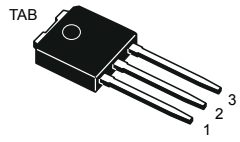
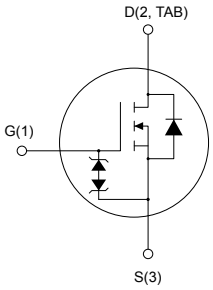
N-channel 950 V, 3 Ω typ., 4 A MDmesh K3 Power MOSFET in an IPAK package



IPAK



AM01476v1_tab

Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STU5N95K3	950 V	3.5 Ω	4 A

- 100% avalanche tested
- Extremely high dv/dt capability
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected

Applications

- Switching applications

Description

This MDmesh K3 Power MOSFET is the result of improvements applied to STMicroelectronics' MDmesh technology, combined with a new optimized vertical structure. This device boasts an extremely low on-resistance, superior dynamic performance and high avalanche capability, rendering it suitable for the most demanding applications.

Product status link
STU5N95K3

Product summary	
Order code	STU5N95K3
Marking	5N95K3
Package	IPAK
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	±30	V
I_D	Drain current (continuous) at T_C = 25 °C	4	A
	Drain current (continuous) at T_C = 100 °C	3	
I_{DM} (1)	Drain current (pulsed)	16	A
P_{TOT}	Total power dissipation at T_C = 25 °C	90	W
I_{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T_J max)	4	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	100	mJ
dv/dt (2)	Peak diode recovery voltage slope	5	V/ns
T_{stg}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range		°C

1. *Pulse width limited by safe operating area.*
2. *I_{SD} ≤ 4 A, di/dt ≤ 100 A/µs, V_{DS} (peak) ≤ $V_{(BR)DSS}$.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	1.39	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	100	°C/W

2 Electrical characteristics

T_C = 25 °C unless otherwise specified.

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0 V	950			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 950 V			1	µA
		V_{GS} = 0 V, V_{DS} = 950 V, T_C = 125 °C (1)			50	
I_{GSS}	Gate body leakage current	V_{GS} = ±20 V, V_{DS} = 0 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 100 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 2 A		3	3.5	Ω

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

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz,V_{GS} = 0 V	-	460	-	pF
C_{oss}	Output capacitance		-	38	-	pF
C_{rss}	Reverse transfer capacitance		-	1	-	pF
$C_{o(tr)}$ (1)	Equivalent output capacitance time related	V_{GS} = 0 V, V_{DS} = 0 to 760 V	-	970	-	pF
$C_{o(er)}$ (2)	Equivalent output capacitance energy related		-	15	-	pF
R_g	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	5.5	-	Ω
Q_g	Total gate charge	V_{DD} = 760 V, I_D = 4 A, V_{GS} = 0 to 10 V (see Figure 15. Test circuit for gate charge behavior)	-	19	-	nC
Q_{gs}	Gate-source charge		-	4.7	-	nC
Q_{gd}	Gate-drain charge		-	12	-	nC

1. *$C_{o(tr)}$ is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.*
2. *$C_{o(er)}$ is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.*

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 475 V, I_D = 2 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform)	-	17	-	ns
t_r	Rise time		-	7	-	ns
$t_{d(off)}$	Turn-off delay time		-	32	-	ns
t_f	Fall time		-	18	-	ns

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		4	A
I_{SDM} (1)	Source-drain current (pulsed)		-		16	A
V_{SD} (2)	Forward on voltage	I_{SD} = 4 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 4 A, di/dt = 100 A/µs, V_{DD} = 60 V (see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	410		ns
Q_{rr}	Reverse recovery charge		-	3.5		µC
I_{RRM}	Reverse recovery current		-	17		A
t_{rr}	Reverse recovery time	I_{SD} = 4 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_J = 150 °C (see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	516		ns
Q_{rr}	Reverse recovery charge		-	4.1		µC
I_{RRM}	Reverse recovery current		-	16		A

