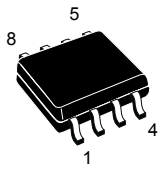
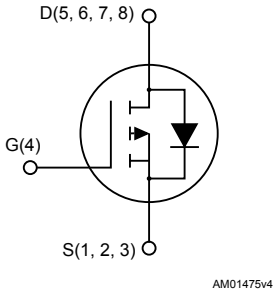
STS10P4LLF6

Datasheet

P-channel -40 V, 12.5 mΩ typ., -10 A STripFET F6 Power MOSFET in SO-8 package



SO-8



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STS10P4LLF6	-40 V	15 mΩ	-10 A

- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

Applications

- Switching applications

Description

This device is a P-channel Power MOSFET developed using the STripFET F6 technology, with a new trench gate structure. The resulting Power MOSFET exhibits very low $R_{DS(on)}$ in all packages.

Product status link
STS10P4LLF6

Product summary	
Order code	STS10P4LLF6
Marking	10P4L
Package	SO-8
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	-40	V
V_{GS}	Gate-source voltage	±20	V
I_D	Drain current (continuous) at T_{amb} = 25 °C	-10	A
	Drain current (continuous) at T_{amb} = 100 °C	-5.6	A
I_{DM} (1)	Drain current (pulsed)	-40	A
P_{TOT}	Total power dissipation at T_{amb} = 25 °C	2.7	W
T_{stg}	Storage temperature	-55 to 150	°C
T_J	Operating junction temperature	150	°C

1. *Pulse width limited by safe operating area.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJA} (1)	Thermal resistance, junction-to-ambient	47	°C/W

1. *When mounted on 1 inch² FR-4 board, 2 oz. Cu., t ≤ 10 sec.*

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = -250 µA	-40			V
I_{DSS}	Zero gate voltage drain current	V_{DS} = -40 V			-1	µA
		V_{DS} = -40 V, T_C = 125 °C			-10	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = -250 µA	-1		-2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = -10 V, I_D = -3 A		12.5	15	mΩ
		V_{GS} = -4.5 V, I_D= -3 A		17	20	

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	-	3525	-	pF
C_{oss}	Output capacitance		-	344	-	pF
C_{rss}	Reverse transfer capacitance		-	238.5	-	pF
Q_g	Total gate charge	V_{DD} = -20 V, I_D = -10 A, V_{GS} = -4.5 V (see Figure 13. Test circuit for gate charge behavior)	-	34	-	nC
Q_{gs}	Gate-source charge		-	11.3	-	nC
Q_{gd}	Gate-drain charge		-	13.8	-	nC

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = -20 V, I_D = -5 A, R_G = 4.7 Ω, V_{GS} = -10 V (see Figure 12. Test circuit for resistive load switching times)	-	49.4	-	ns
t_r	Rise time		-	60.6	-	ns
$t_{d(off)}$	Turn-off-delay time		-	170	-	ns
t_f	Fall time		-	20	-	ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}(1)	Forward on voltage	V_{GS} = 0 V, I_{SD} = -3 A	-		-1.1	V
t_{rr}	Reverse recovery time	I_{SD} = -5 A, di/dt = 100 A/µs, V_{DD} = -32 V, T_J = 150 °C (see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	29		ns
Q_{rr}	Reverse recovery charge		-	27.6		nC
I_{RRM}	Reverse recovery current		-	-1.9		A

