TZA3011A; TZA3011B

30 Mbit/s up to 3.2 Gbit/s A-rate™ laser drivers

1. General description

The TZA3011 is a fully integrated laser driver for optical transmission systems with data rates up to 3.2 Gbit/s. The TZA3011 incorporates all the necessary control and protection functions for a laser driver application with very few external components required and low power dissipation. The dual-loop controls the average monitor current in a programmable range from 150 μA to 1300 μA and the extinction ratio in a programmable range from 5 to 15 (linear scale).

The design is made in the Philips BiCMOS RF process and is available in a HBCC32 package or as bare die. The TZA3011A is intended for use in an application with an AC-coupled laser diode with a 3.3 V laser supply voltage. The TZA3011B is intended for use in an application with a DC-coupled laser diode for both 3.3 V and 5 V laser supply voltages.

2. Features

2.1 General

- A-rate™ from 30 Mbit/s to 3.2 Gbit/s
- Bias current up to 100 mA
- Modulation current up to 100 mA
- Rise and fall times typical 80 ps
- Jitter below 20 ps (peak-to-peak value)
- Modulation output voltage up to 2 V dynamic range
- 1.2 V minimum voltage on the modulation output pin and 0.4 V minimum voltage on pin BIAS
- Retiming function via external clock with disable option
- Pulse width adjustment function with disable option
- Positive Emitter Coupled Logic (PECL), Low Voltage Positive Emitter Coupled Logic (LVPECL) and Current-Mode Logic (CML) compatible data and clock inputs
- Internal common mode voltage available for AC-coupled data and clock inputs and for single-ended applications
- 3.3 V supply voltage
- TZA3011A: AC-coupled laser for 3.3 V laser supply
- TZA3011B: DC-coupled laser for 3.3 V and 5 V laser supply

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2.2 Control features

■ Dual-loop control for constant and accurate optical average power level and extinction ratio (up to 2.7 Gbit/s)

■ Optional average power loop control (up to 3.2 Gbit/s)

■ Optional direct setting of modulation and bias currents

2.3 Protection features

■ Alarm function on operating current

■ Alarm function on monitor current

■ Enable function on bias and modulation currents

■ Soft start on bias and modulation currents

3. Applications

■ SDH/SONET optical transmission systems

■ High current drivers for converters

■ High current drivers for high frequencies

4. Ordering information

Table 1: **Ordering information**

Type number	Package			
	Name	**Description**		**Version**
TZA3011AVH	HBCC32	plastic thermal enhanced bottom chip carrier; 32 terminals; body $5 \times 5 \times 0.65$ mm		SOT560-1
TZA3011BVH				
TZA3011UH	-	bare die; $2\,560 \times 2\,510 \times 380$ µm		-

