STB33N60DM2, STP33N60DM2, STW33N60DM2

N-channel 600 V, 0.110 Ω typ., 24 A MDmesh™ DM2 Power MOSFET in D²PAK, TO-220 and TO-247 packages

Datasheet - production data

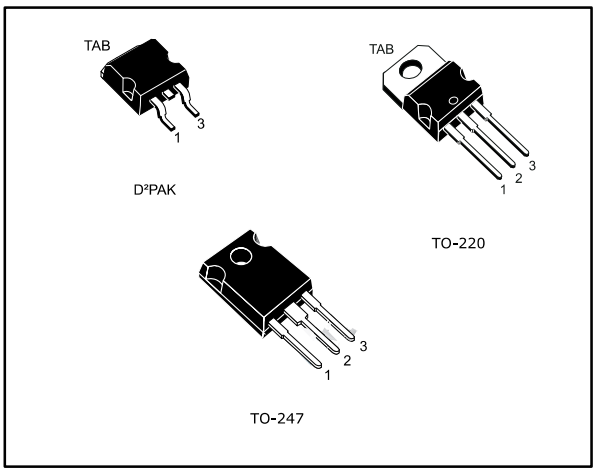
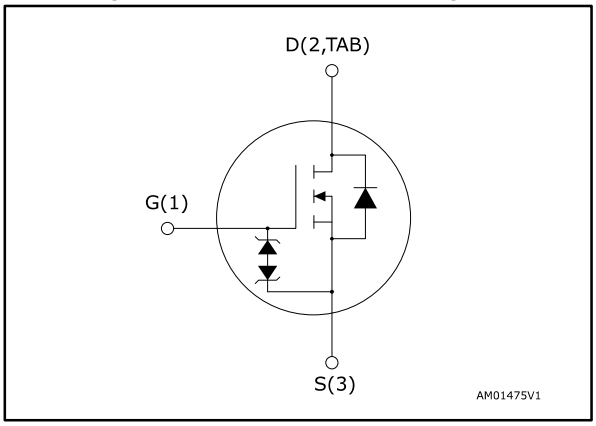


Figure 1: Internal schematic diagram



Features

Order code	V_{DS} @ $T_{Jmax.}$	$R_{DS(on)}$ max.	I_D
STB33N60DM2	650 V	0.130 Ω	24 A
STP33N60DM2	650 V	0.130 Ω	24 A
STW33N60DM2	650 V	0.130 Ω	24 A

- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

Applications

- Switching applications

Description

These high voltage N-channel Power MOSFETs are part of the MDmesh™ DM2 fast recovery diode series. They offer very low recovery charge (Q_{rr}) and time (t_{rr}) combined with low $R_{DS(on)}$, rendering them suitable for the most demanding high efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

Table 1: Device summary

Order code	Marking	Package	Packing
STB33N60DM2	33N60DM2	D²PAK	Tape and reel
STP33N60DM2	33N60DM2	TO-220	Tube
STW33N60DM2	33N60DM2	TO-247	Tube

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	±25	V
I_D	Drain current (continuous) at T_{case} = 25 °C	24	A
	Drain current (continuous) at T_{case} = 100 °C	15.5	
I_{DM}(1)	Drain current (pulsed)	96	A
P_{TOT}	Total dissipation at T_{case} = 25 °C	190	W
dv/dt(2)	Peak diode recovery voltage slope	50	V/ns
dv/dt(3)	MOSFET dv/dt ruggedness	50	
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Operating junction temperature		

Notes:

(1) Pulse width is limited by safe operating area.

(2) I_{SD} ≤ 24 A, di/dt=900 A/µs; V_{DS} peak < $V_{(BR)DSS}$, V_{DD} = 400 V.

(3) V_{DS} ≤ 480 V.

Table 3: Thermal data

Symbol	Parameter	Value			Unit
		D²PAK	TO-220	TO-247	
$R_{thj-case}$	Thermal resistance junction-case	0.66			°C/W
$R_{thj-pcb}$	Thermal resistance junction-pcb(1)	30			
$R_{thj-amb}$	Thermal resistance junction-ambient		62.5	50	

Notes:

(1)When mounted on 1 inch² FR-4, 2 Oz copper board.

