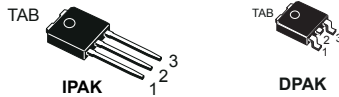


## 5 A, 1200 V, low drop internally clamped IGBT



### Features

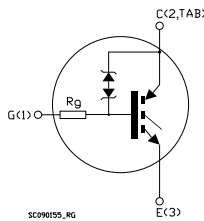
- Low on-voltage drop ( $V_{CE(sat)}$ )
- High current capability
- Off losses include tail current
- High voltage clamping

### 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 ( $V_{GE} = 0\text{ V}$ )	1200	V
$I_C$	Continuous collector current at $T_C = 25\text{ °C}$	10	A
	Continuous collector current at $T_C = 100\text{ °C}$	5	
$I_{CP}^{(1)}$	Pulsed collector current	10	A
$I_{CL}^{(2)}$	Turn-off latching current	10	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
$V_{ECR}$	Emitter-collector voltage	20	V
$E_{AS}^{(3)}$	Single pulse avalanche energy at $T_C = 25\text{ °C}$	10	mJ
	Single pulse avalanche energy at $T_C = 100\text{ °C}$	7	mJ
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	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.  $V_{CLAMP} = 80\% V_{CES}$ ,  $V_{GE} = 15\text{ V}$ ,  $R_G = 10\ \Omega$ ,  $T_J = 150\text{ °C}$
3.  $V_{CE} = 50\text{ V}$ ,  $I_{AV} = 3.3\text{ A}$

**Table 2. Thermal data**

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

## 2 Electrical characteristics

$T_C = 25\text{ °C}$  unless otherwise specified

**Table 3. Static characteristics**

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

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	$V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0\text{ V}$	-	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	$V_{CC} = 960\text{ V}$ , $I_C = 5\text{ A}$ , $R_G = 1\text{ k}\Omega$ , $V_{GE} = 15\text{ V}$ (see Figure 16. Switching waveform)	-	690	-	ns
$t_r$	Current rise time		-	170	-	
$(di/dt)_{on}$	Turn-on current slope		-	39.6	-	
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 960\text{ V}$ , $I_C = 5\text{ A}$ , $R_G = 1\text{ k}\Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Switching waveform)	-	600	-	ns
$t_r$	Current rise time		-	185	-	
$(di/dt)_{on}$	Turn-on current slope		-	39	-	
$t_c$	Cross-over time	$V_{CC} = 960\text{ V}$ , $I_C = 5\text{ A}$ , $R_G = 1\text{ k}\Omega$ , $V_{GE} = 15\text{ V}$ (see Figure 16. Switching waveform)	-	4	-	$\mu$ s
$t_r(V_{off})$	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		-	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	$V_{CC} = 960\text{ V}$ , $I_C = 5\text{ A}$ , $R_G = 1\text{ k}\Omega$ , $V_{GE} = 15\text{ V}$ (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	$V_{CC} = 960\text{ V}$ , $I_C = 5\text{ A}$ , $R_G = 1\text{ k}\Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$ (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	$V_{CC} = 50\text{ V}$ , $L = 1.8\text{ mH}$ $T_{start} = 25\text{ }^\circ\text{C}$ , $R_g = 1\text{ k}\Omega$	3.3			A

