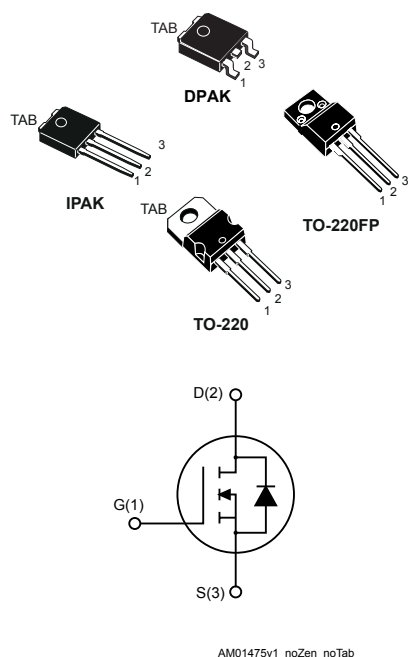


N-channel 800 V, 0.95 Ω typ., 6.5 A MDmesh™ II Power MOSFETs in DPAK, IPAK, TO-220FP and TO-220 packages



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 $T_C = 25\text{ }^{\circ}\text{C}$	6.5	6.5 ⁽¹⁾	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	4	4 ⁽¹⁾	A
$I_{DM}^{(2)}$	Drain current (pulsed)	26	26 ⁽¹⁾	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	90	25	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$; $T_C = 25\text{ }^{\circ}\text{C}$)		2.5	kV
T_j	Operating junction temperature range	-55 to 150		$^{\circ}\text{C}$
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	$^{\circ}\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-ambient		100	62.5		$^{\circ}\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	50				$^{\circ}\text{C/W}$

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 $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AS}$, $V_{DD} = 50\text{ V}$)	240	mJ

2 Electrical characteristics

($T_{CASE} = 25\text{ }^{\circ}\text{C}$ 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
		$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$			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	-	pF
C_{oss}	Output capacitance			460		
C_{rss}	Reverse transfer capacitance			15		
R_g	Gate input resistance	$f = 1\text{ MHz}$ open drain	-	7	-	Ω
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 6.5\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (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 A, V _{GS} = 0 V	-		1.3	V
t _{rr}	Reverse recovery time	I _{SD} = 6.5 A, di/dt = 100 V	-	460		ns
Q _{rr}	Reverse recovery charge	V _{DD} = 50 V (see Figure 18. Test circuit for inductive load switching and diode recovery times)		4		μC
I _{RRM}	Reverse recovery current			17		A
t _{rr}	Reverse recovery time	I _{SD} = 6.5 A, di/dt = 100 A/μs	-	680		ns
Q _{rr}	Reverse recovery charge	V _{DD} = 50 V (see Figure 18. Test circuit for inductive load switching and diode recovery times)		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)

