

# N-Channel Logic Level Enhancement Mode Field Effect Transistor

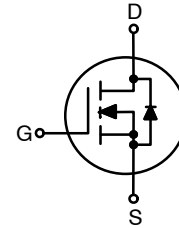
## BSS123L

### Description

This N-channel enhancement mode field effect transistor is produced using high cell density, trench MOSFET technology. This product minimizes on-state resistance while providing rugged, reliable and fast switching performance. This product is particularly suited for low-voltage, low-current applications such as small servo motor control, power MOSFET gate drivers, logic level transistor, high speed line drivers, power management/power supply and switching applications.

### Features

- 0.17 A, 100 V
  - ◆  $R_{DS(on)} = 6 \Omega @ V_{GS} = 10 \text{ V}$
  - ◆  $R_{DS(on)} = 10 \Omega @ V_{GS} = 4.5 \text{ V}$
- High Density Cell Design for Low  $R_{DS(ON)}$
- Rugged and Reliable
- Compact Industry Standard SOT-23 Surface Mount Package
- Very Low Capacitance
- Fast Switching Speed
- This Device is Pb-Free and Halogen Free

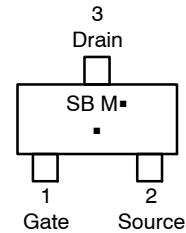


N-Channel



SOT-23-3  
CASE 318-08

### MARKING DIAGRAM



- SB = Specific Device Code
- M = Date Code\*
- = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

### ORDERING INFORMATION

Device	Package	Shipping†
BSS123L	SOT-23-3 (Pb-Free)	3000 / Tape & Reel

†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.

# BSS123L

## ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain–Source Voltage	100	V
V <sub>GSS</sub>	Gate–Source Voltage	±20	V
I <sub>D</sub>	Maximum Drain Current – Continuous	0.17	A
	Maximum Drain Current – Pulsed	0.68	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	–55 to +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 s	300	°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.

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

Symbol	Parameter	Value	Unit
PD	Maximum Power Dissipation (Note 1)	0.36	W
	Derate Above 25°C	2.8	mW/°C
R <sub>θJA</sub>	Thermal Resistance, Junction–to–Ambient (Note 1)	380	°C/W

## ESD RATING (Note 2)

Symbol	Parameter	Value	Unit
HBM	Human Body Model per ANSI/ESDA/JEDEC JS-001-2012	50	V
CDM	Charged Device Model per JEDEC C101C	>2000	V

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
--------	-----------	-----------------	-----	-----	-----	------

### OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain–Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	100	103	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	–	100	–	mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V	–	0.027	1	μA
		V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125°C	–	0.159	60	
		V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V	–	0.07	10	nA
I <sub>GSSF</sub>	Gate–Body Leakage, Forward	V <sub>GS</sub> = 20 V, V <sub>DS</sub> = 0 V	–	0.036	50	nA
I <sub>GSSR</sub>	Gate–Body Leakage, Reverse	V <sub>GS</sub> = –20 V, V <sub>DS</sub> = 0 V	–	–0.019	–50	nA

### ON CHARACTERISTICS (Note 3)

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1 mA	0.8	1.405	2	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I <sub>D</sub> = 1 mA, Referenced to 25°C	–	–2.82	–	mV/°C
R <sub>DS(on)</sub>	Static Drain–Source On–Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.17 A	–	2.98	6	Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.17 A	–	3.17	10	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.17 A, T <sub>J</sub> = 125°C	–	5.63	12	
I <sub>D(ON)</sub>	On–State Drain Current	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 5 V	0.680	0.735	–	A
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.17 A	0.08	2.13	–	S

# BSS123L

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted) (continued)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>DYNAMIC CHARACTERISTICS</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	–	21.5	–	pF
$C_{oss}$	Output Capacitance		–	3.52	–	
$C_{rss}$	Reverse Transfer Capacitance		–	1.67	–	
$R_G$	Gate Resistance	$V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$	–	7.18	–	$\Omega$

## SWITCHING CHARACTERISTICS (Note 3)

$t_{d(on)}$	Turn-On Delay	$V_{DD} = 30\text{ V}, I_D = 0.28\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$	–	2.2	3.4	ns
$t_r$	Turn-On Rise Time		–	1.7	18	
$t_{d(off)}$	Turn-Off Delay		–	5.9	31	
$t_f$	Turn-Off Fall Time		–	5.6	5	
$Q_g$	Total Gate Charge	$V_{DS} = 30\text{ V}, I_D = 0.22\text{ A},$ $V_{GS} = 10\text{ V}$	–	0.793	2.5	nC
$Q_{gs}$	Gate-Source Charge		–	0.092	–	
$Q_{gd}$	Gate-Drain Charge		–	0.171	–	

## DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 440\text{ mA}$ (Note 1)	–	0.867	1.3	V
$T_{rr}$	Diode Reverse Recovery Time	$I_F = 0.2\text{ A}, d_{if}/d_t = 100\text{ A}/\mu\text{s}$	–	11.9	–	ns
$Q_{rr}$	Diode Reverse Recovery Charge		–	1.3	–	nC

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.