## 2.1 Electrical characteristics curves

Figure 1. Output characteristics

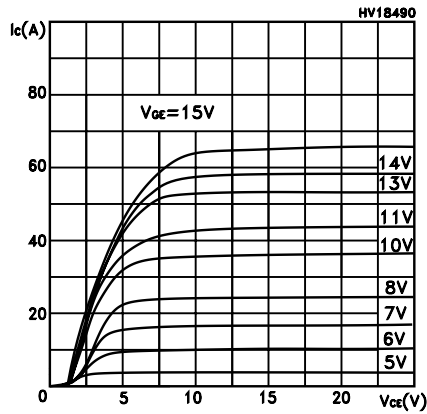


Figure 2. Transfer characteristics

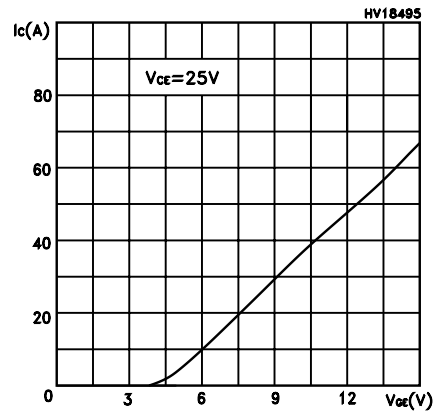


Figure 3. Collector-emitter on voltage vs temperature

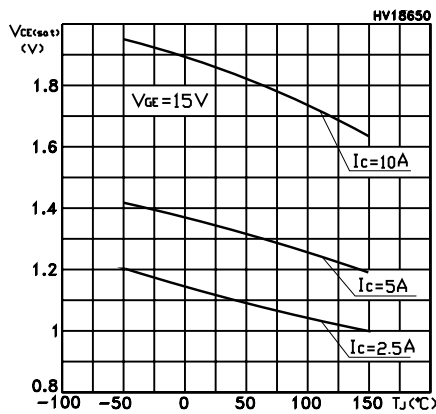


Figure 4. Gate charge vs gate-source voltage

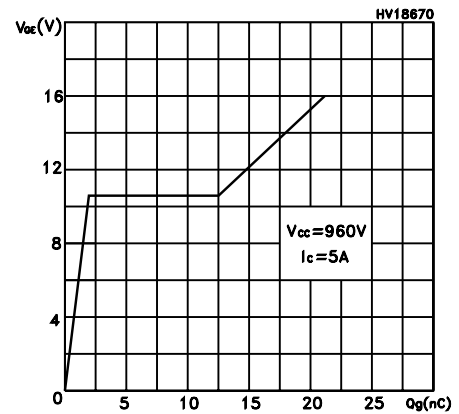


Figure 5. Capacitance variations

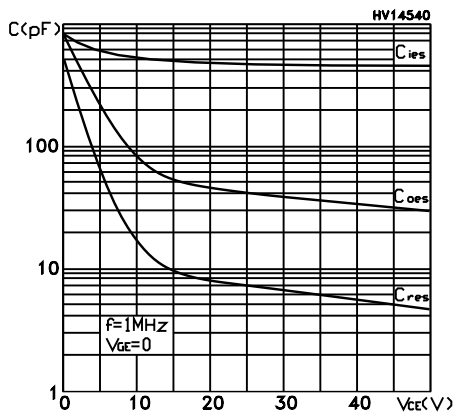


Figure 6. Normalized gate threshold voltage vs temperature

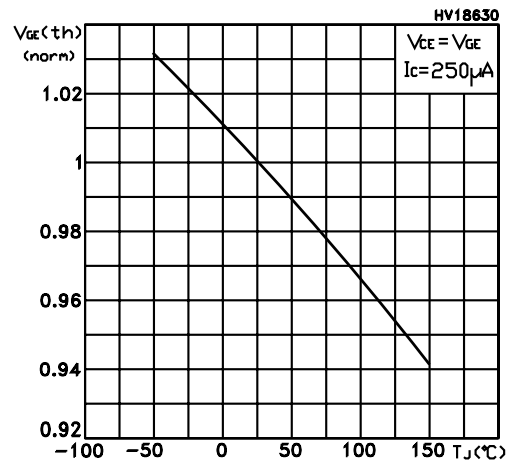


