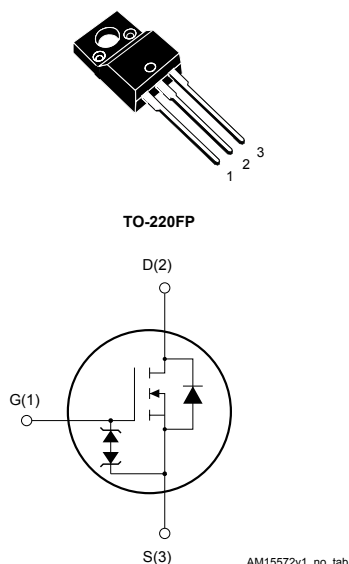


N-channel 800 V, 1.0 Ω typ., 5 A MDmesh K6 Power MOSFET in a TO-220FP package



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STF80N1K1K6	800 V	1.1 Ω	5 A

- Worldwide best $R_{DS(on)}$ x area
- Worldwide best FOM (figure of merit)
- Ultra low gate charge
- 100% avalanche tested
- Zener-protected

Applications

- Flyback converter
- Adapters for tablets, notebook and AIO
- LED lighting

Description

This very high voltage N-channel Power MOSFET is designed using the ultimate MDmesh K6 technology based on 20 years STMicroelectronics experience on super junction technology. The result is the best-in-class on-resistance per area and gate charge for applications requiring superior power density and high efficiency.

Product status link

[STF80N1K1K6](#)

Product summary

Order code	STF80N1K1K6
Marking	80N1K1K6
Package	TO-220FP
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	5	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	3	
$I_{DM}^{(2)}$	Drain current (pulsed)	8	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$	21	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	5	V/ns
$di/dt^{(3)}$	Peak diode recovery current slope	100	A/ μs
$dv/dt^{(4)}$	MOSFET dv/dt ruggedness	120	V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$, $T_C = 25\text{ }^\circ\text{C}$)	2.5	kV
T_{stg}	Storage temperature range	-55 to 150	$^\circ\text{C}$
T_J	Operating junction temperature range		$^\circ\text{C}$

1. Limited by package.
2. Pulse width limited by safe operating area.
3. $I_{SD} \leq 2.5\text{ A}$, $V_{DS}(\text{peak}) = 400\text{ V}$.
4. $V_{DS} \leq 640\text{ V}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	6	$^\circ\text{C/W}$
R_{thJA}	Thermal resistance, junction-to-ambient	62.5	$^\circ\text{C/W}$

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_J max.)	1.5	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	60	mJ

2 Electrical characteristics

$T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Table 4. On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	800			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$			50	
I_{GSS}	Gate body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			± 1	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 50\text{ }\mu\text{A}$	3.0	3.5	4.0	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 1.7\text{ A}$		1.0	1.1	Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 400\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	300	-	pF
C_{oss}	Output capacitance		-	4.5	-	pF
$C_{o(er)}^{(1)}$	Equivalent capacitance energy related	$V_{DS} = 0\text{ to }640\text{ V}$, $V_{GS} = 0\text{ V}$	-	7	-	pF
$C_{o(tr)}^{(2)}$	Equivalent capacitance time related		-	37	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	4.2	-	Ω
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 2.5\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 18. Test circuit for gate charge behavior)	-	5.7	-	nC
Q_{gs}	Gate-source charge		-	1.7	-	nC
Q_{gd}	Gate-drain charge		-	1.8	-	nC

- $C_{o(er)}$ is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 V to the stated value.
- $C_{o(tr)}$ is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 V to the stated value.

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$, $I_D = 2.5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	7.4	-	ns
t_r	Rise time		-	4.3	-	ns
$t_{d(off)}$	Turn-off delay time	see (Figure 16. Test circuit for resistive load switching times and Figure 17. Switching time waveform)	-	22	-	ns
t_f	Fall time		-	14	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		5	A
$I_{SDM}^{(2)}$	Source-drain current (pulsed)		-		8	A
$V_{SD}^{(3)}$	Forward on voltage	$I_{SD} = 5\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	217		ns
Q_{rr}	Reverse recovery charge		-	1.7		μC
I_{RRM}	Reverse recovery current		-	11.8		A
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	333		ns
Q_{rr}	Reverse recovery charge		-	2.3		μC
I_{RRM}	Reverse recovery current		-	10.2		A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

