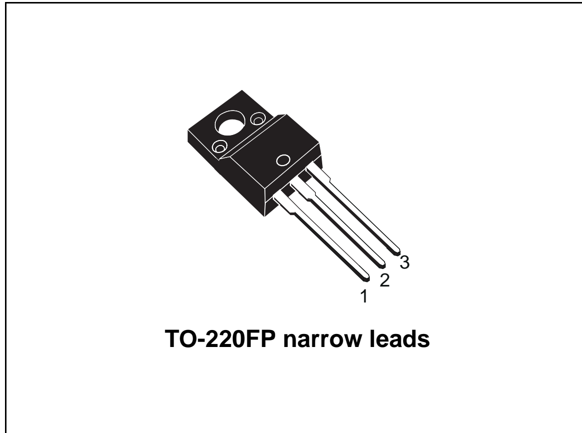
STF6N62K3(045Y)

life.augmented

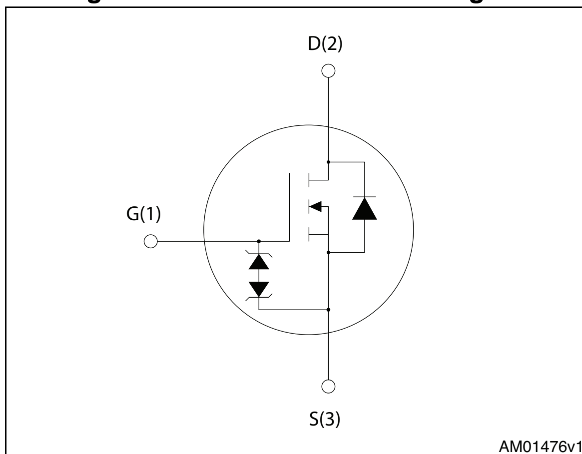
N-channel 620 V, 1.1 Ω typ., 5.5 A MDmesh™ K3 Power MOSFET in a TO-220FP narrow leads package

Datasheet - production data



TO-220FP narrow leads

Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STF6N62K3(045Y)	620 V	1.28 Ω	5.5 A	25 W

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected

Applications

- Switching applications

Description

This MDmesh™ K3 Power MOSFET is the result of improvements applied to SuperMESH™ technology, combined with an optimized vertical structure. This device boasts extremely low on-resistance, superior dynamic performance and high avalanche capability, rendering it suitable for the most demanding applications.

Table 1. Device summary

Order code	Marking	Packages	Packaging
STF6N62K3(045Y)	6N62K3	TO-220FP narrow leads	Tube

This is information on a product in full production. www.st.com

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	620	V
V_{GS}	Gate- source voltage	± 30	V
I_D	Drain current (continuous) at T_C = 25 °C	5.5 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	3.5 (1)	A
I_{DM} (2)	Drain current (pulsed)	22 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	25	W
ESD	Gate-source human body model (C = 100 pF, R = 1.5 kΩ)	2500	V
dv/dt (3)	Peak diode recovery voltage slope	9	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 by package
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 5.5$ A, di/dt $\leq$ 200 A/µs, V_{DD} = 80% $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	5	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	°C/W

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	5.5	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25°C, I_D = I_{AR}, V_{DD} = 50V)	140	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 (V_{GS} = 0)	I_D = 1 mA	620			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 620 V			1	µA
		V_{DS} = 620 V, T_C=125 °C			50	µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V			± 10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 50 µA	3	3.75	4.5	V
$R_{DS(on}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 2.8 A		1.1	1.28	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0	-	706	-	pF
C_{oss}	Output capacitance		-	66	-	pF
C_{rss}	Reverse transfer capacitance		-	8.4	-	pF
$C_{OSS\ eq}$[1]	Equivalent output capacitance	V_{GS} = 0, V_{DS} = 0 to 496 V	-	60	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	4	-	Ω
Q_g	Total gate charge	V_{DD} = 496 V, I_D = 5.5 A, V_{GS} = 10 V (see *Figure 15*)	-	25.7	-	nC
Q_{gs}	Gate-source charge		-	4.6	-	nC
Q_{gd}	Gate-drain charge		-	14.4	-	nC