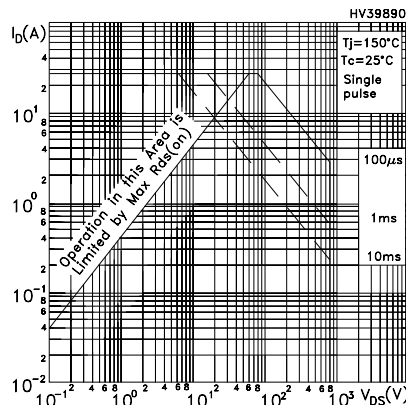
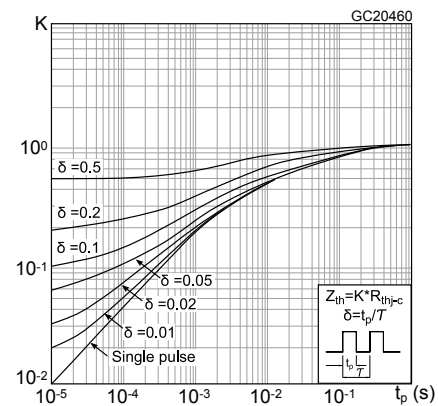
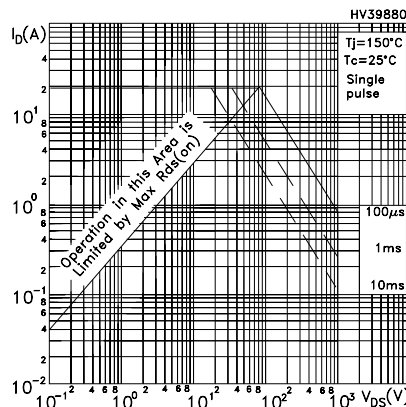
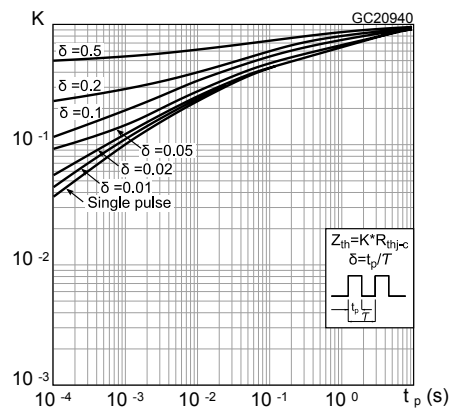
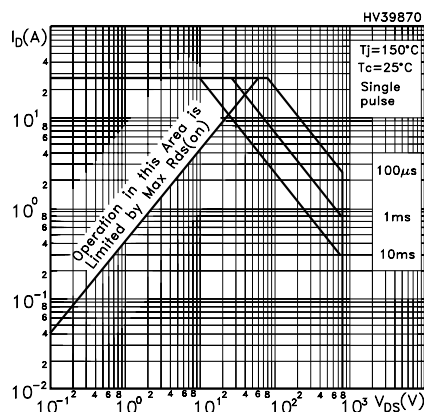
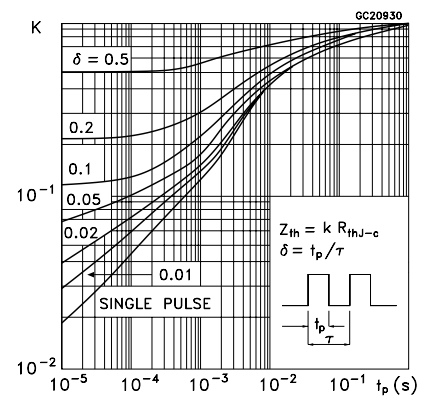
Figure 1. Safe operating area for DPAK and IPAK

