FAIRCHILD SEMICONDUCTOR®

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

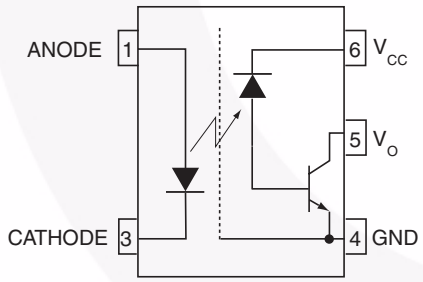
Description

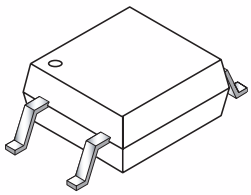
The FODM452 and FODM453 optocouplers consist of an AlGaAs LED optically coupled to a high speed photo-detector transistor. The devices are housed in a compact 5-pin mini flat package for optimum mounting density. The FODM453 features a high CMR rating for optimum common mode transient immunity.

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.	Typ.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1				
	For rated main voltage < 150Vrms		I-IV		
	For rated main voltage < 300Vrms		I-III		
	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	A
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
V_O	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.	Typ.*	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						
I_{OH}	Logic High Output Current	I_F = 0mA, V_O = V_{CC} = 5.5V, T_A =25°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
I_{CCH}	Logic high supply current	I_F = 0 mA, V_O = Open, V_{CC} = 15V, T_A = 25°C		0.05	1	µA
		I_F = 0mA, V_O = Open, V_{CC} = 15V			2	

Transfer Characteristics

Symbol	Parameter	Test Conditions		Min.	Typ.*	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 Voltage	I_F = 16mA, I_O = 3mA, V_{CC} = 4.5V, T_A =2 5°C				0.4	V
		I_F = 16mA, I_O = 2.4mA, V_{CC} = 4.5 V				0.5	

Switching Characteristics (V_{CC} = 5V)

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

Isolation Characteristics

Symbol	Characteristics	Test Conditions	Min.	Typ.*	Max.	Unit
V_{ISO}	Withstand Insulation Test Voltage	RH ≤ 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:

1. 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 1.9kΩ load represents 1 TTL unit load of 1.6mA and 5.6kΩ 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

