MMBF170

N-Channel Enhancement Mode MOSFET
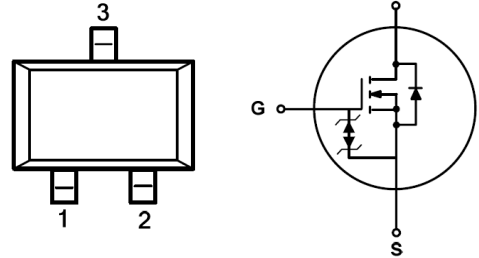
Features

● Surface-mounted package
● Advanced trench cell design
● Extremely low threshold voltage
● ESD protected (HBM > 2KV)

Quick reference

● BV $\geqq$ 60 V
● P_{tot} $\leqq$ 0.83 W
● I_D $\leqq$ 0.5 A
● $R_{DS(ON)}$ $\leqq$ 3 Ω @ V_{GS} = 10 V
● $R_{DS(ON)}$ $\leqq$ 4 Ω @ V_{GS} = 4.5 V

SOT-23

Top View
1 :Gate(G)   2 :Source(S)   3 :Drain(D)

Limiting Values

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	Drain-Source Voltage	T_A = 25 ℃	-	60	V
V_{GS}	Gate-Source Voltage	T_A = 25 ℃	-	± 20	V
I_D*	Drain Current	T_A = 25 ℃, V_{GS} = 10 V	-	0.5	A
I_{DM}*,**	Pulsed Drain Current	T_A = 25 ℃, V_{GS} = 10 V	-	1.7	A
P_{tot}*	Total Power Dissipation	T_A = 25 ℃	-	0.83	W
		T_A = 100 ℃	-	0.33	
T_{stg}	Storage Temperature		- 55	150	℃
T_J	Junction Temperature		-	150	℃
I_S*	Diode Forward Current	T_A = 25 ℃	-	0.4	A
$R_{\theta JA}$*	Thermal Resistance- Junction to Ambient		-	150	℃ / W

Notes：* Surface Mounted on 1 in2 pad area, t ≤ 10 sec   ** Pulse width ≤ 300 μs, duty cycle ≤ 2 %

Electrical Characteristics (T_A = 25 °C Unless Otherwise Noted)