5. Block diagram
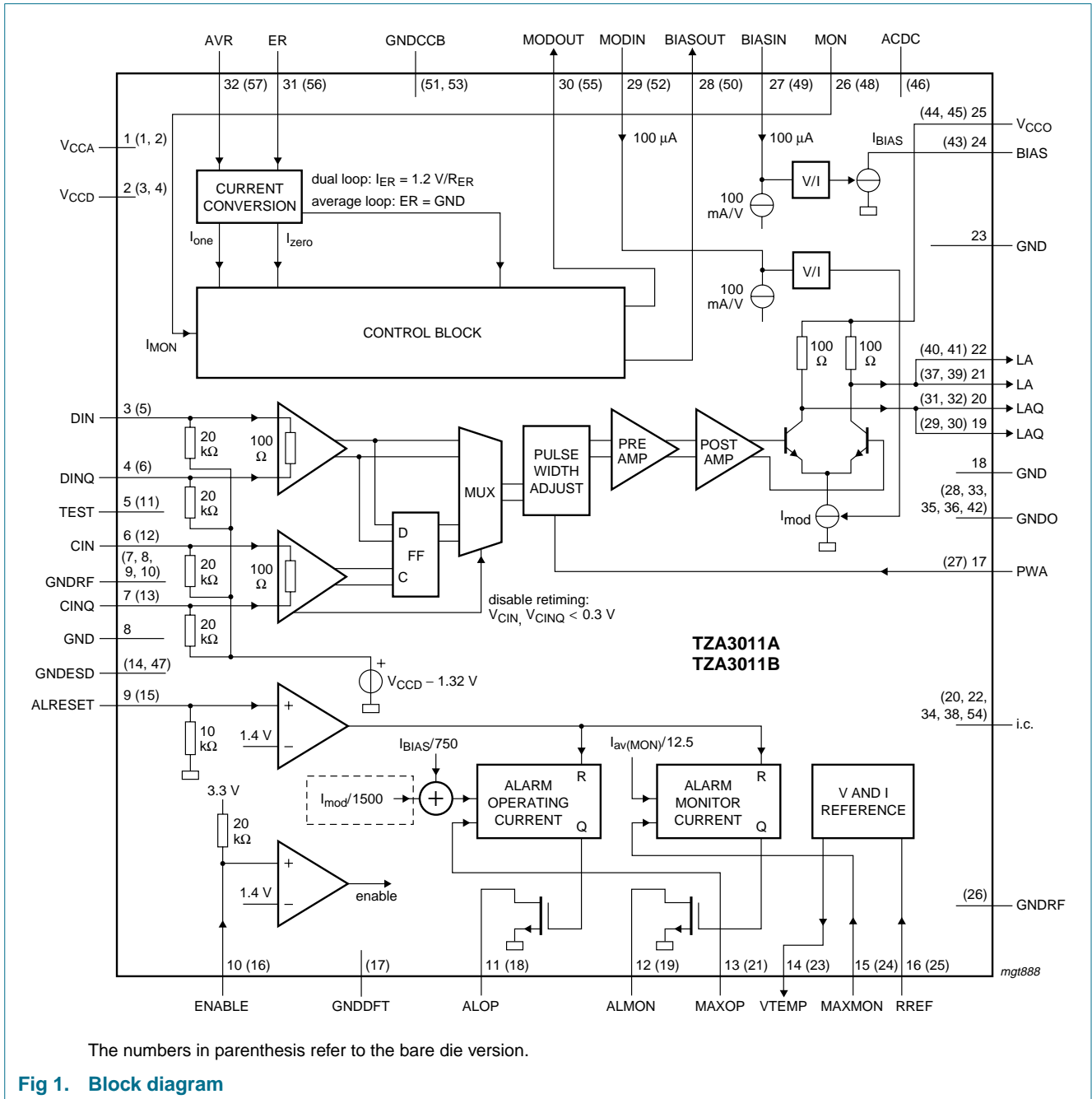
The numbers in parenthesis refer to the bare die version.

Fig 1. Block diagram

6. Pinning information
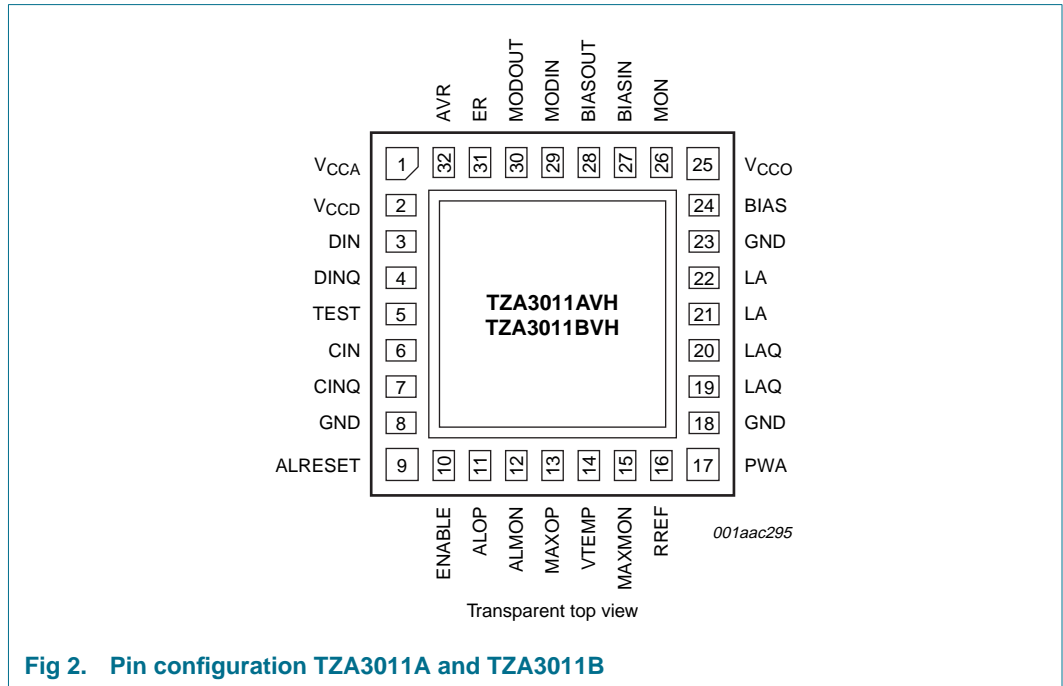
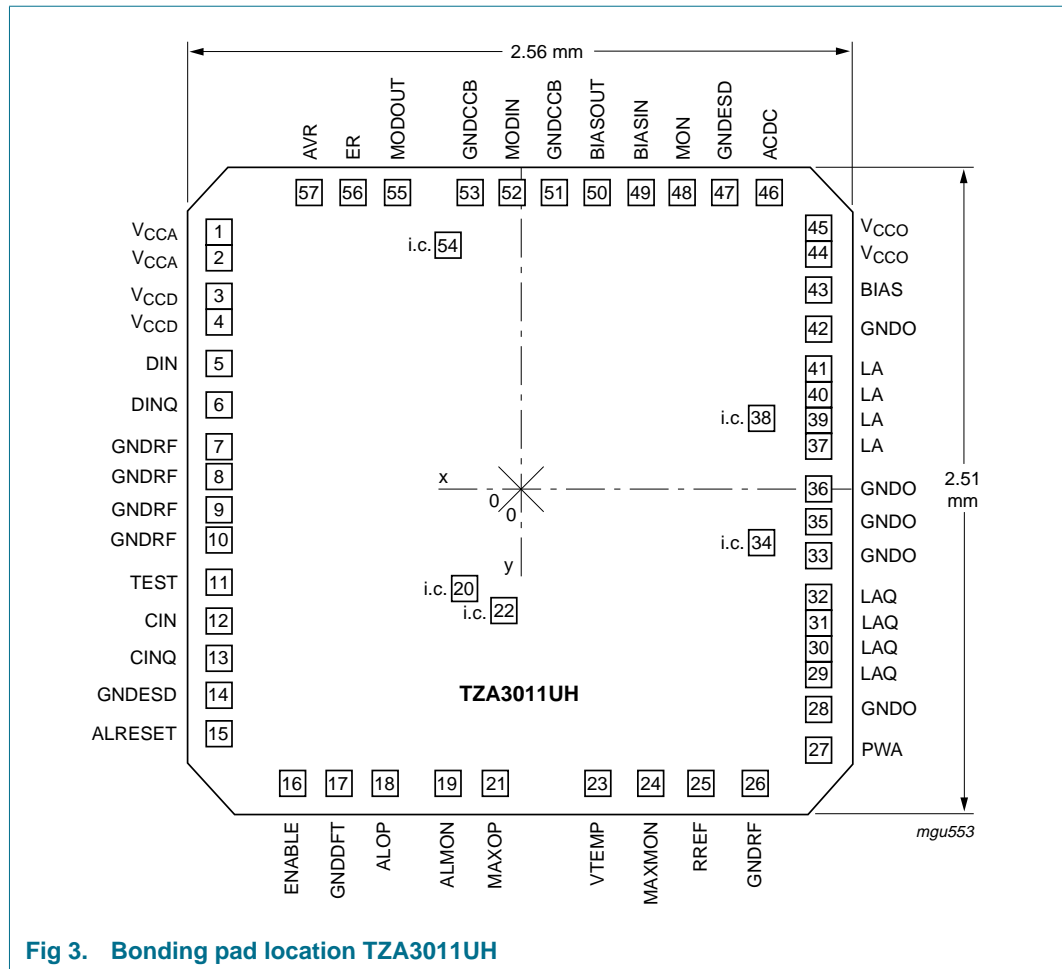### 6.1 Pinning

Fig 2. Pin configuration TZA3011A and TZA3011B

Fig 3. Bonding pad location TZA3011UH

6.2 Pin description

Table 2: Pin description TZA3011A and TZA3011B

Symbol	Pin	Description
GND	die pad	common ground plane for V_{CCA}, V_{CCD}, V_{CCO}, RF and I/O; must be connected to ground
V_{CCA}	1	analog supply voltage
V_{CCD}	2	digital supply voltage
DIN	3	non-inverted data input (RF input)
DINQ	4	inverted data input (RF input)
TEST	5	test pin or test pad; must be connected to ground
CIN	6	non-inverted clock input (RF input)
CINQ	7	inverted clock input (RF input)
GND	8	ground
ALRESET	9	alarm reset input; resets ALMON and ALOP alarms
ENABLE	10	enable input for modulation and bias current
ALOP	11	alarm output on operating current (open-drain)
ALMON	12	alarm output on monitor diode current (open-drain)

Table 2:   Pin description TZA3011A and TZA3011B …continued

Symbol	Pin	Description
MAXOP	13	threshold level input for alarm on operating current
VTEMP	14	temperature dependent voltage output source
MAXMON	15	threshold level input for alarm on monitor diode current
RREF	16	reference current input; must be connected to ground with an accurate (1 %) 10 kΩ resistor
PWA	17	pulse width adjustment input
GND	18	ground
LAQ	19	inverted laser modulation output (RF output); output for dummy load
LAQ	20	inverted laser modulation output (RF output); output for dummy load
LA	21	non-inverted laser modulation output (RF output); output for laser
LA	22	non-inverted laser modulation output (RF output); output for laser
GND	23	ground
BIAS	24	current source output for the laser bias current
V_{CCO}	25	supply voltage for the output stage and the laser diode
MON	26	input for the monitor photodiode (RF input)
BIASIN	27	input for the bias current setting
BIASOUT	28	output of the control block for the bias current
MODIN	29	input for the modulation current setting
MODOUT	30	output of the control block for the modulation current
ER	31	input for the optical extinction ratio setting
AVR	32	input for the optical average power level setting

Table 3:   Bonding pad description TZA3011UH [1]

Symbol	Pad	X	Y	Description
GND	substrate	-	-	common ground plane for V_{CCA}, V_{CCD}, V_{CCO}, RF and I/O; must be connected to ground
V_{CCA}	1	−1123.9	+1029.3	analog supply voltage
V_{CCA}	2	−1123.9	+949.3	analog supply voltage
V_{CCD}	3	−1123.9	+844.3	digital supply voltage
V_{CCD}	4	−1123.9	+764.3	digital supply voltage
DIN	5	−1124.0	+604.3	non-inverted data input (RF input)
DINQ	6	−1124.9	+393.3	inverted data input (RF input)
GNDRF	7	−1123.9	+244.5	ground
GNDRF	8	−1123.9	+139.4	ground
GNDRF	9	−1123.9	+4.7	ground
GNDRF	10	−1123.9	−100.3	ground
TEST	11	−1123.4	−253.4	test pin or test pad; must be connected to ground
CIN	12	−1123.9	−441.2	non-inverted clock input (RF input)
CINQ	13	−1123.9	−697.1	inverted clock input (RF input)
GNDESD	14	−1123.9	−850.8	ground
ALRESET	15	−1123.9	−991.4	alarm reset input; resets ALMON and ALOP alarms

Table 3: **Bonding pad description TZA3011UH** [1] *…continued*

Symbol	Pad	X	Y	Description
ENABLE	16	−829.8	−1123.7	enable input for modulation and bias current
GNDDFT	17	−665.6	−1124.0	ground
ALOP	18	−504.9	−1124	alarm output on operating current (open-drain)
ALMON	19	−267.6	−1124.3	alarm output on monitor diode current (open-drain)
i.c.	20 [2]	−221.5	−344.4	internally connected
MAXOP	21	−98.5	−1124.3	threshold level input for alarm on operating current
i.c.	22 [2]	−48.6	−368.4	internally connected
VTEMP	23	+294.0	−1124.2	temperature dependent voltage output source
MAXMON	24	+466.9	−1124.2	threshold level input for alarm on monitor diode current
RREF	25	+694.9	−1124.0	reference current input; must be connected to ground with an accurate (1 %) 10 kΩ resistor
GNDRF	26	+860.3	−1124.0	ground
PWA	27	+1098.9	−979.4	pulse width adjustment input
GNDO	28	+1099.0	−829.7	ground
LAQ	29	+1099.0	−691.2	inverted laser modulation output (RF output); output for dummy load
LAQ	30	+1099.0	−611.2	inverted laser modulation output (RF output); output for dummy load
LAQ	31	+1099.0	−506.4	inverted laser modulation output (RF output); output for dummy load
LAQ	32	+1099.0	−426.4	inverted laser modulation output (RF output); output for dummy load
GNDO	33	+1099.8	−247.0	ground
i.c.	34 [2]	+839.0	−194.4	internally connected
GNDO	35	+1099.8	−142.0	ground
GNDO	36	+1099.8	−36.8	ground
LA	37	1099.1	105.4	non-inverted laser modulation output (RF output); output for laser
i.c.	38 [2]	839.0	179.6	internally connected
LA	39	1099.1	185.4	non-inverted laser modulation output (RF output); output for laser
LA	40	1099.1	290.5	non-inverted laser modulation output (RF output); output for laser
LA	41	1099.1	370.5	non-inverted laser modulation output (RF output); output for laser
GNDO	42	1099.1	670.8	ground
BIAS	43	1099.0	804.8	current source output for the laser bias current
V_CCO	44	1099.0	944.4	supply voltage for the output stage and the laser diode
V_CCO	45	1099.0	1024.4	supply voltage for the output stage and the laser diode
ACDC	46 [3]	942.5	1124.3	AC or DC coupled laser

Table 3: **Bonding pad description TZA3011UH** [1] *…continued*

Symbol	Pad	X	Y	Description
GNDESD	47	765.0	1123.8	ground
MON	48	602.1	1123.7	input for the monitor photodiode (RF input)
BIASIN	49	431.7	1123.8	input for the bias current setting
BIASOUT	50	267.6	1123.8	output of the control block for the bias current
GNDCCB	51	100.8	1123.8	ground
MODIN	52	−82.7	+1123.8	input for the modulation current setting
GNDCCB	53	−241.1	+1123.8	ground
i.c.	54 [2]	−274.4	+954.4	internally connected
MODOUT	55	−487.2	+1123.8	output of the control block for the modulation current
ER	56	−645.6	+1123.8	input for the optical extinction ratio setting
AVR	57	−802.8	+1123.8	input for the optical average power level setting

[1] All GND connections should be used.
All ground pads must be connected to ground.
Recommended order of bonding: all GND first, then V_{CCA}, V_{CCD} and V_{CCO} supplies and finally the input and output pins.
All coordinates are referenced, in μm, to the center of the die.

[2] Pad is internally connected, do not use.

[3] ACDC pad must be left unconnected for AC-coupling applications. For DC-coupling applications, connect this pad to ground.

