



ON Semiconductor®

# BS170 / MMBF170

## N-Channel Enhancement Mode Field Effect Transistor

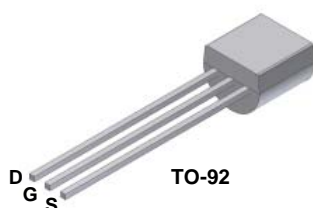
### General Description

These N-Channel enhancement mode field effect transistors are produced using ON Semiconductor'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. They can be used in most applications requiring up to 500mA DC. 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.

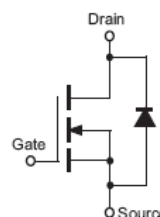
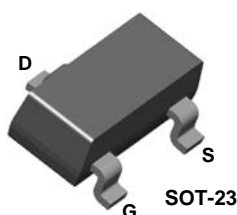
### Features

- High density cell design for low  $R_{DS(ON)}$ .
- Voltage controlled small signal switch.
- Rugged and reliable.
- High saturation current capability.

### BS170



### MMBF170



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

Symbol	Parameter	BS170	MMBF170	Units
$V_{DSS}$	Drain-Source Voltage	60		V
$V_{DGR}$	Drain-Gate Voltage ( $R_{GS} \leq 1M\Omega$ )	60		V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$		V
$I_D$	Drain Current - Continuous	500	500	mA
	- Pulsed	1200	800	
$T_J, T_{STG}$	Operating and Storage 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 $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	BS170	MMBF170	Units
$P_D$	Maximum Power Dissipation	830	300	mW
	Derate above $25^\circ\text{C}$	6.6	2.4	mW/ $^\circ\text{C}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	150	417	$^\circ\text{C}/\text{W}$

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

Symbol	Parameter	Conditions	Type	Min.	Typ.	Max.	Units
OFF CHARACTERISTICS							
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 100μA	All	60			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V	All			0.5	μA
I <sub>GSSF</sub>	Gate - Body Leakage, Forward	V <sub>GS</sub> = 15V, V <sub>DS</sub> = 0V	All			10	nA
ON CHARACTERISTICS (Notes 1)							
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1mA	All	0.8	2.1	3	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 200mA	All		1.2	5	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 10V, I <sub>D</sub> = 200mA	BS170		320		mS
		V <sub>DS</sub> ≥ 2 V <sub>DS(on)</sub> , I <sub>D</sub> = 200mA	MMBF170		320		
Dynamic Characteristics							
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0V, f = 1.0MHz	All		24	40	pF
C <sub>oss</sub>	Output Capacitance		All		17	30	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		All		7	10	pF
Switching Characteristics (Notes 1)							
t <sub>on</sub>	Turn-On Time	V <sub>DD</sub> = 25V, I <sub>D</sub> = 200mA, V <sub>GS</sub> = 10V, R <sub>GEN</sub> = 25Ω	BS170			10	ns
		V <sub>DD</sub> = 25V, I <sub>D</sub> = 500mA, V <sub>GS</sub> = 10V, R <sub>GEN</sub> = 50Ω	MMBF170			10	
t <sub>off</sub>	Turn-Off Time	V <sub>DD</sub> = 25V, I <sub>D</sub> = 200mA, V <sub>GS</sub> = 10V, R <sub>GEN</sub> = 25Ω	BS170			10	ns
		V <sub>DD</sub> = 25V, I <sub>D</sub> = 500mA, V <sub>GS</sub> = 10V, R <sub>GEN</sub> = 50Ω	MMBF170			10	

**Note:**1. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2.0\%$ .**Ordering Information**

Part Number	Package	Package Type	Lead Frame	Pin array
BS170	TO-92	BULK	STRAIGHT	D G S
BS170-D26Z	TO-92	Tape and Reel	FORMING	D G S
BS170-D27Z	TO-92	Tape and Reel	FORMING	D G S
BS170-D74Z	TO-92	AMMO	FORMING	D G S
BS170-D75Z	TO-92	AMMO	FORMING	D G S
MMBF170	SOT-23	Tape and Reel		

