STGB35N35LZ
STGP35N35LZ

Automotive-grade 345 V internally clamped IGBT, E_{AS} 450 mJ

Datasheet - production data

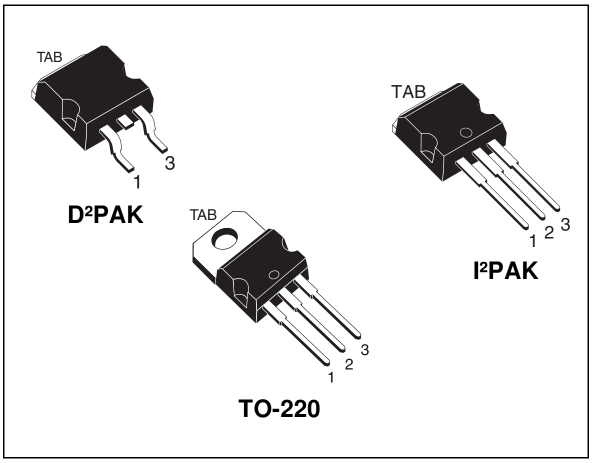
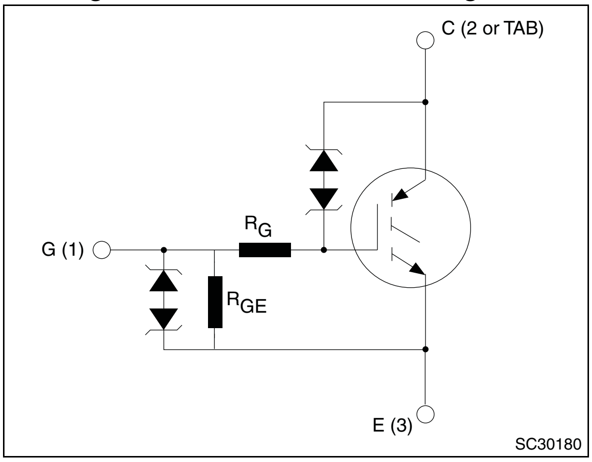


Figure 1. Internal schematic diagram



Features

- Designed for automotive applications and AEC-Q101 qualified
- Low threshold voltage
- Low on-voltage drop
- High voltage clamping feature
- Logic level gate charge
- ESD gate-emitter protection
- Gate and gate-emitter integrated resistors

Application

- Automotive ignition

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
STGB35N35LZ-1	GB35N35LZ	I²PAK	Tube
STGB35N35LZT4	GB35N35LZ	D²PAK	Tape and reel
STGP35N35LZ	GP35N35LZ	TO-220	Tube

Contents

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)	Continuous collector current at T_C = 25 °C	40	A
I_C (1)	Continuous collector current at T_C = 100 °C	30	A
I_{CP} (2)	Pulsed collector current	80	A
V_{GE}	Gate-emitter voltage	$V_{GE\ (clamped)}$	V
P_{TOT}	Total dissipation at T_C = 25 °C	176	W
E_{AS}	Single pulse energy (T_C=25 °C, L=1.6 mH, I_C = 22 A, V_{CC} = 50 V)	450	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_{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 maximum junction temperature

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.85	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	°C/W

2 Electrical characteristics

(T_j =25 °C unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CES(clamped)}$	Collector emitter clamped voltage (V_{GE}=0)	I_C=2 mA,		345		V
		I_C=2 mA, T_j= - 40 °C to 150 °C	320		380	V
$V_{(BR)ECS}$	Emitter collector break-down voltage (V_{GE}=0)	I_C = 75 mA	20	28		V
$V_{GE(clamped)}$	Gate emitter clamped voltage	I_G = ± 2 mA	12	14	16	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 15 V, T_j =150 °C			10	μA
		V_{CE} =200 V, T_j =150 °C			100	μA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ±10 V	500	625	830	μA
R_{GE}	Gate emitter resistance		12	15	20	kΩ
R_G	Gate resistance			1.5		kΩ
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA, T_j=-40 °C	1.4			V
		V_{CE} =V_{GE}, I_C = 1 mA	1.2	1.6	2.3	V
		V_{CE} =V_{GE}, I_C = 1 mA, T_j=150 °C	0.7			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} =4.5 V, I_C = 10 A		1.15	1.5	V
		V_{GE} =4.5 V, I_C = 15 A		1.3	1.7	V

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25V, f = 1MHz, V_{GE} = 0	-	700	-	pF
C_{oes}	Output capacitance		-	150	-	pF
C_{res}	Reverse transfer capacitance		-	6	-	pF
Q_g	Gate charge	V_{CE} = 280V, I_C = 15A, V_{GE} = 5V	-	49	-	nC

Table 6. Functional characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
U.I.S.	Functional test open secondary coil	R_G = 0, T_j = 150 °C, V_{CC} = 50 V, V_{GE} = 5 V, L=1.6 mH	18	-	-	A

