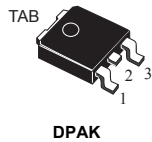
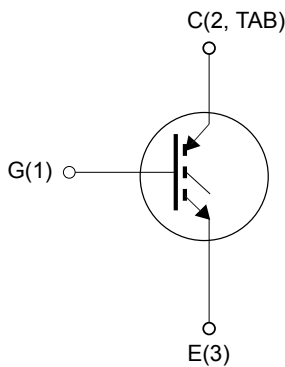


## N-channel 600 V, 10 A, very fast IGBT in DPAK package



DPAK



G1C2TE3



### Product status link

[STGD10NC60HT4](#)

### Product summary

<b>Order code</b>	STGD10NC60HT4
<b>Marking</b>	GD10NC60H
<b>Package</b>	DPAK
<b>Packing</b>	Tape and reel

### 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.

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0\text{ V}$ )	600	V
$I_C$	Continuous collector current at $T_C = 25\text{ °C}$	20	A
$I_C$	Collector current (continuous) at $T_C = 100\text{ °C}$	10	A
$I_{CL}^{(1)}$	Collector current (pulsed)	40	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	60	W
$T_J$	Operating junction temperature range	-55 to 150	°C
$T_{stg}$	Storage temperature range		

1.  $V_{clamp} = 480\text{ V}$ ,  $T_j = 150\text{ °C}$ ,  $R_G = 10\ \Omega$ ,  $V_{GE} = 15\text{ V}$

**Table 2. Thermal data**

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

## 2 Electrical characteristics

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

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$I_C = 1\text{ mA}$ , $V_{GE} = 0\text{ V}$	600			V
$I_{CES}$	Collector cut-off current ( $V_{GE} = 0\text{ V}$ )	$V_{CE} = 600\text{ V}$			150	$\mu\text{A}$
		$V_{CE} = 600\text{ V}$ , $T_C = 125\text{ °C}$ <sup>(1)</sup>			1	mA
$I_{GES}$	Gate-emitter leakage current	$V_{GE} = \pm 20\text{ V}$ , $V_{CE} = 0\text{ V}$			$\pm 100$	nA
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$ , $I_C = 250\text{ }\mu\text{A}$	3.75		5.75	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$ , $I_C = 5\text{ A}$		1.9	2.5	V
		$V_{GE} = 15\text{ V}$ , $I_C = 5\text{ A}$ , $T_C = 125\text{ °C}$		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	$V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0\text{ V}$	-	365	-	pF
$C_{oes}$	Output capacitance		-	43	-	pF
$C_{res}$	Reverse transfer capacitance		-	8.3	-	pF
$Q_g$	Total gate charge	$V_{CE} = 390\text{ V}$ , $I_D = 5\text{ A}$ , $V_{GE} = 0\text{ to }15\text{ V}$ (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	$V_{CC} = 390\text{ V}$ , $I_C = 5\text{ A}$ $R_G = 10\text{ }\Omega$ , $V_{GE} = 15\text{ V}$	-	14.2	-	ns
$t_r$	Current rise time		-	5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 14. Test circuit for inductive load switching and Figure 16. Switching waveform)	-	1000	-	A/ $\mu\text{s}$
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$ , $I_C = 5\text{ A}$ $R_G = 10\text{ }\Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 125\text{ °C}$	-	14	-	ns
$t_r$	Current rise time		-	5	-	ns
$(di/dt)_{on}$	Turn-on current slope		(see Figure 14. Test circuit for inductive load switching and Figure 16. Switching waveform)	-	920	-

