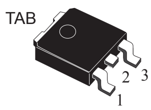
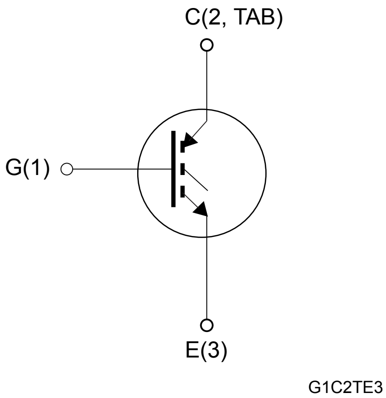
N-channel 600 V, 10 A, very fast IGBT in DPAK package



DPAK



Features

Type	V_{CES}	$V_{CE(sat)}$ max.	I_C @100°C
STGD10NC60HT4	600 V	2.5 V	10 A

- Low on-voltage drop ($V_{CE(sat)}$)
- Low CRES / CIES ratio (no cross-conduction susceptibility)

Applications

- High-frequency motor controls
- SMPS and PFC in both hard switch and resonant topologies

Description

This device is a very fast IGBT developed using advanced PowerMESH™ technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior. This device is well-suited for resonant or soft-switching applications.

Product status link
STGD10NC60HT4

Product summary	
Order code	STGD10NC60HT4
Marking	GD10NC60H
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 V)	600	V
I_C	Continuous collector current at T_C = 25 °C	20	A
I_C	Collector current (continuous) at T_C = 100°C	10	A
I_{CL} (1)	Collector current (pulsed)	40	A
V_{GE}	Gate-emitter voltage	±20	V
P_{TOT}	Total power dissipation at T_C = 25 °C	60	W
T_J	Operating junction temperature range	-55 to 150	°C
T_{stg}	Storage temperature range		

1. *V_{clamp} = 480 V, T_j = 150°C, R_G = 10 Ω, V_{GE} = 15 V*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	2.08	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	°C/W

2 Electrical characteristics

T_{CASE} = 25 °C unless otherwise specified

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	I_C = 1 mA, V_{GE} = 0 V	600			V
I_{CES}	Collector cut-off current (V_{GE} = 0 V)	V_{CE} = 600 V			150	µA
		V_{CE} = 600 V, T_C = 125 °C (1)			1	mA
I_{GES}	Gate-emitter leakage current	V_{GE} = ±20 V, V_{CE} = 0 V			±100	nA
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	3.75		5.75	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 5 A		1.9	2.5	V
		V_{GE} = 15 V, I_C = 5 A, T_C = 125°C		1.7		

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

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	365	-	pF
C_{oes}	Output capacitance		-	43	-	pF
C_{res}	Reverse transfer capacitance		-	8.3	-	pF
Q_g	Total gate charge	V_{CE} = 390 V, I_D = 5 A, V_{GE} = 0 to 15 V (see Figure 15. Gate charge test circuit)	-	22	-	nC
Q_{ge}	Gate-emitter charge		-	4.5	-	nC
Q_{gc}	Gate-collector charge		-	7.5	-	nC

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 5A R_G = 10 Ω, V_{GE} = 15 V (see Figure 14. Test circuit for inductive load switching and Figure 16. Switching waveform)	-	14.2	-	ns
t_r	Current rise time		-	5	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1000	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390 V, I_C = 5 A R_G = 10 Ω, V_{GE} = 15 V, T_j = 125°C (see Figure 14. Test circuit for inductive load switching and Figure 16. Switching waveform)	-	14	-	ns
t_r	Current rise time		-	5	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	920	-	A/µs