1. *Pulse width 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

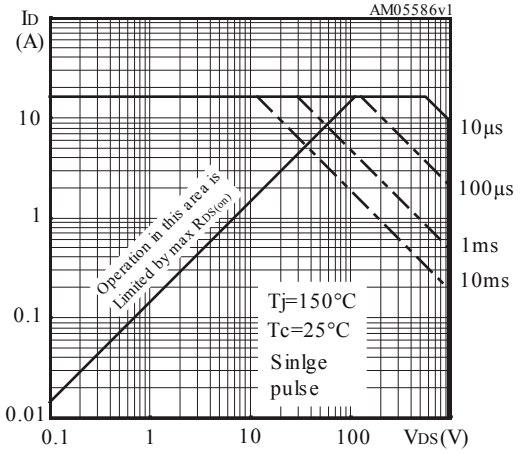


Figure 2. Normalized transient thermal impedance

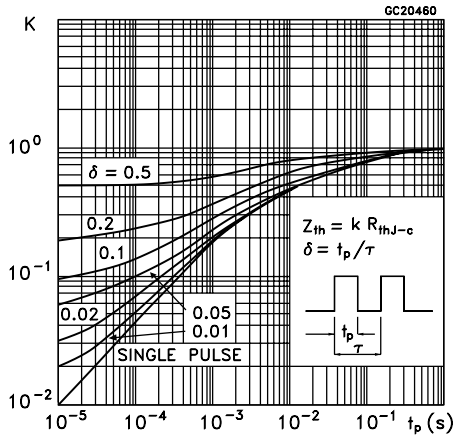


Figure 3. Typical output characteristics

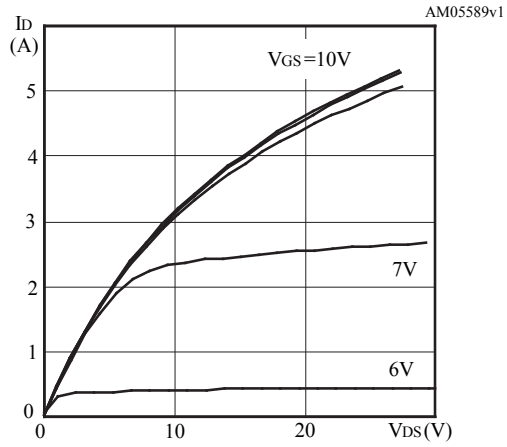


Figure 4. Typical transfer characteristics

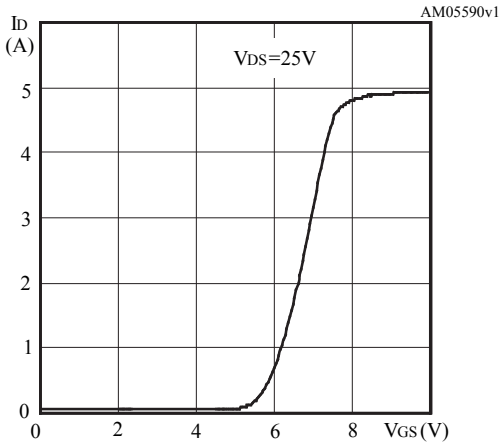


Figure 5. Typical gate charge characteristics

