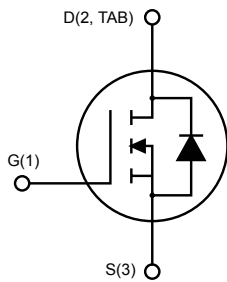
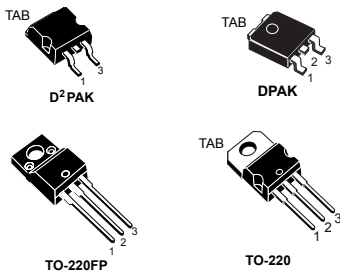


## N-channel 200 V, 0.11 $\Omega$ , 15 A, MESH OVERLAY™ Power MOSFETs in D<sup>2</sup>PAK, DPAK, TO-220FP and TO-220 packages



AM01475v1\_noZen

### Features

Type	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	Package
STB19NF20	200 V	0.16 $\Omega$	15 A	D <sup>2</sup> PAK
STD19NF20				DPAK
STF19NF20				TO-220FP
STP19NF20				TO-220

- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance

### Applications

- Switching applications

### Description

These Power MOSFETs are designed using STMicroelectronics' consolidated strip-layout-based MESH OVERLAY™ process. The result is a product that matches or improves on the performance of comparable standard parts from other manufacturers.

#### Product status links

[STB19NF20](#)

[STD19NF20](#)

[STF19NF20](#)

[STP19NF20](#)

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		D <sup>2</sup> PAK, DPAK, TO-220	TO-220FP	
V <sub>DS</sub>	Drain-source voltage	200		
V <sub>GS</sub>	Gate-source voltage	±20		V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25 °C	15	15 <sup>(1)</sup>	A
	Drain current (continuous) at T <sub>C</sub> = 100 °C	9.45	9.45 <sup>(1)</sup>	
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	60	60 <sup>(1)</sup>	A
P <sub>TOT</sub>	Total dissipation at T <sub>case</sub> = 25 °C	90	25	W
V <sub>ISO</sub>	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s, T <sub>C</sub> = 25 °C)		2.5	kV
dv/dt <sup>(3)</sup>	Peak diode recovery voltage slope	15		V/ns
T <sub>stg</sub>	Storage temperature range	-55 to 150		°C
T <sub>j</sub>	Operating junction temperature range			

1. This value is limited by package.
2. Pulse width is limited by safe operating area.
3. I<sub>SD</sub> ≤ 15 A, di/dt ≤ 300 A/μs, V<sub>DD</sub> = 80 % V<sub>(BR)DSS</sub>

**Table 2. Thermal data**

Symbol	Parameter	Value				Unit
		D <sup>2</sup> PAK	DPAK	TO-220	TO-220FP	
R <sub>thj-case</sub>	Thermal resistance junction-case	1.39			5	°C/W
R <sub>thj-pcb</sub> <sup>(1)</sup>	Thermal resistance junction-pcb	35	50			
R <sub>thj-amb</sub>	Thermal resistance junction-ambient			62.5		

1. When mounted on an 1-inch<sup>2</sup> FR-4, 2oz Cu board

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
I <sub>AR</sub>	Avalanche current, repetitive or not repetitive (pulse width limited by T <sub>jmax</sub> )	15	A
E <sub>AS</sub>	Single-pulse avalanche energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	110	mJ

## 2 Electrical characteristics

( $T_{\text{case}} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$ , $I_{\text{D}} = 1\text{ mA}$	200			V
$I_{\text{DSS}}$	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 200\text{ V}$			1	$\mu\text{A}$
		$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 200\text{ V}$ , $T_{\text{C}} = 125\text{ }^{\circ}\text{C}^{(1)}$			10	
$I_{\text{GSS}}$	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$ , $I_{\text{D}} = 7.5\text{ A}$		0.11	0.16	$\Omega$

1. Defined by design, not subject to production test.

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{\text{iss}}$	Input capacitance	$V_{\text{DS}} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{\text{GS}} = 0\text{ V}$	-	800	-	$\mu\text{F}$
$C_{\text{oss}}$	Output capacitance		-	165	-	
$C_{\text{riss}}$	Reverse transfer capacitance		-	26	-	
$Q_{\text{g}}$	Total gate charge	$V_{\text{DD}} = 160\text{ V}$ , $I_{\text{D}} = 15\text{ A}$ , $V_{\text{GS}} = 0\text{ to }10\text{ V}$ (see Figure 16. Test circuit for gate charge behavior)	-	24	-	nC
$Q_{\text{gs}}$	Gate-source charge		-	4.4	-	
$Q_{\text{gd}}$	Gate-drain charge		-	11.6	-	

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 100\text{ V}$ , $I_{\text{D}} = 7.5\text{ A}$ , $R_{\text{G}} = 4.7\text{ }\Omega$ , $V_{\text{GS}} = 10\text{ V}$ (see Figure 15. Test circuit for resistive load switching times and Figure 20. Switching time waveform)	-	11.5	-	ns
$t_{\text{r}}$	Rise time		-	22	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	19	-	
$t_{\text{f}}$	Fall time		-	11	-	

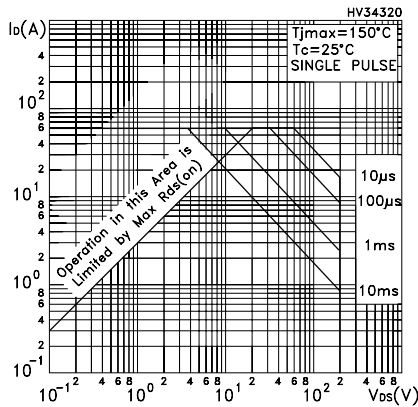
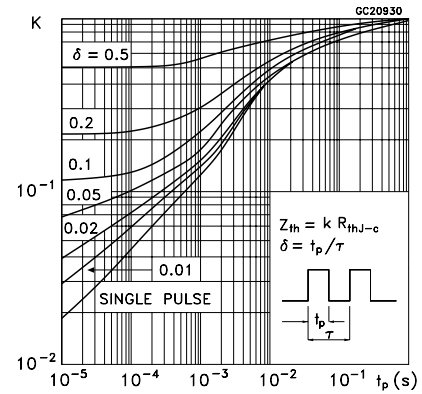
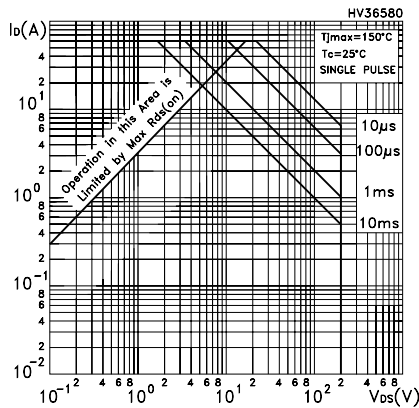
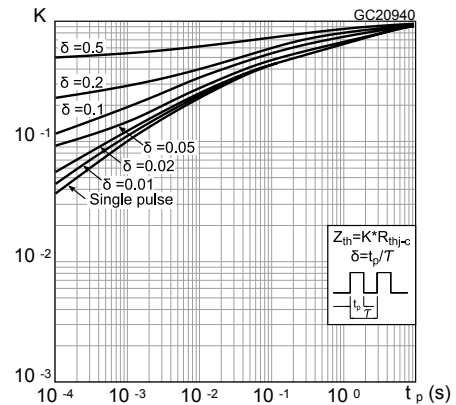
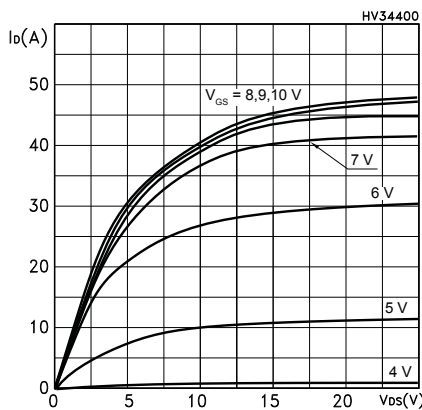
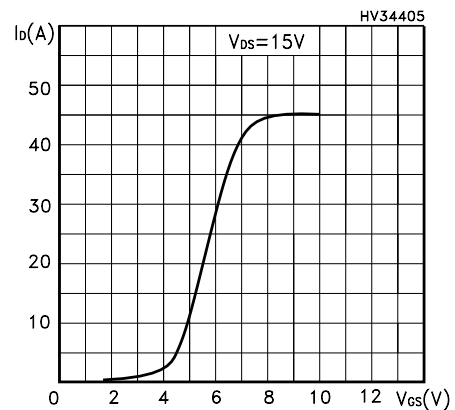
**Table 7. Source-drain diode**

