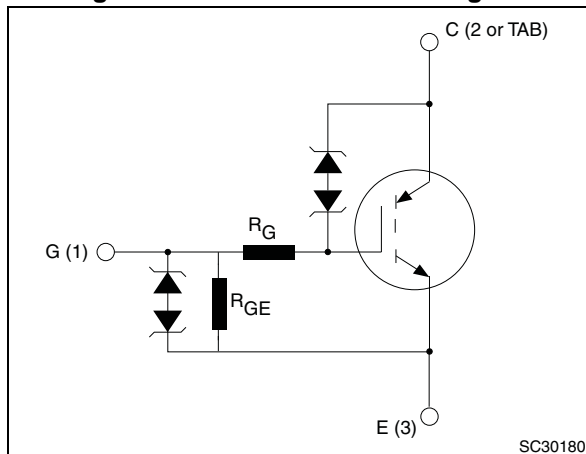


Figure 1. Internal schematic diagram



### Features

- Designed for automotive applications and AEC-Q101 qualified
- 180 mJ of avalanche energy @  $T_C = 150\text{ }^\circ\text{C}$ ,  $L = 3\text{ mH}$
- ESD gate-emitter protection
- Gate-collector high voltage clamping
- Logic level gate drive
- Low saturation voltage
- High pulsed current capability
- Gate and gate-emitter resistor

### Application

- Pencil coil electronic ignition driver

### Description

This application-specific IGBT utilizes the most advanced PowerMESH™ technology. The built-in Zener diodes between gate-collector and gate-emitter provide overvoltage protection capabilities. The device also exhibits low on-state voltage drop and low threshold drive for use in automotive ignition system.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB18N40LZT4	GB18N40LZ	D <sup>2</sup> PAK	Tape and reel
STGD18N40LZ-1	GD18N40LZ	IPAK	Tube
STGD18N40LZT4	GD18N40LZ	DPAK	Tape and reel
STGP18N40LZ	GP18N40LZ	TO-220	Tube

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-emitter voltage (V <sub>GE</sub> = 0)	V <sub>CES(clamped)</sub>	V
V <sub>ECS</sub>	Emitter collector voltage (V <sub>GE</sub> = 0)	20	V
I <sub>C</sub> <sup>(1)</sup>	Collector current (continuous) at T <sub>C</sub> = 100 °C	30	A
I <sub>CP</sub> <sup>(2)</sup>	Pulsed collector current	40	A
V <sub>GE</sub>	Gate-emitter voltage	V <sub>GE(clamped)</sub>	V
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	150	W
E <sub>SCIS</sub> <sup>(3)</sup>	Single pulse energy T <sub>C</sub> = 25 °C, L = 3 mH, V <sub>CC</sub> = 50 V	300	mJ
	Single pulse energy T <sub>C</sub> =150 °C, L = 3 mH, V <sub>CC</sub> = 50 V	180	mJ
ESD	Human body model, R= 1.5 kΩ, C = 100 pF	8	kV
	Machine model, R = 0, C = 100 pF	800	V
	Charged device model	2	kV
T <sub>stg</sub>	Storage temperature	- 55 to 175	°C
T <sub>j</sub>	Operating junction temperature		

1. Calculated according to the iterative formula

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

- Pulse width limited by max. junction temperature
- For E<sub>SCIS</sub> test circuit refer to [Figure 16.: Inductive load switching and E<sub>SCIS</sub> test circuit](#) with A and B not connected.

**Table 3. Thermal data**

Symbol	Parameter	Value		Unit
		DPAK IPAK	D <sup>2</sup> PAK TO-220	
R <sub>thj-case</sub>	Thermal resistance junction-case	1		°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient	100	62.5	°C/W

## 2 Electrical characteristics

( $T_J=25\text{ °C}$  unless otherwise specified)

**Table 4. Static electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CES(\text{clamped})}$	Collector emitter clamped voltage ( $V_{GE} = 0$ )	$I_C = 2\text{ mA}$ $T_J = -40\text{ °C to }150\text{ °C}$	360	390	420	V
$V_{(BR)ECS}$	Emitter collector break-down voltage ( $V_{GE} = 0$ )	$I_C = 75\text{ mA}$	20	28		V
$V_{GE(\text{clamped})}$	Gate emitter clamped voltage	$I_G = \pm 2\text{ mA}$	12		16	V
$I_{CES}$	Collector cut-off current ( $V_{GE} = 0$ )	$V_{CE} = 15\text{ V}, T_J = 150\text{ °C}$			10	$\mu\text{A}$
		$V_{CE} = 200\text{ V}, T_J = 150\text{ °C}$			100	$\mu\text{A}$
$I_{GES}$	Gate-emitter leakage current ( $V_{CE} = 0$ )	$V_{GE} = \pm 10\text{ V}$	450	625	830	$\mu\text{A}$
$R_{GE}$	Gate emitter resistance		12	16	22	k $\Omega$
$R_G$	Gate resistance			1.6		k $\Omega$
$V_{GE(\text{th})}$	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
		$V_{GE} = V_{CE}, I_C = 1\text{ mA}, T_J = 150\text{ °C}$	0.7			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

**Table 5. Dynamic electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0$	-	490	-	pF
$C_{oes}$	Output capacitance		-	90	-	pF
$C_{res}$	Reverse transfer capacitance		-	5	-	pF
$Q_g$	Gate charge	$V_{CE} = 280\text{ V}, I_C = 10\text{ A}, V_{GE} = 5\text{ V}$	-	29	-	nC

Table 6. Resistive load switching time

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

Table 7. Inductive load switching time

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	-	$\mu\text{s}$
$t_f$	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	-	$\mu\text{s}$
$t_f$	Fall time		-	8	-	$\mu\text{s}$
dv/dt	Turn-off voltage slope		-	97	-	$\text{V}/\mu\text{s}$