Table 4: **Physical characteristics of TZA3011UH**

Parameter	Value
Glass passivation	0.3 μm PSG (Phospho Silicate Glass) on top of 0.8 μm of silicon nitride
Bonding pad dimension	minimum dimension of exposed metallization is 80 μm × 80 μm (pad size = 90 μm × 90 μm)
Metallization	2.8 μm AlCu
Thickness	380 μm nominal
Size	2.560 mm × 2.510 mm (6.43 mm^2)
Backing	silicon; electrically connected to GND potential through substrate contacts
Attach temperature	< 440 °C; recommended die attachment is by gluing
Attach time	< 15 s

7. Functional description

7.1 Data and clock input

The TZA3011 operates with differential Positive Emitter Coupled Logic (PECL), Low Voltage Positive Emitter Coupled Logic (LVPECL) and Current-Mode Logic (CML) data and clock inputs with a voltage swing from 100 mV to 1 V (p-p). It is assumed that both the data and clock inputs carry a complementary signal with the specified peak-to-peak value (true differential excitation).

The circuit generates an internal common mode voltage for AC-coupled data and clock inputs and for single-ended applications.

If $V_{DIN} > V_{DINQ}$, the modulation current is sunk by the LA pins and corresponds to an optical 'one' level of the laser.

7.2 Retiming

The retiming function synchronizes the data with the clock to improve the jitter performance. The data latch switches on the rising edge of the clock input. The retiming function is disabled when both clock inputs are below 0.3 V.

At start-up the initial polarity of the laser is unknown before the first rising edge of the clock input.

7.3 Pulse width adjustment

The on-duration of the laser current can be adjusted from −100 ps to +100 ps. The adjustment time is set by resistor R_{PWA}. The maximum allowable capacitive load on pin PWA is 100 pF. Pulse width adjustment is disabled when pin PWA is short-circuited to ground.

7.4 Modulator output stage

The output stage is a high-speed bipolar differential pair with typical rise and fall times of 80 ps and with a modulation current source of up to 100 mA when the LA pins are connected to V_{CCO}.

The modulation current switches between the LA and LAQ outputs. For a good RF performance the inactive branch carries a small amount of the modulation current.

The LA output is optimized for the laser allowing a 2 V dynamic range and a 1.2 V minimum voltage. The LAQ output is optimized for the dummy load.

The output stage of the TZA3011A is optimized for AC-coupled lasers and the output stage of the TZA3011B is optimized for DC-coupled lasers.

The BIAS output is optimized for low voltage requirements (0.4 V minimum for a 3.3 V laser supply; 0.8 V minimum for a 5 V laser supply).

7.5 Dual-loop control

The TZA3011 incorporates a dual-loop control for a constant, accurate and temperature-independent control of the optical average power level and the extinction ratio. The dual-loop guarantees constant optical 'one' and 'zero' levels which are independent of the laser temperature and the laser age.

The dual-loop operates by monitoring the current of the monitor photodiode which is directly proportional to the laser emission. The 'one' and 'zero' current levels of the monitor diode are captured by the detector of the dual-loop control. The pin MON for the monitor photodiode current is an RF input.

The average monitor current is programmable over a wide current range from 150 μA to 1300 μA for both the dual-loop control and the average loop control. The extinction ratio is programmable from 5 to 15.

The maximum allowable capacitive load on pins AVR, ER, BIASOUT and MODOUT is 100 pF.

7.6 Average loop control

The average power control loop maintains a constant average power level of the monitor current over temperature and lifetime of the laser. The average loop control is activated by short-circuiting pin ER to ground.

7.7 Direct current setting

The TZA3011 can also operate in open-loop mode with direct setting of the bias and modulation currents. The bias and modulation current sources are transconductance amplifiers and the output currents are determined by the BIASIN and MODIN voltages respectively. The bias current source has a bipolar output stage with minimum output capacitance for optimum RF performance.

7.8 Soft start

At power-up the bias and modulation current sources are released when $V_{CCA} > 2.7$ V and the reference voltage has reached the correct value of 1.2 V.

The control loop starts with minimum bias and modulation current at power-up and when the device is enabled. The current levels increase until the MON input current matches the programmed average level and, in the case of dual-loop control, the extinction ratio.

7.9 Alarm functions

The TZA3011 features two alarm functions for the detection of excessive laser operating current and monitor diode current due to laser ageing, laser malfunctioning or a too high laser temperature. The alarm threshold levels are programmed by a resistor or a current source. In the TZA3011A, for the AC-coupled application, the operating current is equal to the bias current. In the TZA3011B, for the DC-coupled application, the operating current equals the bias current plus half of the modulation current.

7.10 Enable

A LOW-level on the enable input disables the bias and modulation current sources: the laser is off. A HIGH-level on the enable input or an open enable input switches both current sources on: the laser is operational.

7.11 Reference block

The reference voltage is derived from a band gap circuit and is available at pin RREF. An accurate (1 %) 10 kΩ resistor has to be connected to pin RREF to provide the internal reference current. The maximum capacitive load on pin RREF is 100 pF.

The reference voltage on the setting pins (MAXOP, MAXMON, PWA, ER and AVR) is buffered and derived from the band gap voltage.

The output voltage on pin VTEMP reflects the junction temperature of the TZA3011, the temperature coefficient of V_{VTEMP} equals −2.2 mV/K.

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8. Limiting values

Table 5:   Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). All voltages are referenced to ground; positive currents flow into the IC.

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CCD}	digital supply voltage		−0.5	+3.5	V
V_{CCA}	analog supply voltage		−0.5	+3.5	V
V_{CCO}	output stage supply voltage	3.3 V laser supply	−0.5	+3.5	V
		5 V laser supply (TZA3011B only)	−0.5	+5.3	V
$V_{o(LA)}$	output voltage at pin LA	TZA3011A; V_{CCO} = 3.3 V	1.2	4.5	V
		TZA3011B; V_{CCO} = 3.3 V	0.8	4.1	V
		TZA3011B; V_{CCO} = 5 V	1.2	4.5	V
$V_{o(LAQ)}$	output voltage at pin LAQ	TZA3011A; V_{CCO} = 3.3 V	1.8	4.5	V
		TZA3011B; V_{CCO} = 3.3 V	1.6	4.5	V
		TZA3011B; V_{CCO} = 5 V	2.0	5.2	V
V_{BIAS}	bias voltage	TZA3011A; V_{CCO} = 3.3 V	0.4	3.6	V
		TZA3011B; V_{CCO} = 3.3 V	0.4	3.6	V
		TZA3011B; V_{CCO} = 5 V	0.8	4.1	V
V_n	voltage on other input and output pins				
	analog inputs and outputs		−0.5	V_{CCA} + 0.5	V
	digital inputs and outputs		−0.5	V_{CCD} + 0.5	V
I_n	input current on pins				
	MAXOP, MAXMON, RREF, PWA, ER and AVR		−1.0	0	mA
	VTEMP, BIASOUT and MODOUT		−1.0	+1.0	mA
	ALOP, ALMON and MON		0	5.0	mA
T_{amb}	ambient temperature		−40	+85	°C
T_j	junction temperature		−40	+125	°C
T_{stg}	storage temperature		−65	+150	°C

9. Thermal characteristics

Table 6: **Thermal characteristics**
In compliance with JEDEC standards JESD51-5 and JESD51-7.

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	4 layer printed circuit board in still air with 9 plated vias connected with the heatsink and the first ground plane in the printed circuit board	35	K/W
		HBCC32 die pad soldered to printed circuit board	60	K/W

10. Static characteristics

Table 7: **Characteristics**
$T_{amb} = -40\,°C$ to $+85\,°C$; $R_{th(j-a)} = 35$ K/W; $P_{tot} = 400$ mW; $V_{CCA} = 3.14$ V to 3.47 V; $V_{CCD} = 3.14$ V to 3.47 V; $V_{CCO} = 3.14$ V to 3.47 V; $R_{AVR} = 7.5$ kΩ; $R_{ER} = 62$ kΩ; $R_{MODIN} = 6.2$ kΩ; $R_{BIASIN} = 6.8$ kΩ; $R_{PWA} = 10$ kΩ; $R_{RREF} = 10$ kΩ; $R_{MAXMON} = 13$ kΩ; $R_{MAXOP} = 20$ kΩ; positive currents flow into the IC; all voltages are referenced to ground; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supplies: pins V_{CCA}, V_{CCD} and V_{CCO}						
V_{CCA}	analog supply voltage		3.14	3.3	3.47	V
V_{CCD}	digital supply voltage		3.14	3.3	3.47	V
V_{CCO}	RF output supply voltage	3.3 V laser supply	3.14	3.3	3.47	V
		5 V laser supply	4.75	5.0	5.25	V
I_{CCA}	analog supply current		30	40	50	mA
I_{CCD}	digital supply current		35	45	55	mA
I_{CCO}	RF output supply current	pins LA and LAQ open-circuit				
		3.3 V laser supply	8	15	25	mA
		5 V laser supply	-	20	-	mA
P_{core}	core power dissipation	core excluding output currents $I_{o(LA)}$, $I_{o(LAQ)}$ and I_{BIAS}; PWA and retiming off	-	264	-	mW
P_{tot}	total power dissipation	$V_{BIAS} = 3.3$ V; $I_{BIAS} = 20$ mA; $I_{mod} = 16$ mA [1]	330	400	500	mW
Data and clock inputs: pins DIN and CIN						
$V_{i(p-p)}$	input voltage swing (peak-to-peak value)	$V_{i(DIN)} = (V_{CCD} - 2$ V$)$ to V_{CCD}; $V_{i(CIN)} = (V_{CCD} - 2$ V$)$ to V_{CCD}	100	-	1000	mV
$V_{int(cm)}$	internal common mode voltage	AC-coupled inputs	-	$V_{CCD} - 1.32$	-	V
V_{IO}	input offset voltage	[2]	−10	0	+10	mV
$Z_{i(dif)}$	differential input impedance		80	100	125	Ω
$Z_{i(cm)}$	common mode input impedance		8	10	13	kΩ
$V_{i(CIN)(dis)}$	input voltage for disabled retiming	$V_{CIN} = V_{CINQ}$	-	-	0.3	V
Monitor photodiode input: pin MON						
$V_{i(MON)}$	input voltage	$I_{MON} = 50$ μA to 2500 μA	0.9	1.1	1.3	V
$Z_{i(MON)}$	input impedance	$I_{MON} = 50$ μA to 2500 μA	-	27	-	Ω