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{r(V_{off})}$	Off voltage rise time	V_{CC} = 390 V, I_C = 5 A, R_{GE} = 10 Ω, V_{GE} = 15 V (see Figure 14. Test circuit for inductive load switching and Figure 16. Switching waveform)	-	27	-	ns
$td_{(off)}$	Turn-off delay time		-	72	-	ns
t_f	Current fall time		-	85	-	ns
$t_{r(V_{off})}$	Off voltage rise time	V_{CC} = 390 V, I_C = 5 A, R_{GE} = 10 Ω, V_{GE} = 15 V, T_j = 125°C (see Figure 14. Test circuit for inductive load switching and Figure 16. Switching waveform)	-	50	-	ns
$td_{(off)}$	Turn-off delay time		-	108	-	ns
t_f	Current fall time		-	139	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	V_{CC} = 390 V, I_C = 5 A R_G = 10 Ω, V_{GE} = 15 V (see Figure 14. Test circuit for inductive load switching)	-	31.8	-	µJ
E_{off} (1)	Turn-off switching energy		-	95	-	µJ
E_{ts}	Total switching energy		-	126.8	-	µJ
E_{on}	Turn-on switching energy	V_{CC} = 390 V, I_C = 5 A R_G = 10 Ω, V_{GE} = 15 V, T_j = 125°C (see Figure 14. Test circuit for inductive load switching)	-	61.8	-	µJ
E_{off} (1)	Turn-off switching energy		-	173	-	µJ
E_{ts}	Total switching energy		-	234.8	-	µJ