Table 7. Switching time

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
td(on) t_r	Resistive load Turn-on delay time Rise time	V_{CC} = 14 V, R_L = 1 Ω, V_{GE} = 5 V	-	1.1 7	-	µs µs µs
td(on) t_r	Resistive load Turn-on delay time Rise time	V_{CC} = 14 V, R_L = 1 Ω, V_{GE} = 5 V T_j = 150 °C	-	1 6.6	-	µs 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 = 15 A, V_{GE} = 5 V	-	26.5 5.5 70	-	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 = 15 A, V_{GE} = 5 V T_j = 150 °C	-	28 9 65	-	µs µs V/µs

2.1 Electrical characteristics (curves)

Figure 2. Collector-emitter saturation voltage vs temperature

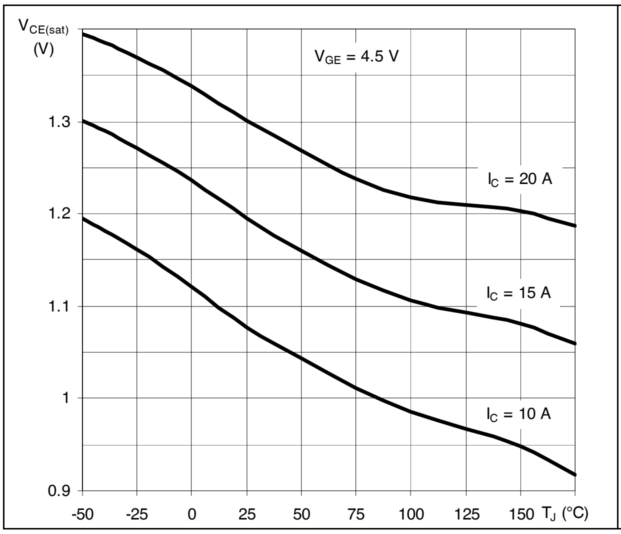


Figure 3. Self clamped inductive switch

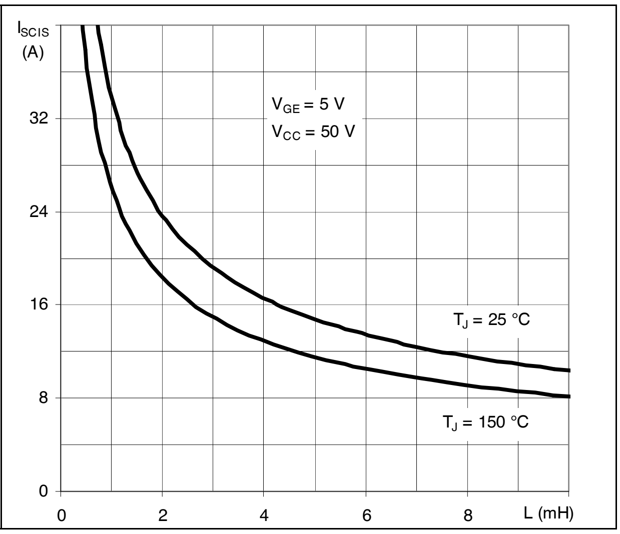


Figure 4. Output characteristics (T_J = 25 °C)

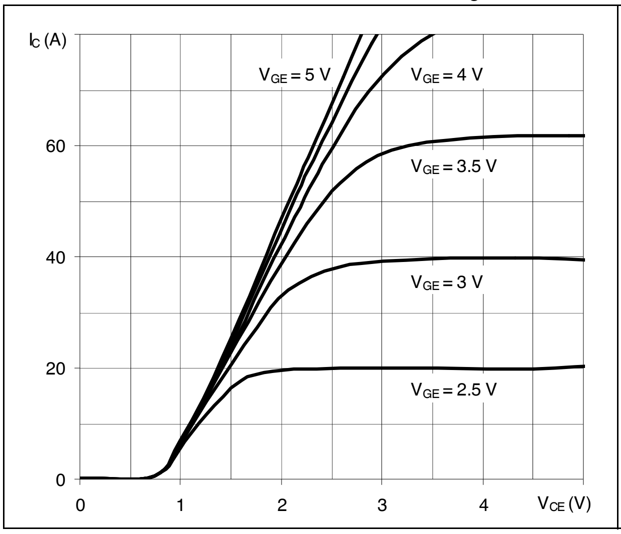


Figure 5. Output characteristics (T_J = -40 °C)

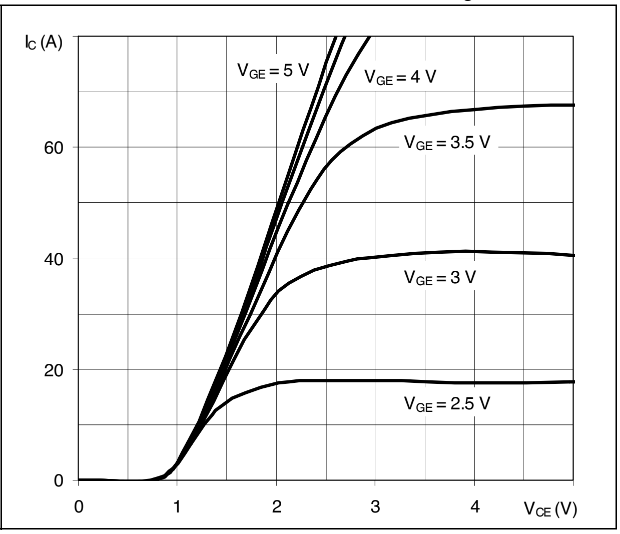


Figure 6. Output characteristics (T_J = 175 °C)

