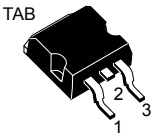
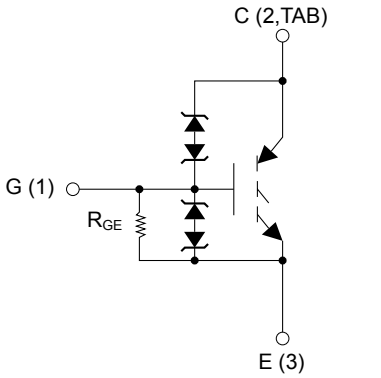
STGB20NB41LZT4

Datasheet

Automotive-grade 412 V, 20 A internally clamped IGBT in a D²PAK package



D²PAK



IGBTG1CTABE3ESD

Features

- AEC-Q101 qualified
- ESD gate-emitter protection
- Gate-collector high voltage clamping
- Logic level gate driving
- Very low saturation voltage
- High current capability

Applications

- Automotive ignition coil driver circuit

Description

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH IGBTs, with outstanding performances. The built-in collector-gate Zener exhibits a very precise active clamping while the gate-emitter Zener supplies an ESD protection.

Product status link
STGB20NB41LZT4

Product summary	
Order code	STGB20NB41LZT4
Marking	GB20NB41LZ
Package	D²PAK
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	$V_{CES(clamped)}$	V
V_{ECR}	Emitter-collector voltage	20	V
I_C	Continuous collector current at T_C = 25 °C	40	A
	Continuous collector current at T_C = 100 °C	20	
I_{CP} (1)	Pulsed collector current	80	A
V_{GE}	Gate-emitter voltage	$V_{GE(clamped)}$	V
E_{as}	Single pulse energy	700	mJ
P_{TOT}	Total power dissipation at T_C = 25 °C	200	W
ESD	Human body model, R = 1.5 kΩ, C = 100 pF	8	kV
T_{stg}	Storage temperature range	-55 to 175	°C
T_J	Operating junction temperature range		°C

1. *Pulse width limited by maximum junction temperature.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.75	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	62.5	°C/W

2 Electrical characteristics

T_J = 25 °C unless otherwise specified

Table 3. Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CES(clamped)}$	Collector-emitter clamped voltage	I_C = 2 mA, V_{GE} = 0 V, T_J= - 40 °C to 150 °C	382	412	442	V
$V_{(BR)ECR}$	Emitter-collector break-down voltage	I_C = 75 mA	20	28		V
$V_{GE(clamped)}$	Gate-emitter clamped voltage	I_G = ±2 mA	12	14	16	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 4.5 V, I_C = 10 A		1.1	1.8	V
		V_{GE} = 4.5 V, I_C = 20 A		1.3	2.0	
$V_{GE(th)}$	Gate threshold voltage	V_{GE} = V_{CE}, I_C = 250 µA,	1.0		2.4	V
I_{CES}	Collector cut-off current	V_{CE} = 15 V, V_{GE} = 0 V, T_J = 150 °C (1)			10	µA
		V_{CE} = 200 V, V_{GE} = 0 V, T_J = 150 °C (1)			100	
I_{GES}	Gate-emitter leakage current	V_{GE} = ±10 V, V_{CE} = 0 V	±0.3	±0.66	±1.0	mA
R_{GE}	Gate-emitter resistance		10	15	30	kΩ

1. *Specified by design, not tested in production.*

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward transconductance	V_{CE} = 25 V, I_C =20 A	-	35	-	S
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	2300	-	pF
C_{oes}	Output capacitance		-	160	-	pF
C_{res}	Reverse transfer capacitance		-	25	-	pF
Q_g	Total gate charge	V_{CE} = 320 V, I_C = 20 A, V_{GE} = 5 V	-	46	-	nC

Table 5. Functional characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
II	Latching current	$V_{(clamp)}$ = 320 V, T_J = 125 °C $R_{G(off)}$ = 1 kΩ , V_{GE} = 10 V		40	-	A
UIS	Functional test open secondary coil	$R_{G(off)}$ = 1 kΩ , L = 1.6 mH, T_J = 125 °C	20		-	A

