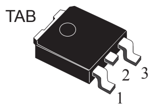
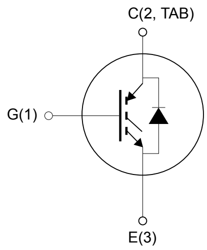
STGD6NC60HDT4

Datasheet

N-channel 600 V, 7 A very fast IGBT



DPAK



NG1E3C2T

Features

Order codes	V_{CES}	$V_{CE(sat)}$ max.	I_C (at T_C = 100 °C)
STGD6NC60HDT4	600 V	2.5 V	7 A

- Low on-voltage drop ($V_{CE(sat)}$)
- Low CRES / CIES ratio (no cross-conduction susceptibility)
- Very soft ultra fast recovery antiparallel diode
- High frequency operation

Applications

- High-frequency inverters
- SMPS and PFC in both hard switch and resonant topologies
- Motor drivers

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
STGD6NC60HDT4

Product summary	
Order code	STGD6NC60HDT4
Marking	GD6NC60HD
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	15	A
	Continuous collector current at T_C = 100 °C	7	A
I_{CP} (1)	Pulsed collector current	21	A
V_{GE}	Gate-emitter voltage	±20	V
I_F	Diode RMS forward current at T_C = 25 °C	10	A
P_{TOT}	Total power dissipation at T_C = 25 °C	63	W
T_{STG}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range		°C

1. *Pulse width limited by maximum junction temperature.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case	2	°C/W
R_{thJA}	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 = 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 3 A		1.9	2.5	V
		V_{GE} = 15 V, I_C = 3 A, T_C = 125 °C		1.7		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	3.75		5.75	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 600 V			10	µA
		V_{GE} = 0 V, V_{CE} = 600 V, T_C = 125 °C [(1)]			1	mA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ± 20 V			±100	nA

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	-	205	-	pF
C_{oes}	Output capacitance		-	32	-	
C_{res}	Reverse transfer capacitance		-	5.5	-	
Q_g	Total gate charge	V_{CC} = 390 V, I_C = 3 A, V_{GE} = 0 to 15 V (see Figure 17. Gate charge test circuit)	-	13.6	-	nC
Q_{ge}	Gate-emitter charge		-	3	-	
Q_{gc}	Gate-collector charge		-	6	-	
I_{CL}	Turn-off SOA minimum current	V_{clamp} = 390 V, T_j = 150 °C, R_G = 10 Ω, V_{GE} = 15 V	-	19	-	A

Table 5. Switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CE} = 390 V, I_C = 3 A, V_{GE} = 15 V, R_G = 10 Ω (see Figure 16. Test circuit for inductive load switching)	-	12	-	ns
t_r	Current rise time		-	5	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	612	-	A/µs
$t_{d(on)}$	Turn-on delay time	V_{CE} = 390 V, I_C = 3 A, V_{GE} = 15 V, R_G = 10 Ω, T_j = 125 °C (see Figure 16. Test circuit for inductive load switching)	-	13	-	ns
t_r	Current rise time		-	4.3	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	560	-	A/µs

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off voltage rise time	V_{CE} = 390 V, I_C = 3 A, V_{GE} = 15 V, R_G = 10 Ω (see Figure 16. Test circuit for inductive load switching)	-	40	-	ns
$t_{d(off)}$	Turn-off delay time		-	76	-	ns
t_f	Current fall time		-	100	-	ns
$t_{r(Voff)}$	Off voltage rise time	V_{CE} = 390 V, I_C = 3 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 125 °C (see Figure 16. Test circuit for inductive load switching)	-	60	-	ns
$t_{d(off)}$	Turn-off delay time		-	98	-	ns
t_f	Current fall time		-	124	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on} (1)	Turn-on switching energy	V_{CE} = 390 V, I_C = 3 A, V_{GE} = 15 V, R_G = 10 Ω (see Figure 16. Test circuit for inductive load switching)	-	20	-	μJ
E_{off} (2)	Turn-off switching energy		-	68	-	μJ
E_{ts}	Total switching energy		-	88	-	μJ
E_{on} (1)	Turn-on switching energy	V_{CE} = 390 V, I_C = 3 A, V_{GE} = 15 V, R_G = 10 Ω, T_J = 125 °C (see Figure 16. Test circuit for inductive load switching)	-	37	-	μJ
E_{off} (2)	Turn-off switching energy		-	93	-	μJ
E_{ts}	Total switching energy		-	130	-	μJ