Figure 7. Collector-emitter on voltage vs collector current

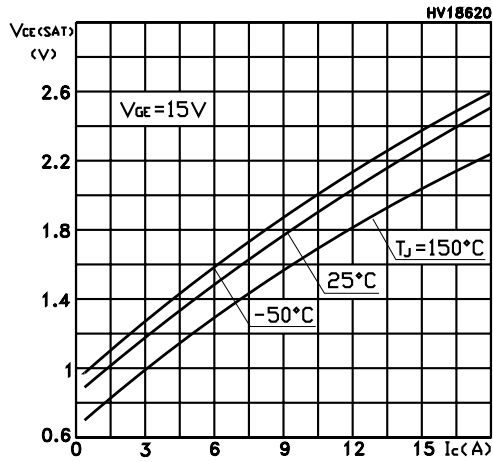


Figure 8. Breakdown voltage vs temperature

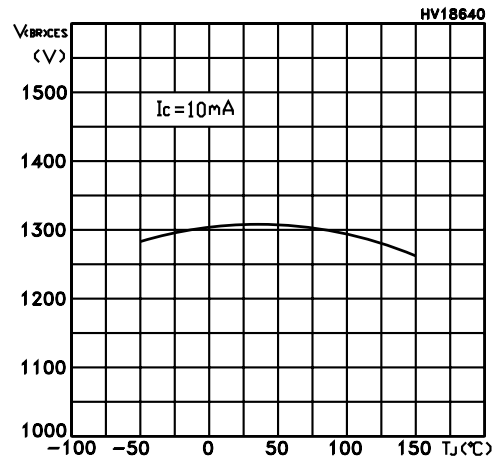


Figure 9. Normalized collector-emitter on voltage vs temperature

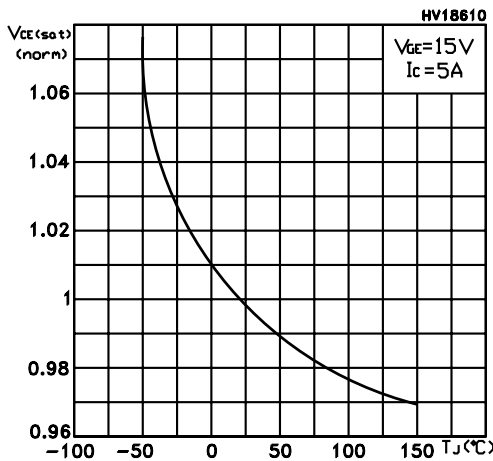


Figure 10. Switching energy vs gate resistance

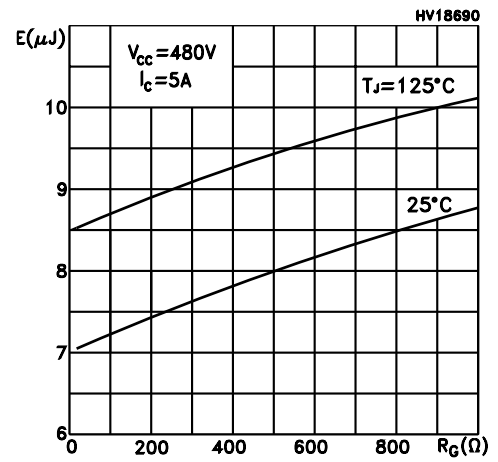


Figure 11. Switching energy vs collector current

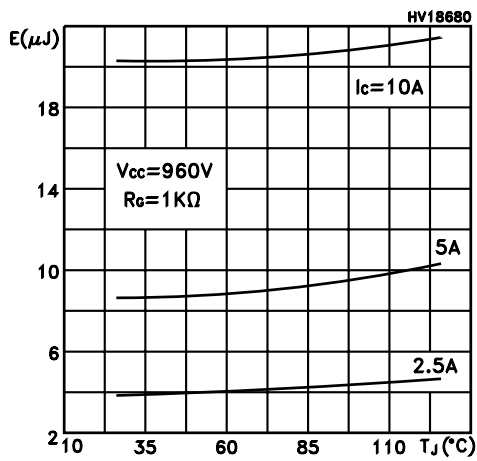
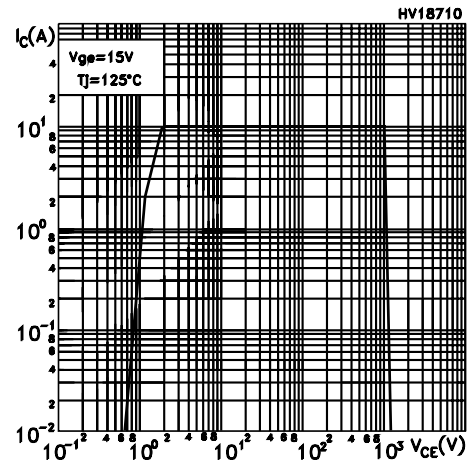
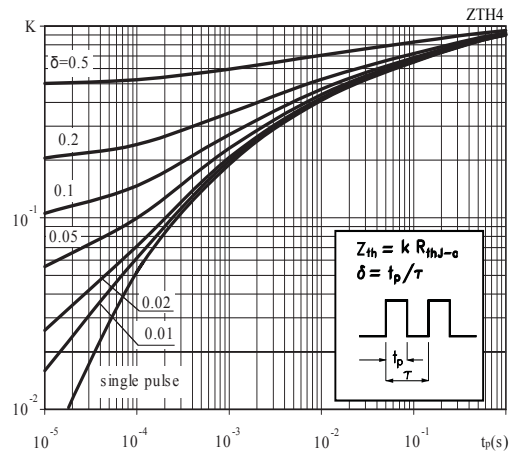


