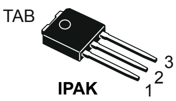
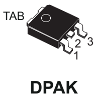
STGD5NB120SZ

Datasheet

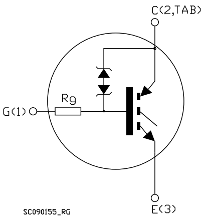
5 A, 1200 V, low drop internally clamped IGBT



IPAK



DPAK



Features

- Low on-voltage drop ($V_{CE(sat)}$)
- High current capability
- Off losses include tail current
- High voltage clamping

Applications

- Switching applications

Description

These devices are low drop internally clamped IGBTs developed using advanced PowerMESH™ technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior.

Product status link
STGD5NB120SZ

1 Electrical ratings

Table 1. **Absolute maximum ratings**

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	1200	V
I_C	Continuous collector current at T_C = 25 °C	10	A
	Continuous collector current at T_C = 100 °C	5	
I_{CP} (1)	Pulsed collector current	10	A
I_{CL} (2)	Turn-off latching current	10	A
V_{GE}	Gate-emitter voltage	±20	V
V_{ECR}	Emitter-collector voltage	20	V
E_{AS} (3)	Single pulse avalanche energy at T_C = 25 °C	10	mJ
	Single pulse avalanche energy at T_C = 100 °C	7	mJ
P_{TOT}	Total power dissipation at T_C = 25 °C	75	W
T_J	Operating junction temperature range	-55 to 150	°C
T_{stg}	Storage temperature range		

1. *Pulse width is limited by maximum junction temperature*
2. V_{CLAMP} = 80% V_{CES}, V_{GE} = 15 V, R_G = 10 Ω, T_J = 150 °C
3. V_{CE} = 50 V , I_{AV} = 3.3 A

Table 2. **Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.67	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	100	°C/W

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 3. **Static characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	V_{GE} = 0 V, I_C = 10 mA	1200			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 5 A		1.3	2.0	V
		V_{GE} = 15 V, I_C = 5 A, T_C = 125 °C		1.2		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	2		5	V
V_{GE}	Gate emitter voltage	V_{CE} = 2.5 V, I_C = 2 A, T_C = 25 to 125 °C			6.5	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 900 V			50	µA
		V_{GE} = 0 V, V_{CE} = 900 V, T_C = 125 °C (1)			250	µA
I_{GES}	Gate-emitter leakage current	V_{GE} = ±20 V, V_{CE} = 0 V			±100	nA
R_G	Gate resistance			4		kΩ

1. *Defined by design, not subject to production test.*

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	-	430	-	pF
C_{oes}	Output capacitance		-	40	-	
C_{res}	Reverse transfer capacitance		-	7	-	

Table 5. Switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 960 V, I_C = 5 A, R_G = 1 kΩ, V_{GE} = 15 V (see Figure 16. Switching waveform)	-	690	-	ns
t_r	Current rise time		-	170	-	
$(di/dt)_{on}$	Turn-on current slope		-	39.6	-	A/μs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 960 V, I_C = 5 A, R_G = 1 kΩ, V_{GE} = 15 V, T_J = 125 °C (see Figure 16. Switching waveform)	-	600	-	ns
t_r	Current rise time		-	185	-	
$(di/dt)_{on}$	Turn-on current slope		-	39	-	A/μs
t_c	Cross-over time	V_{CC} = 960 V, I_C = 5 A, R_G = 1 kΩ, V_{GE} = 15 V (see Figure 16. Switching waveform)	-	4	-	μs
$t_r(V_{off})$	Off voltage rise time		-	2.2	-	
$t_d(off)$	Turn-off delay time		-	12.1	-	
t_f	Current fall time		-	1.13	-	
t_c	Cross-over time	V_{CC} = 960 V, I_C = 5 A, R_G = 1 kΩ, V_{GE} = 15 V, T_J = 125 °C (see Figure 16. Switching waveform)	-	5	-	
$t_r(V_{off})$	Off voltage rise time		-	2.2	-	
$t_d(off)$	Turn-off delay time		-	12.1	-	
t_f	Current fall time		-	2	-	

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on} (1)	Turn-on switching energy	V_{CC} = 960 V, I_C = 5 A, R_G = 1 kΩ, V_{GE} = 15 V (see Figure 16. Switching waveform)	-	2.59	-	mJ
E_{off} (2)	Turn-off switching energy		-	9	-	
E_{ts}	Total switching energy		-	11.59	-	
E_{on} (1)	Turn-on switching energy	V_{CC} = 960 V, I_C = 5 A, R_G = 1 kΩ, V_{GE} = 15 V, T_J = 125 °C (see Figure 16. Switching waveform)	-	2.64	-	mJ
E_{off} (2)	Turn-off switching energy		-	10.2	-	
E_{ts}	Total switching energy		-	12.68	-	

1. *Including the reverse recovery of the diode.*
2. *Including the tail of the collector current.*

Table 7. Functional test

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{AS}	Unclamped inductive switching current	V_{CC} = 50 V, L = 1.8 mH T_{start} = 25 °C, R_g = 1 kΩ	3.3			A

