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December 2010

# BSS138W

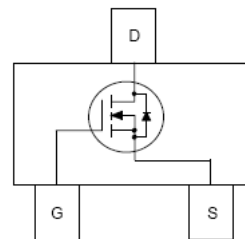
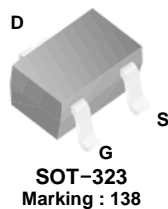
## N-Channel Logic Level Enhancement Mode Field Effect Transistor

### General Description

These N-Channel enhancement mode field effect transistor. These products have been designed to minimize on-state resistance while provide rugged, reliable, and fast switching performance. These products are particularly suited for low voltage, low current applications such as small servo motor control, power MOSFET gate drivers, and other switching applications.

### Features

- $R_{DS(ON)} = 3.5\Omega @ V_{GS} = 10V, I_D = 0.22A$   
 $R_{DS(ON)} = 6.0\Omega @ V_{GS} = 4.5V, I_D = 0.22A$
- High density cell design for extremely low  $R_{DS(ON)}$
- Rugged and Reliable
- Compact industry standard SOT-323 surface mount package



### Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Units
$V_{DSS}$	Drain-Source Voltage	50	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current - Continuous (Note1)	0.21	A
	- Pulsed	0.84	A
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 Seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	Value	Units
$P_D$	Maximum Power Dissipation (Note1)	340	mW
	Derate Above $25^\circ\text{C}$	2.72	$\text{mW}/^\circ\text{C}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note1)	367	$^\circ\text{C}/\text{W}$

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
138	BSS138W	7"	8mm	3000 units

BSS138W — N-Channel Logic Level Enhancement Mode Field Effect Transistor

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted

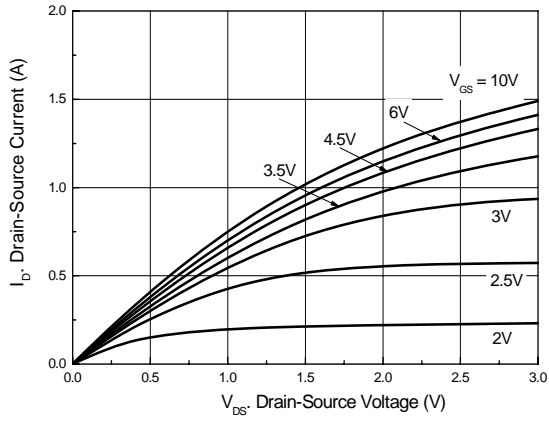
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	50			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu A$ , Referenced to $25^\circ\text{C}$		71		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 50V, V_{GS} = 0V$ $V_{DS} = 50V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ $V_{DS} = 30V, V_{GS} = 0V$			0.5 5 100	$\mu A$ $\mu A$ nA
$I_{GSS}$	Gate-Body Leakage	$V_{GS} = \pm 20V, V_{DS} = 0V$			$\pm 100$	nA
<b>On Characteristics (Note2)</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1mA$	0.8	1.3	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 1mA$ , Referenced to $25^\circ\text{C}$		-3.9		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10V, I_D = 0.22A$ $V_{GS} = 4.5V, I_D = 0.22A$ $V_{GS} = 10V, I_D = 0.22A, T_J = 125^\circ\text{C}$		1.17 1.36 2.16	3.5 6.0 5.8	$\Omega$ $\Omega$ $\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10V, V_{DS} = 5V$	0.2			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 10V, I_D = 0.22A$	0.12			S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz$		38		pF
$C_{oss}$	Output Capacitance			5.9		pF
$C_{rss}$	Reverse Transfer Capacitance			3.5		pF
$R_G$	Gate Resistance	$V_{GS} = 15mV, f = 1.0MHz$		11		$\Omega$
<b>Switching Characteristics (Note2)</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30V, I_D = 0.29A,$ $V_{GS} = 10V, R_{GEN} = 6\Omega$		2.3	5	ns
$t_r$	Turn-On Rise Time			1.9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			6.7	36	ns
$t_f$	Turn-Off Fall Time			6.5	14	ns
$Q_g$	Total Gate Change	$V_{DS} = 25V, I_D = 0.22A,$ $V_{GS} = 10V$		1.1		nC
$Q_{gs}$	Gate-Source Change			0.12		nC
$Q_{gd}$	Gate-Drain Change			0.22		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				0.22	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0V, I_S = 0.44A$ (Note2)			1.4	V

