

# 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	$\pm 30$		V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	6.5	6.5 <sup>(1)</sup>	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	4	4 <sup>(1)</sup>	A
$I_{DM}^{(2)}$	Drain current (pulsed)	26	26 <sup>(1)</sup>	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 1inch<sup>2</sup> 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<sub>CASE</sub> = 25 °C unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 0 V	800			V
I <sub>DSS</sub>	Zero gate voltage drain current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 800 V			10	μA
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 800 V, T <sub>C</sub> = 125 °C <sup>(1)</sup>			100	μA
I <sub>GSS</sub>	Gate body leakage current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±30 V			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3	4	5	V
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3.25 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 <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 50 V, f = 1 MHz, V <sub>GS</sub> = 0 V	-	620	-	pF
C <sub>oss</sub>	Output capacitance			460		
C <sub>rss</sub>	Reverse transfer capacitance			15		
R <sub>g</sub>	Gate input resistance	f = 1 MHz open drain	-	7	-	Ω
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 640 V, I <sub>D</sub> = 6.5 A, V <sub>GS</sub> = 0 to 10 V (see Figure 17. Test circuit for gate charge behavior)	-	18	-	nC
Q <sub>gs</sub>	Gate-source charge			4		
Q <sub>gd</sub>	Gate-drain charge			11		

**Table 6. Switching times**

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 3.25 A, R <sub>G</sub> = 4.7 Ω, V <sub>GS</sub> = 10 V (see Figure 16. Test circuit for resistive load switching times and Figure 21. Switching time waveform)	-	20	-	ns
t <sub>r</sub>	Rise time			8		
t <sub>d(off)</sub>	Turn-off delay time			35		
t <sub>f</sub>	Fall time			10		

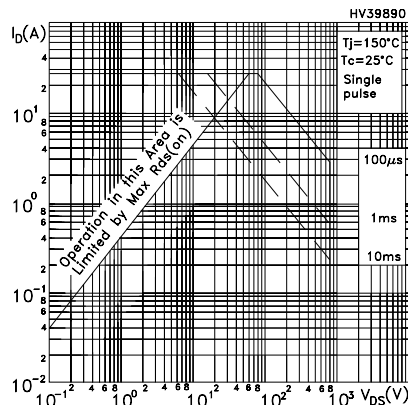
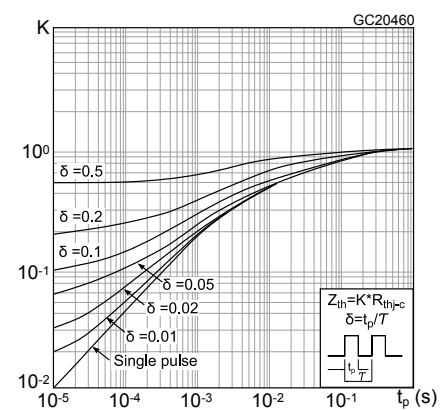
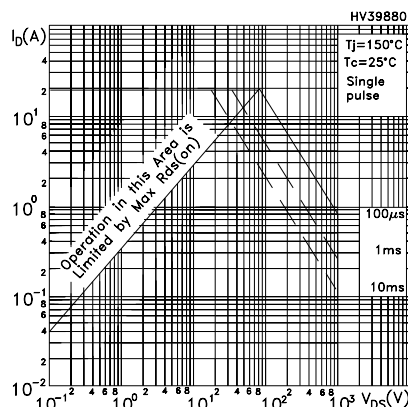
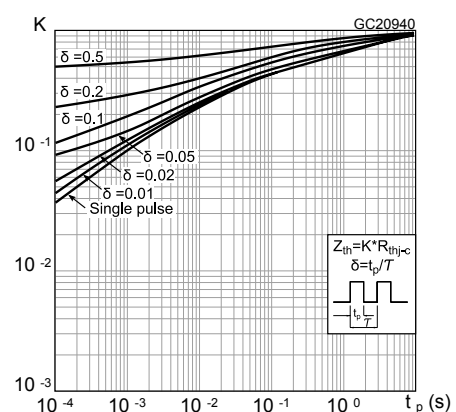
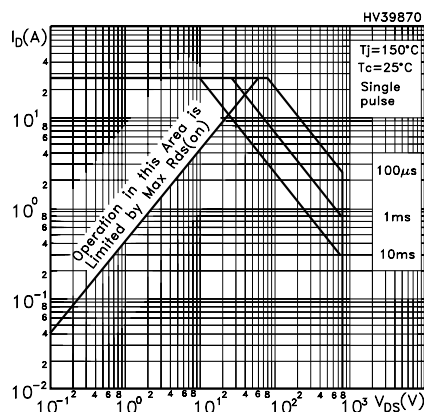
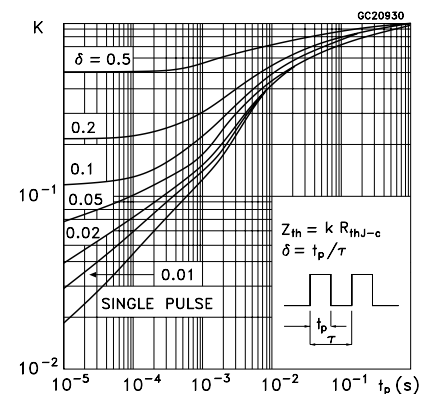
**Table 7. Source-drain diode**

