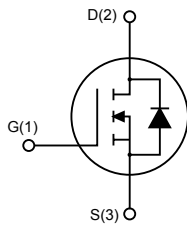
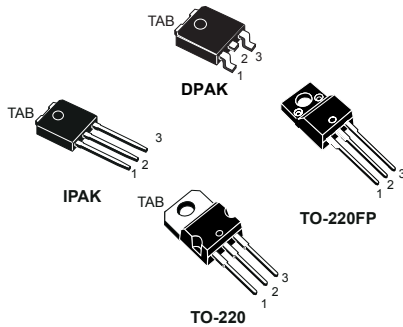


N-channel 800 V, 0.95 Ω typ., 6.5 A MDmesh™ II Power MOSFETs in DPAK, IPAK, TO-220FP and TO-220 packages



AM01475v1_noZen_noTab

Features

Order codes	V_{DS}	$R_{DS(on)max.}$	I_D
STD7NM80	800 V	1.05 Ω	6.5 A
STD7NM80-1			
STF7NM80			
STP7NM80			

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Applications

- Switching applications

Description

These devices are N-channel Power MOSFETs developed using the second generation of MDmesh™ technology. These revolutionary Power MOSFETs associate a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. They are therefore suitable for the most demanding high-efficiency converters.

Product status

STD7NM80
STD7NM80-1
STF7NM80
STP7NM80

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		DPAK, IPAK, TO-220	TO-220FP	
V_{DS}	Drain-source voltage	800		V
V_{GS}	Gate-source voltage	±30		V
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$	6.5	6.5 ⁽¹⁾	A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	4	4 ⁽¹⁾	A
$I_{DM}^{(2)}$	Drain current (pulsed)	26	26 ⁽¹⁾	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	90	25	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$; $T_C = 25\text{ °C}$)		2.5	kV
T_j	Operating junction temperature range	-55 to 150		°C
T_{stg}	Storage temperature range			

1. Limited by maximum junction temperature.
2. Pulse width limited by safe operating area.

Table 2. Thermal data

Symbol	Parameter	Value				Unit
		DPAK	IPAK	TO-220FP	TO-220	
$R_{thj-case}$	Thermal resistance junction-case	1.4		5	1.4	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient		100	62.5		°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	50				°C/W

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

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_{jmax})	1	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AS}$, $V_{DD} = 50\text{ V}$)	240	mJ

2 Electrical characteristics

($T_{CASE} = 25\text{ °C}$ 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	$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$			10	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$, $T_C = 125\text{ °C}^{(1)}$			100	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 30\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 3.25\text{ A}$		0.95	1.05	Ω

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

Table 5. Dynamic

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	620	-	μF
C_{oss}	Output capacitance			460		
C_{riss}	Reverse transfer capacitance			15		
R_g	Gate input resistance	$f = 1\text{ MHz}$ open drain	-	7	-	Ω
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 6.5\text{ A}$, $V_{GS} = 0$ to 10 V (see Figure 17. Test circuit for gate charge behavior)	-	18	-	nC
Q_{gs}	Gate-source charge			4		
Q_{gd}	Gate-drain charge			11		

Table 6. Switching times

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$, $I_D = 3.25\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 16. Test circuit for resistive load switching times and Figure 21. Switching time waveform)	-	20	-	ns
t_r	Rise time			8		
$t_{d(off)}$	Turn-off delay time			35		
t_f	Fall time			10		

Table 7. Source-drain diode

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		6.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				26	

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 6.5 \text{ A}$, $V_{GS} = 0 \text{ V}$	-		1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 6.5 \text{ A}$, $di/dt = 100 \text{ V}$ $V_{DD} = 50 \text{ V}$ (see Figure 18. Test circuit for inductive load switching and diode recovery times)	-	460		ns
Q_{rr}	Reverse recovery charge			4		μC
I_{RRM}	Reverse recovery current			17		A
t_{rr}	Reverse recovery time	$I_{SD} = 6.5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 50 \text{ V}$ (see Figure 18. Test circuit for inductive load switching and diode recovery times)	-	680		ns
Q_{rr}	Reverse recovery charge			6		μC
I_{RRM}	Reverse recovery current			17		A