## 2.1 Electrical characteristics (curves)

Figure 2. Collector-emitter on voltage vs temperature

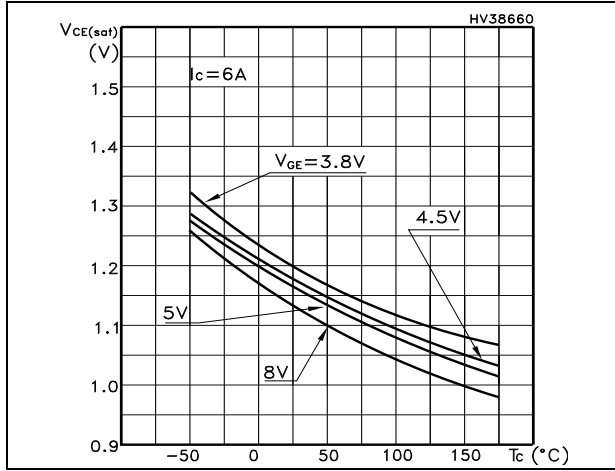


Figure 3. Collector-emitter on voltage vs temperature

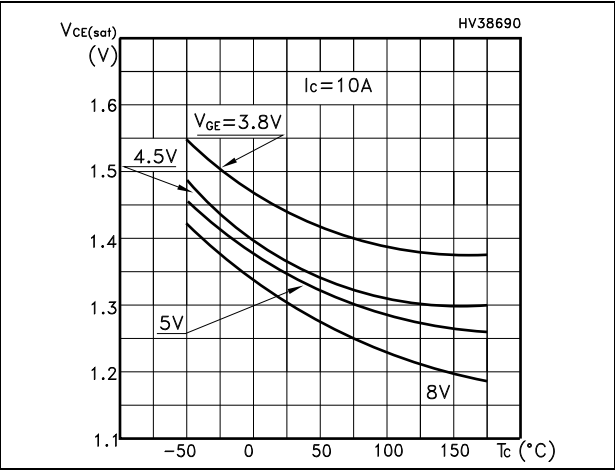


Figure 4. Collector-emitter on voltage vs temperature

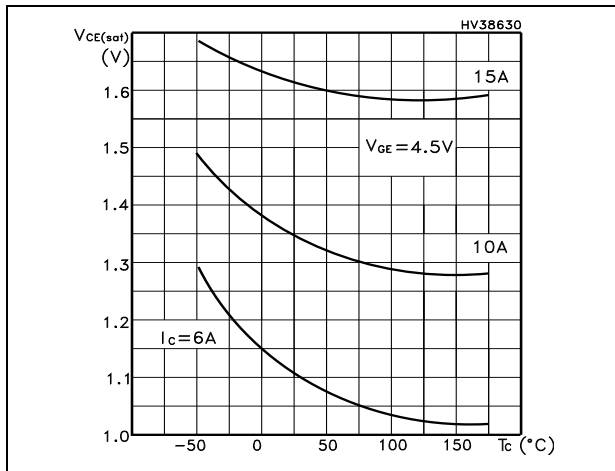


Figure 5. Self clamped inductive switch

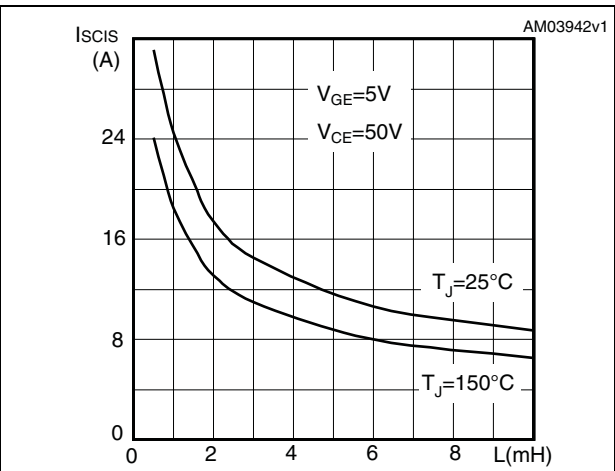


Figure 6. Output characteristics @ 25 °C

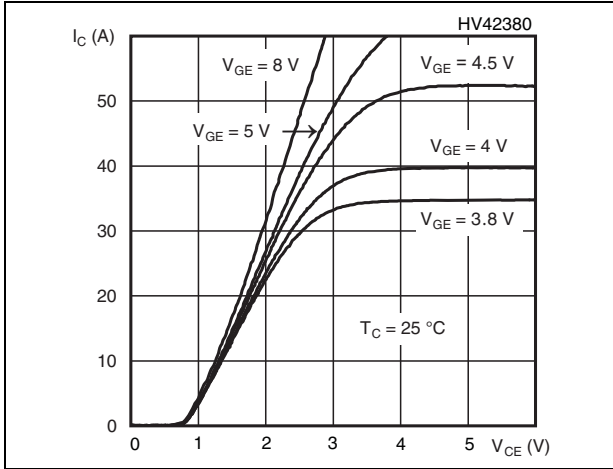


Figure 7. Output characteristics @ -40 °C

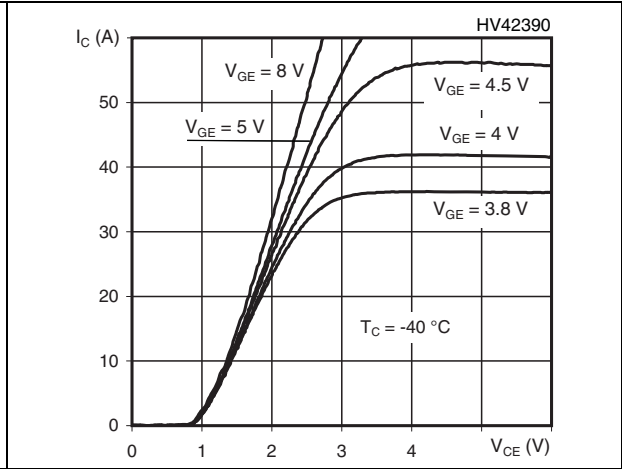


Figure 8. Output characteristics @ 175 °C

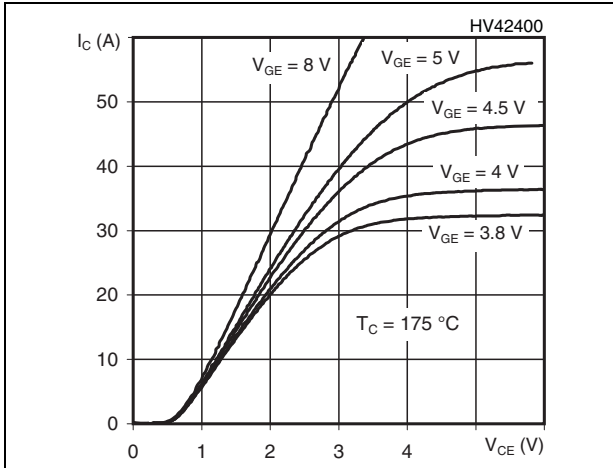


