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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

October 2014

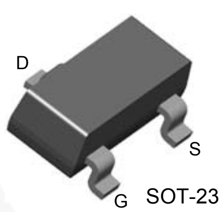
BSS138L
N-Channel Logic Level Enhancement Mode Field Effect Transistor

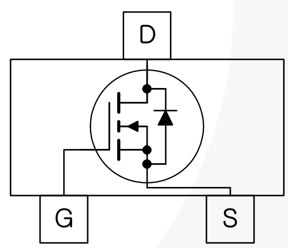
Features

- 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

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 translator, high speed line drivers, power management/power supply and switching applications.





Ordering Information

Part Number	Marking	Package	Packing Method
BSS138L	SL	SOT-23 3L	Tape and Reel

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter		Value	Unit
V_{DSS}	Drain-Source Voltage		50	V
V_{GSS}	Gate-Source Voltage		±20	V
I_D	Maximum Drain Current	Continuous	0.20	A
		Pulsed	0.80	
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purposes, 1/16 inch from Case for 10 Seconds		300	°C

Thermal Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
P_D	Maximum Power Dissipation(1)	0.35	W
	Derate Above 25°C	2.8	mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient(1)	380	°C/W

Note:

1. $R_{\theta JA}$ 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.

a) 380°C/W when mounted on a minimum pad.

Scale 1: 1 on letter size paper

ESD Rating(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	

Note:

2. ESD values are in typical, no over-voltage rating is implied, ESD CDM zap voltage is 2000 V maximum.

Electrical Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	50.0	65.4		V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		58		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 50 V, V_{GS} = 0 V		0.263	500	nA
		V_{DS} = 50 V, V_{GS} = 0 V, T_J = 125°C		0.109	5	µA
		V_{DS} = 30 V, V_{GS} = 0 V		0.062	100	nA
I_{GSSF}	Gate-Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V		0.058	100	nA
I_{GSSR}	Gate-Body Leakage, Reverse	V_{GS} = -20 V, V_{DS} = 0 V		-0.06	-100	
On Characteristics(3)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 1 mA	0.80	1.25	1.50	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25°C		-2.42		mV/°C
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 5 V, I_D = 0.20 A		2.78	3.50	Ω
		V_{GS} = 2.75 V, I_D = 0.20 A		3.78	10	
$I_{D(ON)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	0.20	0.67		A
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 0.22 A	0.12	0.35		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz		12.2	50	pF
C_{oss}	Output Capacitance			3.04	25	pF
C_{rss}	Reverse Transfer Capacitance			1.43	5	pF
R_G	Gate Resistance	V_{GS} = 15 V, V_{GS} = 1.0 MHz		26.6		Ω
Switching Characteristics(3)						
$t_{d(on)}$	Turn-On Delay	V_{DD} = 30 V, I_D = 0.29 A, V_{GS} = 10 V		2.2	5	ns
t_r	Turn-On Rise Time			1.8	18	ns
$t_{d(off)}$	Turn-Off Delay			5.3	36	ns
t_f	Turn-Off Fall Time			5.1	14	ns
Q_g	Total Gate Charge	V_{DS} = 25 V, I_D = 0.22 A, V_{GS} = 10 V, I_G = 0.1 mA		0.549	2.4	nC
Q_{gs}	Gate-Source Charge			0.075		nC
Q_{gd}	Gate-Drain Charge			0.117		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current				0.22	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 115 mA		0.93	1.4	V

Note:

3. Pulse test: pulse width ≤ 300 µs, duty cycle ≤ 2.0%.

Typical Performance Characteristics

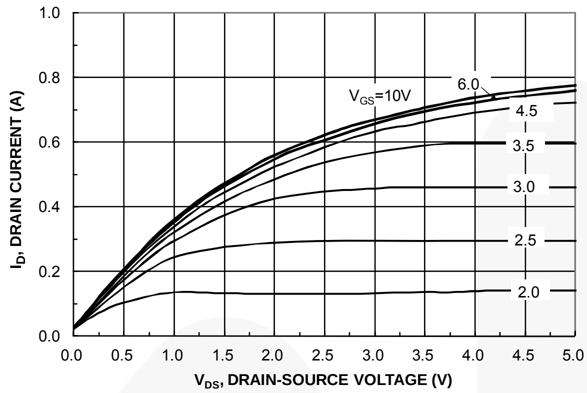


Figure 1. On-Region Characteristics

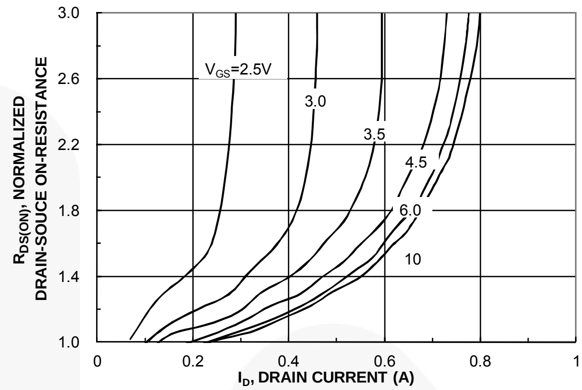


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

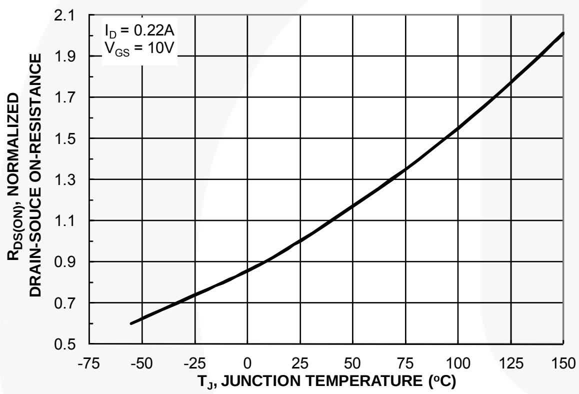


Figure 3. On-Resistance Variation with Temperature

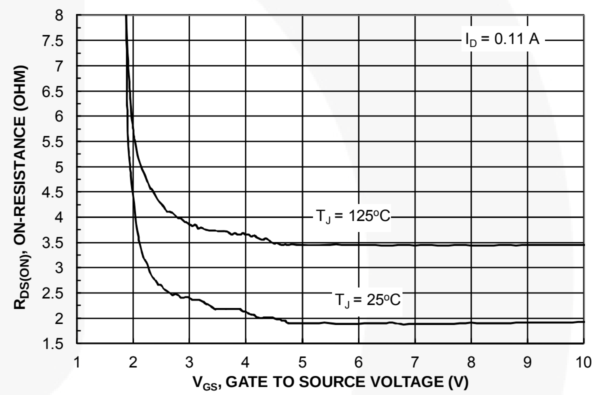


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

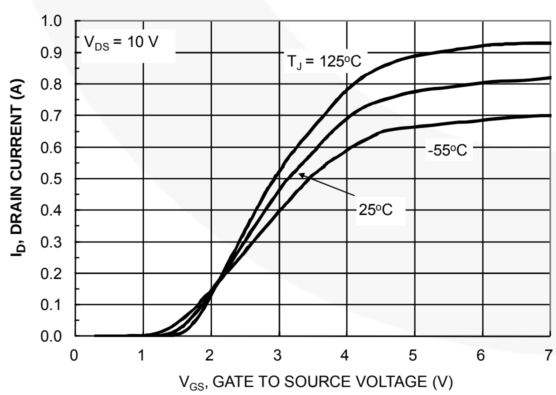


Figure 5. Transfer Characteristics

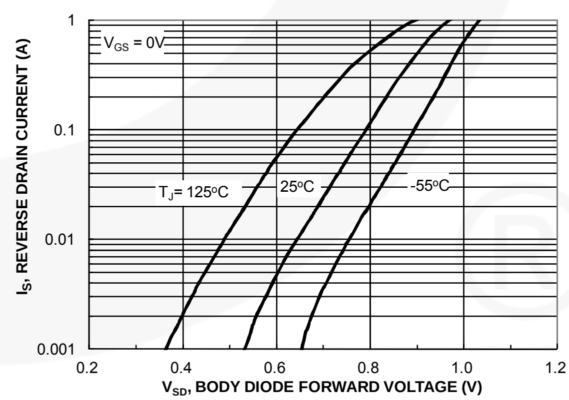


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Performance Characteristics (Continued)