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

Table 7. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	I_F = 1.5 A	-	1.6	2.1	V
		I_F = 1.5 A, T_J = 125 °C	-	1.3		
t_{rr}	Reverse recovery time	I_F = 3 A, V_R = 40 V, di_F/dt = 100 A/μs (see Figure 19. Diode reverse recovery waveform)	-	21		ns
Q_{rr}	Reverse recovery charge		-	14		nC
I_{rrm}	Reverse recovery current		-	1.36		A
t_{rr}	Reverse recovery time	I_F = 3 A, V_R = 40 V, di_F/dt = 100 A/μs, T_J = 125 °C (see Figure 19. Diode reverse recovery waveform)	-	34		ns
Q_{rr}	Reverse recovery charge		-	32		nC
I_{rrm}	Reverse recovery current		-	1.88		A

2.1 Electrical characteristics (curves)

Figure 1. Switching energy vs gate resistance

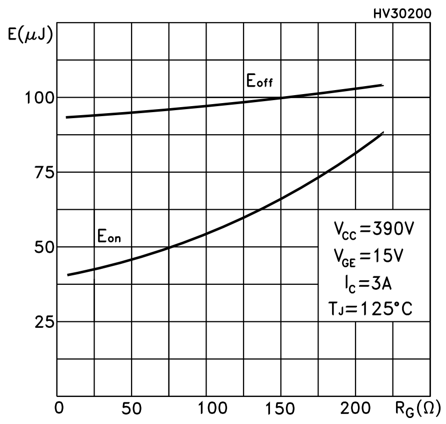


Figure 2. Switching energy vs collector current

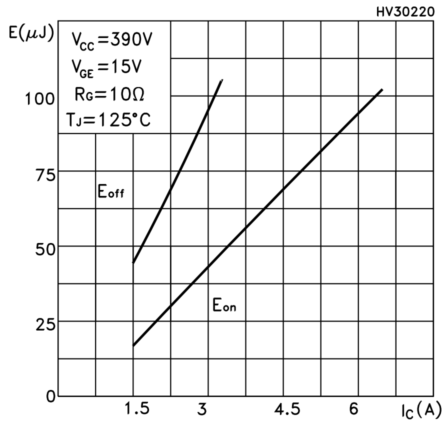


Figure 3. Normalized breakdown voltage vs temperature

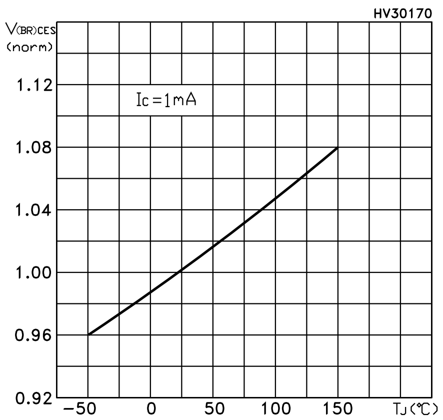


Figure 4. Switching energy vs temperature

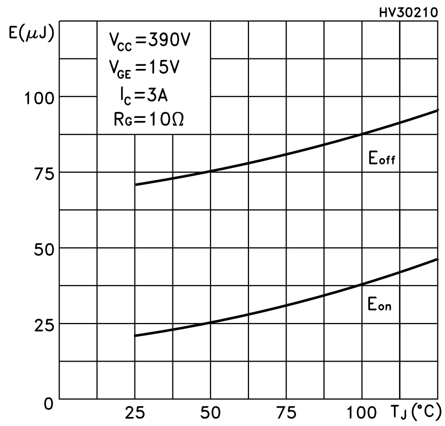


Figure 5. Normalized gate threshold voltage vs temperature

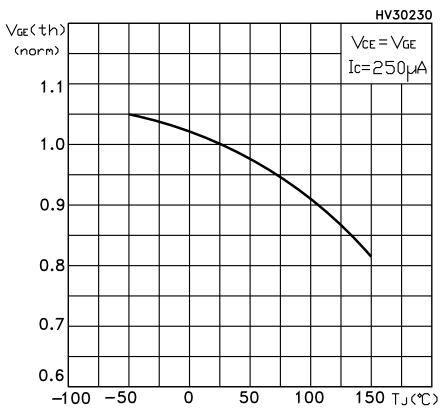


Figure 6. Collector-emitter on voltage vs collector current

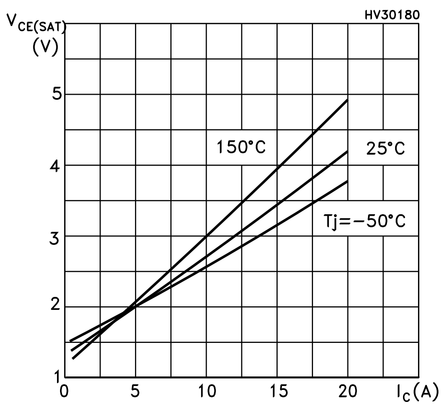


Figure 7. Gate charge vs gate-source voltage