Table 7: **Characteristics** …continued

$T_{amb} = -40\,°C$ to $+85\,°C$; $R_{th(j-a)} = 35$ K/W; $P_{tot} = 400$ mW; $V_{CCA} = 3.14$ V to 3.47 V; $V_{CCD} = 3.14$ V to 3.47 V; $V_{CCO} = 3.14$ V to 3.47 V; $R_{AVR} = 7.5$ kΩ; $R_{ER} = 62$ kΩ; $R_{MODIN} = 6.2$ kΩ; $R_{BIASIN} = 6.8$ kΩ; $R_{PWA} = 10$ kΩ; $R_{RREF} = 10$ kΩ; $R_{MAXMON} = 13$ kΩ; $R_{MAXOP} = 20$ kΩ; positive currents flow into the IC; all voltages are referenced to ground; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Extinction ratio setting for dual-loop control: pins MON and ER						
ER_{min}	low extinction ratio setting	dual-loop set-up; IER > −30 µA [3]				
		linear scale	-	5	7	
		dB scale	-	7	8.5	dB
ER_{max}	high extinction ratio setting	dual-loop set-up; IER < −10 µA [3]				
		linear scale	13	15	-	
		dB scale	11	11.8	-	dB
ER_{acc}	relative accuracy of ER	temperature and V_{CCA} variations; ER = 10; AVR = 550 µA	−10	-	+10	%
$V_{ref(ER)}$	reference voltage on pin ER	$I_{ER} = -35$ µA to −5 µA; $C_{ER} < 100$ pF	1.15	1.20	1.25	V
I_{ER}	current sink on pin ER		−35	-	−5	µA
Average setting for dual-loop control and average loop control: pins MON and AVR						
$I_{av(MON)(low)}$	low average monitor current setting	$I_{AVR} > -280$ µA				
		dual-loop (ER = 5)	-	-	150	µA
		average loop (pin ER to GND)	-	-	150	µA
$I_{av(MON)(max)}$	maximum average monitor current setting	$I_{AVR} = -15.0$ µA				
		dual-loop (ER = 5)	1200	1300	-	µA
		average loop (pin ER to GND)	1200	1300	-	µA
$\Delta I_{av(MON)}$	relative accuracy of average current on pin MON	temperature and V_{CCA} variations; ER = 10; AVR = 550 µA	−10	-	+10	%
$V_{ref(AVR)}$	reference voltage on pin AVR	$I_{AVR} = -250$ µA to −15 µA; $C_{AVR} < 100$ pF	1.15	1.20	1.25	V
$I_{sink(AVR)}$	current sink on pin AVR		−280	-	−15	µA
Control loop modulation output: pin MODOUT						
$I_{source(MODOUT)}$	source current	$V_{MODOUT} = 0.5$ V to 1.5 V; $C_{MODOUT} < 100$ pF	-	-	−200	µA
$I_{sink(MODOUT)}$	sink current	$V_{MODOUT} = 0.5$ V to 1.5 V; $C_{MODOUT} < 100$ pF	200	-	-	µA
Control loop bias output: pin BIASOUT						
$I_{source(BIASOUT)}$	source current	$V_{BIASOUT} = 0.5$ V to 1.5 V; $C_{BIASOUT} < 100$ pF	-	-	−200	µA
$I_{sink(BIASOUT)}$	sink current	$V_{BIASOUT} = 0.5$ V to 1.5 V; $C_{BIASOUT} < 100$ pF	200	-	-	µA
Bias current source: pins BIASIN and BIAS						
$g_{m(bias)}$	bias transconductance	$V_{BIASIN} = 0.5$ V to 1.5 V				
		$V_{BIAS} = V_{CCO} = 3.3$ V	90	110	125	mA/V
		$V_{BIAS} = 4.1$ V; $V_{CCO} = 5.0$ V	95	110	130	mA/V
$I_{source(BIASIN)}$	source current at pin BIASIN	$V_{BIASIN} = 0.5$ V to 1.5 V	−110	−100	−95	µA

Table 7: **Characteristics** …continued

$T_{amb} = -40\,°C$ to $+85\,°C$; $R_{th(j\text{-}a)} = 35\,K/W$; $P_{tot} = 400\,mW$; $V_{CCA} = 3.14\,V$ to $3.47\,V$; $V_{CCD} = 3.14\,V$ to $3.47\,V$; $V_{CCO} = 3.14\,V$ to $3.47\,V$; $R_{AVR} = 7.5\,k\Omega$; $R_{ER} = 62\,k\Omega$; $R_{MODIN} = 6.2\,k\Omega$; $R_{BIASIN} = 6.8\,k\Omega$; $R_{PWA} = 10\,k\Omega$; $R_{RREF} = 10\,k\Omega$; $R_{MAXMON} = 13\,k\Omega$; $R_{MAXOP} = 20\,k\Omega$; positive currents flow into the IC; all voltages are referenced to ground; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{BIAS(max)}$	maximum bias current	$V_{BIASIN} = 1.8\,V$	100	-	-	mA
$I_{BIAS(min)}$	minimum bias current	$V_{BIASIN} = 0\,V$ to $0.4\,V$	-	0.2	0.4	mA
$I_{BIAS(dis)}$	bias current at disable	$V_{ENABLE} < 0.8\,V$	-	-	30	μA
V_{BIAS}	output voltage on pin BIAS	normal operation				
		$V_{CCO} = 3.3\,V$	0.4	-	3.6	V
		$V_{CCO} = 5\,V$	0.8	-	4.1	V
Modulation current source: pin MODIN						
$g_{m(mod)}$	modulation transconductance	$V_{MODIN} = 0.5\,V$ to $1.5\,V$				
		$V_{LA} = V_{LAQ} = V_{CCO} = 3.3\,V$	78	90	105	mA/V
		$V_{LA} = V_{LAQ} = V_{CCO} = 4.5\,V$	80	95	110	mA/V
$I_{source(MODIN)}$	source current at pin MODIN	$V_{MODIN} = 0.5\,V$ to $1.5\,V$	−110	−100	−95	μA
Modulation current outputs: pins LA						
$I_{o(LA)(max)(on)}$	maximum laser modulation output current at LA on	$V_{MODIN} = 1.8\,V$; $V_{LA} = V_{CCO} = 3.3\,V$	[4] 100	-	-	mA
$I_{o(LA)(min)(on)}$	minimum laser modulation output current at LA on	$V_{MODIN} = 0\,V$ to $0.4\,V$; $V_{LA} = V_{CCO} = 3.3\,V$	[4] -	5	6	mA
$I_{o(LA)(min)(off)}$	minimum laser modulation output current at LA off	$V_{LA} = V_{CCO} = 3.3\,V$	[4]			
		$V_{MODIN} = 0.5\,V$	-	-	0.8	mA
		$V_{MODIN} = 1.5\,V$	-	-	2	mA
$Z_{o(LA)}$, $Z_{o(LAQ)}$	output impedance LA and LAQ pins		80	100	125	Ω
$I_{o(LA)(dis)}$, $I_{o(LAQ)(dis)}$	non-inverted and inverted laser modulation output current at disable	$V_{ENABLE} < 0.8\,V$	-	-	200	μA
$V_{o(LA)min}$	minimum output voltage at pin LA	TZA3011A; $V_{CCO} = 3.3\,V$	1.6	-	-	V
		TZA3011B; $V_{CCO} = 3.3\,V$	1.2	-	-	V
		TZA3011B; $V_{CCO} = 5\,V$	1.6	-	-	V
Enable function: pin ENABLE						
V_{IL}	LOW-level input voltage	bias and modulation currents disabled	-	-	0.8	V
V_{IH}	HIGH-level input voltage	bias and modulation currents enabled	2.0	-	-	V
$R_{pu(int)}$	internal pull-up resistance		16	20	30	kΩ
Alarm reset: pin ALRESET						
V_{IL}	LOW-level input voltage	no reset	-	-	0.8	V
V_{IH}	HIGH-level input voltage	reset	2.0	-	-	V
$R_{pd(int)}$	internal pull-down resistance		7	10	15	kΩ

Table 7: **Characteristics** …continued

$T_{amb} = -40\,°C$ to $+85\,°C$; $R_{th(j-a)} = 35$ K/W; $P_{tot} = 400$ mW; $V_{CCA} = 3.14$ V to 3.47 V; $V_{CCD} = 3.14$ V to 3.47 V; $V_{CCO} = 3.14$ V to 3.47 V; $R_{AVR} = 7.5$ kΩ; $R_{ER} = 62$ kΩ; $R_{MODIN} = 6.2$ kΩ; $R_{BIASIN} = 6.8$ kΩ; $R_{PWA} = 10$ kΩ; $R_{RREF} = 10$ kΩ; $R_{MAXMON} = 13$ kΩ; $R_{MAXOP} = 20$ kΩ; positive currents flow into the IC; all voltages are referenced to ground; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Alarm operating current: pins MAXOP and ALOP						
$V_{ref(MAXOP)}$	reference voltage on pin MAXOP	$I_{MAXOP} = 10$ µA to 200 µA	1.15	1.2	1.25	V
N_{MAXOP}	ratio of $I_{oper(alarm)}$ and I_{MAXOP}	$I_{oper(alarm)} = 7.5$ mA to 150 mA				
		$V_{CCO} = 3.3$ V	700	800	900	
		$V_{CCO} = 5.0$ V	750	850	950	
$V_{D(ALOP)L}$	drain voltage at active alarm	$I_{ALOP} = 500$ µA	0	-	0.4	V
Alarm monitor current: pins MAXMON and ALMON						
$V_{ref(MAXMON)}$	reference voltage on pin MAXMON	$I_{MAXMON} = 10$ µA to 200 µA	1.15	1.2	1.25	V
N_{MAXMON}	ratio of $I_{MON(alarm)}$ and I_{MAXMON}	$I_{MON(alarm)} = 150$ µA to 3000 µA	10	15	20	
$V_{D(ALMON)L}$	drain voltage at active alarm	$I_{ALMON} = 500$ µA	0	-	0.4	V
Reference block: pins RREF and VTEMP						
V_{RREF}	reference voltage	$R_{RREF} = 10$ kΩ (1 %); $C_{RREF} < 100$ pF	1.15	1.20	1.25	V
V_{VTEMP}	temperature dependent voltage	$T_j = 25\,°C$; $C_{VTEMP} < 2$ nF	[5] 1.15	1.20	1.25	V
TC_{VTEMP}	temperature coefficient of V_{VTEMP}	$T_j = -25\,°C$ to $+125\,°C$	[5] -	−2.2	-	mV/K
$I_{source(VTEMP)}$	source current of pin VTEMP		-	-	−1	mA
$I_{sink(VTEMP)}$	sink current of pin VTEMP		1	-	-	mA

