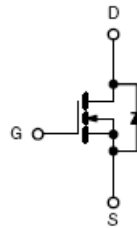# SOT-23 Plastic-Encapsulate MOSFETS

BSS139 N-channel SIPMOS® Small-Signal-Transistor

Features

- V_{DS} 250 V
- I_D 0.04 A
- $R_{DS(on)}$ 100 Ω
- Depletion mode
- High dynamic resistance
- Available grouped in $V_{GS(th)}$

Marking:ST

SOT-23

1. GATE
2. SOURCE
3. DRAIN

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	250	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	250	
Gate-source voltage	V_{GS}	± 14	
Gate-source peak voltage, aperiodic	V_{gs}	± 20	
Continuous drain current, T_A = 25 ℃	I_D	0.04	A
Pulsed drain current, T_A = 25 ℃	$I_{D\ puls}$	0.12	
Max. power dissipation, T_A = 25 ℃	P_{tot}	0.36	W
Operating and storage temperature range	T_j, T_{stg}	− 55 … + 15	℃

Parameter	Symbol	Values	Unit
Thermal resistance, chip-ambient (without heat sink)	R_{thJA}	≤ 350	K/W
chip-substrate – reverse side [1]	R_{thJSR}	≤ 285	
DIN humidity category, DIN 40 040	–	E	–
IEC climatic category, DIN IEC 68-1	–	55/150/56	

[1] For package mounted on aluminum 15 mm x 16.7 mm x 0.7 mm.

Electrical Characteristics at T_j = 25 °C, unless otherwise specified.

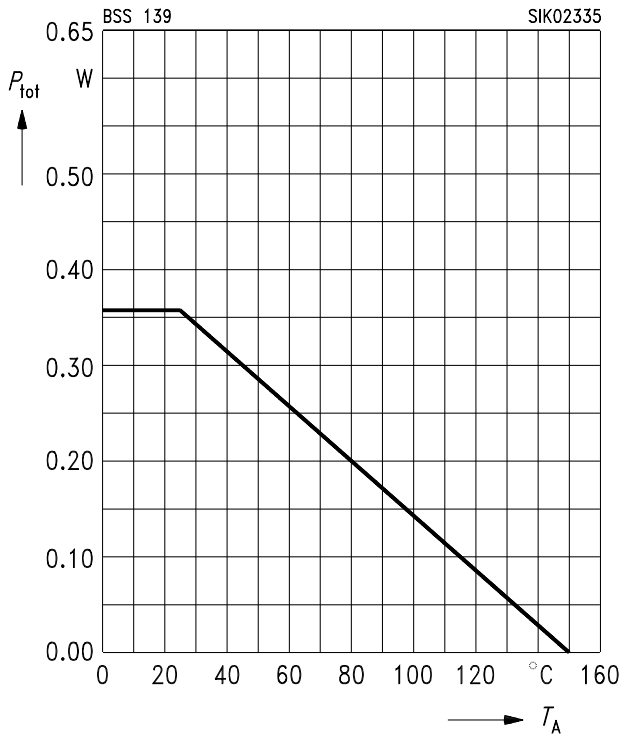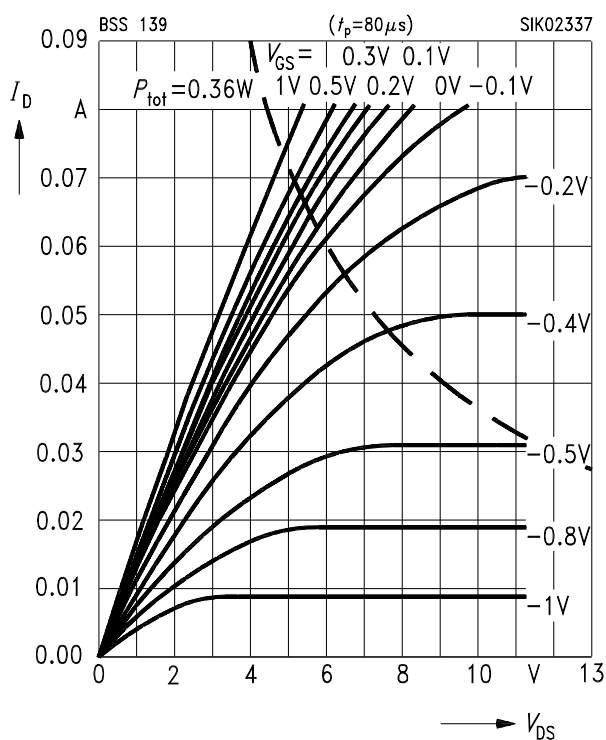| Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Drain-source breakdown voltage V_{GS} = − 3 V, I_D = 0.25 mA	$V_{(BR)DSS}$	250	–	–	V
Gate threshold voltage V_{DS} = 3 V, I_D = 1 mA	$V_{GS(th)}$	− 1.8	− 1.4	− 0.7	
Drain-source cutoff current V_{DS} = 250 V, V_{GS} = − 3 V T_j = 25 °C T_j = 125 °C	I_{DSS}	 – –	 – –	 100 200	 nA µA
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}	–	10	100	nA
Drain-source on-resistance V_{GS} = 0 V, I_D = 0.014 A	$R_{DS(on)}$	–	75	100	Ω
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = 0.04 A	g_{fs}	0.05	0.07	–	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{iss}	–	85	120	pF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	6	10	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	–	2	3	
Turn-on time t_{on}, ($t_{on} = t_{d(on)} + t_r$) V_{DD} = 30 V, V_{GS} = − 2 V ... + 5 V, R_{GS} = 50 Ω, I_D = 0.15 A	$t_{d(on)}$ t_r	– –	4 10	6 15	ns
Turn-off time t_{off}, ($t_{off} = t_{d(off)} + t_f$) V_{DD} = 30 V, V_{GS} = − 2 V ... + 5 V, R_{GS} = 50 Ω, I_D = 0.15 A	$t_{d(off)}$ t_f	– –	10 15	13 20	
Continuous reverse drain current T_A = 25 °C	I_S	–	–	0.04	A
Pulsed reverse drain current T_A = 25 °C	I_{SM}	–	–	0.12	
Diode forward on-voltage I_F = 0.08 A, V_{GS} = 0	V_{SD}	–	0.7	1.2	V

