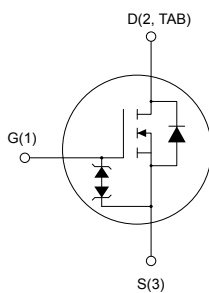
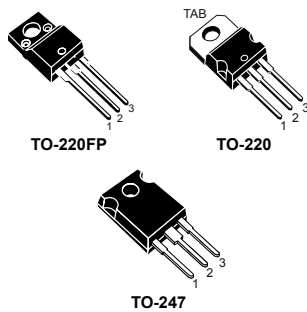




N-channel 950 V, 680 mΩ typ., 10 A MDmesh K3 Power MOSFET
in a TO-220FP, TO-220 and TO-247 packages



AM01476v1_tab



Features

Order codes	V_{DS}	$R_{DS(on)}$ max.	I_D
STF13N95K3	950 V	850 mΩ	10 A
STP13N95K3			
STW13N95K3			

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

Applications

- Switching applications

Description

These MDmesh K3 Power MOSFETs are the result of improvements applied to STMicroelectronics' MDmesh technology, combined with a new optimized vertical structure. These devices boast an extremely low on-resistance, superior dynamic performance and high avalanche capability, rendering them suitable for the most demanding applications.

Product status link

[STF13N95K3](#)

[STP13N95K3](#)

[STW13N95K3](#)

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220FP	TO-220 TO-247	
V _{DS}	Drain-source voltage	950		V
V _{GS}	Gate-source voltage	±30		V
I _D	Drain current (continuous) at T _C = 25 °C	10		A
	Drain current (continuous) at T _C = 100 °C	6		
I _{DM} ⁽¹⁾	Drain current (pulsed)	40		A
P _{TOT}	Total power dissipation at T _C = 25 °C	40	190	W
dv/dt ⁽²⁾	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, T _C = 25 °C)	2.5	-	kV
T _{stg}	Storage temperature range	-55 to 150		°C
T _J	Operating junction temperature range			°C

1. Pulse width is limited by safe operating area.

2. $I_{SD} \leq 10\text{ A}$, $di/dt = 400\text{ A}/\mu\text{s}$, $V_{DS}(\text{peak}) < V_{(BR)DSS}$.

Table 2. Thermal data

Symbol	Parameter	Value			Unit
		TO-220FP	TO-220	TO-247	
R_{thJC}	Thermal resistance, junction-to-case	3.13	0.66		$^{\circ}\text{C}/\text{W}$
R_{thJA}	Thermal resistance, junction-to-ambient	62.5		50	$^{\circ}\text{C}/\text{W}$

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T_J max.)	13	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	400	mJ

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	950	-	-	V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 950\text{ V}$	-	-	1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 950\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$	-	-	50	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$	-	-	± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 5\text{ A}$	-	680	850	m Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	1620	-	pF
C_{oss}	Output capacitance		-	117	-	pF
C_{rss}	Reverse transfer capacitance		-	1.2	-	pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{DS} = 0\text{ to }760\text{ V}$, $V_{GS} = 0\text{ V}$	-	115	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related		-	131	-	pF
R_g	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	2.3	-	Ω
Q_g	Total gate charge	$V_{DD} = 760\text{ V}$, $I_D = 10\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see the Figure 19. Test circuit for gate charge behavior)	-	51	-	nC
Q_{gs}	Gate-source charge		-	10	-	nC
Q_{gd}	Gate-drain charge		-	30	-	nC

- $C_{o(tr)}$ 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} .
- $C_{o(er)}$ 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 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 475\text{ V}$, $I_D = 5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	18	-	ns
t_r	Rise time		-	16	-	ns
$t_{d(off)}$	Turn-off delay time	(see the Figure 18. Test circuit for resistive load switching times and Figure 23. Switching time waveform)	-	50	-	ns
t_f	Fall time		-	21	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	10	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	-	40	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 10\text{ A}$	-	-	1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 10\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$	-	500	-	ns
Q_{rr}	Reverse recovery charge		-	9	-	μC
I_{RRM}	Reverse recovery current	(see the Figure 20. Test circuit for inductive load switching and diode recovery times)	-	36	-	A
t_{rr}	Reverse recovery time	$I_{SD} = 10\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	624	-	ns
Q_{rr}	Reverse recovery charge		-	11	-	μC
I_{RRM}	Reverse recovery current	(see the Figure 20. Test circuit for inductive load switching and diode recovery times)	-	37	-	A