2.1 Electrical characteristics curves

Figure 1. Output characterisics

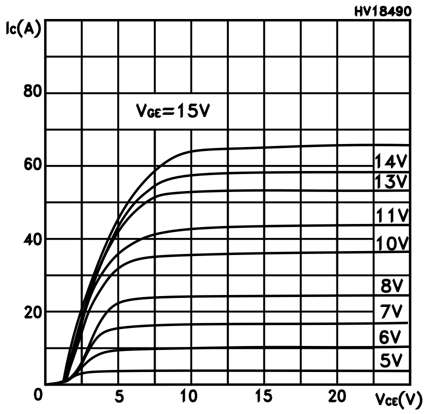


Figure 2. Transfer characteristics

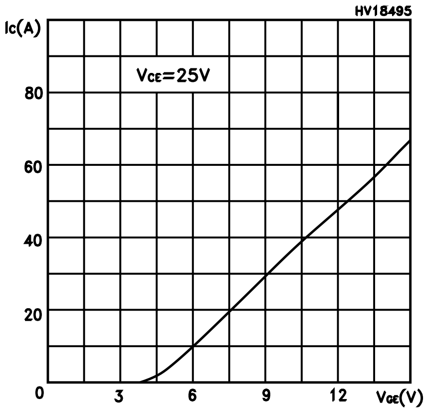


Figure 3. Collector-emitter on voltage vs temperature

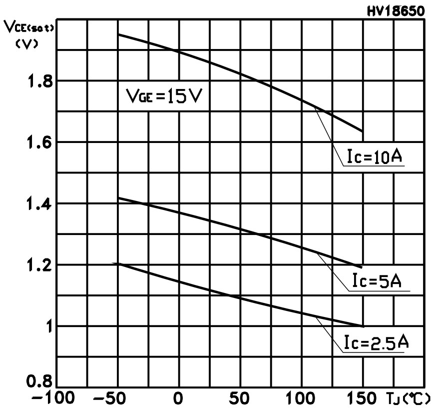


Figure 4. Gate charge vs gate-source voltage

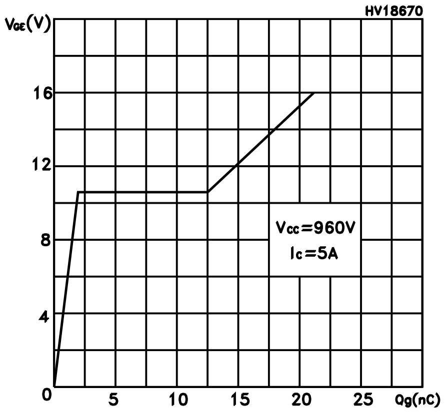


Figure 5. Capacitance variations

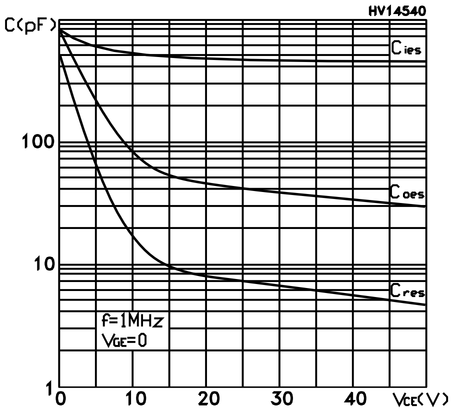


Figure 6. Normalized gate threshold voltage vs temperature

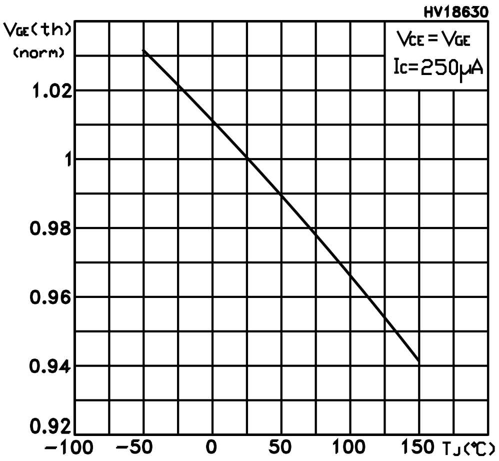


