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December 2010

## FOD0721, FOD0720, FOD0710 High CMR, 25Mbit/sec Logic Gate Optocoupler

#### **Features**

- 20kV/µs minimum CMR
- 40ns max. propagation delay
- Data Rate, Non-Return Zero Coding
  - 25Mbit/sec (FOD0721 and FOD0720)
  - 12.5Mbit/sec (FOD0710)
- Pulse Width Distortion
  - 6ns (FOD0721)
  - 8ns (FOD0720 and FOD0710)
- +5V CMOS compatibility
- Extended industrial temperate range
  - -40 to 100°C temperature range
- Safety and regulatory approvals
  - UL1577, 3750 VACrms for 1 min. (File #E90700, Volume 2)
  - IEC60747-5-2 pending approval

## **Applications**

- Industrial fieldbus communications
  - Profibus, DeviceNet, CAN, RS485
- Programmable logic control
- Isolated data acquisition system

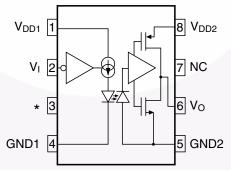
### **Description**

The FOD0721/0720/0710 family utilizes Fairchild's proprietary coplanar packaging technology, Optoplanar and optimized IC design to guarantee minimum 20kV/µs Common Mode Noise Rejection (CMR) rating.

These high-speed logic gate optocouplers consist of a high-speed AlGaAs LED driven by a CMOS IC coupled to a CMOS detector IC, comprising an integrated photodiode, a high-speed transimpedance amplifier and a voltage comparator with an output driver. The CMOS technology coupled to the high efficiency of the LED achieves low power consumption as well as very high speed (40ns propagation delay, 6ns pulse width distortion).

These devices are available in a compact 8-pin small outline package.

#### **Functional Schematic**



\*: Pin 3 must be left unconnected

#### Truth Table

VI	LED	Vo
Н	OFF	Н
L	ON	L

#### **Pin Definitions**

Pin Number	Pin Name	Pin Function Description
1	V <sub>DD1</sub>	Input Supply Voltage
2	VI	Input Data
3		LED Anode – must be left unconnected
4	GND1	Input Ground
5	GND2	Output Ground
6	Vo	Output Data
7	NC	Not Connected
8	V <sub>DD2</sub>	Output Supply Voltage

## Absolute Maximum Ratings (T<sub>A</sub> = 25°C unless otherwise specified.)

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.

Symbol	Parameter	Value	Units
T <sub>STG</sub>	Storage Temperature	-40 to +125	°C
T <sub>OPR</sub>	Operating Temperature	-40 to +100	°C
T <sub>SOL</sub>	Lead Solder Temperature	260 for 10 sec	°C
	Reflow Temperature Profile (Refer to Relow Profile)		
V <sub>DD1</sub>	Input Supply Voltage	0 to 6.0	V
VI	Input Voltage	-0.5 to V <sub>DD1</sub> + 0.5	V
I <sub>I</sub>	Input DC Current	-10 to +10	mA
V <sub>DD2</sub>	Output Supply Voltage	0 to 6.0	V
V <sub>D</sub>	Output Voltage	-0.5 to V <sub>DD2</sub> + 0.5	V
Io	Average Output Current	10	mA
PD1	Input Power Dissipation	90	mW
PD2	Output Power Dissipation	70	mW

### **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 <sub>OPR</sub>	Ambient Operating Temperature	-40	+100	°C
$V_{DD1}, V_{DD2}$	Supply Voltages	4.5	5.5	V
V <sub>IH</sub>	Logic High Input Voltage	2.0	V <sub>DD1</sub>	V
V <sub>IL</sub>	Logic Low Input Voltage	0	0.8	V
t <sub>r</sub> , t <sub>f</sub>	Input Signal Rise and Fall Time		1.0	ms

- A 0.1µF bypass capacitor must be connected between pins 1 and 4, and 5 and 8
- · Pin 3 must be left unconnected

## $\textbf{Electrical Characteristics} \; (T_{A} = -40^{\circ}C \; to \; 100^{\circ}C \; and \; 4.5V \leq V_{DD} \leq 5.5V, \; all \; typicals \; are \; at \; T_{A} = 25^{\circ}C, \; V_{DD} = 5V)$

