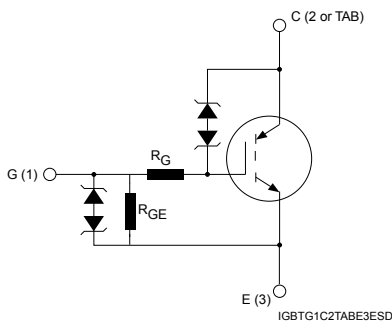
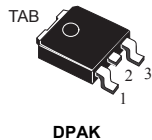



Automotive-grade 390 V internally clamped IGBT E<sub>SCIS</sub> 180 mJ


## Features

- AEC-Q101 qualified 
- SCIS energy of 180 mJ @ T<sub>C</sub> = 150 °C, L = 3 mH
- Parts are 100% tested in SCIS
- ESD gate-emitter protection
- Gate-collector high voltage clamping
- Logic level gate drive
- Very low saturation voltage
- High pulsed current capability
- Gate and gate-emitter resistor

## Applications

- Pencil coil electronic ignition driver

## Description

This application-specific IGBT utilizes the most advanced PowerMESH technology optimized for coil driving in the harsh environment of automotive ignition systems. The device shows very low on-state voltage and very high SCIS energy capability over a wide operating temperature range. Moreover, ESD-protected logic level gate input and an integrated gate resistor means no external protection circuitry is required.



## Product status link

[STGD18N40LZT4](#)

## Product summary

<b>Order code</b>	STGD18N40LZT4
<b>Marking</b>	GD18N40LZ
<b>Package</b>	DPAK
<b>Packing</b>	Tape and reel

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0\text{ V}$ )	$V_{CES(\text{clamped})}$	V
$V_{ECS}$	Emitter-collector voltage ( $V_{GE} = 0\text{ V}$ )	20	V
$I_C$	Continuous collector current at $T_C = 100\text{ °C}$	30	A
$I_{CP}^{(1)}$	Pulsed collector current	40	A
$V_{GE}$	Gate-emitter voltage	$V_{GE(\text{clamped})}$	V
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	150	W
$E_{SCIS}^{(2)}$	Single pulse energy $T_C = 25\text{ °C}$ , $L = 3\text{ mH}$ , $V_{CC} = 50\text{ V}$	300	mJ
	Single pulse energy $T_C = 150\text{ °C}$ , $L = 3\text{ mH}$ , $V_{CC} = 50\text{ V}$	180	mJ
ESD	Human body model, $R = 1.5\text{ k}\Omega$ , $C = 100\text{ pF}$	8	kV
	Machine model, $R = 0$ , $C = 100\text{ pF}$	800	V
	Charged device model	2	kV
$T_{STG}$	Storage temperature range	-55 to 175	°C
$T_J$	Operating junction temperature range		°C

1. Pulse width limited by max. junction temperature.

2. For  $E_{SCIS}$  test circuit refer to Figure 14. Test circuit for inductive load switching with A and B not connected.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case	1	°C/W
$R_{thJA}$	Thermal resistance, junction-to-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
$V_{CES(\text{clamped})}$	Collector-emitter clamped voltage	$I_C = 2\text{ mA}$ , $V_{GE} = 0\text{ V}$ , $T_J = -40\text{ °C}$ to $175\text{ °C}$	360	390	420	V
$V_{(BR)ECS}$	Emitter-collector break-down voltage	$V_{GE} = 0\text{ V}$ , $I_C = 75\text{ mA}$	20	28		V
$V_{GE(\text{clamped})}$	Gate-emitter clamped voltage	$I_G = \pm 2\text{ mA}$	12		16	V
$V_{CE(\text{sat})}$	Collector-emitter saturation voltage	$V_{GE} = 4.5\text{ V}$ , $I_C = 10\text{ A}$		1.35	1.7	V
		$V_{GE} = 4.5\text{ V}$ , $I_C = 10\text{ A}$ , $T_J = 150\text{ °C}$		1.30		V
		$V_{GE} = 3.8\text{ V}$ , $I_C = 6\text{ A}$		1.30		V
$V_{GE(\text{th})}$	Gate-threshold voltage	$V_{GE} = V_{CE}$ , $I_C = 1\text{ mA}$ , $T_J = -40\text{ °C}$	1.4			V
		$V_{GE} = V_{CE}$ , $I_C = 1\text{ mA}$	1.2	1.6	2.3	V
		$V_{GE} = V_{CE}$ , $I_C = 1\text{ mA}$ , $T_J = 150\text{ °C}$ <sup>(1)</sup>	0.7			V
$I_{CES}$	Collector cut-off current	$V_{CE} = 15\text{ V}$ , $V_{GE} = 0\text{ V}$ , $T_J = 150\text{ °C}$ <sup>(1)</sup>			10	$\mu\text{A}$
		$V_{CE} = 200\text{ V}$ , $V_{GE} = 0\text{ V}$ , $T_J = 150\text{ °C}$ <sup>(1)</sup>			100	$\mu\text{A}$
$I_{GES}$	Gate-emitter leakage current	$V_{GE} = \pm 10\text{ V}$ , $V_{CE} = 0\text{ V}$	450	625	830	$\mu\text{A}$
$R_{GE}$	Gate emitter resistance		12	16	22	k $\Omega$
$R_G$	Gate resistance			1.6		k $\Omega$