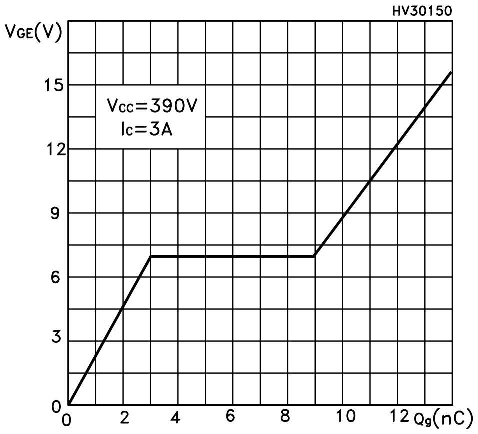


Figure 8. Capacitance variations

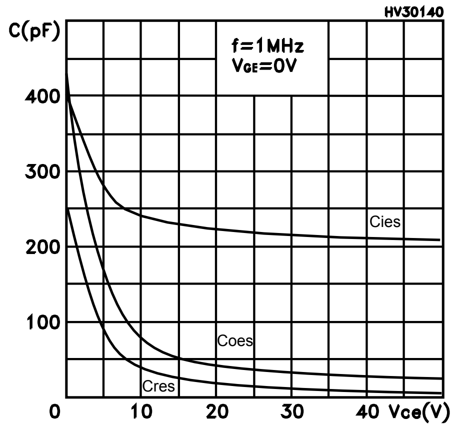


Figure 9. Transconductance

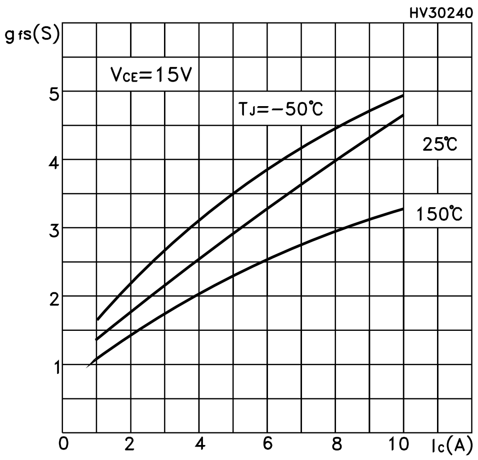


Figure 10. Collector-emitter on-voltage vs temperature

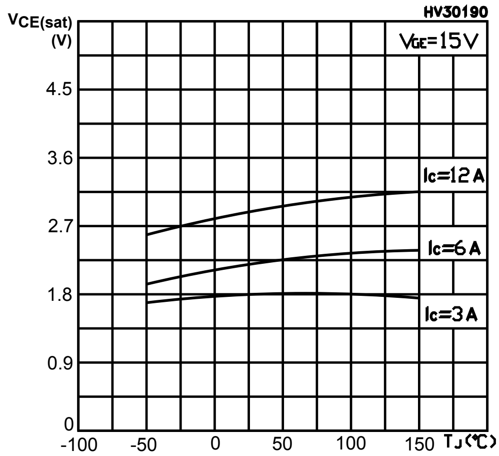


Figure 11. Output characteristics

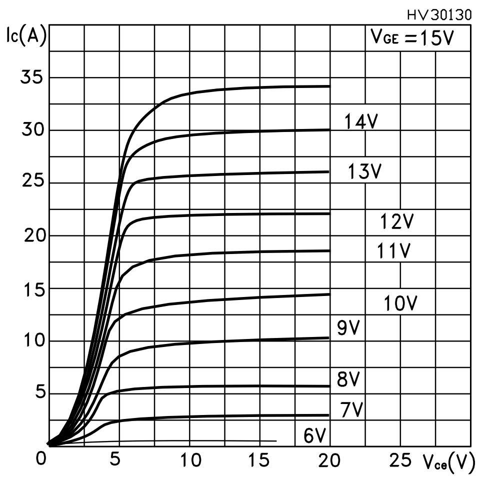


Figure 12. Transfer characteristics

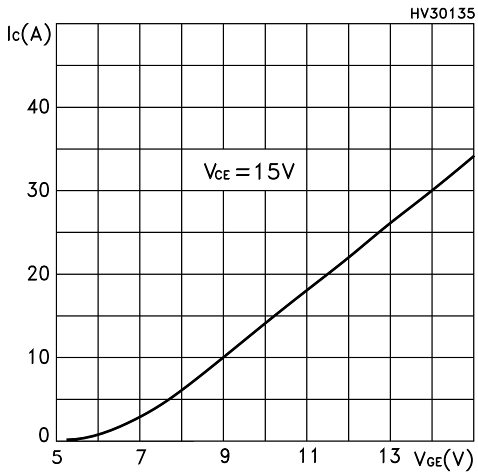


Figure 13. **Thermal impedance**

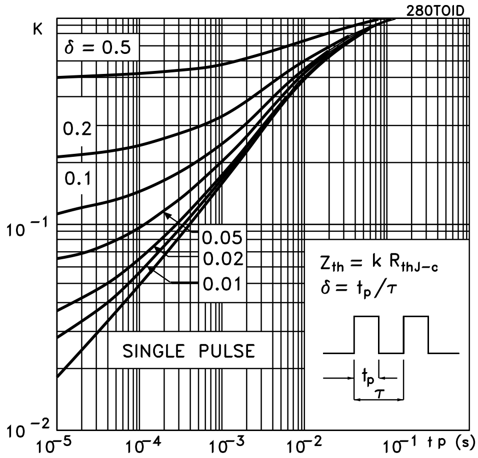


Figure 14. **Turn-off SOA**

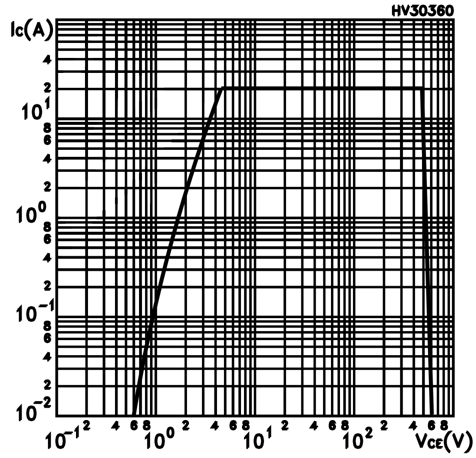
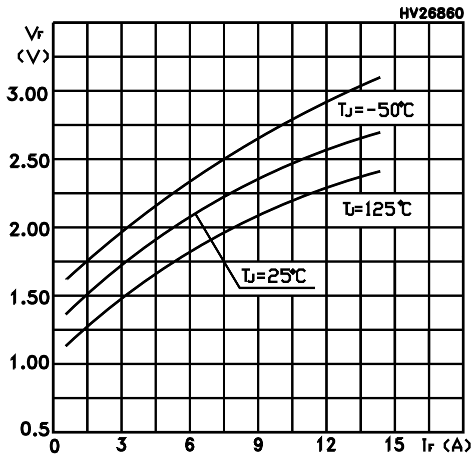