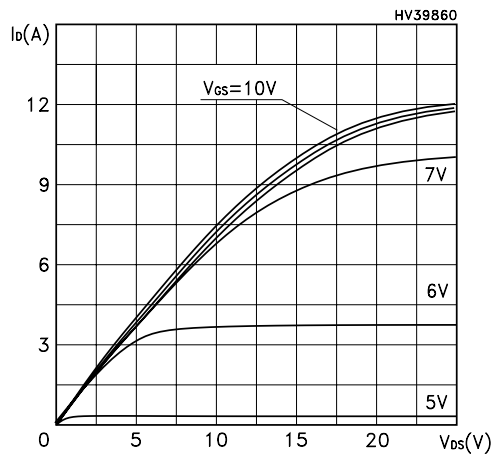
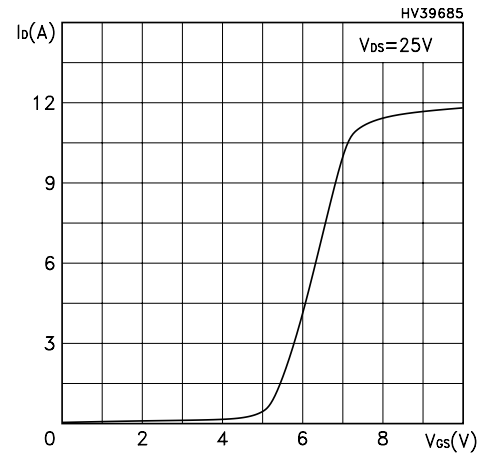
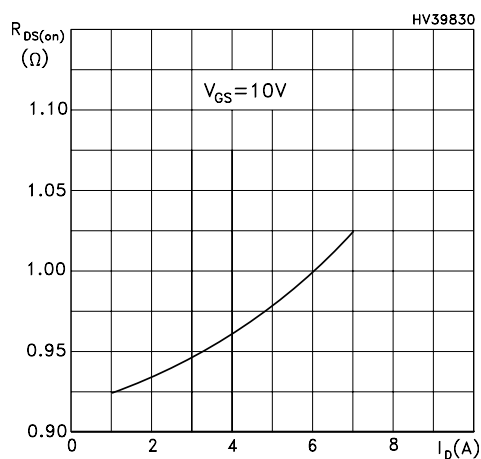
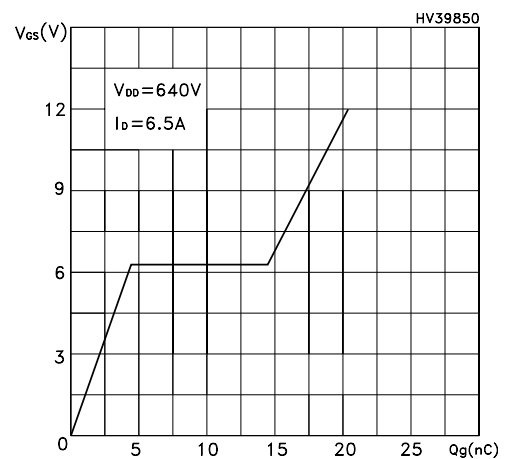
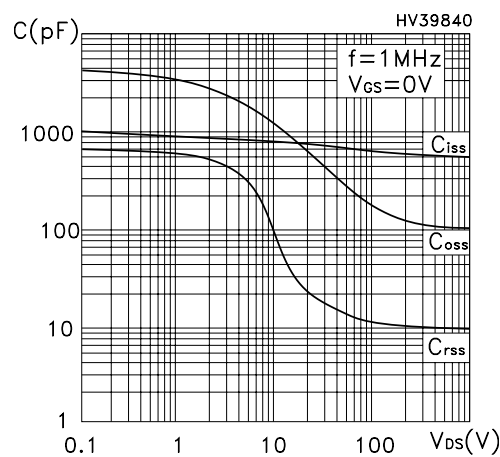
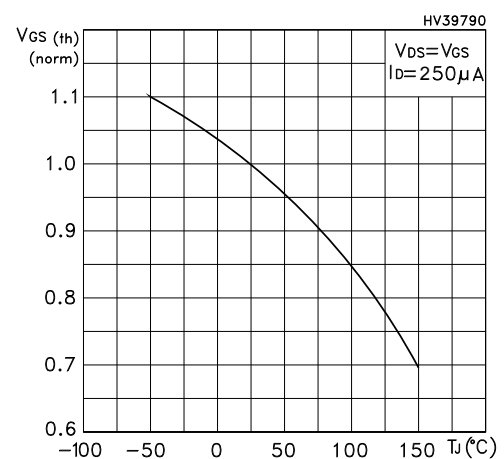
Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I <sub>SD</sub>	Source-drain current		-		6.5	A
I <sub>SDM</sub> <sup>(1)</sup>	Source-drain current (pulsed)				26	

