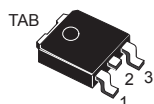
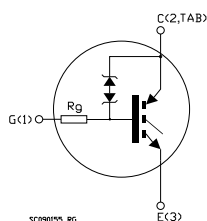


5 A, 1200 V, low drop internally clamped IGBT



DPAK



Features

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

Applications

- Low switching frequency applications

Description

This device is low drop internally clamped IGBT developed using advanced PowerMESH technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior.



Product status link

[STGD5NB120SZ](#)

Product summary

Order code	STGD5NB120SZ
Marking	GD5NB120SZ
Package	DPAK
Packing	Tape and reel

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
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		°C

1. Pulse width is limited by maximum junction temperature.

2. $V_{CLAMP} = 80\% V_{CES}$, $V_{GE} = 15\text{ V}$, $R_G = 10\text{ }\Omega$, $T_J = 150\text{ °C}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	1.67	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	100	°C/W

2 Electrical characteristics

$T_C = 25\text{ }^{\circ}\text{C}$ 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
		$V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$, $T_C = 125\text{ }^{\circ}\text{C}$		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	$V_{CE} = 2.5\text{ V}$, $I_C = 2\text{ A}$, $T_C = 25\text{ to }125\text{ }^{\circ}\text{C}$			6.5	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 900\text{ V}$			50	μA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 900\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}$ ⁽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	-	pF
C_{res}	Reverse transfer capacitance		-	7	-	pF

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	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	39.6	-	A/ μ s
$t_{d(on)}$	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	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	39	-	A/ μ s
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	-	μ s
$t_r(V_{off})$	Off voltage rise time		-	2.2	-	μ s
$t_d(off)$	Turn-off delay time		-	12.1	-	μ s
t_f	Current fall 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)	-	1.13	-	μ s
t_c	Cross-over time		-	5	-	μ s
$t_r(V_{off})$	Off voltage rise time		-	2.2	-	μ s
$t_d(off)$	Turn-off delay time		-	12.1	-	μ s
t_f	Current fall time		-	2	-	μ s

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	-	mJ
E_{ts}	Total switching energy		-	11.59	-	mJ
$E_{on}^{(1)}$	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	-	mJ
E_{ts}	Total switching energy		-	12.68	-	mJ