[1] The total power dissipation P_{tot} is calculated with $V_{BIAS} = V_{CCO} = 3.3$ V and $I_{BIAS} = 20$ mA. In the application V_{BIAS} will be V_{CCO} minus the laser diode voltage which results in a lower total power dissipation.

[2] The specification of the offset voltage is guaranteed by design.

[3] Any (AVR, ER) settings need to respect $I_{MON} > 50$ µA and $I_{MON} < 2500$ µA. Therefore, for large ER settings, minimum/maximum AVR cannot be reached.

[4] The relation between the sink current $I_{o(LA)}$ and the modulation current I_{mod} is: $I_{o(LA)} = I_{mod} \times \dfrac{100}{100 + Z_{L(LA)}}$ where $Z_{L(LA)}$ is the external load on pin LA. The voltage on pin MODIN programmes the modulation current I_{mod}. This current is divided between $Z_{L(LA)}$ and the 100 Ω internal resistor connected to pins LA. When the modulation current is programmed to 100 mA, a typical $Z_{L(LA)}$ of 25 Ω will result in an $I_{o(LA)}$ current of 80 mA, while 20 mA flows via the internal resistor. This corresponds to a voltage swing of 2 V on the real application load.

[5] $V_{VTEMP} = 1.31 + TC_{VTEMP} \times T_j$ and $T_j = T_{amb} + P_{tot} \times R_{th(j-a)}$.

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11. Dynamic characteristics

Table 8: **Characteristics**

$T_{amb} = -40\,°C$ to $+85\,°C$; $R_{th(j-a)} = 35$ K/W; $P_{tot} = 400$ mW; $V_{CCA} = 3.14$ V to 3.47 V; $V_{CCD} = 3.14$ V to 3.47 V; $V_{CCO} = 3.14$ V to 3.47 V; $R_{AVR} = 7.5$ kΩ; $R_{ER} = 62$ kΩ; $R_{MODIN} = 6.2$ kΩ; $R_{BIASIN} = 6.8$ kΩ; $R_{PWA} = 10$ kΩ; $R_{RREF} = 10$ kΩ; $R_{MAXMON} = 13$ kΩ; $R_{MAXOP} = 20$ kΩ; positive currents flow into the IC; all voltages are referenced to ground; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
RF path							
BR	bit rate	dual-loop control		0.03	-	2.7	Gbit/s
		average loop control		0.03	-	3.2	Gbit/s
$J_{LA(p-p)}$	jitter of pin LA output signal (peak-to-peak value)	$R_L = 25$ Ω	[1]	-	-	20	ps
t_r	rise time of voltage on pin LA	20 % to 80 %; $R_L = 25$ Ω; $I_{mod} = 17$ mA	[2] [3]	70	85	110	ps
t_f	fall time of voltage on pin LA	80 % to 20 %; $R_L = 25$ Ω; $I_{mod} = 17$ mA	[2] [3]	50	70	100	ps
$t_{su(D)}$	data input set-up time			60	-	-	ps
$t_{h(D)}$	data input hold time			60	-	-	ps
$t_{en(start)}$	start-up time at enable	direct current setting		-	-	1	μs
Current control							
tc_{int}	internal time constant	dual-loop control operating currents fully settled		30	-	-	ms
Pulse width adjustment							
$t_{PWA(min)}$	minimum pulse width adjustment on pins LA	$R_{PWA} = 6.7$ kΩ; $C_{PWA} < 100$ pF		-	-	−100	ps
t_{PWA}	pulse width adjustment on pins LA	$R_{PWA} = 10$ kΩ; $C_{PWA} < 100$ pF		-	0	-	ps
$t_{PWA(max)}$	maximum pulse width adjustment on pins LA	$R_{PWA} = 20$ kΩ; $C_{PWA} < 100$ pF		80	100	-	ps

[1] The output jitter specification is guaranteed by design.

[2] With a 25 Ω load on the LA pins: $I_{o(LA)} = 14$ mA when $I_{mod} = 17$ mA.

[3] For high modulation current, t_r and t_f are impacted by total inductance between the LA pins and the laser connection.

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12. Application information

12.1 Design equations

12.1.1 Bias and modulation currents

The bias and modulation currents are determined by the voltages on pins BIASIN and MODIN. These voltages are applied by pins BIASOUT and MODOUT for dual-loop control. For average loop control the BIASIN voltage is applied by pin BIASOUT and the MODIN voltage is applied by an external voltage source or an external resistor R_{MODIN}.

For direct setting of bias and the modulation current, the BIASIN and MODIN voltages have to be applied by external voltage sources or by R_{BIASIN} and R_{MODIN} external resistors connected on pins BIASIN and MODIN:

$$I_{BIAS} = (R_{BIASIN} \times 100\ \mu A - 0.5\ V) \times g_{m(bias)}\ [mA]$$

$$I_{mod} = (R_{MODIN} \times 100\ \mu A - 0.5\ V) \times g_{m(mod)} + 5\ [mA]$$

The bias and modulation current sources operate with an input voltage range from 0.5 V to 1.5 V. The output current is at its minimum level for an input voltage below 0.4 V; see Figure 4 and Figure 5.

The bias and modulation current sources are temperature compensated and the adjusted current level remains stable over the temperature range.

The bias and modulation currents increase with increasing resistor values for R_{BIASIN} and R_{MODIN} respectively, this allows resistor tuning to start at a minimum current level.
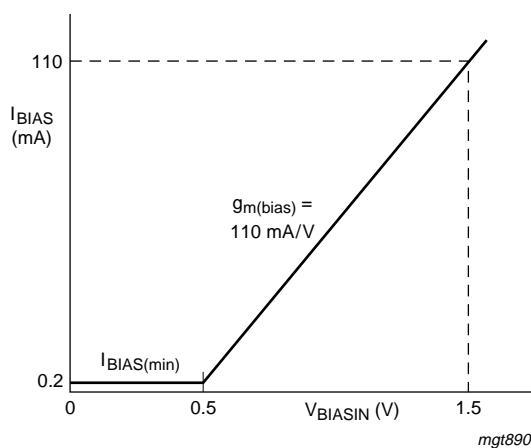
Fig 4. Bias current as a function of BIASIN voltage
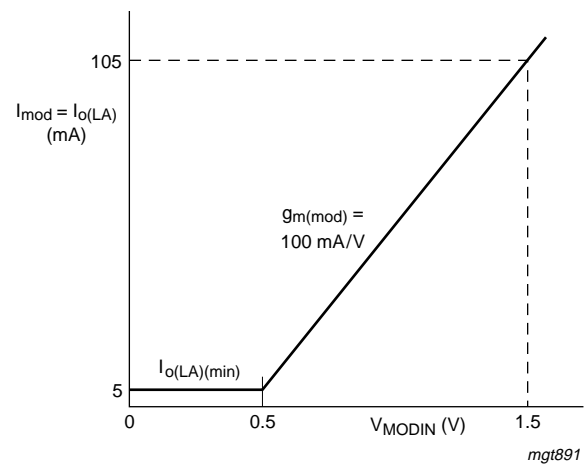
LA current when LA output is on.

$V_{o(LA)} = V_{CCO}$.

Fig 5. Modulation current as a function of MODIN voltage

12.1.2 Average monitor current and extinction ratio

The average monitor current $I_{av(MON)}$ in dual-loop or average loop operation is determined by the source current (I_{AVR}) of the AVR pin. The current can be sunk by an external current source or by an external resistor (R_{AVR}) connected to ground:

$$I_{av(MON)} = 1580 - 5.26 \times I_{AVR} = 1580 - 5.26 \times \frac{V_{AVR}}{R_{AVR}} \ [\mu A]$$

The extinction ratio in dual-loop operation is determined by the source current (I_{ER}) of the ER pin. The current can be sunk by an external current source or by an external resistor

(R_{ER}) connected to ground: $ER = 20 - \dfrac{I_{ER}}{2\ \mu A} = 20 - \dfrac{1}{2\ \mu A} \times \dfrac{V_{ER}}{R_{ER}}$

The average monitor current and the extinction ratio as a function of the I_{AVR} and I_{ER} current are illustrated in Figure 6.

The average monitor current increases with a decreasing I_{AVR} or increasing R_{AVR}, this allows resistor tuning of R_{AVR} to start at minimum I_{AVR} current level.

The formulas used to program AVR and ER are valid for typical conditions; tuning is necessary to achieve good absolute accuracy of AVR and ER values.

