STF19NM50N
STP19NM50N, STW19NM50N

N-channel 500 V, 0.2 Ω, 14 A MDmesh™ II Power MOSFET in TO-220FP, TO-220 and TO-247

Features

Type	V_{DSS} @ T_{Jmax}	$R_{DS(on)}$ max	I_D
STF19NM50N STP19NM50N STW19NM50N	550 V	< 0.25 Ω	14 A

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

Application

- Switching applications

Description

This second generation of MDmesh™ technology, applies the benefits of the multiple drain process to STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product offers improved on-resistance, low gate charge, high dv/dt capability and excellent avalanche characteristics.

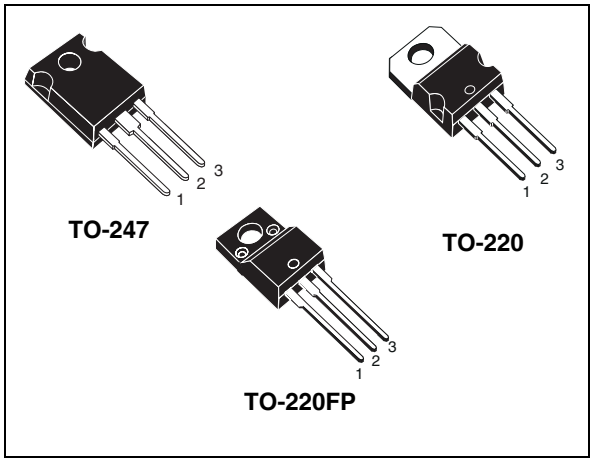


Figure 1. Internal schematic diagram

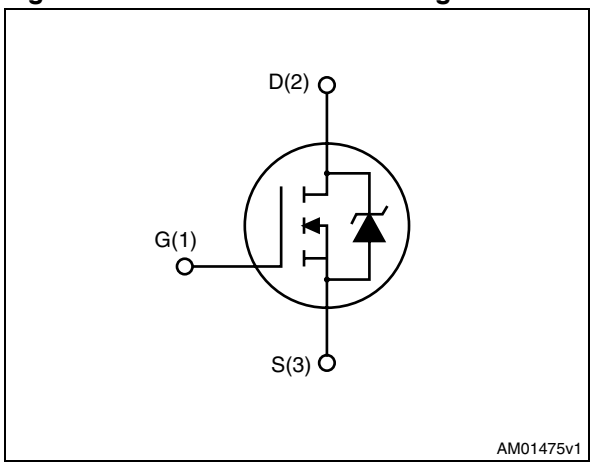


Table 1. Device summary

Order codes	Marking	Package	Packaging
STF19NM50N	19NM50N	TO-220FP	Tube
STP19NM50N		TO-220	
STW19NM50N		TO-247	

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		TO-220	TO-247	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	14		14 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	9		9 (1)	A
I_{DM} (2)	Drain current (pulsed)	56		56 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	110		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 heat sink (t = 1 s; Tc = 25 °C)			2500	V
T_{stg}	Storage temperature	- 55 to 150			°C
T_j	Max. operating junction temperature	150			°C

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 14$ A, di/dt $\leq$ 400 A/µs, $V_{Peak} < V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value			Unit
		TO-220	TO-247	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.14		4.17	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	62.5	50	62.5	°C/W
T_l	Maximum lead temperature for soldering purpose	300			°C

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	7	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25°C, $I_D = I_{AR}$, V_{DD} = 50 V)	208	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	500			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating V_{DS} = Max rating, T_C=125 °C			1 10	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 25 V			10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 7 A		0.2	0.25	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0	-	1000 72 3	-	pF pF pF
$C_{o(tr)}$(1)	Equivalent capacitance time related	V_{DS} = 0 to 400 V, V_{GS} = 0	-	104	-	pF
$C_{o(er)}$(2)	Equivalent capacitance energy related		-	51	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	4.4	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 400 V, I_D = 14 A, V_{GS} = 10 V (see *Figure 19*)	-	34 5 18	-	nC nC nC

