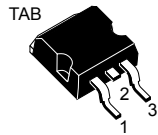
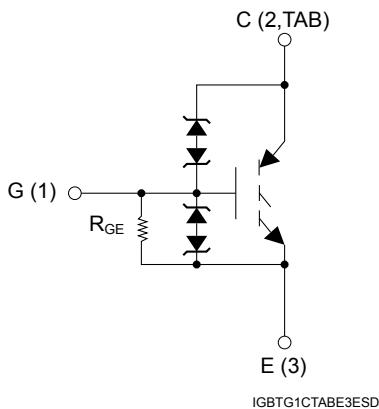



Automotive-grade 412 V, 20 A internally clamped IGBT in a D²PAK package

 D²PAK


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	D ² PAK
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)	$V_{CES(\text{clamped})}$	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	$V_{GE(\text{clamped})}$	V
E_{as}	Single pulse energy	700	mJ
P_{TOT}	Total power dissipation at $T_C = 25$ °C	200	W
ESD	Human body model, $R = 1.5$ k Ω , $C = 100$ 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

$T_J = 25\text{ °C}$ 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 150 °C	382	412	442	V
$V_{(BR)ECR}$	Emitter-collector break-down voltage	$I_C = 75\text{ mA}$	20	28		V
$V_{GE(\text{clamped})}$	Gate-emitter clamped voltage	$I_G = \pm 2\text{ mA}$	12	14	16	V
$V_{CE(\text{sat})}$	Collector-emitter saturation voltage	$V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$		1.1	1.8	V
		$V_{GE} = 4.5\text{ V}$, $I_C = 20\text{ A}$		1.3	2.0	
$V_{GE(\text{th})}$	Gate threshold voltage	$V_{GE} = V_{CE}$, $I_C = 250\text{ }\mu\text{A}$,	1.0		2.4	V
I_{CES}	Collector cut-off current	$V_{CE} = 15\text{ V}$, $V_{GE} = 0\text{ V}$, $T_J = 150\text{ °C}$ ⁽¹⁾			10	μA
		$V_{CE} = 200\text{ V}$, $V_{GE} = 0\text{ V}$, $T_J = 150\text{ °C}$ ⁽¹⁾			100	
I_{GES}	Gate-emitter leakage current	$V_{GE} = \pm 10\text{ V}$, $V_{CE} = 0\text{ V}$	± 0.3	± 0.66	± 1.0	mA
R_{GE}	Gate-emitter resistance		10	15	30	k Ω

1. Specified by design, not tested in production.

Table 4. Dynamic characteristics

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

Table 5. Functional characteristics

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

Table 6. Inductive load switching characteristics (on)

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

Table 7. Inductive load switching characteristics (off)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	$V_{CC} = 320\text{ V}$, $I_C = 20\text{ A}$, $R_G = 1\text{ k}\Omega$, $V_{GE} = 5\text{ V}$	-	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	$V_{CC} = 320\text{ V}$, $I_C = 20\text{ A}$, $R_G = 1\text{ k}\Omega$, $V_{GE} = 5\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	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