Figure 9. Transfer characteristics

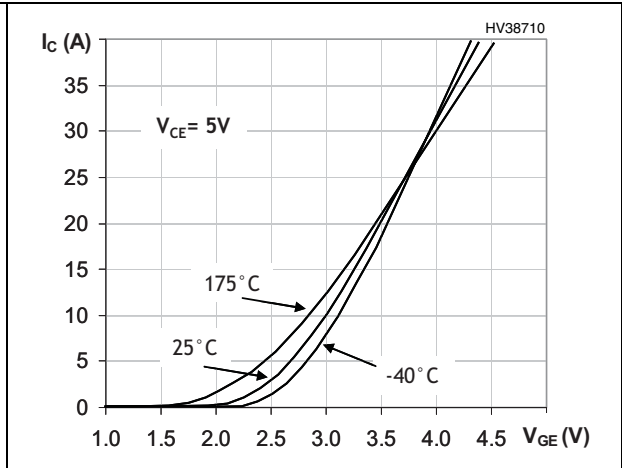


Figure 10. Collector cut-off current vs. temperature

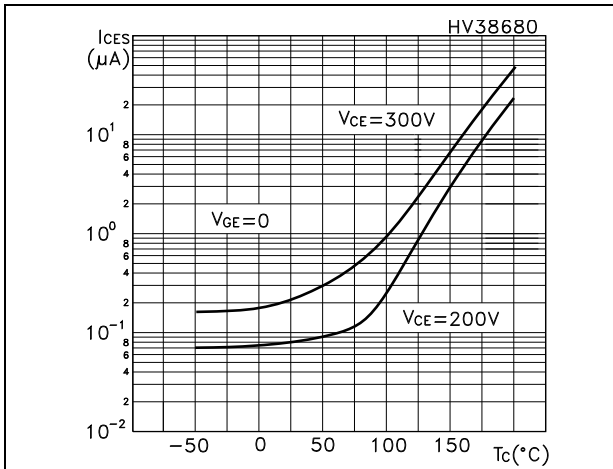


Figure 11. Normalized collector emitter voltage vs temperature

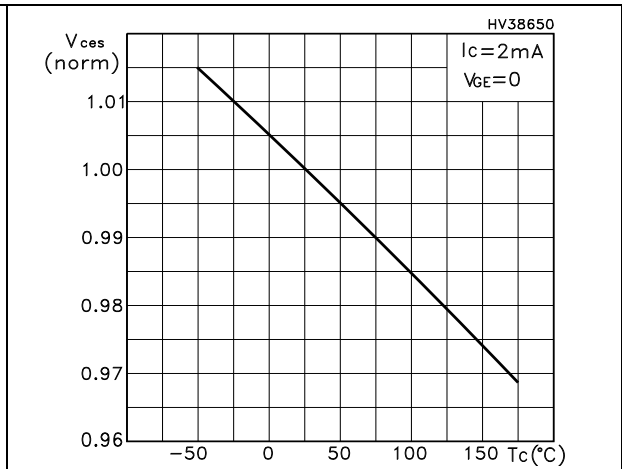


Figure 12. Normalized gate threshold voltage vs temperature

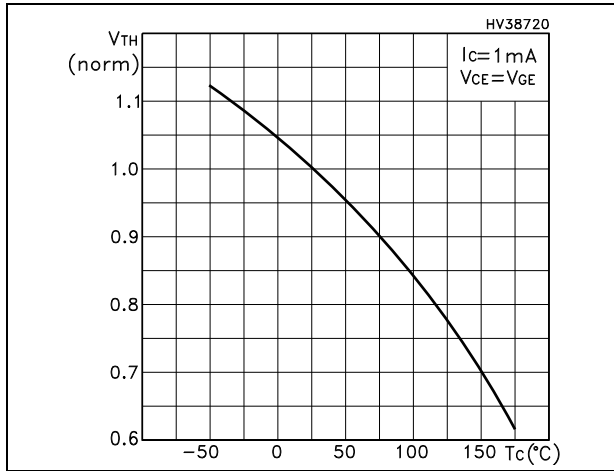


Figure 13. Normalized collector emitter on voltage vs temperature

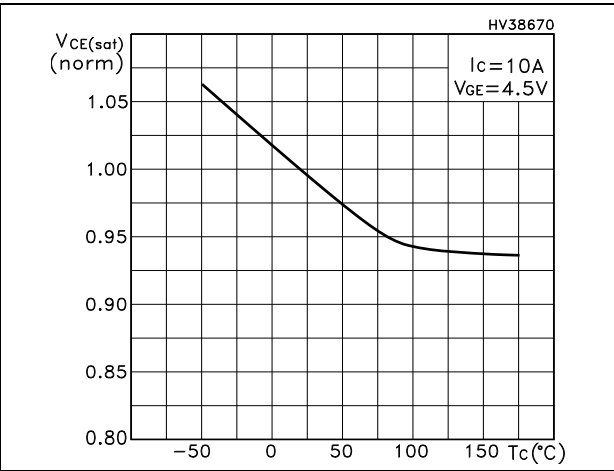


Figure 14. Thermal impedance for D<sup>2</sup>PAK, I<sup>2</sup>PAK, TO-220

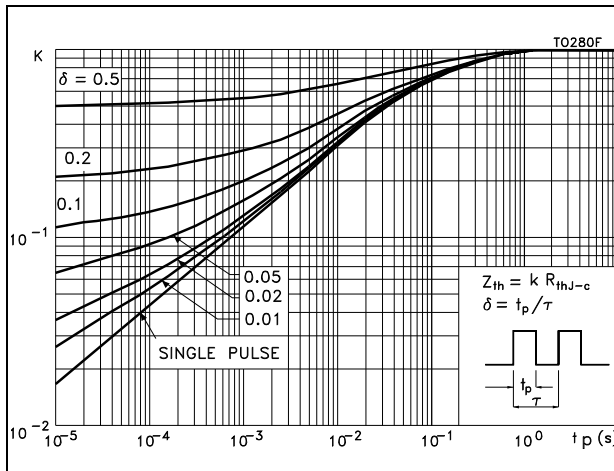
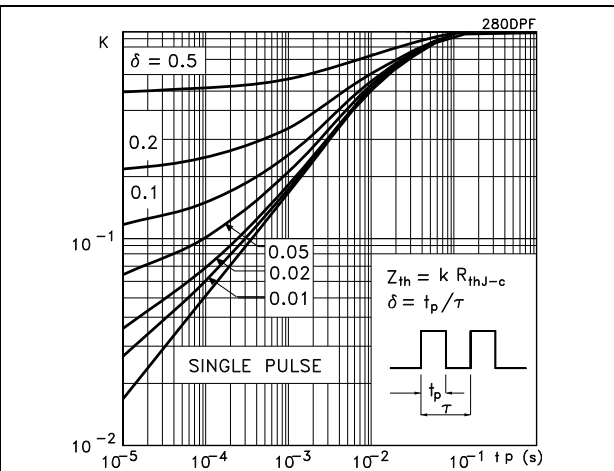