1. *Pulse test: pulse duration = 300 µs, duty cycle 1.5%.*

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

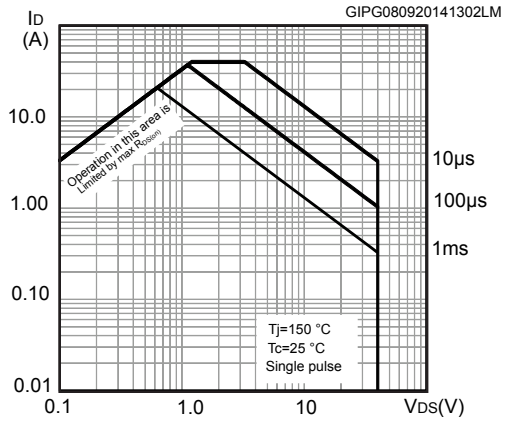


Figure 2. Thermal impedance

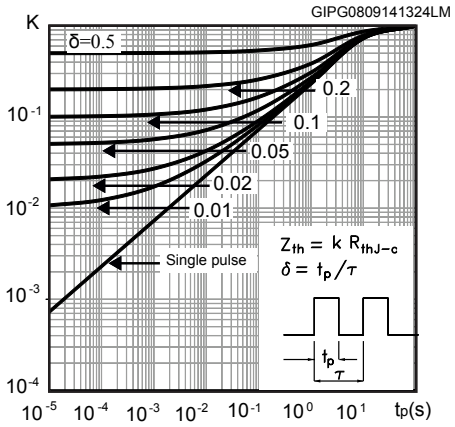


Figure 3. Output characteristics

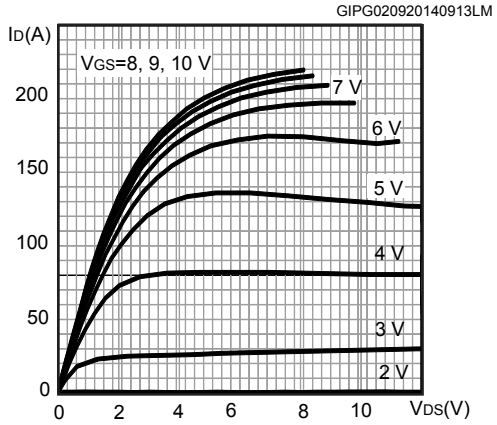


Figure 4. Transfer characteristics

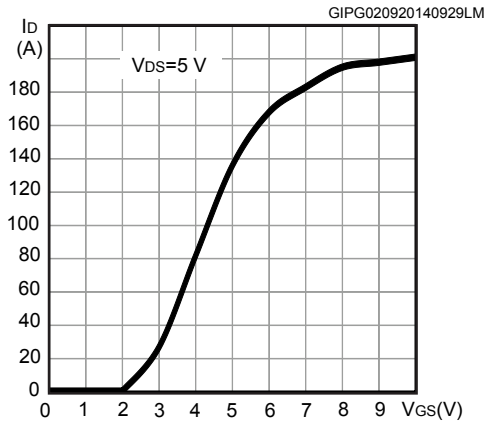


Figure 5. Gate charge vs gate-source voltage

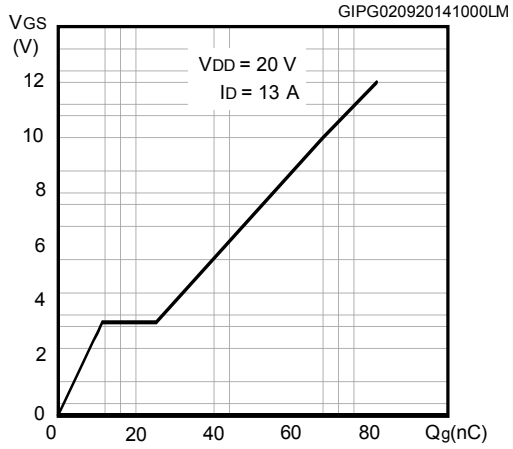
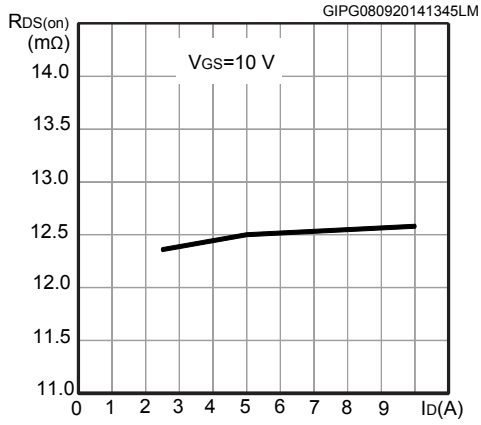


Figure 6. Static drain-source on-resistance



Note: For the P-channel Power MOSFET, current and voltage polarities are reversed.