**Notes:**

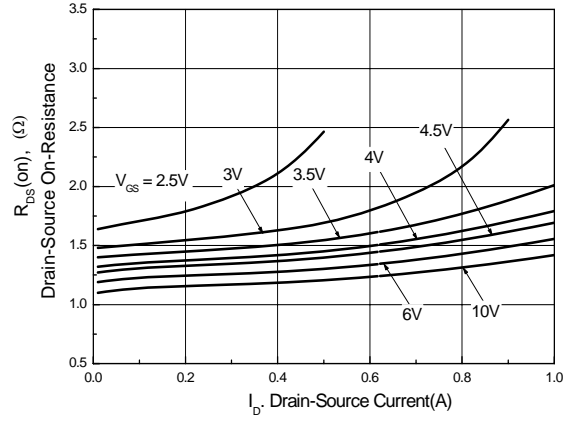
- 367 $^\circ\text{C/W}$  when mounted on a minimum pad.
- Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2.0\%$

## Typical Performance Characteristics

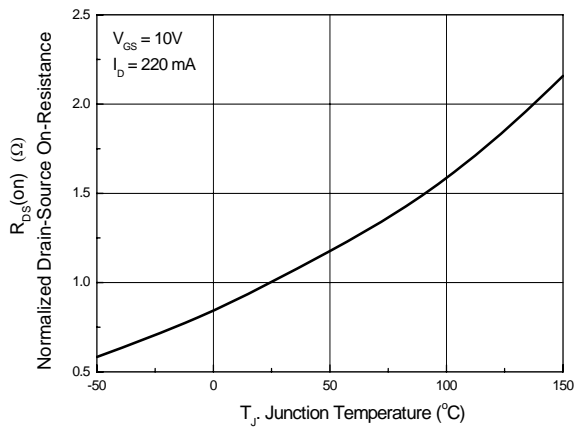
**Figure 1. On-Region Characteristics.**



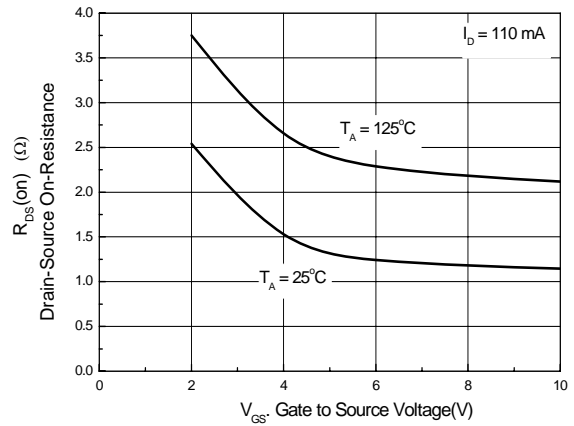
**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**



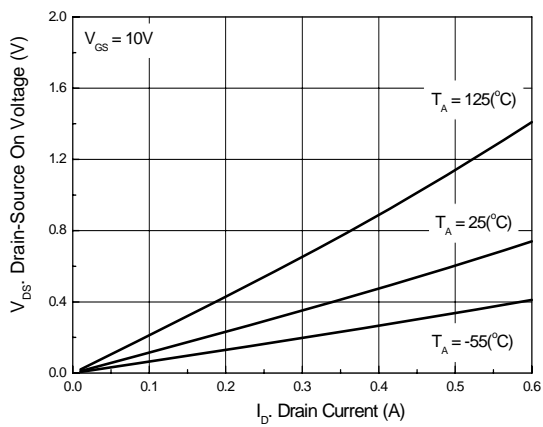
**Figure 3. On-Resistance Variation with Temperature.**



