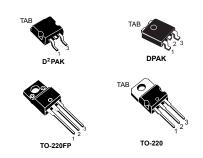
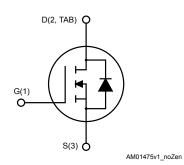
# **STB19NF20**, **STD19NF20 STF19NF20**, **STP19NF20**

**Datasheet** 

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





#### **Features**

Туре	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	l <sub>D</sub>	Package
STB19NF20		0.16 Ω 15 A	15.Λ	D <sup>2</sup> PAK
STD19NF20	200 V			DPAK
STF19NF20	200 V		137	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 striplayout-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

		Va		
Symbol	Parameter	D²PAK, DPAK, TO-220	TO-220FP	Unit
V <sub>DS</sub>	Drain-source voltage	20	00	
V <sub>GS</sub>	Gate-source voltage	±2	20	V
	Drain current (continuous) at T <sub>C</sub> = 25 °C	15	15 <sup>(1)</sup>	
l <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100 °C	9.45	9.45 <sup>(1)</sup>	A
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	60	60 <sup>(1)</sup>	Α
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, $T_C$ = 25 °C)		2.5	kV
dv/dt <sup>(3)</sup>	Peak diode recovery voltage slope	1	5	V/ns
T <sub>stg</sub>	Storage temperature range		. 150	°C
T <sub>j</sub>	Operating junction temperature range	-55 to 150		

- 1. This value is limited by package.
- 2. Pulse width is limited by safe operating area.
- 3.  $I_{SD} \le 15~A$ ,  $di/dt \le 300~A/\mu s$ ,  $V_{DD} = 80~\%~V_{(BR)DSS}$

Table 2. Thermal data

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

<sup>1.</sup> When mounted on an 1-inch2 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	Α
E <sub>AS</sub>	Single-pulse avalanche energy (starting $T_j = 25$ °C, $I_D = I_{AR}$ , $V_{DD} = 50$ V)	110	mJ

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## 2 Electrical characteristics

(T<sub>case</sub> = 25 °C unless otherwise specified)

**Table 4. Static** 

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	$V_{GS} = 0 \text{ V}, I_D = 1 \text{ mA}$	200			V	
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 200 V			1		
I <sub>DSS</sub>	Zero gate voltage drain current	$V_{GS} = 0 \text{ V}, V_{DS} = 200 \text{ V},$ $T_C = 125 ^{\circ}\text{C}^{(1)}$			10	μA	
I <sub>GSS</sub>	Gate-body leakage current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA	
V <sub>GS(th)</sub>	Gate threshold voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2	3	4	V	
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.5 A		0.11	0.16	Ω	

<sup>1.</sup> Defined by design, not subject to production test.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
C <sub>iss</sub>	Input capacitance		-	800	-	
C <sub>oss</sub>	Output capacitance	$V_{DS}$ = 25 V, f = 1 MHz, $V_{GS}$ = 0 V	-	165	-	pF
C <sub>rss</sub>	Reverse transfer capacitance		-	26	-	
Qg	Total gate charge	V <sub>DD</sub> = 160 V, I <sub>D</sub> = 15 A,	-	24	-	
Q <sub>gs</sub>	Gate-source charge	V <sub>GS</sub> = 0 to 10 V	-	4.4	-	nC
Q <sub>gd</sub>	Gate-drain charge	(see Figure 16. Test circuit for gate charge behavior)	-	11.6	-	

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> = 100 V, I <sub>D</sub> = 7.5 A,	-	11.5	-	
t <sub>r</sub>	Rise time	$R_G = 4.7 \Omega, V_{GS} = 10 V$	-	22	-	
t <sub>d(off)</sub>	Turn-off delay time	(see Figure 15. Test circuit for resistive load switching times and	_	19	-	ns
t <sub>f</sub>	Fall time	Figure 20. Switching time waveform)	-	11	-	