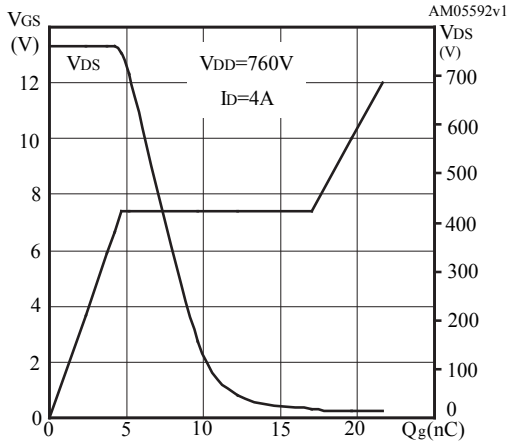


Figure 6. Typical drain-source on-resistance

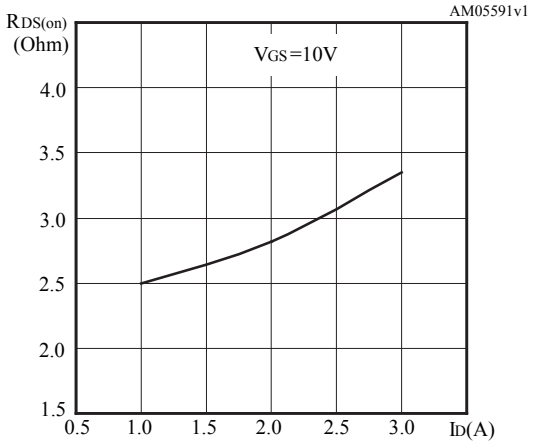


Figure 7. Typical capacitance characteristics

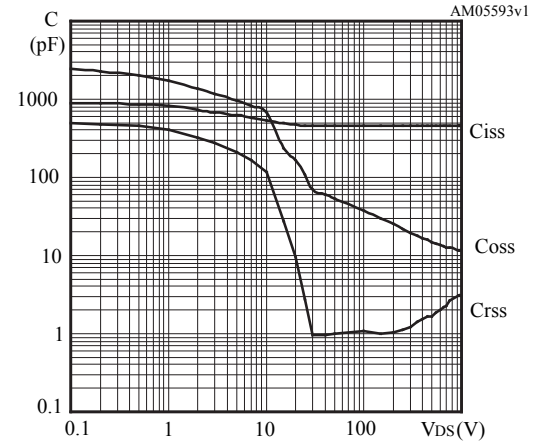


Figure 8. Typical output capacitance stored energy

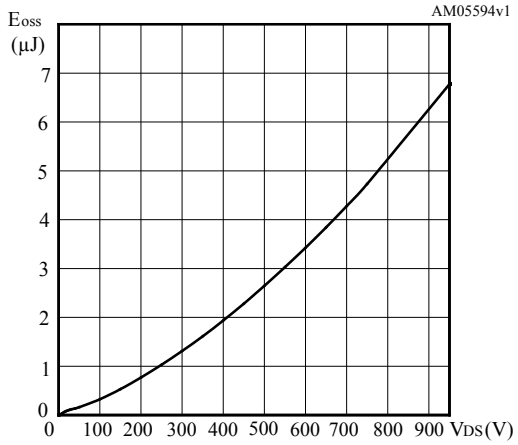


Figure 9. Normalized gate threshold vs temperature

