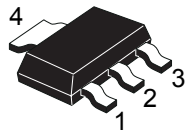
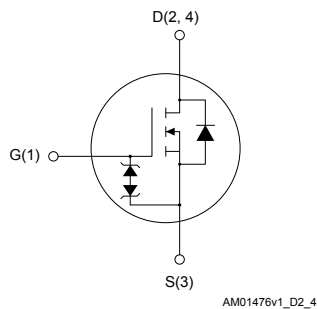


N-channel 600 V, 10.4 Ω typ., 0.44 A SuperMESH Power MOSFET in a SOT-223 package



SOT-223



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STN1NK60ZL	600 V	15 Ω	0.44 A

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Logic level $V_{GS(th)}$
- Zener-protected

Applications

- Switching applications

Description

This high-voltage device is a Zener-protected N-channel Power MOSFET developed using the SuperMESH technology by STMicroelectronics, an optimization of the well-established PowerMESH. In addition to a significant reduction in on-resistance, this device is designed to ensure a high level of dv/dt capability for the most demanding applications.



Product status link

[STN1NK60ZL](#)

Product summary

Order code	STN1NK60ZL
Marking	1NK60ZL
Package	SOT-223
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at $T_A = 25\text{ }^{\circ}\text{C}$	0.44	A
	Drain current (continuous) at $T_A = 100\text{ }^{\circ}\text{C}$	0.3	
$I_{DM}^{(1)}$	Drain current (pulsed)	1.8	A
P_{TOT}	Total power dissipation at $T_A = 25\text{ }^{\circ}\text{C}$	3.3	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	3	V/ns
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. $I_{SD} \leq 0.3\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} = 480\text{ V}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thJA}^{(1)}$	Thermal resistance, junction-to-ambient	38	$^{\circ}\text{C}/\text{W}$

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.)	0.3	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 35\text{ V}$)	150	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	$I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	600	-	-	V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 600\text{ V}$	-	-	1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 600\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}$ ⁽¹⁾	-	-	50	
I_{GSS}	Gate-body leakage current	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$	-	-	± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 50\text{ }\mu\text{A}$	0.9	1.7	2	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 0.25\text{ A}$	-	10.4	15	Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	125	-	pF
C_{oss}	Output capacitance		-	13	-	pF
C_{rss}	Reverse transfer capacitance		-	2	-	pF
Q_g	Total gate charge	$V_{DD} = 480\text{ V}$, $I_D = 0.8\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see the Figure 14. Test circuit for gate charge behavior)	-	9.4	-	nC
Q_{gs}	Gate-source charge		-	0.8	-	nC
Q_{gd}	Gate-drain charge		-	4.5	-	nC

Table 6. Switching times

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$, $I_D = 0.4\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	4.4	-	ns
t_r	Rise time		-	4	-	ns
$t_{d(off)}$	Turn-off delay time	(see the Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	18.4	-	ns
t_f	Fall time		-	41	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	0.44	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	-	1.8	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 0.44 \text{ A}$, $V_{GS} = 0 \text{ V}$	-	-	1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 0.8 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$	-	155	-	ns
Q_{rr}	Reverse recovery charge		-	232	-	nC
I_{RRM}	Reverse recovery current	(see the Figure 15. Test circuit for inductive load switching and diode recovery times)	-	3	-	A
t_{rr}	Reverse recovery time	$I_{SD} = 0.8 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$, $T_J = 150 \text{ }^\circ\text{C}$	-	186	-	ns
Q_{rr}	Reverse recovery charge		-	297	-	nC
I_{RRM}	Reverse recovery current	(see the Figure 15. Test circuit for inductive load switching and diode recovery times)	-	3.2	-	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)