1. Time related 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}
2. Energy related is defined as a constant equivalent capacitance giving the same stored energy 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 $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off-delay time Fall time	V_{DD} = 250 V, I_D = 7 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 20*)	-	12 16 61 17	-	ns 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)		-		14 56	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 14 A, V_{GS} = 0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 14 A, di/dt = 100 A/µs V_{DD} = 60 V (see *Figure 23*)	-	296 3.5 23		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 14 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 23*)	-	346 4 24		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

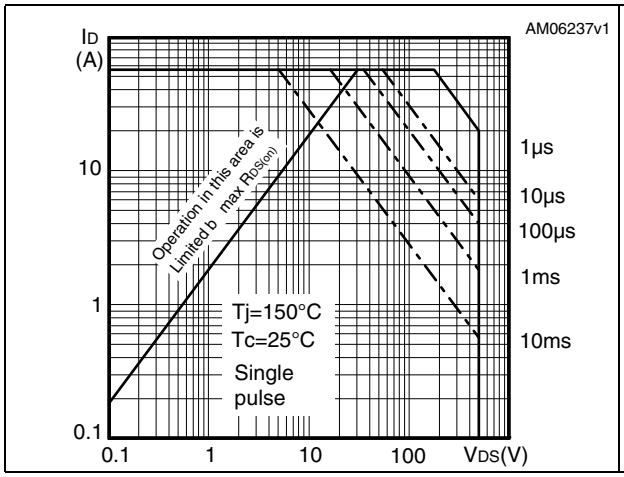


Figure 3. Thermal impedance for TO-220

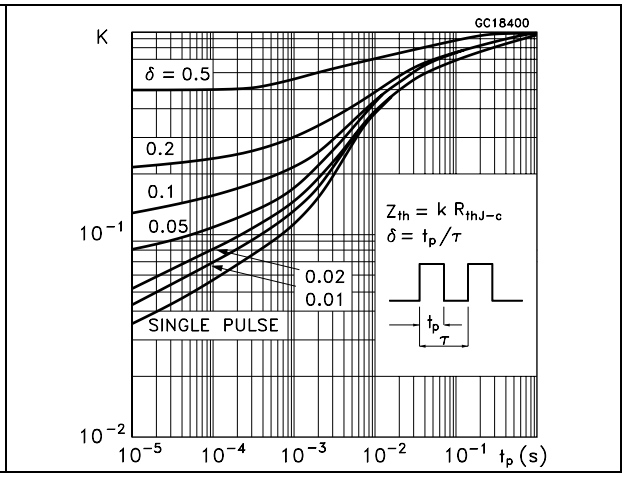


Figure 4. Safe operating area for TO-220FP

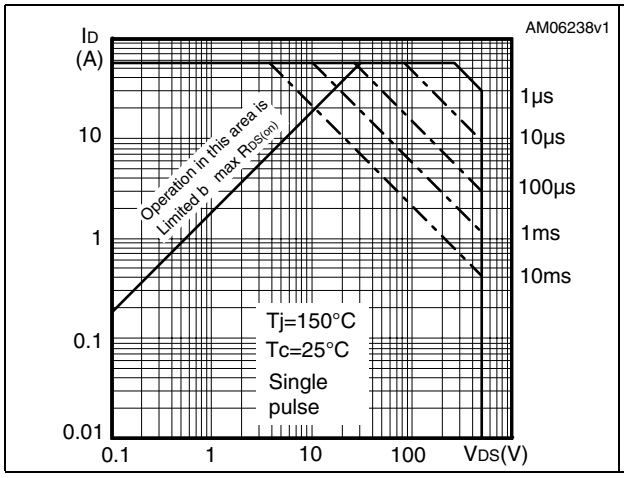