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit	
INPUT CH	INPUT CHARACTERISTICS						
I <sub>DD1L</sub>	Logic Low Input Supply Current	V <sub>I</sub> = 0V		6.5	10.0	mA	
I <sub>DD1H</sub>	Logic High Input Supply Current	$V_I = V_{DD1}$		0.8	3.0	mA	
I <sub>DD1</sub>	Input Supply Current				13.0	mA	
I <sub>I</sub>	Input Current		-10		+10	μA	
OUTPUT (	CHARACTERISTICS		•	•		•	
I <sub>DD2L</sub>	Logic Low Output Supply Current	V <sub>I</sub> = 0V		5.5	9	mA	
I <sub>DD2H</sub>	Logic High Output Supply Current	$V_I = V_{DD1}$		5.3	9	mA	
V <sub>OH</sub>	Logic High Output Voltage	$I_{O} = -20\mu A, V_{I} = V_{IH}$	4.4	5.0		V	
V <sub>OH</sub>		$I_O = -4mA$ , $V_I = V_{IH}$	4.0	4.8		V	
V <sub>OL</sub>	Logic Low Output Voltage	$I_{O} = 20 \mu A, V_{I} = V_{IL}$		0	0.1	V	
V <sub>OL</sub>		$I_O = 4mA$ , $V_I = V_{IL}$		0.5	1.0	V	

## **Isolation Characteristics** (T<sub>A</sub> = -40°C to +100°C unless otherwise specified.)

Symbol	Characteristics	Test Conditions	Min.	Тур.*	Max.	Unit
V <sub>ISO</sub>	Input-Output Isolation Voltage	$f = 60$ Hz, $t = 1.0$ min, $I_{I-O} \le 10\mu A^{(1)(2)}$	3750			Vac <sub>RMS</sub>
R <sub>ISO</sub>	Isolation Resistance	$V_{I-O} = 500V^{(1)}$	10 <sup>11</sup>			Ω
C <sub>ISO</sub>	Isolation Capacitance	$V_{I-O} = 0$ , $f = 1.0MHz^{(1)}$		0.2		pF

<sup>\*</sup>All typicals at T<sub>A</sub> = 25°C

#### Notes:

- 1. Device is considered a two terminal device: Pins 1, 2, 3 and 4 are shorted together and Pins 5, 6, 7 and 8 are shorted together.
- 2. 3,750 VAC RMS for 1 minute duration is equivalent to 4,500 VAC RMS for 1 second duration.

## **Switching Characteristics** ( $T_A = -40$ °C to 100°C and 4.5V $\leq V_{DD} \leq 5.5$ V, all typicals are at $T_A = 25$ °C, $V_{DD} = 5$ V)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
t <sub>PHL</sub>	Propagation Delay Time to Logic Low Output	C <sub>L</sub> = 15pF		21	40	ns
t <sub>PLH</sub>	Propagation Delay Time to Logic High Output	C <sub>L</sub> = 15pF		23	40	ns
PWD	Pulse Width Distortion,   t <sub>PHL</sub> - t	PLH				•
	FOD0710	PW = 80ns, C <sub>L</sub> = 15pF		2	8	ns
	FOD0720	PW = 40ns, C <sub>L</sub> = 15pF		2	8	ns
	FOD0721	PW = 40ns, C <sub>L</sub> = 15pF		2	6	ns
Data Rate	FOD0710				12.5	Mb/s
	FOD0720, FOD0721				25	Mb/s
t <sub>PSK</sub>	Propagation Delay Skew	$C_L = 15pF^{(3)}$			20	ns
t <sub>R</sub>	Output Rise Time (10%–90%)			5		ns
t <sub>F</sub>	Output Fall Time (90%–10%)			4.5		ns
CM <sub>H</sub>	Common Mode Transient Immunity at Output High	$V_I = V_{DD1}, V_O > 0.8 V_{DD2}$ $V_{CM} = 1000V^{(4)}$	20	40		kV/µs
CM <sub>L</sub>	Common Mode Transient Immunity at Output Low	$V_I = 0V, V_O < 0.8,$ $V_{CM} = 1000V^{(4)}$	20	40		kV/μs

#### Notes:

- 3. t<sub>PSK</sub> is equal to the magnitude of the worst case difference in t<sub>PHL</sub> and/or t<sub>PLH</sub> that will be seen between units at any given temperature within the recommended operating conditions.
- 4. 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.