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.
  - $380^\circ\text{C}/\text{W}$  when mounted on a minimum pad.



- ESD values are in typical, no over-voltage rating is implied, ESD CDM zap voltage is 2000 V maximum.
- Pulse test: pulse width  $\leq 300\text{ ms}$ , duty cycle  $\leq 2.0\%$ .

TYPICAL CHARACTERISTICS

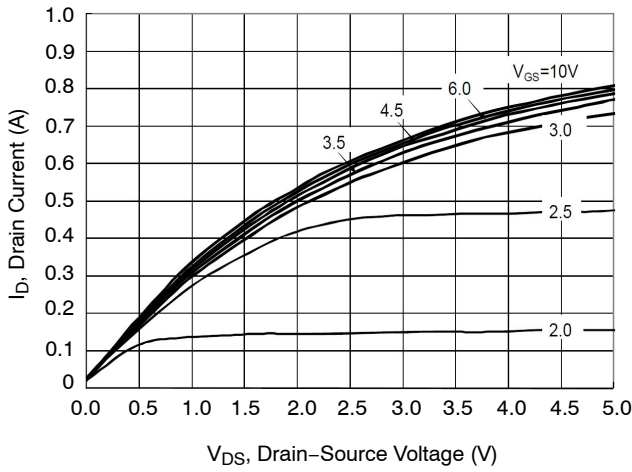


Figure 1. On-Region Characteristics

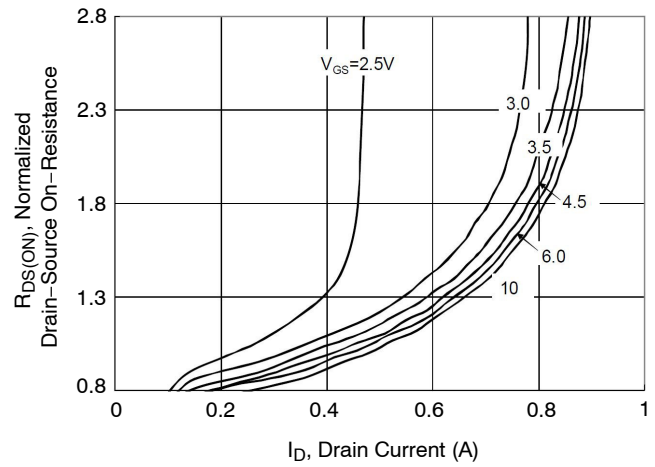


