

# MMBF2201NT1

Preferred Device

## Power MOSFET 300 mAmps, 20 Volts N-Channel SC-70/SOT-323

These miniature surface mount MOSFETs low  $R_{DS(on)}$  assure minimal power loss and conserve energy, making these devices ideal for use in small power management circuitry. Typical applications are dc-dc converters, power management in portable and battery-powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

- Low  $R_{DS(on)}$  Provides Higher Efficiency and Extends Battery Life
- Miniature SC-70/SOT-323 Surface Mount Package Saves Board Space

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	20	Vdc
Gate-to-Source Voltage – Continuous	$V_{GS}$	$\pm 20$	Vdc
Drain Current			mAdc
– Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	300	
– Continuous @ $T_A = 70^\circ\text{C}$	$I_D$	240	
– Pulsed Drain Current ( $t_p \leq 10 \mu\text{s}$ )	$I_{DM}$	750	
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 1.) Derate above $25^\circ\text{C}$	$P_D$	150 1.2	mW mW/ $^\circ\text{C}$
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Thermal Resistance – Junction-to-Ambient	$R_{\theta JA}$	833	$^\circ\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes, for 10 seconds	$T_L$	260	$^\circ\text{C}$

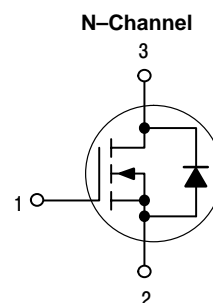
1. Mounted on G10/FR4 glass epoxy board using minimum recommended footprint.



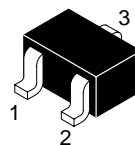
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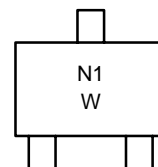
**300 mAmps**  
**20 VOLTS**  
 **$R_{DS(on)} = 1 \Omega$**



### MARKING DIAGRAM

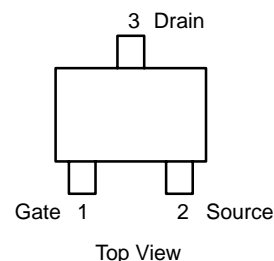


SC-70/SOT-323  
CASE 419  
STYLE 8



W = Work Week

### PIN ASSIGNMENT



### ORDERING INFORMATION

Device	Package	Shipping
MMBF2201NT1	SC-70/ SOT-323	3000 Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 10 μA)	V <sub>(BR)DSS</sub>	20	–	–	Vdc
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 16 Vdc, V <sub>GS</sub> = 0 Vdc) (V <sub>DS</sub> = 16 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	I <sub>DSS</sub>	–	–	1.0 10	μAdc
Gate-Body Leakage Current (V <sub>GS</sub> = ± 20 Vdc, V <sub>DS</sub> = 0)	I <sub>GSS</sub>	–	–	±100	nAdc

### ON CHARACTERISTICS (Note 2.)

Gate Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc)	V <sub>GS(th)</sub>	1.0	1.7	2.4	Vdc
Static Drain-to-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 300 mAdc) (V <sub>GS</sub> = 4.5 Vdc, I <sub>D</sub> = 100 mAdc)	r <sub>DS(on)</sub>	–	0.75 1.0	1.0 1.4	Ohms
Forward Transconductance (V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 200 mAdc)	g <sub>FS</sub>	–	450	–	mMhos

### DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = 5.0 V)	C <sub>iSS</sub>	–	45	–	pF
Output Capacitance	(V <sub>DS</sub> = 5.0 V)	C <sub>oSS</sub>	–	25	–	
Transfer Capacitance	(V <sub>DG</sub> = 5.0 V)	C <sub>rSS</sub>	–	5.0	–	

### SWITCHING CHARACTERISTICS (Note 3.)

Turn-On Delay Time	(V <sub>DD</sub> = 15 Vdc, I <sub>D</sub> = 300 mAdc, R <sub>L</sub> = 50 Ω)	t <sub>d(on)</sub>	–	2.5	–	ns
Rise Time		t <sub>r</sub>	–	2.5	–	
Turn-Off Delay Time		t <sub>d(off)</sub>	–	15	–	
Fall Time		t <sub>f</sub>	–	0.8	–	
Gate Charge (See Figure 5)		Q <sub>T</sub>	–	1400	–	pC

### SOURCE-DRAIN DIODE CHARACTERISTICS

Continuous Current	I <sub>S</sub>	–	–	0.3	A
Pulsed Current	I <sub>SM</sub>	–	–	0.75	
Forward Voltage (Note 3.)	V <sub>SD</sub>	–	0.85	–	V

- Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
- Switching characteristics are independent of operating junction temperature.

