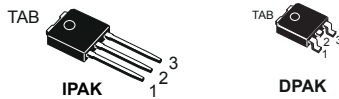


5 A, 1200 V, low drop internally clamped IGBT

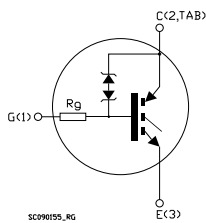


Features

- 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	± 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. $V_{CLAMP} = 80\% V_{CES}$, $V_{GE} = 15\text{ V}$, $R_G = 10\text{ }\Omega$, $T_J = 150\text{ °C}$
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	μA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 900\text{ V}$, $T_C = 125\text{ °C}$ ⁽¹⁾			250	μA
I_{GES}	Gate-emitter leakage current	$V_{GE} = \pm 20\text{ V}$, $V_{CE} = 0\text{ V}$			± 100	nA
R_G	Gate resistance			4		k Ω

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	-	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	$V_{CC} = 960\text{ V}$, $I_C = 5\text{ A}$, $R_G = 1\text{ k}\Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Switching waveform)	-	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

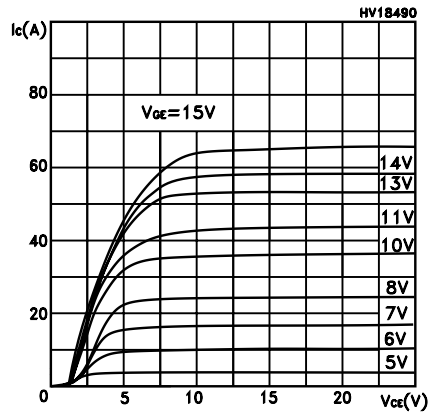


Figure 2. Transfer characteristics

