STGD19N40LZ

Automotive-grade 390 V internally clamped IGBT
E_{SCIS} 180 mJ

Datasheet - production data

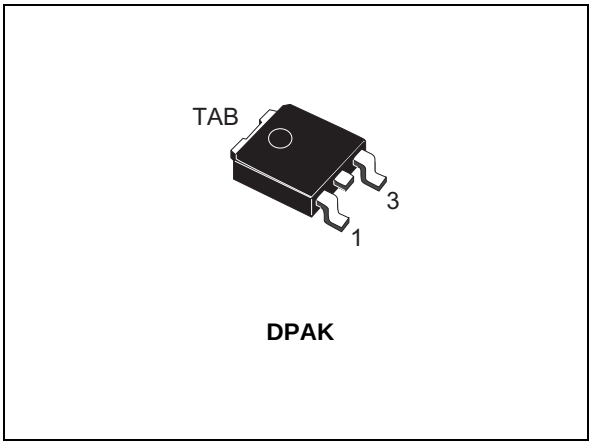
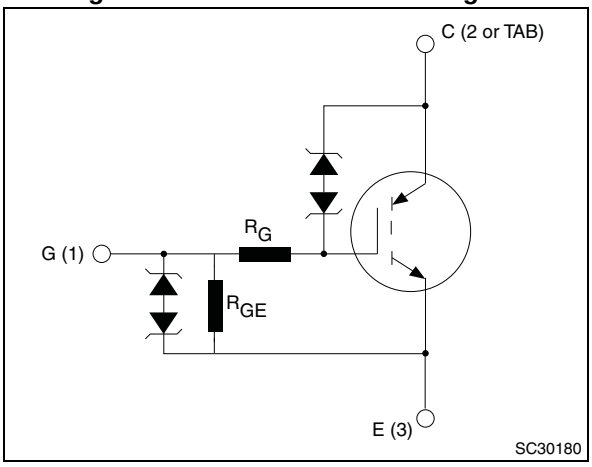


Figure 1. Internal schematic diagram



Features

- AEC-Q101 qualified
- 180 mJ of avalanche energy @ T_C = 150 °C, L = 3 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

Applications

- 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 systems.

Table 1. Device summary

Order code	Marking	Packages	Packing
STGD19N40LZ	GD19N40LZ	DPAK	Tape and reel

This is information on a product in full production. www.st.com

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (v_{GE} = 0)	$V_{CES(clamped)}$	V
V_{ECS}	Emitter collector voltage (V_{GE} = 0)	20	V
I_C (1)	Collector current (continuous) at T_C = 100 °C	25	A
I_{CP} (2)	Pulsed collector current	40	A
V_{GE}	Gate-emitter voltage	$V_{GE(clamped)}$	V
P_{TOT}	Total dissipation at T_C = 25 °C	125	W
E_{SCIS} (3)	Single pulse energy T_C = 25 °C, L = 3 mH, V_{CC} = 50 V	300	mJ
	Single pulse energy T_C =150 °C, L = 3 mH, V_{CC} = 50 V	180	mJ
I_{SCIS}	Avalanche current T_C = 25 °C, L = 3 mH, V_{CC} = 50 V	13.1	A
	Avalanche current T_C = 150 °C, L = 3 mH, V_{CC} = 50 V	10.2	A
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_{STG}	Storage temperature	– 55 to 175	°C
T_J	Operating junction temperature		

1. Calculated according to the iterative formula

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

2. Pulse width limited by max. junction temperature allowed
3. For E_{SCIS} test circuit refer to *Figure 16*. (Inductive load switching), with A and B not connected.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.2	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient device in free air	100	°C/W

2 Electrical characteristics

T_J = 25 °C unless otherwise specified.

