FAIRCHILD SEMICONDUCTOR®

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

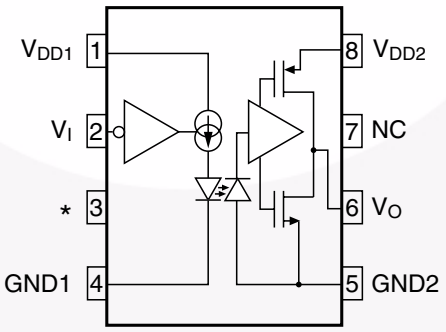
Description

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

V_I	LED	V_O
H	OFF	H
L	ON	L

Pin Definitions

Pin Number	Pin Name	Pin Function Description
1	V_{DD1}	Input Supply Voltage
2	V_I	Input Data
3		LED Anode – must be left unconnected
4	GND1	Input Ground
5	GND2	Output Ground
6	V_O	Output Data
7	NC	Not Connected
8	V_{DD2}	Output Supply Voltage

Absolute Maximum Ratings (T_A = 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_{STG}	Storage Temperature	-40 to +125	°C
T_{OPR}	Operating Temperature	-40 to +100	°C
T_{SOL}	Lead Solder Temperature	260 for 10 sec	°C
	Reflow Temperature Profile (Refer to Relow Profile)		
V_{DD1}	Input Supply Voltage	0 to 6.0	V
V_I	Input Voltage	-0.5 to V_{DD1} + 0.5	V
I_I	Input DC Current	-10 to +10	mA
V_{DD2}	Output Supply Voltage	0 to 6.0	V
V_D	Output Voltage	-0.5 to V_{DD2} + 0.5	V
I_O	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_{OPR}	Ambient Operating Temperature	-40	+100	°C
V_{DD1}, V_{DD2}	Supply Voltages	4.5	5.5	V
V_{IH}	Logic High Input Voltage	2.0	V_{DD1}	V
V_{IL}	Logic Low Input Voltage	0	0.8	V
t_r, t_f	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

Electrical Characteristics (T_A = -40°C to 100°C and 4.5V ≤ V_{DD} ≤ 5.5V, all typicals are at T_A = 25°C, V_{DD} = 5V)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
INPUT CHARACTERISTICS						
I_{DD1L}	Logic Low Input Supply Current	V_I = 0V		6.5	10.0	mA
I_{DD1H}	Logic High Input Supply Current	V_I = V_{DD1}		0.8	3.0	mA
I_{DD1}	Input Supply Current				13.0	mA
I_I	Input Current		-10		+10	µA
OUTPUT CHARACTERISTICS						
I_{DD2L}	Logic Low Output Supply Current	V_I = 0V		5.5	9	mA
I_{DD2H}	Logic High Output Supply Current	V_I = V_{DD1}		5.3	9	mA
V_{OH}	Logic High Output Voltage	I_O = -20µA, V_I = V_{IH}	4.4	5.0		V
V_{OH}		I_O = -4mA, V_I = V_{IH}	4.0	4.8		V
V_{OL}	Logic Low Output Voltage	I_O = 20µA, V_I = V_{IL}		0	0.1	V
V_{OL}		I_O = 4mA, V_I = V_{IL}		0.5	1.0	V

Isolation Characteristics (T_A = -40°C to +100°C unless otherwise specified.)

Symbol	Characteristics	Test Conditions	Min.	Typ.*	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	f = 60Hz, t = 1.0 min, I_{I-O} ≤ 10µA[1][2]	3750			Vac_{RMS}
R_{ISO}	Isolation Resistance	V_{I-O} = 500V[1]	10^{11}			Ω
C_{ISO}	Isolation Capacitance	V_{I-O} = 0 , f = 1.0MHz[1]		0.2		pF