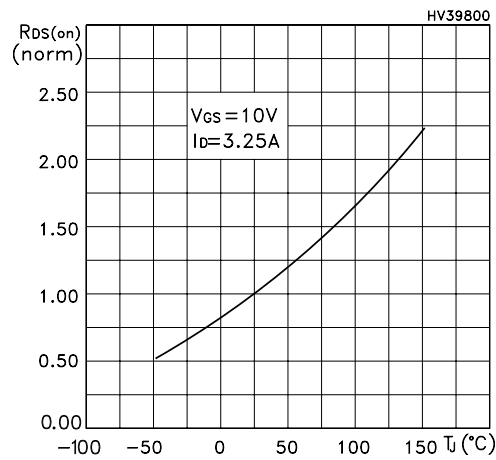
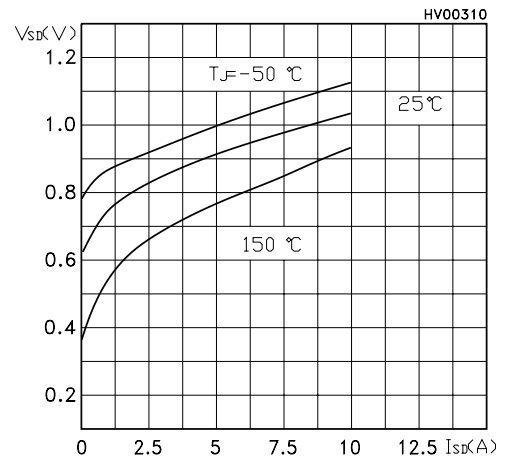
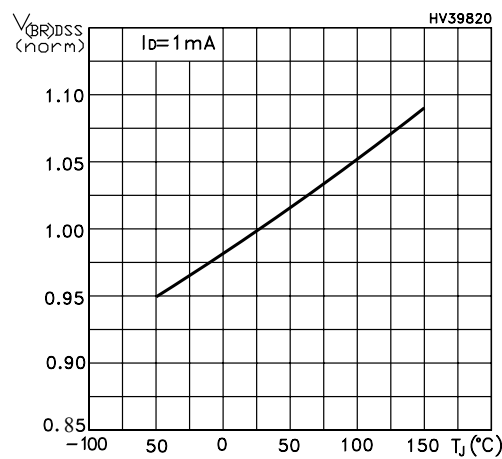
Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V <sub>SD</sub> <sup>(2)</sup>	Forward on voltage	I <sub>SD</sub> = 6.5 A, V <sub>GS</sub> = 0 V	-		1.3	V
t <sub>rr</sub>	Reverse recovery time	I <sub>SD</sub> = 6.5 A, di/dt = 100 V	-	460		ns
Q <sub>rr</sub>	Reverse recovery charge	V <sub>DD</sub> = 50 V (see <a href="#">Figure 18. Test circuit for inductive load switching and diode recovery times</a> )		4		μC
I <sub>RRM</sub>	Reverse recovery current			17		A
t <sub>rr</sub>	Reverse recovery time	I <sub>SD</sub> = 6.5 A, di/dt = 100 A/μs	-	680		ns
Q <sub>rr</sub>	Reverse recovery charge	V <sub>DD</sub> = 50 V (see <a href="#">Figure 18. Test circuit for inductive load switching and diode recovery times</a> )		6		μC
I <sub>RRM</sub>	Reverse recovery current			17		A

1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

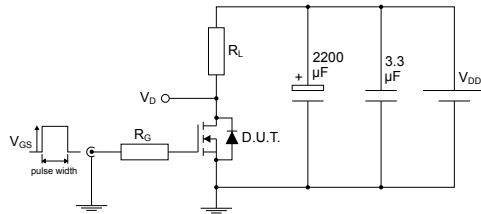
## 2.1 Electrical characteristics (curves)

**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**


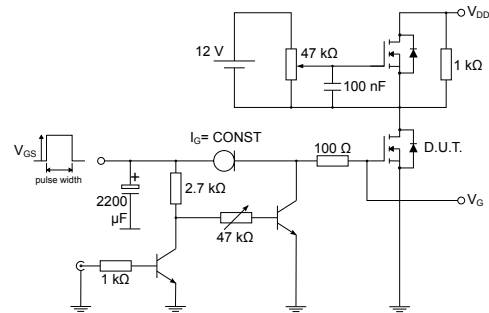
**Figure 7. Output characteristics**

**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**


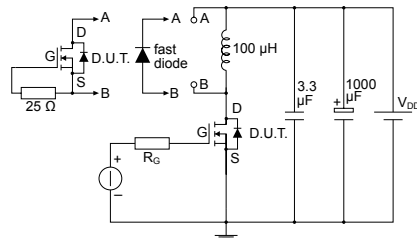
### 3 Test circuits

**Figure 16. Test circuit for resistive load switching times**


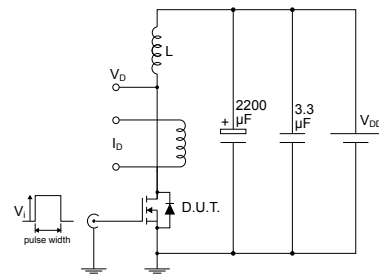
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**Figure 17. Test circuit for gate charge behavior**