Fig 6. Average monitor current and extinction ratio as a function of I_{AVR} and I_{ER}
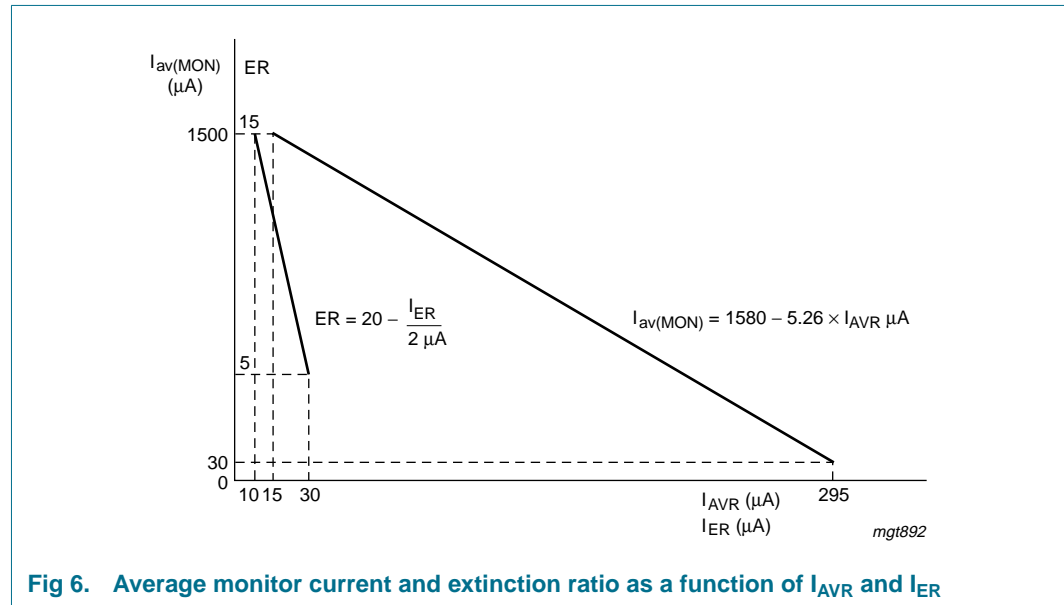
12.1.3 Dual-loop control

The dual-loop control measures the monitor current (I_{MON}) corresponding with an optical 'one' level and the I_{MON} corresponding with the optical 'zero' level. The measured $I_{MON(one)}$ and $I_{MON(zero)}$ are compared with the average monitor current setting and the extinction ratio setting according to:

$$I_{av(MON)} = \frac{I_{MON(one)} + I_{MON(zero)}}{2}$$

$$ER = \frac{I_{MON(one)}}{I_{MON(zero)}}$$

The dual-loop controls the bias and the modulation current for obtaining the $I_{MON(one)}$ and $I_{MON(zero)}$ current levels which correspond with the programmed AVR and ER settings.

Performance of the dual-loop for high data-rate is linked to the quality of the incoming IMON signal: a high performance interconnection between monitor photodiode and MON input is requested for maximum data rate applications (2.7 Gbit/s).

The operational area of the dual-loop and the control area of the monitor input current must respect the following equations:

$$50 \text{ μA} < I_{MON(zero)} < 500 \text{ μA}$$

$$250 \text{ μA} < I_{MON(one)} < 2500 \text{ μA}$$

Stability of ER and AVR settings are guaranteed over a range of temperature and supply voltage variations.

12.1.4 Alarm operating current

The alarm threshold $I_{oper(alarm)}$ on the operating current is determined by the source current I_{MAXOP} of the MAXOP pin. The current range for I_{MAXOP} is from 10 μA to 200 μA which corresponds with an $I_{oper(alarm)}$ from 7.5 mA to 150 mA. The I_{MAXOP} current can be sunk by an external current source or by connecting R_{MAXOP} to ground:

$$I_{oper(alarm)} = N_{MAXOP} \times \frac{V_{MAXOP}}{R_{MAXOP}}$$

The operating current equals the bias current for an AC-coupled laser application and equals the bias current plus half of the modulation current for the DC-coupled laser application:

$$I_{oper(TZA3011A)} = I_{BIAS}$$

$$I_{oper(TZA3011B)} = I_{BIAS} + \frac{I_{mod}}{2}$$

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12.1.5 Alarm monitor current

The alarm threshold $I_{MON(alarm)}$ on the monitor current is determined by the source current I_{MAXMON} of the MAXMON pin. The current range for I_{MAXMON} is from 10 µA to 200 µA which corresponds with an $I_{MON(alarm)}$ from 150 µA to 3000 µA. The I_{MAXMON} current can be sunk by an external current source or by connecting R_{MAXMON} to ground:

$$I_{MON(alarm)} = N_{MAXMON} \times \frac{V_{MAXMON}}{R_{MAXMON}}$$

12.1.6 Pulse width adjustment

The pulse width adjustment time is determined by the value of resistor R_{PWA}; see Figure 7.

$$t_{PWA} = 200 \times \frac{R_{PWA} - 10\ k\Omega}{R_{PWA}}\ \text{[ps]}$$

The t_{PWA} range is from −100 ps to +100 ps which corresponds with a R_{PWA} range between a minimum resistance of 6.7 kΩ and a maximum resistance of 20 kΩ. The PWA function is disabled when the PWA input is short-circuited to ground; t_{PWA} equals 0 ps for a disabled PWA function.
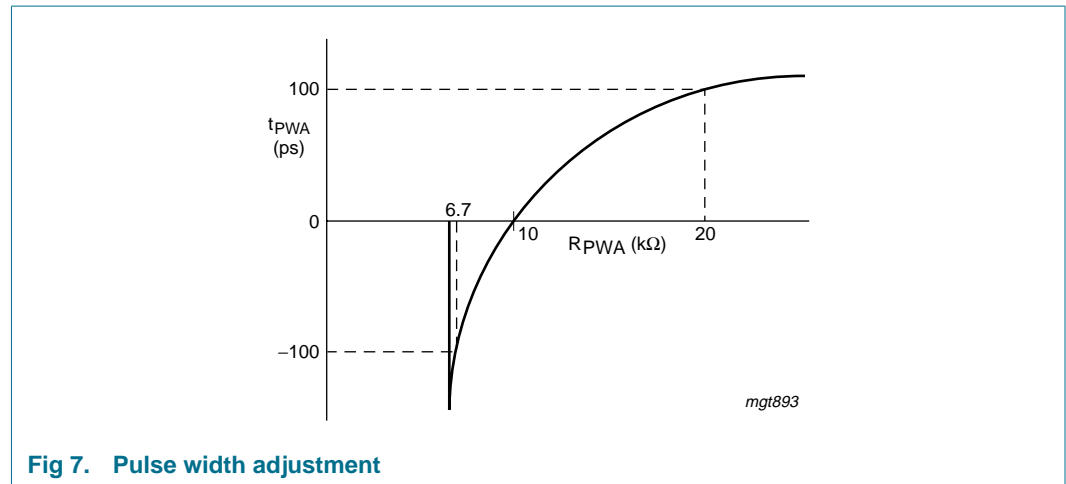
Fig 7. Pulse width adjustment

12.2 TZA3011A with dual-loop control

A simplified application using the TZA3011A with dual-loop control and with an AC-coupled laser at 3.3 V laser voltage is illustrated in Figure 8. The average power level and the extinction ratio are determined by the resistors R_{AVR} and R_{ER}. The MODOUT and BIASOUT outputs are connected to the MODIN and the BIASIN inputs respectively. The alarm threshold on the operating current is made temperature dependent with resistor R_{VTEMP} connected between VTEMP and MAXOP. This alarm detects the end of life of the laser.

$$I_{oper(alarm)} = N_{MAXOP} \times \left(\frac{V_{MAXOP}}{R_{MAXOP}} - \frac{TC_{VTEMP} \times (T_j - 25\ °C)}{R_{VTEMP}} \right)$$

The resistor R_{PWA} enables pulse width adjustment for optimizing the eye diagram.
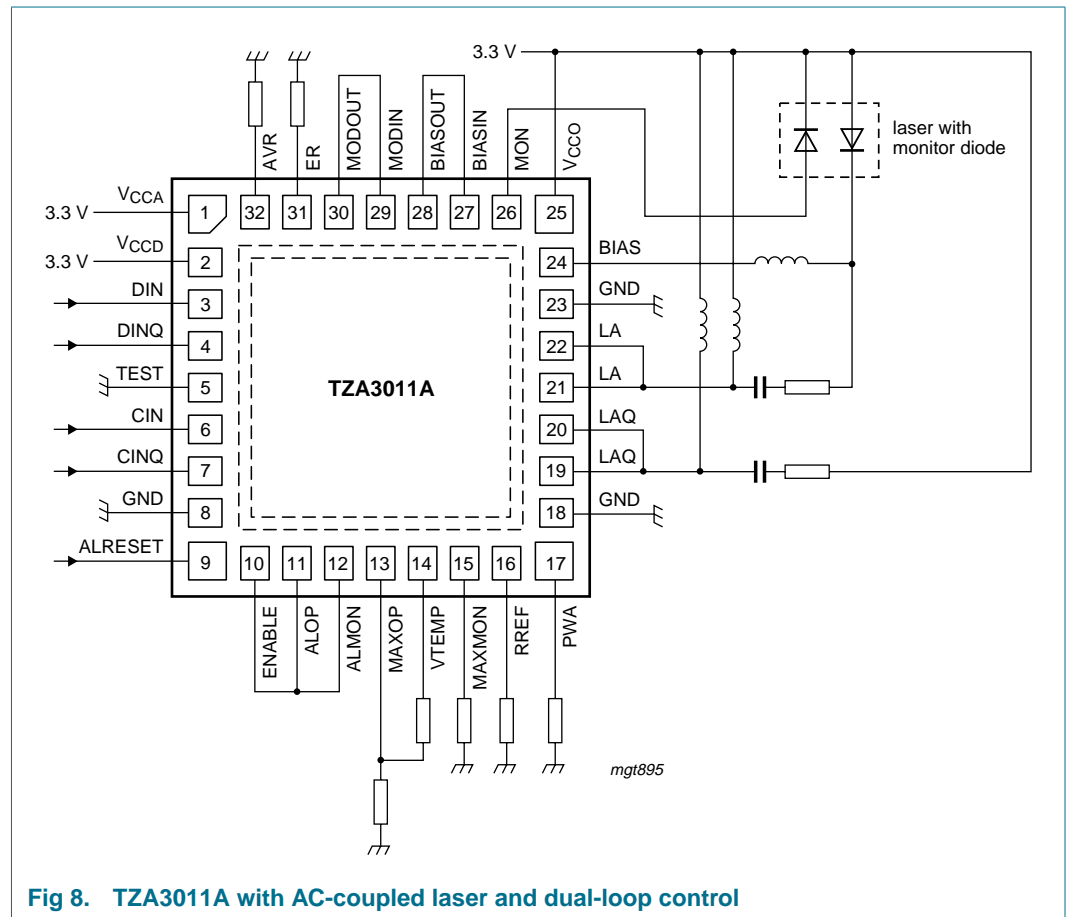
Fig 8. TZA3011A with AC-coupled laser and dual-loop control