## Typical Electrical Characteristics

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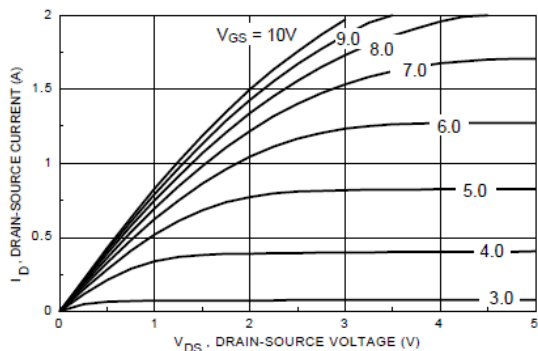


Figure 1. On-Region Characteristics.

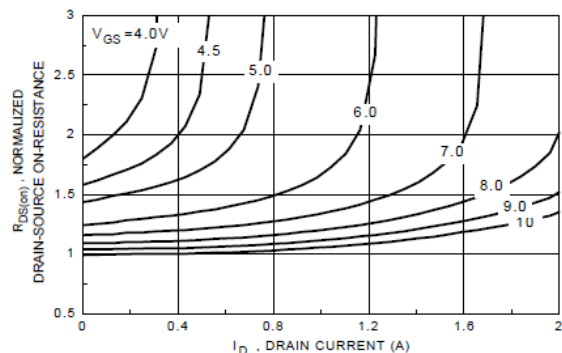


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

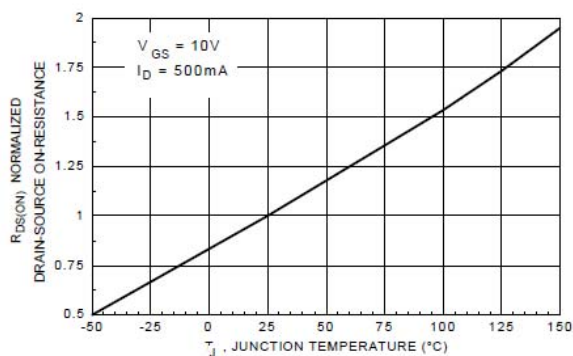


Figure 3. On-Resistance Variation with Temperature.

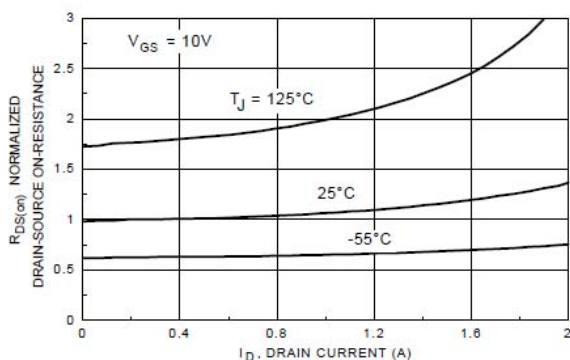


Figure 4. On-Resistance Variation with Drain Current and Temperature.

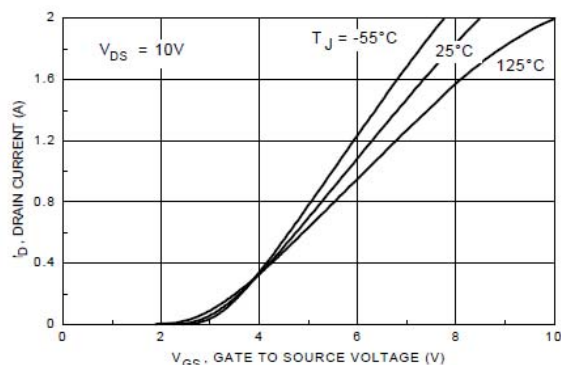


Figure 5. Transfer Characteristics.

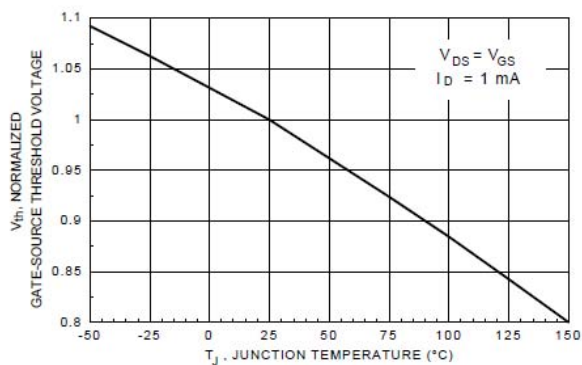


Figure 6. Gate Threshold Variation with Temperature.