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

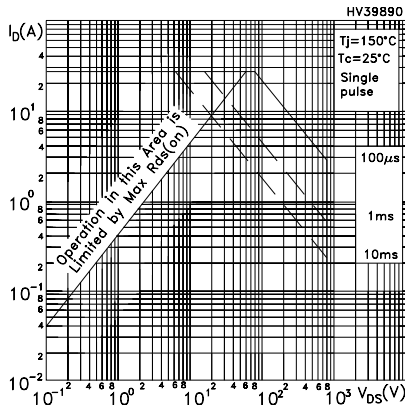
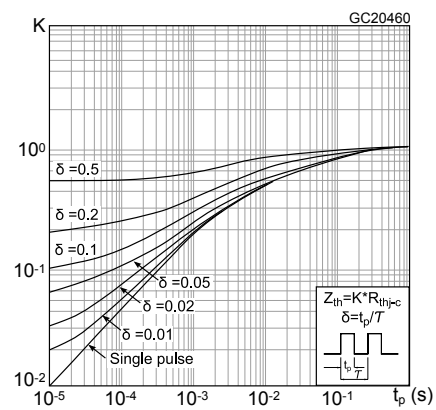
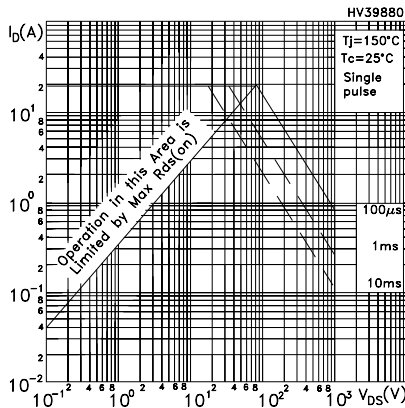
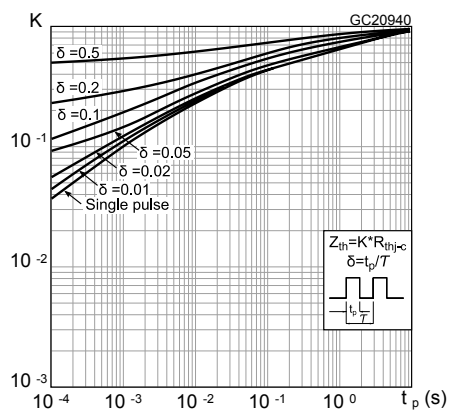
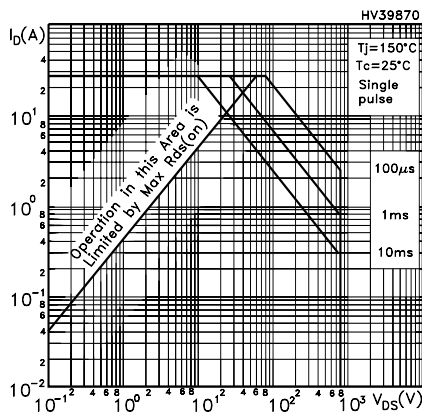
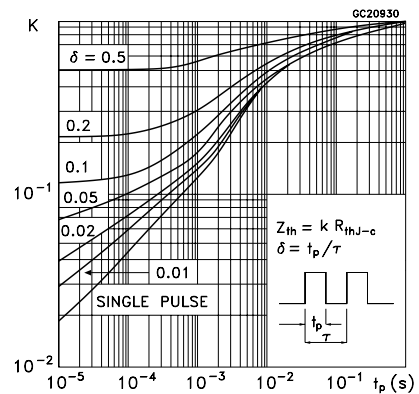
2.1 Electrical characteristics (curves)
Figure 1. Safe operating area for DPAK and IPAK

