STP20NM65N
STF20NM65N

N-channel 650 V, 0.250 Ω, 15 A TO-220, TO-220FP
second generation MDmesh™ Power MOSFET

Features

Order codes	V_{DSS} @T_{jmax}	$R_{DS(on)}$ max.	I_D
STP20NM65N	710 V	0.270 Ω	15 A
STF20NM65N			

- 100 % avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Application

- Switching applications

Description

These devices are N-channel Power MOSFETs realized using the second generation MDmesh™ technology. This revolutionary Power MOSFET associates a new vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

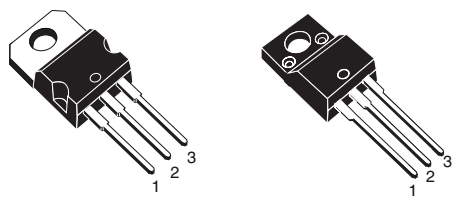

Figure 1. Internal schematic diagram

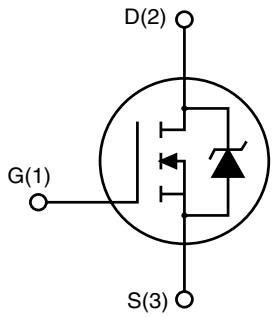

Table 1. Device summary

Order codes	Marking	Package	Packaging
STP20NM65N	20NM65N	TO-220	Tubes
STF20NM65N	20NM65N	TO-220FP	Tubes

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220	TO-220FP	
V_{DS}	Drain source voltage	650		V
V_{GS}	Gate source voltage	± 25		V
I_D	Drain current continuous T_C =25 °C	15	15(1)	A
I_D	Drain current continuous T_C =100 °C	9.45		A
I_{DM} (2)	Drain current pulsed	60		A
P_{TOT}	Total dissipation at T_C=25 °C	125	30	W
dv/dt (3)	Peak diode recovery voltage slope	15		V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heatsink (t=1 s; T_C = 25 °C)		2500	V
T_{stg} T_J	Storage temperature Max. operating junction temperature	-55 to 150 150		°C

1. Limited only by maximum temperature allowed.
2. Pulse width limited by safe operating area.
3. I_{SD} ≤15 A, di/dt ≤400 A/µs, $V_{DS\ peak} \leq V_{(BR)DSS}$, V_{DD} = 80 % $V_{(BR)DSS}$.

Table 3. Thermal data

Symbol	Parameters	Value		Unit
		TO-220	TO-220FP	
R_{thjc}	Thermal resistance junction-case max.	1	4.17	°C/W
R_{thja}	Thermal resistance junction-ambient max.	62.50		°C/W
T_J	Max. lead temperature for soldering purposes	300		°C

Table 4. Avalanche characteristics

Symbol	Parameters	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj max)	4	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	115	mJ

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified).

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0	650			V
I_{DSS}	Zero gate voltage drain current (V_{GS}=0)	V_{DS} = max rating V_{DS} = max rating @ 125 °C			1 100	µA µA
I_{GSS}	Gate body leakage (V_{DS}=0)	V_{GS}= ±25 V, V_{DS}=0			100	nA
$V_{GS(th)}$	Gate threshold voltage	I_D = 250 µA, V_{GS} = V_{DS}	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	I_D=7.5 A, V_{GS}=10 V		0.250	0.270	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse capacitance	V_{DS} = 50 V, f = 1MHz, V_{GS} = 0	-	1280 110 10	-	pF pF pF
$C_{oss\ eq}$ (1)	Equivalent output capacitance	V_{DS} = 0 to V_{GS} = 0	-	260	-	pF
R_G	Intrinsic gate resistance	f = 1MHz open drain	-	4.8	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate source charge Gate-drain charge	V_{DD} = 520 V, I_D = 15 A, V_{GS} = 10 V	-	44 8 22	-	nC nC nC

1. $C_{oss\ eq}$: 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 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 325 V, I_D=7.5 A R_g=4.7 Ω, V_{GS}=10 V	-	15 13.5	-	ns ns
$t_{d(off)}$ t_f	Turn-off-delay time Fall time		-	75 21	-	ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source drain current Source drain current (pulsed)		-		15 60	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 15 A, V_{GS} = 0	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 15 A, di/dt = 100 A/µs V_{DD} = 60 V (see)	-	455		ns
Q_{rr}	Reverse recovery charge			5.5		nC
I_{RRM}	Reverse recovery current			24.5		A
t_{rr}	Reverse recovery time	I_{SD} =15 A, di/dt = 100 A/µs V_{DD} = 60 V, Tj = 150 °C	-	710		ns
Q_{rr}	Reverse recovery charge			8		nC
I_{RRM}	Reverse recovery current			24		A