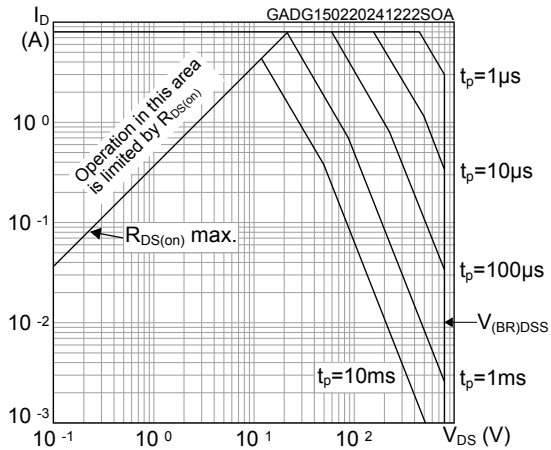


Figure 2. Maximum transient thermal impedance

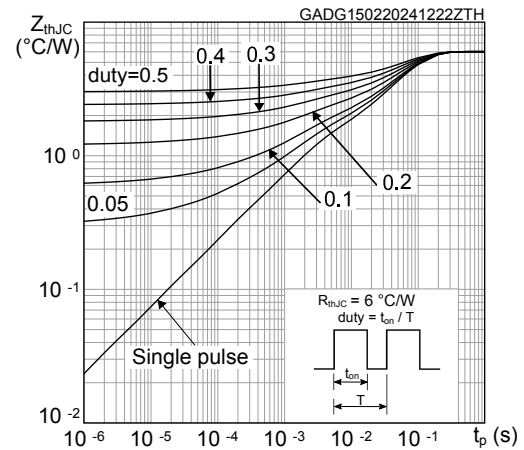


Figure 3. Typical output characteristics

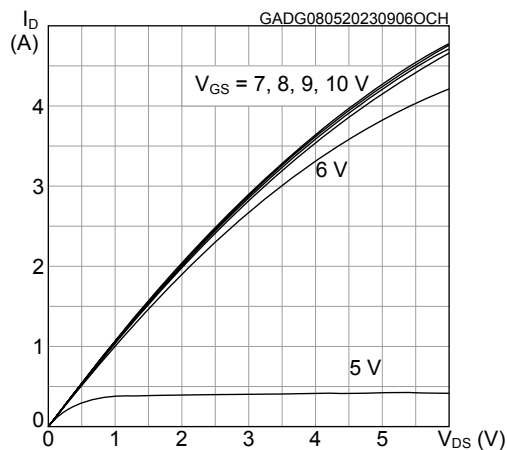


Figure 4. Typical transfer characteristics