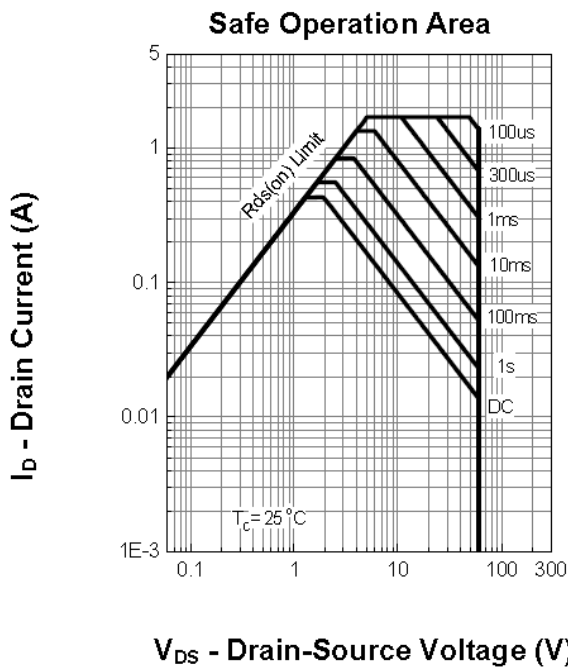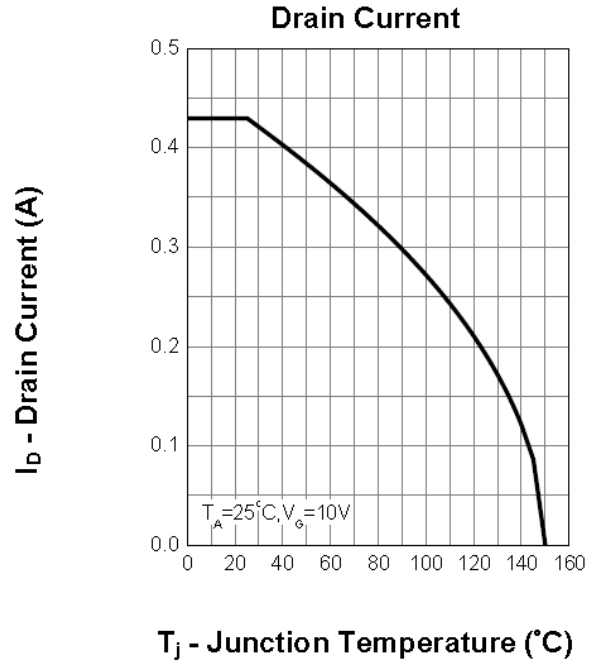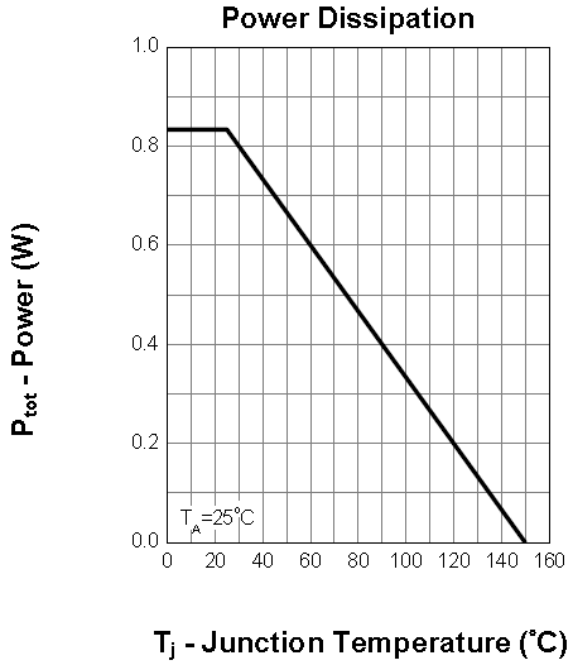| Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_{DS} = 250 µA	60	-	-	V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, I_{DS} = 250 µA	1.0	1.6	2.5	V
I_{DSS}	Drain Leakage Current	V_{DS} = 48 V, V_{GS} = 0 V	-	-	1	µA
		T_J = 85 ℃	-	-	30	µA
I_{GSS}	Gate Leakage Current	V_{GS} = ± 20 V, V_{DS} = 0 V	-	-	± 10	µA
$R_{DS(ON)}{}^a$	On-State Resistance	V_{GS} = 10 V, I_{DS} = 0.4 A		1.9	3.0	Ω
		V_{GS} = 4.5 V, I_{DS} = 0.3 A	-	2.4	4.0	
Diode Characteristics						
$V_{SD}{}^a$	Diode Forward Voltage	I_{SD} = 0.4 A, V_{GS} = 0 V	-	0.7	1.3	V
t_{rr}	Reverse Recovery Time	I_{SD} = 0.4 A, dI_{SD} / dt = 100 A / µs	-	40	-	ns
Q_{rr}	Reverse Recovery Charge		-	40	-	nC
Dynamic Characteristics[b]						
R_G	Gate Resistance	$V_{GS} = V_{DS}$ = 0 V, F = 1 MHz	-	130	-	Ω
C_{iss}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 25 V Frequency = 1 MHz	-	30	-	pF
C_{oss}	Output Capacitance		-	4.2	-	
C_{rss}	Reverse Transfer Capacitance		-	3	-	
$t_d(on)$	Turn-on Delay Time	V_{DS} = 30 V, V_{GEN} = 10 V, R_G = 25 Ω, R_L = 150 Ω, I_{DS} = 0.2 A	-	3.9	9	ns
t_r	Turn-on Rise Time		-	3.5	8	
$t_d(off)$	Turn-off Delay Time		-	16	40	
t_f	Turn-off Fall Time		-	10	20	
Q_g	Total Gate Charge	V_{GS} = 4.5 V, V_{DS} = 10 V, I_{DS} = 0.4 A	-	305	-	pC
Q_{gs}	Gate-Source Charge		-	85	-	
Q_{gd}	Gate-Drain Charge		-	205	-	

Notes：a : Pulse test ; pulse width ≤ 300 µs, duty cycle ≤ 2 %   b : Guaranteed by design, not subject to production testing

Typical Characteristics

Power Dissipation

P_{tot} - Power (W) vs T_j - Junction Temperature (°C)

$T_A = 25°C$

Drain Current

I_D - Drain Current (A) vs T_j - Junction Temperature (°C)

$T_A = 25°C, V_G = 10V$

Safe Operation Area

I_D - Drain Current (A) vs V_{DS} - Drain-Source Voltage (V)

Rds(on) Limit
100us
300us
1ms
10ms
100ms
1s
DC
$T_c = 25°C$

Thermal Transient Impedance

Normalized Effective Transient vs Square Wave Pulse Duration (sec)

Duty = 0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
Mounted on 1in^2 pad
$R_{\theta JA}$: 150 °C/W