Figure 7. Capacitance variation

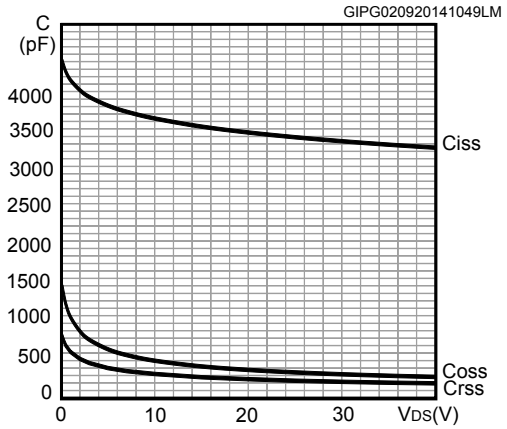


Figure 8. Normalized gate threshold voltage vs temperature

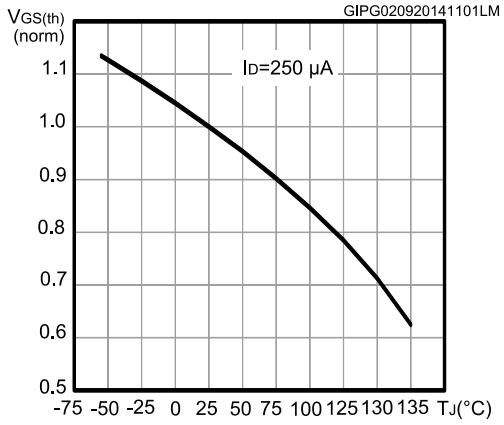


Figure 9. Normalized on-resistance vs temperature

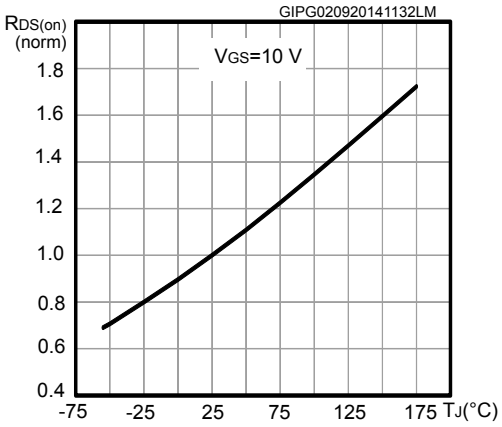


Figure 10. Normalized $V_{BR(DSS)}$ vs temperature

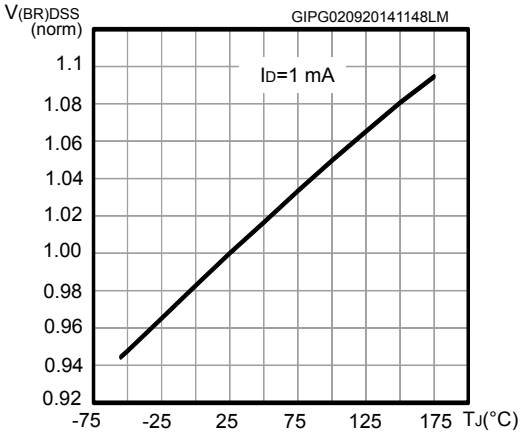
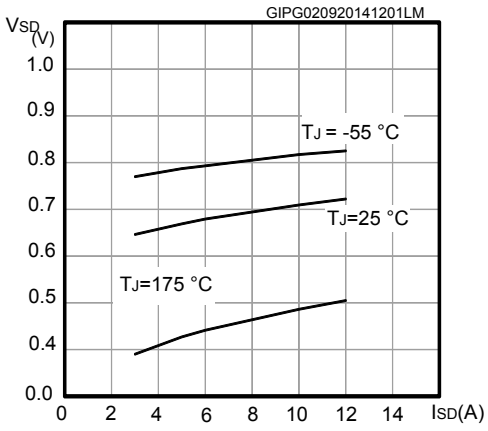


Figure 11. Source-drain diode forward characteristics



Note: For the P-channel Power MOSFET, current and voltage polarities are reversed.

