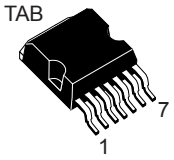
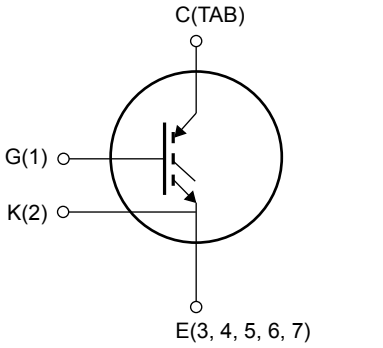
STGH50H65B2-7AG

Datasheet

Automotive-grade trench gate field-stop 650 V, 50 A high-speed HB2 series IGBT in an H2PAK-7 package



H²PAK-7



IGBTG1K2E34567CTAB_no_diode

Features

- AEC-Q101 qualified
- Maximum junction temperature: T_J = 175 °C
- High speed switching series
- Minimized tail current
- Low $V_{CE(sat)}$ = 1.6 V (typ.) @ I_C = 50 A
- Tight parameter distribution
- Low thermal resistance
- Positive $V_{CE(sat)}$ temperature coefficient
- Excellent switching performance thanks to the extra driving kelvin pin

Application

- On board charger (OBC)
- PFC converter - single phase input
- LLC resonant converter
- High frequency converters

Description

The newest IGBT 650 V HB2 series represents an evolution of the advanced proprietary trench gate field-stop structure. The performance of the HB2 series is optimized in terms of conduction, thanks to a better $V_{CE(sat)}$ behavior at low current values, as well as in terms of reduced switching energy.

Product status link
STGH50H65B2-7AG

Product summary	
Order code	STGH50H65B2-7AG
Marking	G50H65B2AG
Package	H²PAK-7
Packing	Tape and reel

1 Electrical ratings

T_J = 25 °C unless otherwise specified.

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	650	V
I_C	Continuous collector current at T_C = 25 °C	108(1)	A
	Continuous collector current at T_C = 100 °C	68	
I_{CP}(2)	Pulsed collector current (t_p ≤ 1 µs, T_J < 175 °C)	200	A
V_{GE}	Gate-emitter voltage	±20	V
	Transient gate-emitter voltage (t_p ≤ 10 µs)	±30	
P_{TOT}	Total power dissipation at T_C = 25 °C	385	W
T_{STG}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range	-55 to 175	°C

1. *Limited by package.*
2. *Defined by R_{thJC} and limited by maximum junction temperature, not tested in production.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.39	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	50	°C/W

2 Electrical characteristics

T_J = 25 °C unless otherwise specified.

Table 3. Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	V_{GE} = 0 V, I_C = 1 mA	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 50 A		1.6	2.0	V
		V_{GE} = 15 V, I_C = 50 A, T_J = 125 °C		1.8		
		V_{GE} = 15 V, I_C = 50 A, T_J = 175 °C		1.9		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA	5	6	7	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 650 V			25	µA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ±20 V			±100	nA

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	2928	-	pF
C_{oes}	Output capacitance		-	387	-	pF
C_{res}	Reverse transfer capacitance		-	73	-	pF
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 50 A, V_{GE} = 0 to 15 V (see Figure 20. Gate charge test circuit)	-	152	-	nC
Q_{ge}	Gate-emitter charge		-	21	-	nC
Q_{gc}	Gate-collector charge		-	70	-	nC

Table 5. IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	V_{CE} = 400 V, I_C = 50 A, V_{GE} = 15 V, R_G = 4.7 Ω (see Figure 19. Test circuit for inductive load switching)	-	116	-	ns
t_f	Current fall time		-	39	-	ns
E_{off} (1)	Turn-off switching energy		-	527	-	µJ
$t_{d(off)}$	Turn-off delay time	V_{CE} = 400 V, I_C = 50 A, V_{GE} = 15 V, R_G = 4.7 Ω, T_J = 175 °C (see Figure 19. Test circuit for inductive load switching)	-	137	-	ns
t_f	Current fall time		-	77	-	ns
E_{off} (1)	Turn-off switching energy		-	911	-	µJ

