

# MOSFET – Power, Single N-Channel, SO8FL

## 40 V, 3.1 mΩ, 83 A

### NTMFS3D1N04XM

#### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Small Footprint (5 x 6 mm) with Compact Design
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### Applications

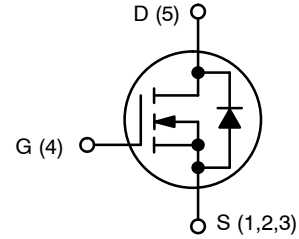
- Motor Drive
- Battery Protection
- Oring

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

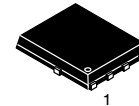
Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		$V_{DSS}$	40	V
Gate-to-Source Voltage		DC $V_{GS}$	$\pm 20$	V
Continuous Drain Current	Steady State	$T_C = 25^\circ\text{C}$	$I_D$	83 A
		$T_C = 100^\circ\text{C}$		58
Power Dissipation		$T_C = 25^\circ\text{C}$	$P_D$	39 W
Continuous Drain Current $R_{\theta JA}$	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	25 A
		$T_A = 100^\circ\text{C}$		18
Pulsed Drain Current		$T_A = 25^\circ\text{C}$ , $t_p = 10 \mu\text{s}$	$I_{DM}$	506 A
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55 to 175	$^\circ\text{C}$
Source Current (Body Diode)		$I_S$	55	A
Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 4.6 \text{ A}$ )		$E_{AS}$	133	mJ
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	3.1 mΩ @ 10 V	83 A

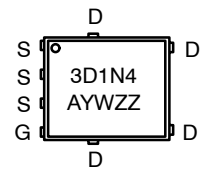


N-CHANNEL MOSFET



SO-8 FLAT LEAD  
CASE 488AA

#### MARKING DIAGRAM



- 3D1N4 = Specific Device code
- A = Assembly Location
- Y = Year
- W = Work Week
- ZZ = Lot Traceability

#### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 5 of this data sheet.

# NTMFS3D1N04XM

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	3.79	°C/W
Thermal Resistance, Junction-to-Ambient (Notes 1, 2)	$R_{\theta JA}$	41.6	

- Surface-mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz Cu pad.
- The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^\circ\text{C}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS} / \Delta T_J$	$I_D = 1\text{ mA}$ , Referenced to 25°C		15		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{ V}, T_J = 25^\circ\text{C}$			10	μA
		$V_{DS} = 40\text{ V}, T_J = 125^\circ\text{C}$			100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

### ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 25^\circ\text{C}$		2.7	3.1	mΩ
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 40\text{ μA}, T_J = 25^\circ\text{C}$	2.5		3.5	V
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{GS(TH)} / \Delta T_J$	$V_{GS} = V_{DS}, I_D = 40\text{ μA}$		-7.2		mV/°C
Forward Transconductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 20\text{ A}$		79.6		S

### CHARGES & CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1002		pF
Output Capacitance	$C_{OSS}$			717		
Reverse Transfer Capacitance	$C_{RSS}$			18.4		
Total Gate Charge	$Q_{G(TOT)}$	$V_{DD} = 20\text{ V}, I_D = 50\text{ A}, V_{GS} = 10\text{ V}$		15.6		nC
Threshold Gate Charge	$Q_{G(TH)}$			2.94		
Gate-to-Source Charge	$Q_{GS}$			4.82		
Gate-to-Drain Charge	$Q_{GD}$			2.84		
Gate Resistance	$R_G$		$f = 1\text{ MHz}$		1.0	

### SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	Resistive Load, $V_{GS} = 0/10\text{ V}$ , $V_{DD} = 20\text{ V}, I_D = 50\text{ A}, R_G = 0\text{ Ω}$		13.8		ns
Rise Time	$t_r$			4.6		
Turn-Off Delay Time	$t_{d(OFF)}$			18.8		
Fall Time	$t_f$			4.15		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 20\text{ A}, T_J = 25^\circ\text{C}$		0.82	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 20\text{ A}, T_J = 125^\circ\text{C}$		0.67		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, I_S = 50\text{ A}$ , $di/dt = 100\text{ A/μs}, V_{DD} = 20\text{ V}$		29		ns
Charge Time	$t_a$			11.3		ns
Discharge Time	$t_b$			17.8		ns
Reverse Recovery Time	$Q_{RR}$			14.5		nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- Switching characteristics are independent of operating junction temperatures