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{r(V_{off})}$	Off voltage rise time	$V_{CC} = 390\text{ V}$ , $I_C = 5\text{ A}$ , $R_{GE} = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ (see Figure 14. Test circuit for inductive load switching and Figure 16. Switching waveform)	-	27	-	ns
$t_{d(off)}$	Turn-off delay time		-	72	-	ns
$t_f$	Current fall time		-	85	-	ns
$t_{r(V_{off})}$	Off voltage rise time	$V_{CC} = 390\text{ V}$ , $I_C = 5\text{ A}$ , $R_{GE} = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 125^\circ\text{C}$ (see Figure 14. Test circuit for inductive load switching and Figure 16. Switching waveform)	-	50	-	ns
$t_{d(off)}$	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	$V_{CC} = 390\text{ V}$ , $I_C = 5\text{ A}$ $R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ (see Figure 14. Test circuit for inductive load switching)	-	31.8	-	$\mu\text{J}$
$E_{off}^{(1)}$	Turn-off switching energy		-	95	-	$\mu\text{J}$
$E_{ts}$	Total switching energy		-	126.8	-	$\mu\text{J}$
$E_{on}$	Turn-on switching energy	$V_{CC} = 390\text{ V}$ , $I_C = 5\text{ A}$ $R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 125^\circ\text{C}$ (see Figure 14. Test circuit for inductive load switching)	-	61.8	-	$\mu\text{J}$
$E_{off}^{(1)}$	Turn-off switching energy		-	173	-	$\mu\text{J}$
$E_{ts}$	Total switching energy		-	234.8	-	$\mu\text{J}$