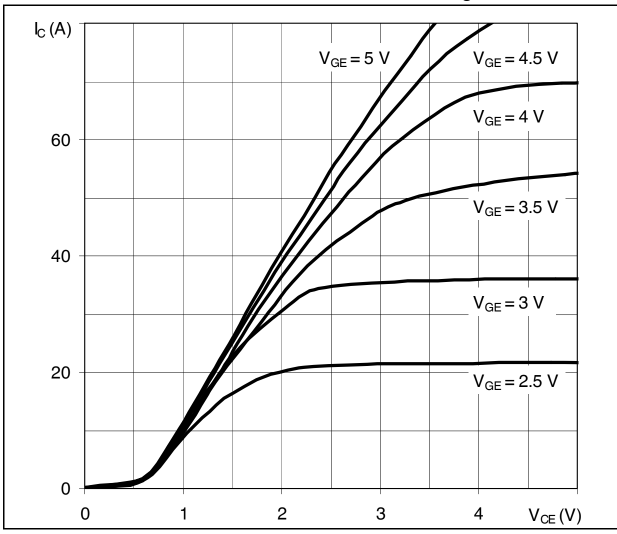


Figure 7. Transfer characteristics

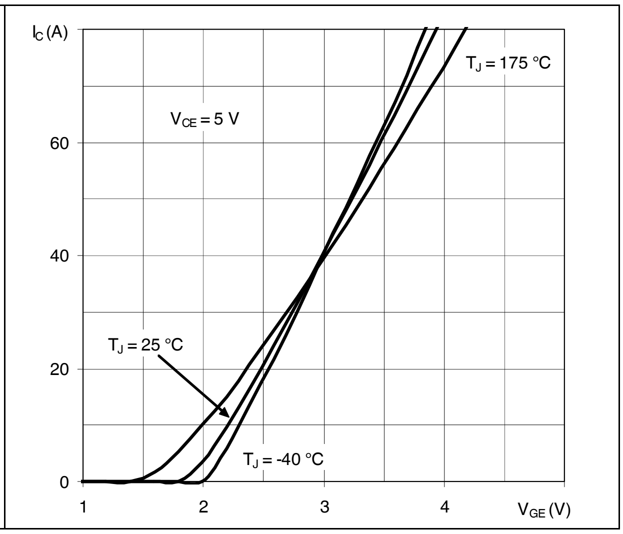


Figure 8. Collector cut-off current vs temperature

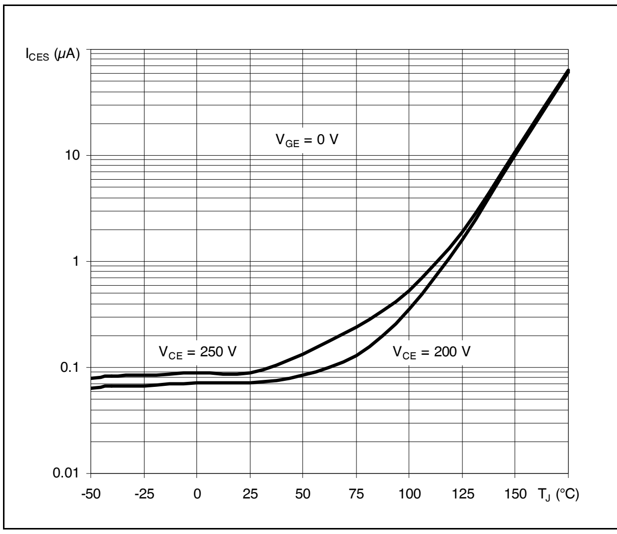


Figure 9. Normalized collector emitter voltage vs temperature

