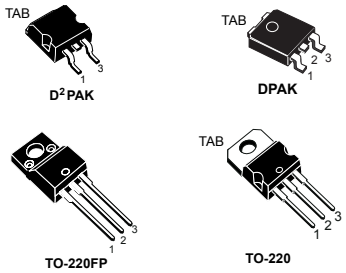
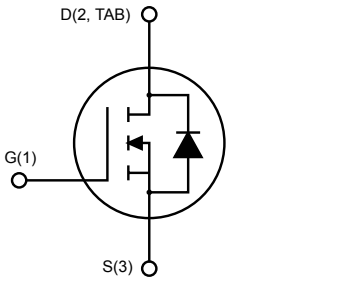
STB19NF20, STD19NF20
STF19NF20, STP19NF20

Datasheet

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





Features

Type	V_{DS}	$R_{DS(on)}$ max.	I_D	Package
STB19NF20	200 V	0.16 Ω	15 A	D²PAK
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
		D²PAK, 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
		D²PAK	DPAK	TO-220	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.39			5	°C/W
$R_{thj\text{-}pcb}$(1)	Thermal resistance junction-pcb	35	50			
$R_{thj\text{-}amb}$	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_{case} = 25 °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 V, I_D = 1 mA	200			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 200 V			1	µA
		V_{GS} = 0 V, V_{DS} = 200 V, T_C = 125 °C(1)			10	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 7.5 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_{DS} = 25 V, f = 1 MHz, V_{GS} = 0 V	-	800	-	pF
C_{oss}	Output capacitance		-	165	-	
C_{rss}	Reverse transfer capacitance		-	26	-	
Q_g	Total gate charge	V_{DD} = 160 V, I_D = 15 A, V_{GS} = 0 to 10 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
$t_{d(on)}$	Turn-on delay time	V_{DD} = 100 V, I_D = 7.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 15. Test circuit for resistive load switching times and Figure 20. Switching time waveform)	-	11.5	-	ns
t_r	Rise time		-	22	-	
$t_{d(off)}$	Turn-off delay time		-	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_{SDM}(1)	Source-drain current (pulsed)		-		60	A
V_{SD}(2)	Forward on voltage	I_{SD} = 15 A, V_{GS} = 0 V	-		1.6	V