1. Including the tail of the collector current.

## 2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

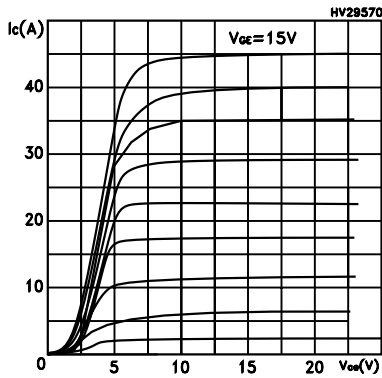


Figure 2. Transfer characteristics

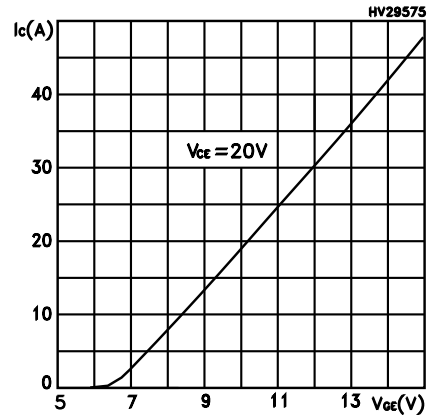


Figure 3. Collector-emitter on voltage vs temperature

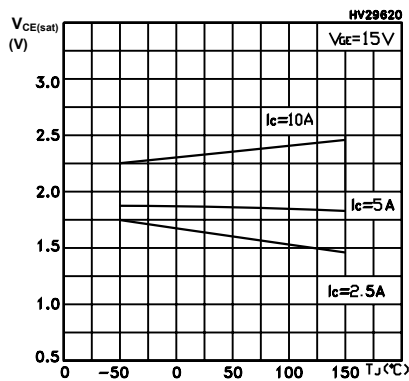


Figure 4. Gate charge vs gate-source voltage

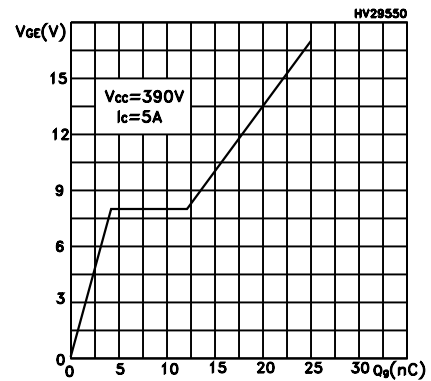


Figure 5. Capacitance variations