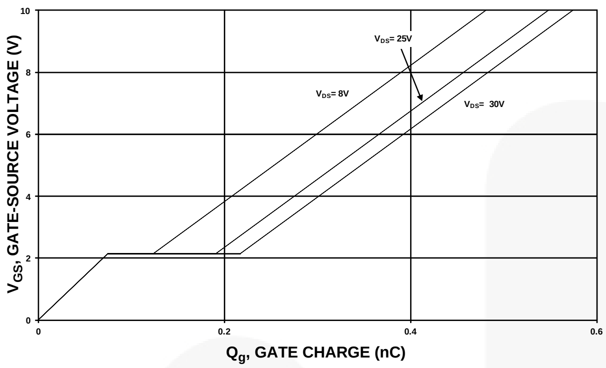


Figure 7. Gate Charge Characteristics

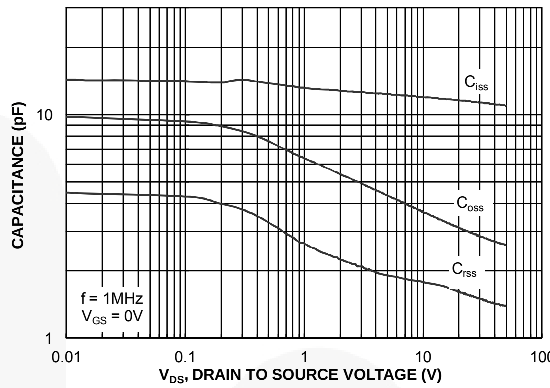


Figure 8. Capacitance Characteristics

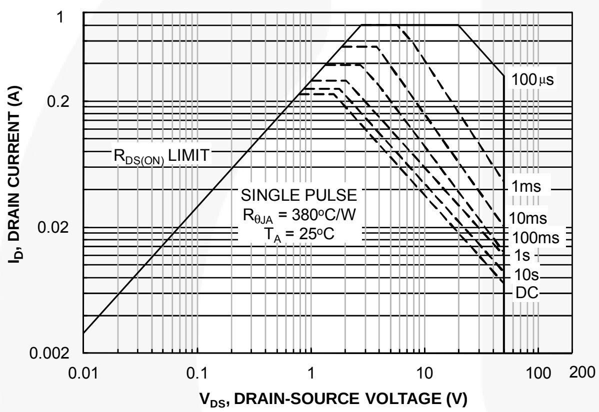


Figure 9. Maximum Safe Operating Area

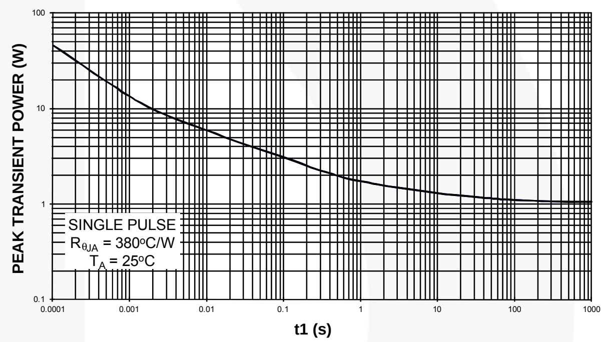


Figure 10. Single Pulse Maximum Power Dissipation

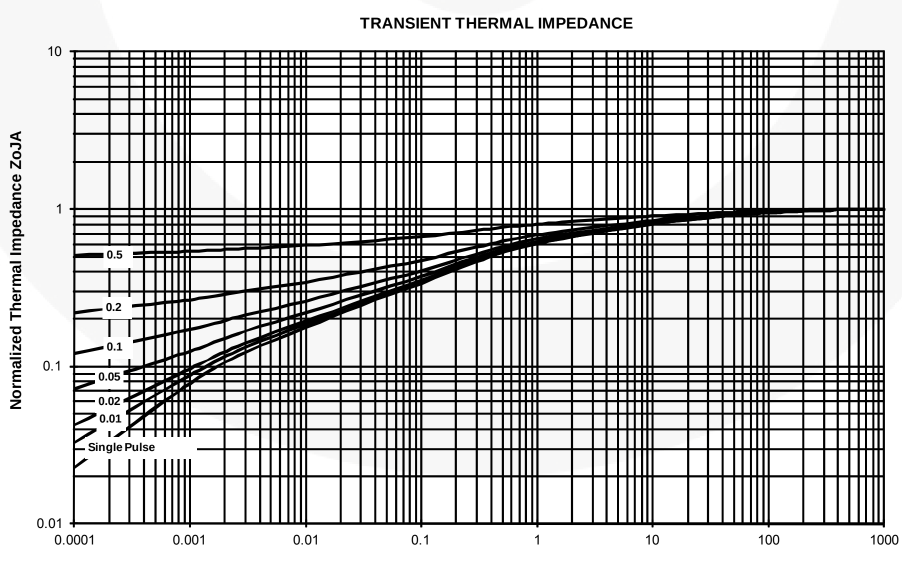
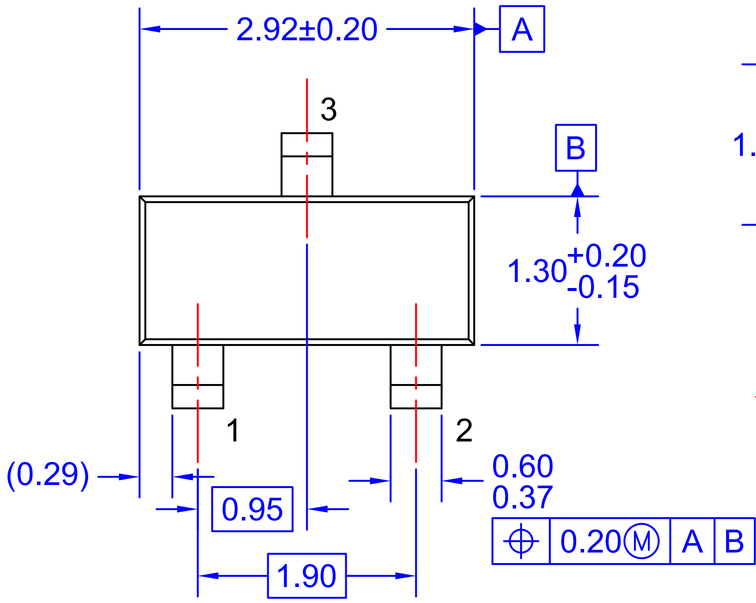
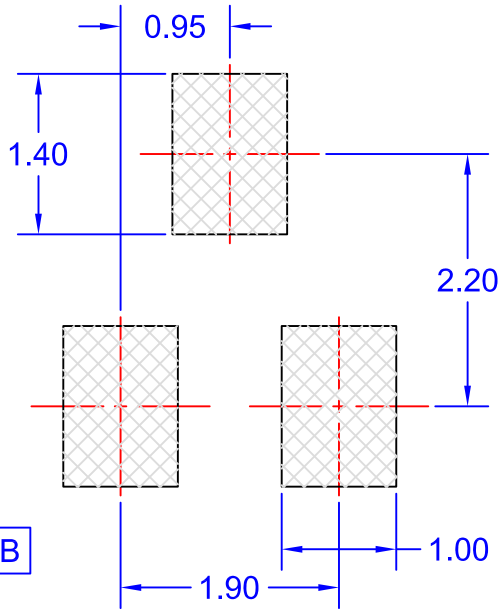
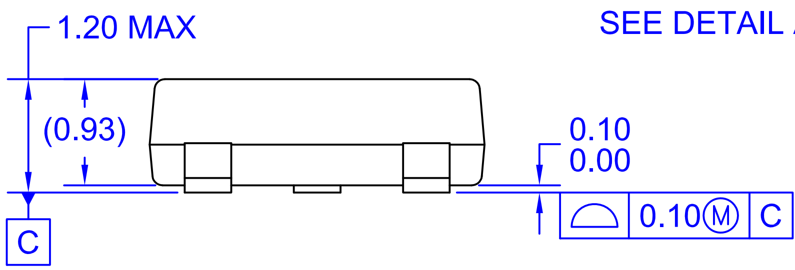


