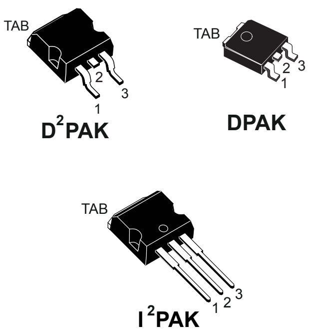
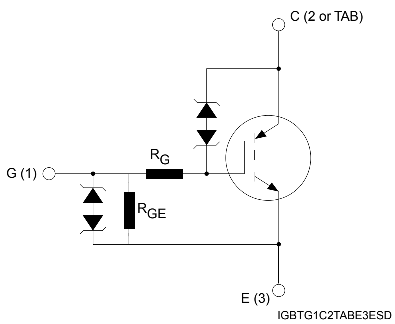
STGB25N36LZAG, STGD25N36LZAG, STGI25N36LZAG

Datasheet

Automotive-grade 360 V internally clamped IGBT E_{SCIS} 300 mJ





Product status link
STGB25N36LZAG
STGD25N36LZAG
STGI25N36LZAG

Features

- AEC-Q101 qualified
- SCIS energy of 300 mJ @ T_J = 25 °C
- Parts are 100% tested in SCIS
- ESD gate-emitter protection
- Gate-collector high voltage clamping
- Logic level gate drive
- Very low saturation voltage
- High pulsed current capability
- Gate and gate-emitter resistor

Applications

- Automotive ignition coil driver circuit

Description

This application-specific IGBT utilizes the most advanced PowerMESH technology optimized for coil driving in the harsh environment of automotive ignition systems. These devices show very low on-state voltage and very high SCIS energy capability over a wide operating temperature range. Moreover, ESD-protected logic level gate input and an integrated gate resistor means no external protection circuitry is required.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	$V_{CES(clamped)}$	V
V_{ECS}	Emitter-collector voltage (V_{GE} = 0 V)	20	V
I_C	Continuous collector current at T_C = 25 °C, V_{GE} = 4 V	25	A
	Continuous collector current at T_C = 100 °C, V_{GE} = 4 V	25	A
I_{CP} (1)	Pulsed collector current	50	A
V_{GE}	Gate-emitter voltage	$V_{GE(clamped)}$	V
P_{TOT}	Total power dissipation at T_C = 25 °C	150	W
E_{SCIS_25} (2)	Self-clamping inductive switching energy	300	mJ
E_{SCIS_150} (3)	Self-clamping inductive switching energy @ T_J = 150 °C	170	mJ
ESD	Human body model, R = 1.5 kΩ, C = 100 pF	4	kV
	Charged device model	2	kV
T_{STG}	Storage temperature range	-55 to 175	°C
T_J	Operating junction temperature range		°C

1. *Pulse width limited by maximum junction temperature.*
2. *Starting T_j = 25 °C, L = 3 mH, R_g = 1 kΩ, V_{cc} = 50 V during inductor charging and V_{cc} = 0 V during the time in clamp. Parts are 100% electrically tested in production.*
3. *Starting T_j = 150 °C, L = 3 mH, R_g = 1 kΩ, V_{cc} = 50 V during inductor charging and V_{cc} = 0 V during the time in clamp.*

Table 2. Thermal data

Symbol	Parameter	Value			Unit
		D²PAK	DPAK	I²PAK	
$R_{thj-case}$	Thermal resistance junction-case	1			°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5	100	62.5	°C/W

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 3. Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CES(clamped)}$	Collector-emitter clamped voltage	I_C = 2 mA, V_{GE} = 0 V		350		V
		I_C = 2 mA, V_{GE} = 0 V, T_J= - 40 °C to 175 °C	325		385	V
$V_{(BR)ECS}$	Emitter-collector break-down voltage	I_C = 75 mA, V_{GE} = 0 V	20			V
$V_{GE(clamped)}$	Gate-emitter clamped voltage	I_G = ±2 mA, T_J= - 40 °C to 175 °C	12		16	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 4 V, I_C = 6 A		1.1	1.25	V
		V_{GE} = 4.5 V, I_C = 10 A, T_J = 175 °C		1.25	1.55	V
$V_{GE(th)}$	Gate-threshold voltage	V_{GE} = V_{CE}, I_C = 1 mA	1.3	1.7	2.1	V
		V_{GE} = V_{CE}, I_C = 1 mA, T_J = 175 °C		1.05		V
I_{CES}	Collector cut-off current	V_{CE} = 15 V, V_{GE} = 0 V, T_J = 150 °C			20	µA
		V_{CE} = 200 V, V_{GE} = 0 V, T_J = 150 °C			100	µA
I_{GES}	Gate-emitter leakage current	V_{GE} = ±10 V, V_{CE} = 0 V		625		µA
		V_{GE} = ±10 V, V_{CE} = 0 V, T_J = -40 °C to 175 °C	450		900	µA
R_{GE}	Gate emitter resistance		11	16	22	kΩ
R_G	Gate resistance			120		Ω

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	1004	-	pF
C_{oes}	Output capacitance		-	86.6	-	
C_{res}	Reverse transfer capacitance		-	14	-	
Q_g	Total gate charge	V_{CE} = 13 V, I_C = 10 A, V_{GE} = 0 to 5 V	-	25.7	-	nC

Table 5. Resistive load switching characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 14 V, V_{GE} = 5 V, R_L = 1 Ω, R_G = 1 kΩ (see Figure 17. Test circuit for resistive load switching)	-	1.1	-	μs
t_r	Current rise time		-	3.6	-	μs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 14 V, V_{GE} = 5 V, R_L= 1 Ω, R_G = 1 kΩ, T_J = 150 °C (see Figure 17. Test circuit for resistive load switching)	-	1.06	-	μs
t_r	Current rise time		-	3.5	-	μs

