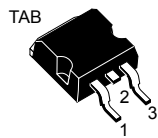
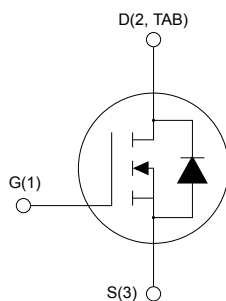


Automotive-grade N-channel 650 V, 58 mΩ typ., 42 A MDmesh M5 Power MOSFET in a D²PAK package


D²PAK


AM01475v1_noZen


Product status link
[STB43N65M5](#)
Product summary

Order code	STB43N65M5
Marking	43N65M5
Package	D ² PAK
Packing	Tape and reel

Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STB43N65M5	650 V	63 mΩ	42 A

- AEC-Q101 qualified
- Extremely low R_{DS(on)}
- Low gate charge and input capacitance
- Excellent switching performance
- 100% avalanche tested



Applications

- Switching applications

Description

This device is an N-channel Power MOSFET based on the MDmesh M5 innovative vertical process technology combined with the well-known PowerMESH horizontal layout. The resulting product offers extremely low on-resistance, making it particularly suitable for applications requiring high power and superior efficiency.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	42	A
	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	26.5	
$I_{DM}^{(1)}$	Drain current (pulsed)	168	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	250	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(3)}$	MOSFET dv/dt ruggedness	50	
T_{stg}	Storage temperature range	-55 to 150	$^{\circ}\text{C}$
T_J	Operating junction temperature range		

1. Pulse width is limited by safe operating area.
2. $I_{SD} \leq 42\text{ A}$, $di/dt = 150\text{ A}/\mu\text{s}$; $V_{DS\text{ peak}} < V_{(BR)DSS}$; $V_{DD} = 80\% V_{(BR)DSS}$.
3. $V_{DS} \leq 520\text{ V}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.5	$^{\circ}\text{C}/\text{W}$
$R_{thJA}^{(1)}$	Thermal resistance, junction-to-ambient	30	

1. When mounted on a standard 1 inch² area of FR-4 PCB with 2-oz copper.

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max.)	7	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	650	mJ

2 Electrical characteristics

$T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	650	-	-	V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 650\text{ V}$	-	-	1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 650\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$	-	-	100	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 25\text{ V}$	-	-	± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 21\text{ A}$	-	58	63	m Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	4400	-	pF
C_{oss}	Output capacitance		-	100	-	pF
C_{rss}	Reverse transfer capacitance		-	5.3	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }520\text{ V}$, $V_{GS} = 0\text{ V}$	-	300	-	pF
R_g	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	1.2	-	Ω
Q_g	Total gate charge	$V_{DD} = 520\text{ V}$, $I_D = 21\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see the Figure 15. Test circuit for gate charge behavior)	-	100	-	nC
Q_{gs}	Gate-source charge		-	23	-	nC
Q_{gd}	Gate-drain charge		-	40	-	nC

1. $C_{oss\text{ eq.}}$ is an equivalent capacitance that provides the same charging time as C_{oss} while V_{DS} is rising from 0 V to the stated value.

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	$V_{DD} = 400\text{ V}$, $I_D = 28\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	73	-	ns
$t_{r(v)}$	Voltage rise time		-	15	-	ns
$t_{f(i)}$	Current fall time	(see the Figure 16. Test circuit for inductive load switching and diode recovery times and Figure 19. Switching time waveform)	-	12	-	ns
$t_{c(off)}$	Crossing time		-	19	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	42	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	-	168	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 42\text{ A}$, $V_{GS} = 0\text{ V}$	-	-	1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 42\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$	-	420	-	ns
Q_{rr}	Reverse recovery charge		-	8	-	μC
I_{RRM}	Reverse recovery current	(see the Figure 16. Test circuit for inductive load switching and diode recovery times)	-	40	-	A
t_{rr}	Reverse recovery time	$I_{SD} = 42\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	530	-	ns
Q_{rr}	Reverse recovery charge		-	12	-	μC
I_{RRM}	Reverse recovery current	(see the Figure 16. Test circuit for inductive load switching and diode recovery times)	-	44	-	A

