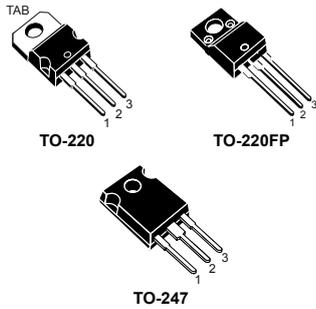




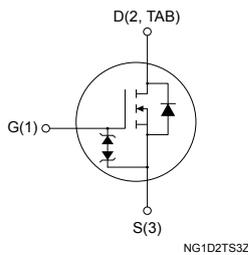
N-channel 800 V, 780 mΩ typ., 9 A SuperMESH Power MOSFETs in TO-220, TO-220FP and TO-247 packages



TO-220

TO-220FP

TO-247



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STP10NK80Z	800 V	900 mΩ	9 A
STP10NK80ZFP			
STW10NK80Z			

- 100% avalanche tested
- Gate charge minimized
- Very low intrinsic capacitance
- Zener-protected

Applications

- Switching applications

Description

These high-voltage devices are Zener-protected N-channel Power MOSFETs developed using the SuperMESH technology by STMicroelectronics, an optimization of the well-established PowerMESH. In addition to a significant reduction in on-resistance, these devices are designed to ensure a high level of dv/dt capability for the most demanding applications.



Product status links

[STP10NK80Z](#)

[STP10NK80ZFP](#)

[STW10NK80Z](#)

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220 TO-247	TO-220FP	
V _{DS}	Drain-source voltage	800		V
V _{GS}	Gate-source voltage	±30		V
I _D	Drain current (continuous) at T _C = 25 °C	9	9 ⁽¹⁾	A
	Drain current (continuous) at T _C = 100 °C	6	6 ⁽¹⁾	
I _{DM} ⁽²⁾	Drain current (pulsed)	36	36 ⁽¹⁾	A
P _{TOT}	Total power dissipation at T _C = 25 °C	160	40	W
ESD	Gate-source human body model (C = 100 pF, R = 1.5 kΩ)	4		kV
dv/dt ⁽³⁾	Peak diode recovery voltage slope	4.5		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 _J	Operating junction temperature range	-55 to 150		°C
T _{stg}	Storage temperature range			

- Limited by maximum junction temperature.
- Pulse width limited by safe operating area.
- $I_{SD} \leq 9\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DS}(\text{peak}) < V_{(BR)DSS}$.

Table 2. Thermal data

Symbol	Parameter	Value			Unit
		TO-220FP	TO-220	TO-247	
R _{thJC}	Thermal resistance, junction-to-case	3.1	0.78		°C/W
R _{thJA}	Thermal resistance, junction-to-ambient	62.5		50	°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.)	9	A
E _{AS}	Single pulse avalanche energy (starting T _J = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	290	mJ

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	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	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu\text{A}$	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 4.5\text{ A}$		780	900	$\text{m}\Omega$

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	2180	-	pF
C_{oss}	Output capacitance		-	205	-	pF
C_{riss}	Reverse transfer capacitance		-	38	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0$ to 640 V , $V_{GS} = 0\text{ V}$	-	105	-	pF
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 9\text{ A}$, $V_{GS} = 0$ to 10 V (see the Figure 18. Test circuit for gate charge behavior)	-	72	-	nC
Q_{gs}	Gate-source charge		-	12.5	-	nC
Q_{gd}	Gate-drain charge		-	37	-	nC

1. $C_{oss\text{ eq.}}$ 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 6. Switching times

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$, $I_D = 4.5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see the Figure 17. Test circuit for resistive load switching times and Figure 22. Switching time waveform)	-	30	-	ns
t_r	Rise time		-	20	-	ns
$t_{d(off)}$	Turn-off delay time		-	65	-	ns
t_f	Fall time		-	17	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		9	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		36	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 9\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 9\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$,	-	645		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 45\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	6.4		μC
I_{RRM}	Reverse recovery current	(see the Figure 19. Test circuit for inductive load switching and diode recovery times)	-	20		A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area for TO-220