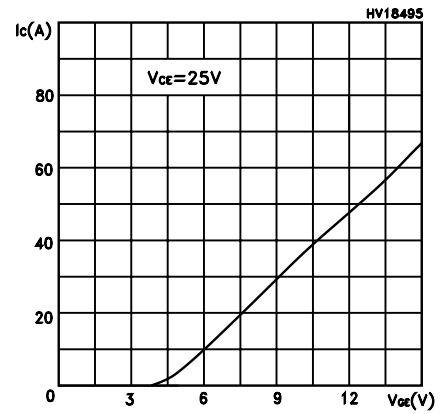


Figure 3. Collector-emitter on voltage vs temperature

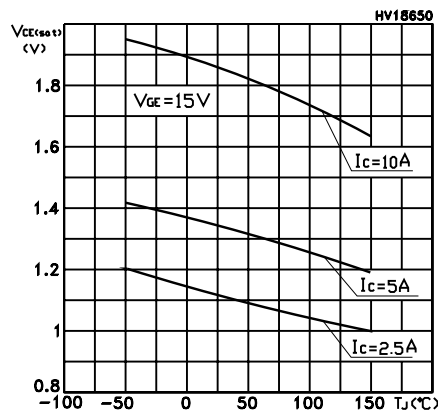


Figure 4. Gate charge vs gate-source voltage

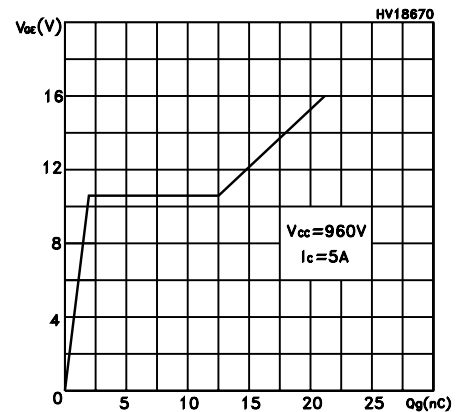


Figure 5. Capacitance variations

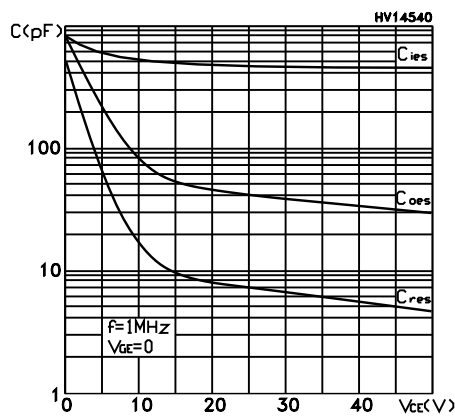


Figure 6. Normalized gate threshold voltage vs temperature

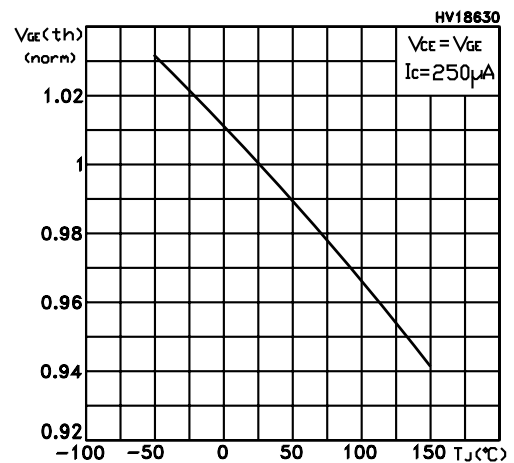


Figure 7. Collector-emitter on voltage vs collector current

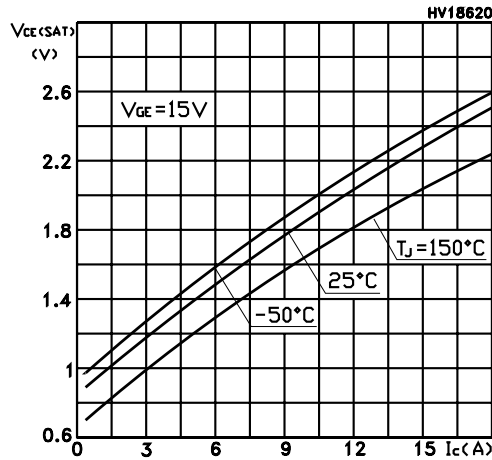


Figure 8. Breakdown voltage vs temperature

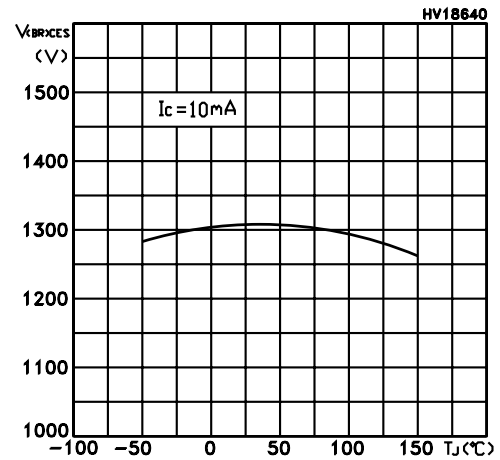


Figure 9. Normalized collector-emitter on voltage vs temperature

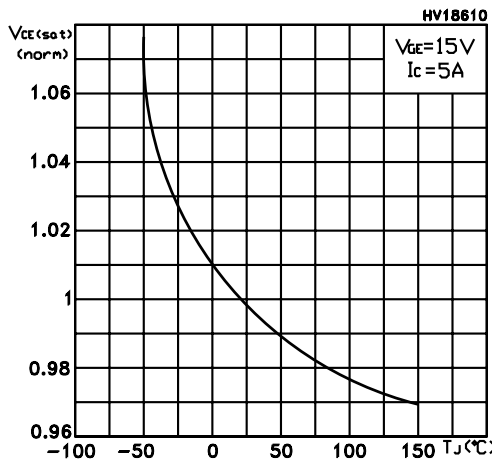


Figure 10. Switching energy vs gate resistance

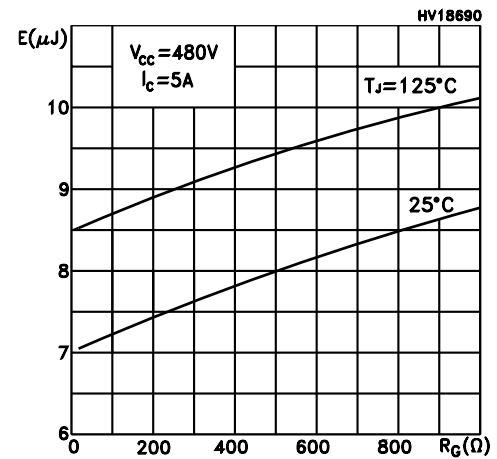


Figure 11. Switching energy vs collector current

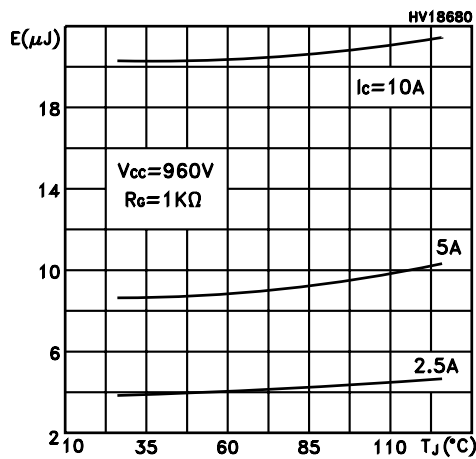


Figure 12. Turn-off SOA

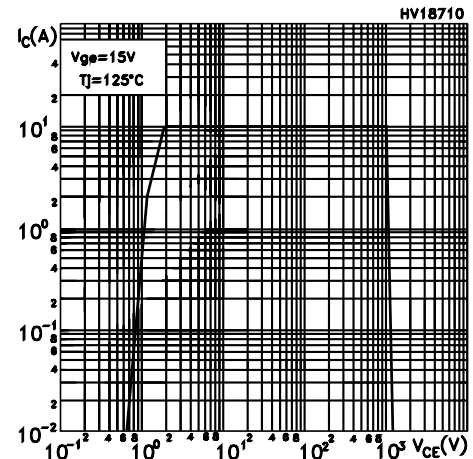
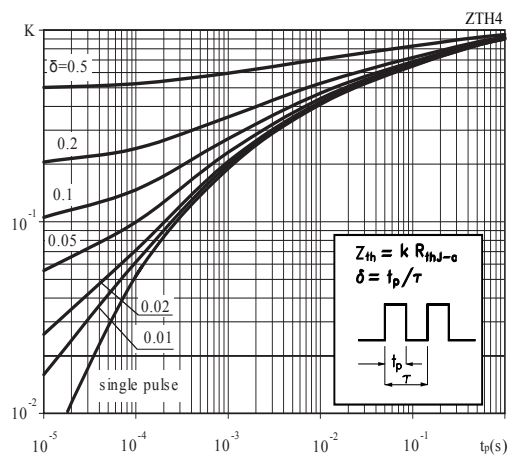


