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July 2016

## BSS138\_F085

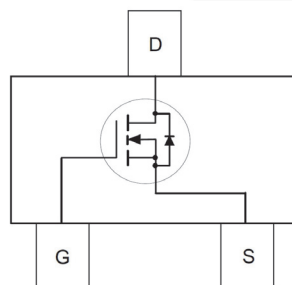
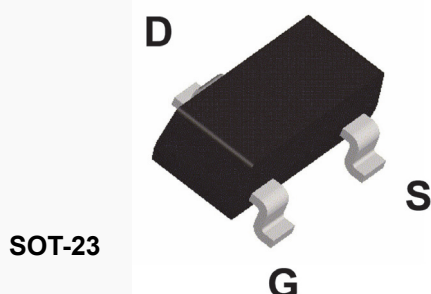
### N-Channel Logic Level Enhancement Mode Field Effect Transistor

#### General Description

These N-Channel enhancement mode field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. 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

- Automotive Qualified
- 0.22 A, 50 V.  $R_{DS(ON)} = 3.5\Omega$  @  $V_{GS} = 10\text{ V}$   
 $R_{DS(ON)} = 6.0\Omega$  @  $V_{GS} = 4.5\text{ V}$
- High density cell design for extremely low  $R_{DS(ON)}$
- Rugged and Reliable
- Compact industry standard SOT-23 surface mount package



#### Absolute Maximum Ratings

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

Symbol	Parameter	Units	Symbol
$V_{DSS}$	Drain-Source Voltage	50	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current – Continuous (Note 1)	0.22	A
	– Pulsed	0.88	
$P_D$	Maximum Power Dissipation (Note 1)	0.36	W
	Derate Above $25^\circ\text{C}$	2.8	mW/ $^\circ\text{C}$
$T_J, T_{STG}$	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

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	350	$^\circ\text{C/W}$
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#### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
SS	BSS138_F085	7"	8mm	3000 units

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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## Off Characteristics

$BV_{DSS}$	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	50			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$		72		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$			0.5	$\mu\text{A}$
		$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}, T_J = 125^\circ\text{C}$			5	$\mu\text{A}$
		$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$			100	nA
$I_{GSS}$	Gate–Body Leakage	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			$\pm 100$	nA

## On Characteristics (Note2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1\text{ mA}$	0.8	1.3	1.5	V
$\Delta V_{GS(th)} / \Delta T_J$	Gate Threshold Voltage Temperature Coefficient	$I_D = 1\text{ mA}$ , Referenced to $25^\circ\text{C}$		-2		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 10\text{ V}, I_D = 0.22\text{ A}$		0.7	3.5	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 0.22\text{ A}$		1.0	6.0	
		$V_{GS} = 10\text{ V}, I_D = 0.22\text{ A}, T_J = 125^\circ\text{C}$		1.1	5.8	
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	0.2			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 0.22\text{ A}$	0.12	0.5		S

## Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$		27		pF
$C_{oss}$	Output Capacitance			13		pF
$C_{rss}$	Reverse Transfer Capacitance			6		pF
$R_G$	Gate Resistance	$V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$		9		$\Omega$

## Switching Characteristics (Note2)

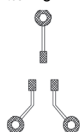
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 0.29\text{ A}, R_{GEN} = 6\text{ }\Omega$		2.8	5.8	ns
$t_r$	Turn-On Rise Time			2.1	4.4	ns
$t_{d(off)}$	Turn-Off Delay Time			9.6	19.2	ns
$t_f$	Turn-Off Fall Time			8.4	16.8	ns
$Q_g$	Total Gate Charge	$V_{DS} = 25\text{ V}, V_{GS} = 10\text{ V}, I_D = 0.22\text{ A}$		1.7	2.4	nC
$Q_{gs}$	Gate–Source Charge			0.1		nC
$Q_{gd}$	Gate–Drain Charge			0.4		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	$V_{GS} = 0\text{ V}, I_S = 0.44\text{ A}$ (Note 2)	0.8	1.4	V

## Notes:

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  $R_{\theta JA}$  is determined by the user's board design.



