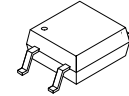


# High Noise Immunity, 3.3V/5V, 10 Mbit/sec Logic Gate Output (Open Collector) Optocoupler

## FODM8061



MFP5 4.1X4.4, 2.54P  
 CASE 100AM

### Description

The FODM8061 is a 3.3 V/5 V high-speed logic gate output (open collector) optocoupler, which supports isolated communications allowing digital signals to communicate between systems without conducting ground loops or hazardous voltages. It utilizes onsemi's patented coplanar packaging technology, OPTOPLANAR<sup>®</sup>, and optimized IC design to achieve high noise immunity, characterized by high common mode transient immunity specifications.

This optocoupler consists of an AlGaAs LED at the input, optically coupled to a high speed integrated photo-detector logic gate. The output of the detector IC is an open collector schottky-clamped transistor. The coupled parameters are guaranteed over the wide temperature range of -40°C to +110°C. A maximum input signal of 5mA will provide a minimum output sink current of 13 mA (fan out of 8).

### Features

- High Noise Immunity Characterized by Common Mode Transient Immunity (CMTI)
  - ◆ 20 kV/μs Minimum CMTI
- High Speed
  - ◆ 10 Mbit/sec Data Rate (NRZ)
  - ◆ 80 ns Max. Propagation Delay
  - ◆ 25 ns Max. Pulse Width Distortion
  - ◆ 40 ns Max. Propagation Delay Skew
- 3.3 V LVTTTL/LVCMOS Compatibility
- Specifications Guaranteed over 3 V to 5.5 V Supply Voltage and -40°C to +110°C Temperature Range
- Safety and Regulatory Approvals
  - ◆ UL1577, 3750 VAC<sub>RMS</sub> for 1 min.
  - ◆ DIN EN/IEC60747-5-5

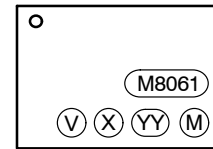
### Applications

- Microprocessor System Interface
  - ◆ SPI, I<sup>2</sup>C
- Industrial Fieldbus Communications
  - ◆ DeviceNet, CAN, RS485
- Programmable Logic Control
- Isolated Data Acquisition System
- Voltage Level Translator
- Isolating MOSFET/IGBT Gate Drivers

### Related resources

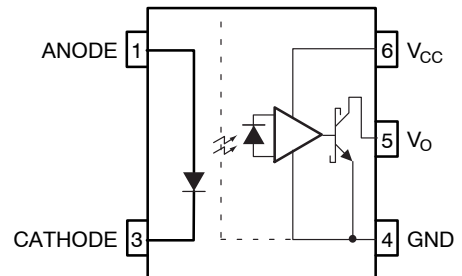
- [www.onsemi.com/products](http://www.onsemi.com/products)
- [www.onsemi.com/FODM611](http://www.onsemi.com/FODM611)
- [www.onsemi.com/FODM8071](http://www.onsemi.com/FODM8071)

### MARKING DIAGRAM



- M8061 = Device Number
- V = DIN EN/IEC60747-5-5 Option  
 (Note: Only Appears on Parts Ordered with This Option)
- X = One Digit Year Code, e.g., '9'
- YY = Two Digit Work Week Ranging from '01' to '53'
- M = Assembly Package Code

### FUNCTIONAL SCHEMATIC



### TRUTH TABLE

LED	Output
Off	High
On	Low

### ORDERING INFORMATION

See detailed ordering and shipping information on page 9 of this data sheet.

# FODM8061

## PIN DEFINITIONS

Number	Name	Function Description
1	ANODE	Anode
3	CATHODE	Cathode
4	GND	Output Ground
5	V <sub>O</sub>	Output Voltage
6	V <sub>CC</sub>	Output Supply Voltage

## SAFETY AND INSULATION RATINGS FOR MINI-FLAT PACKAGE (SO5 PIN)

(As per IEC60747-5-5. This optocoupler is suitable for "safe electrical insulation" only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.)