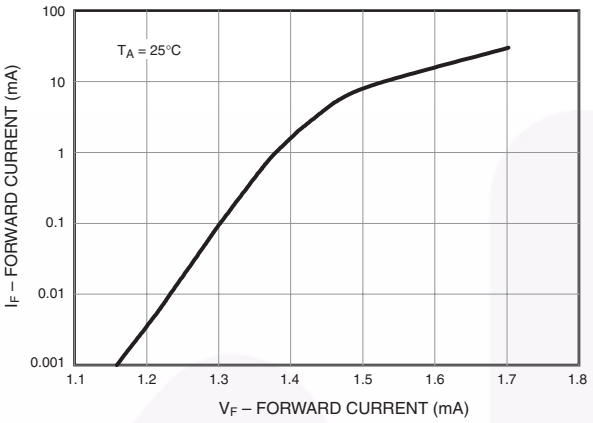


Fig. 2 Normalized Current Transfer Ratio vs. Input Current

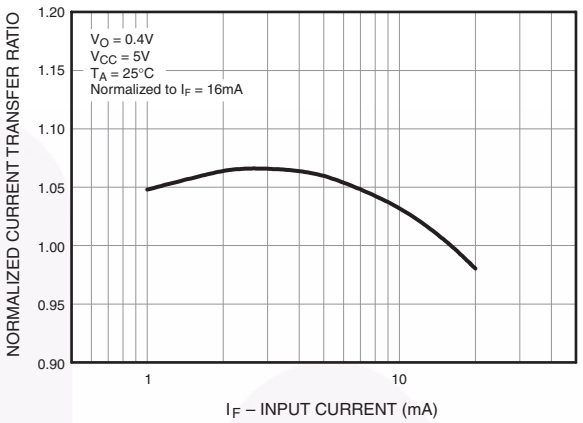


Fig. 3 Normalized Current Transfer Ratio vs. Ambient Temperature

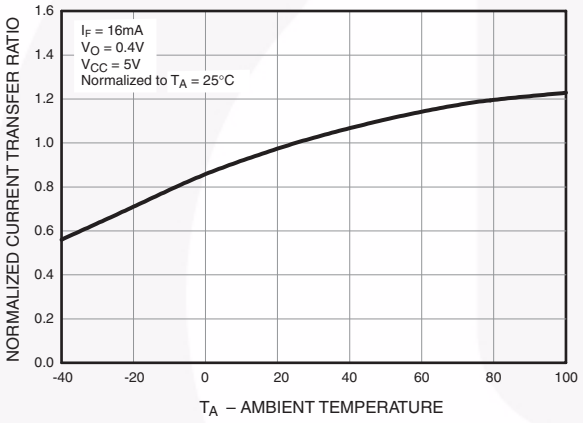


Fig. 4 Logic High Output Current vs. Ambient Temperature

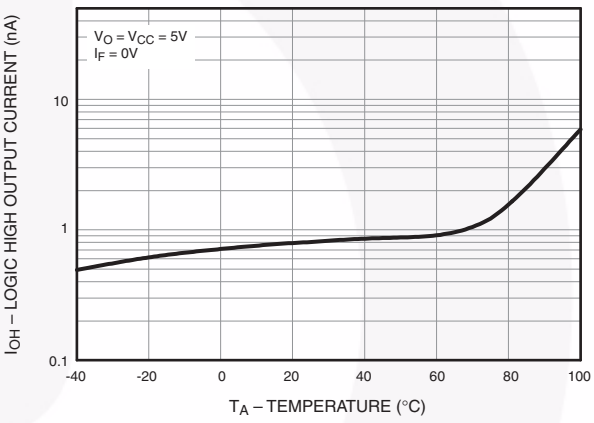


Fig. 5 DC and Pulsed Transfer Characteristics

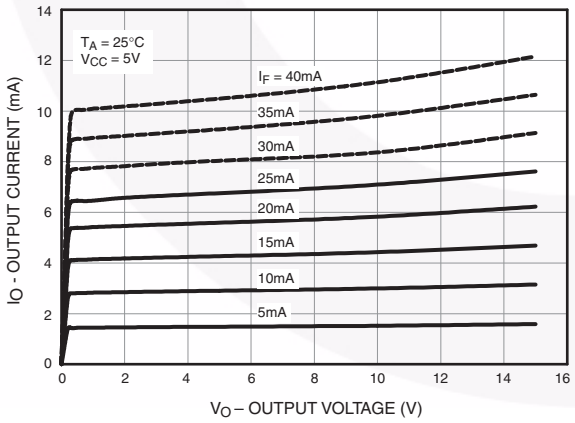
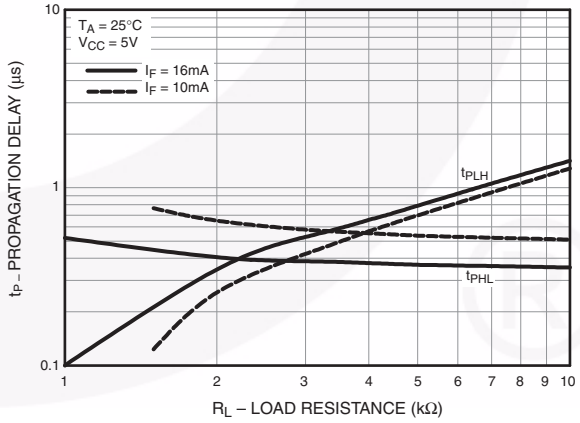


Fig. 6 Propagation Delay vs. Load Resistance



Typical Performance Curves (Continued)

