Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	DPAK	TO-220FP	Unit
V_{GS}	Gate-source voltage	± 25		V
I_D	Drain current (continuous) at T_C = 25 °C	5	5(1)	A
I_D	Drain current (continuous) at T_C = 100 °C	3.2	3.2(1)	A
I_{DM}(2)	Drain current (pulsed)	20	20(1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	60	20	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s; T_C=25 °C)		2500	V
dv/dt (3)	Peak diode recovery voltage slope	15		V/ns
dv/dt(4)	MOSFET dv/dt ruggedness	50		
T_{stg}	Storage temperature	- 55 to 150		°C
T_j	Max. operating junction temperature			

1. Limited by maximum junction temperature.
2. Pulse width limited by safe operating area.
3. $I_{SD} \leq 5$ A, di/dt $\leq$ 400 A/µs; $V_{DS\ peak} < V_{(BR)DSS}$, V_{DD}=400 V
4. $V_{DS} \leq 520$ V

Table 3. Thermal data

Symbol	Parameter	DPAK	TO-220FP	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	2.08	6.25	°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb max	50(1)		°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max		62.5	°C/W

1. When mounted on 1 inch² FR-4, 2 Oz copper board

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	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_{AR}; V_{DD}=50V)	103	mJ

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0, I_D = 1 mA	650			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0, V_{DS} = 650 V			1	µA
		V_{GS} = 0, V_{DS} = 650 V, T_C=125 °C			100	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0, V_{GS} = ± 25 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 2.5 A		0.98	1.15	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0	-	280	-	pF
C_{oss}	Output capacitance		-	15.1	-	pF
C_{rss}	Reverse transfer capacitance		-	0.83	-	pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 520 V, V_{GS} = 0	-	108	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	7	-	Ω
Q_g	Total gate charge	V_{DD} = 520 V, I_D = 5 A, V_{GS} = 10 V (see *Figure 17*)	-	9.5	-	nC
Q_{gs}	Gate-source charge		-	2.45	-	nC
Q_{gd}	Gate-drain charge		-	4.45	-	nC

1. $C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 325 V, I_D = 2.5 A, R_G = 4.7 Ω V_{GS} = 10 V (see *Figure 16* and *21*)	-	20	-	ns
t_r	Rise time		-	8	-	ns
$t_{d(off)}$	Turn-off delay time		-	7	-	ns
t_f	Fall time		-	25	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5	A
I_{SDM} (1)	Source-drain current (pulsed)		-		20	A
V_{SD} (2)	Forward on voltage	I_{SD} = 5 A, V_{GS} = 0	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs V_{DD} = 60 V (see *Figure 21*)	-	280		ns
Q_{rr}	Reverse recovery charge		-	1.65		µC
I_{RRM}	Reverse recovery current		-	11.5		A
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 21*)	-	440		ns
Q_{rr}	Reverse recovery charge		-	2.6		µC
I_{RRM}	Reverse recovery current		-	12		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 2. Safe operating area for DPAK