## **Typical Performance Curves**

Figure 1. Typical Output Voltage vs. Input Voltage

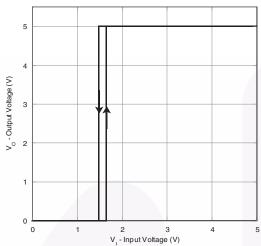


Figure 3. Typical Propogation Delay vs. Ambient Temperature (FOD0710)

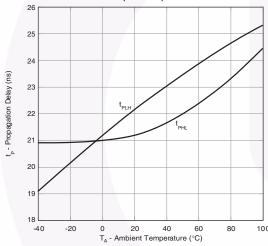


Figure 5. Typical Propogation Delay vs. Ambient Temperature (FOD0721/FOD0720)

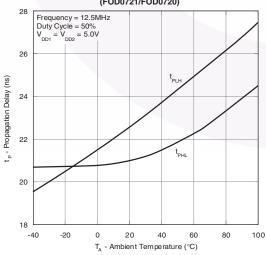


Figure 2. Typical Input Voltage Switching Threshold vs. Input Supply Voltage

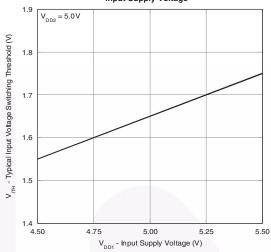


Figure 4. Typical Pulse Width Distortion vs. Ambient Temperature (FOD0710)

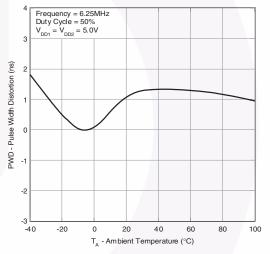
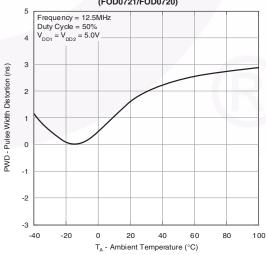


Figure 6. Typical Pulse Width Distortion vs. Ambient Temperature (FOD0721/FOD0720)



## **Typical Performance Curves** (Continued)

Figure 7. Typical Rise and Fall Time vs. Ambient Temperature

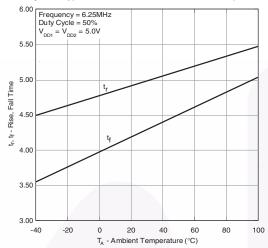


Figure 9. Typical Pulse Width Distortion vs. Output Load Capacitance (FOD0710)

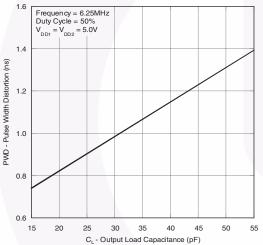


Figure 11. Typical Pulse Width Distortion vs. Output Load Capacitance (FOD0721/FOD0720)

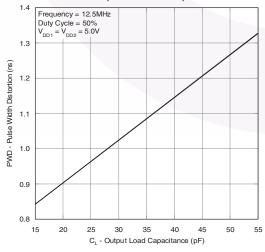


Figure 8. Typical Propogation Delay vs. Output Load Capacitance (FOD0710)

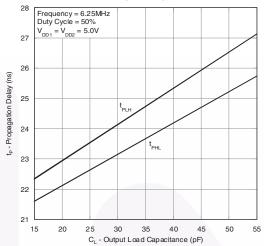


Figure 10. Typical Propogation Delay vs. Output Load Capacitance (FOD0721/FOD0720)

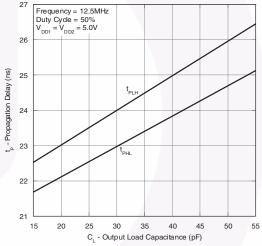
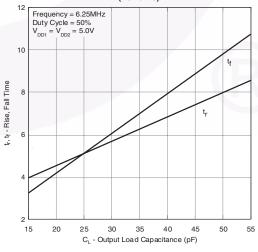
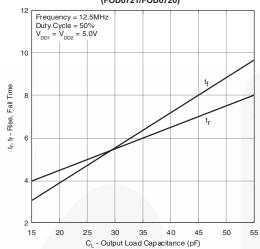


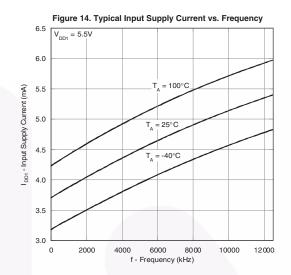
Figure 12. Typical Rise and Fall Time vs. Output Load Capacitance (FOD0710)

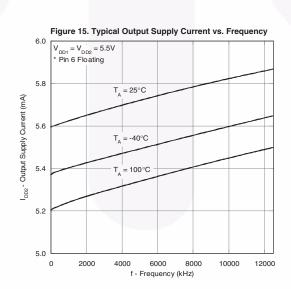


## Typical Performance Curves (Continued)

Figure 13. Typical Rise and Fall Time vs. Output Load Capacitance (FOD0721/FOD0720)