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

2.1 Electrical characteristics (curves)

Figure 1. Total power dissipation vs temperature

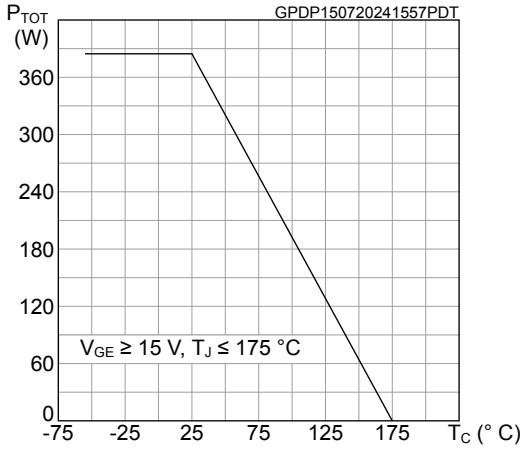


Figure 2. Collector current vs temperature

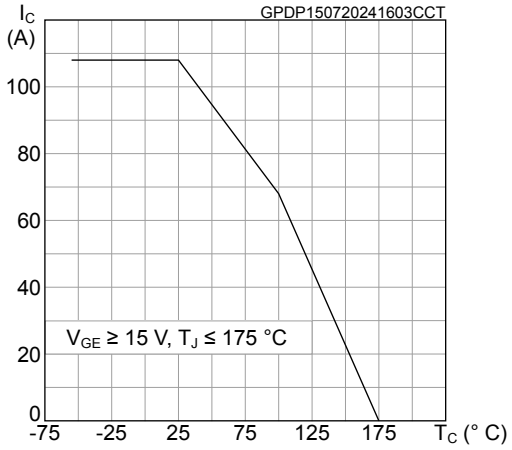


Figure 3. Typical output characteristics (T_J = 25 °C)

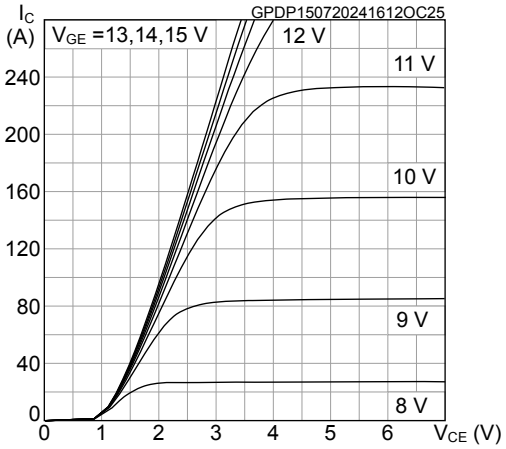


Figure 4. Typical output characteristics (T_J = 175 °C)