# NTMFS3D1N04XM

## TYPICAL CHARACTERISTICS

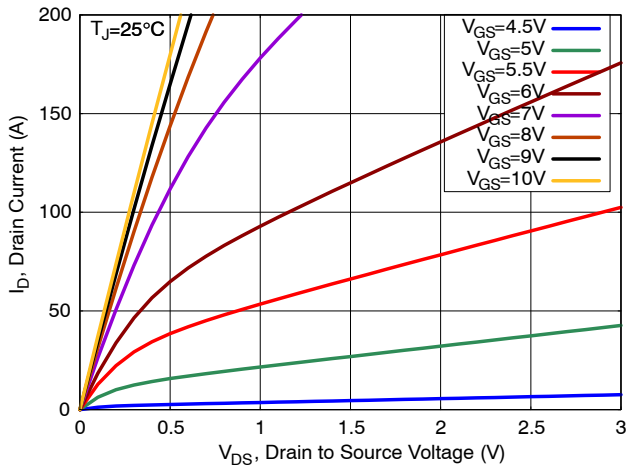


Figure 1. On-Region Characteristics

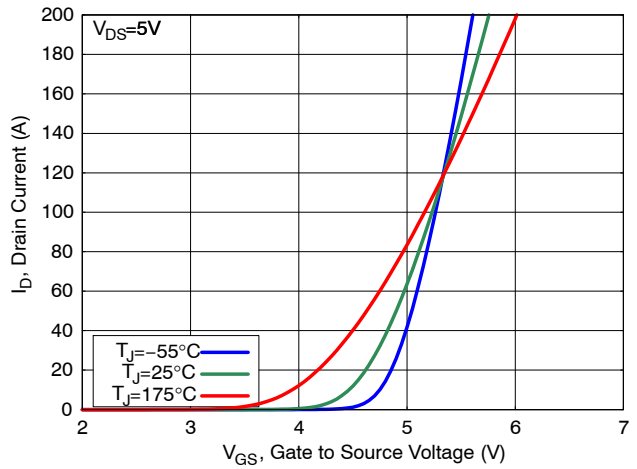


Figure 2. Transfer Characteristics

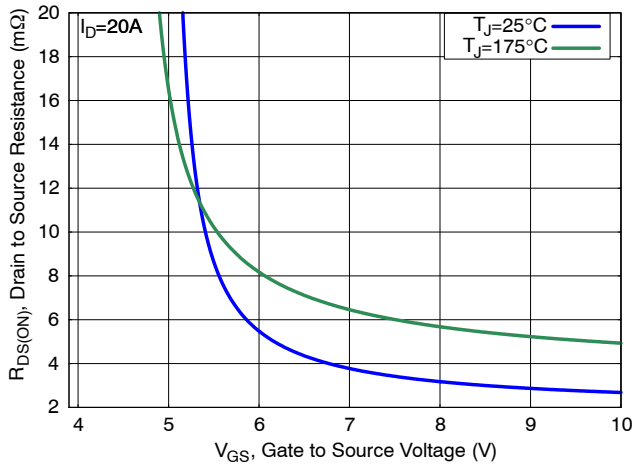


Figure 3. On-Resistance vs. Gate Voltage

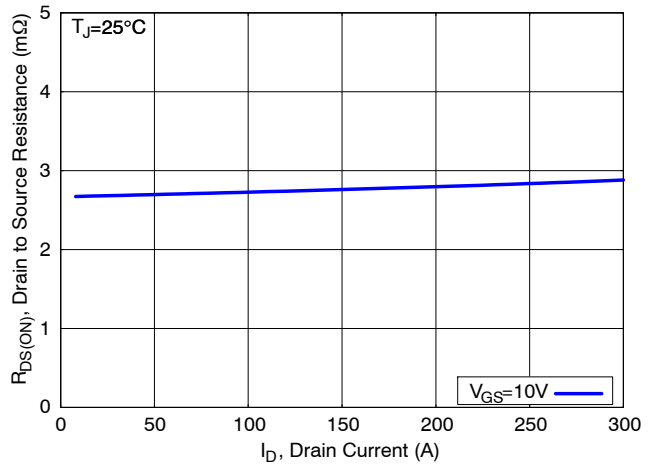


