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 °C	6.5	6.5 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	4	4 (1)	A
I_{DM} (2)	Drain current (pulsed)	26	26 (1)	A
P_{TOT}	Total dissipation at T_C = 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
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	
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.4		5	1.4	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient		100	62.5		°C/W
$R_{thj\text{-}pcb}$ (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 °C, I_D = I_{AS}, V_{DD} = 50 V)	240	mJ

2 Electrical characteristics

(T_{CASE} = 25 °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 mA, V_{GS} = 0 V	800			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 800 V			10	µA
		V_{GS} = 0 V, V_{DS} = 800 V, T_C = 125 °C(1)			100	µA
I_{GSS}	Gate body leakage current	V_{DS} = 0 V, V_{GS} = ±30 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 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_{iss}	Input capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	620	-	pF
C_{oss}	Output capacitance			460		
C_{rss}	Reverse transfer capacitance			15		
Rg	Gate input resistance	f = 1 MHz open drain	-	7	-	Ω
Q_g	Total gate charge	V_{DD} = 640 V, I_D = 6.5 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 V, I_D = 3.25 A, R_G = 4.7 Ω, V_{GS} = 10 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

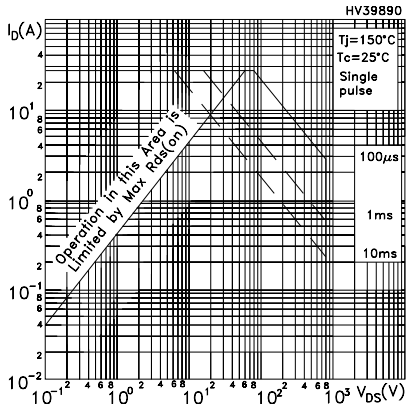


Figure 2. Thermal impedance for DPAK and IPAK

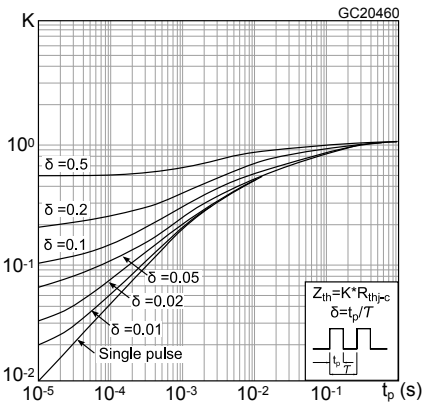


Figure 3. Safe operating area for TO-220FP

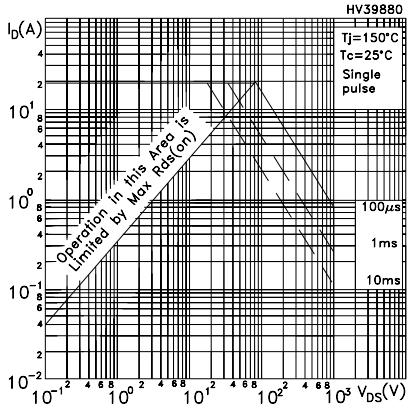


Figure 4. Thermal impedance for TO-220FP

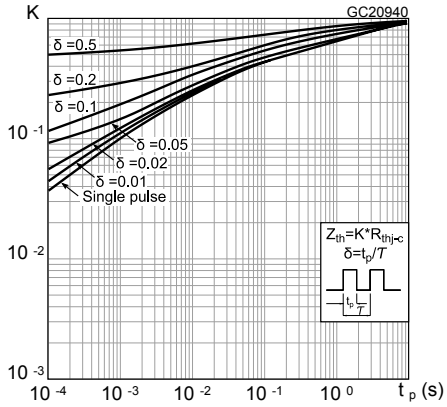


Figure 5. Safe operating area for TO-220

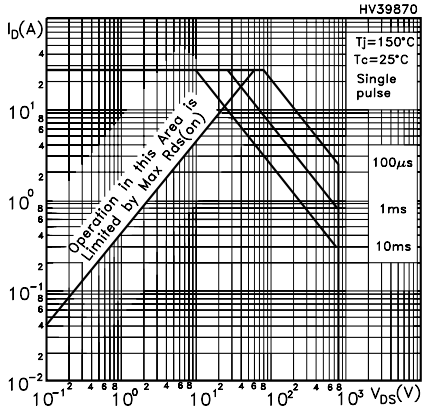


Figure 6. Thermal impedance for TO-220