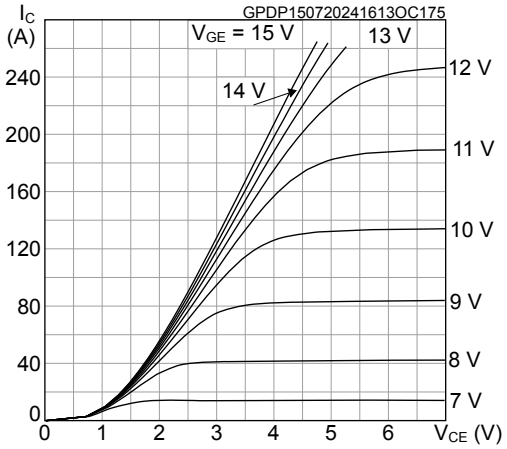


Figure 5. Typical transfer characteristics

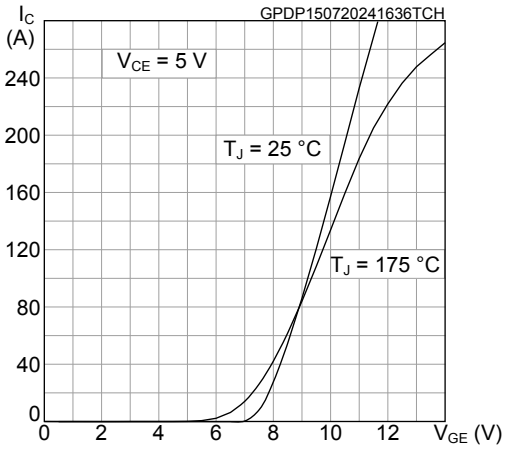


Figure 6. Typical $V_{CE(sat)}$ vs temperature

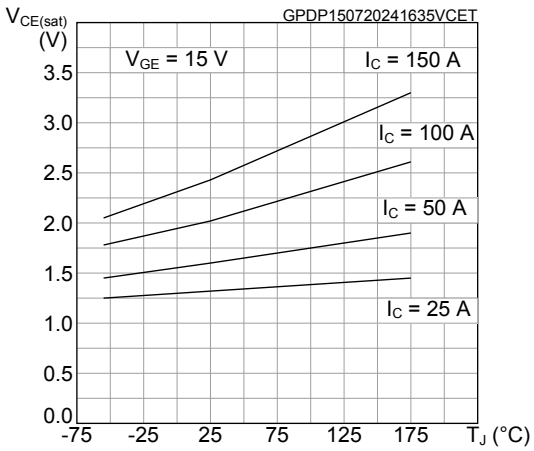


Figure 7. Typical $V_{CE(sat)}$ vs collector current

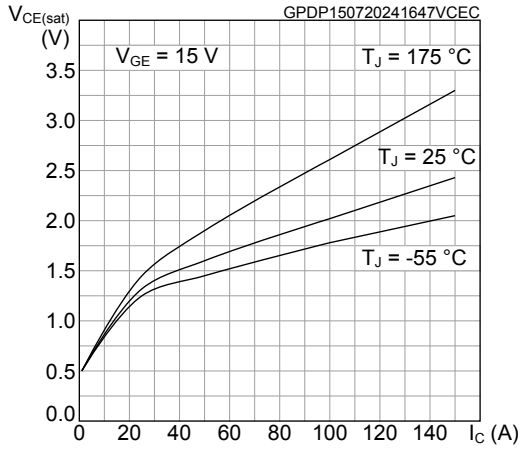


Figure 8. Forward bias safe operating area

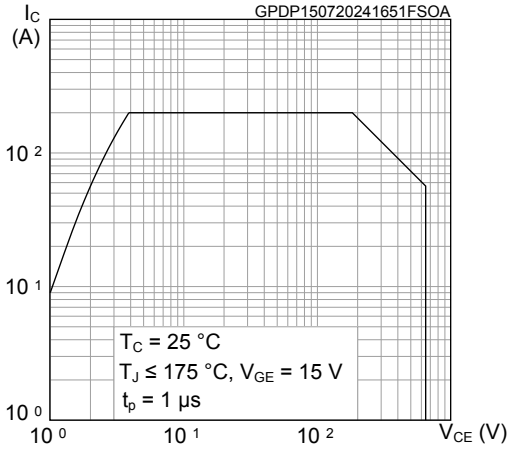


Figure 9. Normalized gate threshold vs temperature

