

DESCRIPTION

The MMDF3N04HD is the N-Channel logic enhancement mode power field effect transistor, is produced using high cell density advanced trench technology.

This high density process is especially tailored to minimize on-state resistance. These devices are particularly suited for low voltage application, notebook computer power management and other battery powered circuits.

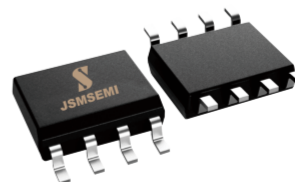
FEATURE

- ◆ 60V/6.3A, $R_{DS(ON)} = 30m\Omega$ (typ.) @ $V_{GS} = 10V$
- ◆ 60V/5.0A, $R_{DS(ON)} = 37m\Omega$ (typ.) @ $V_{GS} = 4.5V$
- ◆ Super high design for extremely low $R_{DS(ON)}$
- ◆ Exceptional on-resistance and Maximum DC current capability
- ◆ Full RoHS compliance
- ◆ SOP8 package design

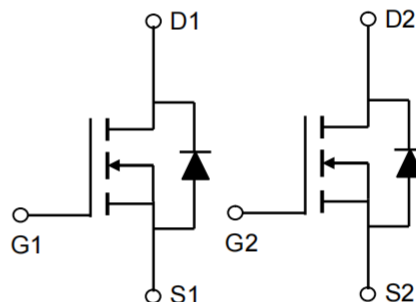
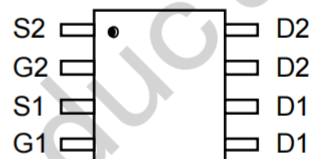
APPLICATIONS

- ◆ Power Management
- ◆ Portable Equipment
- ◆ DC/DC Converter
- ◆ Load Switch
- ◆ DSC
- ◆ LCD Display inverter

PIN CONFIGURATION



Top View



ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ C$ Unless otherwise noted)

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ^A	$T_A = 25^\circ C$	6.3	A
	$T_A = 70^\circ C$	5	
Pulsed Drain Current ^B	I_{DM}	40	
Power Dissipation	$T_A = 25^\circ C$	2	W
	$T_A = 70^\circ C$	1.28	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ C$

Thermal Characteristics					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10s$	$R_{\theta JA}$	50	62.5	$^\circ C/W$
Maximum Junction-to-Ambient ^A	Steady-State		73	110	$^\circ C/W$
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	31	40	$^\circ C/W$

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.
 Absolute maximum ratings are stress rating only and functional device operation is not implied

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

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Parameters						
V _{(BR)DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D = 250uA	60			V
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D = 250uA	1.0	1.8	3.0	V
I _{GSS}	Gate Leakage Current	V _{DS} =0V, V _{GS} =±20V			±100	nA
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 48V, V _{GS} =0			1	uA
		V _{DS} = 48V, V _{GS} =0 T _J =55°C			5	
R _{DS(ON)}	Drain-Source On-Resistance	V _{GS} = 10V, I _D = 6.3A		30	45	mΩ
		V _{GS} = 4.5V, I _D = 5.0A		37	55	
Source-Drain Diode						
V _{SD}	Diode Forward Voltage	I _S = 1.0A, V _{GS} =0V		0.8	1.3	V
Dynamic Parameters						
Q _g	Total Gate Charge	V _{DS} = 30V V _{GS} = 10V I _D = 5.0A		15.6	16	nC
Q _{gs}	Gate-Source Charge			1.3		
Q _{gd}	Gate-Drain Charge			4.5		
C _{iss}	Input Capacitance	V _{DS} = 25V V _{GS} =0V f=1MHz		520		pF
C _{oss}	Output Capacitance			105		
C _{rss}	Reverse Transfer Capacitance			60		
T _{d(on)}	Turn-On Time	V _{DS} = 30V I _D = 1A V _{GEN} = 10V R _G =6Ω		8	16	nS
T _r				6	12	
T _{d(off)}	Turn-Off Time			25	46	
T _f				4	8	

Note: 1. Pulse test: pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$

2. Static parameters are based on package level with recommended wire bonding

■ **TYPICAL CHARACTERISTICS** (25°C Unless Note)