Symbol	Parameter	Min	Typ	Max	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1	-	-	-	
	For Rated Main Voltage <150 Vrms	-	I-IV	-	
	For Rated Main Voltage <300 Vrms	-	I-III	-	
	Climatic Classification	-	40/110/21	-	
	Pollution Degree (DIN VDE 0110/1.89)	-	2	-	
CTI	Comparative Tracking Index	175	-	-	
V <sub>PR</sub>	Input to Output Test Voltage, Method b, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge <5 pC	1060	-	-	
V <sub>PR</sub>	Input to Output Test Voltage, Method a, V <sub>IORM</sub> × 1.5 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 60 s, Partial Discharge <5 pC	848	-	-	
V <sub>IORM</sub>	Max Working Insulation Voltage	565	-	-	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over Voltage	4000	-	-	V <sub>peak</sub>
	External Creepage	5.0	-	-	mm
	External Clearance	5.0	-	-	mm
	Insulation Thickness	0.5	-	-	mm
T <sub>Case</sub>	Safety Limit Values, Maximum Values Allowed in the Event of a Failure, Case Temperature	150	-	-	°C
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V	10 <sup>9</sup>	-	-	Ω

# FODM8061

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

Symbol	Parameter	Value	Unit
T <sub>STG</sub>	Storage Temperature	-40 to +125	°C
T <sub>OPR</sub>	Operating Temperature	-40 to +110	°C
T <sub>J</sub>	Junction Temperature	-40 to +125	°C
T <sub>SOL</sub>	Lead Solder Temperature (Refer to Reflow Temperature Profile)	260 for 10 s	°C
I <sub>F</sub>	Forward Current	50	mA
V <sub>R</sub>	Reverse Voltage	5.0	V
V <sub>CC</sub>	Supply Voltage	0 to 7.0	V
V <sub>O</sub>	Output Voltage	-0.5 to V <sub>CC</sub> +0.5	V
I <sub>O</sub>	Average Output Current	50	mA
PD <sub>I</sub>	Input Power Dissipation (Note 1), (Note 2)	100	mW
PD <sub>O</sub>	Output Power Dissipation (Note 1), (Note 2)	85	mW

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.

1. No derate required to 110°C.

2. Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
T <sub>A</sub>	Ambient Operating Temperature	-40	+110	°C
V <sub>CC</sub> , V <sub>DD</sub>	Supply Voltages (Note 3)	3.0	5.5	V
V <sub>FL</sub>	Logic Low Input Voltage	0	0.8	V
I <sub>FH</sub>	Logic High Input Current (Note 4)	6.3	15	mA
I <sub>FL</sub>	Logic Low Input Current	-	250	μA
N	Fan Out (at R <sub>L</sub> = 1 kΩ)	-	5	TTL Loads
R <sub>L</sub>	Output Pull-up Resistor	330	4k	Ω

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

3. 0.1 μF bypass capacitor must be connected between pins 4 and 6.

4. Recommended I<sub>FH</sub> is 9.3 mA for operation above T<sub>A</sub> = 100°C.

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V <sub>ISO</sub>	Input-Output Isolation Voltage	f = 60 Hz, t = 1.0 min, I <sub>I-O</sub> ≤ 10 μA (Note 5), (Note 6)	3750	-	-	VAC <sub>RMS</sub>
R <sub>ISO</sub>	Isolation Resistance	V <sub>I-O</sub> = 500 V (Note 5)	-	10 <sup>12</sup>	-	Ω
C <sub>ISO</sub>	Isolation Capacitance	V <sub>I-O</sub> = 0 V f = 1.0 Mhz (Note 5)	-	0.6	-	pF

5. Device is considered a two terminal device: Pins 1 and 3 are shorted, and Pins 4, 5, and 6 are shorted together.

6. 3,750 VAC<sub>RMS</sub> for 1 minute duration is equivalent to 4,500 VAC<sub>RMS</sub> for 1 second duration.

# FODM8061

## ELECTRICAL CHARACTERISTICS (Apply over all recommended conditions)

( $T_A = -40^{\circ}\text{C}$  to  $+110^{\circ}\text{C}$ ,  $3.0\text{ V} \leq V_{CC} \leq 5.5\text{ V}$ , unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ*	Max	Unit	
<b>INPUT CHARACTERISTICS</b>							
$V_F$	Forward Voltage	$I_F = 10\text{ mA}$ (Figure 1)	1.05	1.45	1.8	V	
$BV_R$	Input Reverse Breakdown Voltage	$I_R = 10\text{ }\mu\text{A}$	5.0	–	–	V	
$I_{FHL}$	Threshold Input Current	$V_O = 0.6\text{ V}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$	$T_A < 85^{\circ}\text{C}$ , (Figure 2)	–	3.4	5.0	mA
			$T_A = 85^{\circ}\text{C}$ to $110^{\circ}\text{C}$	–	4.2	7.5	