1. *Including the tail of the collector current.*

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

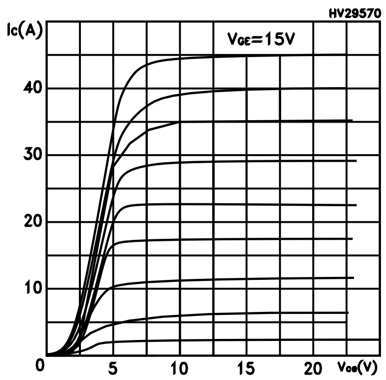


Figure 2. Transfer characteristics

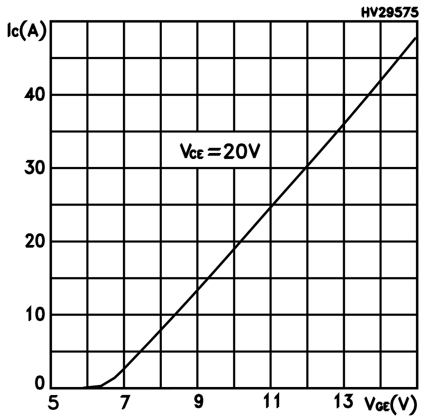


Figure 3. Collector-emitter on voltage vs temperature

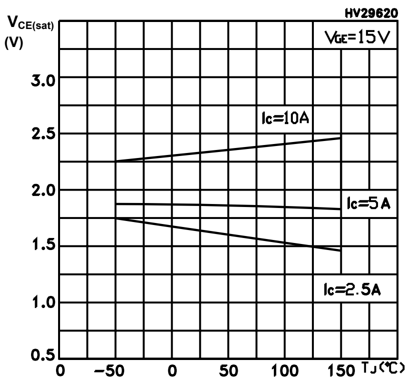


Figure 4. Gate charge vs gate-source voltage

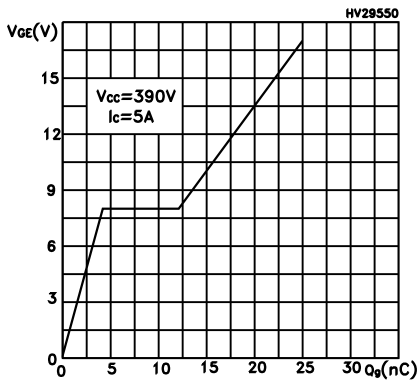


Figure 5. Capacitance variations

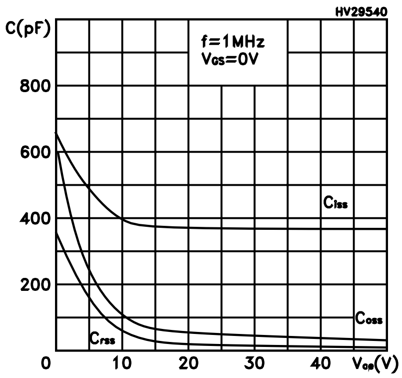


Figure 6. Normalized gate threshold voltage vs temperature

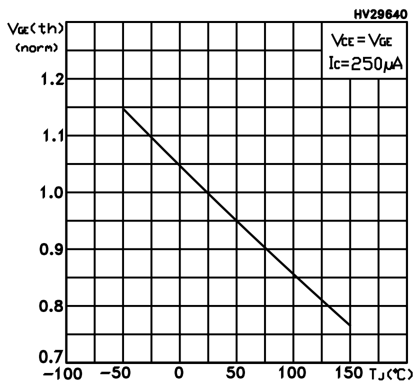