Figure 7. Collector-emitter on voltage vs collector current

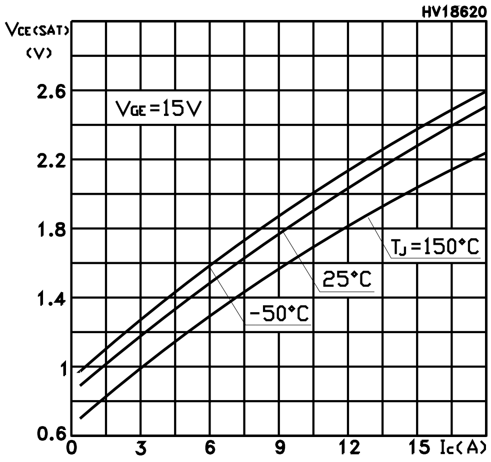


Figure 8. Breakdown voltage vs temperature

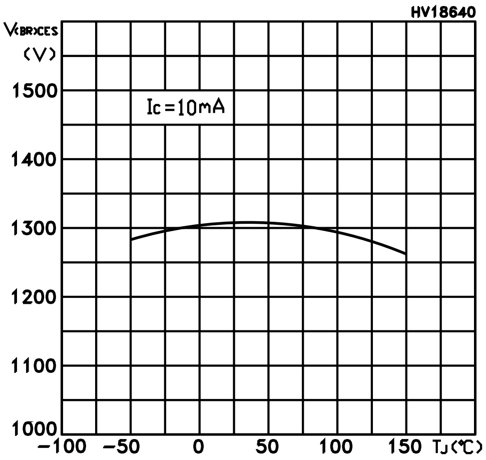


Figure 9. Normalized collector-emitter on voltage vs temperature

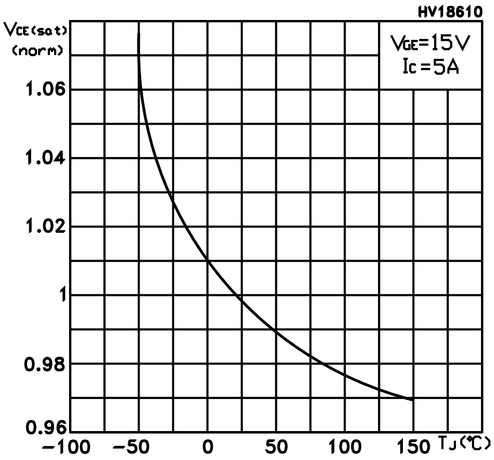


Figure 10. Switching energy vs gate resistance

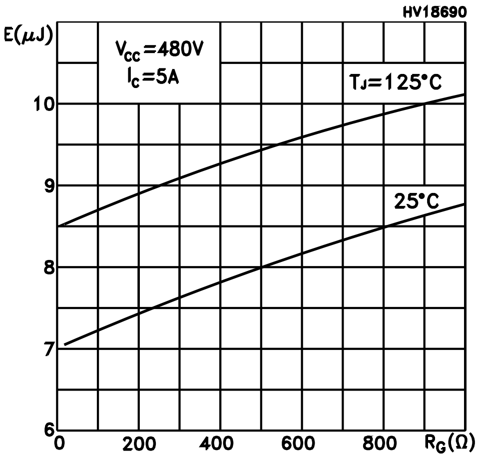


Figure 11. Switching energy vs collector current

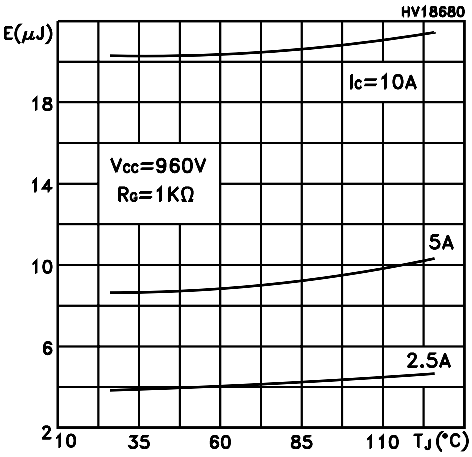


Figure 12. Turn-off SOA

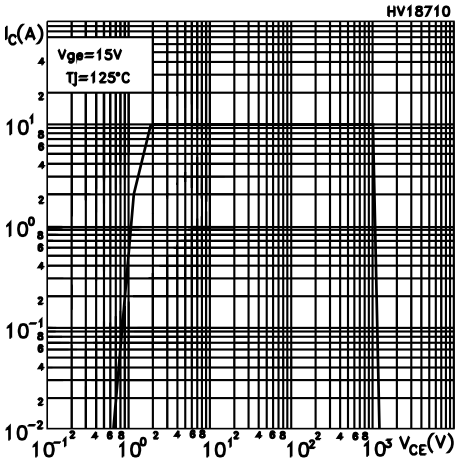
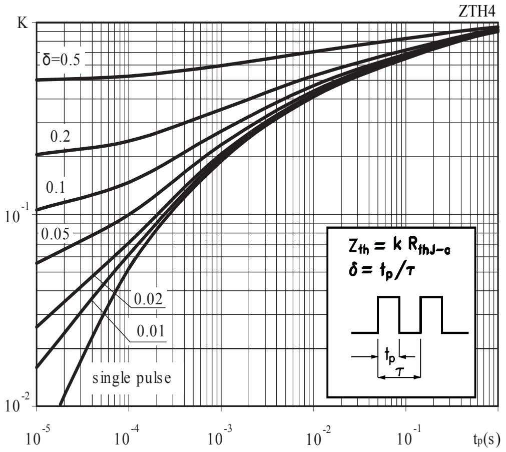