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

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

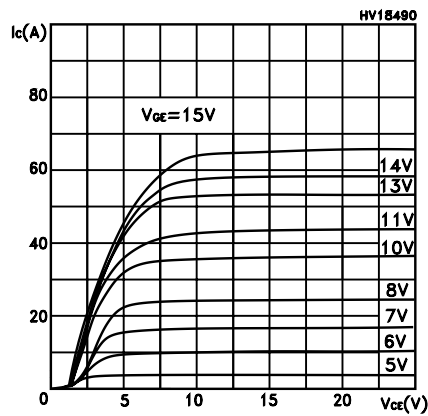


Figure 2. Transfer characteristics

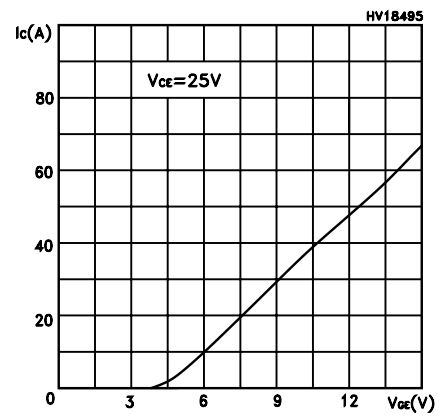


Figure 3. Collector-emitter on voltage vs temperature

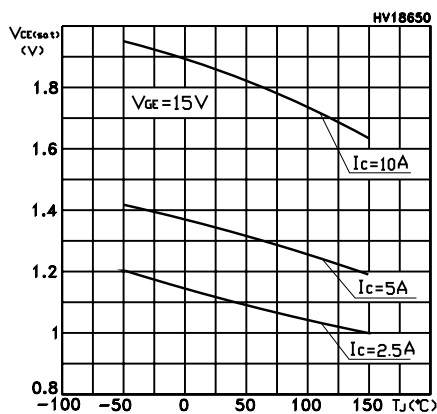


Figure 4. Gate charge vs gate-source voltage

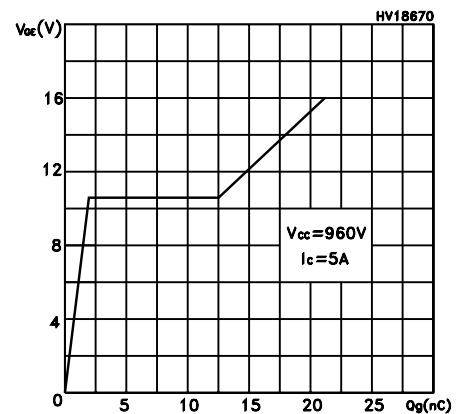


Figure 5. Capacitance variations

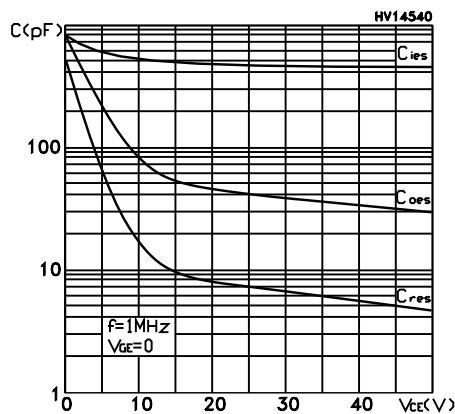


Figure 6. Normalized gate threshold voltage vs temperature

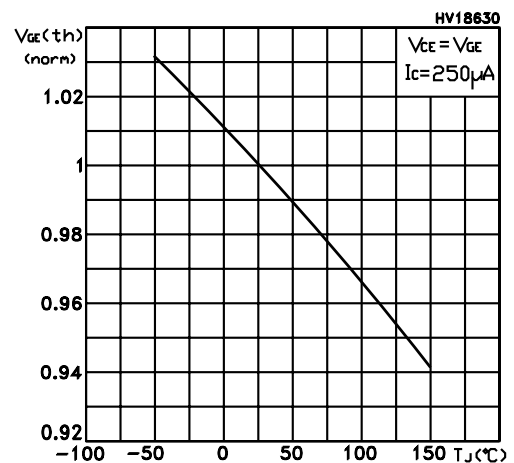