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

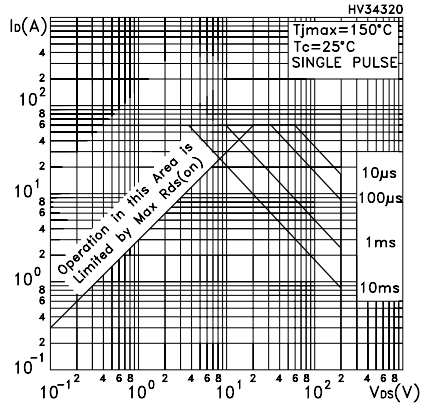


Figure 2. Thermal impedance for D²PAK, DPAK and TO-220

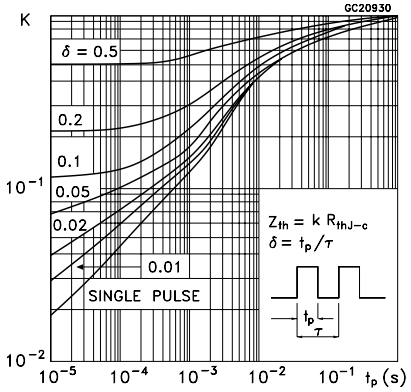


Figure 3. Safe operating area for TO-220FP

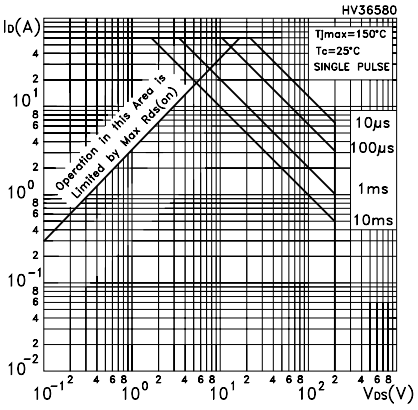


Figure 4. Thermal impedance for TO-220FP

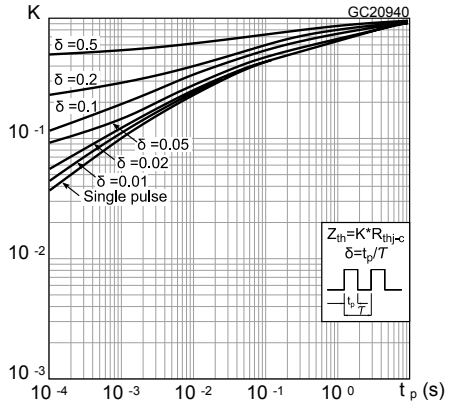


Figure 5. Output characteristics

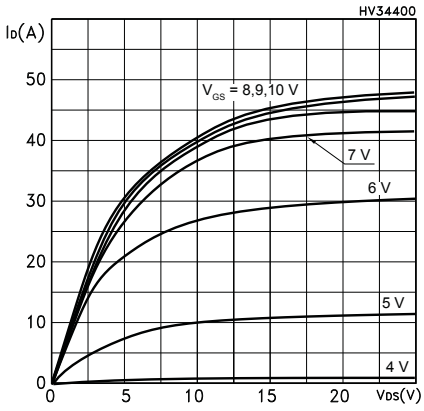


Figure 6. Transfer characteristics

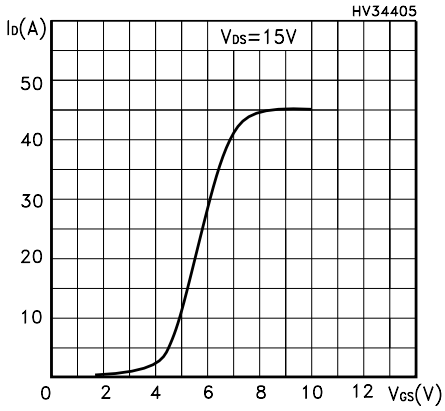


Figure 7. Static drain-source on-resistance

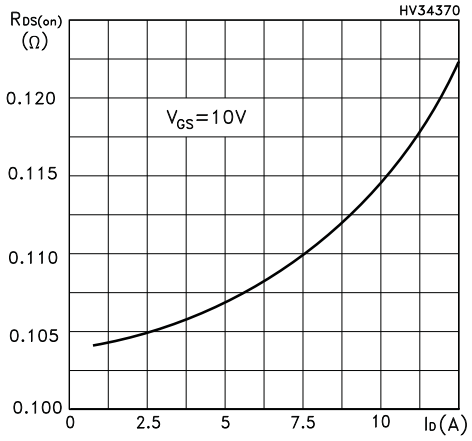