Fig. 7 Propagation Delay vs. Ambient Temperature

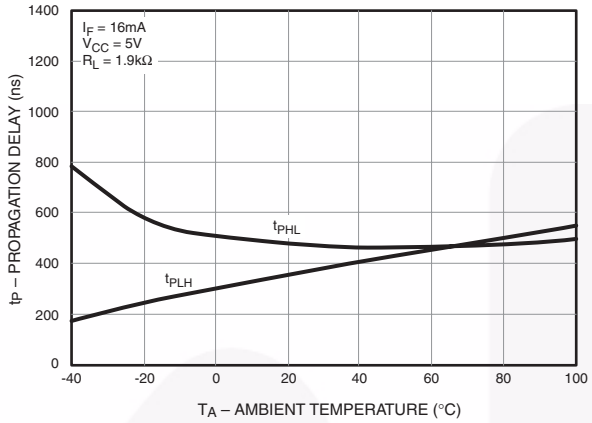
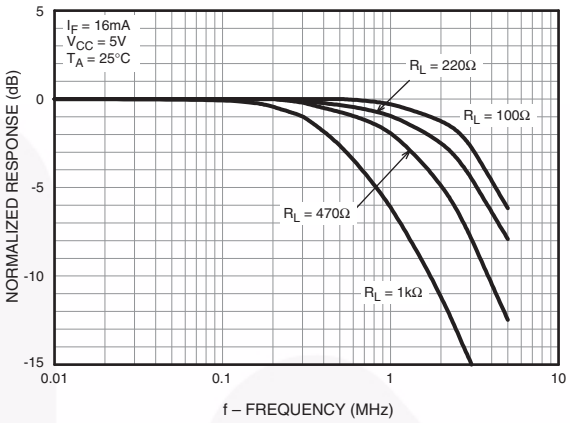