12.3 TZA3011B with dual-loop control

A simplified application using the TZA3011B with dual-loop control and with a DC-coupled laser at 3.3 V or 5 V laser voltage is illustrated in Figure 9. The average power level and the extinction ratio are determined by the resistors R_{AVR} and R_{ER}. The MODOUT and BIASOUT outputs are connected to the MODIN and the BIASIN inputs respectively.

The open-drain outputs ALOP and ALMON are short-circuited with pin ENABLE causing an active alarm to disable the bias and modulation current sources. The ALRESET input will reset the alarm latches and enable normal operation.
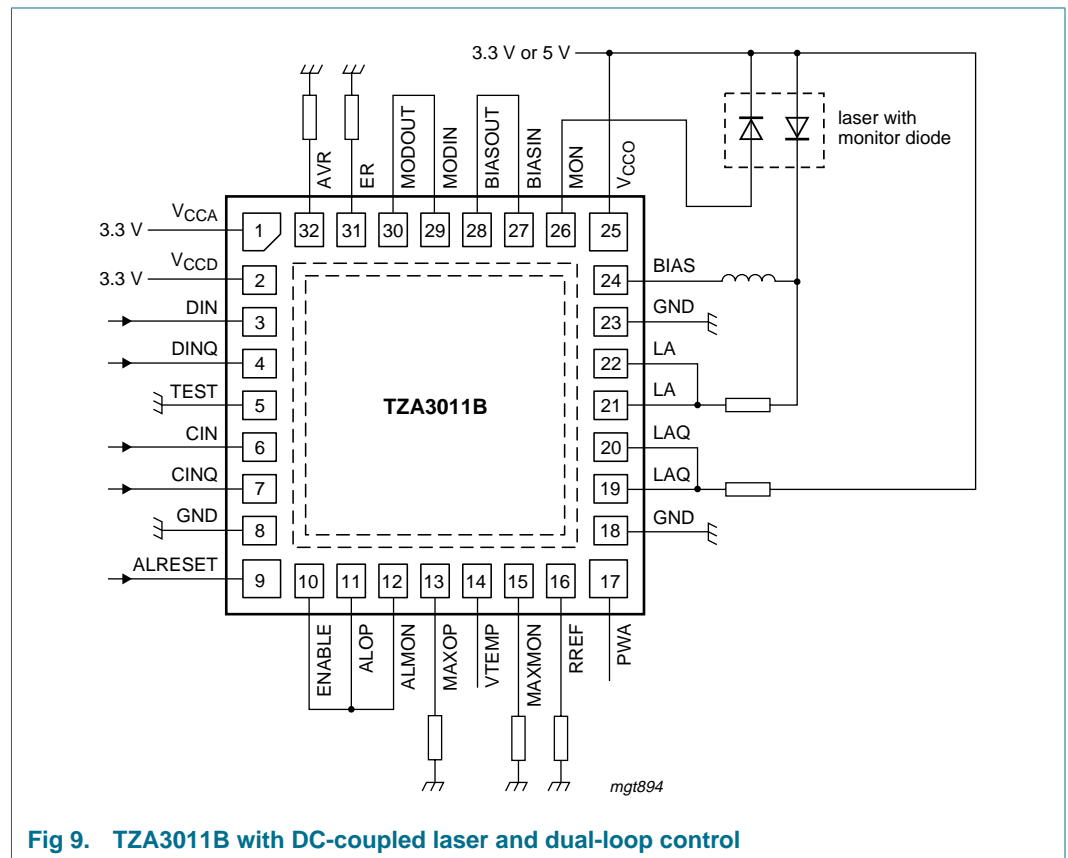
Fig 9. TZA3011B with DC-coupled laser and dual-loop control

12.4 TZA3011B with average loop control

A simplified application using the TZA3011B with average loop control and a DC-coupled laser at 3.3 V or 5 V laser voltage is illustrated in Figure 10. The ER pin is short-circuited to ground for the average loop control. The average power level is determined by the resistor R_{AVR}. The average loop controls the bias current and the BIASOUT output is connected to the BIASIN input. The modulation current is determined by the MODIN input voltage which is generated by the resistor R_{MODIN} and the 100 µA source current of the MODIN pin.
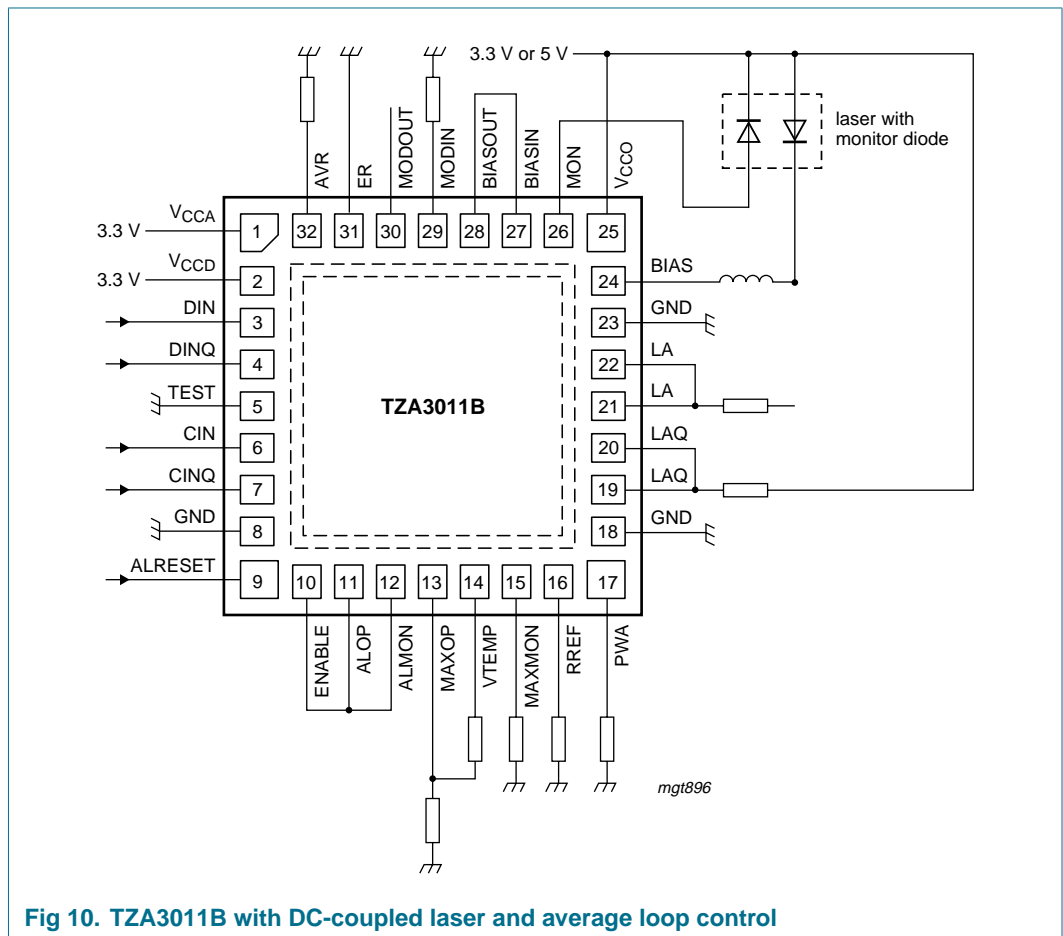
Fig 10. TZA3011B with DC-coupled laser and average loop control

