

High Precision Silicon Photonic AFE with 4 IDACs, 12 VDACS and Multi-channel ADC

Features

- 4-channel 12-bit current output DACs (IBIAS)
 - High current output capability, 245-mA / 350-mA full scale range
 - Low headroom voltage, less than 150-mV while 350-mA output current
 - Power supply (PVDD) from 0.5 V to 2.5 V
 - EN_IBIAS pin fast shutdown
- 12-channel 12-bit voltage output DACs (Heater Bias)
 - Programable full-scale output range: 0 to 2.5 V, 0 to 5 V
 - 60 mA current source and sink capability
 - Power supply (VDRIVE) from 2.7 V to 5.5 V, VDRIVE voltage level can be higher than VDD
 - Support different voltage levels between VDRIVE0 and VDRIVE1
- Rich and Flexible system monitor and measurement resource
 - Integrated 12-bit, 500 kSPS SAR ADC core
 - Up to 21-channel multi-IOs, use for mPD and RSSI
 - DAC signal readback: IBIAS voltage, Heater bias voltage and GDAC voltage
 - System voltage monitor: VDD, VIO, PVDD, VDRIVE
 - Integrated current mirror, support source mode and sink mode, with configurable gain $\times 1$ or $\times 3$
 - Internal common pull-down resistors, value from 250 Ω to 16k Ω
 - Support external ADC mode
 - Over temperature alarm and IBIAS short-circuit alarm
- 4-channel 12-bit general purpose voltage output DACs (GDAC)
 - Programable full-scale output range: 0 to 2.5 V, 0 to 5 V
 - 10 mA current source and sink capability
- 4-channel analog comparator with DAC on negative input (reuse from GDAC)
 - Adjustable hysteresis voltage: 0 to 150 mV
 - Assert loss of signal (LOS) within 1 μ s
- Digital interface: Compatible with both I²C and SPI
- Temperature range: -40 °C to +125°C
- Package: WLCSP 3.50 \times 3.53 - 56

Applications

- 800G and 1.6T silicon photonics module

Description

The TPAFE003A is a highly integrated controller and monitor optimized for silicon photonics module.

The TPAFE003A include four 12-bit current output DACs (IBIAS), twelve 12-bit voltage output DACs (Heater Bias), up to 21 channels multi-IO and a 12-bit, 500-kSPS ADC. The TPAFE003A also include four 12-bit general purpose DACs (GDAC) and four analog comparators.

The IBIAS in TPAFE003A support a full-scale output range of 350mA per channel, and support using in multi-channel parallel mode, providing sufficient bias current for the lasers of silicon photonic modules. The IBIAS power supply voltage pin supports a voltage range of 0.5 V to 2.5 V, and the power supply voltage drop from PVDD to IBIAS pin can be as low as 150mV under 350mA output. For lasers of different specifications, it can achieve very high system efficiency and excellent temperature performance. The IBIAS is also capable of fast shutting down by external hardware pins EN_IBIAS 0 to 3.

The Heater Bias in TPAFE003A provides both current source and sink capability, with a maximum current of ± 60 mA per channel, make it suitable for DC bias of Mach-Zehnder modulators (MZM). Additionally, the power supply of Heater Bias, VDRIVE0 and VDRIVE1, are not limited by VDD, and VDRIVE0 and VDRIVE1 can be different from each other.

The ADC in TPAFE003A is a 500 kSPS SAR ADC with up to 21 channels. Which can be used as current measurement of monitor photodiode (mPD), received signal strength indicator (RSSI) or other voltage or current monitoring. The equal current measurement full scale range is from 50 μ A to 10 mA. Most of the ADC channels include current mirrors with a 1 : 1 or 1 : 3 current ratio. The current mirror eliminates the need for external pull-down resistors for the mPD and support both common cathode and common anode topologies. The ADC also provides 16 channels software alarm with programable threshold. Besides, the TPAFE003A also support external ADC measurement.

The analog comparators in TPAFE003A is for the fast loss of signal (LOS) report, and the GDACs can be use as either comparator reference inputs or general purpose DAC outputs.

The TPAFE003A is featured with small size and high integration, wide supply range and operating temperature range, which make the device an excellent choice for high speed silicon-photonics modules.