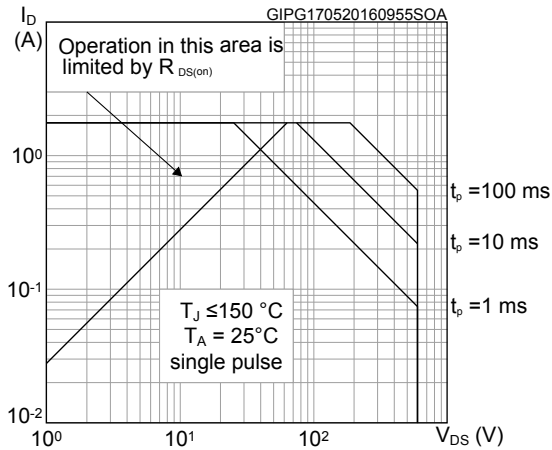
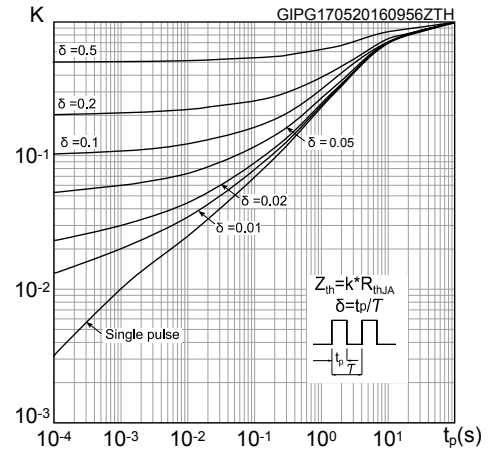
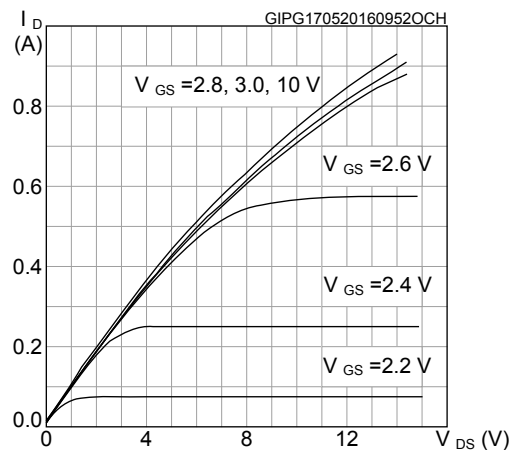
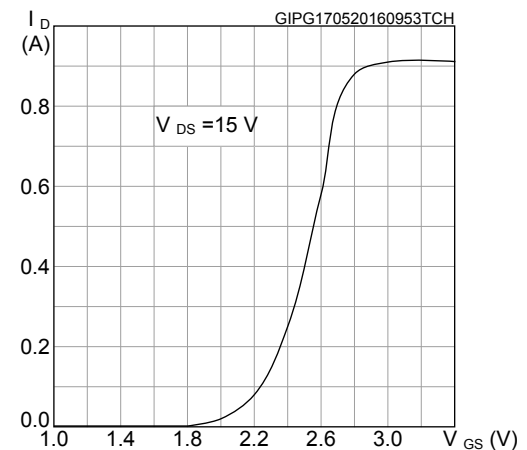
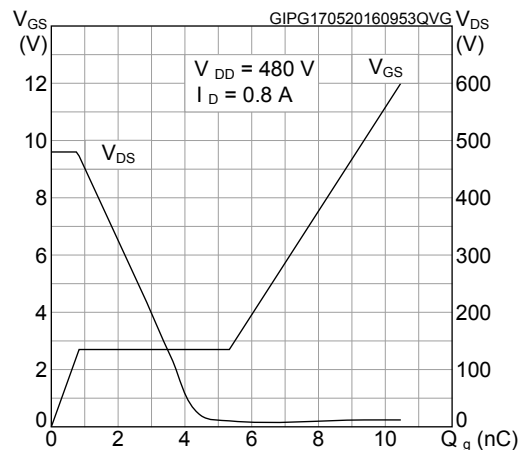
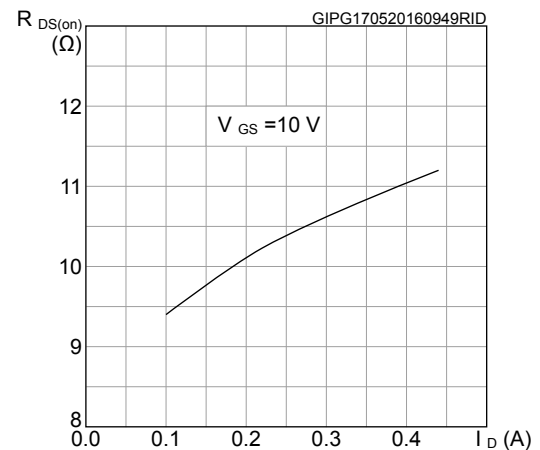
Figure 1. Safe operating area