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


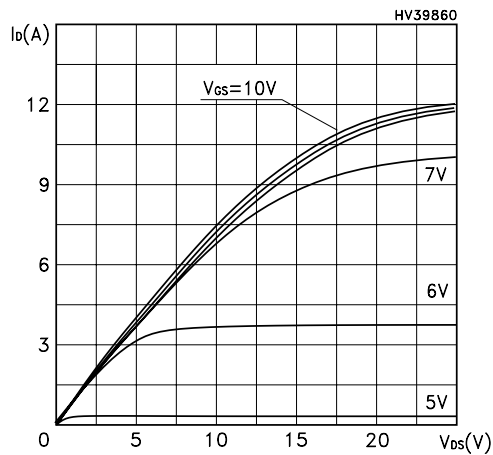
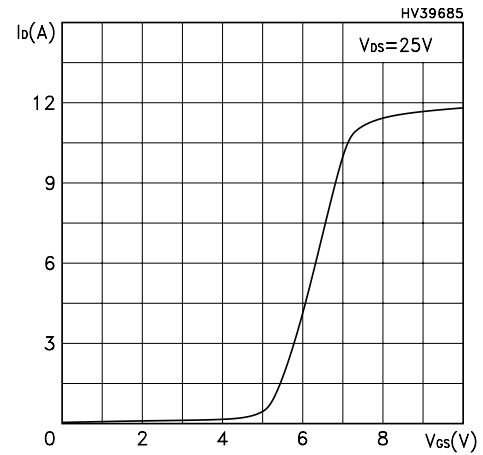
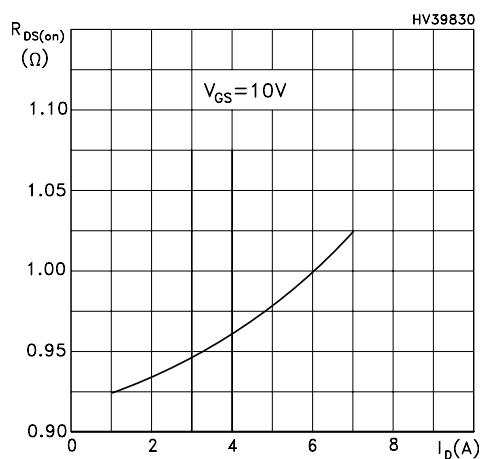
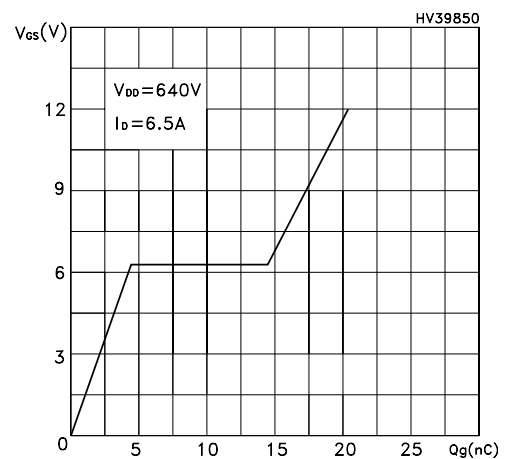
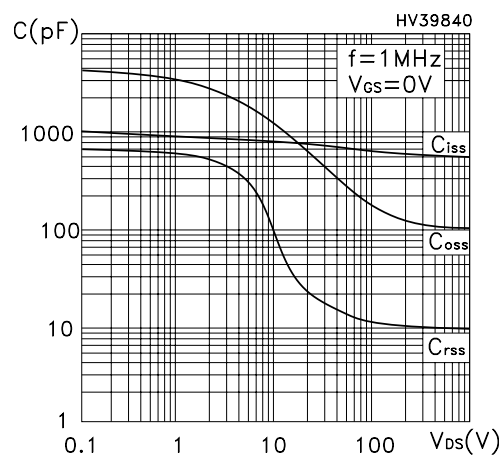
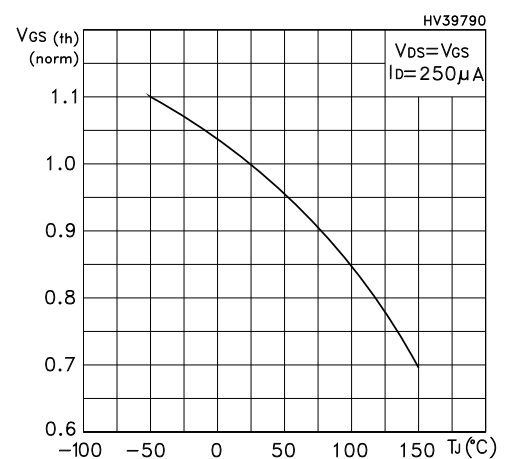
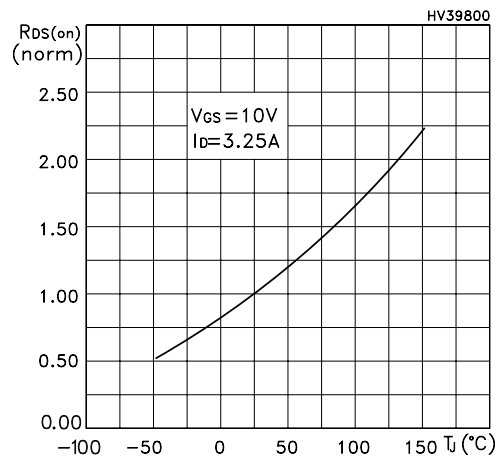
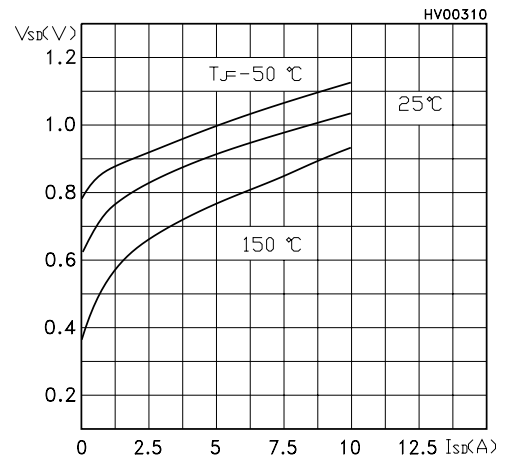
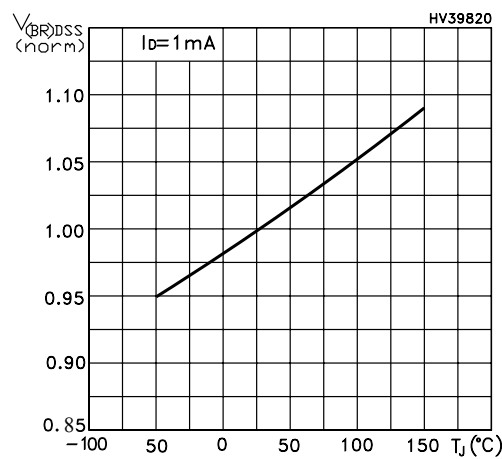
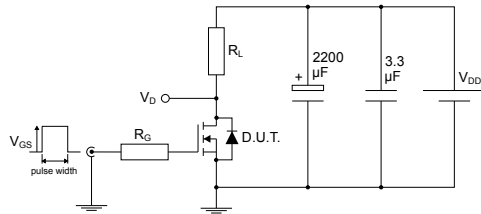
Figure 7. Output characteristics