Table 6. Inductive load switching characteristics (on)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 320 V, I_C = 20 A, V_{GE} = 5 V, R_G = 1 kΩ	-	1	-	µs
t_r	Rise time		-	0.22	-	µs
$di/dt_{(on)}$	Turn-on current slope		-	140	-	A/µs
E_{on}	Turn-on switching energy		-	5	-	mJ
E_{on}	Turn-on switching energy	V_{CC} = 320 V, I_C = 20 A, V_{GE} = 5 V, R_G = 1 kΩ, T_J = 150 °C	-	5.1	-	mJ

Table 7. Inductive load switching characteristics (off)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	V_{CC} = 320 V, I_C = 20 A, R_G = 1 kΩ, V_{GE} = 5 V	-	12.1	-	µs
$t_{r(v)}$	Voltage rise time		-	2.5	-	µs
$t_{f(i)}$	Current fall time		-	1.6	-	µs
$t_{c(off)}$	Crossing time		-	4.4	-	µs
E_{off} (1)	Turn-off switching energy		-	12.9	-	ms
$t_{d(v)}$	Voltage delay time	V_{CC} = 320 V, I_C = 20 A, R_G = 1 kΩ, V_{GE} = 5 V, T_J = 125 °C	-	13.4	-	µs
$t_{r(v)}$	Voltage rise time		-	3.16	-	µs
$t_{f(i)}$	Current fall time		-	2.7	-	µs
$t_{c(off)}$	Crossing time		-	6	-	µs
E_{off} (1)	Turn-off switching energy		-	18.4	-	ms

