Product Preview

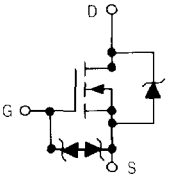
Medium Power Surface Mount Products

TMOS Dual N-Channel with Monolithic Zener ESD Protected Gate

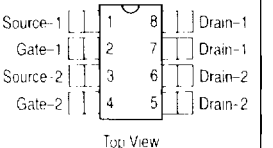
MMDF4N01Z
Motorola Preferred Device

DUAL TMOS POWER MOSFET 4.0 AMPERES 20 VOLTS $R_{DS(on)}$ = 0.045 OHM

EZFETs™ are an advanced series of power MOSFETs which utilize Motorola's High Cell Density TMOS process and contain monolithic back-to-back zener diodes. These zener diodes provide protection against ESD and unexpected transients. These miniature surface mount MOSFETs feature ultra low $R_{DS(on)}$ and true logic level performance. 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. EZFET 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.



CASE 751-05, Style 11
SO-8



- Zener Protected Gates Provide Electrostatic Discharge Protection
- Ultra 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

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MAXIMUM RATINGS (T_J = 25 C unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	20	Vdc
Drain-to-Gate Voltage (R_{GS} = 1.0 MΩ)	V_{DGR}	20	Vdc
Gate- to Source Voltage — Continuous	V_{GS}	± 8.0	Vdc
Drain Current — Continuous @ T_A = 25 C (1) — Continuous @ T_A = 70 C (1) — Pulsed Drain Current (3)	I_D I_D I_{DM}	4.5 4.0 23	Adc Apk
Total Power Dissipation @ T_A = 25 C (1) Linear Derating Factor (1)	P_D	2.0 16	Watts mW/ C
Total Power Dissipation @ T_A = 25 C (2) Linear Derating Factor (2)	P_D	1.39 11.11	Watts mW/ C
Operating and Storage Temperature Range	T_J, T_{stg}	– 55 to 150	C

THERMAL RESISTANCE

Rating	Symbol	Typ.	Max.	Unit
Thermal Resistance — Junction to Ambient, PCB Mount (1)	$R_{\theta JA}$	—	62.5	C/W
— Junction to Ambient, PCB Mount (2)	$R_{\theta JA}$	—	90	

(1) When mounted on 1 inch square FR-4 or G-10 board (V_{GS} = 4.5 V, @ 10 Seconds)
(2) When mounted on minimum recommended FR-4 or G-10 board (V_{GS} = 4.5 V, @ Steady State)
(3) Repetitive rating; pulse width limited by maximum junction temperature.

DEVICE MARKING

D4N01Z

ORDERING INFORMATION

Device	Reel Size	Tape Width	Quantity
MMDF4N01ZR2	13"	12 mm embossed tape	2500 units

This document contains information on a new product. Specifications and information are subject to change without notice.
Preferred devices are Motorola recommended choices for future use and best overall value.

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ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain–to–Source Breakdown Voltage (Cpk ≥ 2.0) (3) (V_{GS} = 0 Vdc, I_D = 0.25 mAdc)	$V_{(BR)DSS}$	20	—	—	Vdc
Temperature Coefficient (Positive)		—	15	—	mV/°C
Zero Gate Voltage Drain Current (V_{DS} = 20 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	2.0	μAdc
(V_{DS} = 20 Vdc, V_{GS} = 0 Vdc, T_J = 125°C)		—	—	10	
Gate–Body Leakage Current (V_{GS} = ± 8.0 Vdc, V_{DS} = 0)	I_{GSS}	—	—	5.0	
ON CHARACTERISTICS(1)					
Gate Threshold Voltage (Cpk ≥ 2.0) (3) (V_{DS} = V_{GS}, I_D = 0.25 mAdc)	$V_{GS(th)}$	0.7	0.83	1.1	Vdc
Threshold Temperature Coefficient (Negative)		—	3.0	—	mV/°C
Static Drain–to–Source On–Resistance (Cpk ≥ 2.0) (3) (V_{GS} = 4.5 Vdc, I_D = 4.0 Adc)	$R_{DS(on)}$	—	35	45	mΩ
(V_{GS} = 2.7 Vdc, I_D = 2.0 Adc)		—	45	55	
Forward Transconductance (V_{DS} = 2.5 Vdc, I_D = 2.0 Adc)	g_{FS}	5.0	8.5	—	Mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = 10 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	—	450	630	pF
Output Capacitance	C_{oss}	—	160	225	
Transfer Capacitance	C_{rss}	—	330	460	
SWITCHING CHARACTERISTICS(2)					
Turn–On Delay Time (V_{DS} = 6.0 Vdc, I_D = 4.0 Adc, V_{GS} = 4.5 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	—	28	40	ns
Rise Time	t_r	—	128	180	
Turn–Off Delay Time	$t_{d(off)}$	—	194	270	
Fall Time	t_f	—	195	270	
Turn–On Delay Time (V_{DD} = 6.0 Vdc, I_D = 4.0 Adc, V_{GS} = 2.7 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	—	50	70	ns
Rise Time	t_r	—	340	475	
Turn–Off Delay Time	$t_{d(off)}$	—	106	150	
Fall Time	t_f	—	197	275	
Gate Charge (see figure 8) (V_{DS} = 10 Vdc, I_D = 4.0 Adc, V_{GS} = 4.5 Vdc)	Q_T	—	10.5	15	nC
	Q_1	—	0.8	—	
	Q_2	—	4.4	—	
	Q_3	—	3.0	—	
SOURCE–DRAIN DIODE CHARACTERISTICS					
Forward On–Voltage(1) (I_S = 4.0 Adc, V_{GS} = 0 Vdc)	V_{SD}	—	0.84	1.2	Vdc
(I_S = 4.0 Adc, V_{GS} = 0 Vdc, T_J = 125°C)		—	0.65	—	
Reverse Recovery Time (I_S = 4.0 Adc, V_{GS} = 0 Vdc, dI_S/dt = 100 A/μs)	t_{rr}	—	250	—	ns
	t_a	—	88	—	
	t_b	—	162	—	
Reverse Recovery Storage Charge	Q_{RR}	—	1.0	—	μC

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

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

(3) Reflects typical values. $C_{pk} = \left| \frac{\text{Max limit} - \text{Typ}}{3 \times \text{SIGMA}} \right|$

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