Figure 7. Collector-emitter on voltage vs collector current

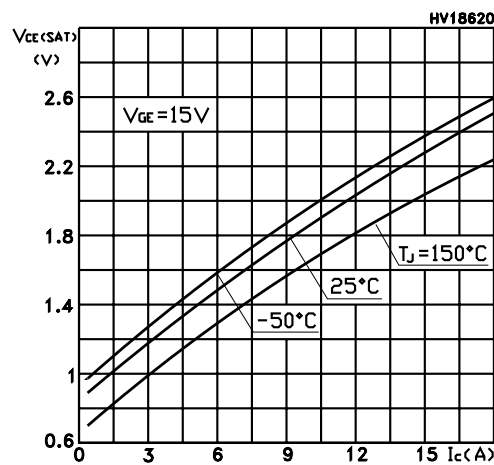


Figure 8. Breakdown voltage vs temperature

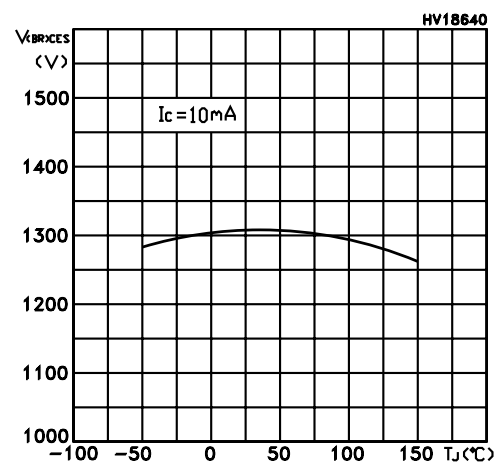


Figure 9. Normalized collector-emitter on voltage vs temperature

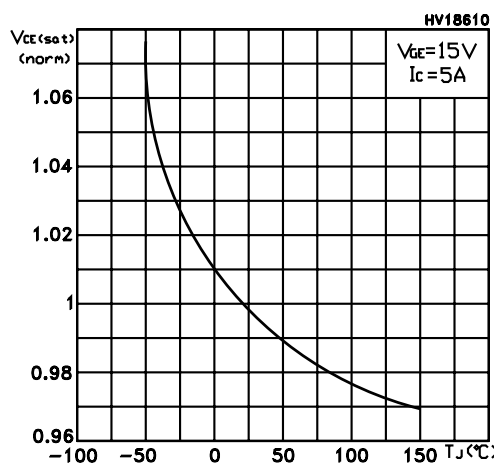


Figure 10. Switching energy vs gate resistance

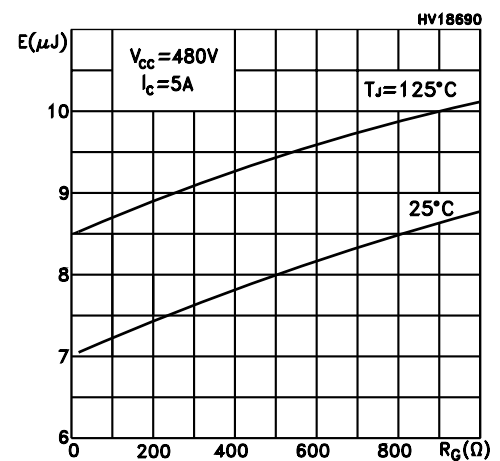


Figure 11. Switching energy vs collector current

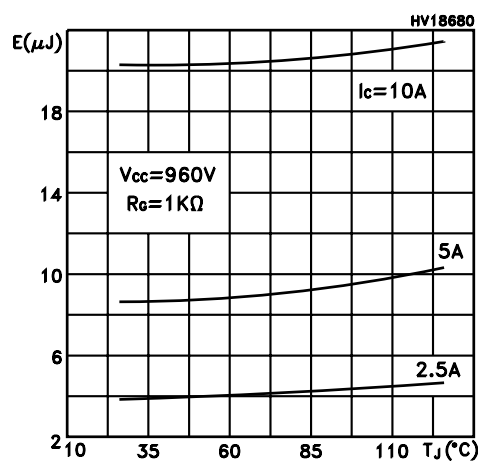


Figure 12. Turn-off SOA

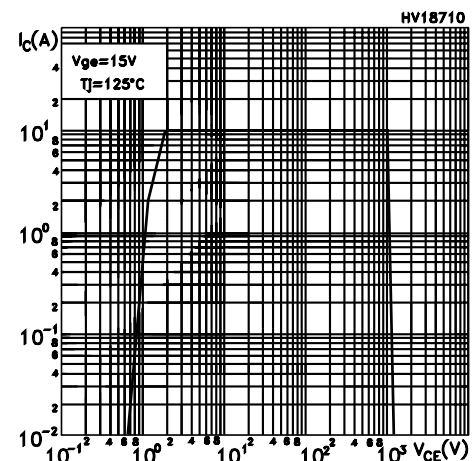
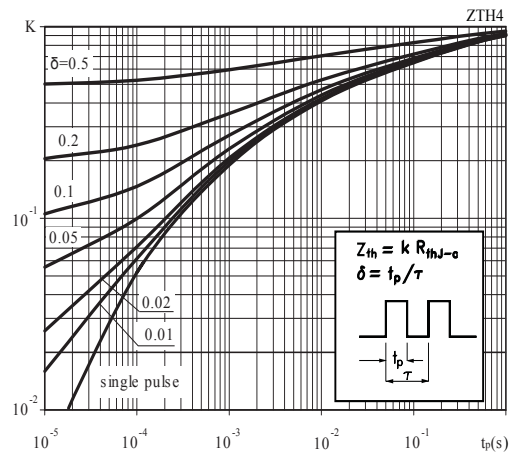