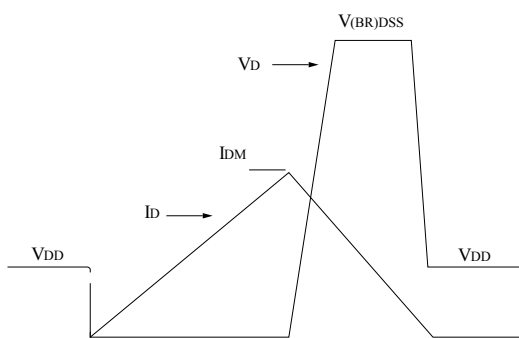
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**Figure 18. Test circuit for inductive load switching and diode recovery times**


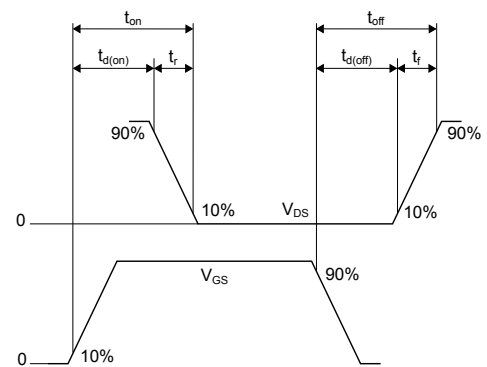
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**Figure 19. Unclamped inductive load test circuit**


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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**

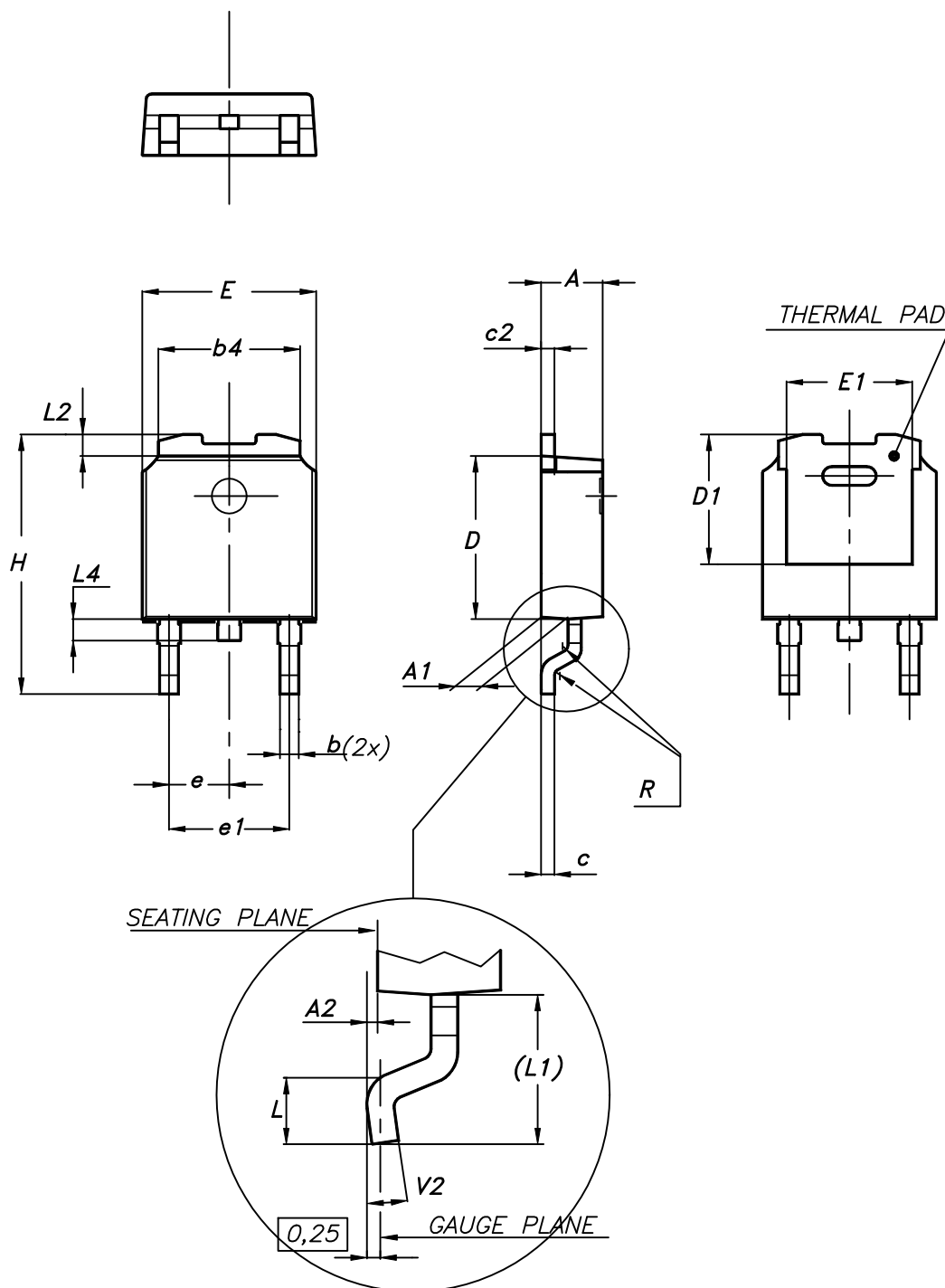
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In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com).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