Figure 5. Thermal impedance for TO-220FP

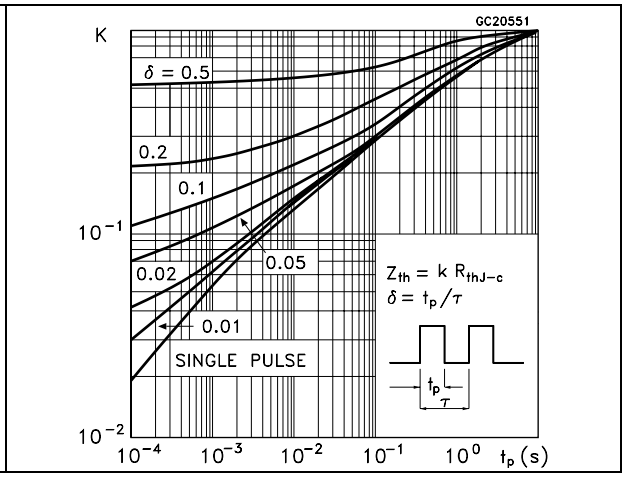


Figure 6. Safe operating area for TO-247

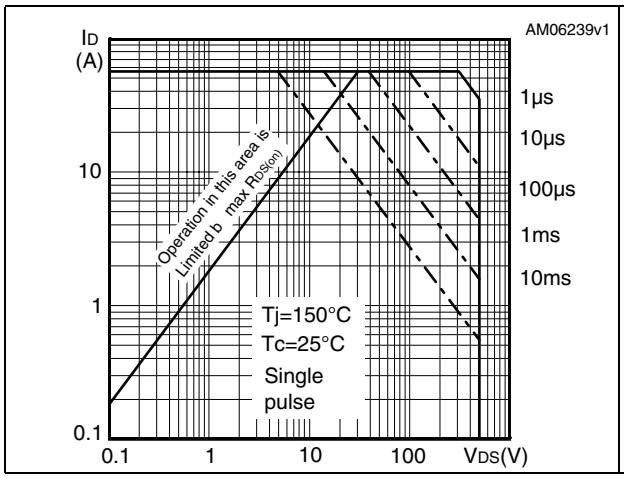


Figure 7. Thermal impedance for TO-247

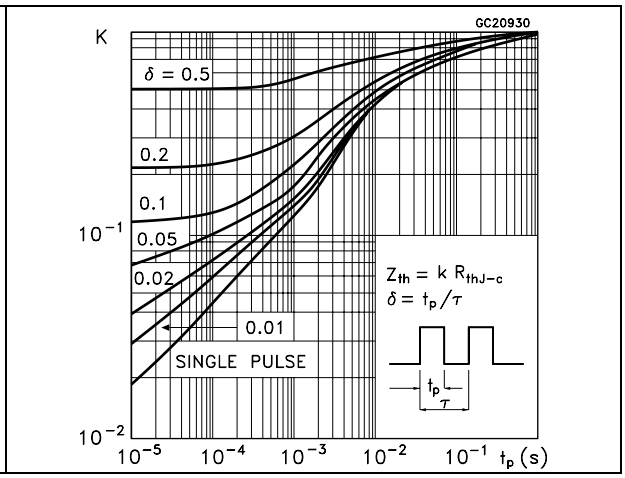


Figure 8. Output characteristics

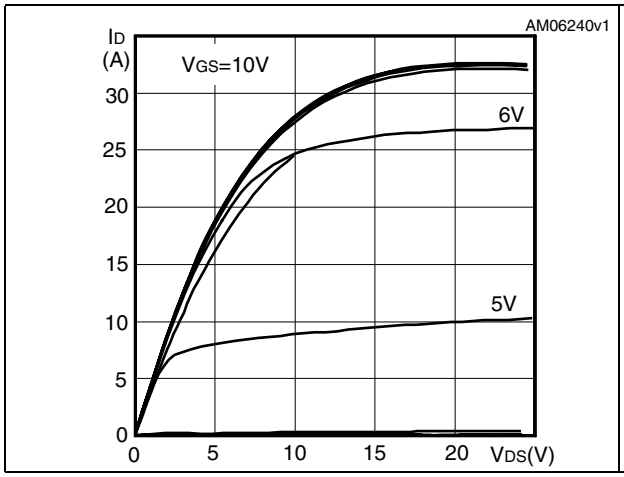


Figure 9. Transfer characteristics

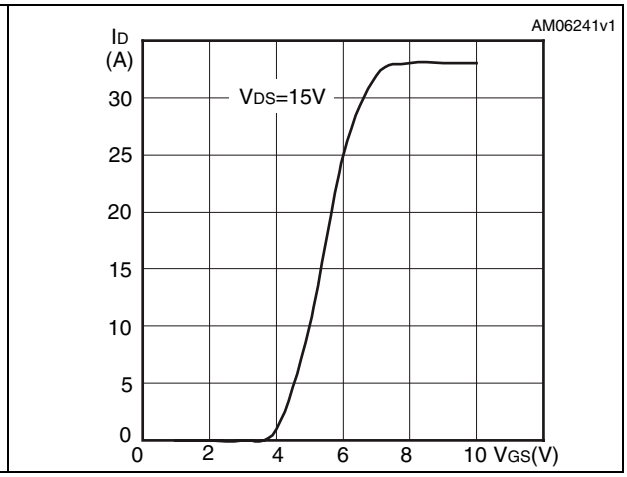


Figure 10. Gate charge vs gate-source voltage

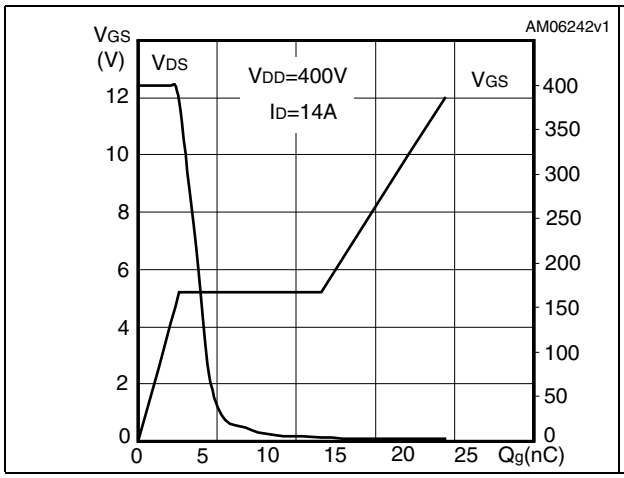


Figure 11. Static drain-source on resistance