Figure 4. On-Resistance vs. Drain Current

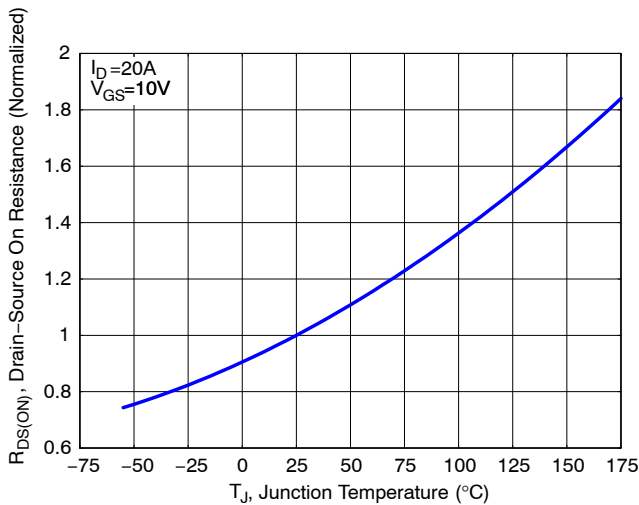


Figure 5. Normalized ON Resistance vs. Junction Temperature

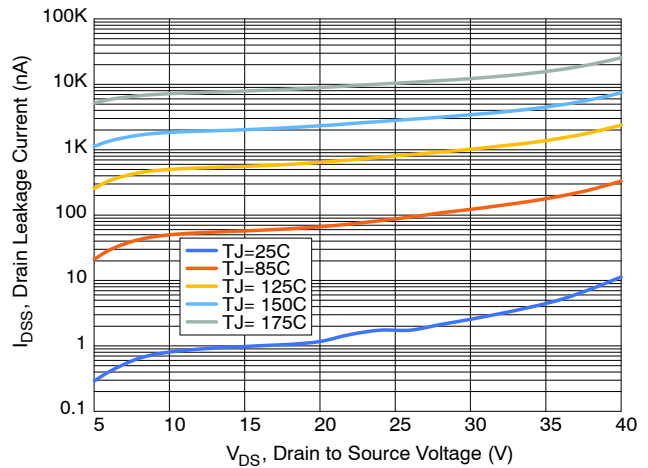


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTMFS3D1N04XM

## TYPICAL CHARACTERISTICS

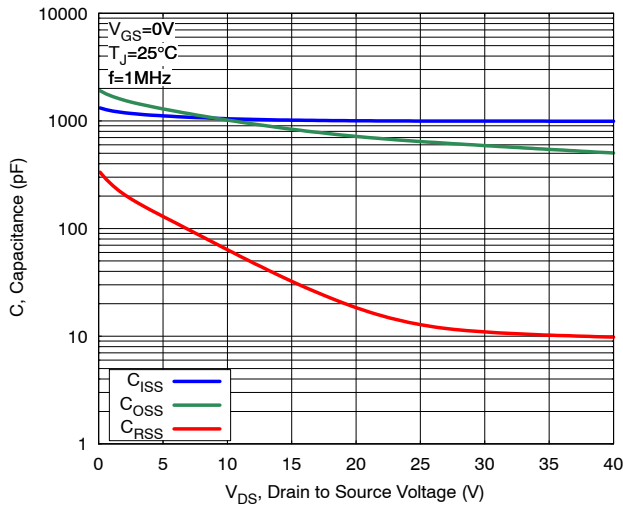


Figure 7. Capacitance Characteristics