Figure 7. Collector-emitter on voltage vs collector current

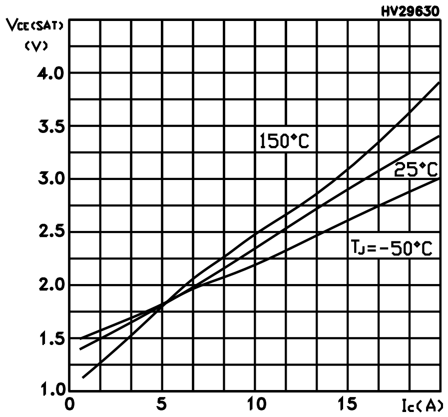


Figure 8. Normalized breakdown voltage vs temperature

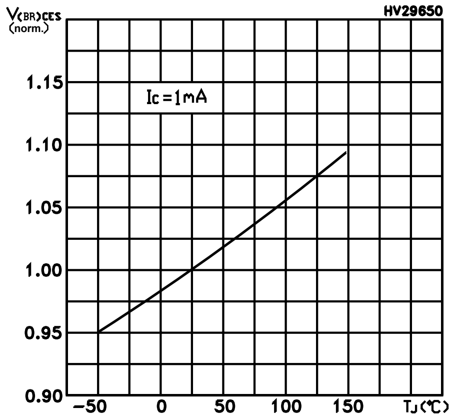


Figure 9. Switching energy vs temperature

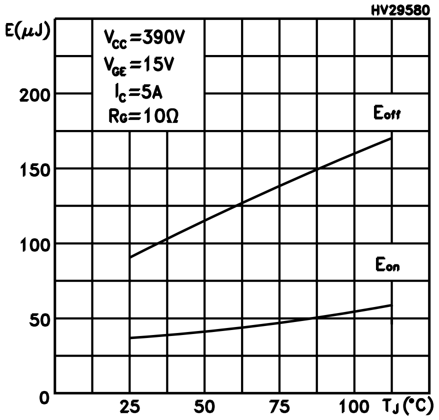


Figure 10. Switching energy vs gate resistance

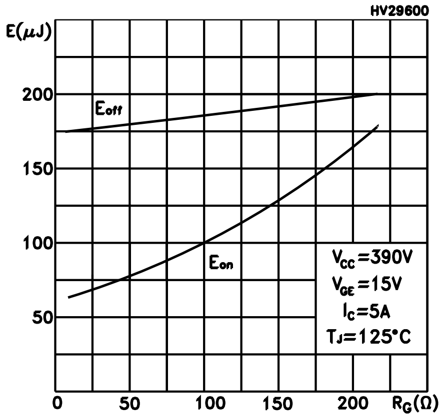


Figure 11. Switching energy vs collector current

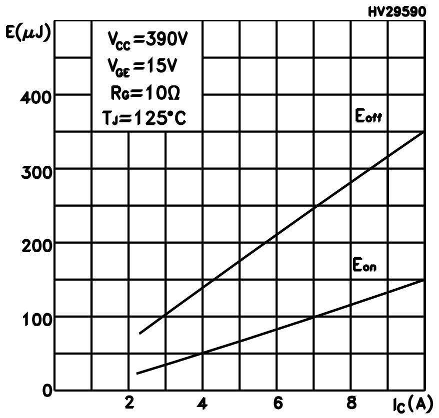


Figure 12. Thermal Impedance

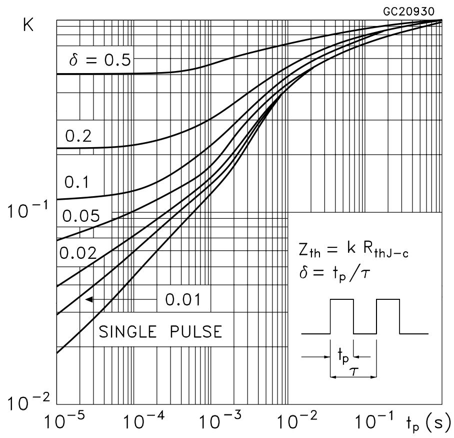
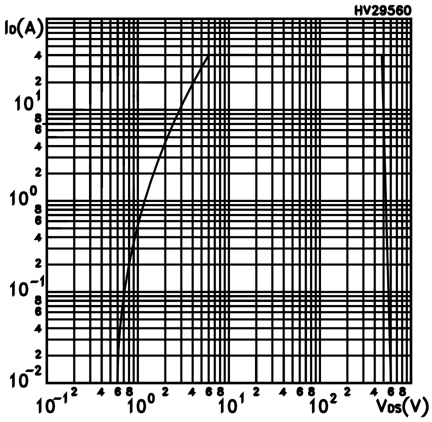