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} = 310 V, I_D = 2.75 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 14*)	-	13	-	ns
t_r	Rise time		-	12.5	-	ns
$t_{d(off)}$	Turn-off-delay time		-	27	-	ns
t_f	Fall time		-	19	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5.5	A
I_{SDM} (1)	Source-drain current (pulsed)		-		22	A
V_{SD} (2)	Forward on voltage	I_{SD} = 5.5 A, V_{GS} = 0	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 5.5 A, di/dt = 100 A/µs V_{DD} = 30 V (see *Figure 19*)	-	190		ns
Q_{rr}	Reverse recovery charge		-	970		nC
I_{RRM}	Reverse recovery current		-	10.5		A
t_{rr}	Reverse recovery time	I_{SD} = 5.5 A, di/dt = 100 A/µs V_{DD} = 30 V, T_j = 150 °C (see *Figure 19*)	-	255		ns
Q_{rr}	Reverse recovery charge		-	1520		nC
I_{RRM}	Reverse recovery current		-	12		A

1. Pulse width limited by safe operating area
2. Pulsed: 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} = ± 1mA, I_D=0	30	-	-	V

The built-in back-to-back Zener diodes have been specifically designed to enhance not only the device's ESD capability, but also to make them capable of safely absorbing any voltage transients that may occasionally be applied from gate to source. In this respect, the Zener voltage is appropriate to achieve efficient and cost-effective protection of device integrity. The integrated Zener diodes thus eliminate the need for external components.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

