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December 2014



FODM8071 3.3V/5V Logic Gate Output Optocoupler with High Noise Immunity

Features

- High-noise Immunity Characterized by Common Mode Rejection
 - 20 kV/µs Minimum Common Mode Rejection
- High Speed
 - 20 Mbit/s Date Rate (NRZ)
 - 55 ns Maximum Propagation Delay
 - 20 ns Maximum Pulse Width Distortion
 - 30 ns Maximum Propagation Delay Skew
- 3.3 V and 5 V CMOS 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_{RMS} for 1 Minute
 - DIN EN/IEC60747-5-5

Applications

- Microprocessor System Interface:
 - SPI, I²C
- Industrial Fieldbus Communications:
 DeviceNet, CAN, RS485

Schematic and Package Outline

- Programmable Logic Control
- Isolated Data Acquisition System
- Voltage Level Translator

Description

The FODM8071 is a 3.3V/5V high-speed logic gate output optocoupler, which supports isolated communications allowing digital signals to communicate between systems without conducting ground loops or hazardous voltages. It utilizes Fairchild's patented coplanar packaging technology, Optoplanar[®], and optimized IC design to achieve high-immunity, characterized by high common mode rejection specifications.

This high-speed logic gate output optocoupler, housed in a compact 5-pin Mini-Flat package, consists of a highspeed AlGaAs LED at the input coupled to a CMOS detector IC at the output. The detector IC comprises an integrated photodiode, a high-speed transimpedance amplifier and a voltage comparator with an output driver. The CMOS technology coupled with a high-efficiency LED achieves low power consumption as well as very high speed (55 ns propagation delay, 20 ns pulse width distortion).

Related Resources

- FOD8001 Product Folder
- FOD0721 Product Folder

Truth Table

LED	Output
Off	High
On	Low

Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, 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.

Parameter	Characteristics	
Installation Classifications per DIN VDE	< 150 V _{RMS}	I–IV
0110/1.89 Table 1, For Rated Mains Voltage	< 300 V _{RMS}	I–III
Climatic Classification	40/110/21	
Pollution Degree (DIN VDE 0110/1.89)	2	
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V	Input-to-Output Test Voltage, Method A, $V_{IORM} \times 1.6 = V_{PR}$, Type and Sample Test with t _m = 10 s, Partial Discharge < 5 pC	904	V _{peak}
V _{PR}	Input-to-Output Test Voltage, Method B, $V_{IORM} \times 1.875 = V_{PR}$, 100% Production Test with $t_m = 1 \text{ s}$, Partial Discharge < 5 pC	1060	V _{peak}
VIORM	Maximum Working Insulation Voltage	565	V _{peak}
V _{IOTM}	Highest Allowable Over-Voltage	4000	V _{peak}
	External Creepage	≥ 5	mm
	External Clearance	≥ 5	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.4	mm
Τ _S	Case Temperature ⁽¹⁾	150	°C
I _{S,INPUT}	Input Current ⁽¹⁾	200	mA
P _{s,output}	Output Power ⁽¹⁾	300	mW
R _{IO}	Insulation Resistance at T _S , V _{IO} = 500 V ⁽¹⁾	> 10 ⁹	Ω

Note:

1. Safety limit values - maximum values allowed in the event of a failure.

Pin Definitions

Number	Name	Function Description
1	ANODE	Anode
3	CATHODE	Cathode
4	GND	Output Ground
5	Vo	Output Voltage
6	V _{DD}	Output Supply Voltage

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. $T_A = 25^{\circ}C$ unless otherwise specified.

Symbol	Parameter	Value	Unit
T _{STG}	Storage Temperature	-40 to +125	°C
T _{OPR}	Operating Temperature	-40 to +110	°C
TJ	Junction Temperature	-40 to +125	°C
T _{SOL}	Lead Solder Temperature (Refer to Reflow Temperature Profile)	260 for 10 seconds	°C
۱ _F	Forward Current	20	mA
V _R	Reverse Voltage	5	V
V _{DD}	Supply Voltage	0 to 6.0	V
Vo	Output Voltage	-0.5 to V _{DD} + 0.5	V
Ι _Ο	Average Output Current	10	mA
PDI	Input Power Dissipation ⁽²⁾⁽⁴⁾	40	mW
PDO	Output Power Dissipation ⁽³⁾⁽⁴⁾	70	mW

Notes:

- 2. Derate linearly from 95°C at a rate of -1.4 mW/°C
- 3. Derate linearly from 100 $^\circ\text{C}$ at a rate of -3.47 mW/ $^\circ\text{C}.$
- 4. 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

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Max.	Unit
T _A	Ambient Operating Temperature	-40	+110	°C
V _{DD}	Supply Voltages ⁽⁵⁾	3.0	5.5	V
V _{FL}	Logic Low Input Voltage	0	0.8	V
I _{FH}	Logic High Input Current	5	16	mA
I _{OL}	Logic Low Output Current	0	7	mA

Note:

5. 0.1µF bypass capacitor must be connected between 4 and 6.

