FAIRCHILD SEMICONDUCTOR®

December 2010

BSS138W

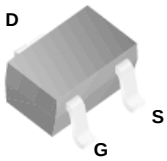
N-Channel Logic Level Enhancement Mode Field Effect Transistor

General Description

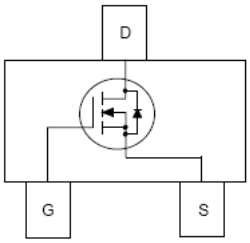
These N-Channel enhancement mode field effect transistor. These products have been designed to minimize on-state resistance while provide rugged, reliable, and fast switching performance.These products are particularly suited for low voltage, low current applications such as small servo motor control,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

Features

- $R_{DS(ON)}$ = 3.5Ω @ V_{GS} = 10V, I_D = 0.22A
  $R_{DS(ON)}$ = 6.0Ω @ 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



SOT−323
Marking : 138



Absolute Maximum Ratings T_A = 25°C unless otherwise noted

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

Thermal Characteristics

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

Package Marking and Ordering Information

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

Electrical Characteristics T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA	50			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C		71		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 50V, V_{GS} = 0V V_{DS} = 50V, V_{GS} = 0V, T_J = 125°C V_{DS} = 30V, V_{GS} = 0V			0.5 5 100	μA μA nA
I_{GSS}	Gate-Body Leakage	V_{GS} = ±20V, V_{DS} = 0V			±100	nA
On Characteristics (Note2)						
$V_{GS(th)}$	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°C		-3.9		mV/°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°C		1.17 1.36 2.16	3.5 6.0 5.8	Ω Ω Ω
$I_{D(ON)}$	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
Dynamic Characteristics						
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		Ω
Switching Characteristics (Note2)						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 30V, I_D = 0.29A, V_{GS} = 10V, R_{GEN} = 6Ω		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
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} = 0V, I_S = 0.44A (Note2)			1.4	V

Notes:

1. 367°C/W when mounted on a minimum pad.

2. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2.0%

Typical Performance Characteristics

Figure 1. On-Region Characteristics.

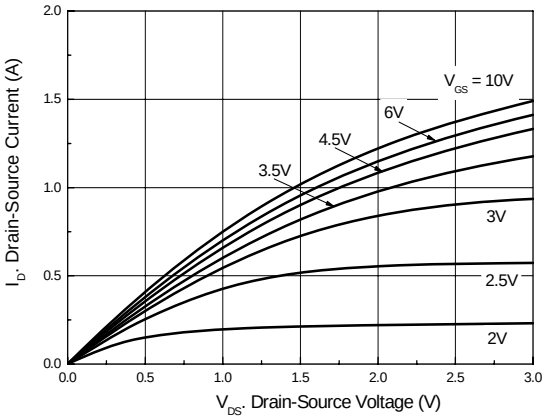


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

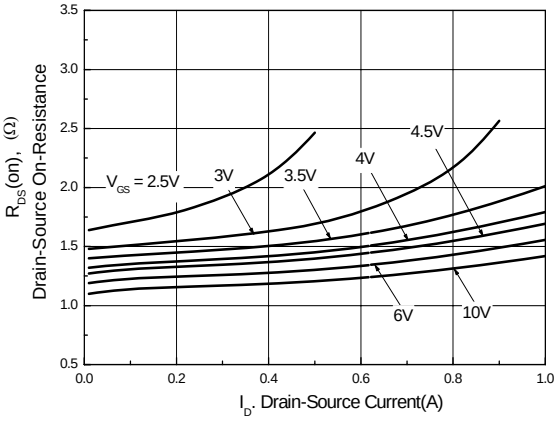


Figure 3. On-Resistance Variation with Temperature.

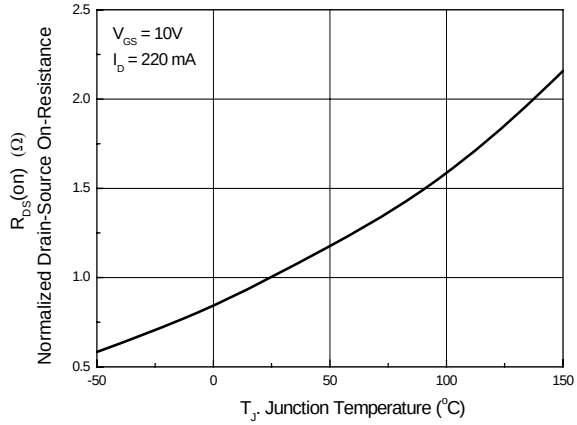


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

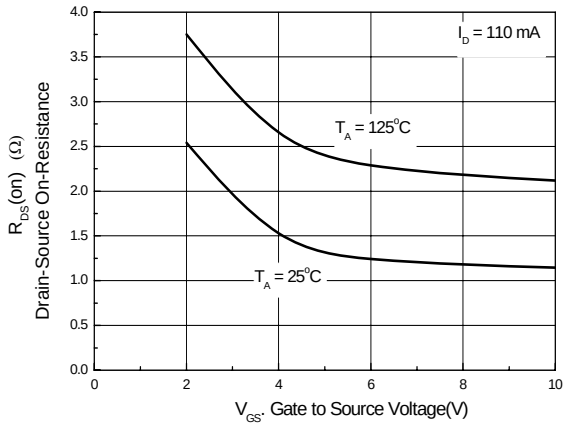


Figure 5. Drain-Source On Voltage with Temperature.