Figure 2. 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

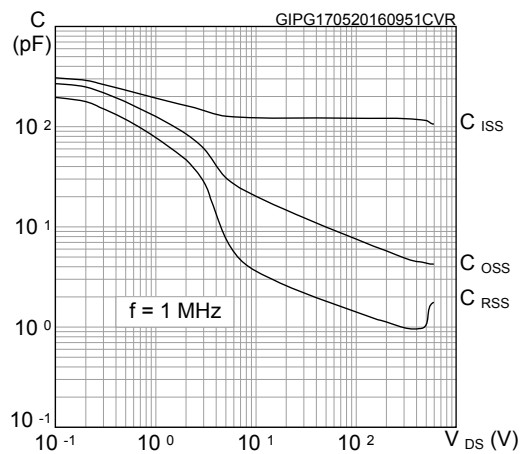


Figure 8. Normalized gate threshold vs temperature

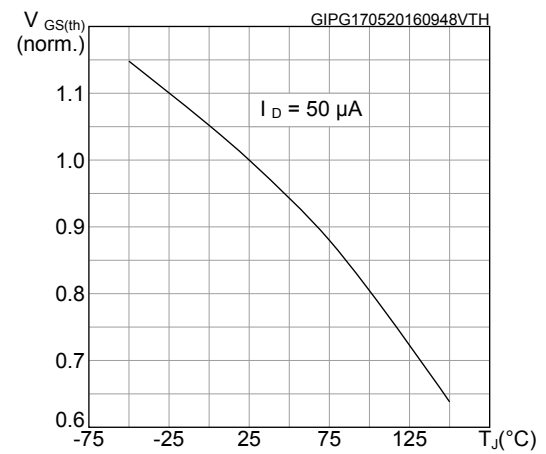


Figure 9. Normalized on-resistance vs temperature

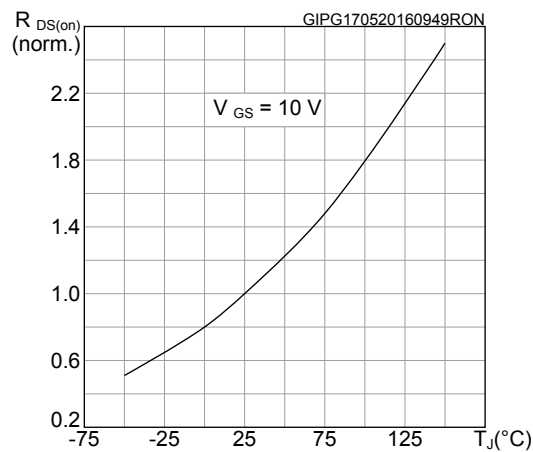


Figure 10. Normalized breakdown voltage vs temperature

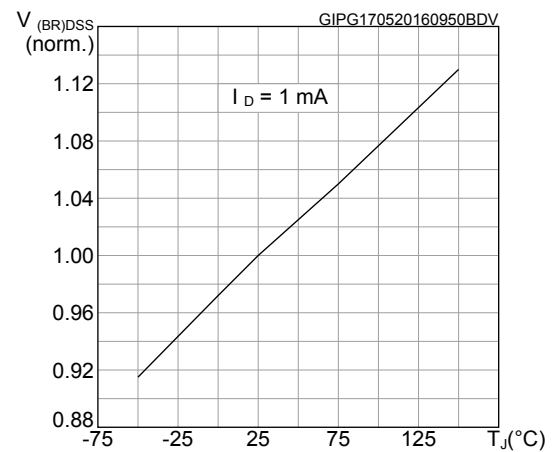


Figure 11. Maximum avalanche energy vs temperature

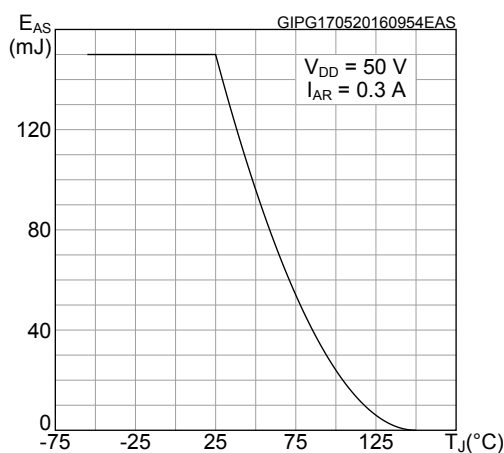
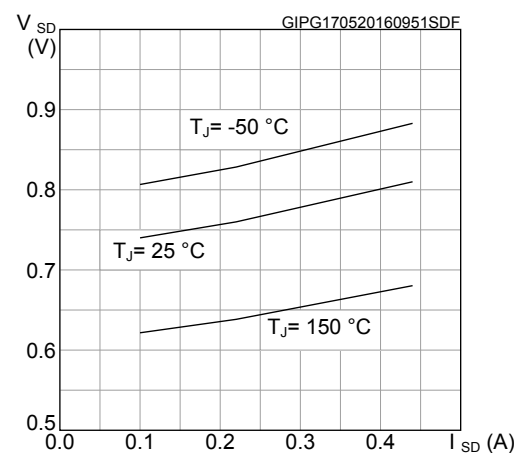


Figure 12. Typical reverse diode forward characteristics



3 Test circuits

Figure 13. Test circuit for resistive load switching times


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Figure 14. Test circuit for gate charge behavior

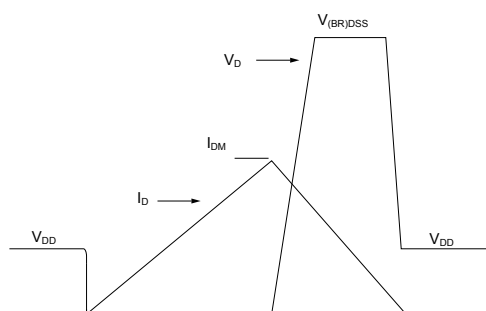

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Figure 15. Test circuit for inductive load switching and diode recovery times


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Figure 16. Unclamped inductive load test circuit