Table 6. Inductive load switching characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	V_{CC} = 300 V, L = 1 mH, I_C = 10 A, V_{GE} = 5 V, R_G = 1 kΩ (see Figure 16. Test circuit for inductive load switching)	-	7.4	-	μs
t_f	Current fall time		-	5.1	-	μs
dV/dt	Turn-off voltage slope		-	160	-	V/μs
$t_{d(off)}$	Turn-off delay time	V_{CC} = 300 V, L = 1 mH, I_C = 10 A, V_{GE} = 5 V, R_G = 1 kΩ, T_J = 150 °C (see Figure 16. Test circuit for inductive load switching)	-	7.5	-	μs
t_f	Current fall time		-	7.0	-	μs
dV/dt	Turn-off voltage slope		-	144	-	V/μs

2.1 Electrical characteristics (curves)

Figure 1. $V_{CE(sat)}$ vs junction temperature (I_C = 6 A)

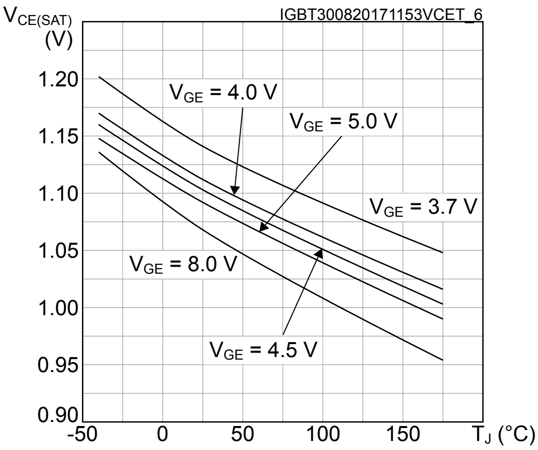


Figure 2. $V_{CE(sat)}$ vs junction temperature (I_C = 10 A)

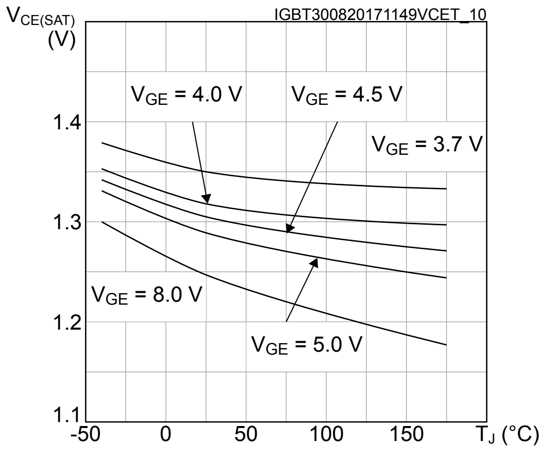


Figure 3. Self-clamped inductive switching current

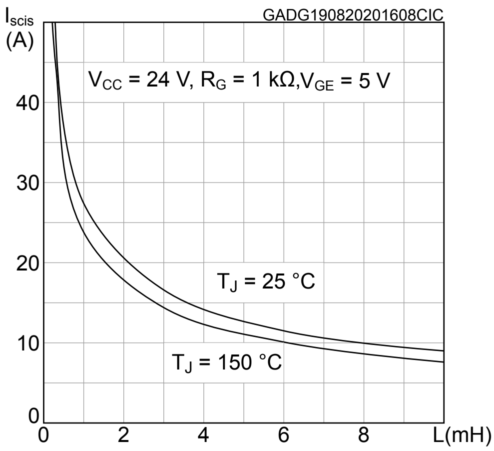


Figure 4. Output characteristics (T_J = 25 °C)

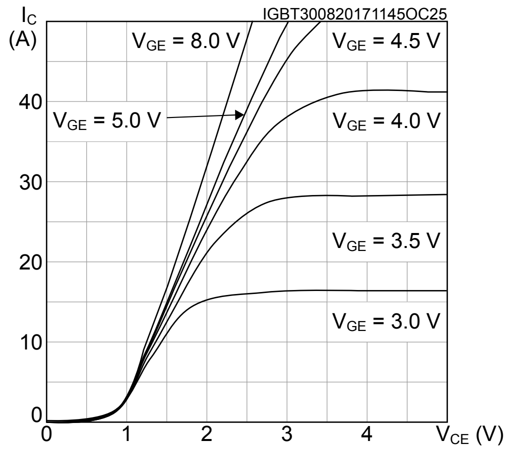


Figure 5. Output characteristics (T_J = -40 °C)

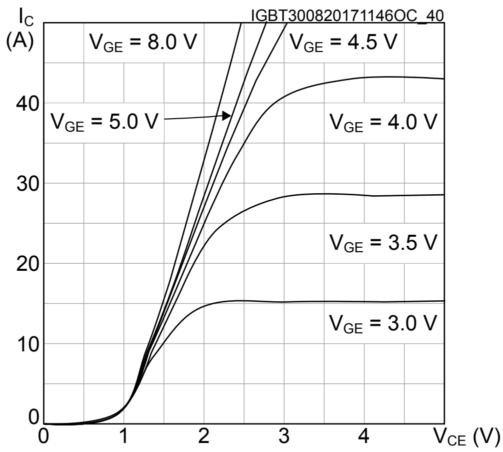


Figure 6. Output characteristics (T_J = 175 °C)