Figure 15. Thermal impedance for DPAK, IPAK





### 3 Test circuits

Figure 16. Inductive load switching and  $E_{SCIS}$  test circuit



Figure 17. Resistive load switching

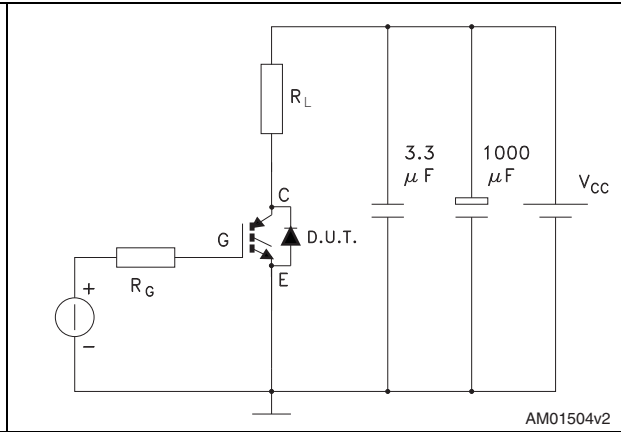


Figure 18. Gate charge test circuit

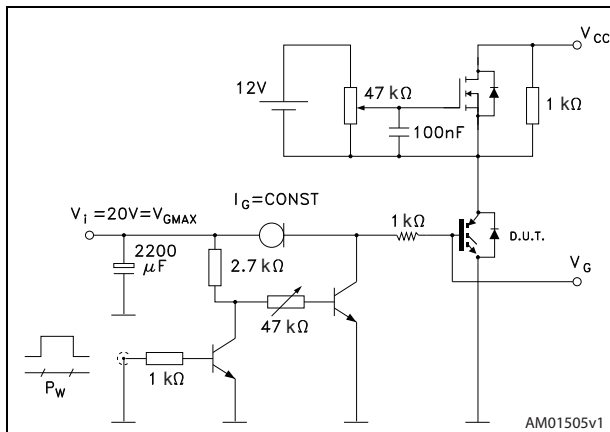
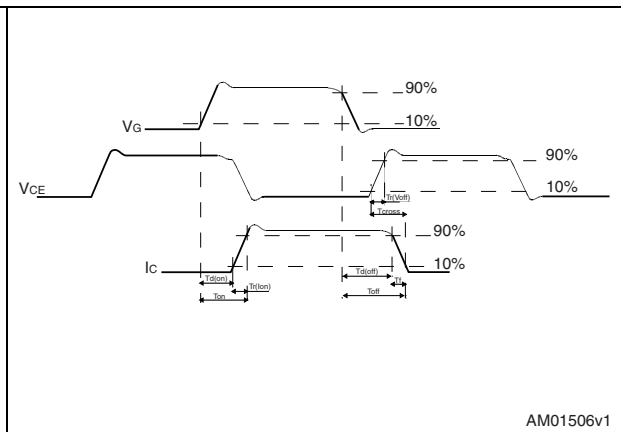


Figure 19. Switching waveform

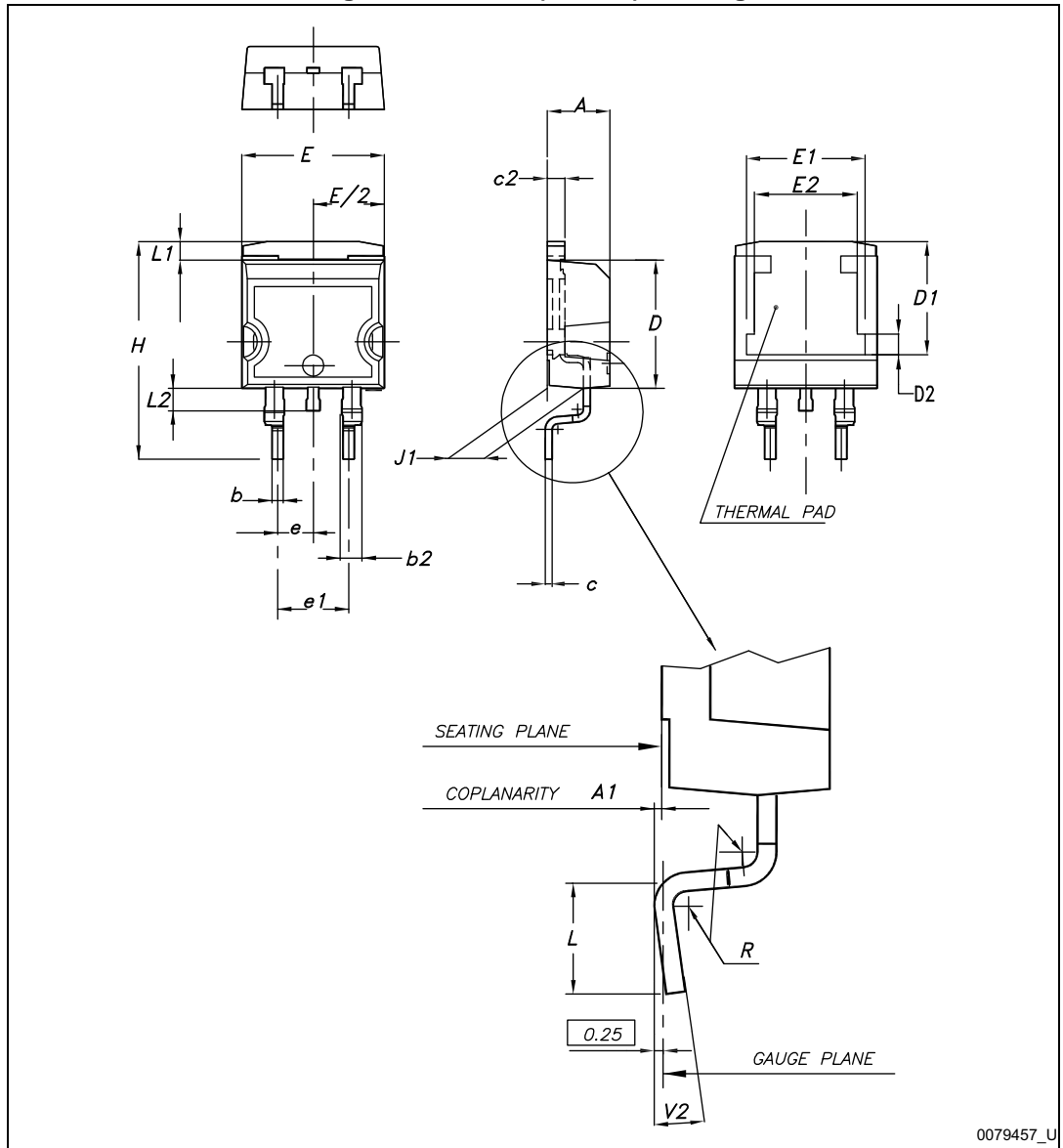


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 STGB18N40LZT4, D<sup>2</sup>PAK