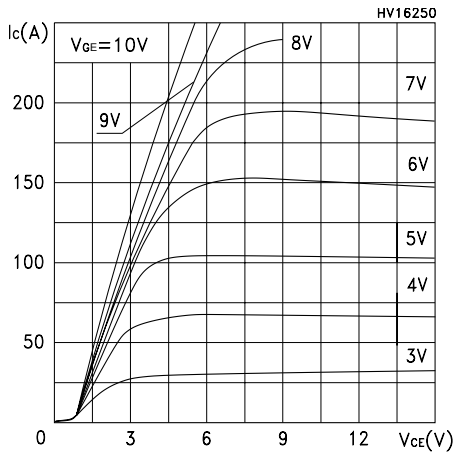


Figure 2. Typical transfer characteristics

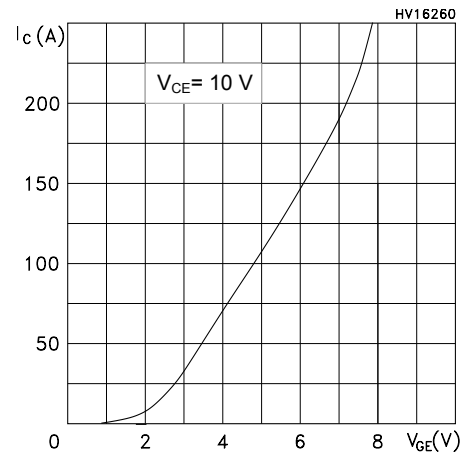


Figure 3. Normalized $V_{GE(th)}$ vs temperature

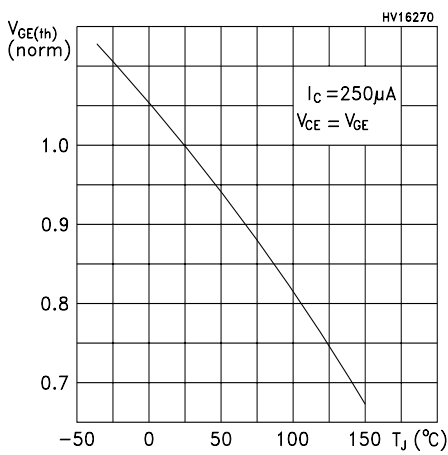


Figure 4. Typical transconductance characteristics

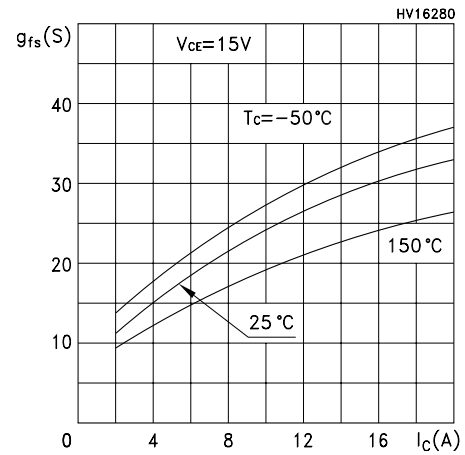


Figure 5. Normalized $V_{CE(sat)}$ vs temperature

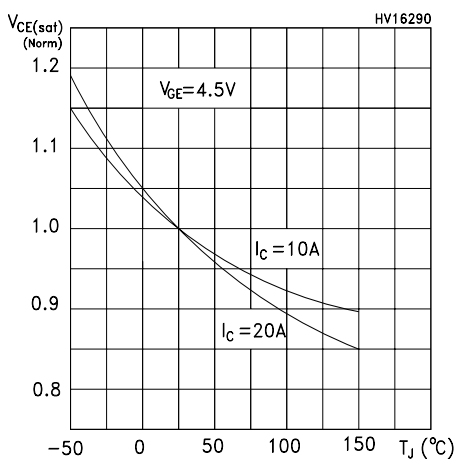


Figure 6. Typical $V_{CE(sat)}$ vs V_{GE}

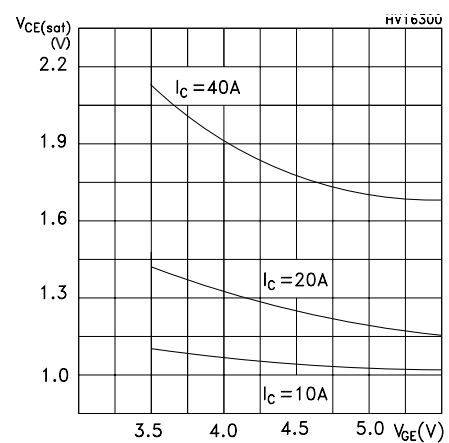


Figure 7. Typical capacitance characteristics

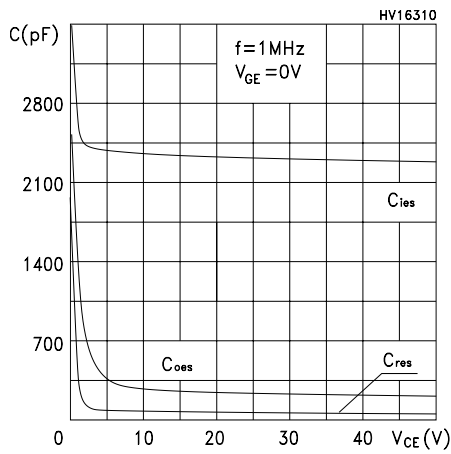


Figure 8. Typical gate charge characteristics