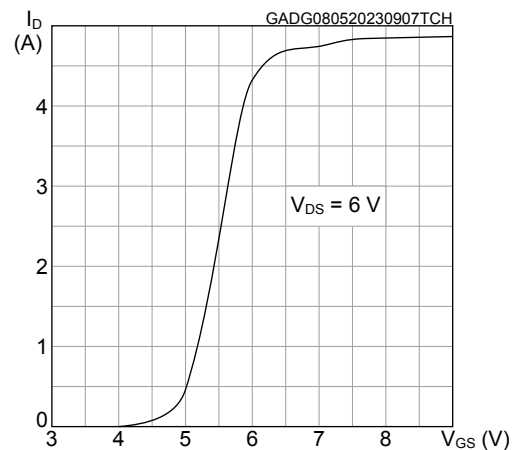


Figure 5. Typical drain-source on-resistance

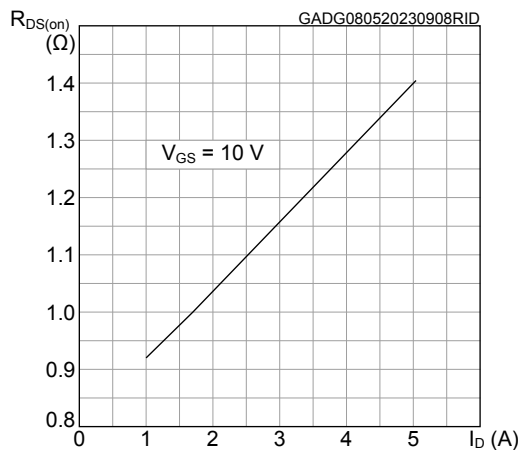


Figure 6. Normalized on-resistance vs temperature

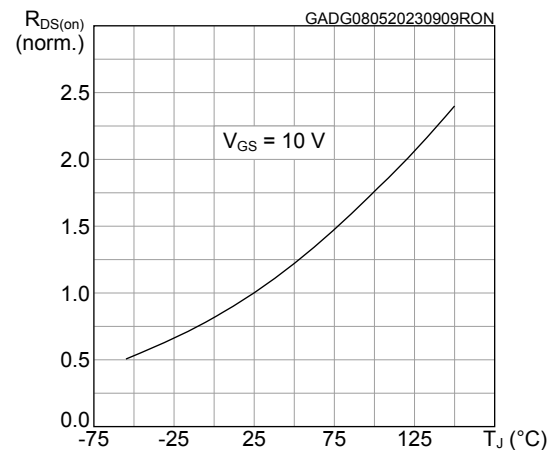


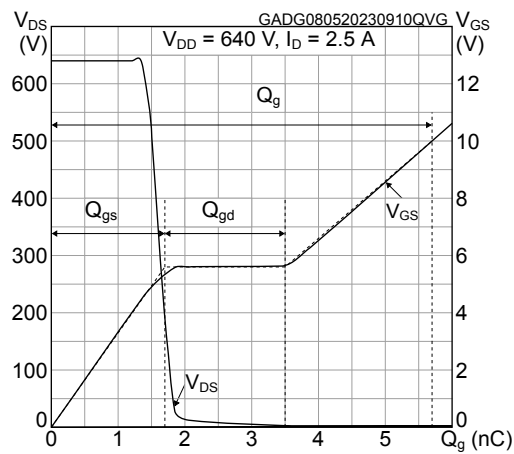
