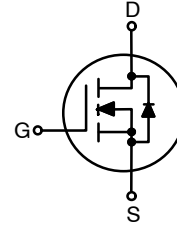


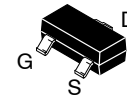
# N-Channel Logic Level Enhancement Mode Field Effect Transistor

## BSS138K



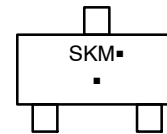
### Features

- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Ultra-Small Surface Mount Package
- Green Compound
- ESD HBM = 2000 V as per JEDEC A114A;  
ESD CDM = 2000 V as per JEDEC C101C
- This Device is Pb-Free and is RoHS Compliant



SOT-23-3  
CASE 318-08

### MARKING DIAGRAM



- SK = Specific Device Code  
M = Assembly Operation Month  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ABSOLUTE MAXIMUM RATINGS

( $T_A = 25^\circ\text{C}$  unless otherwise noted) (Note 1)

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain-Source Voltage	50	V
$V_{GSS}$	Gate-Source Voltage	$\pm 12$	V
$I_D$	Drain Current – Continuous	0.22	A
	Drain Current – Pulsed	0.88	
$P_D$	Total Device Dissipation	350	mV
	Derating above $T_A = 25^\circ\text{C}$	2.8	mW/ $^\circ\text{C}$
$T_J$	Operating Junction Temperature Range	-55 to +150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to +150	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

### THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 2)	350	V

2. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch. Minimum land pad size.

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
BSS138K	SOT-23-3 (Pb-Free)	3000 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# BSS138K

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain–Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 10 μA	50	–	–	V
$\frac{BV_{DSS}}{T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	–	0.11	–	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 50 V, V <sub>GS</sub> = 0 V	–	–	0.1	μA
I <sub>GSS</sub>	Gate–Body Leakage	V <sub>GS</sub> = ±12 V, V <sub>DS</sub> = 0 V	–	–	±1	μA
		V <sub>GS</sub> = ±10 V, V <sub>DS</sub> = 0 V	–	–	±0.5	
		V <sub>GS</sub> = ±5 V, V <sub>DS</sub> = 0 V	–	–	±0.05	

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	0.6	–	1.2	V
$\frac{V_{GS(th)}}{T_J}$	Gate Threshold Voltage Temperature Coefficient	I <sub>D</sub> = 1 mA, Referenced to 25°C	–	–1.4	–	mV/°C
R <sub>DS(on)</sub>	Static Drain–Source On–Resistance	V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 50 mA	–	–	2.5	Ω
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 50 mA	–	–	2.0	
		V <sub>GS</sub> = 5 V, I <sub>D</sub> = 50 mA,	–	–	1.6	
I <sub>D(ON)</sub>	On–State Drain Current	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 5 V	0.2	–	–	A
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 200 mA	200	–	–	mS

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	–	58	–	pF
C <sub>oss</sub>	Output Capacitance		–	9.75	–	
C <sub>rss</sub>	Reverse Transfer Capacitance		–	5.2	–	
R <sub>G</sub>	Gate Resistance	V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 mV	–	281	–	Ω

### SWITCHING CHARACTERISTICS

t <sub>D(ON)</sub>	Turn–On Delay Time	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 0.29 A, V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω	–	–	5	ns
t <sub>r</sub>	Turn–On Rise Time		–	–	5	
t <sub>D(OFF)</sub>	Turn–Off Delay Time		–	–	60	
t <sub>f</sub>	Turn–Off Fall Time		–	–	35	
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 25 V, I <sub>D</sub> = 0.2 A, V <sub>GS</sub> = 10 V, I <sub>G</sub> = 0.1 mA	–	–	2.4	nC
Q <sub>gs</sub>	Gate–Source Charge		–	–	0.5	
Q <sub>gd</sub>	Gate–Drain Charge		–	–	0.5	