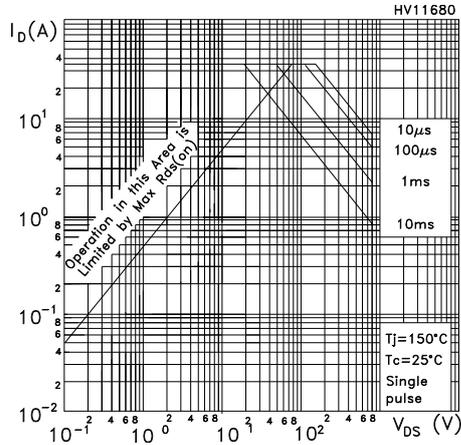


Figure 2. Normalized transient thermal impedance for TO-220

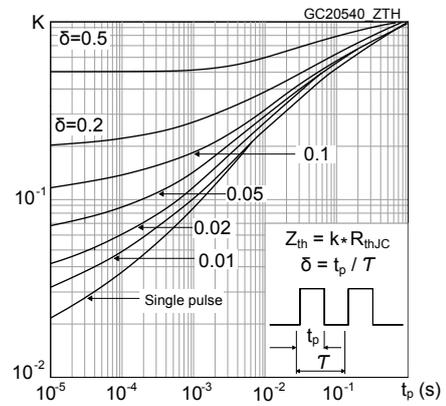


Figure 3. Safe operating area for TO-220FP

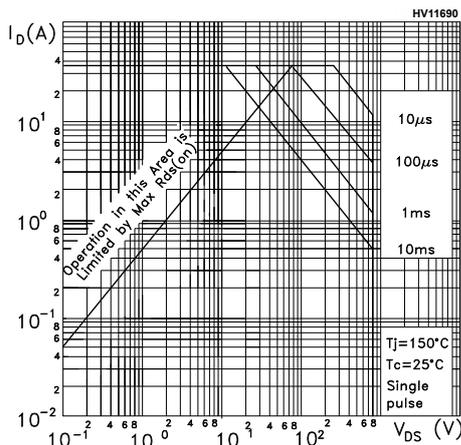


Figure 4. Normalized transient thermal impedance for TO-220 FP

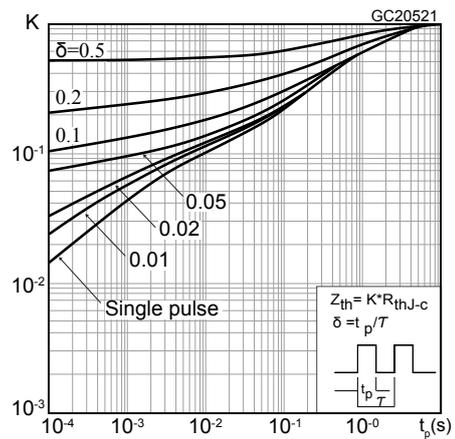


Figure 5. Safe operating area for TO-247

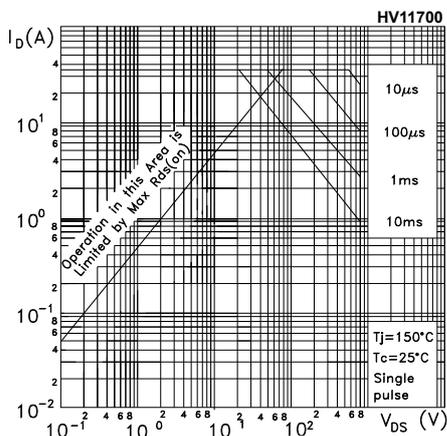


Figure 6. Normalized transient thermal impedance for TO-247