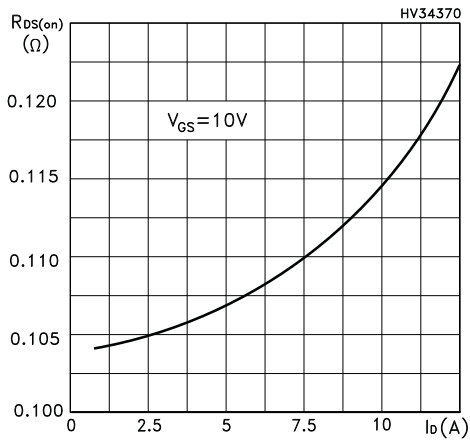
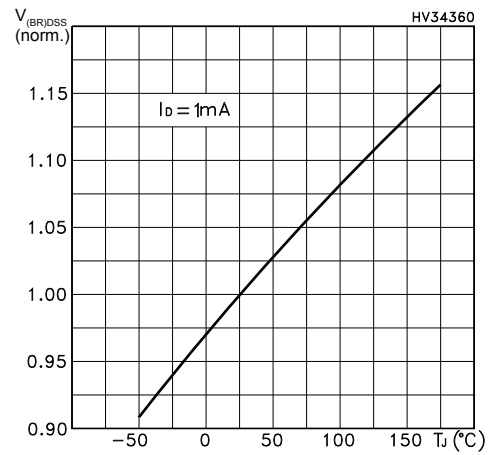
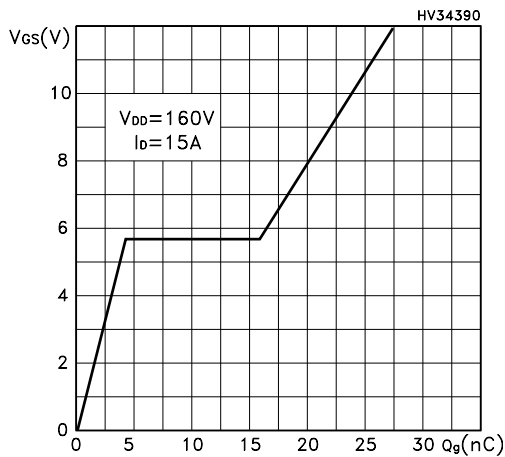
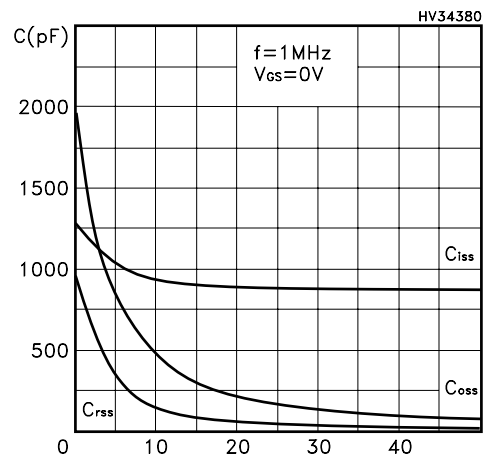
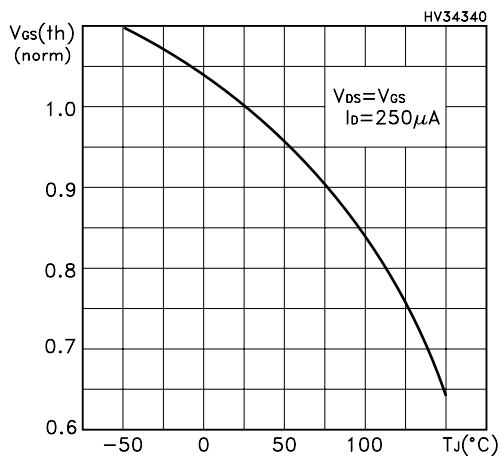
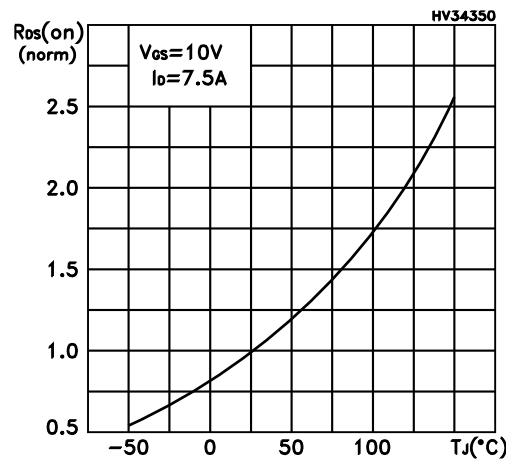
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{SD}}$	Source-drain current		-		15	A
$I_{\text{SDM}}^{(1)}$	Source-drain current (pulsed)		-		60	A
$V_{\text{SD}}^{(2)}$	Forward on voltage	$I_{\text{SD}} = 15\text{ A}$ , $V_{\text{GS}} = 0\text{ V}$	-		1.6	V