Figure 13. Thermal impedance



3 Test circuits

Figure 14. Test circuit for inductive load switching

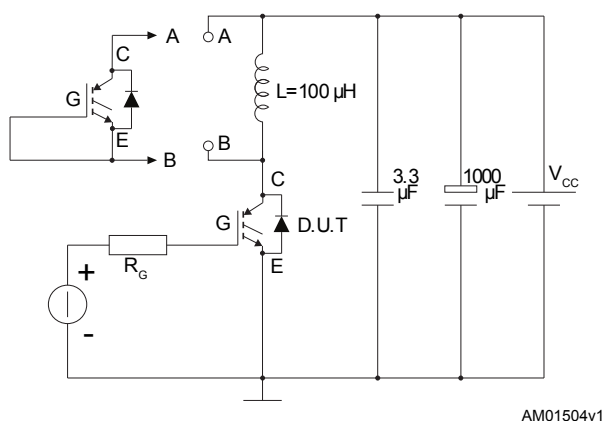


Figure 15. Gate charge test circuit

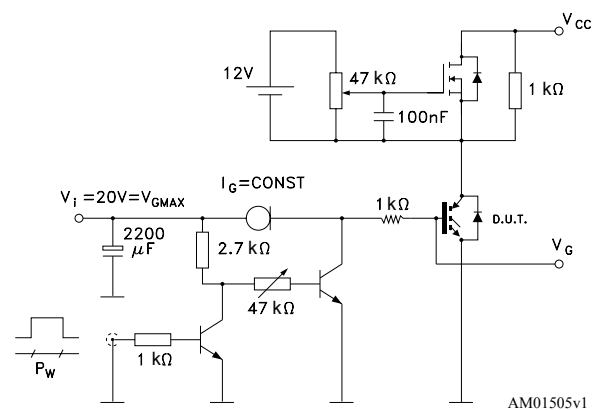
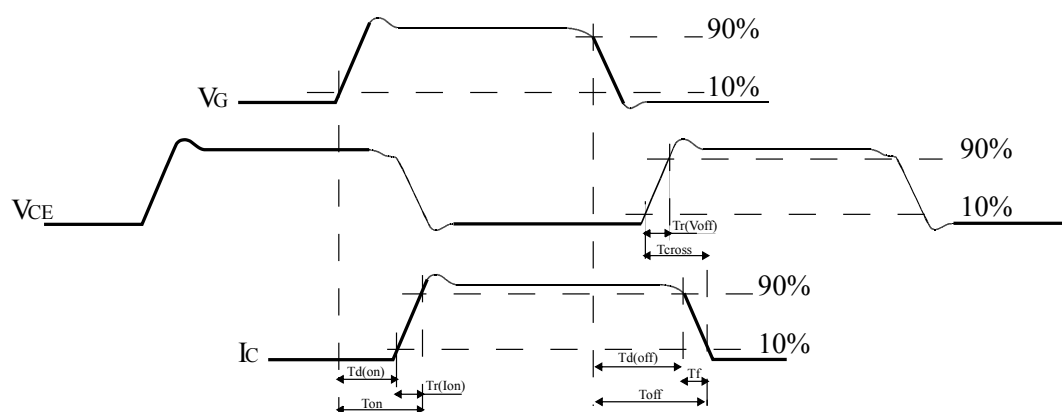