Figure 8. Normalized $V_{(BR)DSS}$ vs temperature

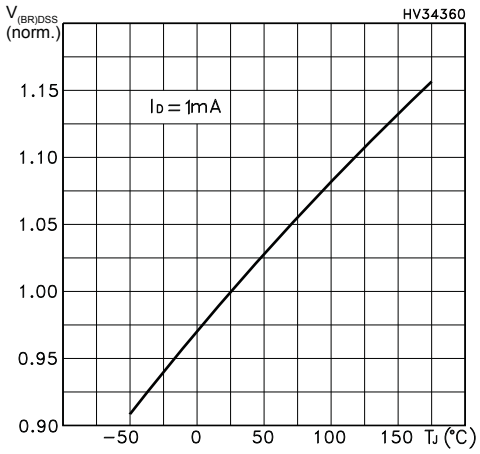


Figure 9. Gate charge vs gate-source voltage

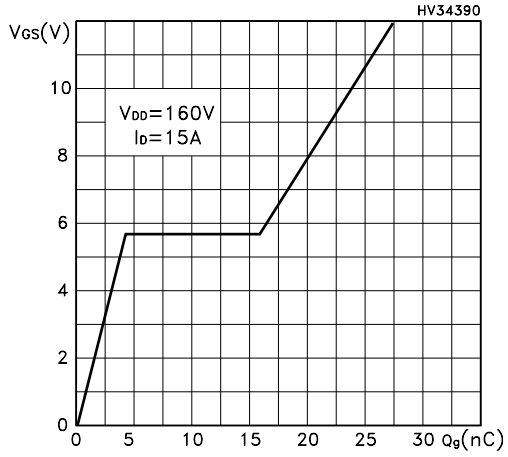


Figure 10. Capacitance variations

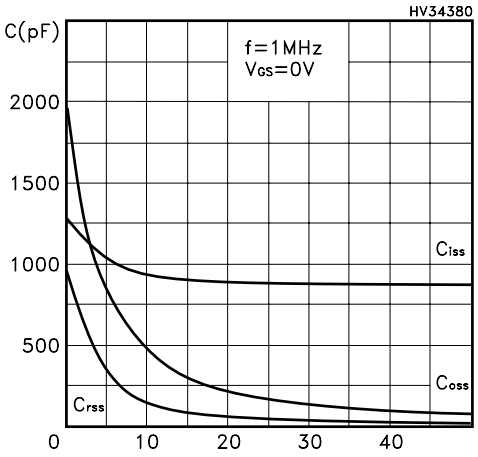


Figure 11. Normalized gate threshold voltage vs temperature

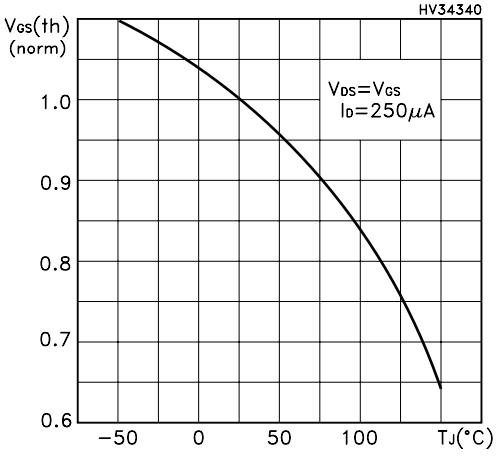


Figure 12. Normalized on-resistance vs temperature

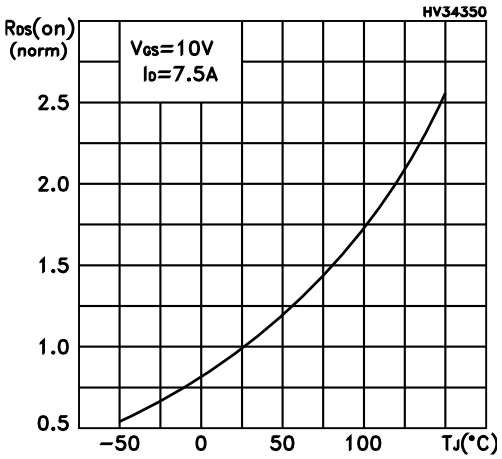


Figure 13. Source-drain diode forward characteristics

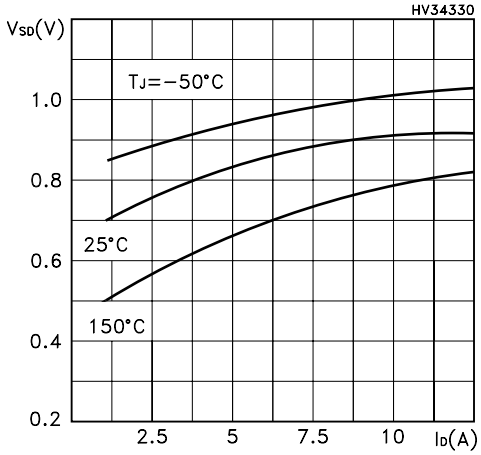
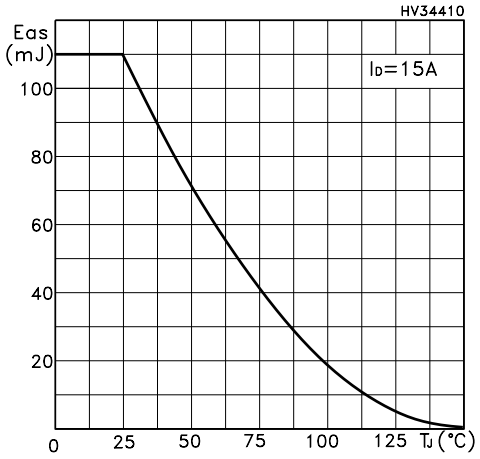