Electrical Characteristics

Apply over all recommended conditions. T_A = -40°C to +110°C, 3.0 V \leq V_{DD} \leq 5.5 V, unless otherwise specified. Typical value is measured at T_A = 25°C and V_{DD} = 3.3 V.

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Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
INPUT CH	ARACTERISTICS	-	I		1	1
V _F	Forward Voltage	I _F = 10 mA (Figure 2)	1.05	1.35	1.8	V
BV _R	Input Reverse Breakdown Voltage	I _R = 10 μA	5	15		V
I _{FHL}	Threshold Input Current	(Figure 3)		2.8	5.0	mA
OUTPUT	CHARACTERISTICS					
	Logic Low Output	V _{DD} = 3.3 V, I _F = 10 mA (Figures 4 and 6)		3.3	4.8	mA
I _{DDL}	Supply Current	V _{DD} = 5.0 V, I _F = 10 mA (Figures 4 and 7)		4.0	5.0	mA
	Logic High Output	V _{DD} = 3.3 V, I _F = 0 mA (Figure 5)		3.3	4.8	mA
IDDH	Supply Current	V _{DD} = 5.0 V, I _F = 0 mA (Figure 5)		4.0	5.0	mA
		V_{DD} = 3.3 V, I _O = -20 µA, I _F = 0 mA	V _{DD} – 0.1 V	3.3		V
V	Logic High Output	V_{DD} = 3.3 V, I _O = -4 mA, I _F = 0 mA	V _{DD} – 0.5 V	3.1		V
V _{OH}	Voltage	V_{DD} = 5.0 V, I _O = -20 µA, I _F = 0 mA	V _{DD} – 0.1 V	5.0		V
		V_{DD} = 5.0 V, I_{O} = -4 mA, I_{F} = 0 mA	V _{DD} – 0.5 V	4.9		V
V	Logic Low Output	I _O = 20 μA, I _F = 10 mA		0.0027	0.01	V
V _{OL}	Voltage	I _O = 4 mA, I _F = 10 mA		0.27	0.80	V

Electrical Characteristics (Continued)

Apply over all recommended conditions.T_A = -40°C to +110°C, 3.0 V \leq V_{DD} \leq 5.5 V, unless otherwise specified. Typical value is measured at T_A = 25°C and V_{DD} = 3.3 V.

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Date Rate ⁽⁶⁾					20	Mbps
t _{PW}	Pulse Width		50			ns
t _{PHL}	Propagation Delay Time to Logic Low Output	C _L = 15 pF (Figures 8, 9, and 13)		31	55	ns
t _{PLH}	Propagation Delay Time to Logic High Output	C _L = 15 pF (Figures 8, 9, and 13)		25	55	ns
PWD	Pulse Width Distortion, t _{PHL} - t _{PLH}	C _L = 15 pF (Figures 10 and 11)		5.5	20	ns
t _{PSK}	Propagation Delay Skew	$C_{L} = 15 \text{ pF}^{(7)}$			30	ns
t _R	Output Rise Time (10% to 90%)	(Figure 12 and 13)		5.8		ns
t _F	Output Fall Time (90% to 10%)	(Figure 12 and 13)		5.3		ns
CM _H	Common Mode Transient Immunity at Output High	$ \begin{array}{l} I_{F} = 0 \text{ mA}, V_{O} > 0.8 \text{ V}_{DD}, \\ V_{CM} = 1000 \text{ V}, T_{A} = 25^{\circ}\text{C}, \\ (Figure 14)^{(8)} \end{array} $	20	40		kV/µs
CM _L	Common Mode Transient Immunity at Output Low	$ I_F = 5 \text{ mA}, V_O < 0.8 \text{ V}, \\ V_{CM} = 1000 \text{ V}, T_A = 25^{\circ}\text{C}, \\ (Figure 14)^{(8)} $	20	40		kV/µs
C _{PDO}	Output Dynamic Power Dissipation Capacitance ⁽⁹⁾			4		pF