Typical Characteristics

Characteristics
at T_j = 25 ℃, unless otherwise specified.
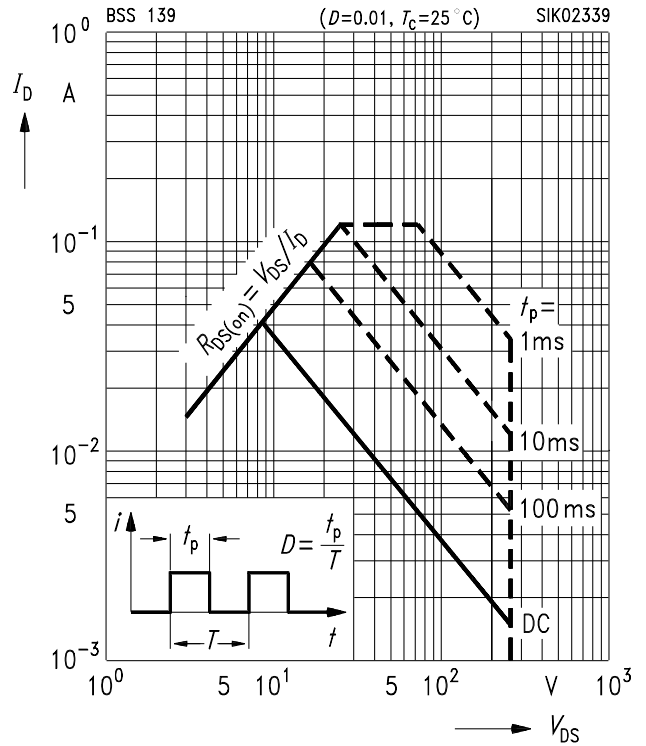
Total power dissipation $P_{tot} = f(T_A)$

Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ ℃

Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 μs
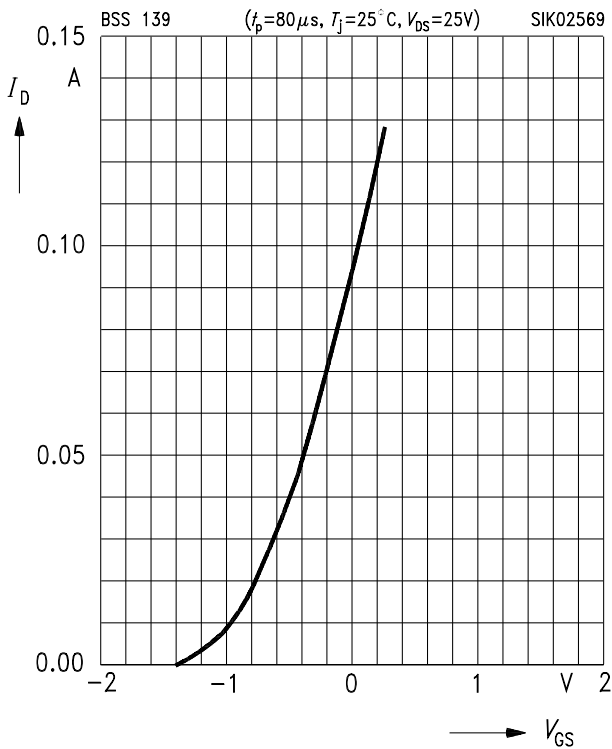

Typ. drain-source on-resistance
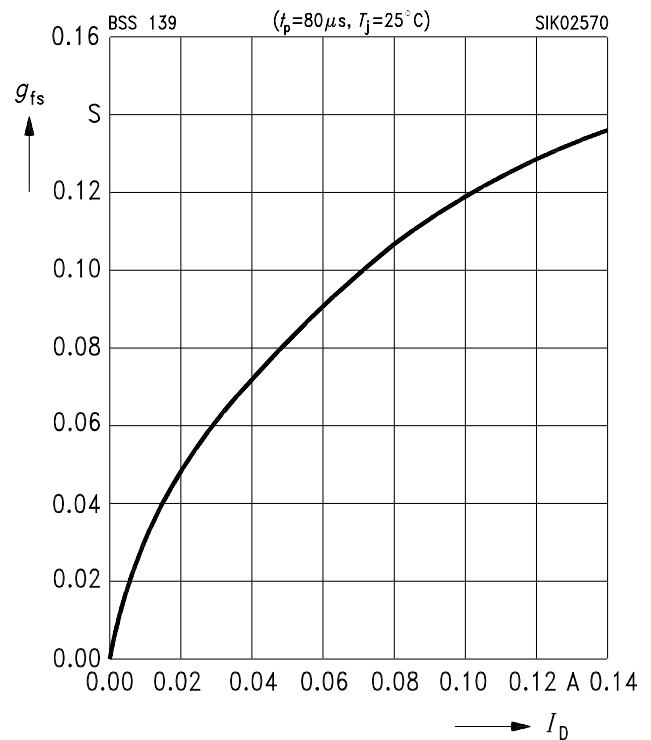$R_{DS(on)} = f(I_D)$
parameter: V_{GS}
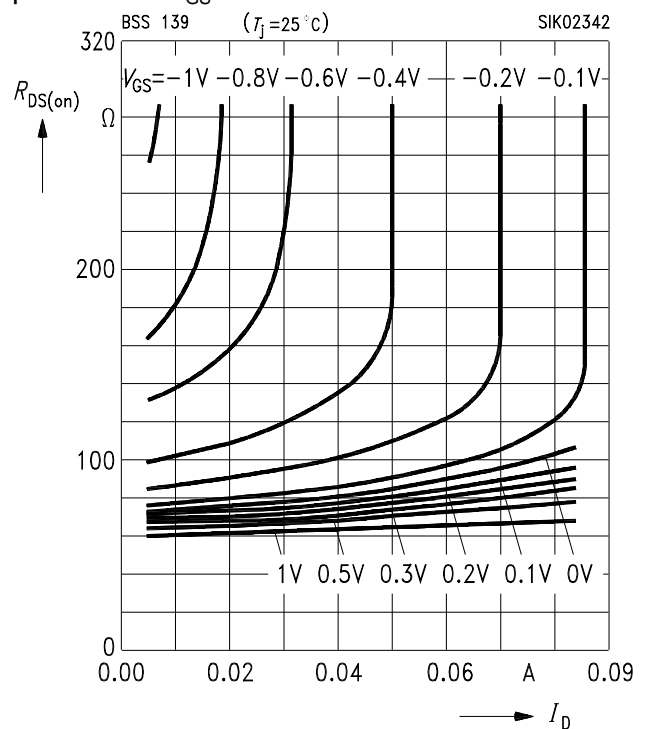
Typical Characteristics