1. *Including the tail of the collector current.*

2.1 Electrical characteristics (curves)

Figure 1. Typical output characteristics

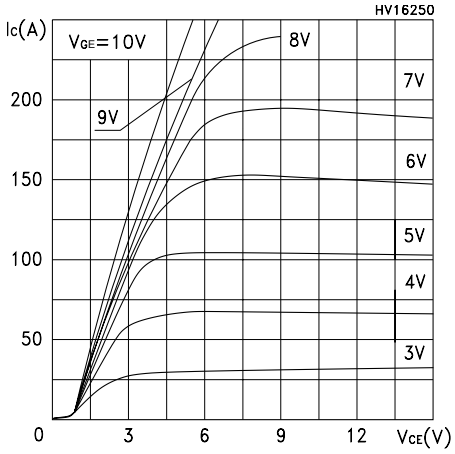


Figure 2. Typical transfer characteristics

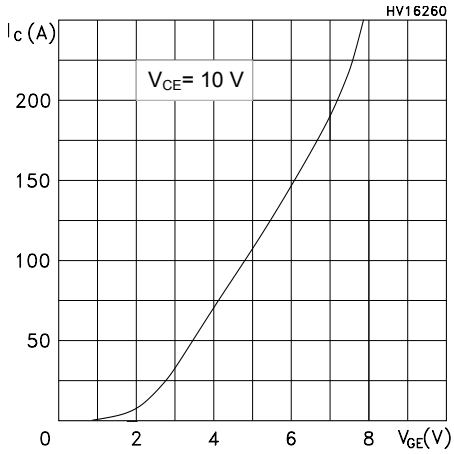


Figure 3. Normalized $V_{GE(th)}$ vs temperature

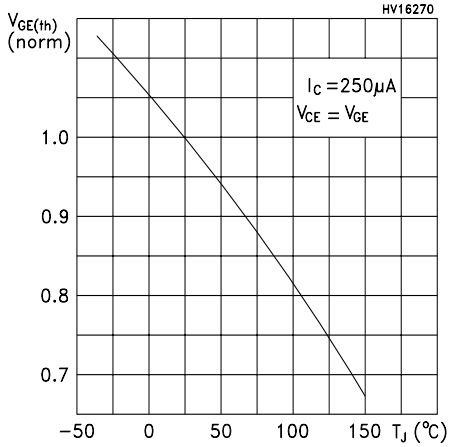


Figure 4. Typical transconductance characteristics

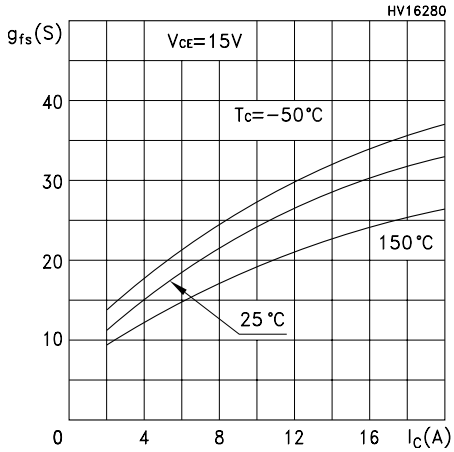


Figure 5. Normalized $V_{CE(sat)}$ vs temperature

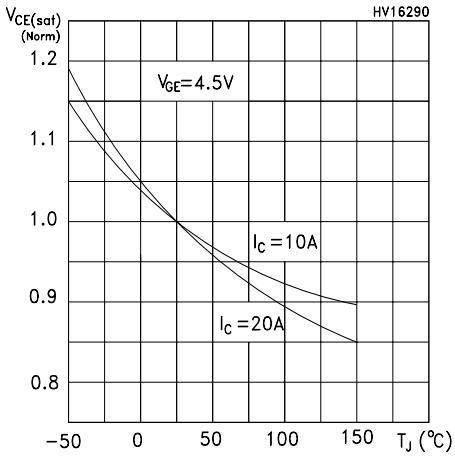


Figure 6. Typical $V_{CE(sat)}$ vs V_{GE}

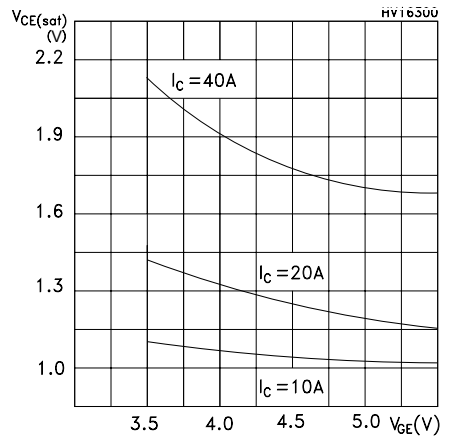


Figure 7. Typical capacitance characteristics

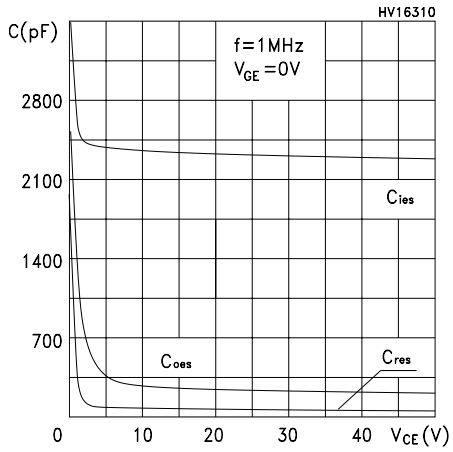


Figure 8. Typical gate charge characteristics