Figure 15. **Emitter-collector diode characteristics**



3 Test circuits

Figure 16. Test circuit for inductive load switching

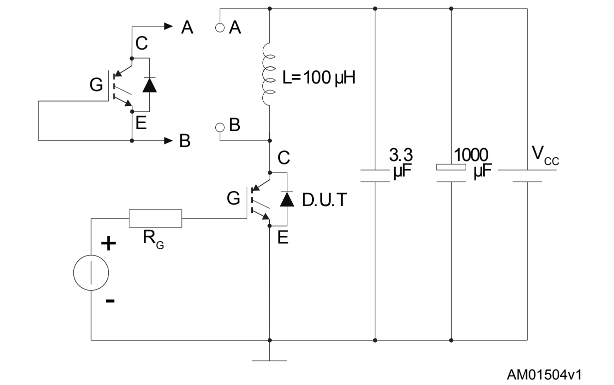


Figure 17. Gate charge test circuit

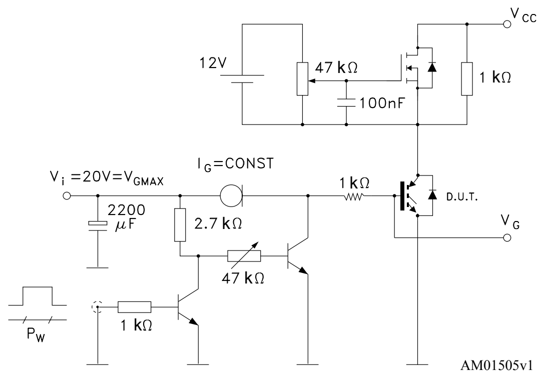


Figure 18. Switching waveform

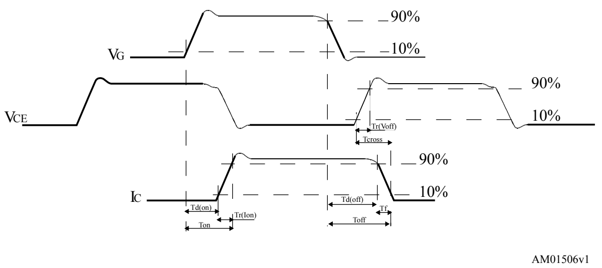