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


AM01468v1

Figure 17. Test circuit for gate charge behavior


AM01469v1

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


AM01470v1

Figure 19. Unclamped inductive load test circuit


AM01471v1

Figure 20. Unclamped inductive waveform


AM01472v1

Figure 21. Switching time waveform

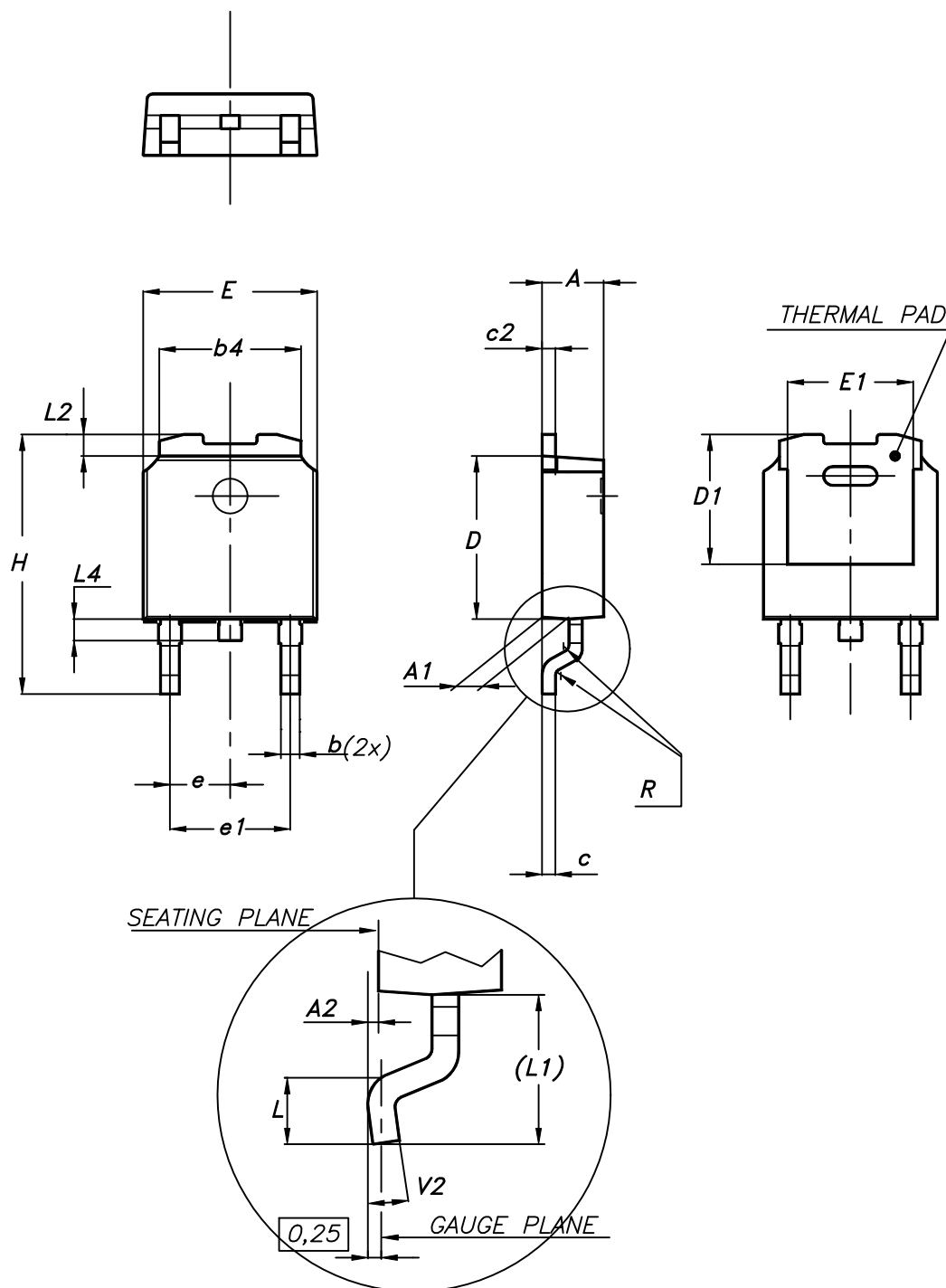

