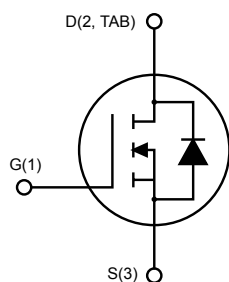
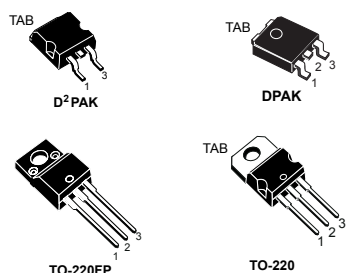


N-channel 200 V, 0.11 Ω , 15 A, MESH OVERLAY™ Power MOSFETs in D²PAK, DPAK, TO-220FP and TO-220 packages



AM01475v1_noZen

Features

Type	V _{DS}	R _{DS(on)} max.	I _D	Package
STB19NF20	200 V	0.16 Ω	15 A	D ² 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 ² PAK, DPAK, TO-220	TO-220FP	
V _{DS}	Drain-source voltage	200		
V _{GS}	Gate-source voltage	±20		V
I _D	Drain current (continuous) at T _C = 25 °C	15	15 ⁽¹⁾	A
	Drain current (continuous) at T _C = 100 °C	9.45	9.45 ⁽¹⁾	
I _{DM} ⁽²⁾	Drain current (pulsed)	60	60 ⁽¹⁾	A
P _{TOT}	Total dissipation at T _{case} = 25 °C	90	25	W
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s, T _C = 25 °C)		2.5	kV
dv/dt ⁽³⁾	Peak diode recovery voltage slope	15		V/ns
T _{stg}	Storage temperature range	-55 to 150		°C
T _j	Operating junction temperature range			

1. This value is limited by package.
2. Pulse width is limited by safe operating area.
3. I_{SD} ≤ 15 A, di/dt ≤ 300 A/μs, V_{DD} = 80 % V_{(BR)DSS}

Table 2. Thermal data

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

1. When mounted on an 1-inch² FR-4, 2oz Cu board

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I _{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T _{jmax})	15	A
E _{AS}	Single-pulse avalanche energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 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_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 200\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 200\text{ V}$, $T_{\text{C}} = 125\text{ }^{\circ}\text{C}^{(1)}$			10	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 20\text{ V}$			± 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	Ω

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

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	800	-	pF
C_{oss}	Output capacitance		-	165	-	
C_{rss}	Reverse transfer capacitance		-	26	-	
Q_{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_{gs}	Gate-source charge		-	4.4	-	
Q_{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	$V_{\text{DD}} = 100\text{ V}$, $I_{\text{D}} = 7.5\text{ A}$, $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$	-	11.5	-	ns
t_{r}	Rise time		-	22	-	
$t_{\text{d(off)}}$	Turn-off delay time	(see Figure 15. Test circuit for resistive load switching times and Figure 20. Switching time waveform)	-	19	-	
t_{f}	Fall time		-	11	-	

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{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		μC
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		μC
I_{RRM}	Reverse recovery current		-	9.9		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 D²PAK, DPAK and TO-220