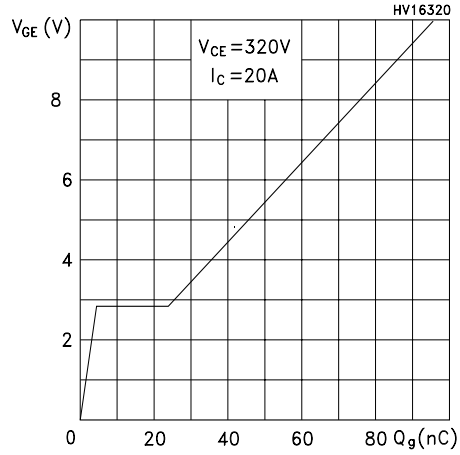


Figure 9. Typical switching energy vs R_G

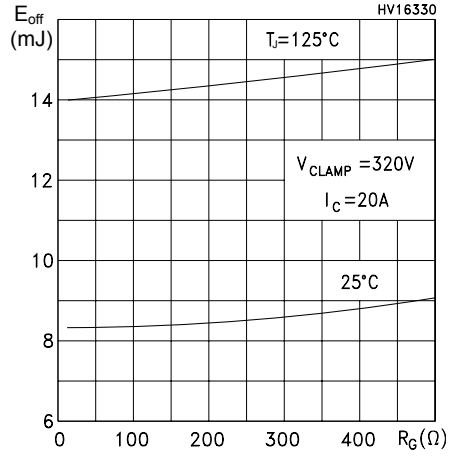


Figure 10. Typical switching energy vs collector current

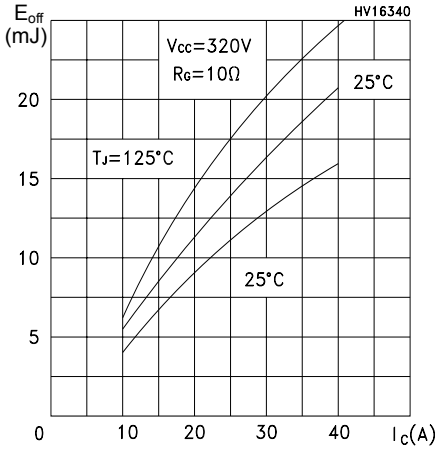


Figure 11. Normalized collector-emitter clamped voltage

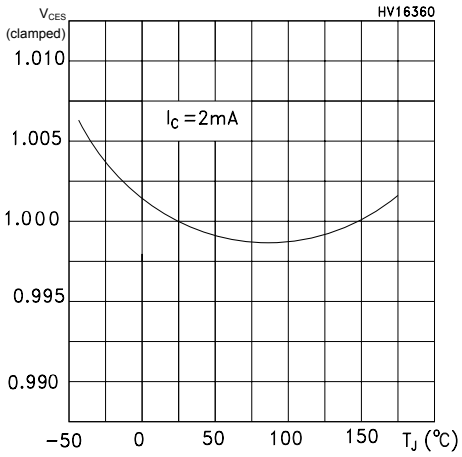


Figure 12. Normalized gate-emitter clamped voltage

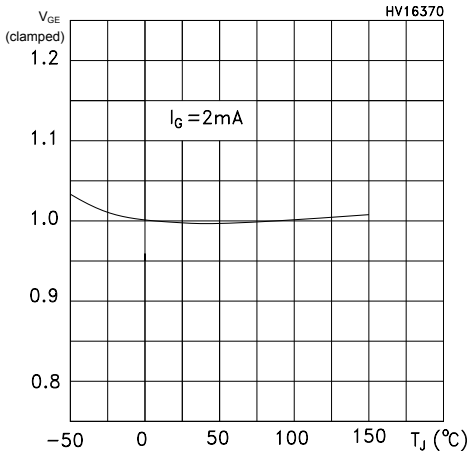


Figure 13. Typical switching energy vs temperature

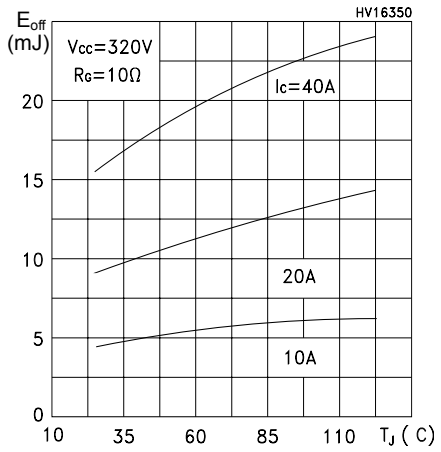


Figure 14. Safe operating area

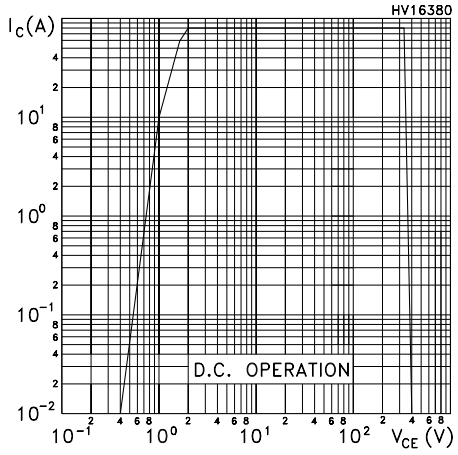
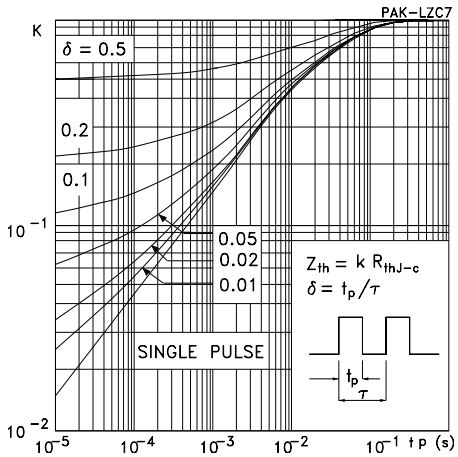


Figure 15. Normalized transient thermal impedance



3 Package information

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.