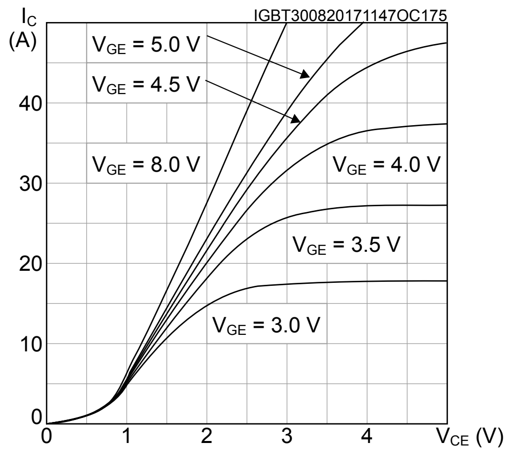


Figure 7. Transfer characteristics

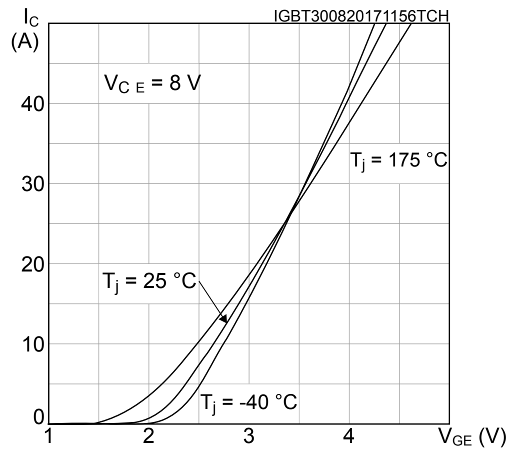


Figure 8. Collector current vs case temperature

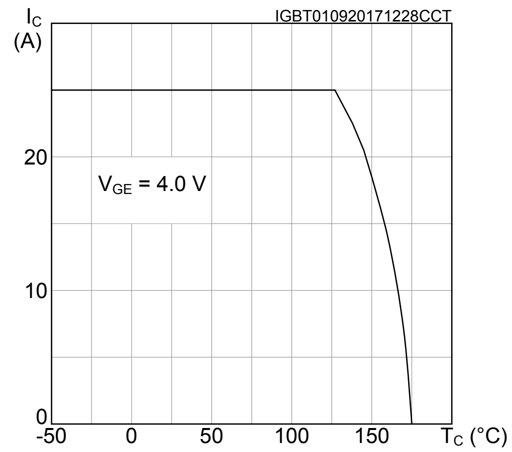


Figure 9. Leakage current vs temperature

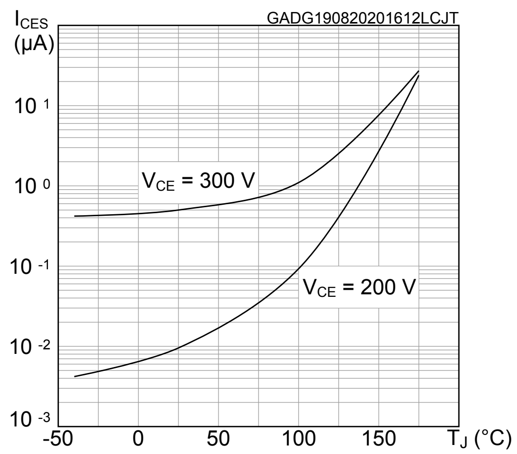


Figure 10. Normalized $V_{CES(clamped)}$ vs temperature

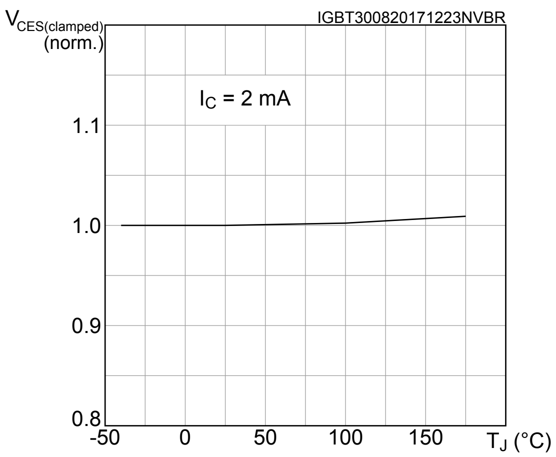


Figure 11. Normalized $V_{GE(th)}$ vs temperature

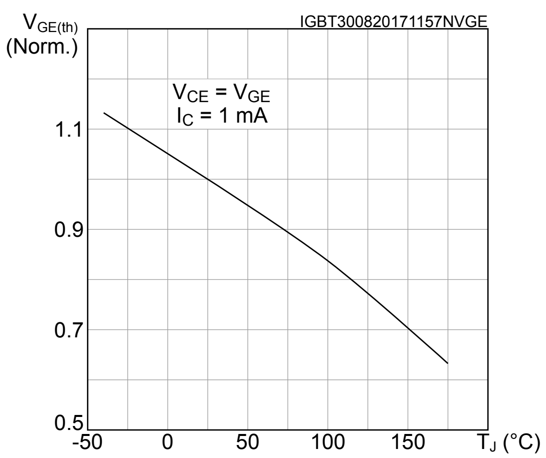


Figure 12. Gate charge vs gate-emitter voltage

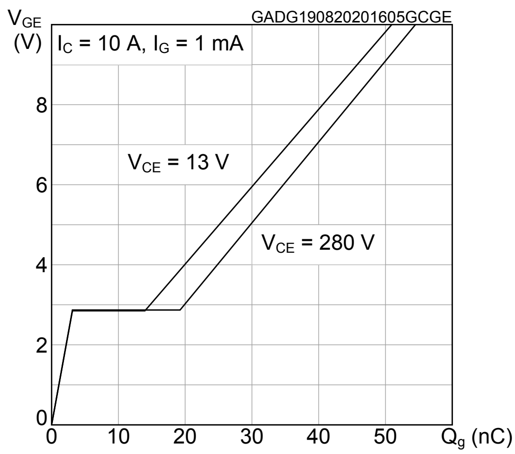