AM01471v1

Figure 17. Unclamped inductive waveform


AM01472v1

Figure 18. Switching time waveform

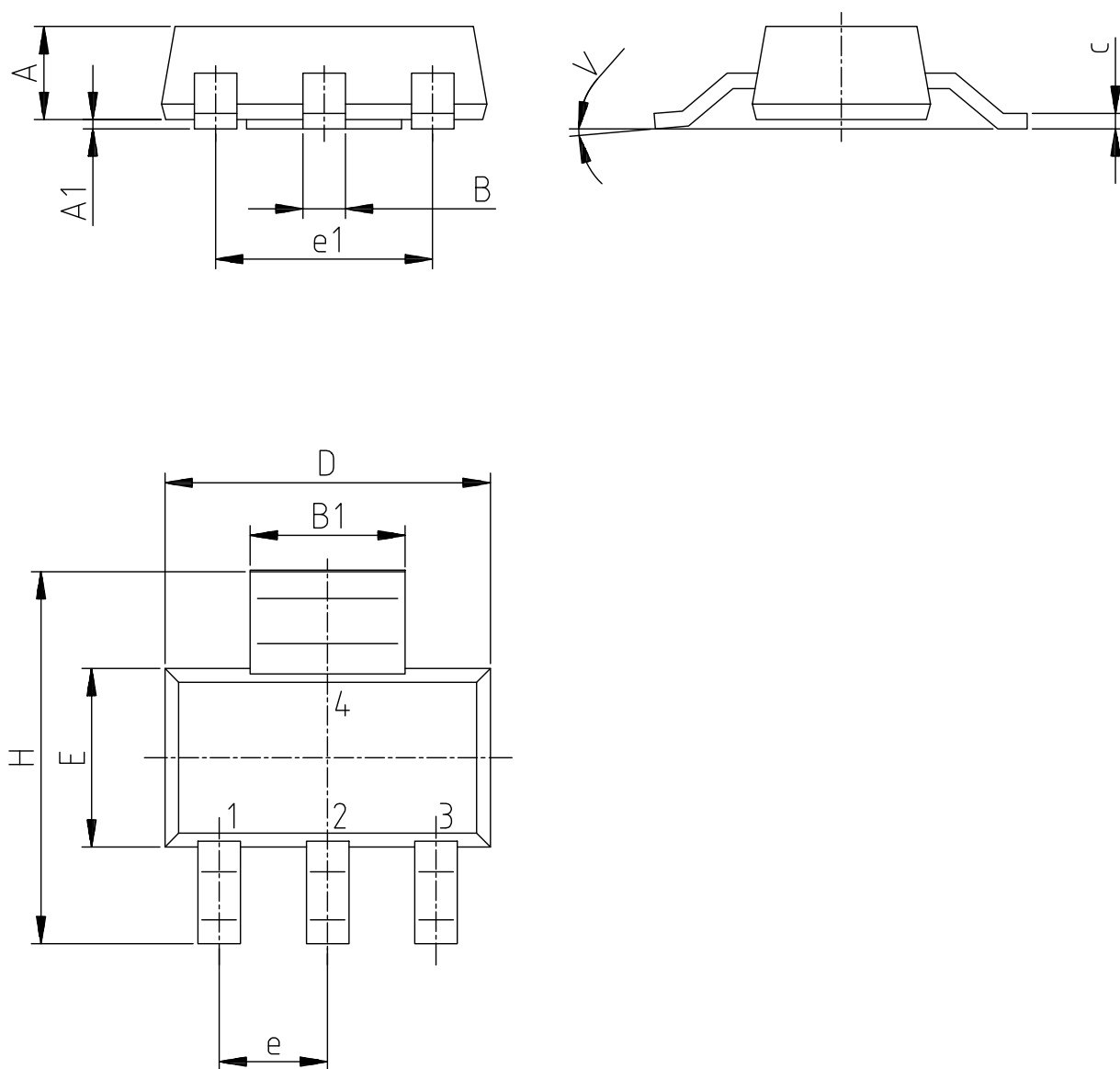

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4 Package information

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 SOT-223 package information