Figure 13. Thermal impedance



3 Test circuits

Figure 14. Test circuit for inductive load switching

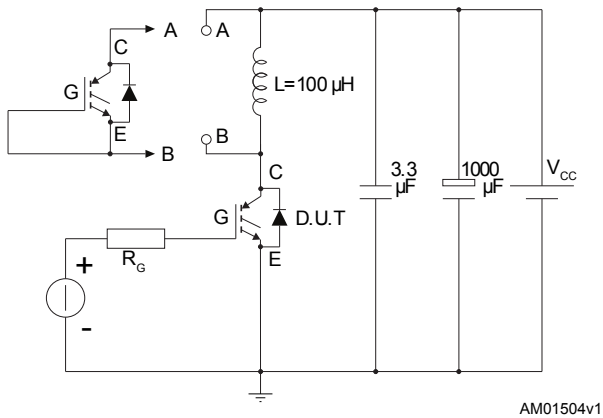


Figure 15. Gate charge test circuit

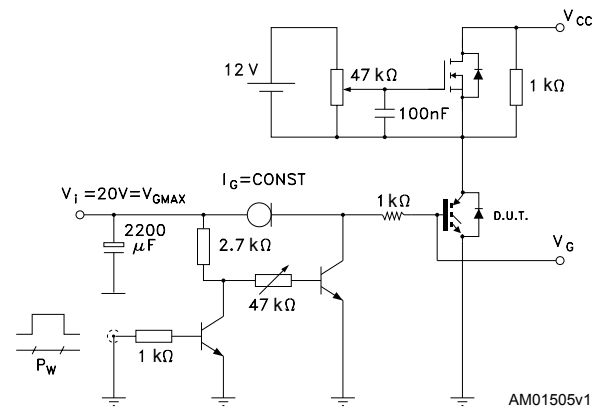
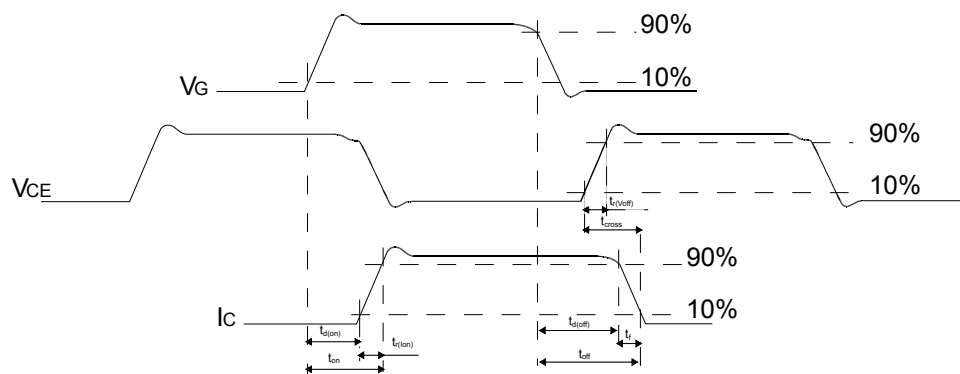