Figure 13. Turn-off SOA



3 Test circuits

Figure 14. Test circuit for inductive load switching

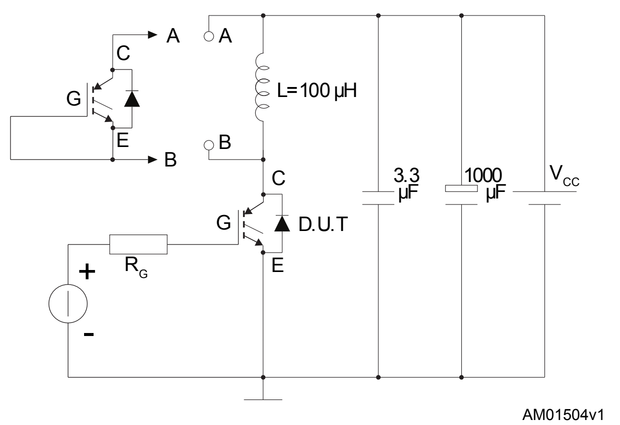


Figure 15. Gate charge test circuit

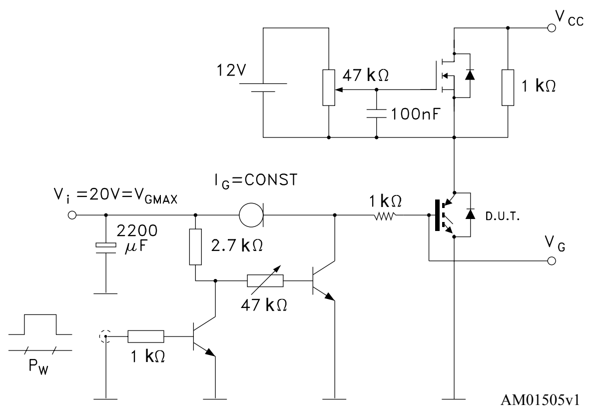
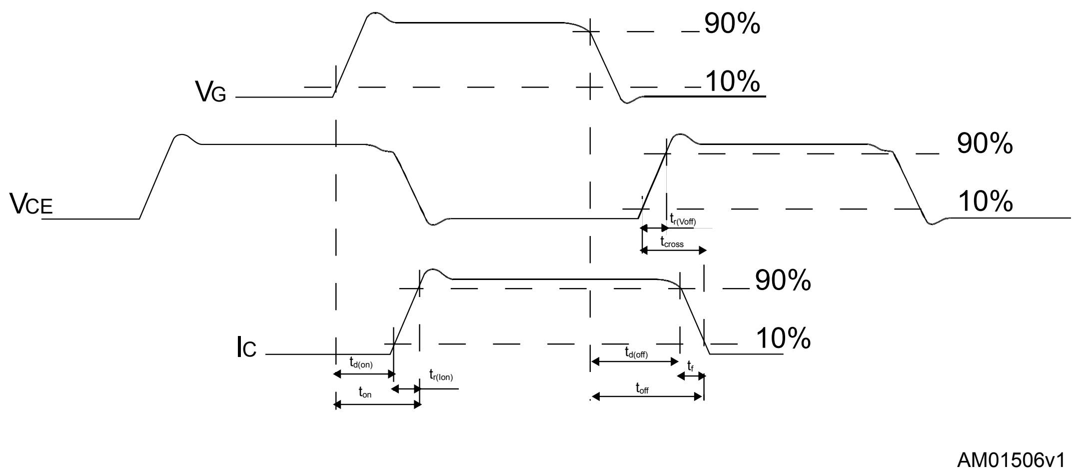


Figure 16. Switching waveform



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 DPAK (TO-252) type A2 package information