3 Test circuits

Figure 12. Test circuit for resistive load switching times

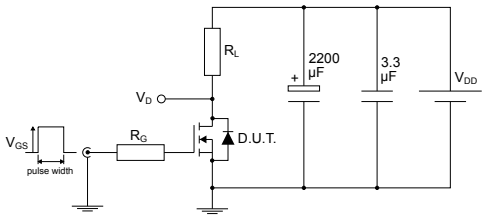


Figure 13. Test circuit for gate charge behavior

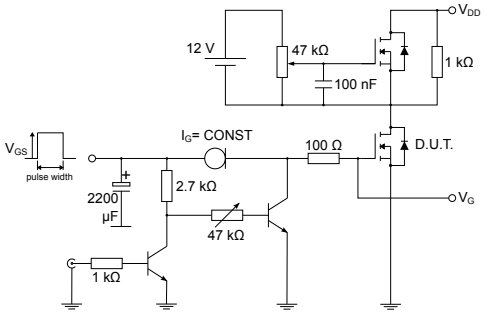


Figure 14. Test circuit for inductive load switching and diode recovery times

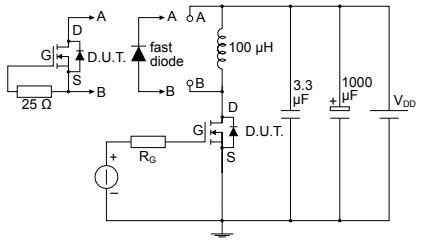


Figure 15. Unclamped inductive load test circuit

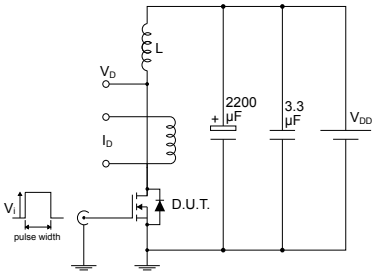


Figure 16. Unclamped inductive waveform

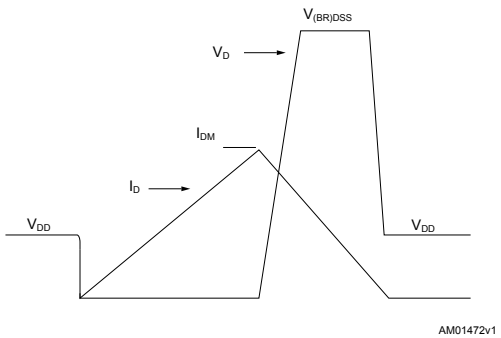
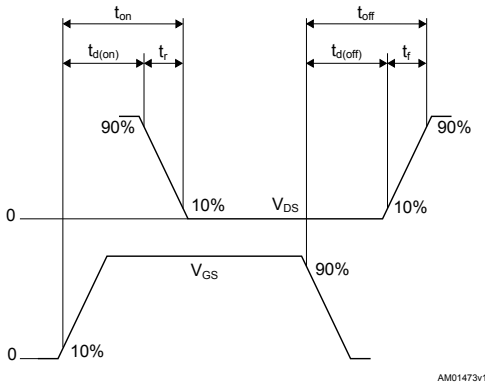