Figure 13. Thermal impedance



3 Test circuits

Figure 14. Test circuit for inductive load switching

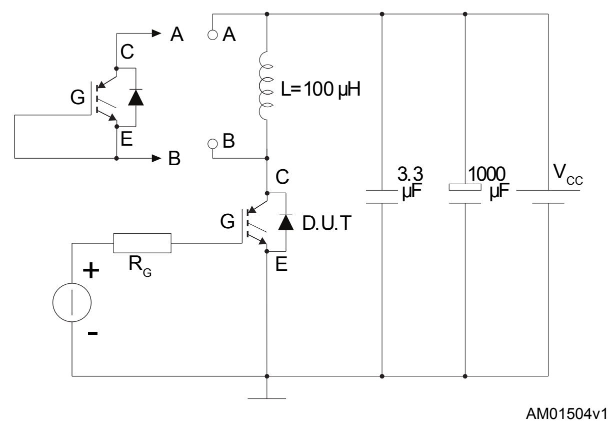


Figure 15. Gate charge test circuit

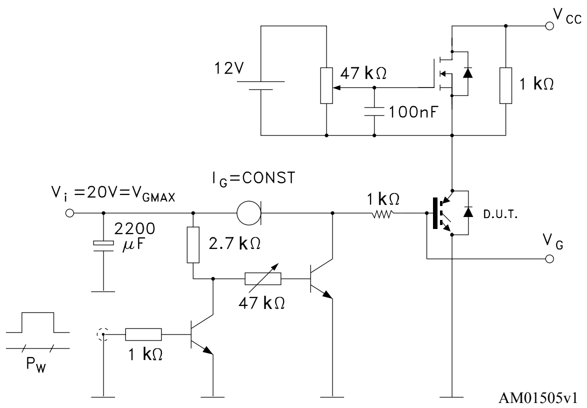
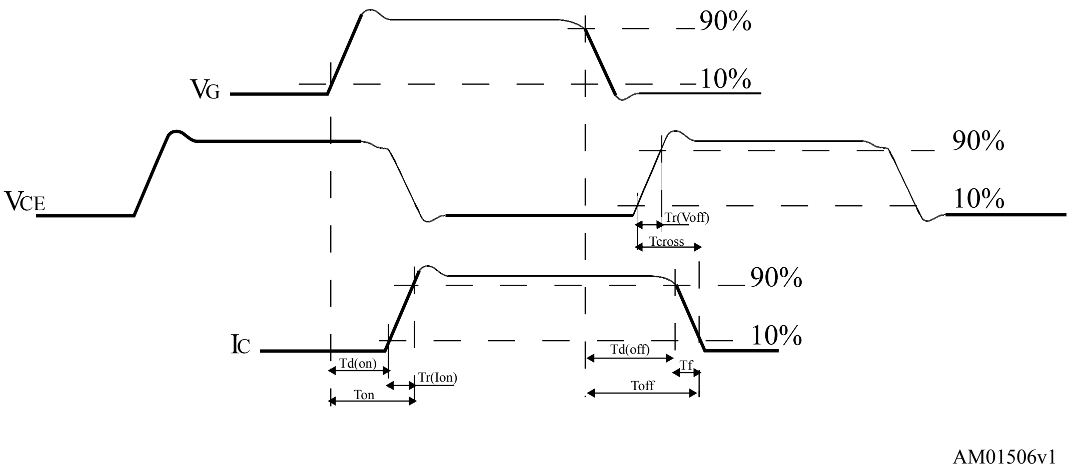