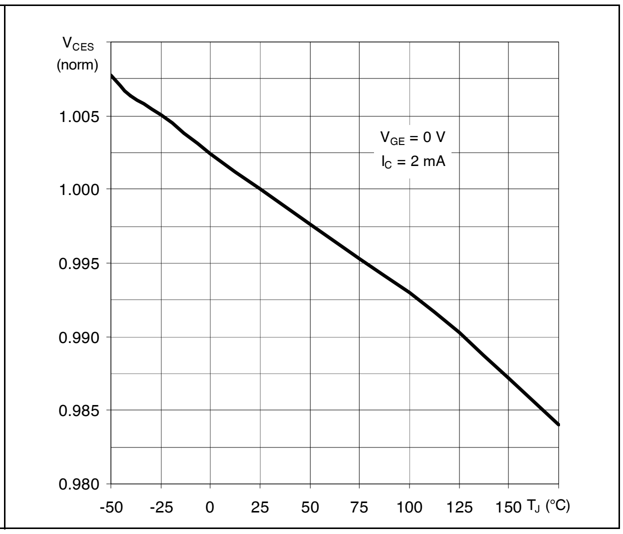


Figure 10. Normalized gate threshold voltage vs temperature

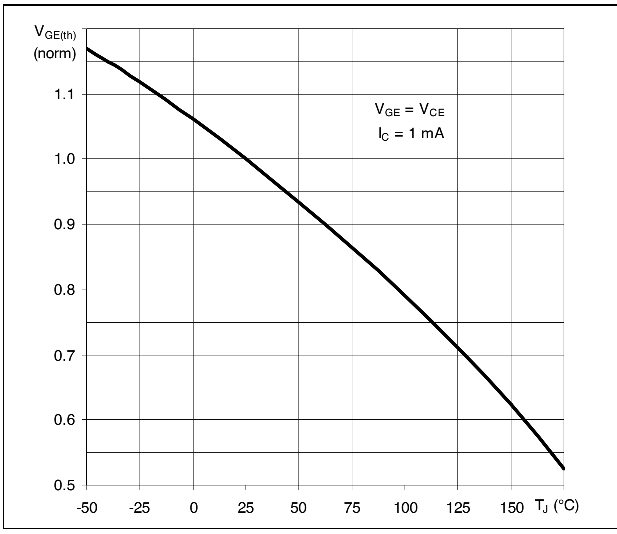


Figure 11. Gate charge

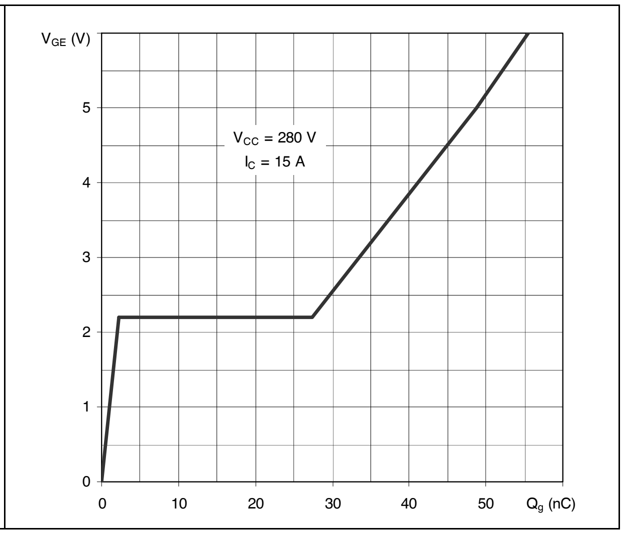
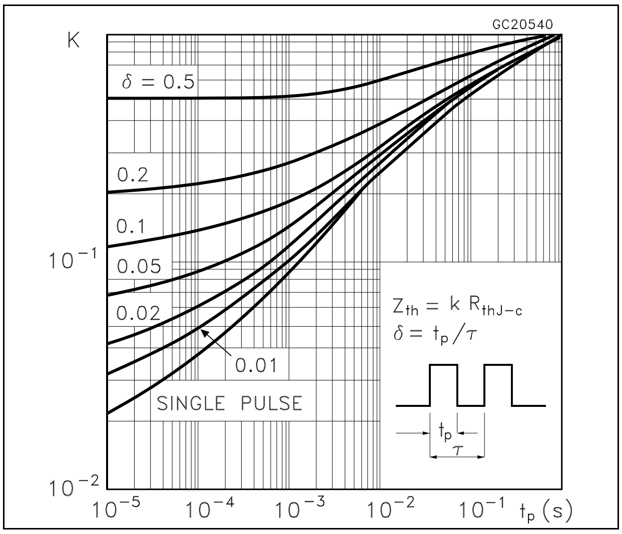


