N-CHANNEL POWER MOS FET FOR SWITCHING S-90N0232SUA

The S-90N0232SUA is an N-channel power MOS FET that realizes a low on-state resistance and ultra high-speed switching characteristics. It is suitable for speeding up switching, enabling a high efficient set and energy saving. A gate protection diode is built in as a countermeasure for static electricity. Small SOT-89-3 package realize high-density mounting.
This product can be driven directly by a 2.5 V power source. If use this product in combination with SII switching regulator products, you can get the highest performance.

■ Features

- Low on-state resistance: $R_{DS(on)1}$ = 0.11 Ω Max. (V_{GS} = 4.5 V, I_D = 1.5 A)
  $R_{DS(on)2}$ = 0.17 Ω Max. (V_{GS} = 2.5 V, I_D = 1.5 A)
- Ultra high-speed switching
- Operational voltage: 2.5 V drive available
- Built-in gate protection diode
- Small package: SOT-89-3

■ Applications

- Notebook PCs
- Cellular and portable phones
- On-board power supplies

■ Packages

- SOT-89-3 (Package drawing code: UP003-A)

■ Item code

- Item code : S-90N0232SUA-TF
- Delivery form : Taping only

■ Pin Configuration

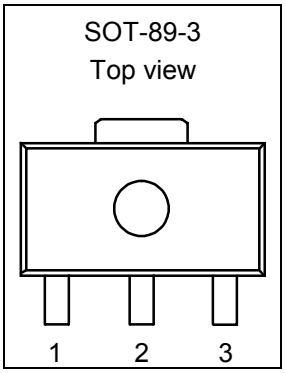


Figure 1

Table 1

Pin No.	Symbol	Description
1	G	Gate pin
2	D	Drain pin
3	S	Source pin

■ Equivalent Circuit

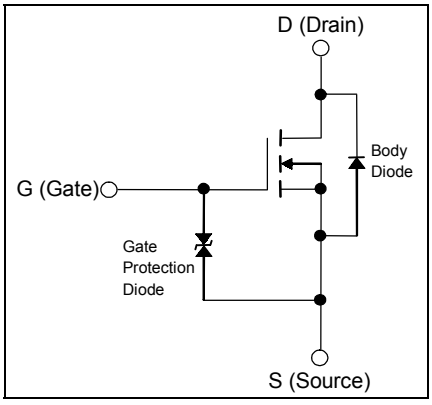


Figure 2

Caution The diode connected between the gate and source of the transistor serves as a protector against electrostatic discharge. Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in gate protection diode.
And when this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

■ Absolute Maximum Ratings

Table 2

(Ta = 25°C unless otherwise specified)

Item	Symbol	Conditions	Ratings	Unit
Drain to source voltage (When between gate and source short circuits)	V_{DSS}	V_{GS} = 0 V	20	V
Gate to source voltage (When between drain and source short circuits)	V_{GSS}	V_{DS} = 0 V	±12	
Drain current (DC)	I_D		3	A
Drain current (Pulse)	I_{DP}	PW = 10 µs, Duty Cycle≤1%	9	
Reverse drain current	I_{DR}		3	
Power dissipation *1, *2	P_D		2.5	W
Channel temperature	T_{ch}		150	°C
Storage temperature	T_{stg}		–55 to +150	

Caution The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

***1.** Mounted on a ceramics board (1225 $mm^2 \times 1$ mm)
***2.** The allowable power dissipation differs depending on the mounting form.

■ Electrical Characteristics

DC characteristics

Table 3

(Ta = 25°C unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain cut-off current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	—	—	10	μA
Gate to source leakage current	I_{GSS}	V_{GS} = ±12 V, V_{DS} = 0 V	—	—	±10	
Gate to source cut-off voltage	$V_{GS(off)}$	I_D = 1 mA, V_{DS} = 10 V	0.7	—	1.4	V
Drain to source on-state resistance *1	$R_{DS(on)1}$	I_D = 1.5 A, V_{GS} = 4.5 V	—	0.08	0.11	Ω
	$R_{DS(on)2}$	I_D = 1.5 A, V_{GS} = 2.5 V	—	0.13	0.17	
Forward transfer admittance *1	$\|Y_{fs}\|$	I_D = 1.5 A, V_{DS} = 10 V	—	6	—	S
Body drain diode forward voltage	V_f	I_f = 3 A, V_{GS} = 0 V	—	0.85	1.1	V