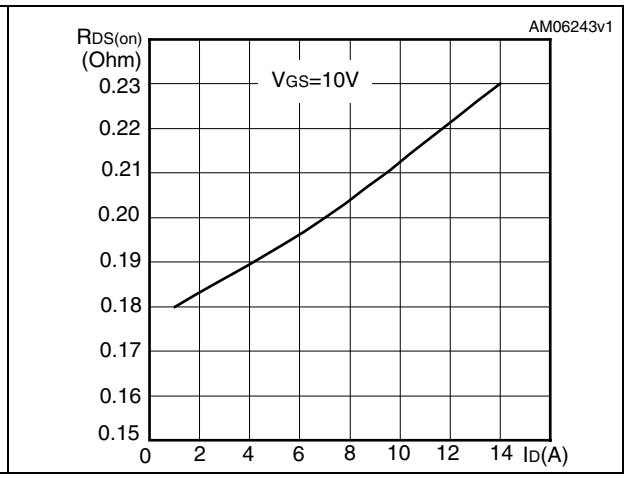


Figure 12. Capacitance variations

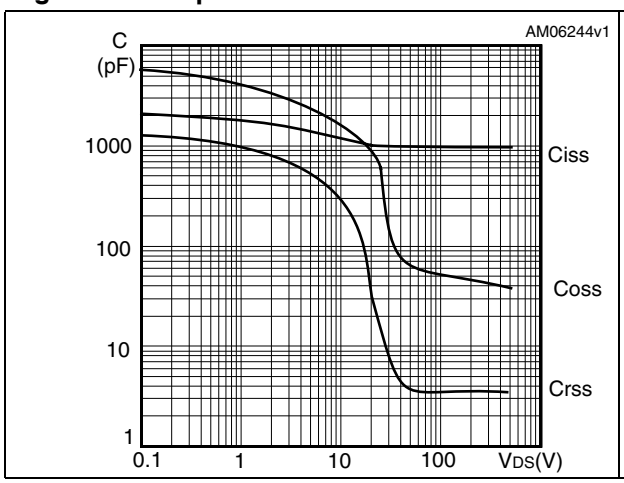


Figure 13. Output capacitance stored energy

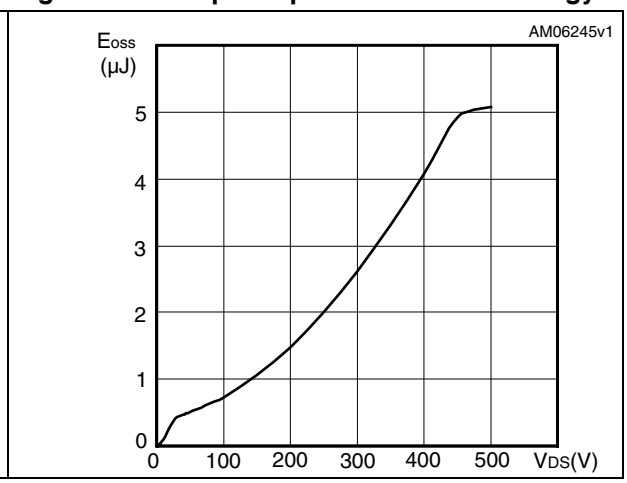


Figure 14. Normalized gate threshold voltage vs temperature

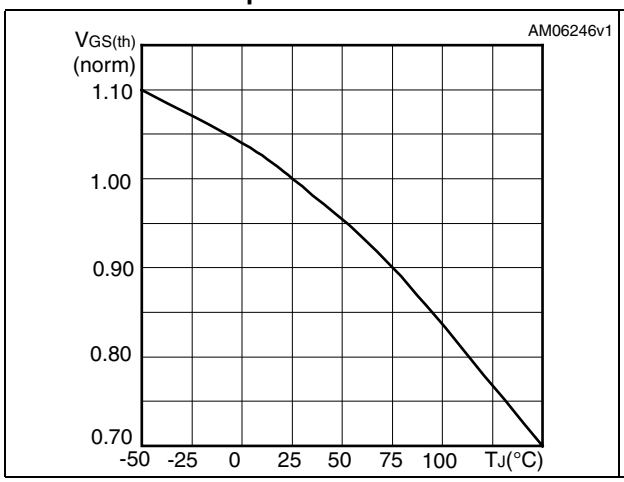


Figure 15. Normalized on resistance vs temperature

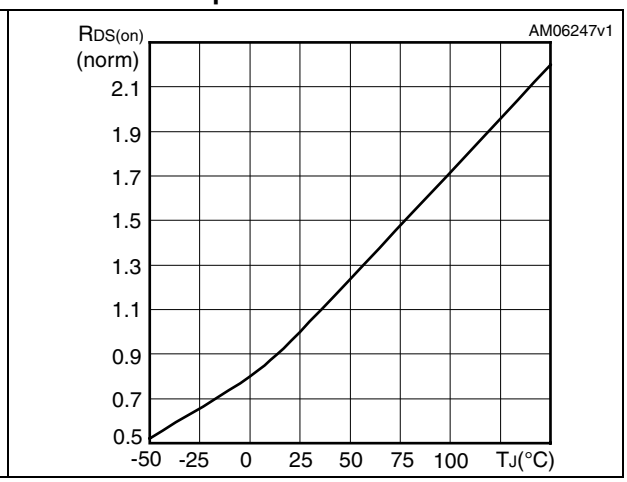


Figure 16. Source-drain diode forward characteristics

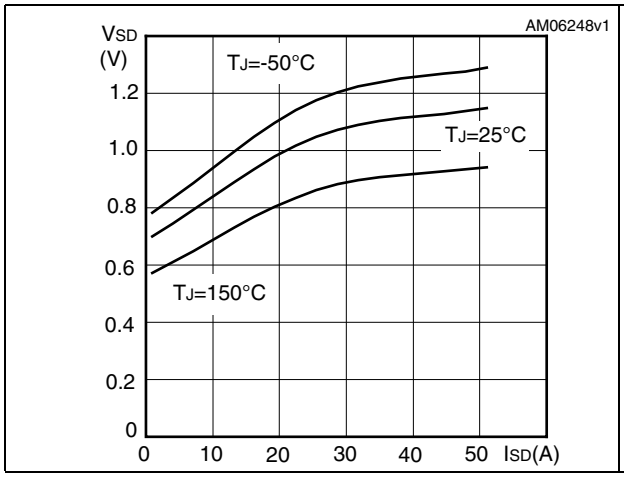
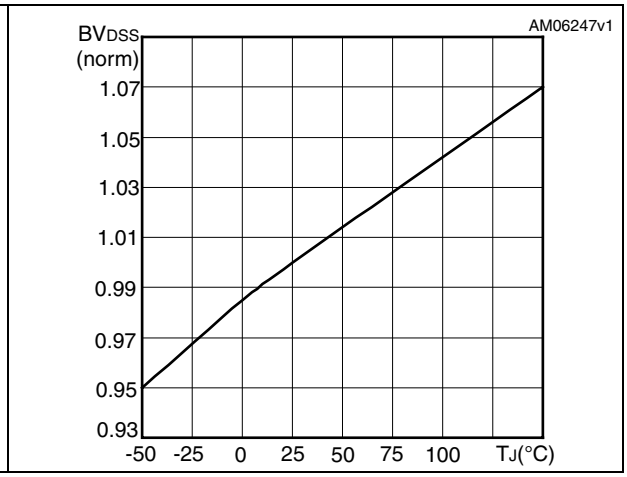