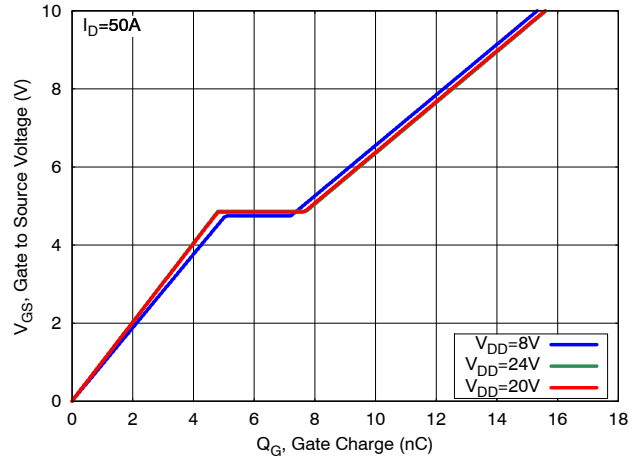


Figure 8. Gate Charge Characteristics

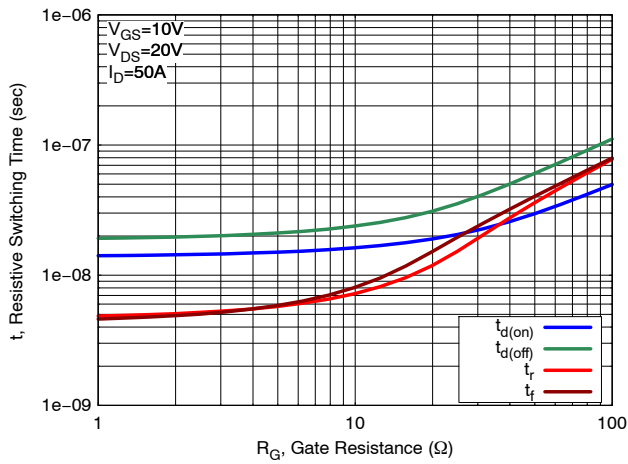


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

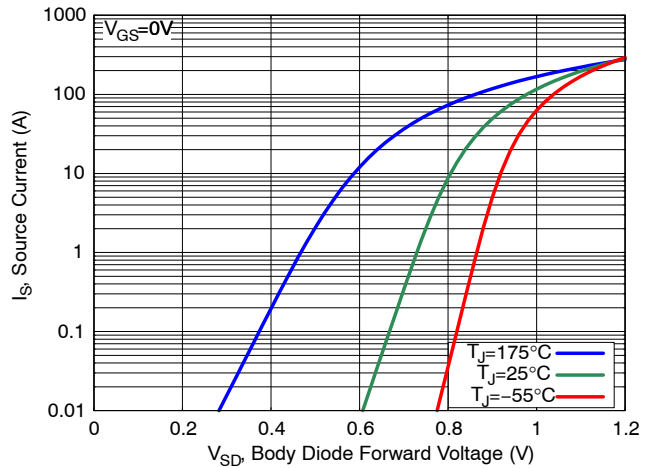


Figure 10. Diode Forward Characteristics

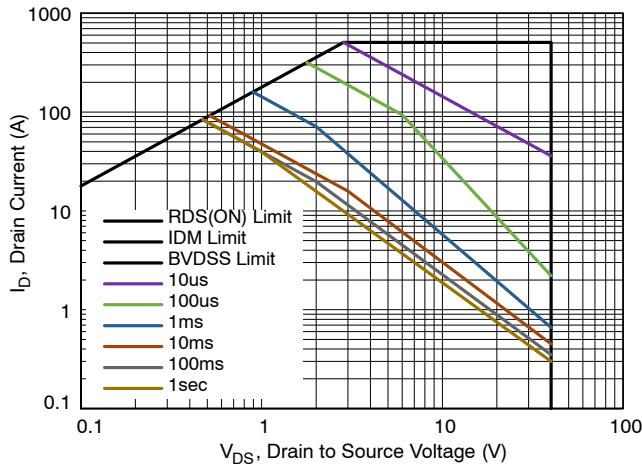


Figure 11. Safe Operating Area (SOA)