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I <sub>SD</sub>	Source-drain current		-		15	Α
I <sub>SDM</sub> <sup>(1)</sup>	Source-drain current (pulsed)		-		60	Α
V <sub>SD</sub> <sup>(2)</sup>	Forward on voltage	I <sub>SD</sub> = 15 A, V <sub>GS</sub> = 0 V	-		1.6	V

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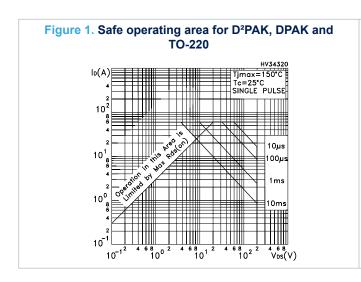
Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t <sub>rr</sub>	Reverse recovery time	$I_{SD} = 15 \text{ A, di/dt} = 100 \text{ A/}\mu\text{s,}$	-	125		ns
Q <sub>rr</sub>	Reverse recovery charge	V <sub>DD</sub> = 50 V	-	0.55		μC
I <sub>RRM</sub>	Reverse recovery current	(see Figure 17. Test circuit for inductive load switching and diode recovery times)	-	8.8		А
t <sub>rr</sub>	Reverse recovery time	$I_{SD} = 15 \text{ A, di/dt} = 100 \text{ A/}\mu\text{s,}$	-	148		ns
Q <sub>rr</sub>	Reverse recovery charge	$V_{DD}$ = 50 V, $T_j$ = 150 °C	-	0.73		μC
I <sub>RRM</sub>	Reverse recovery current	(see Figure 17. Test circuit for inductive load switching and diode recovery times)	-	9.9		Α

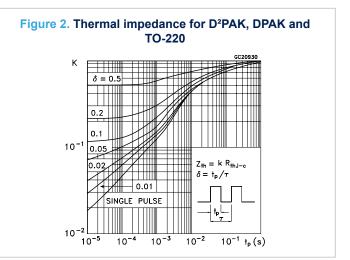
- 1. Pulse width is limited by safe operating area.
- 2. Pulse test: pulse duration = 300  $\mu$ s, duty cycle 1.5%.

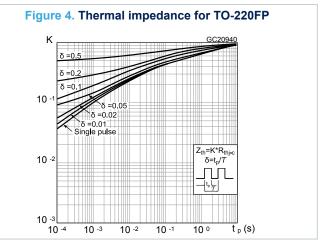
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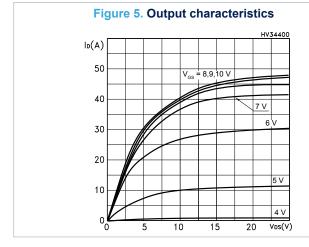


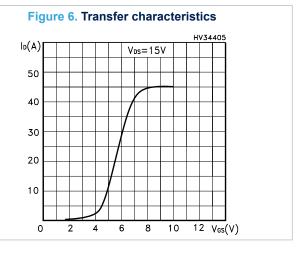
#### 2.1 Electrical characteristics (curves)











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Figure 7. Static drain-source on-resistance