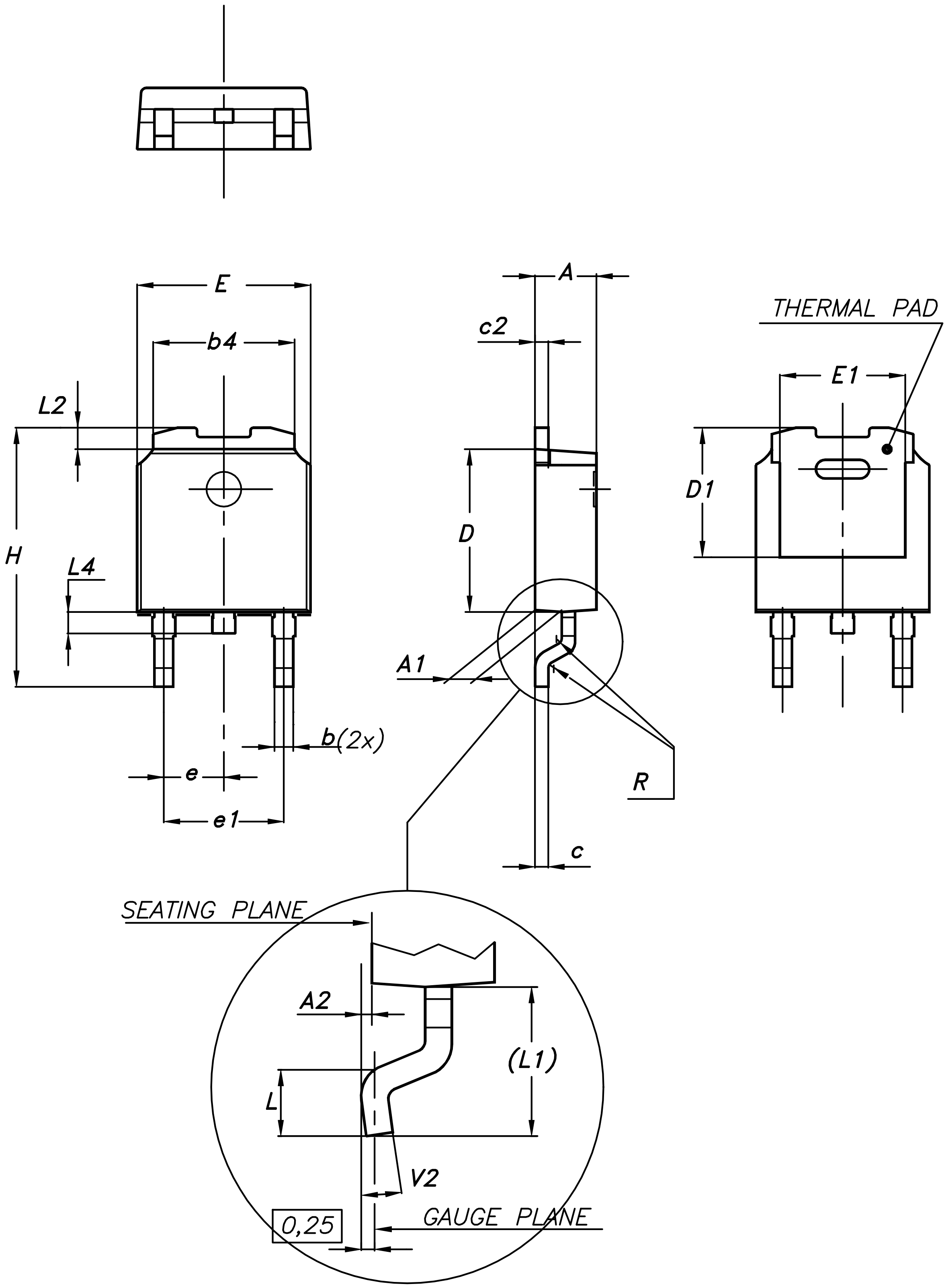


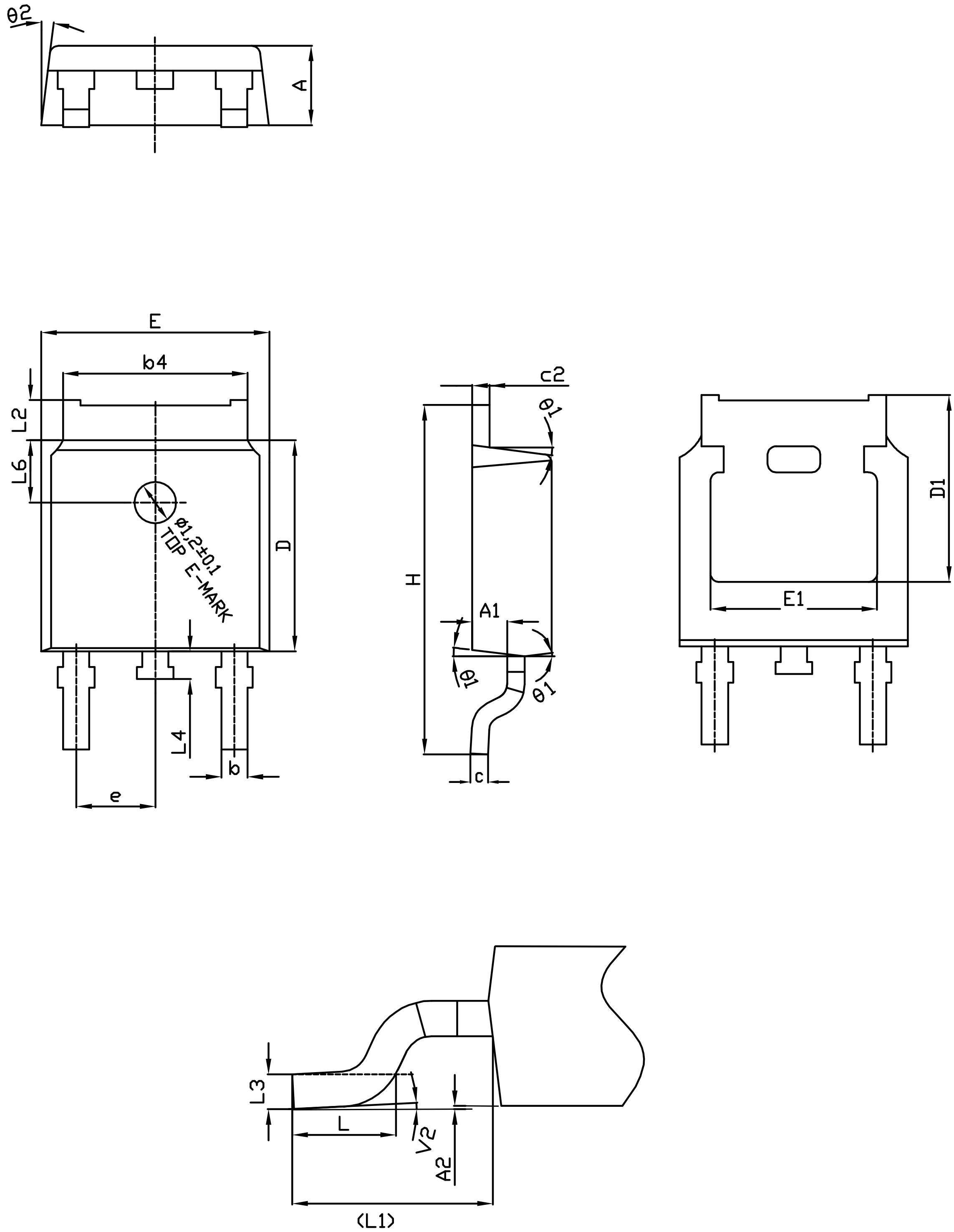
Figure 17. DPAK (TO-252) type A2 package outline