Figure 16. Switching waveform

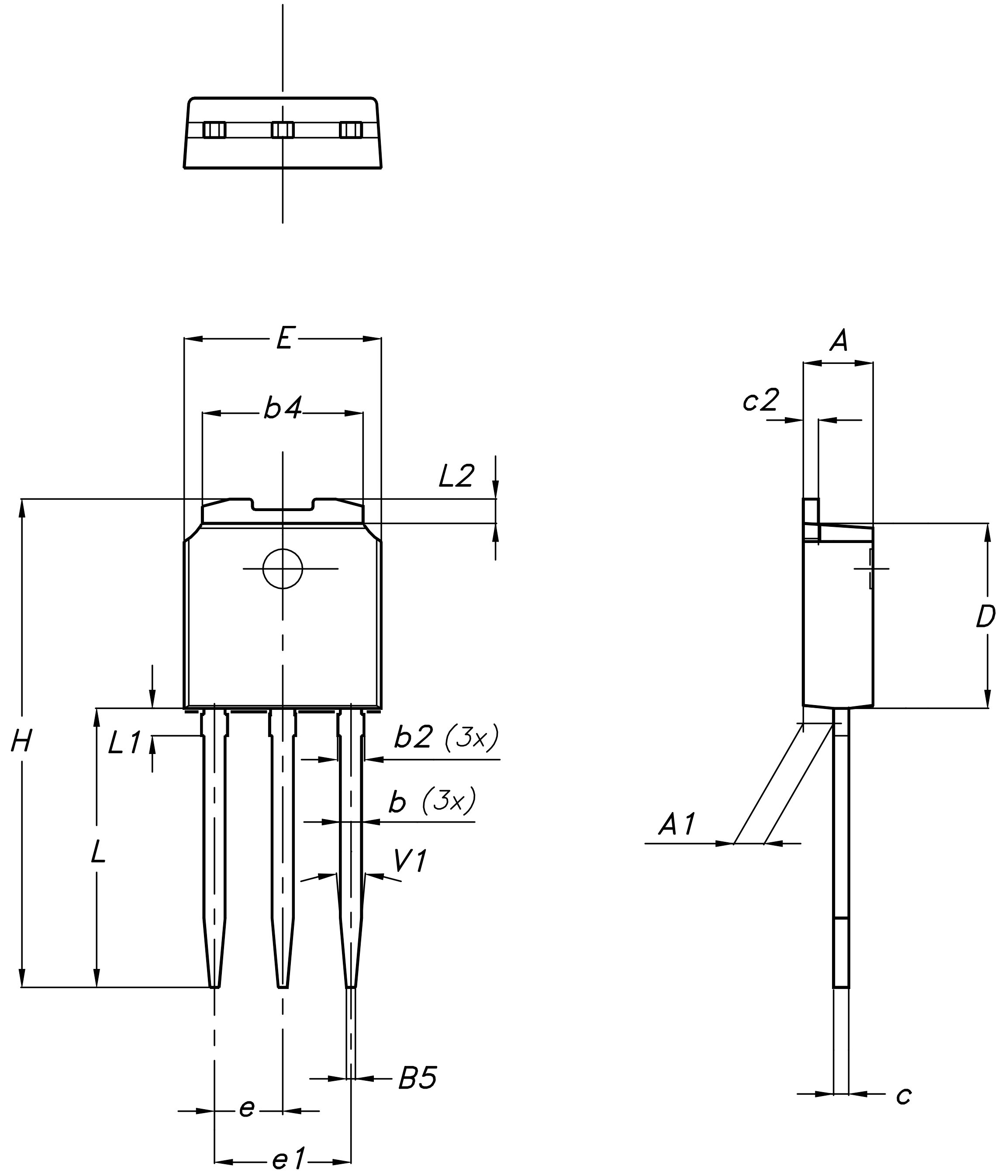


4 Package information

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 IPAK (TO-251) type A package information