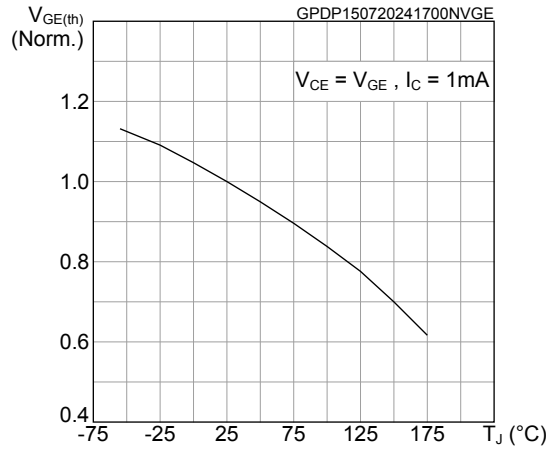


Figure 10. Typical capacitance characteristics

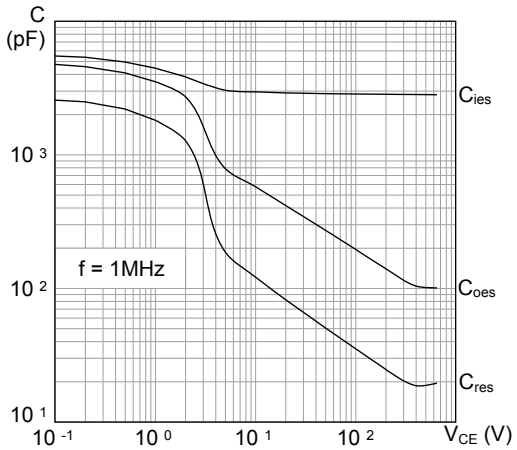


Figure 11. Typical gate charge characteristics

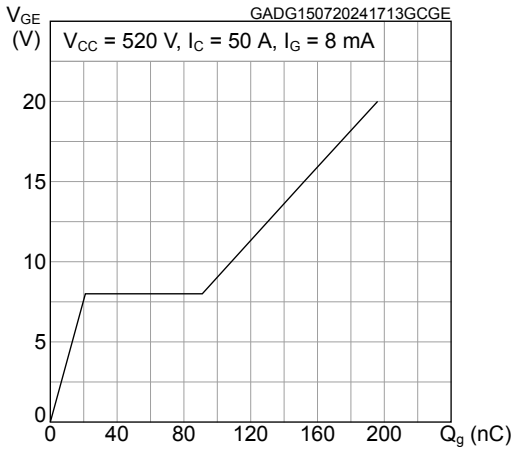


Figure 12. Typical switching energy vs collector current

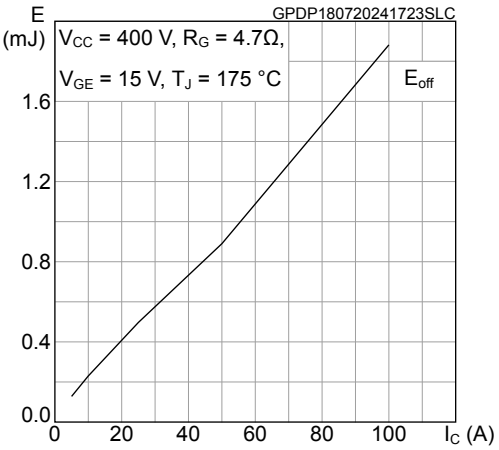


Figure 13. Typical switching energy vs temperature

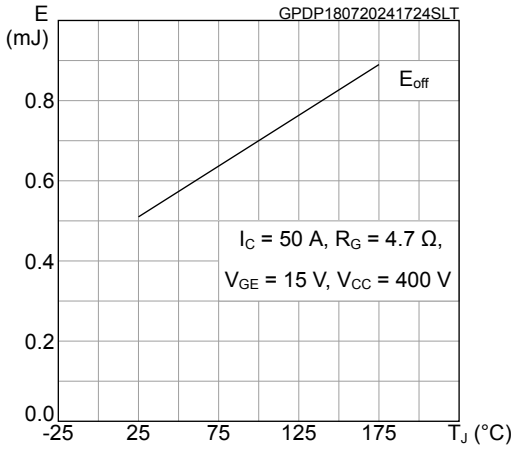