## Typical Electrical Characteristics (continued)

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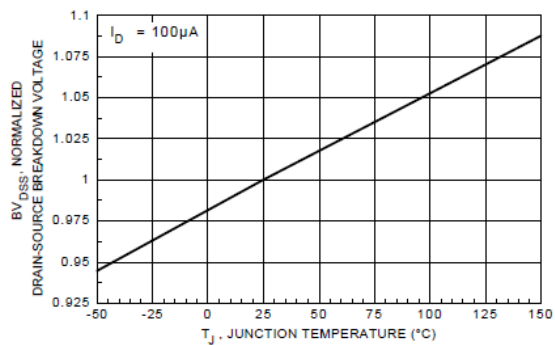


Figure 7. Breakdown Voltage Variation with Temperature.

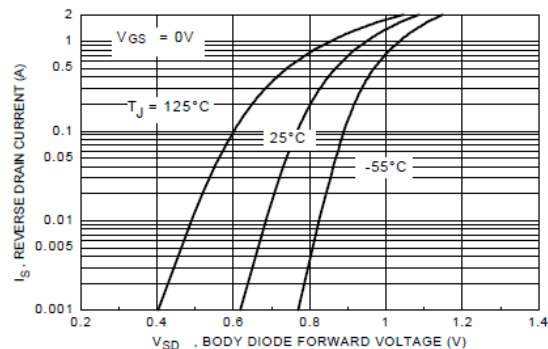


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

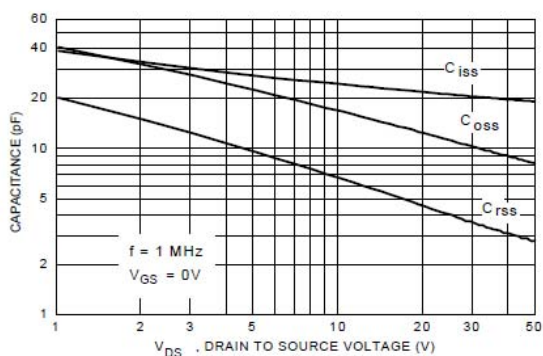


Figure 9. Capacitance Characteristics.

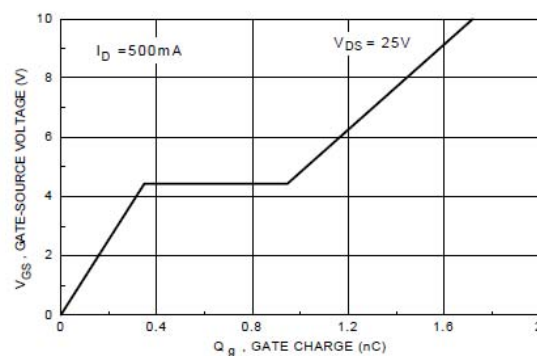


Figure 10. Gate Charge Characteristics.

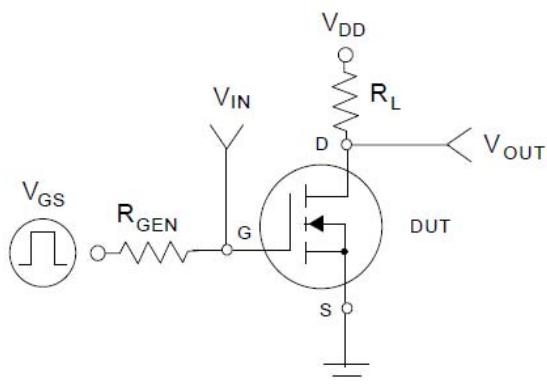


Figure 11. Switching Test Circuit.