Notes:

6. Data rate is based on 10 MHz, 50% NRZ pattern with a 50 nsec minimum bit time.

- 7. 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 (±5°C), at the same operating conditions, with equal loads (R_L = 350 Ω and C_L = 15 pF), and with an input rise time less than 5 ns.
- 8. Common mode transient immunity at output high is the maximum tolerable positive dVcm/dt on the leading edge of the common mode impulse signal, Vcm, to assure that the output will remain high. Common mode transient immunity at output low is the maximum tolerable negative dVcm/dt on the trailing edge of the common pulse signal, Vcm, to assure that the output will remain low.
- Unloaded dynamic power dissipation is calculated as follows: C_{PD} x V_{DD} x f + I_{DD} + V_{PD} where f is switched time in MHz.

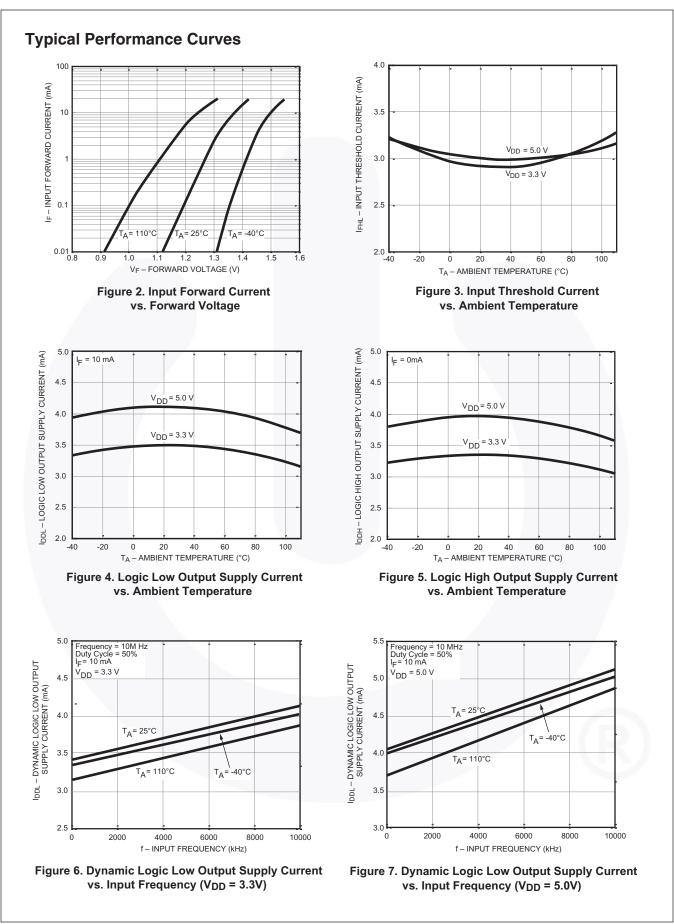
Isolation Characteristics

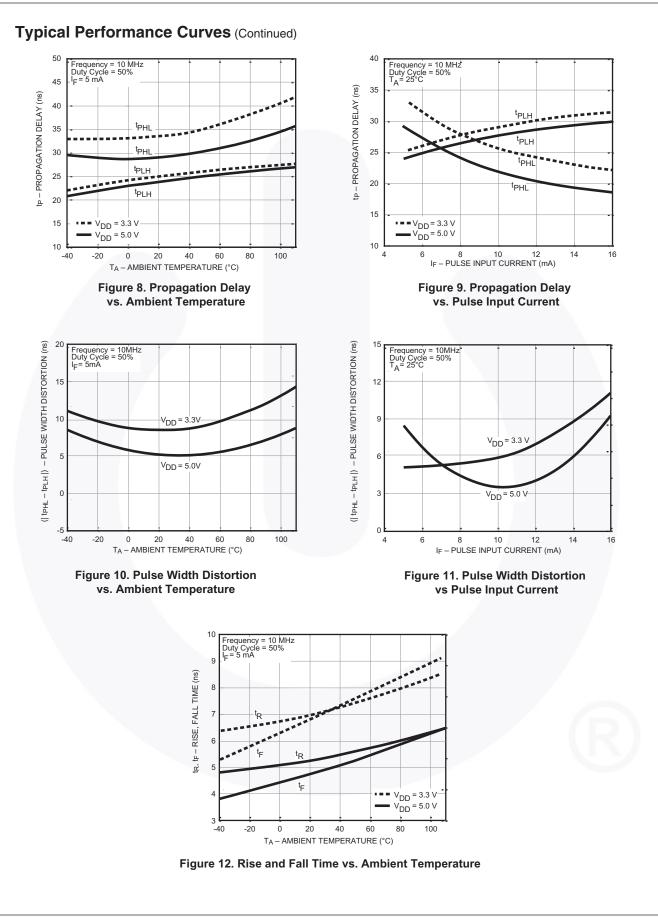
Symbol	Parameter	Conditions	Min.	Тур.	Max.	Unit
V _{ISO}	Input-Output Isolation Voltage	f = 60 Hz, t = 1.0 minute, $I_{I-O} \le 10 \ \mu A^{(10)(11)}$	3750			Vac _{RMS}
R _{ISO}	Isolation Resistance	V _{I-O} = 500 V ⁽¹⁰⁾	10 ¹¹			Ω
C _{ISO}	Isolation Capacitance	V _{I-O} = 0 V, f = 1.0 MHz ⁽¹⁰⁾		0.2		pF

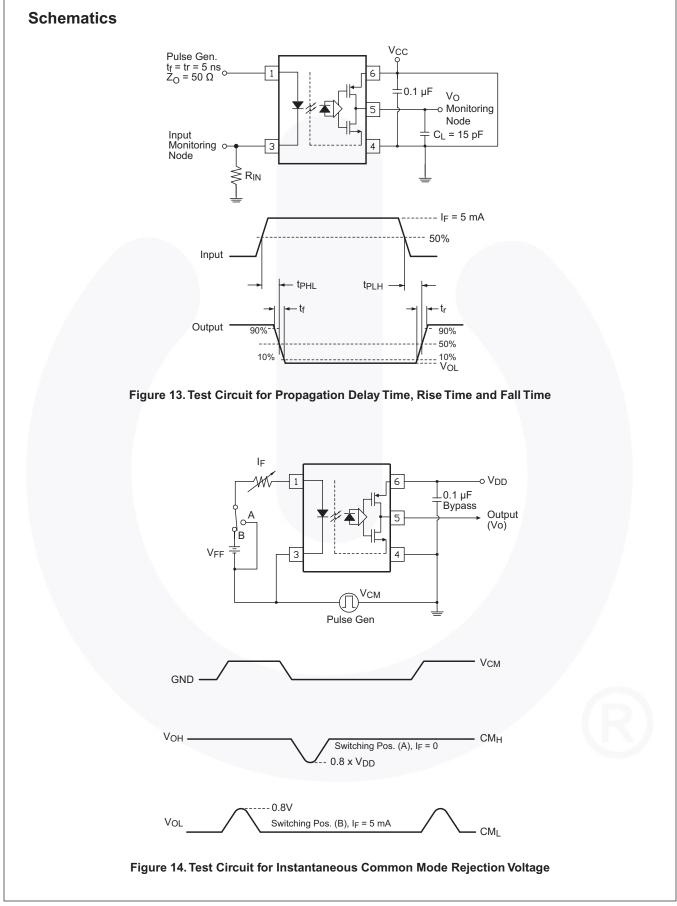
Notes:

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

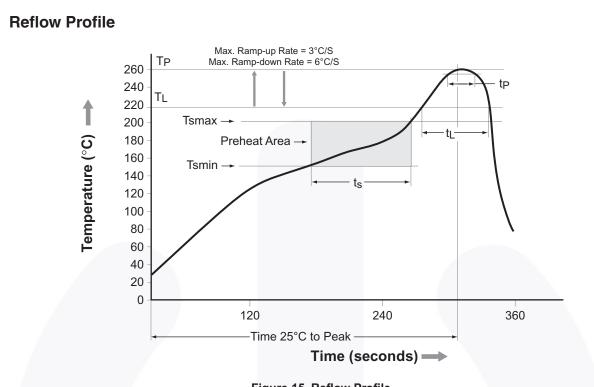
11.3,750 VAC_{RMS} for 1 minute duration is equivalent to 4,500 VAC_{RMS} for 1 second duration.