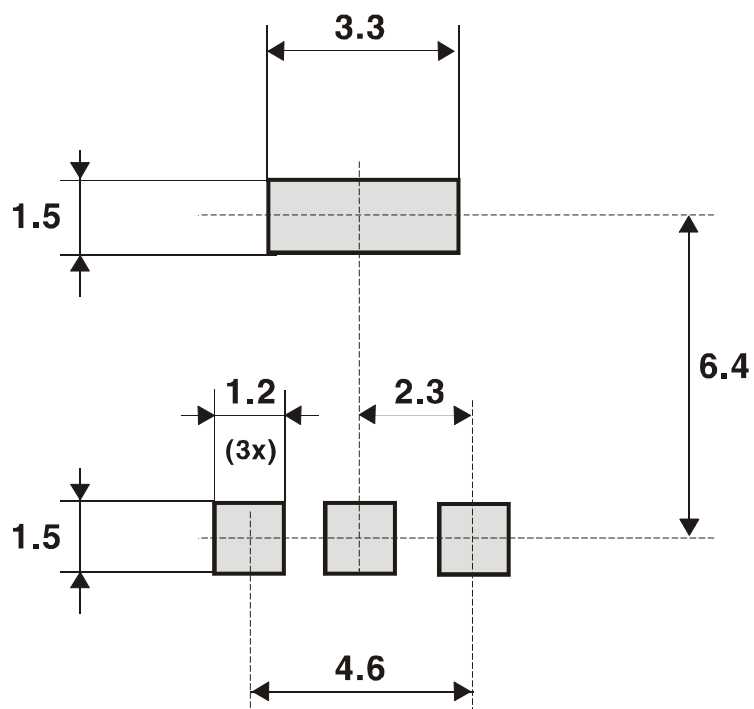
Figure 19. SOT-223 package outline



0046067_15

Table 8. SOT-223 package mechanical data

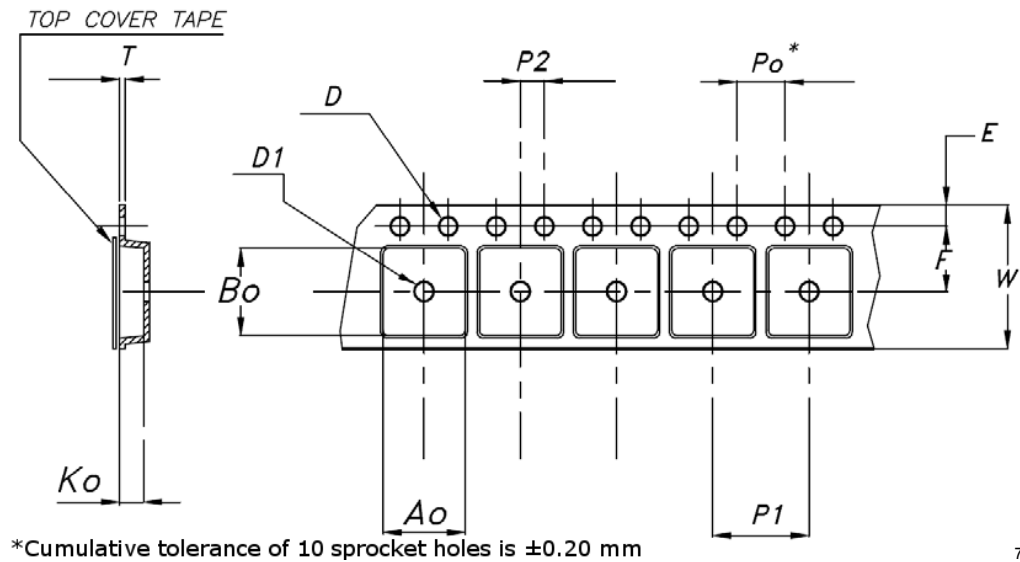
Dim.	mm		
	Min.	Typ.	Max.
A			1.8
B	0.6	0.7	0.85
B1	2.9	3	3.15
c	0.24	0.26	0.35
D	6.3	6.5	6.7