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	$V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0\text{ V}$	-	490	-	pF
$C_{oes}$	Output capacitance		-	90	-	
$C_{res}$	Reverse transfer capacitance		-	5	-	
$Q_g$	Total gate charge	$V_{CE} = 280\text{ V}$ , $I_C = 10\text{ A}$ , $V_{GE} = 0$ to $5\text{ V}$	-	29	-	nC

**Table 5. Resistive load switching characteristics**

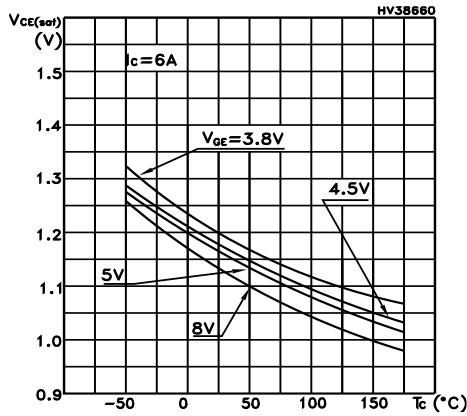
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 14\text{ V}$ , $V_{GE} = 5\text{ V}$ , $R_L = 1\ \Omega$	-	0.65	-	$\mu\text{s}$
$t_r$	Current rise time		-	3.5	-	$\mu\text{s}$
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 14\text{ V}$ , $V_{GE} = 5\text{ V}$ , $R_L = 1\ \Omega$ , $T_J = 150\text{ }^\circ\text{C}$	-	0.65	-	$\mu\text{s}$
$t_r$	Current rise time		-	3.8	-	$\mu\text{s}$

**Table 6. Inductive load switching characteristics**

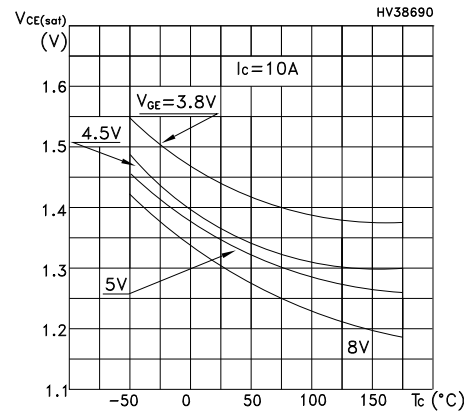
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 300\text{ V}$ , $L = 1\text{ mH}$ , $I_C = 10\text{ A}$ , $V_{GE} = 5\text{ V}$ ,	-	13.5	-	$\mu\text{s}$
$t_f$	Current fall time		-	5.5	-	$\mu\text{s}$
$dV/dt$	Turn-off voltage slope		-	105	-	$\text{V}/\mu\text{s}$
$t_{d(off)}$	Turn-off delay time	$V_{CC} = 300\text{ V}$ , $L = 1\text{ mH}$ , $I_C = 10\text{ A}$ , $V_{GE} = 5\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$	-	14.2	-	$\mu\text{s}$
$t_f$	Current fall time		-	8	-	$\mu\text{s}$
$dV/dt$	Turn-off voltage slope		-	97	-	$\text{V}/\mu\text{s}$