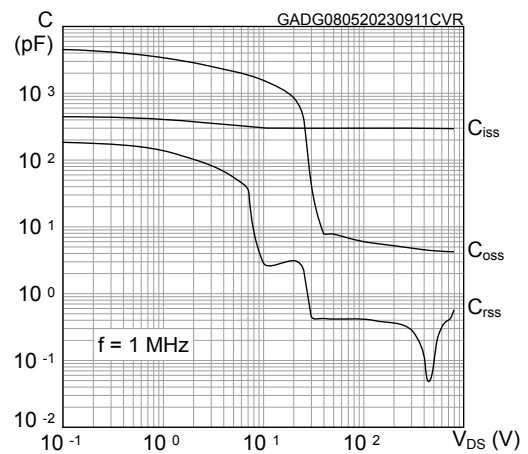
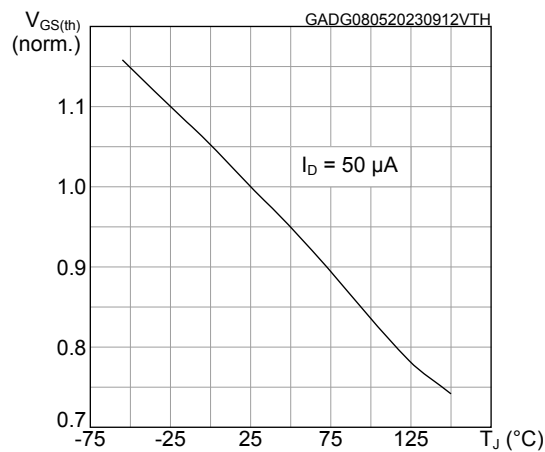
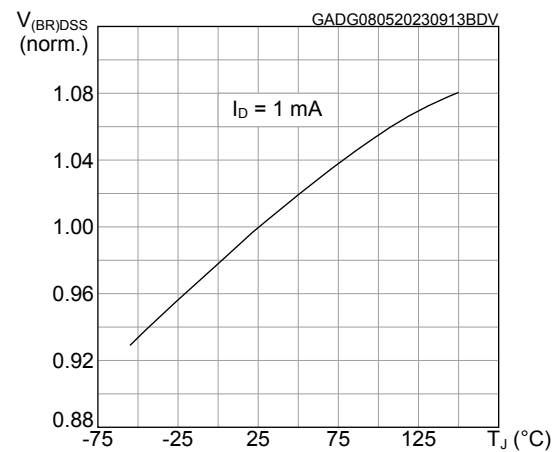
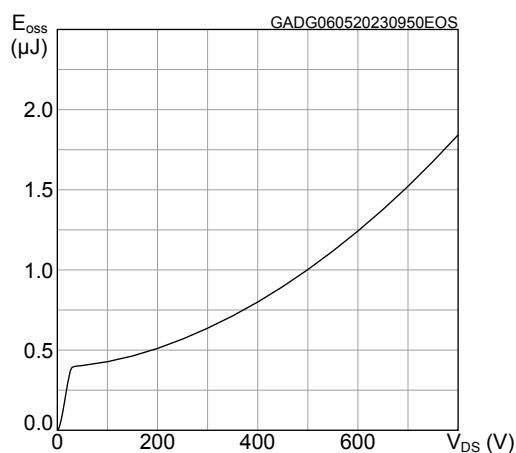
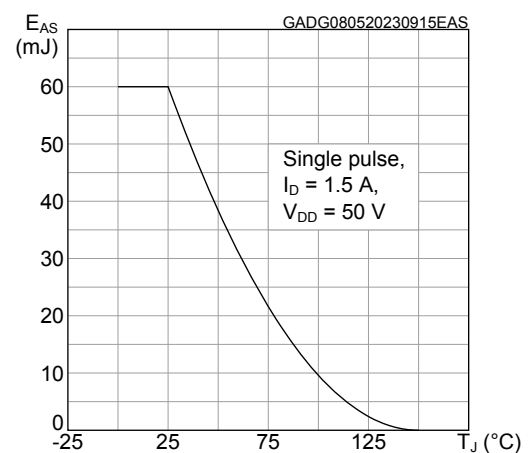
Figure 7. Typical gate charge characteristics