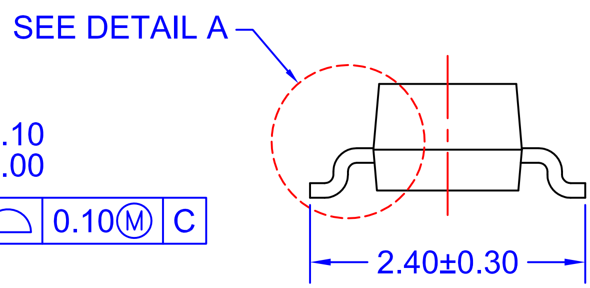
Figure 11. Transient Thermal Response Curve.

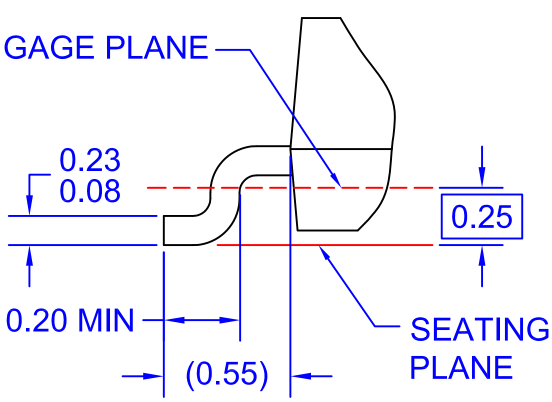




LAND PATTERN RECOMMENDATION







DETAIL A
SCALE: 2X

NOTES: UNLESS OTHERWISE SPECIFIED

A) REFERENCE JEDEC REGISTRATION TO-236, VARIATION AB, ISSUE H.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS ARE INCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M - 2009.
E) DRAWING FILE NAME: MA03DREV12

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