Figure 1. Output Characteristics

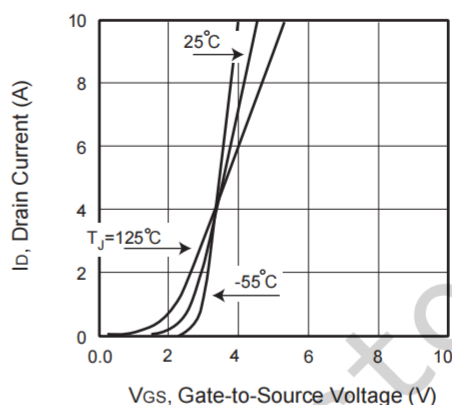


Figure 2. Transfer Characteristics



Figure 3. Capacitance



Figure 4. On-Resistance Variation with Temperature

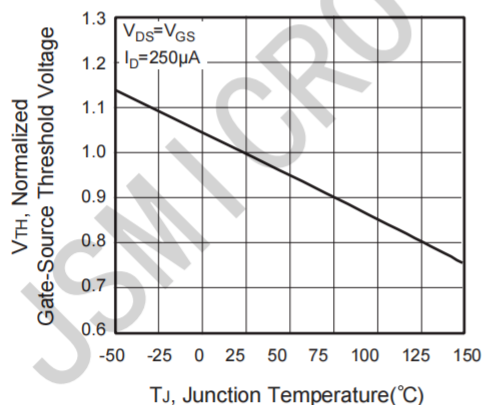


Figure 5. Gate Threshold Variation with Temperature

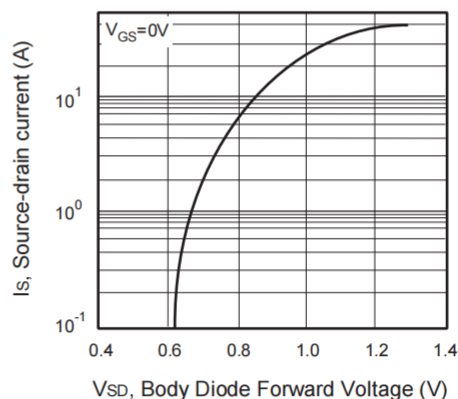


Figure 6. Body Diode Forward Voltage Variation with Source Current

■ **TYPICAL CHARACTERISTICS** (continuous)



Figure 7. Gate Charge



Figure 8. Maximum Safe Operating Area



Figure 9. Switching Test Circuit



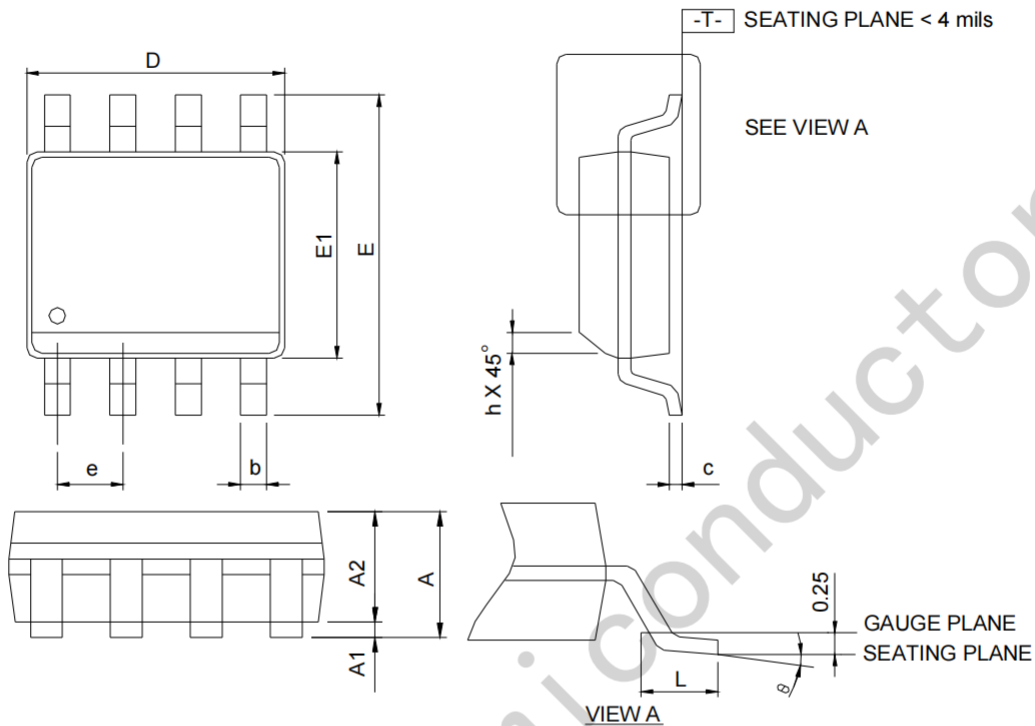
Figure 10. Switching Waveforms



Figure 11. Normalized Thermal Transient Impedance Curve

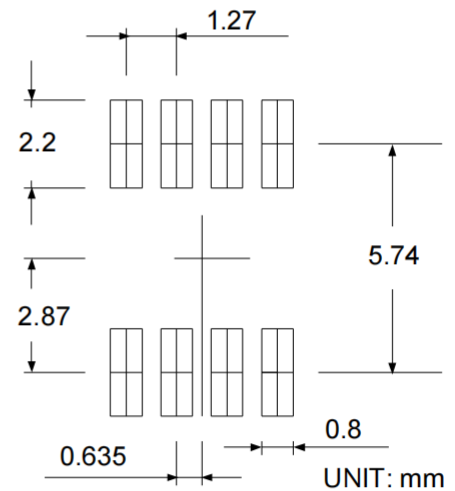
Package Information

SOP-8



SYMBOL	SOP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	-	1.75	-	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	-	0.049	-
b	0.31	0.51	0.012	0.020
c	0.17	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

RECOMMENDED LAND PATTERN



Note: 1. Follow JEDEC MS-012 AA.

2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.

3. Dimension "E" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.