

## Product Preview

### Medium Power Surface Mount Products

# TMOS Dual N-Channel Field Effect Transistors



**MMDF3200Z**

Motorola Preferred Device

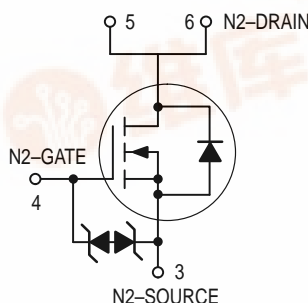
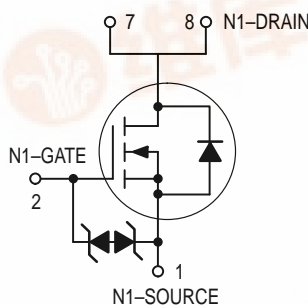
**DUAL TMOS  
POWER MOSFET  
11.5 AMPERES  
20 VOLTS  
 $R_{DS(on)} = 0.015 \text{ OHM}$**



**CASE 751-06, Style 11  
SO-8**

WaveFET™ devices are an advanced series of power MOSFETs which utilize Motorola's latest MOSFET technology process to achieve the lowest possible on-resistance per silicon area. They are capable of withstanding high energy in the avalanche and commutation modes and the drain-to-source diode has a very low reverse recovery time. WaveFET™ devices are designed for use in low voltage, high speed switching applications where power efficiency is important. Typical applications are dc-dc converters, and power management in portable and battery powered products such as computers, printers, cellular and cordless phones. They can also be used for low voltage motor controls in mass storage products such as disk drives and tape drives. The avalanche energy is specified to eliminate the guesswork in designs where inductive loads are switched and offer additional safety margin against unexpected voltage transients.

- Zener Protected Gates Provide Electrostatic Discharge Protection
- Designed to withstand 200 V Machine Model and 2000 V Human Body Model
- Low  $R_{DS(on)}$  Provides Higher Efficiency and Extends Battery Life
- Logic Level Gate Drive — Can Be Driven by Logic ICs
- Miniature SO-8 Surface Mount Package — Saves Board Space
- Diode Is Characterized for Use In Bridge Circuits
- Diode Exhibits High Speed, With Soft Recovery
- $I_{DSS}$  Specified at Elevated Temperature
- Mounting Information for SO-8 Package Provided



N1-Source	1	8	N1-Drain
N1-Gate	2	7	N1-Drain
N2-Source	3	6	N2-Drain
N2-Gate	4	5	N2-Drain

TOP VIEW

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

Rating	Symbol	Max	Unit
Drain-to-Source Voltage	$V_{DSS}$	20	V
Drain-to-Gate Voltage ( $R_{GS} = 1.0 \text{ M}\Omega$ )	$V_{DGR}$	20	V
Gate-to-Source Voltage — Continuous	$V_{GS}$	$\pm 12$	V
Operating and Storage Temperature Range	$T_J, T_{stg}$	$-55$ to $150$	$^\circ\text{C}$

#### DEVICE MARKING

Device	Reel Size	Tape Width	Quantity
D3200 MMDF3200Z	13"	12 mm embossed tape	4000 units

This document contains information on a product under development. Motorola reserves the right to change or discontinue this product without notice. HDTMOS is a trademark of Motorola, Inc. TMOS is a registered trademark of Motorola, Inc.

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



**MOTOROLA**

## MMDF3200Z

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

When mounted on 1 inch square (25.40 mm square) FR-4 or G-10 board ( $V_{GS} = 10\text{ V}$  @ 10 Seconds)

Parameter	Symbol	Maximum	Unit
Drain Current — Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	11.5	A
— Continuous @ $T_A = 70^\circ\text{C}$	$I_D$	9.2	A
— Pulsed Drain Current (1)	$I_{DM}$	57.5	A
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	2.0	Watts
Linear Derating Factor		16	mW/ $^\circ\text{C}$
Thermal Resistance — Junction to Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C/W}$
Continuous Source Current (Diode Current)	$I_S$	TBD	A

When mounted on 1 inch square (25.40 mm square) FR-4 or G-10 board ( $V_{GS} = 10\text{ V}$  @ Steady State)

Parameter	Symbol	Maximum	Unit
Drain Current — Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	8.0	A
— Continuous @ $T_A = 70^\circ\text{C}$	$I_D$	5.9	A
— Pulsed Drain Current (1)	$I_{DM}$	40	A
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	1.28	Watts
Linear Derating Factor		10.2	mW/ $^\circ\text{C}$
Thermal Resistance — Junction to Ambient	$R_{\theta JA}$	98	$^\circ\text{C/W}$
Continuous Source Current (Diode Current)	$I_S$	TBD	A

When mounted on minimum FR-4 or G-10 board ( $V_{GS} = 10\text{ V}$  @ Steady State)

Parameter	Symbol	Maximum	Unit
Drain Current — Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	7.1	A
— Continuous @ $T_A = 70^\circ\text{C}$	$I_D$	5.2	A
— Pulsed Drain Current (1)	$I_{DM}$	35.5	A
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	0.75	Watts
Linear Derating Factor		6.0	mW/ $^\circ\text{C}$
Thermal Resistance — Junction to Ambient	$R_{\theta JA}$	166	$^\circ\text{C/W}$
Continuous Source Current (Diode Current)	$I_S$	TBD	A

(1) Repetitive rating; pulse width limited by maximum junction temperature.

