MICROCOUPLER™

Low Profile Surface Mountable Optocoupler

FODB100 Sample Kit

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SEMICONDUCTOR®

Introduction

Over the last few decades, there has been an exponential growth in the semiconductor sector spawning new products and technologies. This trend has been recently stimulated by a driving force towards miniaturization, resulting in more compact applications and products being introduced into the industrial, consumer and communications markets. Integrated Circuits have been at the center of this transition, with optocouplers being of no exception.
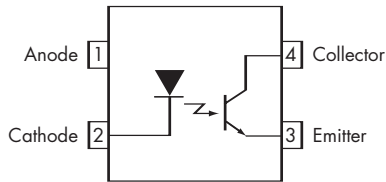

FODB100

MICROCOUPLER™ Package

Description

The FODB100 single channel MICRO-COUPLER is an all Pb-free, low profile miniature surface mount optocoupler in a Ball Grid Array (BGA) package. It consists of an aluminum gallium arsenide infrared emitting diode driving a silicon phototransistor.
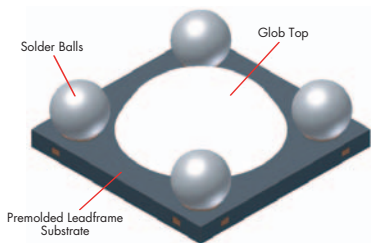

FODB100 Schematic

Features

- Low profile package (1.20mm maximum mounted height)
- Land pattern allows for optimum board space savings
- High Current Transfer Ratio (CTR) at low IF
- Minimum isolation distance of 0.45mm
- High steady state isolation voltage of $2500V_{rms}$
- Data rates up to 120Kbits/s (NRZ)
- Minimum creepage distance of 2mm
- Wide operating temperature range of -40°C to +125°C
- Available in tape and reel quantities of 3000 units
- Applicable to Pb-free infrared ray reflow (260°C max)
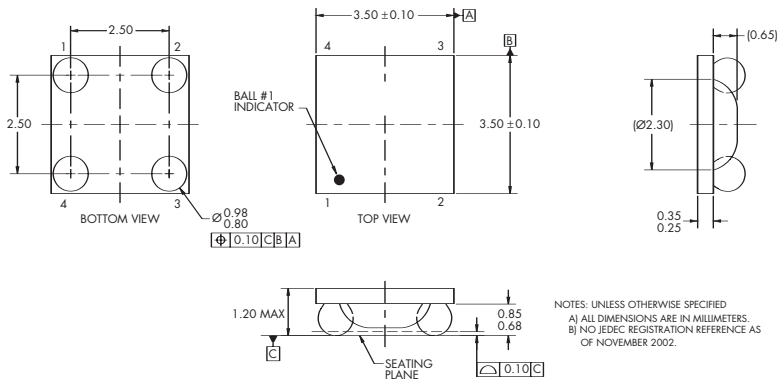- UL, VDE certifications pending.

Advantages

- Improved CTR performance over temperature
- Wide operating temperature range as compared to conventional optocouplers
- Owing to its low profile, small volume and footprint, this package can further save on board real estate giving hardware designers more flexibility and allowing for overall systems cost savings
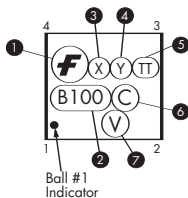- High IR reflow soldering capability in lead free environments.
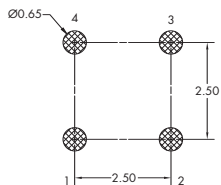
Package Information

Solder Balls

Glob Top

Premolded Leadframe Substrate

Package Dimensions

BOTTOM VIEW

2.50

2.50

1 2

4 3

$\varnothing$ 0.98 / 0.80

$\boxed{\oplus}$ 0.10 C B A

BALL #1 INDICATOR

TOP VIEW

3.50 ±0.10 A

4 3 B

1 2

3.50 ±0.10

(0.65)

($\varnothing$2.30)

0.35 / 0.25

1.20 MAX

SEATING PLANE

C

0.85 / 0.68

0.10 C

NOTES: UNLESS OTHERWISE SPECIFIED
A) ALL DIMENSIONS ARE IN MILLIMETERS.
B) NO JEDEC REGISTRATION REFERENCE AS OF NOVEMBER 2002.

Marking Information

Ball #1
Indicator

Definitions	
1	Fairchild logo
2	Device number (FODB100)
3	One digit year code e.g. "4" for 2004
4	6-week date code character
5	Die run code
6	Assembly package code
7	VDE 0884 approved (optional)

Recommended Land Pattern

Notes:
1. All dimensions in mm
2. It is recommended to use 6 mils of stencil thickness on PCB

Recommended Infrared Reflow Soldering Profile

Reflow Profile for Pb Free

	Convection Reflow
Average ramp-up rate (183°C to peak)	3°C/sec max
Preheat Temperature 125(±25)°C to 200°C	60-180°C
Temperature maintained above 220°C	60-150 sec
Time within 5°C of actual peak temperature	20-40 sec
Peak temperature range	260 ±5°C
Ramp down rate	6°C/sec max
Time 25°C to peak temperature	8 min max

Note: Surface Mount Adhesives (SMA) isn't recommended to be used on the dome area (white dome).