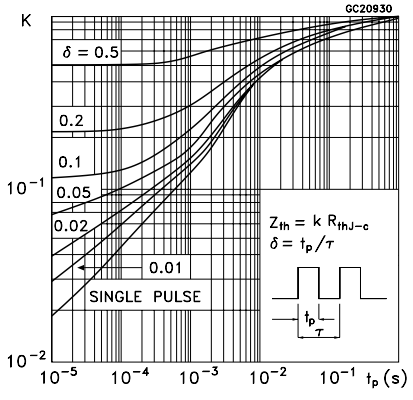


Figure 7. Output characterisics

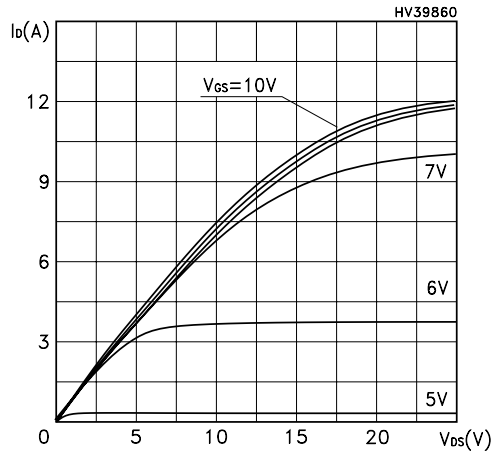


Figure 8. Transfer characteristics

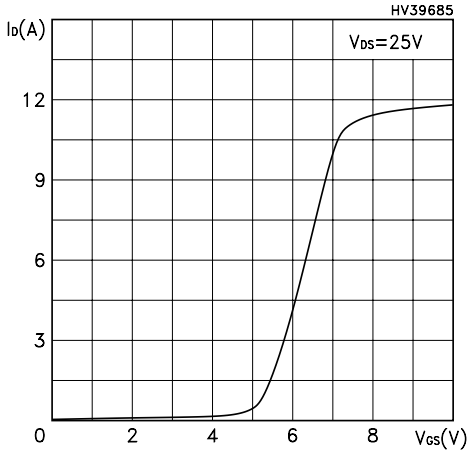


Figure 9. Static drain-source on-resistance

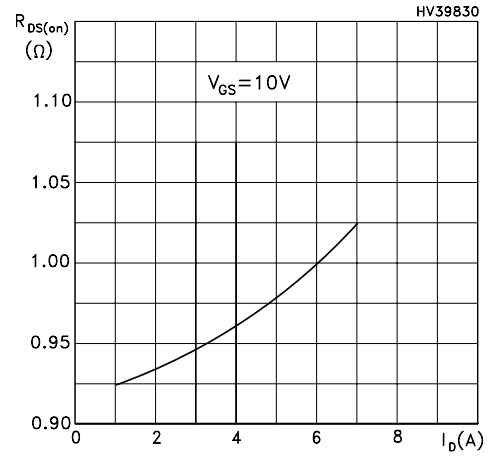


Figure 10. Gate charge vs gate-source voltage

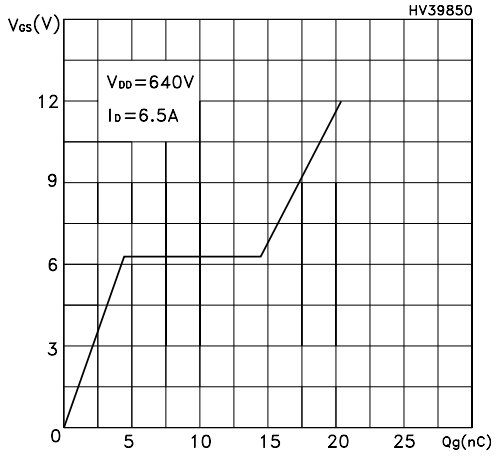


Figure 11. Capacitance variations

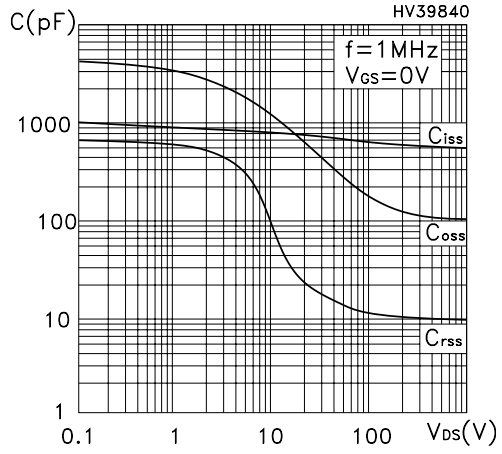


Figure 12. Normalized gate threshold voltage vs temperature

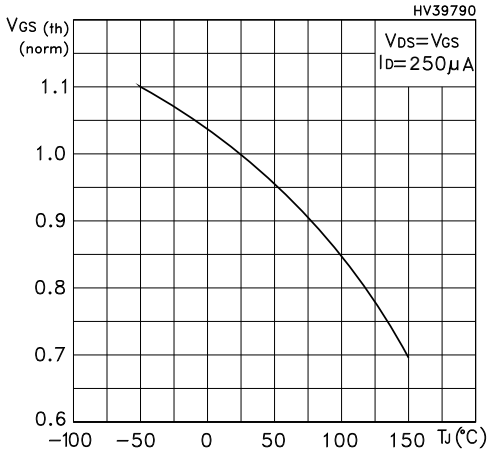


Figure 13. Normalized on-resistance vs temperature

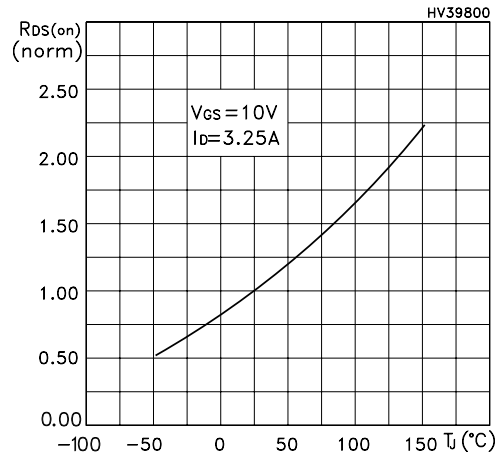


Figure 14. Source-drain diode forward characteristics

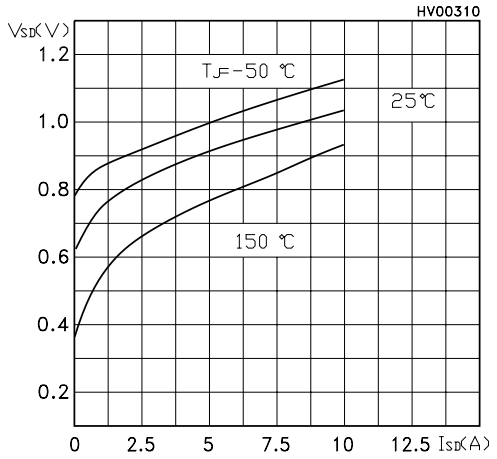
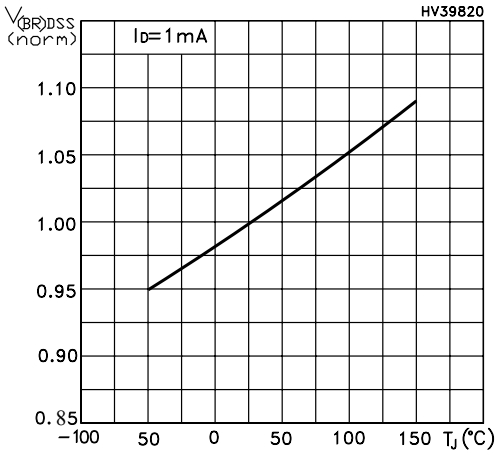


Figure 15. Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 16. Test circuit for resistive load switching times