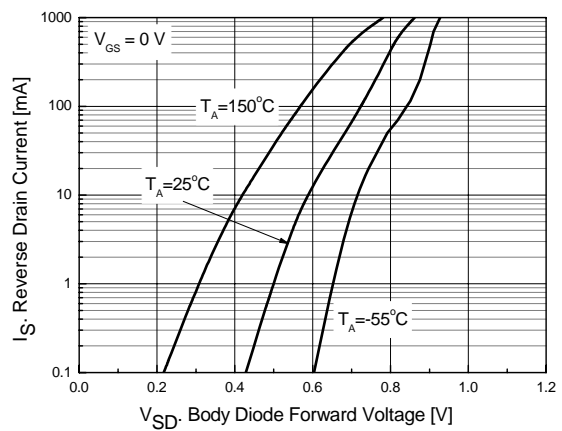
**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**



**Figure 5. Drain-Source On Voltage with Temperature.**



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



Typical Performance Characteristics (Continued)

Figure 7. Gate Charge Characteristics.

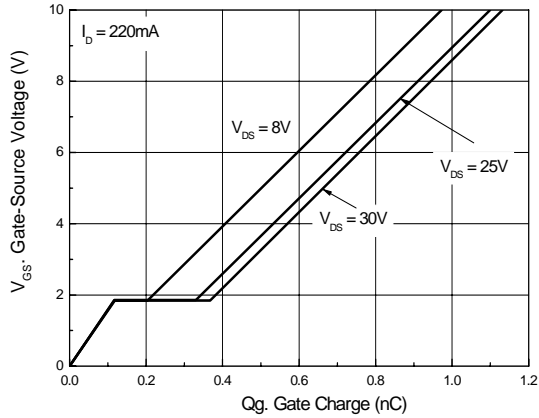


Figure 8. Capacitance Characteristics.

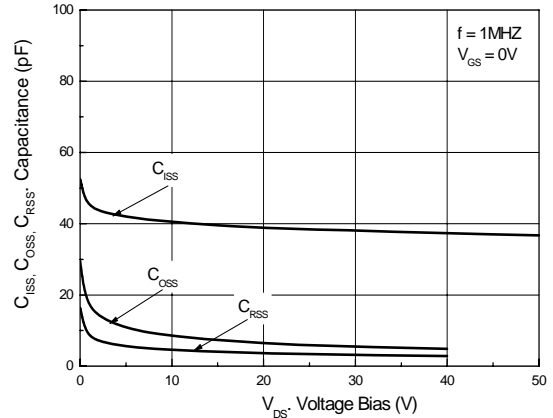


Figure 9. Maximum Safe Operating Area.

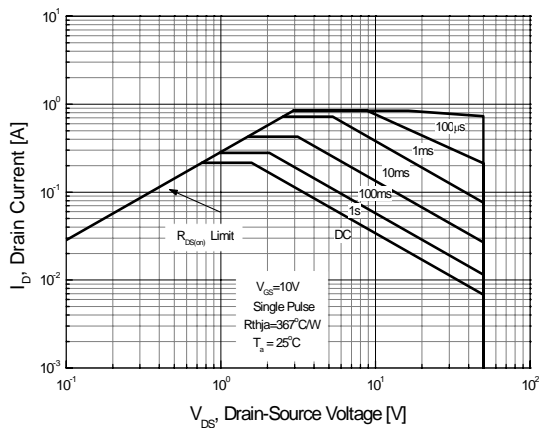


Figure 10. Single Pulse Maximum Power Dissipation.