*All typicals at T_A = 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 ≤ V_{DD} ≤ 5.5V, all typicals are at T_A = 25°C, V_{DD} = 5V)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_{PHL}	Propagation Delay Time to Logic Low Output	C_L = 15pF		21	40	ns
t_{PLH}	Propagation Delay Time to Logic High Output	C_L = 15pF		23	40	ns
PWD	Pulse Width Distortion, $\lvert t_{PHL} - t_{PLH} \rvert$					
	FOD0710	PW = 80ns, C_L = 15pF		2	8	ns
	FOD0720	PW = 40ns, C_L = 15pF		2	8	ns
	FOD0721	PW = 40ns, C_L = 15pF		2	6	ns
Data Rate	FOD0710				12.5	Mb/s
	FOD0720, FOD0721				25	Mb/s
t_{PSK}	Propagation Delay Skew	C_L = 15pF[3]			20	ns
t_R	Output Rise Time (10%–90%)			5		ns
t_F	Output Fall Time (90%–10%)			4.5		ns
$\lvert CM_H \rvert$	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
$\lvert CM_L \rvert$	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_{PSK} is equal to the magnitude of the worst case difference in t_{PHL} and/or t_{PLH} 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

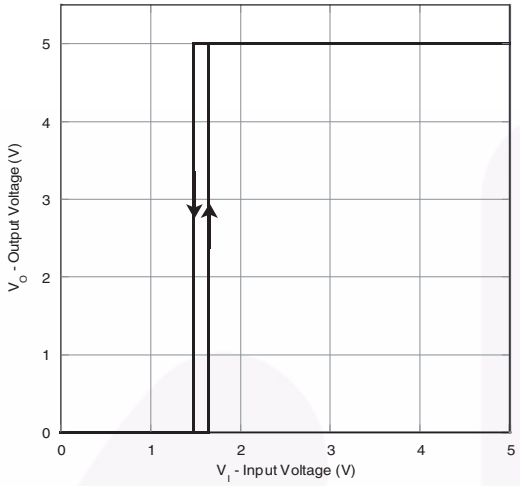


Figure 2. Typical Input Voltage Switching Threshold vs. Input Supply Voltage

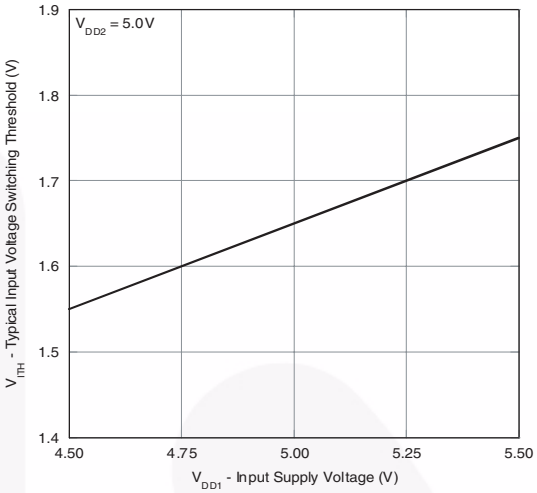


Figure 3. Typical Propogation Delay vs. Ambient Temperature (FOD0710)

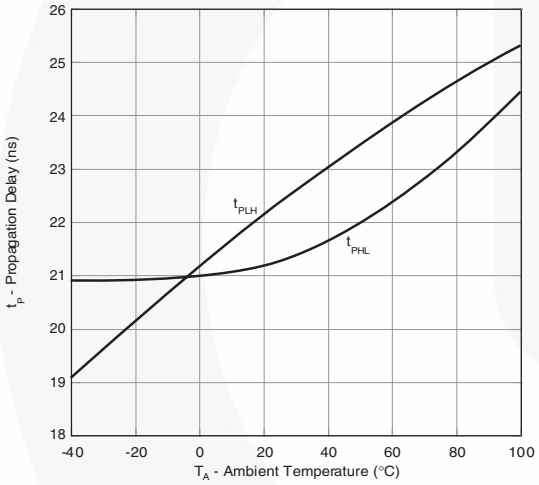


Figure 4. Typical Pulse Width Distortion vs. Ambient Temperature (FOD0710)