Figure 17. IPAK (TO-251) type A package outline



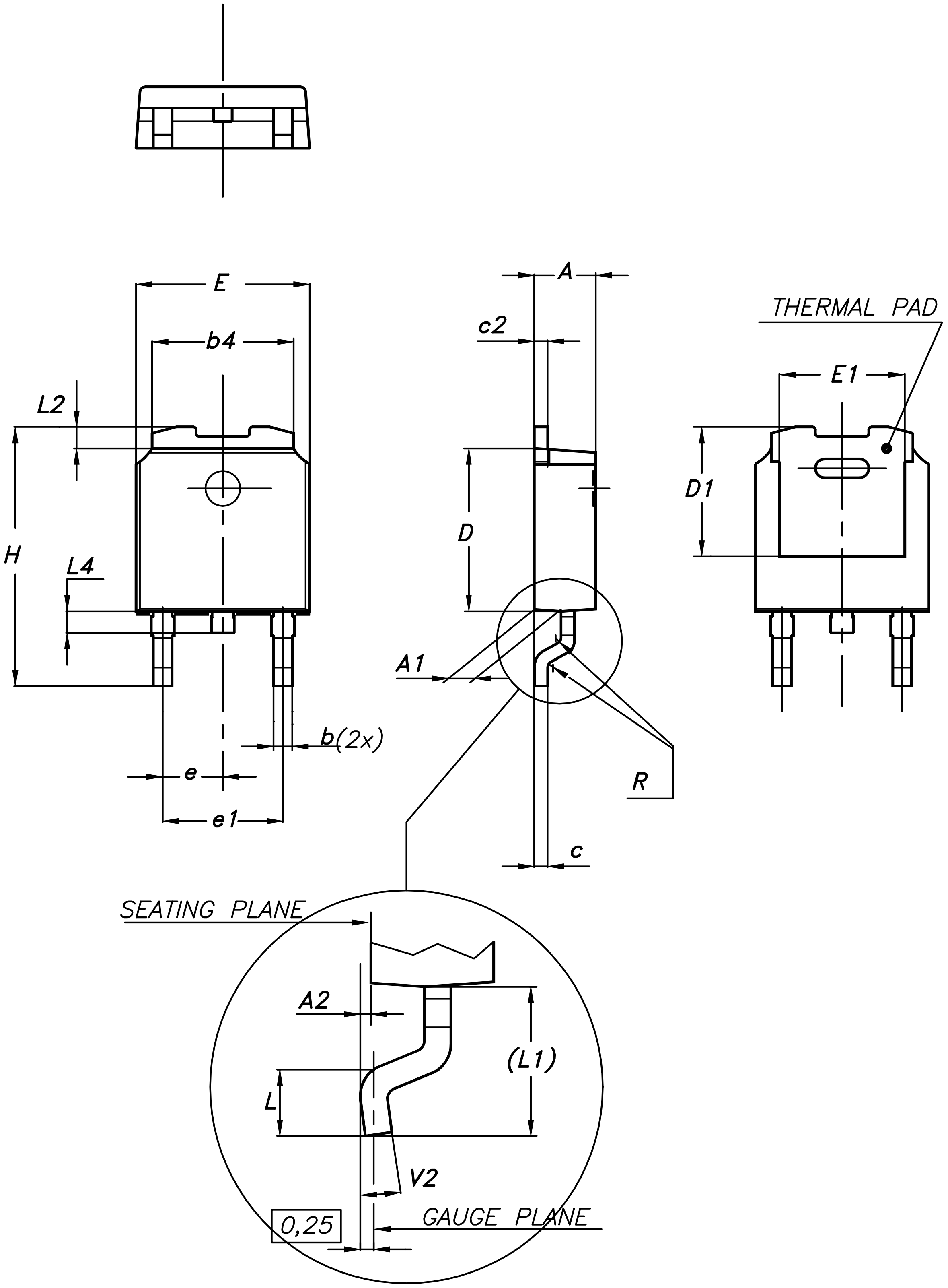
0068771_IK_typeA_rev14

Table 8. **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°	

4.2 DPAK (TO-252) type A2 package information

Figure 18. DPAK (TO-252) type A2 package outline



0068772_type-A2_rev26

Table 9. **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°

4.3 DPAK (TO-252) type C2 package information

Figure 19. **DPAK (TO-252) type C2 package outline**

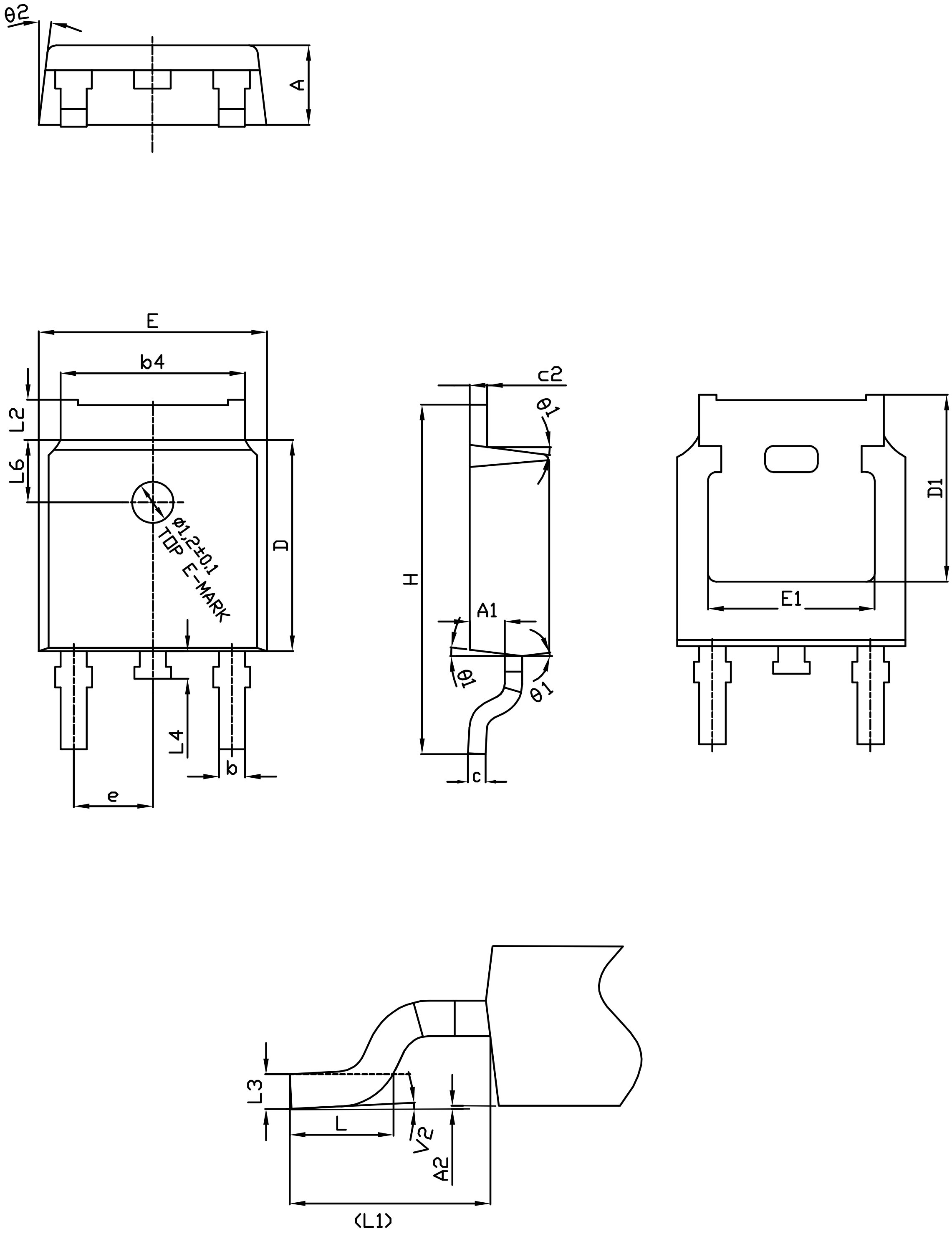