## OUTPUT CHARACTERISTICS

$V_{OL}$	Logic LOW Output Voltage	$I_F = \text{rated } I_{FHL}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$ (Figure 3)	–	0.4	0.6	V
$I_{OH}$	Logic HIGH Output Current	$I_F = 250\text{ }\mu\text{A}$ , $V_O = 3.3\text{ V}$ , (Figure 4)	–	8.0	50.0	$\mu\text{A}$
		$I_F = 250\text{ }\mu\text{A}$ , $V_O = 5.0\text{ V}$ , (Figure 4)	–	2.1	30.0	$\mu\text{A}$
$I_{CCL}$	Logic LOW Output Supply Current	$I_F = 10\text{ mA}$ , $V_{CC} = 3.3\text{ V}$ , (Figure 5), (Figure 7)	–	6.0	8.5	mA
		$I_F = 10\text{ mA}$ , $V_{CC} = 5.0\text{ V}$ , (Figure 5), (Figure 7)	–	7.5	10.0	mA
$I_{CCH}$	Logic HIGH Output Supply Current	$I_F = 0\text{ mA}$ , $V_{CC} = 3.3\text{ V}$ , (Figure 6), (Figure 7)	–	4.0	7.0	mA
		$I_F = 0\text{ mA}$ , $V_{CC} = 5.0\text{ V}$ , (Figure 6), (Figure 7)	–	6.0	9.0	mA

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.

\*Typical value is measured at  $T_A = 25^{\circ}\text{C}$  and  $V_{CC} = 3.3\text{ V}$ .

## SWITCHING CHARACTERISTICS (Apply over all recommended conditions)

( $T_A = -40^{\circ}\text{C}$  to  $+110^{\circ}\text{C}$ ,  $3.0\text{ V} \leq V_{CC} \leq 5.5\text{ V}$ ,  $I_F = 7.5\text{ mA}$ , unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ*	Max	Unit
Date Rate		$R_L = 350\text{ }\Omega$	–	–	10	Mbps
$t_{PHL}$	Propagation Delay Time to Logic Low Output	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , (Figure 8), (Figure 11)	–	43	80	ns
$t_{PLH}$	Propagation Delay Time to Logic High Output	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , (Figure 8), (Figure 11)	–	50	80	ns
PWD	Pulse Width Distortion, $ t_{PHL} - t_{PLH} $	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , (Figure 9)	–	7	25	ns
$t_{PSK}$	Propagation Delay Skew	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , (Note 7)	–	–	40	ns
$t_R$	Output Rise Time, (10% to 90%)	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , (Figure 10), (Figure 11)	–	20	–	ns
$t_F$	Output Fall Time, (90% to 10%)	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , (Figure 10), (Figure 11)	–	10	–	ns
$ CM_H $	Common Mode Transient Immunity at Output High	$I_F = 0\text{ mA}$ , $V_O > 0.8 \times V_{CC}$ , $V_{CM} = 1000\text{ V}$ (Note 8), (Figure 12)	20	40	–	kV/ $\mu\text{s}$
$ CM_L $	Common Mode Transient Immunity at Output Low	$I_F = 7.5\text{ mA}$ , $V_O < 0.8 \times V_{CC}$ , $V_{CM} = 1000\text{ V}$ (Note 8), (Figure 12)	20	40	–	kV/ $\mu\text{s}$

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.

\*Typical value is measured at  $T_A = 25^{\circ}\text{C}$  and  $V_{CC} = 3.3\text{ V}$ .

- $t_{PSK}$  is equal to the magnitude of the worst case difference in  $t_{PHL}$  and/or  $t_{PLH}$  that will be seen between any two units from the same manufacturing date code that are operated at same case temperature ( $\pm 5^{\circ}\text{C}$ ), at same operating conditions, with equal loads ( $R_L = 350\text{ }\Omega$  and  $C_L = 15\text{ pF}$ ), and with an input rise time less than 5 ns.
- Common mode transient immunity at output high is the maximum tolerable positive  $dV_{cm}/dt$  on the leading edge of the common mode impulse signal,  $V_{cm}$ , to assure that the output will remain high. Common mode transient immunity at output low is the maximum tolerable negative  $dV_{cm}/dt$  on the trailing edge of the common pulse signal,  $V_{cm}$ , to assure that the output will remain low.