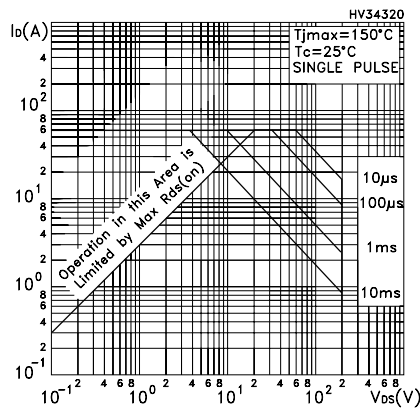


Figure 2. Thermal impedance for D²PAK, DPAK and TO-220

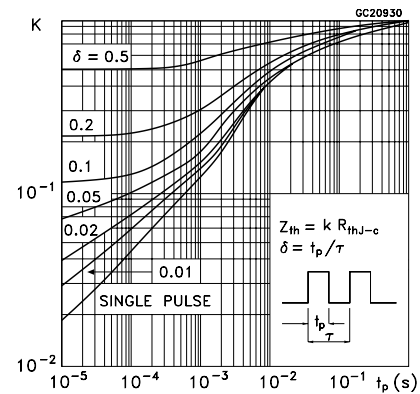


Figure 3. Safe operating area for TO-220FP

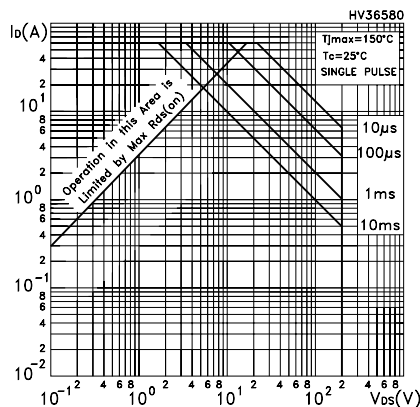


Figure 4. Thermal impedance for TO-220FP

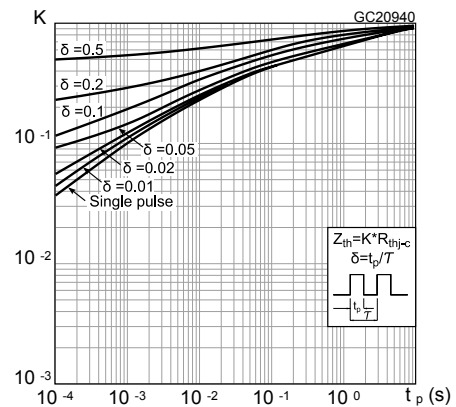


Figure 5. Output characteristics

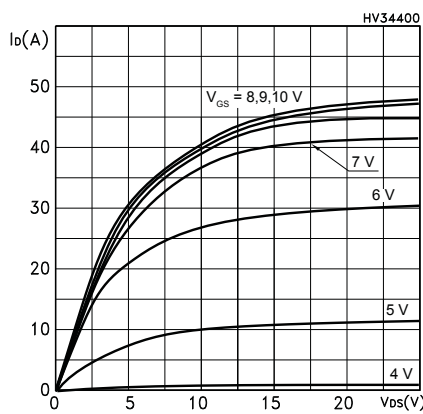


Figure 6. Transfer characteristics

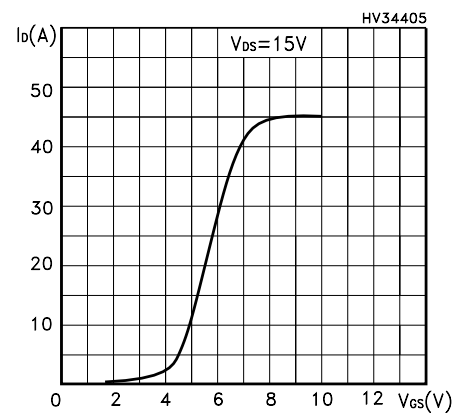


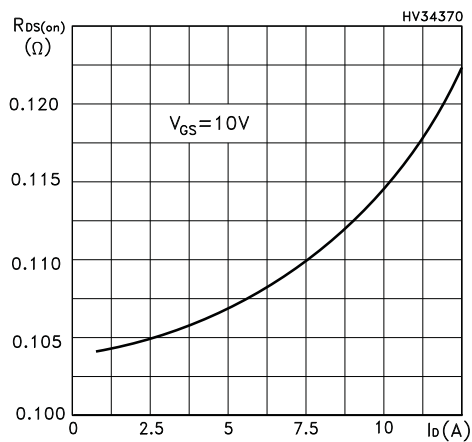
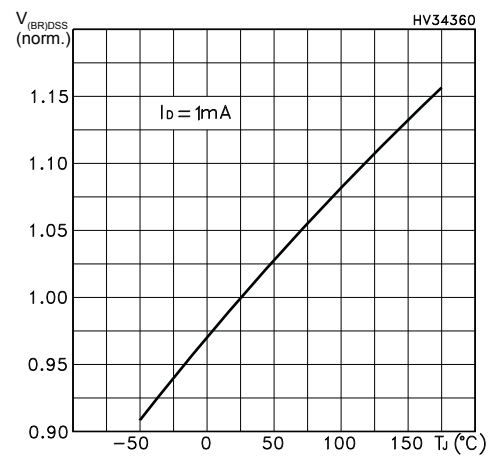
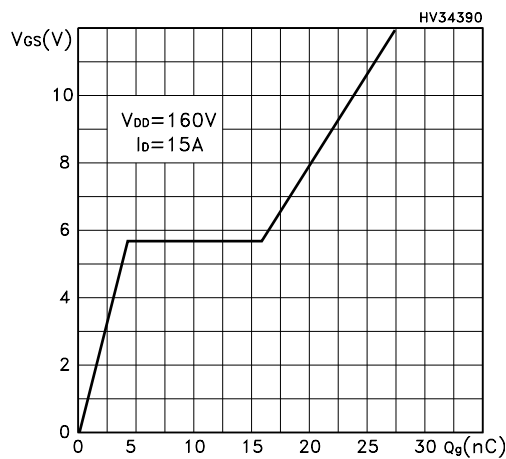
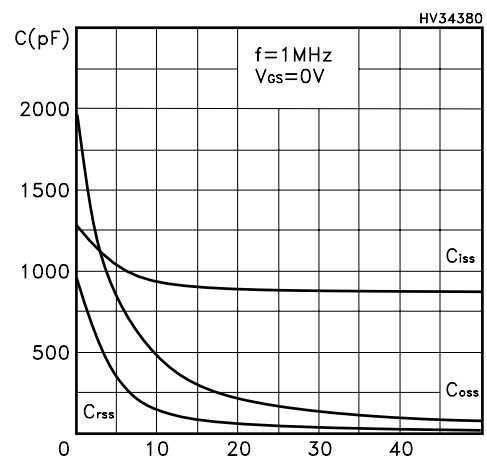
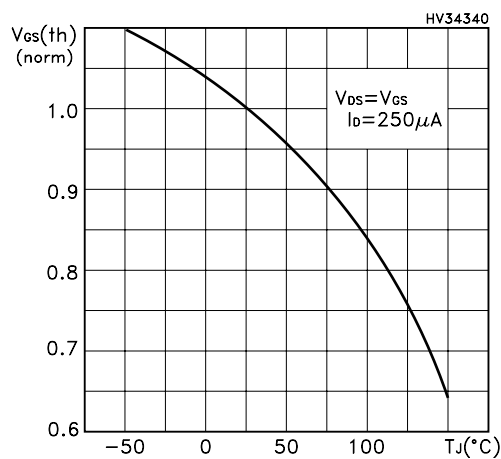
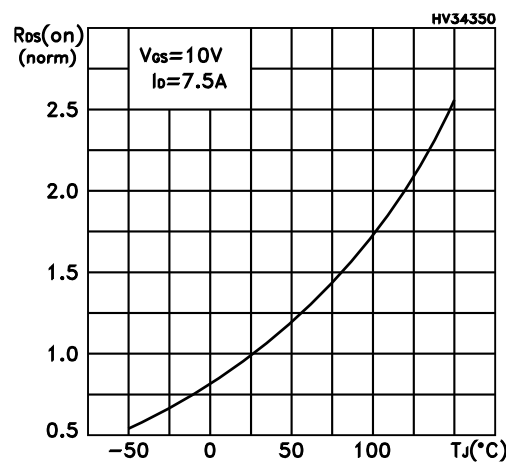
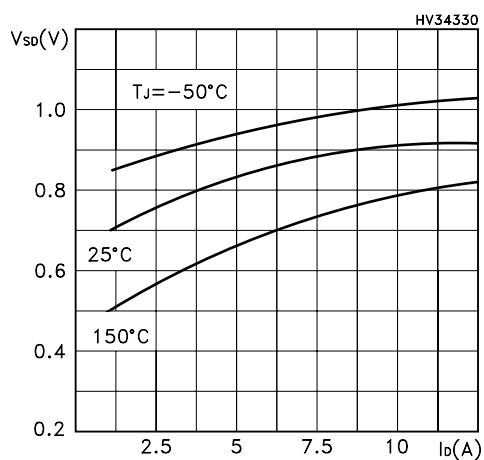
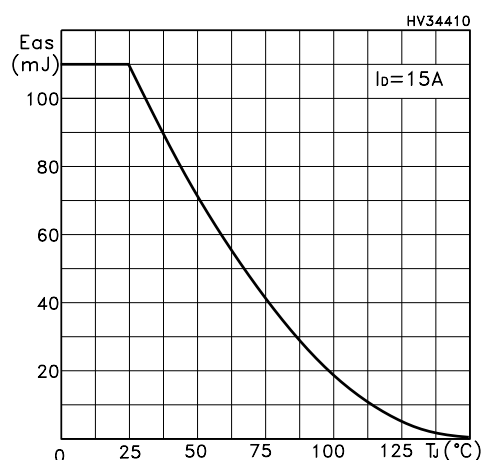
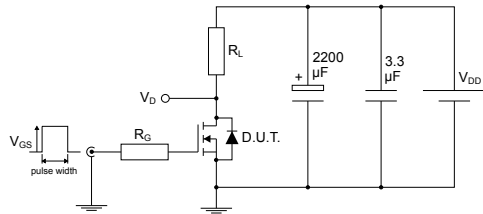
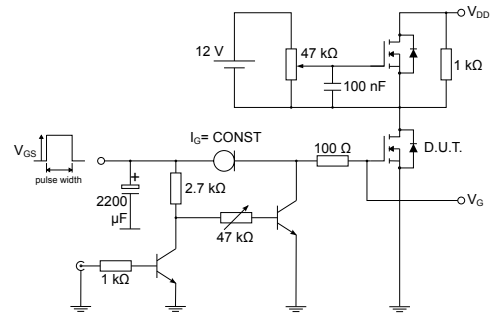
Figure 7. Static drain-source on-resistance