***1.** Effective during pulse test (600 μs).

Dynamic characteristics

Table 4

(Ta = 25°C unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	—	185	—	pF
Output capacitance	C_{oss}		—	65	—	
Feedback capacitance	C_{rss}		—	45	—	

Switching characteristics

Table 5

(Ta = 25°C unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Turn-on delay time	$t_{d(on)}$	V_{GS} = 5 V, I_D = 1.5 A,	—	10	—	ns
Rise time	t_r	V_{DD} = 10 V	—	35	—	
Turn-off delay time	$t_{d(off)}$		—	45	—	
Fall time	t_f		—	30	—	

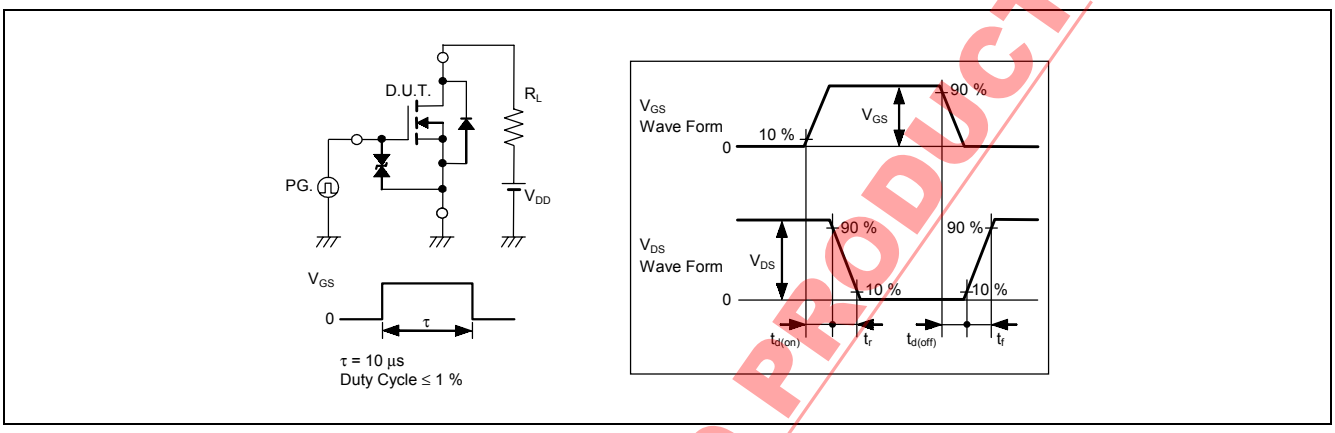


Figure 3

Thermal characteristics

Table 6

(Ta = 25°C unless otherwise specified)

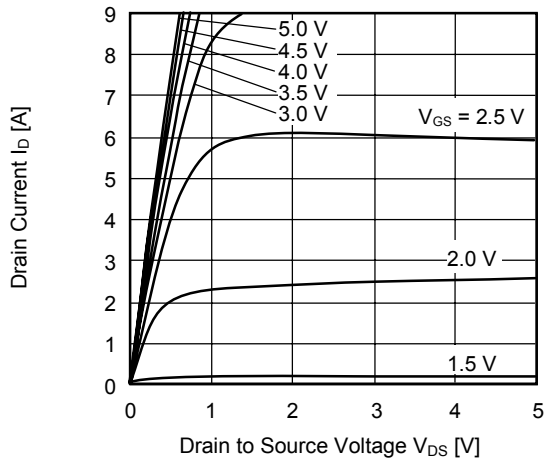
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal resistance (Channel to ambience)	$R_{th(ch-a)}$	Mounted on a ceramics board (1225 $mm^2 \times 1$ mm)	—	50	—	°C/W