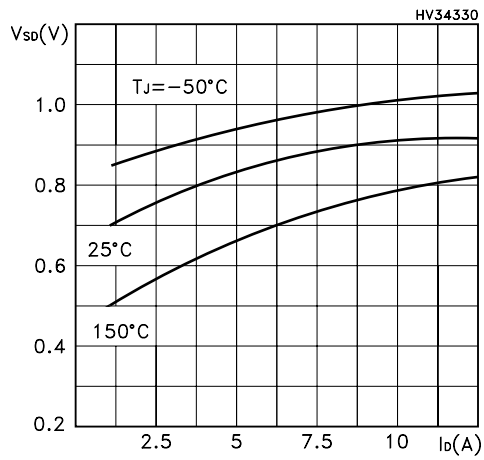
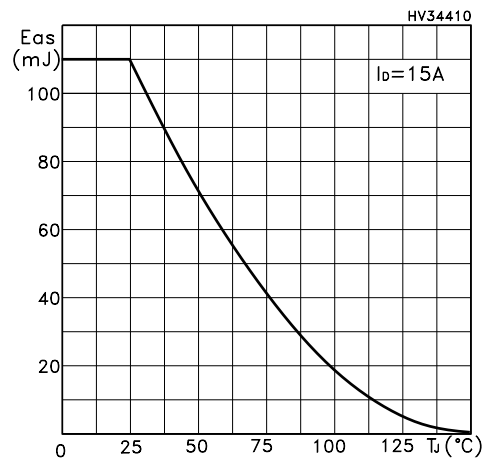
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{rr}$	Reverse recovery time	$I_{SD} = 15\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 50\text{ V}$ (see Figure 17. Test circuit for inductive load switching and diode recovery times)	-	125		ns
$Q_{rr}$	Reverse recovery charge		-	0.55		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	8.8		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 15\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 50\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ (see Figure 17. Test circuit for inductive load switching and diode recovery times)	-	148		ns
$Q_{rr}$	Reverse recovery charge		-	0.73		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	9.9		A

1. Pulse width is limited by safe operating area.
2. Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

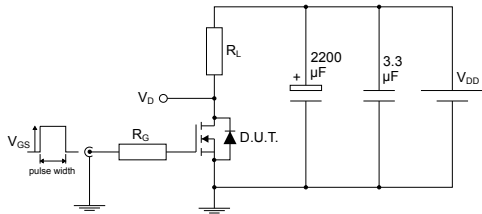
## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area for D<sup>2</sup>PAK, DPAK and TO-220**

**Figure 2. Thermal impedance for D<sup>2</sup>PAK, DPAK and TO-220**

**Figure 3. Safe operating area for TO-220FP**

**Figure 4. Thermal impedance for TO-220FP**

**Figure 5. Output characteristics**

**Figure 6. Transfer characteristics**


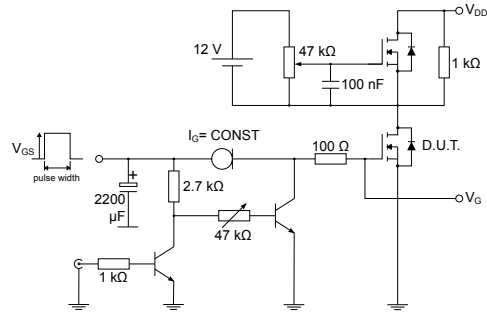
**Figure 7. Static drain-source on-resistance**

**Figure 8. Normalized  $V_{(BR)DSS}$  vs temperature**

**Figure 9. Gate charge vs gate-source voltage**

**Figure 10. Capacitance variations**

**Figure 11. Normalized gate threshold voltage vs temperature**

**Figure 12. Normalized on-resistance vs temperature**


**Figure 13. Source-drain diode forward characteristics**

**Figure 14. Maximum avalanche energy vs temperature**


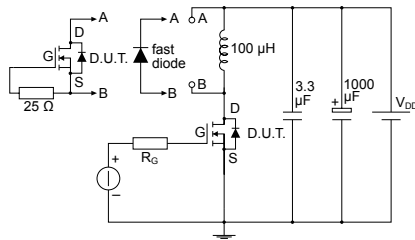
### 3 Test circuits

**Figure 15. Test circuit for resistive load switching times**


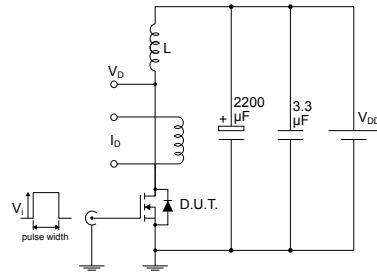
AM01468v1

**Figure 16. Test circuit for gate charge behavior**


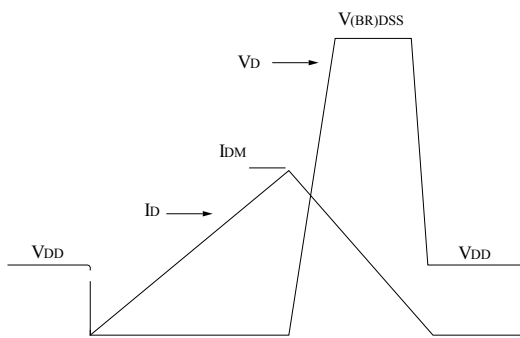
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**Figure 17. Test circuit for inductive load switching and diode recovery times**


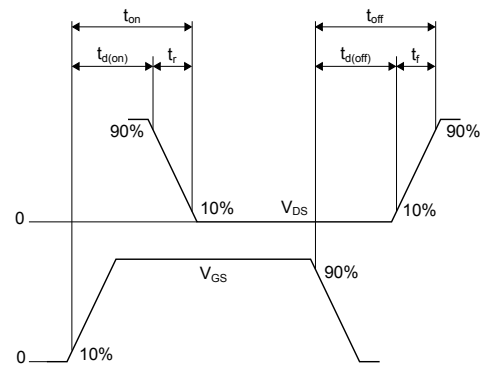
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**Figure 18. Unclamped inductive load test circuit**