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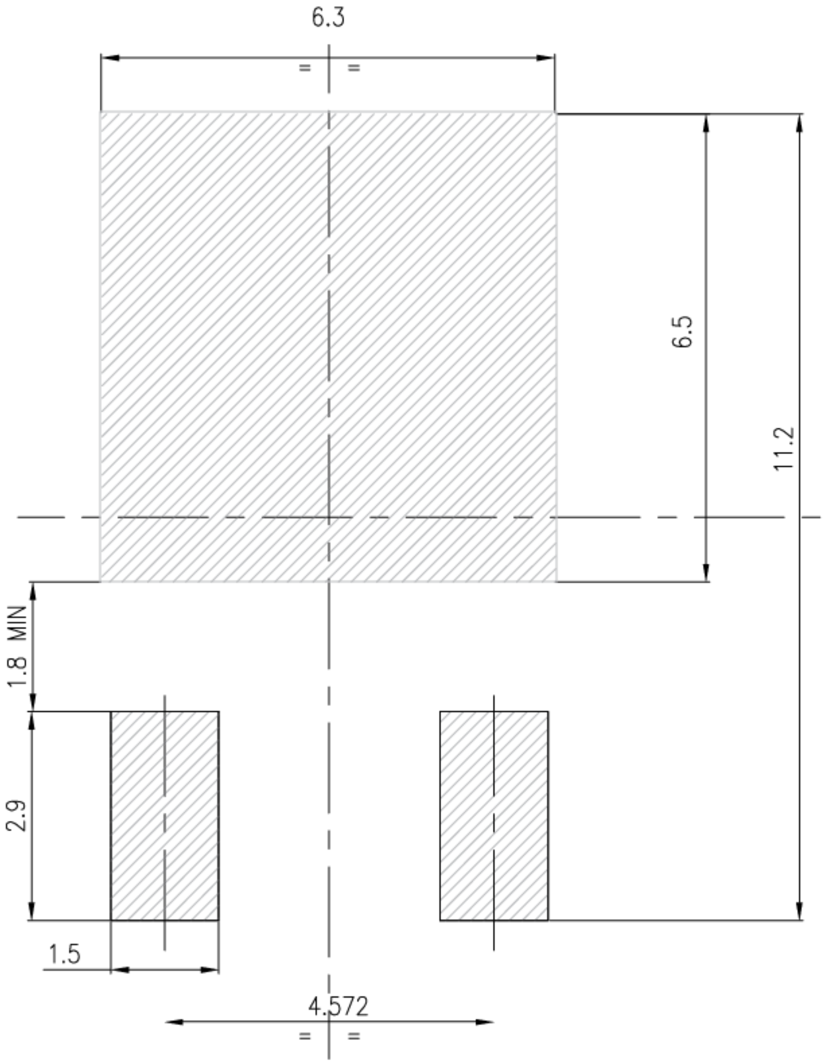
Table 10. **DPAK (TO-252) type C2 mechanical data**

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	5.10		5.60
E	6.50	6.60	6.70
E1	5.20		5.50
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
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 20. DPAK (TO-252) recommended footprint (dimensions are in mm)



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4.4 DPAK (TO-252) packing information