■ Precautions

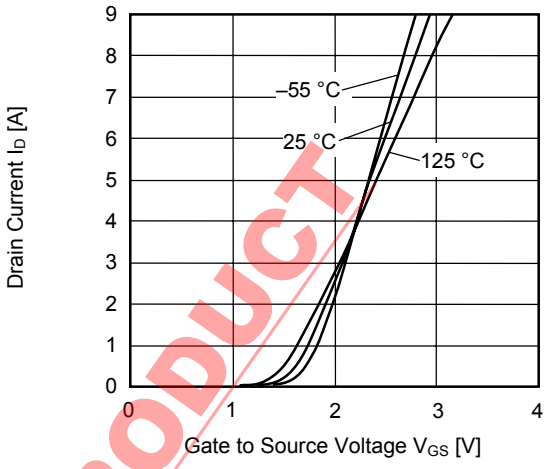
- The application conditions for the input voltage, output voltage, and load current should not exceed the allowable package power dissipation after mounting.
- SII claims no responsibility for any disputes arising out of or in connection with any infringement by products including this IC of patents owned by a third party.

■ Typical Characteristics

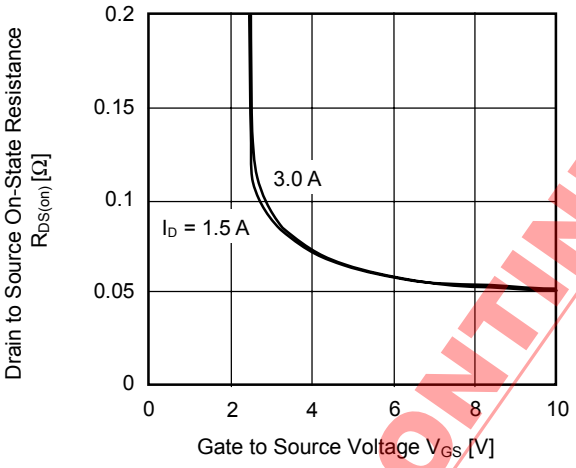
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE
Pulse test (600 µs), Ta = 25°C



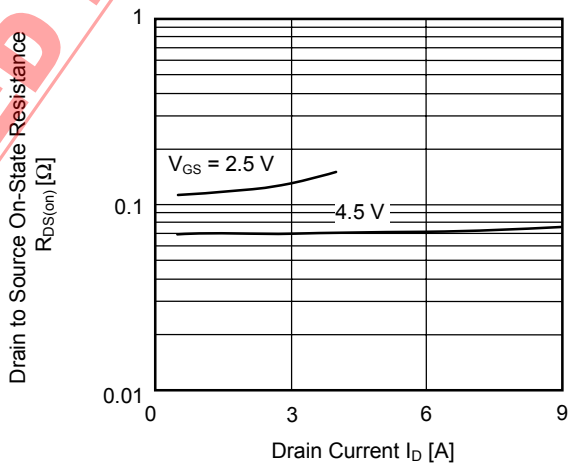
DRAIN CURRENT vs. GATE TO SOURCE VOLTAGE
Pulse test (600 µs), V_{DS} = 10 V



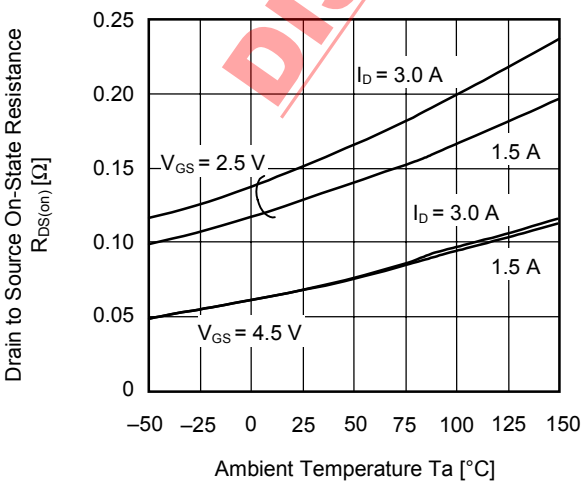
DRAIN TO SOURCE ON-STATE RESISTANCE
vs. GATE TO SOURCE VOLTAGE
Pulse test (600 µs), Ta = 25°C