Typ. transfer characteristics $I_D = f(V_{GS})$
parameter: $t_p = 80$ µs, $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$
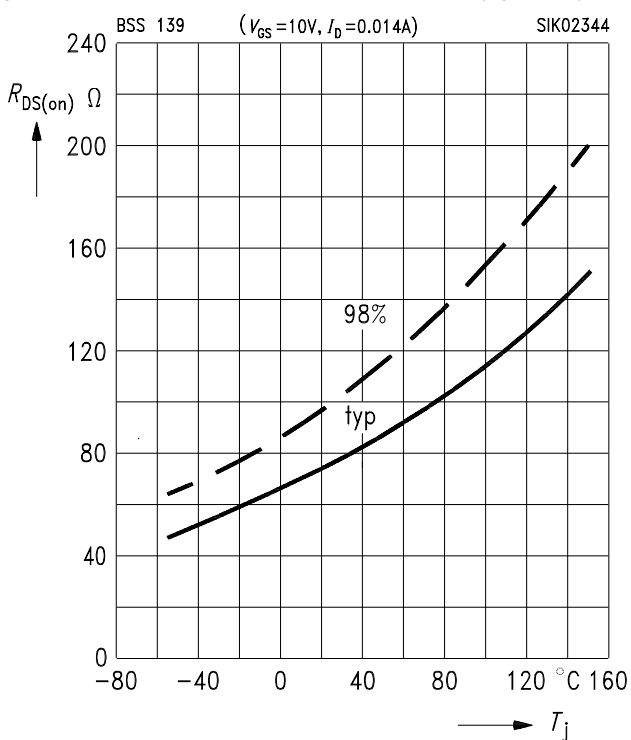
Typ. forward transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} \geq 2 \times I_D \times R_{DS(on)max.}$, $t_p = 80$ µs

BSS 139 $(t_p=80\mu s, T_j=25°C, V_{DS}=25V)$ SIK02569

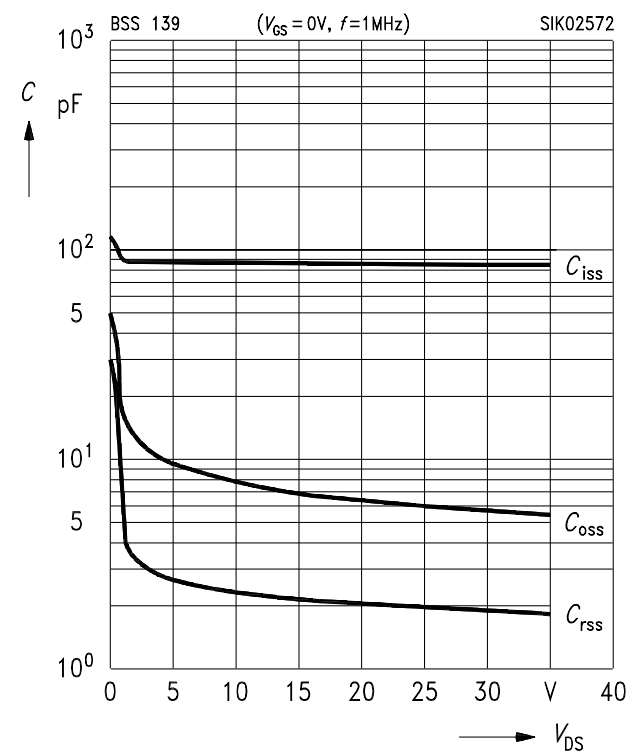BSS 139 $(t_p=80\mu s, T_j=25°C)$ SIK02570