Figure 20. D<sup>2</sup>PAK (TO-263) drawing

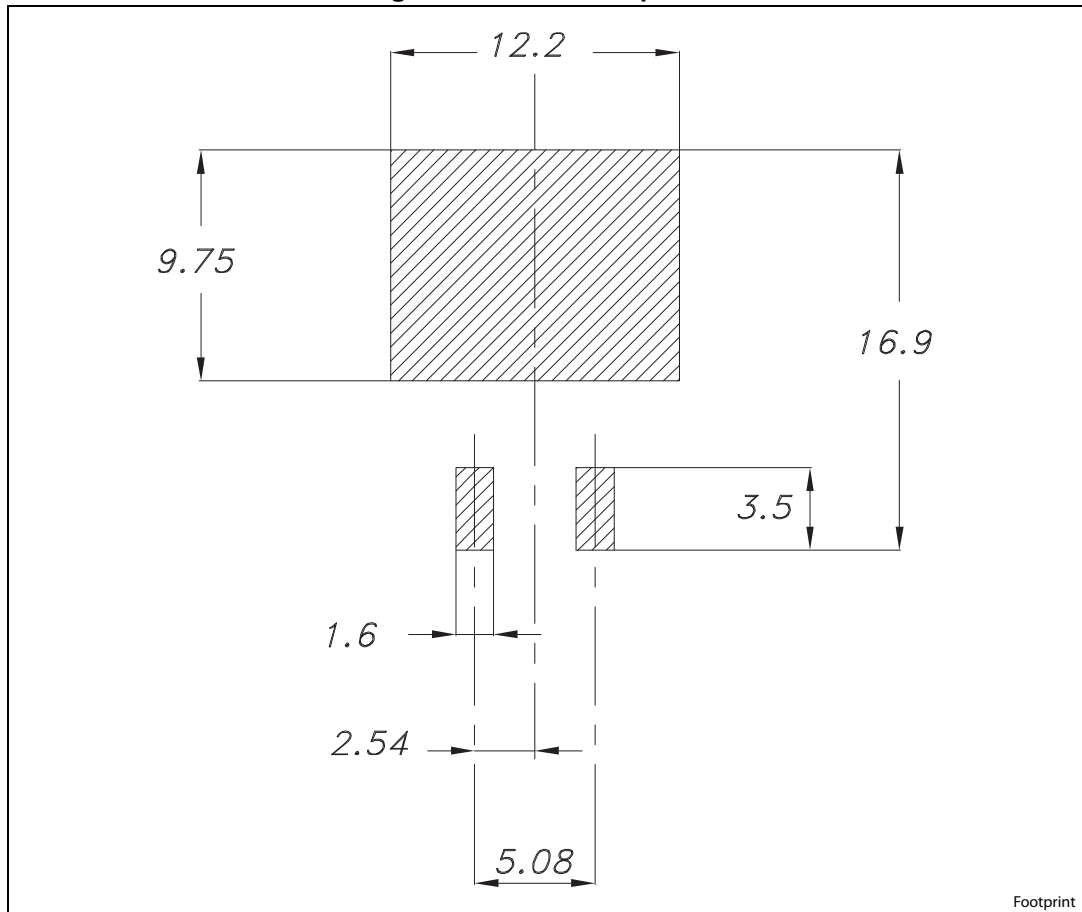


0079457\_U

Table 8. D<sup>2</sup>PAK (TO-263) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10		10.40
E1	8.50	8.70	8.90
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 21. D<sup>2</sup>PAK footprint<sup>(a)</sup>