Electrical Specifications

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise specified)			
Parameters	**Symbol**	**Value**	**Units**
Total Package Storage Temperature	T_{STG}	-55 to +150	°C
Operating Temperature	T_{OPR}	-40 to +125	°C
Junction Temperature	T_j	130	°C
Emitter Continuous Forward Current	$I_{F (avg)}$	30	mA
Reverse Input Voltage	V_R	6	V
Power Dissipation	P_D	40	mW
Derate linearly (above 25°C)		0.6	mW/°C
Detector Continuous Collector Current		50	mA
Power Dissipation	P_D	150	mW
Derate linearly (above 25°C)		1.42	mW/°C
Collector-Emitter Voltage	V_{CEO}	75	V
Emitter-Collector Voltage	V_{ECO}	7	V

ELECTRICAL CHARACTERISTICS (T_A = 25°C)						
INDIVIDUAL COMPONENT CHARACTERISTICS						
Parameters	**Test Conditions**	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Emitter Forward Voltage	(I_F = 2mA)	V_F	1.0		1.5	V
Reverse Current	(V_R = 6V)	I_R			10	µA
Detector Breakdown Voltage Collector to Emitter	(I_C = 100mA, I_F = 0)	BV_{CEO}	75			V
Emitter to Collector	(I_E = 100µA, $_F$ = 0)	BV_{ECO}	7			
Collector Dark Current	(V_{CE} = 75V, I_F = 0)	I_{CEO}			100	nA
Capacitance	(V_{CE} = 0V, f = 1MHz)	C_{CE}		8		pF

Electrical Specifications

TRANSFER CHARACTERISTICS $(T_A = 25°C)$

Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
Current Transfer Ratio[1]	$(I_F = 1\ mA, V_{CE} = 5V)$	CTR	100			%
Saturated Current Transfer Ratio (Collector to Emitter)	$(I_F = 1.6mA, V_{CE} = 0.4V)$	$CTR_{CE(SAT)}$	100			%
	$(I_F = 1.0mA, V_{CE} = 0.4V)$		75			
Saturation Voltage	$(I_F = 3.0mA, I_C = 1.8mA)$ $(I_F = 1.6mA, I_C = 1.6mA)$	$V_{CE(SAT)}$			0.4	V
Rise Time (Non-Saturated)	$(I_C = 2mA, V_{CE} = 5V)$ $(R_L = 1K\ )$	t_r		1		μs
Fall Time (Non-Saturated)	$(I_C = 2mA, V_{CE} = 5V)$ $(R_L = 1K)$	t_f		5		
Propagation Delay High to Low	$I_F = 1.6mA, V_{CC} = 5.0V$ $R_L = 750$	T_{PHL}		3		μs
	$I_F = 1.6mA, V_{CC} = 5.0V$ $R_L = 4.7K$			12		
Propagation Delay Low to High	$I_F = 1.6mA, V_{CC} = 5.0V$ $R_L = 750$	T_{PLH}		5		μs
	$I_F = 1.6mA, V_{CC} = 5.0V$ $R_L = 4.7K$			19		

ISOLATION CHARACTERISTICS

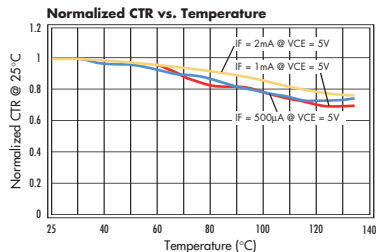| Characteristic	Test Conditions	Symbol	Min	Typ	Max	Unit
Steady State Isolation Voltage[2]	$(RH \le 50\%,$ $T_A = 25°C, t = 1\ sec)$	V_{ISO}	2500			V(rms)
Resistance (input to output)[2]	$(V_{I-O} = 500\ VDC)$	R_{ISO}	10^{12}			
Capacitance (input to output)[2]	$f = 1MHz$	C_{ISO}		0.3	0.5	pF

Notes:
1. CTR bin (FODB100 only)
   FODB101: 100% – 200%
   FODB102: 150% – 300%
2. Pin 1 and Pin 2 are shorted as input and Pin 3 and Pin 4 are shorted as output.
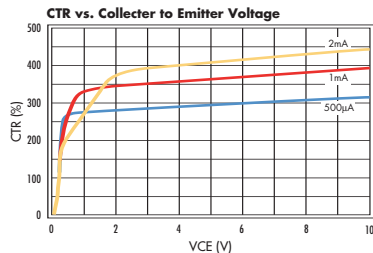
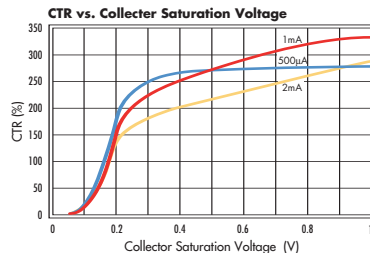# Typical Characteristic Curves