Table 4. Static electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CES(clamped)}$	Collector emitter clamped voltage (V_{GE} = 0)	I_C = 2 mA		390		V
		I_C = 2 mA, T_J = - 40 °C to 175 °C	365		425	V
$V_{(BR)ECS}$	Emitter collector break-down voltage (V_{GE} = 0)	I_C = 75 mA		28		V
		I_C = 75 mA, T_J = - 40 °C to 175 °C	20			V
$V_{GE(clamped)}$	Gate emitter clamped voltage	I_G = ±2 mA T_J = - 40 °C to 175 °C	12		16	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 15 V, T_J = 175 °C			20	µA
		V_{CE} = 200 V, T_J = 175 °C			100	µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ±10 V		625		µA
		V_{GE} = ±10 V, T_J = - 40 °C to 175 °C	450		830	µA
R_{GE}	Gate emitter resistance	0 < V_{GE} < V_{GE} (clamped)	12	16	22	kΩ
R_G	Gate resistance			1.6		kΩ
$V_{GE(th)}$	Gate threshold voltage	V_{GE} =V_{CE}, I_C = 1 mA, T_J = - 40 °C	1.75	2.3	2.9	V
		V_{GE} =V_{CE}, I_C = 1 mA	1.55	2.0	2.6	V
		V_{GE} =V_{CE}, I_C = 1 mA, T_J = 175 °C	1.05	1.4	2.0	V
$V_{CE(sat)}$	Collector emitter saturation voltage	V_{GE} = 4.5 V, I_C = 10 A		1.5		V
		V_{GE} = 4.5 V, I_C = 10 A, T_J = - 40 °C to 175 °C			1.85	V
		V_{GE} = 3.8 V, I_C = 6 A		1.35		V
		V_{GE} = 3.8 V, I_C = 6 A, T_J = - 40 °C to 175 °C			1.65	V

Table 5. Dynamic electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0	-	730	-	pF
C_{oes}	Output capacitance		-	85	-	pF
C_{res}	Reverse transfer capacitance		-	4	-	pF
Q_g	Gate charge	V_{CE} = 280 V, I_C = 10 A, V_{GE} = 5 V	-	17	-	nC

Table 6. Switching on/off

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Resistive load Turn-on delay time Rise time	V_{CC} = 14 V, R_L = 1 Ω, V_{GE} = 5 V R_G = 1 kΩ	-	0.65 3.5	-	µs µs
$t_{d(on)}$ t_r	Resistive load Turn-on delay time Rise time	V_{CC} = 14 V, R_L = 1 Ω, V_{GE} = 5 V, R_G = 1 kΩ, T_J = 150 °C	-	0.65 3.8	-	µs µs
$t_{d(off)}$ t_f dv/dt	Inductive load Turn-off delay time Fall time Turn-off voltage slope	V_{CC} = 300 V, L = 1 mH I_C = 10 A, V_{GE} = 5 V, R_G = 1 kΩ	-	13.5 5.5 105	-	µs µs V/µs
$t_{d(off)}$ t_f dv/dt	Inductive load Turn-off delay time Fall time Turn-off voltage slope	V_{CC} = 300 V, L = 1 mH I_C = 10 A, V_{GE} = 5 V, R_G = 1 kΩ, T_J = 150 °C	-	14.2 8 97	-	µs µs V/µs

2.1 Electrical characteristics (curves)

Figure 2. Collector-emitter on voltage vs. temperature (I_C = 6 A)

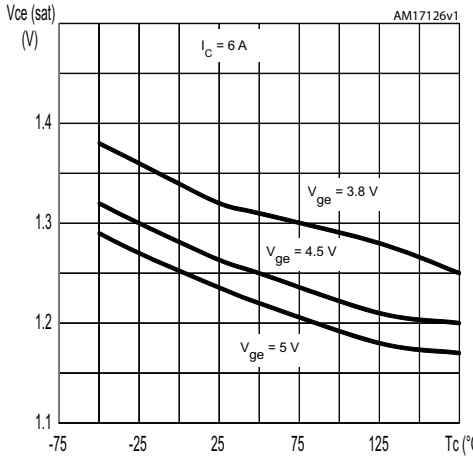


Figure 3. Collector-emitter on voltage vs. temperature (I_C = 10 A)

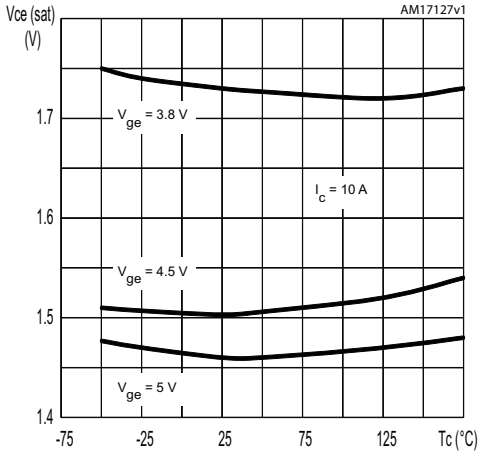


Figure 4. Collector-emitter on voltage vs. temperature (V_{GE} = 4.5 V)