Figure 8. Typical capacitance characteristics

Figure 9. Normalized gate threshold vs temperature

Figure 10. Normalized breakdown voltage vs temperature

Figure 11. Typical output capacitance stored energy

Figure 12. Maximum avalanche energy vs temperature


Figure 13. Typical reverse diode forward characteristics

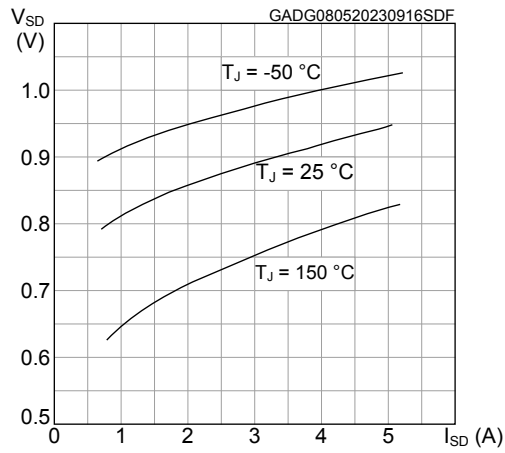


Figure 14. Typical inductive load switching energy vs I_D

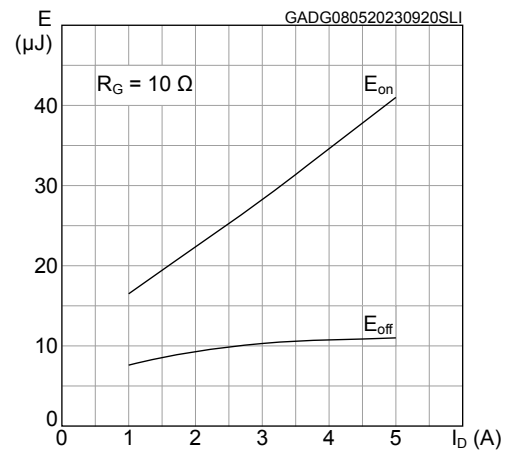
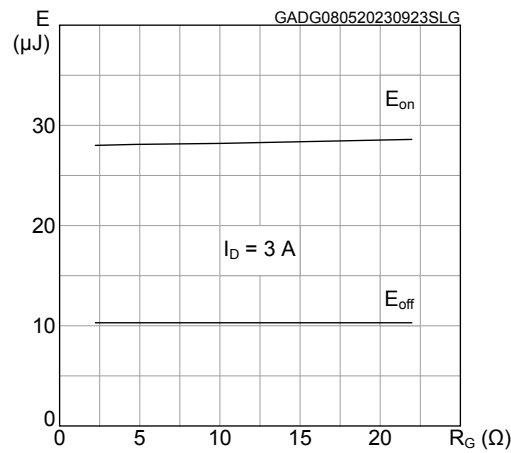
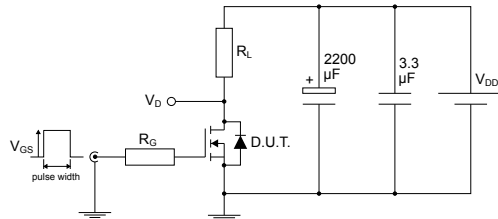


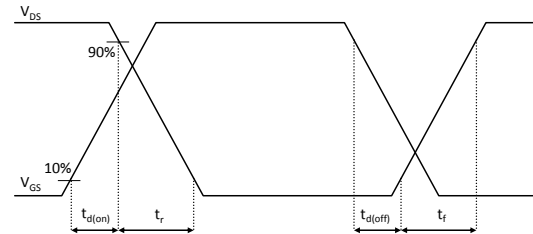
Figure 15. Typical inductive load switching energy vs R_G



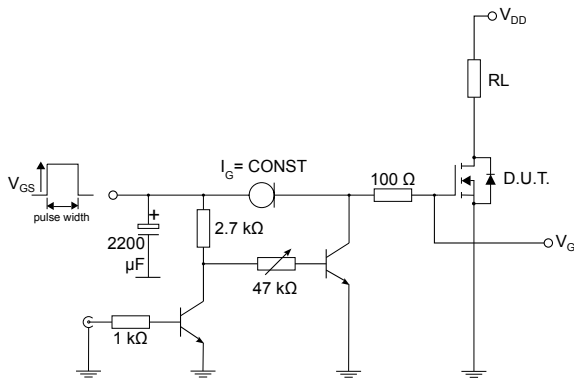
3 Test circuits

Figure 16. Test circuit for resistive load switching times


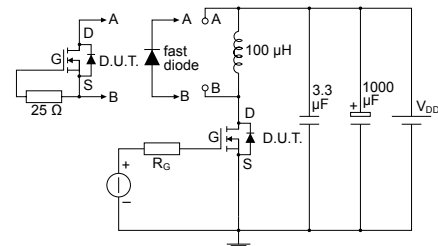
AM01468v1

Figure 17. Switching time waveform


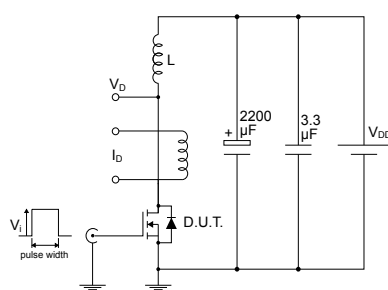
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Figure 18. Test circuit for gate charge behavior


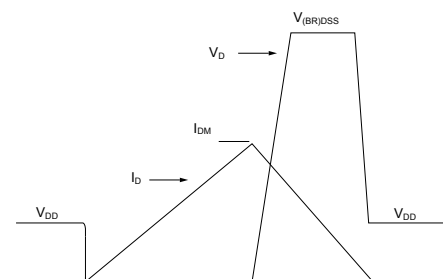
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Figure 19. Test circuit for inductive load switching and diode recovery times