Figure 17. Switching time waveform



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 SO-8 package information

Figure 18. **SO-8 package outline**

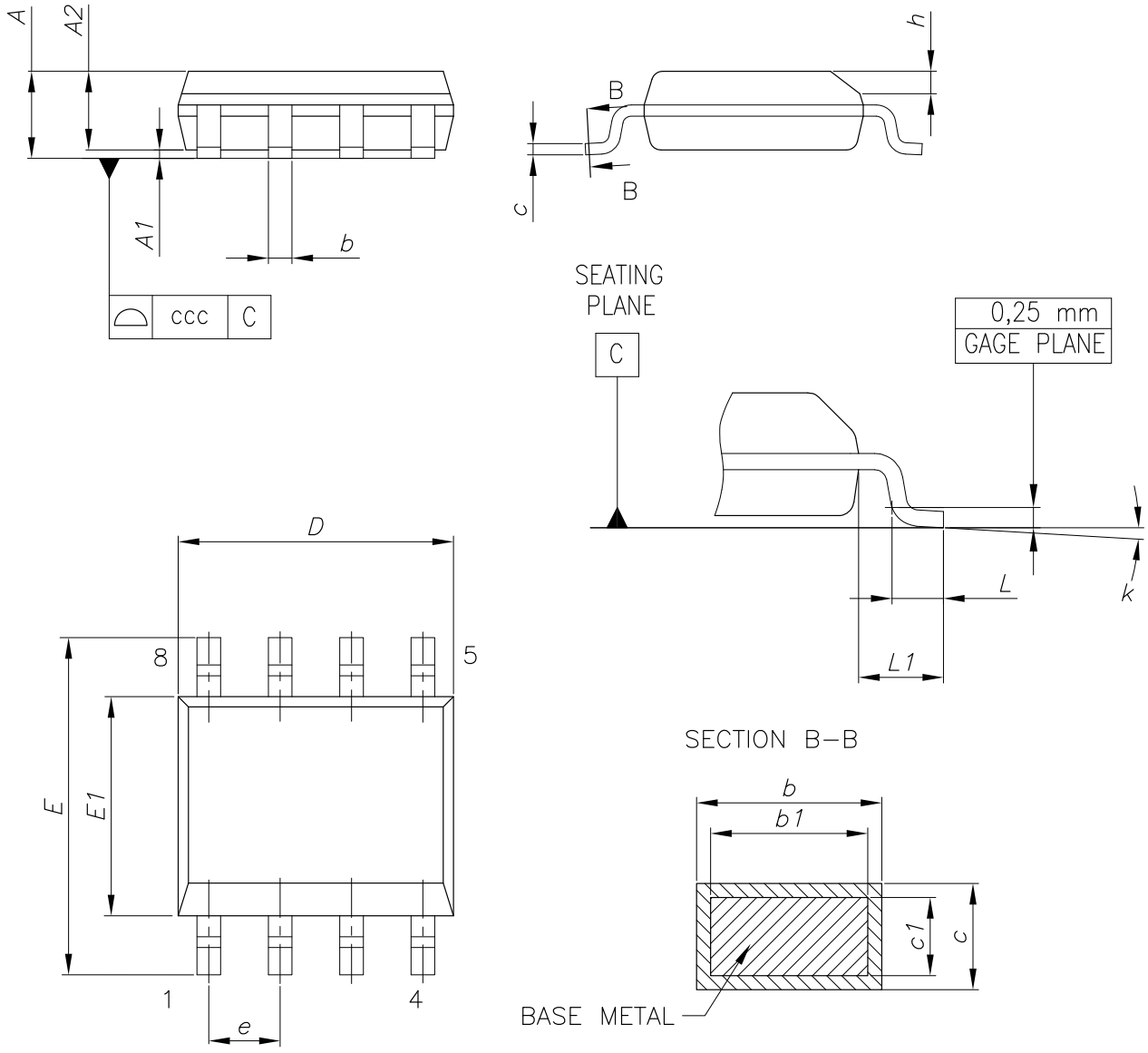


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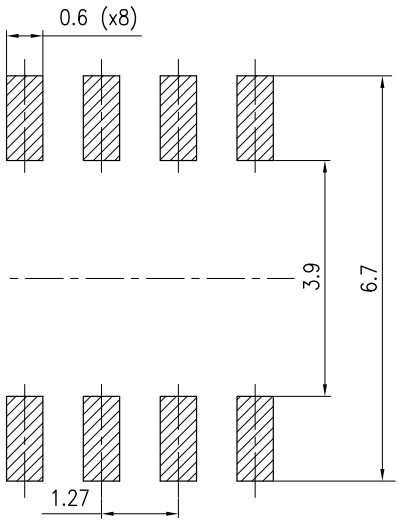
Table 7. **SO-8 mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A			1.75
A1	0.10		0.25
A2	1.25		
b	0.31		0.51
b1	0.28		0.48
c	0.10		0.25
c1	0.10		0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27	
h	0.25		0.50
L	0.40		1.27
L1		1.04	
L2		0.25	
k	0°		8°
ccc			0.10