Figure 14. Maximum avalanche energy vs temperature



3 Test circuits

Figure 15. Test circuit for resistive load switching times

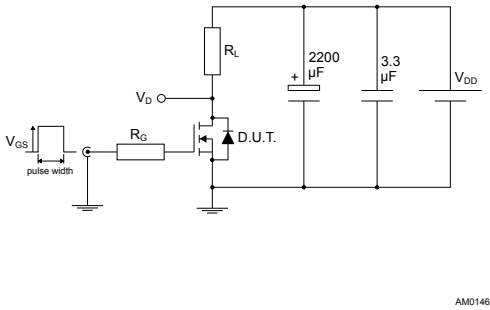


Figure 16. Test circuit for gate charge behavior

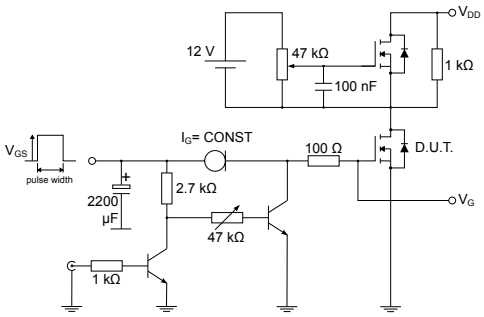


Figure 17. Test circuit for inductive load switching and diode recovery times

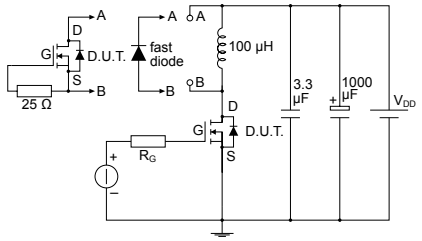


Figure 18. Unclamped inductive load test circuit

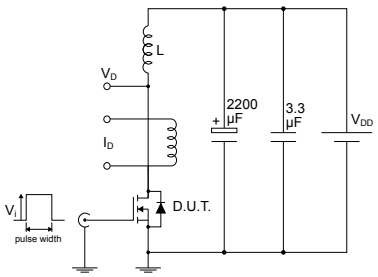


Figure 19. Unclamped inductive waveform

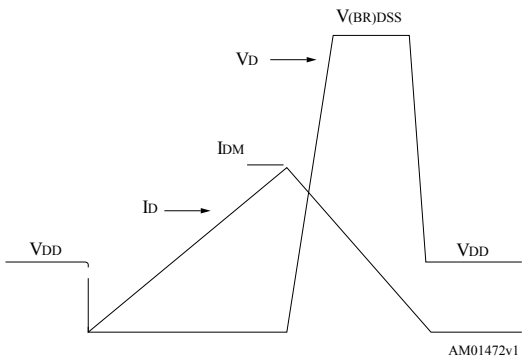
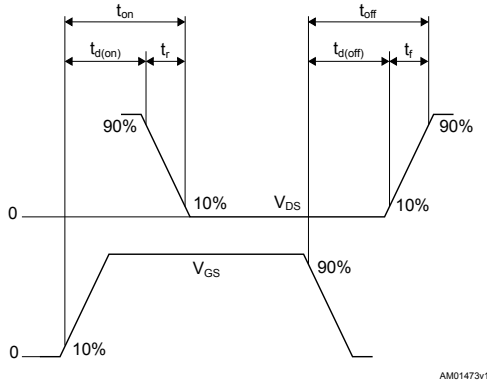


Figure 20. Switching time waveform



4 Ordering information

Table 8. **Order codes**

Order code	Marking	Package	Packing
STB19NF20	19NF20	D^2PAK	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