Figure 2. Thermal impedance for DPAK and IPAK

Figure 3. Safe operating area for TO-220FP

Figure 4. Thermal impedance for TO-220FP

Figure 5. Safe operating area for TO-220

Figure 6. Thermal impedance for TO-220


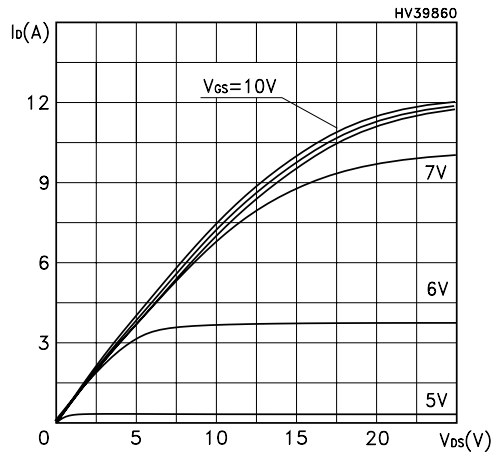
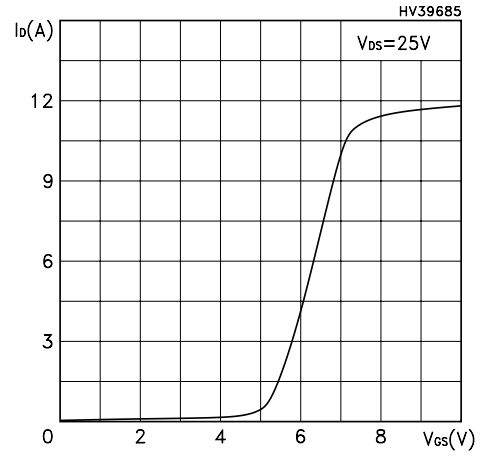
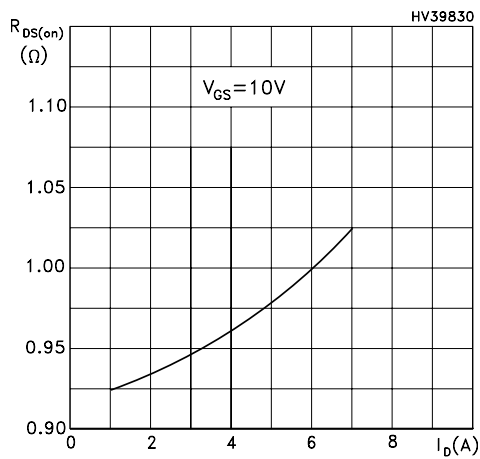
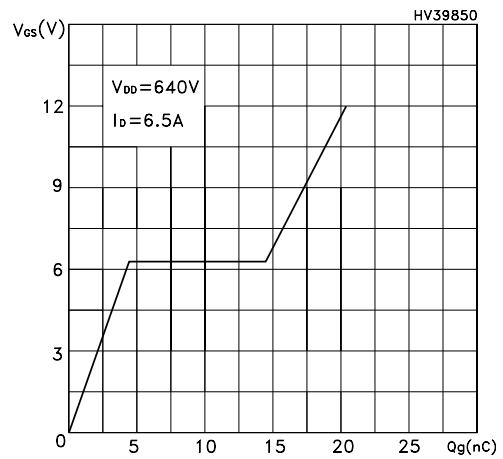
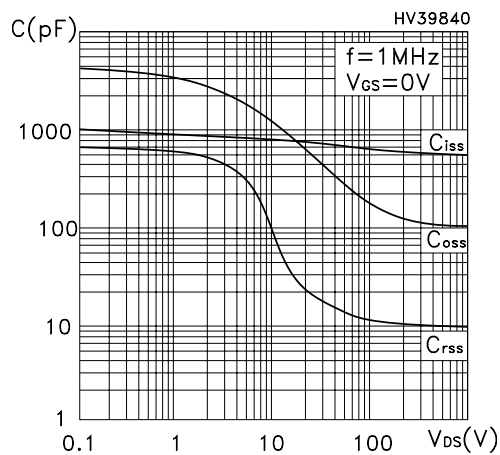
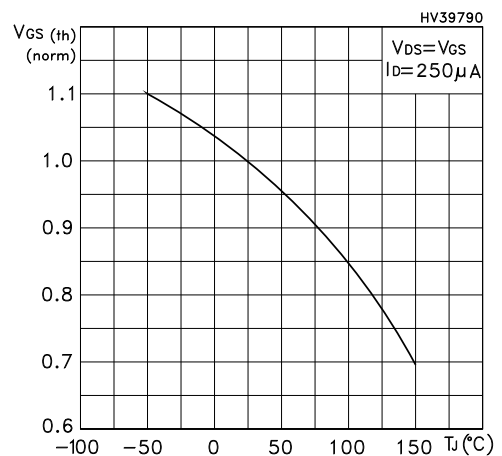
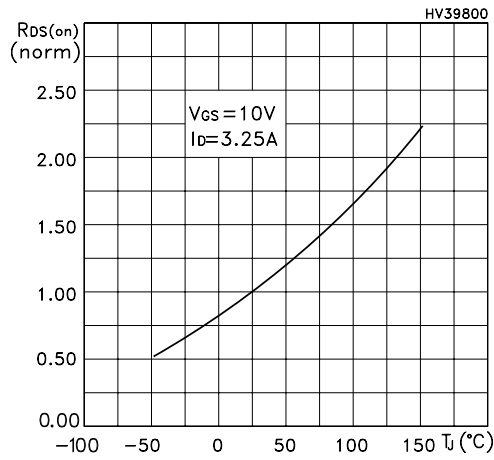
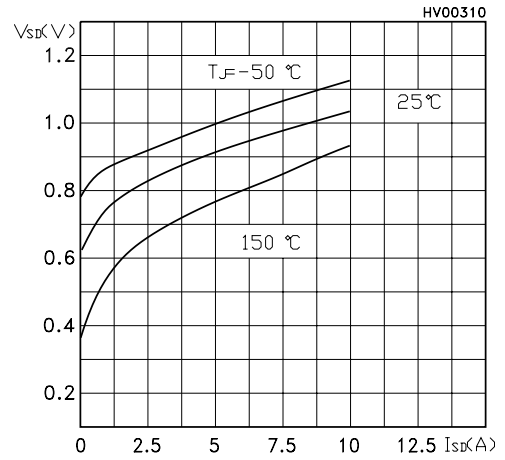
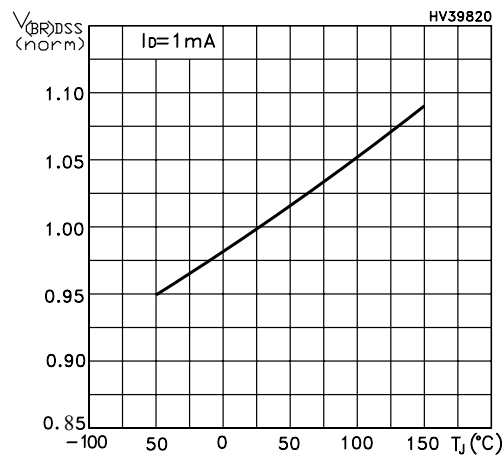
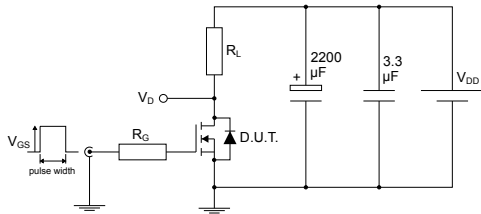
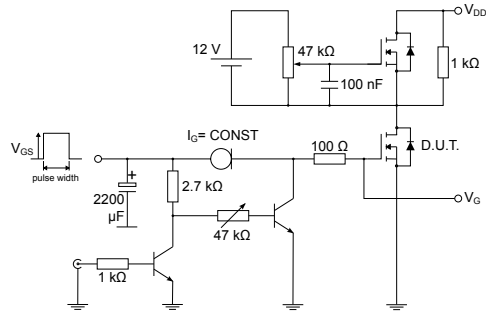
Figure 7. Output characteristics