Figure 12. Thermal impedance



3 Test circuits

Figure 13. Test circuit for inductive load switching

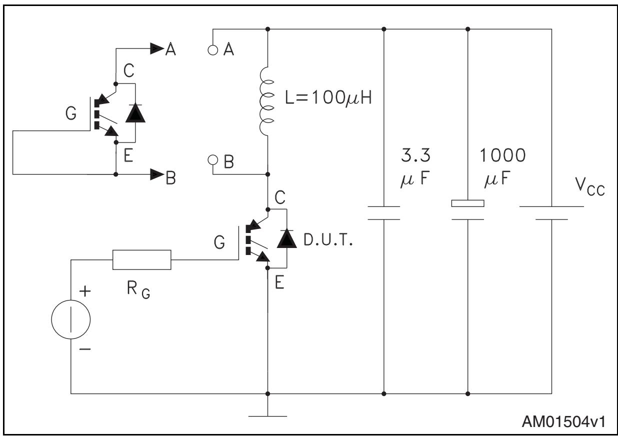


Figure 14. Gate charge test circuit

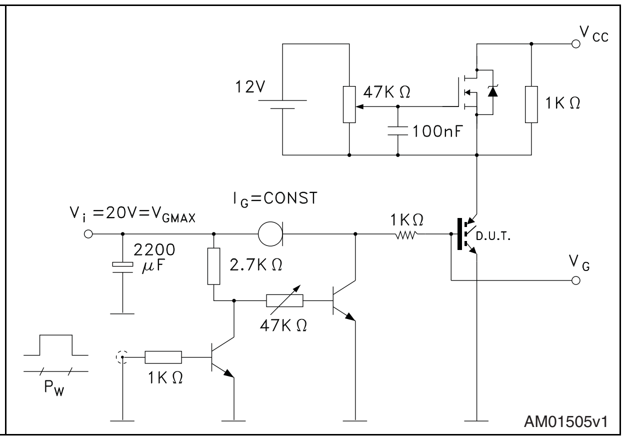
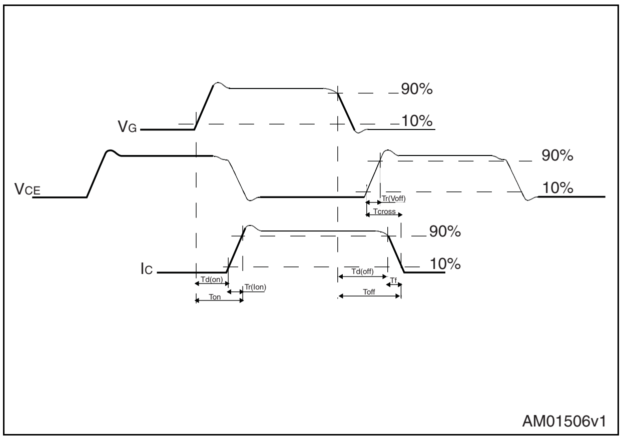


Figure 15. Switching waveform



4 Package mechanical data