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

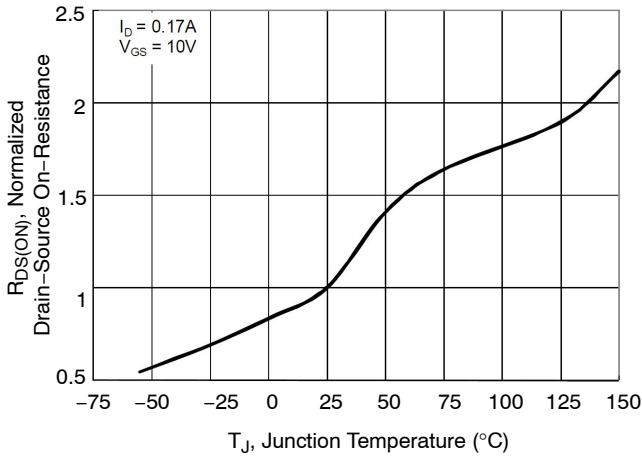


Figure 3. On-Resistance Variation with Temperature

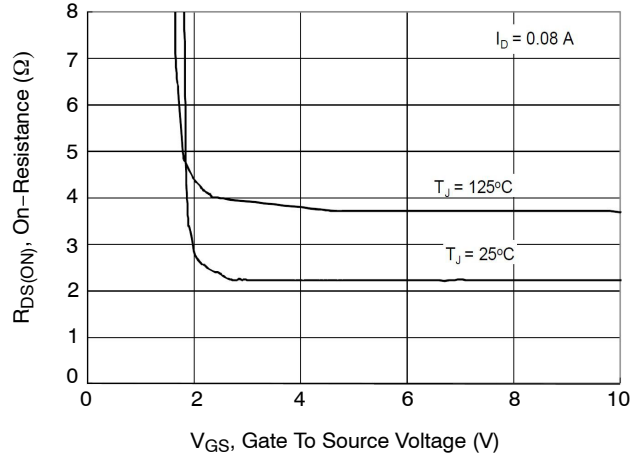


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

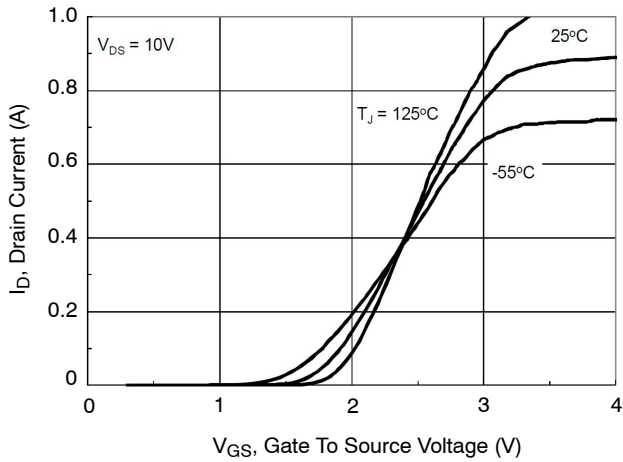


Figure 5. Transfer Characteristics

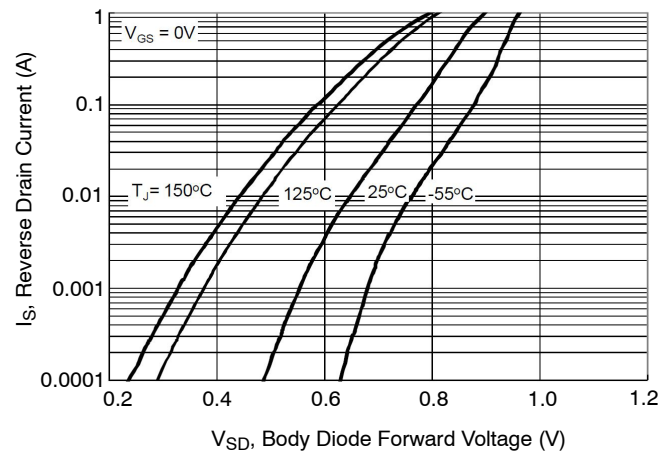


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

# BSS123L

## TYPICAL CHARACTERISTICS (continued)

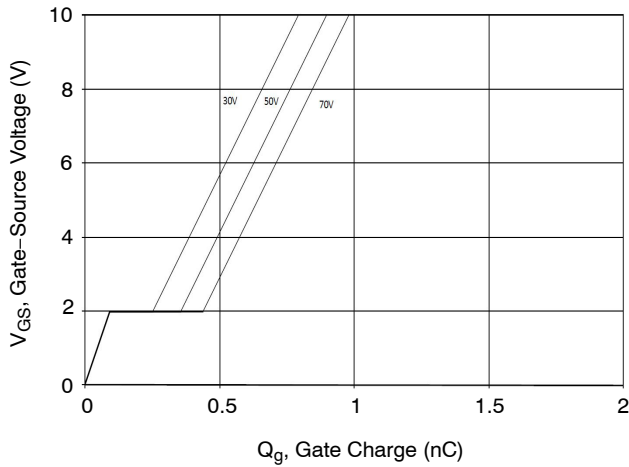