Figure 8. Transfer characteristics

Figure 9. Static drain-source on-resistance

Figure 10. Gate charge vs gate-source voltage

Figure 11. Capacitance variations

Figure 12. Normalized gate threshold voltage vs temperature


Figure 13. Normalized on-resistance vs temperature

Figure 14. Source-drain diode forward characteristics

Figure 15. Normalized $V_{(BR)DSS}$ vs temperature


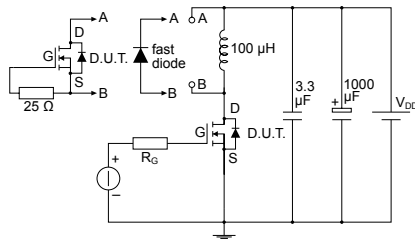
3 Test circuits

Figure 16. Test circuit for resistive load switching times


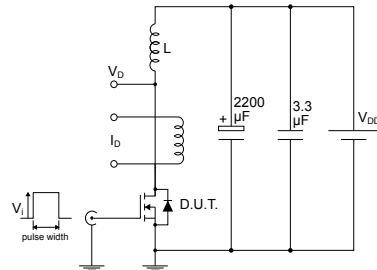
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Figure 17. Test circuit for gate charge behavior


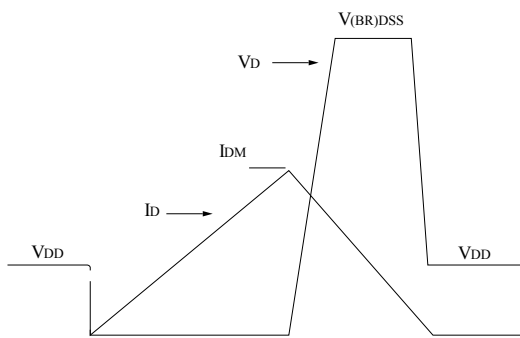
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Figure 18. Test circuit for inductive load switching and diode recovery times


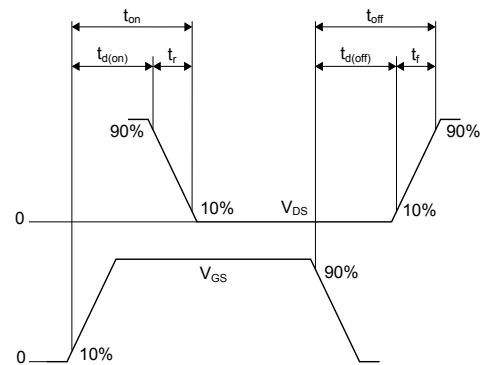
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Figure 19. Unclamped inductive load test circuit


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Figure 20. Unclamped inductive waveform


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Figure 21. Switching time waveform


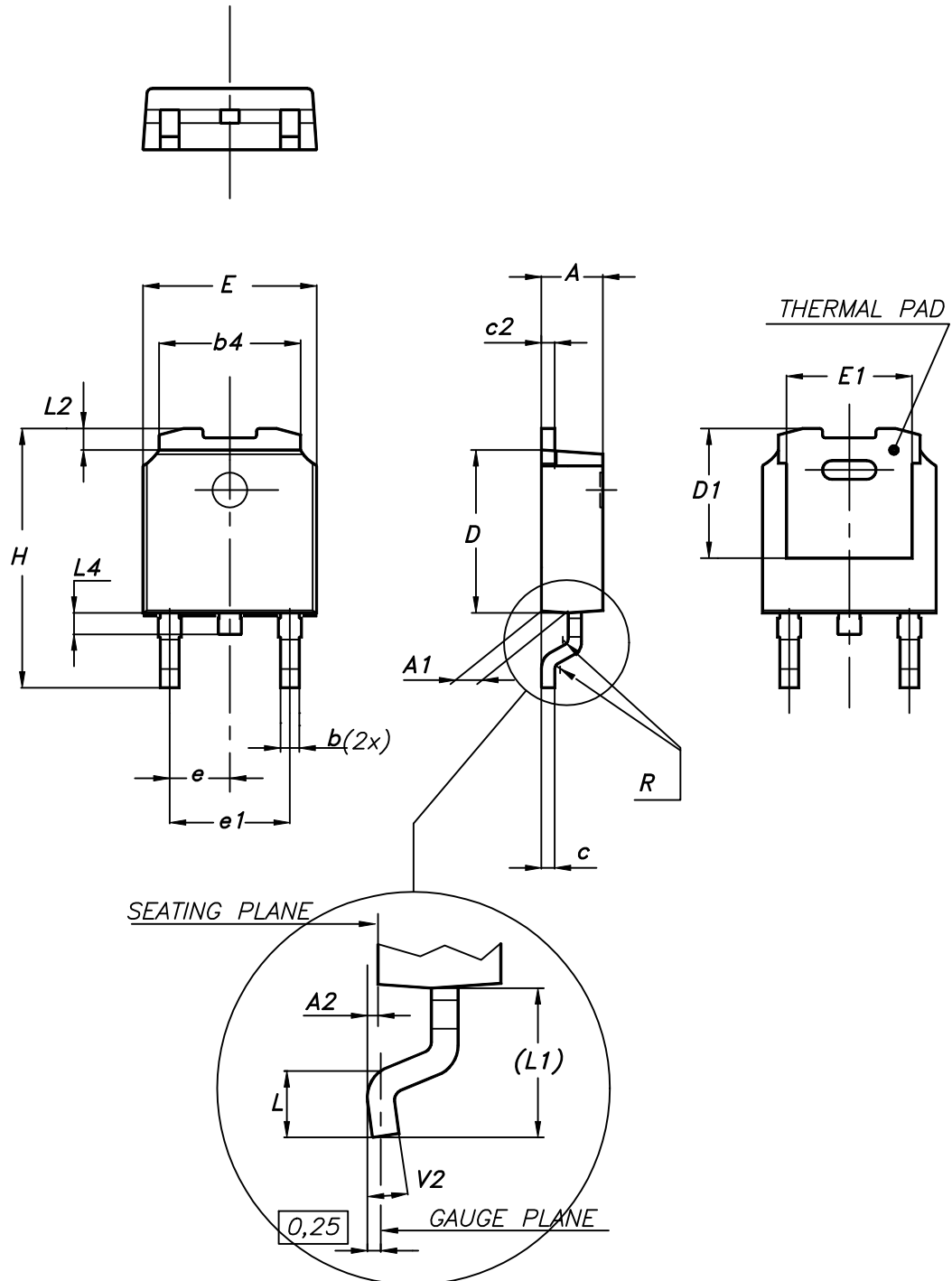
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4 Package information