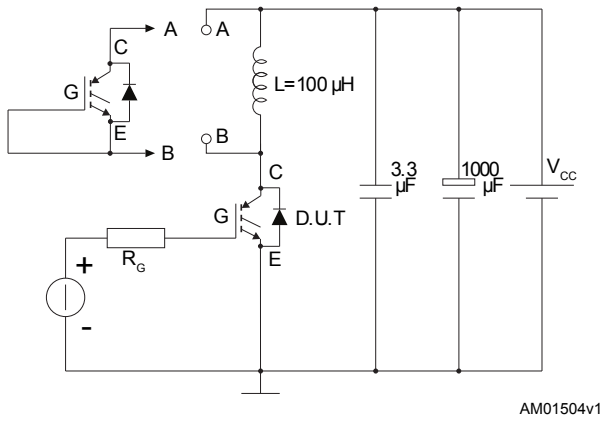
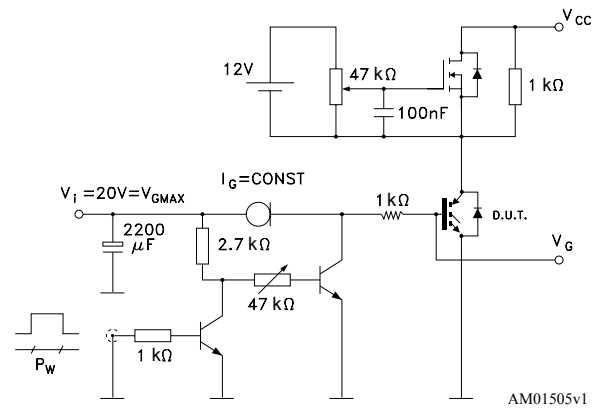
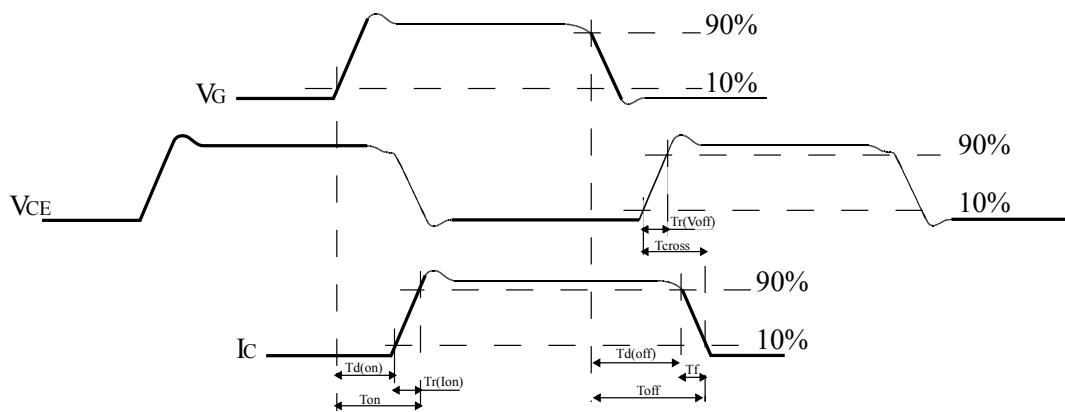
Figure 12. Turn-off SOA