1. Pulse width is limited by safe operating area.
2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

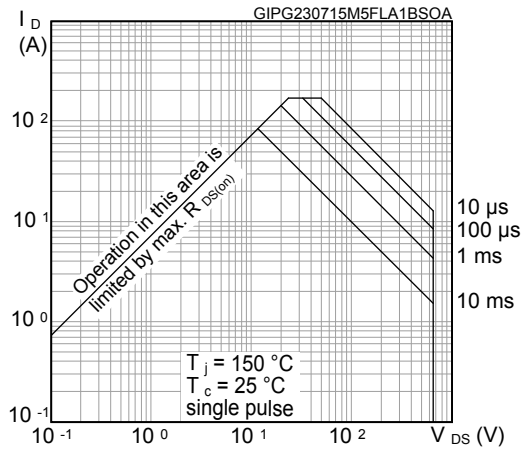
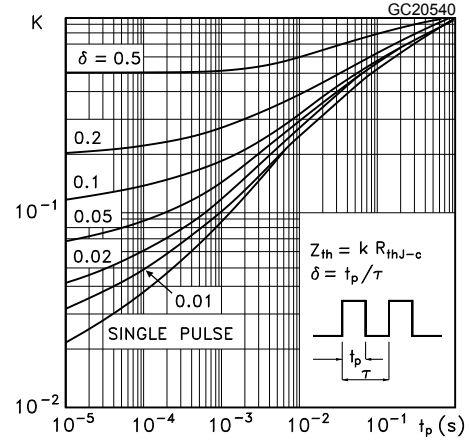
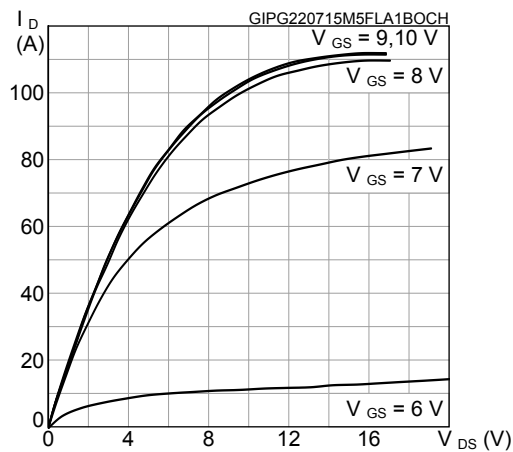
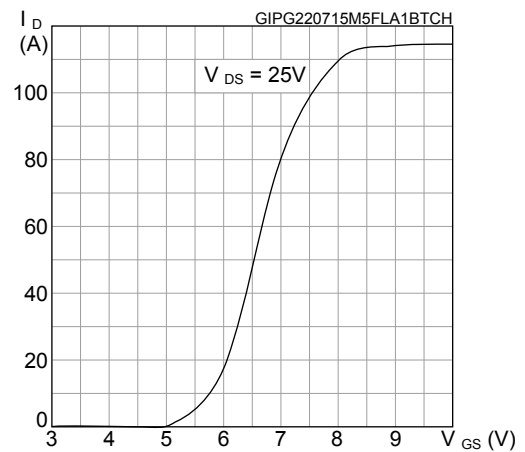
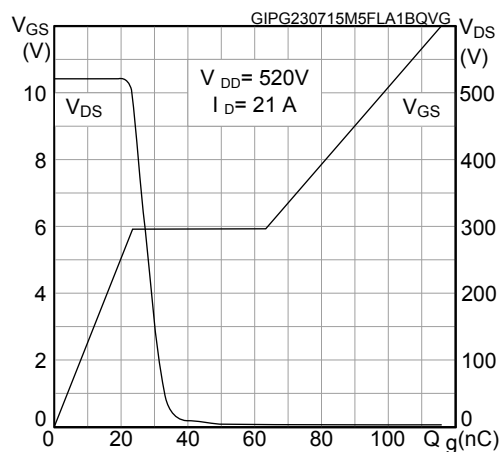
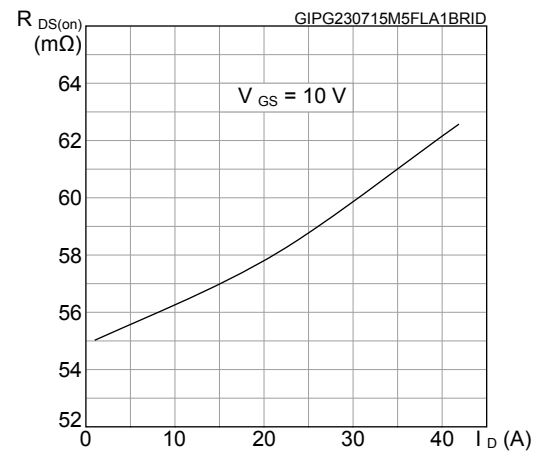
Figure 1. Safe operating area