1. Pulse width is limited by safe operating area.

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

2.1 Electrical characteristics (curves)

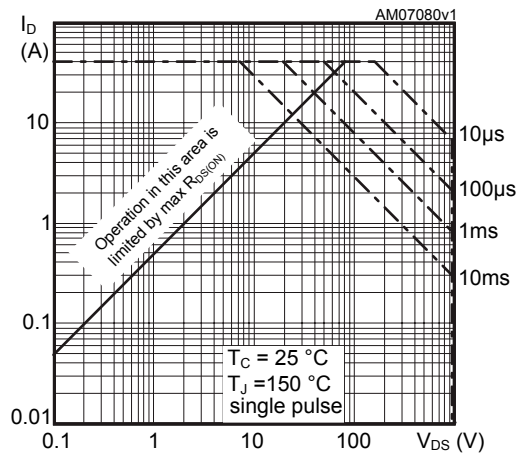
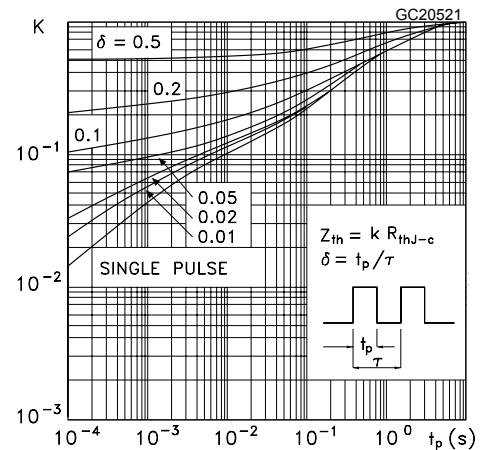
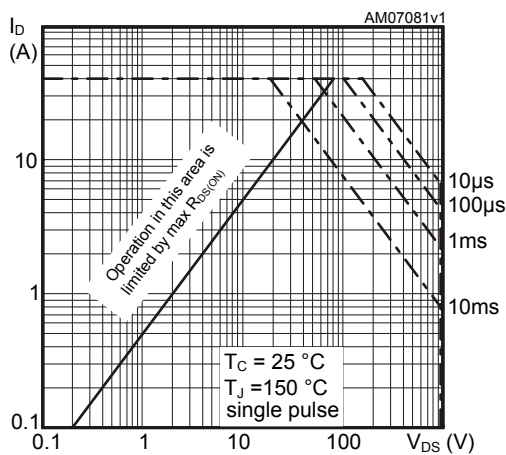
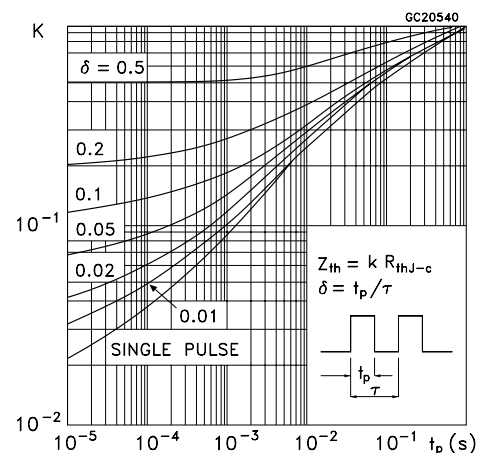
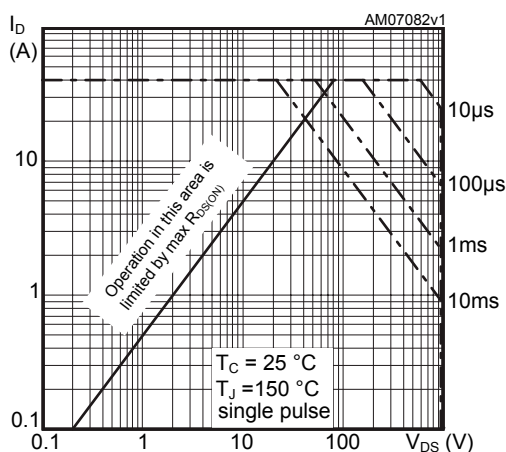
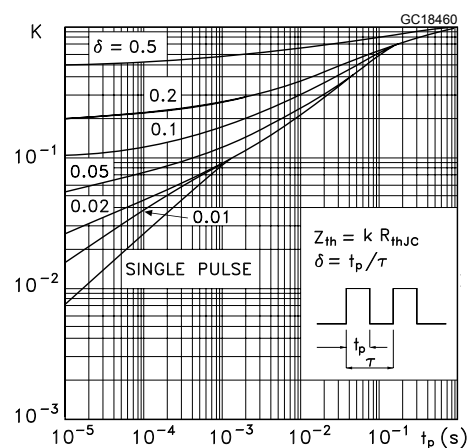
Figure 1. Safe operating area for TO-220FP