Drain-source on-resistance
$R_{DS(on)} = f(T_j)$
parameter: $I_D = 0.014$ A, $V_{GS} = 0$ V, (spread)

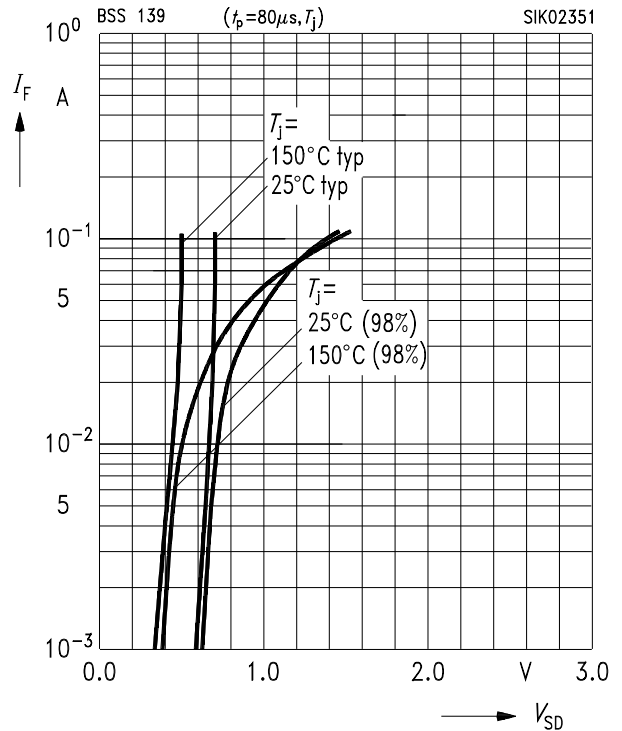**Typ. capacitances** $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

BSS 139 $(V_{GS}=10V, I_D=0.014A)$ SIK02344

98%

typ

BSS 139 $(V_{GS}=0V, f=1MHz)$ SIK02572

C_{iss}

C_{oss}

C_{rss}

Typical Characteristics

Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = 3\ V$, $I_D = 1\ mA$, (spread)

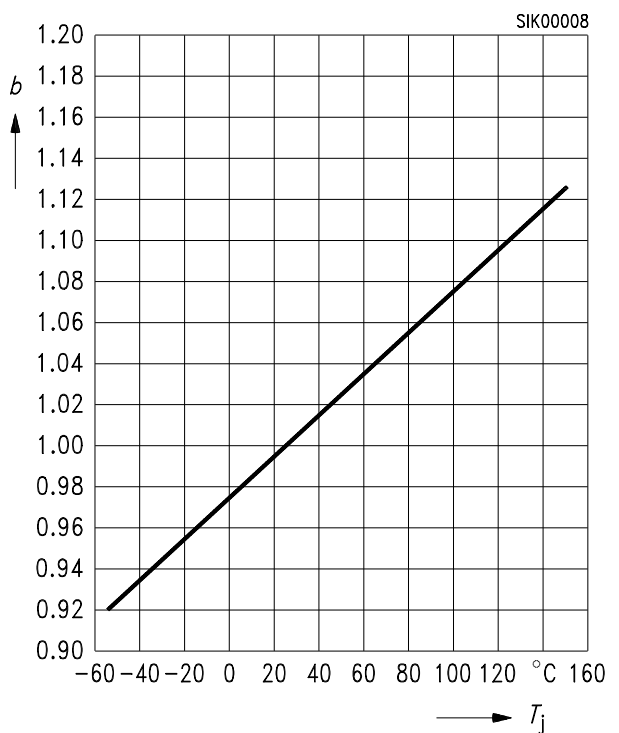BSS 139 $(V_{GS}=V_{DS},\ I_D=1mA)$ SIK02571