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

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

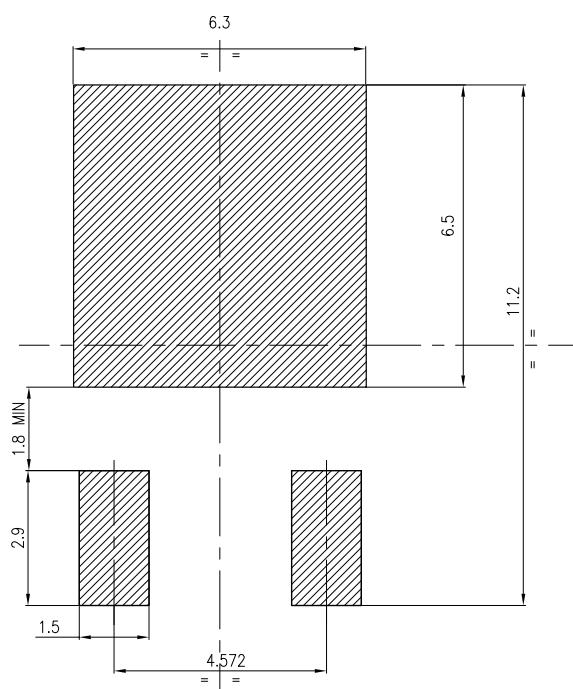


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**Table 8. DPAK (TO-252) type A2 mechanical data**

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°

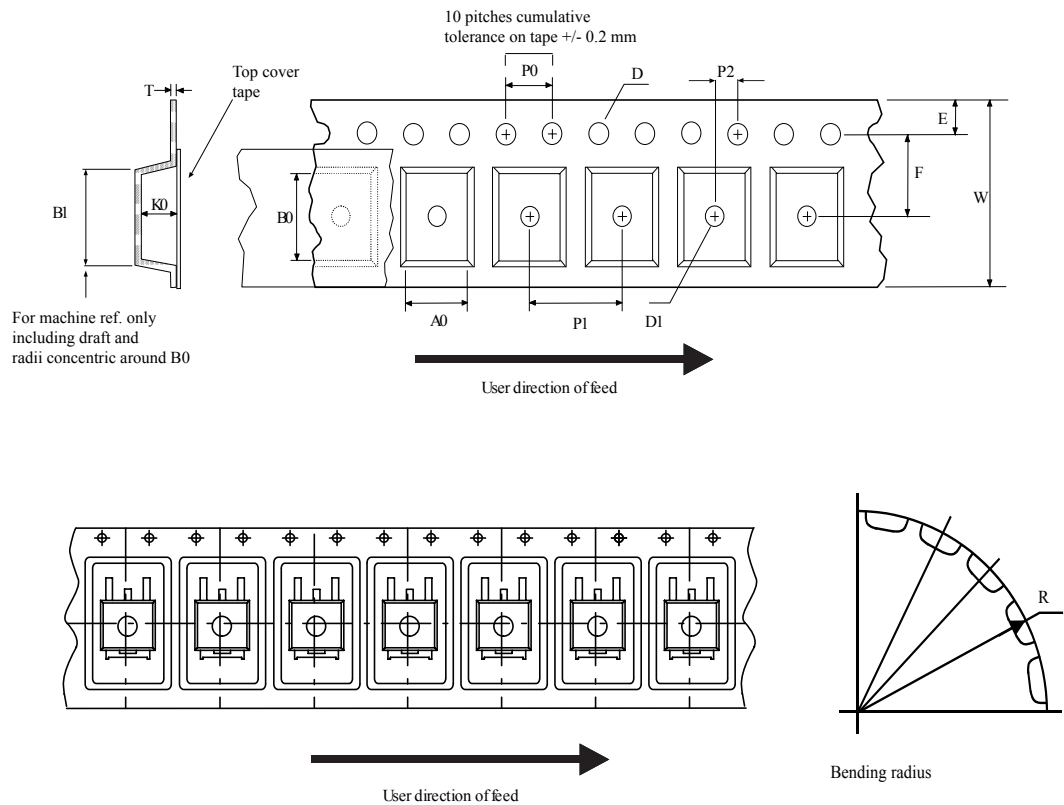
**Figure 23. DPAK (TO-252) recommended footprint (dimensions are in mm)**