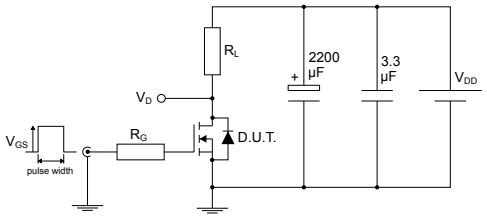


Figure 17. Test circuit for gate charge behavior

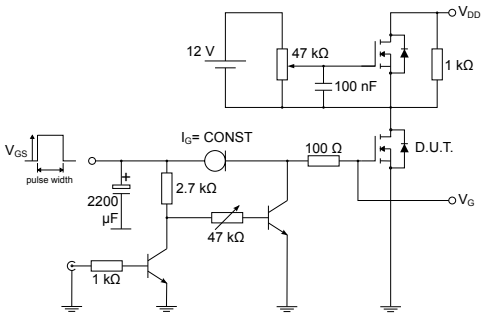


Figure 18. Test circuit for inductive load switching and diode recovery times

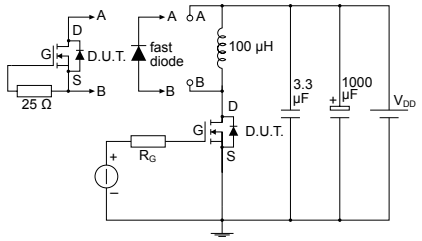


Figure 19. Unclamped inductive load test circuit