3.1 D²PAK (TO-263) type A package information

Figure 16. **D²PAK (TO-263) type A package outline**

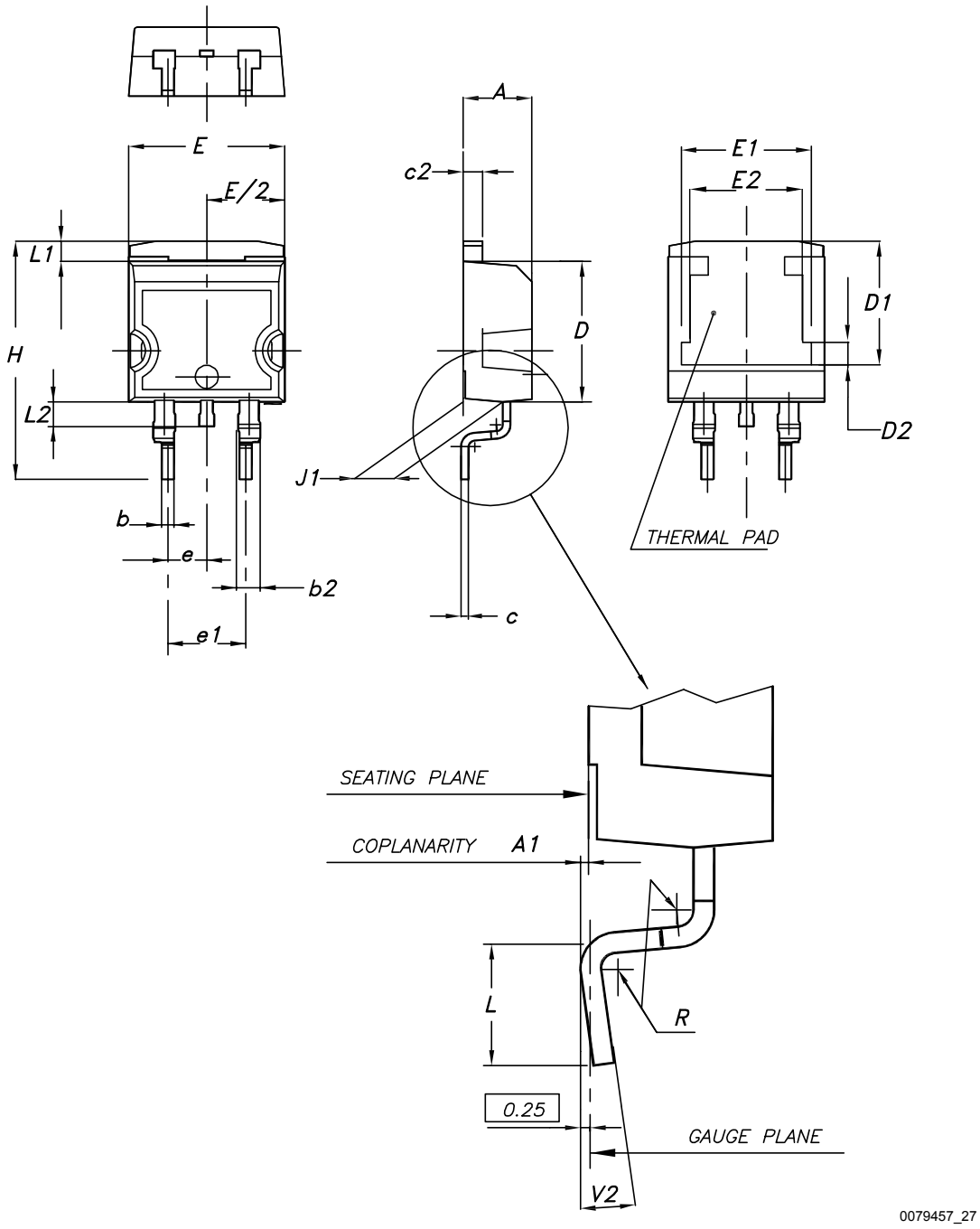
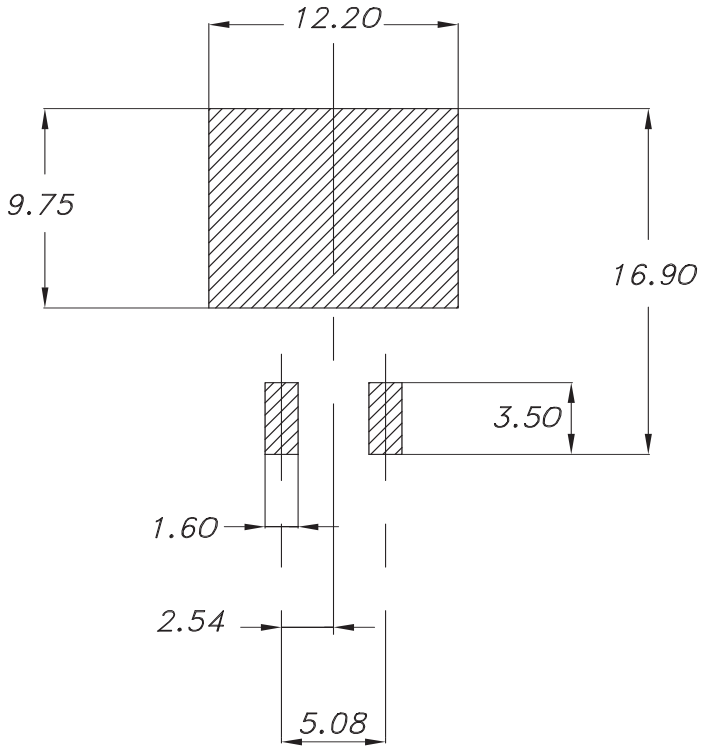