Figure 7. Gate Charge Characteristics

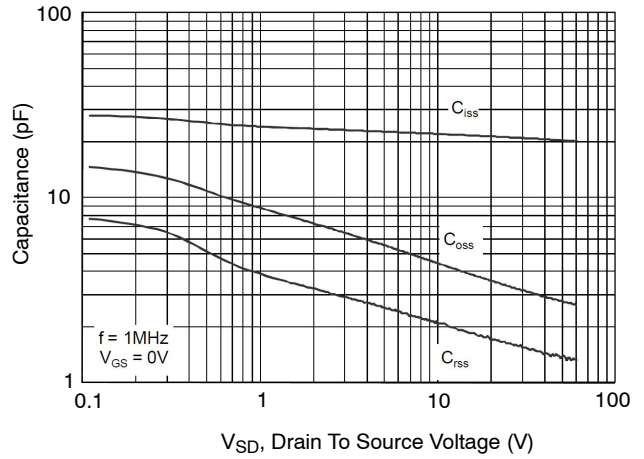


Figure 8. Capacitance Characteristics

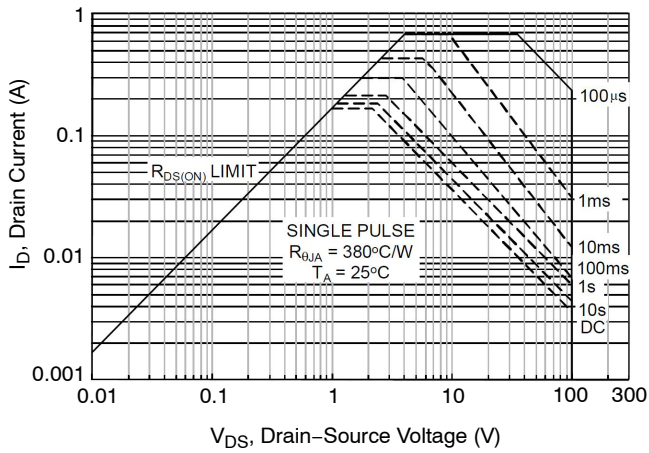


Figure 9. Maximum Safe Operating Area

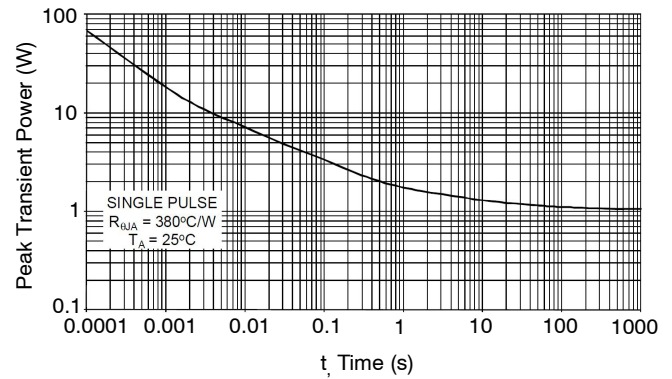


Figure 10. Single Pulse Maximum Power Dissipation

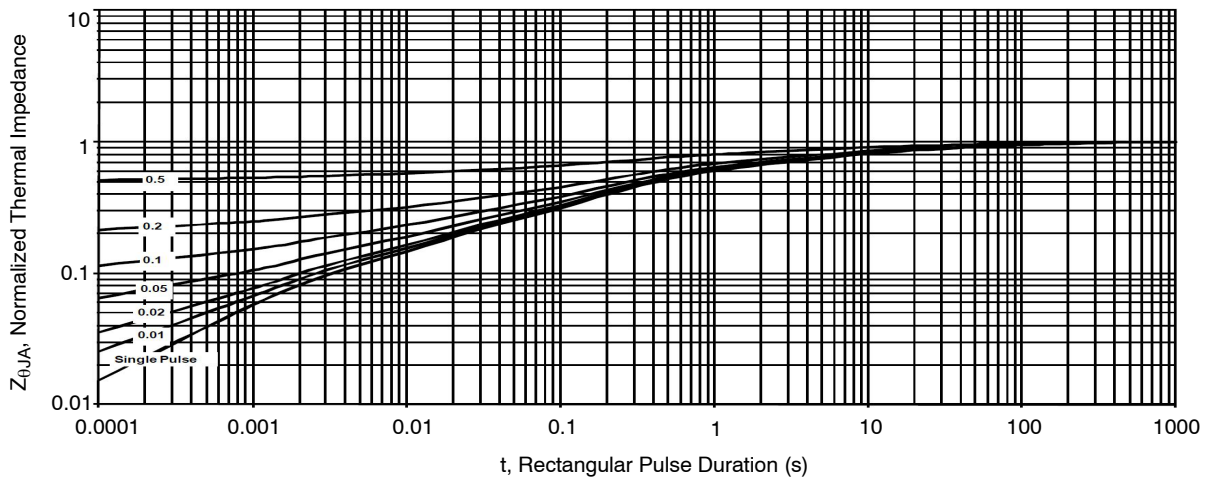


Figure 11. Transient Thermal Response Curve

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)