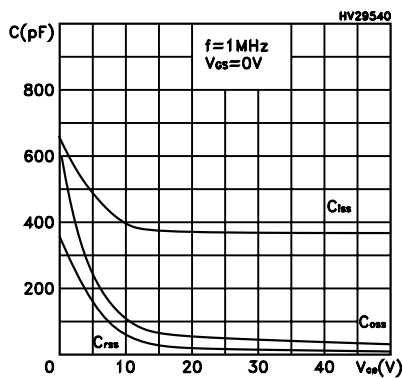


Figure 6. Normalized gate threshold voltage vs temperature

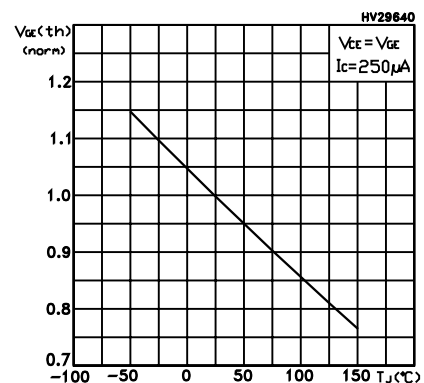


Figure 7. Collector-emitter on voltage vs collector current

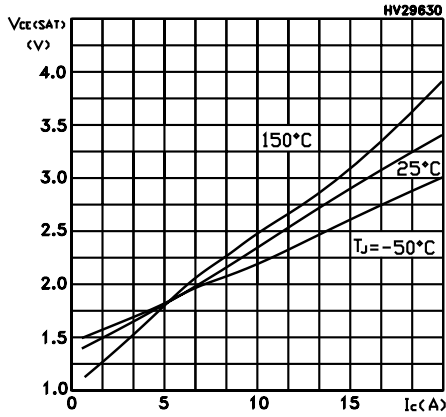


Figure 8. Normalized breakdown voltage vs temperature

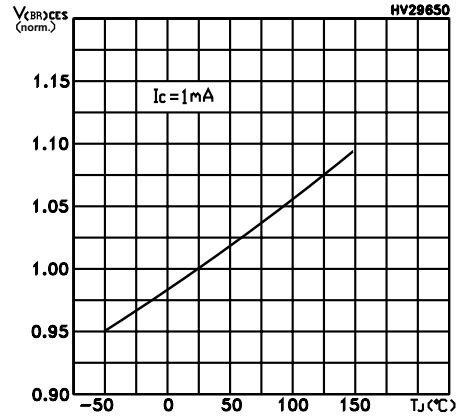


Figure 9. Switching energy vs temperature

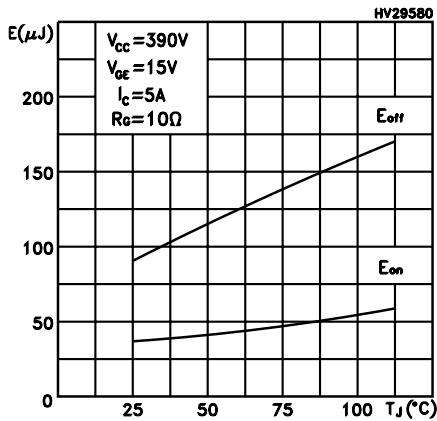