Figure 2. Thermal impedance

Figure 3. Output characteristics

Figure 4. Transfer characteristics

Figure 5. Gate charge vs gate-source voltage

Figure 6. Static drain-source on-resistance


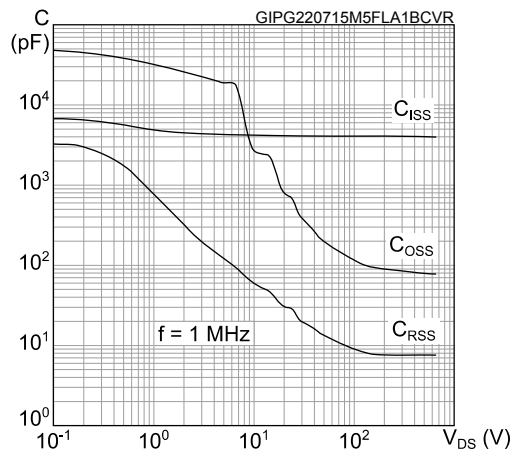
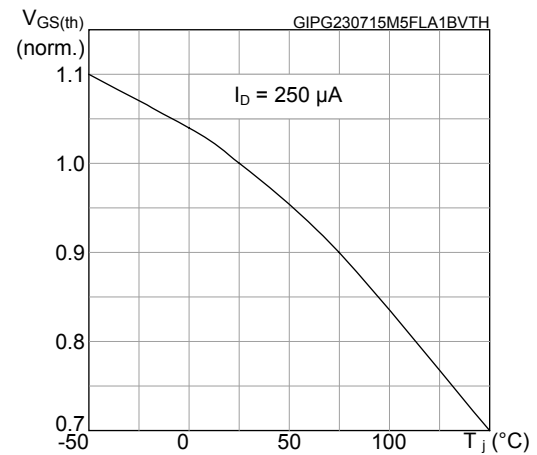
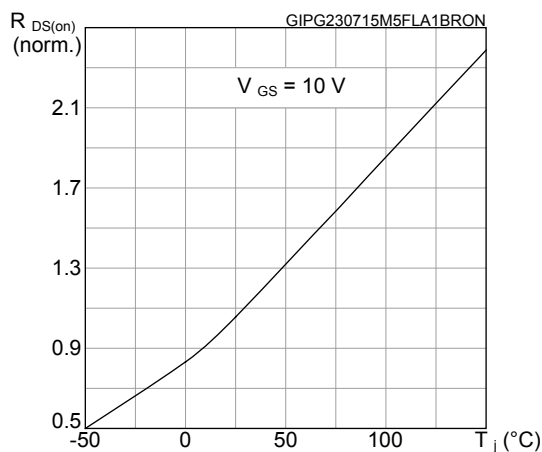
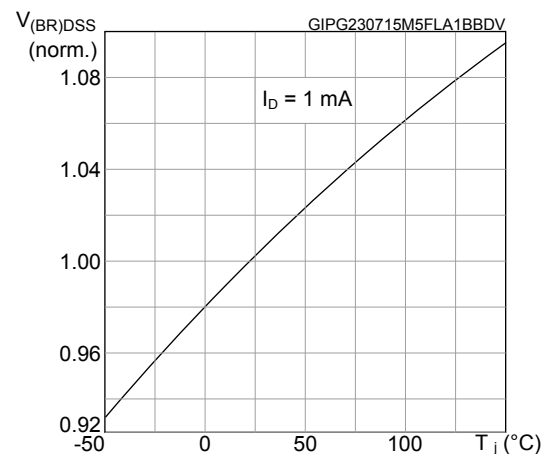
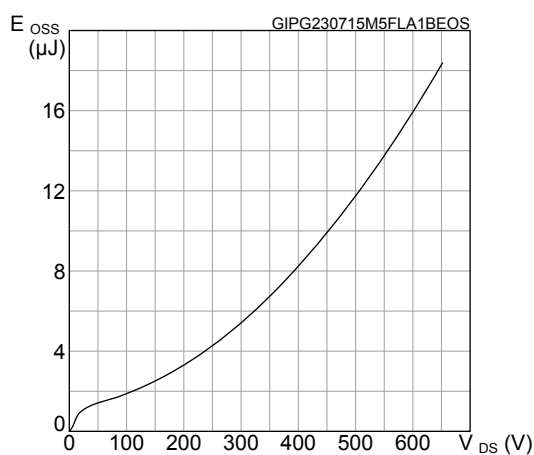
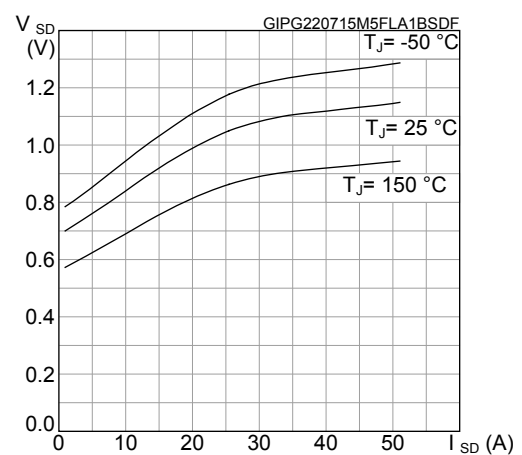
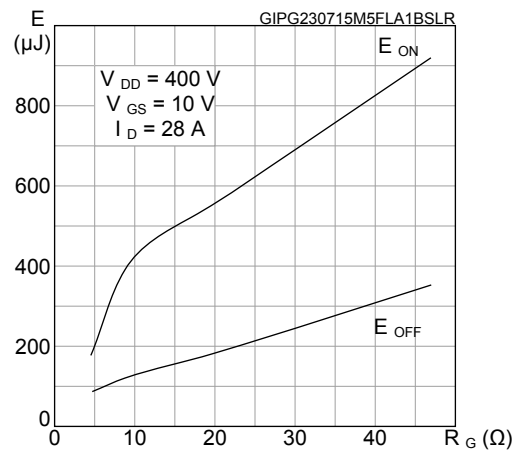
Figure 7. Capacitance variations

Figure 8. Normalized gate threshold voltage vs temperature

Figure 9. Normalized on-resistance vs temperature

Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

Figure 11. Output capacitance stored energy

Figure 12. Source-drain diode forward characteristics


Figure 13. Switching energy vs gate resistance



Note: E_{on} including reverse recovery of a SiC diode.