### DRAIN–SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

V <sub>sd</sub>	Drain–Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 115 mA	–	–	1.2	V
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Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL CHARACTERISTICS

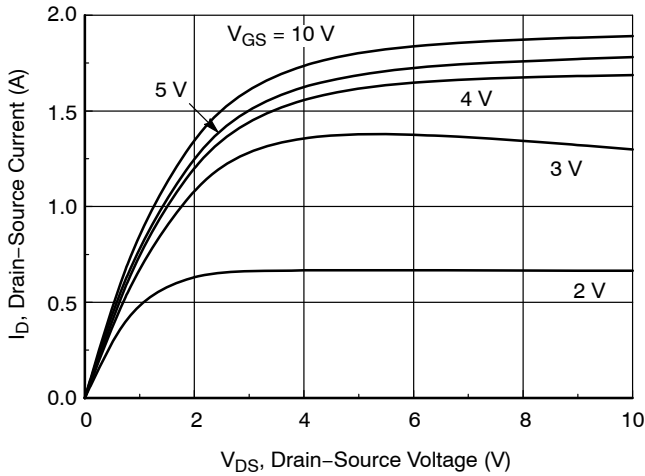


Figure 1. On-Region Characteristics

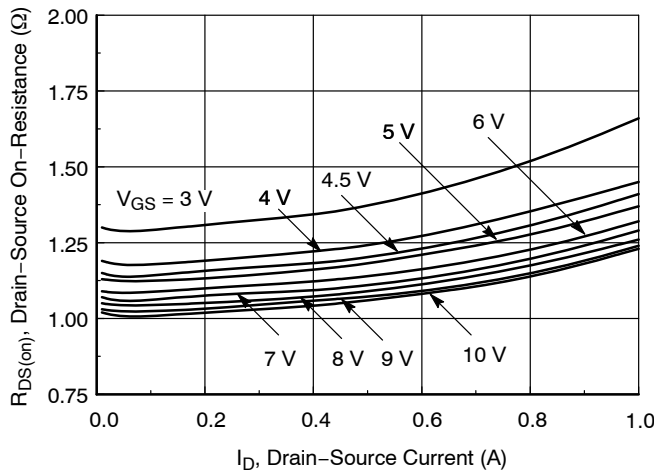