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


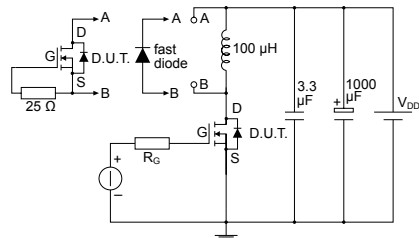
3 Test circuits

Figure 15. Test circuit for resistive load switching times


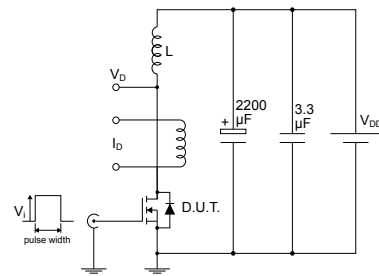
AM01468v1

Figure 16. Test circuit for gate charge behavior


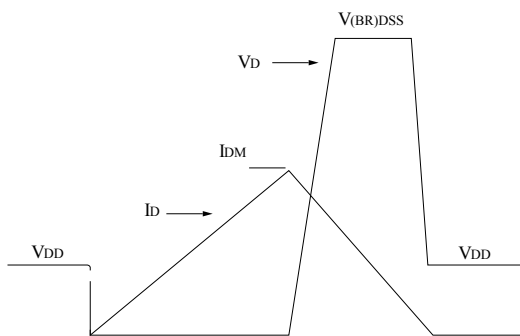
AM01469v1

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


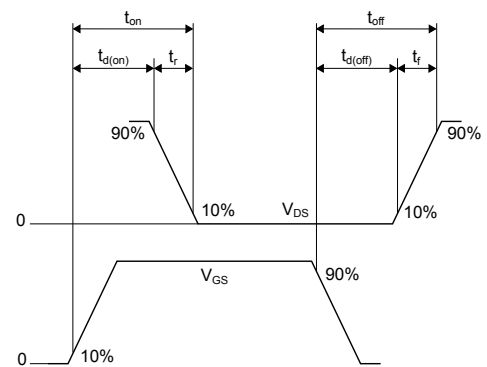
AM01470v1

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

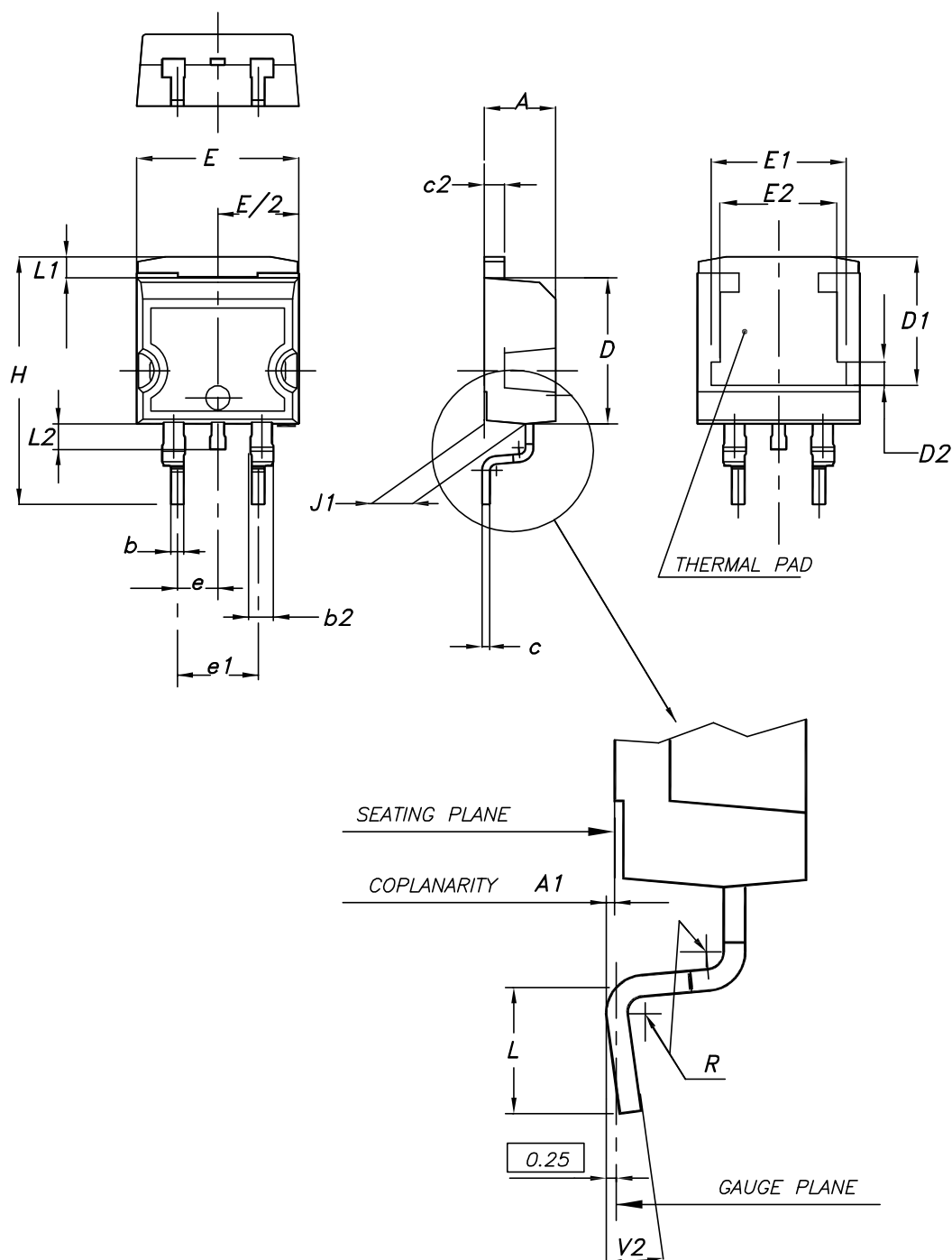
Order code	Marking	Package	Packing
STB19NF20	19NF20	D ² PAK	Tape and reel
STD19NF20		DPAK	
STF19NF20		TO-220FP	Tube
STP19NF20		TO-220	