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

**OFF CHARACTERISTICS**

Drain-to-Source Breakdown Voltage ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 0.25\text{ mAdc}$ ) Temperature Coefficient (Positive)	$V_{(BR)DSS}$	20 —	— TBD	— —	Vdc mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current ( $V_{DS} = 20\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) ( $V_{DS} = 20\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $T_J = 125^\circ\text{C}$ )	$I_{DSS}$	— —	— —	1.0 10	$\mu\text{Adc}$
Gate-Body Leakage Current ( $V_{GS} = \pm 12\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	—	TBD	1.0	$\mu\text{A}$

**ON CHARACTERISTICS(1)**

Gate Threshold Voltage ( $V_{DS} = V_{GS}$ , $I_D = 0.25\text{ mAdc}$ ) Threshold Temperature Coefficient (Negative)	$V_{GS(th)}$	0.5 —	0.8 TBD	1.2 —	Vdc mV/ $^\circ\text{C}$
Static Drain-to-Source On-Resistance ( $V_{GS} = 4.5\text{ Vdc}$ , $I_D = 11.5\text{ Adc}$ ) ( $V_{GS} = 2.5\text{ Vdc}$ , $I_D = 5.9\text{ Adc}$ )	$R_{DS(on)}$	— —	TBD TBD	15 25	$\text{m}\Omega$
Forward Transconductance ( $V_{DS} = 8.0\text{ Vdc}$ , $I_D = 3.0\text{ Adc}$ )	$g_{FS}$	5.0	TBD	—	Mhos

**DYNAMIC CHARACTERISTICS**

Input Capacitance	( $V_{DS} = 15\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$	—	TBD	TBD	pF
Output Capacitance		$C_{oss}$	—	TBD	TBD	
Transfer Capacitance		$C_{rss}$	—	TBD	TBD	

**SWITCHING CHARACTERISTICS(2)**

Turn-On Delay Time	( $V_{DD} = 16\text{ Vdc}$ , $I_D = 11.5\text{ Adc}$ , $V_{GS} = 4.5\text{ Vdc}$ , $R_G = 10\ \Omega$ )	$t_{d(on)}$	—	TBD	TBD	ns
Rise Time		$t_r$	—	TBD	TBD	
Turn-Off Delay Time		$t_{d(off)}$	—	TBD	TBD	
Fall Time		$t_f$	—	TBD	TBD	
Gate Charge See Figure 8	( $V_{DS} = 16\text{ Vdc}$ , $I_D = 11.5\text{ Adc}$ , $V_{GS} = 4.5\text{ Vdc}$ )	$Q_T$	—	TBD	TBD	nC
		$Q_1$	—	TBD	—	
		$Q_2$	—	TBD	—	
		$Q_3$	—	TBD	—	

**SOURCE-DrAIN DIODE CHARACTERISTICS**

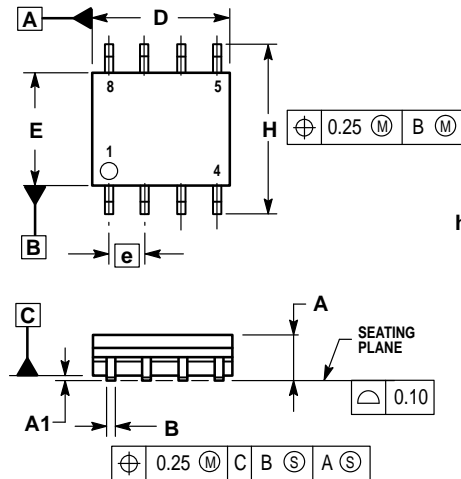
Forward On-Voltage	(I <sub>S</sub> = 11.5 Adc, V <sub>GS</sub> = 0 Vdc) (I <sub>S</sub> = 11.5 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	V <sub>SD</sub>	— —	TBD TBD	1.2 —	Vdc
Reverse Recovery Time	(I <sub>S</sub> = 11.5 Adc, V <sub>GS</sub> = 0 Vdc, dI <sub>S</sub> /dt = 100 A/μs)	t <sub>rr</sub>	—	TBD	—	ns
		t <sub>a</sub>	—	TBD	—	
		t <sub>b</sub>	—	TBD	—	
Reverse Recovery Stored Charge		Q <sub>RR</sub>	—	TBD	—	μC

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

(2) Switching characteristics are independent of operating junction temperature.

# MMDF3200Z

## PACKAGE DIMENSIONS



### NOTES:


1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETER.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

MILLIMETERS		
DIM	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0°	7°

### STYLE 11:

- PIN 1. SOURCE 1
- GATE 1
- SOURCE 2
- GATE 2
- DRAIN 2
- DRAIN 2
- DRAIN 1
- DRAIN 1

**CASE 751-06  
ISSUE T**

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

Mfax is a trademark of Motorola, Inc.

### How to reach us:

**USA/EUROPE/Locations Not Listed:** Motorola Literature Distribution;  
P.O. Box 5405, Denver, Colorado 80217. 1-303-675-2140 or 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.: SPD, Strategic Planning Office, 4-32-1,  
Nishi-Gotanda, Shinagawa-ku, Tokyo 141, Japan. 81-3-5487-8488

**Customer Focus Center: 1-800-521-6274**

**Mfax™:** RMFAX0@email.sps.mot.com – TOUCHTONE 1-602-244-6609  
Motorola Fax Back System – US & Canada ONLY 1-800-774-1848  
– <http://sps.motorola.com/mfax/>

**ASIA/PACIFIC:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

**HOME PAGE:** <http://motorola.com/sps/>



**MOTOROLA**