Figure 13. Capacitance variations

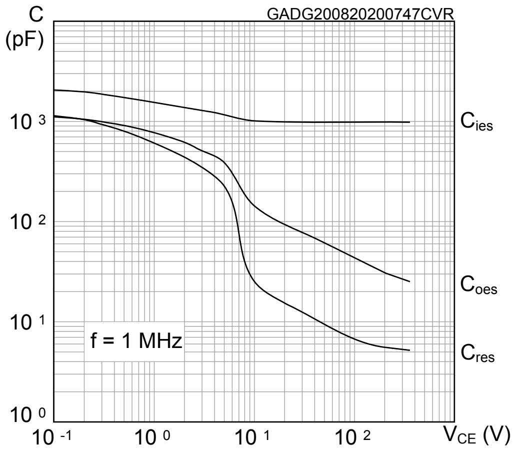


Figure 14. Thermal impedance for D²PAK and I²PAK

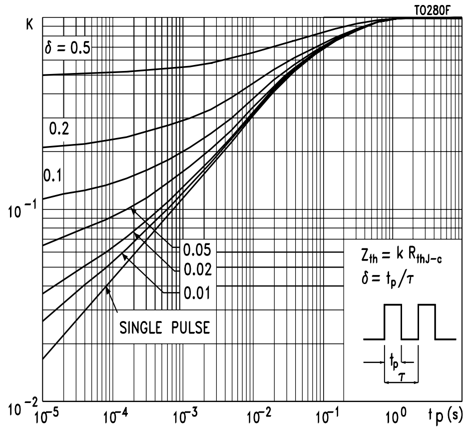
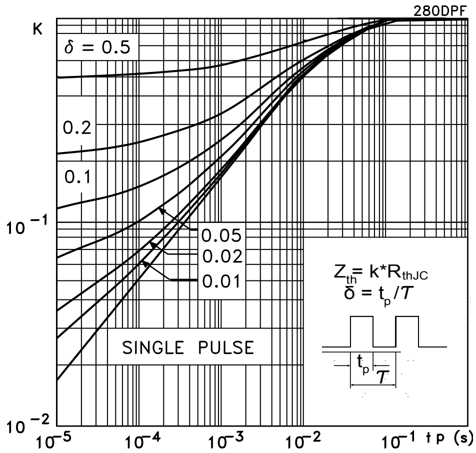


Figure 15. Thermal impedance for DPAK



3 Test circuits

Figure 16. Test circuit for inductive load switching

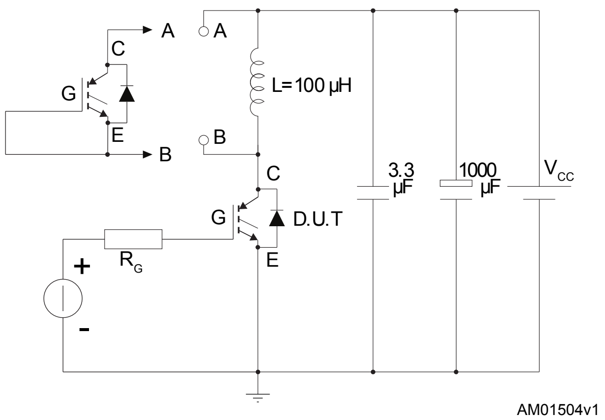


Figure 17. Test circuit for resistive load switching

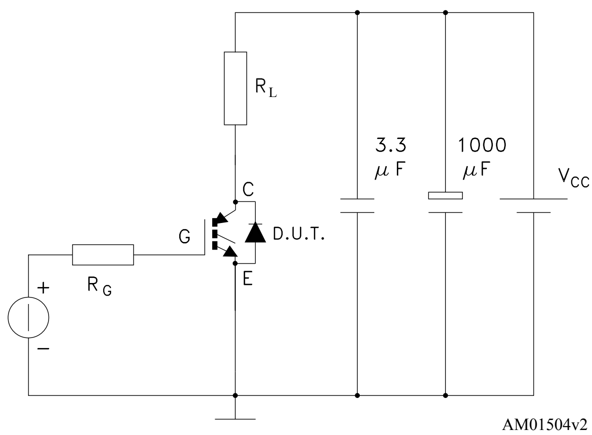


Figure 18. Gate charge test circuit

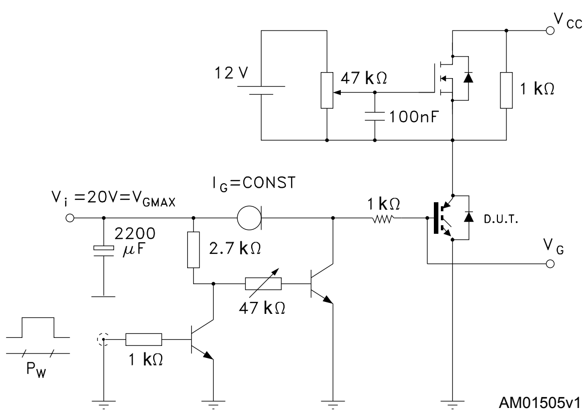
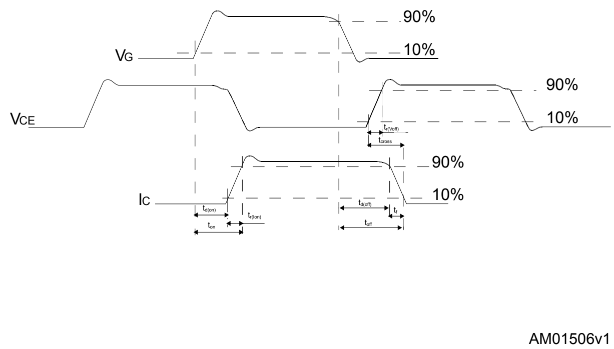