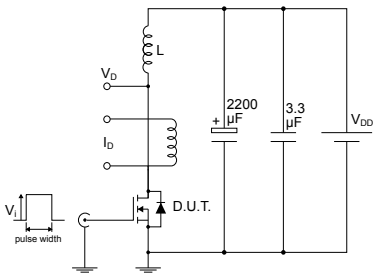


Figure 20. Unclamped inductive waveform

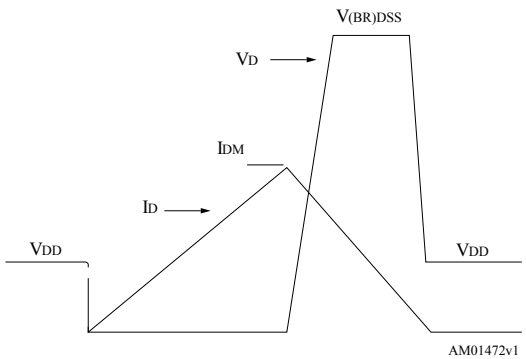
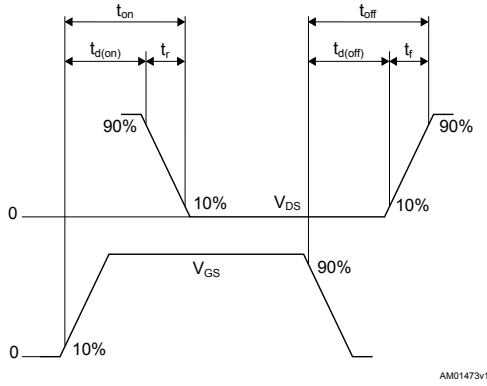


Figure 21. Switching time waveform



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**

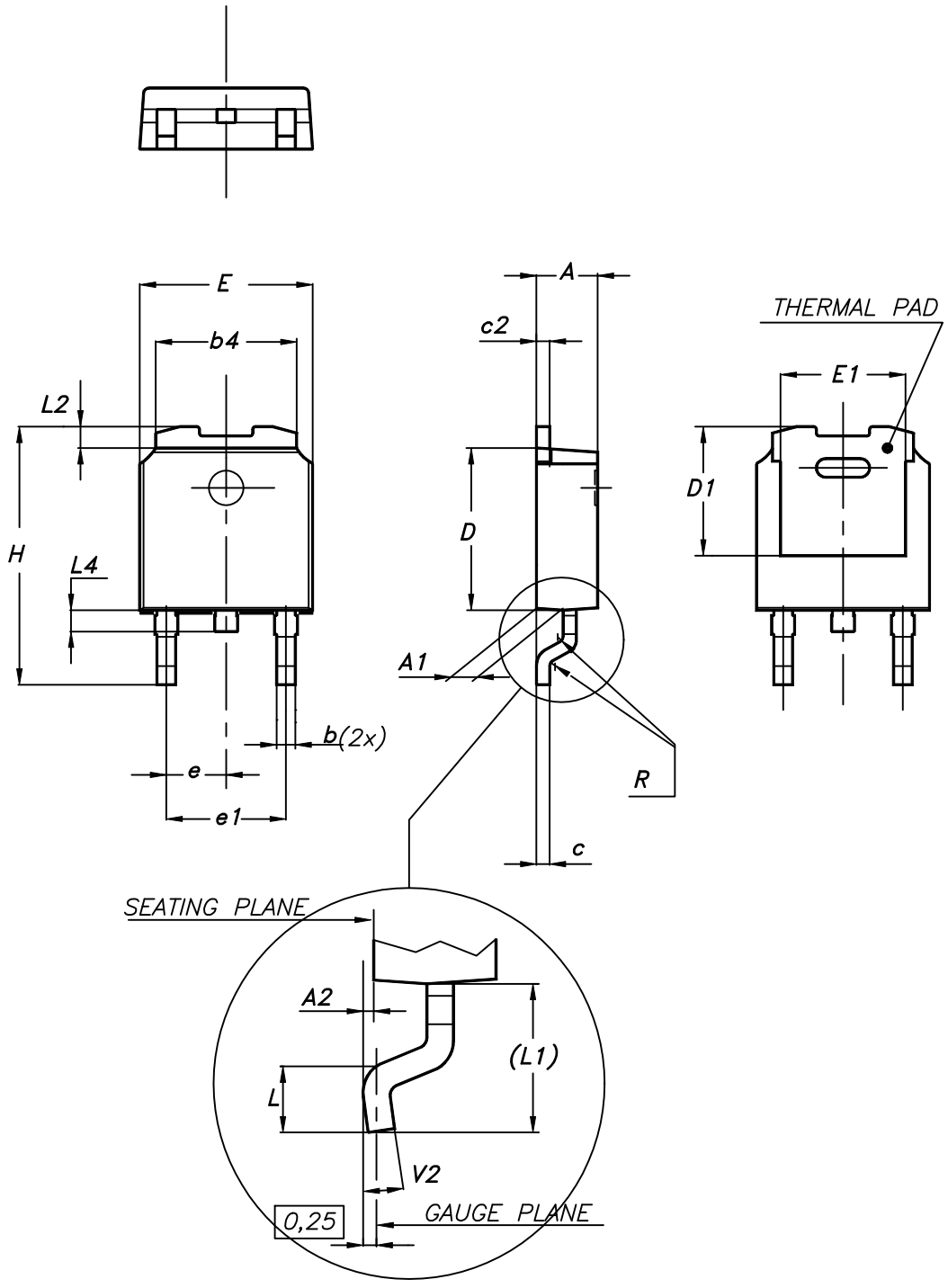
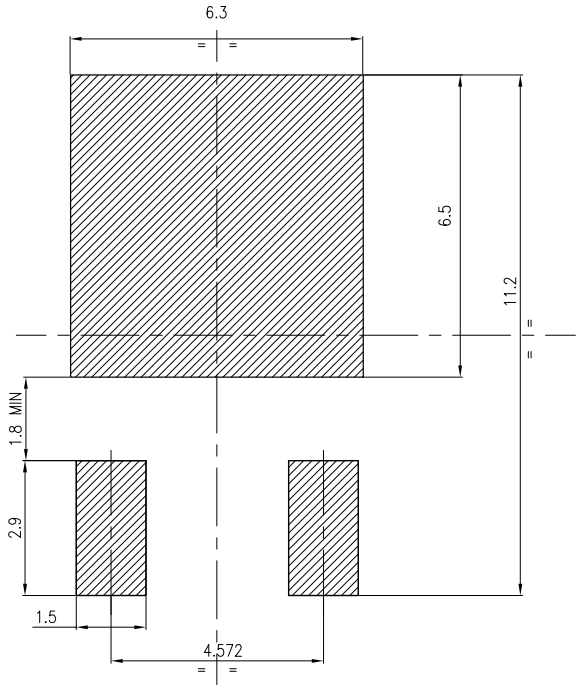