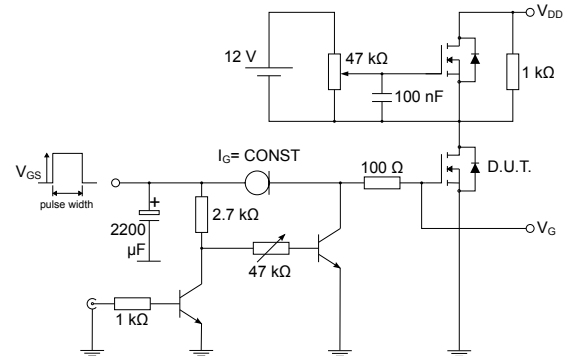
3 Test circuits

Figure 14. Test circuit for resistive load switching times



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Figure 15. Test circuit for gate charge behavior



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Figure 16. Test circuit for inductive load switching and diode recovery times



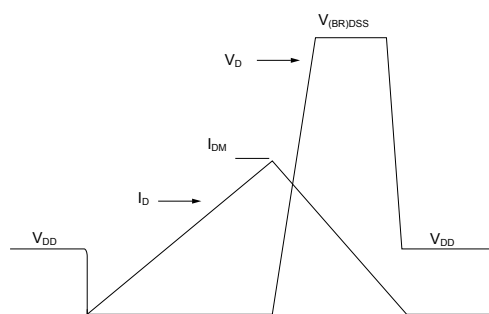
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Figure 17. Unclamped inductive load test circuit



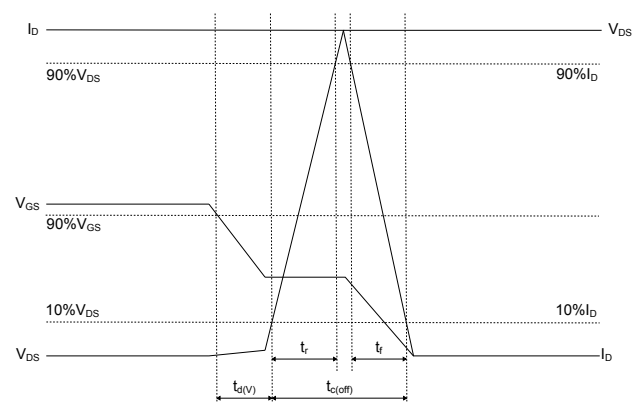
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Figure 18. Unclamped inductive waveform



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Figure 19. Switching time waveform