a)  $350^\circ\text{C/W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

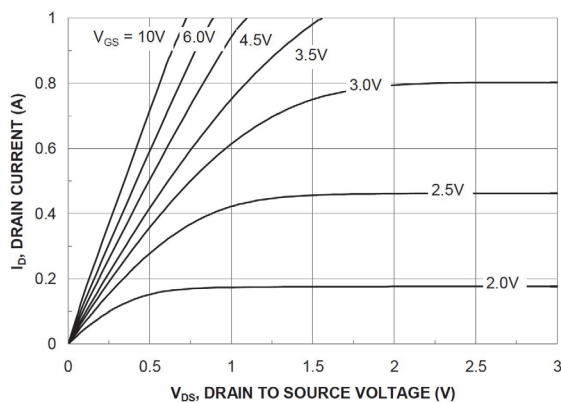


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

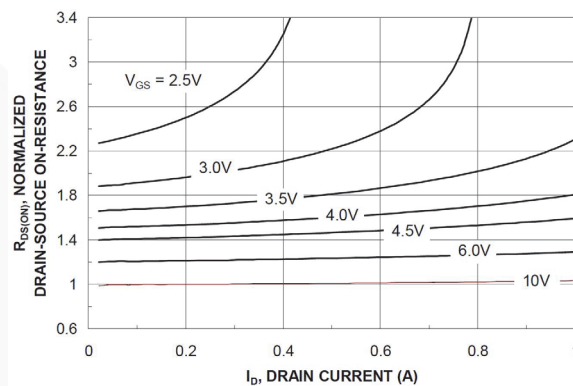


Figure 3. On-Resistance Variation with Temperature

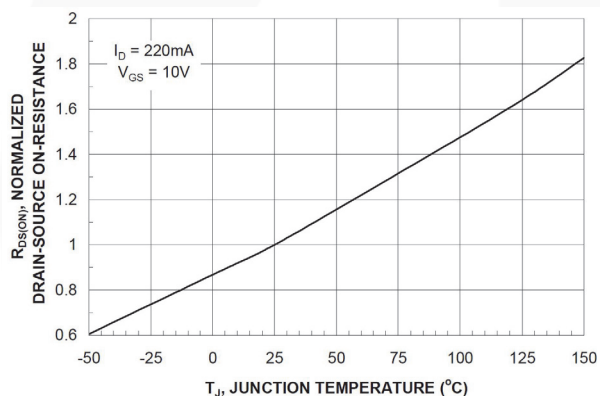


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

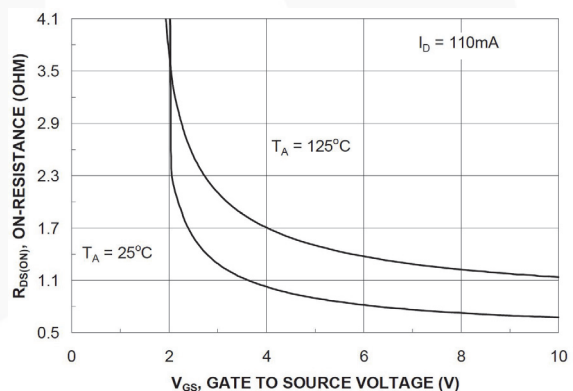


Figure 5. Transfer Characteristics

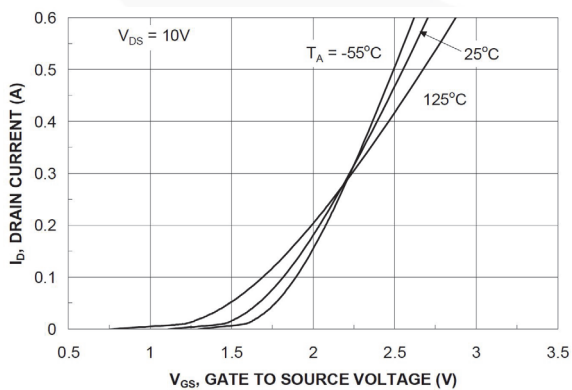
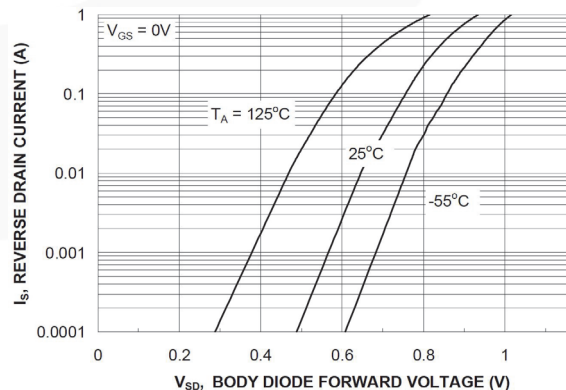


Figure 5. Body Diode Forward Voltage Variation with Source Current and Temperature