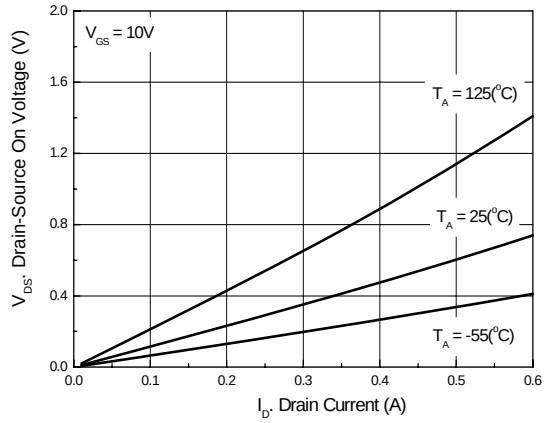
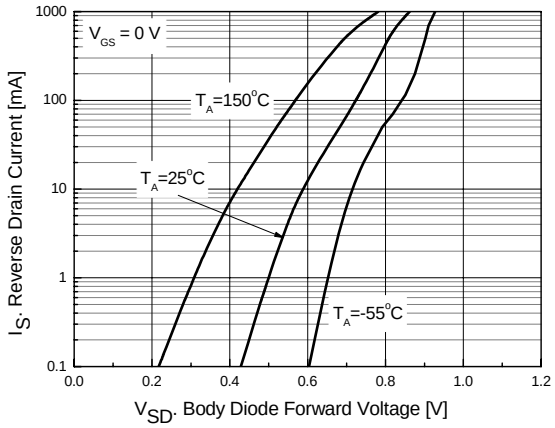


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.



Typical Performance Characteristics (Continued)

Figure 7. Gate Charge Characteristics.

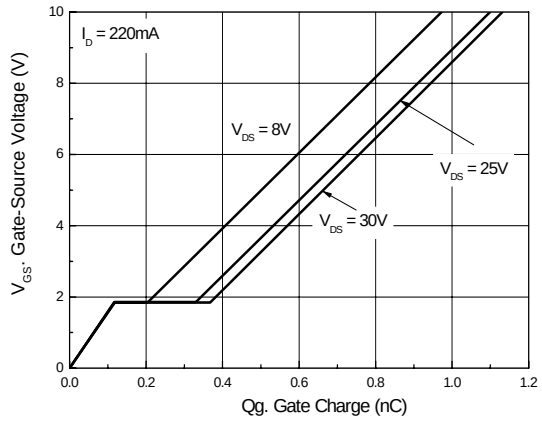


Figure 8. Capacitance Characteristics.

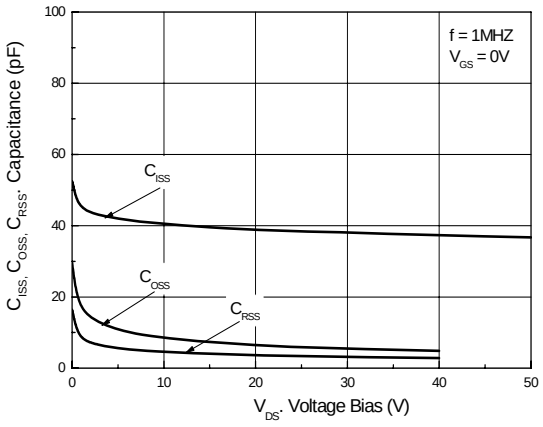


Figure 9. Maximum Safe Operating Area.

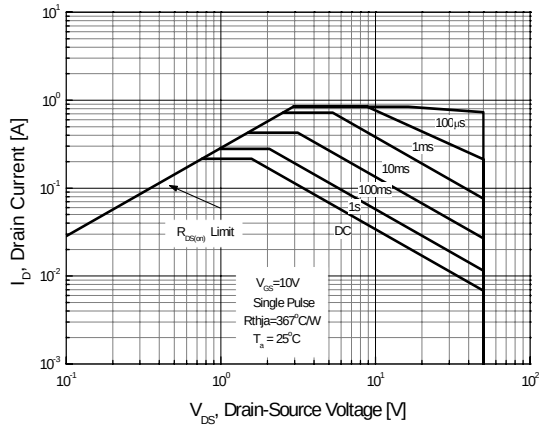


Figure 10. Single Pulse Maximum Power Dissipation.