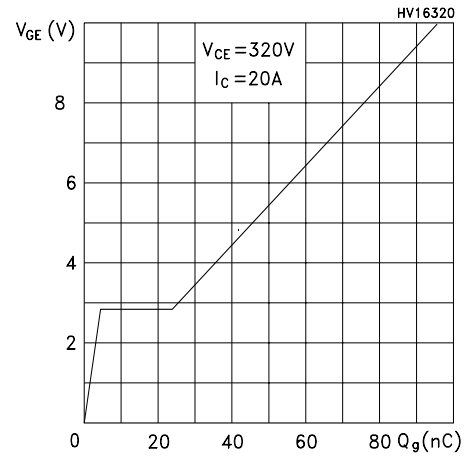


Figure 9. Typical switching energy vs R_G

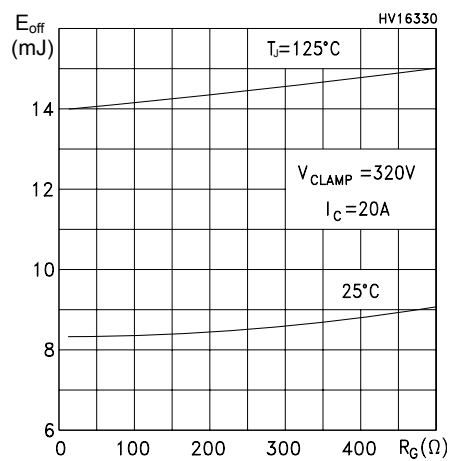


Figure 10. Typical switching energy vs collector current

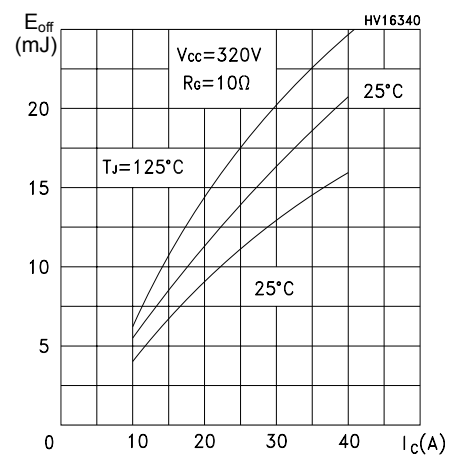


Figure 11. Normalized collector-emitter clamped voltage

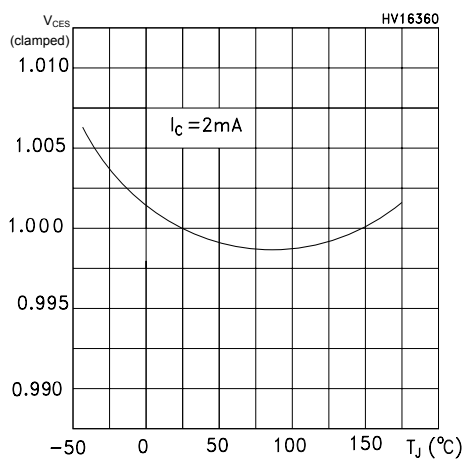


Figure 12. Normalized gate-emitter clamped voltage

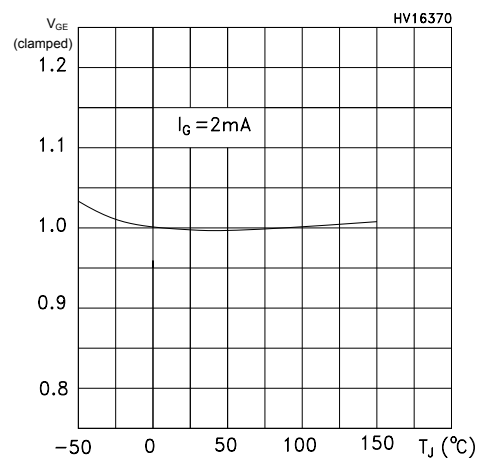


Figure 13. Typical switching energy vs temperature

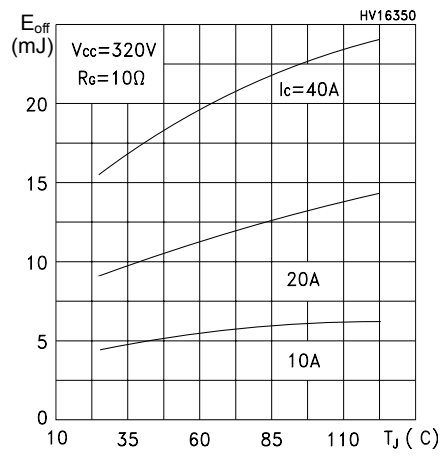


Figure 14. Safe operating area

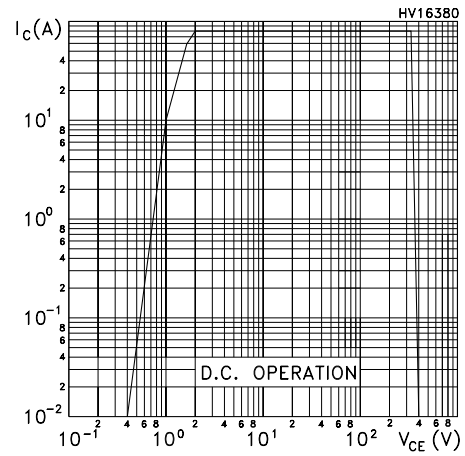
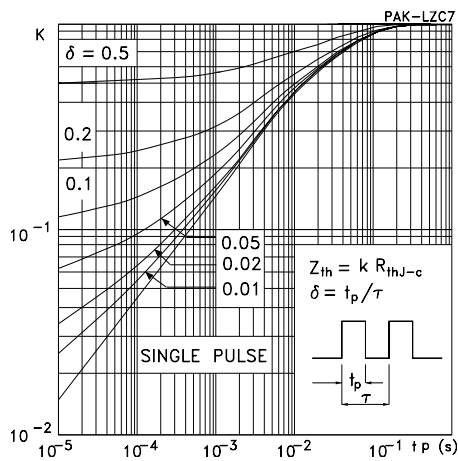