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4 Package information

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

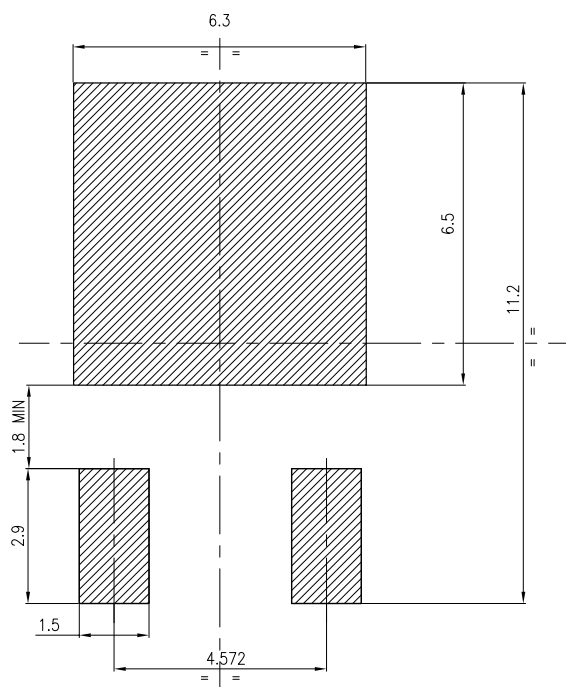


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Table 8. DPAK (TO-252) type A2 mechanical data

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°

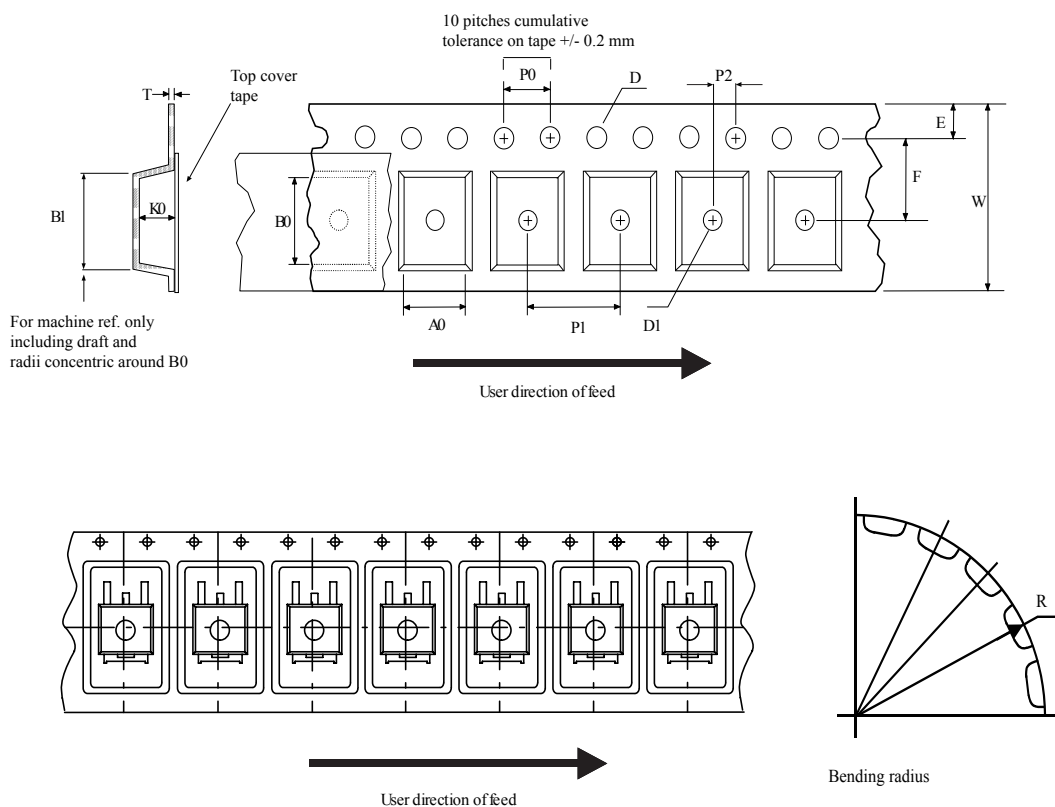
Figure 23. DPAK (TO-252) recommended footprint (dimensions are in mm)