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.

4.1 DPAK (TO-252) type A2 package information

Figure 22. DPAK (TO-252) type A2 package outline

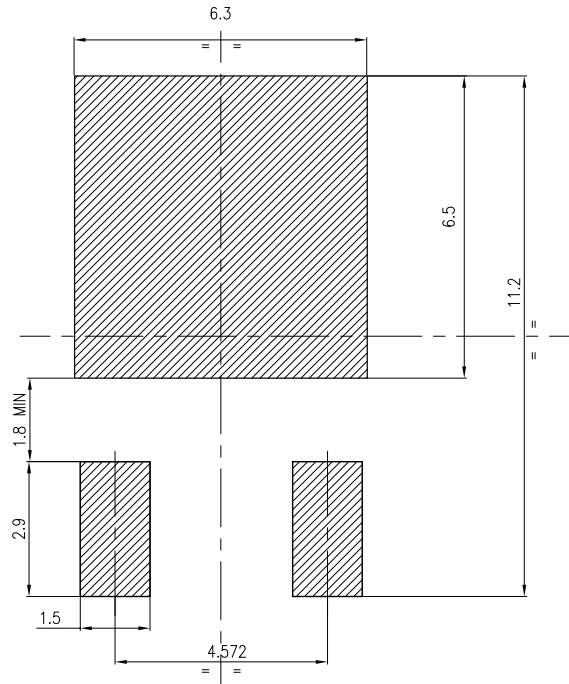


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Table 8. DPAK (TO-252) type A2 mechanical data

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°

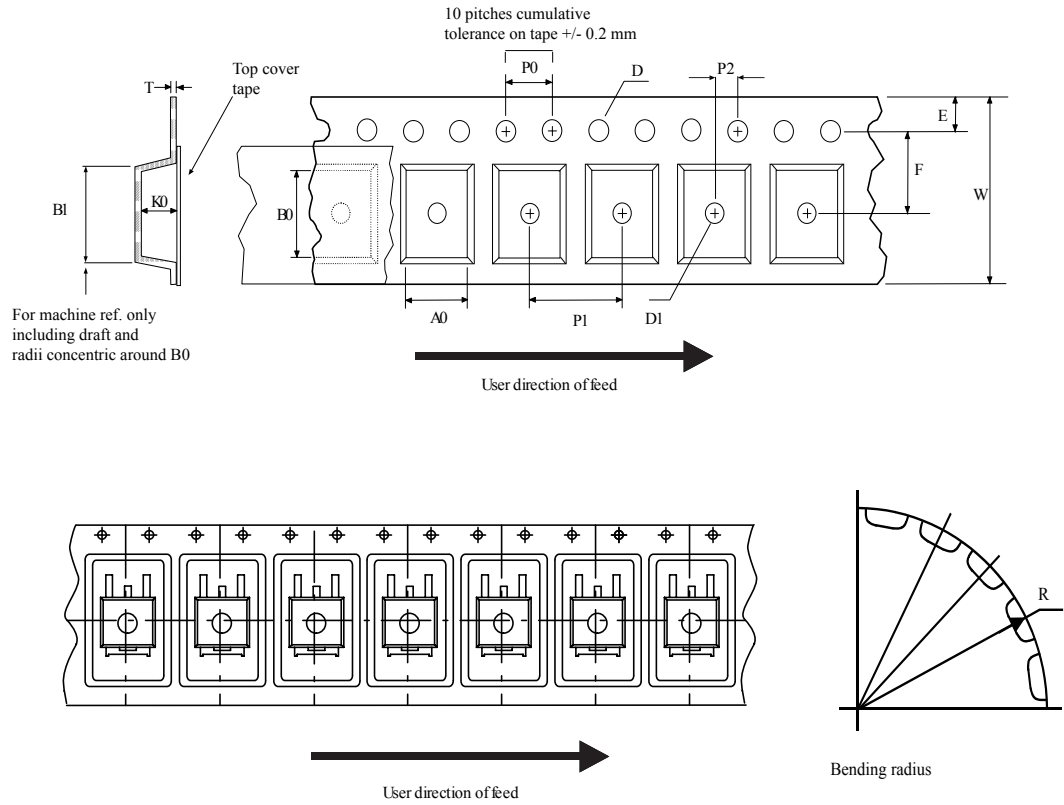
Figure 23. DPAK (TO-252) recommended footprint (dimensions are in mm)