## Typical Performance Characteristics

Figure 7. Gate Charge Characteristics

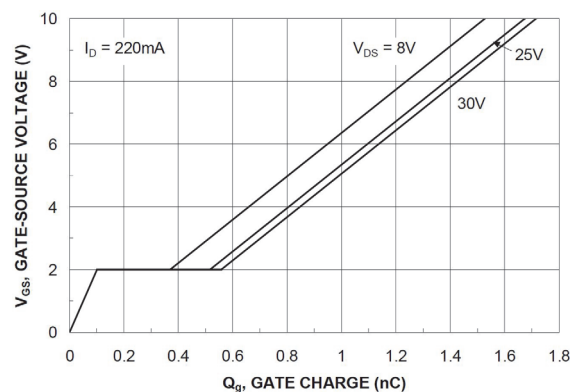


Figure 8. Capacitance Characteristics

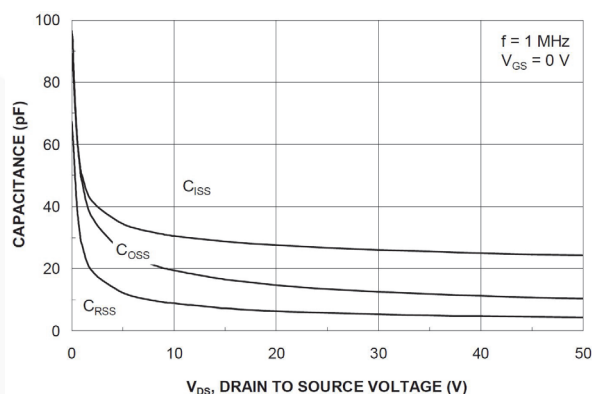


Figure 9. Maximum Safe Operating Area

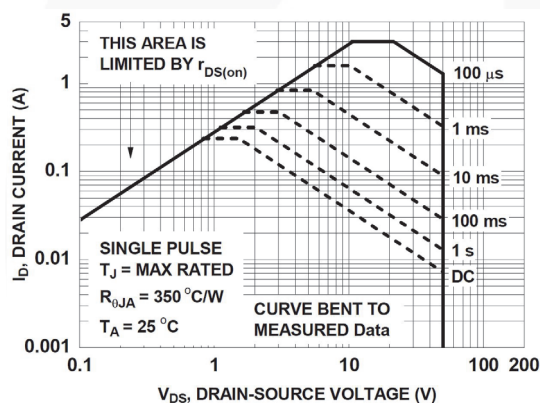


Figure 10. Single Pulse Maximum Power Dissipation

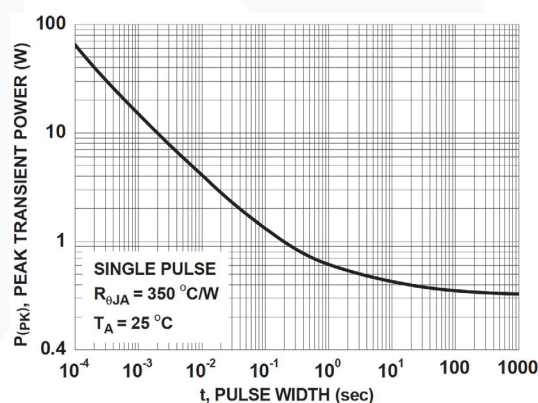
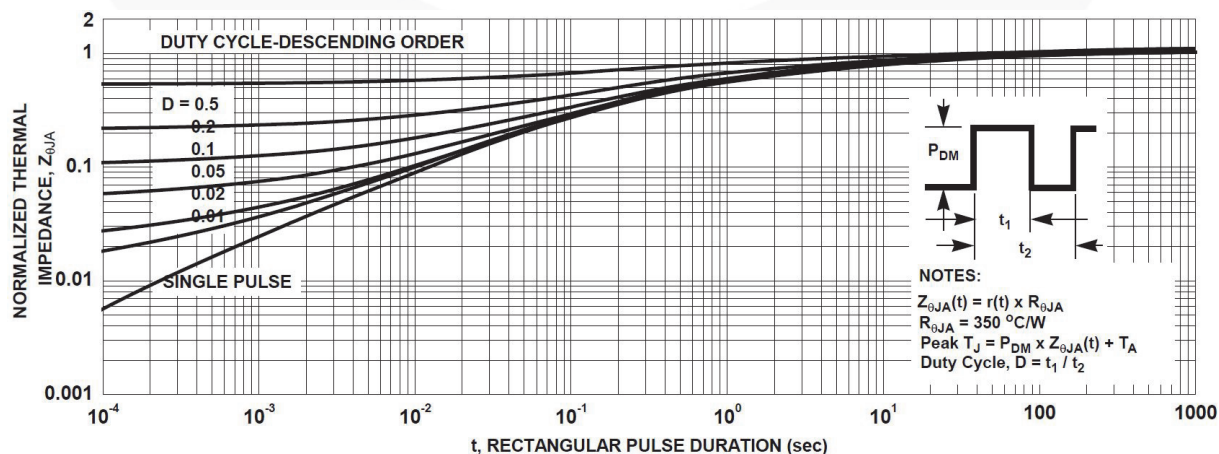