Figure 19. Switching waveform



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 D²PAK (TO-263) type A package information

Figure 20. D²PAK (TO-263) type A package outline

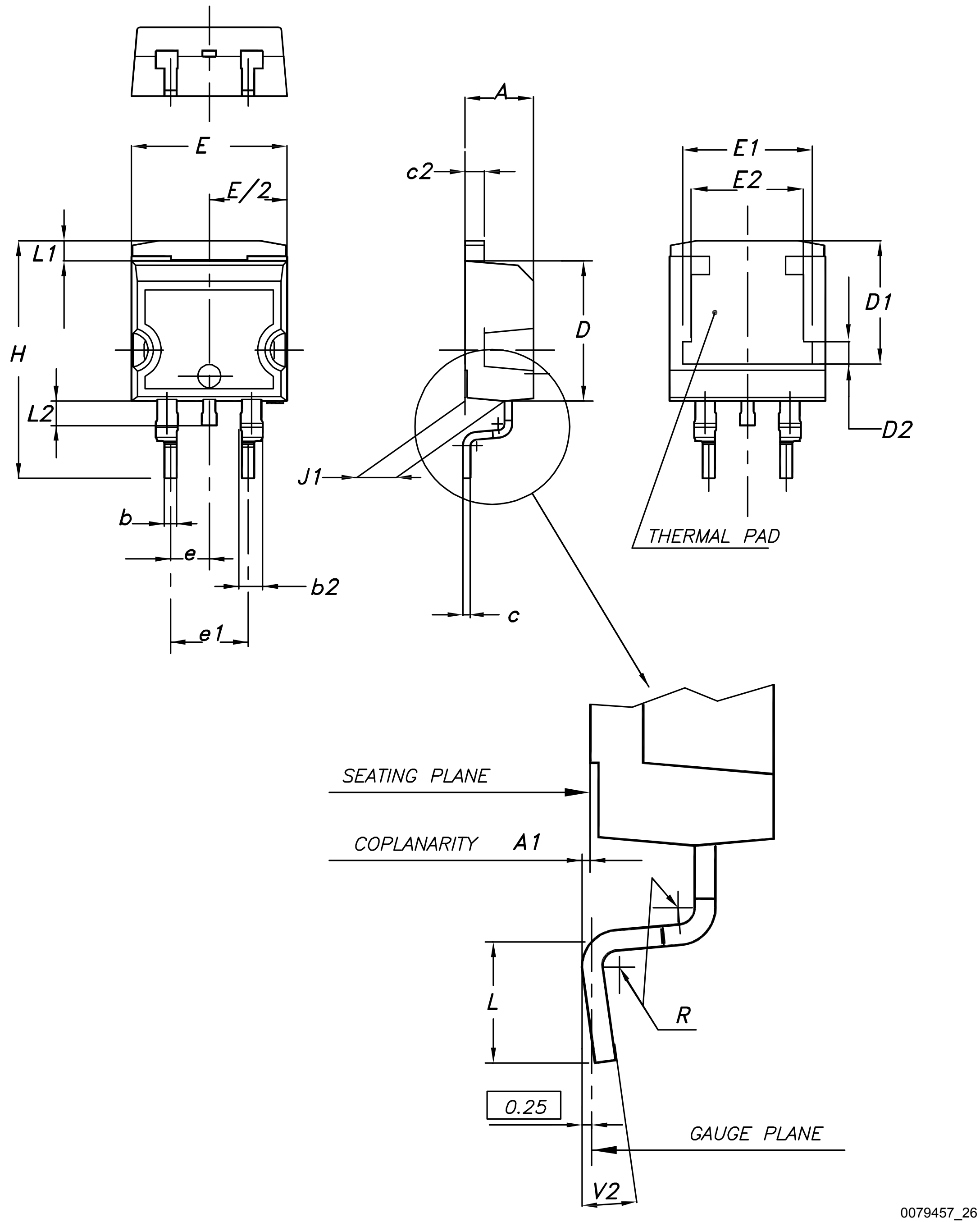


Table 7. D²PAK (TO-263) type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