Figure 10. Switching energy vs gate resistance

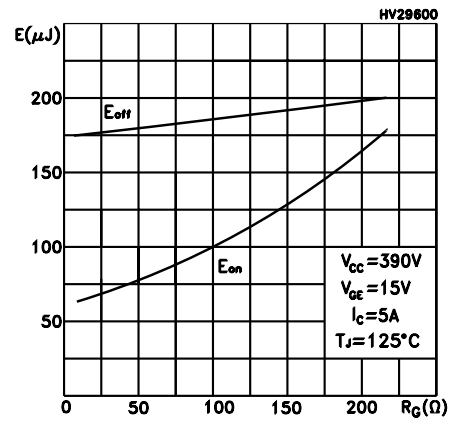


Figure 11. Switching energy vs collector current

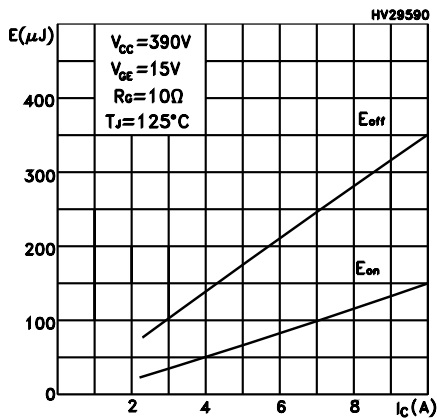
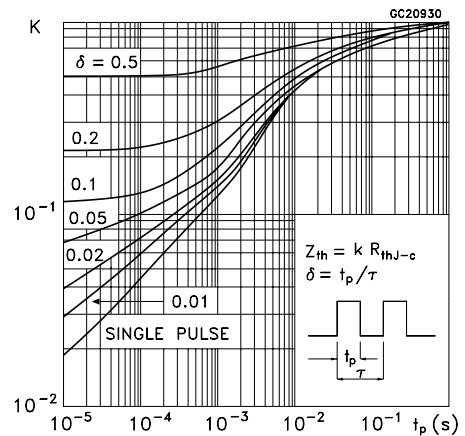
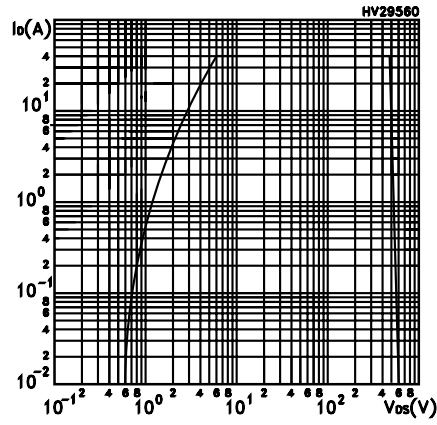


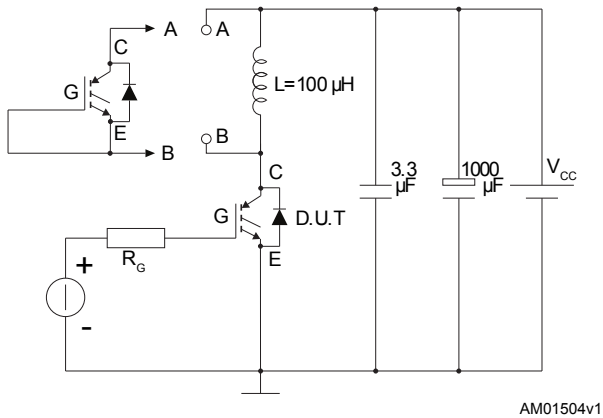
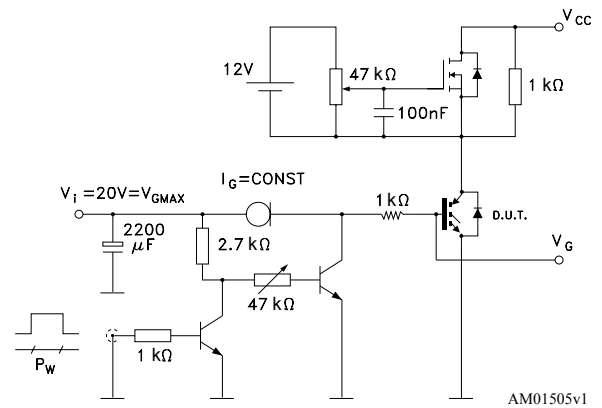
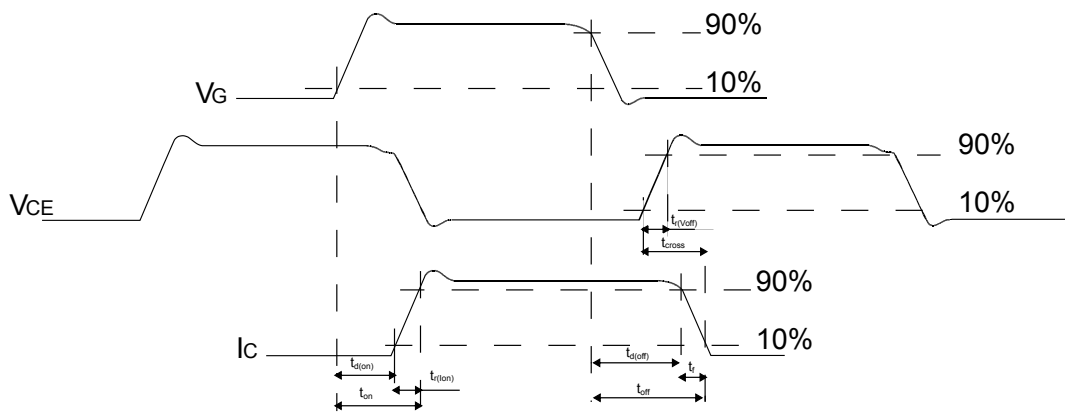
Figure 12. Thermal Impedance