## 2.1 Electrical characteristics (curves)

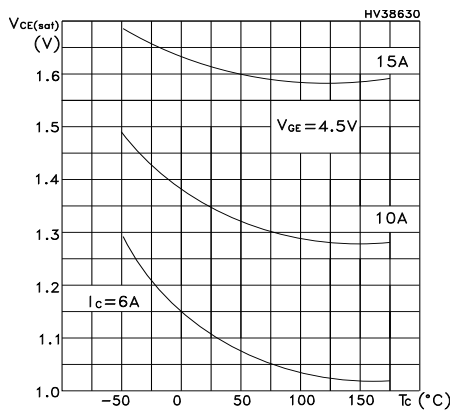
**Figure 1. Collector-emitter on voltage vs temperature**



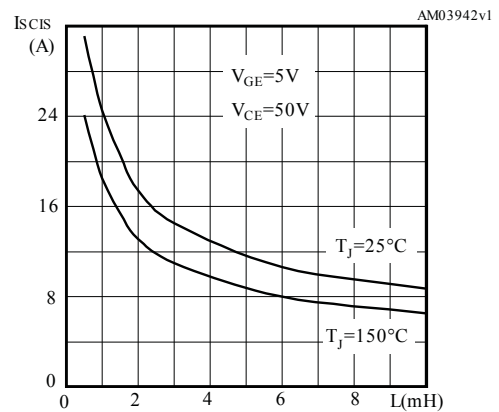
**Figure 2. Collector-emitter on voltage vs temperature**



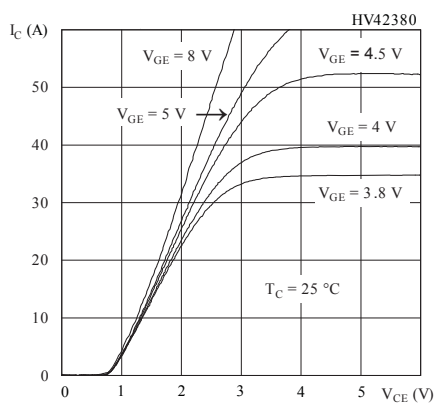
**Figure 3. Collector-emitter on voltage vs temperature**



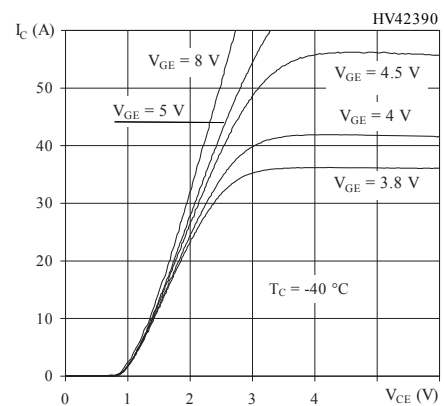
**Figure 4. Self clamped inductive switch**



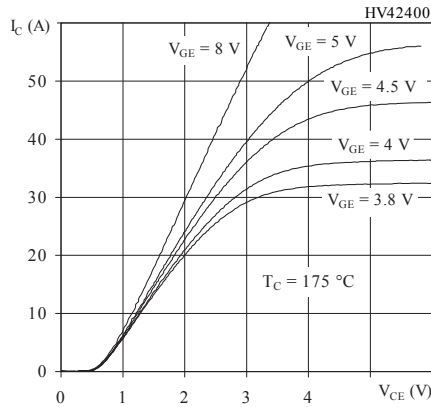
**Figure 5. Output characteristics at 25 °C**



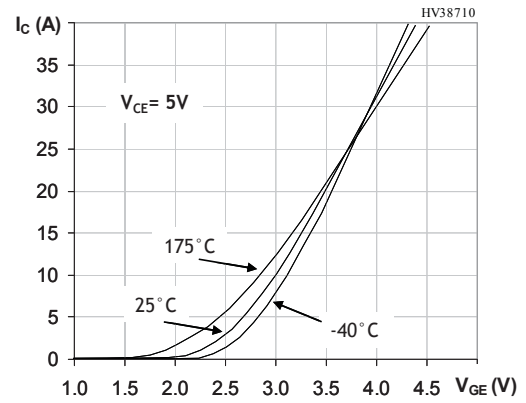
**Figure 6. Output characteristics at -40 °C**



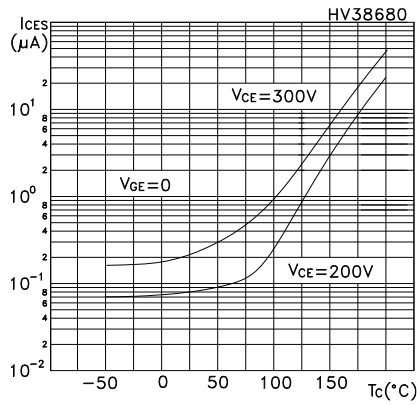
**Figure 7. Output characteristics at 175 °C**