5 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.

5.1 D²PAK (TO-263) type A package information

Figure 21. D²PAK (TO-263) type A package outline



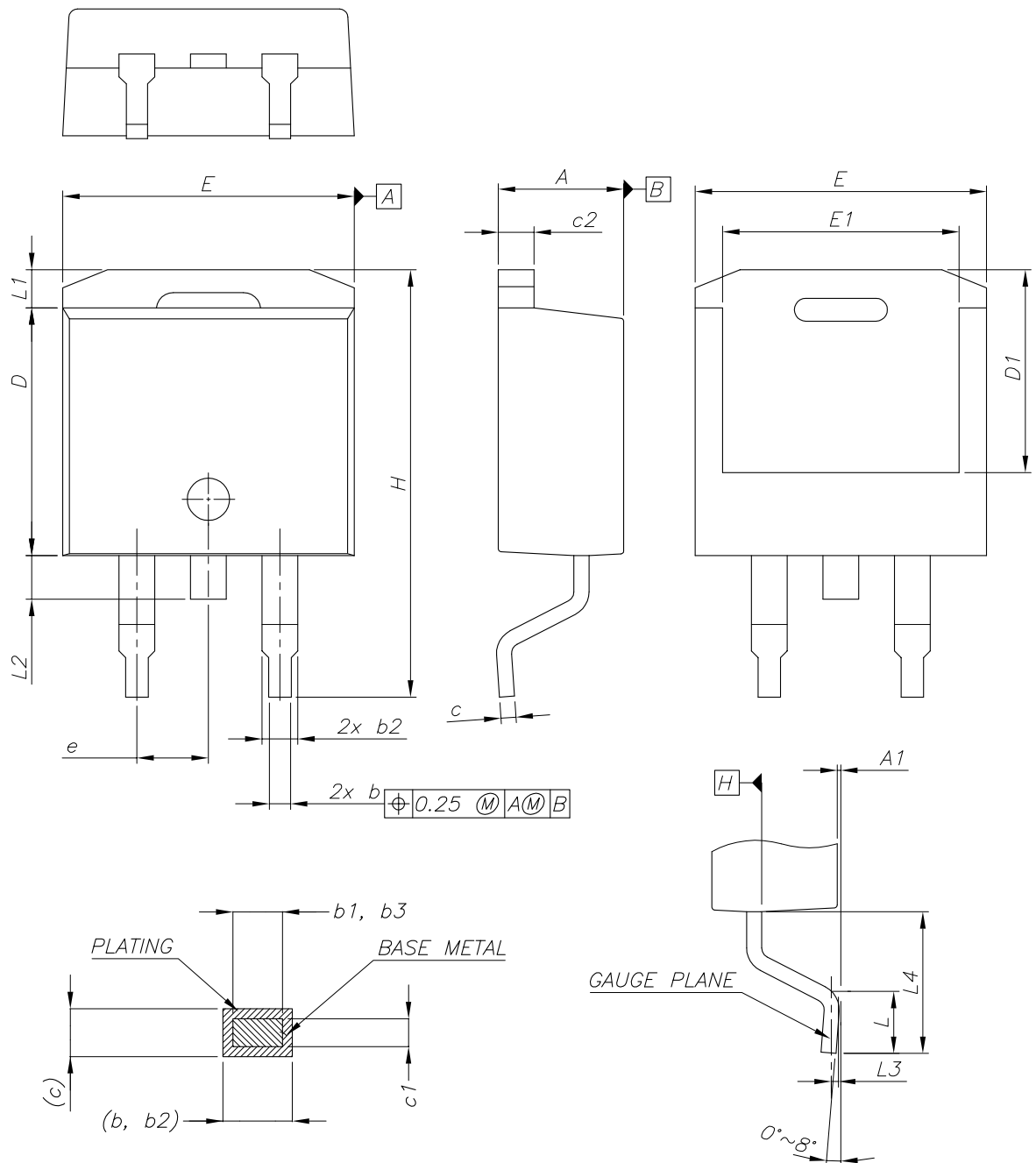
0079457_25

Table 9. D²PAK (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 D²PAK (TO-263) type B package information