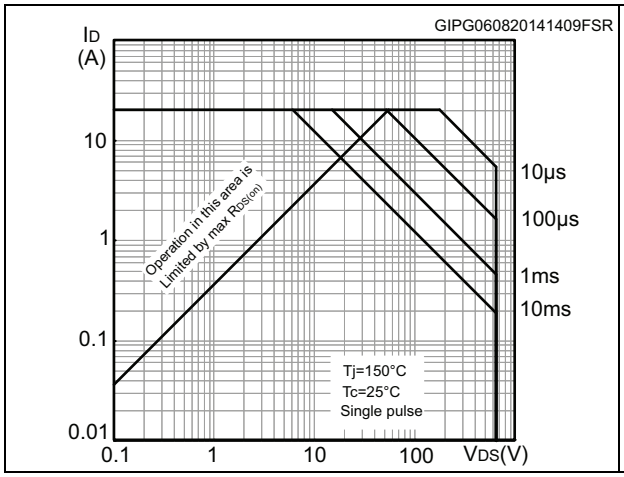


Figure 3. Thermal impedance for DPAK

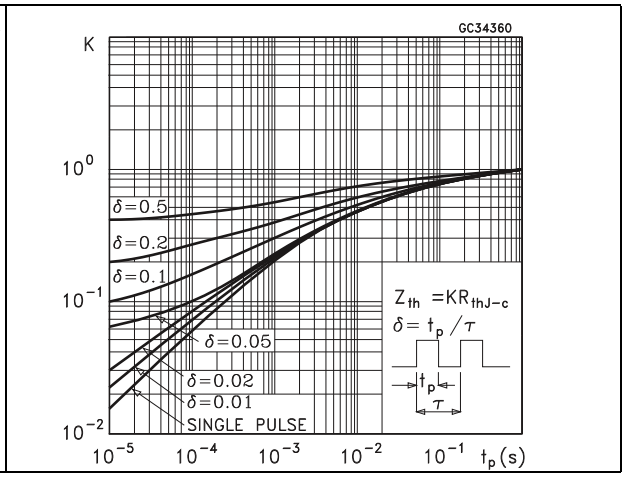


Figure 4. Safe operating area for TO-220FP

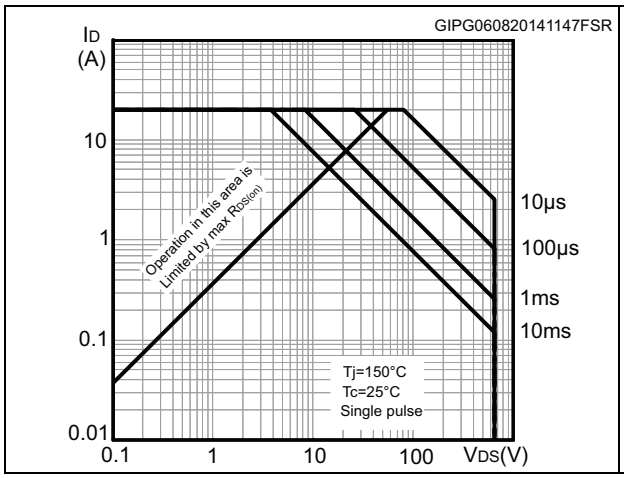


Figure 5. Thermal impedance for TO-220FP

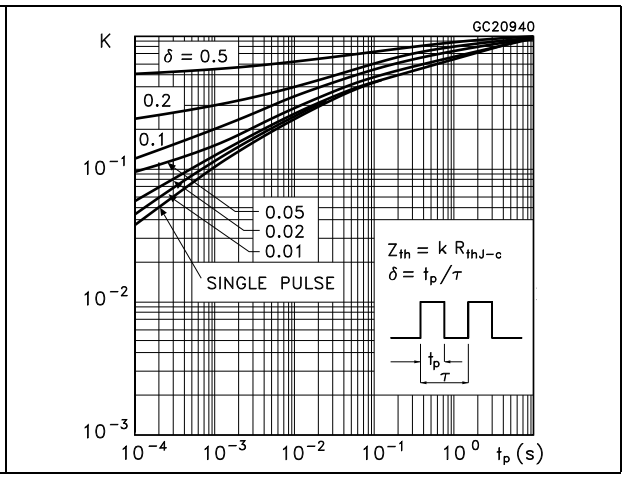


Figure 6. Output characteristics

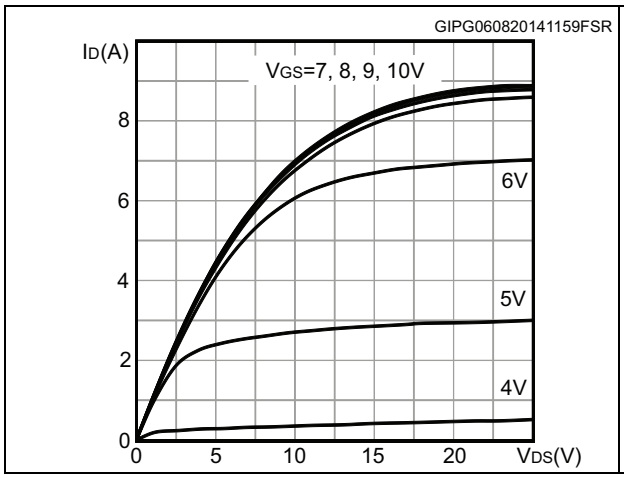


Figure 7. Transfer characteristics

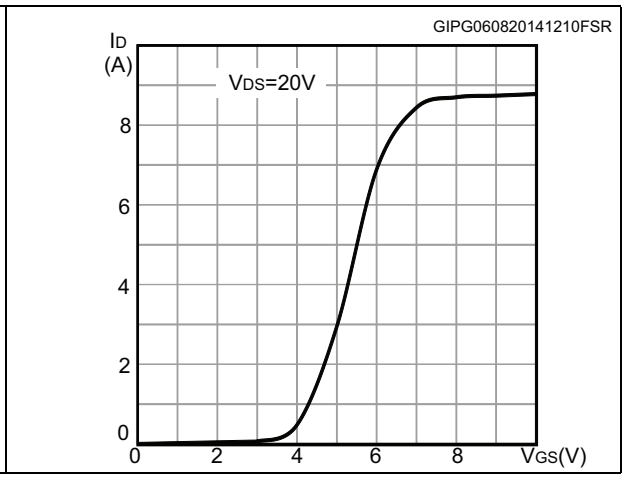


Figure 8. Gate charge vs gate-source voltage

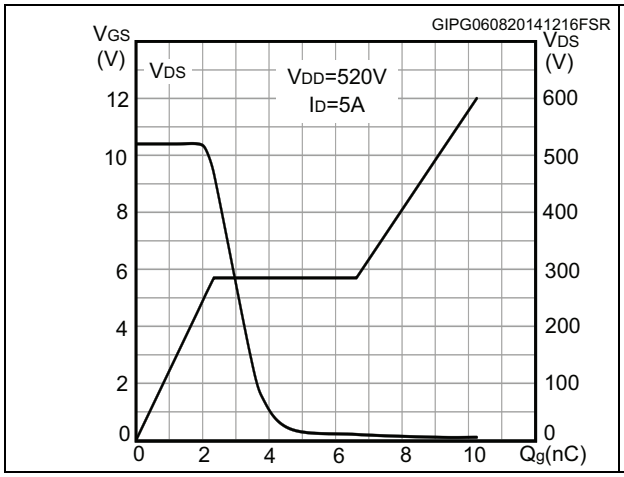


Figure 9. Static drain-source on-resistance