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 C2 package information

Figure 18. **DPAK (TO-252) type C2 package outline**

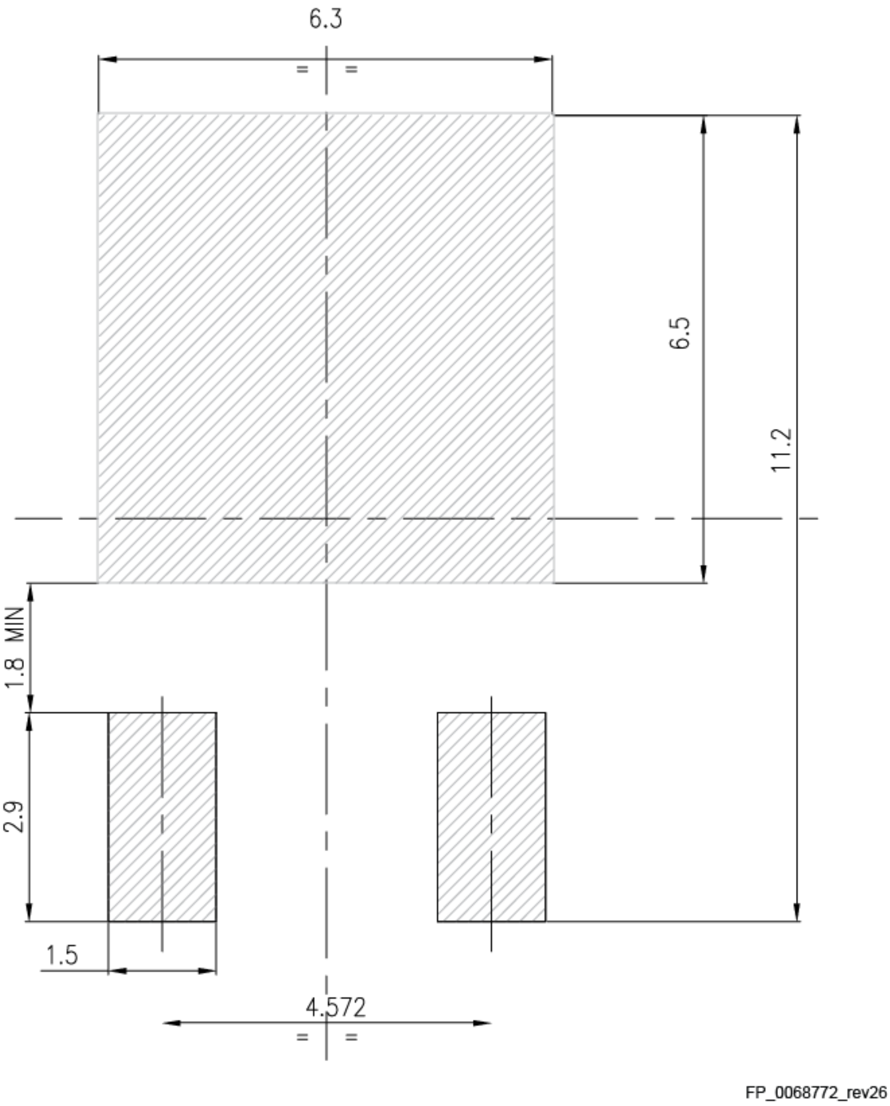


0068772_type-C2_rev26

Table 8. **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 19. **DPAK (TO-252) recommended footprint (dimensions are in mm)**