a. All dimension are in millimeters

### 4.2 STGD18N40LZ-1, IPAK

Figure 22. IPAK (TO-251) type A drawing

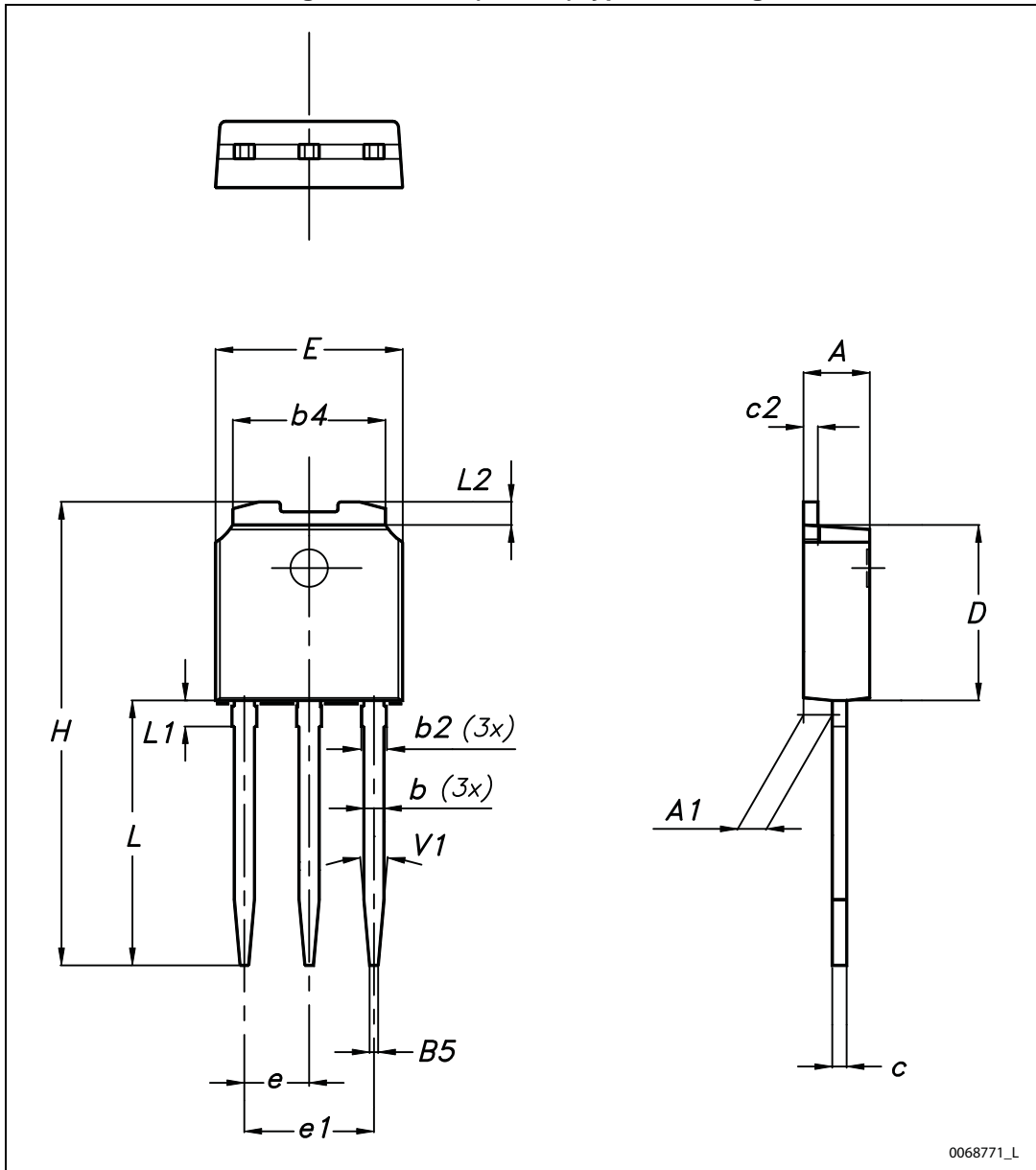


Table 9. IPAK (TO-251) type A mechanical data

DIM	mm.		
	min.	typ.	