Figure 2. Normalized transient thermal impedance for TO-220FP

Figure 3. Safe operating area for TO-220

Figure 4. Normalized transient thermal impedance for TO-220

Figure 5. Safe operating area for TO-247

Figure 6. Normalized transient thermal impedance for TO-247


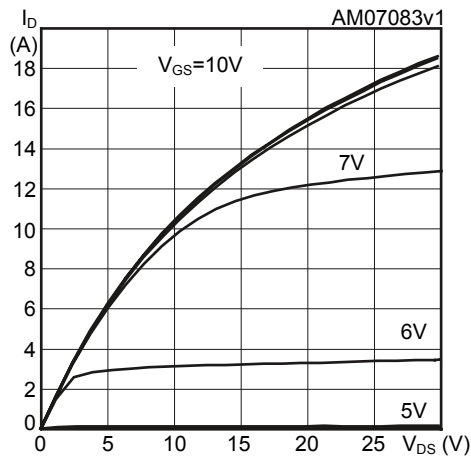
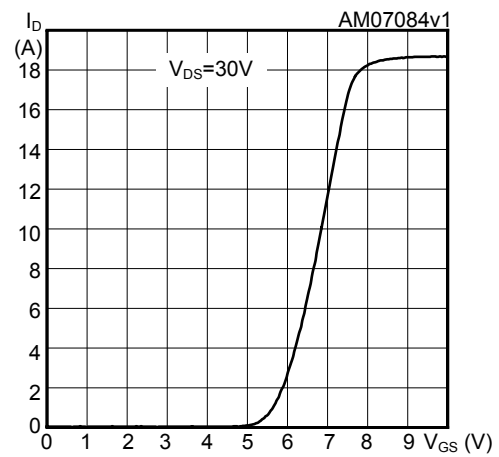
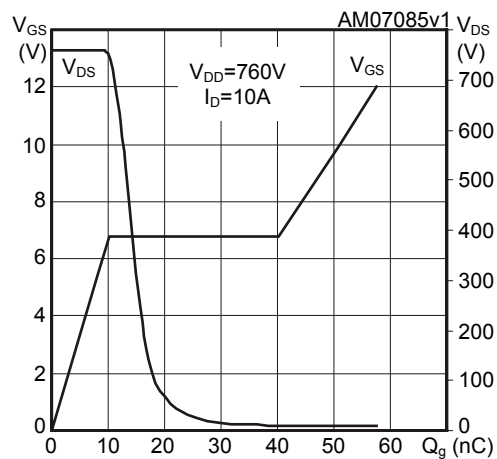
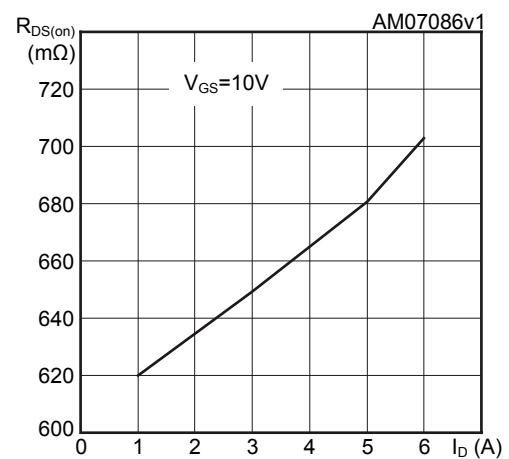
