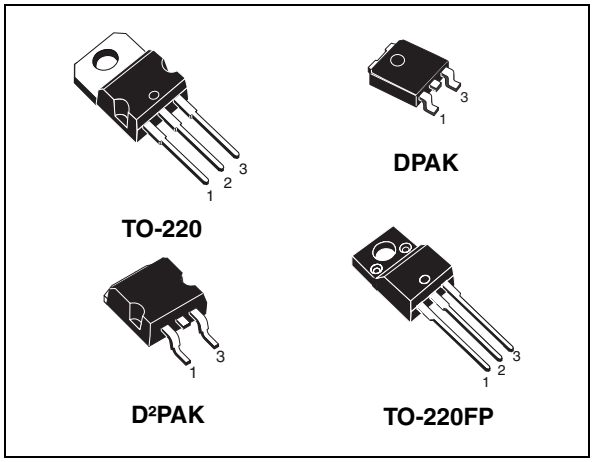
STB12NM50N - STD12NM50N
STF12NM50N - STP12NM50N

N-channel 500V - 0.29Ω - 11A - TO-220 /FP- D^{2}PAK - DPAK
Second generation MDmesh™ Power MOSFET

General features

Type	V_{DSS} (@Tjmax)	$R_{DS(on)}$	I_D
STB12NM50N	550V	<0.38Ω	11A
STD12NM50N	550V	<0.38Ω	11A
STF12NM50N	550V	<0.38Ω	11A (1)
STP12NM50N	550V	<0.38Ω	11A

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



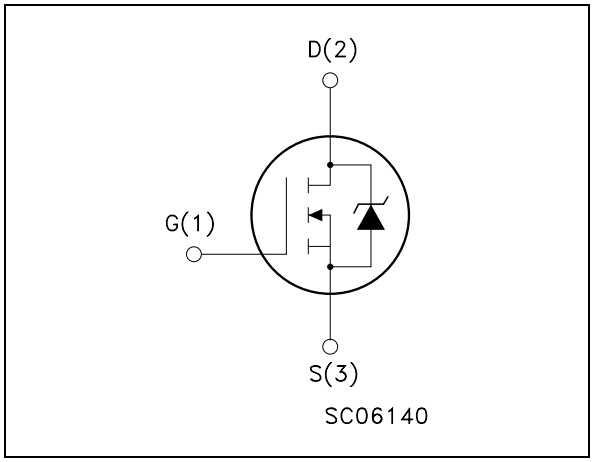
Description

This series of devices is realized with the second generation of 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

Applications

- Switching application

Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STB12NM50N	B12NM50N	D²PAK	Tape & reel
STD12NM50N	D12NM50N	DPAK	Tape & reel
STF12NM50N	F12NM50N	TO-220FP	Tube
STP12NM50N	P12NM50N	TO-220	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220-D/D²PAK	TO-220FP	
V_{DS}	Drain-source voltage (V_{GS} = 0)	500		V
V_{GS}	Gate-source voltage	± 25		V
I_D	Drain current (continuous) at T_C = 25°C	11	11(1)	A
I_D	Drain current (continuous) at T_C=100°C	6.7	6.7(1)	A
I_{DM}(2)	Drain current (pulsed)	44	44 (1)	A
P_{TOT}	Total dissipation at T_C = 25°C	100	25	W
	Derating factor	0.8	0.2	W/°C
dv/dt(3)	Peak diode recovery voltage slope	15		V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1s;T_C=25°C)	--	2500	V
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 150		°C

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 11A$, di/dt $\leq 400A/\mu s$, V_{DD} =80%$V_{(BR)DSS}$

Table 2. Thermal data

Symbol	Parameter	Value			Unit
		TO-220 D²PAK	DPAK	TO-220FP	
$R_{thj-case}$	Thermal resistance junction-case max	1.25		5	°C/W
R_{thj-a}	Thermal resistance junction-ambient max	62.5	100	62.5	°C/W
T_l	Maximum lead temperature for soldering purpose	300			°C

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj Max)	5	A
E_{AS}	Single pulse avalanche energy (starting Tj=25°C, Id=Ias, Vdd=50V)	350	mJ

2 Electrical characteristics

(T_{CASE}=25°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 = 1mA, V_{GS}= 0	500			V
dv/dt(1)	Peak diode recovery voltage slope	Vdd=400V, Id=11A, Vgs=10V		44		V/ns
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} = ±20V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10V, I_D= 5.5A		0.29	0.38	Ω

1. Characteristic value at turn off inductive load

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
g_{fs} (1)	Forward transconductance	V_{DS} =15V, I_D = 5.5A		8		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25V, f=1 MHz, V_{GS}=0		880 230 30		pF pF pF
$C_{oss\ eq}$(2).	Equivalent output capacitance	V_{GS}=0, V_{DS} =0V to 400V		130		pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}=400V, I_D = 11A V_{GS} =10V		30 6 15		nC nC nC
R_g	Gate input resistance	f=1MHz Gate DC Bias=0 test signal level=20mV open drain		4.5		Ω

1. Pulsed: pulse duration=300µs, 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} inceases from 0 to 80% V_{DSS}

Table 6. Switching times

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD}=250 V, I_D= 5.5A, R_G=4.7Ω, V_{GS}=10V		15 15 60 14		ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current				11	A
I_{SDM}(1)	Source-drain current (pulsed)				44	A
V_{SD}(2)	Forward on voltage	I_{SD}=11A, V_{GS}=0			1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}=11A, di/dt = 100A/µs, V_{DD}=100V, Tj=25°C		340 3.5 20		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}=11A, di/dt = 100A/µs, V_{DD}=100V, Tj=150°C		420 4 20		ns µC A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area for TO-220/ DPAK/ D²PAK