e		2.3	
e1		4.6	
E	3.3	3.5	3.7
H	6.7	7	7.3
V			10 deg
A1	0.02		0.1

Figure 20. SOT-223 recommended footprint (dimensions are in mm)


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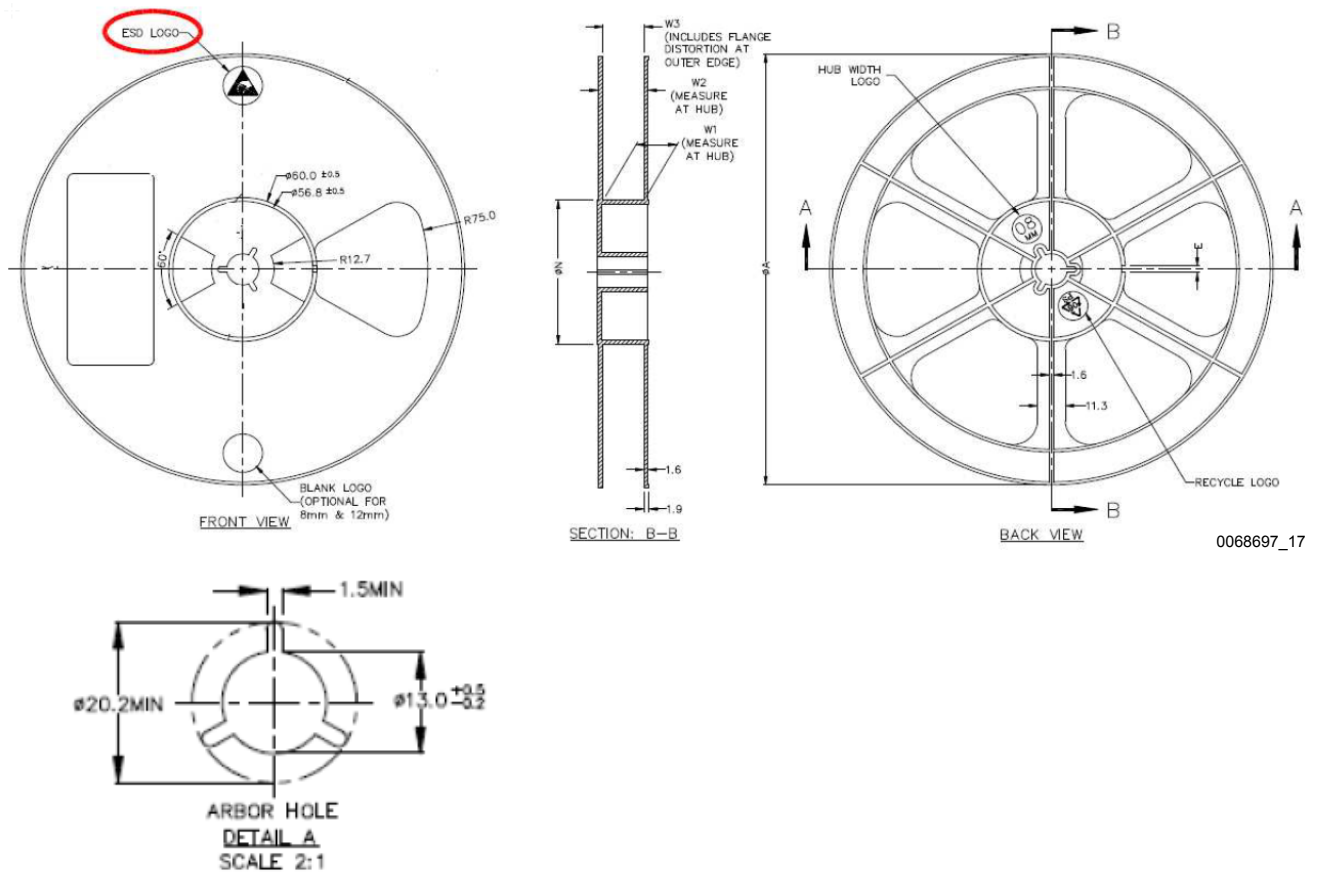
4.2 SOT-223 packing information