Figure 14. Typical switching energy vs supply voltage

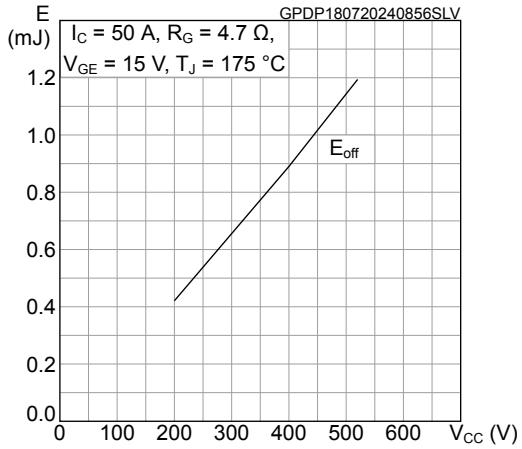


Figure 15. Typical switching energy vs gate resistance

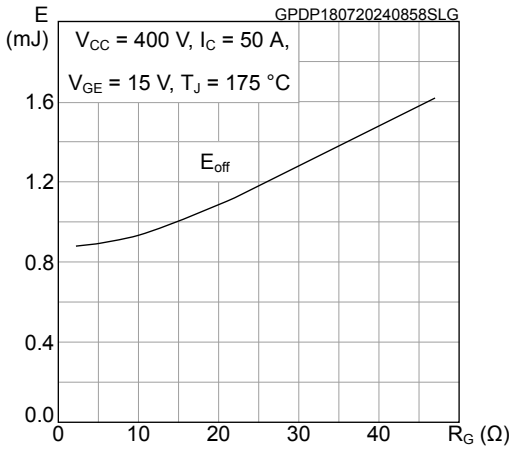


Figure 16. Typical switching times vs collector current

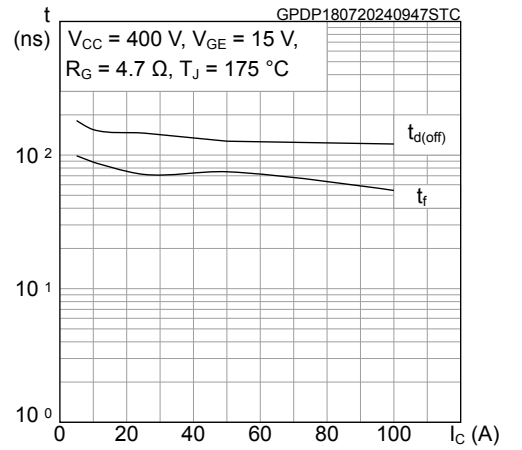


Figure 17. Typical switching times vs gate resistance

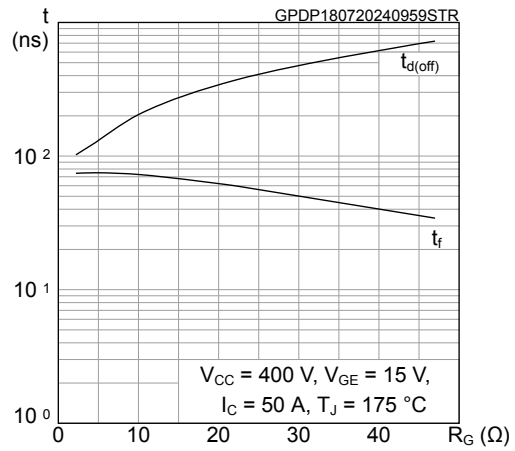
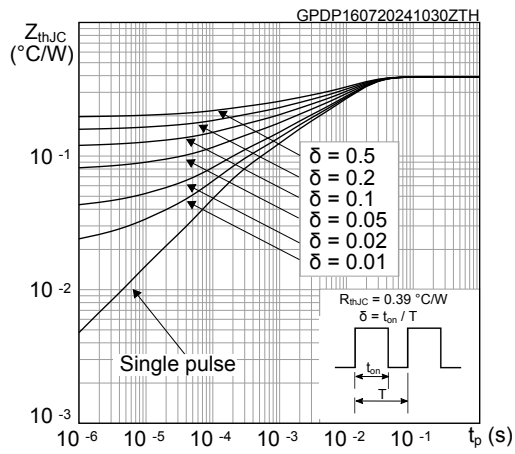