**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**




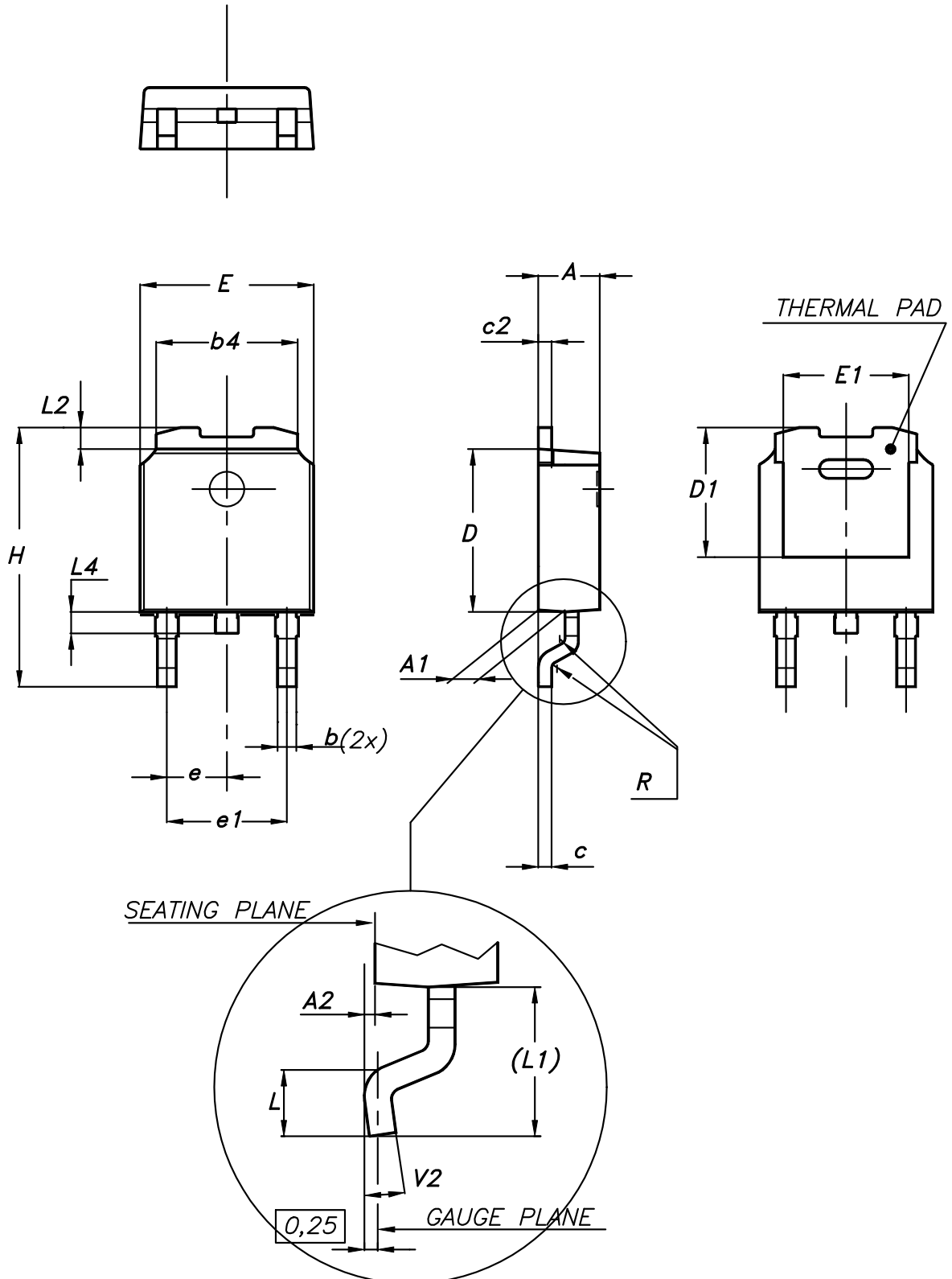
## 4 Package information

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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 DPAK (TO-252) type A2 package information