**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**




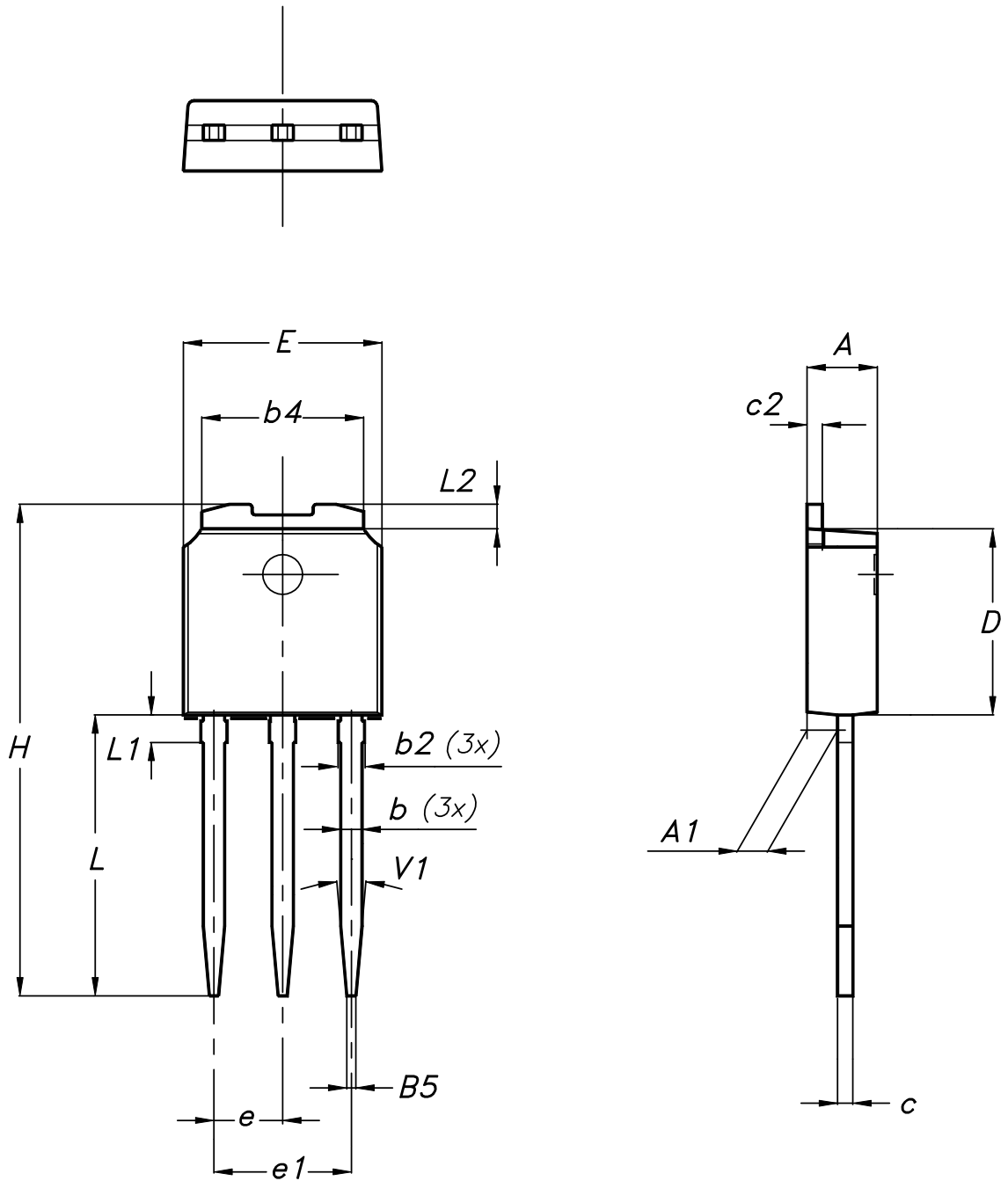
## 4 Package information

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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 IPAK (TO-251) type A package information