AM01470v1

Figure 20. Unclamped inductive load test circuit


AM01471v1

Figure 21. Unclamped inductive waveform


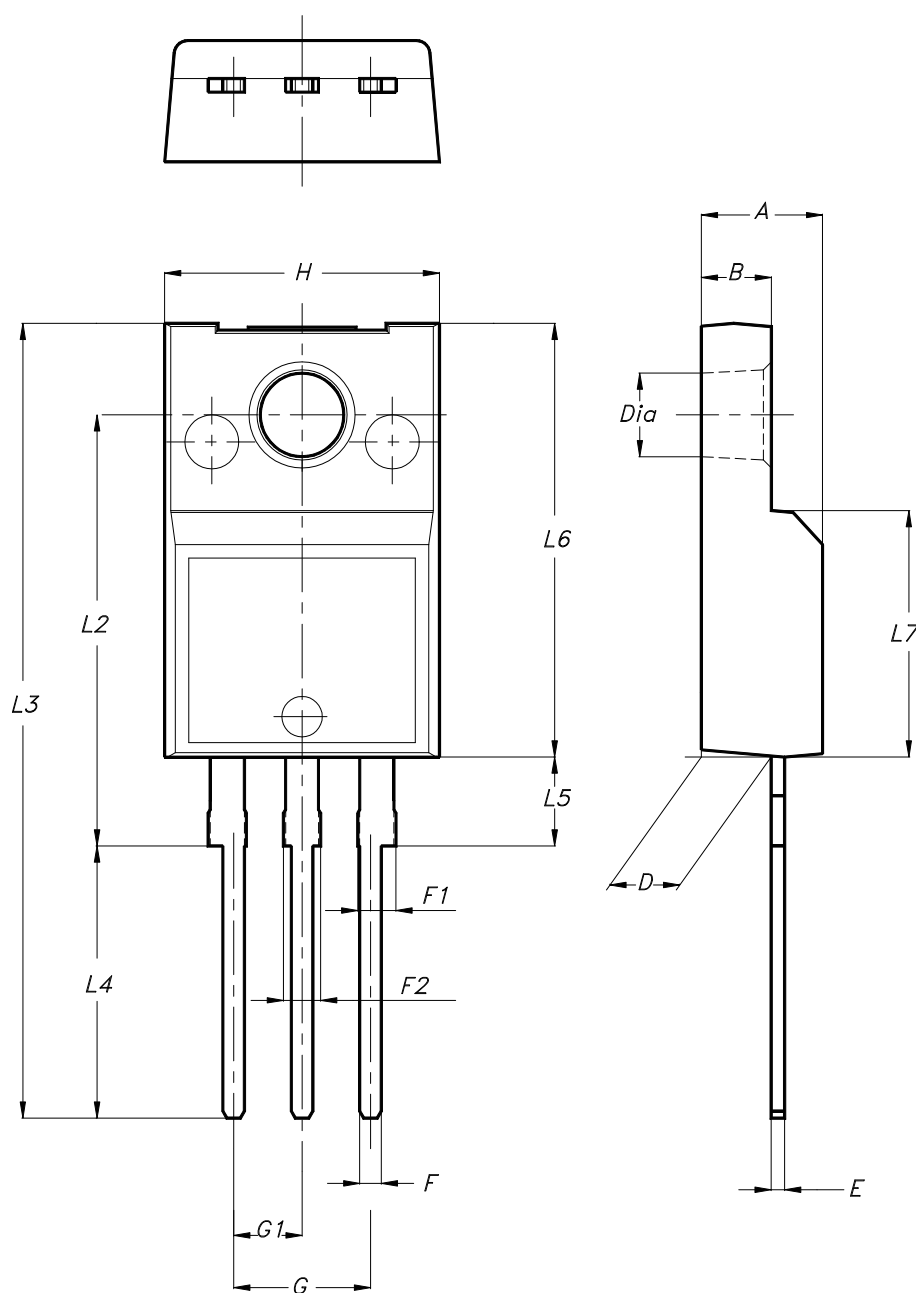
AM01472v1

4 Package information

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.

4.1 TO-220FP type B package information

Figure 22. TO-220FP type B package outline



7012510_B_rev.14

Table 8. TO-220FP type B package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.70
F	0.75		1.00
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.20
G1	2.40		2.70
H	10.00		10.40
L2		16.00	
L3	28.60		30.60
L4	9.80		10.60
L5	2.90		3.60
L6	15.90		16.40
L7	9.00		9.30
Dia	3.00		3.20

Revision history

Table 9. Document revision history

Date	Revision	Changes
19-Feb-2024	1	First release.

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