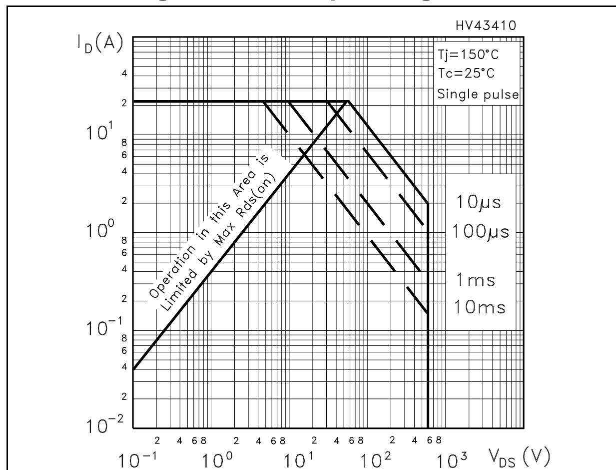


Figure 3. Thermal impedance

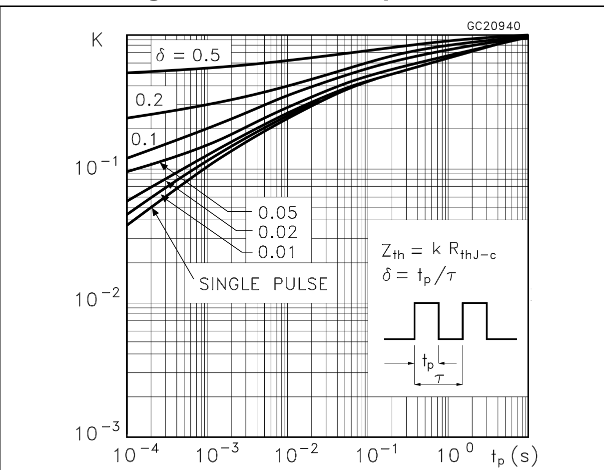


Figure 4. Output characteristics

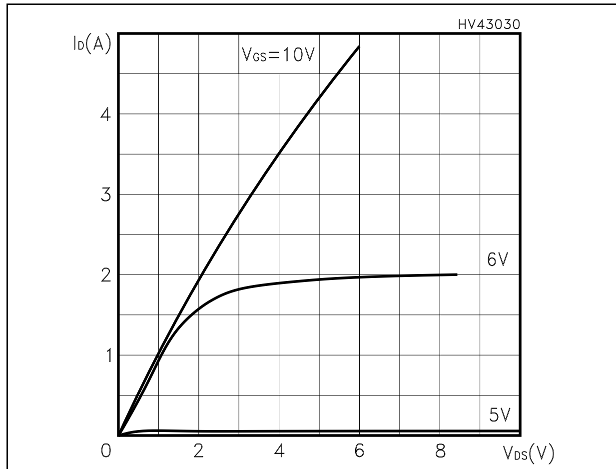


Figure 5. Transfer characteristics

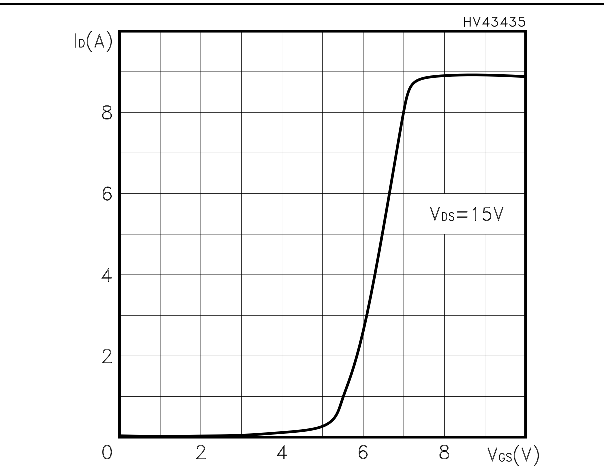


Figure 6. Normalized $V_{(BR)DSS}$ vs temperature

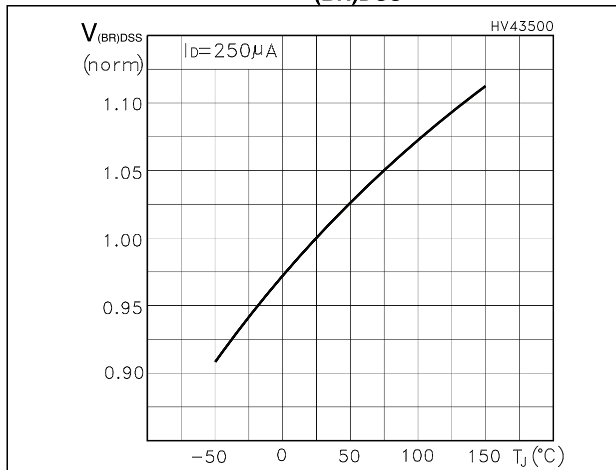


Figure 7. Static drain-source on-resistance

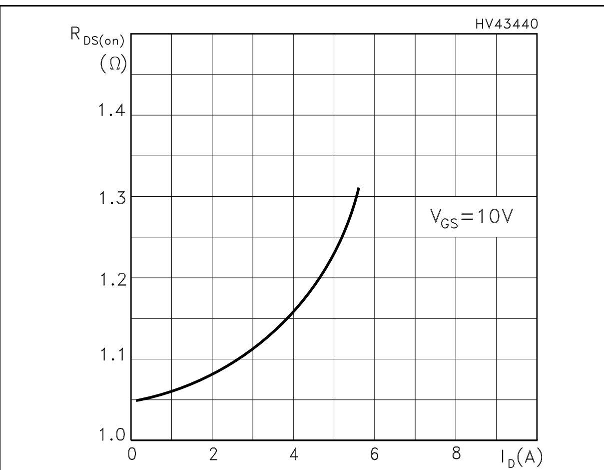


Figure 8. Gate charge vs gate-source voltage