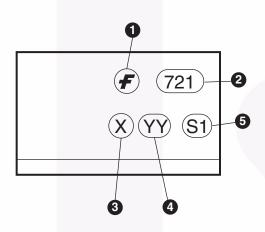
## **Ordering Information**

Option	Order Entry Identifier	Description		
No Suffix	FOD0721	Shipped in Tubes (50 units per tube)		
R2	FOD0721R2	Tape and Reel (2500 units per reel)		



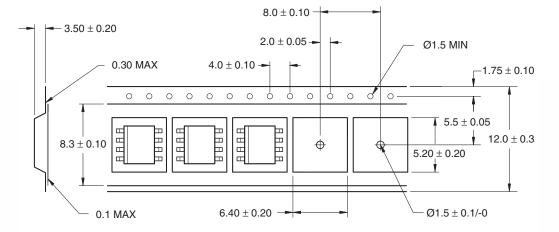
All packages are lead free per JEDEC: J-STD-020B standard.

## **Marking Information**



Definiti	ons
1	Fairchild logo
2	Device number
3	One digit year code, e.g., '8'
4	Two digit work week ranging from '01' to '53'
5	Assembly package code

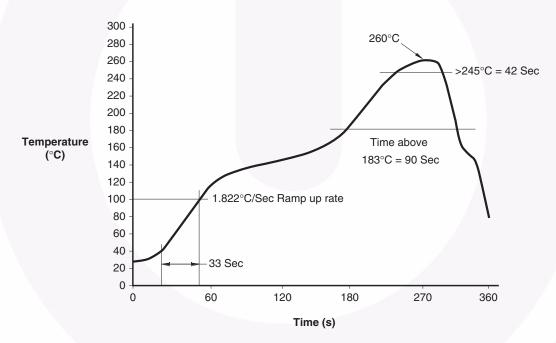
## **Carrier Tape Specification**



User Direction of Feed ————Note:

## All dimensions are in millimeters.

### **Reflow Profile**



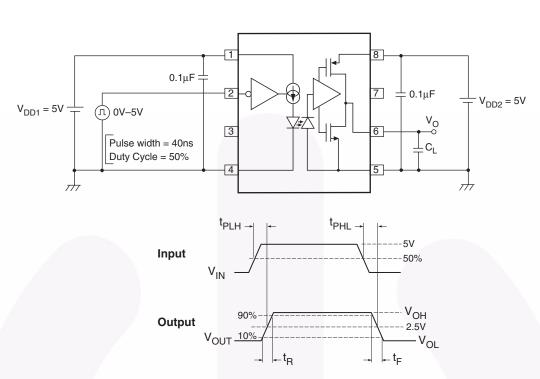


Figure 16. Test Circuit for Propogation Delay Time and Rise Time, Fall Time

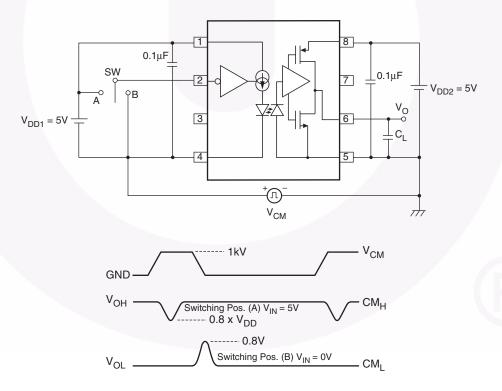
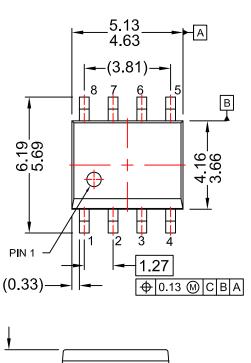
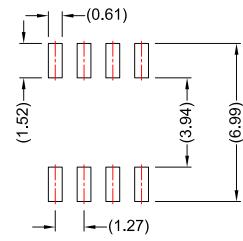
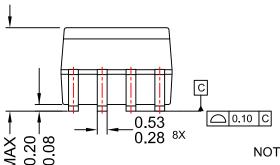


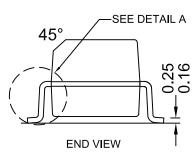
Figure 17. Test Circuit for Instantaneous Common Mode Rejection Voltage





LAND PATTERN RECOMMENDATION



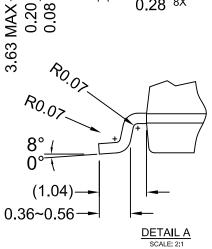






- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M.
- E) DRAWING FILENAME: MKT-M08Erev5





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