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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FOD2712A
Optically Isolated Error Amplifier

Features

- Optocoupler, precision reference and error amplifier in single package

Pin Definitions

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 +85	°C
	Reflow Temperature Profile (refer to 15)		
V_{LED}	Input Voltage	13.2	V
I_{LED}	Input DC Current	20	mA
V_{CEO}	Collector-Emitter Voltage	30	V
V_{ECO}	Emitter-Collector Voltage	7	V
I_C	Collector Current	50	mA
PD1	Input Power Dissipation(1)	145	mW
PD2	Transistor Power Dissipation(2)	85	mW
PD3	Total Power Dissipation(3)	145	mW

Notes:

1. Derate linearly from 25°C at a rate of 2.42mW/°C
2. Derate linearly from 25°C at a rate of 1.42mW/°C.
3. Derate linearly from 25°C at a rate of 2.42mW/°C.

Electrical Characteristics (V_{CC} = 12V, T_A = 25°C unless otherwise specified)

Input Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	LED Forward Voltage	I_{LED} = 10mA, $V_{COMP} = V_{FB}$ (Fig.1)			1.5	V
V_{REF}	Reference Voltage	$V_{COMP} = V_{FB}$, I_{LED} = 10mA (Fig.1)				
	-40°C to +85°C		1.221		1.259	V
	25°C		1.228	1.240	1.252	
$V_{REF\ (DEV)}$	Deviation of V_{REF} over temperature See Note 1	T_A = -40 to +85°C		4	12	mV
$\frac{\Delta V_{REF}}{\Delta V_{COMP}}$	Ratio of Vref Variation to the Output of the Error Amplifier	I_{LED} = 10 mA, $V_{COMP} = V_{REF}$ to 12V (Fig. 2)		-1.5	-2.7	mV/V
I_{REF}	Feedback Input Current	I_{LED} = 10mA, R1 = 10kΩ (Fig. 3)		0.15	0.5	µA
$I_{REF\ (DEV)}$	Deviation of I_{REF} Over Temperature See Note 1	T_A = -40 to +85°C		0.15	0.3	µA
$I_{LED\ (MIN)}$	Minimum Drive Current	$V_{COMP} = V_{FB}$ (Fig.1)		55	80	µA
$I_{(OFF)}$	Off-state Error Amplifier Current	V_{LED} = 6V, V_{FB} = 0 (Fig.4)		0.001	0.1	µA
$\lvert Z_{OUT}\rvert$	Error Amplifier Output Impedance See Note 2	$V_{COMP} = V_{FB}$, I_{LED} = 0.1mA to 15mA, f < 1kHZ		0.25		Ω

Notes:

1. The deviation parameters $V_{REF(DEV)}$ and $I_{REF(DEV)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage, ΔV_{REF}, is defined as:

$$\lvert\Delta V_{REF}\rvert(\text{ppm/°C}) = \frac{\{V_{REF(DEV)}/V_{REF}(T_A = 25°C)\} \times 10^6}{\Delta T_A}$$

   where ΔT_A is the rated operating free-air temperature range of the device.

2. The dynamic impedance is defined as $|Z_{OUT}| = \Delta V_{COMP}/\Delta I_{LED}$. When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:

$$\lvert Z_{OUT,\ TOT}\rvert = \frac{\Delta V}{\Delta I} \approx \lvert Z_{OUT}\rvert \times \left[1 + \frac{R1}{R2}\right]$$

Electrical Characteristics (V_{CC} = 12V, T_A = 25°C unless otherwise specified) (Continued)

Output Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector Dark Current	V_{CE} = 10V (Fig. 5)			50	nA
BV_{CEO}	Collector-Emitter Voltage Breakdown	I_C = 1.0mA	70			V
BV_{ECO}	Emitter-Collector Voltage Breakdown	I_E = 100µA	7			V

Transfer Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
CTR	Current Transfer Ratio	I_{LED} = 10mA, $V_{COMP} = V_{FB}$, V_{CE} = 5V (Fig. 6)	100		200	%
$V_{CE\ (SAT)}$	Collector-Emitter Saturation Voltage	I_{LED} = 10mA, $V_{COMP} = V_{FB}$, I_C = 2.5mA (Fig. 6)			0.4	V

Isolation Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{I-O}	Input-Output Insulation Leakage Current	RH = 45%, T_A = 25°C, t = 5s, V_{I-O} = 3000 VDC (Note 1)			1.0	µA
V_{ISO}	Withstand Insulation Voltage	RH ≤ 50%, T_A = 25°C, t = 1 min. (Note 1)	2500			Vrms
R_{I-O}	Resistance (Input to Output)	V_{I-O} = 500 VDC (Note 1)		10^{12}		Ω

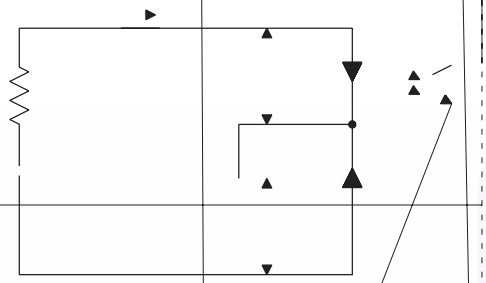
Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
B_W	Bandwidth	Fig. 7		10		kHz
$\|CMH\|$	Common Mode Transient Immunity at Output HIGH	I_{LED} = 0mA, $\|V_{cm}\|$ = 10 V_{PP} RL = 2.2kΩ (Fig. 8) (Note 2)		1.0		kV/µs
$\|CML\|$	Common Mode Transient Immunity at Output LOW	I_{LED} = 10mA, $\|V_{cm}\|$ = 10 V_{PP} RL = 2.2kΩ (Fig. 8) (Note 2)		1.0		kV/µs

