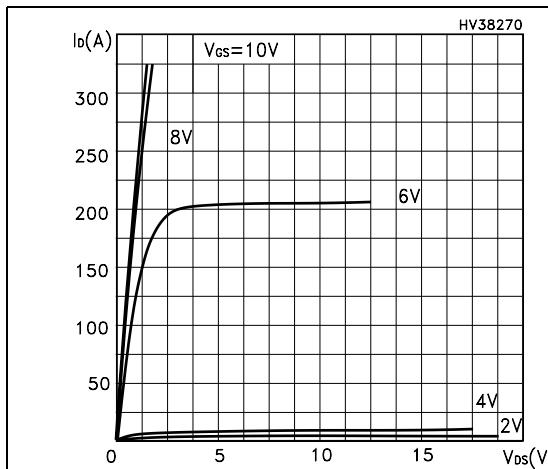


Figure 5. Transfer characteristics

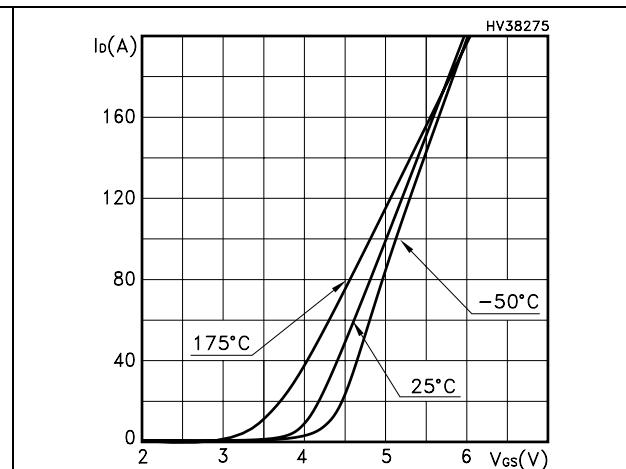


Figure 6. Transconductance

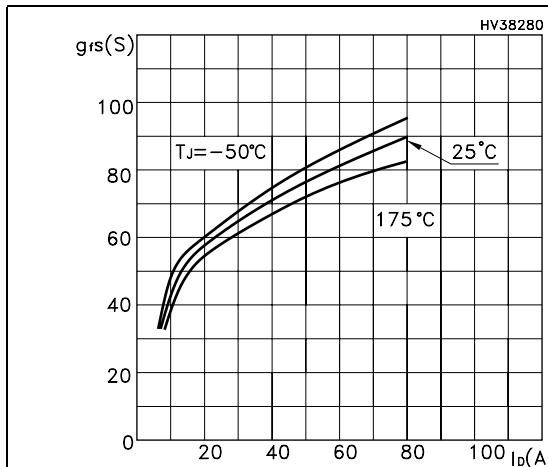


Figure 7. Static drain-source on resistance