Fig. 8 Frequency Response



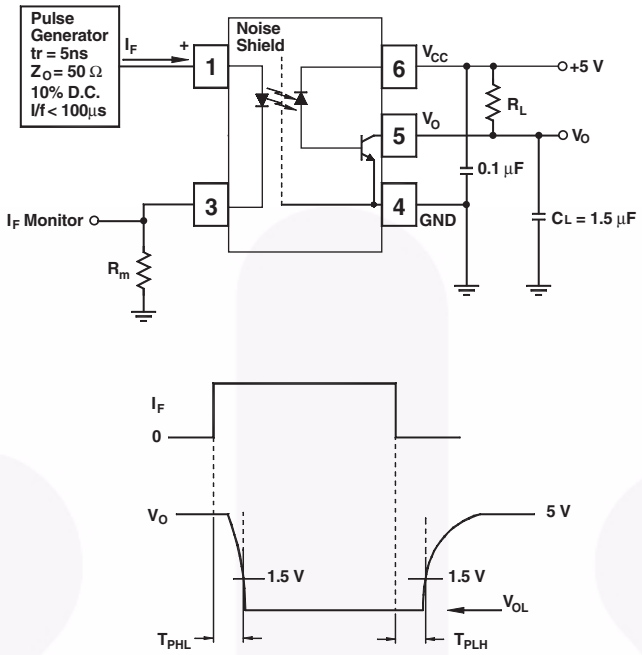


Fig. 9 Switching Time Test Circuit

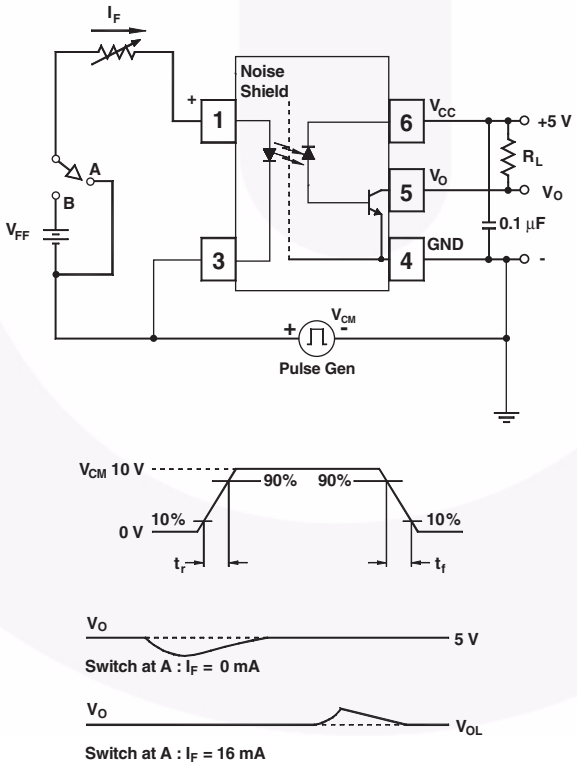
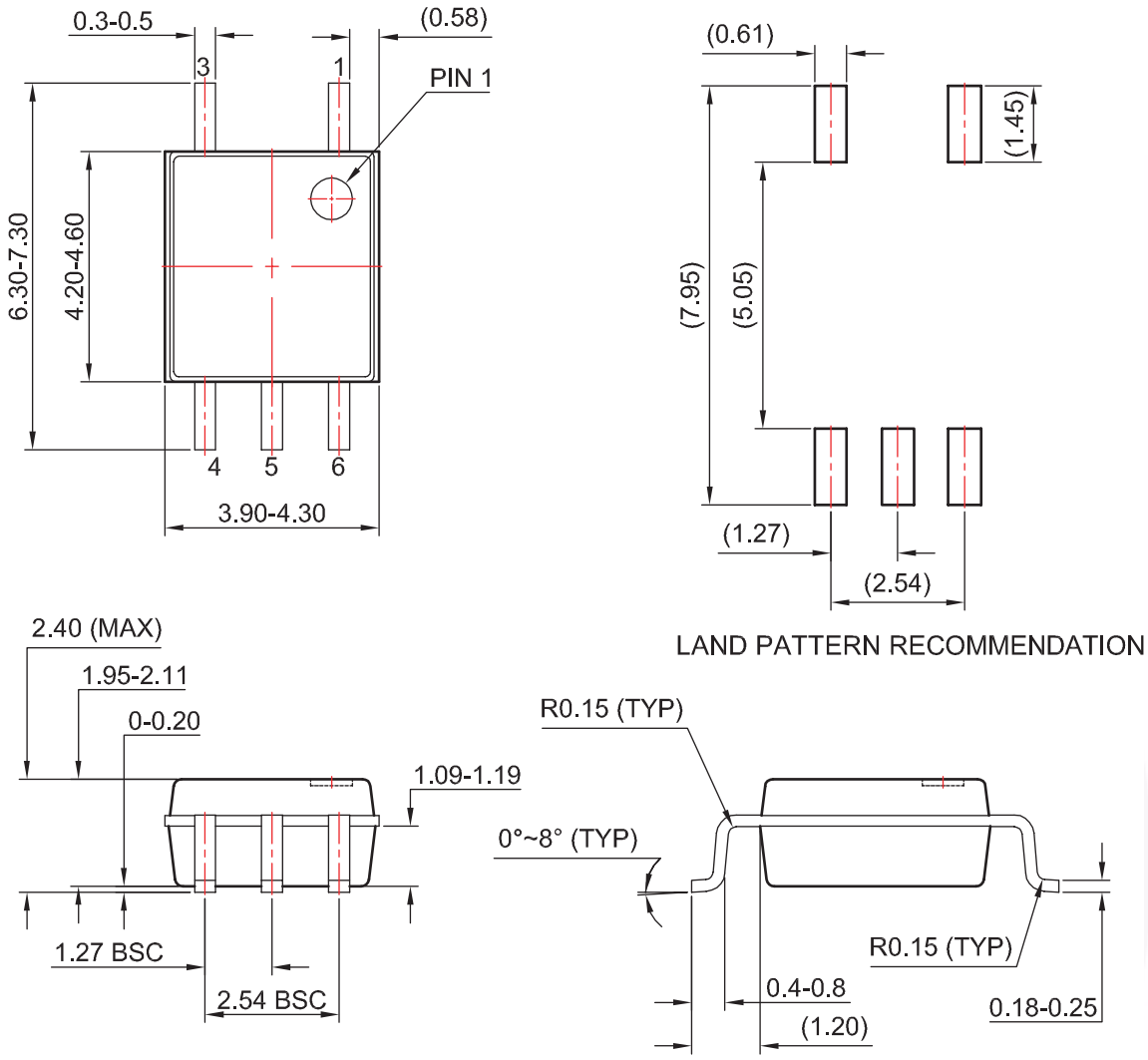