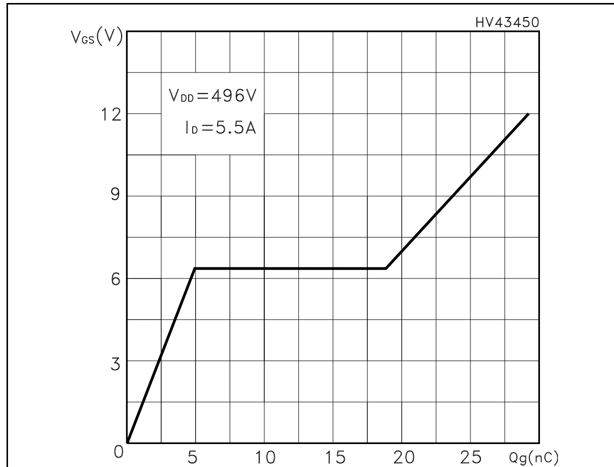


Figure 9. Capacitance variations

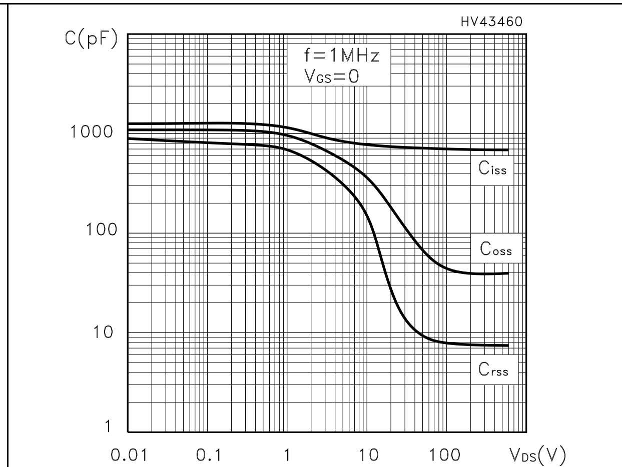


Figure 10. Normalized gate threshold voltage vs temperature

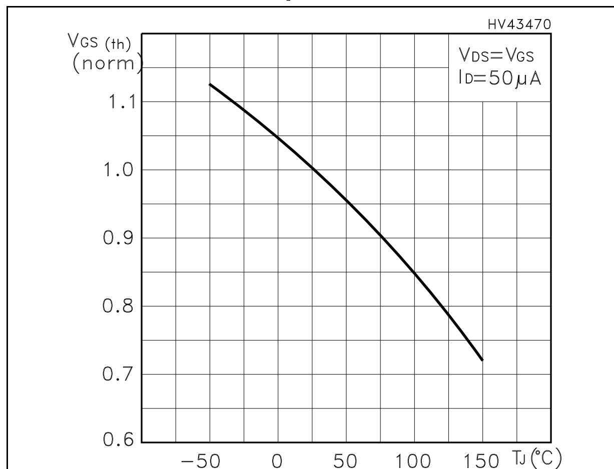


Figure 11. Normalized on-resistance vs temperature

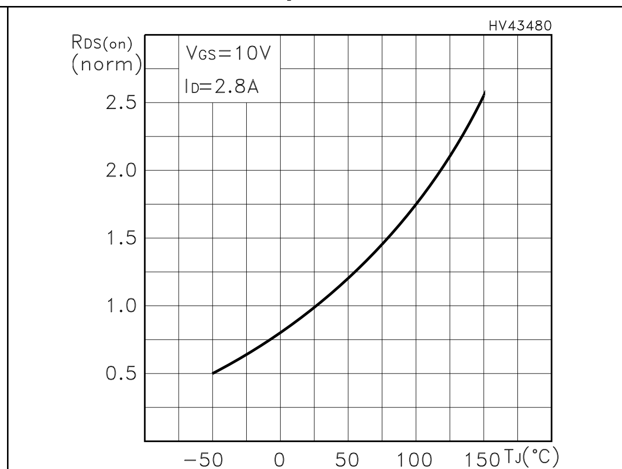


Figure 12. Source-drain diode forward characteristics

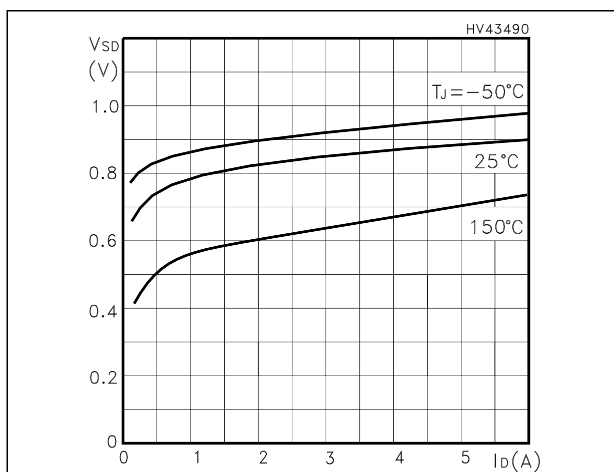
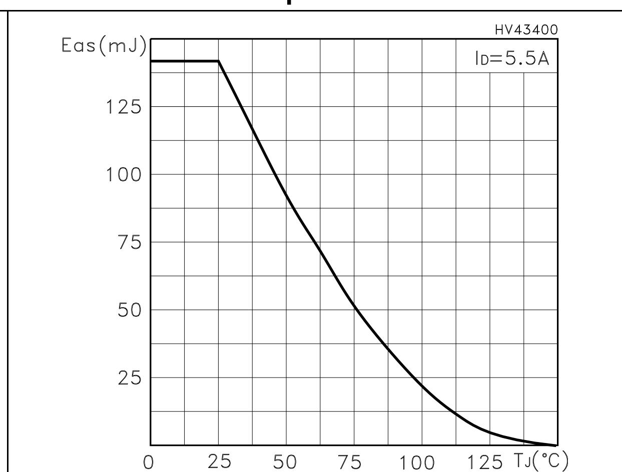