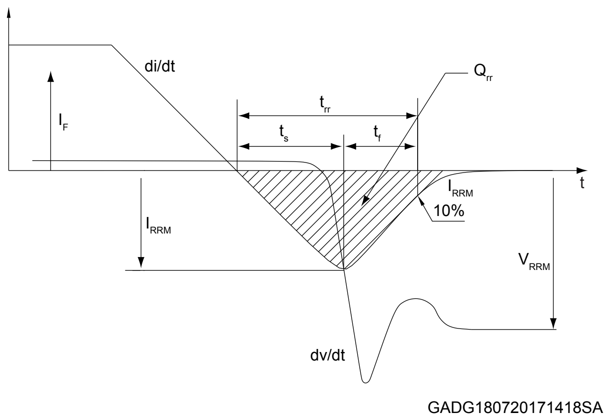


Figure 19. Diode reverse recovery waveform



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 20. DPAK (TO-252) type A2 package outline

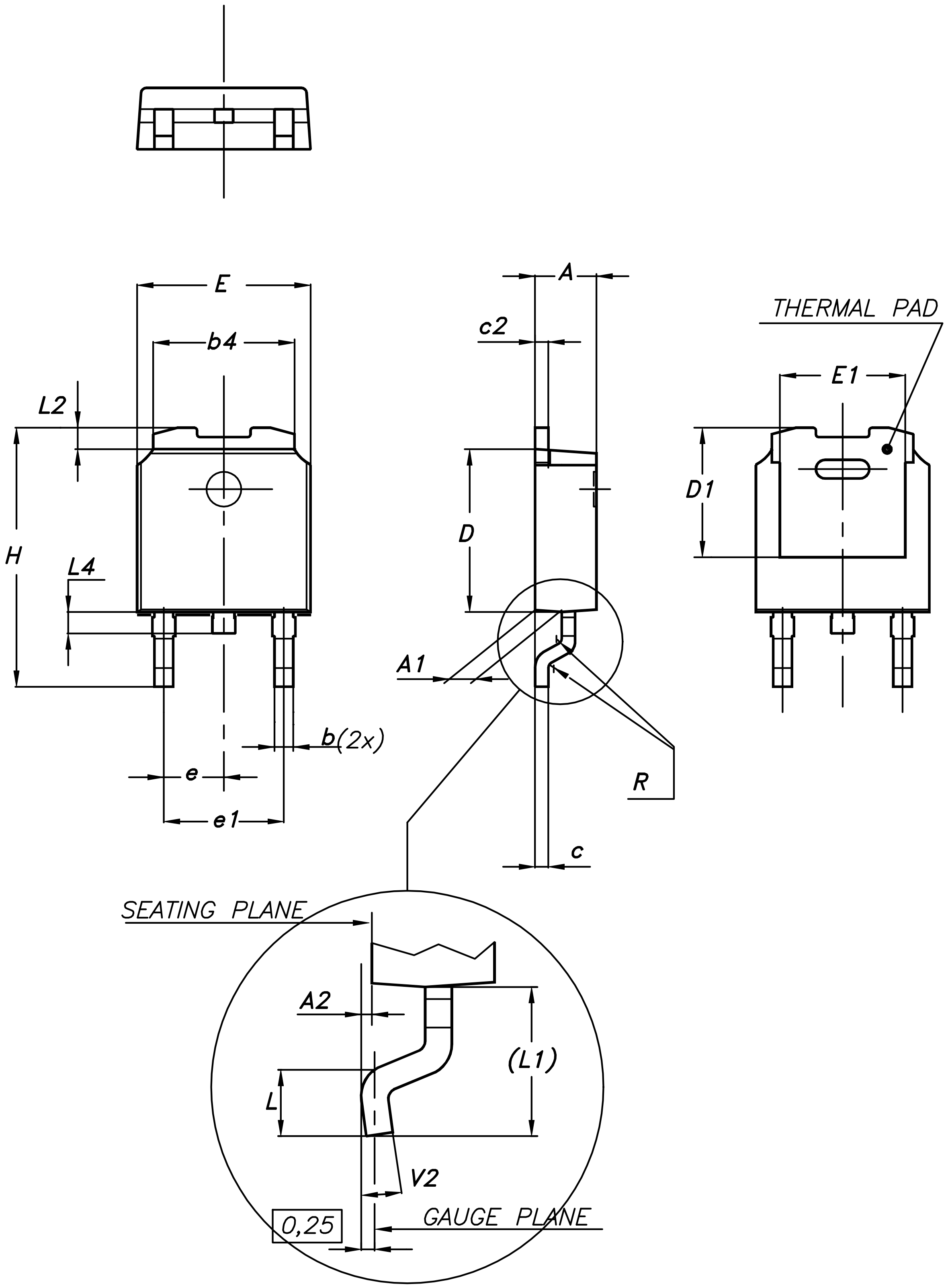


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Table 8. **DPAK (TO-252) type A2 mechanical data**