Fig. 10 Common Mode Immunity Test Circuit

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.

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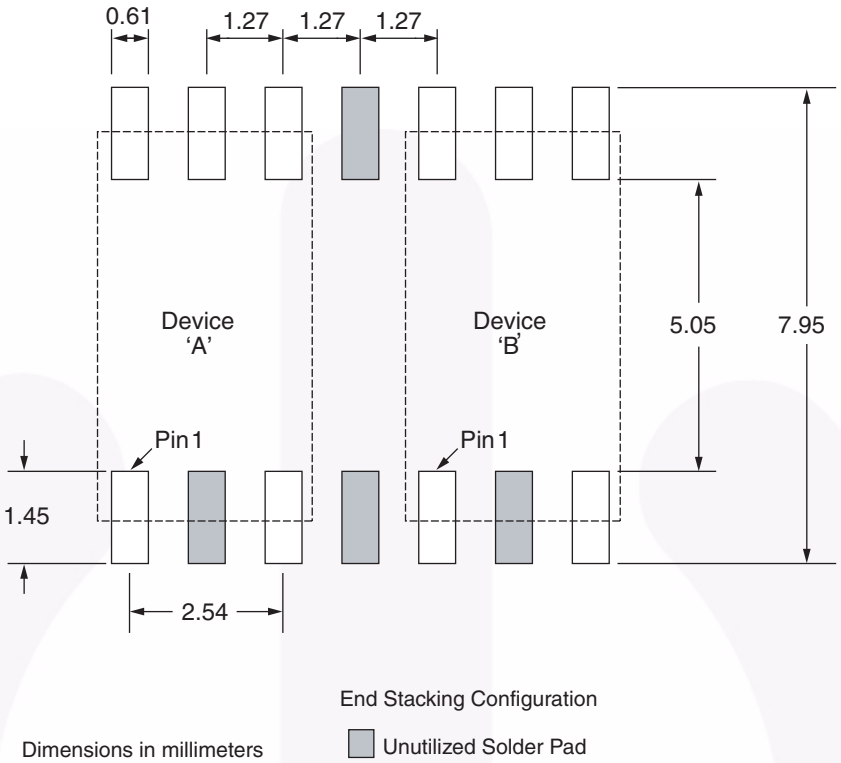
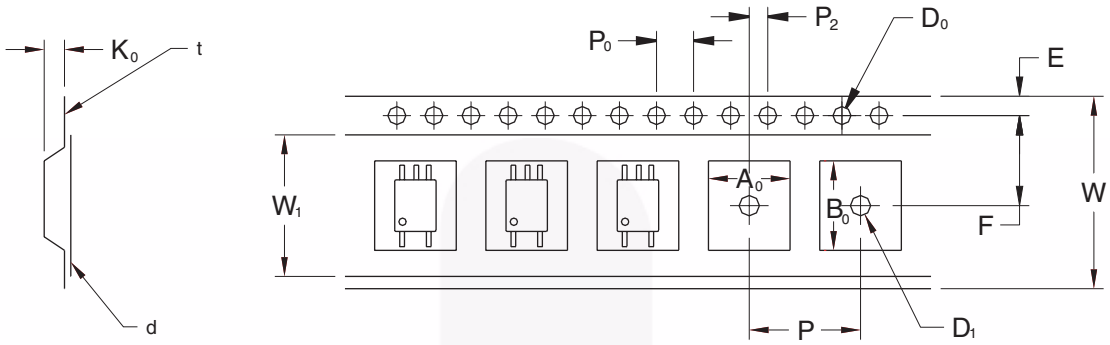
http://www.fairchildsemi.com/packaging/