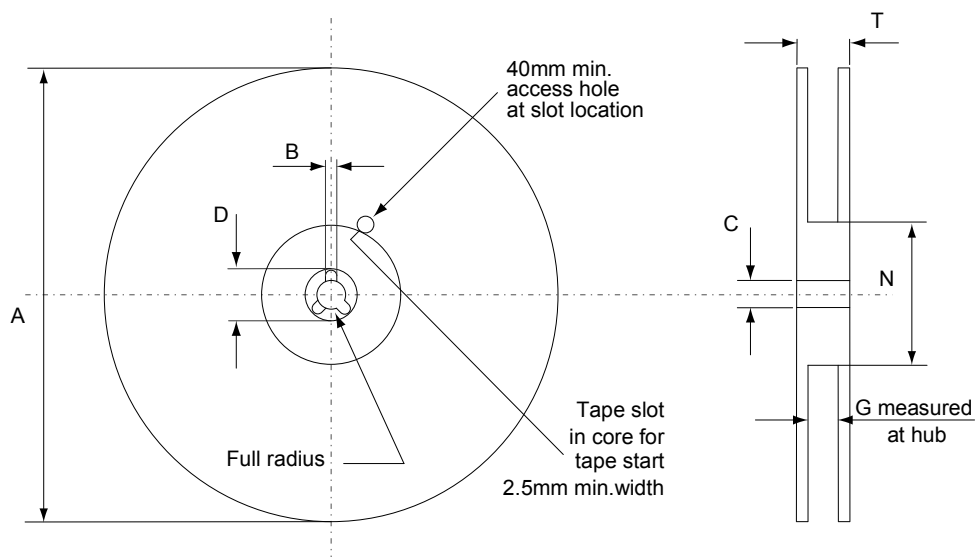
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4.2 DPAK (TO-252) packing information

Figure 24. DPAK (TO-252) tape outline



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Figure 25. DPAK (TO-252) reel outline


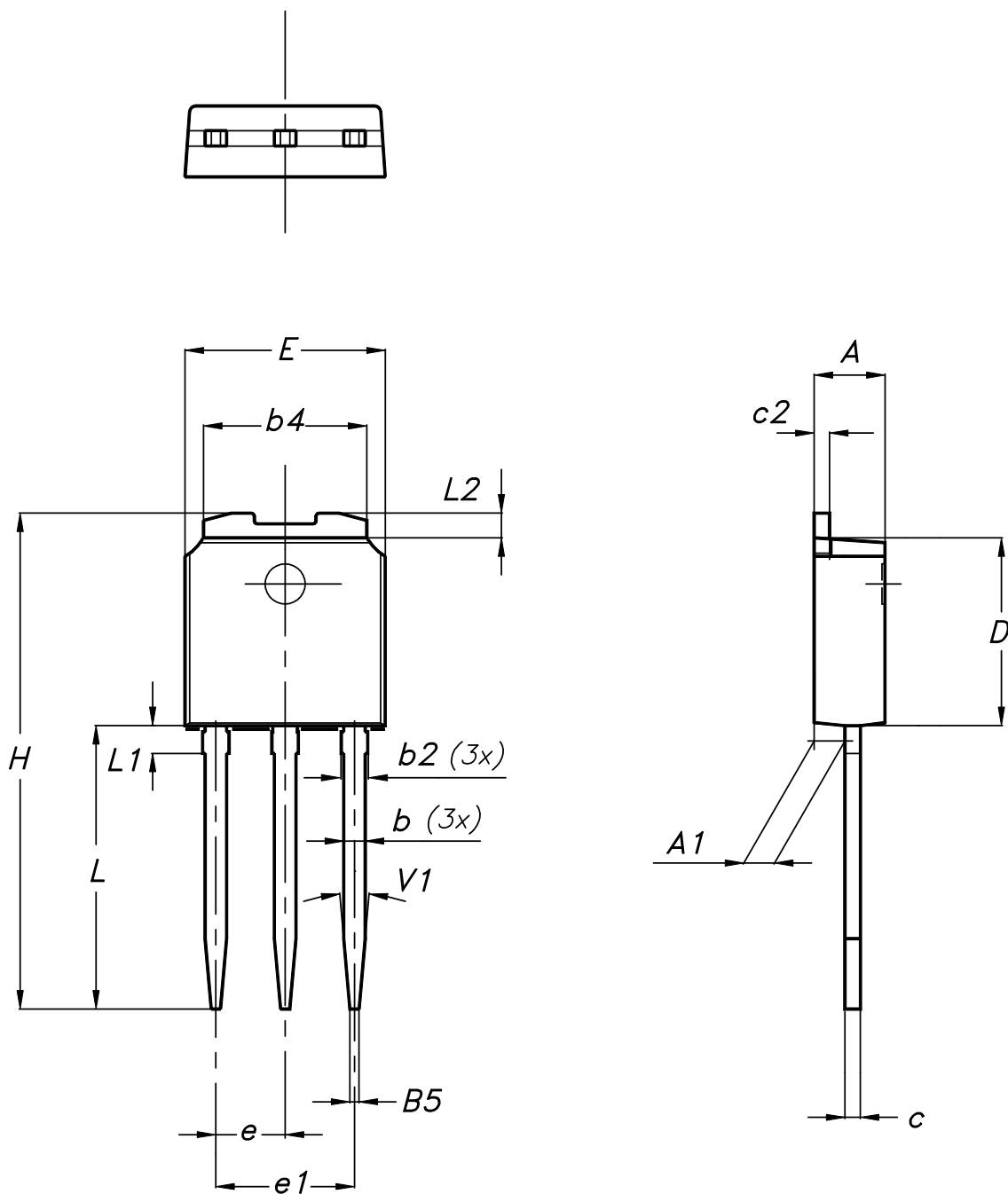
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Table 9. DPAK (TO-252) tape and reel mechanical data