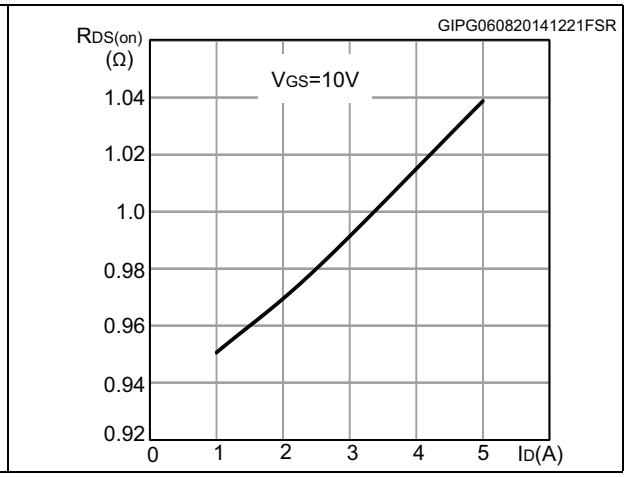


Figure 10. Capacitance variations

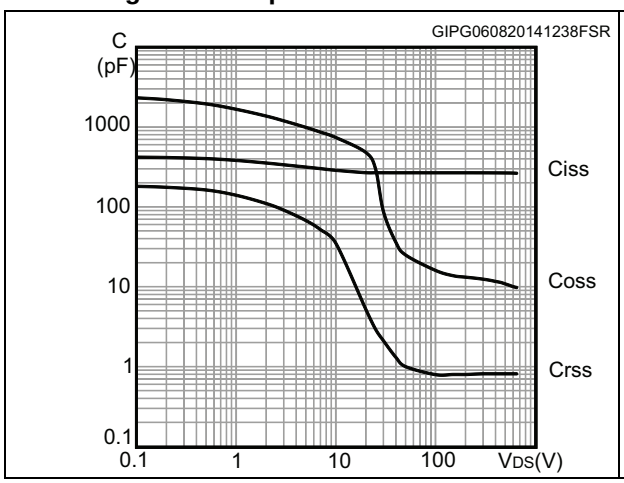


Figure 11. Output capacitance stored energy

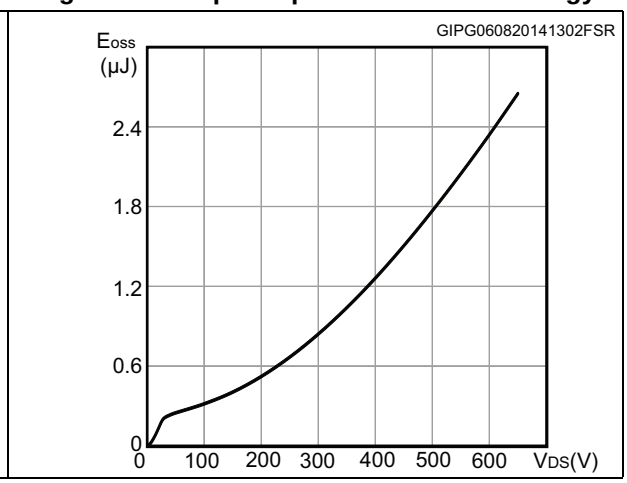


Figure 12. Normalized gate threshold voltage vs temperature

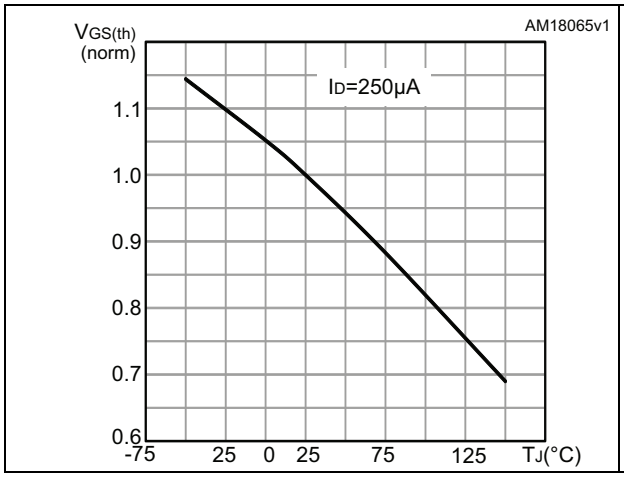


Figure 13. Normalized on-resistance vs temperature

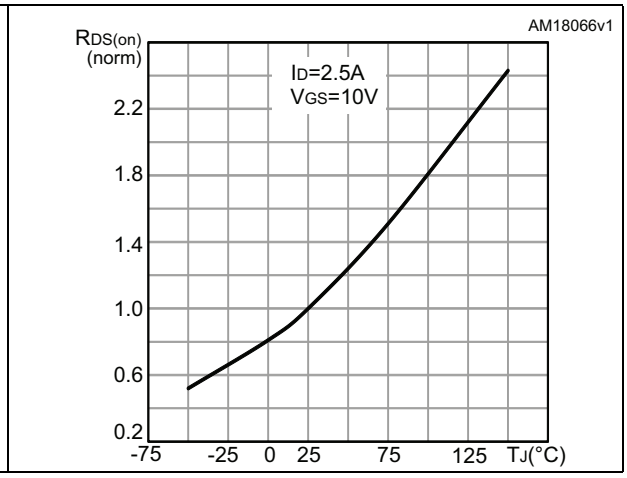


Figure 14. Source-drain diode forward characteristics

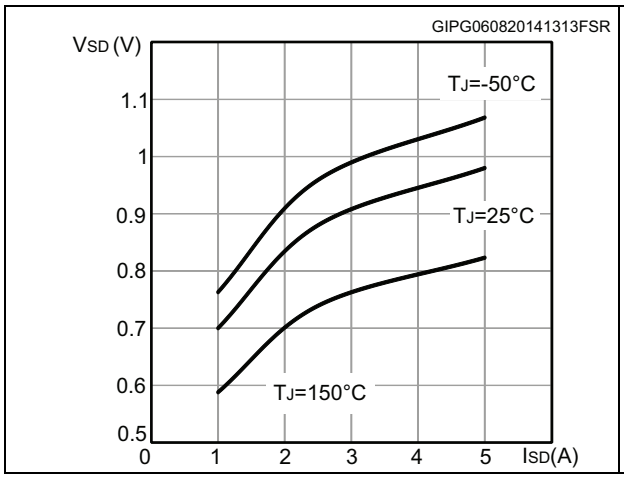
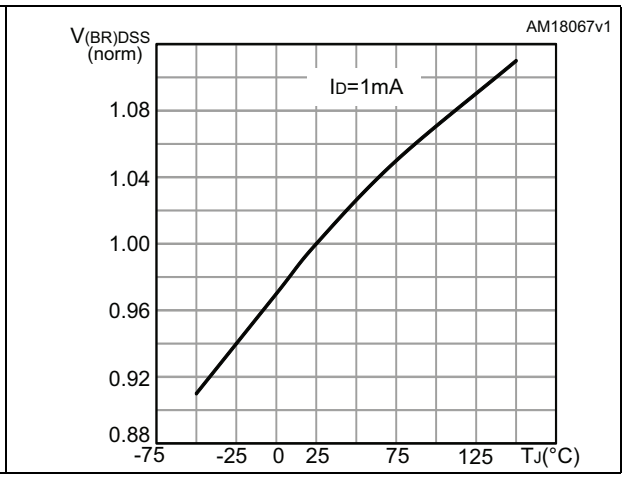