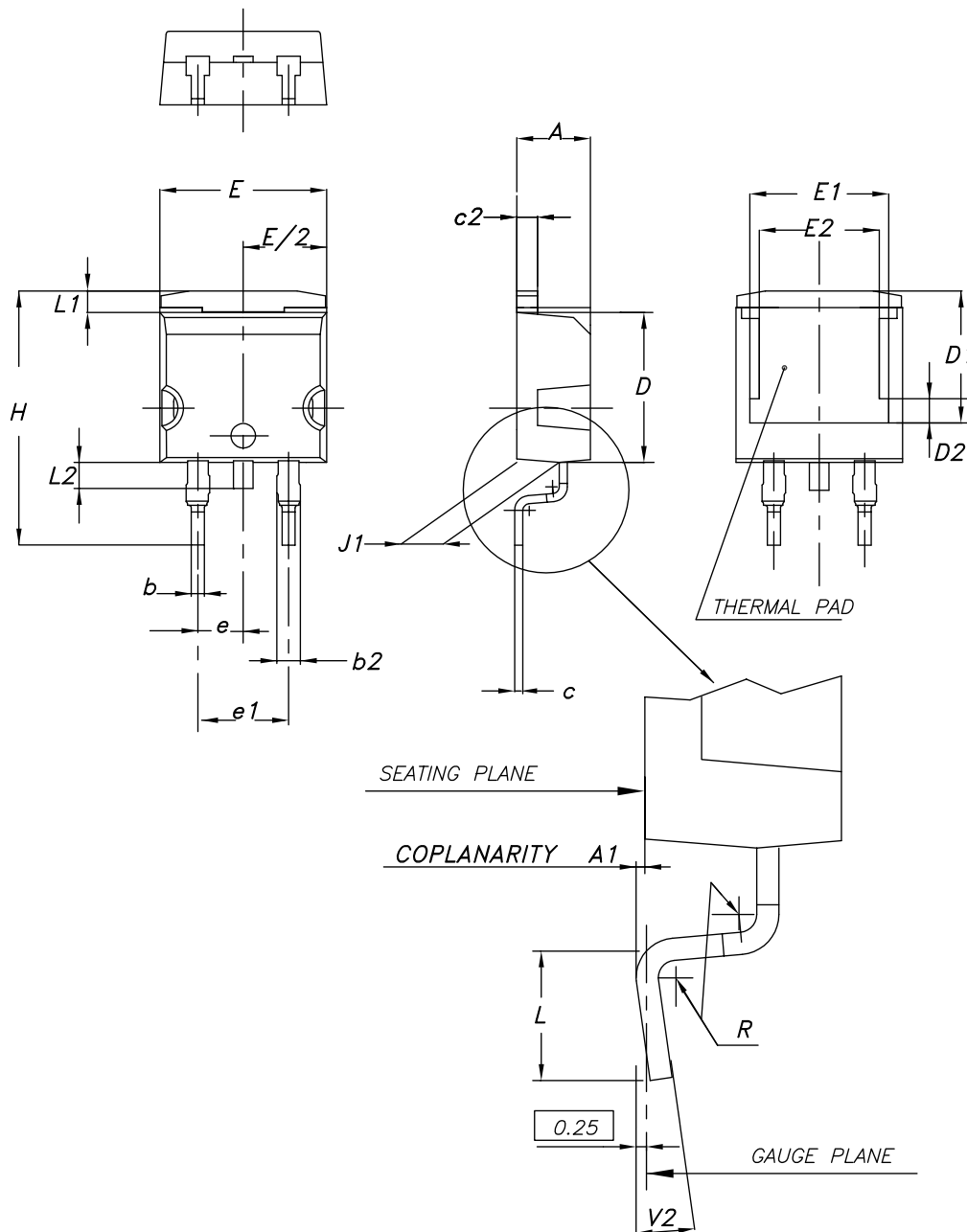
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4 Package information

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 D²PAK (TO-263) type A2 package information