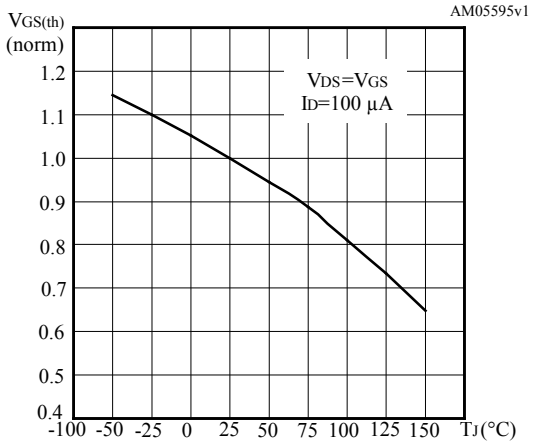


Figure 10. Normalized on-resistance vs temperature

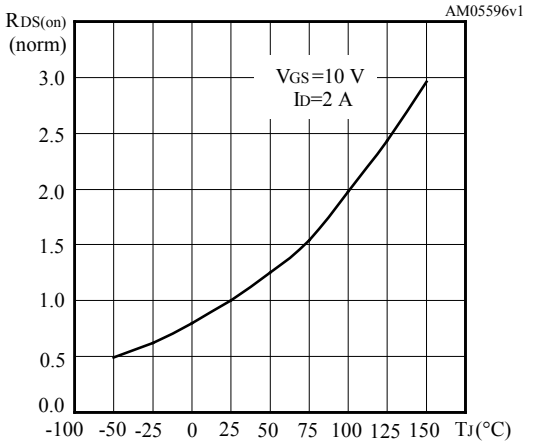


Figure 11. Normalized breakdown voltage vs temperature

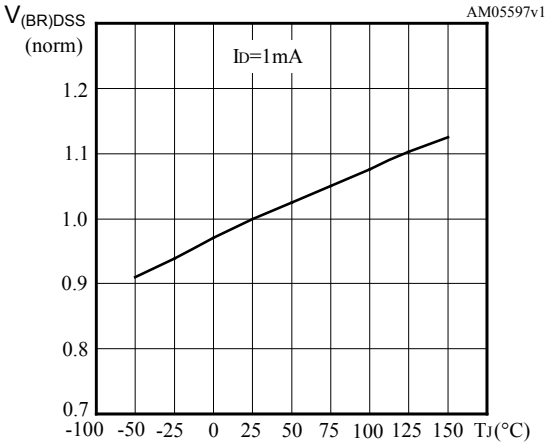


Figure 12. Typical reverse diode forward characteristics

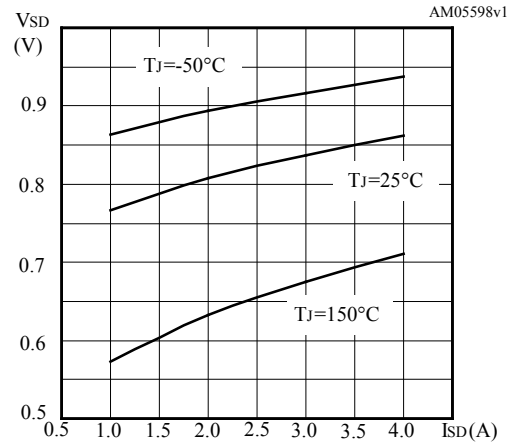
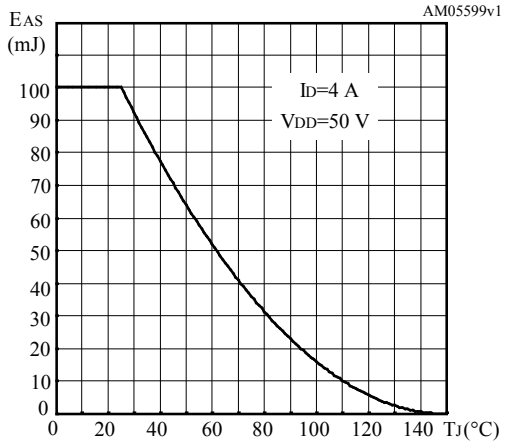
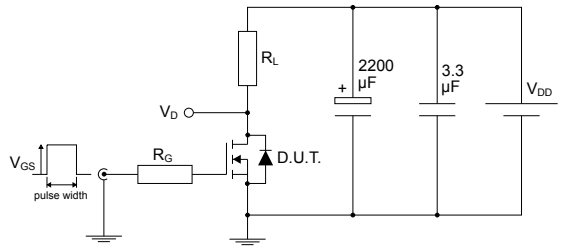