Figure 15. Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 16. Switching times test circuit for resistive load

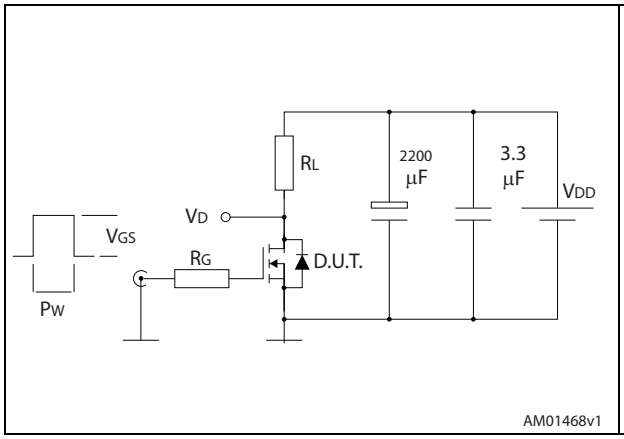


Figure 17. Gate charge test circuit

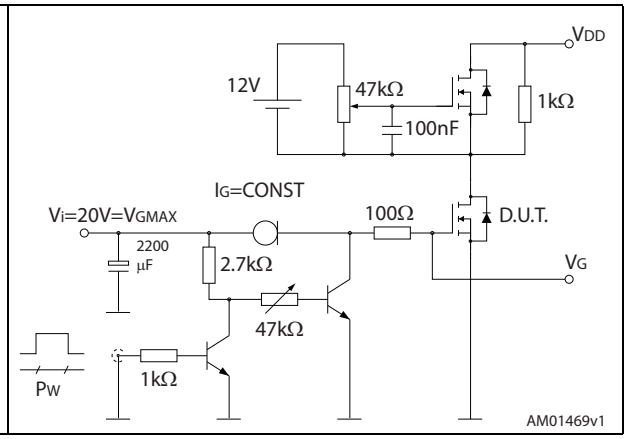


Figure 18. Test circuit for inductive load switching and diode recovery times

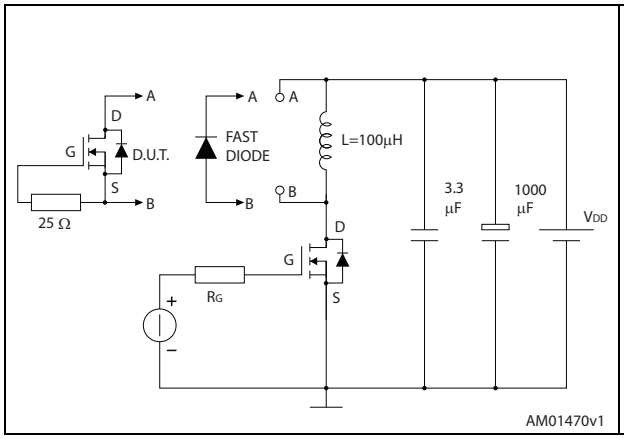


Figure 19. Unclamped inductive load test circuit

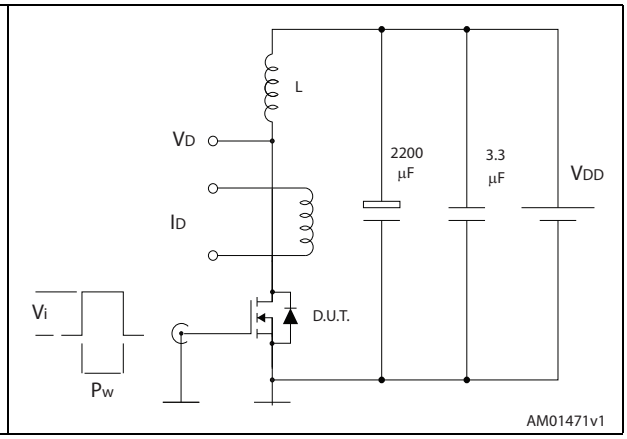


Figure 20. Unclamped inductive waveform

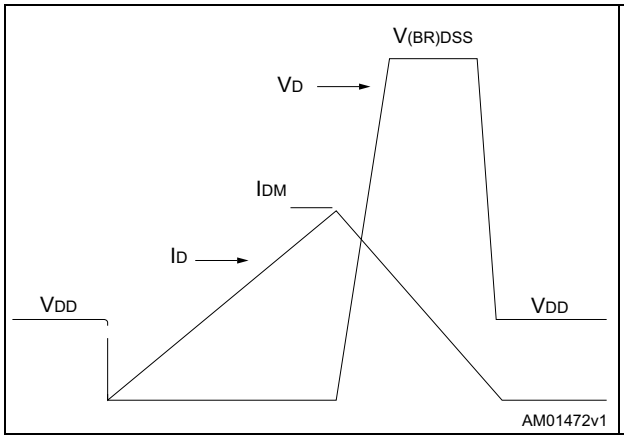