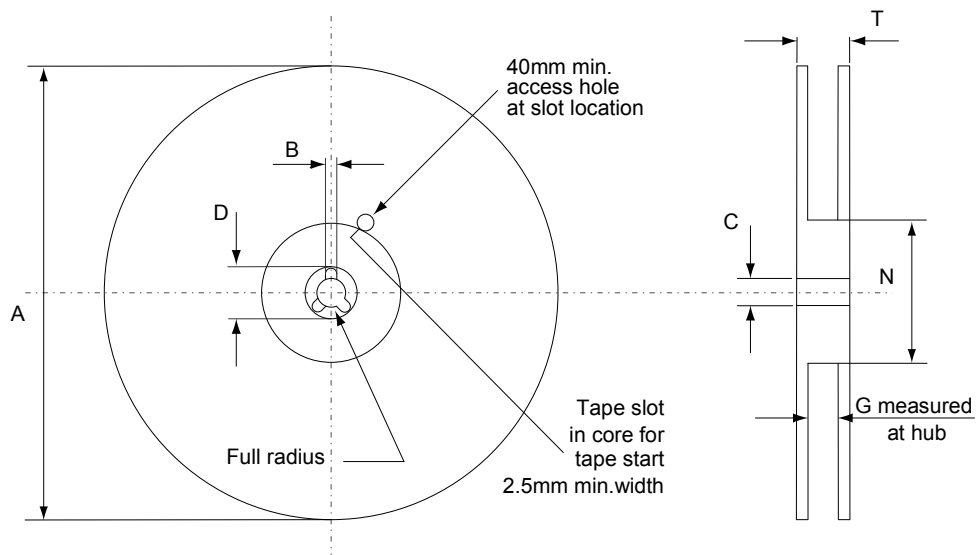
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## 4.2 DPAK (TO-252) packing information

**Figure 24. DPAK (TO-252) tape outline**



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**Figure 25. DPAK (TO-252) reel outline**


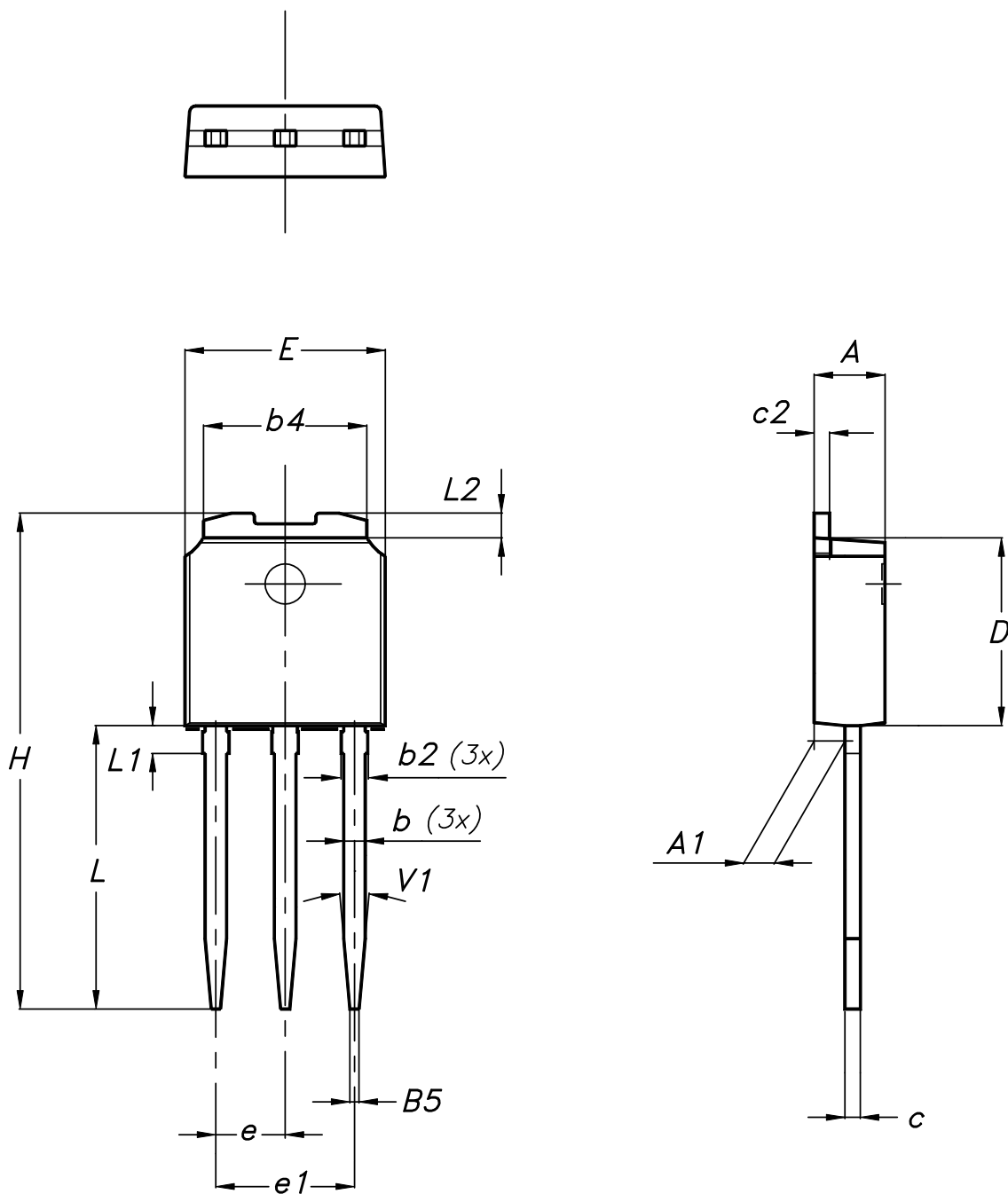
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**Table 9. DPAK (TO-252) tape and reel mechanical data**