13. Package outline

HBCC32: plastic thermal enhanced bottom chip carrier; 32 terminals; body 5 x 5 x 0.65 mm   **SOT560-1**
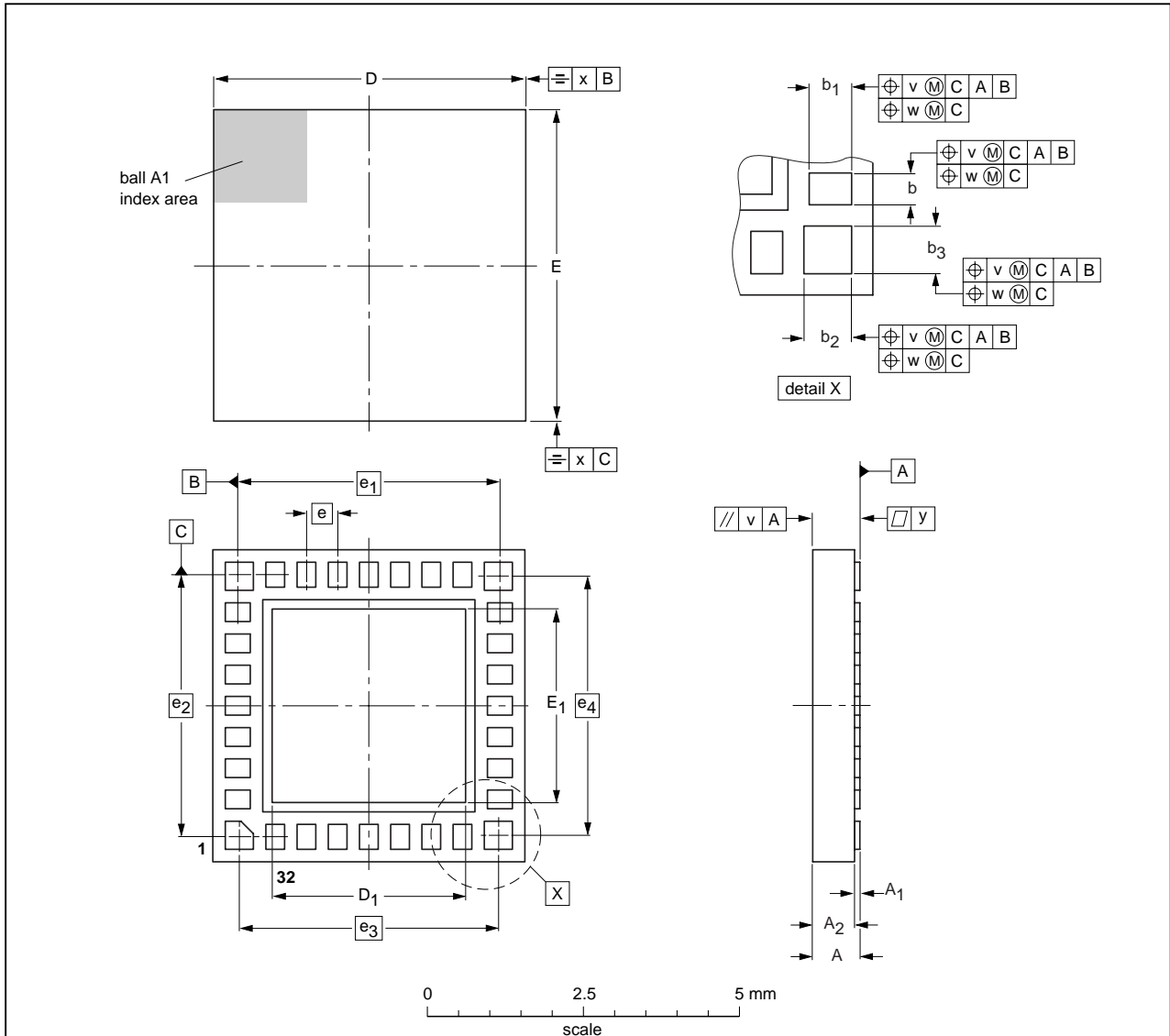
DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁	A₂	b	b₁	b₂	b₃	D	D₁	E	E₁	e	e₁	e₂	e₃	e₄	v	w	x	y
mm	0.8	0.10 0.05	0.7 0.6	0.35 0.20	0.5 0.3	0.50 0.35	0.50 0.35	5.1 4.9	3.2 3.0	5.1 4.9	3.2 3.0	0.5	4.2	4.2	4.15	4.15	0.2	0.15	0.15	0.05

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT560-1		MO-217				~~00-02-01~~ 03-03-12

Fig 11. Package outline SOT560-1 (HBCC32)

14. Soldering

14.1 Introduction to soldering surface mount packages

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *Data Handbook IC26; Integrated Circuit Packages* (document order number 9398 652 90011).

There is no soldering method that is ideal for all surface mount IC packages. Wave soldering can still be used for certain surface mount ICs, but it is not suitable for fine pitch SMDs. In these situations reflow soldering is recommended.

14.2 Reflow soldering

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement. Driven by legislation and environmental forces the worldwide use of lead-free solder pastes is increasing.

Several methods exist for reflowing; for example, convection or convection/infrared heating in a conveyor type oven. Throughput times (preheating, soldering and cooling) vary between 100 seconds and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 °C to 270 °C depending on solder paste material. The top-surface temperature of the packages should preferably be kept:

- below 225 °C (SnPb process) or below 245 °C (Pb-free process)
  - for all BGA, HTSSON..T and SSOP..T packages
  - for packages with a thickness ≥ 2.5 mm
  - for packages with a thickness < 2.5 mm and a volume ≥ 350 mm^3 so called thick/large packages.
- below 240 °C (SnPb process) or below 260 °C (Pb-free process) for packages with a thickness < 2.5 mm and a volume < 350 mm^3 so called small/thin packages.

Moisture sensitivity precautions, as indicated on packing, must be respected at all times.

14.3 Wave soldering

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

To overcome these problems the double-wave soldering method was specifically developed.

If wave soldering is used the following conditions must be observed for optimal results:

- Use a double-wave soldering method comprising a turbulent wave with high upward pressure followed by a smooth laminar wave.
- For packages with leads on two sides and a pitch (e):
  - larger than or equal to 1.27 mm, the footprint longitudinal axis is **preferred** to be parallel to the transport direction of the printed-circuit board;

- smaller than 1.27 mm, the footprint longitudinal axis **must** be parallel to the transport direction of the printed-circuit board.

The footprint must incorporate solder thieves at the downstream end.

- For packages with leads on four sides, the footprint must be placed at a 45° angle to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves downstream and at the side corners.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Typical dwell time of the leads in the wave ranges from 3 seconds to 4 seconds at 250 °C or 265 °C, depending on solder material applied, SnPb or Pb-free respectively.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

14.4 Manual soldering

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C.

When using a dedicated tool, all other leads can be soldered in one operation within 2 seconds to 5 seconds between 270 °C and 320 °C.

14.5 Package related soldering information

Table 9: Suitability of surface mount IC packages for wave and reflow soldering methods

Package [1]	Soldering method	
	Wave	**Reflow** [2]
BGA, HTSSON..T [3], LBGA, LFBGA, SQFP, SSOP..T [3], TFBGA, VFBGA, XSON	not suitable	suitable
DHVQFN, HBCC, HBGA, HLQFP, HSO, HSOP, HSQFP, HSSON, HTQFP, HTSSOP, HVQFN, HVSON, SMS	not suitable [4]	suitable
PLCC [5], SO, SOJ	suitable	suitable
LQFP, QFP, TQFP	not recommended [5] [6]	suitable
SSOP, TSSOP, VSO, VSSOP	not recommended [7]	suitable
CWQCCN..L [8], PMFP [9], WQCCN..L [8]	not suitable	not suitable

[1] For more detailed information on the BGA packages refer to the *(LF)BGA Application Note* (AN01026); order a copy from your Philips Semiconductors sales office.

[2] All surface mount (SMD) packages are moisture sensitive. Depending upon the moisture content, the maximum temperature (with respect to time) and body size of the package, there is a risk that internal or external package cracks may occur due to vaporization of the moisture in them (the so called popcorn effect). For details, refer to the Drypack information in the *Data Handbook IC26; Integrated Circuit Packages; Section: Packing Methods*.

[3] These transparent plastic packages are extremely sensitive to reflow soldering conditions and must on no account be processed through more than one soldering cycle or subjected to infrared reflow soldering with peak temperature exceeding 217 °C ± 10 °C measured in the atmosphere of the reflow oven. The package body peak temperature must be kept as low as possible.

[4] These packages are not suitable for wave soldering. On versions with the heatsink on the bottom side, the solder cannot penetrate between the printed-circuit board and the heatsink. On versions with the heatsink on the top side, the solder might be deposited on the heatsink surface.

[5] If wave soldering is considered, then the package must be placed at a 45° angle to the solder wave direction. The package footprint must incorporate solder thieves downstream and at the side corners.

[6] Wave soldering is suitable for LQFP, QFP and TQFP packages with a pitch (e) larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.

[7] Wave soldering is suitable for SSOP, TSSOP, VSO and VSSOP packages with a pitch (e) equal to or larger than 0.65 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.5 mm.

[8] Image sensor packages in principle should not be soldered. They are mounted in sockets or delivered pre-mounted on flex foil. However, the image sensor package can be mounted by the client on a flex foil by using a hot bar soldering process. The appropriate soldering profile can be provided on request.

[9] Hot bar soldering or manual soldering is suitable for PMFP packages.

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15. Revision history

Table 10:   Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
TZA3011A_TZA3011B_6	20050120	Product data sheet	-	9397 750 14437	TZA3011A_TZA3011B_5
Modifications:		• The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors. • change unit bits/s to bit/s.			
TZA3011A_TZA3011B_5	20030402	Product specification		9397 750 11282	TZA3011A_TZA3011B_4
TZA3011A_TZA3011B_4	20021106	Product specification		9397 750 10185	TZA3011A_TZA3011B_3
TZA3011A_TZA3011B_3	20020523	Preliminary specification		9397 750 09671	TZA3011A_TZA3011B_2
TZA3011A_TZA3011B_2	20020312	Preliminary specification		9397 750 09231	TZA3011A_B_1
TZA3011A_B_1	20010129	Objective specification		9397 750 07764	-

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16. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
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[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

17. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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Bare die — All die are tested and are guaranteed to comply with all data sheet limits up to the point of wafer sawing for a period of ninety (90) days from the date of Philips' delivery. If there are data sheet limits not guaranteed, these will be separately indicated in the data sheet. There are no post packing tests performed on individual die or wafer. Philips Semiconductors has no control of third party procedures in the sawing, handling, packing or assembly of the die. Accordingly, Philips Semiconductors assumes no liability for device functionality or performance of the die or systems after third party sawing, handling, packing or assembly of the die. It is the responsibility of the customer to test and qualify their application in which the die is used.

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19. Trademarks

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20. Contact information

For additional information, please visit: **http://www.semiconductors.philips.com**

For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**

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