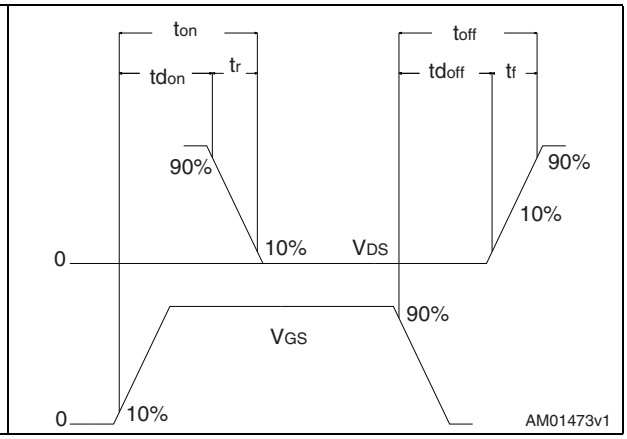


Figure 21. Switching time waveform



4 Package mechanical data

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, STD7N65

Figure 22. DPAK(TO-252) type A drawing

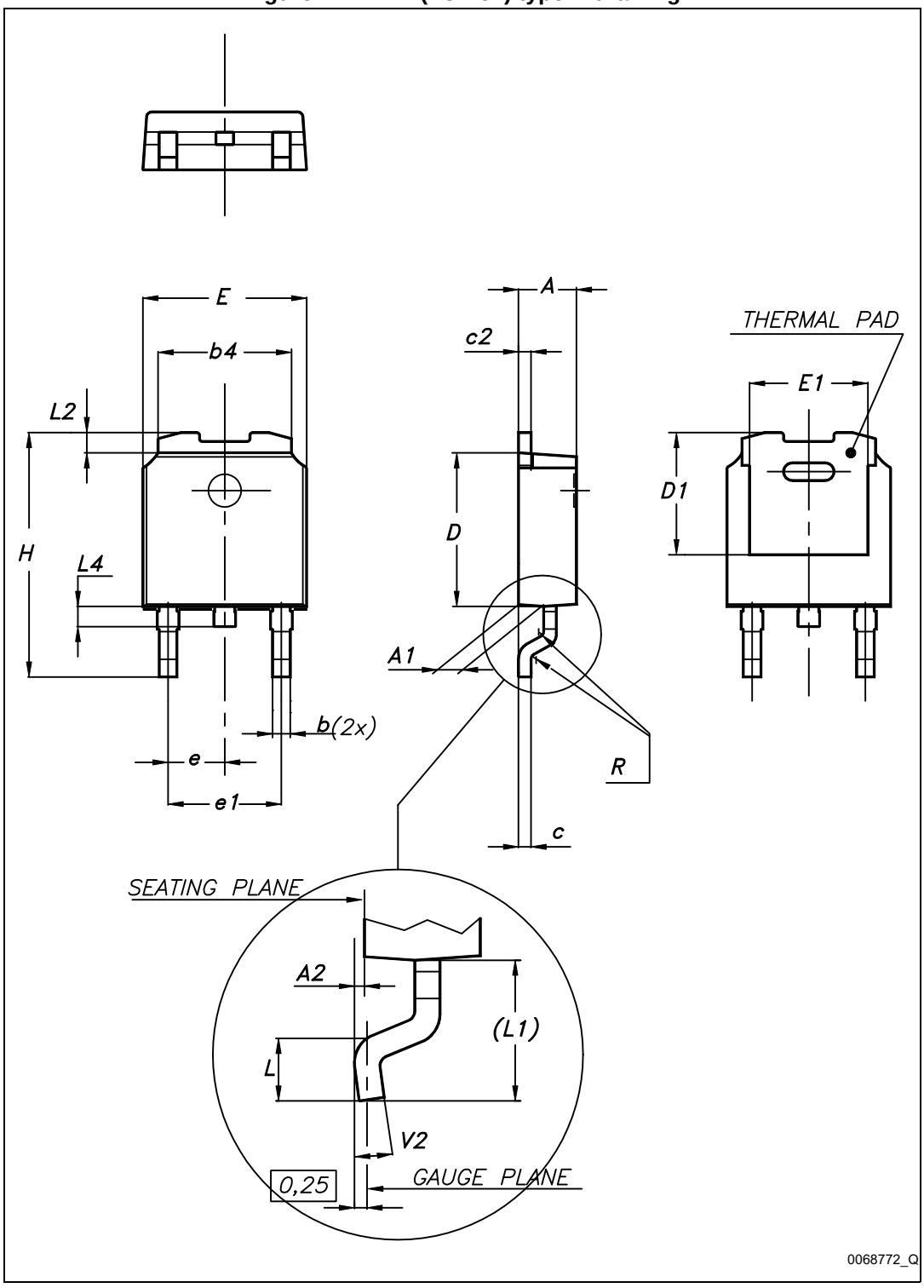


Table 9. DPAK (TO-252) type A mechanical data

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		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
L1		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 23. DPAK (TO-252) type C drawing