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (Pulse width limited by T_{jmax})	5.5	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	570	mJ

2 Electrical characteristics

(T_{case} = 25 °C unless otherwise specified)

Table 5: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 1 mA	600			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 600 V			1	µA
		V_{GS} = 0 V, V_{DS} = 600 V, T_{case} = 125 °C			100	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			±10	µA
$V_{GS(th)}$	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 = 12 A		0.110	0.130	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	1870	-	pF
C_{oss}	Output capacitance		-	87	-	
C_{rss}	Reverse transfer capacitance		-	2	-	
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DD} = 480 V, V_{GS} = 0 V	-	157	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D= 0 A	-	4.5	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 24 A, V_{GS} = 10 V (see	-	43	-	nC
Q_{gs}	Gate-source charge		-	9.8	-	
Q_{gd}	Gate-drain charge		-	21	-	

Notes:

(1) $C_{oss\ eq.}$ 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
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 12 A R_G = 4.7 Ω, V_{GS} = 10 V (see	-	17	-	ns
t_r	Rise time		-	8	-	
$t_{d(off)}$	Turn-off delay time		-	62	-	
t_f	Fall time		-	9	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		24	A
I_{SDM}(1)	Source-drain current (pulsed)		-		96	A
V_{SD}(2)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 24 A	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 24 A, di/dt = 100 A/µs, V_{DD} = 60 V (see	-	150		ns
Q_{rr}	Reverse recovery charge		-	0.5		µC
I_{RRM}	Reverse recovery current		-	8.8		A
t_{rr}	Reverse recovery time	I_{SD} = 24 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C	-	316		ns
Q_{rr}	Reverse recovery charge		-	2.85		µC
I_{RRM}	Reverse recovery current		-	18		A

Notes:

(1) Pulse width is limited by safe operating area.

(2) Pulse test: pulse duration = 300 µs, duty cycle 1.5%.

Table 9: Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	I_{GS} = ±250 µA, I_D = 0 A	±30	-	-	V

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area for D²PAK

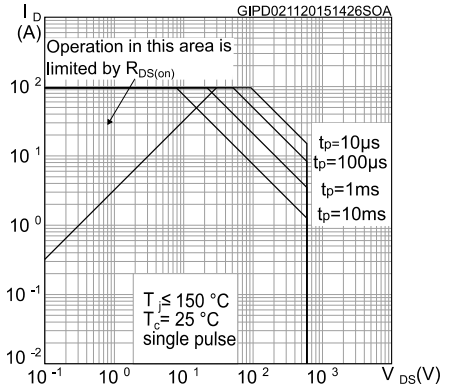


Figure 3: Thermal impedance for D²PAK

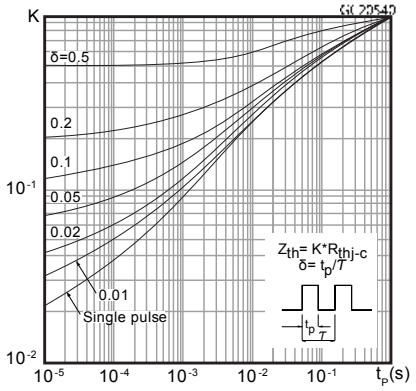


Figure 4: Safe operating area for TO-220

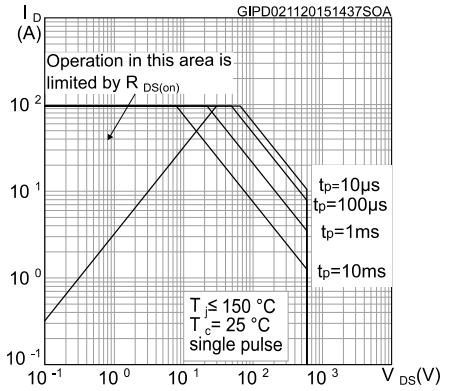


Figure 5: Thermal impedance for TO-220

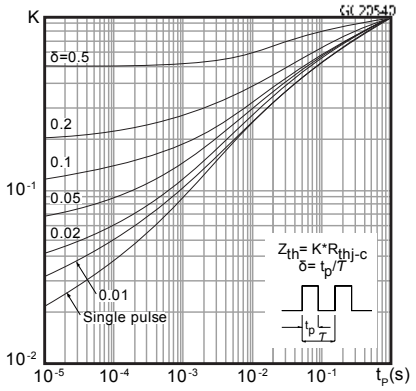


Figure 6: Safe operating area for TO-247

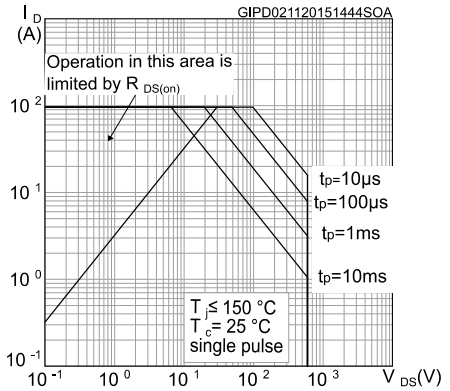


Figure 7: Thermal impedance for TO-247