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



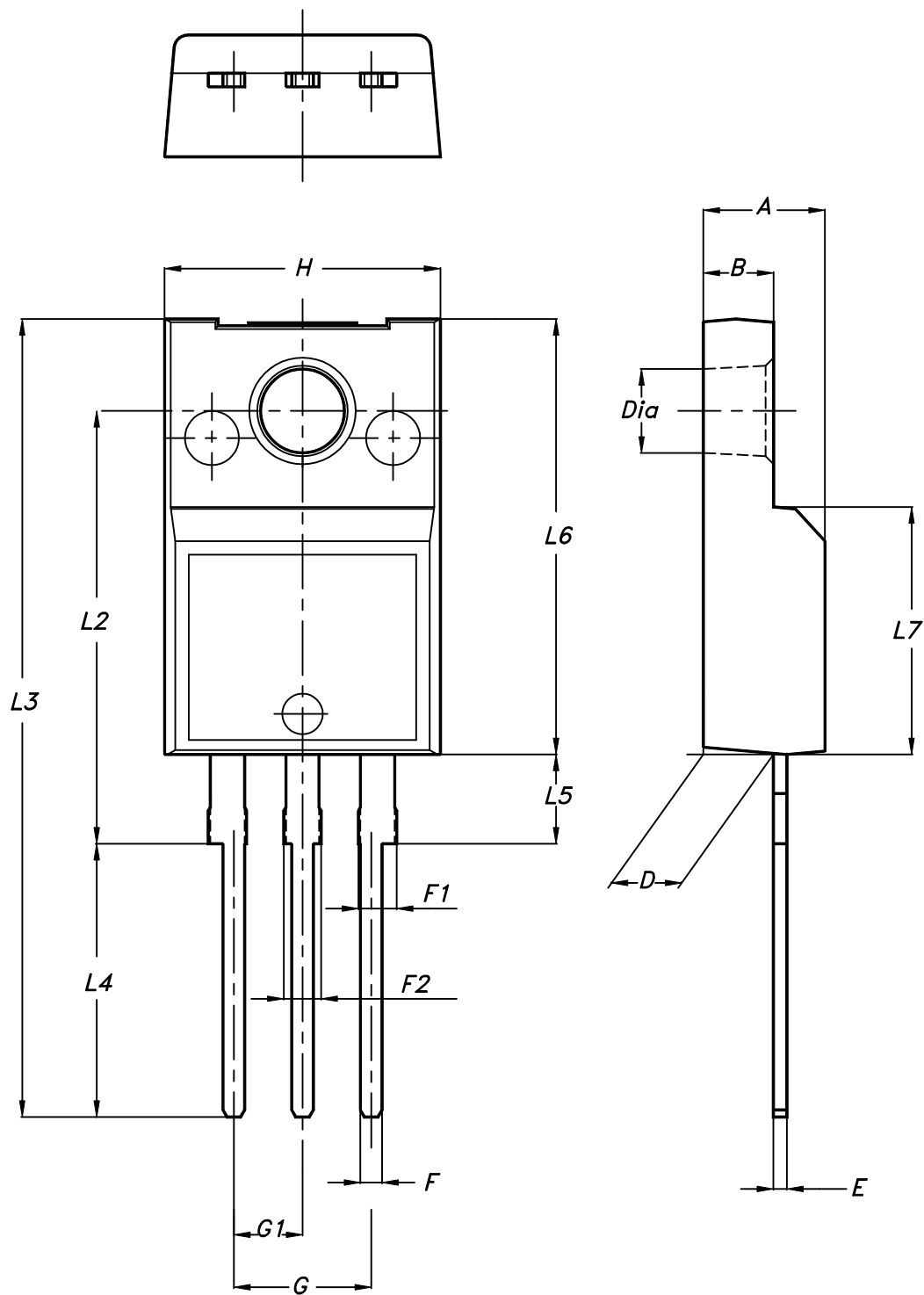
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Table 10. IPAK (TO-251) type A package mechanical data