Table 8. **DPAK (TO-252) type A2 mechanical data**

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)**



4.2 DPAK (TO-252) packing information

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

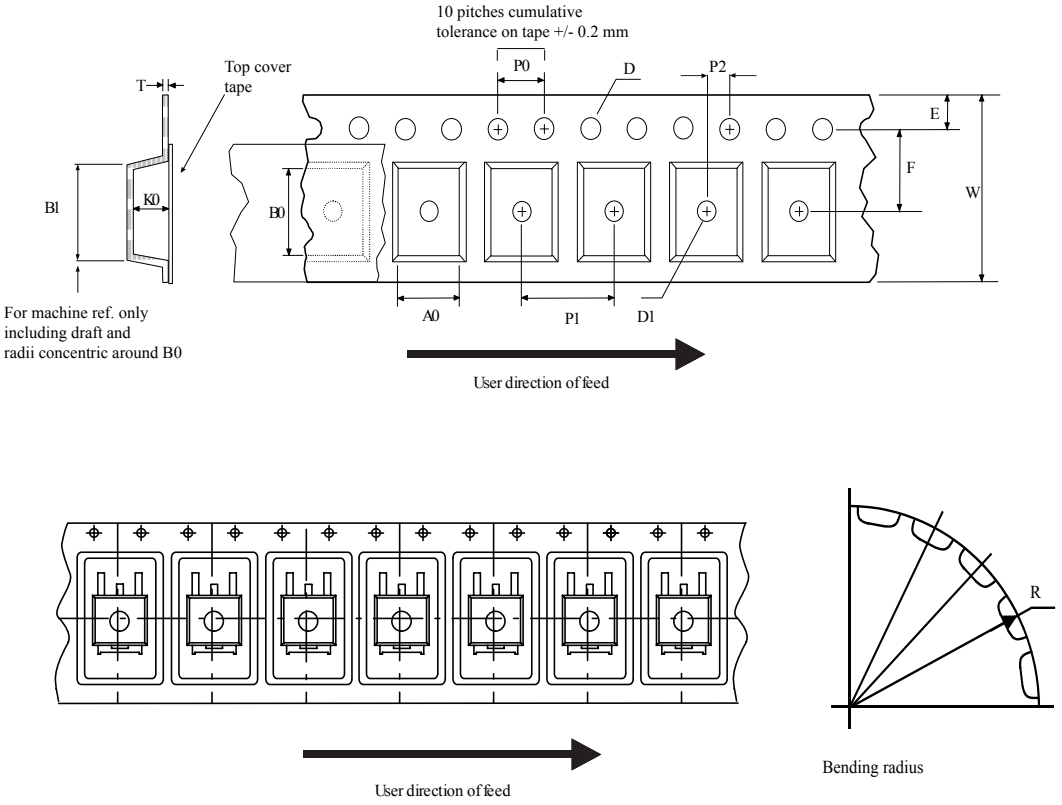


Figure 25. **DPAK (TO-252) reel outline**

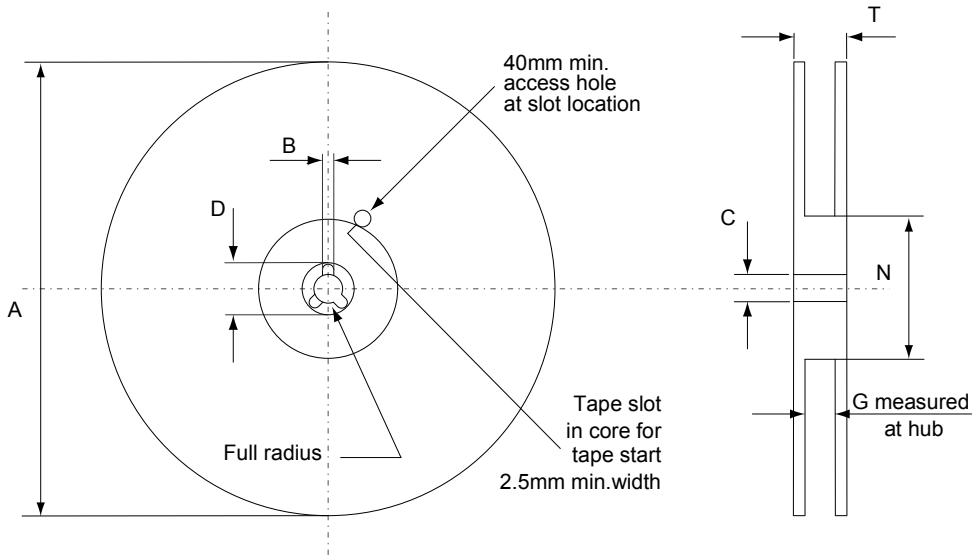


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Table 9. **DPAK (TO-252) tape and reel mechanical data**

