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July 2010

FODM452, FODM453 5-Pin Mini Flat Package High Speed Transistor Optocoupler

Features

- Compact 5-pin mini flat package
- High speed-1 MBit/s
- Superior CMR-15kV/µs at V_{CM} = 1500V (FODM453)
- Performance guaranteed over temperature (0–70°C)
- U.L. recognized (File # E90700)
- VDE0884 recognized (File # 136480)
 - Ordering option V, e.g., FODM452V
- 260°C reflow capability for Pb-free assembly

Applications

- Line receivers
- Pulse transformer replacement
- Output interface to CMOS-LSTTL-TTL
- Wide bandwidth analog coupling

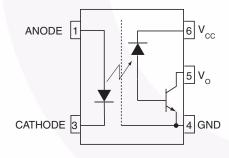
Description

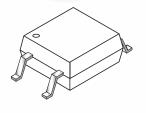
The FODM452 and FODM453 optocouplers consist of an AlGaAs LED optically coupled to a high speed photodetector transistor. The devices are housed in a compact 5-pin mini flat package for optimum mounting density. The FODM453 features a high CMR rating for optimum common mode transient immunity.

Related Resources

- www.fairchildsemi.com/products/opto/
- www.fairchildsemi.com/pf/FO/FODM611.html
- www.fairchildsemi.com/pf/FO/FODM8061.html
- www.fairchildsemi.com/pf/FO/FODM8071.html

Functional Schematic





Truth Table

LED	Output
Off	High
On	Low

Pin Definitions

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

Safety and Insulation Ratings for Mini-Flat Package (SO5 Pin)

As per IEC60747-5-2 (Pending Certification). 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.	Тур.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1				
	For rated main voltage < 150Vrms		I-IV		
	For rated main voltage < 300Vrms		1-111		
	Climatic Classification		40/85/21		
	Pollution Degree (DIN VDE 0110/1.89)		2		
CTI	Comparative Tracking Index	175			
V _{PR}	Input to Output Test Voltage, Method b, VIORM x 1.875 = V_{PR} , 100% Production Test with t_m = 1 sec, Partial Discharge < 5 pC	1060			
V _{PR}	Input to Output Test Voltage, Method a, VIORM x 1.5 = V_{PR} , Type and Sample Test with t_m = 60 sec, Partial Discharge < 5 pC	848			
V _{IORM}	Max Working Insulation Voltage	565			V _{peak}
V _{IOTM}	Highest Allowable Over Voltage	4000			V _{peak}
	External Creepage	5.0			mm
	External Clearance	5.0			mm
	Insulation thickness	0.5			mm
T _{Case}	Safety Limit Values, Maximum Values allowed in the event of a failure, Case Temperature	150			°C
R _{IO}	Insulation Resistance at T _S , V _{IO} = 500V	10 ⁹			Ω

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

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 +85	°C
EMITTER			
I _F (avg)	DC/Average Forward Input Current	25	mA
I _F (pk)	Peak Forward Input Current (50% duty cycle, 1ms P.W.)	50	mA
I _F (trans)	Peak Transient Input Current (≤1µs P.W., 300pps)	1.0	Α
V _R	Reverse Input Voltage	5	V
P _D	Input Power Dissipation (No derating required over specified operating temp range)	45	mW
DETECTOR			-
I _O (avg)	Average Output Current	8	mA
I _O (pk)	Peak Output Current	16	mA
V _{CC}	Supply Voltage	-0.5 to 30	V
Vo	Output Voltage	-0.5 to 20	V
P _D	Output Power Dissipation (No derating required over specified operating temp range)	100	mW

Electrical Characteristics (T_A = 0 to 70°C unless otherwise specified)