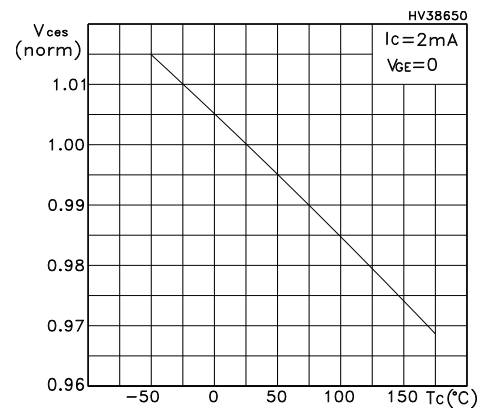
**Figure 8. Transfer characteristics**



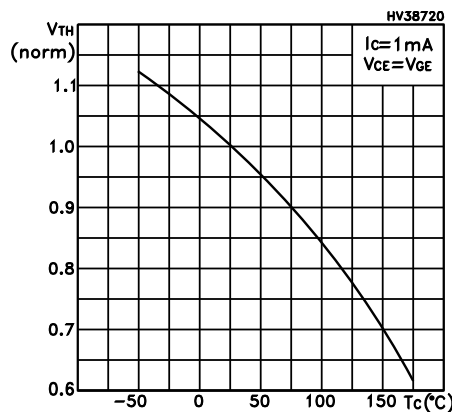
**Figure 9. Collector cut-off current vs temperature**



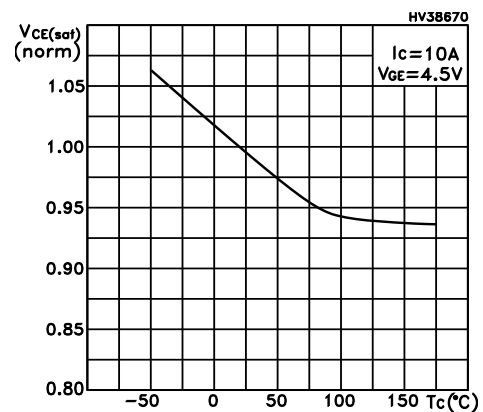
**Figure 10. Normalized collector emitter voltage vs temperature**



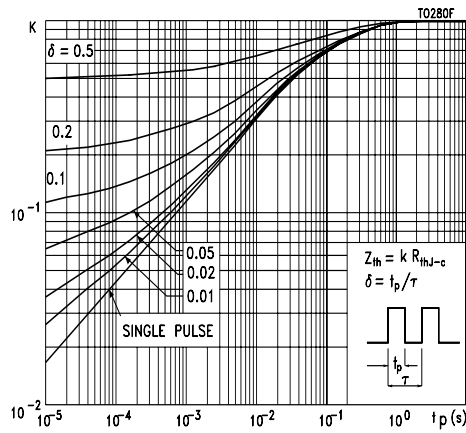
**Figure 11. Normalized gate threshold voltage vs temperature**