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



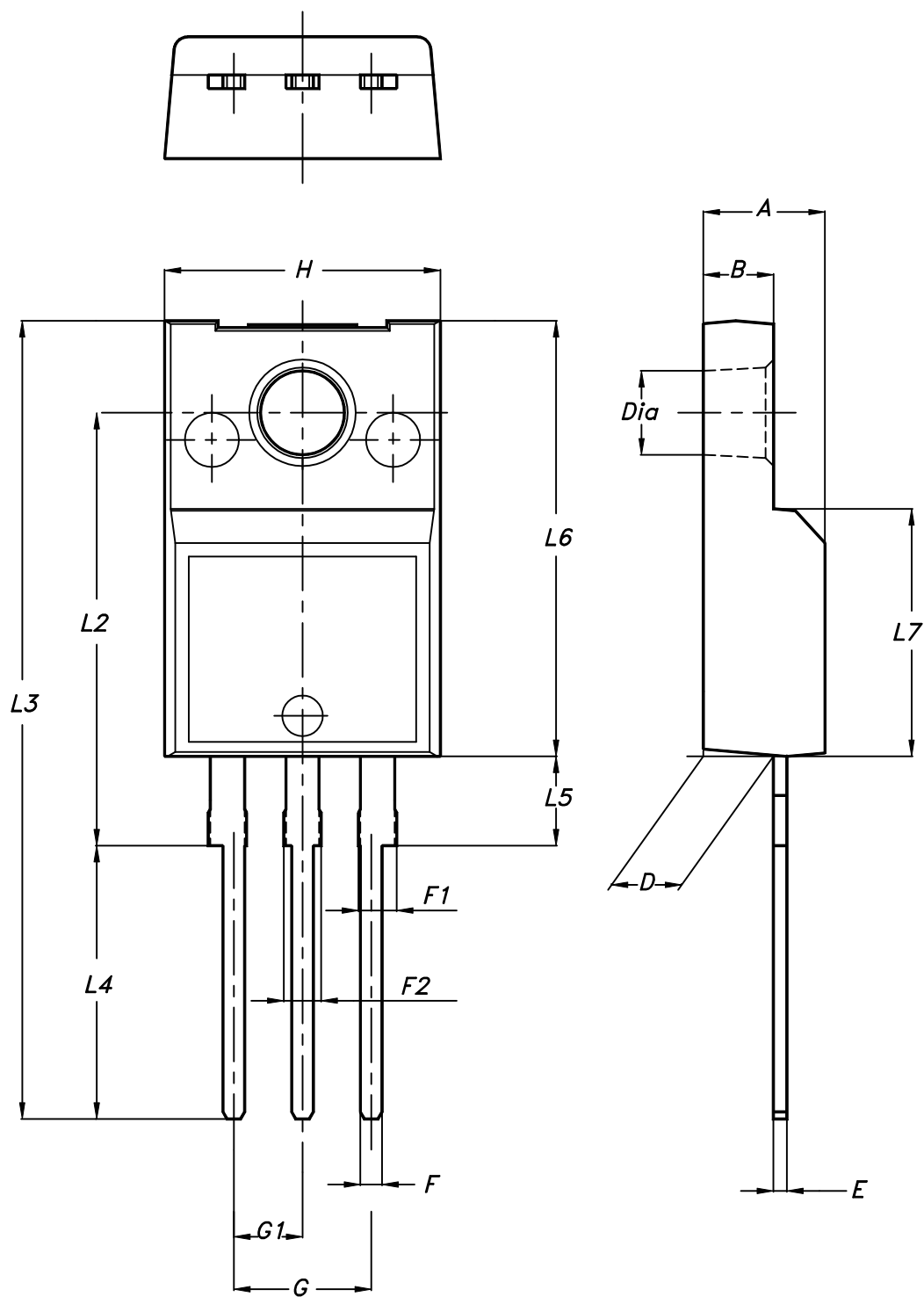
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**Table 10. IPAK (TO-251) type A package mechanical data**