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**

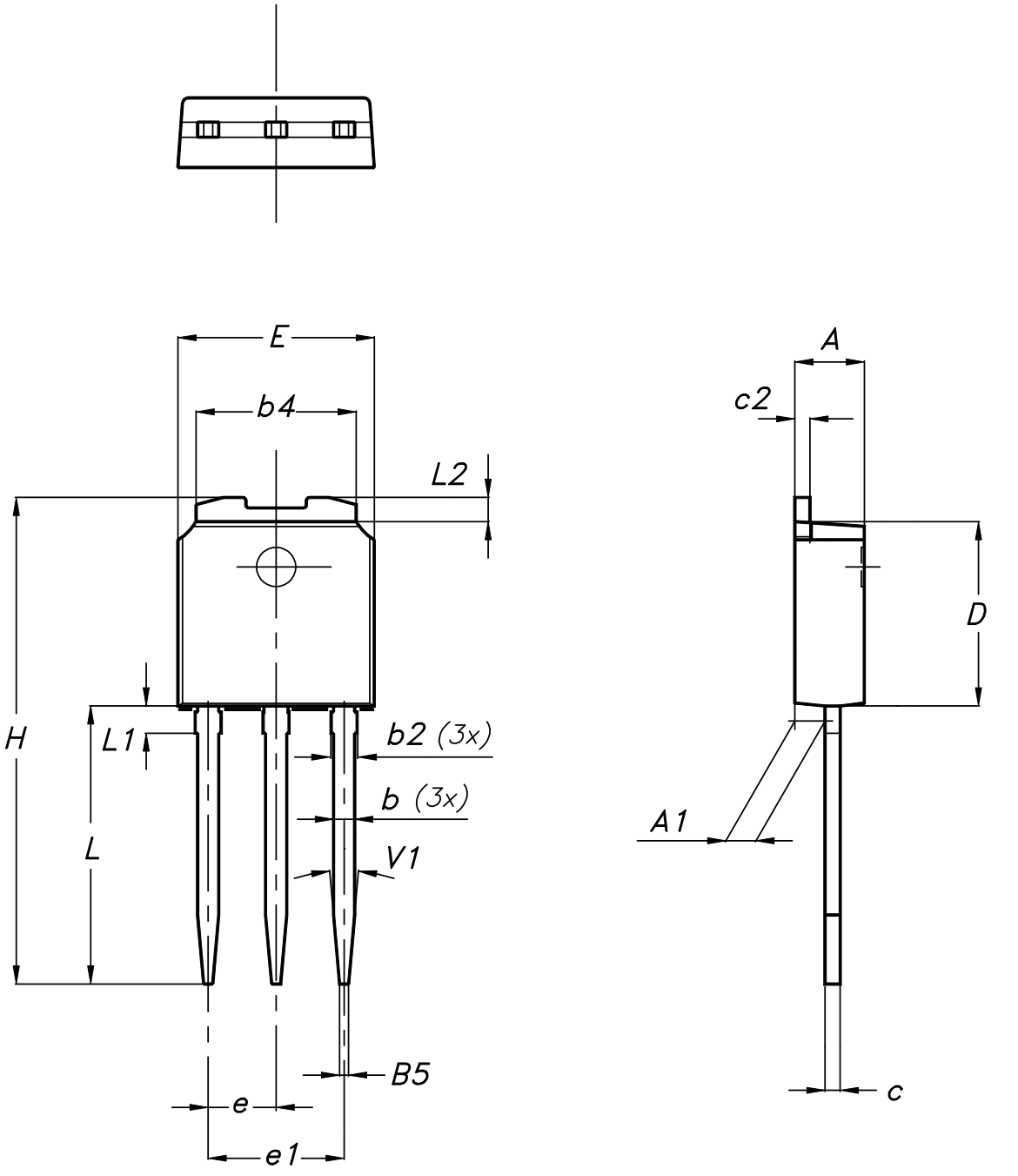

Table 10. **IPAK (TO-251) type A package mechanical data**

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**

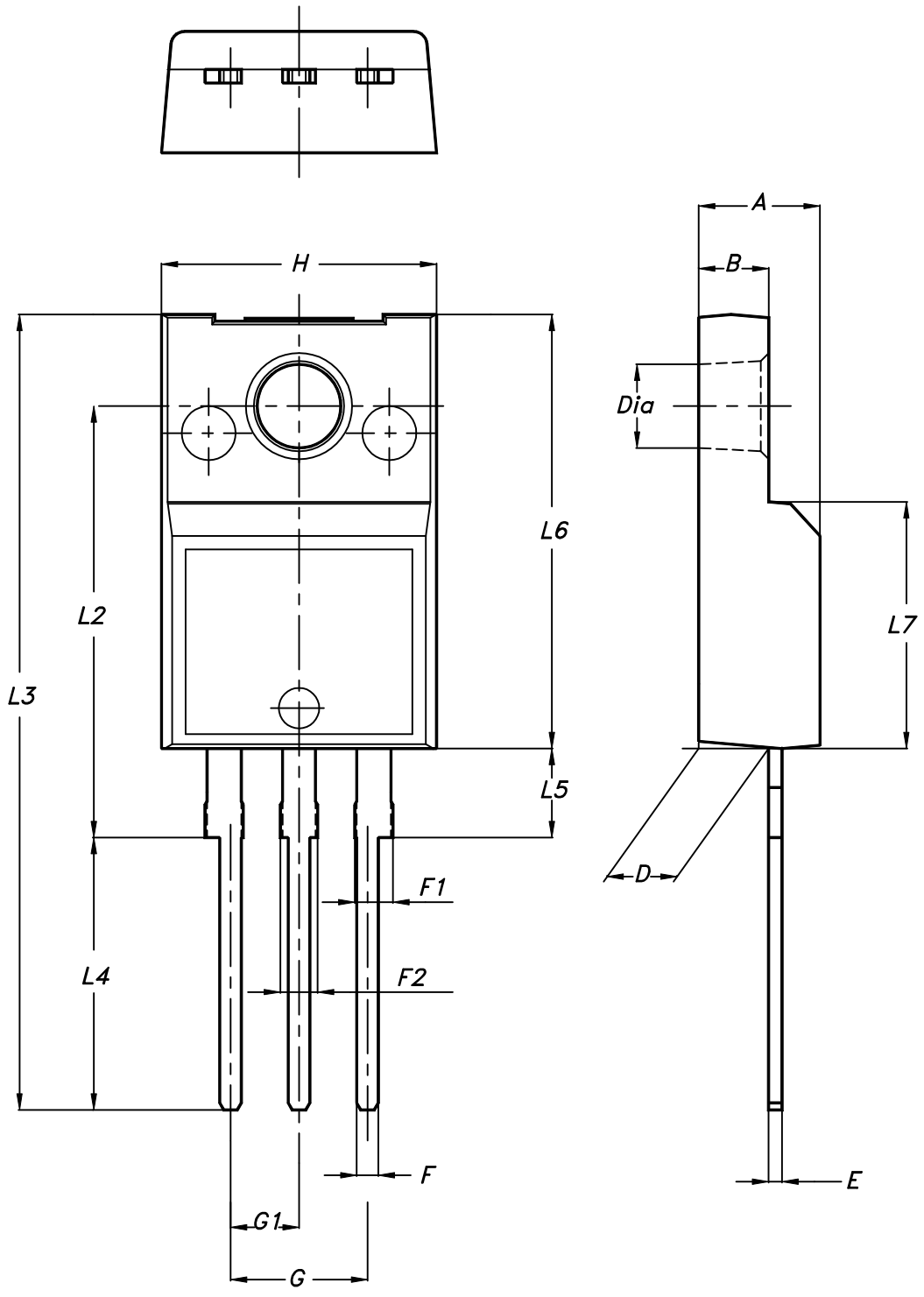

Table 11. **TO-220FP package mechanical data**

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**