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



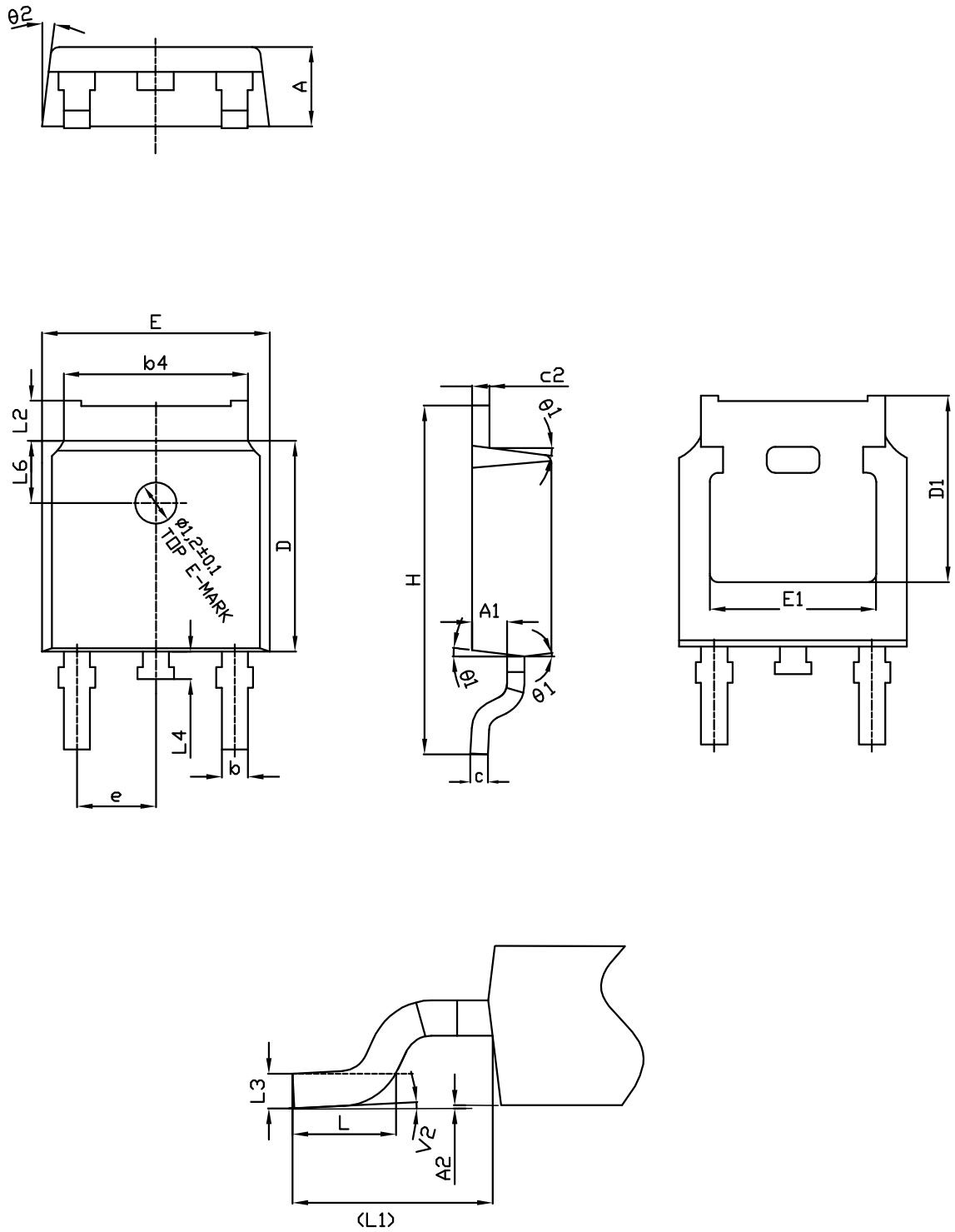
0068772\_type-A2\_rev26

**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

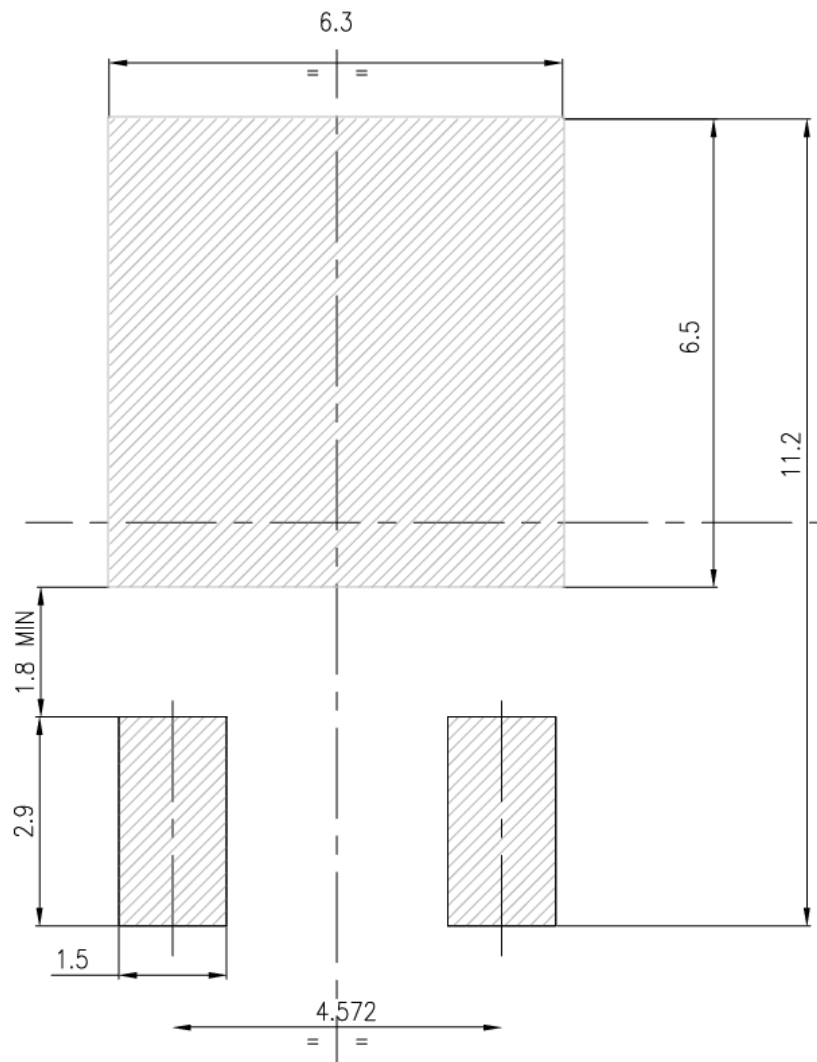
Figure 18. DPAK (TO-252) type C2 package outline