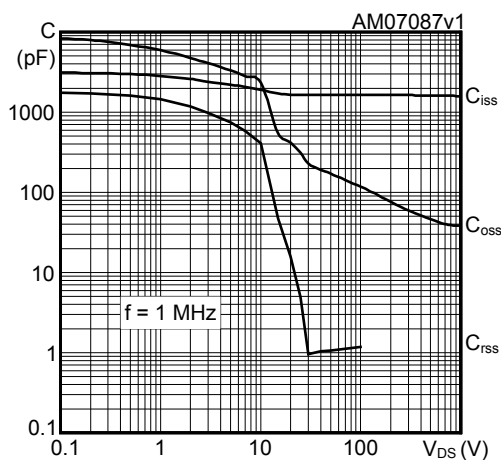
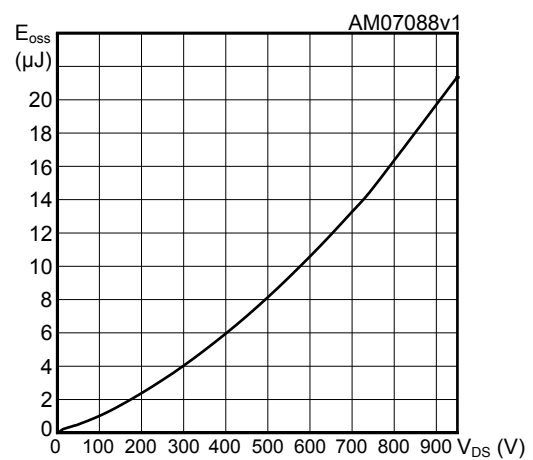
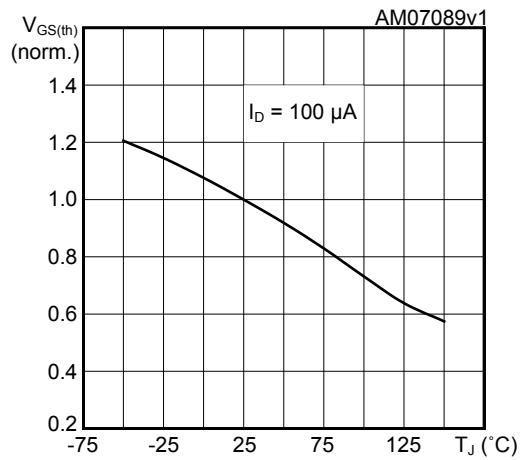
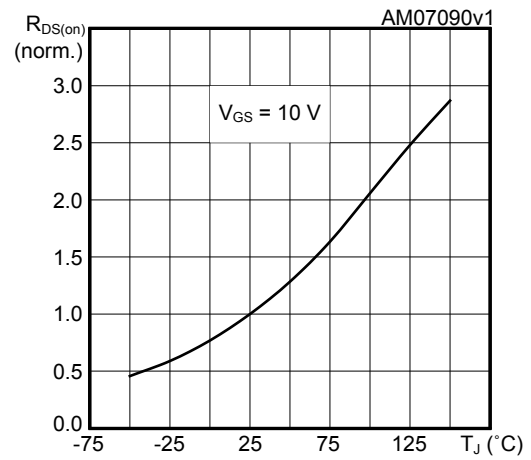
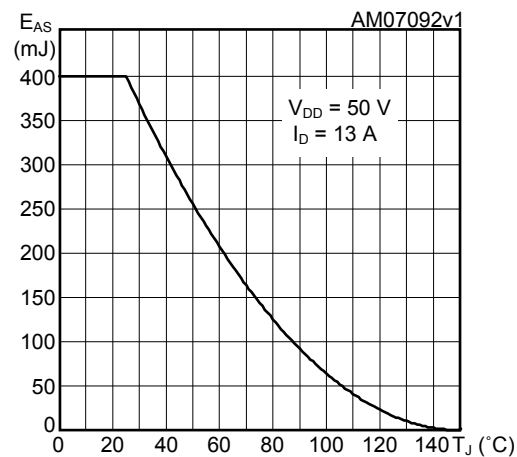
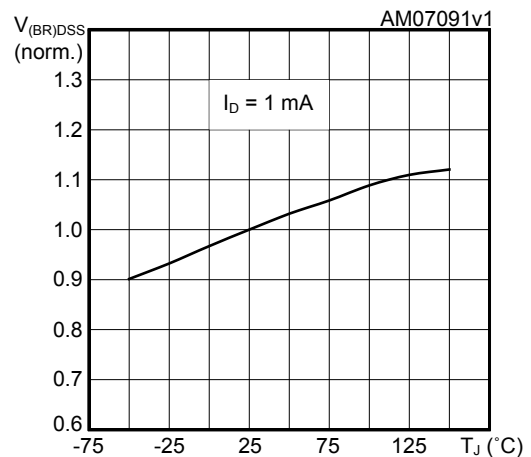
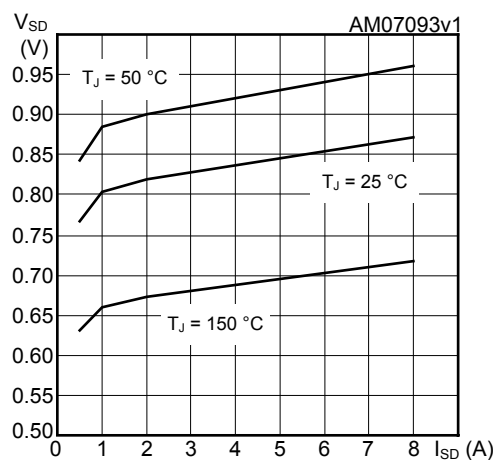
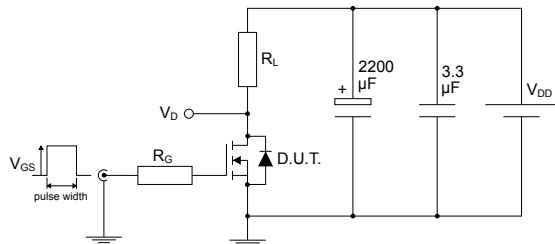
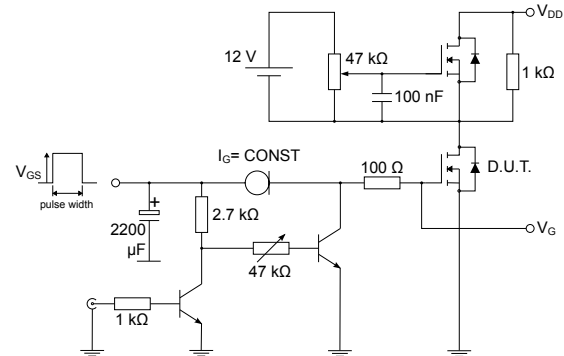
Figure 7. Typical output characteristics