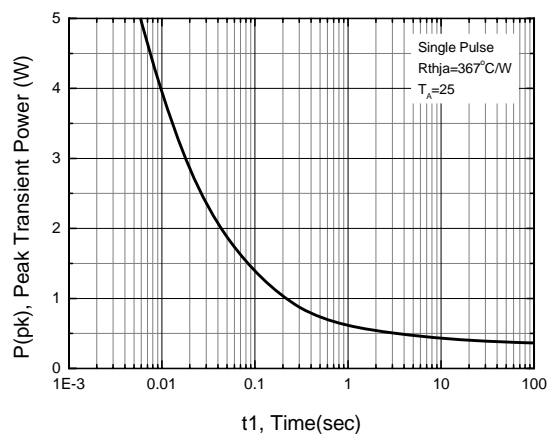
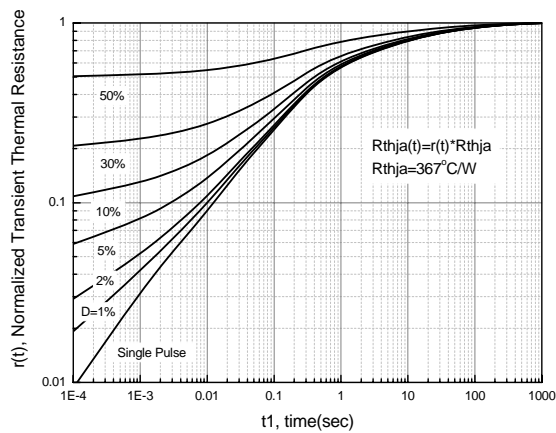
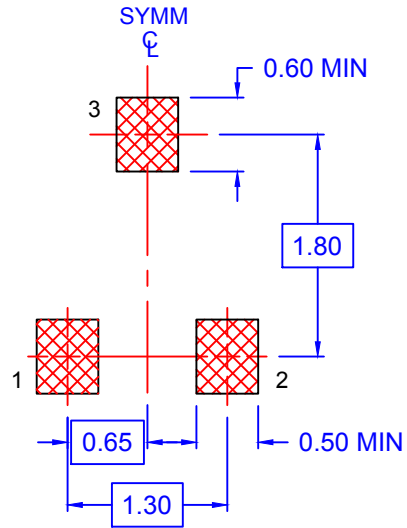
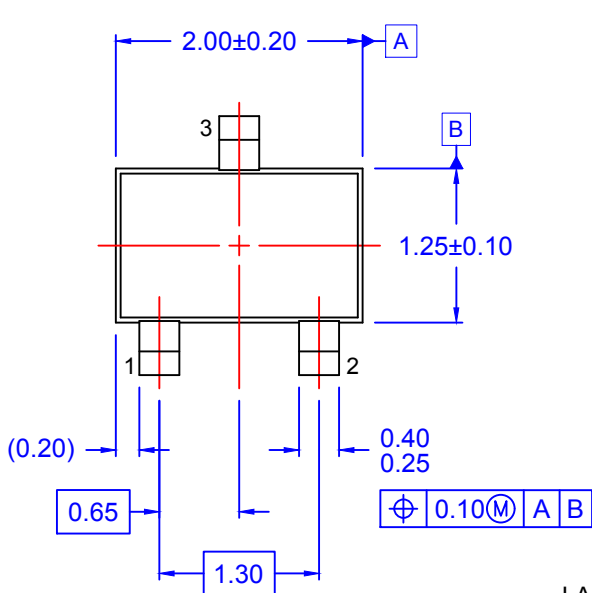
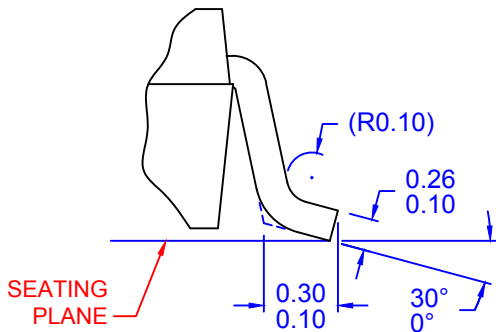
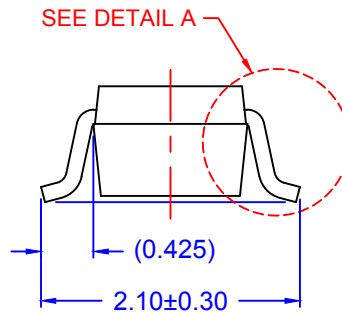
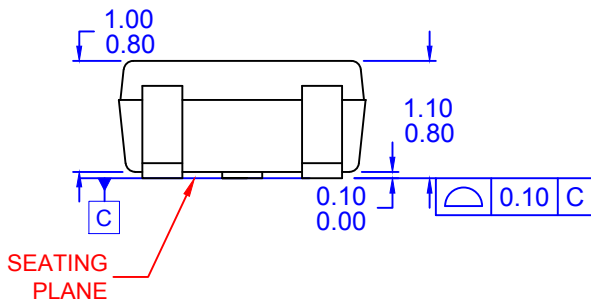


Figure 11. Transient Thermal Response Curve.





LAND PATTERN RECOMMENDATION



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