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

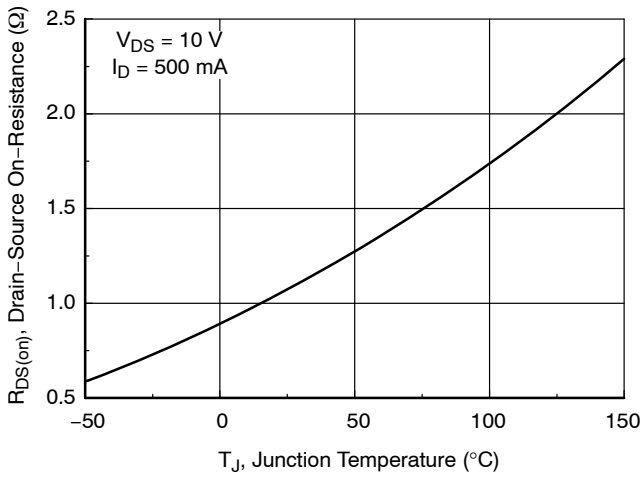


Figure 3. On-Resistance Variation with Temperature

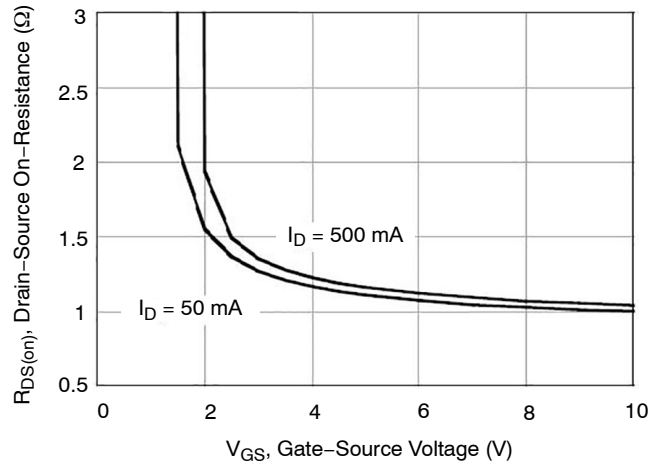


Figure 4. On-Resistance Variation with Gate-Source Voltage

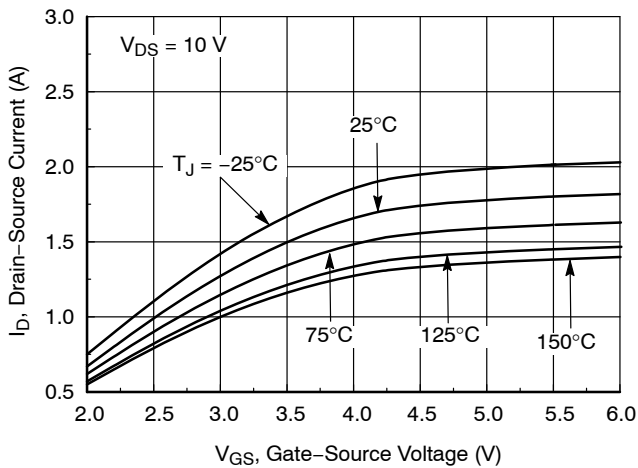


Figure 5. Transfer Characteristics

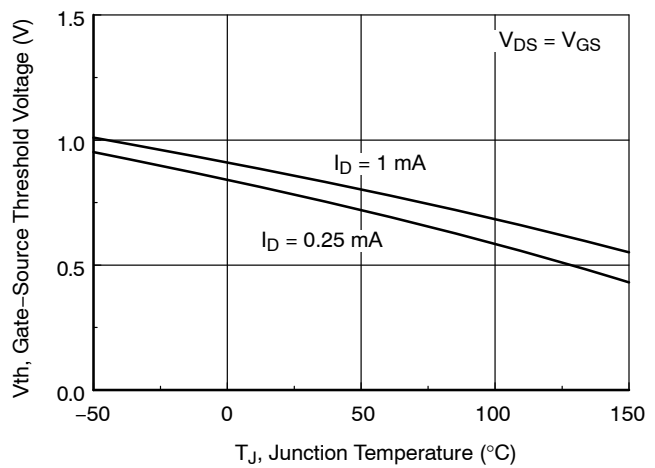
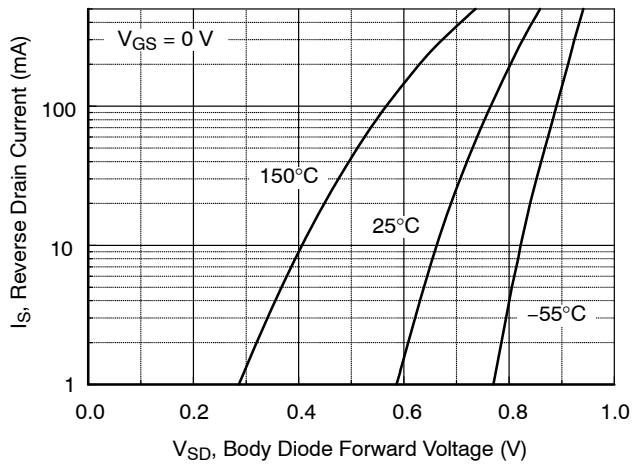