Figure 16. Switching waveform



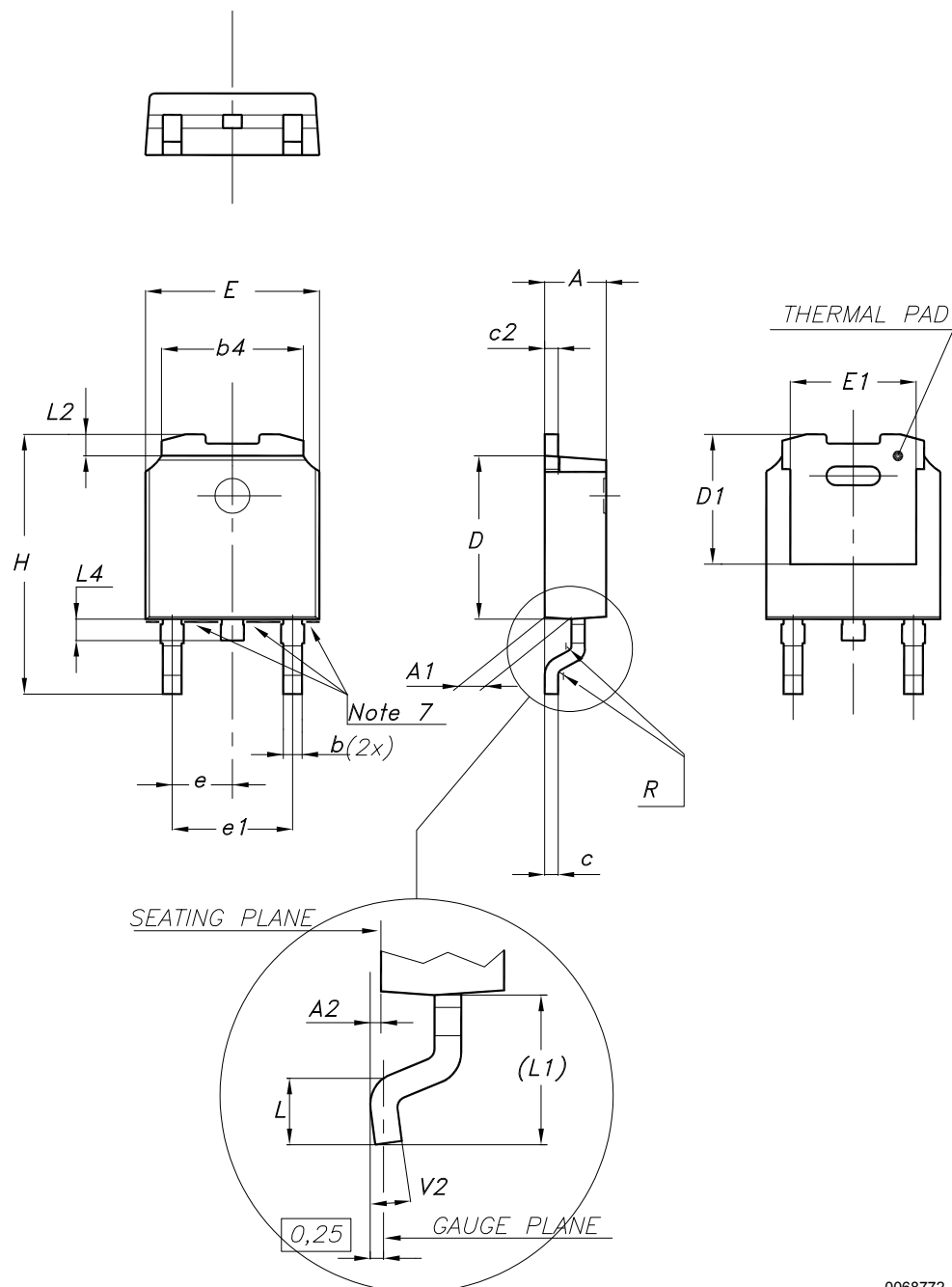
AM01506v1

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 DPAK (TO-252) type A2 package information