## TYPICAL CHARACTERISTICS

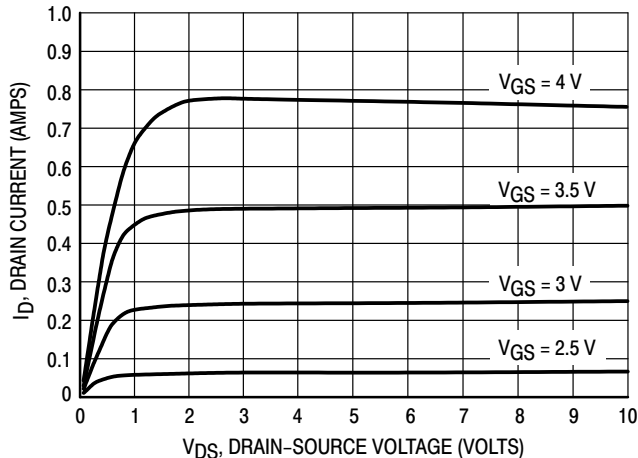


Figure 1. Typical Drain Characteristics

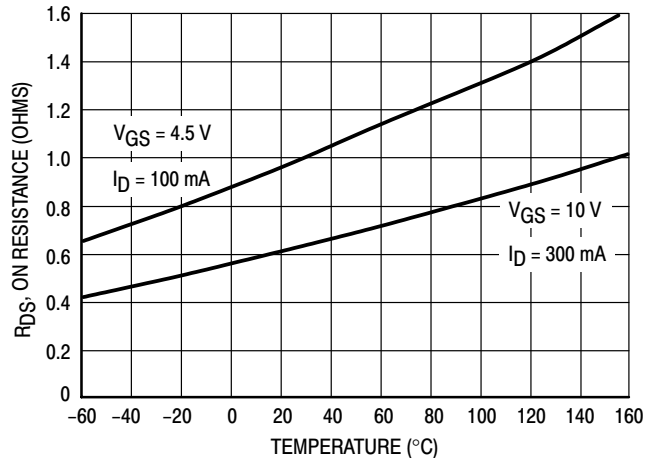
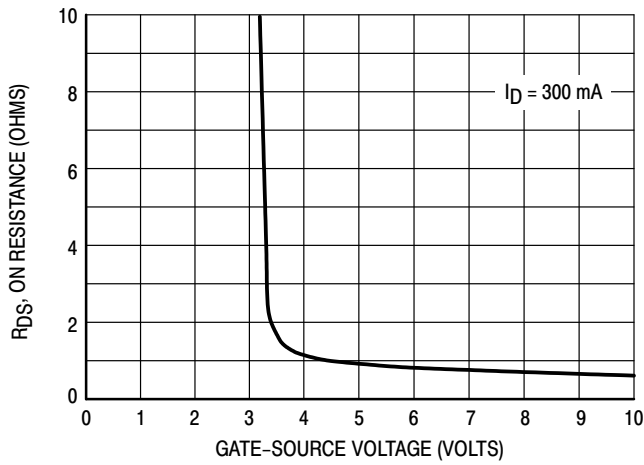