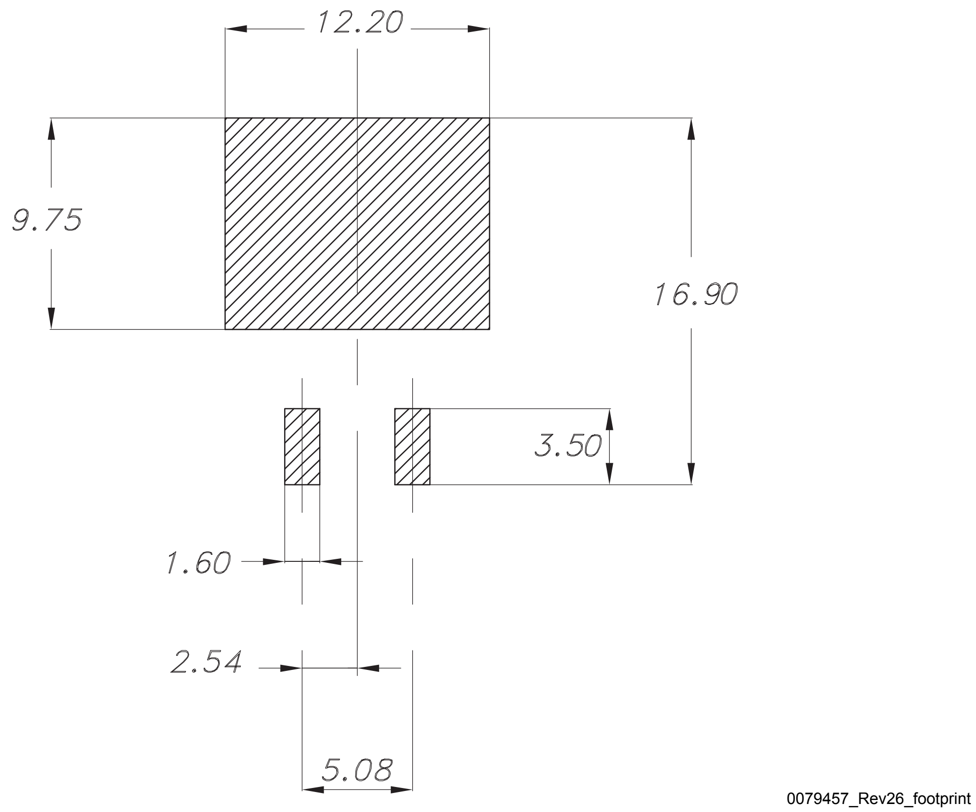


Figure 21. D²PAK (TO-263) recommended footprint (dimensions are in mm)

4.2 DPAK (TO-252) type A2 package information

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

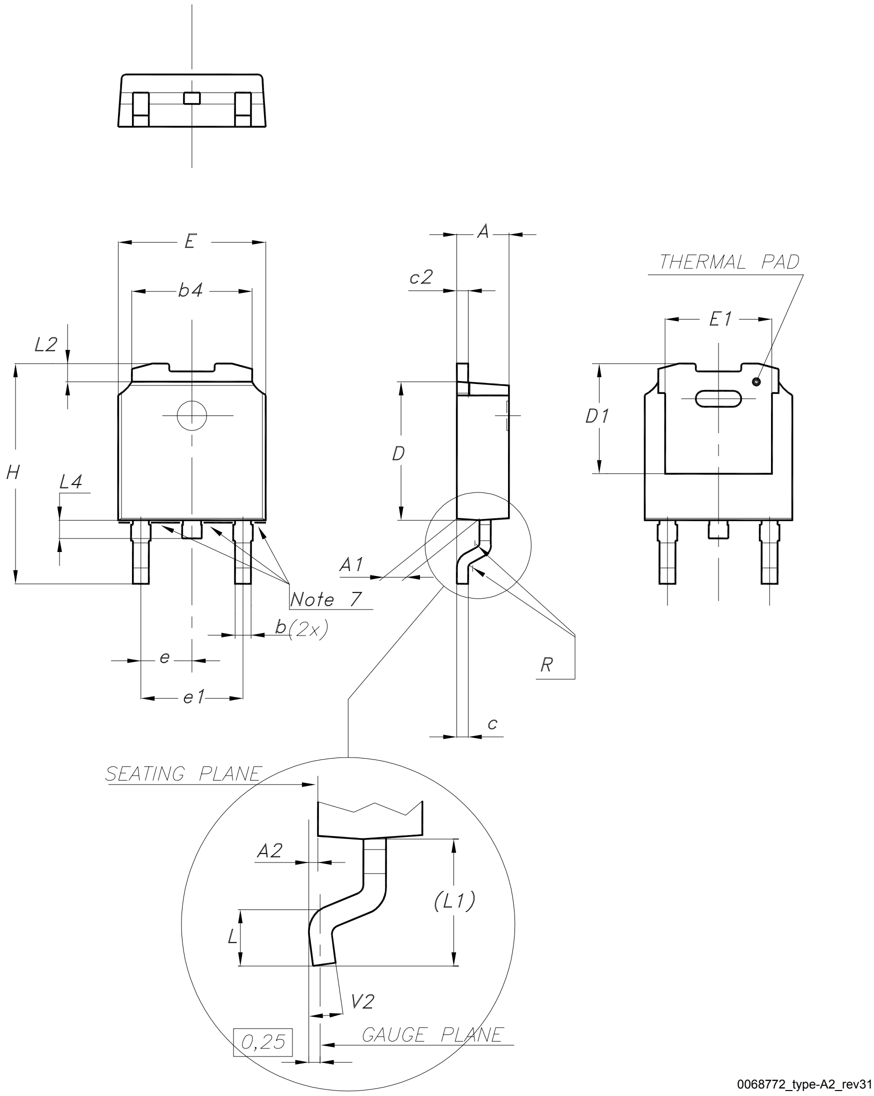
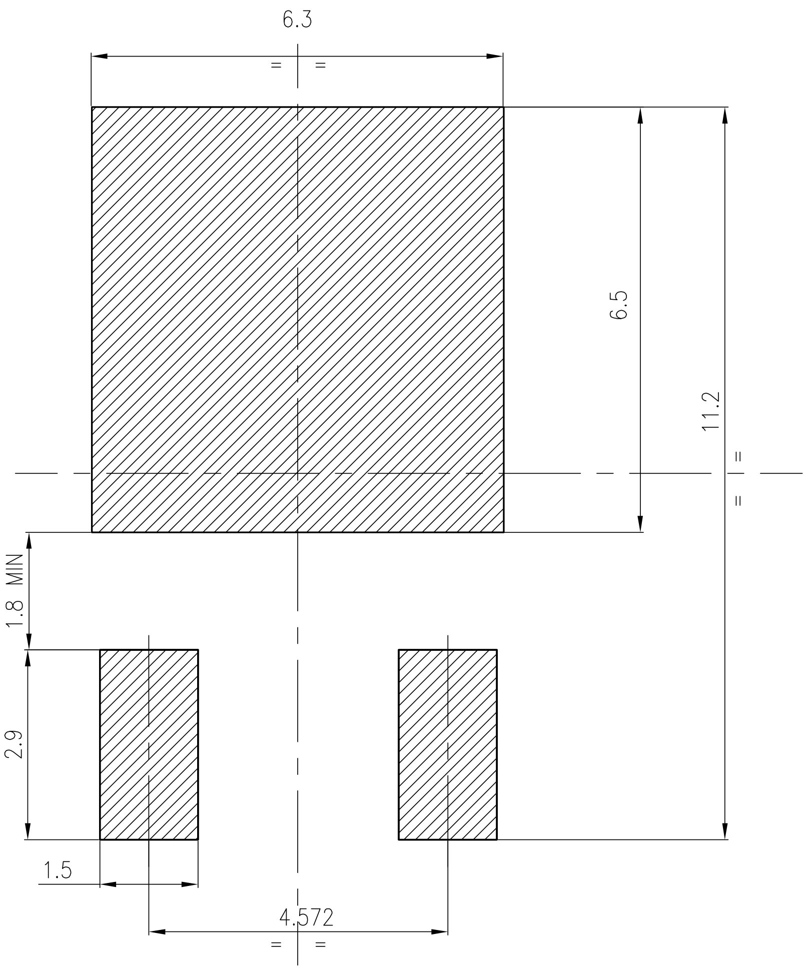