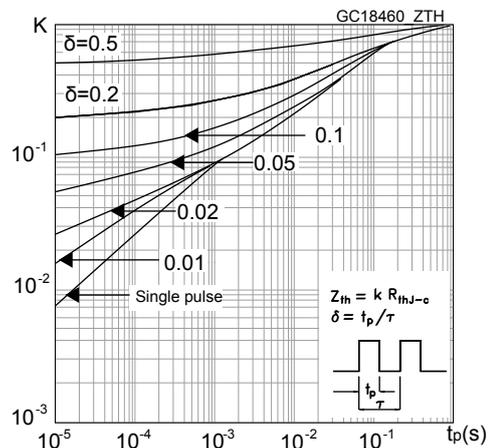


Figure 7. Typical output characteristics

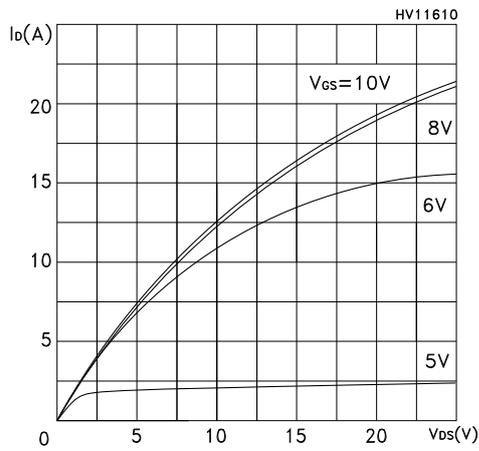


Figure 8. Typical transfer characteristics

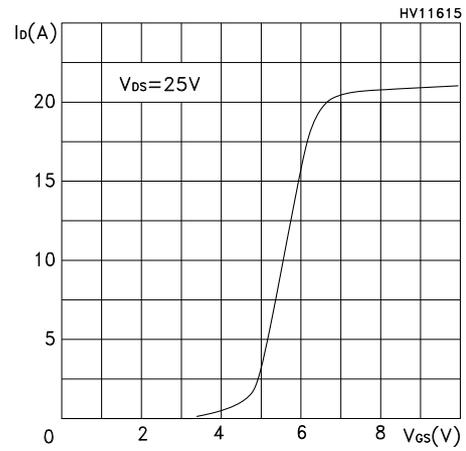


Figure 9. Typical gate charge characteristics

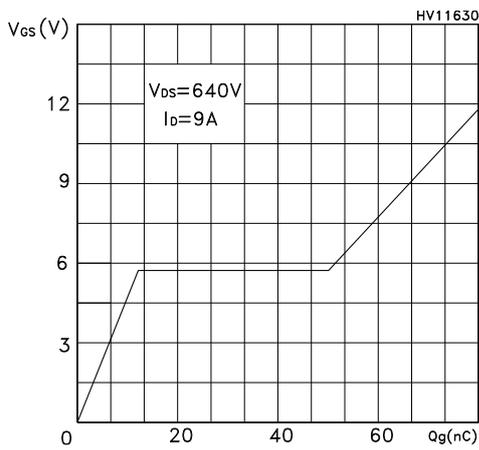


Figure 10. Typical drain-source on-resistance

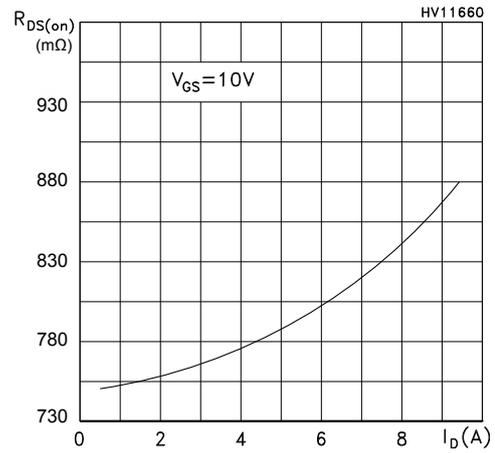


Figure 11. Typical capacitance characteristics

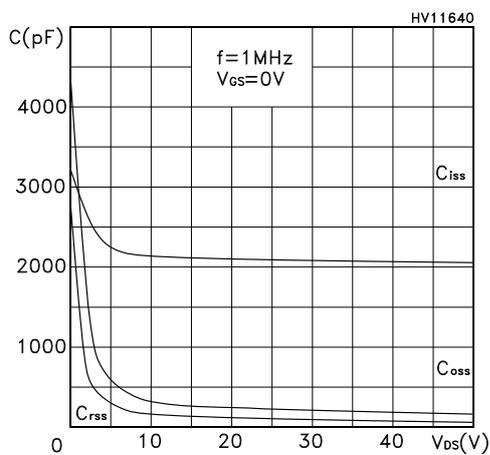


