STB20NM50FD
STF20NM50FD - STP20NM50FD

N-channel 500 V, 0.22 Ω, 20 A D²PAK, TO-220FP, TO-220
FDmesh™ Power MOSFET (with fast diode)

Features

Type	V_{DSS}	$R_{DS(on)}$ max	$R_{DS(on)}$* Qg	I_D
STB20NM50FD	500 V	< 0.25 Ω	8.36 Ω* nC	20 A
STF20NM50FD	500 V	< 0.25 Ω	8.36 Ω* nC	20 A
STP20NM50FD	500 V	< 0.25 Ω	8.36 Ω* nC	20 A

- High dv/dt and avalanche capabilities
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance
- Tight process control and high manufacturing yields

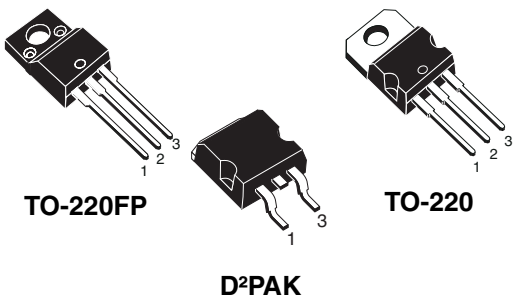
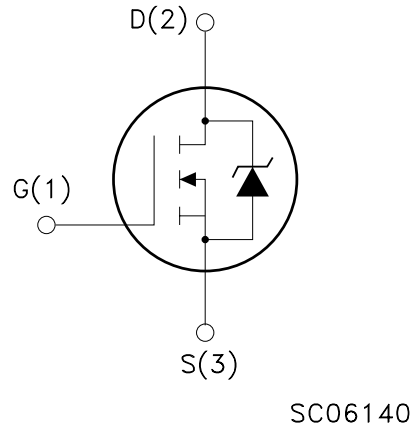


Figure 1. Internal schematic diagram



Application

- Switching applications

Description

The FDmesh™ associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode. It is therefore strongly recommended for bridge topologies, in particular ZVS phase-shift converters.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB20NM50FD	B20NM50FD	D²PAK	Tape and reel
STF20NM50FD	F20NM50FD	TO-220FP	Tube
STP20NM50FD	P20NM50FD	TO-220	Tube

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D²PAK TO-220	TO-220FP	
V_{DS}	Drain-source voltage (V_{GS}=0)	500		V
V_{GS}	Gate-source voltage	± 30		V
I_D	Drain current (continuous) at T_C = 25 °C	20	20 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	14	14(1)	A
I_{DM} (2)	Drain current (pulsed)	80	80(1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	192	45	W
dv/dt (3)	Peak diode recovery voltage slope	20		V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s;T_C=25 °C)	--	2500	V
T_{stg}	Storage temperature	-65 to 150		°C
T_j	Operating junction temperature	150		°C

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 20$ A, di/dt $\leq$ 200 A/µs, V_{DD} = 80% $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	TO-220	D²PAK	TO-220FP	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.65		2.8	°C/W
$R_{thj-amb}$	Thermal resistance junction-amb max	62.5	--	62.5	°C/W
$R_{thj-pcb}$	Thermal resistance junction-pcb max	--	30	--	°C/W
T_l	Maximum lead temperature for soldering purposes	300			°C

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj max)	10	A
E_{AS}	Single pulse avalanche energy (starting Tj = 25 °C, I_D = I_{AS}, V_{DD} = 35 V)	700	mJ

2 Electrical characteristics

(T_{CASE}=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 = 250 µA, V_{GS}= 0	500			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating, @125 °C			1 10	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ± 30 V			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10 V, I_D= 10 A		0.22	0.25	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} > $I_{D(on)}$ x $R_{DS(on)max}$, I_D= 10 A		9		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V, f =1 MHz, V_{GS} = 0		1380 290 40		pF pF pF
$C_{oss\ eq.}$ (2)	Equivalent output capacitance	V_{GS} = 0, V_{DS} = 0 to 400 V		130		pF
Rg	Gate input resistance	f=1 MHz Gate DC Bias=0 Test signal level=20 mV open drain		2.8		Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 400 V, I_D = 20 A V_{GS} = 10 V		38 18 10	53	nC nC nC

1. Pulsed: pulse duration = 300 µs, duty cycle 1.5%
2. $C_{oss\ eq.}$ 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 7. Switching times

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 250 V, I_D = 10 A, R_G = 4.7 Ω, V_{GS} = 10 V		22 20		ns ns
$t_{r(Voff)}$ t_f t_c	Off-voltage rise time Fall time Cross-over time	V_{DD} = 400 V, I_D = 20 A, R_G = 4.7 Ω, V_{GS} = 10 V		6 15 30		ns 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)				20 80	A A
V_{SD}(2)	Forward on voltage	I_{SD} = 20 A, V_{GS}=0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} =20 A, di/dt =100 A/µs, V_{DD} = 60 V, T_J=150 °C		245 2 16		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 for TO-220 / D²PAK