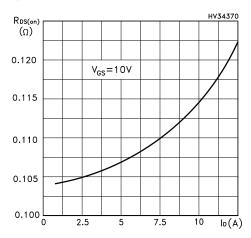


Figure 8. Normalized  $V_{(BR)DSS}$  vs temperature

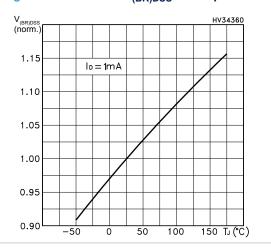


Figure 9. Gate charge vs gate-source voltage

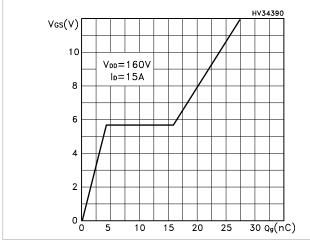


Figure 10. Capacitance variations

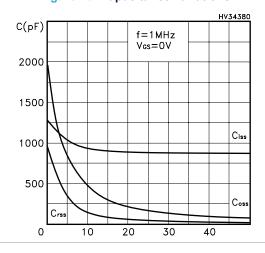


Figure 11. Normalized gate threshold voltage vs temperature

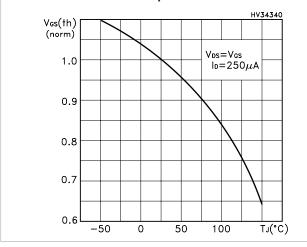
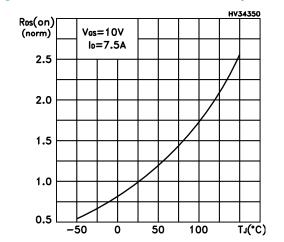


Figure 12. Normalized on-resistance vs temperature



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Figure 13. Source-drain diode forward characteristics

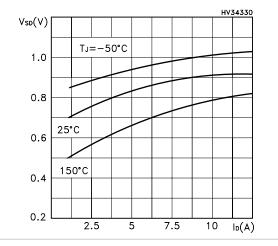
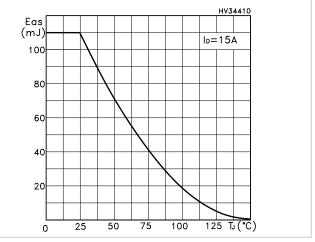


Figure 14. Maximum avalanche energy vs temperature



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### 3 Test circuits

Figure 15. Test circuit for resistive load switching times

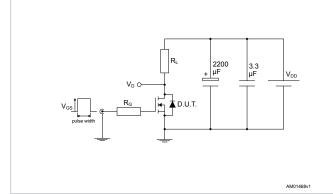


Figure 16. Test circuit for gate charge behavior

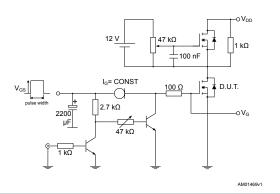


Figure 17. Test circuit for inductive load switching and diode recovery times

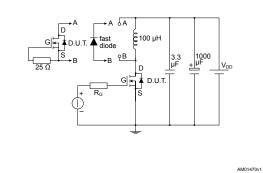


Figure 18. Unclamped inductive load test circuit

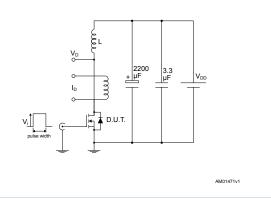


Figure 19. Unclamped inductive waveform

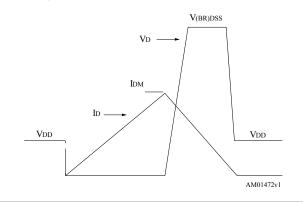
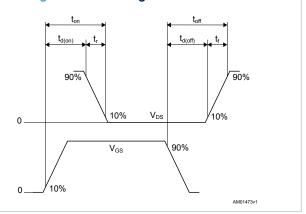


Figure 20. Switching time waveform



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# 4 Ordering information

Table 8. Order codes

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

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# 5 Package information

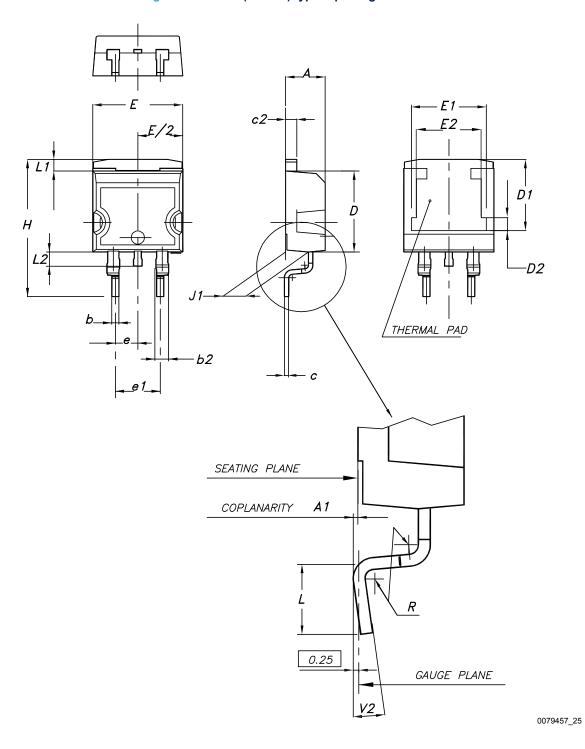
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