Figure 16. Switching waveform



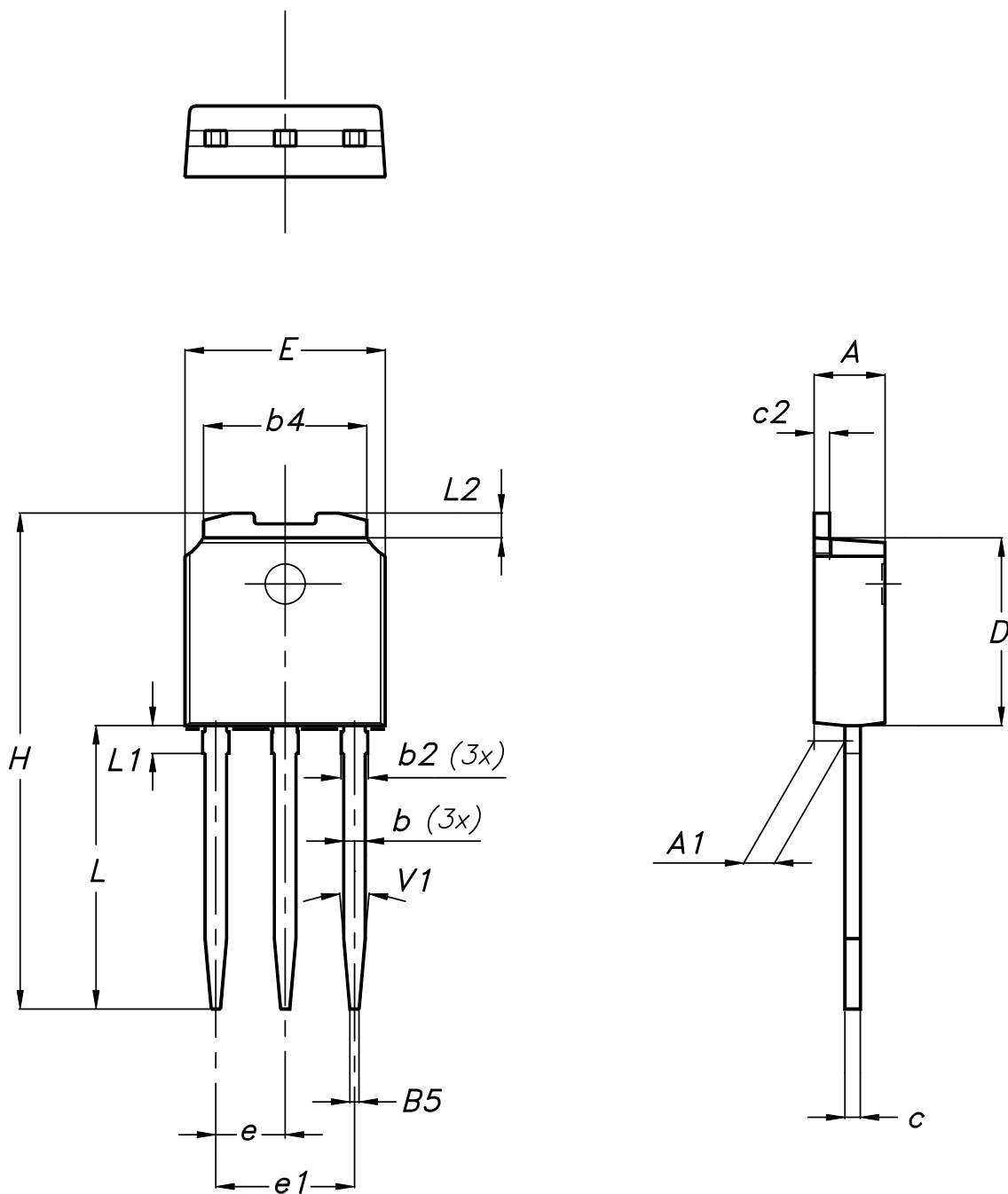
AM01506v1

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



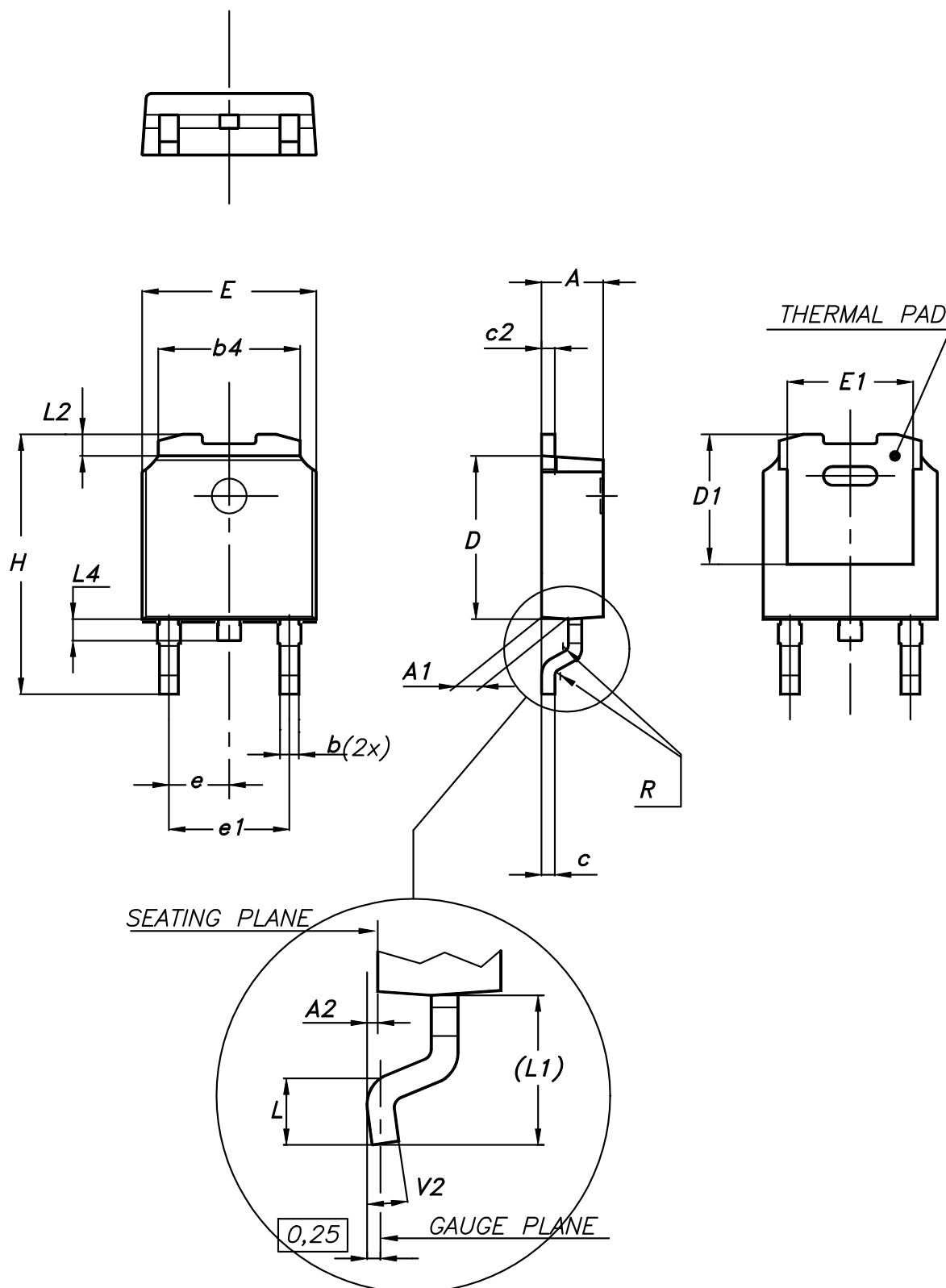
0068771_IK_typeA_rev14

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