Figure 8. Typical transfer characteristics

Figure 9. Typical gate charge characteristics

Figure 10. Typical drain-source on-resistance

Figure 11. Typical capacitance characteristics

Figure 12. Typical output capacitance stored energy


Figure 13. Normalized gate threshold vs temperature

Figure 14. Normalized on-resistance vs temperature

Figure 15. Maximum avalanche energy vs temperature

Figure 16. Normalized breakdown voltage vs temperature

Figure 17. Typical reverse diode forward characteristics


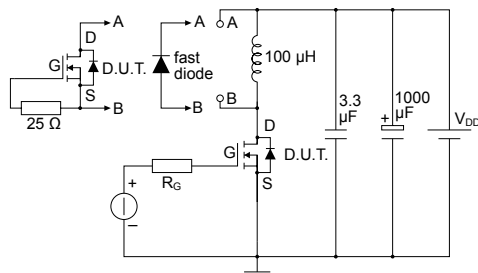
3 Test circuits

Figure 18. Test circuit for resistive load switching times


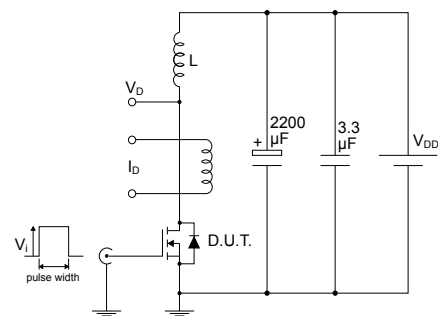
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Figure 19. Test circuit for gate charge behavior


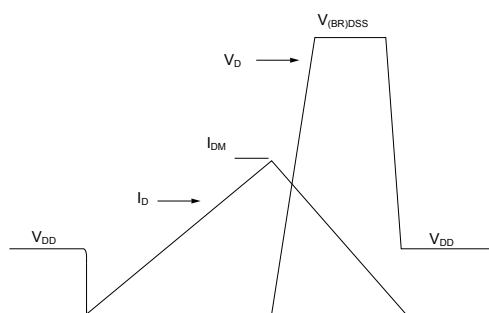
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Figure 20. Test circuit for inductive load switching and diode recovery times


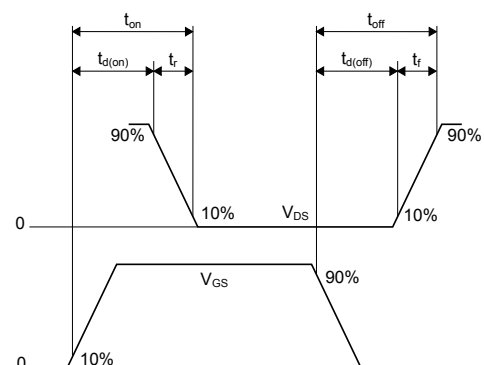
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Figure 21. Unclamped inductive load test circuit