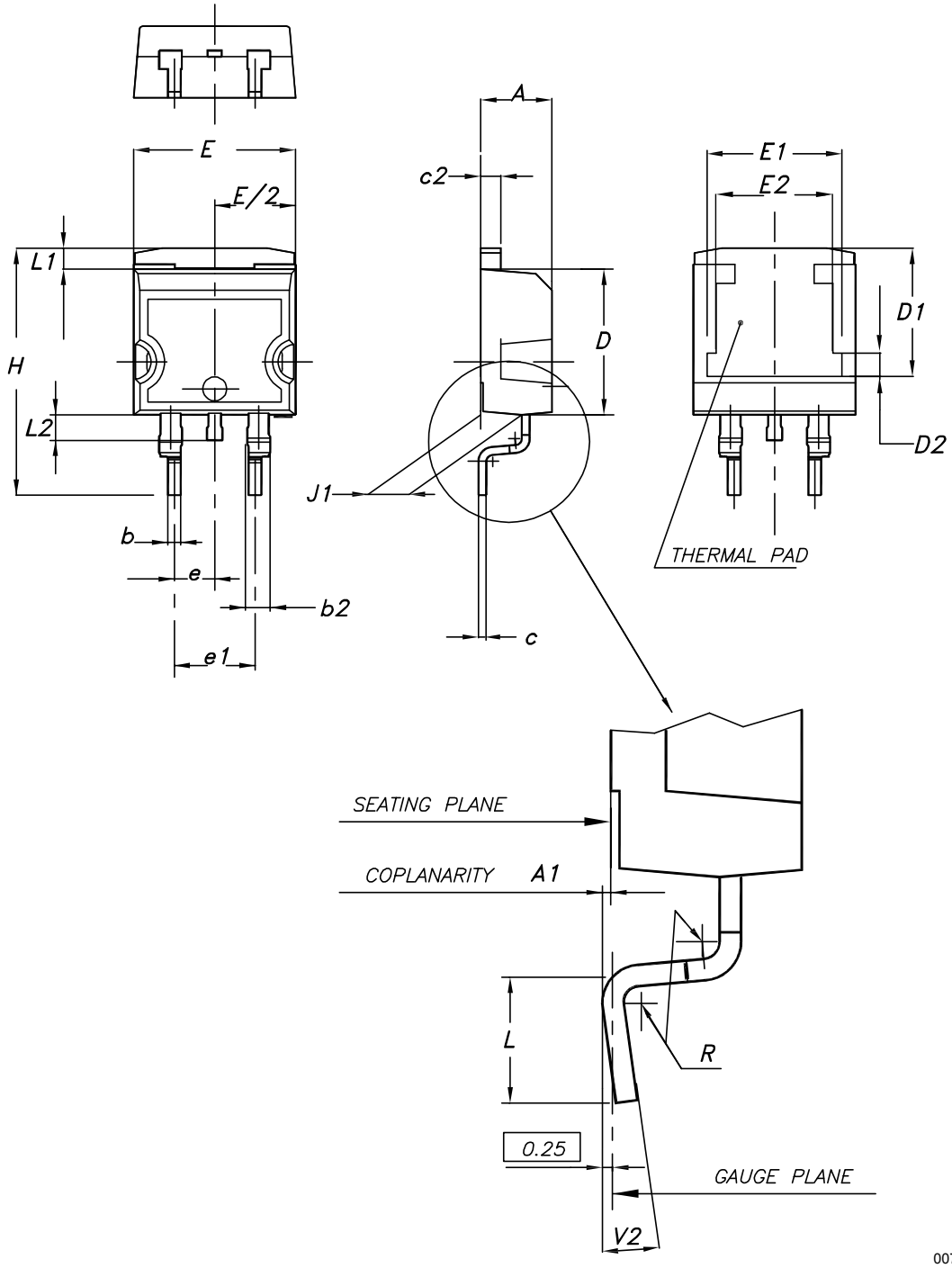


Table 9. D²PAK (TO-263) type A package mechanical data

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

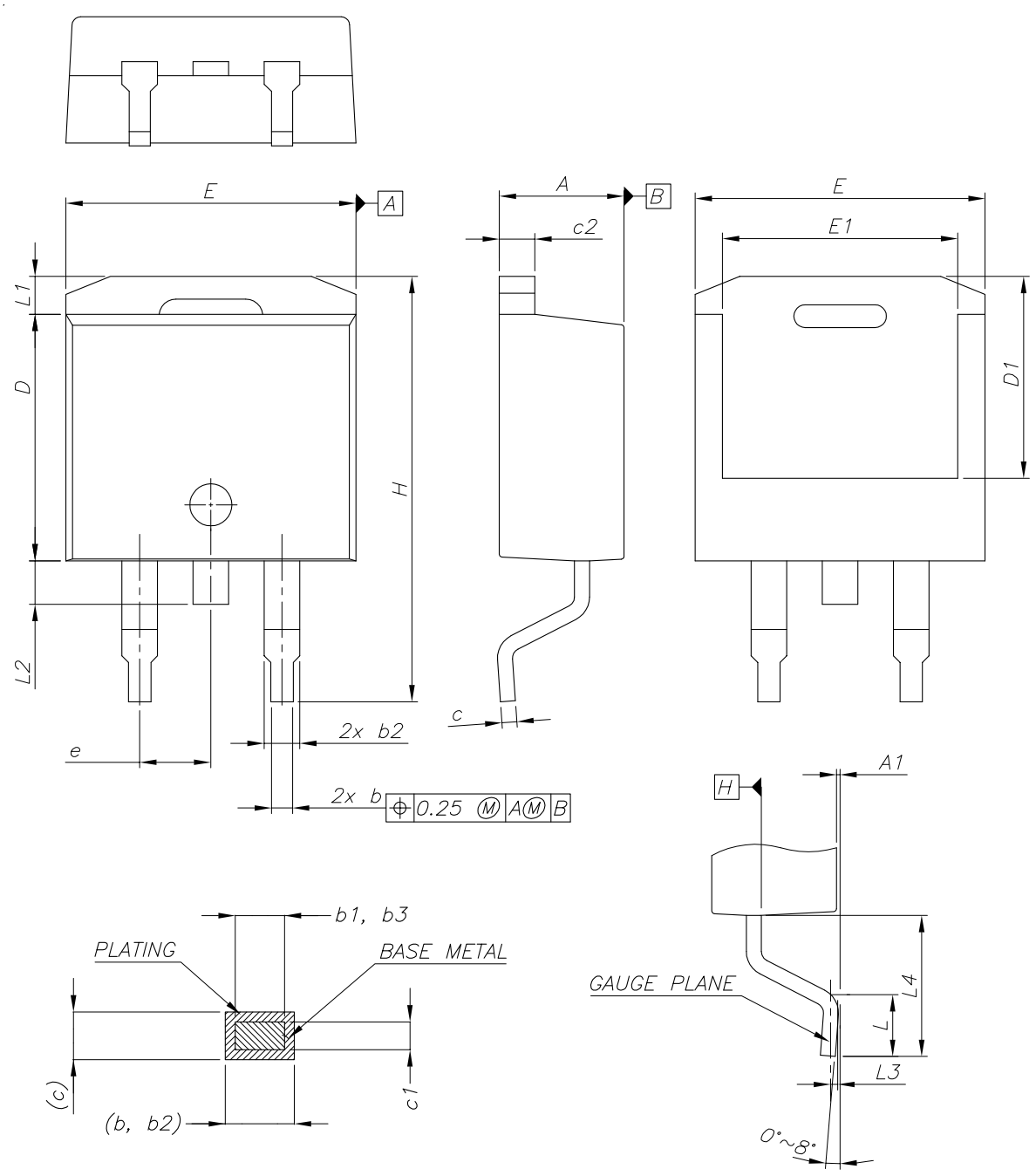


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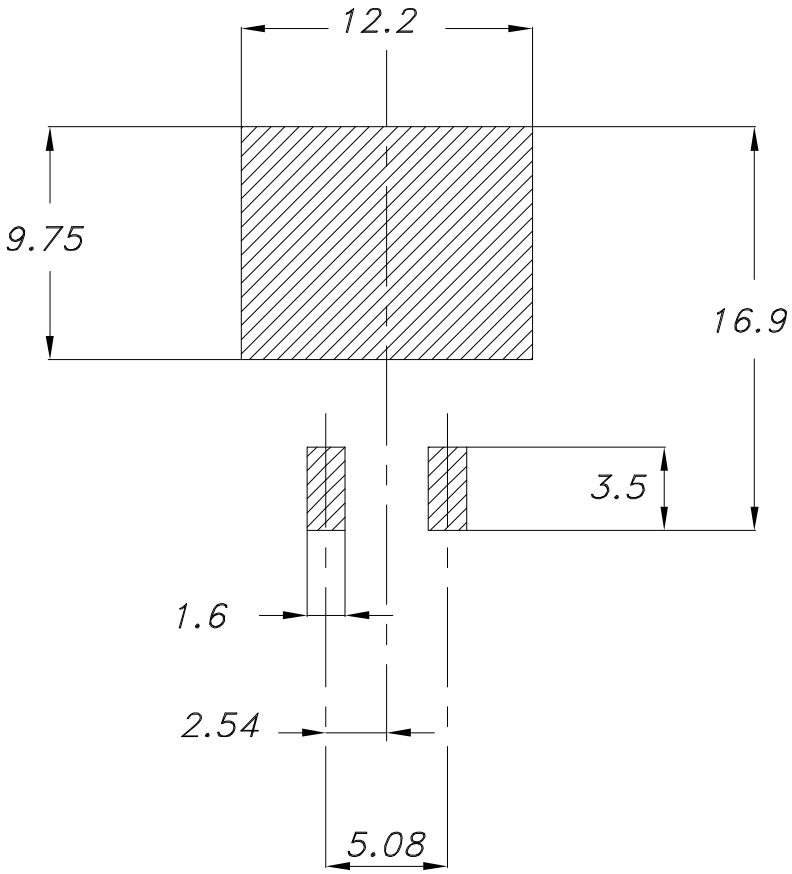
Table 10. **D²PAK (TO-263) type B mechanical data**