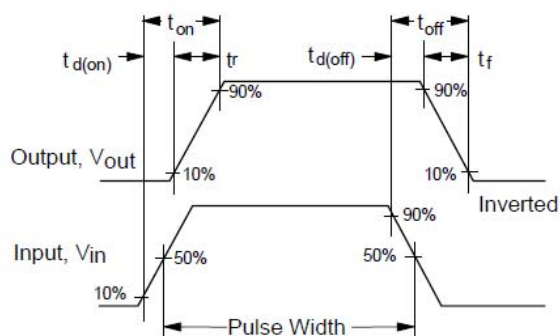


Figure 12. Switching Waveforms.

# Typical Electrical Characteristics (continued)

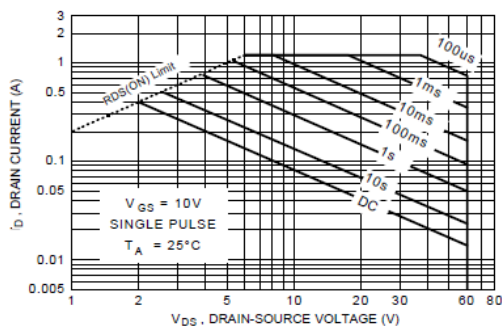


Figure 13. BS170 Maximum Safe Operating Area.

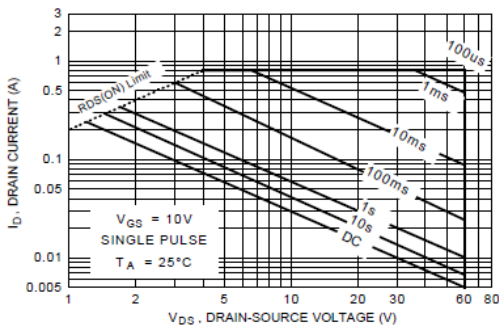


Figure 14. MMBF170 Maximum Safe Operating Area.

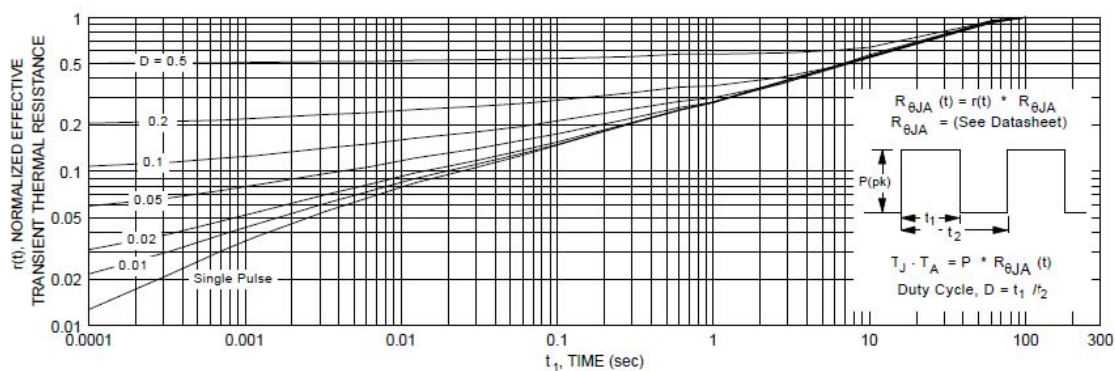


Figure 15. TO-92, BS170 Transient Thermal Response Curve.