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Figure 22. Unclamped inductive waveform


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Figure 23. Switching time waveform


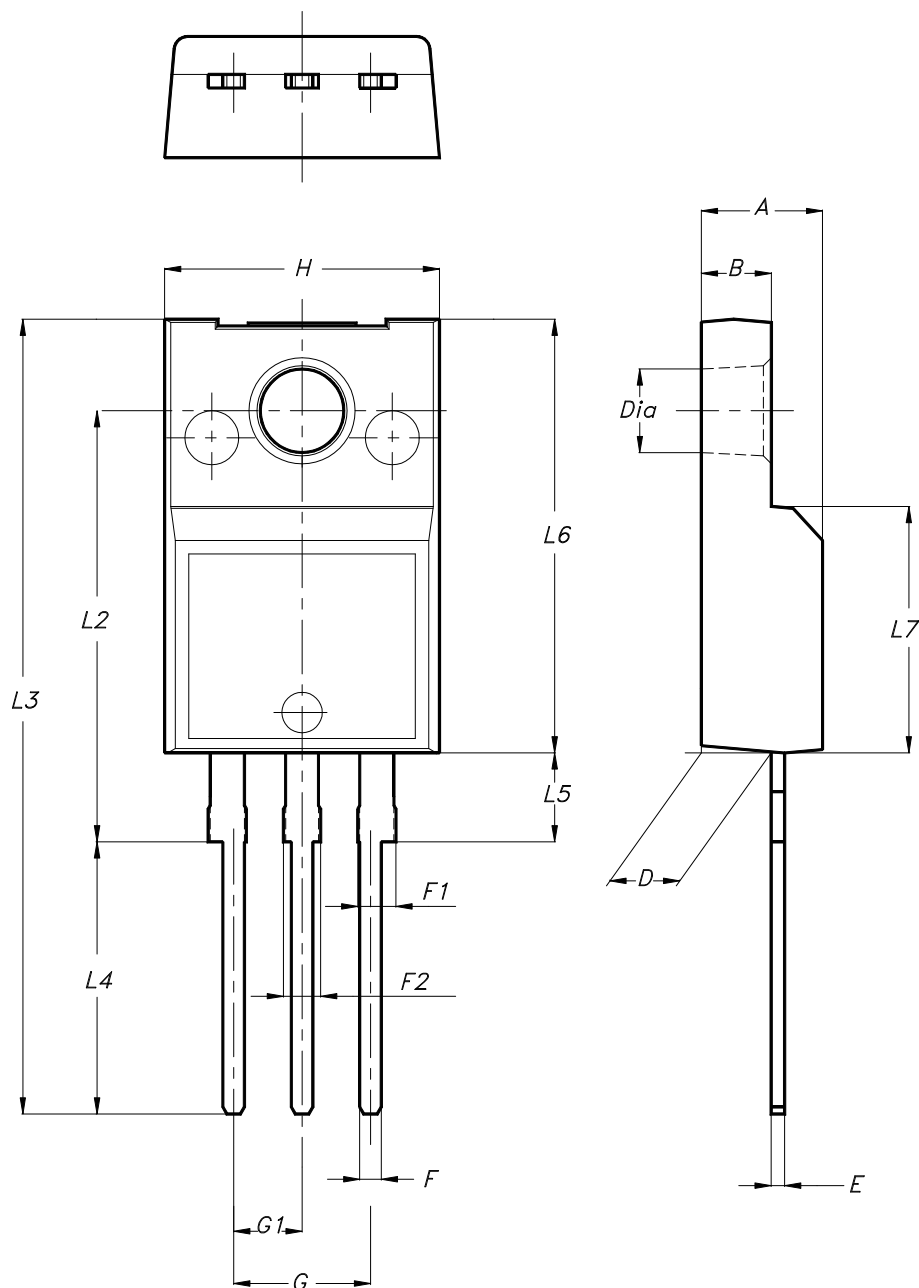
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4 Package information

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 24. TO-220FP type B package outline