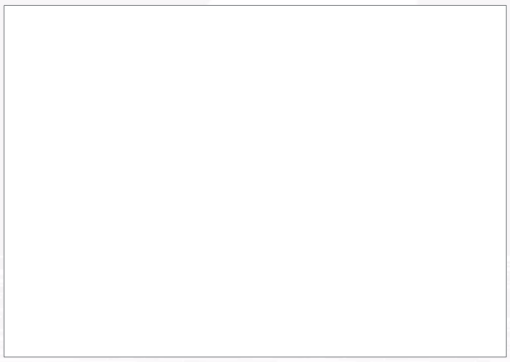
Notes:

1. Device is considered as a two terminal device: Pins 1, 2, 3 and 4 are shorted together and Pins 5, 6, 7 and 8 are shorted together.
2. 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.

Test Circuits



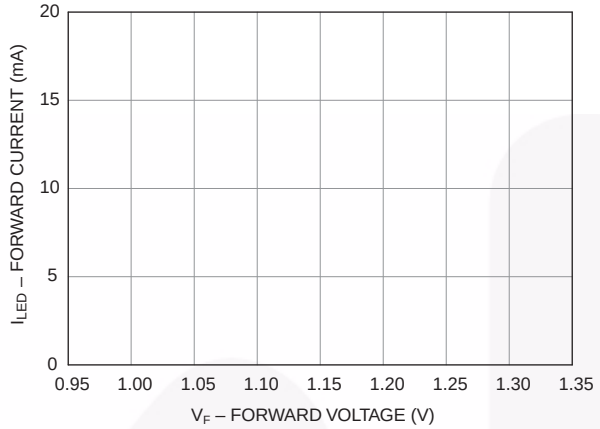
Typical Performance Curves



IREF – REFERENCE CURRENT (nA)

Typical Performance Curves (Continued)

Fig.13 LED Forward Current vs. Forward Voltage



Typical Performance Curves (Continued)

Fig. 18 Collector Current vs. Collector Voltage

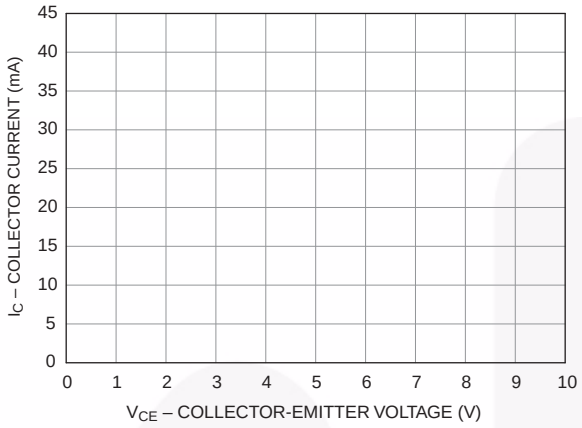


Fig. 19 Delta V_{REF}/Delta V_{COMP}

The FOD2712A

The FOD2712A is an optically isolated error amplifier. It incorporates three of the most common elements necessary to make an isolated power supply, a reference voltage, an error amplifier, and an optocoupler. It is functionally equivalent to the popular AZ431L shunt voltage regulator plus the CNY17F-3 optocoupler.

Powering the Secondary Side

The LED pin in the FOD2712A powers the secondary side, and in particular provides the current to run the LED. The actual structure of the FOD2712A dictates the minimum voltage that can be applied to the LED pin: The error amplifier output has a minimum of the reference voltage, and the LED is in series with that. Minimum voltage applied to the LED pin is thus 1.24V + 1.5V = 2.74V. This voltage can be generated either directly from the output of the converter, or else from a slaved secondary winding. The secondary winding will not affect regulation, as the input to the FB pin may still be taken from the output winding.

The LED pin needs to be fed through a current limiting resistor. The value of the resistor sets the amount of current through the LED, and thus must be carefully selected in conjunction with the selection of the primary side resistor.

Feedback

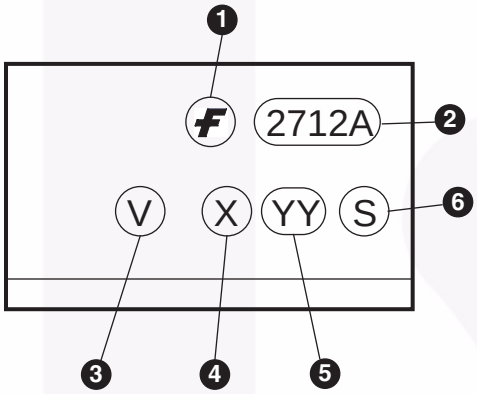
Output voltage of a converter is determined by selecting a resistor divider from the regulated output to the FB pin. The FOD2712A attempts to regulate its FB pin to the reference voltage, 1.24V. The ratio of the two resistors should thus be:

The absolute value of the top resistor is set by the input offset current of 0.8µA. To achieve 1% accuracy, the resistance of R_{TOP} should be:

Ordering Information

Option	Example Part Number	Description
V	FOD2712AV	VDE 0884
R2	FOD2712AR2	Tape and reel (2500 units per reel)
R2V	FOD2712AR2V	VDE 0884, Tape and reel (2500 units per reel)

Marking Information

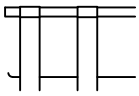


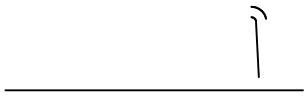
Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., ‘3’
5	Two digit work week ranging from ‘01’ to ‘53’
6	Assembly package code

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	

SEE DETAIL A





NOTES:

A) NO STANDARD APPLIES TO THIS PACKAGE