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Output Characteristics

V_{GS} = 4,5,6,8,10 V

3.0 V
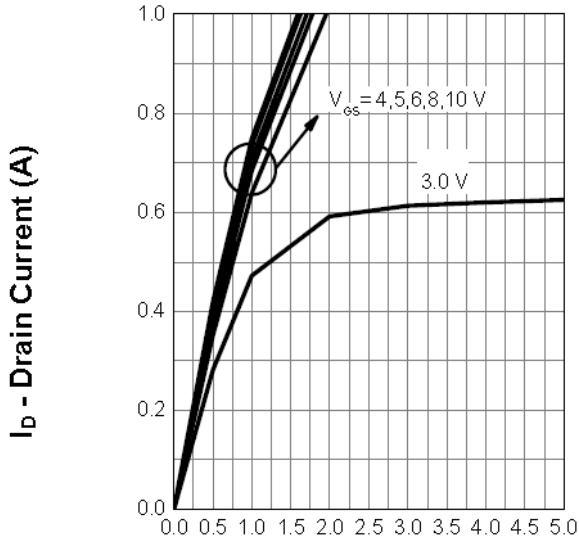
I_D - Drain Current (A)

V_{DS} - Drain-Source Voltage (V)

Drain-Source On Resistance

V_{GS} = 4.5V
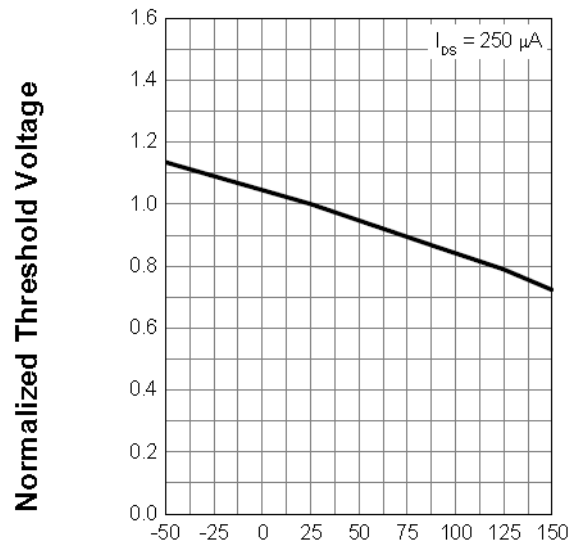
V_{GS} = 10 V

$R_{DS(ON)}$ - On Resistance (Ω)
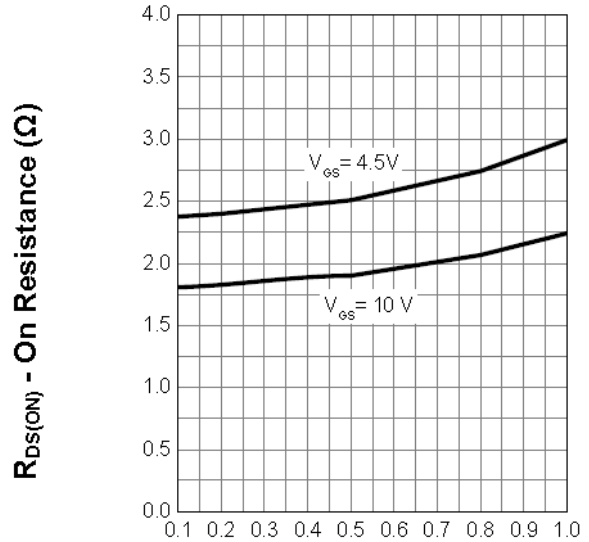
I_D - Drain Current (A)