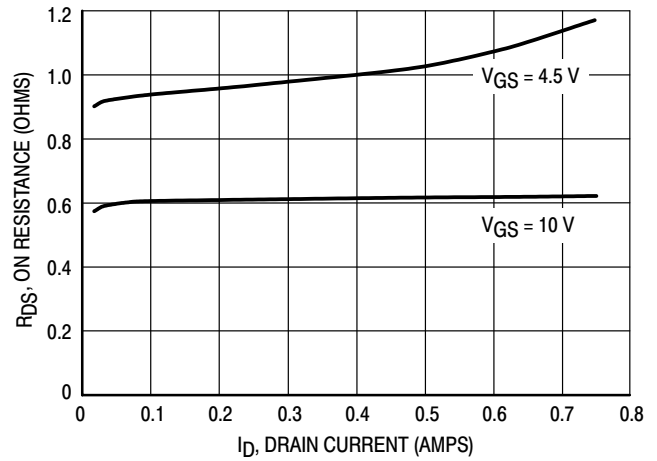
Figure 2. On Resistance versus Temperature

# MMBF2201NT1

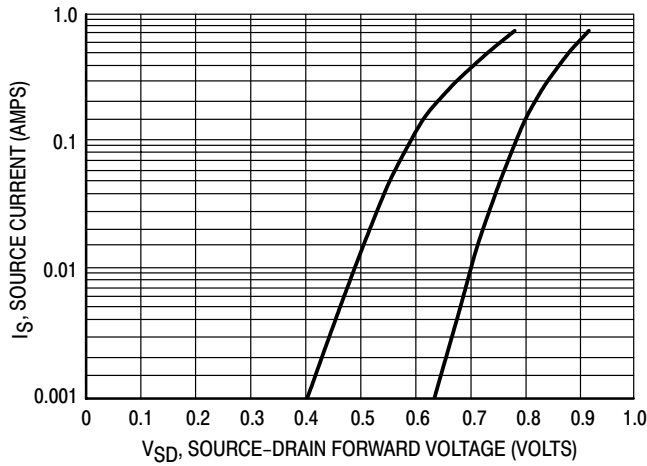
## TYPICAL CHARACTERISTICS



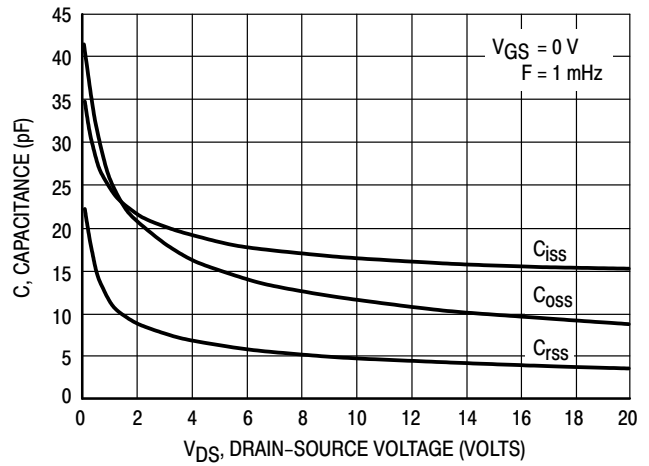
**Figure 3. On Resistance versus Gate-Source Voltage**



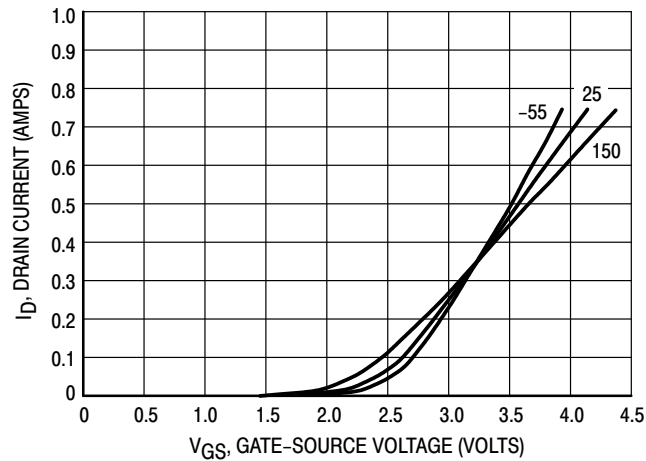
**Figure 4. On Resistance versus Drain Current**