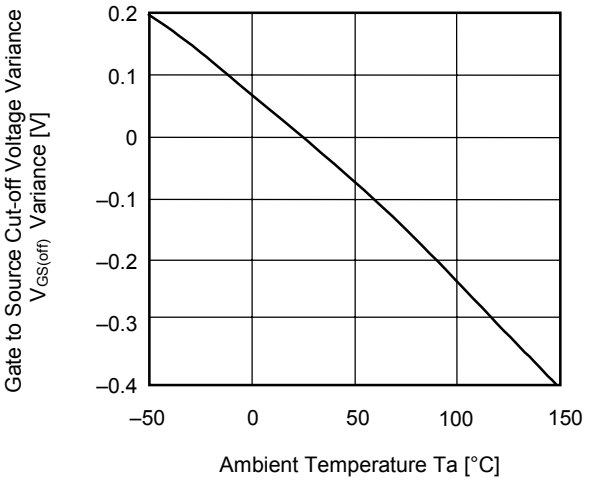
DRAIN TO SOURCE ON-STATE RESISTANCE
vs. DRAIN CURRENT
Pulse test (600 µs), Ta = 25°C



DRAIN TO SOURCE ON-STATE RESISTANCE
vs. AMBIENT TEMPERATURE
Pulse test (600 µs)

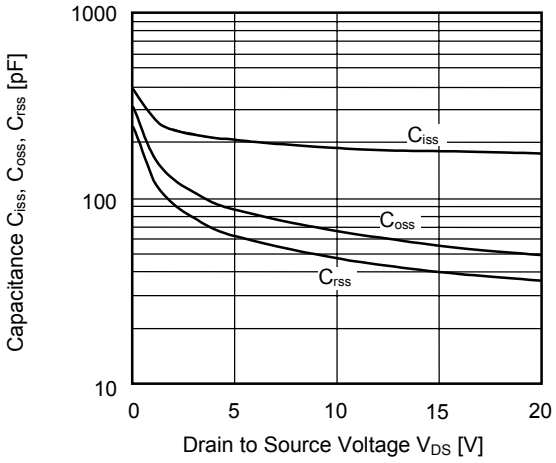


GATE TO SOURCE CUT-OFF VOLTAGE VARIANCE
vs. AMBIENT TEMPERATURE
V_{DS} = 10 V, I_D = 1 mA



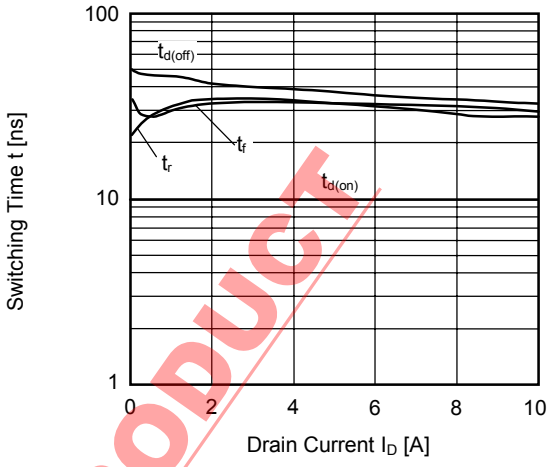
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