Figure 6. Gate Threshold Variation with Temperature

# BSS138K

## TYPICAL CHARACTERISTICS (continued)

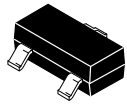


**Figure 7. Reverse Drain Current Variation with Diode Forward Voltage and Temperature**

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

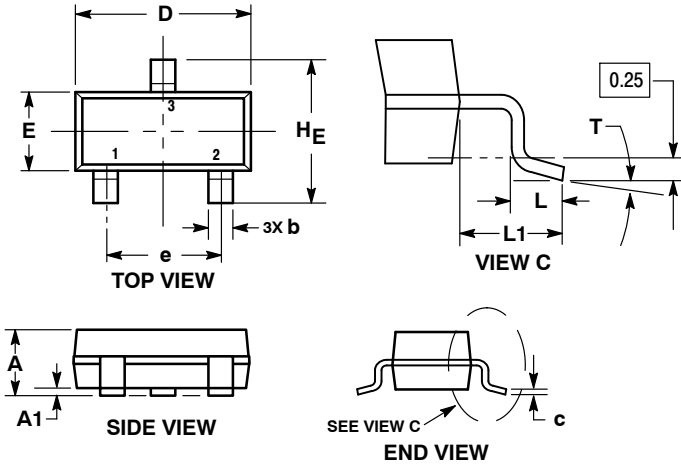
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**SOT-23 (TO-236)**  
CASE 318-08  
ISSUE AS

DATE 30 JAN 2018

SCALE 4:1

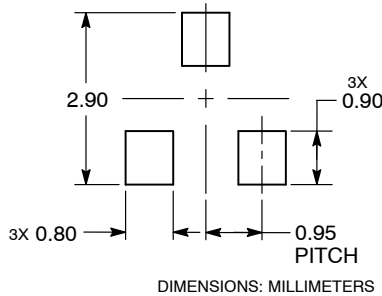


**NOTES:**

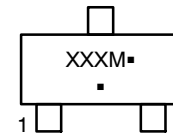
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.039	0.044
A1	0.01	0.06	0.10	0.000	0.002	0.004
b	0.37	0.44	0.50	0.015	0.017	0.020
c	0.08	0.14	0.20	0.003	0.006	0.008
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.080
L	0.30	0.43	0.55	0.012	0.017	0.022
L1	0.35	0.54	0.69	0.014	0.021	0.027
HE	2.10	2.40	2.64	0.083	0.094	0.104
T	0°	---	10°	0°	---	10°

**RECOMMENDED SOLDERING FOOTPRINT**



**GENERIC MARKING DIAGRAM\***



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

STYLE 1 THRU 5:  
CANCELLED

STYLE 6:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

STYLE 7:  
PIN 1. EMITTER  
2. BASE  
3. COLLECTOR

STYLE 8:  
PIN 1. ANODE  
2. NO CONNECTION  
3. CATHODE

STYLE 9:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 10:  
PIN 1. DRAIN  
2. SOURCE  
3. GATE

STYLE 11:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE-ANODE

STYLE 12:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE

STYLE 13:  
PIN 1. SOURCE  
2. DRAIN  
3. GATE

STYLE 14:  
PIN 1. CATHODE  
2. GATE  
3. ANODE

STYLE 15:  
PIN 1. GATE  
2. CATHODE  
3. ANODE

STYLE 16:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE

STYLE 17:  
PIN 1. NO CONNECTION  
2. ANODE  
3. CATHODE

STYLE 18:  
PIN 1. NO CONNECTION  
2. CATHODE  
3. ANODE

STYLE 19:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE-ANODE

STYLE 20:  
PIN 1. CATHODE  
2. ANODE  
3. GATE

STYLE 21:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

STYLE 22:  
PIN 1. RETURN  
2. OUTPUT  
3. INPUT

STYLE 23:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 24:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE

STYLE 25:  
PIN 1. ANODE  
2. CATHODE  
3. GATE

STYLE 26:  
PIN 1. CATHODE  
2. ANODE  
3. NO CONNECTION

STYLE 27:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE

STYLE 28:  
PIN 1. ANODE  
2. ANODE  
3. ANODE

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