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.

Table 8. D²PAK (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		
E	10		10.40
E1	8.50		
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 16. D²PAK (TO-263) drawing

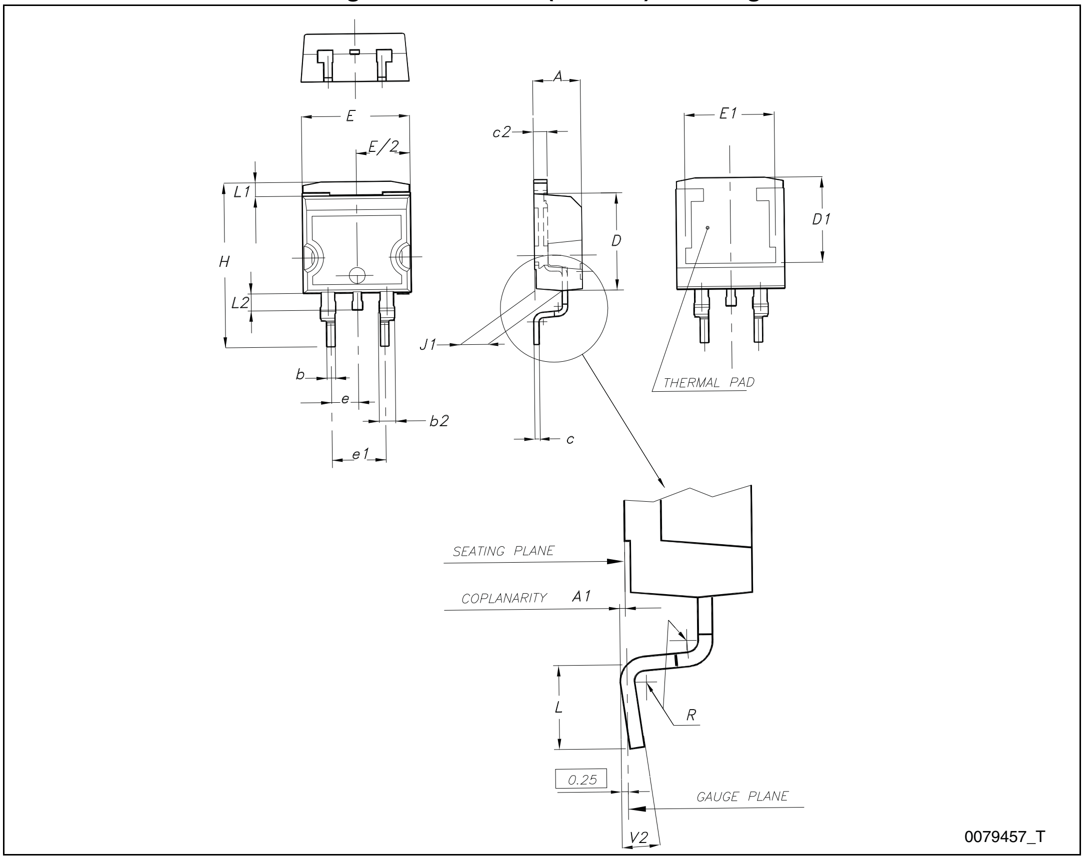
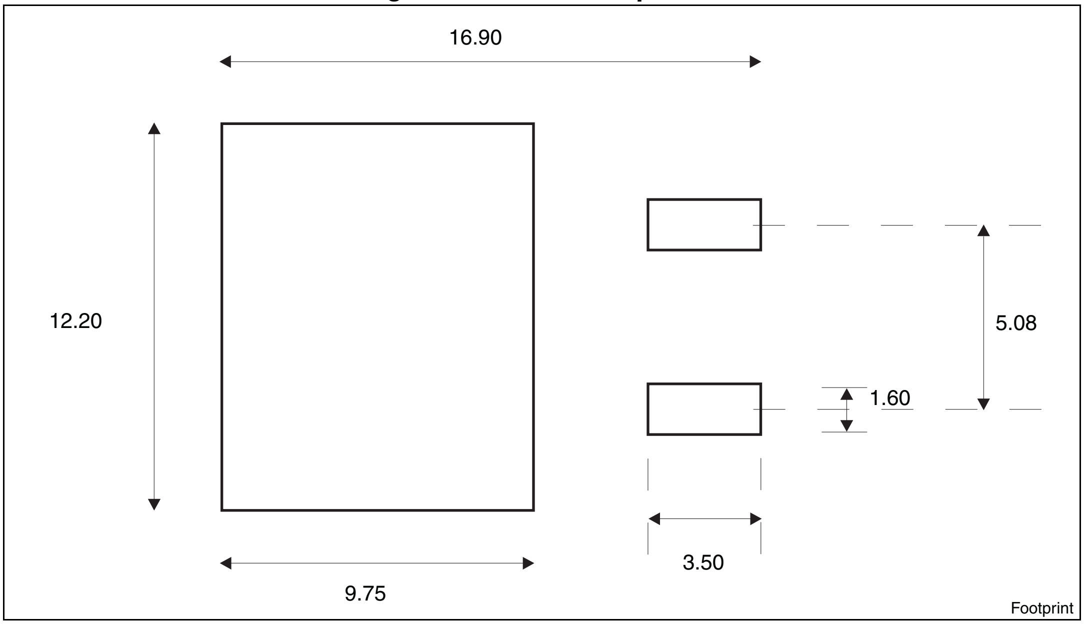