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**

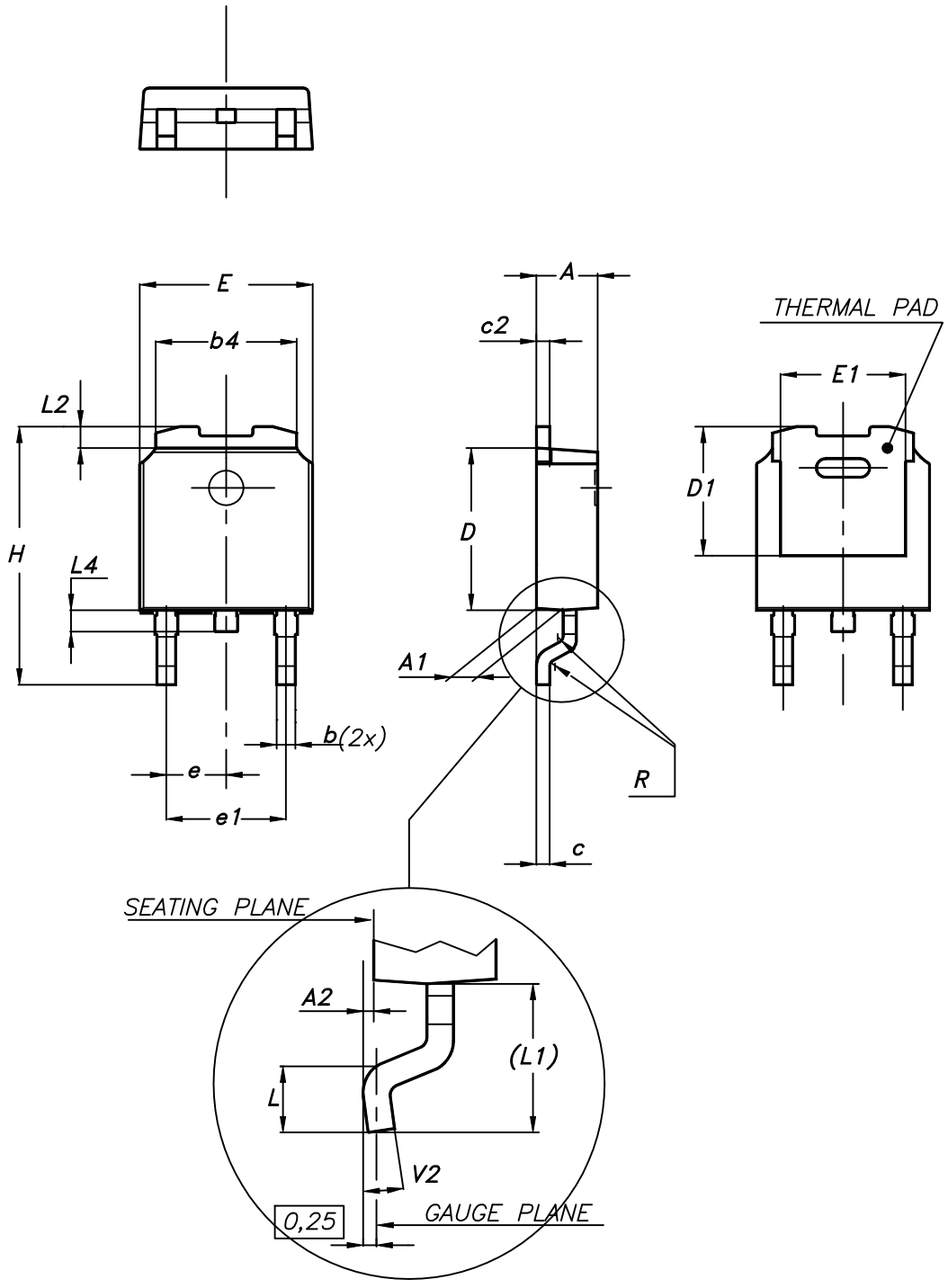


Table 11. **DPAK (TO-252) type A2 mechanical data**

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**

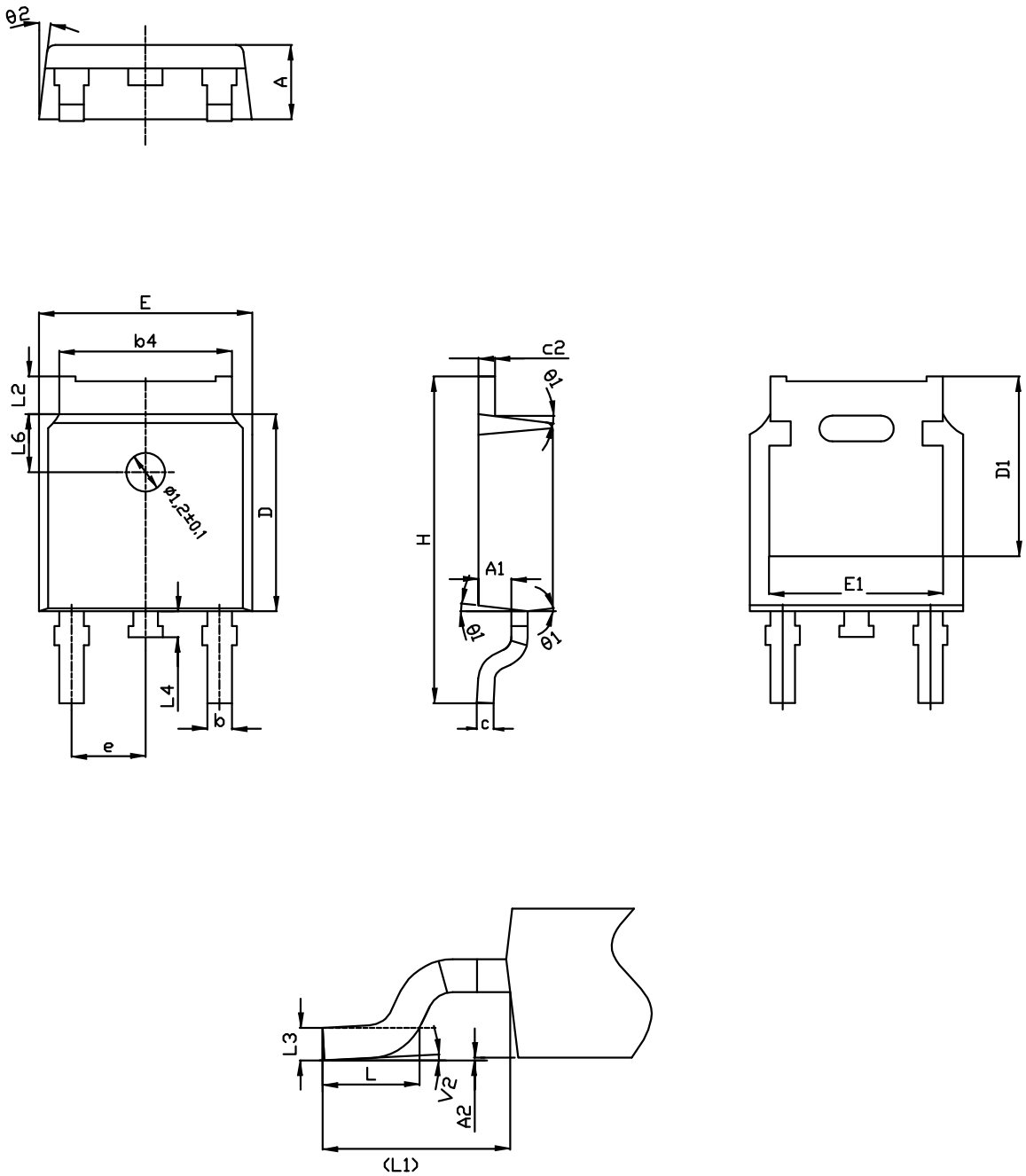


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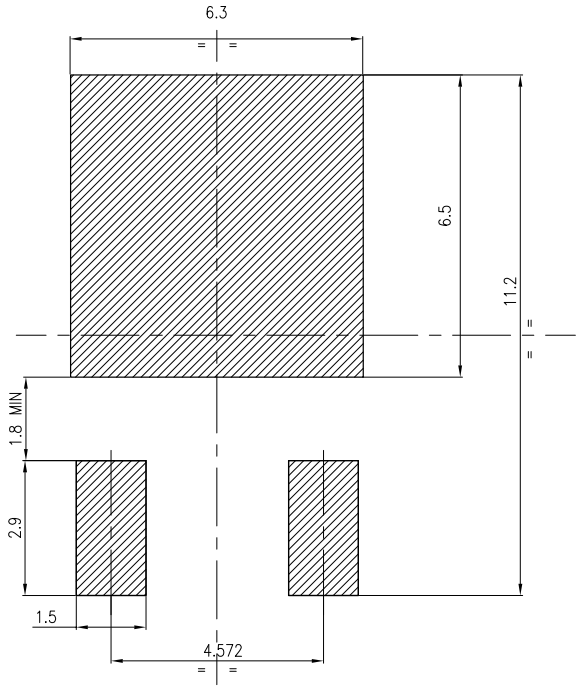
Table 12. DPAK (TO-252) type C2 mechanical data