Table 8. **DPAK (TO-252) type A2 mechanical data**

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)**



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4.3 I²PAK package information

Figure 24. I²PAK package outline

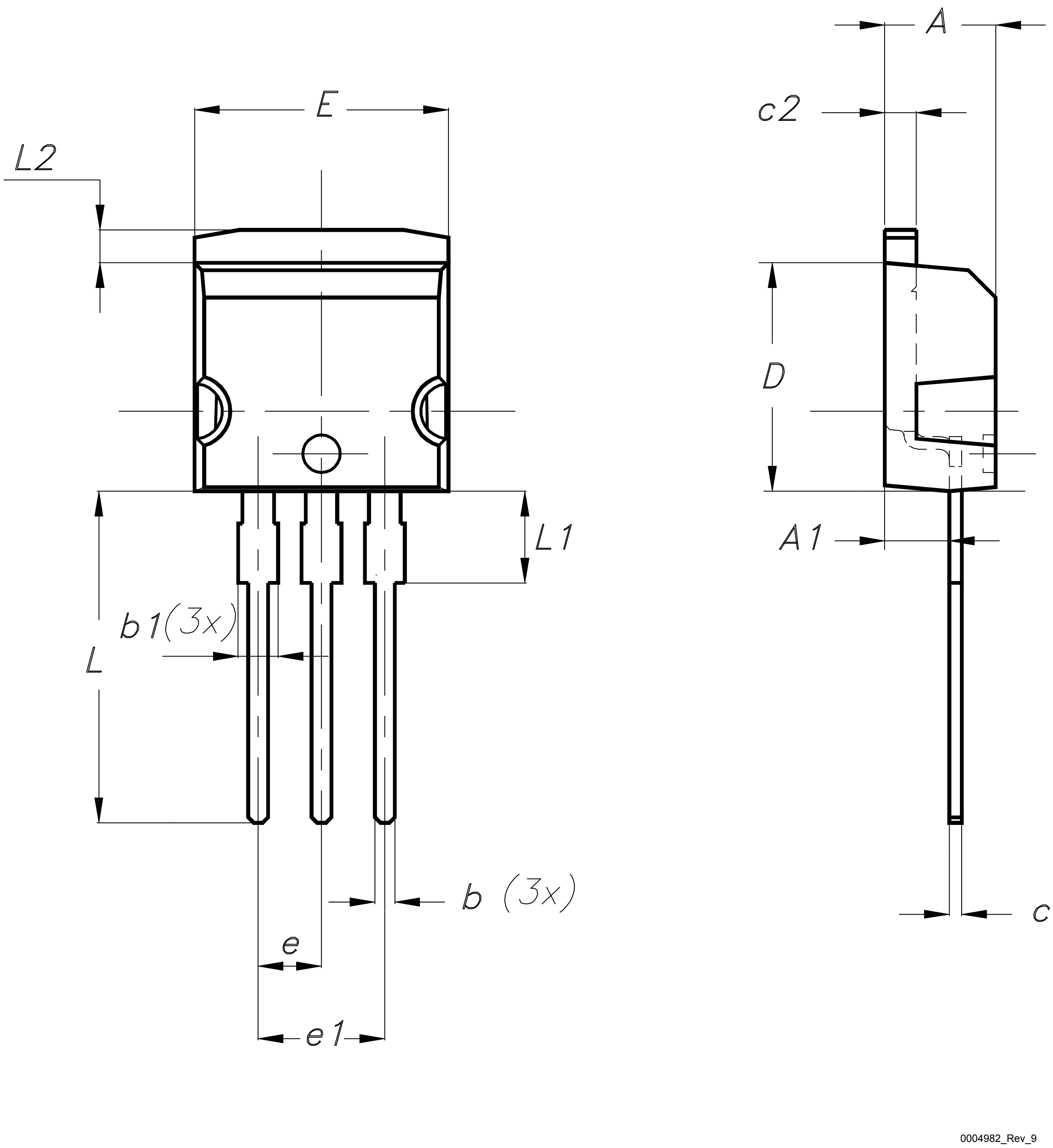

Table 9. I²PAK package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40	-	4.60
A1	2.40	-	2.72
b	0.61	-	0.88
b1	1.14	-	1.70
c	0.49	-	0.70
c2	1.23	-	1.32
D	8.95	-	9.35
e	2.40	-	2.70
e1	4.95	-	5.15
E	10.00	-	10.40
L	13.00	-	14.00
L1	3.50	-	3.93
L2	1.27	-	1.40