Figure 13. Maximum avalanche energy vs temperature



3 Test circuits

Figure 14. Switching times test circuit for resistive load

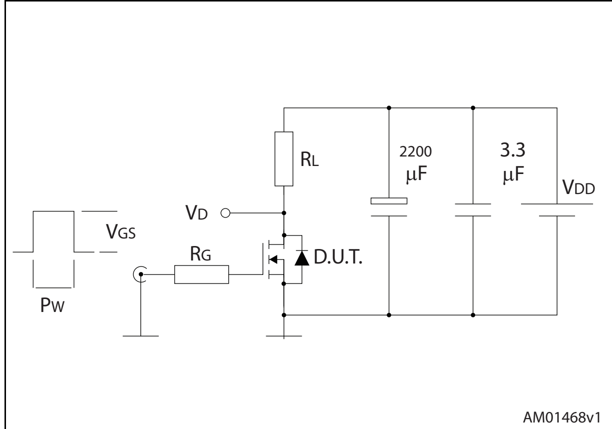


Figure 15. Gate charge test circuit

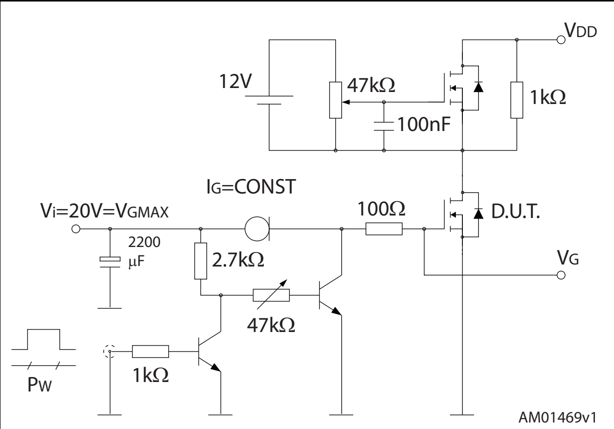


Figure 16. Test circuit for inductive load switching and diode recovery times

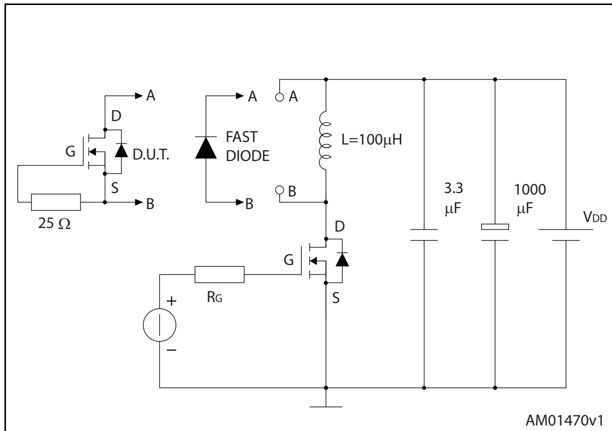


Figure 17. Unclamped inductive load test circuit

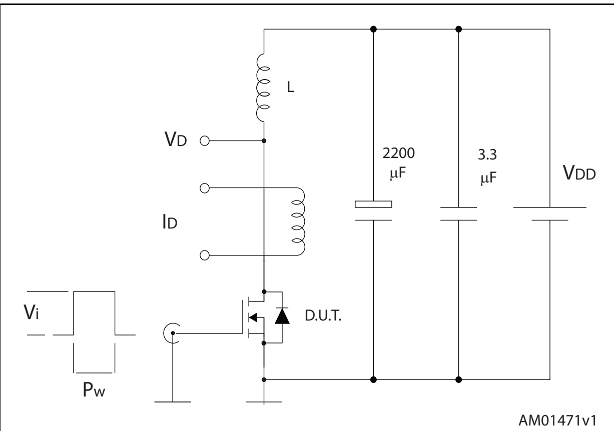


Figure 18. Unclamped inductive waveform

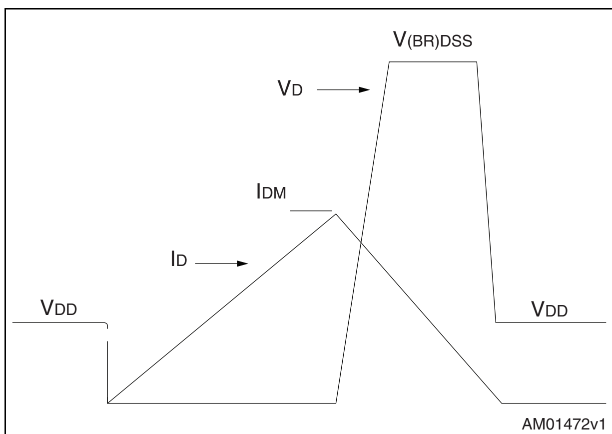
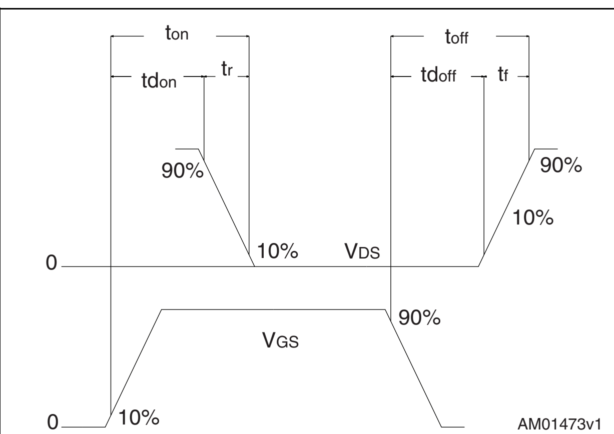


Figure 19. Switching time waveform