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)**



5.5 D²PAK and DPAK packing information

Figure 27. Tape outline

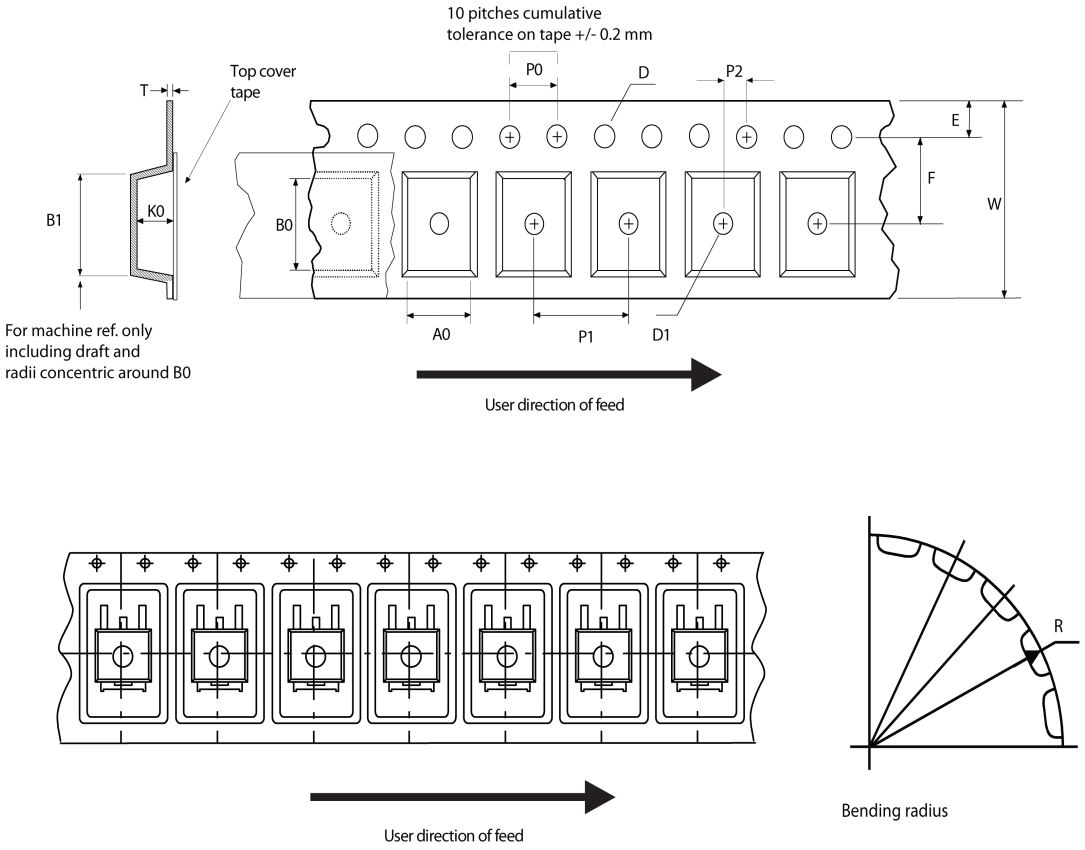


Figure 28. **Reel outline**

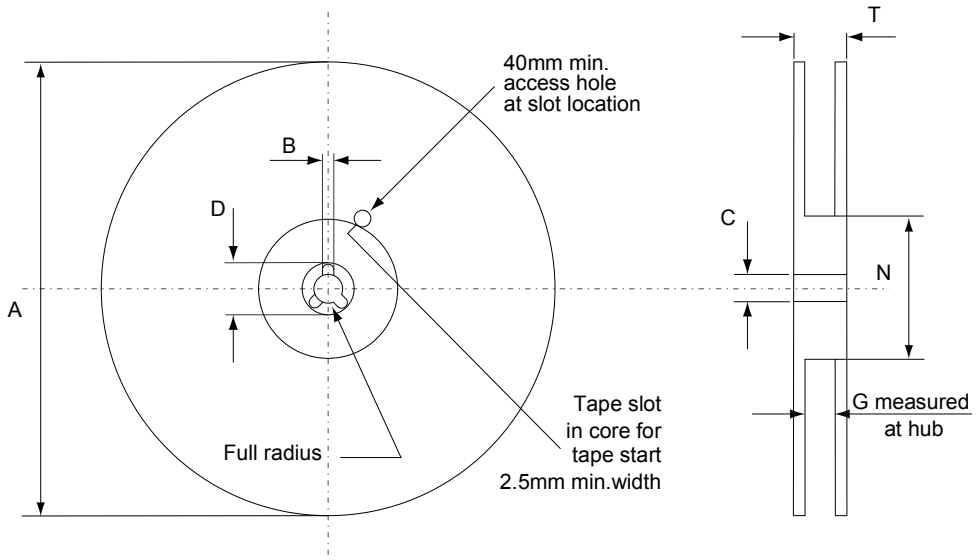


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Table 13. **D²PAK tape and reel mechanical data**