Figure 22. D²PAK (TO-263) type B package outline

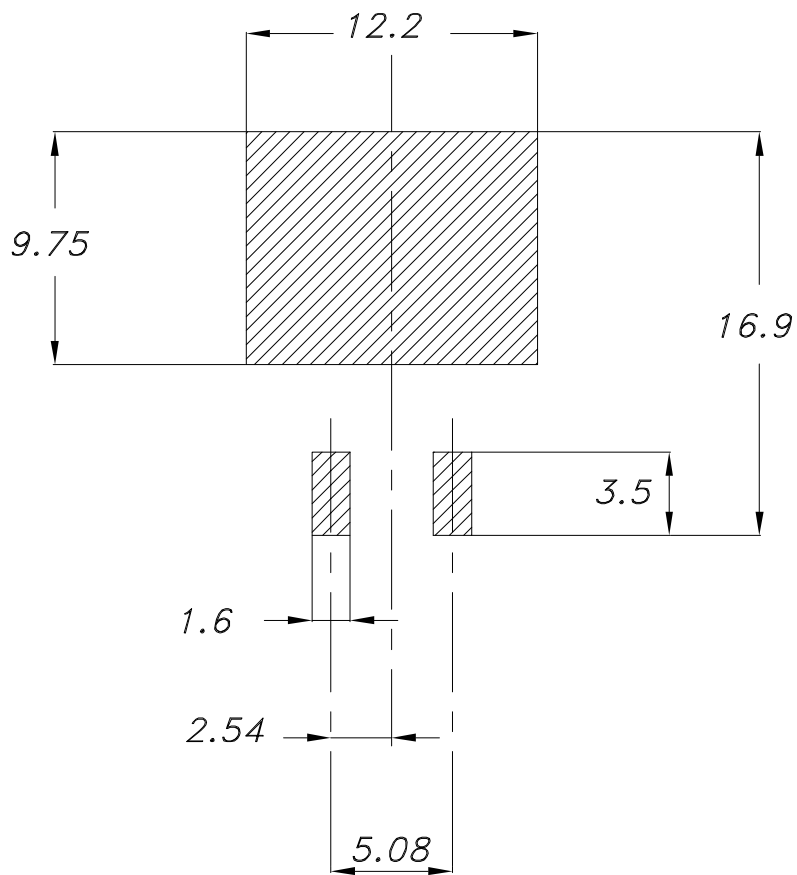


0079457_25_B

Table 10. D²PAK (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

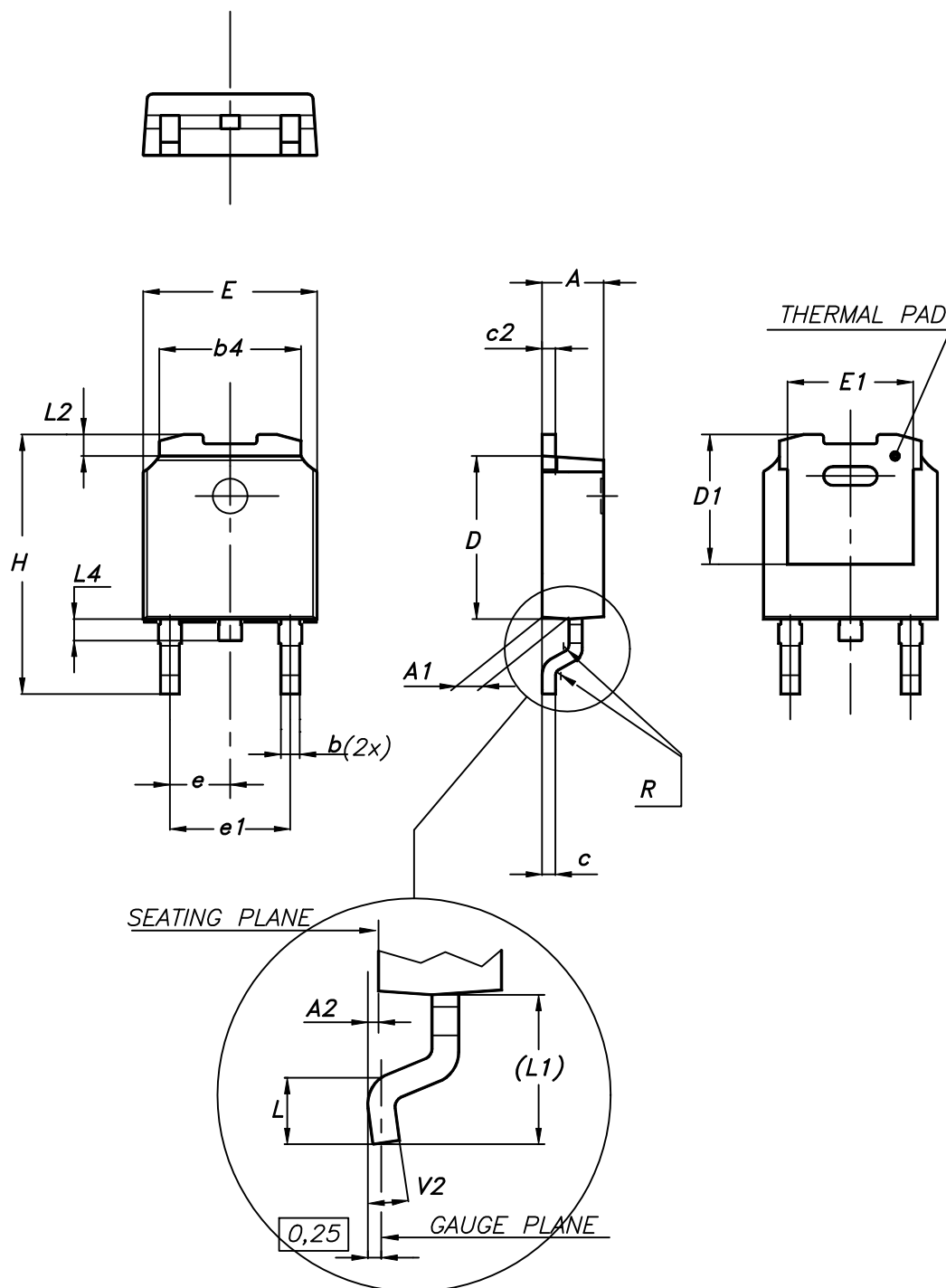
Figure 23. D²PAK (TO-263) recommended footprint (dimensions are in mm)