Footprint Drawing for PCB Layout



Dimensions in millimeters

Tape and Reel Dimensions

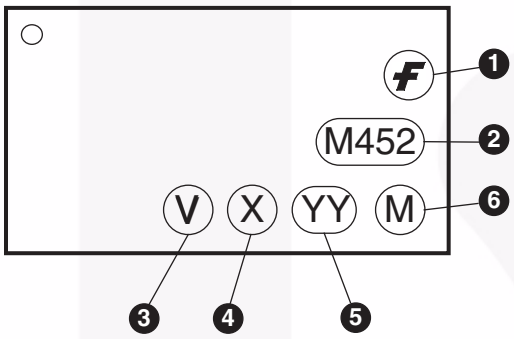


		2.54 Pitch
Description	**Symbol**	**Dimensions (mm)**
Tape Width	W	12.00 +0.30/-0.10
Tape Thickness	t	0.30 ±0.05
Sprocket Hole Pitch	P_0	4.00 ±0.10
Sprocket Hole Diameter	D_0	1.50 +0.10/-0.0
Sprocket Hole Location	E	1.75 ±0.10
Pocket Location	F	5.50 ±0.10
	P_2	2.00 ±0.10
Pocket Pitch	P	8.00 ±0.10
Pocket 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

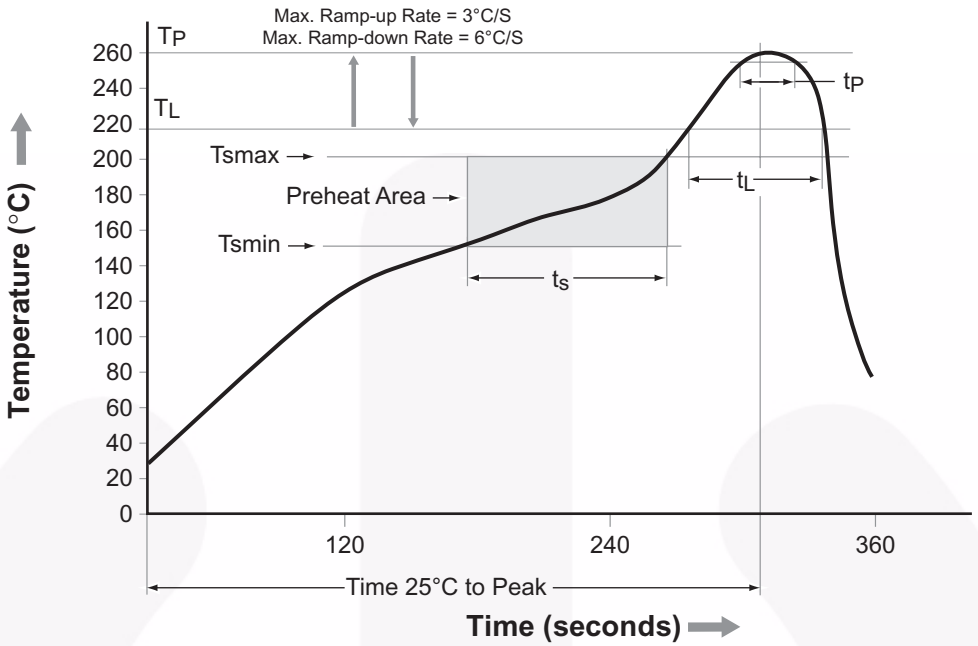
Option	Order Entry Identifier (example)	Description
R2	FODM452R2	Tape and Reel (2500 per reel)
V	FODM452V	IEC60747-5-2
R2V	FODM452R2V	IEC60747-5-2, Tape and Reel (2500 per reel)

Marking Information



Definitions	
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 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 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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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.

Rev. I49