AM01471v1

**Figure 19. Unclamped inductive waveform**


AM01472v1

**Figure 20. Switching time waveform**


AM01473v1



## 4 Ordering information

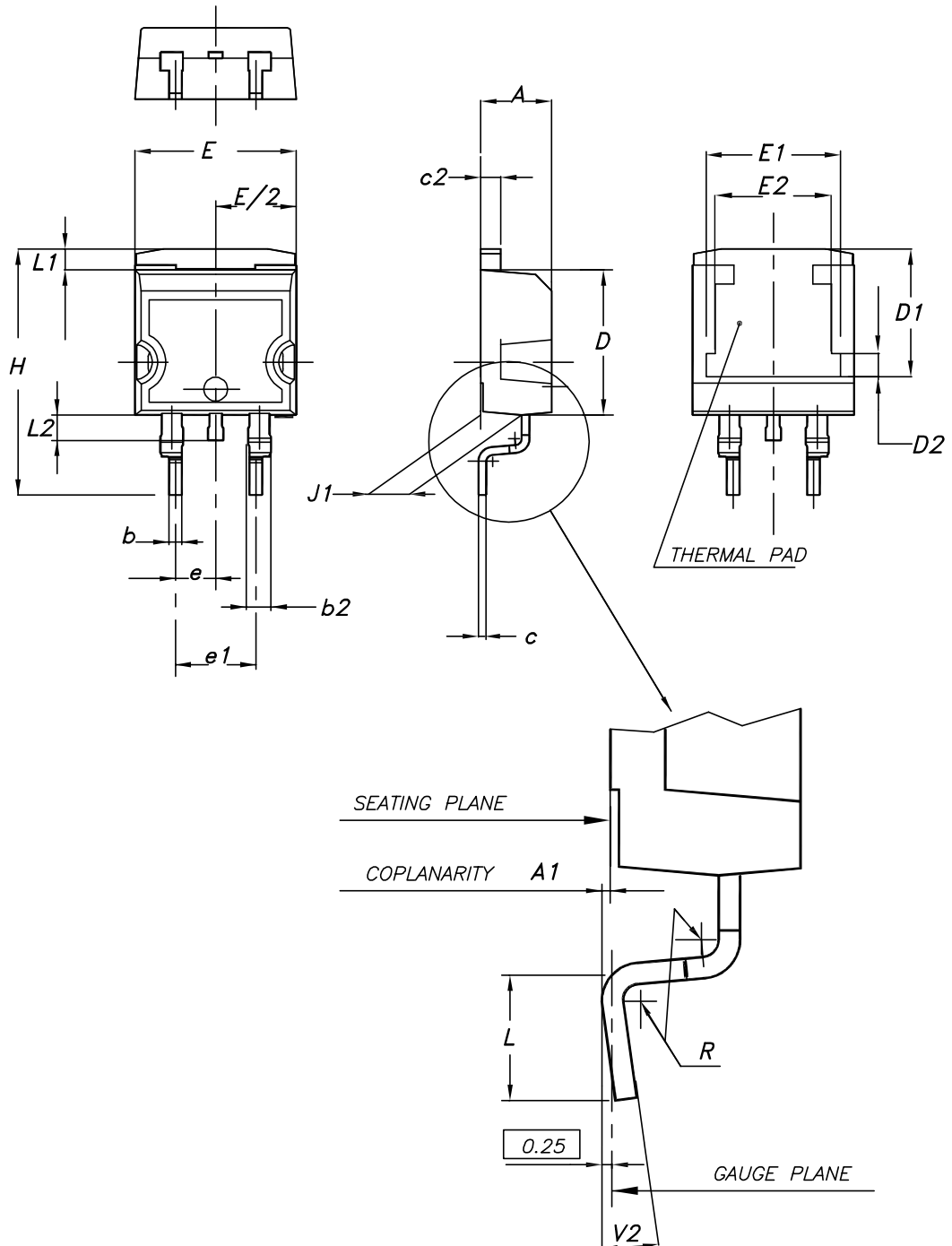
**Table 8. Order codes**

Order code	Marking	Package	Packing
STB19NF20	19NF20	D <sup>2</sup> PAK	Tape and reel
STD19NF20		DPAK	
STF19NF20		TO-220FP	Tube
STP19NF20		TO-220	

## **5 Package information**

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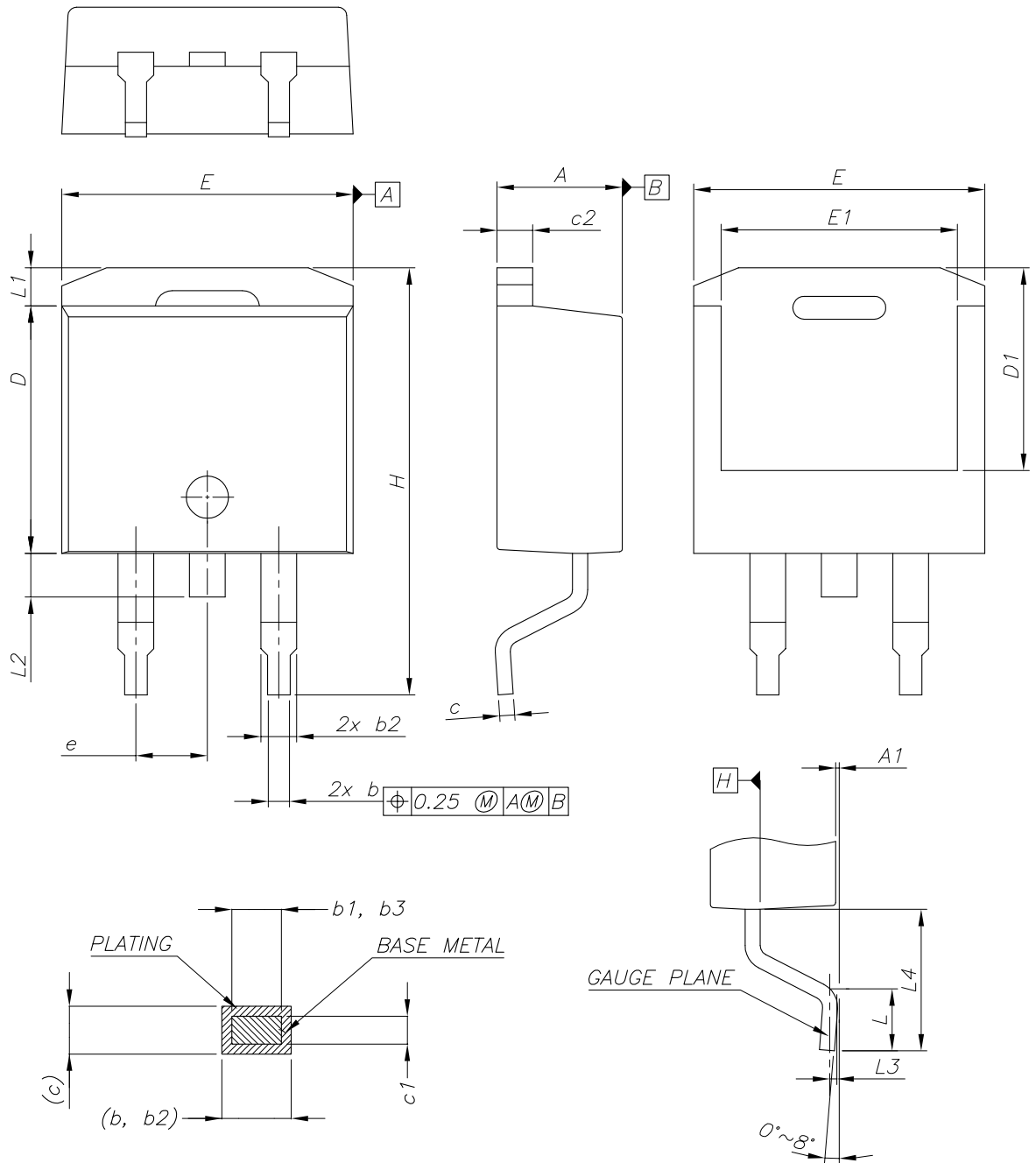
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.