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## 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



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

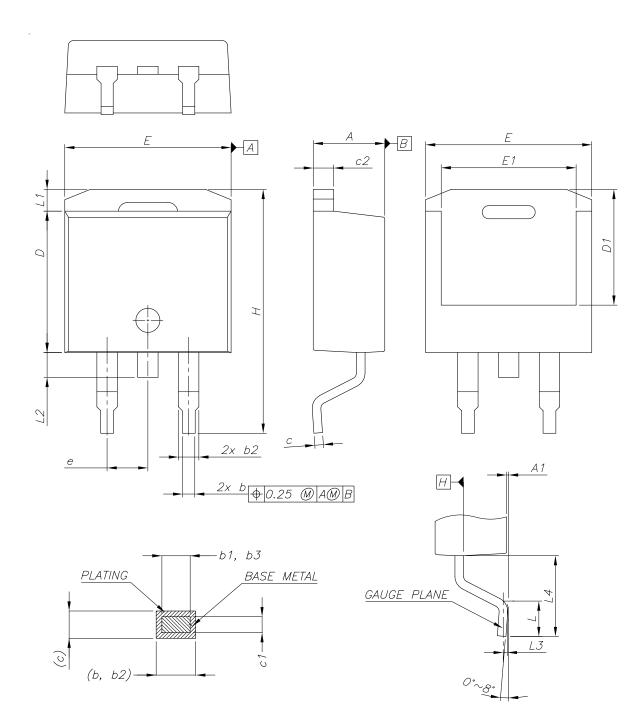
Dim.		mm	
DIM.	Min.	Тур.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
С	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
Е	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
е		2.54	
e1	4.88		5.28
Н	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75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

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# 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

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

Dim.	mm			
Dim.	Min.	Тур.	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	
С	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	
е		2.54 BSC		
Н	15.00		15.60	
L	1.90		2.50	
L1			1.65	
L2			1.78	
L3		0.25		
L4	4.78		5.28	

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9.75 16.9 2.54 5.08

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

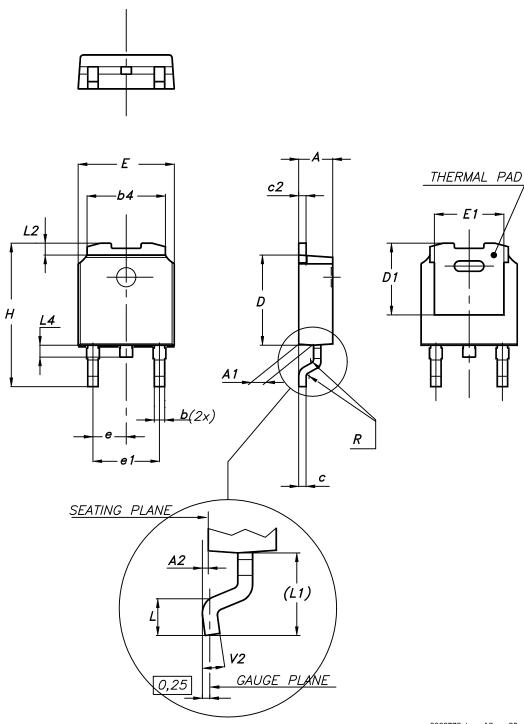
Footprint

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

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



0068772\_type-A2\_rev25

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

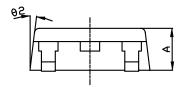
Dim.	mm			
	Min.	Тур.	Max.	
Α	2.20		2.40	
A1	0.90		1.10	
A2	0.03		0.23	
b	0.64		0.90	
b4	5.20		5.40	
С	0.45		0.60	
c2	0.48		0.60	
D	6.00		6.20	
D1	4.95	5.10	5.25	
E	6.40		6.60	
E1	5.10	5.20	5.30	
е	2.159	2.286	2.413	
e1	4.445	4.572	4.699	
Н	9.35		10.10	
L	1.00		1.50	
L1	2.60	2.80	3.00	
L2	0.65	0.80	0.95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