V_{GS} = 0 V, f = 1 MHz, Ta = 25°C



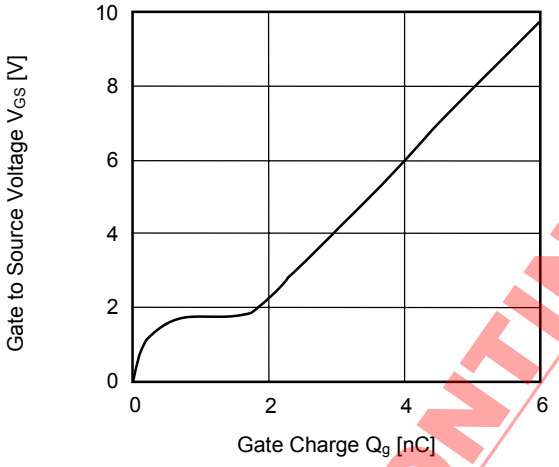
SWITCHING TIME vs. DRAIN CURRENT

V_{GS} = 5 V, V_{DD} = 10 V, PW = 10 µs,
Duty Cycle≤1%, Ta = 25°C



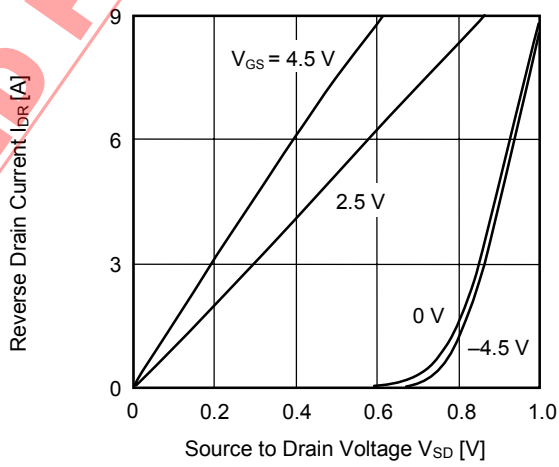
GATE TO SOURCE VOLTAGE vs. GATE CHARGE

V_{DS} = 10 V, I_D = 3 A, Ta = 25°C



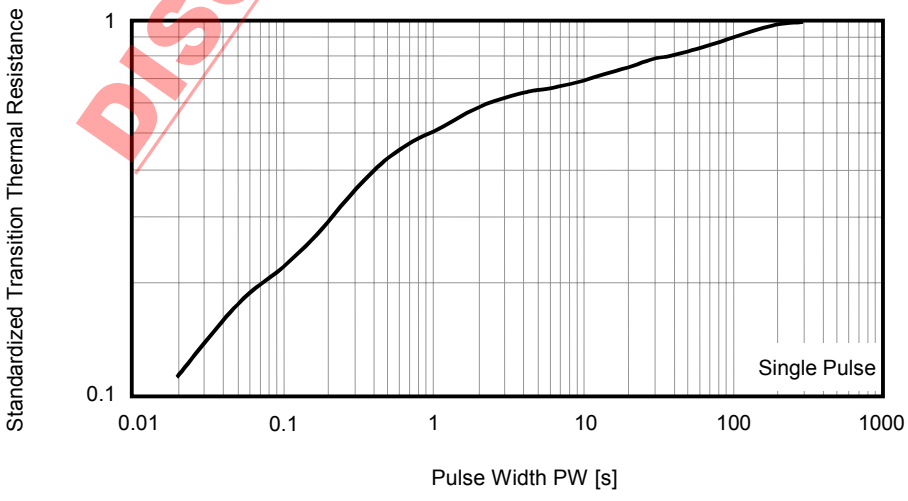
REVERSE DRAIN CURRENT vs. SOURCE TO DRAIN VOLTAGE

Pulse test (600 µs), Ta = 25°C



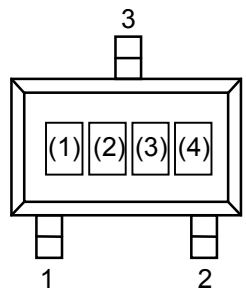
STANDARDIZED TRANSITION THERMAL RESISTANCE vs. PULSE WIDTH

$R_{th(ch-a)}$ = 50°C/W, Ta = 25°C, Mounted on a ceramics board (1225 $mm^2 \times 1$ mm)



■ Marking Specification

SOT-23-3
Top view

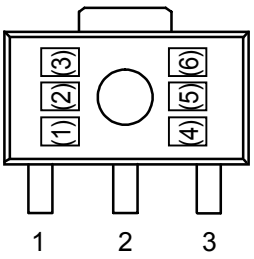


(1)~(3) : Product code (Refer to **Product name vs. Product code**)
(4) : Lot number

Product name vs. Product code

Product name	Product abbreviation		
	(1)	(2)	(3)
S-90N0113SMA-TF	O	N	A
S-90N0212SMA-TF	O	N	B
S-90N0312SMA-TF	O	N	C

SOT-89-3
Top view

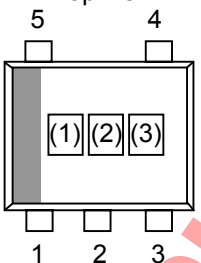


(1)~(3) : Product code (Refer to **Product name vs. Product code**)
(4)~(6) : Lot number

Product name vs. Product code

Product name	Product abbreviation		
	(1)	(2)	(3)
S-90N0133SUA-TF	O	N	G
★ S-90N0232SUA-TF	O	N	H
S-90N0332SUA-TF	O	N	I
S-90N0442SUA-TF	O	N	J