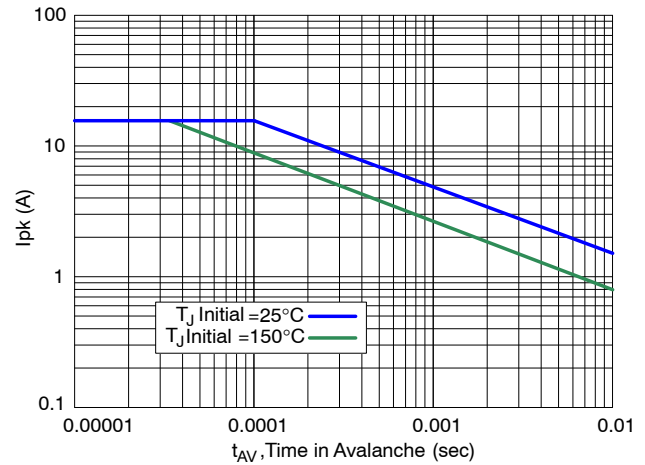


Figure 12. Ipeak vs. Time in Avalanche

# NTMFS3D1N04XM

## TYPICAL CHARACTERISTICS

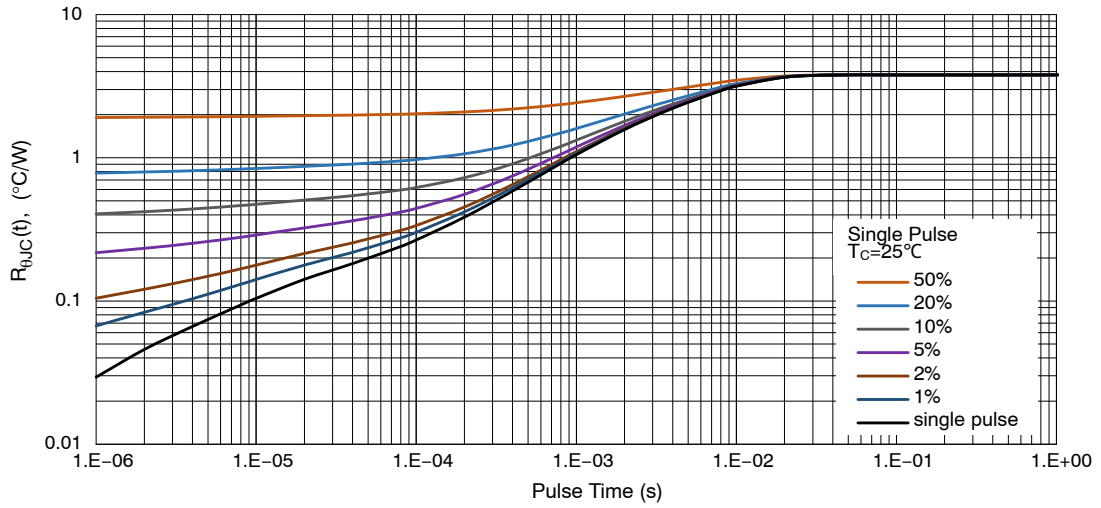


Figure 13. Transient Thermal Response

### DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
NTMFS3D1N04XMT1G	3D1N4	DFN5 (Pb-Free)	1500 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS



1  
SCALE 2:1

DFN5 5x6, 1.27P  
(SO-8FL)  
CASE 488AA  
ISSUE N

DATE 25 JUN 2018



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
θ	0°	---	12°

### GENERIC MARKING DIAGRAM\*



- XXXXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- ZZ = Lot Traceability

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.



- STYLE 1:  
PIN 1. SOURCE  
2. SOURCE  
3. SOURCE  
4. GATE  
5. DRAIN
- STYLE 2:  
PIN 1. ANODE  
2. ANODE  
3. ANODE  
4. NO CONNECT  
5. CATHODE

DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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DESCRIPTION:	DFN5 5x6, 1.27P (SO-8FL)	PAGE 1 OF 1

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