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Min.	Тур.*	Max.	Unit
EMITTER				•		
V _F	Input Forward Voltage	I _F = 16mA, T _A = 25°C		1.60	1.7	V
		I _F = 16mA			1.8	
B _{VR}	Input Reverse Breakdown Voltage	I _R = 10μA	5.0			V
$\Delta V_F / \Delta T_A$	Temperature Coefficient of Forward Voltage	I _F = 16mA		-1.8		mV/°C
DETECTOR	8		•			
I _{OH}	Logic High Output Current	$I_F = 0mA, V_O = V_{CC} = 5.5V, T_A = 25^{\circ}C$.001	0.5	μA
		I _F = 0 mA, V _O = V _{CC} = 15V, T _A =25°C		.001	1	
		I _F = 0mA, V _O = V _{CC} = 15V			50	
I _{CCL}	Logic Low Supply Current	I _F = 16mA, V _O = Open, V _{CC} = 15V		100	200	μA
Іссн	Logic high supply current	$I_F = 0 \text{ mA}, V_O = \text{Open}, V_{CC} = 15V,$ $T_A = 25^{\circ}\text{C}$		0.05	1	μA
		$I_F = 0mA, V_O = Open, V_{CC} = 15V$			2	

Transfer Characteristics

Symbol	Parameter	Test Conditions		Min.	Тур.*	Max	Unit
COUPLED							
CTR	Current Transfer Ratio ⁽¹⁾	I _F = 16mA, V _{CC} = 4.5V	T _A = 25°C V _{OL} =0.4V	20		50	%
			V _{OL} =0.5V	15			
V _{OL}	Logic LOW Output	I _F = 16mA, I _O = 3mA, V _{CC} =	= 4.5V, T _A =2 5°C			0.4	V
	Voltage	$I_F = 16mA, I_O = 2.4mA, V_{CO}$; = 4.5 V			0.5	

Switching Characteristics ($V_{CC} = 5V$)

Symbol	Parameter	Test Conditions	Device	Min.	Тур.*	Max.	Unit
T _{PHL}	Propagation Delay	$R_L = 1.9k\Omega$, $I_F = 16mA$, $T_A = 25^{\circ}C^{(2)}$ (Fig. 9)			0.40	0.8	μs
	Time to Logic LOW	$R_L = 1.9k\Omega, I_F = 16mA^{(2)}$ (Fig. 9)				1.0	μs
T _{PLH}	Propagation Delay	$R_L = 1.9k\Omega$, $I_F = 16mA$, $T_A = 25^{\circ}C^{(2)}$ (Fig. 9)			0.35	0.8	μs
	Time to Logic HIGH	$R_L = 1.9k\Omega, I_F = 16mA^{(2)}$ (Fig. 9)				1.0	μs
CM _H	Common Mode Transient Immunity	$I_F = 0$ mA, $V_{CM} = 10V_{P-P}$, $R_L = 1.9$ k Ω , $T_A = 25$ °C $^{(3)}$ (Fig. 10)	FODM452	5	15		KV/µs
	at Logic HIGH	I_F = 0mA, V_{CM} = 1500 V_{P-P} , R_L = 1.9kΩ T_A = 25°C ⁽³⁾ (Fig. 10)	FODM453	15	40		KV/µs
CM _L	Common Mode Transient Immunity	I_F = 16mA, V_{CM} = 10 V_{P-P} , R_L = 1.9kΩ, T_A = 25°C ⁽³⁾ (Fig. 10)	FODM452	5	15		KV/µs
	at Logic LOW	I_F = 16mA, V_{CM} = 1500 V_{P-P} , R_L = 1.9kΩ, T_A = 25°C ⁽³⁾ (Fig. 10)	FODM453	15	40		KV/µs
BW	Bandwidth	$R_L = 100\Omega$			3		MHz

Isolation Characteristics

Symbol	Characteristics	Test Conditions	Min.	Typ.*	Max.	Unit
V _{ISO}	Withstand Insulation Test Voltage	RH \leq 50%, T _A = 25°C, t = 1 min. ⁽⁴⁾	3750			V _{RMS}
C _{I-O}	Capacitance (Input to Output)	$f = 1MHz^{(4)}$		0.2		pF

^{*}All Typicals at $T_A = 25$ °C

Notes:

- Current Transfer Ratio is defined as a ratio of output collector current, I_O, to the forward LED input current, I_F, times 100%.
- 2. The 1.9k Ω load represents 1 TTL unit load of 1.6mA and 5.6k Ω pull-up resistor.
- 3. Common mode transient immunity in logic high level is the maximum tolerable (positive) dV_{cm}/dt on the leading edge of the common mode pulse signal V_{CM} , to assure that the output will remain in a logic high state (i.e., $V_O > 2.0V$). Common mode transient immunity in logic low level is the maximum tolerable (negative) dV_{cm}/dt on the trailing edge of the common mode pulse signal, V_{CM} , to assure that the output will remain in a logic low state (i.e., $V_O < 0.8V$).
- 4. Device is considered a two terminal device: Pins 1, and 3 are shorted together and Pins 4, 5, and 6 are shorted together.