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.30	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10°	

### 4.3 STGD18N40LZT4, DPAK

Figure 23. DPAK (TO-252) type A drawing

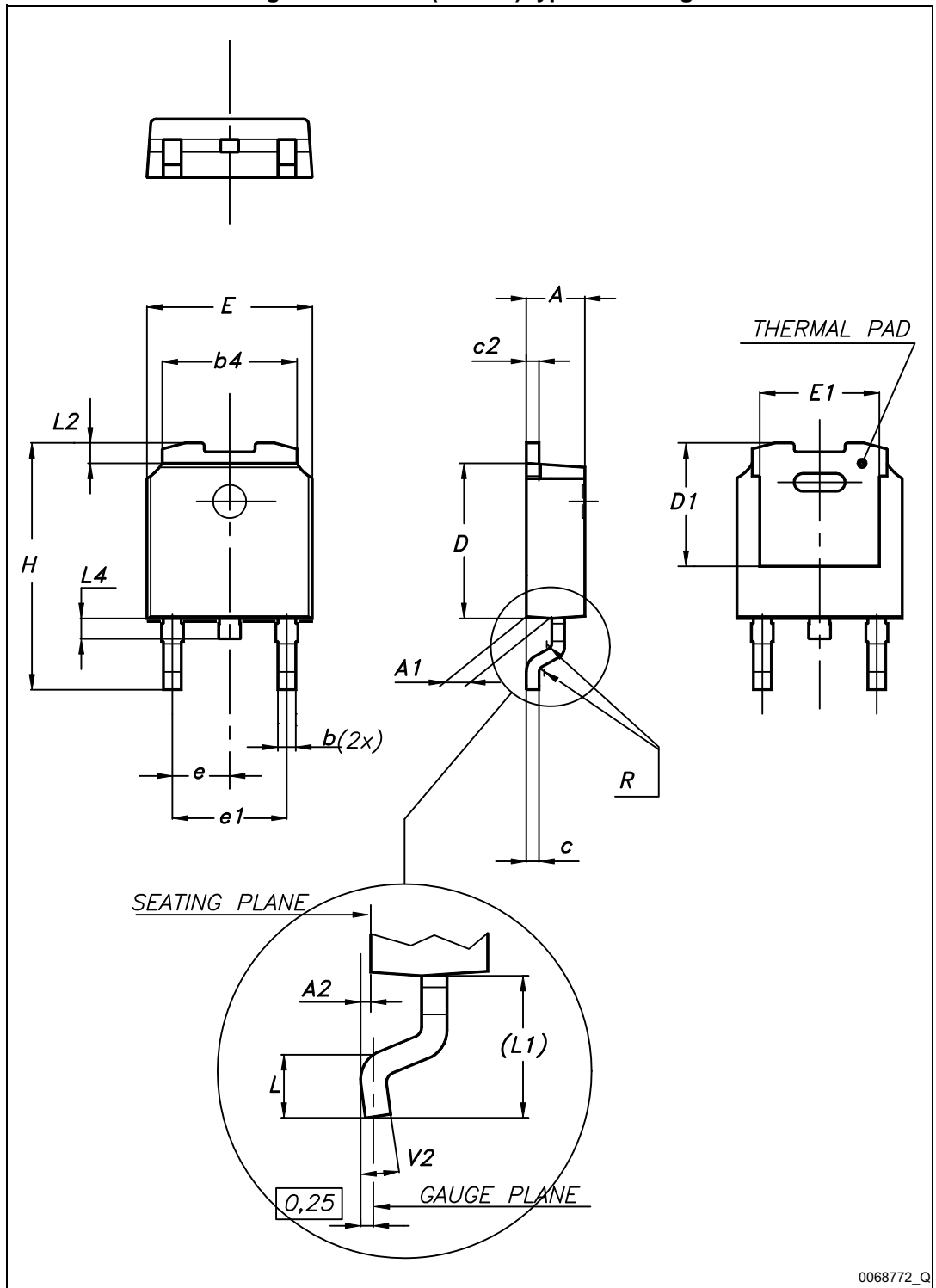
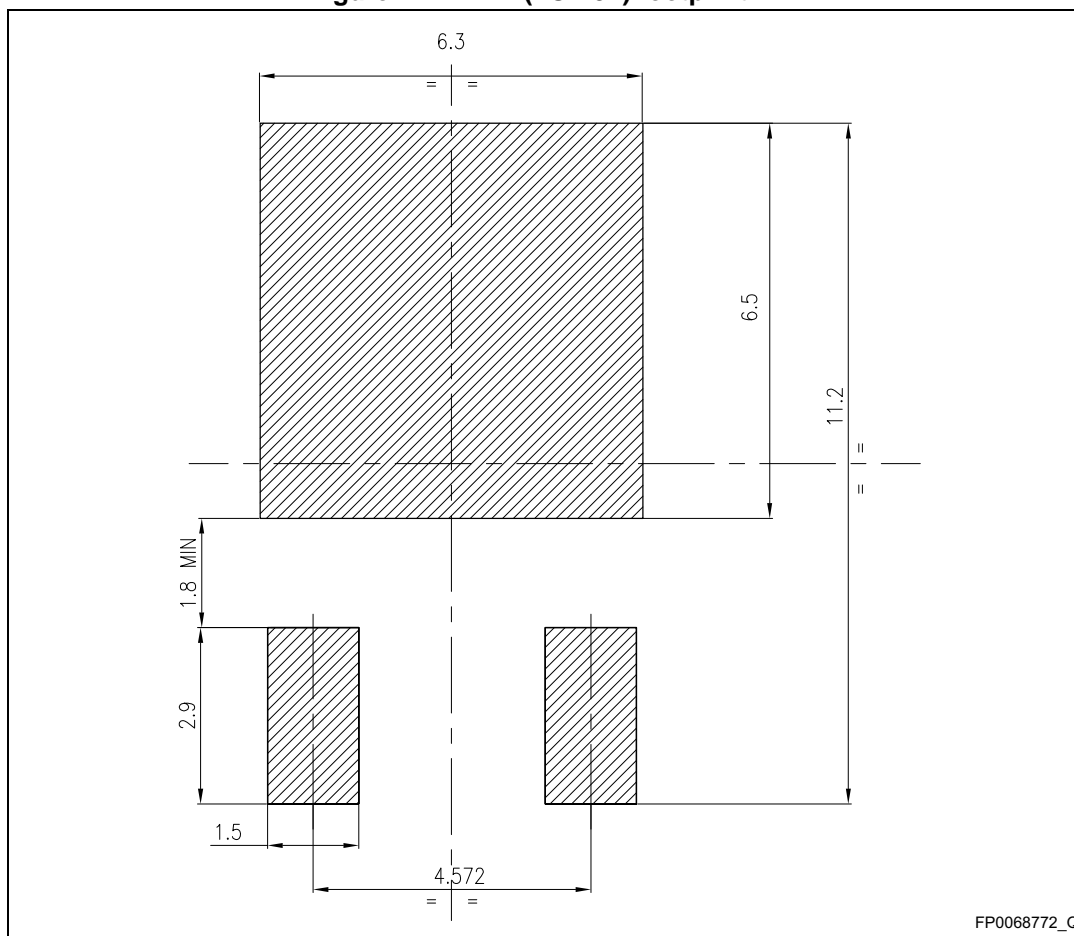