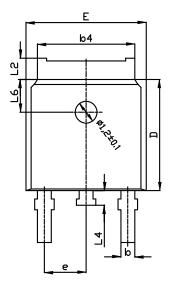
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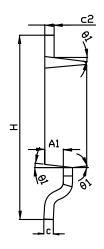


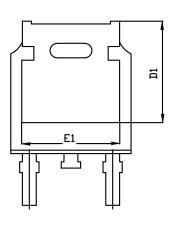
# 5.4 DPAK (TO-252) type C2 package information

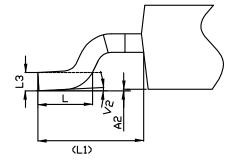
Figure 25. DPAK (TO-252) type C2 package outline











0068772\_C2\_25

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

Dim.	mm			
Dim.	Min.	Тур.	Max.	
Α	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	
С	0.47		0.60	
c2	0.47		0.60	
D	6.00	6.10	6.20	
D1	5.10		5.60	
Е	6.50	6.60	6.70	
E1	5.20		5.50	
е	2.186	2.286	2.386	
Н	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°	

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

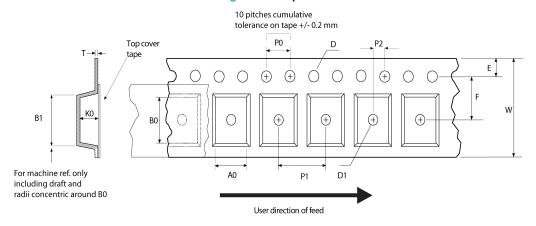
FP\_0068772\_25

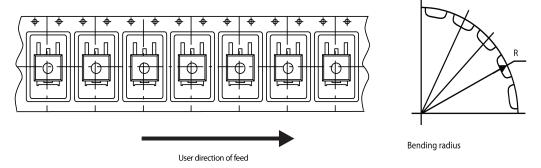
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## 5.5 D<sup>2</sup>PAK and DPAK packing information

Figure 27. Tape outline



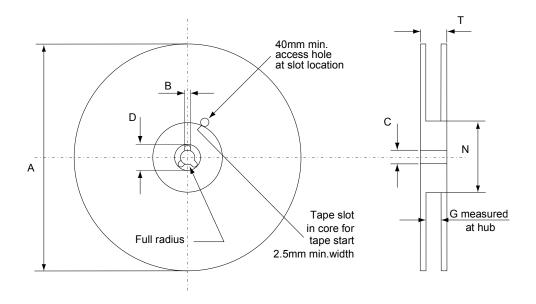


AM08852v1

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Figure 28. Reel outline



AM06038v1

Table 13. D2PAK tape and reel mechanical data

Таре		Reel			
Dim.	mm		Dim.	mm	
Dilli.	Min.	Max.	Dilli.	Min.	Max.
A0	10.5	10.7	А		330
В0	15.7	15.9	В	1.5	
D	1.5	1.6	С	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	Т		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base quantity 1		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
Т	0.25	0.35			
W	23.7	24.3			

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Table 14. DPAK tape and reel mechanical data