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 21. DPAK (TO-252) type C2 package outline

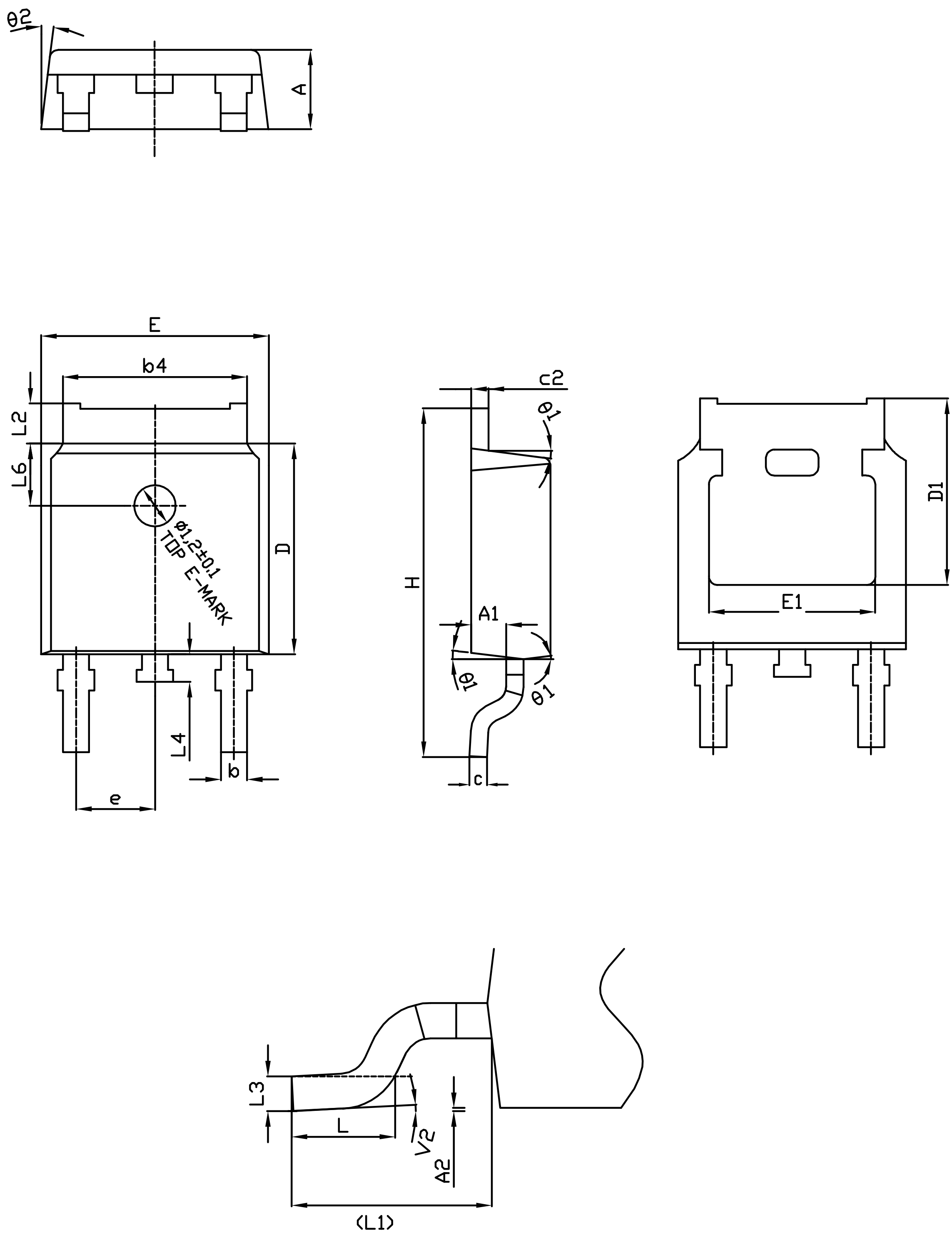

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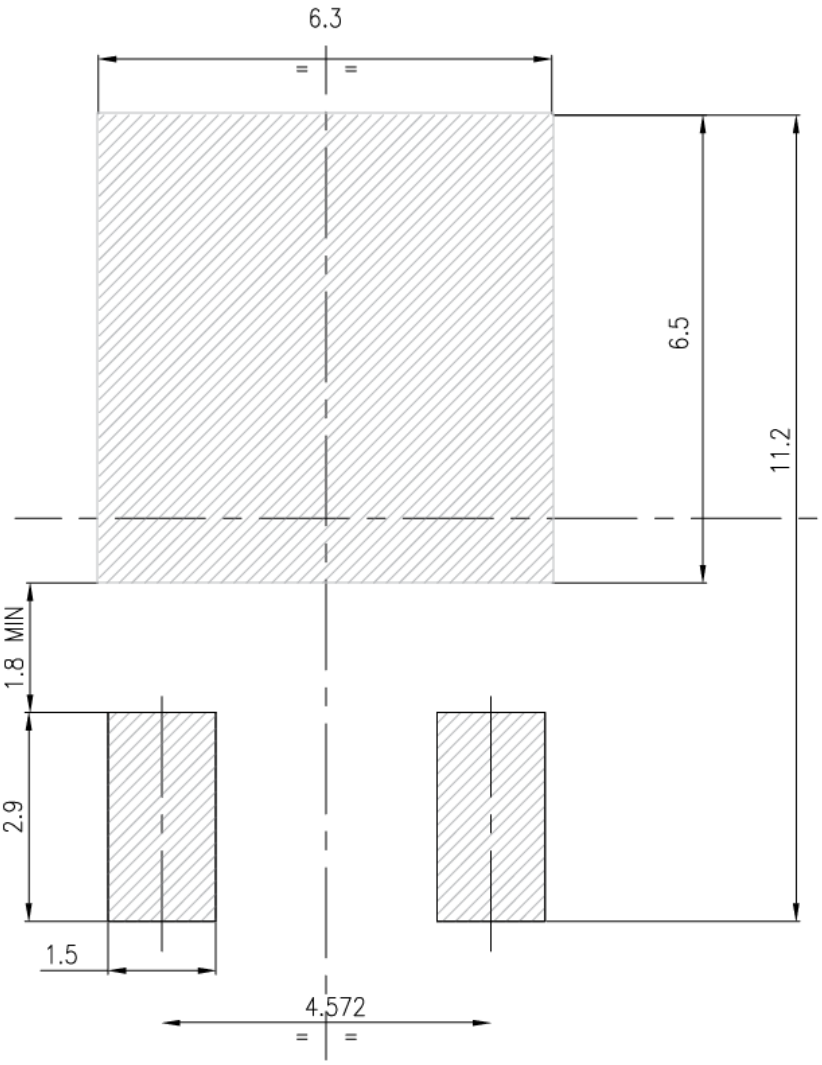
Table 9. **DPAK (TO-252) type C2 mechanical data**