**5.1 D<sup>2</sup>PAK (TO-263) type A package information**
**Figure 21. D<sup>2</sup>PAK (TO-263) type A package outline**


0079457\_25

**Table 9. D<sup>2</sup>PAK (TO-263) type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

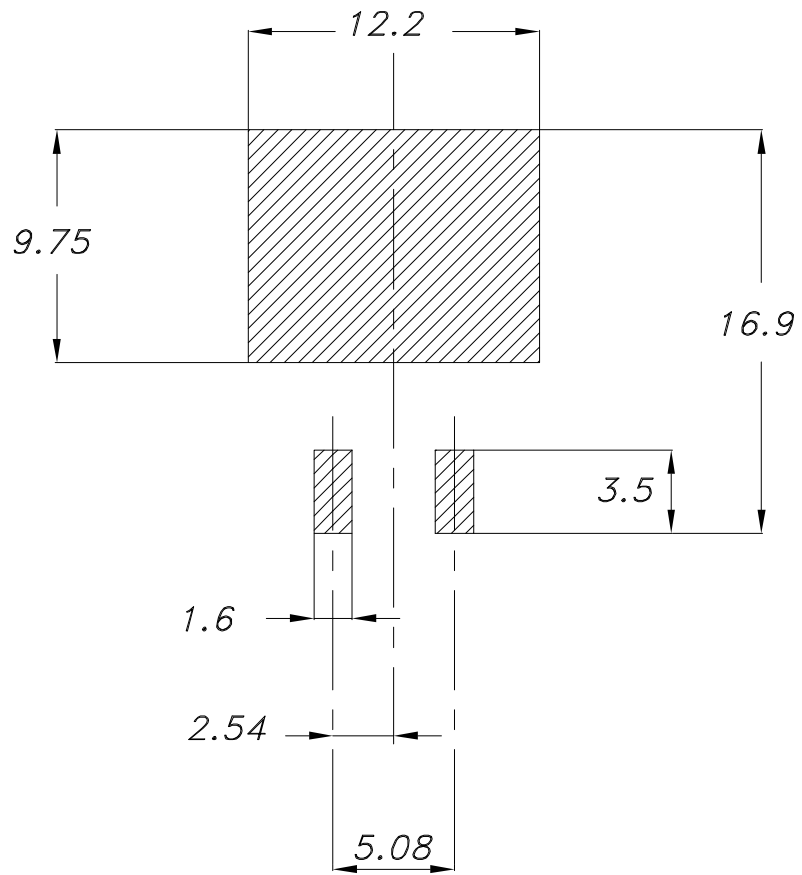
**5.2 D<sup>2</sup>PAK (TO-263) type B package information**
**Figure 22. D<sup>2</sup>PAK (TO-263) type B package outline**


0079457\_25\_B

**Table 10. D<sup>2</sup>PAK (TO-263) type B mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.36		4.56
A1	0		0.25
b	0.70		0.90
b1	0.51		0.89
b2	1.17		1.37
b3	1.36		1.46
c	0.38		0.694
c1	0.38		0.534
c2	1.19		1.34
D	8.60		9.00
D1	6.90		7.50
E	10.15		10.55
E1	8.10		8.70
e	2.54 BSC		
H	15.00		15.60
L	1.90		2.50
L1			1.65
L2			1.78
L3		0.25	
L4	4.78		5.28

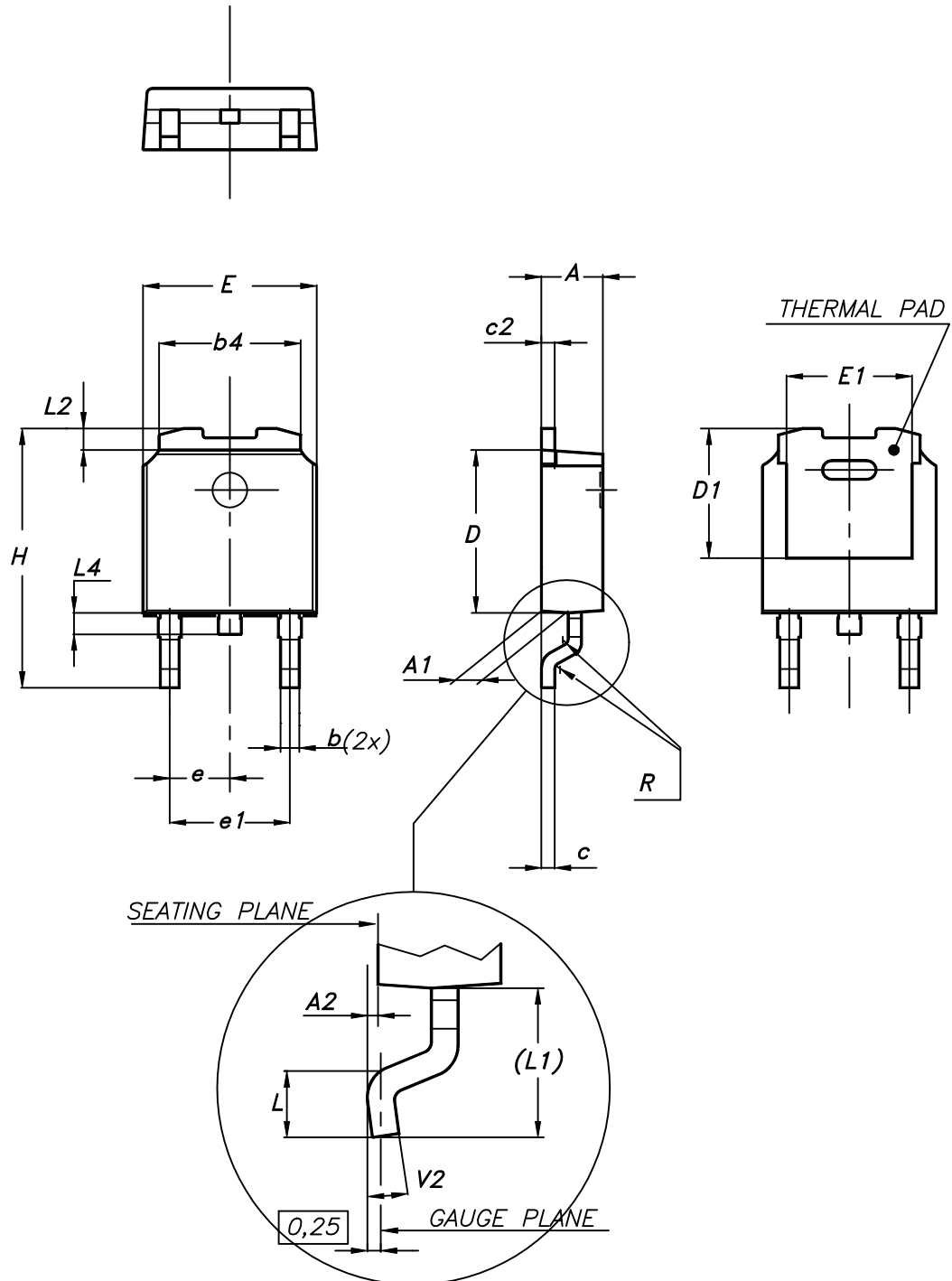
Figure 23. D<sup>2</sup>PAK (TO-263) recommended footprint (dimensions are in mm)