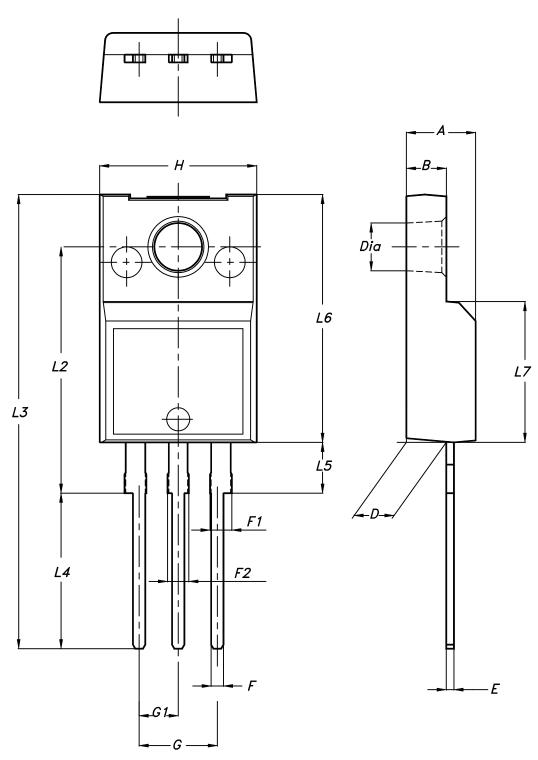
Таре		Reel				
Dim.	mm		Dim.	r	mm	
Diiii.	Min.	Max.	Diiii.	Min.	Max.	
A0	6.8	7	А		330	
В0	10.4	10.6	В	1.5		
B1		12.1	С	12.8	13.2	
D	1.5	1.6	D	20.2		
D1	1.5		G	16.4	18.4	
E	1.65	1.85	N	50		
F	7.4	7.6	Т		22.4	
K0	2.55	2.75				
P0	3.9	4.1	Base qty.		2500	
P1	7.9	8.1	Bull	k qty.	2500	
P2	1.9	2.1				
R	40					
Т	0.25	0.35				
W	15.7	16.3				

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# 5.6 TO-220FP package information

Figure 29. TO-220FP package outline



7012510\_Rev\_12\_B

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Table 15. TO-220FP package mechanical data

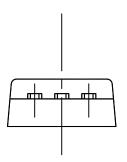
Dim.	mm			
Dilli.	Min.	Тур.	Max.	
Α	4.4		4.6	
В	2.5		2.7	
D	2.5		2.75	
E	0.45		0.7	
F	0.75		1	
F1	1.15		1.70	
F2	1.15		1.70	
G	4.95		5.2	
G1	2.4		2.7	
Н	10		10.4	
L2		16		
L3	28.6		30.6	
L4	9.8		10.6	
L5	2.9		3.6	
L6	15.9		16.4	
L7	9		9.3	
Dia	3		3.2	

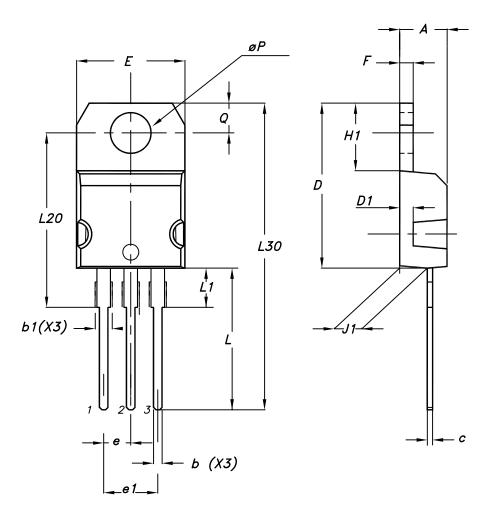
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# 5.7 TO-220 type A package information

Figure 30. TO-220 type A package outline





0015988\_typeA\_Rev\_21

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Table 16. TO-220 type A package mechanical data

Dim.	mm			
	Min.	Тур.	Max.	
А	4.40		4.60	
b	0.61		0.88	
b1	1.14		1.55	
С	0.48		0.70	
D	15.25		15.75	
D1		1.27		
E	10.00		10.40	
е	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		
øΡ	3.75		3.85	
Q	2.65		2.95	

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# **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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