Figure 15. Normalized transient thermal impedance

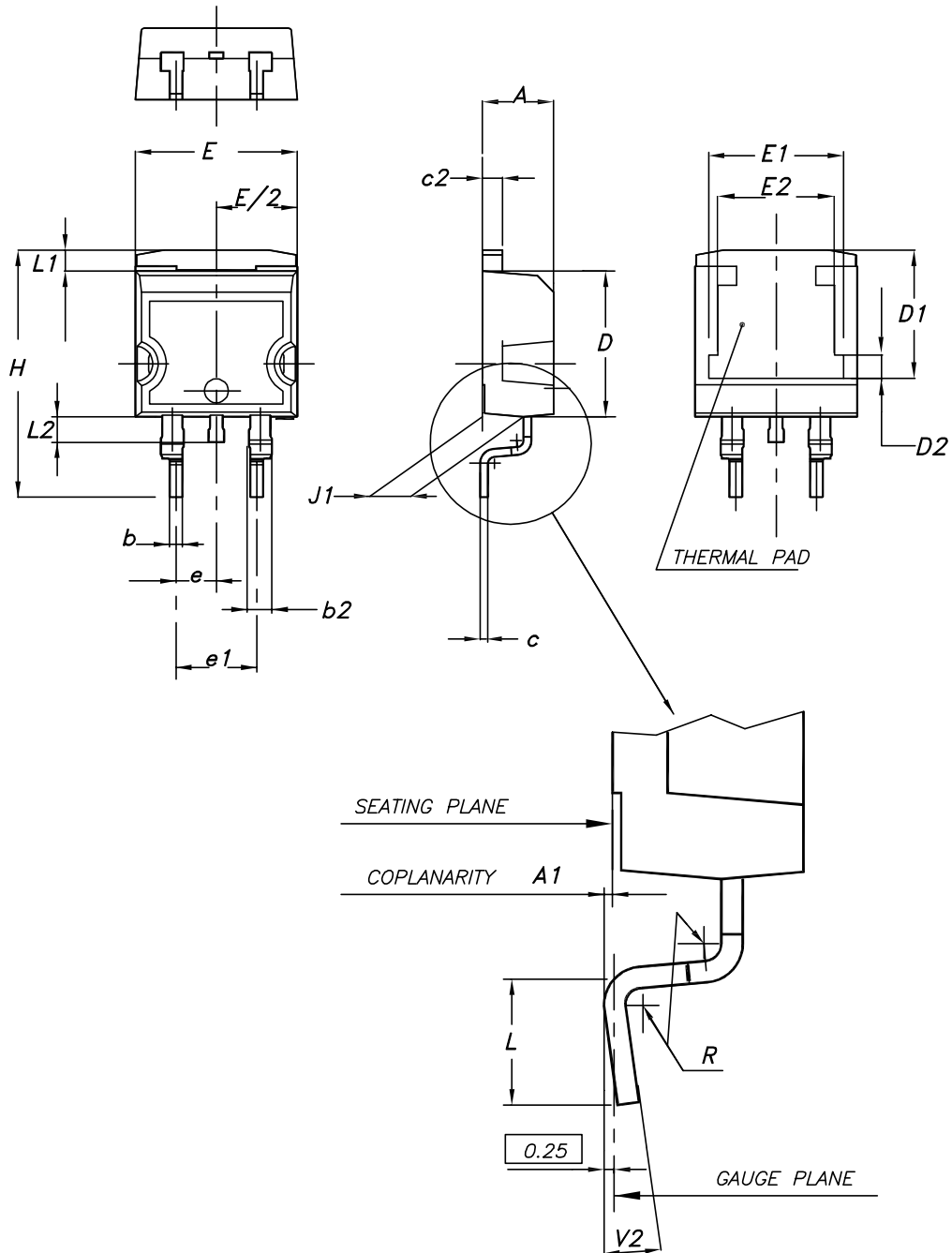


3 Package information

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

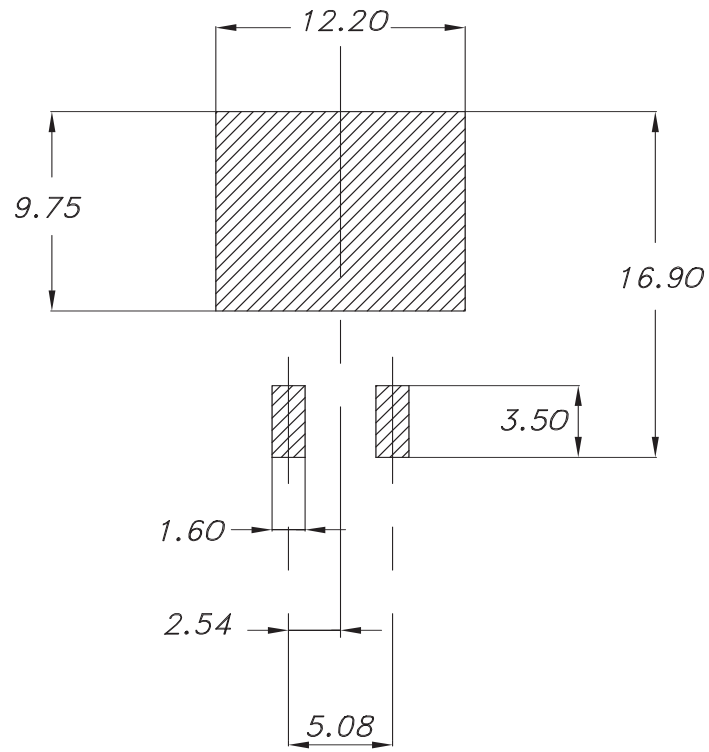


0079457_27

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°