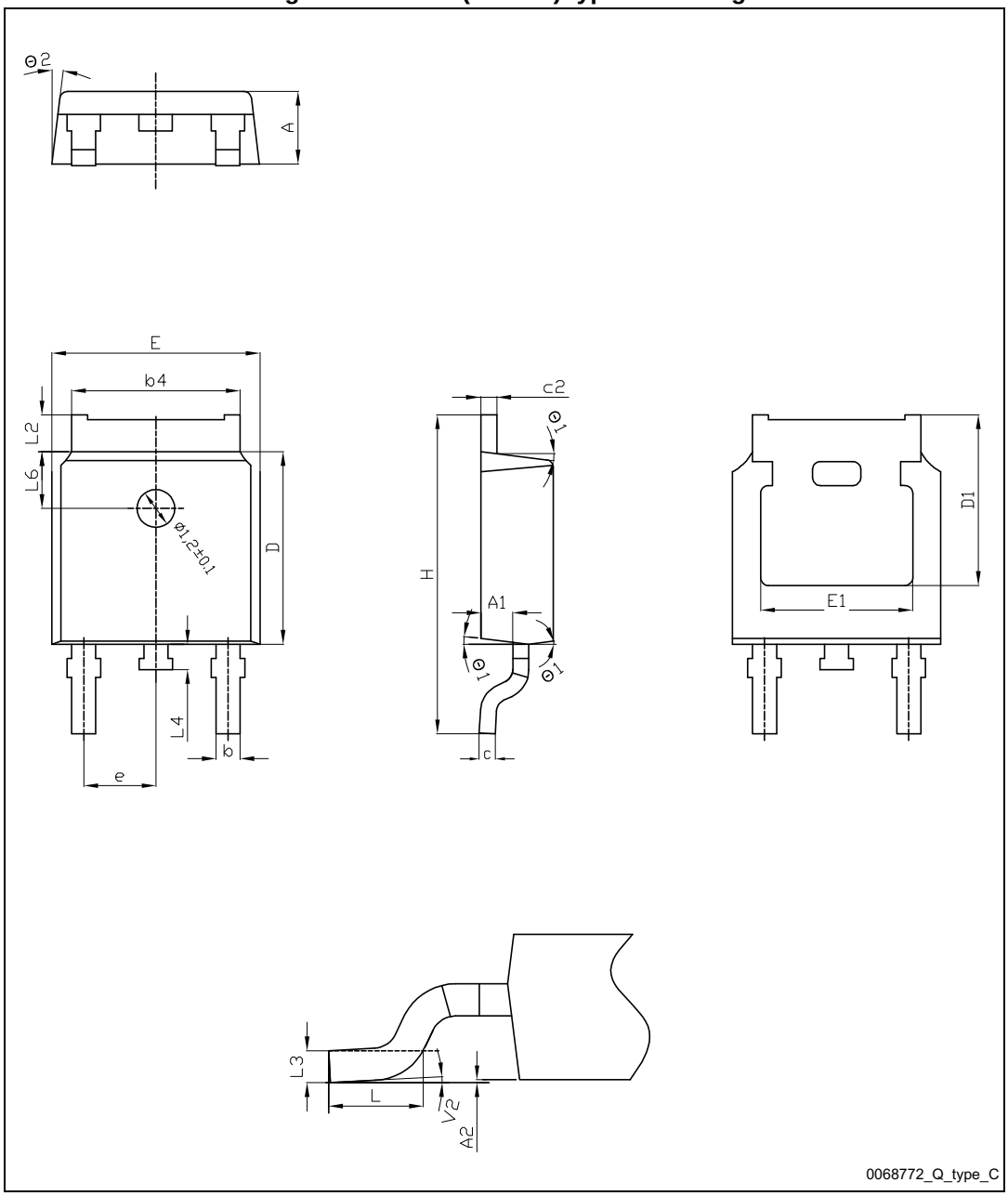
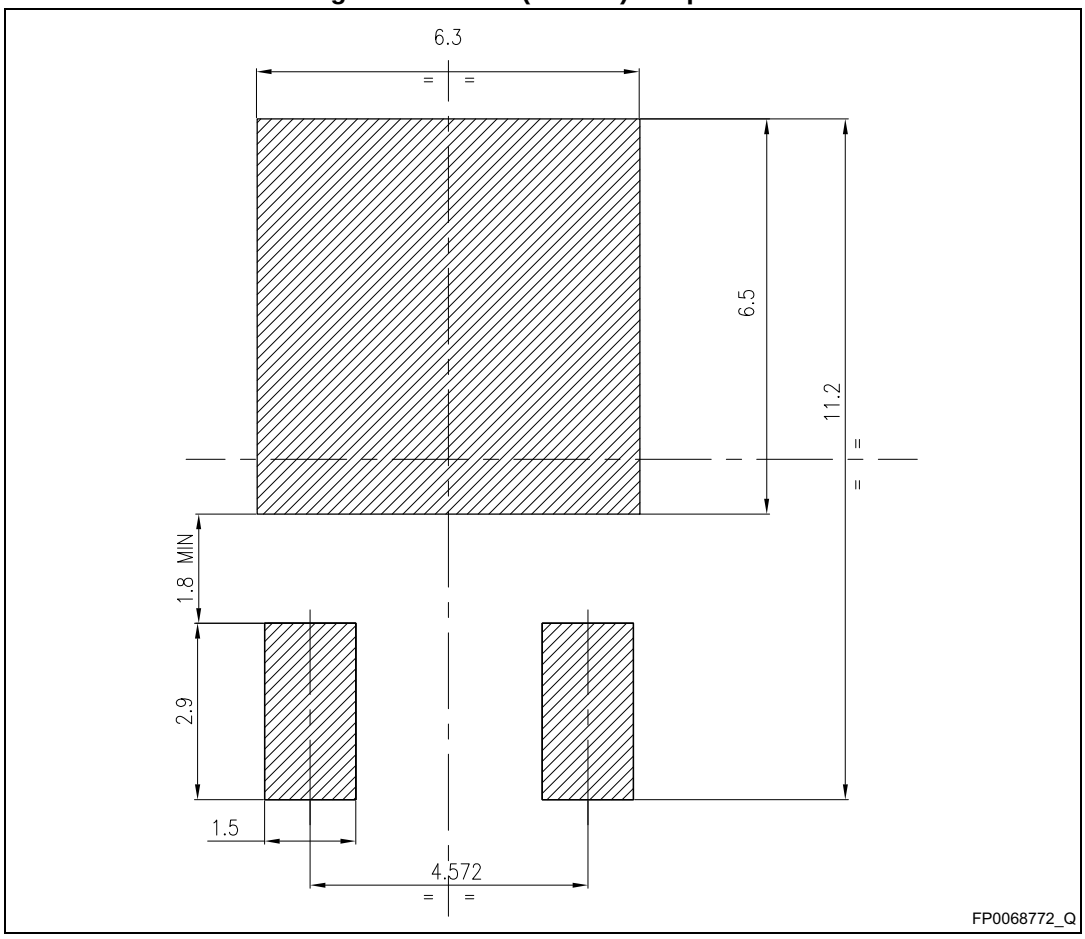