Typical Performance Curves

Fig. 1 Input Forward Current vs Forward Voltage

TA = 25°C

TA = 2

Fig. 2 Normalized Current Transfer Ratio vs. Input Current

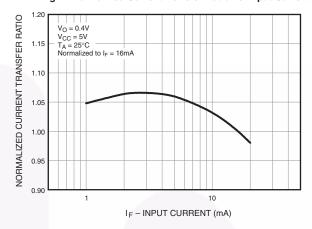


Fig. 3 Normalized Current Transfer Ratio vs. Ambient Temperature

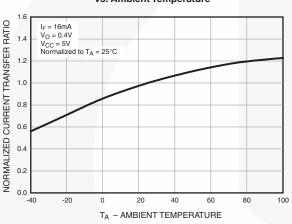


Fig. 4 Logic High Output Current vs. Ambient Temperature

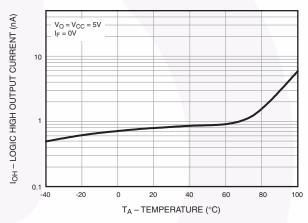


Fig. 5 DC and Pulsed Transfer Characteristics

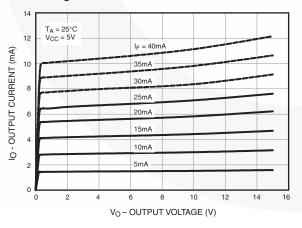
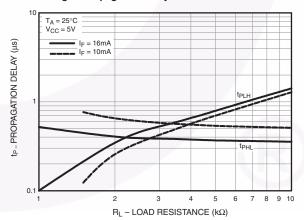


Fig. 6 Propagation Delay vs. Load Resistance



Typical Performance Curves (Continued)

Fig. 7 Propagation Delay vs. Ambient Temperature

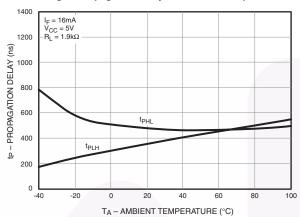
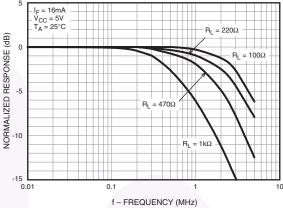
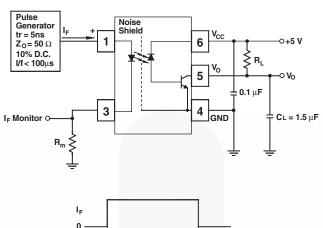


Fig. 8 Frequency Response





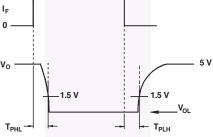
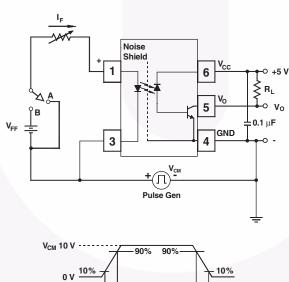


Fig. 9 Switching Time Test Circuit



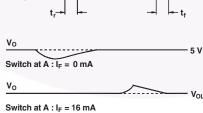
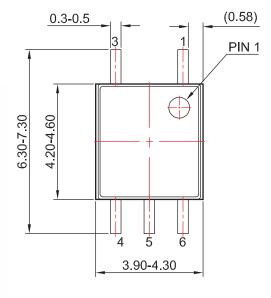
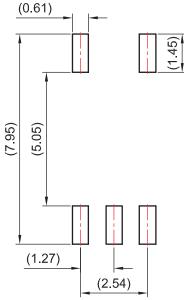
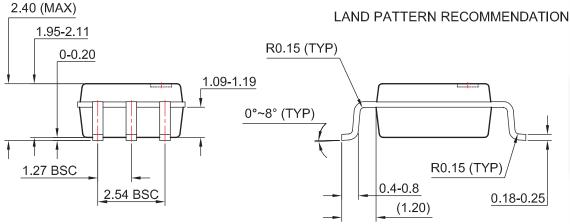