Figure 12. Normalized gate threshold vs temperature

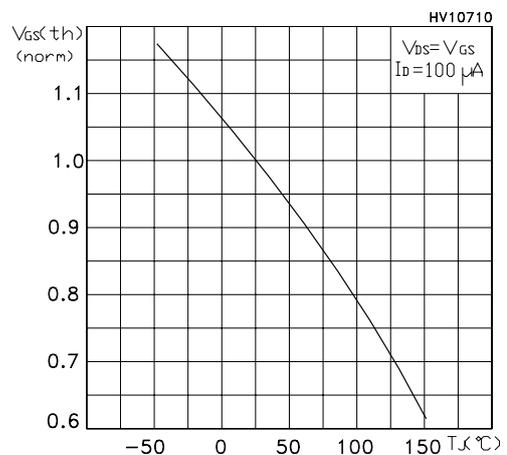


Figure 13. Normalized on-resistance vs temperature

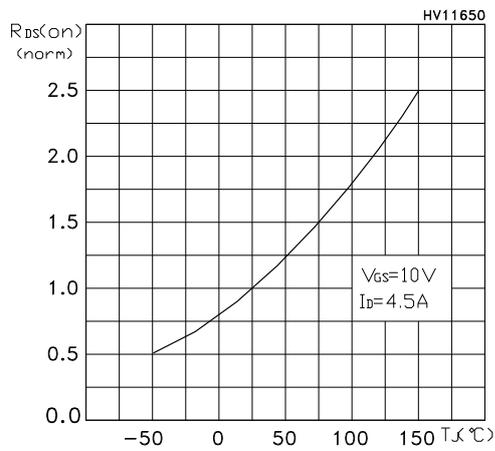


Figure 14. Normalized breakdown voltage vs temperature

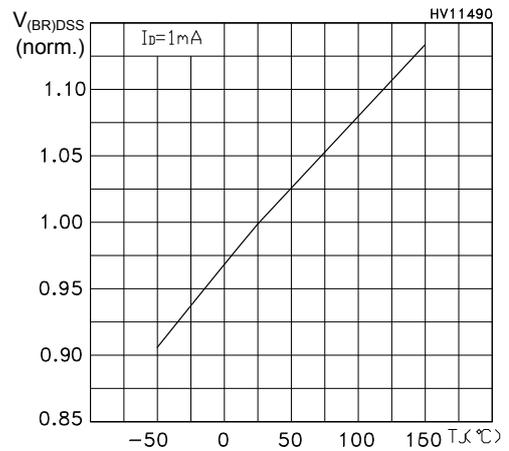


Figure 15. Maximum avalanche energy vs temperature

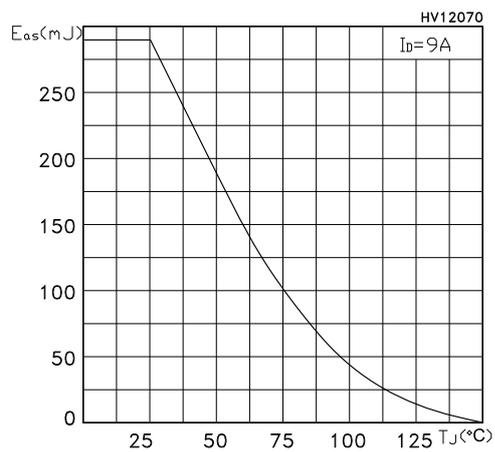
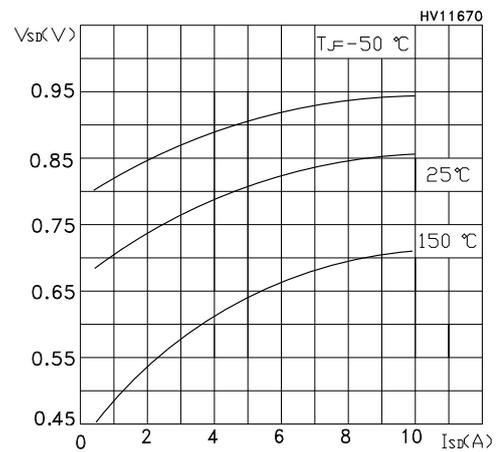
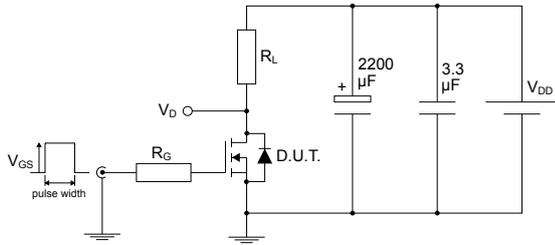