Figure 18. Maximum transient thermal impedance



3 Test circuits

Figure 19. Test circuit for inductive load switching

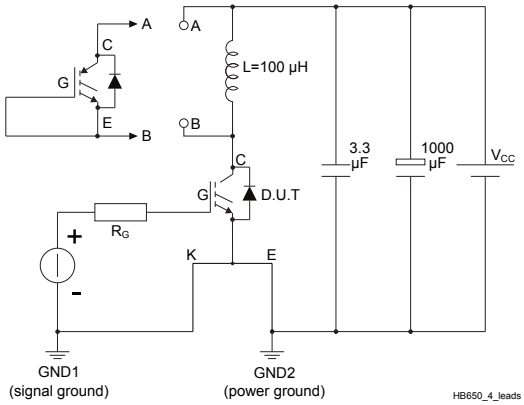


Figure 20. Gate charge test circuit

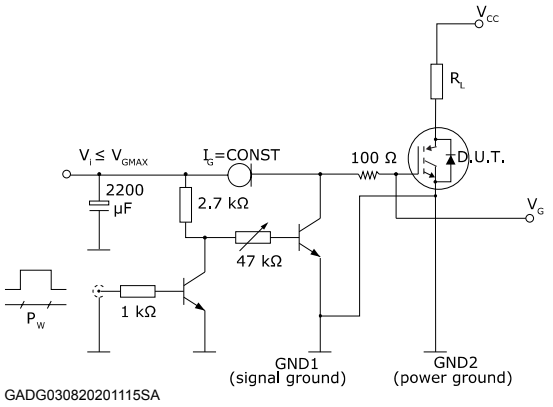
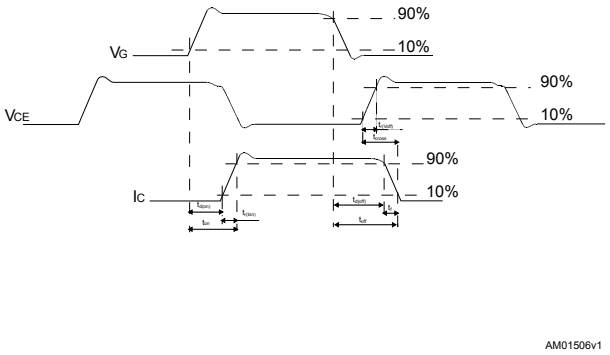


Figure 21. Switching waveform



4 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.