**Figure 12. Normalized collector emitter on voltage vs temperature**



**Figure 13. Thermal impedance**



### 3 Test circuits

Figure 14. Test circuit for inductive load switching

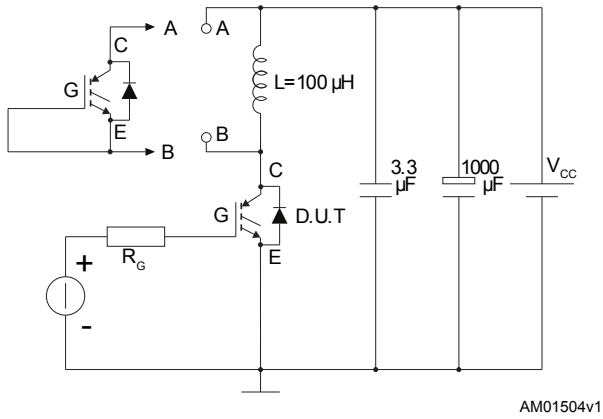


Figure 15. Test circuit for resistive load switching

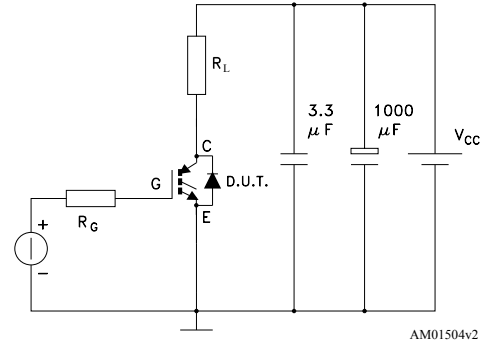


Figure 16. Gate charge test circuit

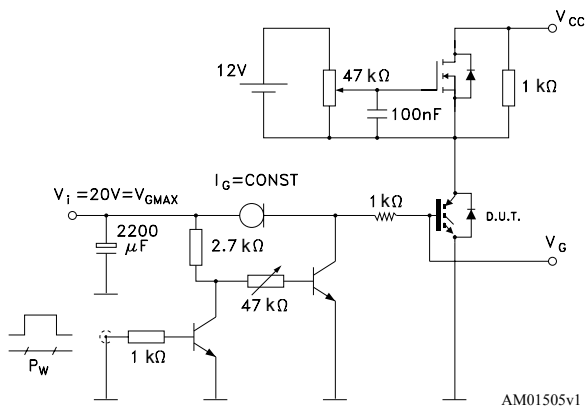
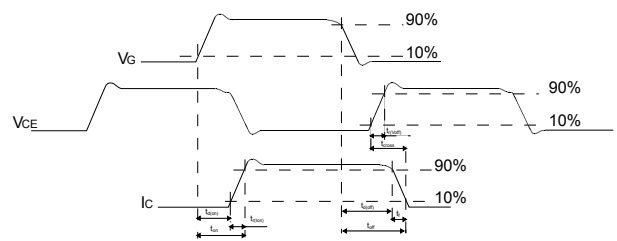