Figure 17. D²PAK footprint[a]



a. All dimension are in millimeters

Table 9. I²PAK (TO-262) mechanical data

DIM.	mm.		
	min.	typ	max.
A	4.40		4.60
A1	2.40		2.72
b	0.61		0.88
b1	1.14		1.70
c	0.49		0.70
c2	1.23		1.32
D	8.95		9.35
e	2.40		2.70
e1	4.95		5.15
E	10		10.40
L	13		14
L1	3.50		3.93
L2	1.27		1.40

Figure 18. I²PAK (TO-262) drawing

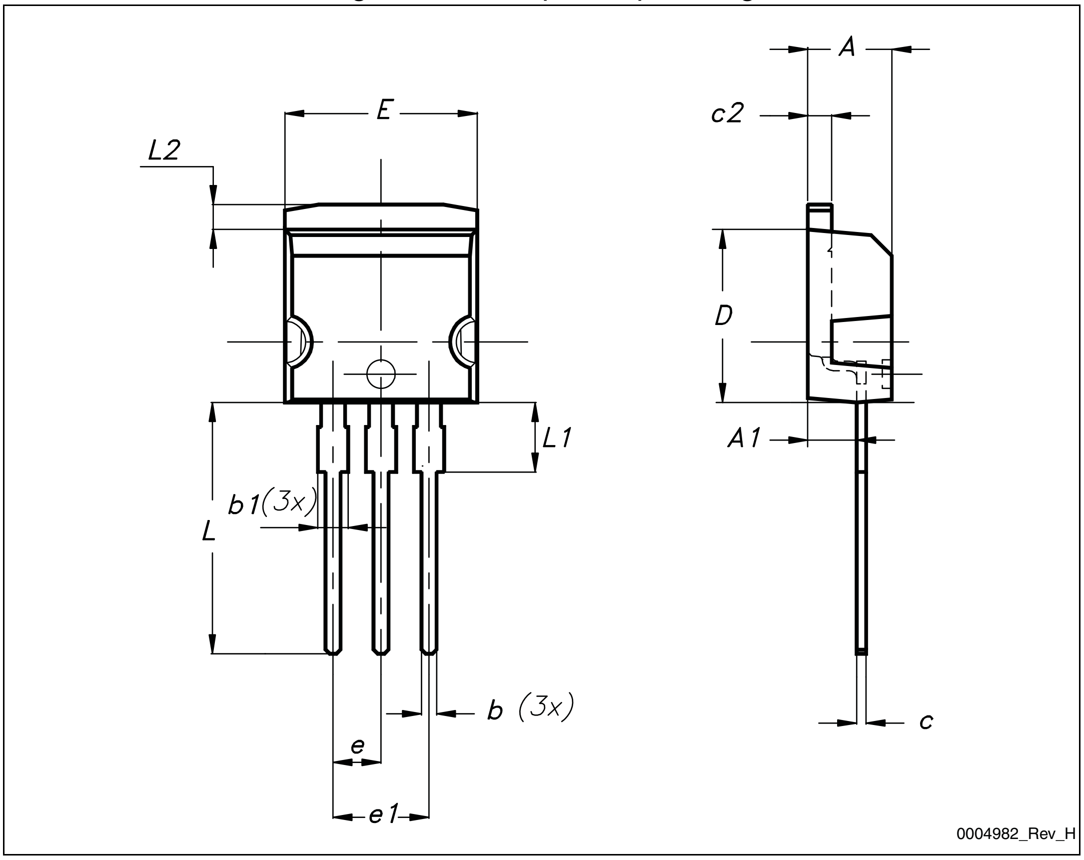
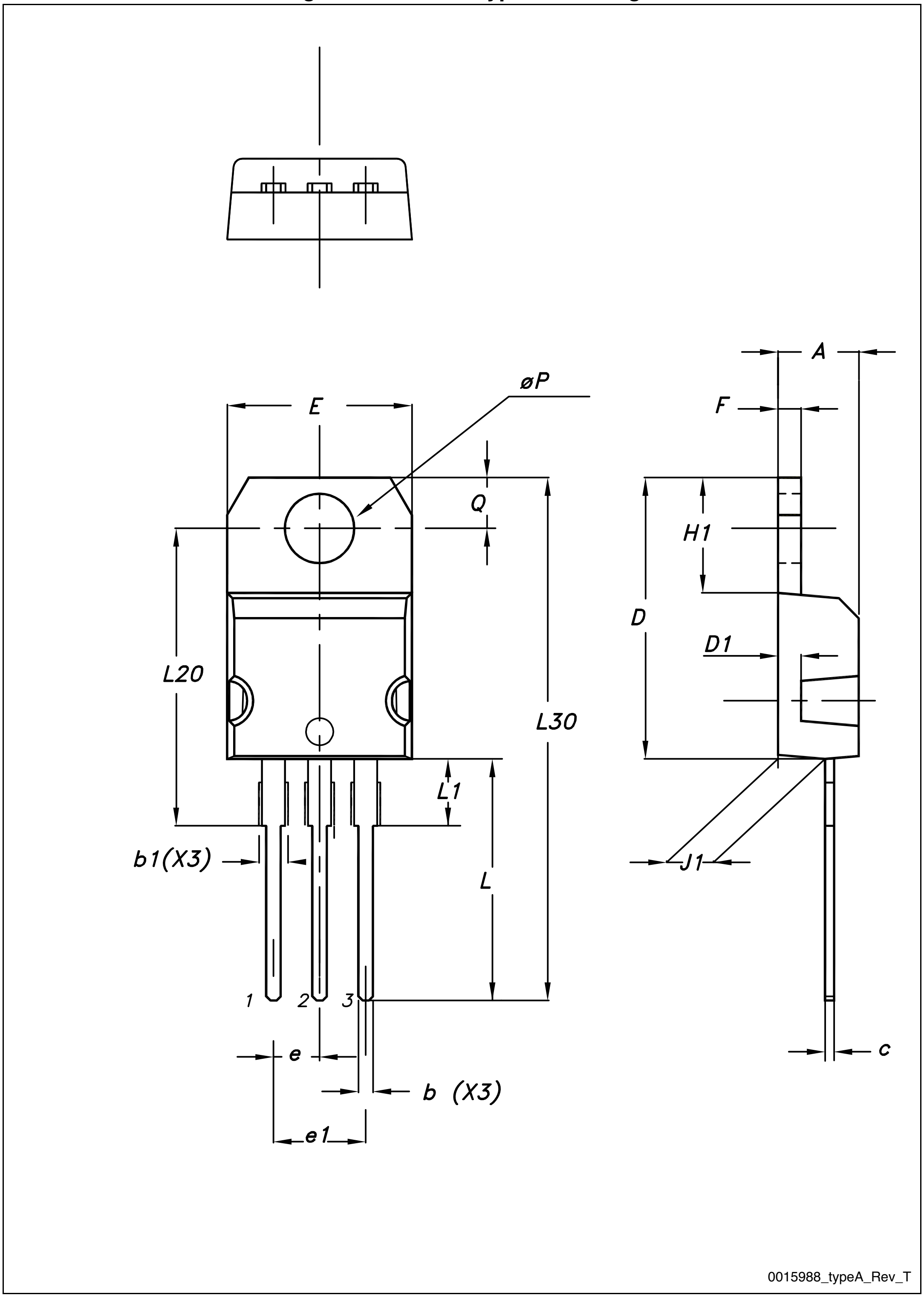


Table 10. TO-220 type A mechanical data

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	
∅P	3.75		3.85
Q	2.65		2.95

Figure 19. TO-220 type A drawing



5 Packaging mechanical data

Table 11. D²PAK (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			

Figure 20. Tape for D²PAK (TO-263)