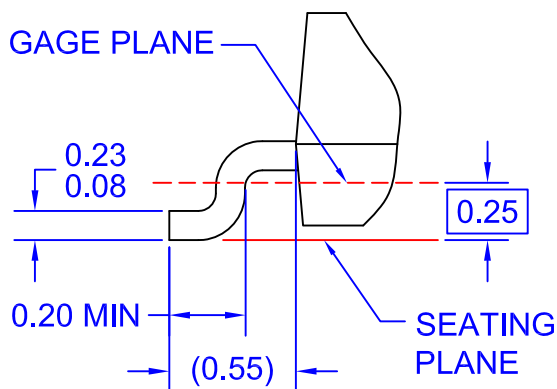
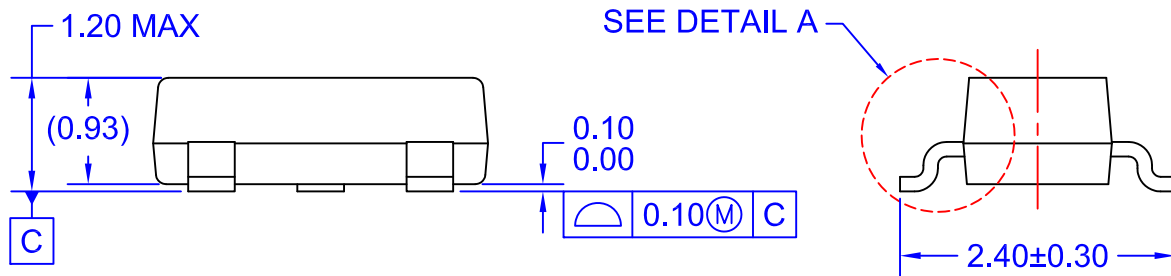
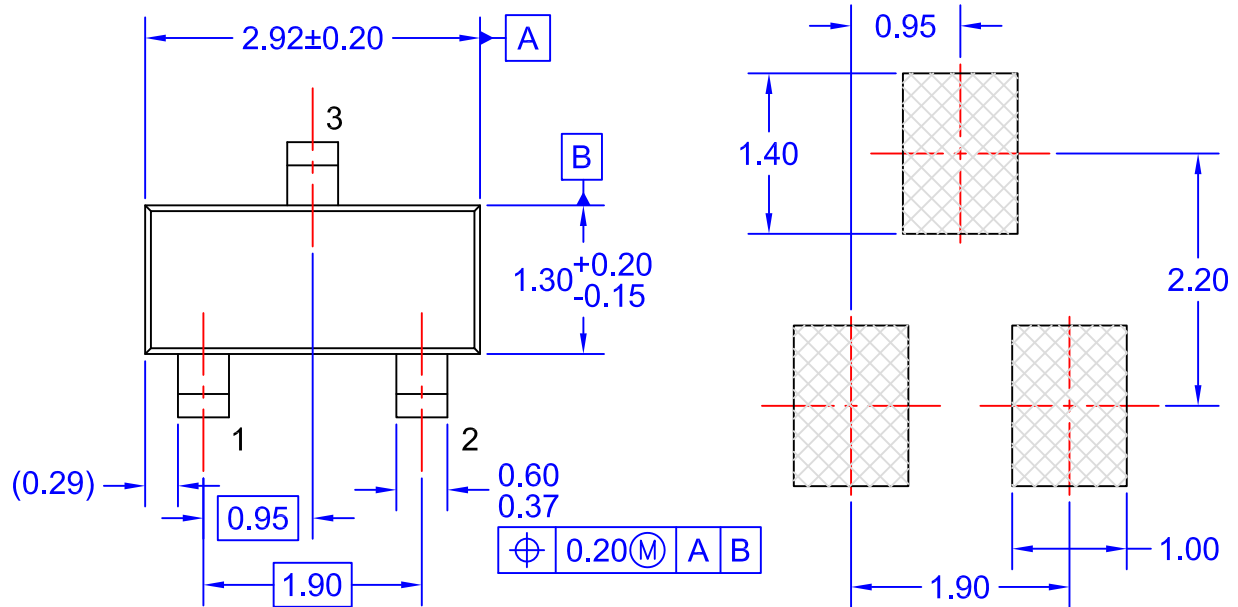


Figure 11. Transient Thermal Response Curve

Thermal characterization performed using the conditions described in Note 1a  
Transient thermal response will change depending on the circuit board design





**DETAIL A**  
SCALE: 2X

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