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SFT-9400B

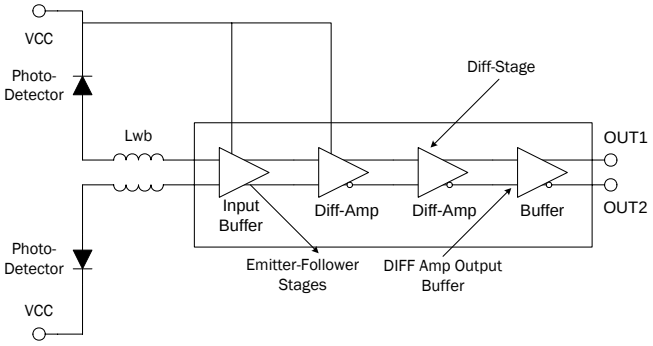
60GHz DIFFERENTIAL INPUT TRANSIMPEDANCE AMPLIFIER

Product Description

RFMD's SFT-9400B is a high performance heterojunction bipolar transistor transimpedance amplifier designed for 43Gb/s SONET/SDH, 40GbE, and 100GbE phase modulation and multiple diode detector applications. The SFT-9400B uses high performance Indium Phosphide device technology that delivers high transimpedance, large dynamic range, and a >50GHz bandwidth. Performance is enhanced through the use of a patented circuit topology that reduces duty cycle distortion under high photocurrent conditions and allows high transimpedance with low DC power to be realized. The SFT-9400B is supplied in bare die form.

Optimum Technology Matching® Applied

- ☐ GaAs HBT
- ☐ GaAs MESFET
- ☐ InGaP HBT
- ☐ SiGe BiCMOS
- ☐ Si BiCMOS
- ☐ SiGe HBT
- ☐ GaAs pHEMT
- ☐ Si CMOS
- ☐ Si BJT
- ☐ GaN HEMT
- ☑ InP HBT
- ☐ RF MEMS
- ☐ LDMOS



Features

- Low Noise InP HBT Technology
- Differential Input and Output TIA
- >50GHz S21 Bandwidth
- 32dB Differential S21 Gain
- +3.3V_{DC} Power Supply
- Low Duty Cycle Distortion
- Offset Adjustment
- Adjustable Dynamic Range
- Offset Override™ Circuit
- 90mA Low I_{CC} (Typical)

Applications

- OC-768 Optical Receivers
- 40DPSK Optical Receivers
- 100GbE Optical Receivers
- 40Gbps_100Gbps Transponders

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Electrical Specifications					
S21 Bandwidth		>50		GHz	3dB
Differential Transimpedance		2000		Ω	C_{PD}=50fF, R_D=15Ω
Transimpedance Bandwidth (3dB)		>50		GHz	C_{PAR}=15fF, L_{INT}=0.15nH
Gain		32		dB	Differential, 100Ω In/Out
Gain Ripple		1.0	3.0	dB	Differential, 100Ω In/Out
S21 3dB Bandwidth		>50		GHz	Differential, 100Ω In/Out
Group Delay Deviation		10		ps p-p	Differential, 100Ω In/Out, 30kHz-F_C
Optical Sensitivity		-15(2)		dBm	Assuming 0.9A/W responsivity, measured at 10^{-12} BER with 2^{31}-1
Differential Overload Current		7		mA_{P-P}	Assuming 0.9A/W responsivity, measured at 10^{-12} BER with PRBS 2^{31}-1
Input Referred Noise Per Input		15 (1)		pA/sqrt (Hz)	F=50GHz
Maximum Output Voltage Swing	250	400	500	mV_{P-P}	Differential, 100Ω In/Out
Input DC Voltage		0.8		V	
Output DC Voltage		3.05		V	50Ω termination to V_{CC}
Input and Output Return Loss	-10			dB	Differential, 100Ω In/Out
Supply Voltage	3.15	3.30	3.45	V	
Supply Current		90	100	mA	V_{CC}=3.3V, V_{CC2}=3.3V, total current
Power Dissipation		297	330	mW	

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Current (I_{CC})	110	mA
Device Supply Voltage (V_{CC})	+3.5	V_{DC}
Voltage Difference (V_{CC}-V_{CC2})	0.3	V_{DC}
Optical Input Power	4	mV_{P-P}
Operating Junction Temperature (T_J)	+125	°C
Storage Temperature Range (T_S)	-40 to +150	°C

Caution! ESD sensitive device.