Typical Application Circuit

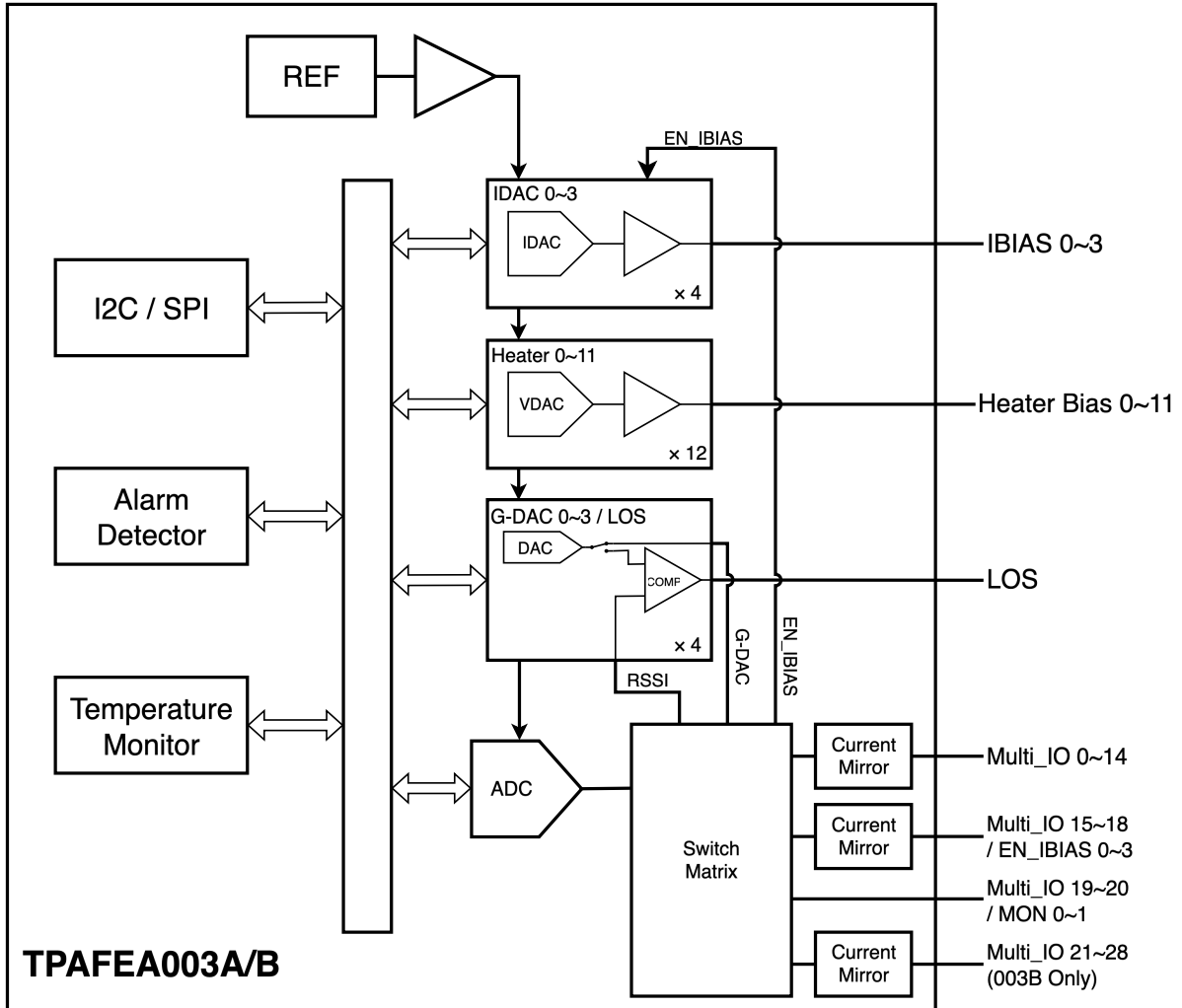


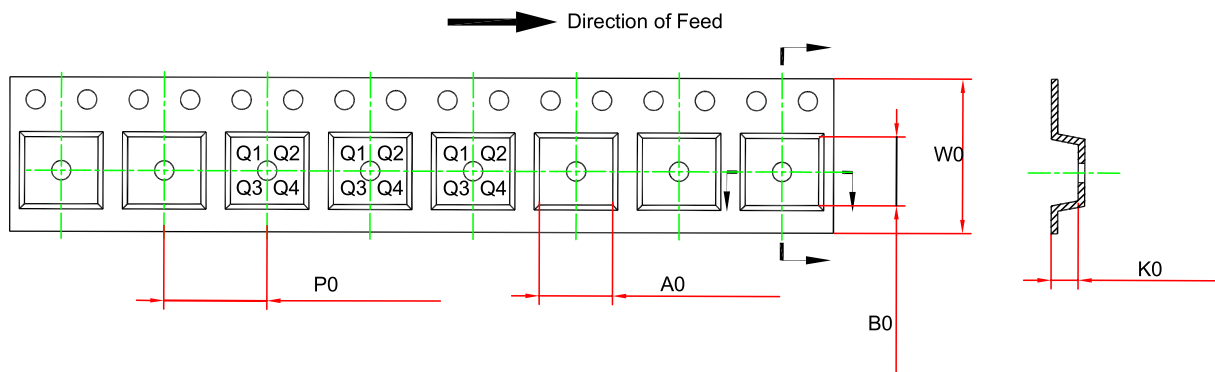
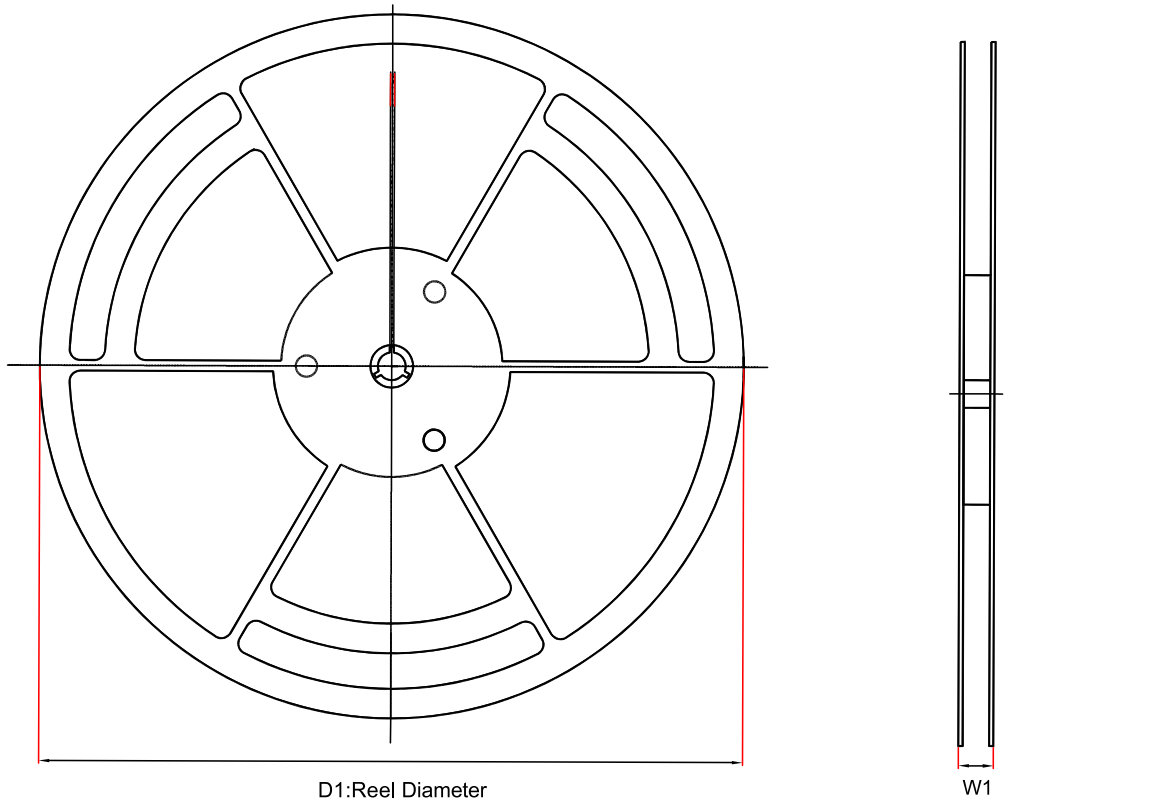
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**High Precision Silicon Photonic AFE with 4 IDACs, 12 VDACs and
Multi-channel ADC****Product Family Table**

Order Number	IBIAS Output Channel	IBIAS Output Range	Heater Bias Output Channel	Multi-IO Channel	Package
TPAFEA003A-WLPR	4	0 ~ 245 mA 0 ~ 350 mA	12	21	WLCSP3.50×3.53-56