Footprint

5.3 DPAK (TO-252) type A2 package information

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



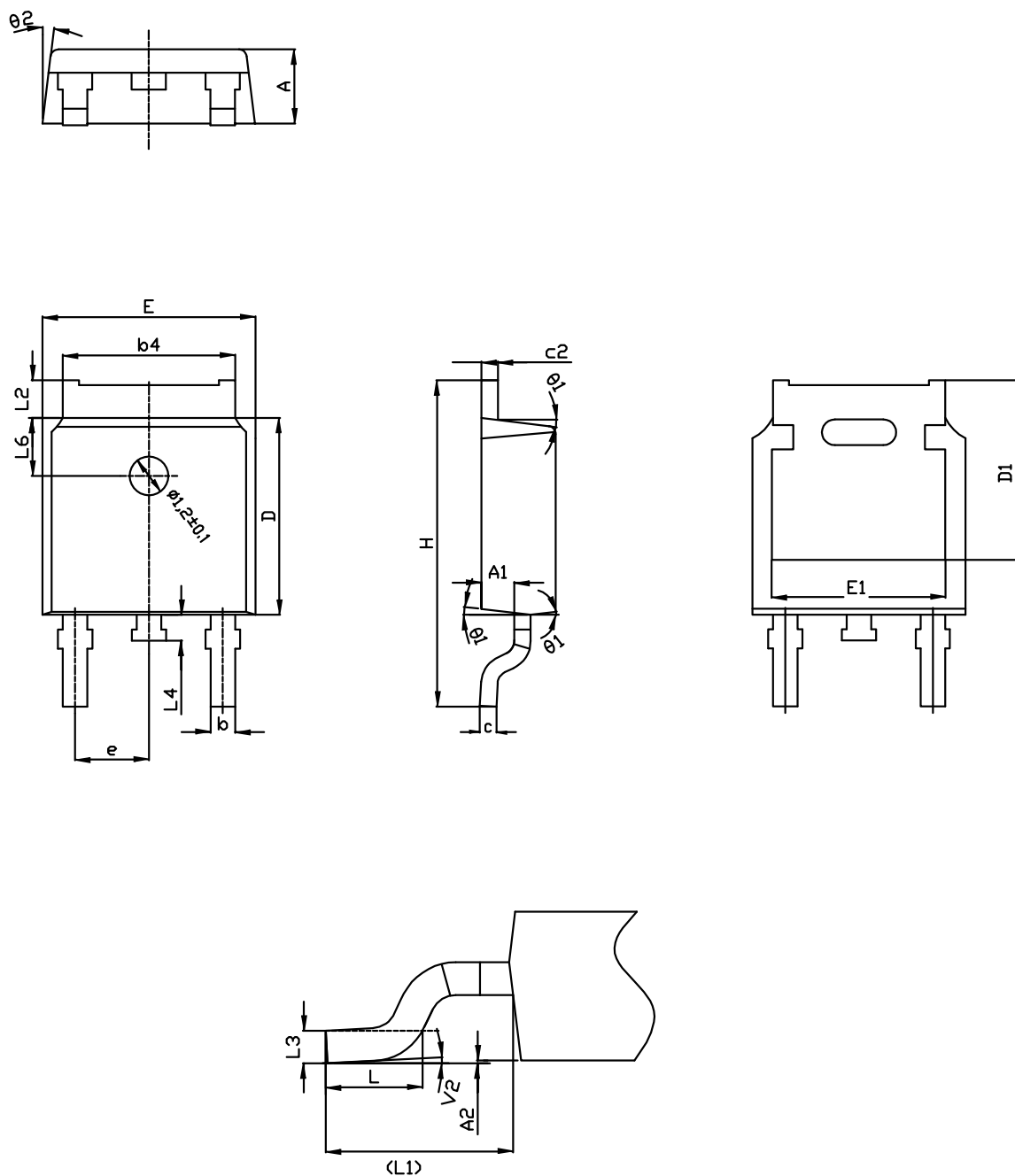
0068772_type-A2_rev25

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

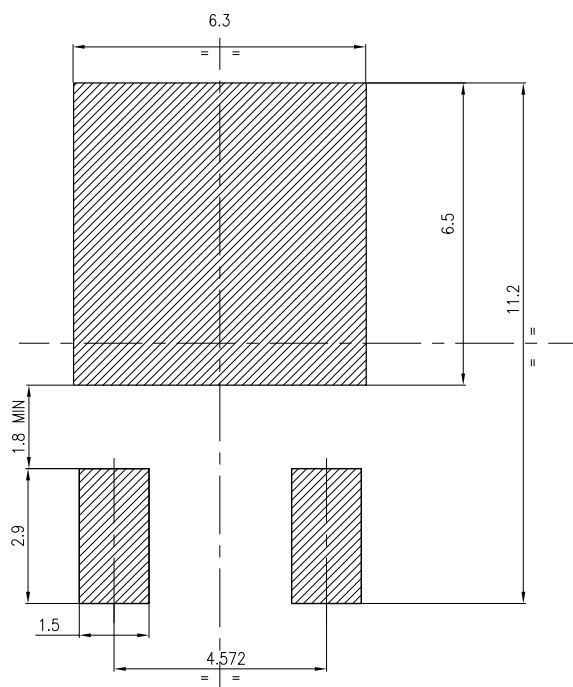


0068772_C2_25

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°

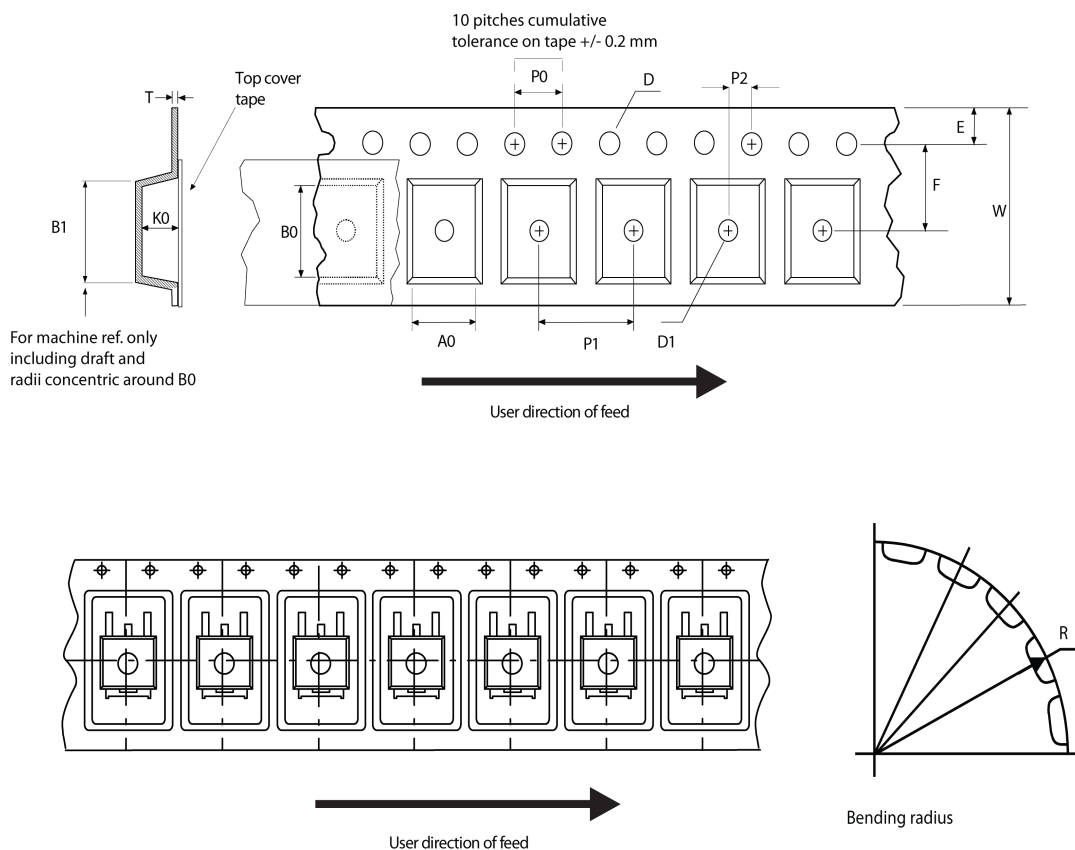