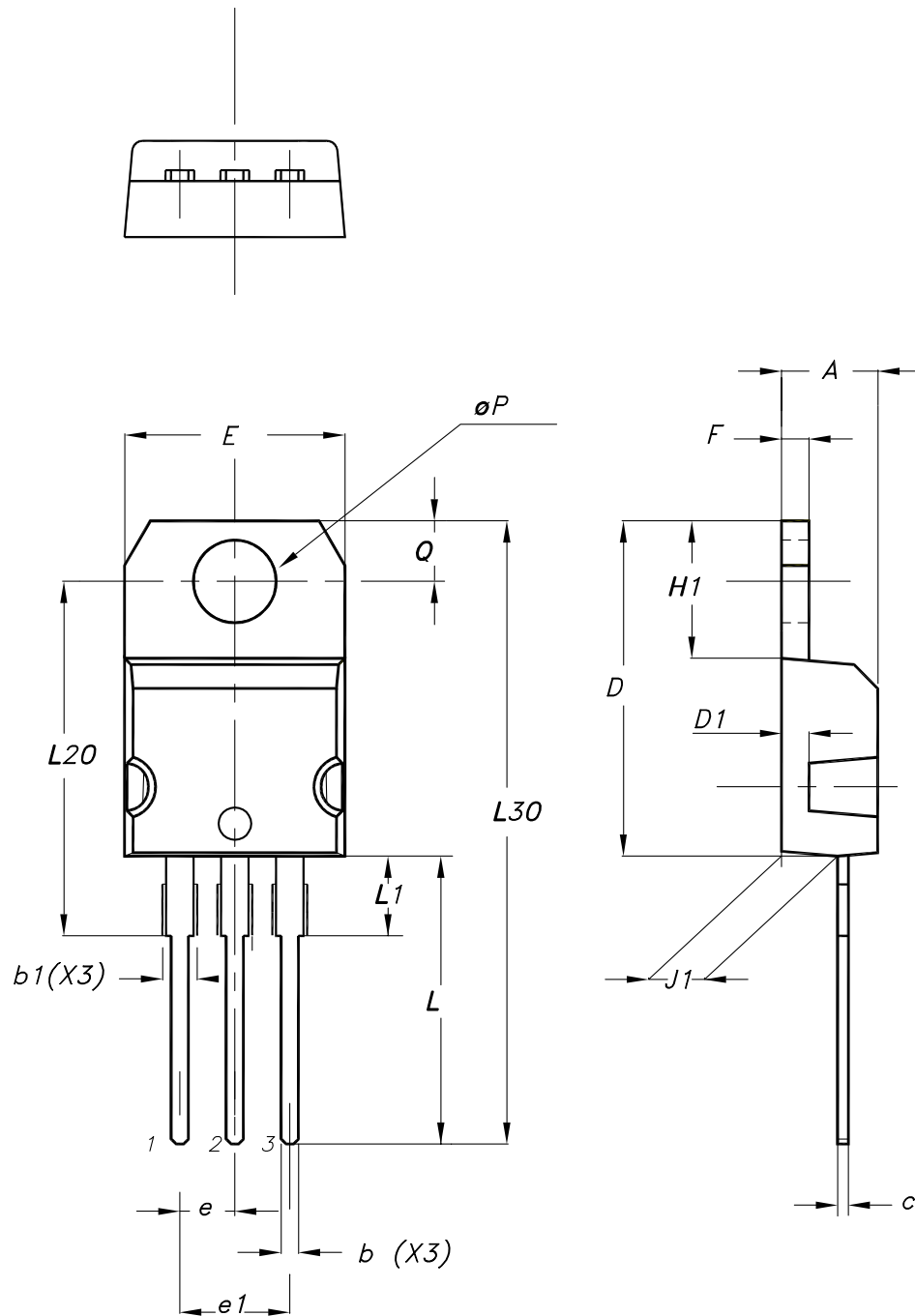
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Table 8. TO-220FP type B package mechanical data