TYPICAL PERFORMANCE CURVES

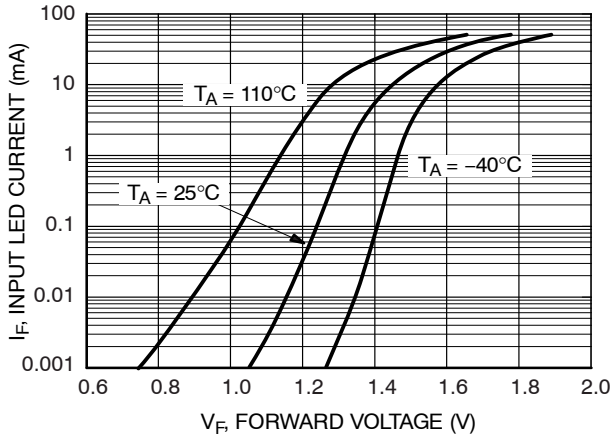


Figure 1. Input LED Current vs. Forward Voltage

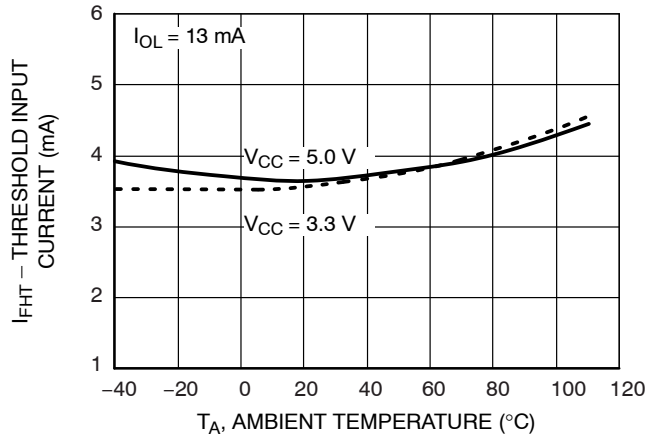


Figure 2. Threshold Input Current vs. Ambient Temperature

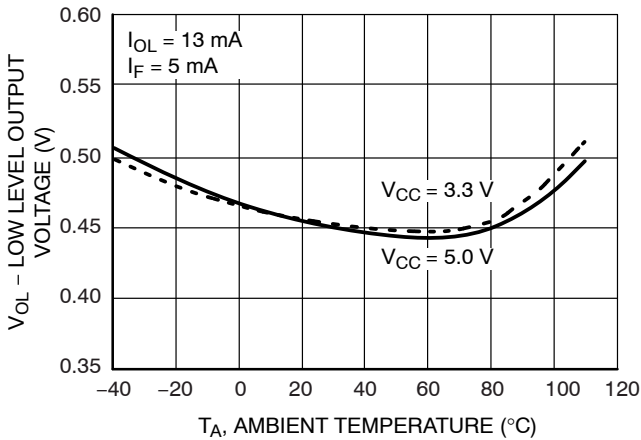


Figure 3. Low Level Output Voltage vs. Ambient Temperature

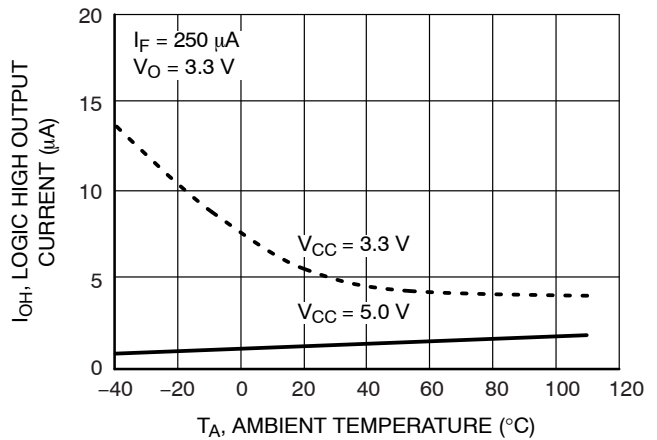


Figure 4. Logic High Output Current vs. Ambient Temperature

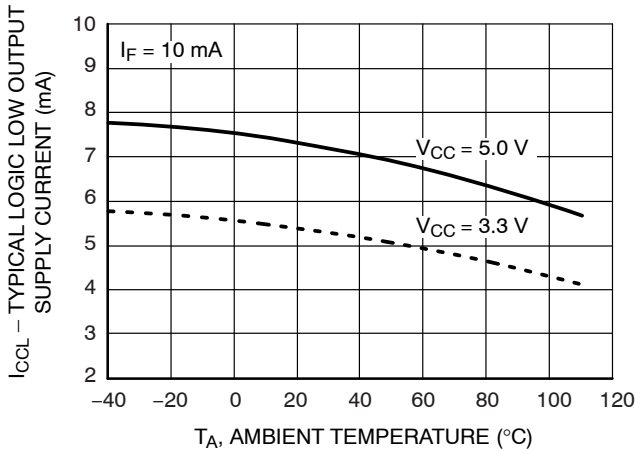


Figure 5. Typical Logic Low Output Supply Current vs. Ambient Temperature

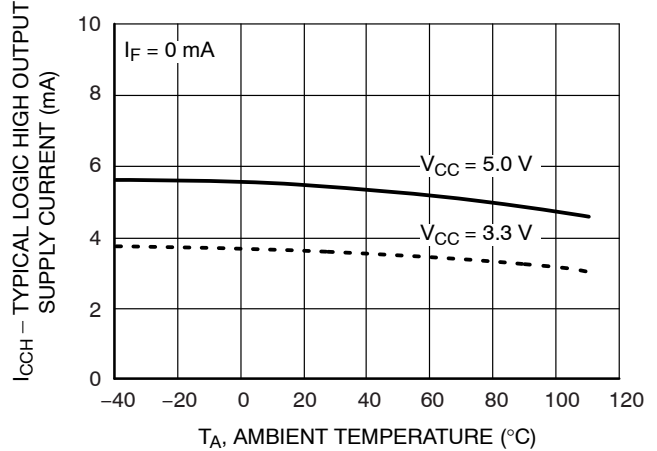


Figure 6. Typical Logic High Output Supply Current vs. Ambient Temperature

TYPICAL PERFORMANCE CURVES (CONTINUED)