**Figure 5. Source-Drain Forward Voltage**



**Figure 6. Capacitance Variation**



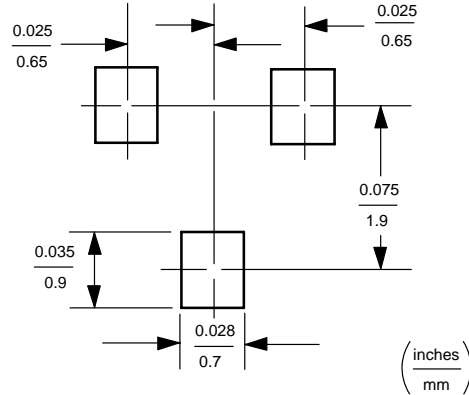
**Figure 7. Transfer Characteristics**

**INFORMATION FOR USING THE SC-70/SOT-323 SURFACE MOUNT PACKAGE**

**MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS**

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection

interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



**SC-70/SOT-323 POWER DISSIPATION**

The power dissipation of the SC-70/SOT-323 is a function of the drain pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by  $T_{J(max)}$ , the maximum rated junction temperature of the die,  $R_{\theta JA}$ , the thermal resistance from the device junction to ambient, and the operating temperature,  $T_A$ . Using the values provided on the data sheet for the SC-70 package,  $P_D$  can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature  $T_A$  of 25°C,

one can calculate the power dissipation of the device which in this case is 150 milliwatts.

$$P_D = \frac{150^{\circ}C - 25^{\circ}C}{833^{\circ}C/W} = 150 \text{ milliwatts}$$

The 833°C/W for the SC-70/SOT-323 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 150 milliwatts. There are other alternatives to achieving higher power dissipation from the SC-70/SOT-323 package. Another alternative would be to use a ceramic substrate or an aluminum core board such as Thermal Clad™. Using a board material such as Thermal Clad, an aluminum core board, the power dissipation can be doubled using the same footprint.

**SOLDERING PRECAUTIONS**

The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.\*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference should be a maximum of 10°C.

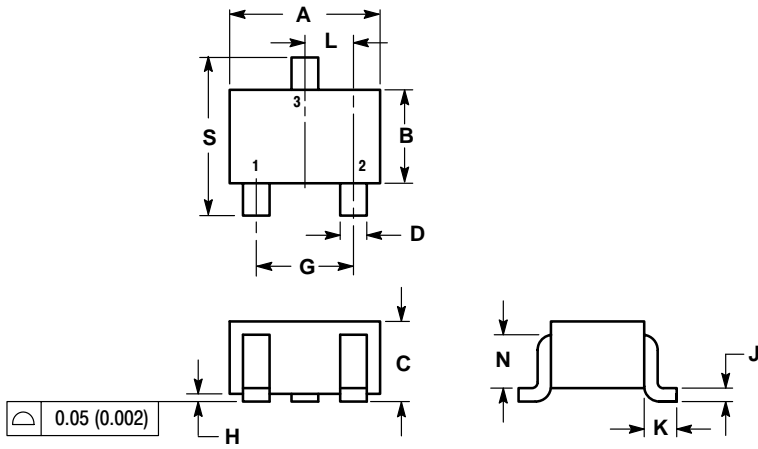
- The soldering temperature and time should not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient should be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used as the use of forced cooling will increase the temperature gradient and result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling

\* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

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## PACKAGE DIMENSIONS

SC-70/SOT-323  
 CASE 419-04  
 ISSUE L



- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.032	0.040	0.80	1.00
D	0.012	0.016	0.30	0.40
G	0.047	0.055	1.20	1.40
H	0.000	0.004	0.00	0.10
J	0.004	0.010	0.10	0.25
K	0.017 REF		0.425 REF	
L	0.026 BSC		0.650 BSC	
N	0.028 REF		0.700 REF	
S	0.079	0.095	2.00	2.40

- STYLE 8:  
 PIN 1. GATE  
 2. SOURCE  
 3. DRAIN

**Notes**

**Notes**

Thermal Clad is a registered trademark of the Bergquist Company.

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