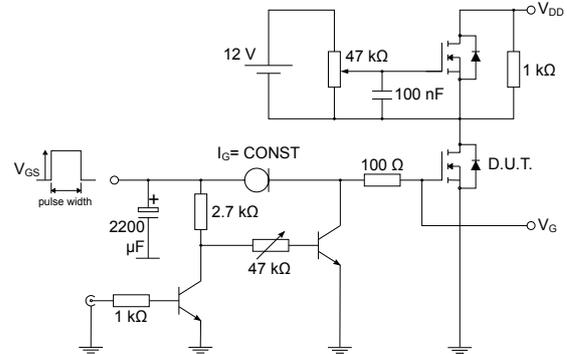
Figure 16. Typical reverse diode forward characteristics



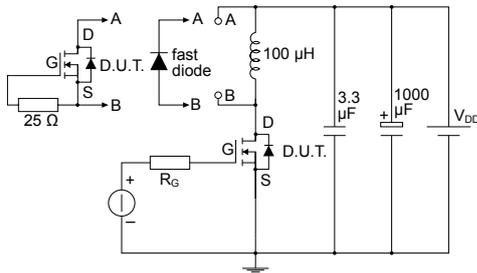
3 Test circuits

Figure 17. Test circuit for resistive load switching times


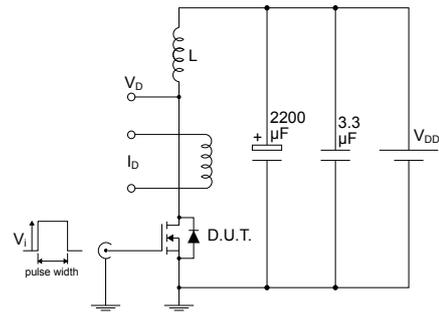
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Figure 18. Test circuit for gate charge behavior


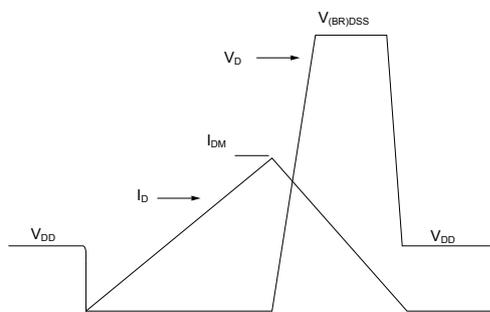
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Figure 19. Test circuit for inductive load switching and diode recovery times


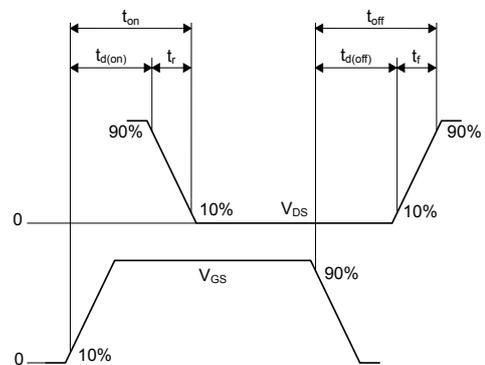
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Figure 20. Unclamped inductive load test circuit