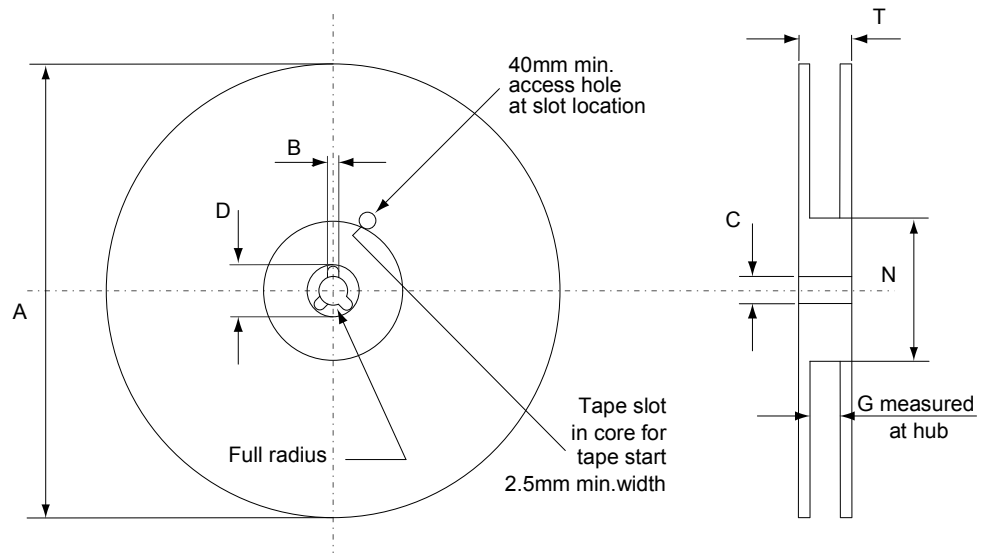
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4.2 DPAK (TO-252) packing information

Figure 24. DPAK (TO-252) tape outline



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Figure 25. DPAK (TO-252) reel outline


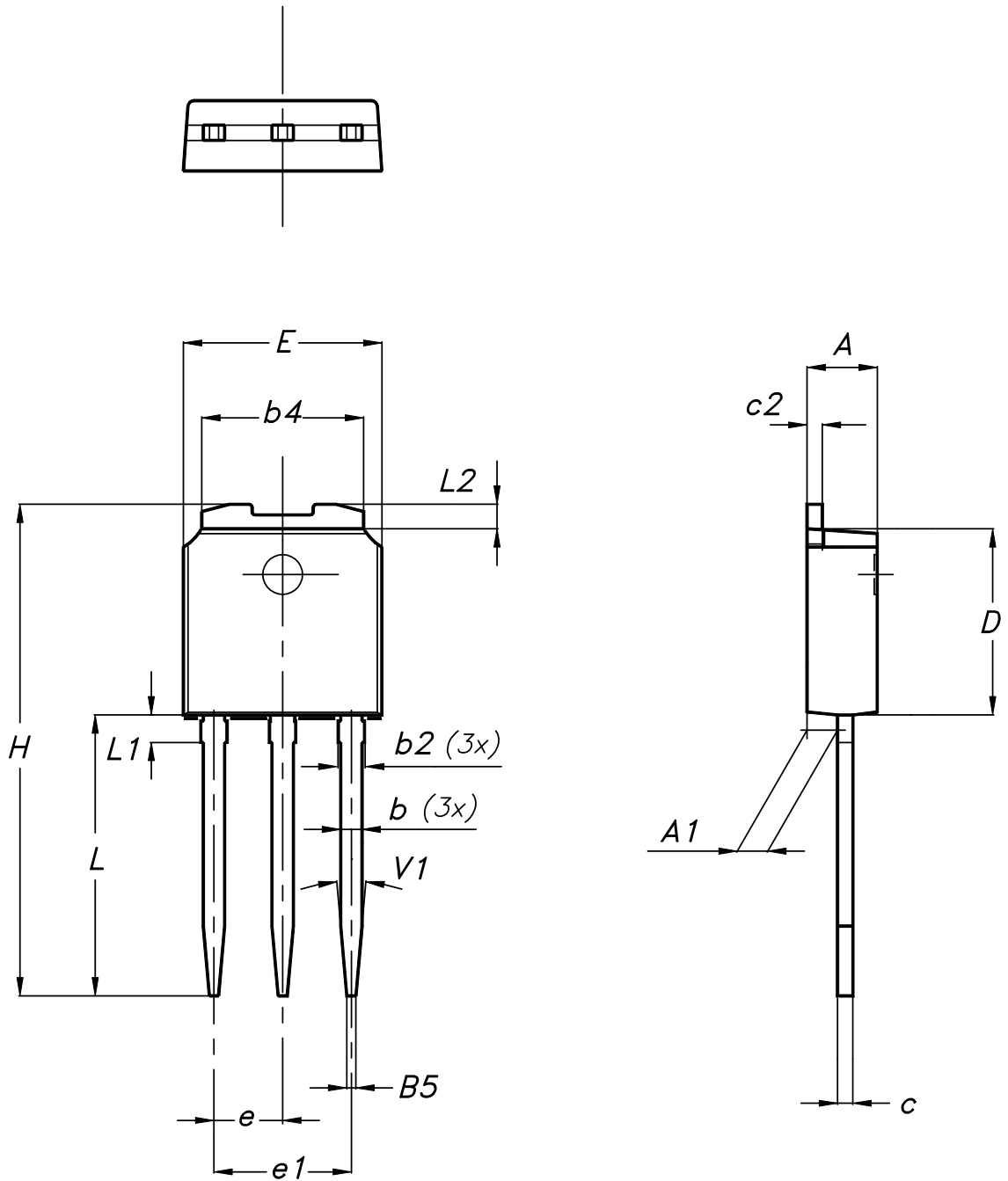
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Table 9. DPAK (TO-252) tape and reel mechanical data