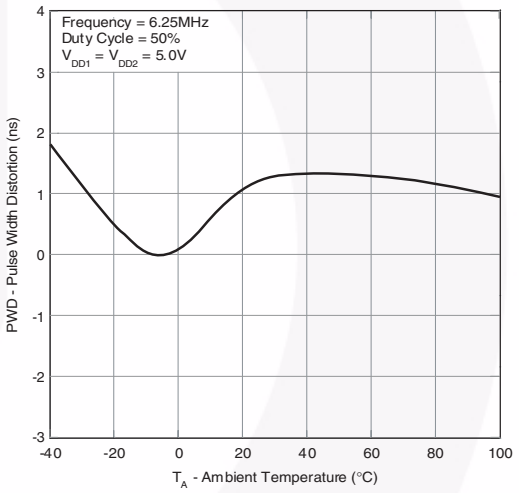


Figure 5. Typical Propogation Delay vs. Ambient Temperature (FOD0721/FOD0720)

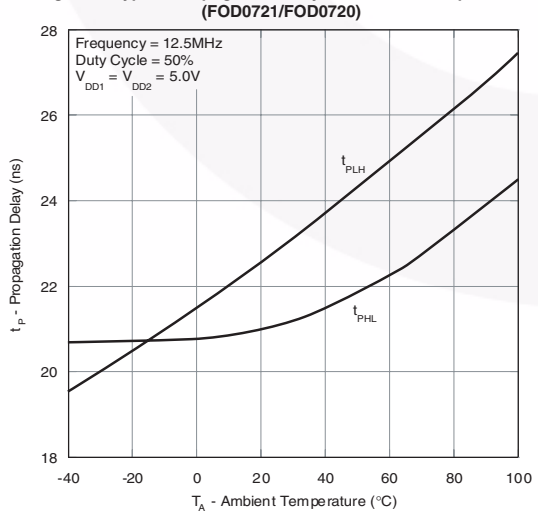
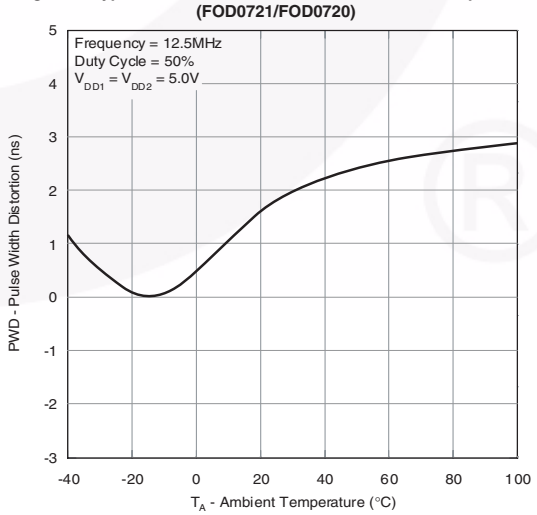


Figure 6. Typical Pulse Width Distortion vs. Ambient Temperature (FOD0721/FOD0720)



Typical Performance Curves (Continued)

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

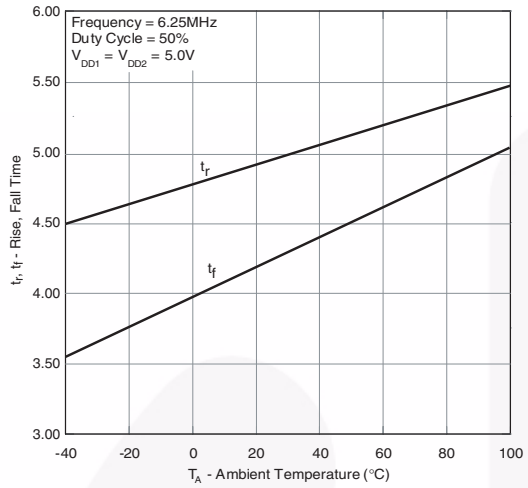


Figure 8. Typical Propogation Delay vs. Output Load Capacitance (FOD0710)

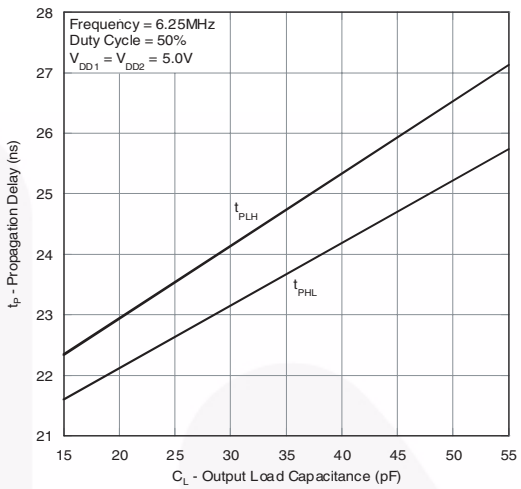


Figure 9. Typical Pulse Width Distortion vs. Output Load Capacitance (FOD0710)