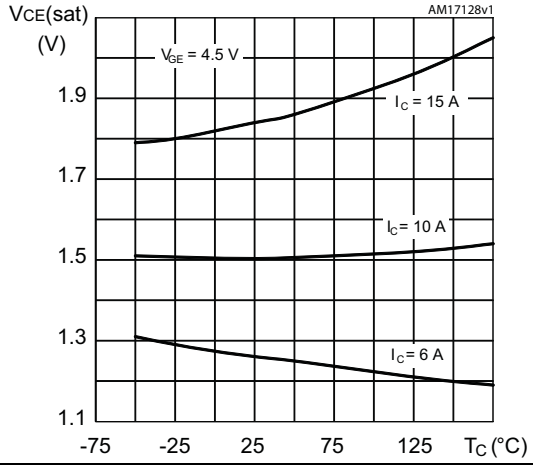


Figure 5. Self clamped inductive switch

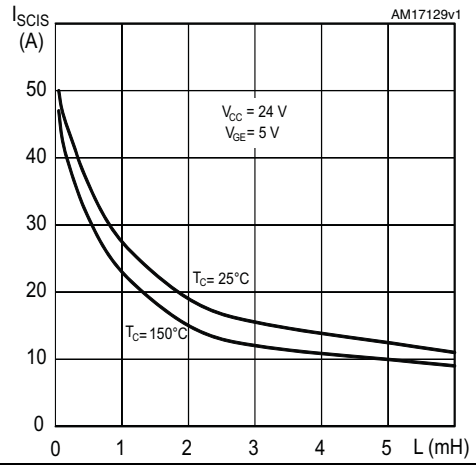


Figure 6. Output characteristics (T_J= 25 °C)

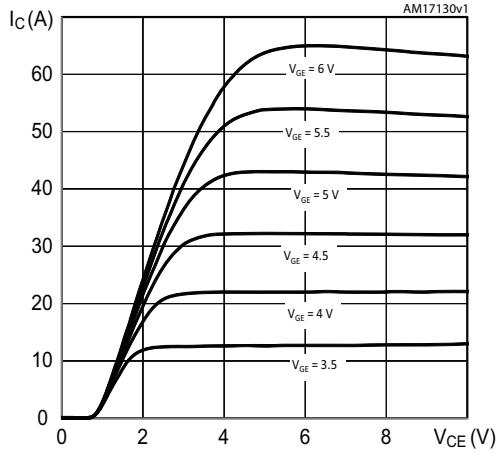


Figure 7. Output characteristics (T_J= -175 °C)

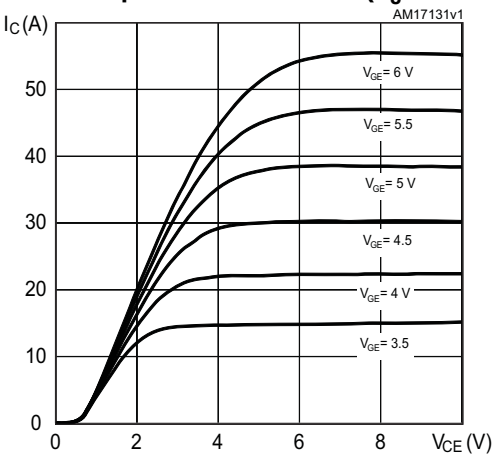


Figure 8. Output characteristics (T_J= -40 °C)