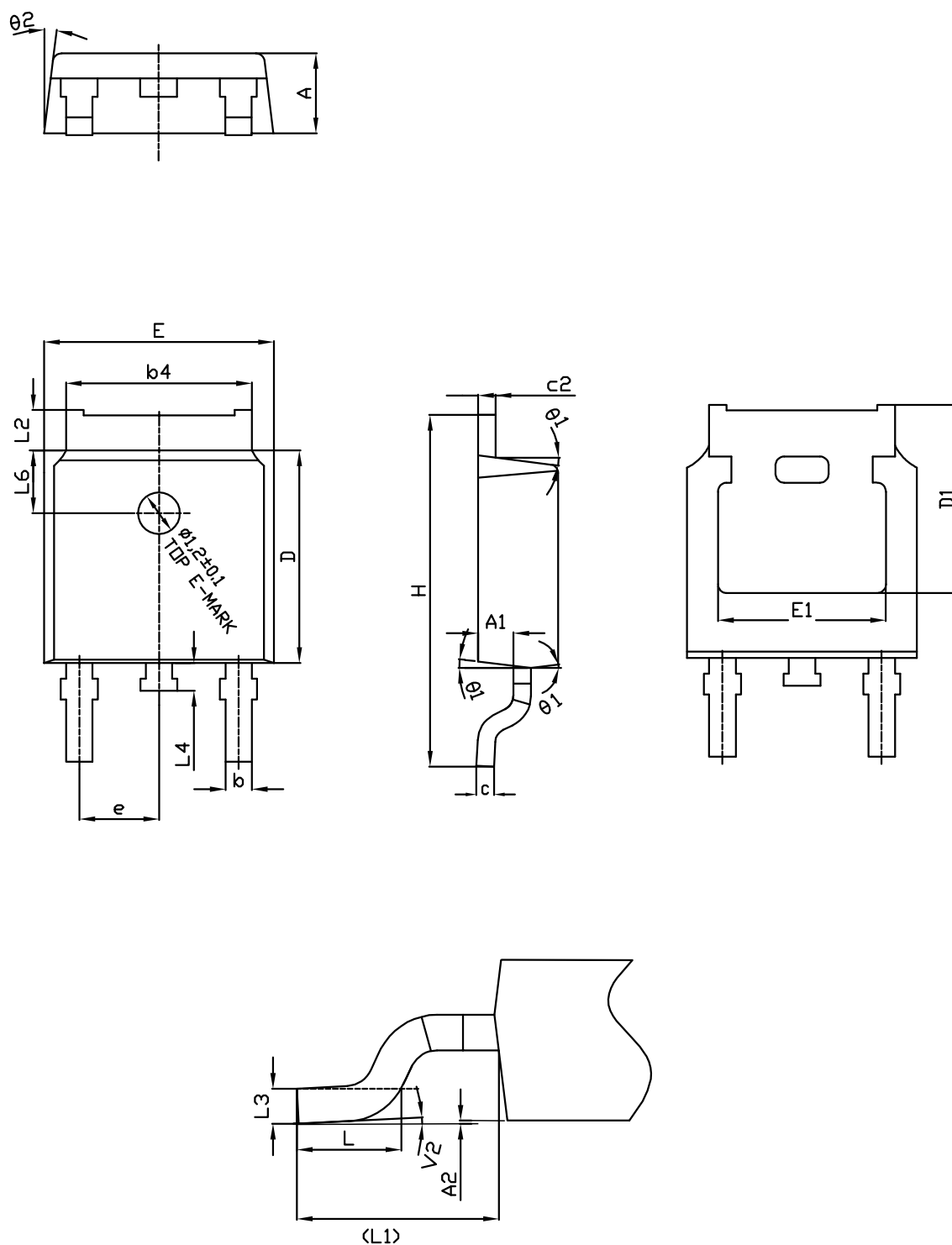
0068772_type-A2_rev26

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

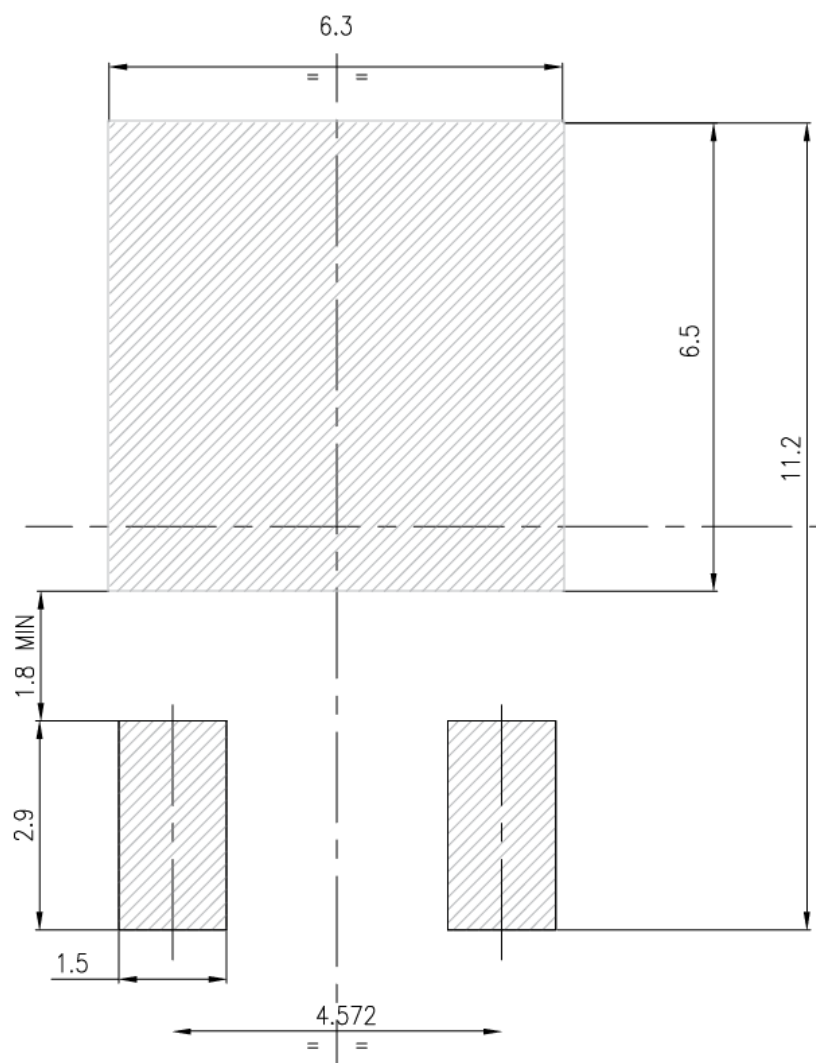


0068772_type-C2_rev26

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°