**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°

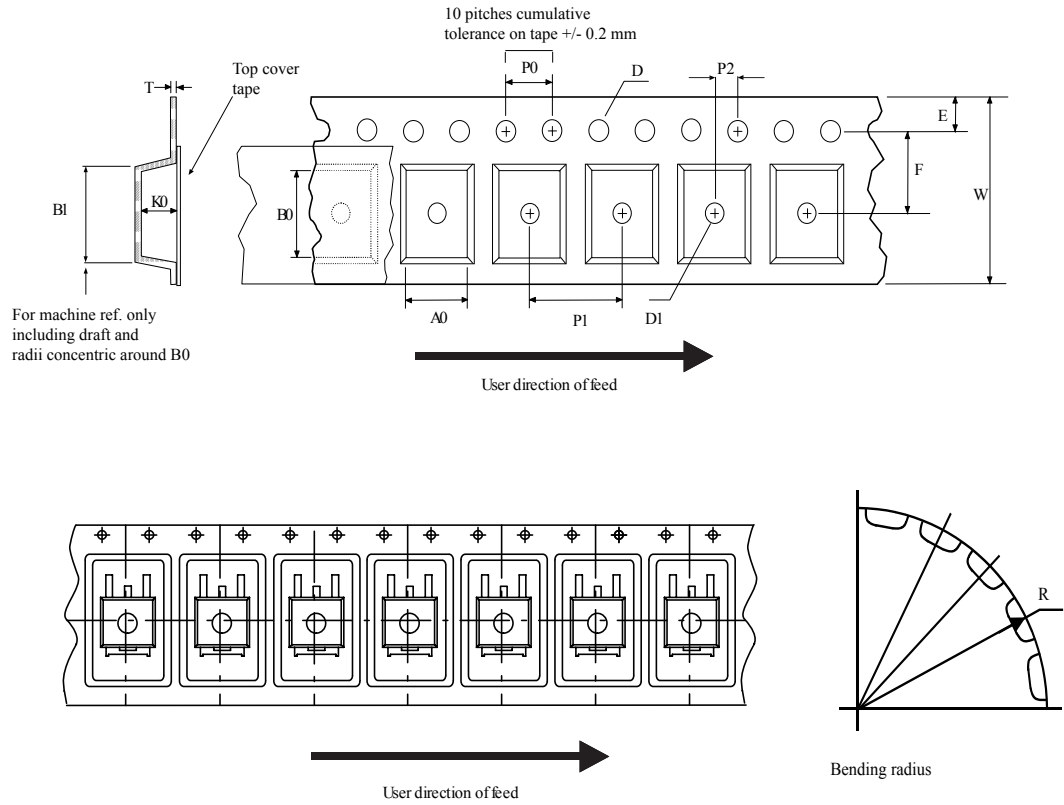
Figure 19. DPAK (TO-252) recommended footprint (dimensions are in mm)



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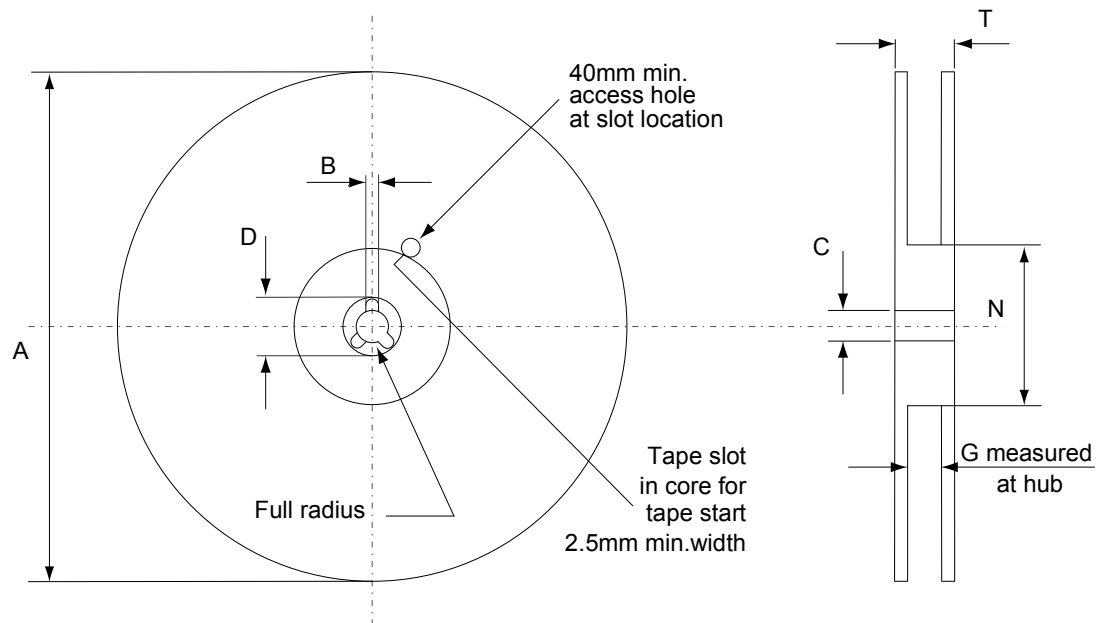
### 4.3 DPAK (TO-252) packing information

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	Version	Changes
27-Feb-2019	1	Initial release.

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