4.1 H²PAK-7 package information

Figure 22. **H²PAK-7 package outline**

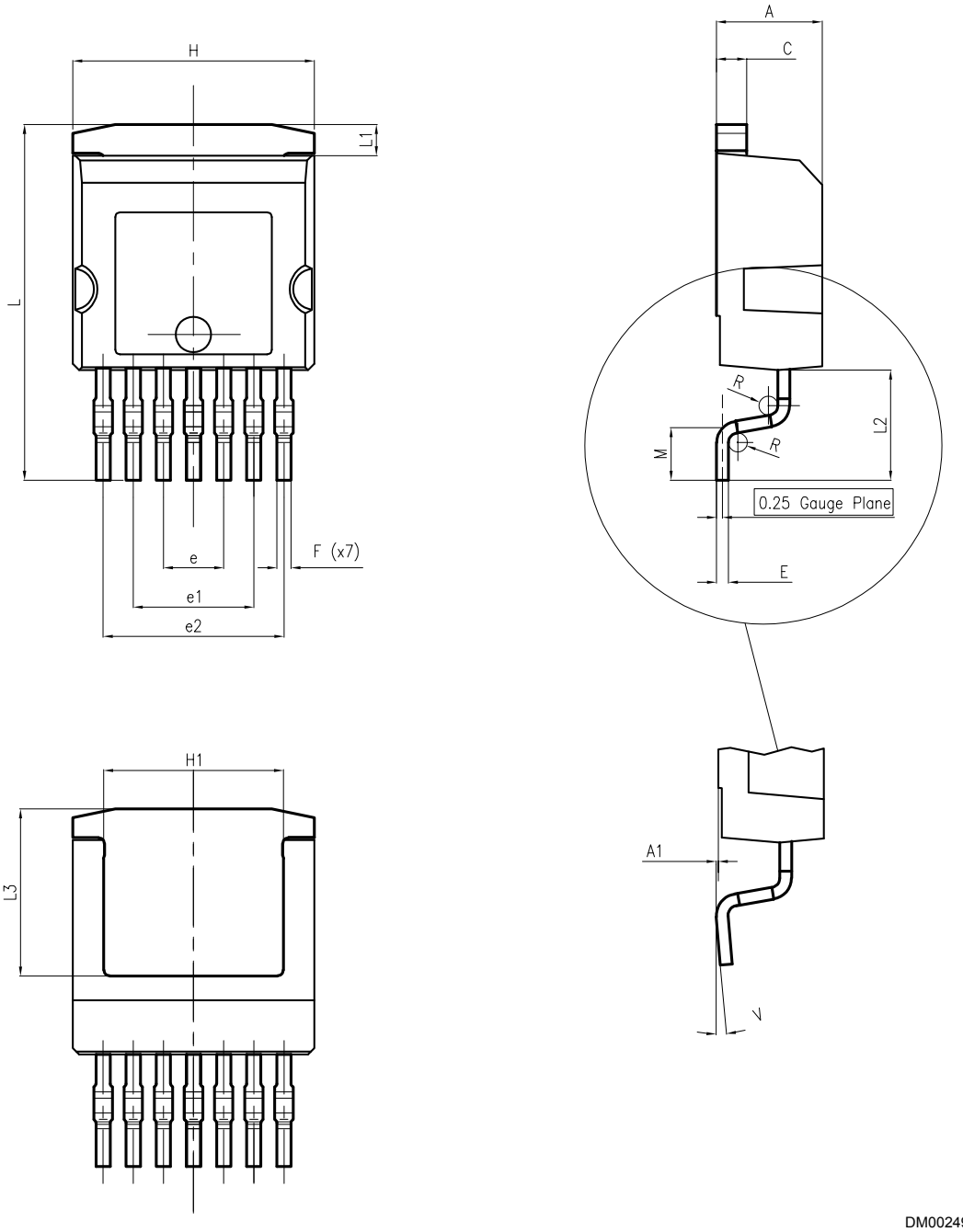


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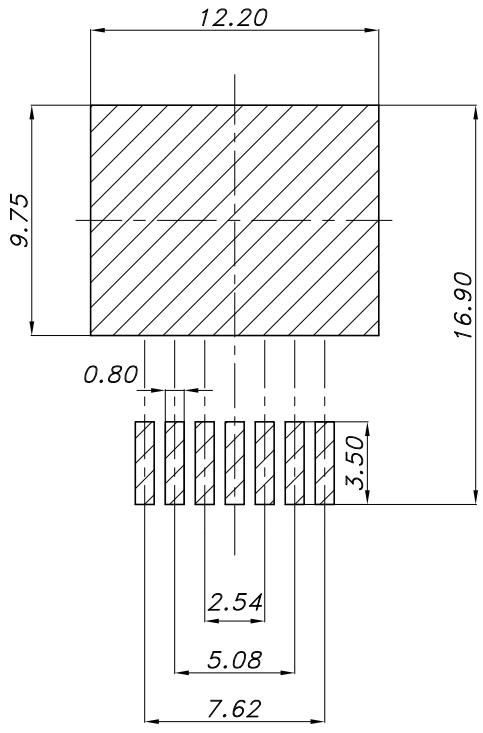
Table 6. **H²PAK-7 package mechanical data**