Figure 26. PAK (TO-252) recommended footprint (dimensions are in mm)



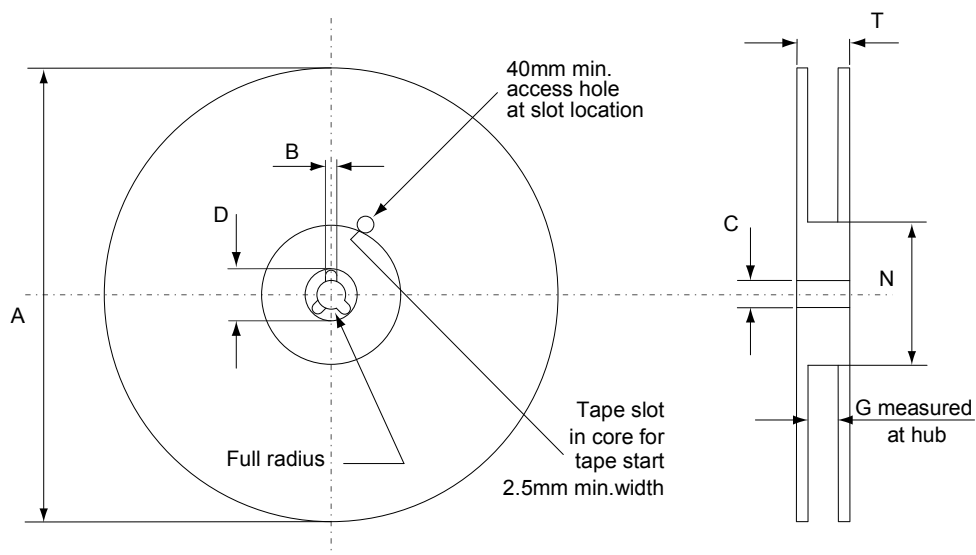
FP_0068772_25

5.5 D²PAK and DPAK packing information

Figure 27. Tape outline



AM08852v1

Figure 28. Reel outline


AM06038v1

Table 13. D²PAK tape and reel mechanical data

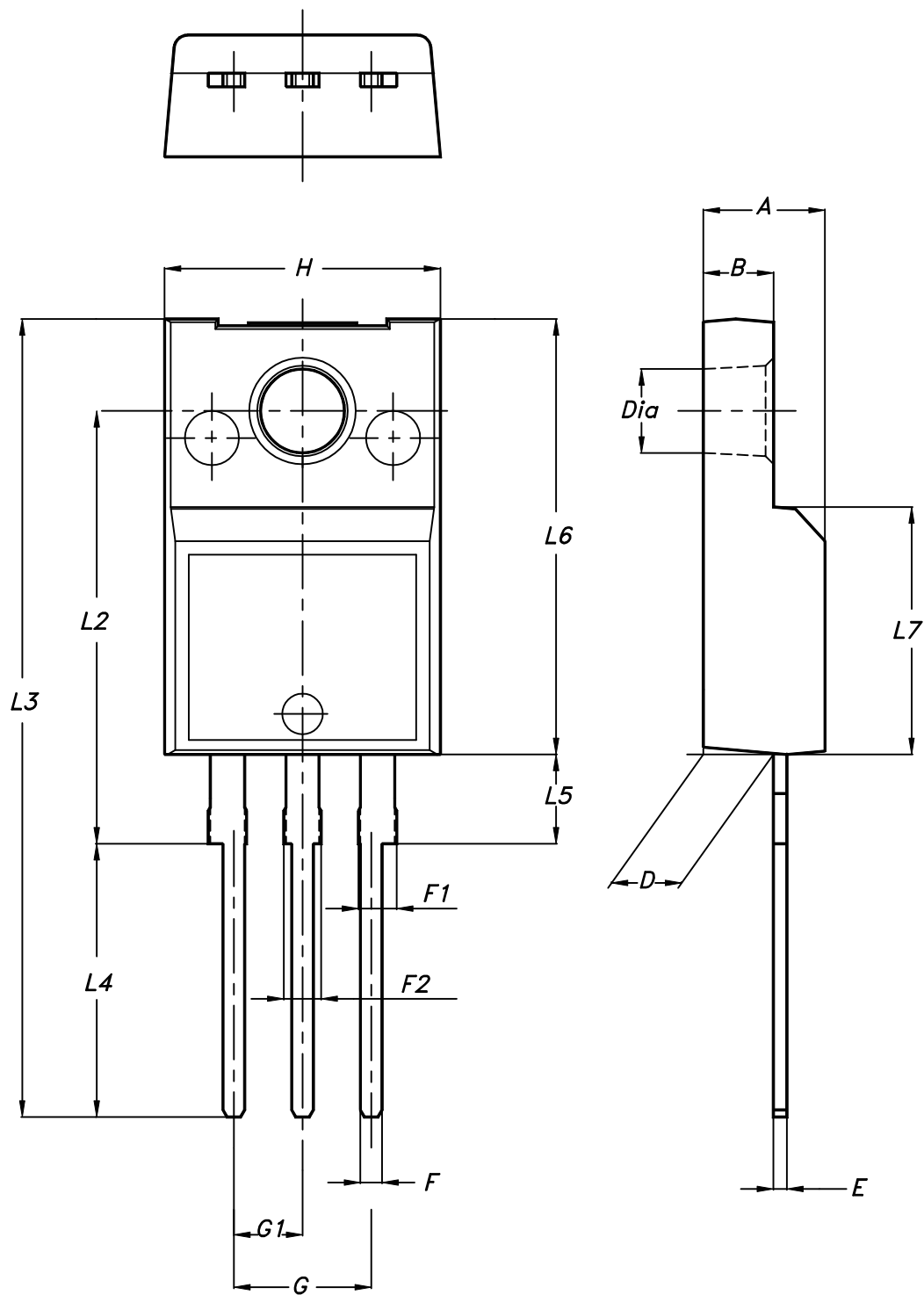
Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			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