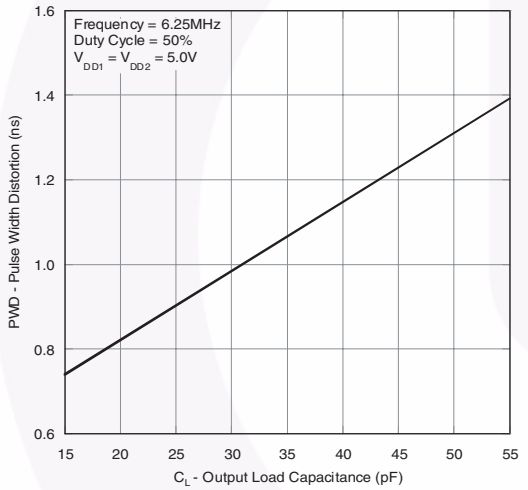


Figure 10. Typical Propogation Delay vs. Output Load Capacitance (FOD0721/FOD0720)

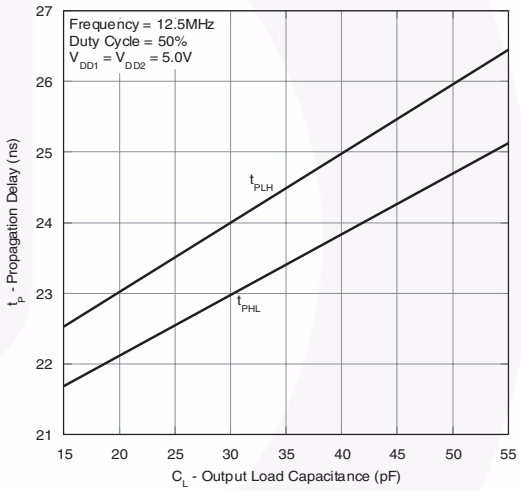


Figure 11. Typical Pulse Width Distortion vs. Output Load Capacitance (FOD0721/FOD0720)

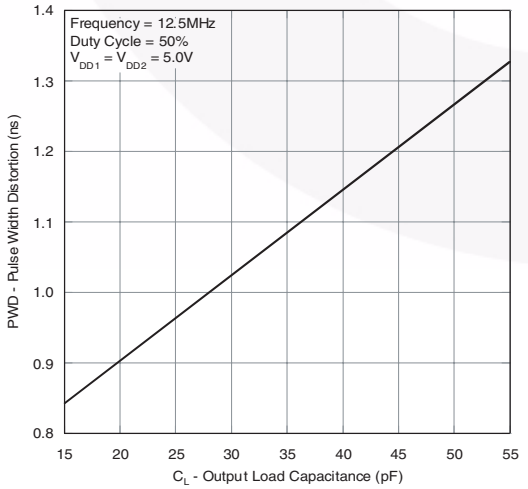
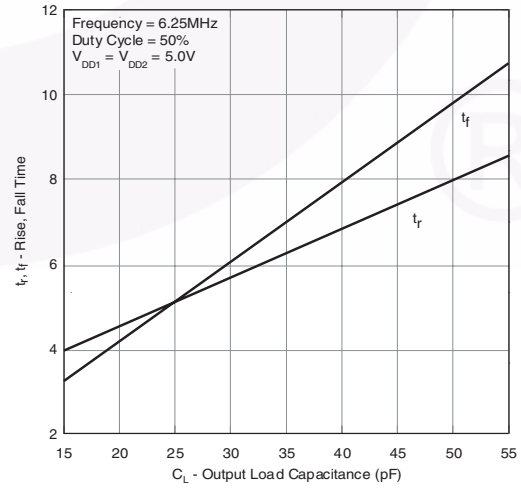