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

4.2 TO-220 type A package information

Figure 25. TO-220 type A package outline



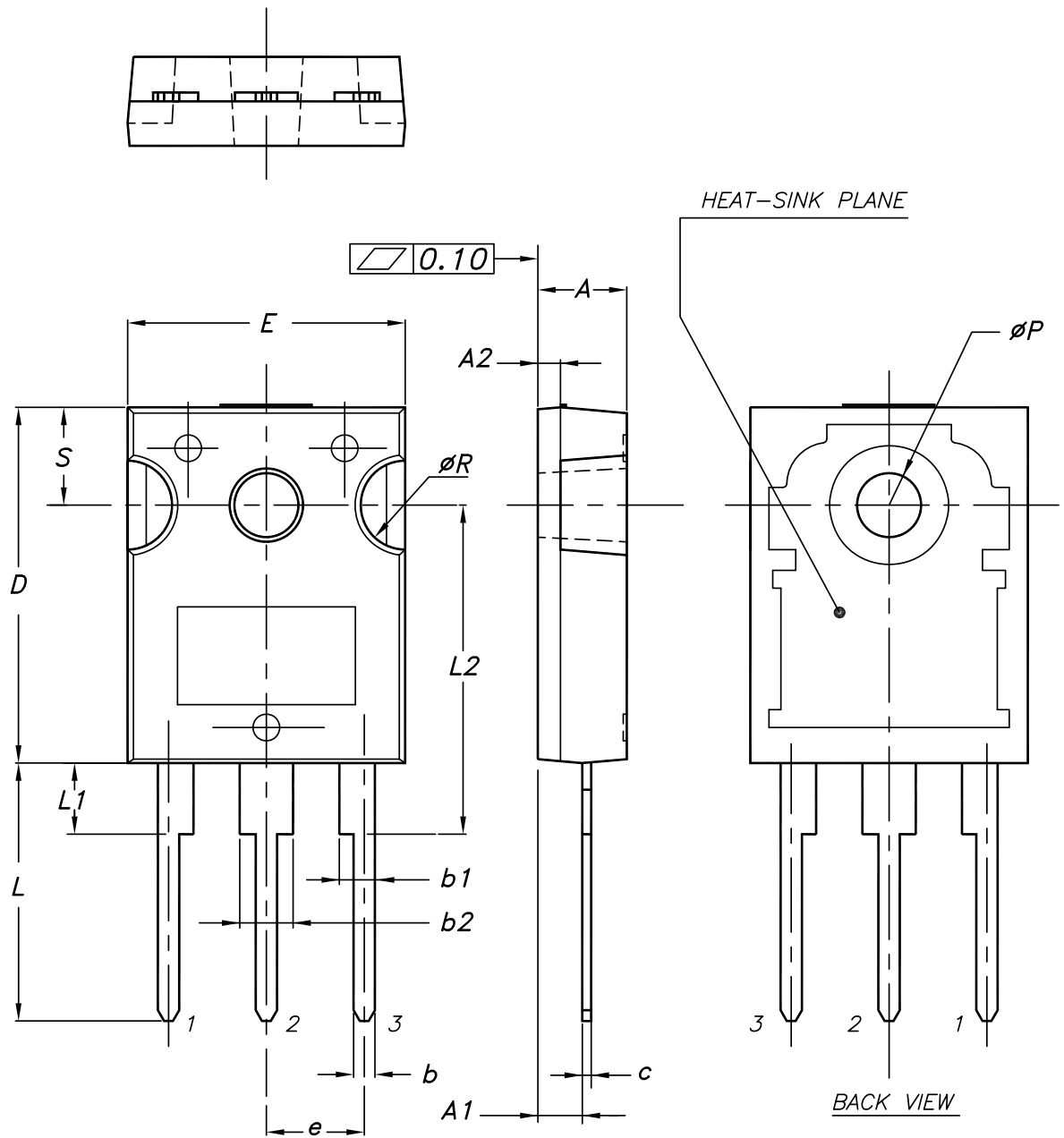
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Table 9. TO-220 type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		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	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95
Slug flatness		0.03	0.10

4.3 TO-247 package information

Figure 26. TO-247 package outline



0075325_11

Table 10. TO-247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
A2		1.27	
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	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70



5 Ordering information

Table 11. Order codes

Order codes	Marking	Package	Packing
STF13N95K3	13N95K3	TO-220FP	Tube
STP13N95K3		TO-220	
STW13N95K3		TO-247	

Revision history

Table 12. Document revision history

Date	Revision	Changes
15-May-2009	1	First release.
02-Sep-2010	2	Document status promoted from preliminary data to datasheet.
21-Jun-2012	3	Added new device in I ² PAKFP. <i>Table 1: Device summary, Table 2: Absolute maximum ratings, Table 3: Thermal data, Figure 2: Safe operating area for TO-220FP and I²PAKFP, Figure 3: Thermal impedance for TO-220FP and I²PAKFP</i> have been modified accordingly. <i>Table 10: I²PAKFP mechanical data and Figure 26: I²PAKFP drawing</i> have been added.
28-Jan-2026	4	Removed order code STFI13N95K3. Updated Section 4: Package information . Minor text changes.



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