Figure 21. **DPAK (TO-252) tape outline**

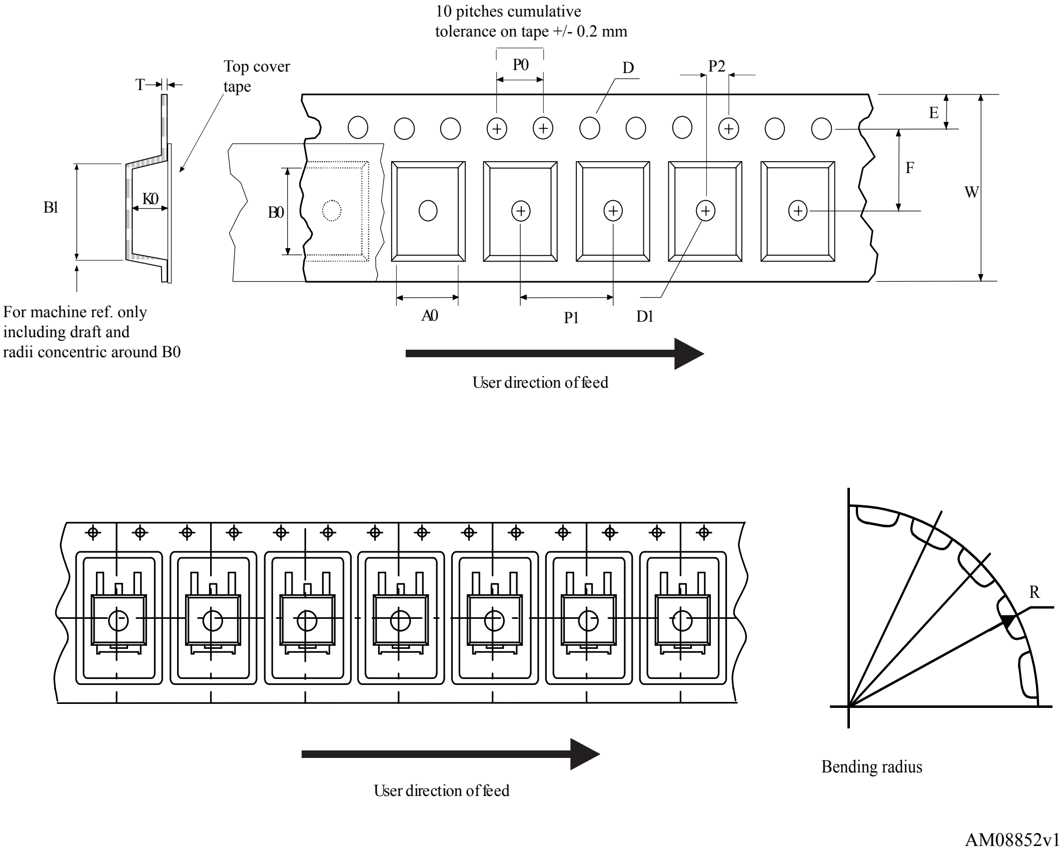

Figure 22. **DPAK (TO-252) reel outline**

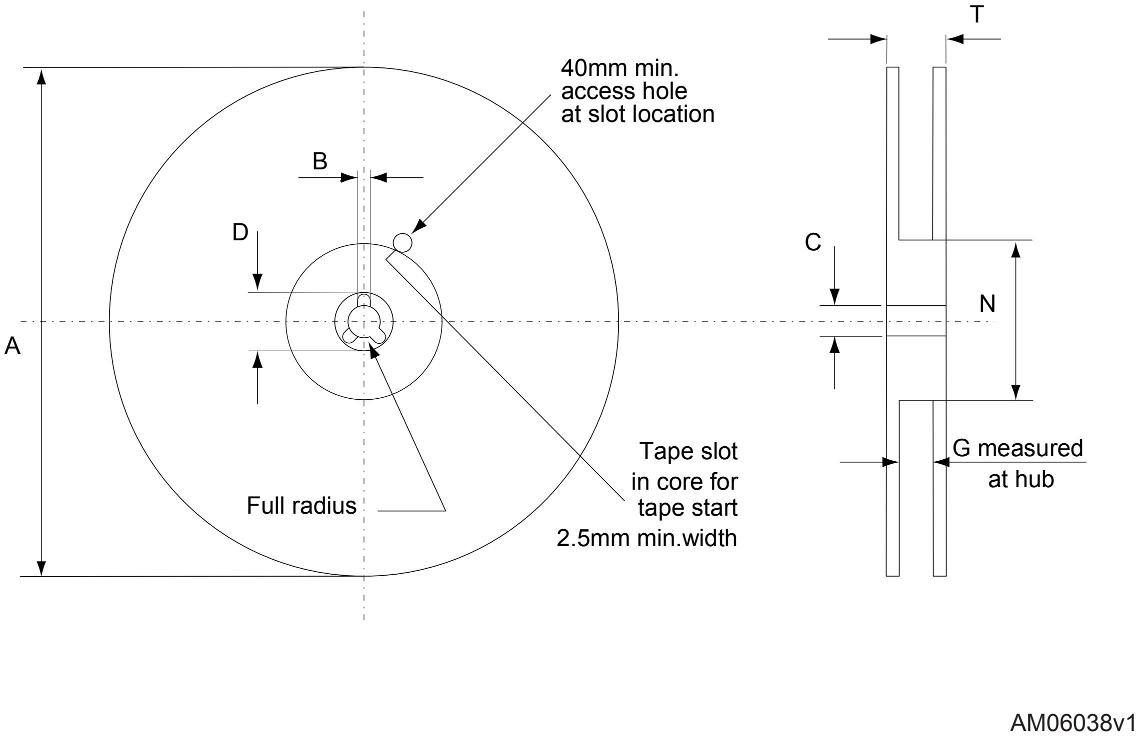

Table 11. **DPAK (TO-252) tape and reel mechanical data**

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			

5 Ordering information

Table 12. Order codes

Order code	Marking	Package	Packing
STGD5NB120SZ-1	GD5NB120SZ	IPAK	Tube
STGD5NB120SZT4	GD5NB120SZ	DPAK	Tape e reel

Revision history

Table 13. **Document revision history**

Date	Version	Changes
06-Oct-2003	5	No history because migration
18-Jan-2005	6	Final datasheet
13-Nov-2008	7	Insert new value in *Table 2: Absolute maximum ratings*
08-Jan-2019	8	The document status is production data. Updated Section 4 Package information. Minor text changes.

Contents

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