Figure 12. Typical Rise and Fall Time vs. Output Load Capacitance (FOD0710)



Typical Performance Curves (Continued)

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

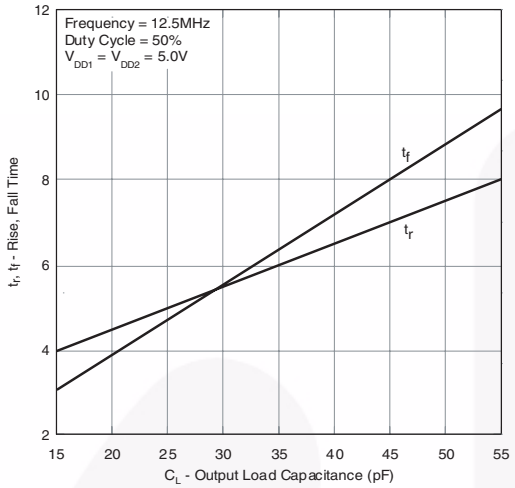


Figure 14. Typical Input Supply Current vs. Frequency

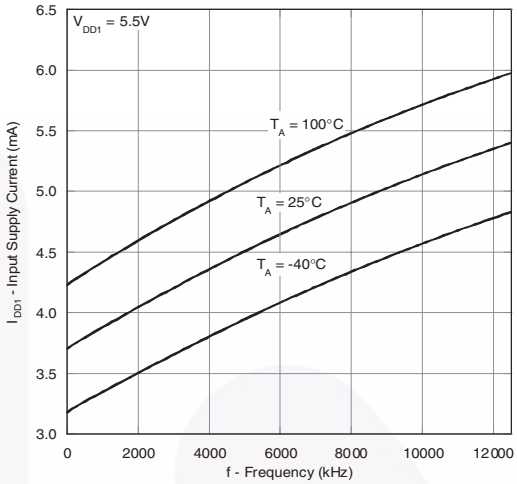
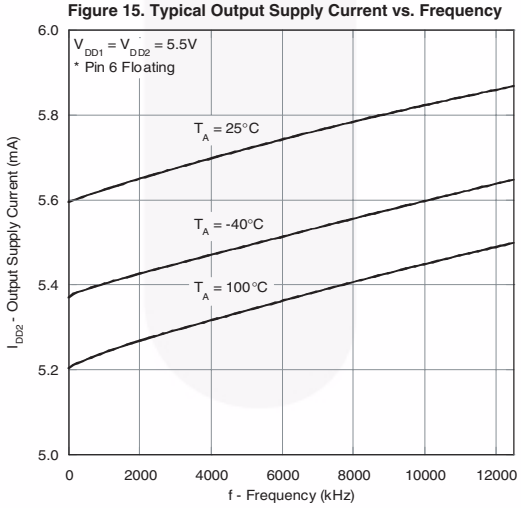
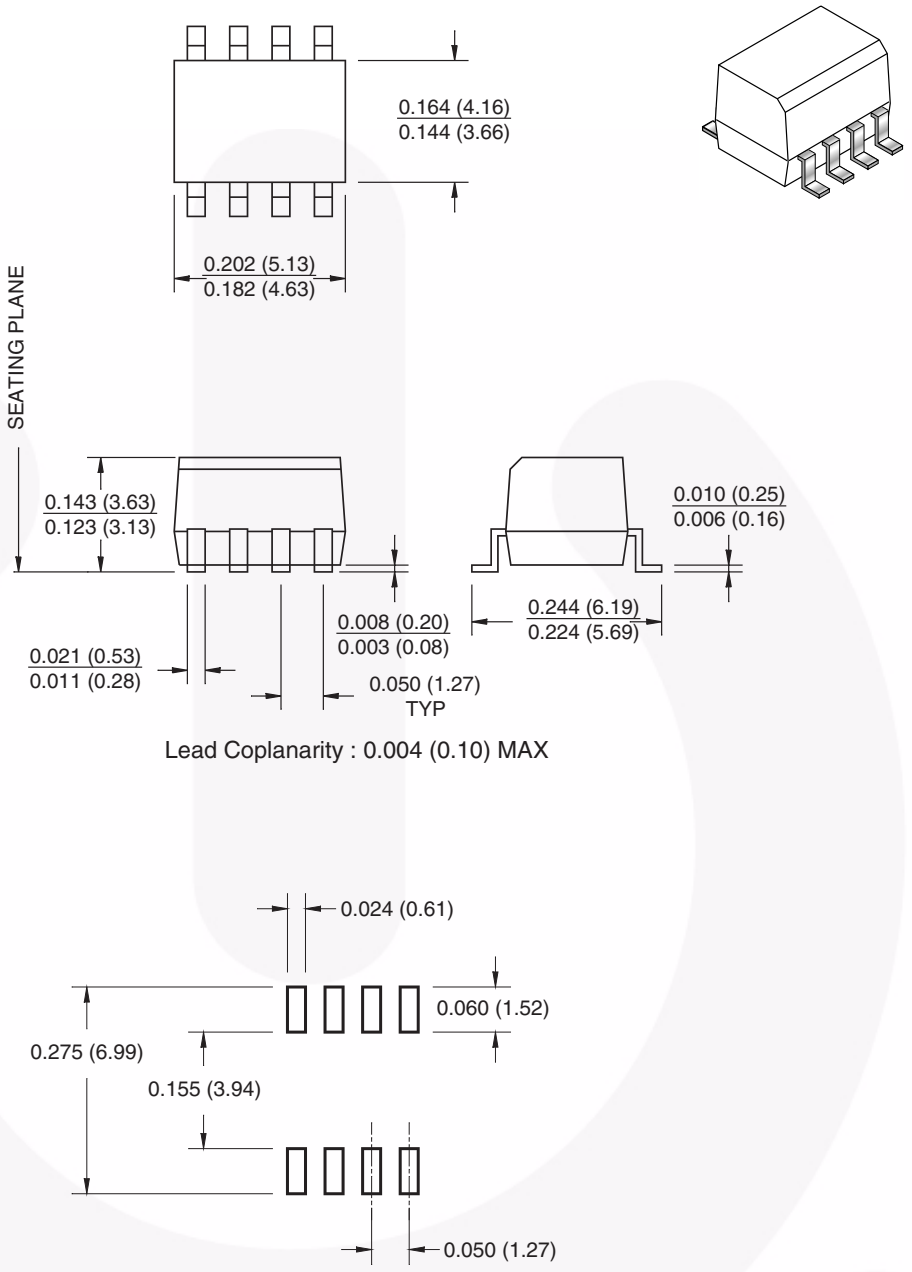