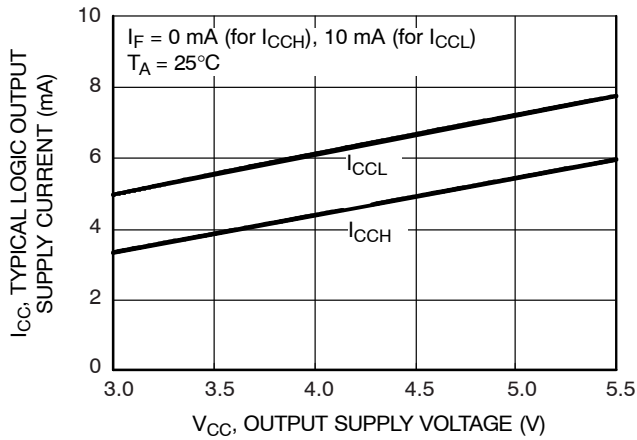


Figure 7. Typical Logic Output Supply Current vs. Output Supply Voltage

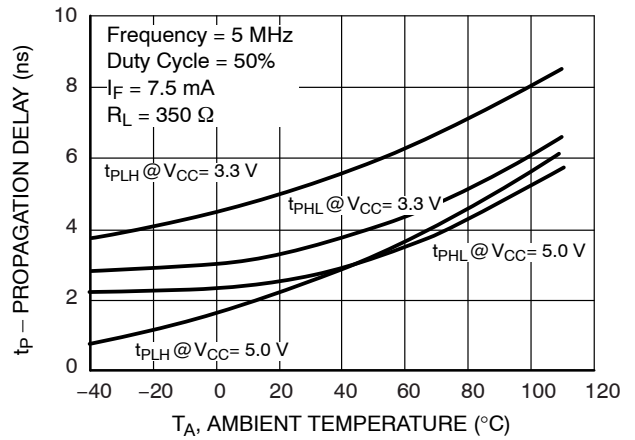


Figure 8. Typical Propagation Delay vs. Ambient Temperature

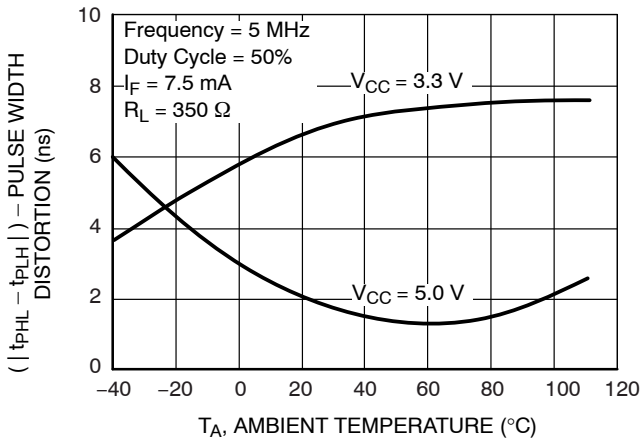


Figure 9. Typical Pulse Width Distortion vs. Ambient Temperature