Footprint

**5.3 DPAK (TO-252) type A2 package information**

Figure 24. DPAK (TO-252) type A2 package outline



0068772\_type-A2\_rev25

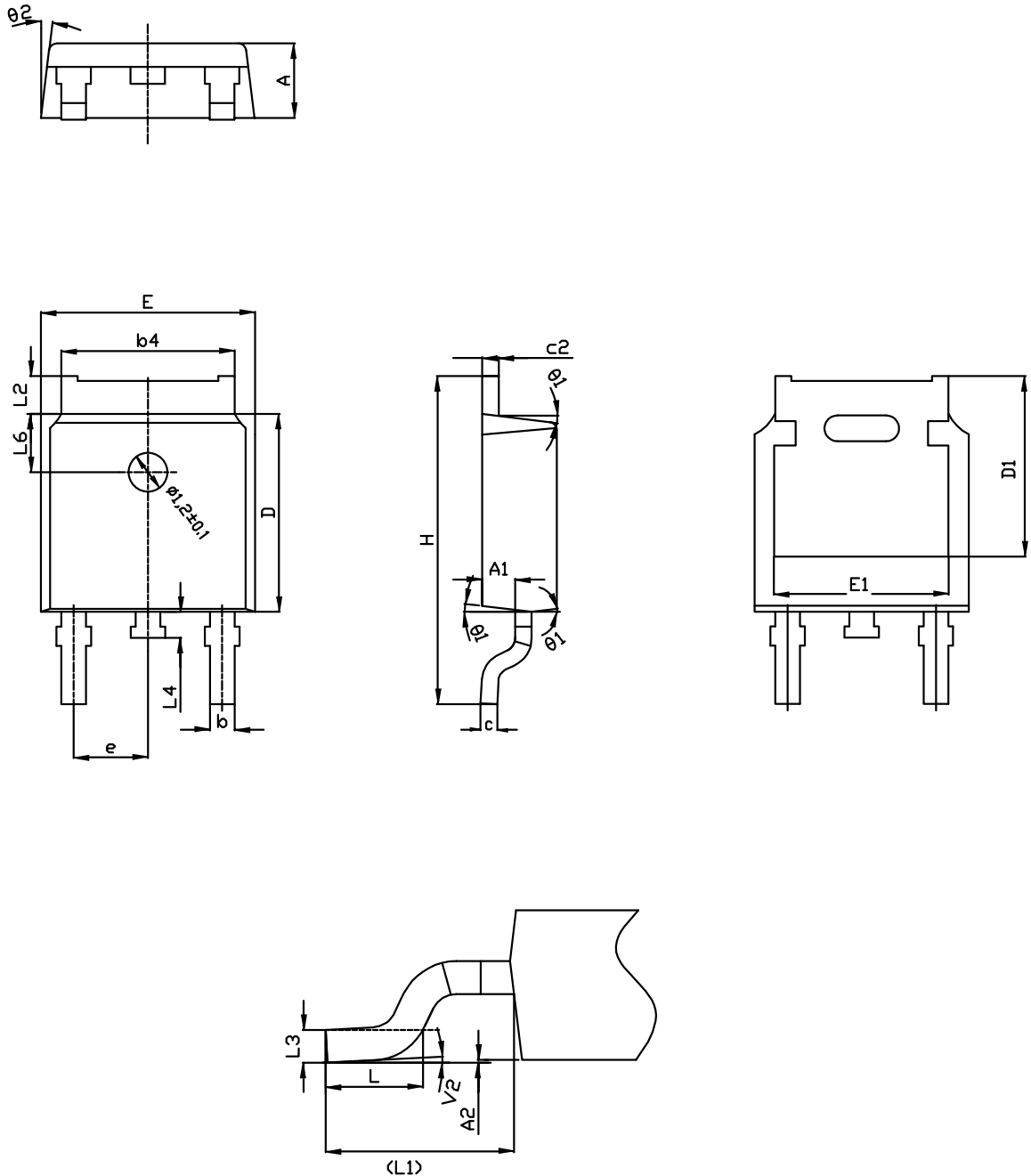


**Table 11. DPAK (TO-252) type A2 mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	5.10	5.20	5.30
e	2.159	2.286	2.413
e1	4.445	4.572	4.699
H	9.35		10.10
L	1.00		1.50
L1	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

## 5.4 DPAK (TO-252) type C2 package information

Figure 25. DPAK (TO-252) type C2 package outline

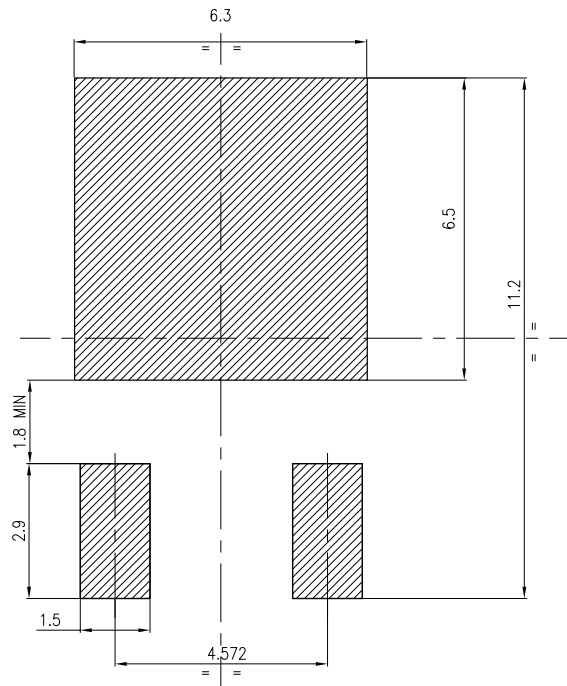


0068772\_C2\_25

**Table 12. DPAK (TO-252) type C2 mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.90	1.01	1.10
A2	0.00		0.10
b	0.72		0.85
b4	5.13	5.33	5.46
c	0.47		0.60
c2	0.47		0.60
D	6.00	6.10	6.20
D1	5.10		5.60
E	6.50	6.60	6.70
E1	5.20		5.50
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.90		1.25
L3	0.51 BSC		
L4	0.60	0.80	1.00
L6	1.80 BSC		
θ1	5°	7°	9°
θ2	5°	7°	9°
V2	0°		8°