Figure 17. DPAK (TO-252) type A2 package outline



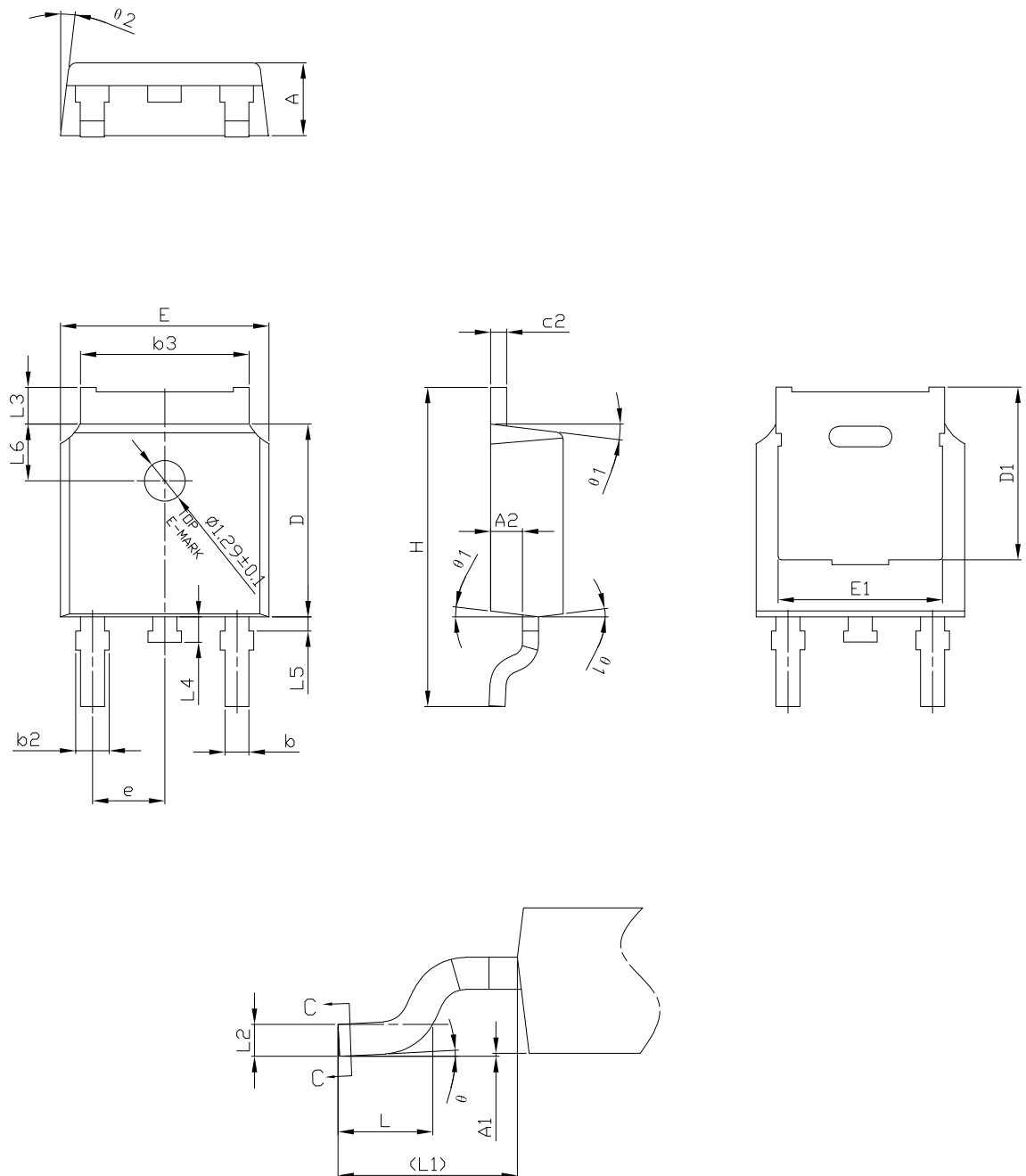
0068772_type-A2_rev34

Table 7. 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°

4.2 DPAK (TO-252) type C3 package information

Figure 18. DPAK (TO-252) type C3 package outline

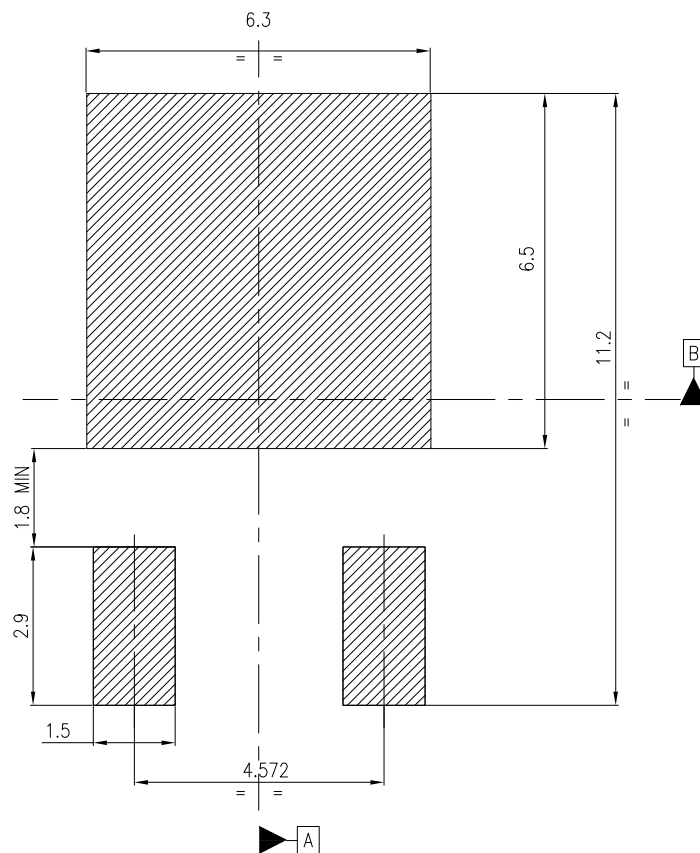


0068772_type-C3_rev34

Table 8. DPAK (TO-252) type C3 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.00		0.10