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



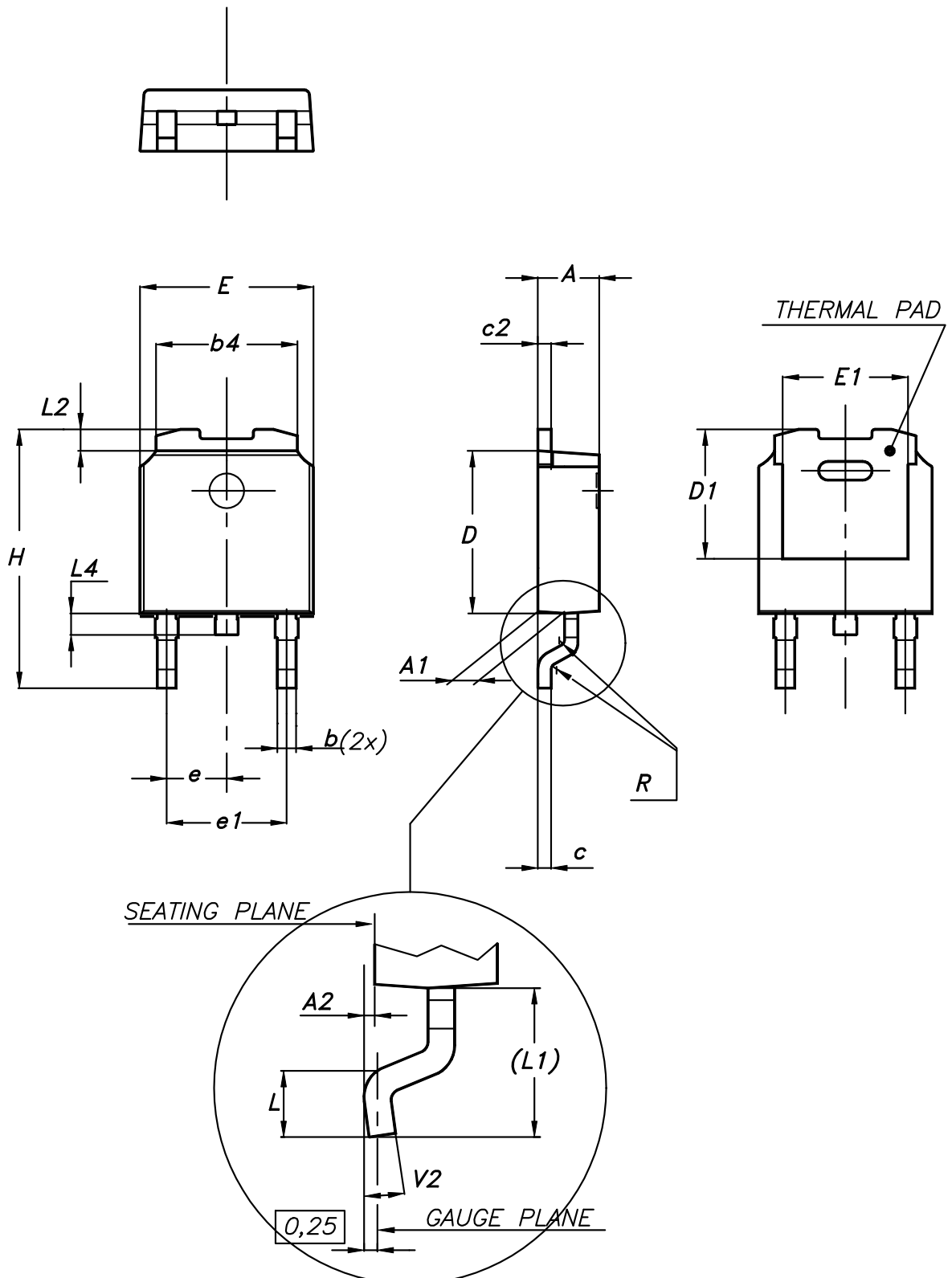
0068771\_IK\_typeA\_rev14

**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



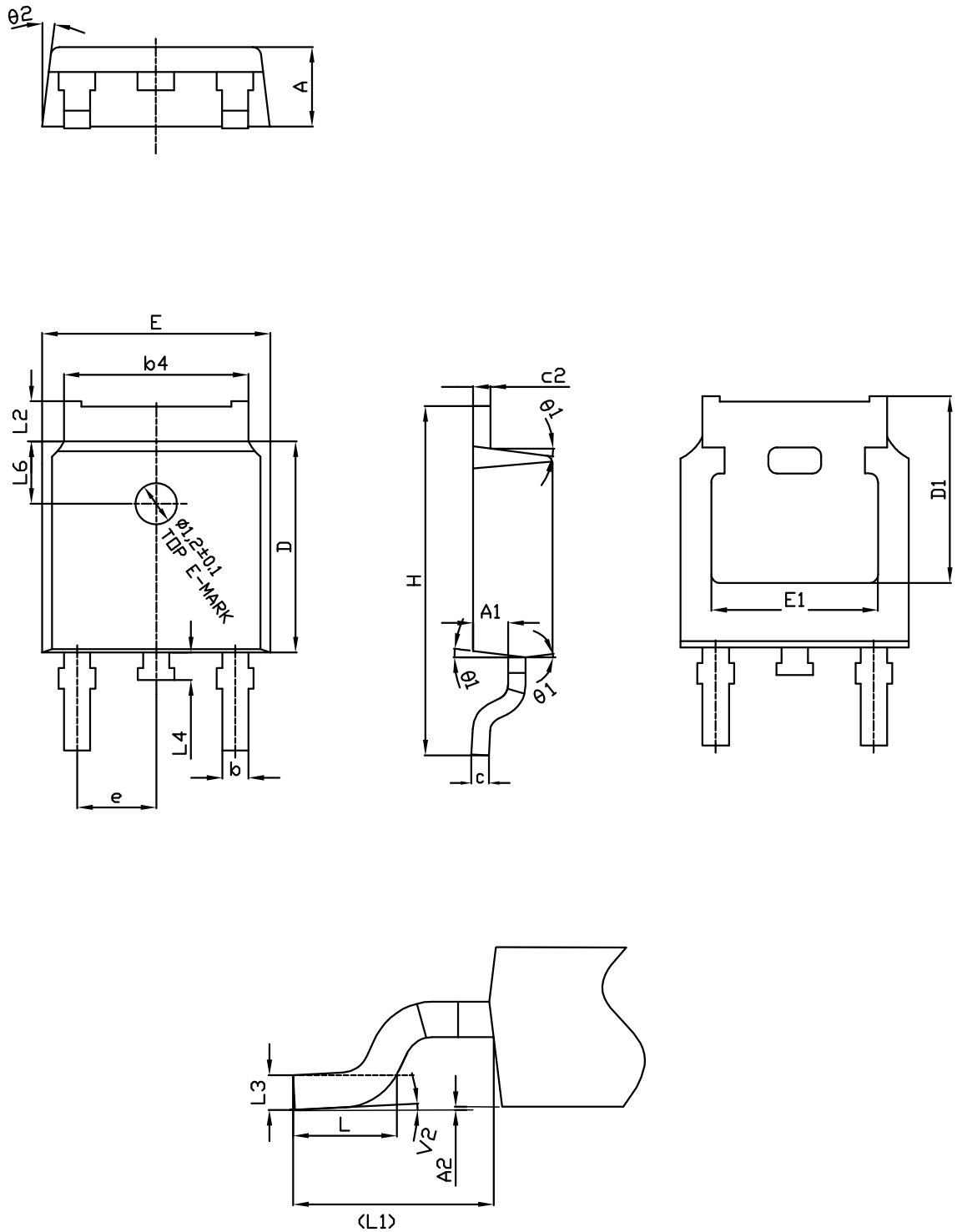