$V_{GS(th)}$ V

- −3.0
- −2.6
- −2.4
- −2.2
- −2.0   2%
- −1.8
- −1.6   typ
- −1.4
- −1.2
- −1.0   98%
- −0.8
- −0.6
- −0.4
- −0.2
- 0.0

−60 −40 −20 0 20 40 60 80 100 120 °C 160 T_j
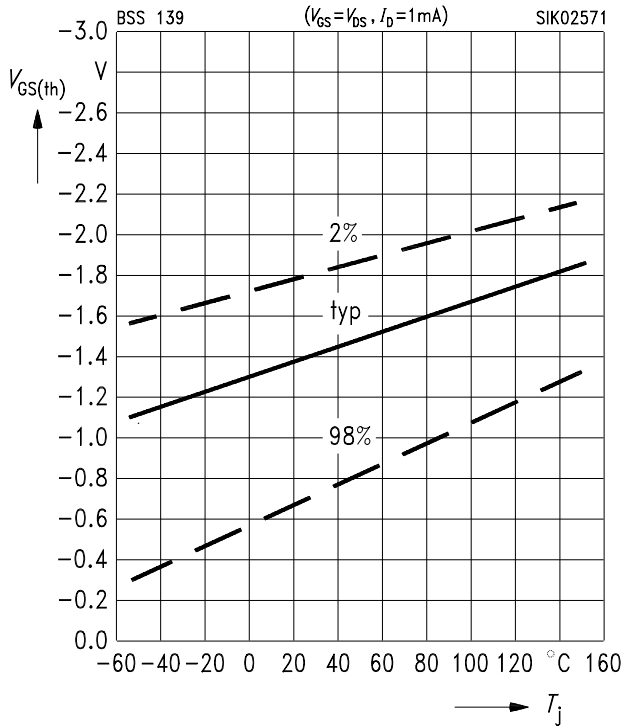
Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80\ \mu s$, T_j, (spread)

BSS 139 $(t_p=80\mu s, T_j)$ SIK02351

I_F A

$T_j =$ 150°C typ
25°C typ

$T_j =$ 25°C (98%)
150°C (98%)

- 10^0
- 10^{-1}
- 5
- 10^{-2}
- 5
- 10^{-3}

0.0   1.0   2.0   V   3.0 V_{SD}

Drain current $I_D = f(T_A)$
parameter: $V_{GS} \geq 3\ V$

BSS 139 $(V_{GS} \geq 10V)$ SIK02349

I_D A

- 0.075
- 0.060
- 0.050
- 0.040
- 0.030
- 0.020
- 0.010
- 0.000

0 20 40 60 80 100 120 °C 160 T_A
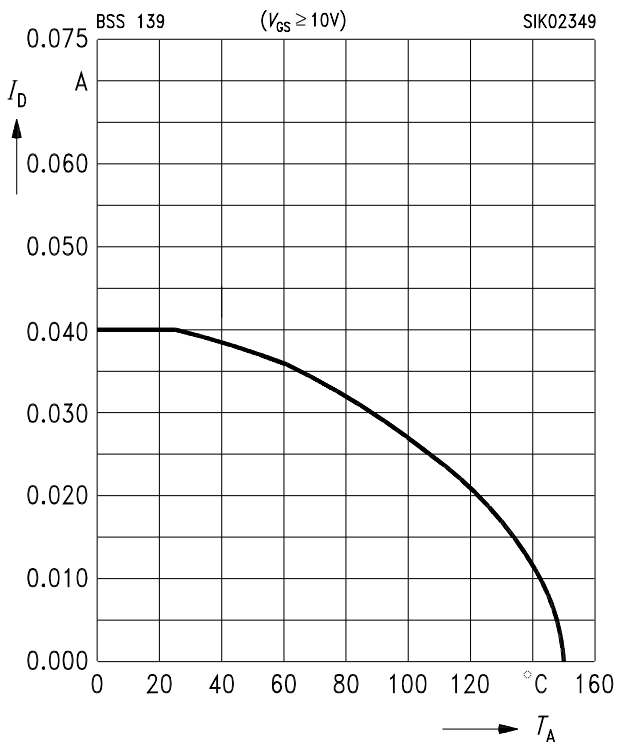
Drain-source breakdown voltage
$V_{(BR)\ DSS} = b \times V_{(BR)DSS}$ (25 ℃)