Transfer Characteristics

I_D = 0.4 A

$R_{DS(ON)}$ - On Resistance (Ω)
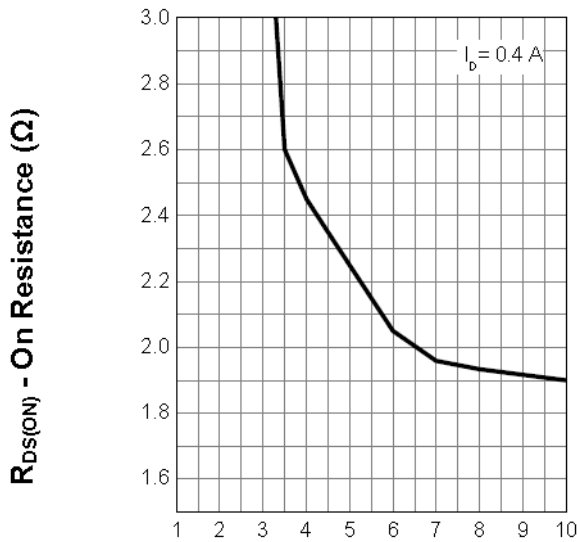
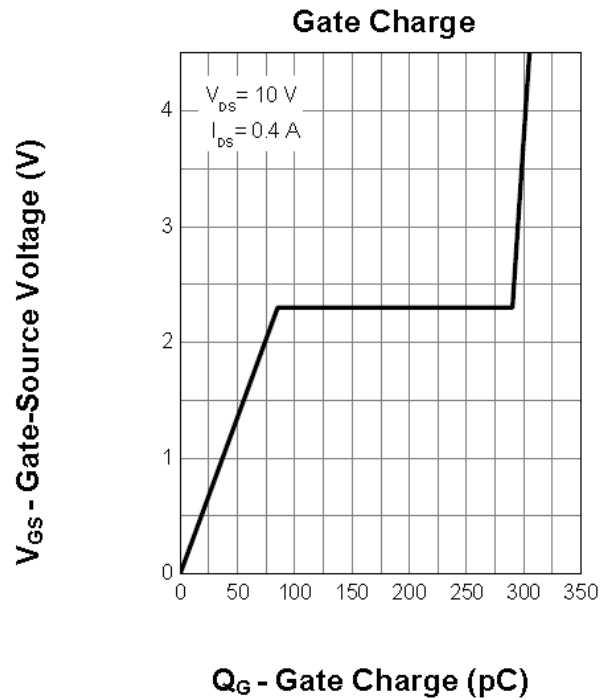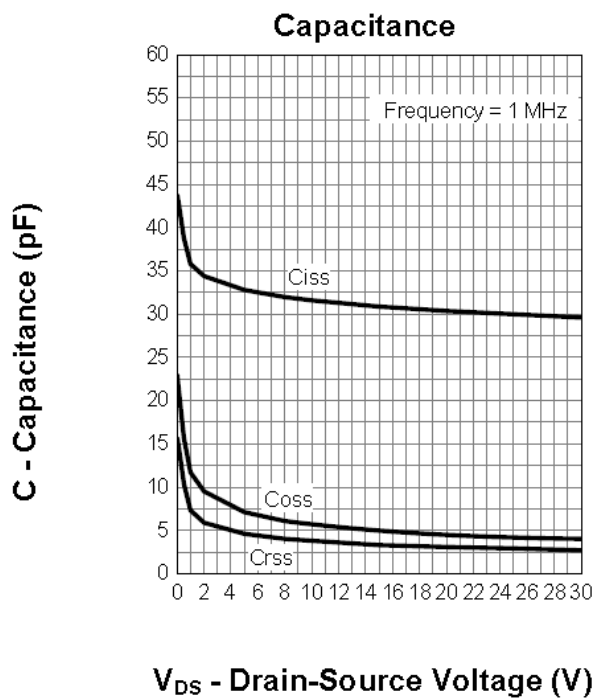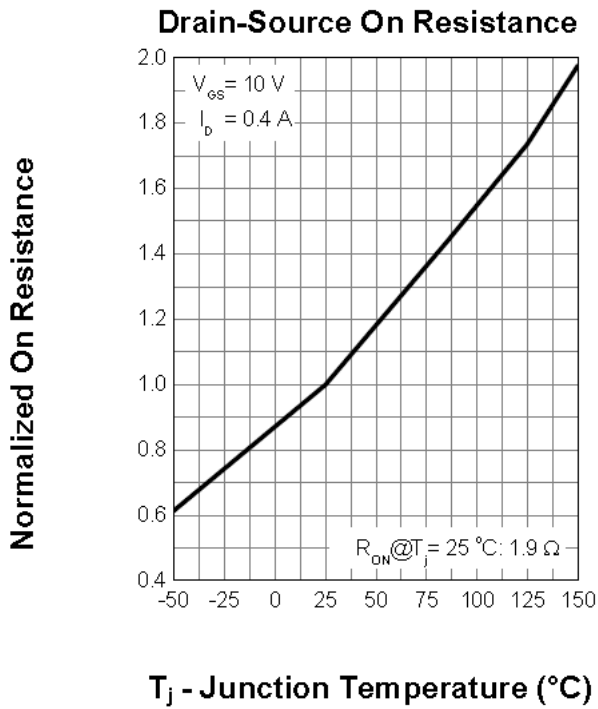V_{GS} - Gate-Source Voltage (V)

Gate Threshold Voltage

I_{DS} = 250 μA

Normalized Threshold Voltage

T_j - Junction Temperature (°C)

Drain-Source On Resistance

$V_{GS} = 10\ V$
$I_D = 0.4\ A$

$R_{ON}@T_j = 25\ ^\circ C: 1.9\ \Omega$

Normalized On Resistance

T_j - Junction Temperature (°C)