5-Pin SON(A)
Top view

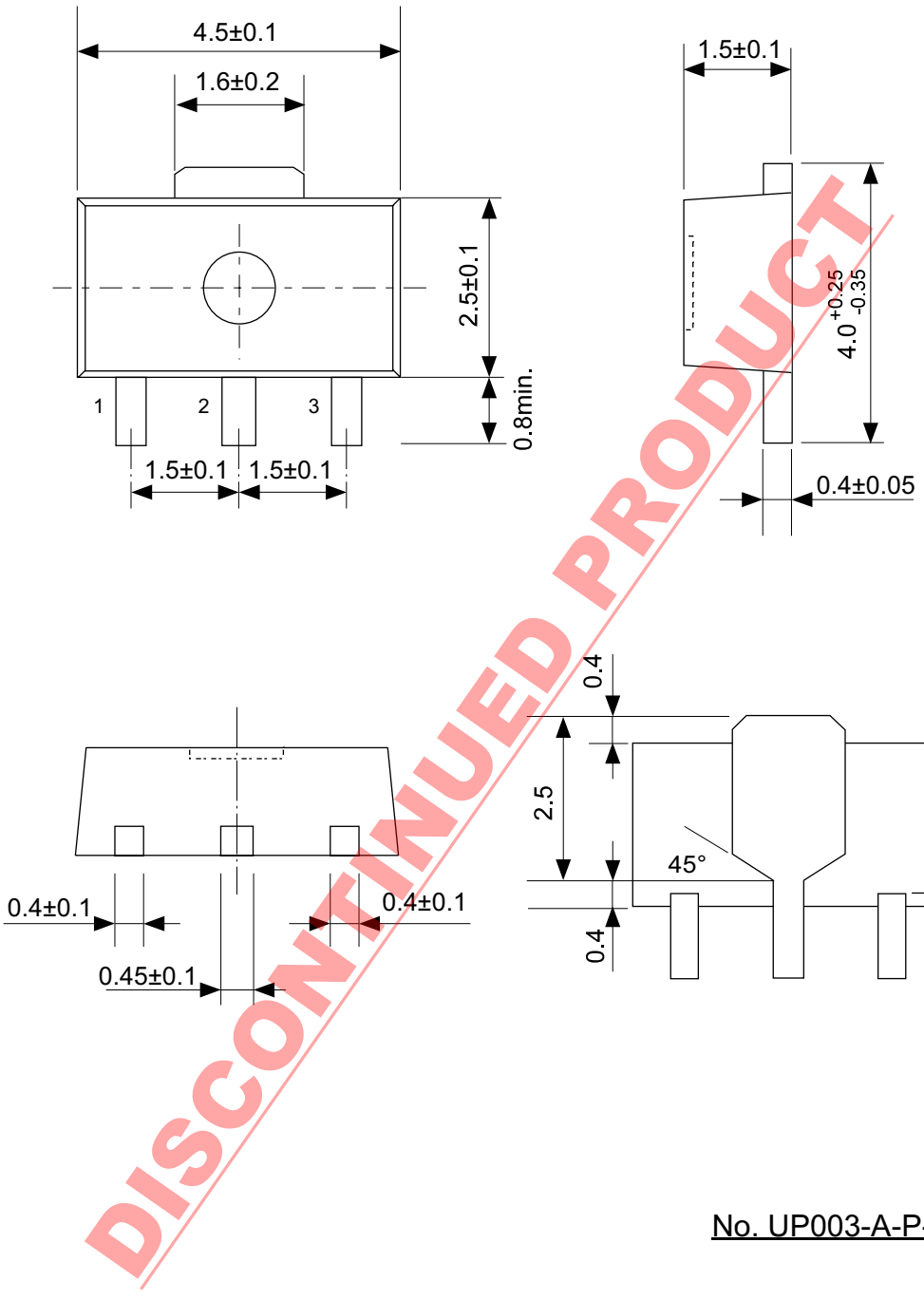


(1)~(3) : Product code (Refer to **Product name vs. Product code**)