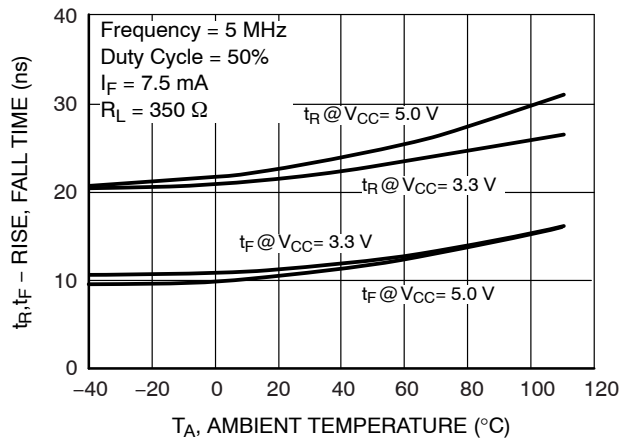
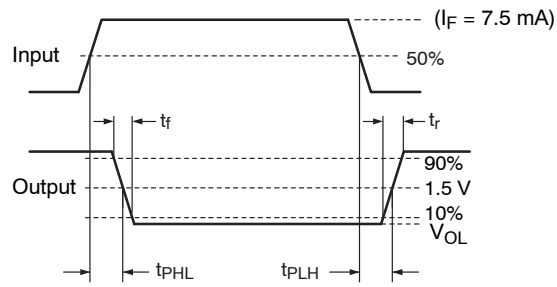
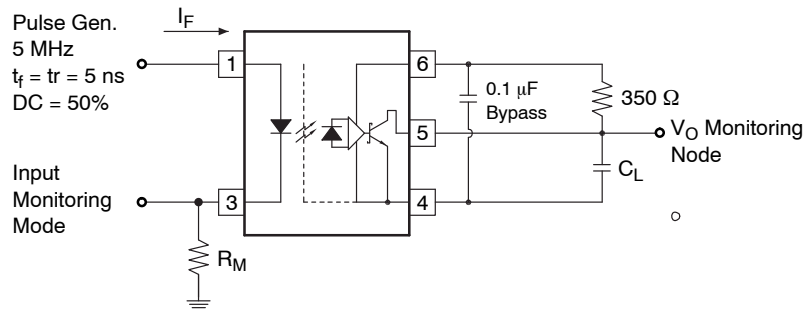


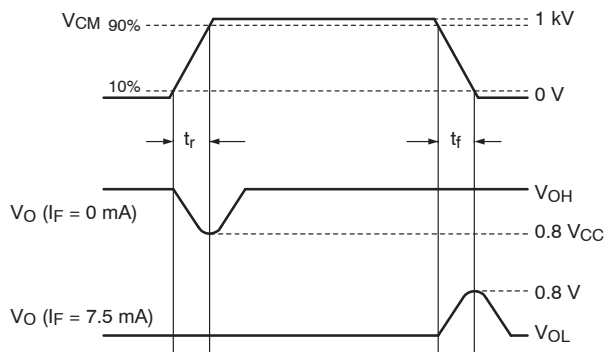
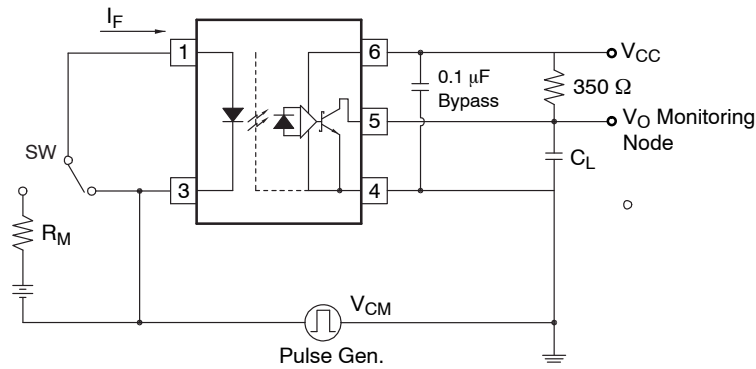
Figure 10. Typical Rise and Fall Time vs. Ambient Temperature