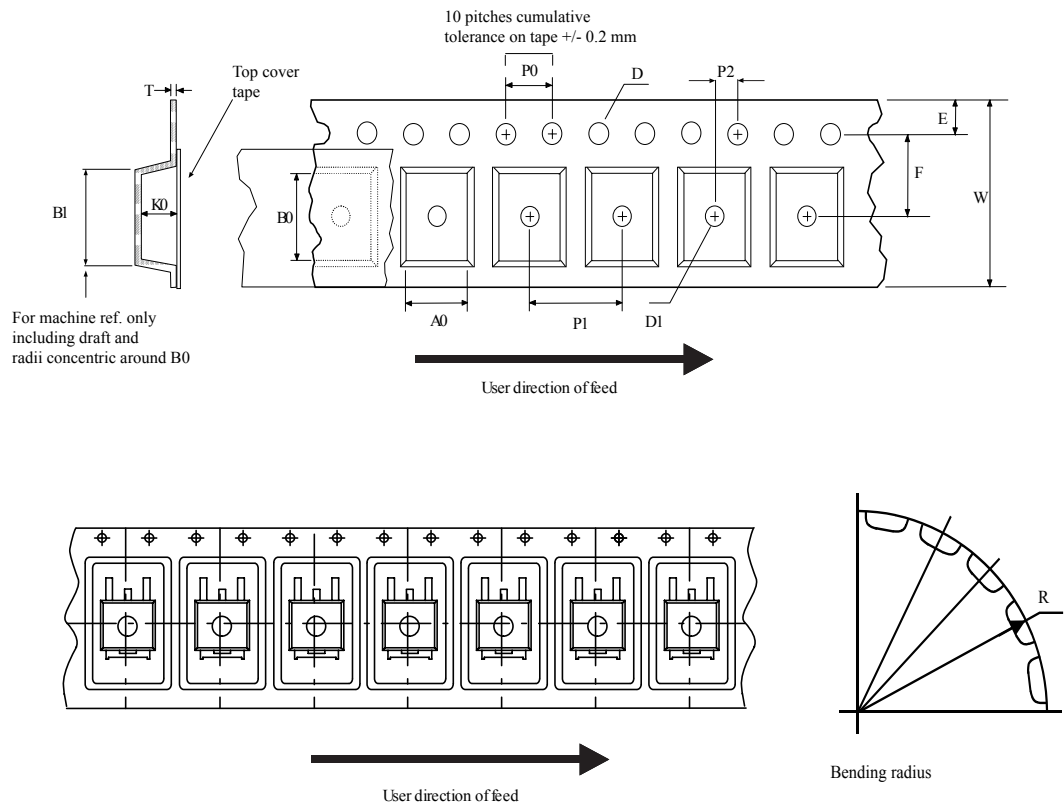
Figure 20. DPAK (TO-252) recommended footprint (dimensions are in mm)



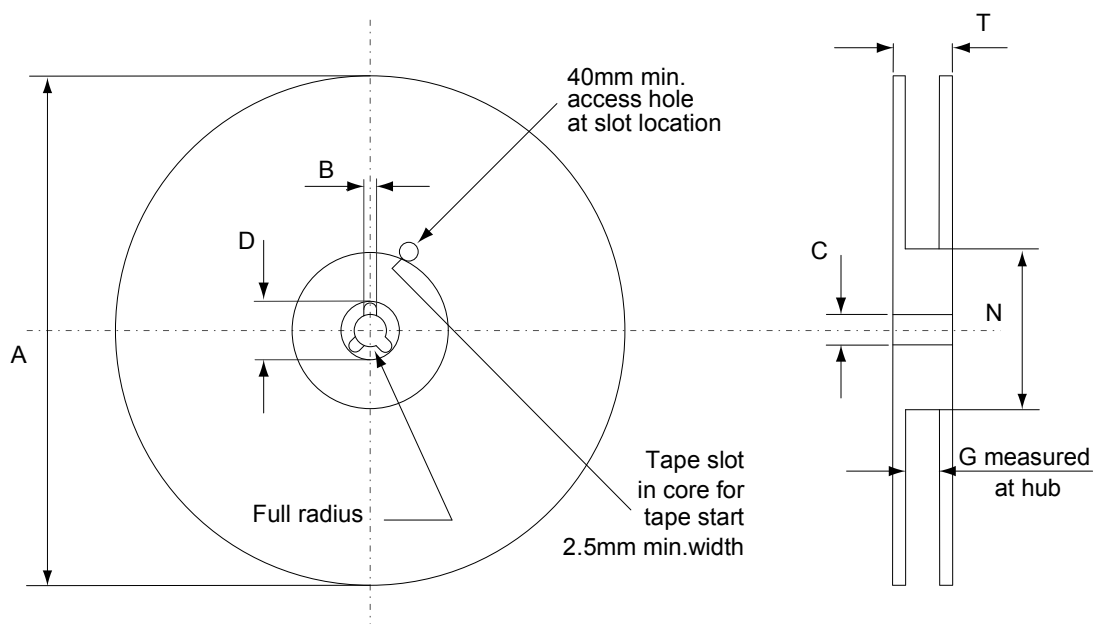
FP_0068772_rev26

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 Section 4 Package information . Minor text changes.

Contents

1	Electrical ratings	2
2	Electrical characteristics.....	3
2.1	Electrical characteristics curves	4
3	Test circuits	8
4	Package information.....	9
4.1	IPAK (TO-251) type A package information	9
4.2	DPAK (TO-252) type A2 package information	11
4.3	DPAK (TO-252) type C2 package information	13
4.4	DPAK (TO-252) packing information.....	16
5	Ordering information	19
	Revision history	20

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2019 STMicroelectronics – All rights reserved