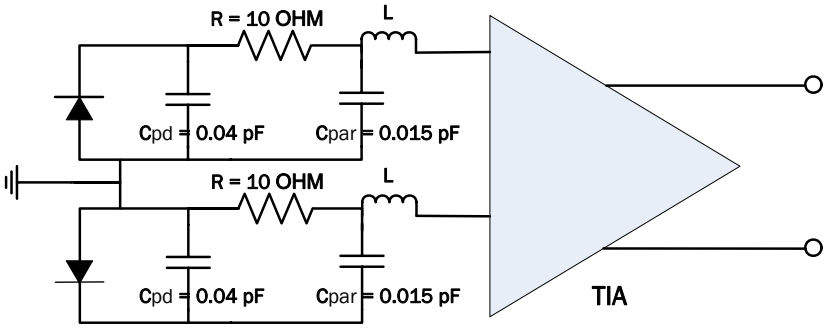
Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EUDirective2002/95/EC (at time of this document revision).

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Electrical Specifications, cont.					
Photodiode Current Monitor		Yes			
Dynamic Range Adjust		Yes			

Notes:
1. Measured value.
2. Calculated from input noise current density.

Model Used For Transimpedance Calculation



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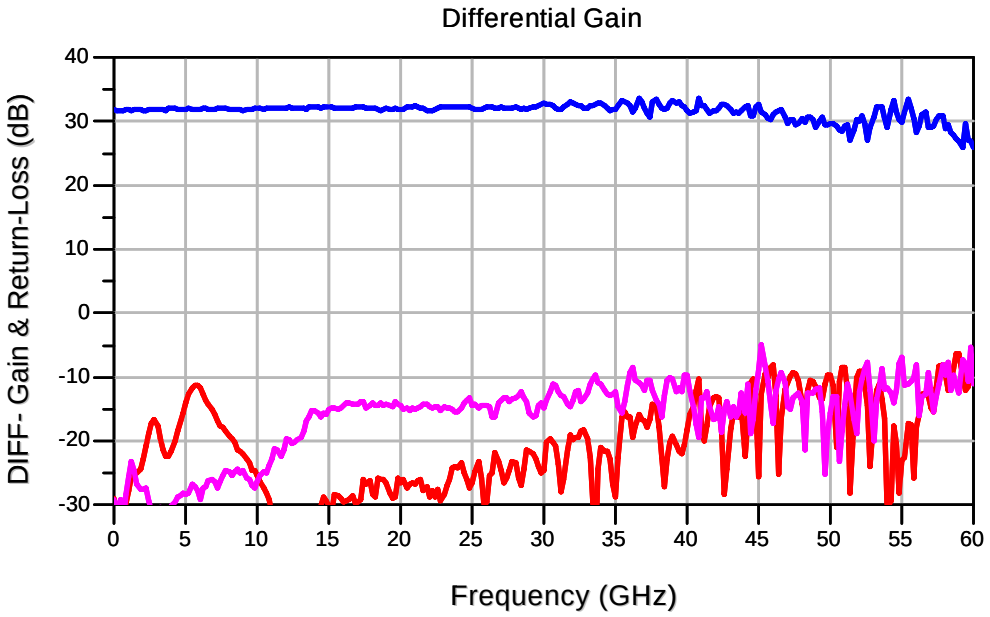
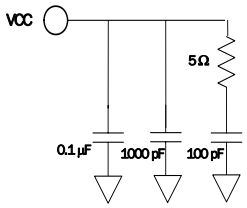
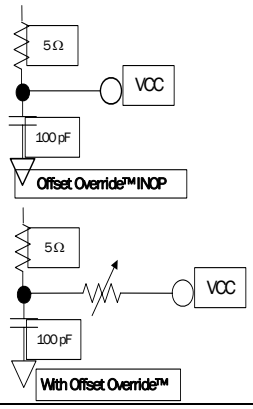
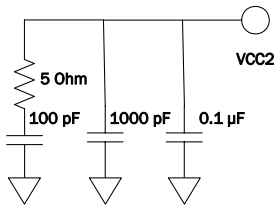
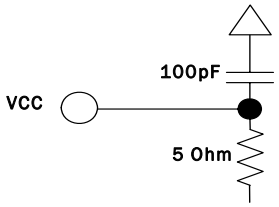
DIFF - Gain and Return Loss (dB)



Note: All electrical measurements performed using diode probe station.