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



4.3 DPAK (TO-252) packing information

Figure 23. **DPAK (TO-252) tape outline**

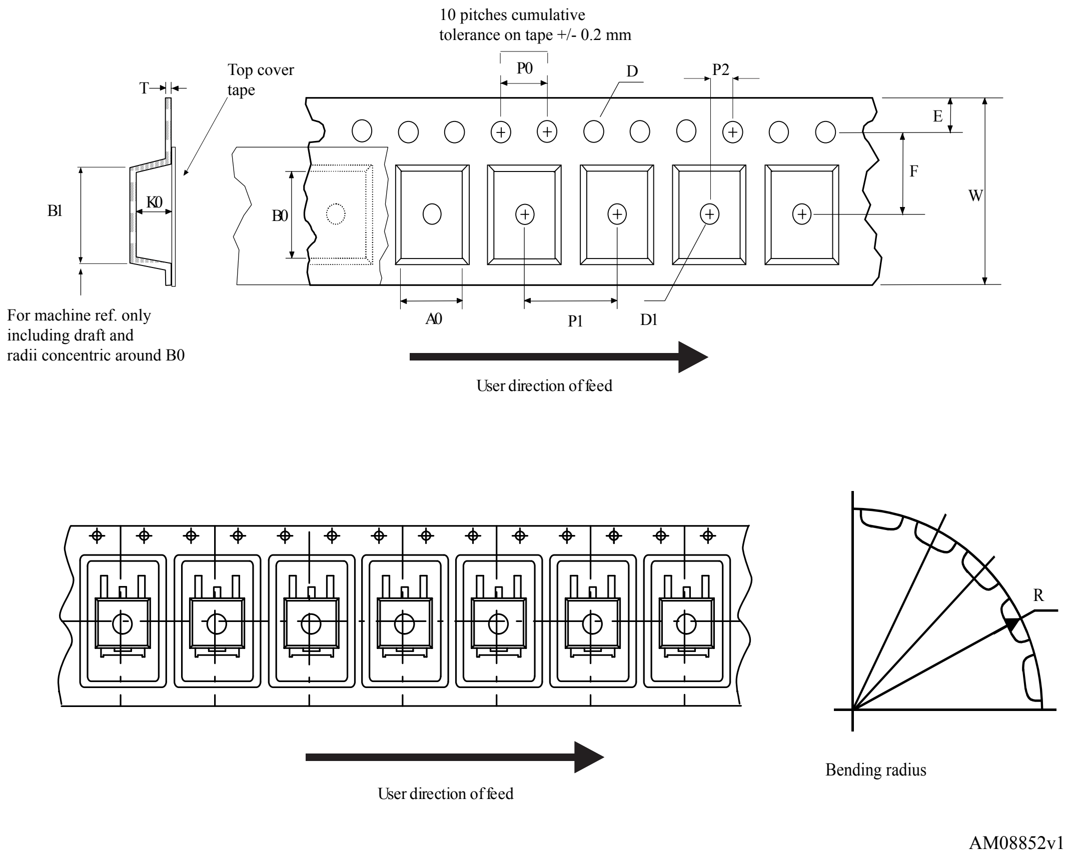


Figure 24. **DPAK (TO-252) reel outline**

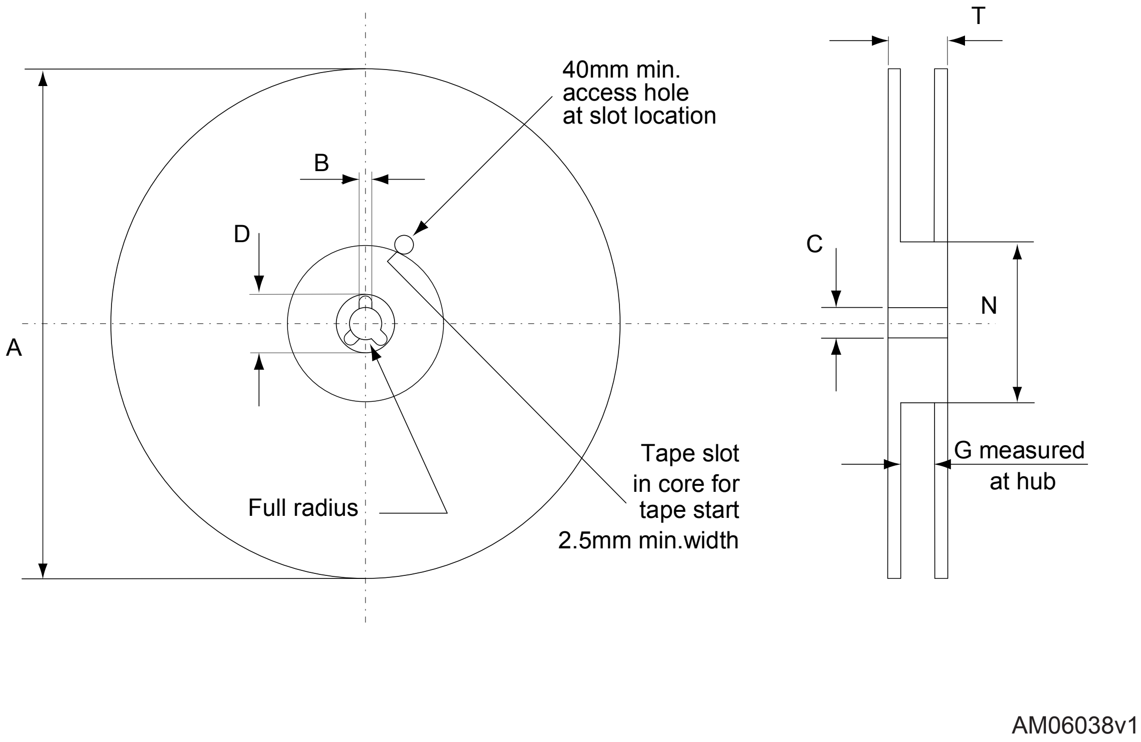


Table 10. **DPAK (TO-252) tape and reel mechanical data**

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 11. **Document revision history**

Date	Revision	Changes
01-Oct-2018	1	First release.
04-Dec-2018	2	Added Section 4.1 DPAK (TO-252) type A2 package information and Section 4.2 DPAK (TO-252) type C2 package information.

Contents