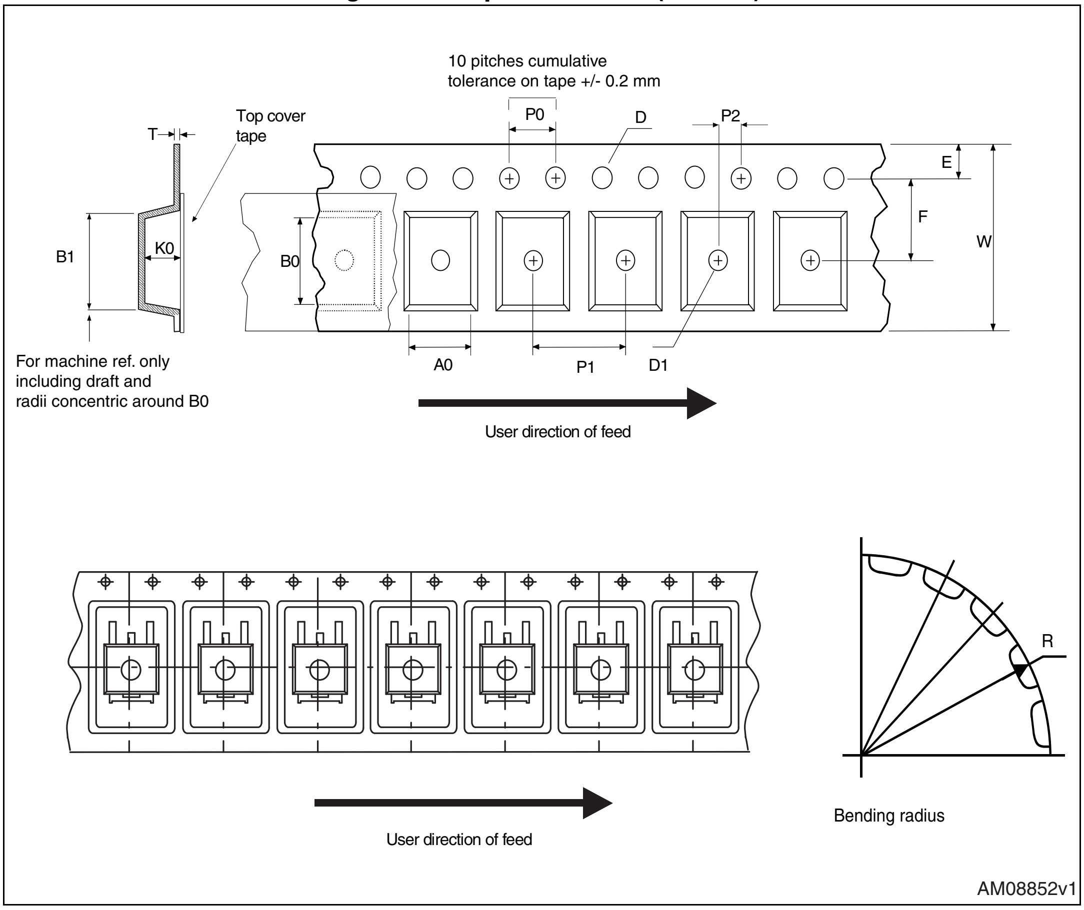
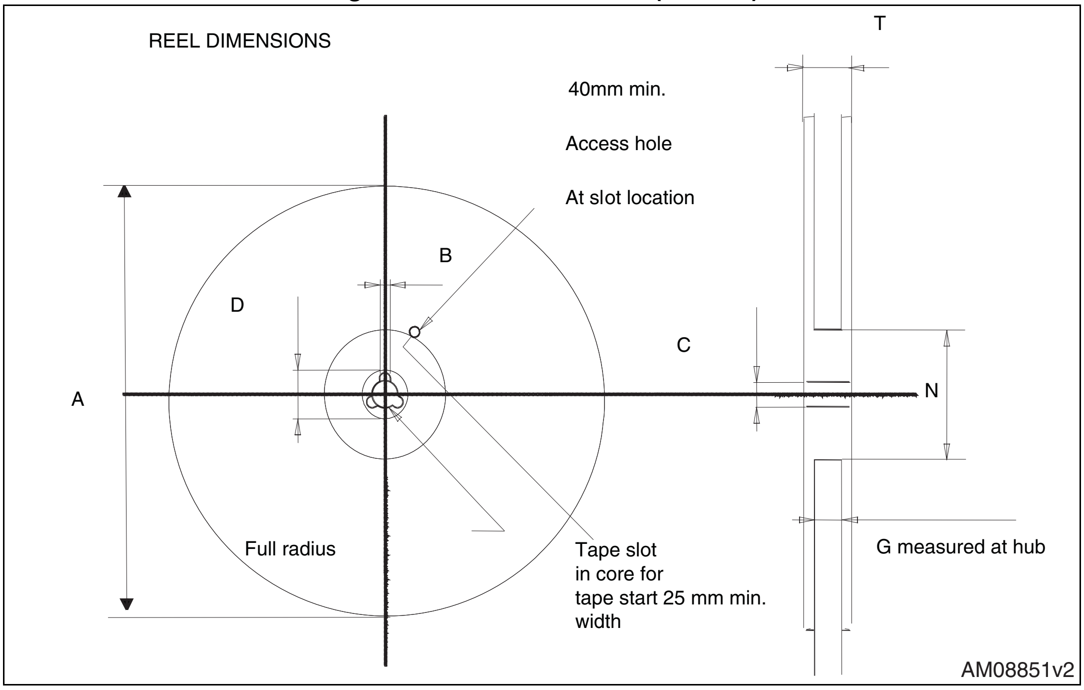


Figure 21. Reel for D²PAK (TO-263)



6 Revision history

Table 12. Document revision history

Date	Revision	Changes
29-Mar-2006	1	Initial release.
03-Jun-2009	2	Document status promoted from preliminary data to datasheet.
05-Nov-2009	3	Inserted *Chapter 2.1: Electrical characteristics (curves)*
16-Feb-2010	4	Added new package, mechanical data: TO-220
03-Jun-2010	5	– Added *Figure 12: Thermal impedance* – Modifed *Figure 4*, *Figure 5*, *Figure 6* and *Figure 7* – D^2PAK mechanical data has been updated
28-May-2013	6	– Updated title in cover page, *Chapter 5: Packaging mechanical data* and *Chapter 5: Packaging mechanical data*.