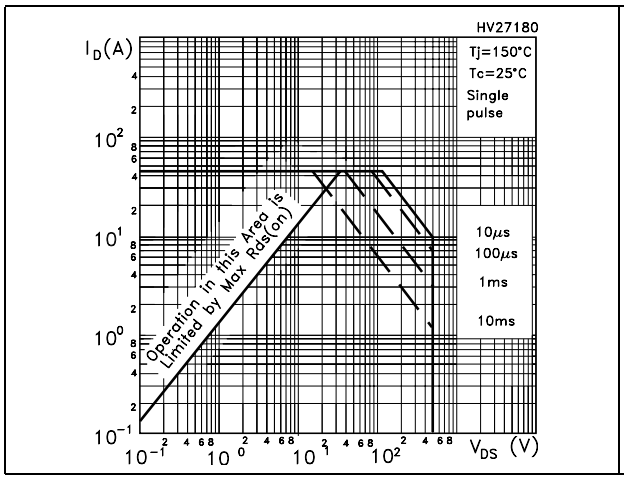


Figure 2. Thermal impedance for TO-220/ DPAK/ D²PAK

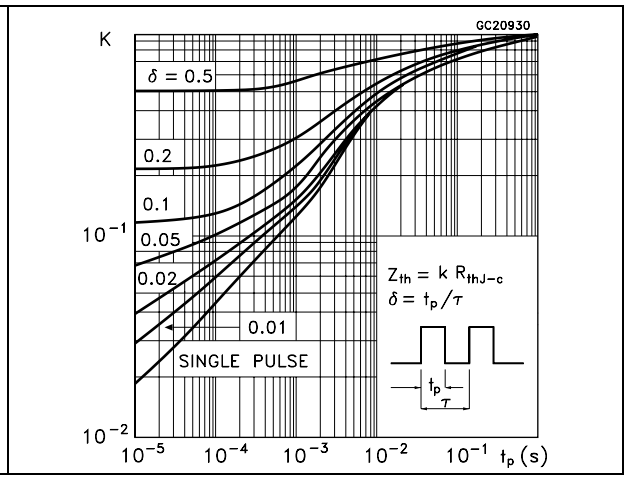


Figure 3. Safe operating area for TO-220FP

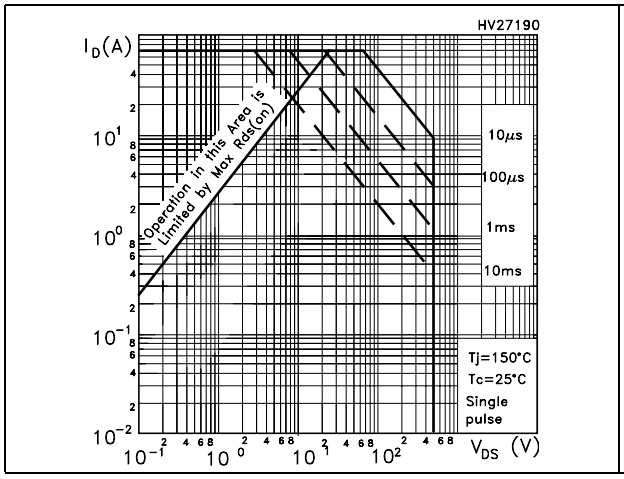


Figure 4. Thermal impedance for TO-220FP

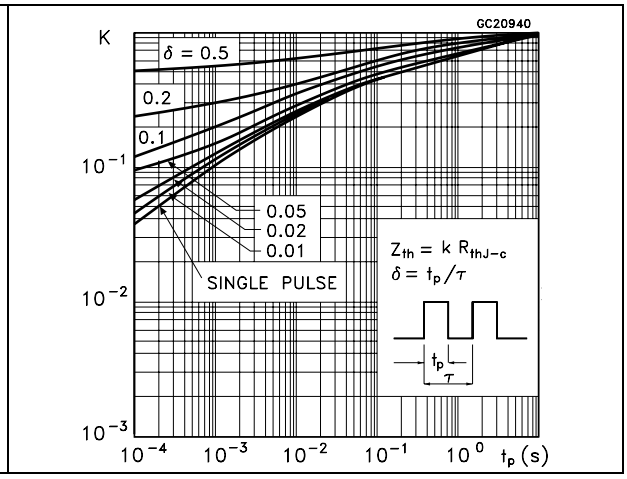


Figure 5. Output characterisics

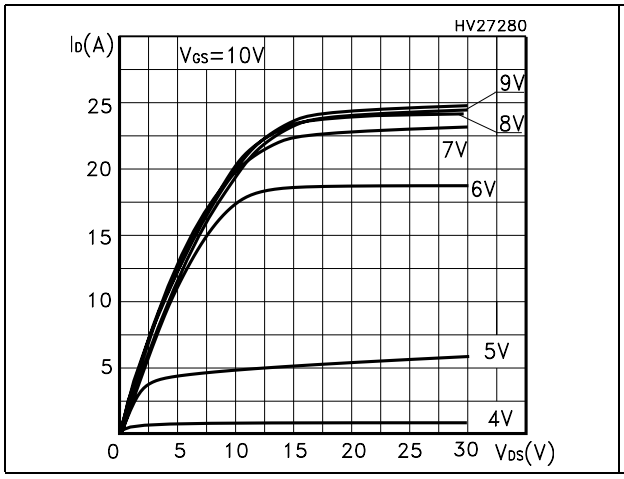


Figure 6. Transfer characteristics