0068772\_type-A2\_rev26

**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

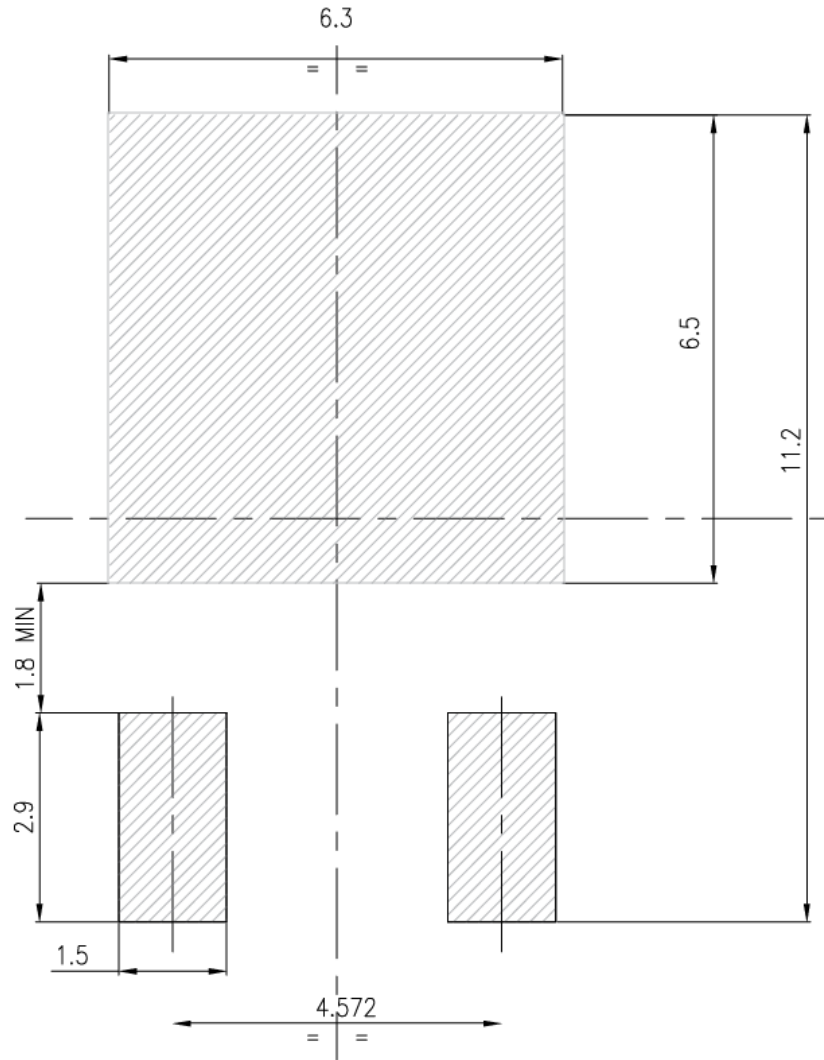
Figure 19. DPAK (TO-252) type C2 package outline