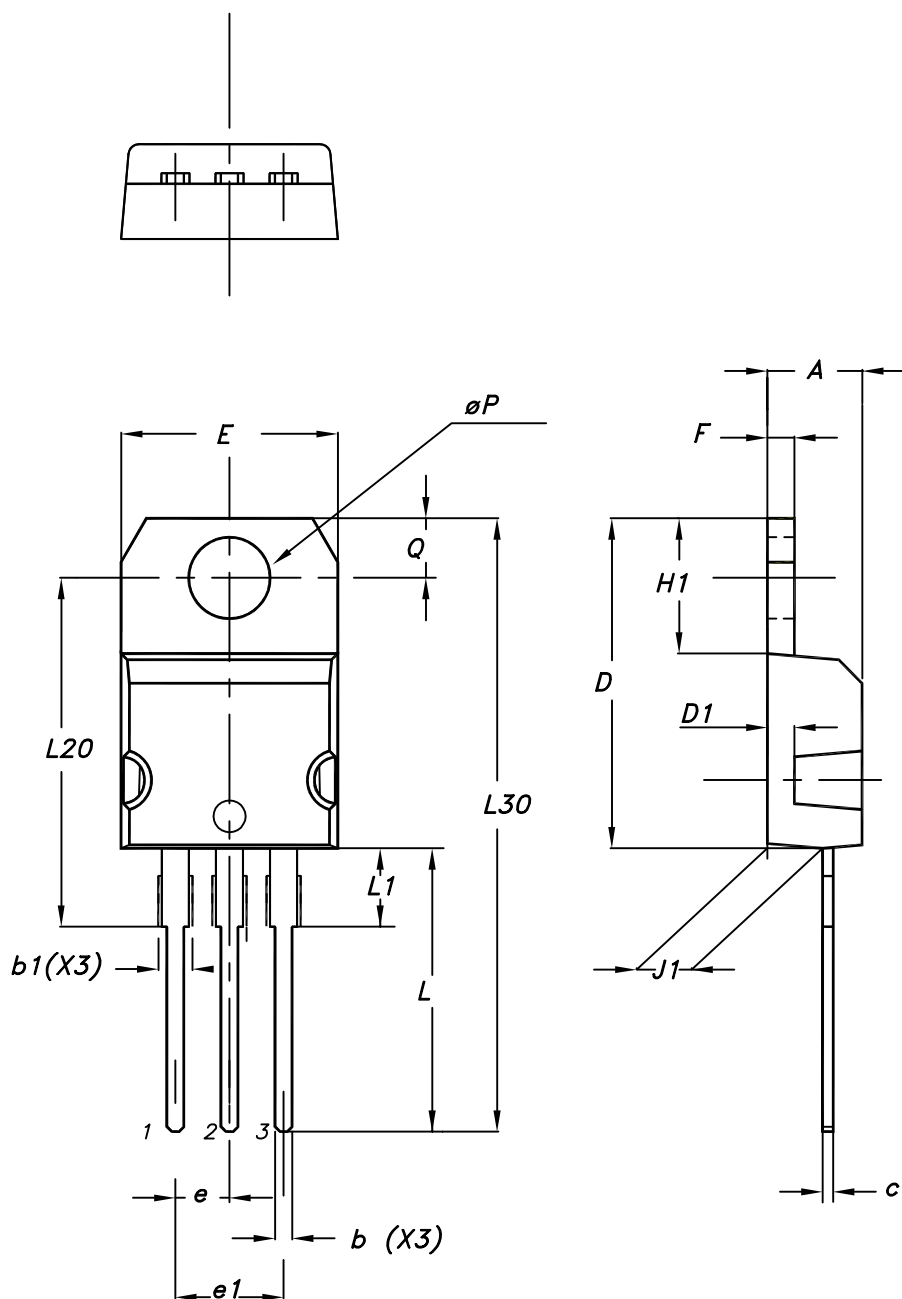
7012510_Rev_12_B

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)
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Contents

1	Electrical ratings	2
2	Electrical characteristics	3
2.1	Electrical characteristics (curves)	5
3	Test circuits	8
4	Ordering information	9
5	Package information	10
5.1	D ² PAK (TO-263) type A package information	10
5.2	D ² PAK (TO-263) type B package information	12
5.3	DPAK (TO-252) type A2 package information	15
5.4	DPAK (TO-252) type C2 package information	17
5.5	D ² PAK and DPAK packing information	20
5.6	TO-220FP package information	23
5.7	TO-220 type A package information	25
	Revision history	28

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