Normalized CTR at Vce = 2V

Normalized CTR vs. Temperature

Normalized CTR @ 25°C

IF = 2mA @ VCE = 2V
IF = 1mA @ VCE = 2V
IF = 500µA @ VCE = 2V

Temperature (°C)

Normalized CTR at V_{ce} = 5V

Normalized CTR vs. Temperature

Normalized CTR @ 25°C

IF = 2mA @ VCE = 5V
IF = 1mA @ VCE = 5V
IF = 500µA @ VCE = 5V

Temperature (°C)

CTR vs. V_{ce}

CTR vs. Collecter to Emitter Voltage

CTR (%)

2mA
1mA
500µA

VCE (V)

CTR vs. $V_{ce(SAT)}$

CTR vs. Collecter Saturation Voltage

CTR (%)

1mA
500µA
2mA

Collector Saturation Voltage (V)

Applications, Markets, Safety Approvals

Primary Application:

Feedback loop switch mode power supply

Secondary Application:

Ground loop isolation and signal to noise isolation

Target Markets:

- Communications – chargers, adapters
- Consumer – appliances, set top boxes
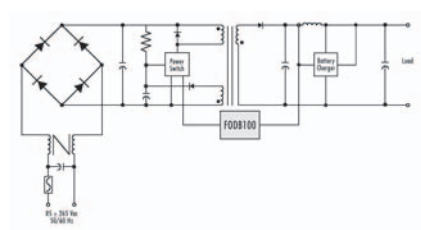- Industrial – power supplies, motor control

Safety Agency Approvals:

UL and VDE certifications pending
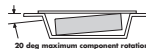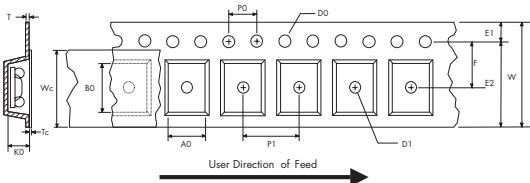
Application Schematic Diagrams:
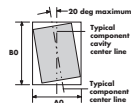
DC to DC Converter

AC to DC Battery Charger
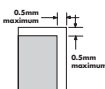
Tape and Reel Specifications

Optocoupler Embossed Carrier Tape Configuration

User Direction of Feed

Sketch A (Side or Front Sectional View)
Component Rotation
20 deg maximum component rotation

Sketch B (Top View)
Component Rotation
20 deg maximum

Sketch C (Top View)
Component lateral movement
0.5mm maximum

Dimensions are in millimeters													
Pkg Type	A0	B0	W	D0	D1	E1	E2	F	P1	P0	K0	T	Wc	Tc
Optocoupler (12mm)	3.80 ±0.10	3.80 ±0.10	12.0 +0.3/ -0.1	1.50 +0.25/ - 0.00	1.50 +0.25/ - 0.00	1.75 ±0.10	10.25 min	5.50 ±0.05	8.0 ±0.1	4.0 ±0.1	1.40 ±0.10	0.279 ±0.02	0.2 ±0.3	0.06 ±0.02

Note: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C.)
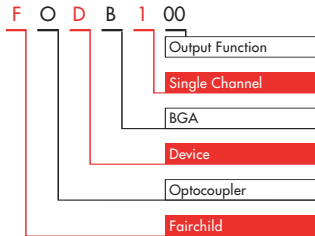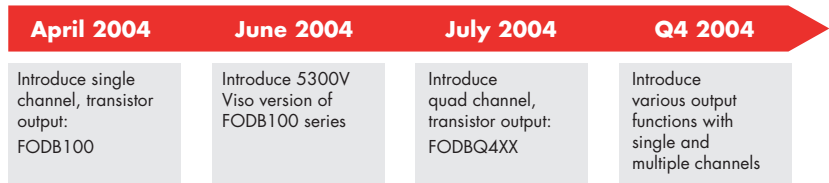
Optocoupler Reel Configuration

W1 Measured at Hub
Dim N
See Detail AA
W3
W2 Max Measured at Hub
13" Diameter Reel
Dim A Max

B Min
Dim C
Dim D Min
Detail AA

Dimensions are in inches and millimeters								
Tape Size	Reel Option	Dim A	Dim B	Dim C	Dim D	Dim N	Dim W1	Dim W2	Dim W3 (LSL-USL)
12mm	13" Dia	13.00 330	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	7.00 178	0.488 +0.078/-0.000 12.4 +2/-0	0.724 18.4	0.469 – 0.606 11.9 – 15.4

Ordering Information

FODB100

```
F   O   D   B   1   00
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	Output Function
	Single Channel
	BGA
	Device
	Optocoupler
	Fairchild

Roadmap

April 2004	June 2004	July 2004	Q4 2004
Introduce single channel, transistor output: FODB100	Introduce 5300V Viso version of FODB100 series	Introduce quad channel, transistor output: FODBQ4XX	Introduce various output functions with single and multiple channels

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