Figure 15. Typical Output Supply Current vs. Frequency



Small Outline Package Dimensions



Note:
All dimensions are in millimeters.

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

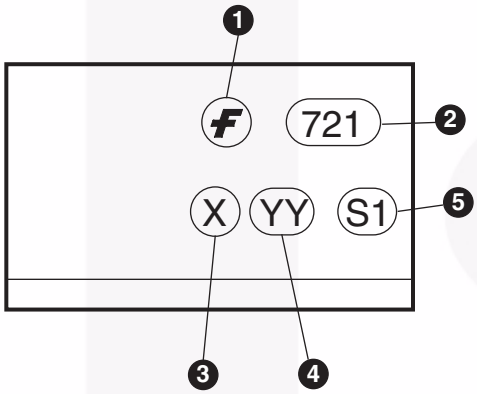
Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
http://www.fairchildsemi.com/packaging/

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)

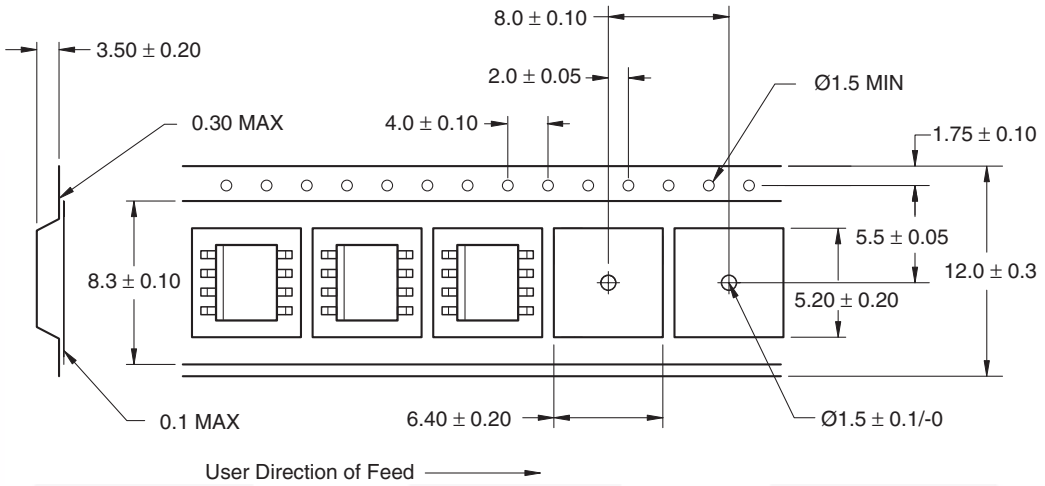
All packages are lead free per JEDEC: J-STD-020B standard.

Marking Information



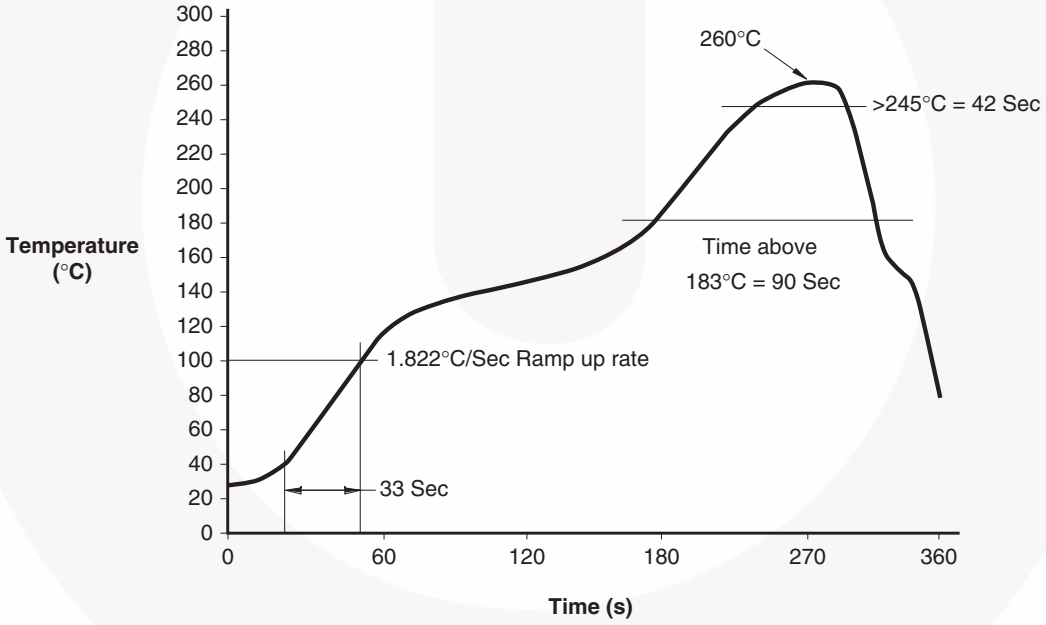
Definitions	
1	Fairchild logo
2	Device number
3	One digit year code, e.g., ‘8’
4	Two digit work week ranging from ‘01’ to ‘53’
5	Assembly package code

Carrier Tape Specification



Note:
All dimensions are in millimeters.