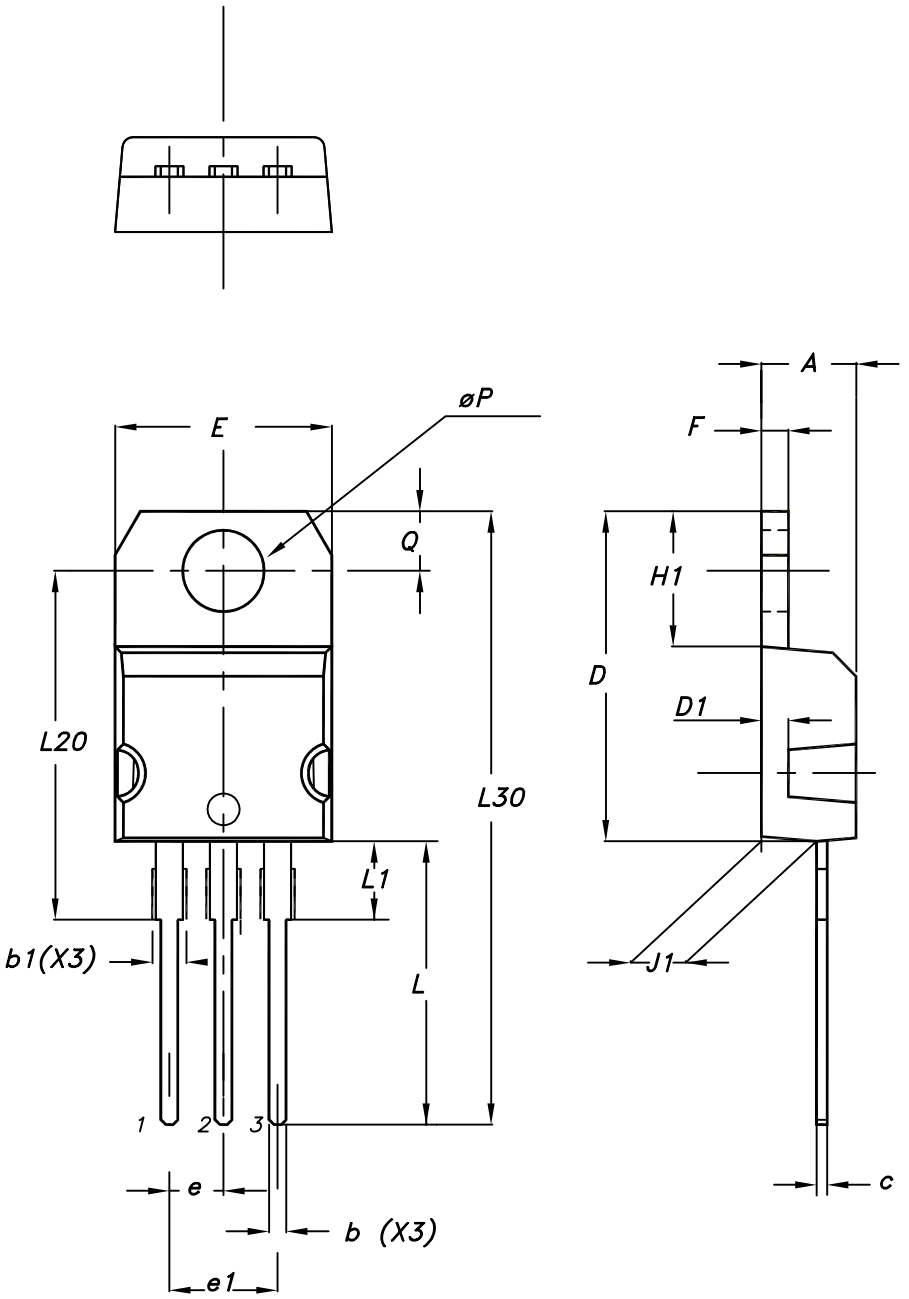

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Table 12. **TO-220 type A package mechanical data**

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: *Electrical characteristics (curves)*.
02-Oct-2009	3	Corrected marking and description on first page.
20-Aug-2018	4	Updated Section 4 Package information. Minor text changes.

Contents