# FODM8061

## SCHEMATICS



**Figure 11. Test Circuit for Propagation Delay Time, Rise Time and Fall Time**



**Figure 12. Test Circuit for Instantaneous Common Mode Rejection Voltage**

# FODM8061

## REFLOW PROFILE

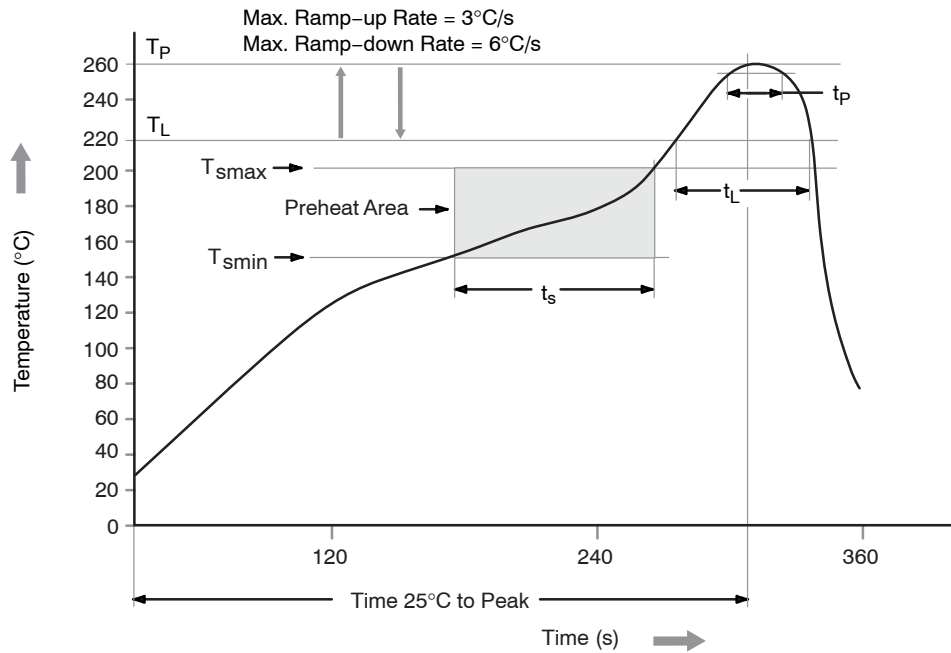


Figure 13. Reflow Profile

Table 1. REFLOW PROFILE

Profile Feature	Pb-Free Assembly Profile
Temperature Minimum ( $T_{smin}$ )	150°C
Temperature Maximum ( $T_{smax}$ )	200°C
Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ )	60 – 120 seconds
Ramp-up Rate ( $t_L$ to $t_p$ )	3°C/second max.
Liquidous Temperature ( $T_L$ )	217°C
Time ( $t_L$ ) Maintained Above ( $T_L$ )	60 – 150 seconds
Peak Body Package Temperature	260°C +0°C / -5°C
Time ( $t_p$ ) within 5°C of 260°C	30 seconds
Ramp-down Rate ( $T_P$ to $T_L$ )	6°C/second max.
Time 25°C to Peak Temperature	8 minutes max.



# FODM8061

## ORDERING INFORMATION

Part Number	Package	Shipping†
FODM8061	MFP5 4.1X4.4, 2.54P (Pb-Free)	100 Units / Tube
FODM8061R2	MFP5 4.1X4.4, 2.54P (Pb-Free)	2500 / Tape & Reel
FODM8061V	MFP5 4.1X4.4, 2.54P IEC60747-5-5 (Pb-Free)	100 Units / Tube
FODM8061R2V	MFP5 4.1X4.4, 2.54P IEC60747-5-5 (Pb-Free)	2500 / Tape & Reel

†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.