4.3 DPAK (TO-252) packing information

Figure 20. DPAK (TO-252) tape outline

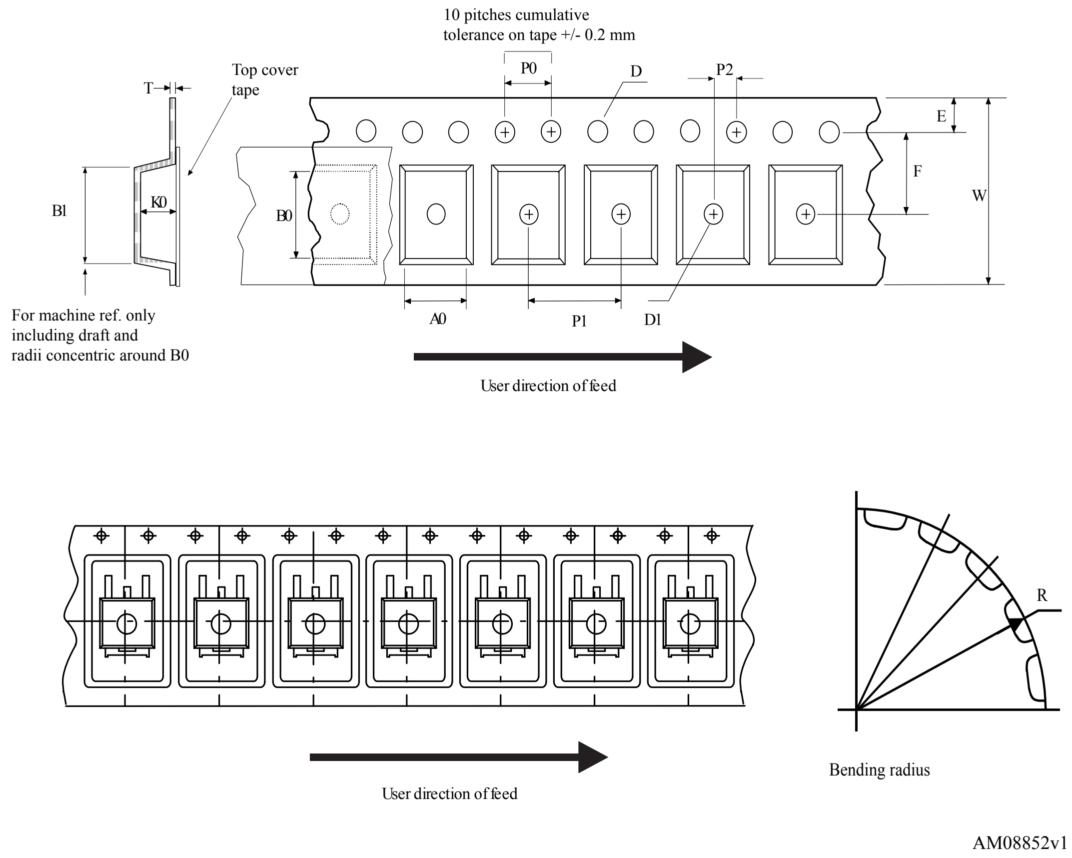


Figure 21. **DPAK (TO-252) reel outline**

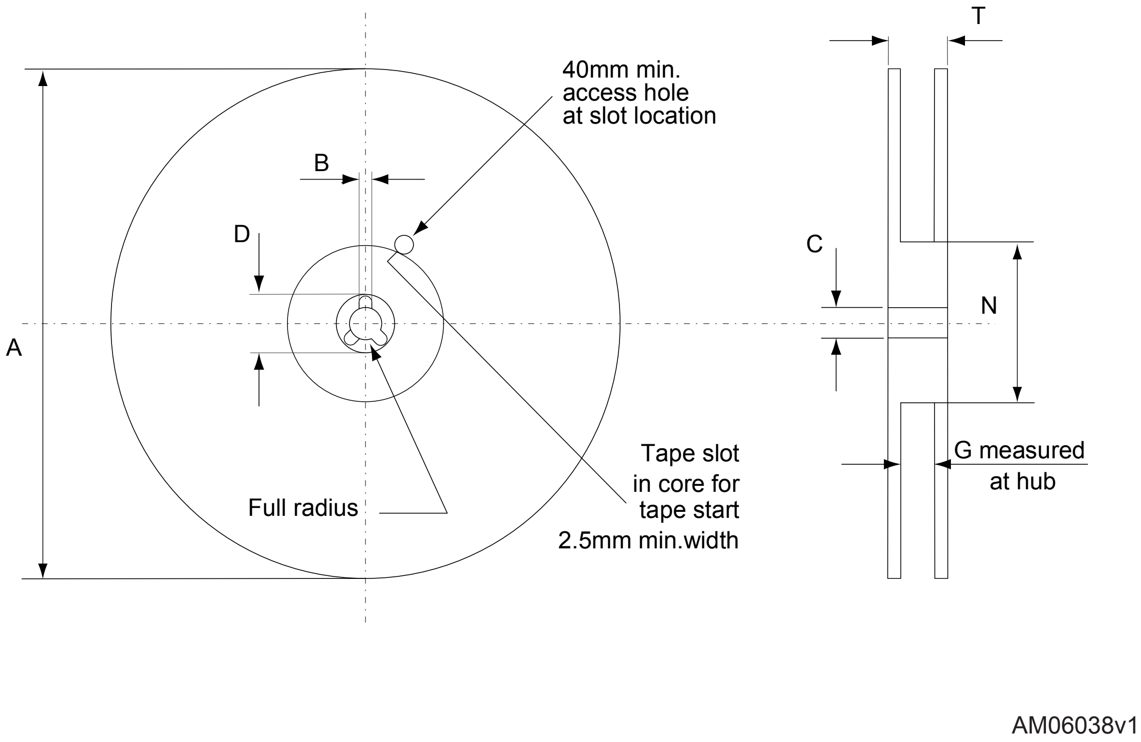


Table 9. **DPAK (TO-252) tape and reel mechanical data**

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	Version	Changes
27-Feb-2019	1	Initial release.

Contents