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**

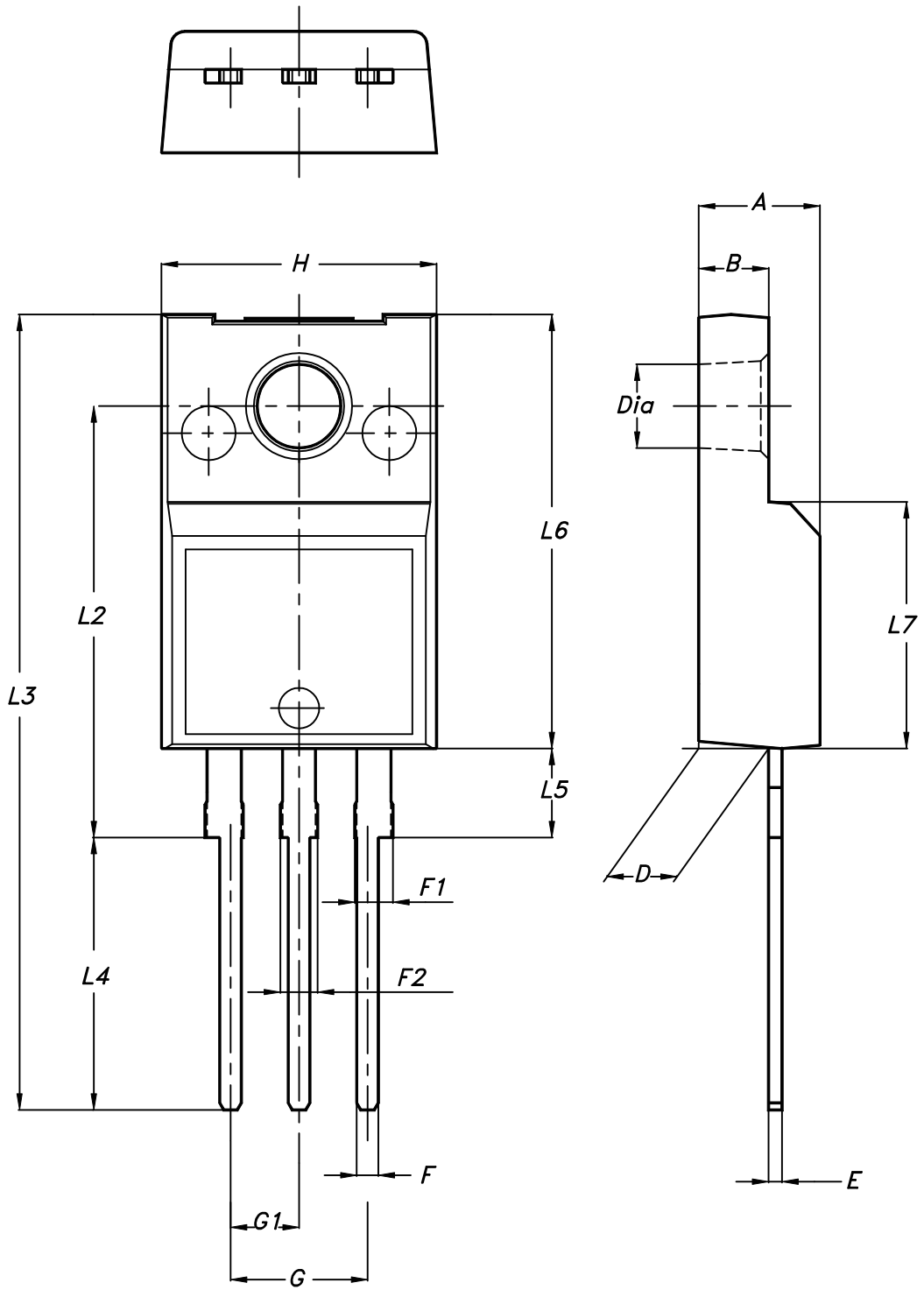

Table 15. **TO-220FP package mechanical data**

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**

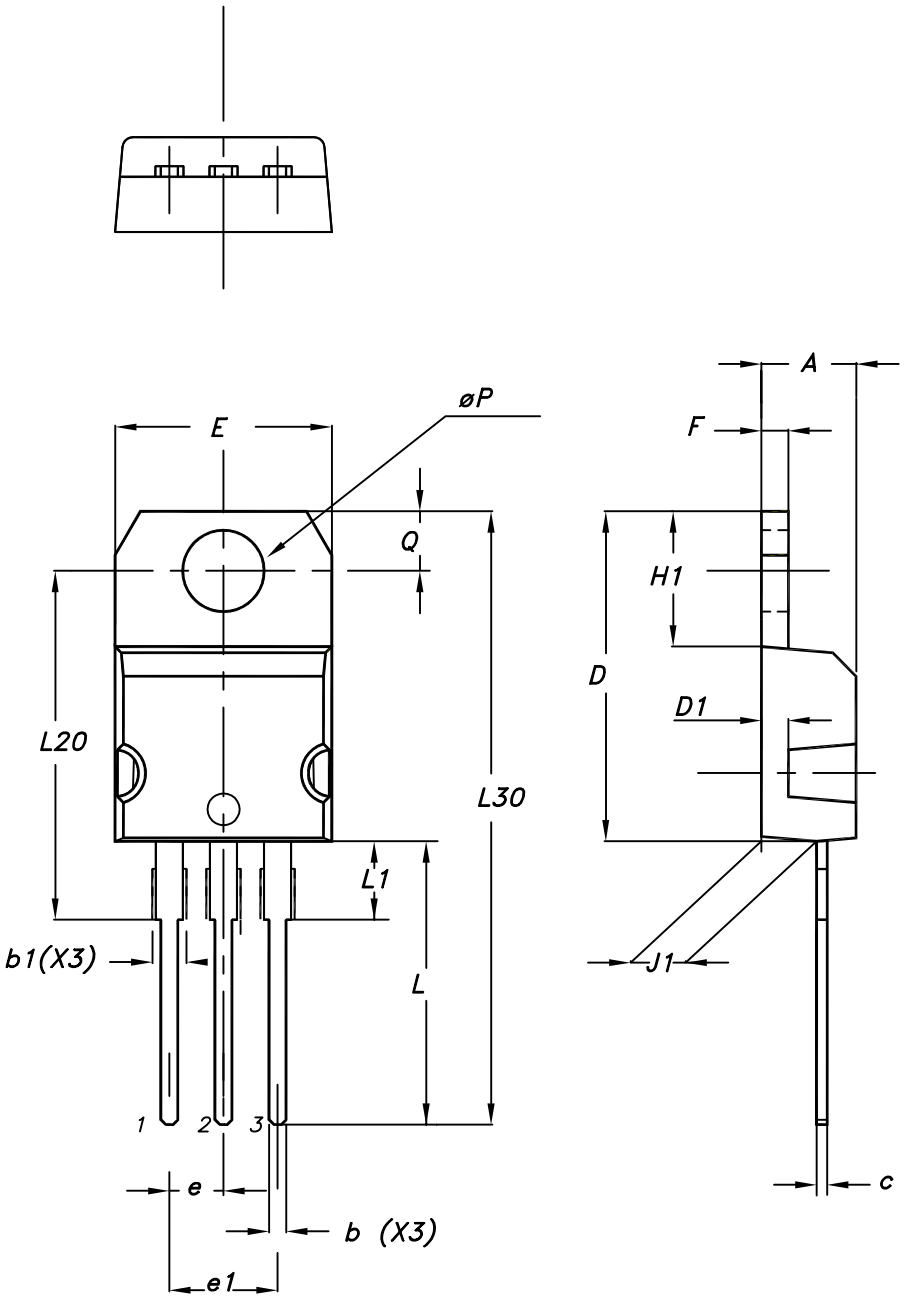

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Table 16. **TO-220 type A package mechanical data**

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 *Section 4: Package information* and *Section 4: Package information*. Minor text changes.
16-Apr-2015	6	Throughout document: – added DPAK package information – text and formatting updates Updated *Figure 1: Internal schematic diagram* Updated *Table 2: Absolute maximum ratings* Updated *Table 3: Thermal data* Updated and renamed *Table 5: Static* (was On/off states)
09-Aug-2018	7	Removed maturity status indication from cover page. The document status is production data. Updated Table 5. Dynamic. Updated Section 5 Package information. Minor text changes

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