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# MECHANICAL CASE OUTLINE

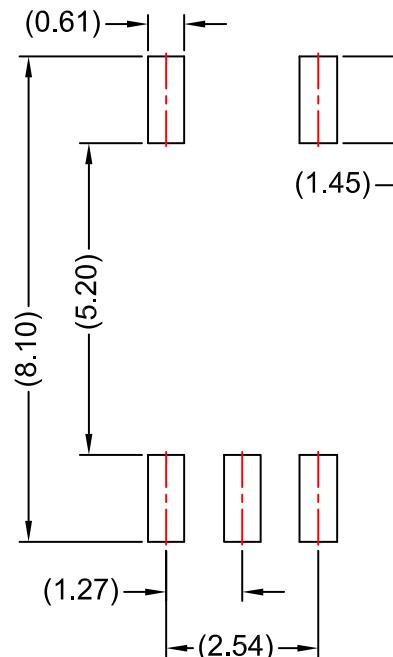
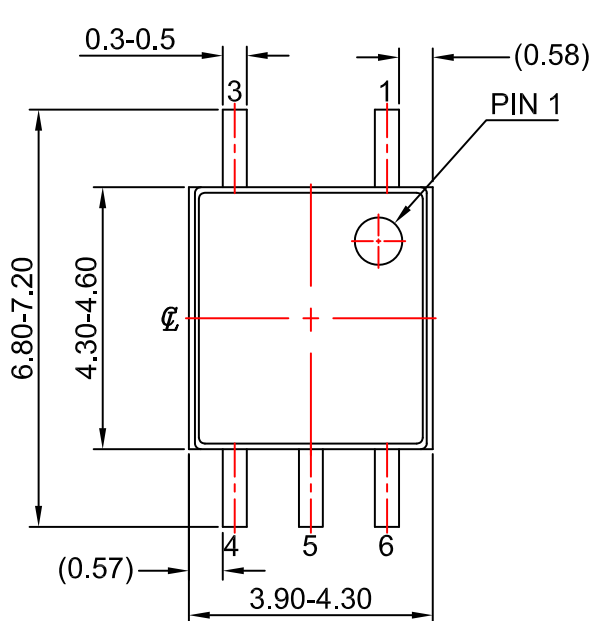
## PACKAGE DIMENSIONS

ON Semiconductor®

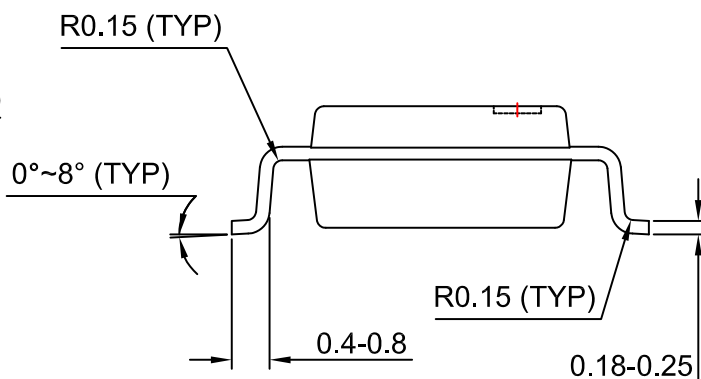
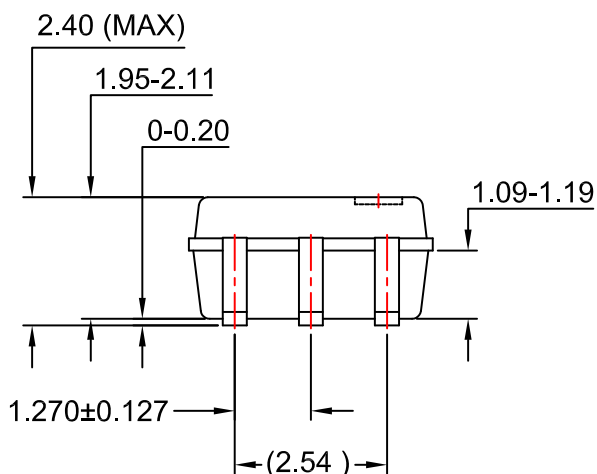


MFP5 4.1X4.4, 2.54P  
CASE 100AM  
ISSUE O

DATE 31 AUG 2016



### LAND PATTERN RECOMMENDATION



#### NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

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