Product name vs. Product code

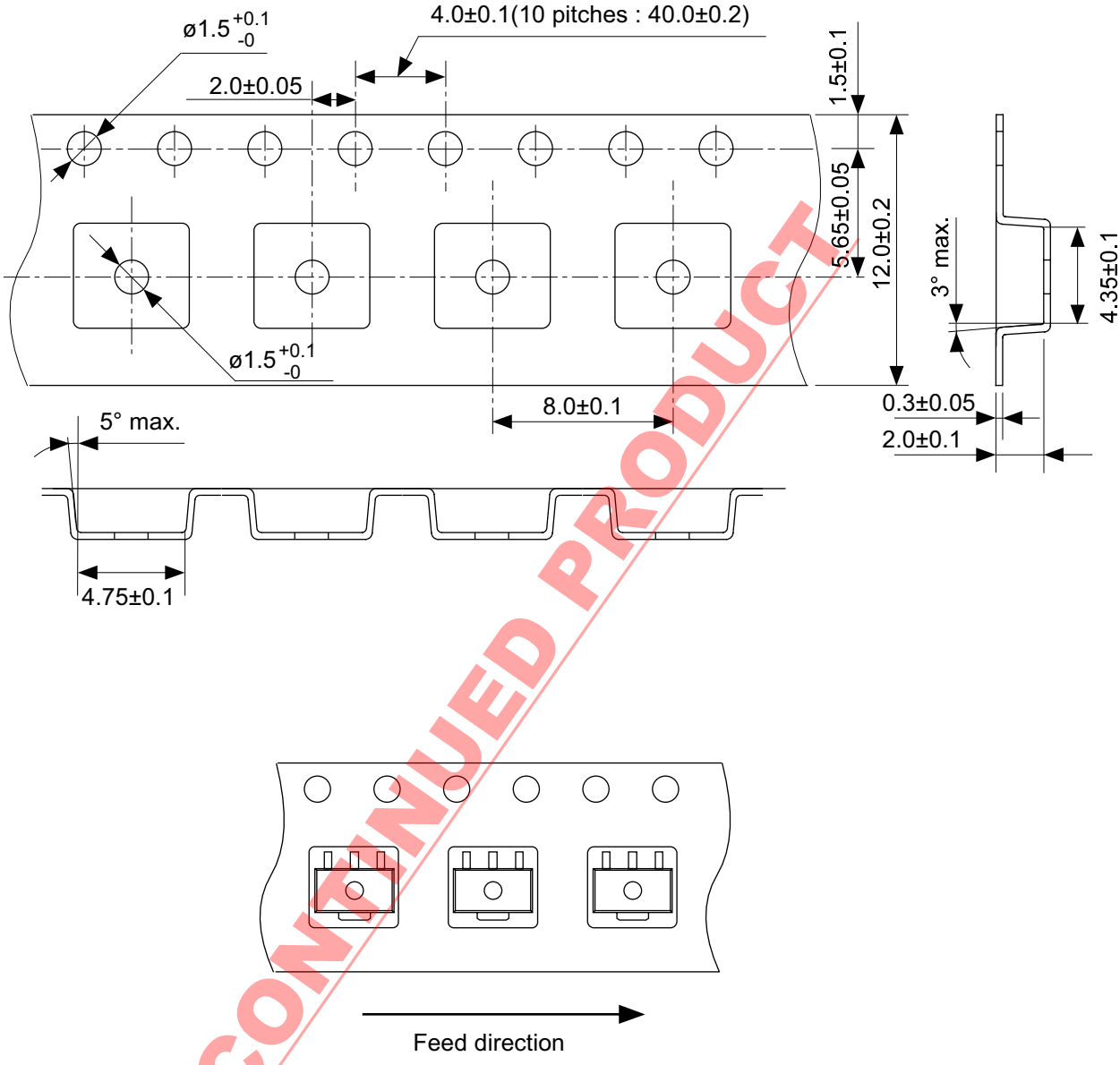
Product name	Product abbreviation		
	(1)	(2)	(3)
S-90N0513SPN-TF	O	N	M

Remark The mark ★ shows the product indicated in this data sheet.