Figure 13. Maximum avalanche energy vs temperature



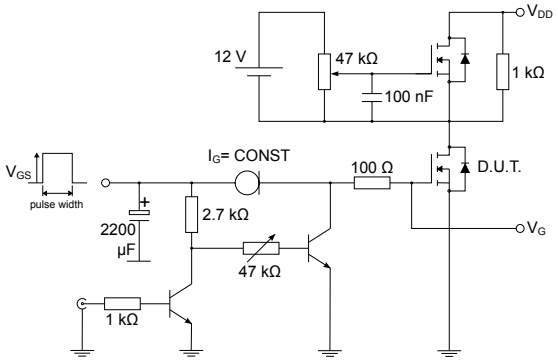
3 Test circuits

Figure 14. Test circuit for resistive load switching times



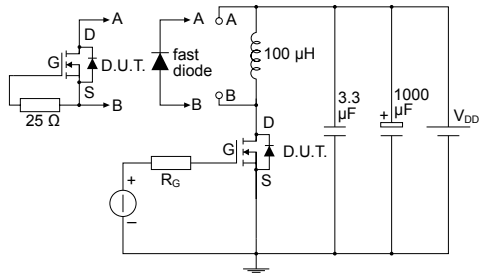
AM01468v1

Figure 15. Test circuit for gate charge behavior



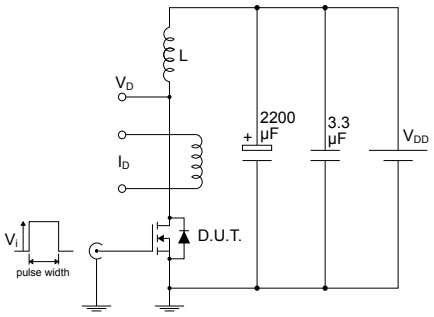
AM01469v1

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



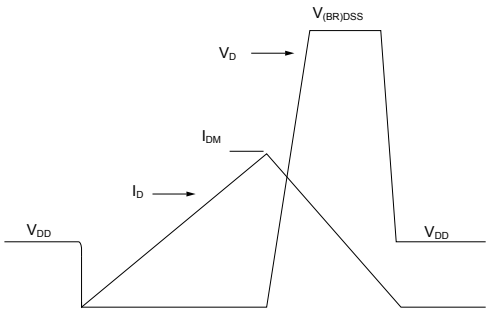
AM01470v1

Figure 17. Unclamped inductive load test circuit



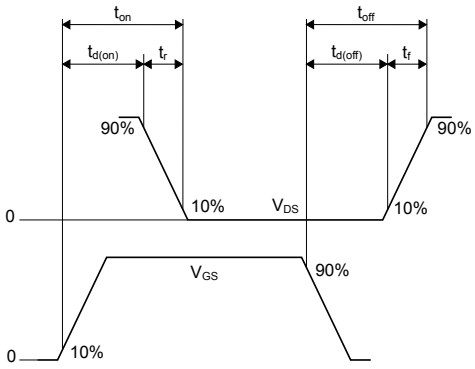
AM01471v1

Figure 18. Unclamped inductive waveform



AM01472v1

Figure 19. Switching time waveform



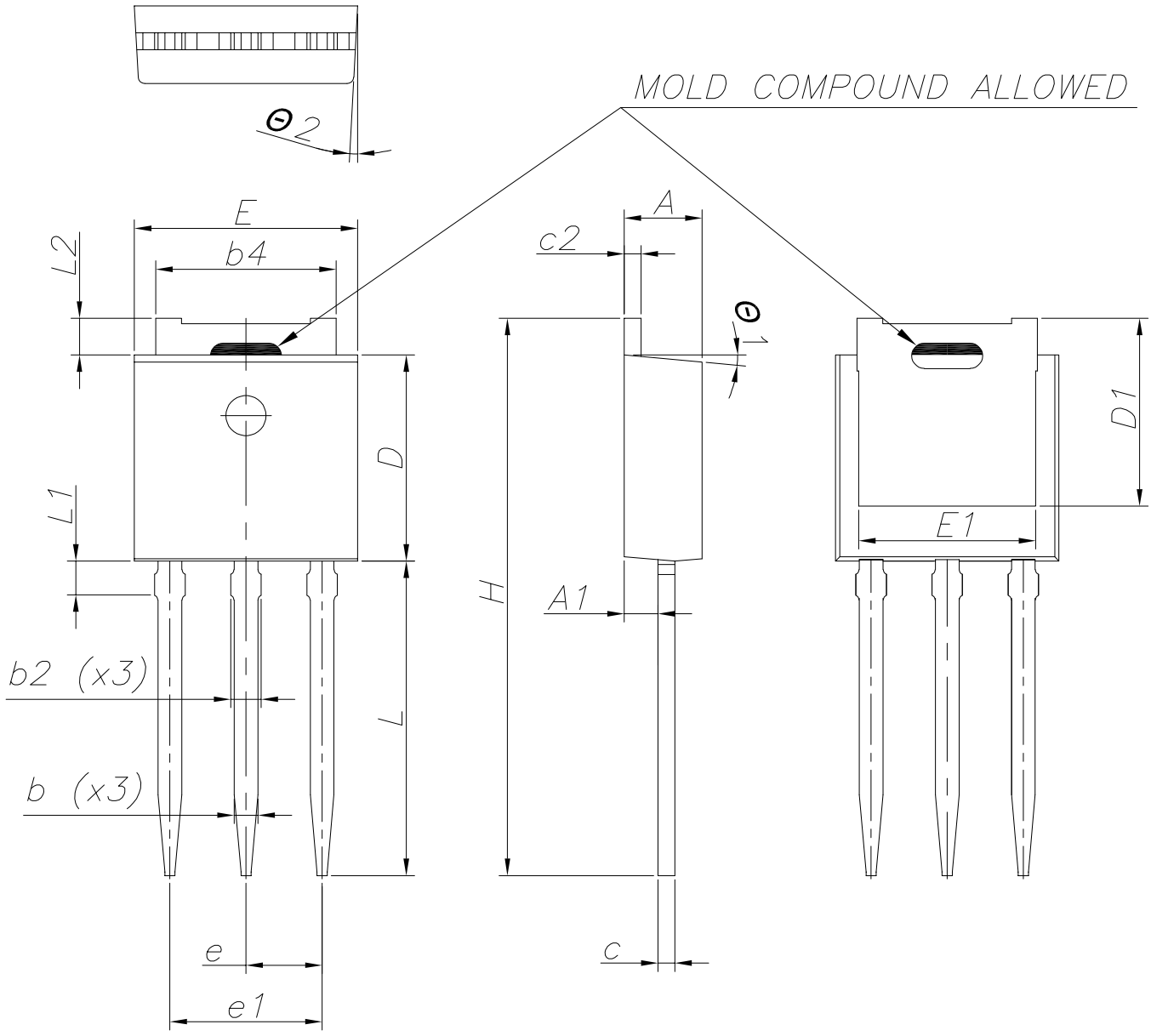
AM01473v1

4 Package information

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.

4.1 IPAK (TO-251) type E package information

Figure 20. IPAK (TO-251) type E package outline



0068771_E_rev.16

Table 7. **IPAK (TO-251) type E package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.35
A1	0.90	1.00	1.10
b	0.66		0.79
b2			0.90
b4	5.23	5.33	5.43
c	0.46		0.59
c2	0.46		0.59
D	6.00	6.10	6.20
D1	5.30	5.53	5.75
E	6.50	6.60	6.70
E1	5.05	5.23	5.40
e	2.20	2.25	2.30
e1	4.40	4.50	4.60
H	16.18	16.48	16.78
L	9.00	9.30	9.60
L1	0.80	1.00	1.20
L2	0.90	1.08	1.25
Θ1	3°	5°	7°
Θ2	1°	3°	5°

Revision history

Table 8. **Document revision history**

Date	Version	Changes
17-May-2023	1	First release. Part number previously included in datasheet DS6265.

Contents

IMPORTANT NOTICE – READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.