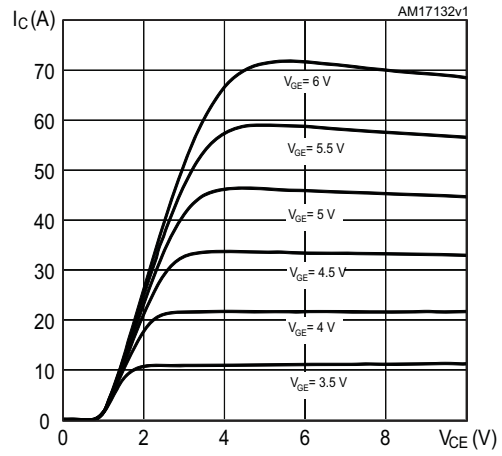


Figure 9. Transfer characteristics

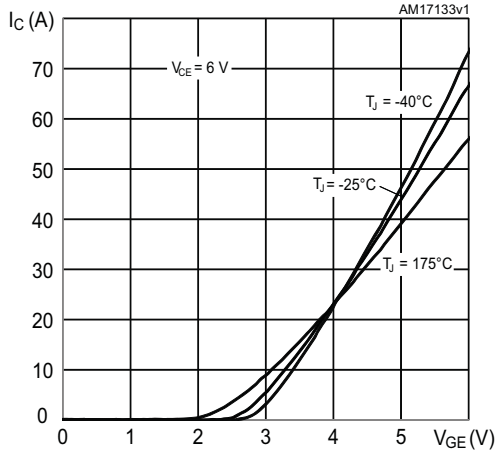


Figure 10. Collector cut-off current vs. temperature

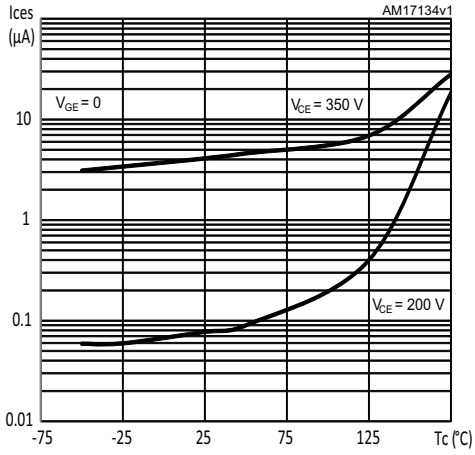


Figure 11. Normalized collector emitter voltage vs. temperature (I_C = 2 mA)

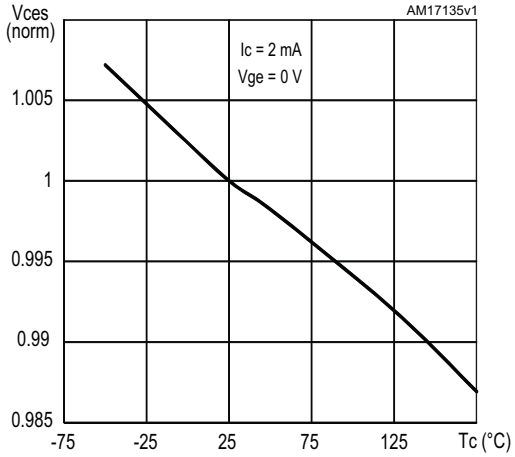


Figure 12. Normalized gate threshold voltage vs. temperature

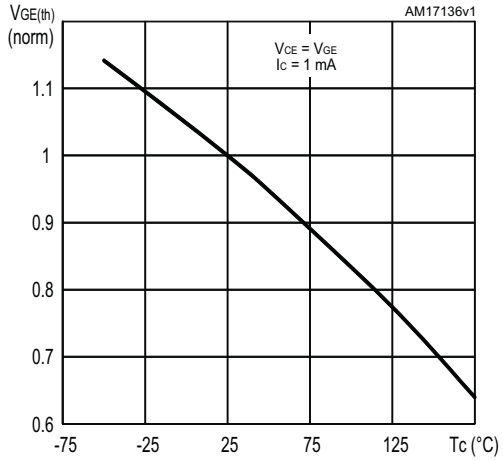


Figure 13. Normalized collector emitter on voltage vs. temperature (I_C = 10 A)