A2	0.90	1.01	1.10
b	0.72		0.85
b2	0.72		1.10
b3	5.13	5.33	5.46
c	0.47		0.60
c2	0.47		0.60
D	6.00	6.10	6.20
D1	5.20	5.45	5.70
E	6.50	6.60	6.70
E1	5.00	5.20	5.40
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	0.51 BSC		
L3	0.90		1.25
L4	0.60	0.80	1.00
L5	0.15		0.75
L6	1.80 REF		
θ	0°		8°
θ1	5°	7°	9°
θ2	5°	7°	9°

Figure 19. DPAK (TO-252) recommended footprint (dimensions are in mm)



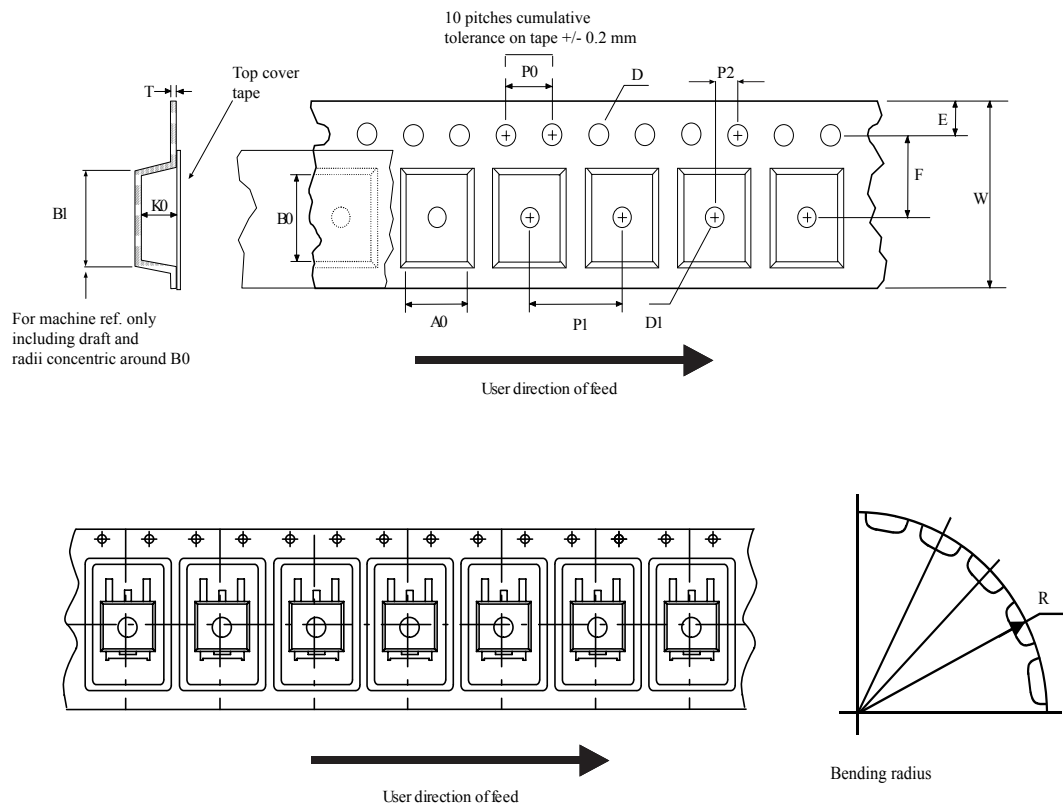
Notes:

- 1) This footprint is able to ensure insulation up to 630 Vrms (according to CEI IEC 664-1)
- 2) The device must be positioned within $\boxed{\oplus 0.05 \text{ A B}}$

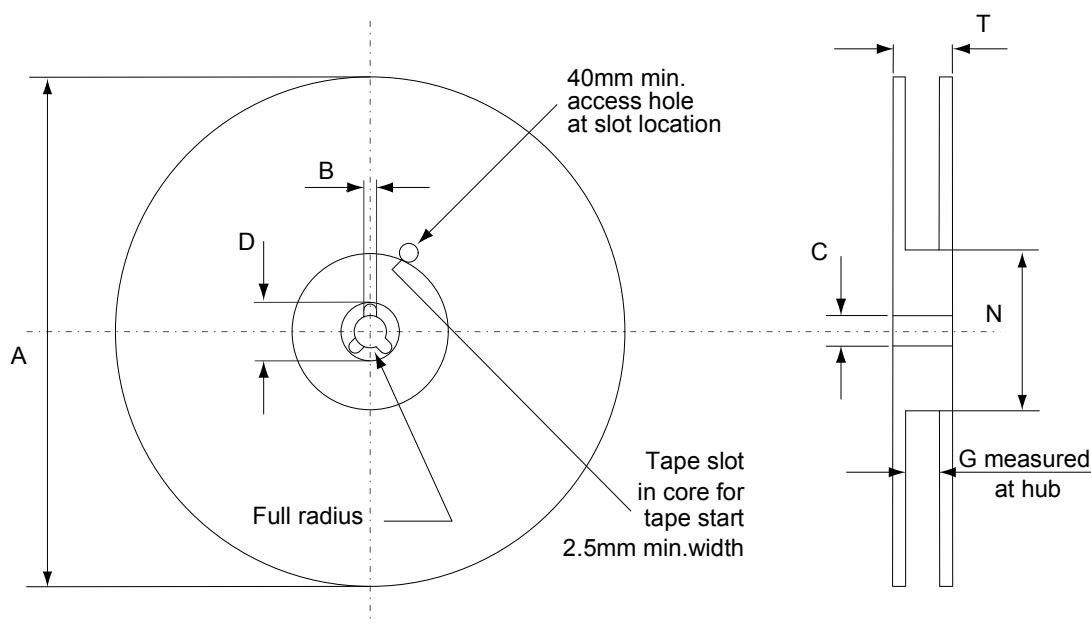
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4.3 DPAK (TO-252) packing information

Figure 20. DPAK (TO-252) tape outline



AM08852v1

Figure 21. DPAK (TO-252) reel outline


AM06038v1

Table 9. 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			

Revision history

Table 10. Document revision history

Date	Revision	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 <i>Section 4 Package information</i> . Minor text changes.
15-Jun-2021	9	Removed IPAK package and document updated accordingly. Modified applications section on cover page. Modified <i>Table 1. Absolute maximum ratings</i> . Removed <i>Table 7: Functional test</i> . Minor text changes.
13-Apr-2023	10	Updated <i>Section 4 Package information</i> . Minor text changes.

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