Figure 17. Normalized B_{VDSS} vs temperature



3 Test circuits

Figure 18. Switching times test circuit for resistive load

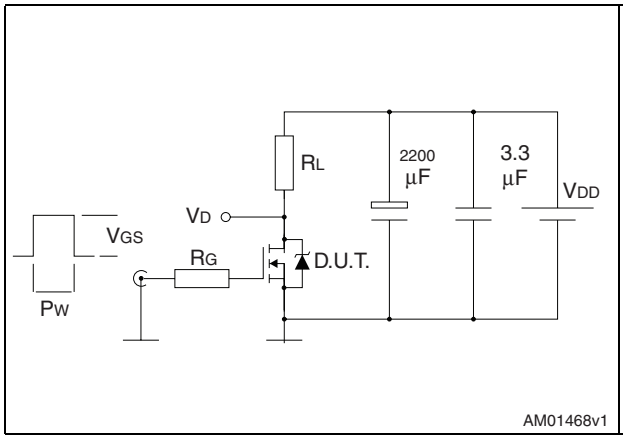


Figure 19. Gate charge test circuit

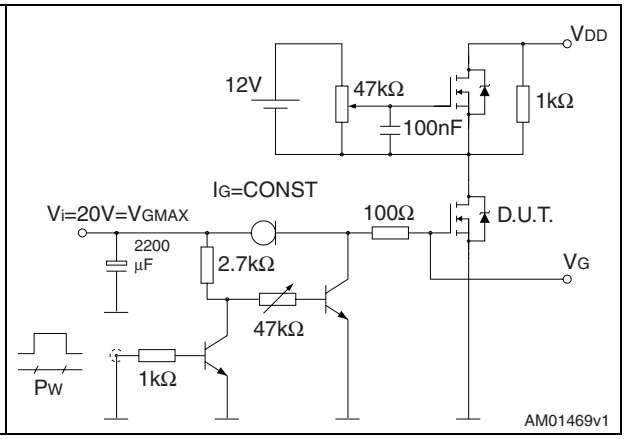


Figure 20. Test circuit for inductive load switching and diode recovery times

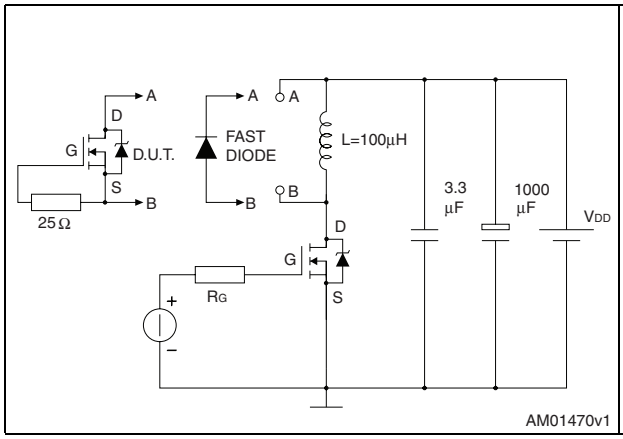