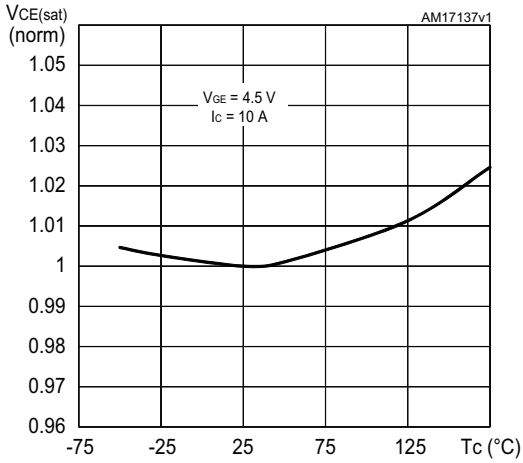


Figure 14. Thermal impedance

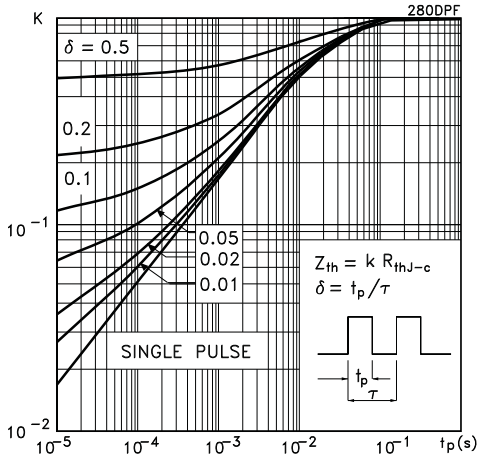
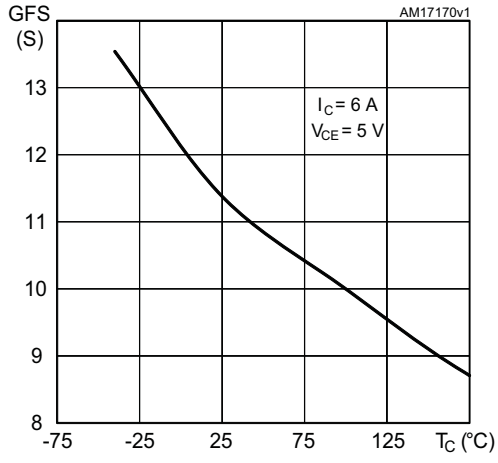


Figure 15. Transconductance vs. temperature



3 Test circuits

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

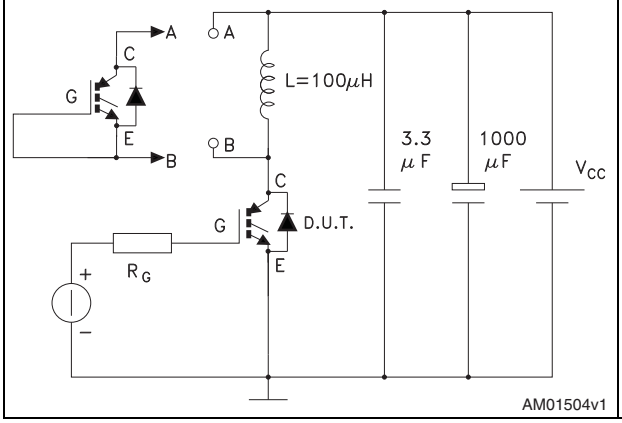


Figure 17. Resistive load switching

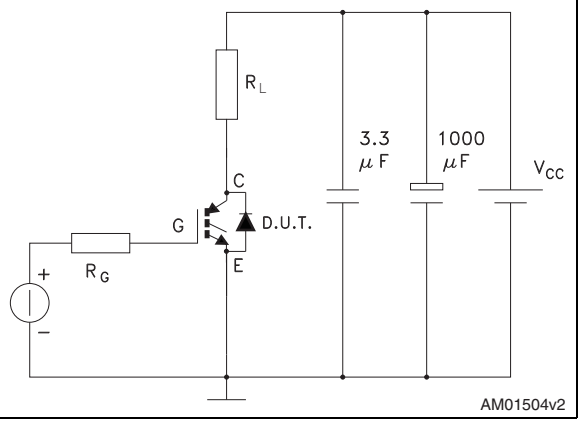


Figure 18. Gate charge test circuit

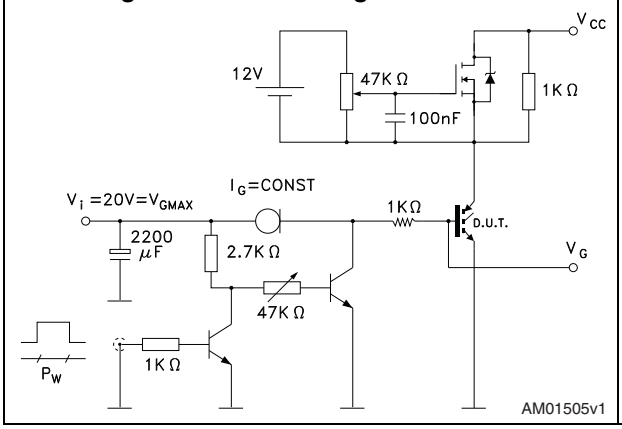
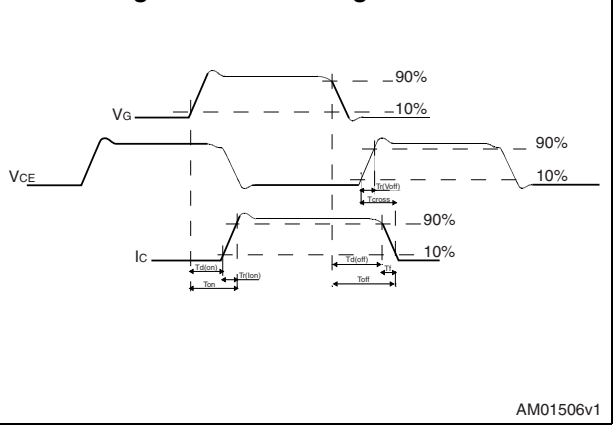