Figure 20. D²PAK (TO-263) type A2 package outline



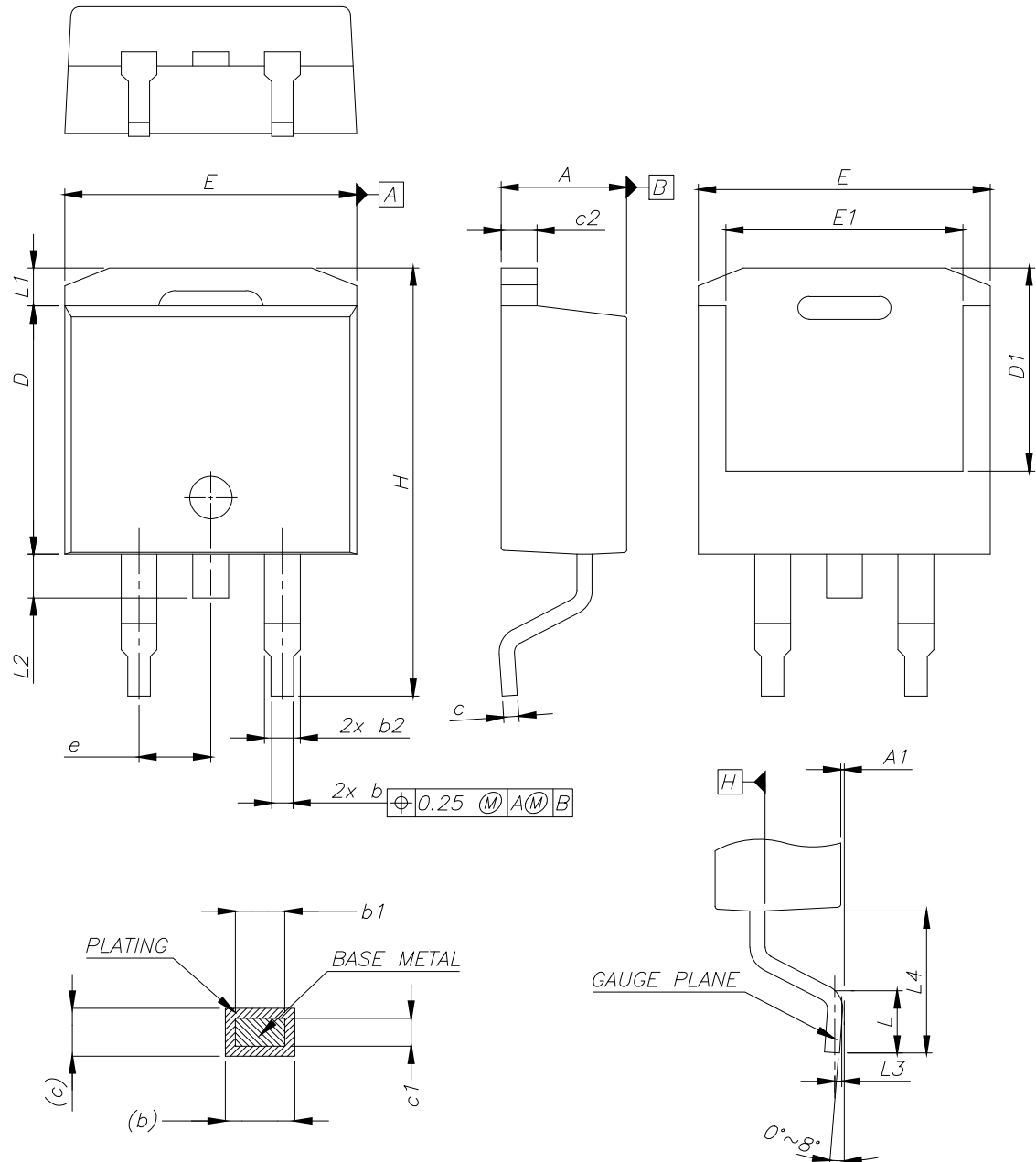
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Table 8. D²PAK (TO-263) type A2 package mechanical data

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	8.70	8.90	9.10
E2	7.30	7.50	7.70
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°

4.2 D²PAK (TO-263) type B package information

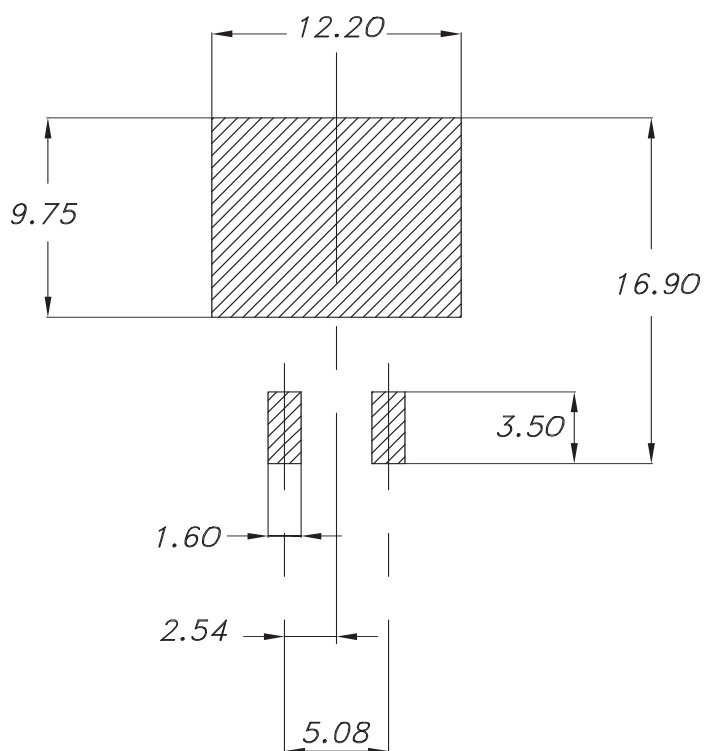
Figure 21. D²PAK (TO-263) type B package outline