Reflow Profile



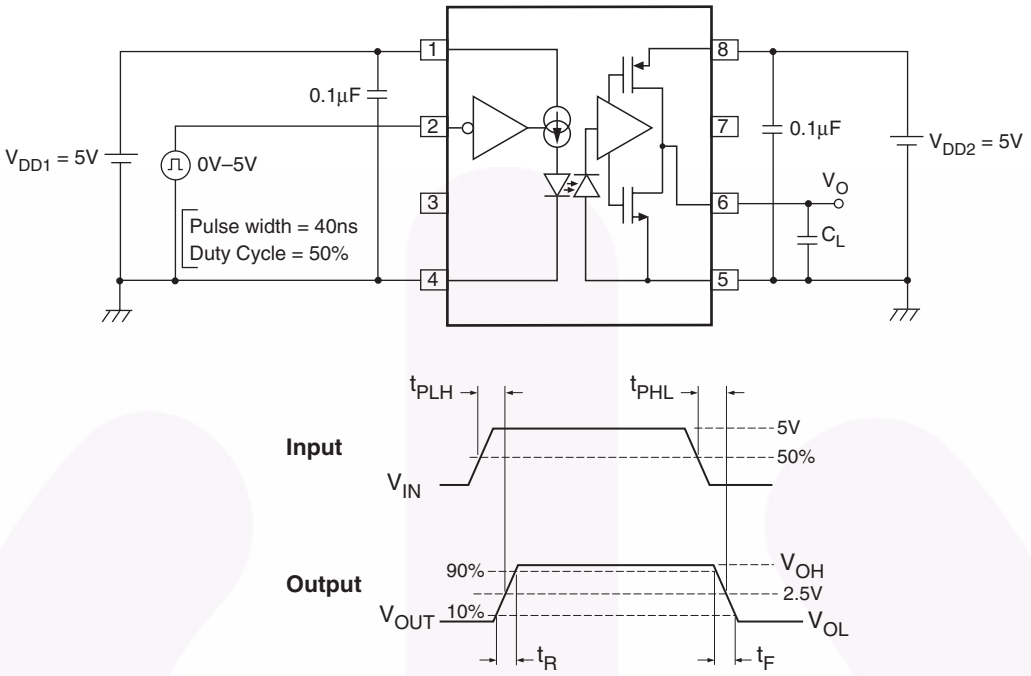


Figure 16. Test Circuit for Propogation Delay Time and Rise Time, Fall Time

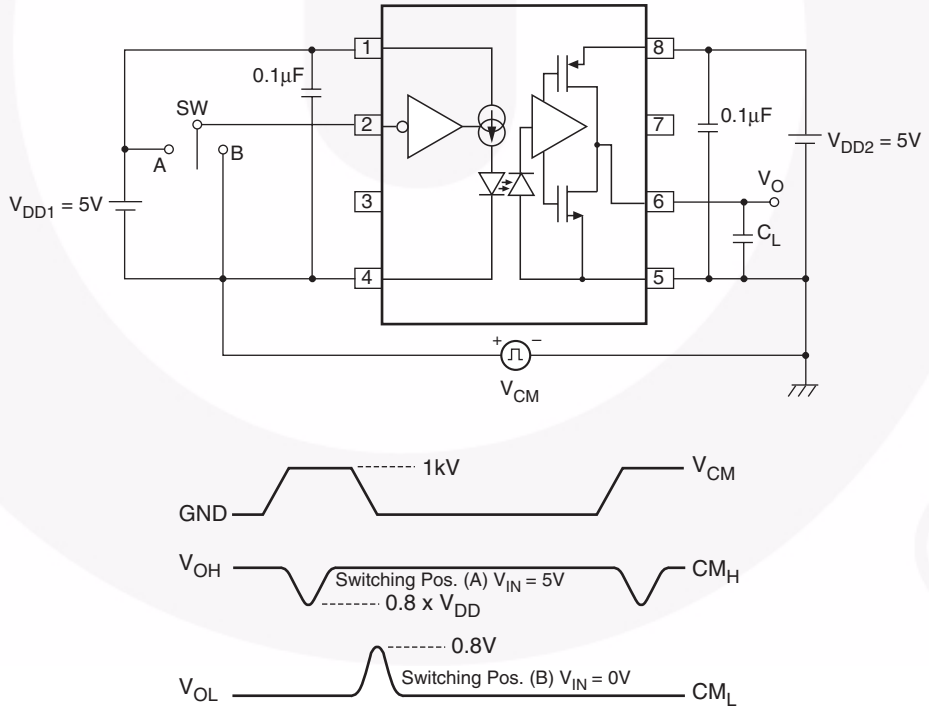


Figure 17. Test Circuit for Instantaneous Common Mode Rejection Voltage

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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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