Pin	Function	Description	Interface Schematic
1	GND	Ground connection. Keep ribbon or bond wire connections physically short and connect immediately to ground plane for best performance.	
2	INN	Input voltage, NEGATIVE. Connect to optical photo detector (PD) output. Keep ribbon or bond wire connection physically short.	
3	GND	Ground connection. Keep ribbon or bond wire connection physically short and connect immediately to ground plane for best performance.	
4	INP	Input voltage, POSITIVE. Connect to optical photo detector (PD) output. Keep ribbon or bond wire connection physically short.	
5	GND	Ground connection. Keep ribbon or bond wire connections physically short and connect immediately to ground plane for best performance.	
6	VCC	Power supply input for Input Buffer & input Differential Amplifier. Separate power supply connection to this pad and to the V_{CC2} pad is required. Bypass with decoupling capacitor. V_{CC} and V_{CC2} should be powered up together and should not differ in input voltage level by more than $0.3V_{DC}$. Refer to the Application Circuit for connection details. 5Ω resistor is optional but recommended for best performance.	
7	T2	Tap point 2. Used for manual or automatic offset voltage override (Offset Override™). T1 and T2 can receive an input voltage between $+1.5V_{DC}$ and V_{CC} to aid in balancing the optical receive circuit. Either T1 or T2 can be set with a fixed input voltage between $+1.5V_{DC}$ and V_{CC}, with the other tap point input voltage adjusted to achieve a combination of improved gain flatness and reduced jitter (improved eye diagram definition & opening). A bypass capacitor connected to ground is required. 5Ω resistor is optional but recommended for best performance. Refer to the Application Circuit "A" for connection details with Offset Override™ operational. If offset voltage override is not employed, T1 and T2 are connected to V_{CC} as shown in Application Circuit "B".	
8	GND	Ground connection. Keep ribbon or bond wire connection physically short and connect immediately to ground plane for best performance.	
9	GND	Ground connection. Keep ribbon or bond wire connections physically short and connect immediately to ground plane for best performance.	
10	OUTP	Output, POSITIVE.	
11	GND	Ground connection. Keep ribbon or bond wire connection physically short and connect immediately to ground plane for best performance.	
12	OUTN	Output, NEGATIVE.	
13	GND	Ground connection. Keep ribbon or bond wire connections physically short and connect immediately to ground plane for best performance.	
14	VCC2	Power supply input for output Differential Amplifier. Separate power supply connection to this pad and to the V_{CC2} pad is required. Bypass with decoupling capacitor. V_{CC} and V_{CC2} should be powered up together and should not differ in input voltage level by more than $0.3V_{DC}$. Refer to the Application Circuit for connection details. 5Ω resistor is optional but recommended for best performance.	
15	T1	Tap point 1. Used for manual or automatic offset voltage override (Offset Override™). T1 and T2 can receive an input voltage between $+1.5V_{DC}$ and V_{CC} to aid in balancing the optical receive circuit. Either T1 or T2 can be set with a fixed input voltage between $+1.5V_{DC}$ and V_{CC}, with the other tap point input voltage adjusted to achieve a combination of improved gain flatness and reduced jitter (improved eye diagram definition & opening). A bypass capacitor connected to ground is required. 5Ω resistor is optional but recommended for best performance. Refer to the Application Circuit "A" for connection details with Offset Override™ operational. If offset voltage override is not employed, T1 and T2 are connected to V_{CC} as shown in Application Circuit "B".	
16	GND	Ground connection. Keep ribbon or bond wire connection physically short and connect immediately to ground plane for best performance.	