Source-Drain Diode Forward

$T_j = 150\ ^\circ C$

$T_j = 25\ ^\circ C$

I_S - Source Current (A)

V_{SD} - Source-Drain Voltage (V)

Capacitance

Frequency = 1 MHz

Ciss

Coss

Crss

C - Capacitance (pF)

V_{DS} - Drain-Source Voltage (V)

Gate Charge

$V_{DS} = 10\ V$
$I_{DS} = 0.4\ A$

V_{GS} - Gate-Source Voltage (V)

Q_G - Gate Charge (pC)

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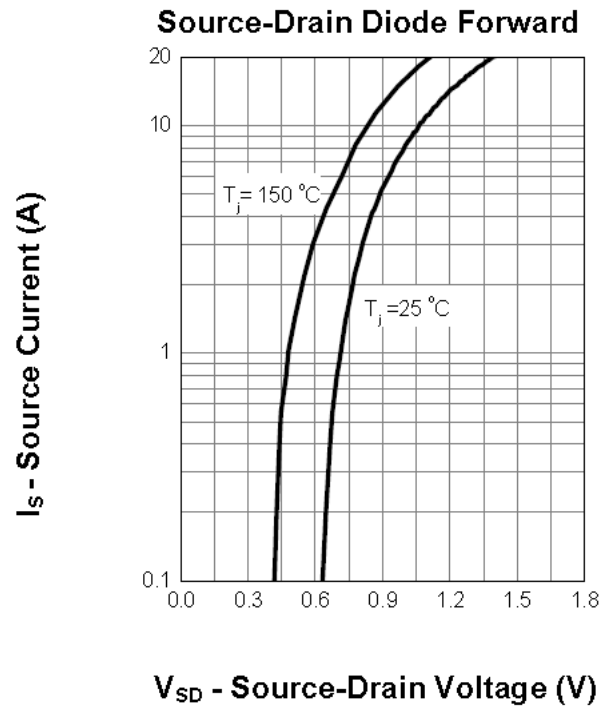
Package Dimensions

SOT-23
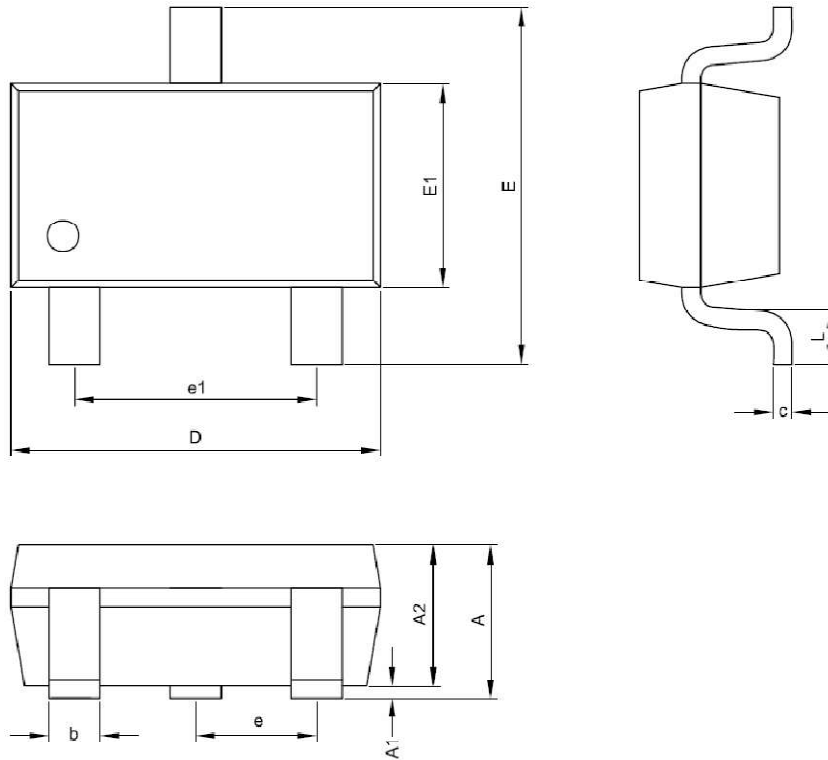
Symbol	Dimensions In Millimeters	
	MIN.	MAX.
A	—	1.12
A1	0.00	0.1
A2	0.90	1.02
D	2.90 BSC	
E	2.40 BSC	
E1	1.20	1.40
c	0.08	0.25
b	0.30	0.50
e	0.95 BSC	
e1	1.90 BSC	
L	0.20	0.60

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