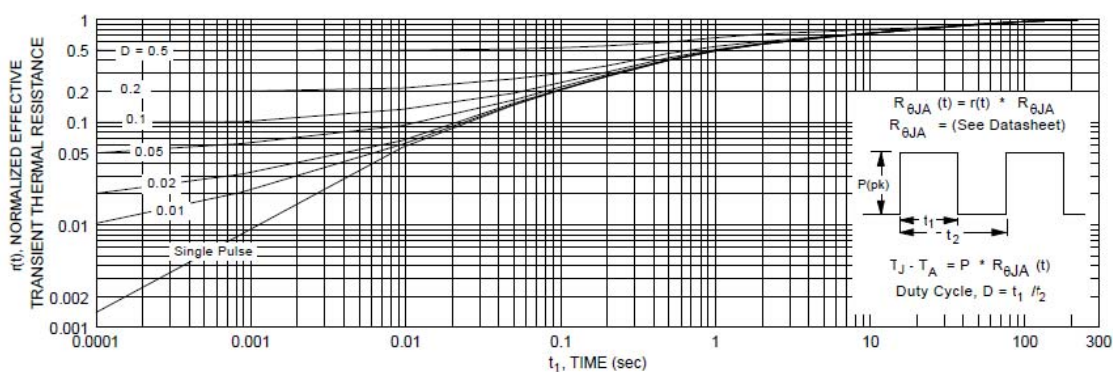
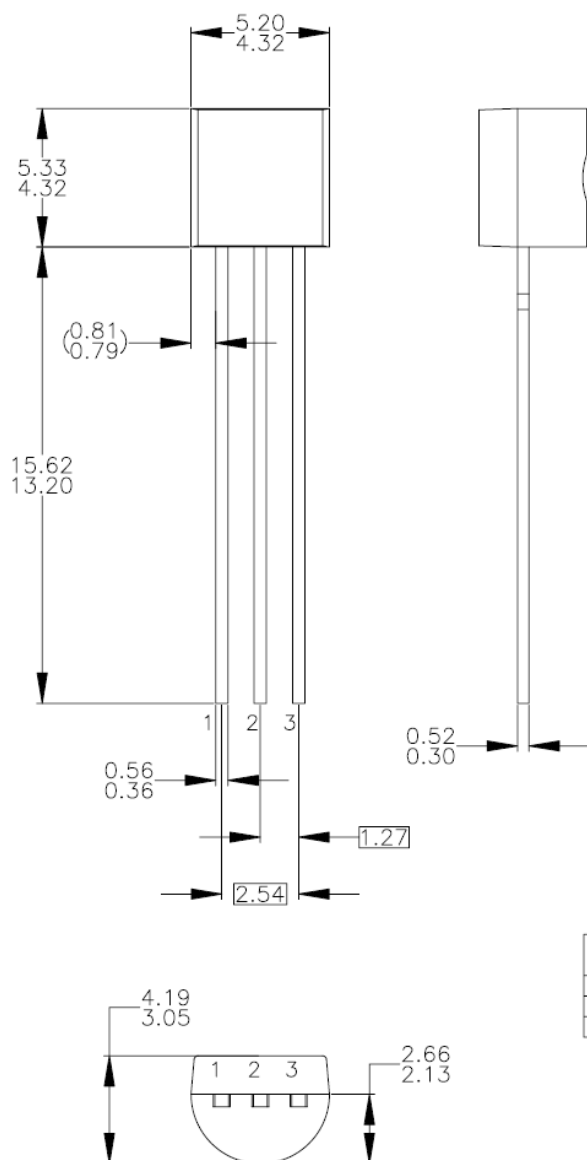


Figure 16. SOT-23, MMBF170 Transient Thermal Response Curve.

## Mechanical Dimensions ( TO-92 )

## TO-92



NOTES: UNLESS OTHERWISE SPECIFIED

- A) DRAWING WITH REFERENCE TO JEDEC TO-92 RECOMMENDATIONS.  
 B) ALL DIMENSIONS ARE IN MILLIMETERS.  
 C) DRAWING CONFORMS TO ASME Y14.5M-1994.  
 D) TO-92 (92,94,96,97,98) PIN CONFIGURATION:

PIN	92			94			96			97			98		
	P	F	M	P	F	M	P	F	M	P	F	M	P	F	M
1	E	S	S	E	S	S	B	D	G	C	G	D	C	G	D
2	B	D	G	C	G	D	E	S	S	B	D	G	E	S	S
3	C	G	D	B	D	G	C	G	D	E	S	S	B	D	G

## LEGEND:

P - BIPOLAR      E - EMITTER      D - DRAIN  
 F - JFET          B - BASE          S - SOURCE  
 M - DMOS          C - COLLECTOR      G - GATE

- E) FOR PACKAGE 92, 94, 96, 97 AND 98:  
 PIN CONFIGURATION DRAIN "D" AND SOURCE "S"  
 ARE INTERCHANGEABLE AT JFET "F" OPTION.  
 F) DRAWING FILENAME: MKT-2A03DREV3.

Dimensions in Millimeters