Figure 19. **SO-8 recommended footprint (dimensions are in mm)**



0016023_So-807_footprint_Rev10

4.2 SO-8 packing information

Figure 20. **SO-8 tape and reel dimensions**

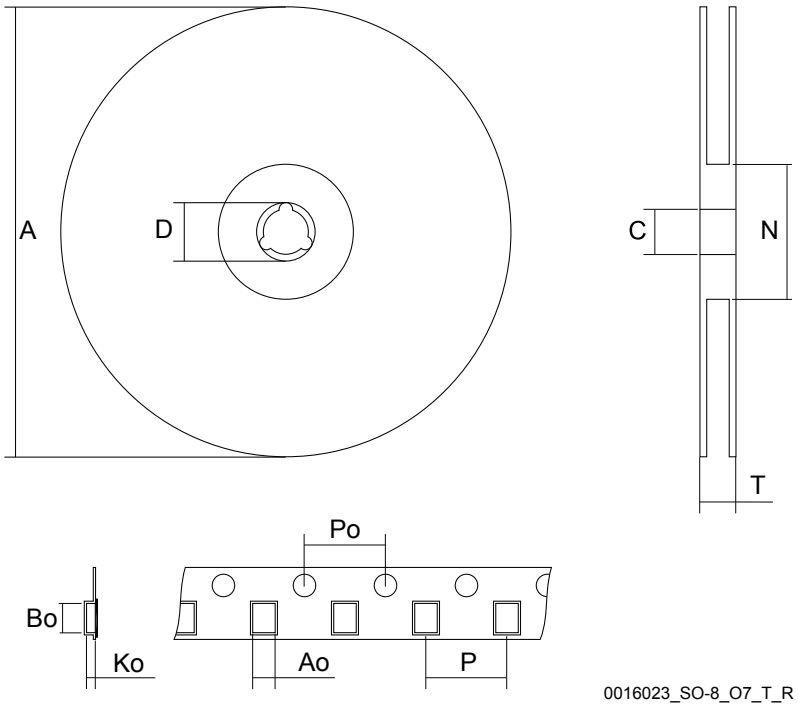


Figure 21. **Tape orientation**

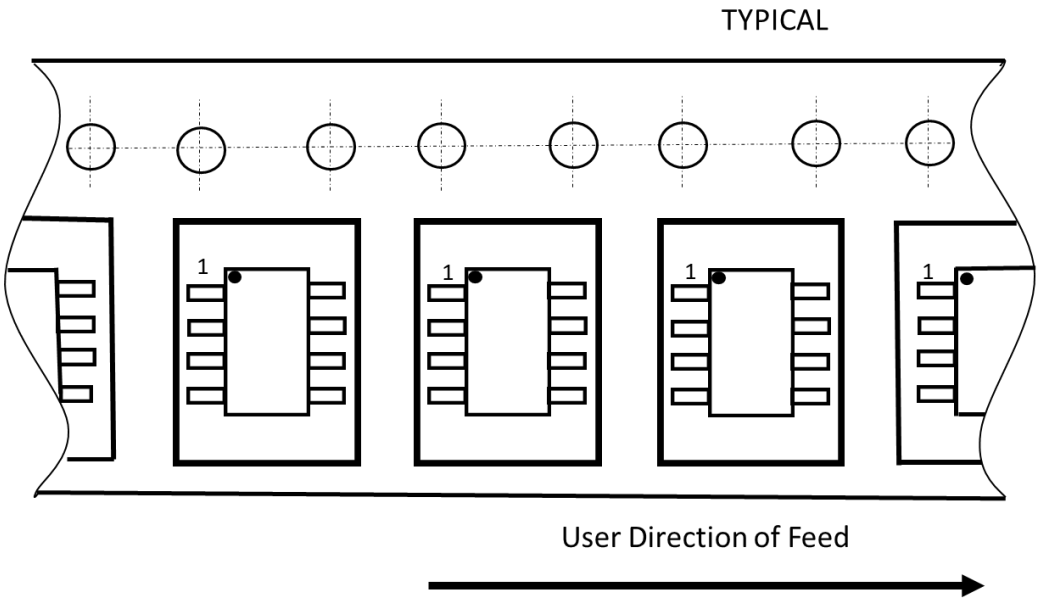


Table 8. **SO-8 tape and reel mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A		-	330
C	12.8		13.2
D	20.2		
N	60		
T			22.4
Ao	6.5		6.7
Bo	5.4		5.6
Ko	2.0		2.2
Po	3.9		4.1
P	7.9		8.1

Revision history

Table 9. **Document revision history**

Date	Revision	Changes
20-Jan-2014	1	First revision.
09-Sep-2014	2	Changed the title. Updated *Section "Features" and Section "Description"*. Updated *Table 4: "On/off states", Table 5: "Dynamic", Table 6: "Switching times", Table 7: "Source-drain diode"*. Added *Section 3: "Electrical characteristics (curves)"*.
16-Dec-2014	3	Document status promoted from preliminary data to production data. Minor text changes.
09-Dec-2020	4	Updated title and features in cover page. Updated Section 1 Electrical ratings and Section 2 Electrical characteristics. Minor text changes.
21-Jan-2021	5	Updated Internal schematic. Minor text changes.

Contents