Figure 21. Unclamped inductive load test circuit

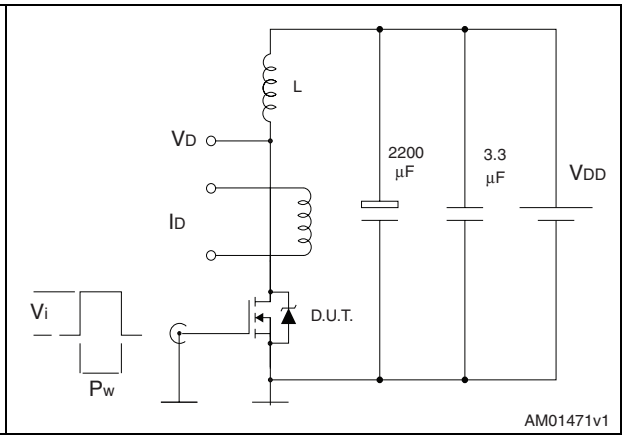


Figure 22. Unclamped inductive waveform

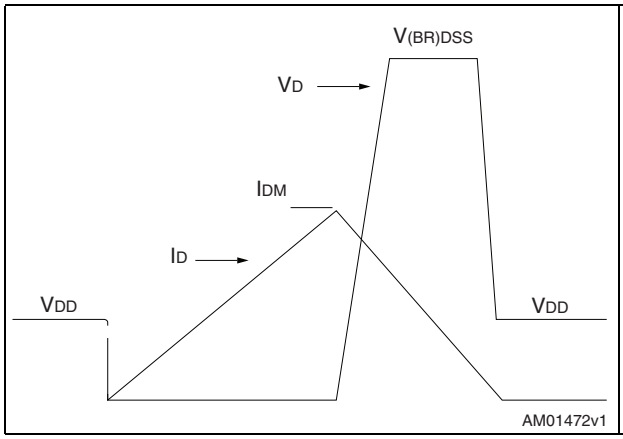
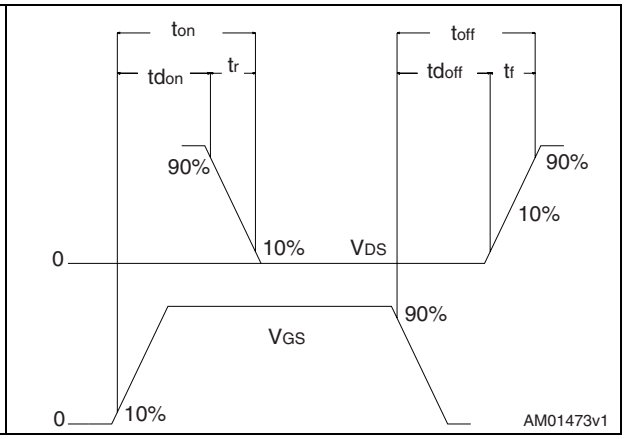


Figure 23. Switching time waveform



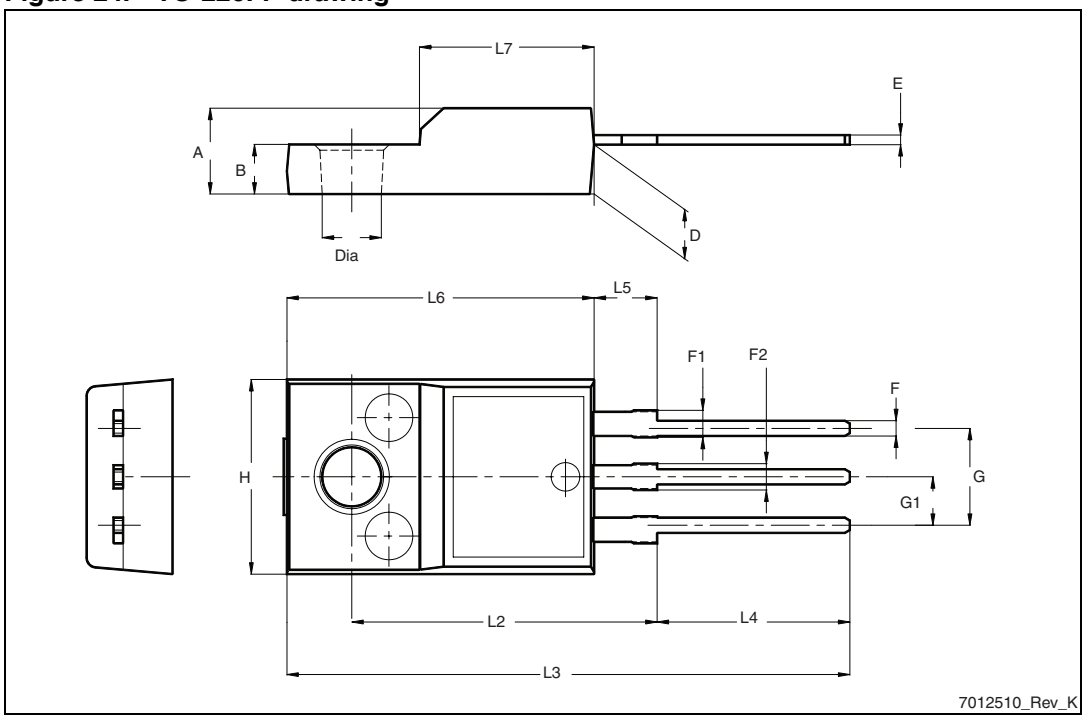
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