Figure 17. Switching waveform



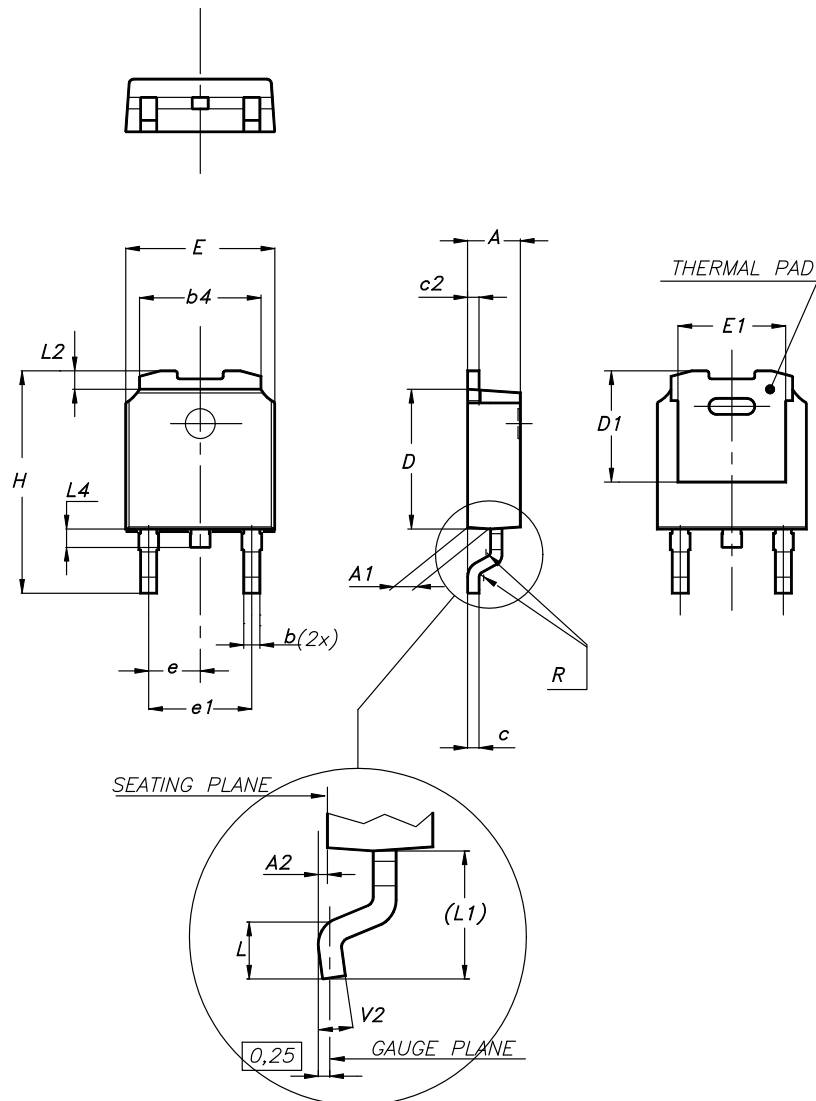


## 4 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 DPAK (TO-252) type A2 package information

**Figure 18.** DPAK (TO-252) type A2 package outline

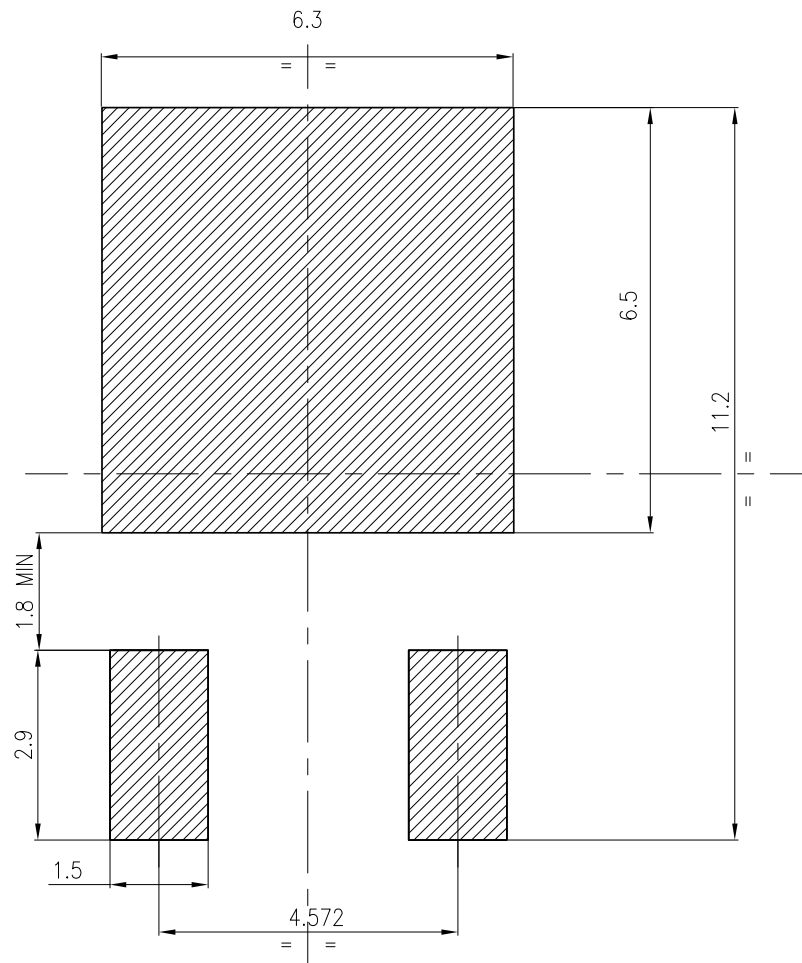


0068772\_type-A2\_rev30

**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°

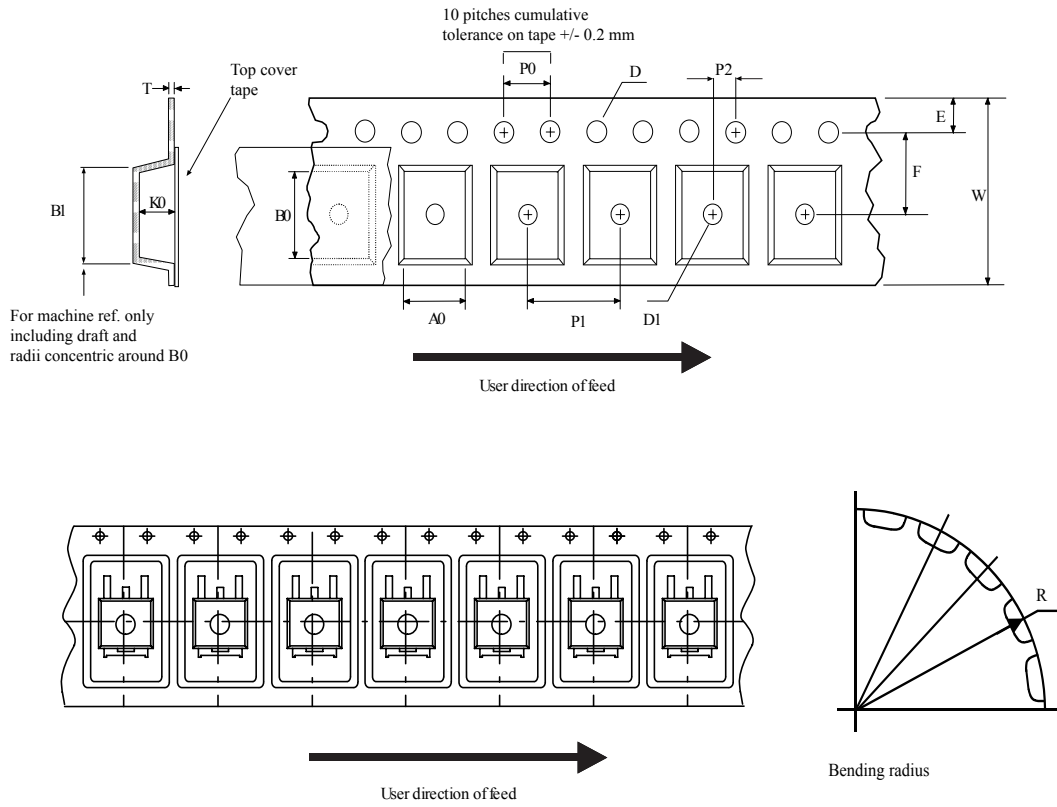
Figure 19. DPAK (TO-252) recommended footprint (dimensions are in mm)



FP\_0068772\_30