FODM8071 — 3.3V/5V Logic Gate Output Optocoupler with High Noise Immunity



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Profile Feature	Pb-Free Assembly Profile		
Temperature Min. (Tsmin)	150°C		
Temperature Max. (Tsmax)	200°C		
Time (t _S) from (Tsmin to Tsmax)	60–120 seconds		
Ramp-up Rate (t _L to t _P)	3°C/second maximum		
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 $(T_P \text{ to } T_L)$	6°C/second maximum		
Time 25°C to Peak Temperature	8 minutes maximum		

Ordering Information

Part Number	Package	Packing Method
FODM8071	Mini-Flat 5-Pin	Tube (100 Units)
FODM8071R2	Mini-Flat 5-Pin	Tape and Reel (2500 Units)
FODM8071V	Mini-Flat 5-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 Units)
FODM8071R2V	Mini-Flat 5-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (2500 Units)

All packages are lead free per JEDEC: J-STD-020B standard.

Marking Information

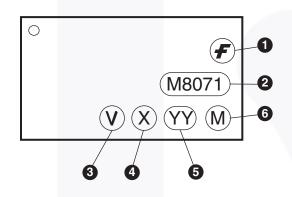
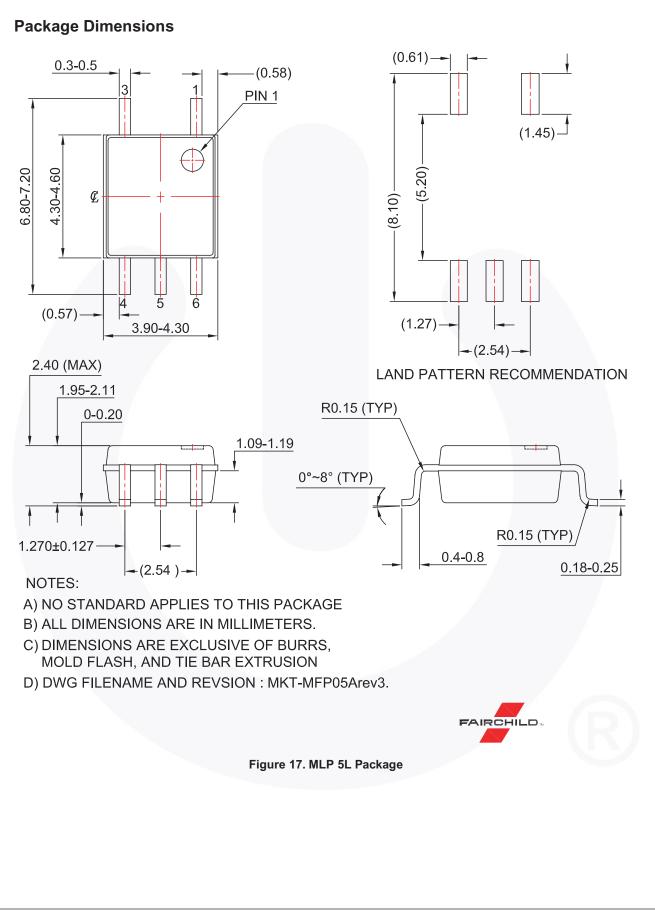
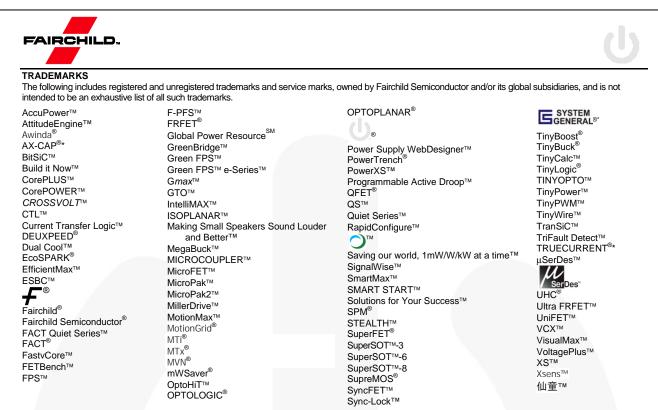


Figure 16. Top Mark

Table 1. Top Mark Definitions

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1	Fairchild Logo	
2	Device Number	
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)	
4	One-Digit Year Code, e.g., "4"	
5	Digit Work Week, Ranging from "01" to "53"	
6	Assembly Package Code	





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ООО "ЛайфЭлектроникс"

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