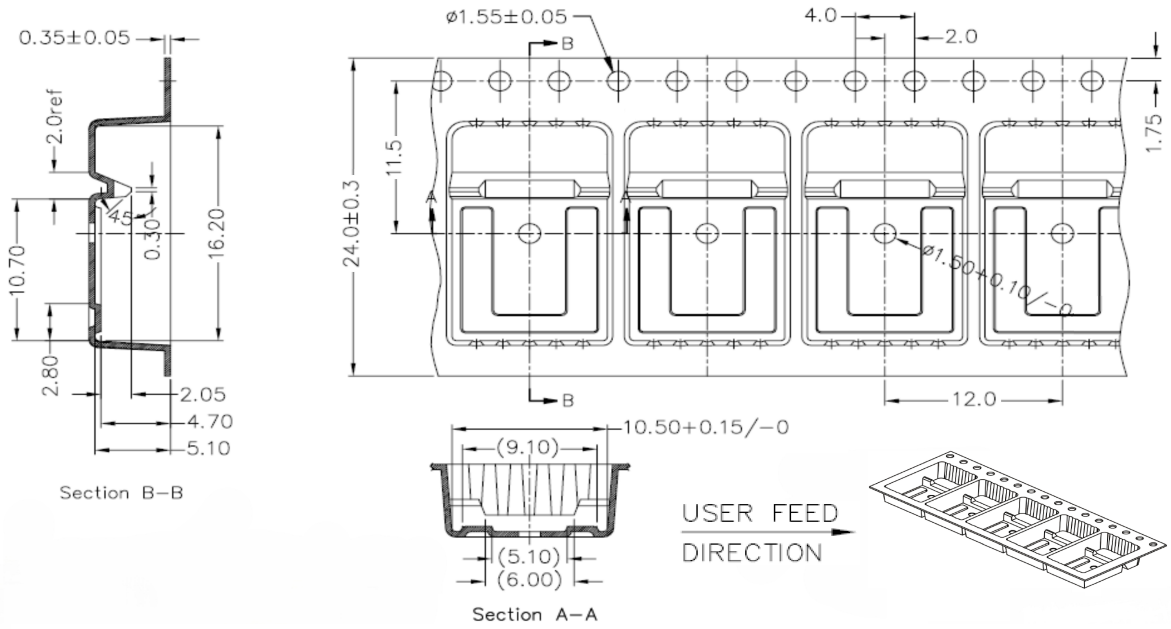
Figure 17. D²PAK (TO-263) recommended footprint (dimensions are in mm)



0079457_Rev27_footprint

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.

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