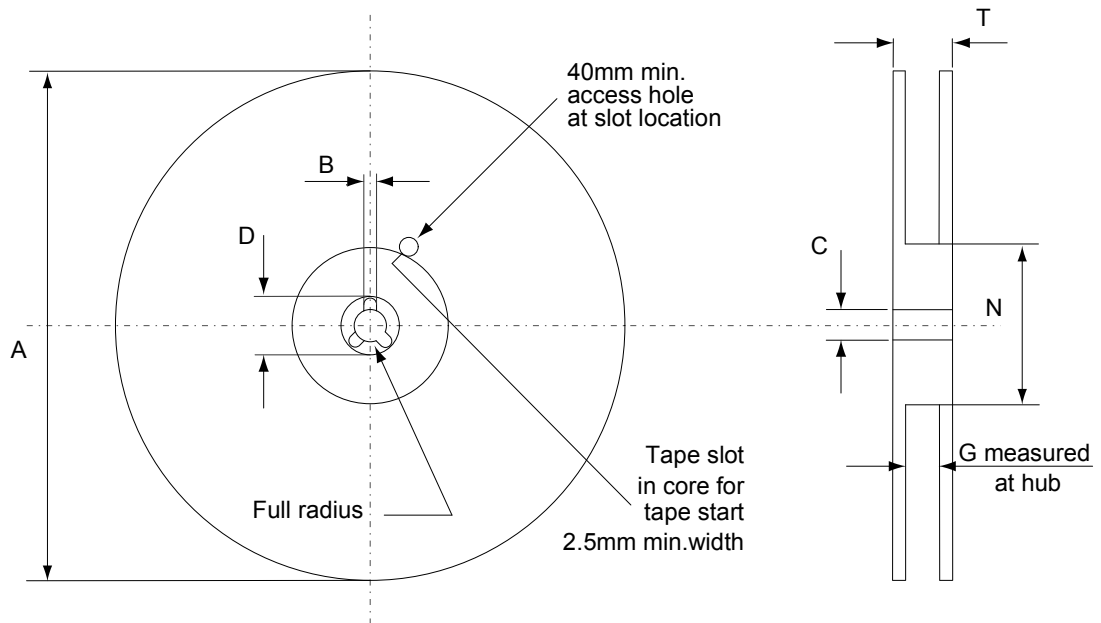
## 4.2 DPAK packing information

Figure 20. DPAK (TO-252) tape outline



AM08852v1

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



AM06038v1

**Table 8. DPAK (TO-252) tape and reel mechanical data**

Dim.	Tape		Dim.	Reel	
	mm			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 9. Document revision history**

Date	Revision	Changes
20-Jan-2021	1	Initial release.

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