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Table 9. D²PAK (TO-263) type B mechanical data

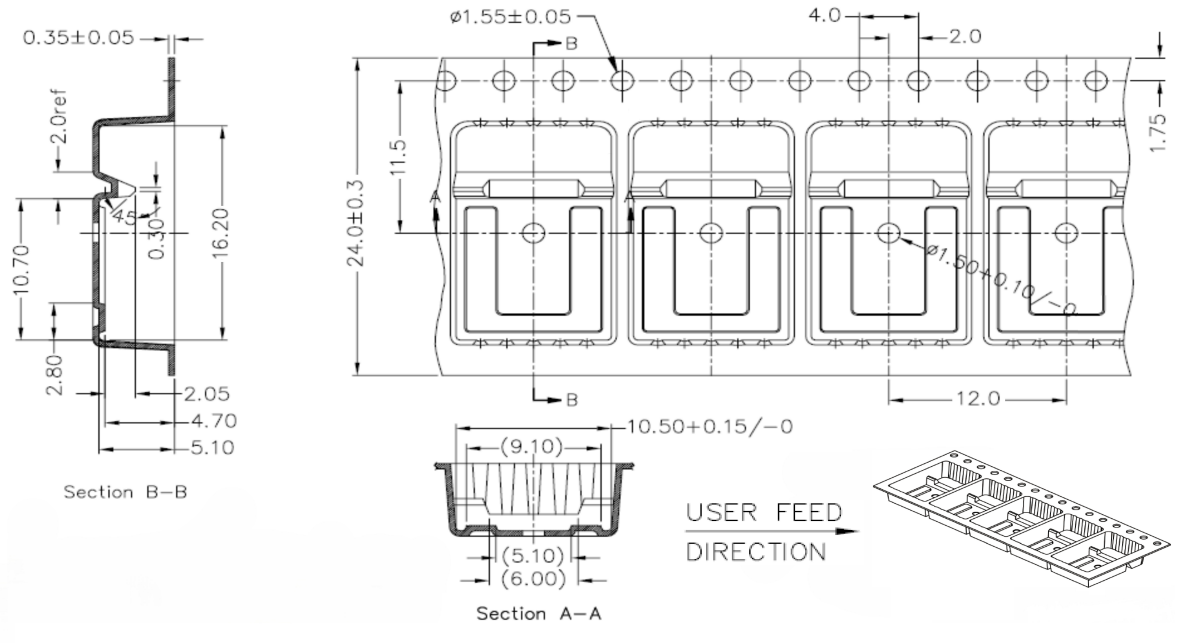
Dim.	mm		
	Min.	Typ.	Max.
A	4.36		4.56
A1	0.00		0.25
b	0.70		0.90
b1	0.51		0.89
b2	1.17		1.37
c	0.38		0.694
c1	0.38		0.534
c2	1.19		1.34
D	8.60		9.00
D1	6.90		7.50
E	10.15		10.55
E1	8.10		8.70
e	2.54 BSC		
H	15.00		15.60
L	1.90		2.50
L1			1.65
L2			1.78
L3		0.25	
L4	4.78		5.28

Figure 22. D²PAK (TO-263) recommended footprint (dimensions are in mm)


0079457_Rev27_footprint

4.3 D²PAK packing information

Figure 23. D²PAK tape drawing (dimensions are in mm)



DM01095771_2

Revision history

Table 10. Document revision history

Date	Revision	Changes
23-Jul-2015	1	Initial release.
13-Nov-2018	2	Updated features in cover page. Updated <i>Section 3 Test circuits</i> and <i>Section 4.1 D²PAK (TO-263) type A2 package information</i> . Minor text changes.
19-Aug-2025	3	Updated Section 4: Package information . Minor text changes.

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