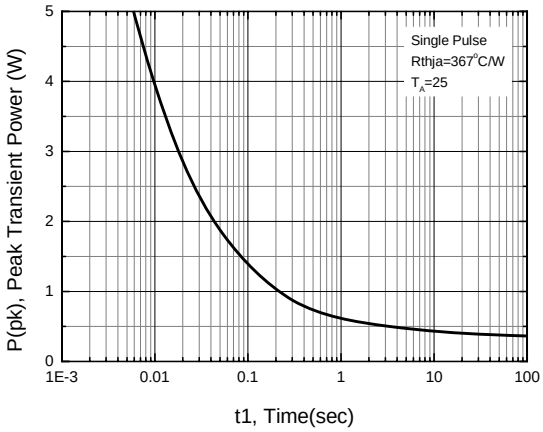
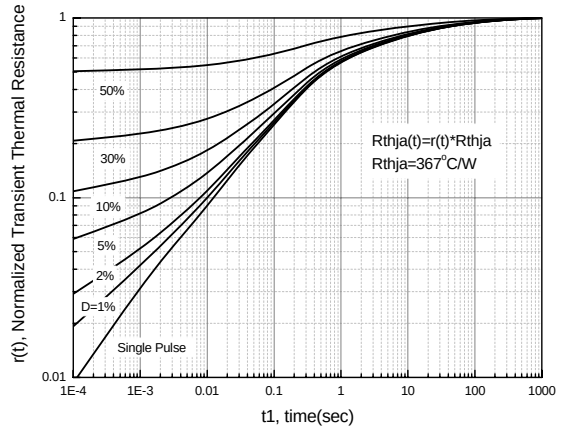
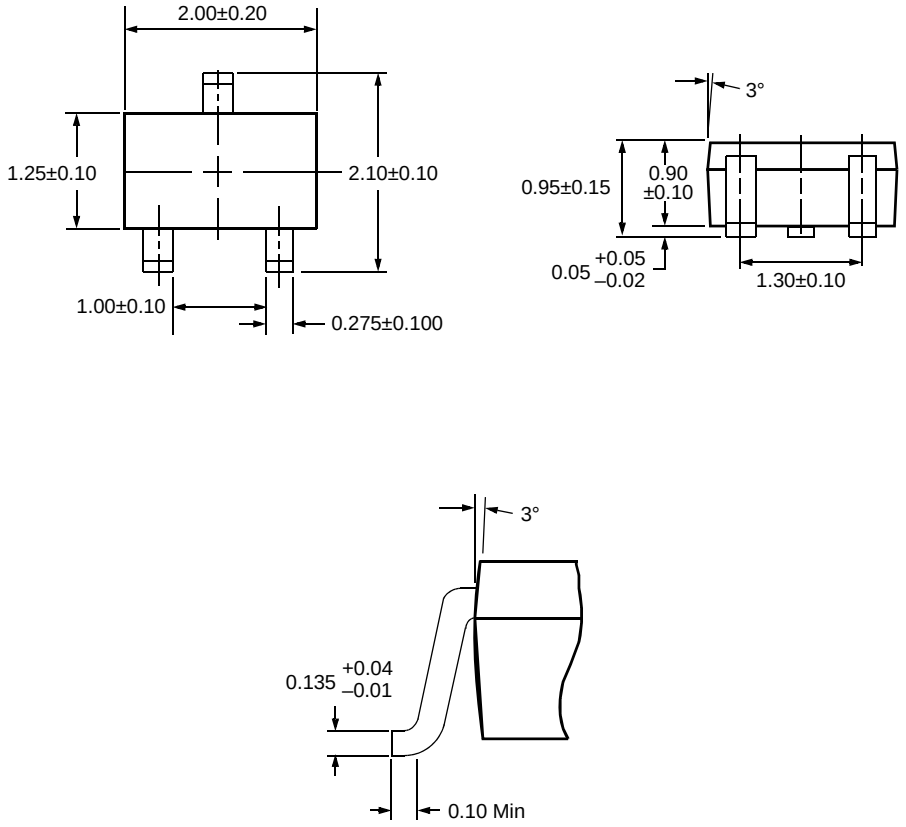


Figure 11. Transient Thermal Response Curve.



Physical Dimensions

SOT-323



Dimensions in Millimeters

FAIRCHILD
SEMICONDUCTOR®

TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™
Auto-SPM™
Build it Now™
CorePLUS™
CorePOWER™
CROSSVOLT™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficientMax™
ESBC™
F®
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FlashWriter®*
FPS™
F-PFS™
FRFET®
Global Power Resource℠
Green FPS™
Green FPS™ e-Series™
Gmax™
GTO™
IntelliMAX™
ISOPLANAR™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
Motion-SPM™
OptoHiT™
OPTOLOGIC®
OPTOPLANAR®
®
PDP SPM™
Power-SPM™
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
RapidConfigure™
™
Saving our world, 1mW/W/kW at a time™
SignalWise™
SmartMax™
SMART START™
SPM®
STEALTH™
SuperFET®
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SupreMOS®
SyncFET™
Sync-Lock™
SYSTEM GENERAL®*
The Power Franchise®
the power franchise
TinyBoost™
TinyBuck™
TinyCalc™
TinyLogic®
TINYOPTO™
TinyPower™
TinyPWM™
TinyWire™
TriFault Detect™
TRUECURRENT™*
µSerDes™
SerDes
UHC®
Ultra FRFET™
UniFET™
VCX™
VisualMax™
XS™

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I50