Table 10. DPAK (TO-252) type A mechanical data

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		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
L1		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 24. DPAK (TO-252) footprint (b)



b. All dimensions are in millimeters

4.4 STGP18N40LZ, TO-220

Figure 25. TO-220 type A drawing

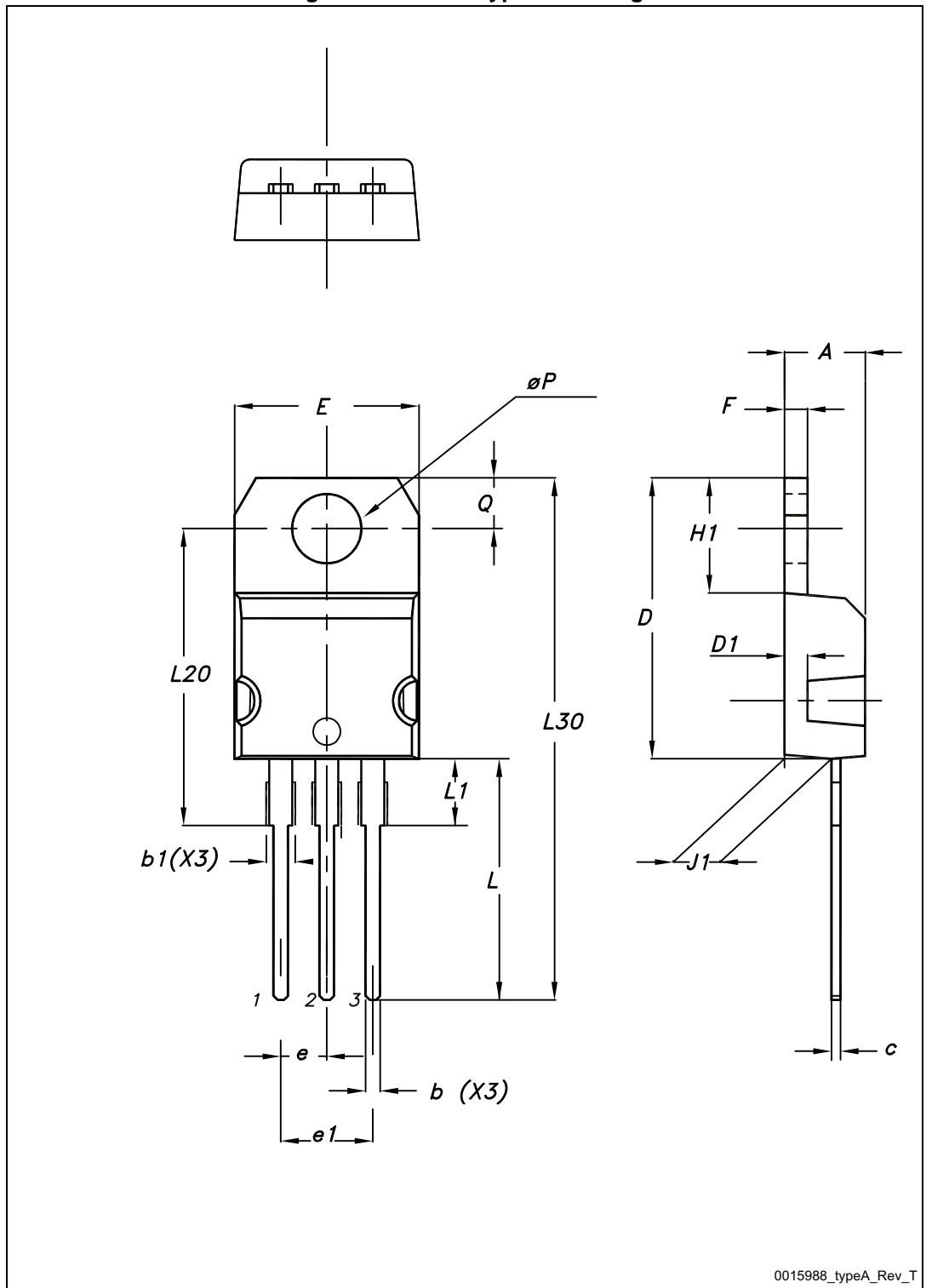


Table 11. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

## 5 Packaging mechanical data

Figure 26. Tape for DPAK and D<sup>2</sup>PAK

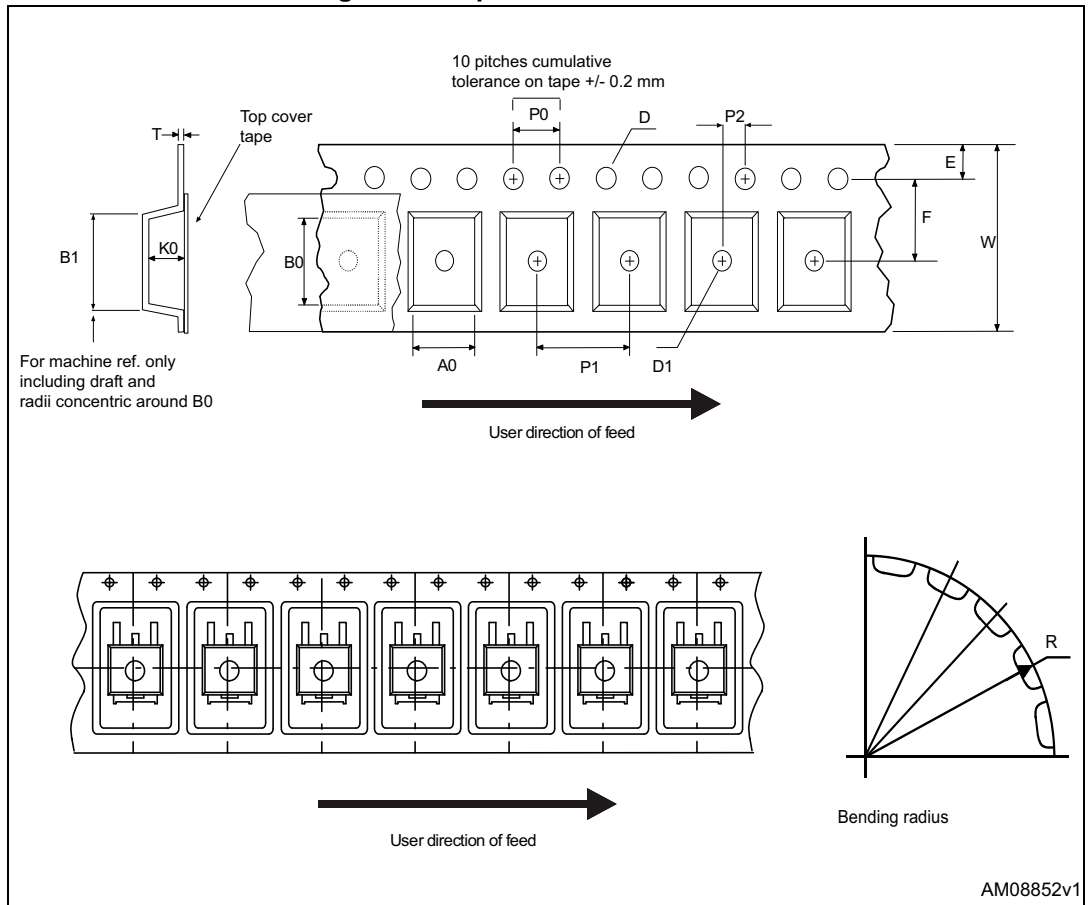


Figure 27. Reel for DPAK and D<sup>2</sup>PAK

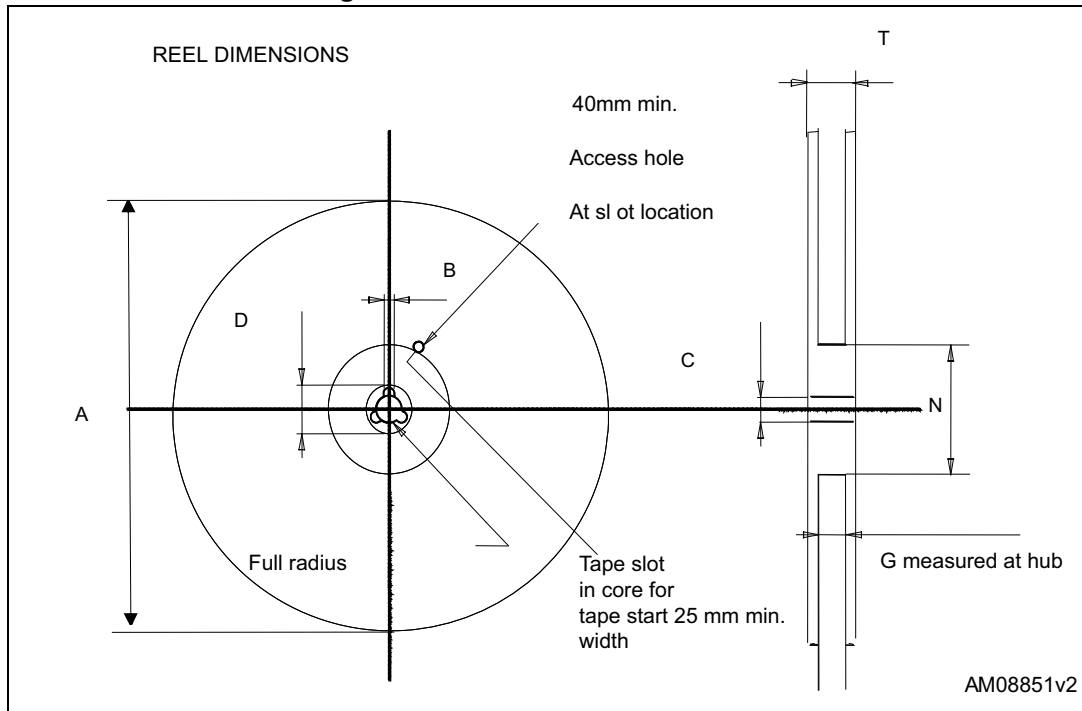


Table 12. DPAK (TO-252) tape and reel mechanical data

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			

Table 13. D<sup>2</sup>PAK (TO-263) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

## 6 Revision history

Table 14. Document revision history

Date	Revision	Changes
18-Jan-2008	1	Initial release.
07-Mar-2008	2	Modified <a href="#">Figure 7</a> , <a href="#">Figure 8</a> , <a href="#">Figure 10</a> .
07-May-2008	3	Modified <a href="#">Figure 9</a>
31-Mar-2009	4	Added new package, mechanical data: TO-220
18-May-2009	5	Modified <a href="#">Figure 5</a>
12-Nov-2014	6	Updated <a href="#">Table 1: Device summary</a> , <a href="#">Table 2: Absolute maximum ratings</a> and <a href="#">Table 3: Thermal data</a> Updated <a href="#">3: Test circuits</a> Updated <a href="#">Section 4: Package mechanical data</a> Updated <a href="#">Section 5: Packaging mechanical data</a> Minor text changes



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