AM01471v1

Figure 21. Unclamped inductive waveform


AM01472v1

Figure 22. Switching time waveform


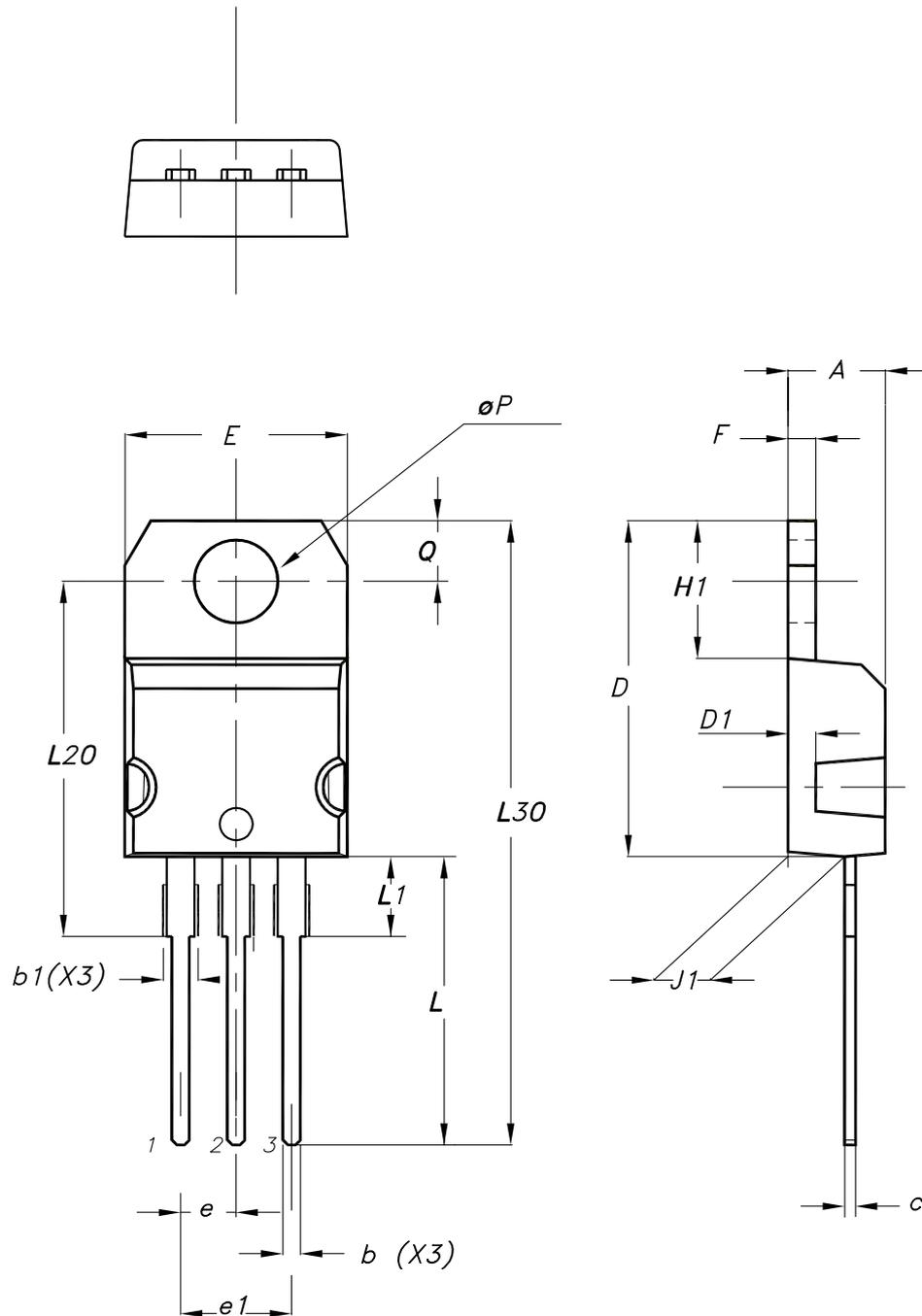
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4 Package information

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-220 type A package information