4.4 D²PAK and DPAK packing information

Figure 25. Tape outline

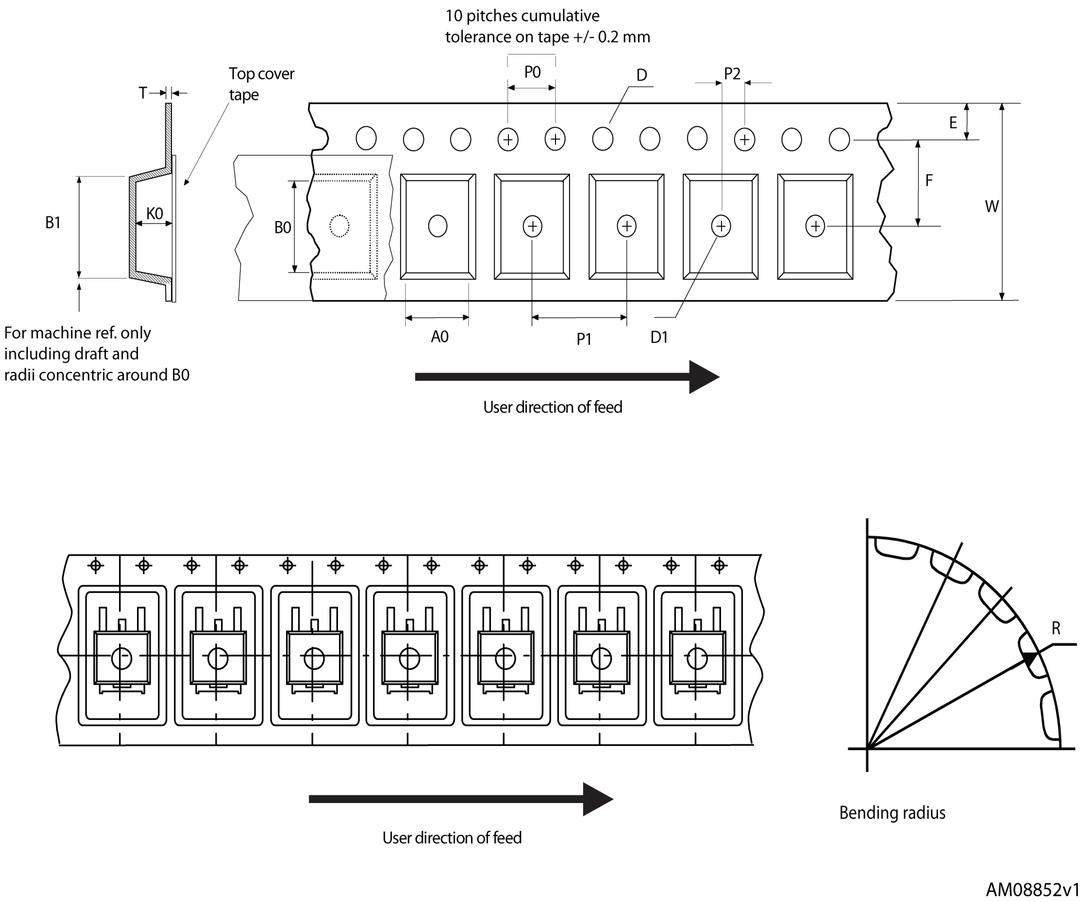

Figure 26. Reel outline

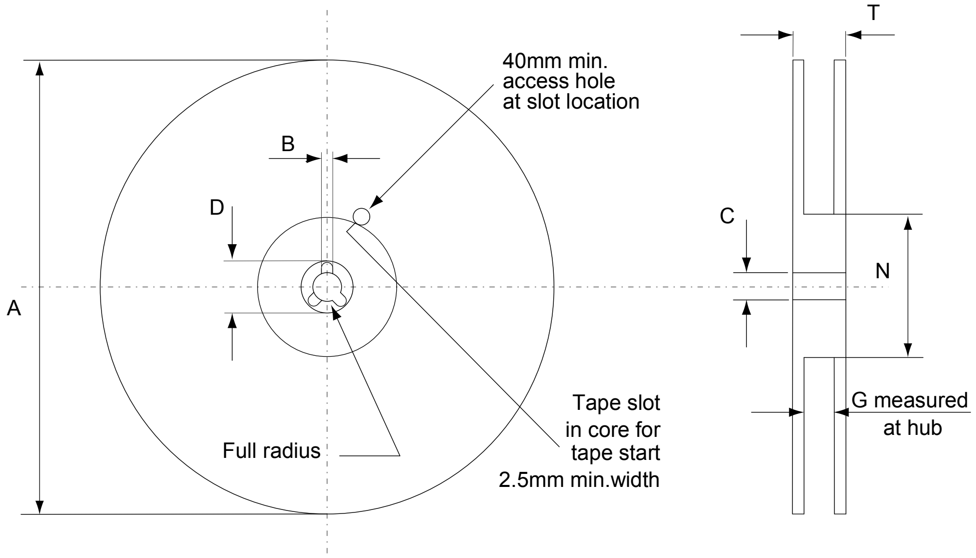

Table 10. D²PAK tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Table 11. **DPAK 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			

5 Ordering information

Table 12. Order codes

Order code	Marking	Package	Packing
STGB25N36LZAG	GB25N36LZ	D^2PAK	Tape and reel
STGD25N36LZAG	GD25N36LZ	DPAK	Tape and reel
STGI25N36LZAG	GI25N36LZ	I^2PAK	Tube

Revision history

Table 13. Document revision history

Date	Revision	Changes
19-Aug-2020	1	First release.
02-Feb-2023	2	Updated Table 6. Inductive load switching characteristics.

Contents