**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)

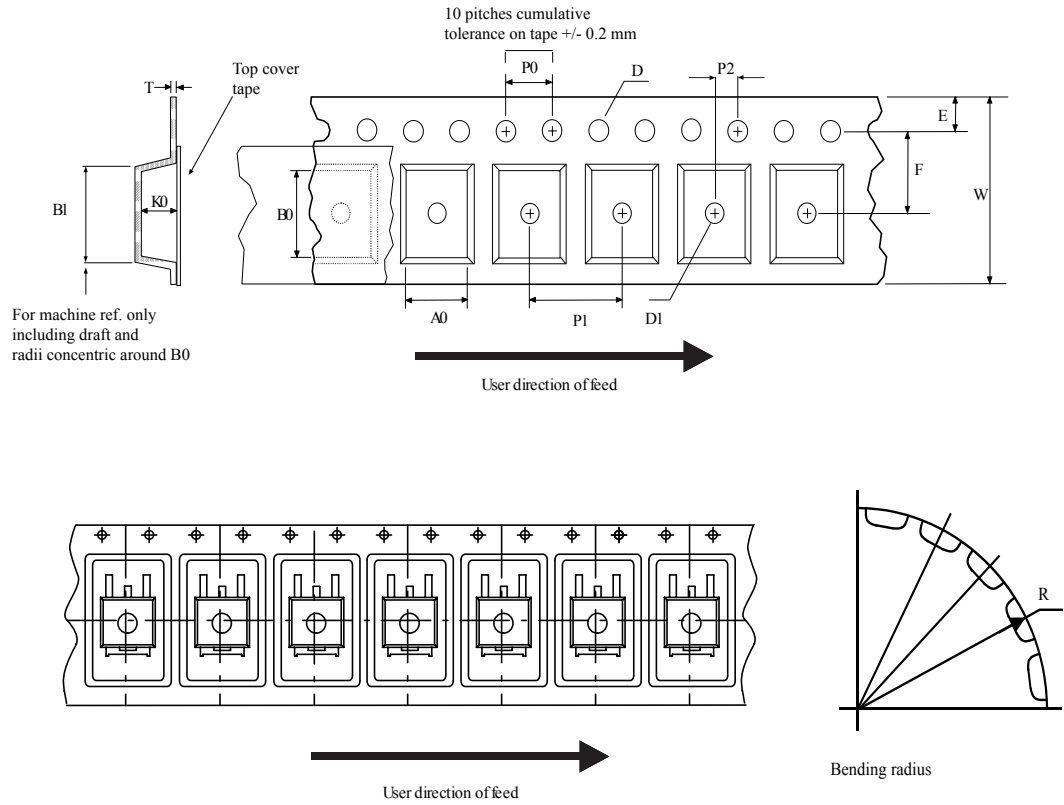


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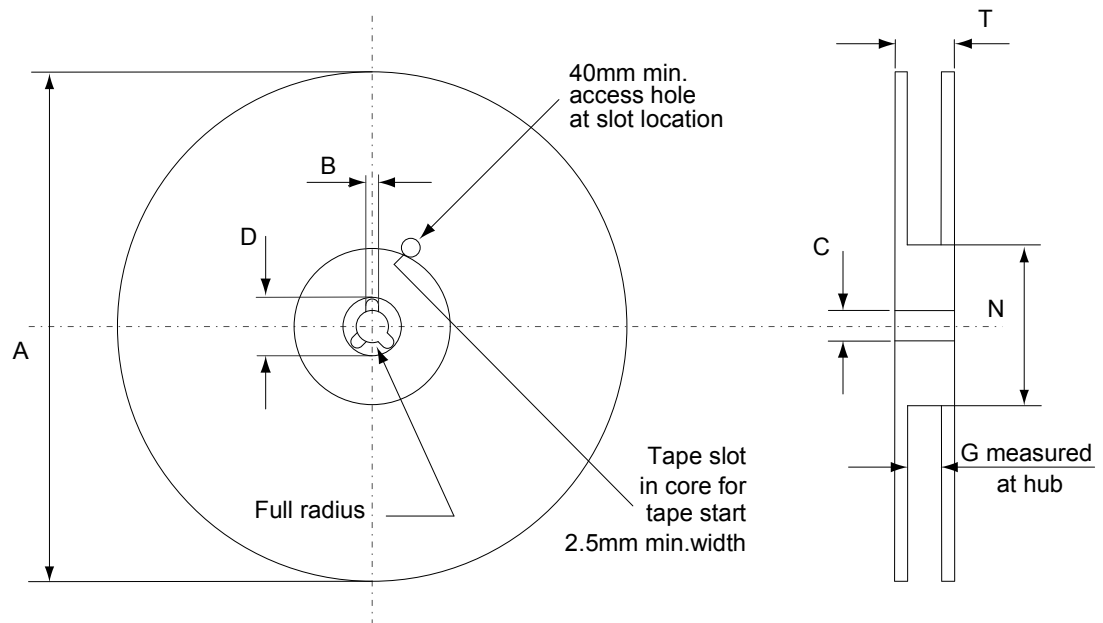
#### 4.4 DPAK (TO-252) packing information

Figure 21. DPAK (TO-252) tape outline



AM08852v1

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



AM06038v1

**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 <i>Table 2: Absolute maximum ratings</i>
08-Jan-2019	8	The document status is production data. Updated <a href="#">Section 4 Package information</a> . Minor text changes.

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