SIK00008

b

- 1.20
- 1.18
- 1.16
- 1.14
- 1.12
- 1.10
- 1.08
- 1.06
- 1.04
- 1.02
- 1.00
- 0.98
- 0.96
- 0.94
- 0.92
- 0.90

−60 −40 −20 0 20 40 60 80 100 120 °C 160 T_j

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads　　　　　　　　　　　　　　**SOT-23**
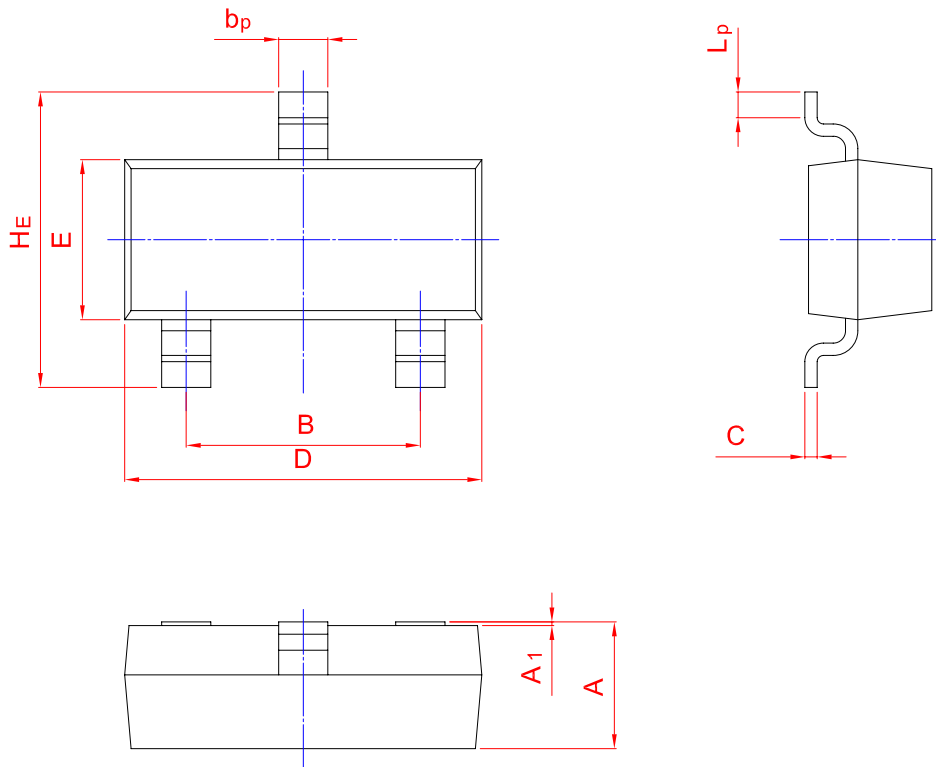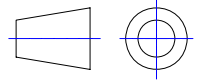
UNIT	A	B	b$_p$	C	D	E	H$_E$	A$_1$	L$_p$
mm	1.40 0.95	2.04 1.78	0.50 0.35	0.19 0.08	3.10 2.70	1.65 1.20	3.00 2.20	0.100 0.013	0.50 0.20

REV01: 09/2011