Table 10. DPAK (TO-252) type C mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	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
c	0.47		0.60
c2	0.47		0.60
D	6.00	6.10	6.20
D1	5.25		
E	6.50	6.60	6.70
e	2.186	2.286	2.386
E1	4.70		
H	9.80	10.10	10.40
L	1.40	1.50	1.70
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°

Figure 24. DPAK (TO-252) footprint [(a)]



a. All dimensions are in millimeters

4.2 TO-220FP, STF7N65

Figure 25. TO-220FP drawing

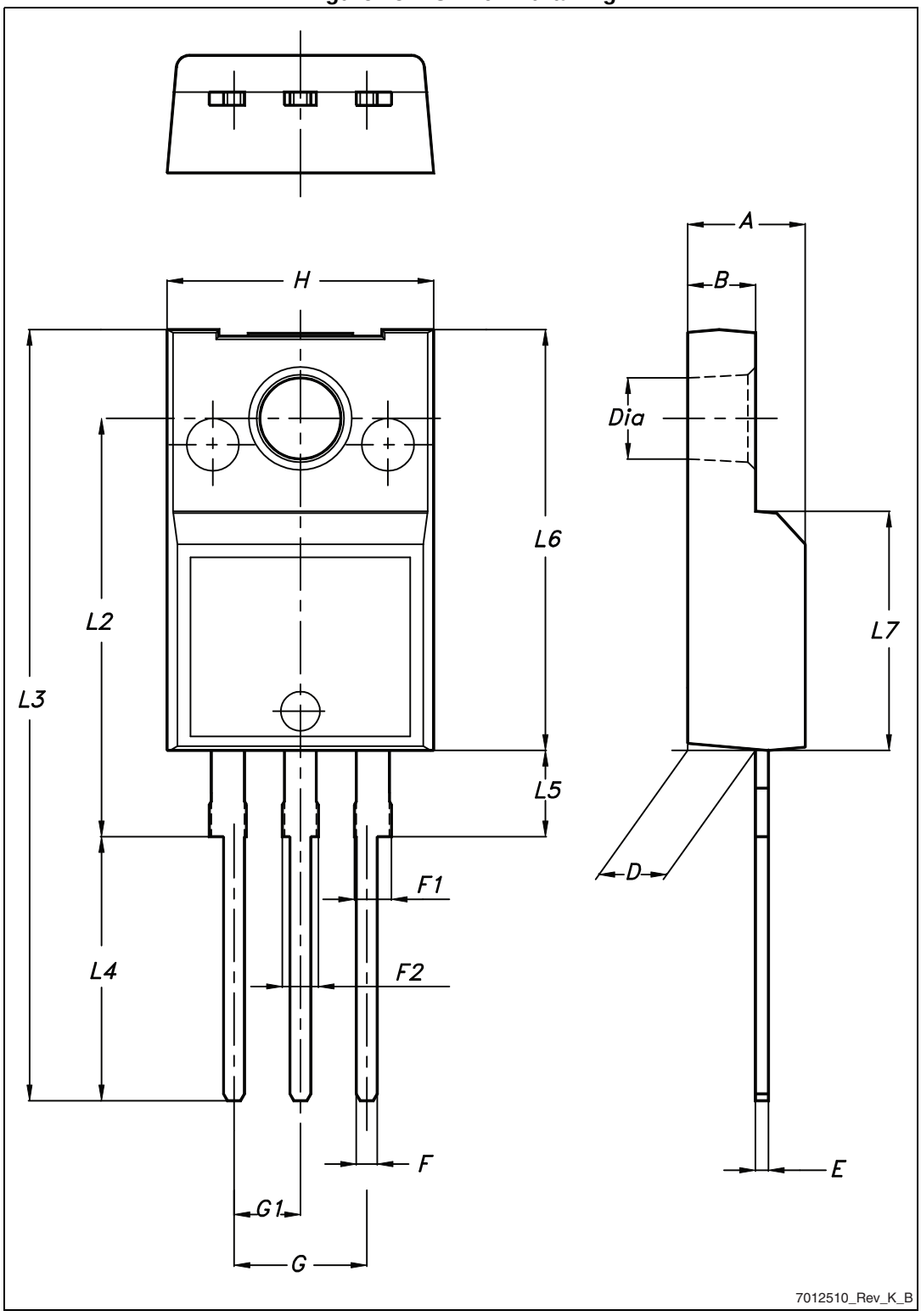


Table 11. TO-220FP mechanical data

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
θ	3		3.2

5 Packaging mechanical data

Figure 26. Tape for DPAK(TO-252)