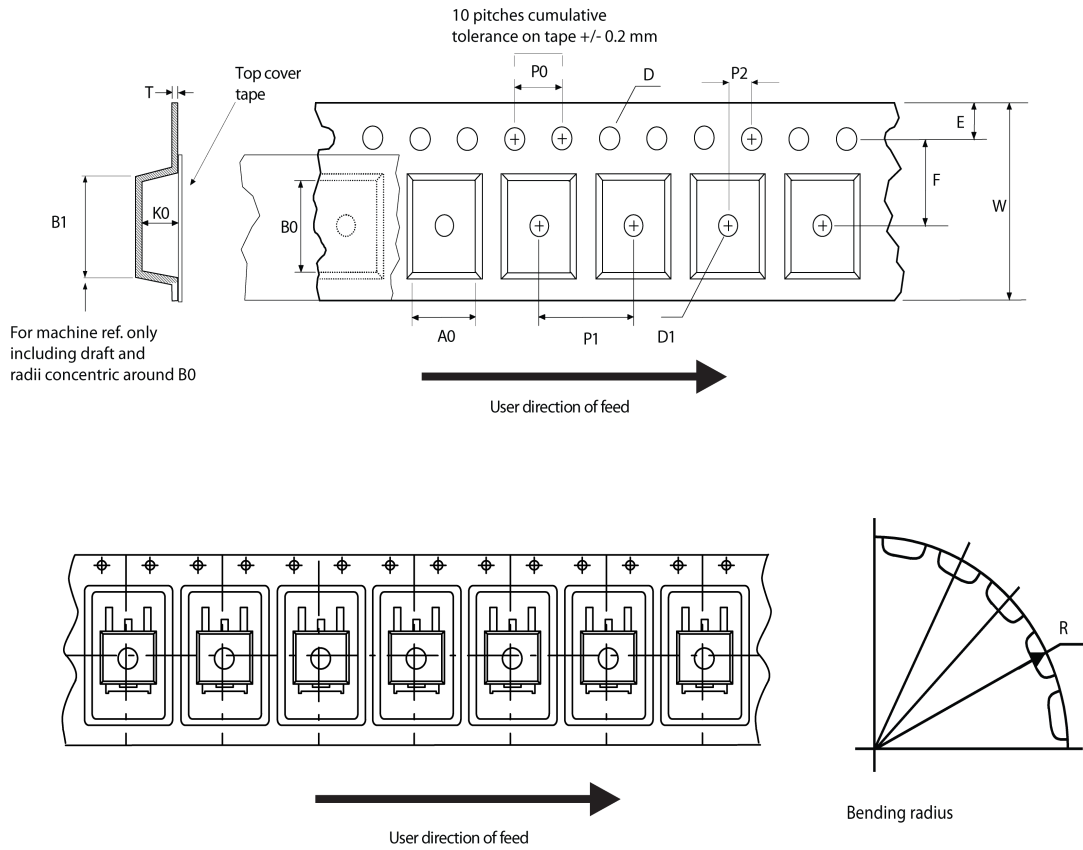
Figure 26. DPAK (TO-252) recommended footprint (dimensions are in mm)



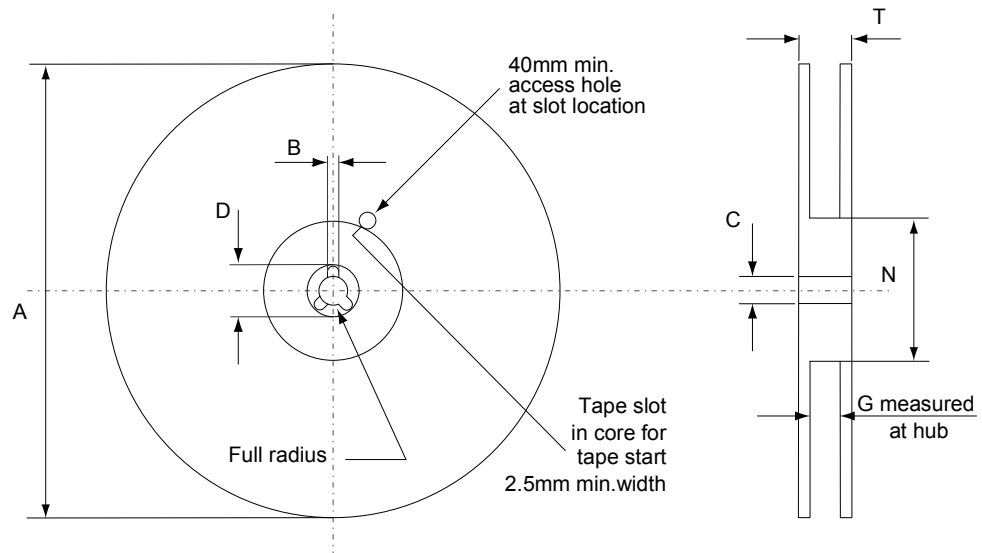
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## 5.5 D<sup>2</sup>PAK and DPAK packing information

Figure 27. Tape outline



AM08852v1

**Figure 28. Reel outline**


AM06038v1

**Table 13. D<sup>2</sup>PAK tape and reel mechanical data**

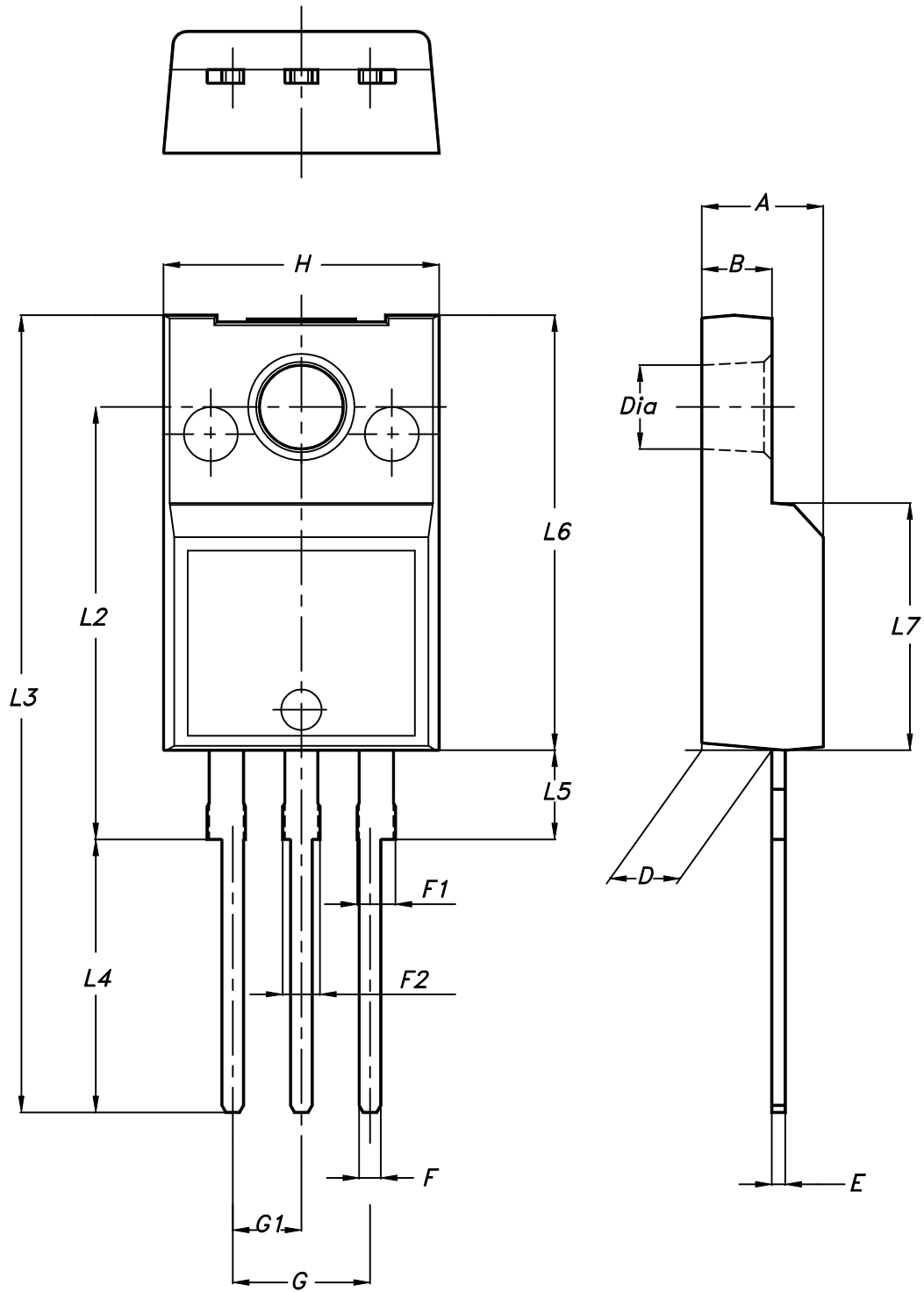
Tape			Reel			
Dim.	mm		Dim.	mm		
	Min.	Max.		Min.	Max.	
A0	10.5	10.7	A		330	
B0	15.7	15.9	B	1.5		
D	1.5	1.6	C	12.8	13.2	
D1	1.59	1.61	D	20.2		
E	1.65	1.85	G	24.4	26.4	
F	11.4	11.6	N	100		
K0	4.8	5.0	T		30.4	
P0	3.9	4.1	Base quantity Bulk quantity			
P1	11.9	12.1				1000
P2	1.9	2.1				1000
R	50					
T	0.25	0.35				
W	23.7	24.3				