Fig. 10 Common Mode Immunity Test Circuit

Package Dimensions







Notes:

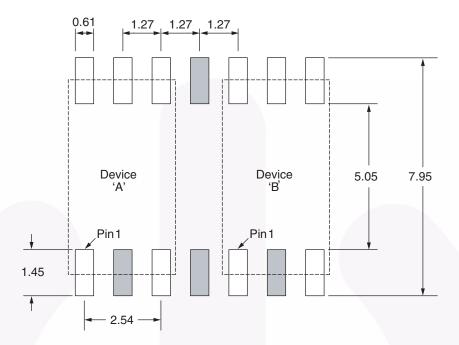
- 1. No standard applies to this package.
- 2. All dimensions are in millimeters.
- 3. Dimensions are exclusive of burrs, mold flash, and tie bar extrusion.
- 4. Drawings filesname and revision: MKT-MFP05A.

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.

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Footprint Drawing for PCB Layout

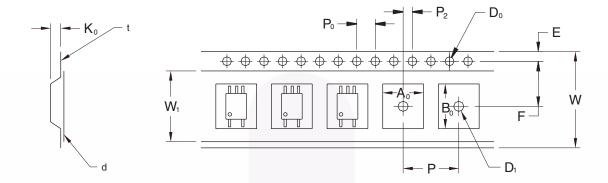


Dimensions in millimeters

End Stacking Configuration

Unutilized Solder Pad

Tape and Reel Dimensions

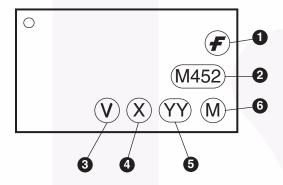


		2.54 Pitch
Description	Symbol	Dimensions (mm)
Tape Width	W	12.00 +0.30/-0.10
Tape Thickness	t	0.30 ±0.05
Sprocket Hole Pitch	P ₀	4.00 ±0.10
Sprocket Hole Diameter	D ₀	1.50 +0.10/-0.0
Sprocket Hole Location	E	1.75 ±0.10
Pocket Location	F	5.50 ±0.10
	P ₂	2.00 ±0.10
Pocket Pitch	Р	8.00 ±0.10
Pocket Dimension	A ₀	4.40 ±0.10
	B ₀	7.30 ±0.10
	K ₀	2.30 ±0.10
Pocket Hole Diameter	D ₁	1.50 Min.
Cover Tape Width	W ₁	9.20
Cover Tape Thickness	d	0.065 ±0.010
Max. Component Rotation or Tilt		10° Max.
Devices Per Reel		2500
Reel Diameter		330mm (13")

Ordering Information

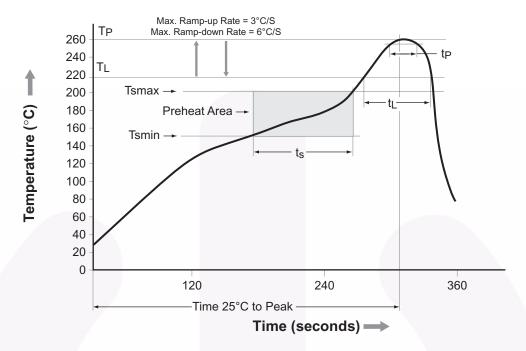
Option	Order Entry Identifier (example)	Description
R2	FODM452R2	Tape and Reel (2500 per reel)
V	FODM452V	IEC60747-5-2
R2V	FODM452R2V	IEC60747-5-2, Tape and Reel (2500 per reel)

Marking Information



Definiti	ions	
1	Fairchild logo	
2	Device number	
3	IEC60747-5-2 mark (Note: Only appears on parts ordered with VDE option – See order entry table)	
4	One digit year code, e.g., '7'	
5	Two digit work week ranging from '01' to '53'	
6	Assembly package code	

Reflow Profile



Profile Freature	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 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.





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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.
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