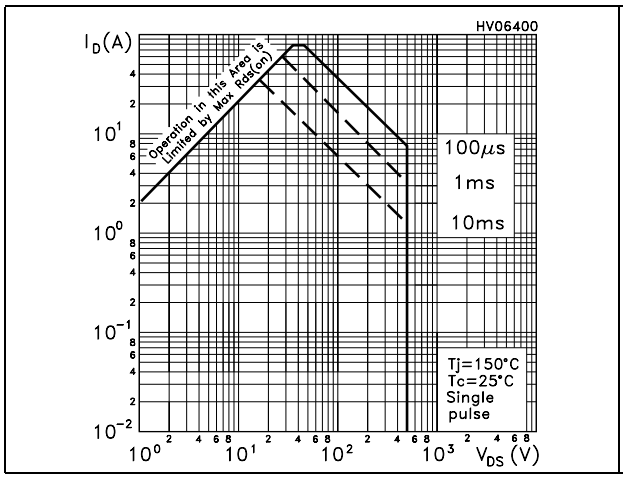


Figure 3. Thermal impedance for TO-220 / D²PAK

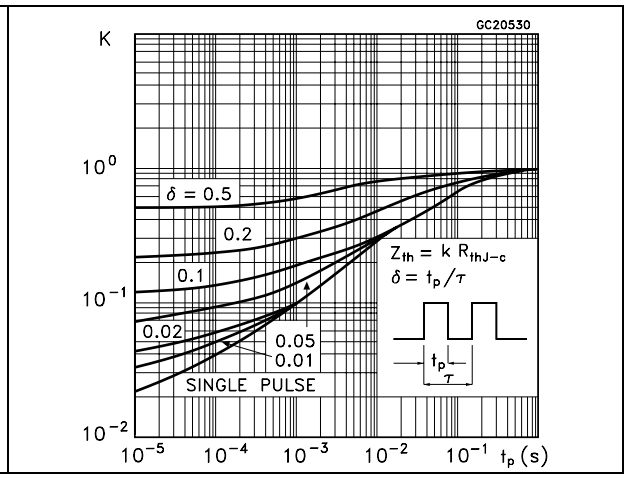


Figure 4. Safe operating area for TO-220FP

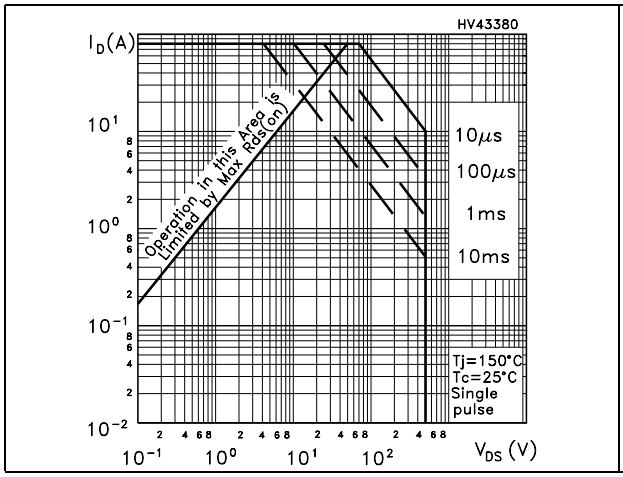


Figure 5. Thermal impedance for TO-220FP

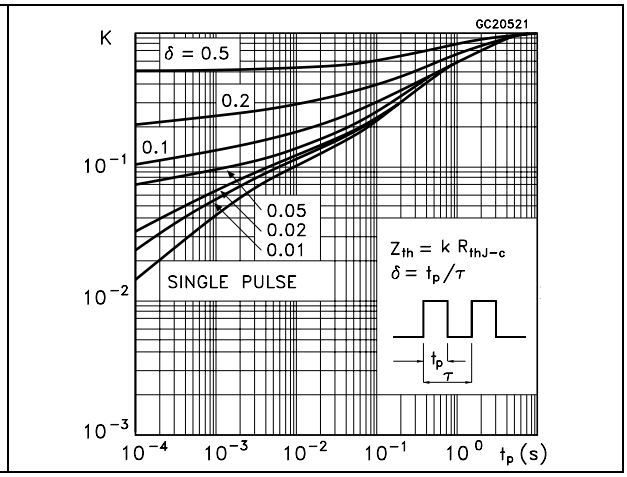


Figure 6. Output characteristics

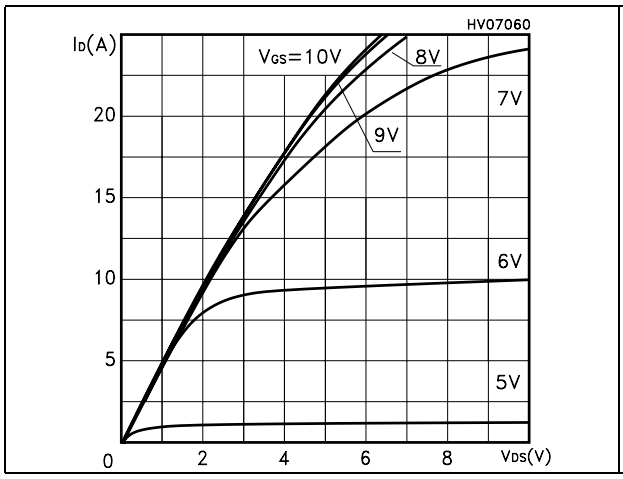


Figure 7. Transfer characteristics