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			

4.3 IPAk (TO-251) type A package information

Figure 26. IPAk (TO-251) type A package outline



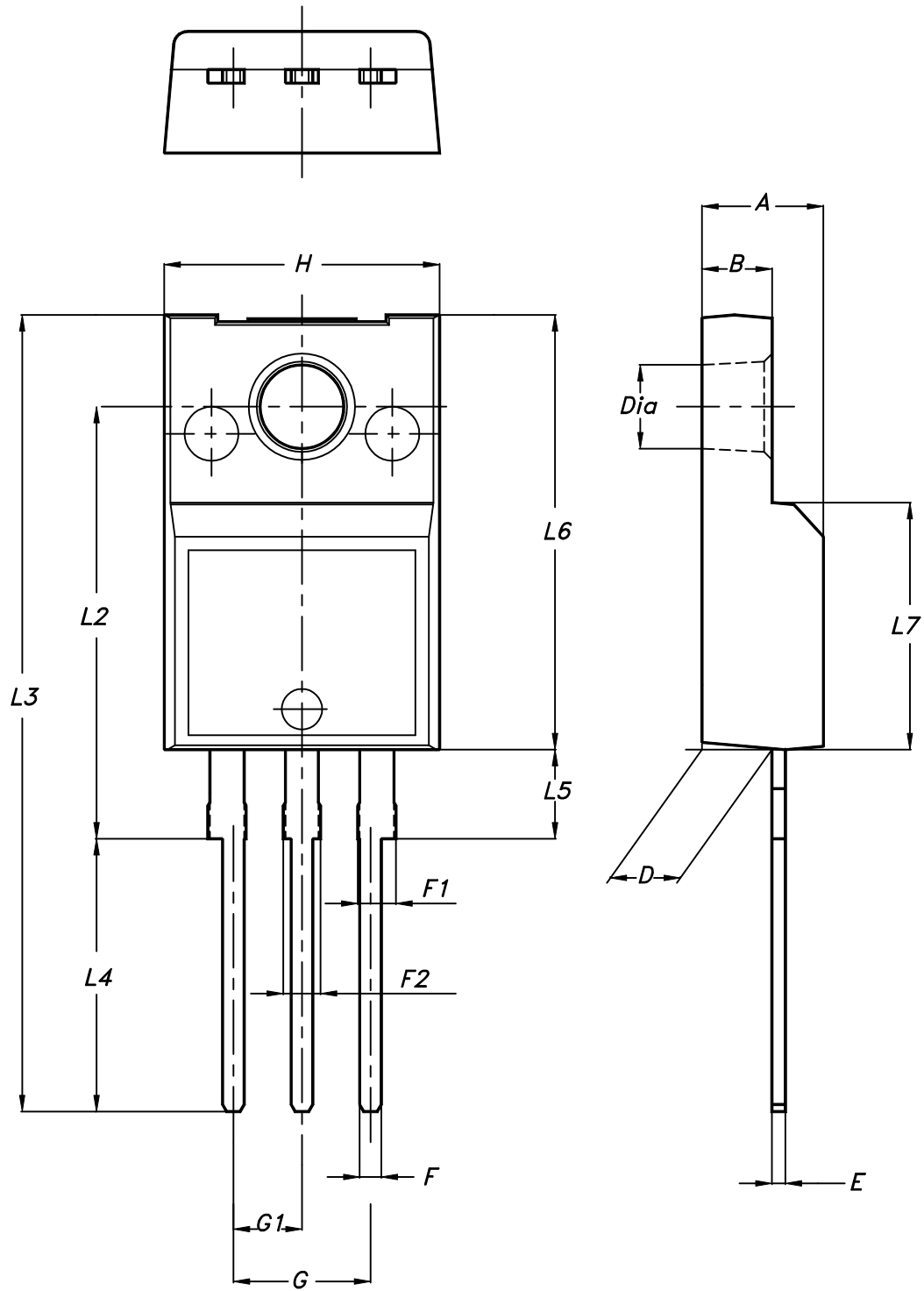
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Table 10. IPAK (TO-251) type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.30	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10°	