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.

Figure 20. TO-220FP narrow leads drawing

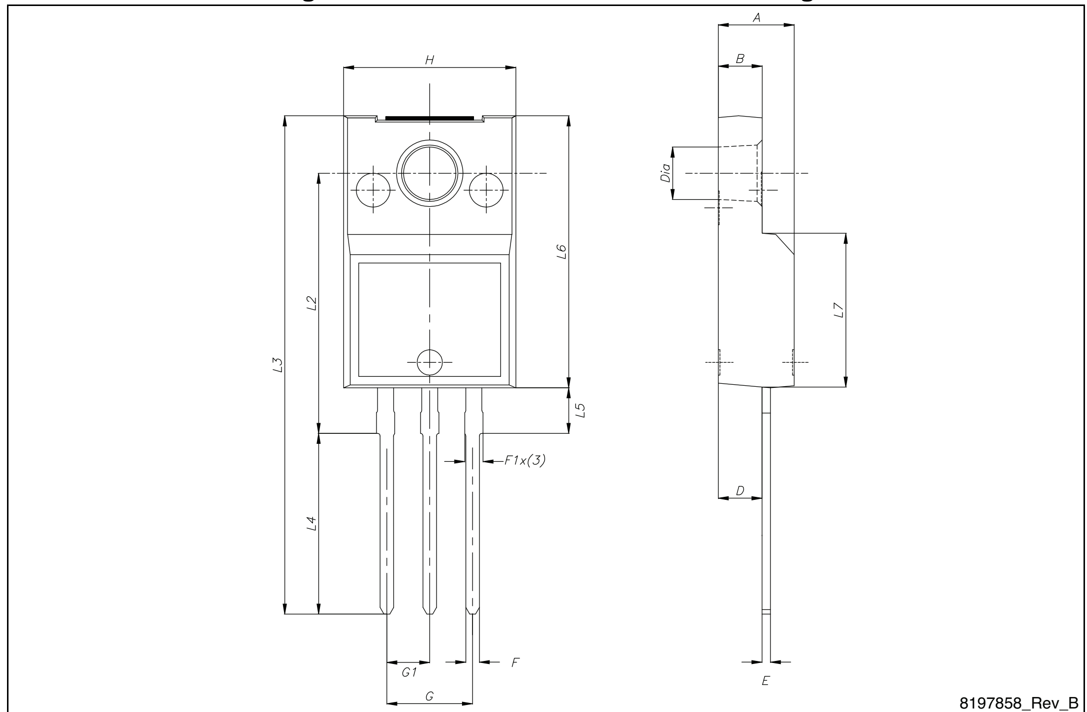


Table 10. TO-220FP narrow leads mechanical data

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	0.95		1.20
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2	15.20		15.60
L3	28.6		30.6
L4	10.3		11.1
L5	2.60	2.70	2.90
L6	15.8	16.0	16.2
L7	9		9.3
Dia	3		3.2

5 Revision history

Table 11. Document revision history

Date	Revision	Changes
04-Nov-2009	1	First release
19-Sep-2014	2	– Modified: *Figure 14*, *15*, *16*, *17* – Minor text changes.

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