Figure 23. TO-220 type A package outline



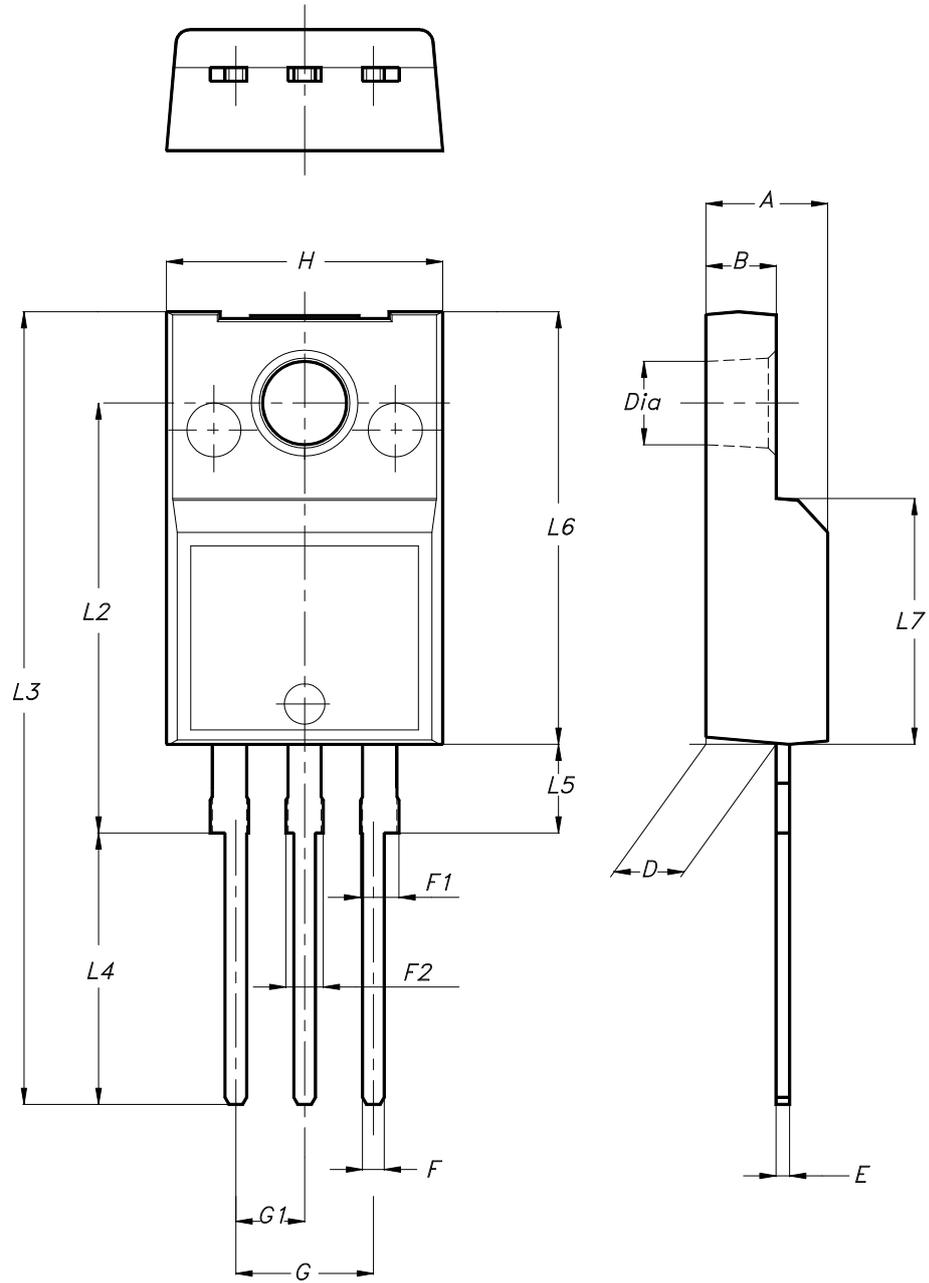
0015988_typeA_Rev_24

Table 8. 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

4.2 TO-220FP type B package information

Figure 24. TO-220FP type B package outline



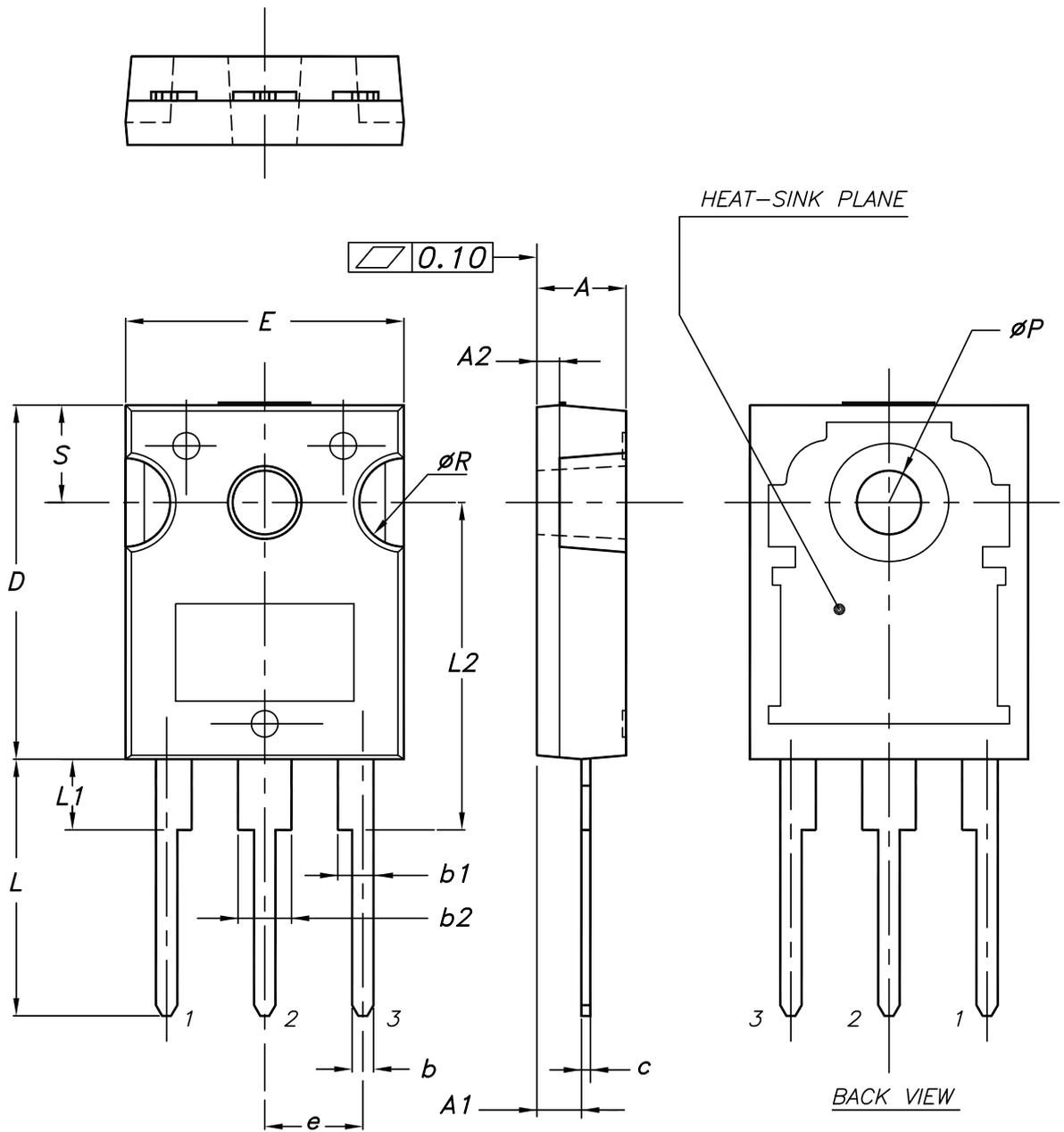
7012510_B_rev.14

Table 9. 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

4.3 TO-247 package information

Figure 25. 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
STP10NK80Z	P10NK80Z	TO-220	Tube
STP10NK80ZFP	P10NK80ZFP	TO-220FP	
STW10NK80Z	W10NK80Z	TO-247	

Revision history

Table 12. Document revision history

Date	Version	Changes
08-Sep-2005	4	Complete document
10-Mar-2006	5	Inserted ecopack indication
28-Sep-2005	6	New template, no content change
15-Mar-2012	7	Content reworked to improve readability. Minor text changes in cover page. Updated <i>Table 5</i> . Updated <i>Section 4: Package mechanical data</i> .
22-Jan-2026	8	Updated Section 4: Package information . Minor text changes.



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