Dim.	mm	
	Min.	Max.
A	4.30	4.80
A1	0.03	0.20
C	1.17	1.37
e	2.34	2.74
e1	4.88	5.28
e2	7.42	7.82
E	0.45	0.60
F	0.50	0.70
H	10.00	10.40
H1	7.40	8.00
L	14.75	15.25
L1	1.27	1.40
L2	4.35	4.95
L3	6.85	7.25
M	1.90	2.50
R	0.20	0.60
V	0°	8°

Figure 23. **H²PAK-7 recommended footprint**

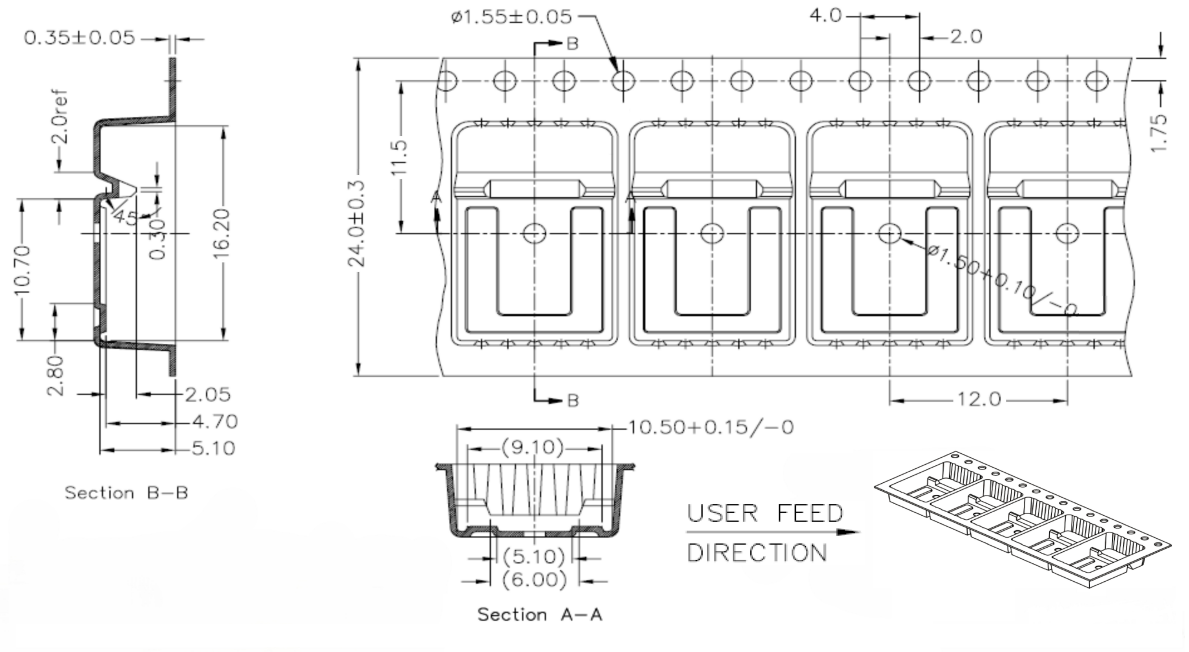


footprint_DM00249216_6

Note: Dimensions are in mm.

4.2 H²PAK-7 packing information

Figure 24. H²PAK-7 tape drawing (dimensions are in mm)



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Revision history

Table 7. **Document revision history**

Date	Revision	Changes
18-Jul-2024	1	First release.
17-Jan-2025	2	Updated *Table 3. Static characteristics*.
12-May-2025	3	Updated Section 4.2: H²PAK-7 packing information.

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