Figure 19. Switching waveform



4 Package 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

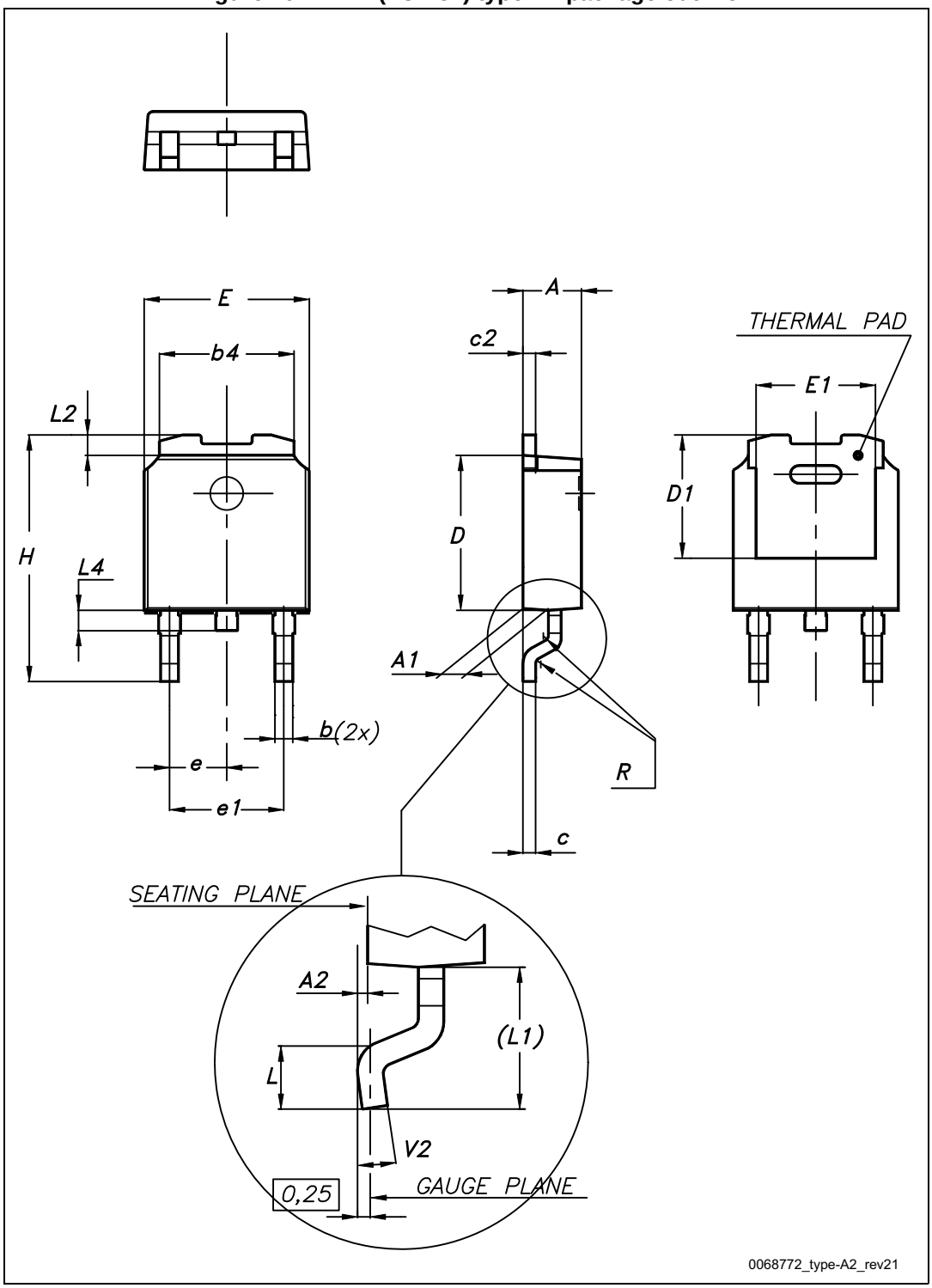
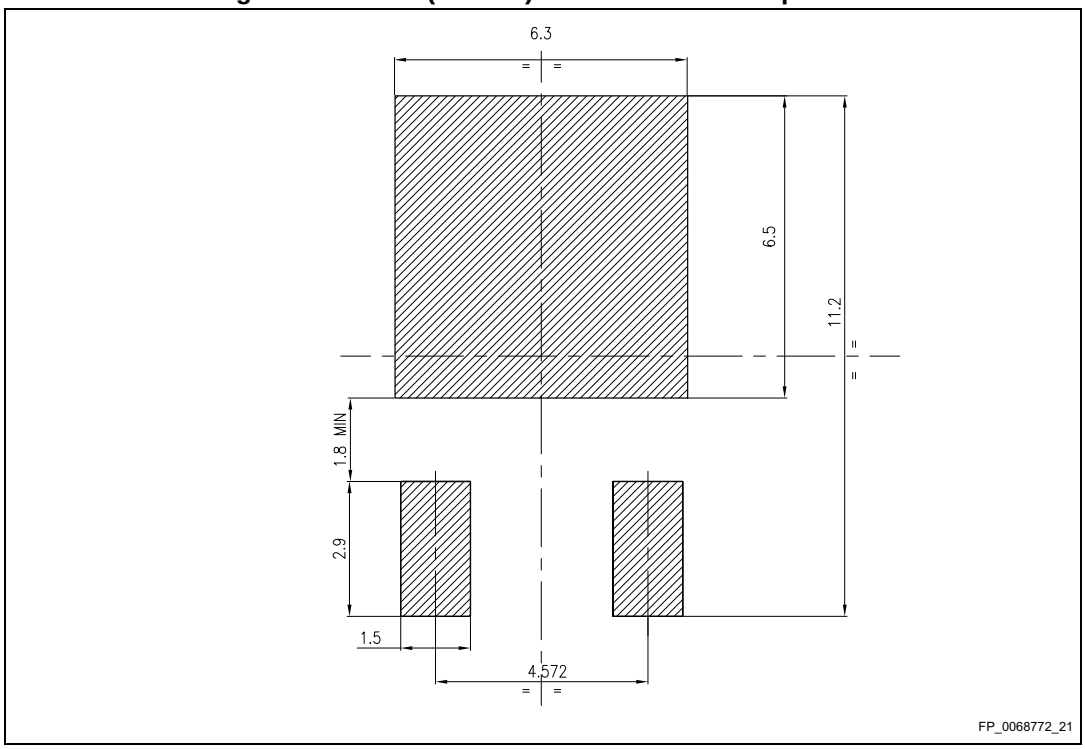