Table 8. D²PAK (TO-263) type A package mechanical data

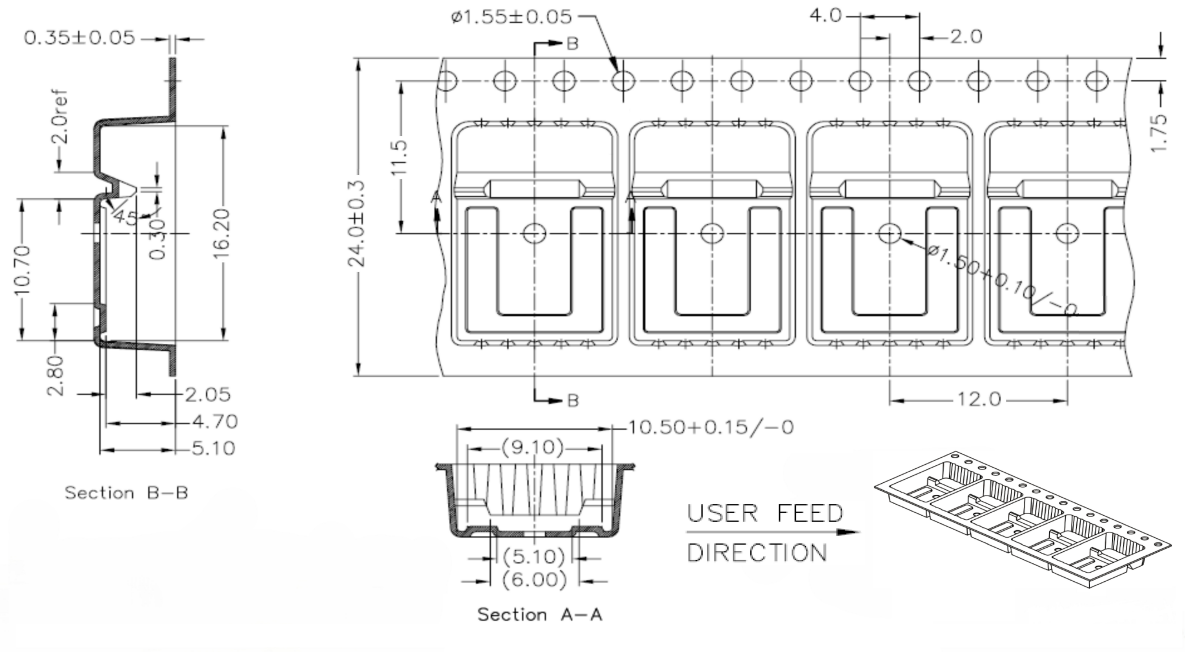
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 17. D²PAK (TO-263) recommended footprint (dimensions are in mm)



3.2 D²PAK packing information

Figure 18. D²PAK tape drawing



DM01095771_1

Revision history

Table 9. **Document revision history**

Date	Revision	Changes
25-Oct-2024	1	First release.

Contents