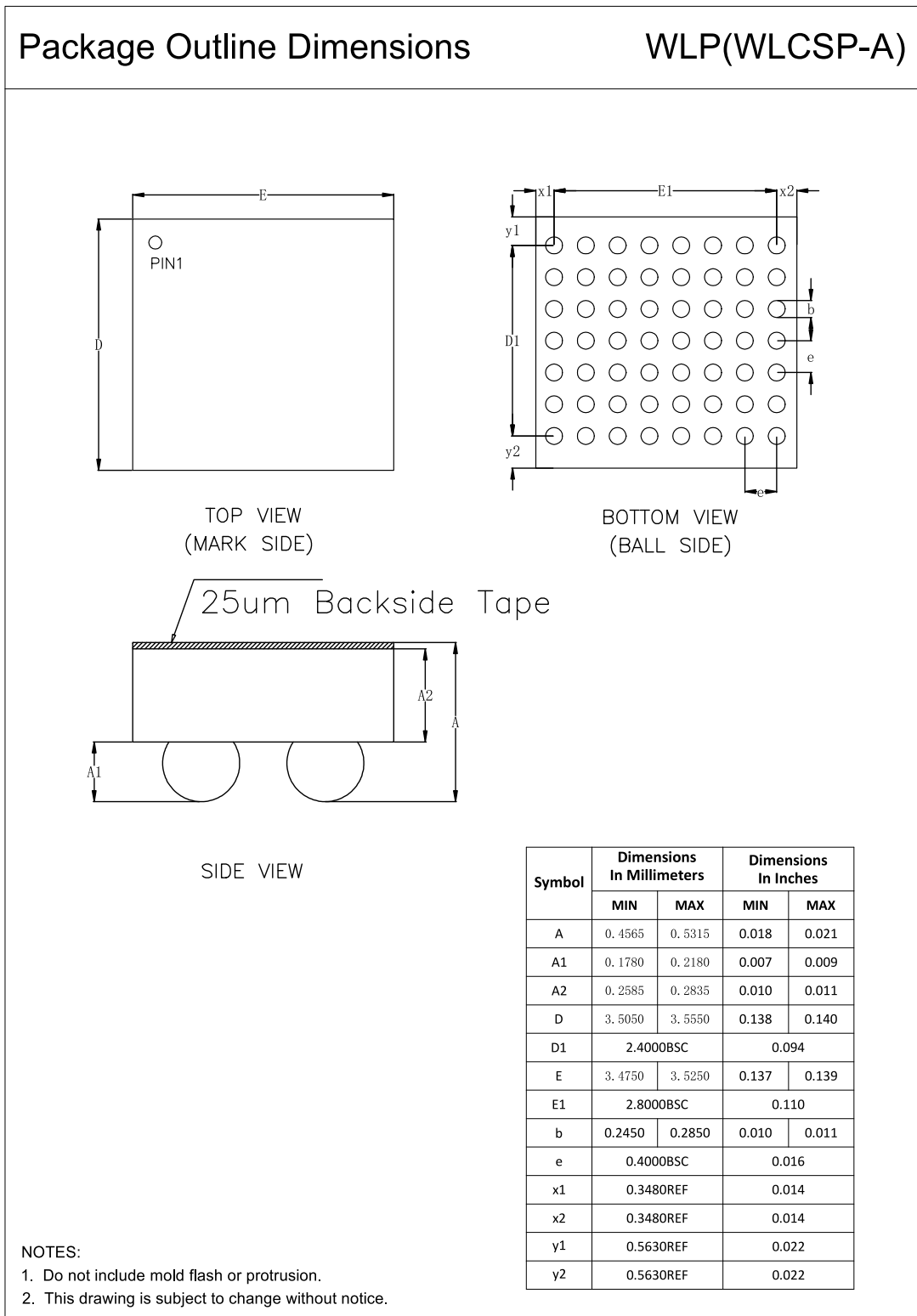
Tape and Reel Information



Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPAFEA003A-WLPR	WLCSP3.5X3.53-56	179	14.8	3.75	3.75	0.75	4	12	Q1

Package Outline Dimensions

TPAFEA003A-WLPR



High Precision Silicon Photonic AFE with 4 IDACs, 12 VDACS and Multi-channel ADC**Order Information**

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPAFEA003A-WLPR	-40 to 125 °C	WLCSP 3.5×3.53-56L	03A	1	Tape and Reel, 2000	Green

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

**High Precision Silicon Photonic AFE with 4 IDACs, 12 VDACS and
Multi-channel ADC****IMPORTANT NOTICE AND DISCLAIMER**

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