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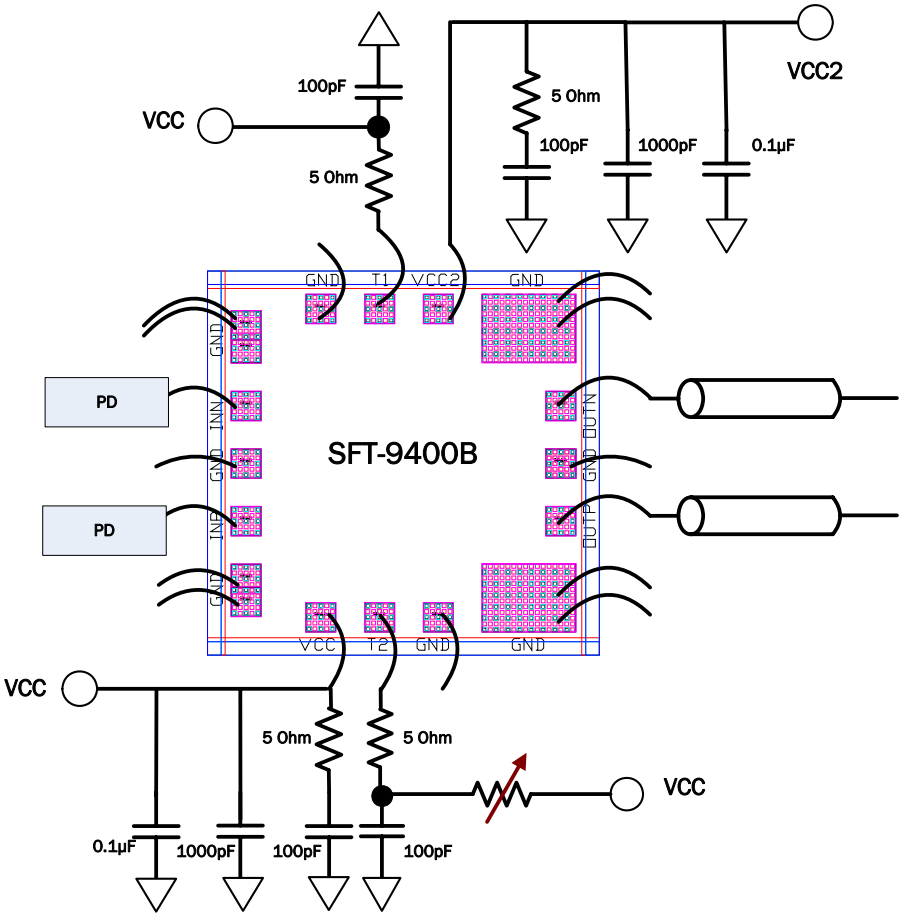
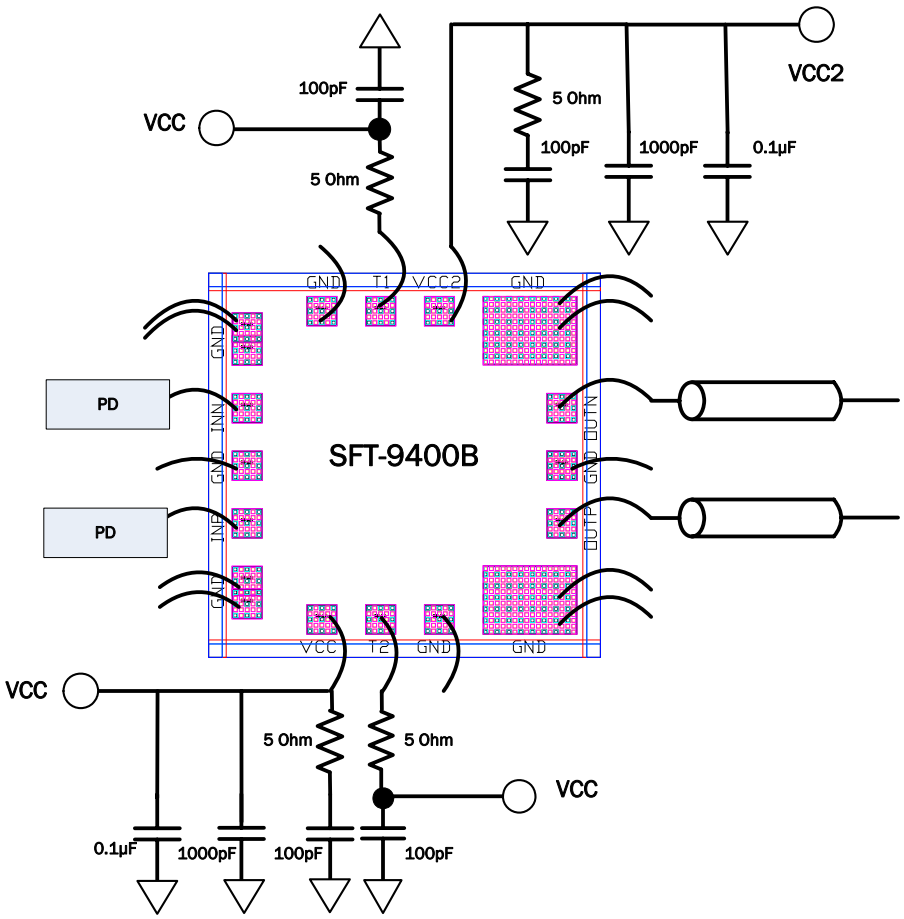
Application Circuit "A"