Table 7. DPAK (TO-252) type A2 mechanical data

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	2.16	2.28	2.40
e1	4.40		4.60
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 21. DPAK (TO-252) recommended footprint [(a)]



a. All dimensions are in millimeters

4.2 Packing information

Figure 22. Tape outline for DPAK (TO-252)

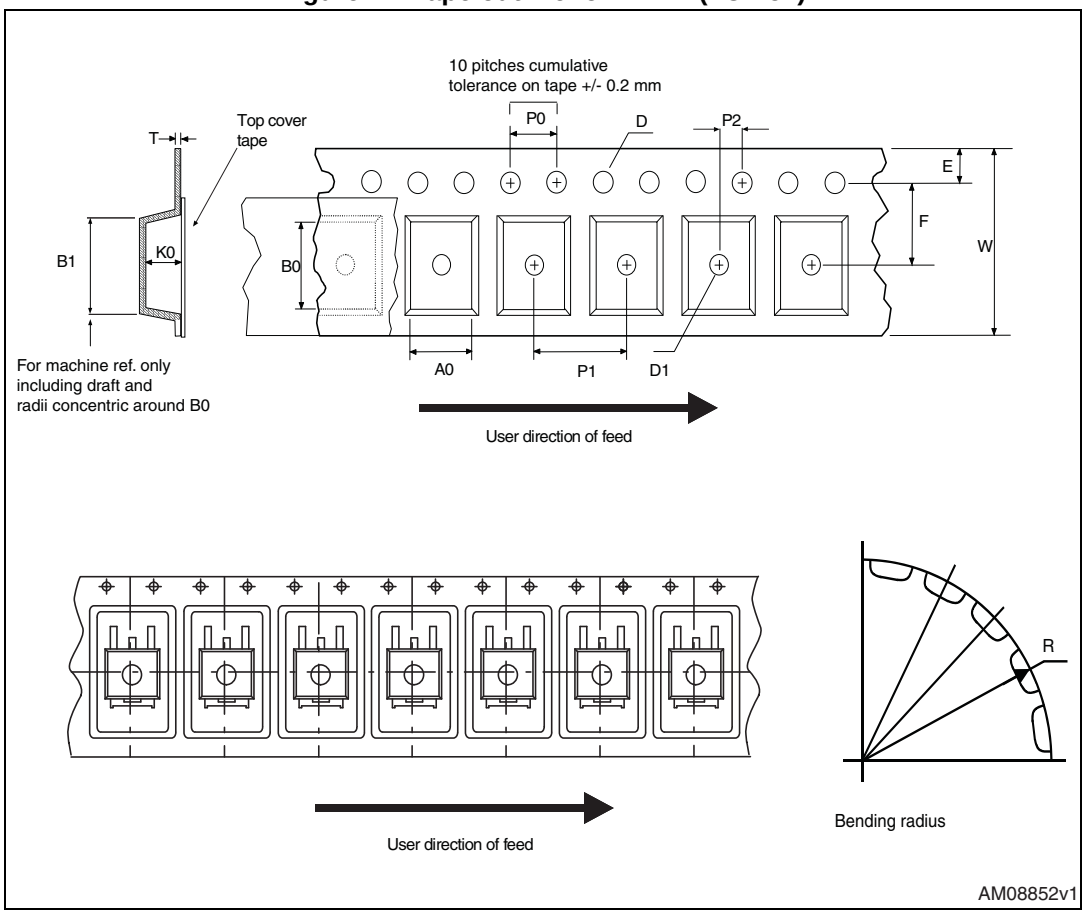


Figure 23. Reel outline for DPAK (TO-252)

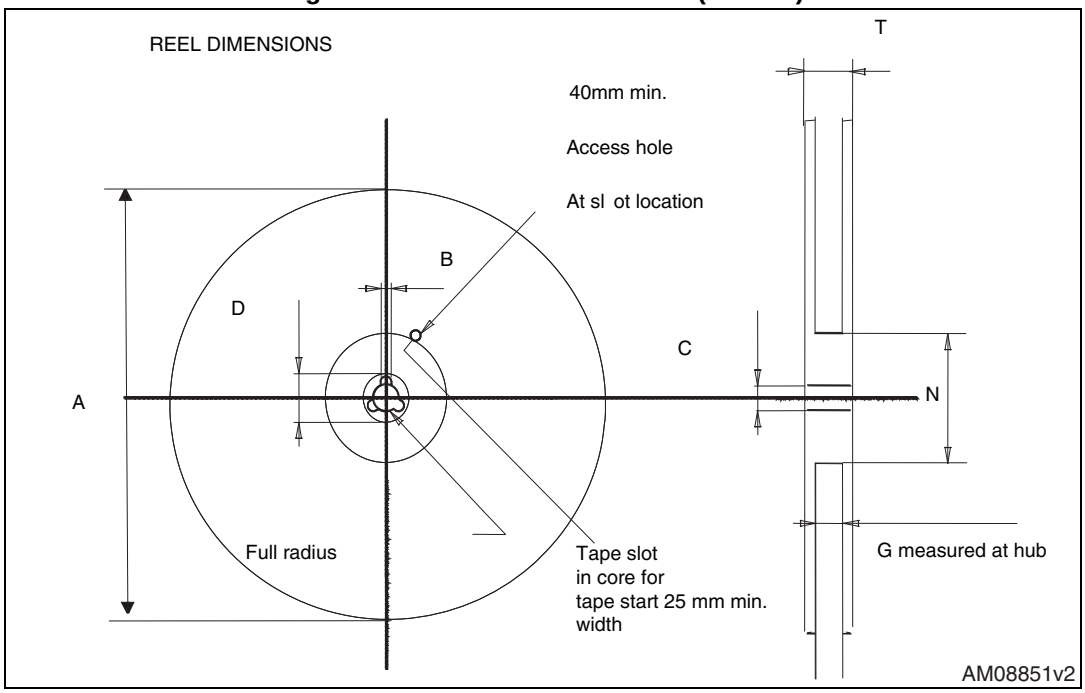


Table 8. DPAK (TO-252) tape and reel mechanical data

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			

5 Revision history

Table 9. Document revision history

Date	Revision	Changes
22-Apr-2013	1	Initial release.
20-May-2013	2	Added *Figure 15.*
17-Apr-2014	3	Modified title and features Modified $V_{CES(clamped)}$, $V_{(BR)ECS}$ and I_{GES} test conditions Modified *Figure 5* and *9* Updated *Section 4: Package information* Minor text changes
04-Jun-2014	4	Updated features in cover page.
30-Jul-2015	5	Text and formatting changes throughout document. Updated *Section 4: Package information*
05-Oct-2016	6	Updated *Figure 9: Transfer characteristics*. Minor text changes.

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