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



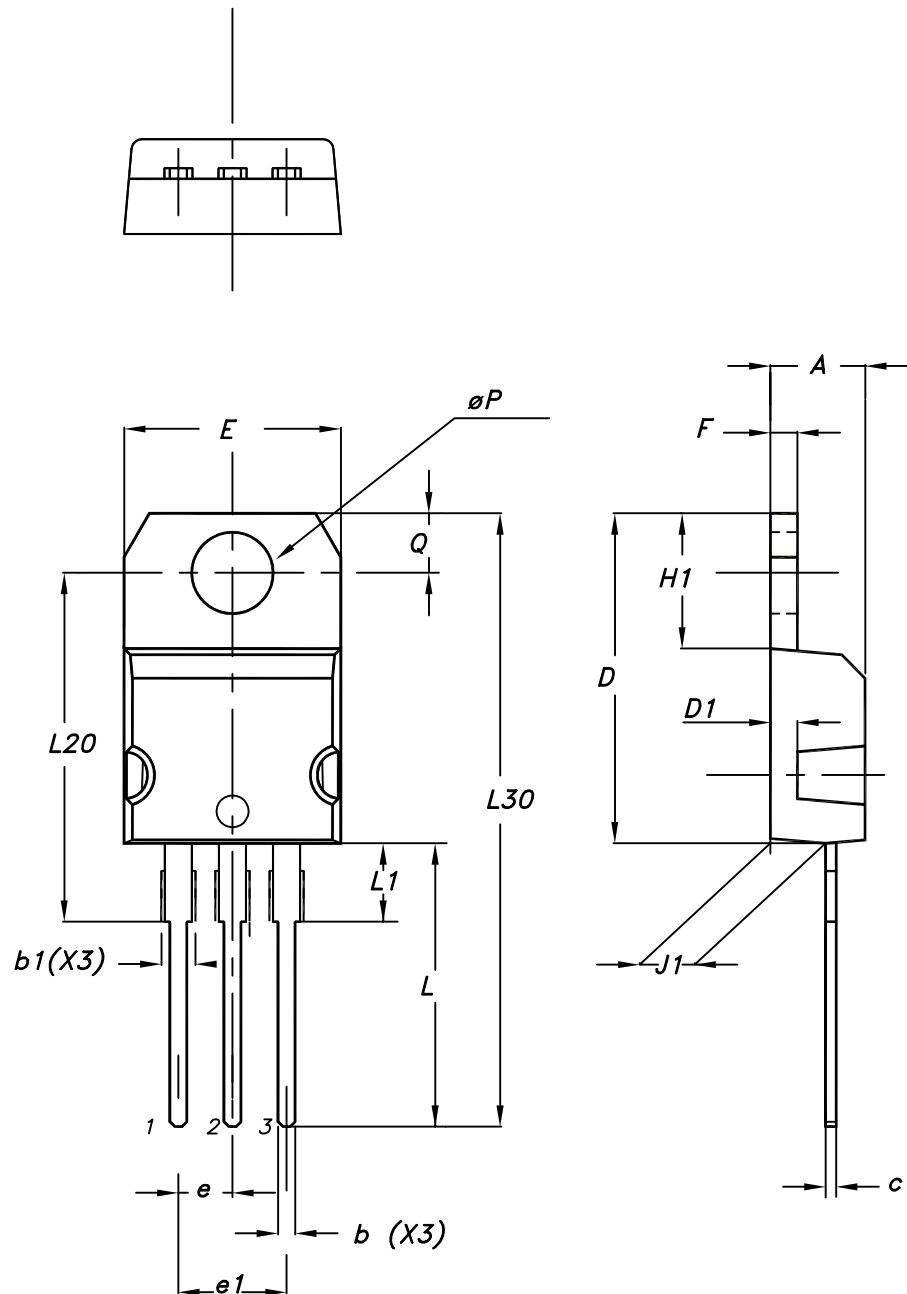
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Table 11. TO-220FP package mechanical data

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.

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