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

2.1 Electrical characteristecs (curves)

Figure 2. Safe operating area for TO-220

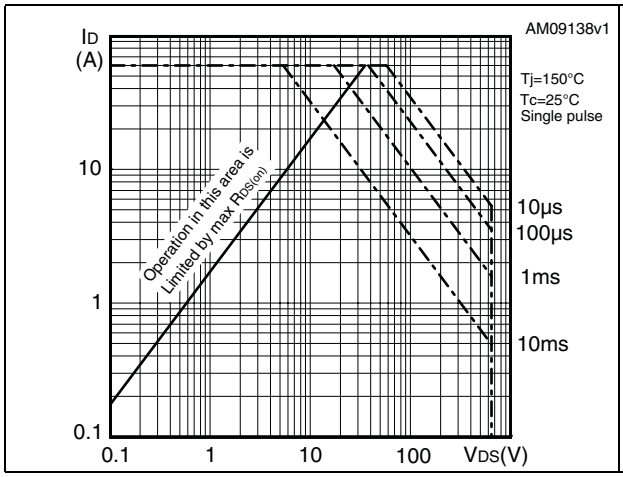

Figure 3. Thermal impedance for TO-220

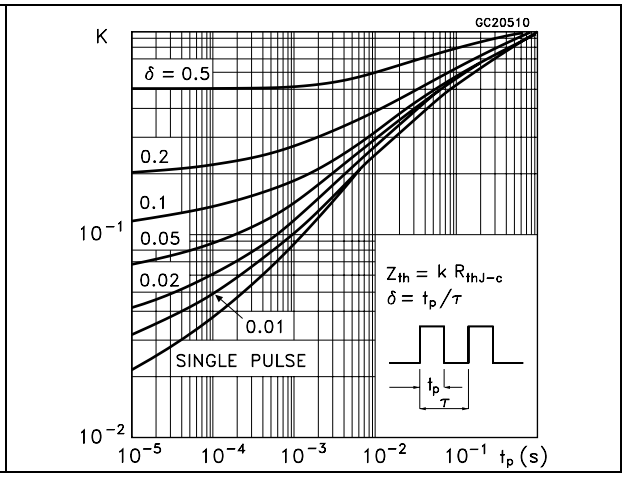

Figure 4. Safe operating area for TO-220FP

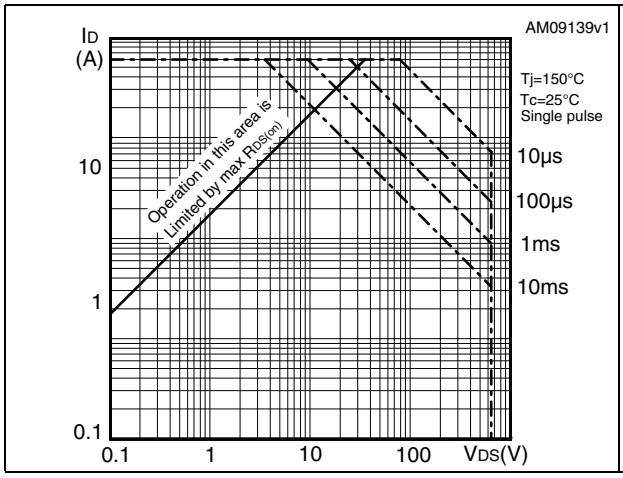

Figure 5. Thermal impedance for TO-220FP

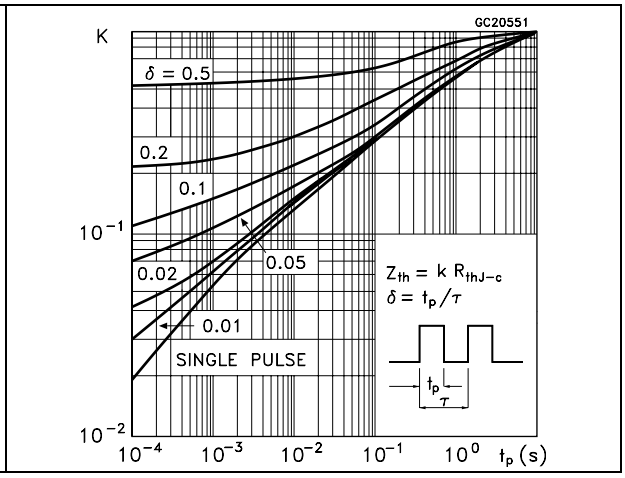

Figure 6. Output characteristics

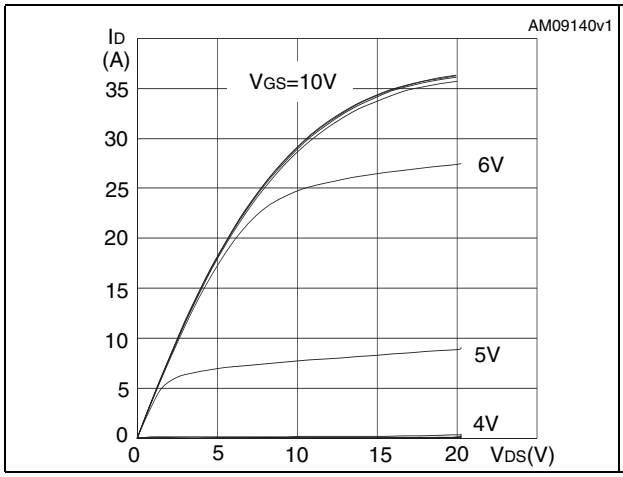

Figure 7. Transfer characteristics