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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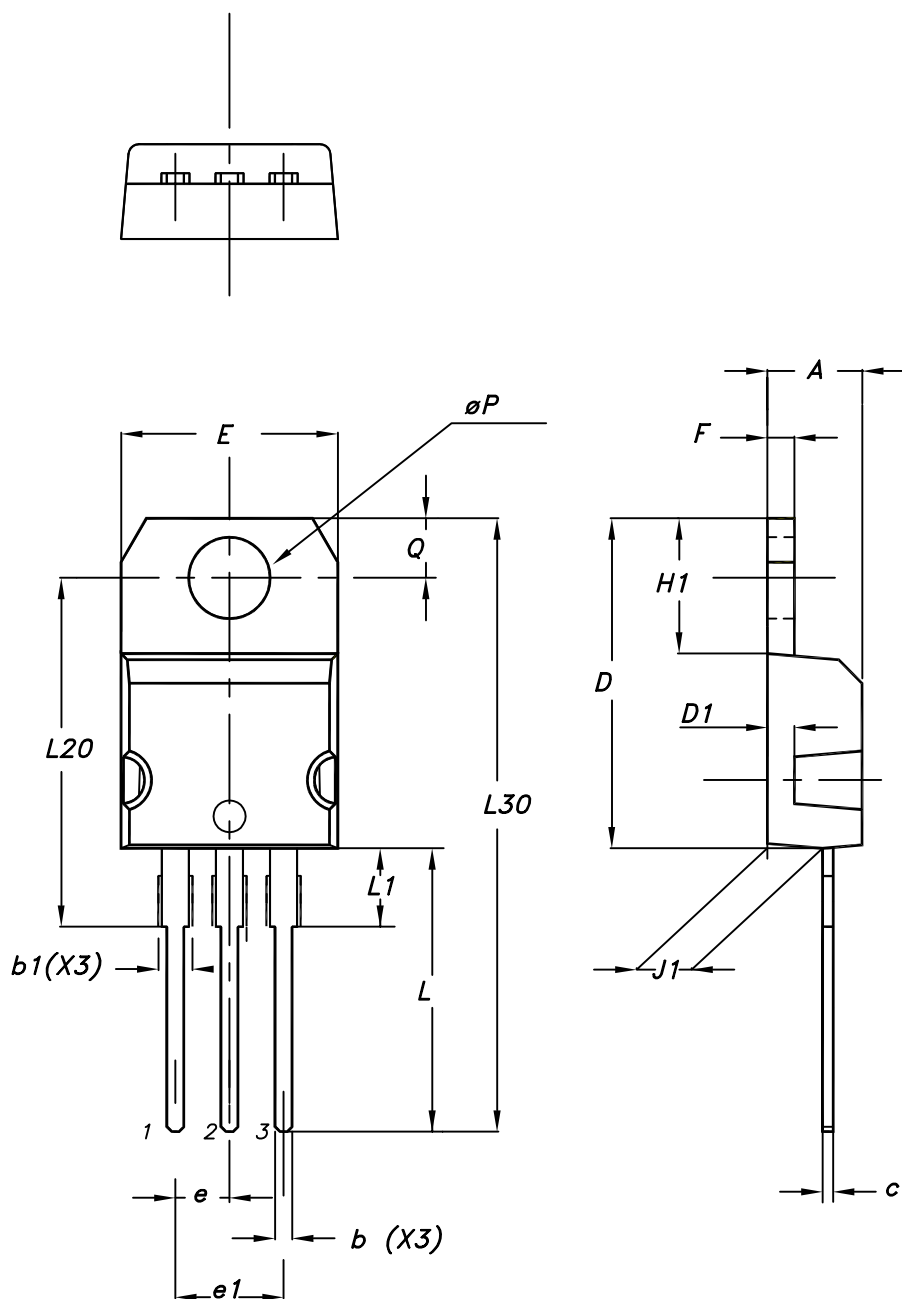


**Table 11. TO-220FP package mechanical data**

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 <a href="#">Section 4 Package information</a> . Minor text changes.

## Contents

<b>1</b>	<b>Electrical ratings .....</b>	<b>2</b>
<b>2</b>	<b>Electrical characteristics.....</b>	<b>3</b>
2.1	Electrical characteristics (curves) .....	5
<b>3</b>	<b>Test circuits .....</b>	<b>8</b>
<b>4</b>	<b>Package information.....</b>	<b>9</b>
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
<b>5</b>	<b>Ordering information .....</b>	<b>21</b>
	<b>Revision history .....</b>	<b>22</b>



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