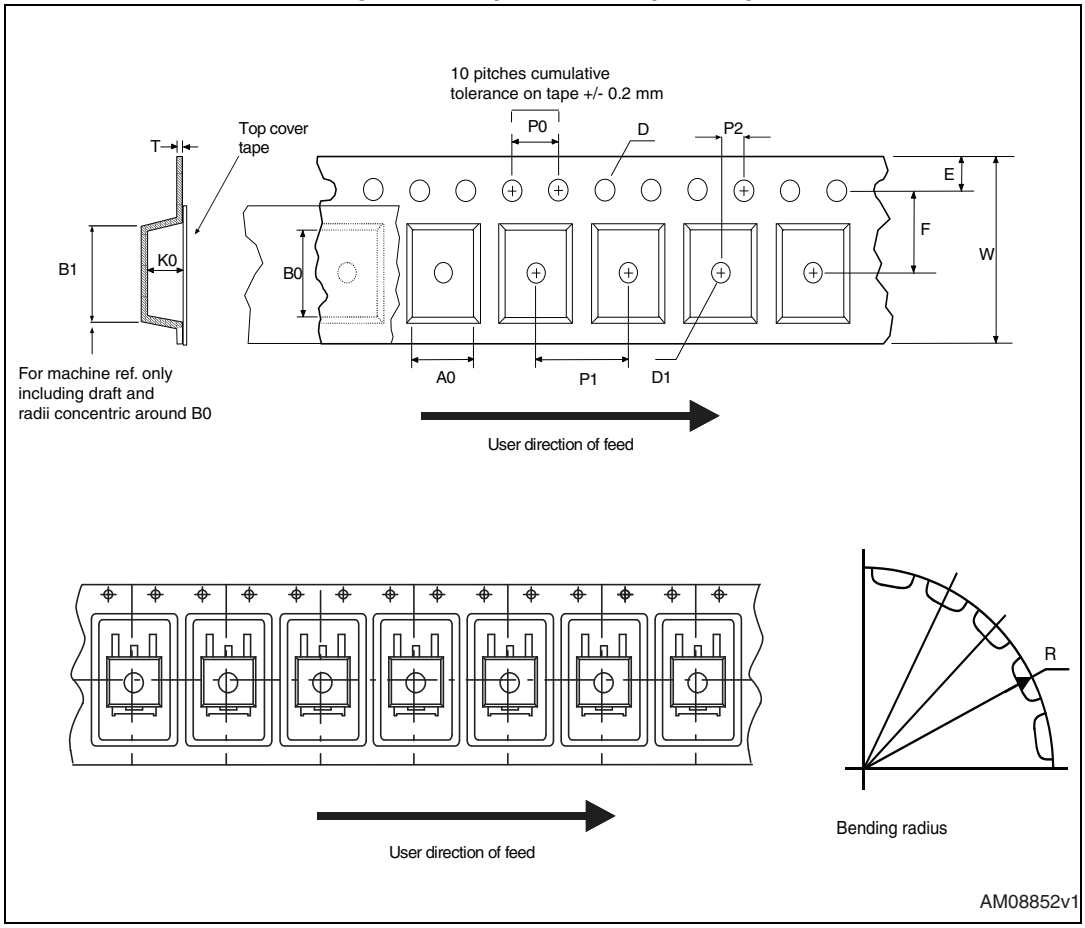


Figure 27. Reel for DPAK(TO-252)

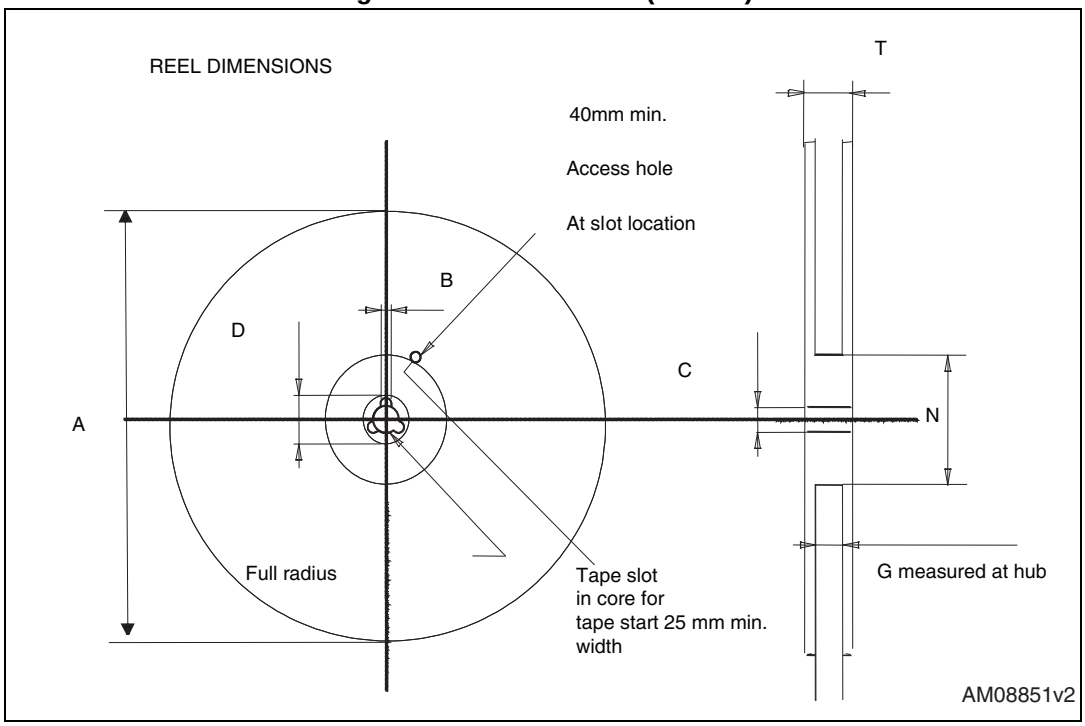


Table 12. DPAK (TO-252) tape and reel mechanical data

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			

6 Revision history

Table 13. Document revision history

Date	Revision	Changes
16-Oct-2014	1	First release.