Table 9. TO-220FP mechanical data

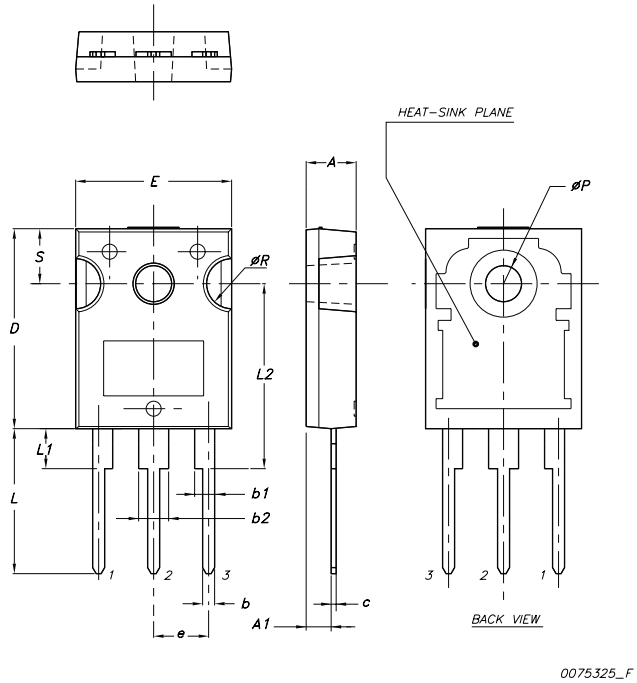
Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 24. TO-220FP drawing



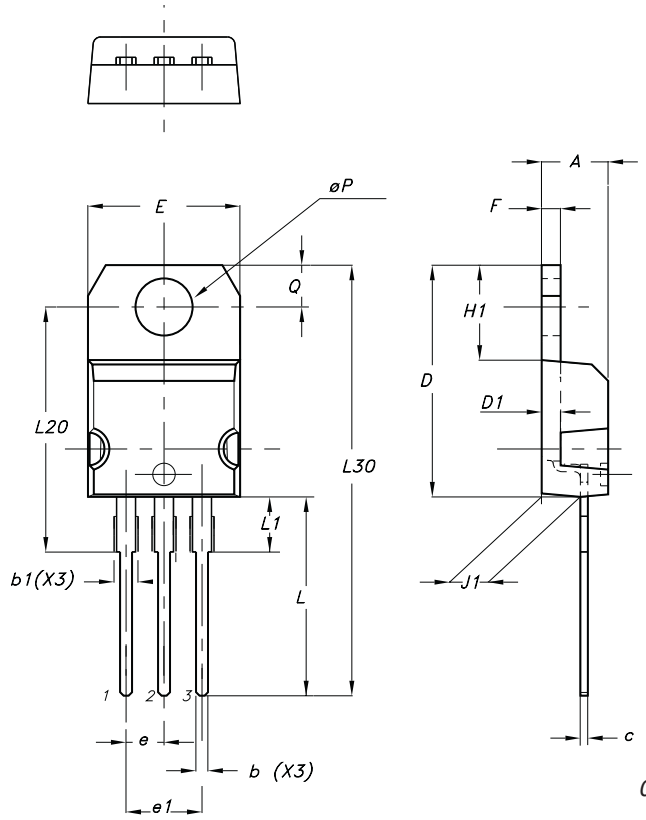
TO-247 mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



TO-220 type A mechanical data

Dim	mm		
	Min	Typ	Max
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
09-Feb-2010	1	First release

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