Application Circuit "B"



Pad Name	Size	Pad Center	
		X Coordinate	Y Coordinate
GND	100umx310um	111	232
INN	75umx75um	98.5	650
GND	75umx75um	98.5	500
INP	75umx75um	98.5	350
GND	75umx75um	289	901
T1	75umx75um	439	901
VCC2	75umx75um	589	901
GND	237umx176um	820	850
OUTN	75umx75um	901	650
GND	75umx75um	901	500
OUTP	75umx75um	901	350
GND	237umx176um	820	149
GND	75umx75um	589	98
T2	75umx75um	439	98
VCC	75umx75um	289	98

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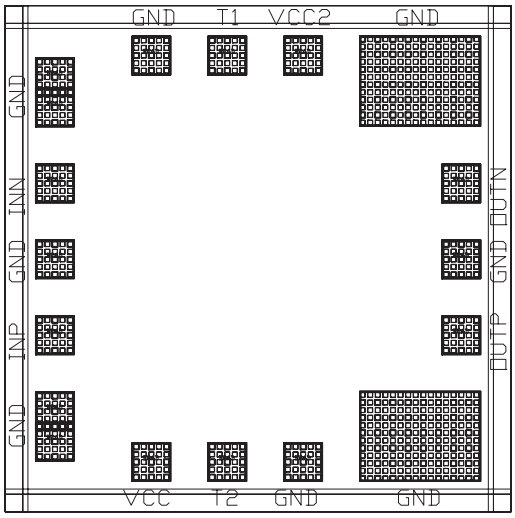

Pad Diagram

Description of External Connections and How They Operate

V_{CC}_V_{CC2}:
Separate DC power supply connections are required for the input and output stages of the TIA. Each power supply should be bypassed separately with decoupling capacitors. A parallel network of 100pF, 1000pF, and 0.1µF capacitors is recommended. VCC and VCC2 should be powered up together and should not differ by more than 0.3V_{DC} applied.

CV_{CC}:
An off die bypass capacitor is required. Ribbon or wirebond length is critical and should be minimized.

T1 and T2:
Tap points 1 and 2. Used for manual or automatic offset voltage override. T1 and T2 can receive an input voltage between +1.5V_{DC} and V_{CC} to aid in balancing the optical receive circuit. Either T1 or T2 can be set with a fixed input voltage between +1.5V_{DC} and V_{CC}, with the other tap point input voltage adjusted to achieve a combination of improved gain flatness and reduced jitter (improved eye diagram definition & opening). A bypass capacitor connected to ground is required if T1 & T2 function is used. 5Ω resistor is optional but recommended for best performance. Refer to the Application Circuit for connection details. If offset voltage override is not employed leave T1 & T2 open with no connection.

Representative GelPak with Label

Ordering Information

Part Number	Description	Delivery Method	Die/Gelpak
SFT9400B	60GHz TIA, 1mmx1mm die	GelPak	1 or more
SFT9400BSB	Sample Bag, 60GHz TIA	GelPak	3
SFT9400BSR	Sample Reel, 60GHz TIA	GelPak	100
SFT9400BMECH	Mechanical Sample, 60GHz TIA	GelPak	1 or more
SFT9400BMS	Mechanical Sample Bag, 60GHz TIA	GelPak	3

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