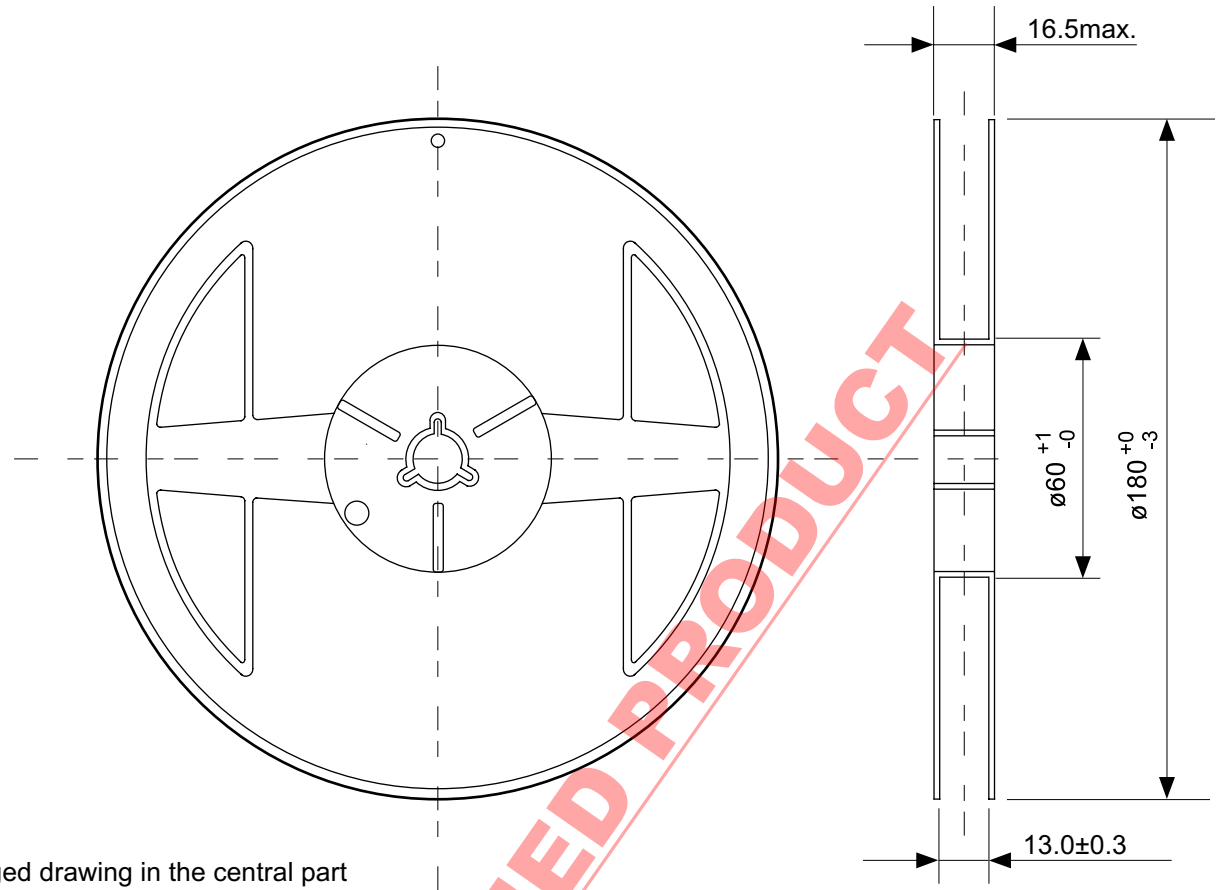
No. UP003-A-P-SD-1.1

TITLE	SOT893-A-PKG Dimensions
No.	UP003-A-P-SD-1.1
SCALE	
UNIT	mm
Seiko Instruments Inc.	

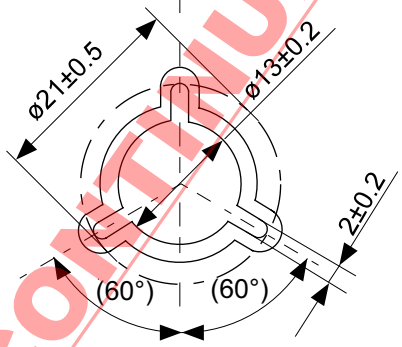


No. UP003-A-C-SD-1.1

TITLE	SOT893-A-Carrier Tape
No.	UP003-A-C-SD-1.1
SCALE	
UNIT	mm
Seiko Instruments Inc.	



Enlarged drawing in the central part



No. UP003-A-R-SD-1.1

TITLE	SOT893-A-Reel		
No.	UP003-A-R-SD-1.1		
SCALE		QTY.	1,000
UNIT	mm		
Seiko Instruments Inc.			

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