**Table 14. DPAK tape and reel mechanical data**

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

5.6 TO-220FP package information

Figure 29. TO-220FP package outline

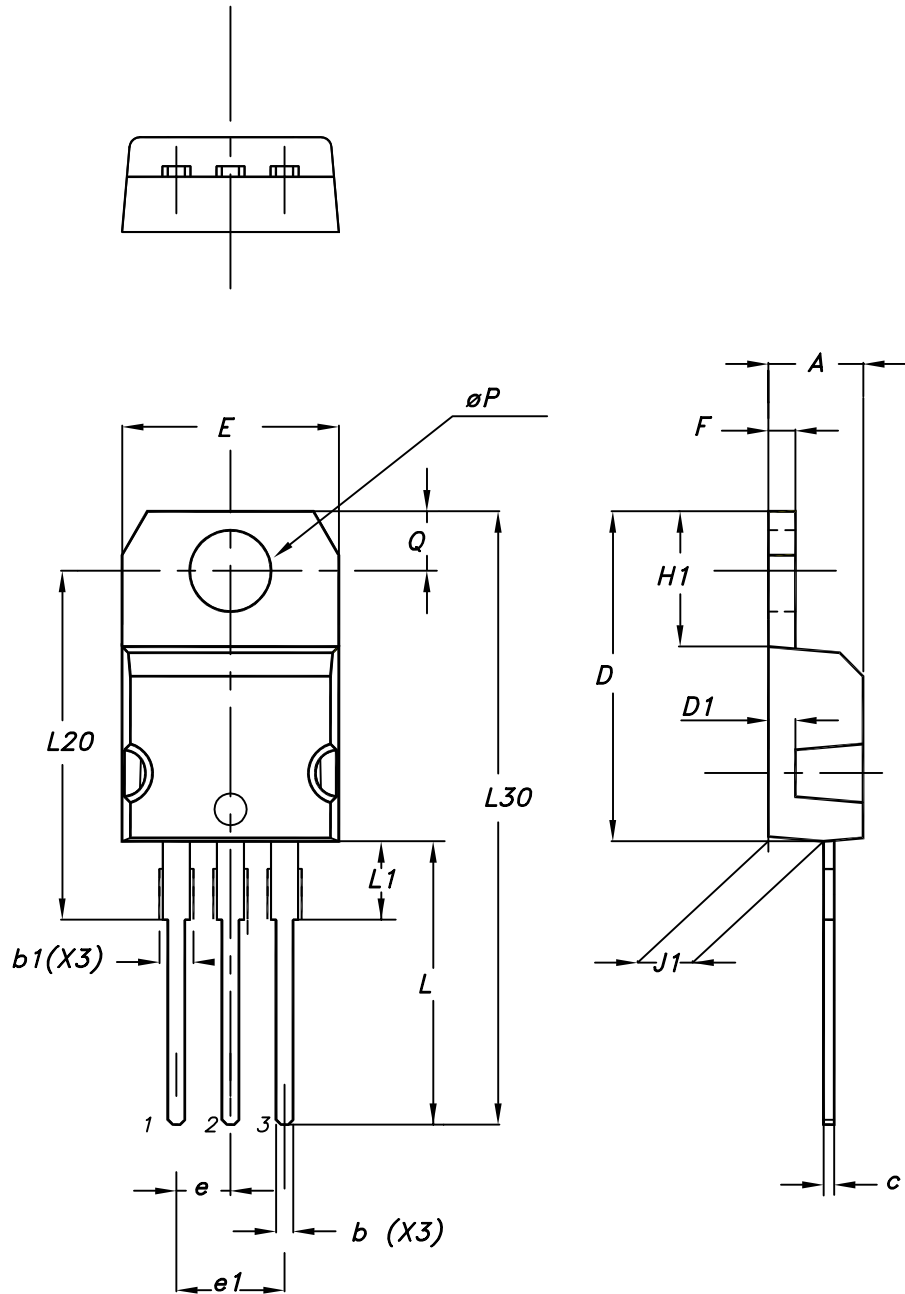


7012510\_Rev\_12\_B



**Table 15. TO-220FP package 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

**5.7 TO-220 type A package information**
**Figure 30. TO-220 type A package outline**


0015988\_typeA\_Rev\_21

**Table 16. 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

## Revision history

**Table 17. Document revision history**

Date	Version	Changes
13-Oct-2006	1	First release.
17-Nov-2006	2	Part number has been modified.
02-Feb-2007	3	Preliminary version.
16-Feb-2007	4	TO-220FP package has been added.
15-Oct-2012	5	Updated <i>Section 4: Package information</i> and <i>Section 4: Package information</i> . Minor text changes.
16-Apr-2015	6	Throughout document: – added DPAK package information – text and formatting updates Updated <i>Figure 1: Internal schematic diagram</i> Updated <i>Table 2: Absolute maximum ratings</i> Updated <i>Table 3: Thermal data</i> Updated and renamed <i>Table 5: Static</i> (was On/off states)
09-Aug-2018	7	Removed maturity status indication from cover page. The document status is production data. Updated <a href="#">Table 5. Dynamic</a> . Updated <a href="#">Section 5 Package information</a> . Minor text changes

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