Figure 21. SOT-223 tape outline



7737436_3

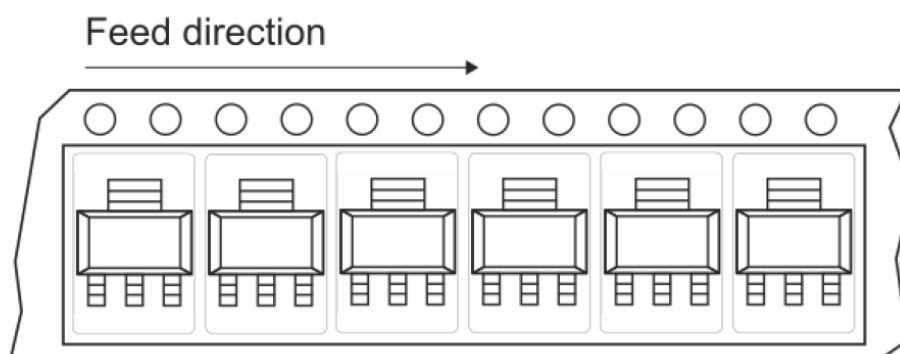
Figure 22. SOT-223 reel outline



0068697_17

Table 9. SOT-223 tape and reel mechanical data

Tape				Tape		
Dim.	mm			Dim.	mm	
	Min.	Typ.	Max.		Min.	Max.
A0	6.75	6.85	6.95	A		180
B0	7.30	7.40	7.50	N	60	
K0	1.80	1.90	2.00	W1		12.4
F	5.40	5.50	5.60	W2		18.4
E	1.65	1.75	1.85	W3	11.9	15.4
W	11.7	12.0	12.3			
P2	1.90	2.00	2.10	Base quantity pcs		1000
P0	3.90	4.00	4.10	Bulk quantity pcs		1000
P1	7.90	8.00	8.10			
T	0.25	0.30	0.35			
DΦ	1.50	1.55	1.60			
D1Φ	1.50	1.60	1.70			

Figure 23. SOT-223 package orientation in carrier tape


0050115_20

Revision history

Table 10. Document revision history

Date	Revision	Changes
12-Nov-2015	1	First release.
05-Dec-2016	2	Modified: features in cover page. Modified <i>Table 2: "Absolute maximum ratings"</i>, <i>Table 3: "Thermal data"</i>, <i>Table 4: "Avalanche characteristics"</i>, <i>Table 5: "On/off-state"</i>, <i>Table 6: "Dynamic"</i>, <i>Table 7: "Switching times"</i> and <i>Table 8: "Sourcedrain diode"</i>. Datasheet promoted from preliminary data to production data. Modified <i>Section 3.1: "Electrical characteristics (curves)"</i>. Minor text changes.
16-Jan-2026	3	Updated <i>Section Features</i> and <i>Section Description</i>. Updated <i>Table 4. On/off states</i>. Updated <i>Section 4: Package information</i>. Minor text changes.
14-Jul-2026	4	Added Figure 23. SOT-223 package orientation in carrier tape. Minor text changes.

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