4.4 TO-220FP package information

Figure 27. TO-220FP package outline



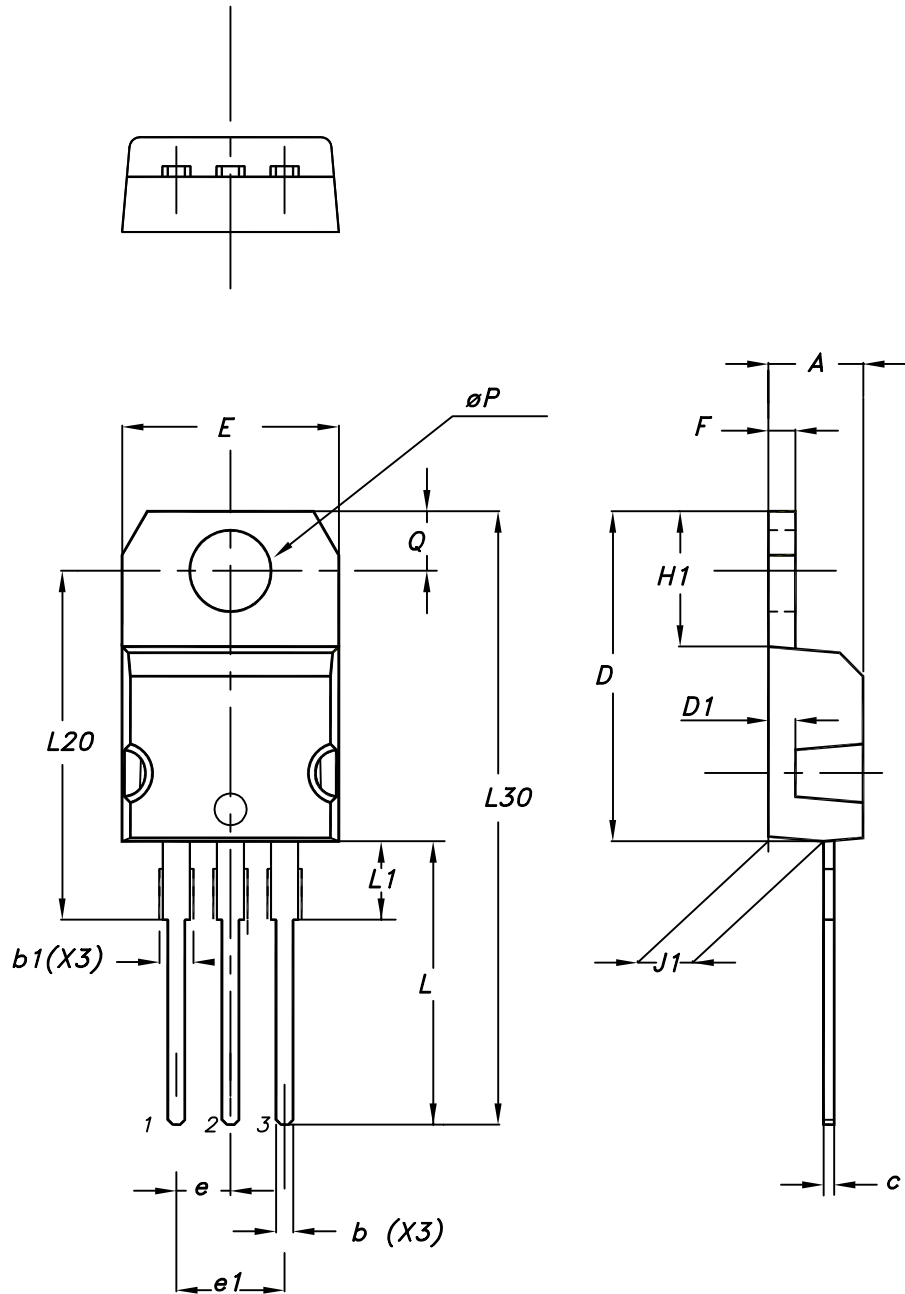
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Table 11. TO-220FP package mechanical data

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

4.5 TO-220 type A package information

Figure 28. TO-220 type A package outline



0015988_typeA_Rev_21

Table 12. 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

5 Ordering information

Table 13. Order codes

Order code	Marking	Package	Packing
STD7NM80	D7NM80	DPAK	Tape and reel
STD7NM80-1	D7NM80	IPAK	Tube
STF7NM80	F7NM80	TO-220FP	
STP7NM80	P7NM80	TO-220	

Revision history

Table 14. Document revision history

Date	Version	Changes
22-Sep-2006	1	First release.
09-Oct-2007	2	Added new section: <i>Electrical characteristics (curves)</i> .
02-Oct-2009	3	Corrected marking and description on first page.
20-Aug-2018	4	Updated Section 4 Package information . Minor text changes.

Contents

1	Electrical ratings	2
2	Electrical characteristics	3
2.1	Electrical characteristics (curves)	5
3	Test circuits	8
4	Package information	9
4.1	DPAK (TO-252) type A2 package information	9
4.2	DPAK (TO-252) packing information	12
4.3	IPAK (TO-251) type A package information	14
4.4	TO-220FP package information	16
4.5	TO-220 type A package information	18
5	Ordering information	21
	Revision history	22



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