DATA SHEET

TZA3001AHL; TZA3001BHL; TZA3001U

SDH/SONET STM4/OC12 laser drivers

Objective specification
File under Integrated Circuits, IC19

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Philips Semiconductors

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FEATURES

- 622 Mbits/s data input, both Current-Mode Logic (CML) and Positive Emitter-Coupled Logic (PECL) compatible (800 mV peak-to-peak maximum)
- Adaptive laser output control, stabilizing optical ONE and ZERO levels
- Optional external (non-adaptive) control of laser modulation and biasing currents
- Automatic Laser Shutdown (ALS)
- Few external components required
- Rise and fall times typically 120 ps
- Jitter <50 mUI peak-to-peak
- RF output current sinking capability of 60 mA
- Bias current sinking capability of 90 mA
- Power dissipation typically 475 mW
- Low cost LQFP32 plastic package
- Single 5 V power supply.

TZA3001AHL

- Laser alarm output for signalling extremely low and high bias current conditions.

TZA3001BHL

- Loop mode for testing STM4 622 Mbits/s optical interfaces; CML and PECL compatible.

TZA3001U

- Naked die version with combined bias alarm and loop mode functionality.

DESCRIPTION

The TZA3001AHL, TZA3001BHL and TZA3001U are fully integrated laser drivers for STM4/OC12 (622 Mbits/s) systems, incorporating the RF path between the data multiplexer and the laser diode. Since the bias and modulation control circuits are integrated on the IC, the external component count is low (only decoupling capacitors and adjustment resistors are required).

The TZA3001AHL features an alarm function for signalling extreme bias current conditions. The alarm low and high threshold levels can be adjusted to suit the application using only a resistor. An additional RF data input is provided with the TZA3001BHL to facilitate remote (loop mode) system testing.

The TZA3001U is a naked die version for use in compact laser module designs. The die contains 40 pads and features the combined functionality of the TZA3001AHL and TZA3001BHL.

APPLICATIONS

- SDH/SONET STM4/OC12 optical transmission systems
- SDH/SONET STM4/OC12 optical laser modules.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TZA3001AHL	LQFP32	plastic low profile quad flat package; 32 leads; body 5 × 5 × 1.4 mm	SOT401-1
TZA3001BHL	LQFP32	plastic low profile quad flat package; 32 leads; body 5 × 5 × 1.4 mm	SOT401-1
TZA3001U	–	naked die; 2000 × 2000 × 380 μm	–

BLOCK DIAGRAMS

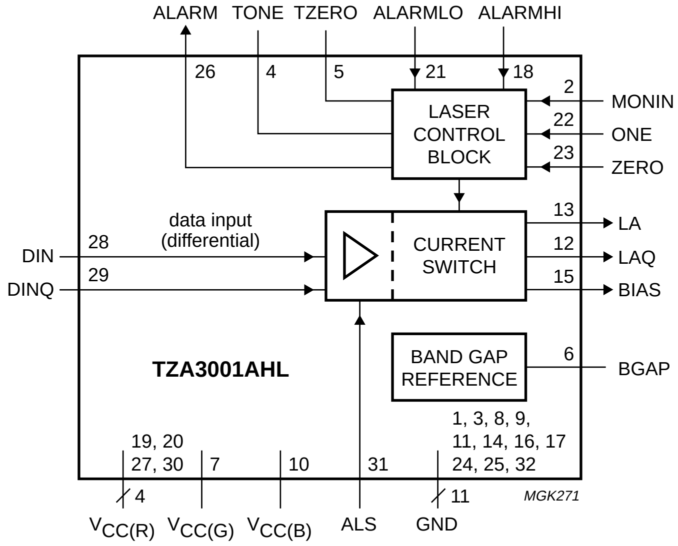


Fig.1 Block diagram: TZA3001AHL.

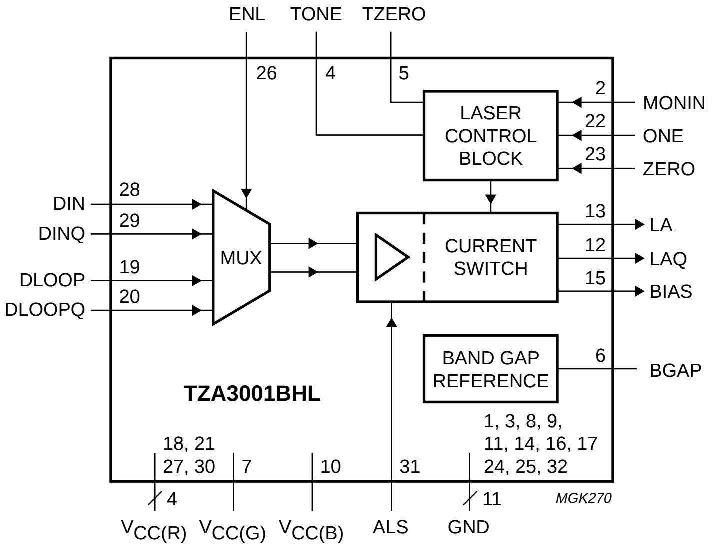


Fig.2 Block diagram: TZA3001BHL.

PINNING

TZA3001AHL

SYMBOL	PIN	DESCRIPTION
GND	1	ground
MONIN	2	monitor photo diode current input
GND	3	ground
TONE	4	connection for external capacitor used to set optical ONE control loop time constant (optional)
TZERO	5	connection for external capacitor used to set optical ZERO control loop time constant (optional)
BGAP	6	connection for external band gap decoupling capacitor
$V_{CC(G)}$	7	supply voltage; note 1
GND	8	ground
GND	9	ground
$V_{CC(B)}$	10	supply voltage; note 1
GND	11	ground
LAQ	12	inverted laser modulation output
LA	13	laser modulation output
GND	14	ground
BIAS	15	laser bias current output
GND	16	ground
GND	17	ground
ALARMHI	18	maximum bias current alarm reference level input
$V_{CC(R)}$	19	supply voltage; note 1
$V_{CC(R)}$	20	supply voltage; note 1
ALARMLO	21	minimum bias current alarm reference level input
ONE	22	optical ONE reference level input
ZERO	23	optical ZERO reference level input
GND	24	ground
GND	25	ground
ALARM	26	alarm output
$V_{CC(R)}$	27	supply voltage; note 1
DIN	28	data input
DINQ	29	inverted data input
$V_{CC(R)}$	30	supply voltage; note 1
ALS	31	automatic laser shutdown input
GND	32	ground

TZA3001BHL

SYMBOL	PIN	DESCRIPTION
GND	1	ground
MONIN	2	monitor photo diode current input
GND	3	ground
TONE	4	connection for external capacitor used to set optical ONE control loop time constant (optional)
TZERO	5	connection for external capacitor used to set optical ZERO control loop time constant (optional)
BGAP	6	connection for external band gap decoupling capacitor
$V_{CC(G)}$	7	supply voltage; note 1
GND	8	ground
GND	9	ground
$V_{CC(B)}$	10	supply voltage; note 1
GND	11	ground
LAQ	12	inverted laser modulation output
LA	13	laser modulation output
GND	14	ground
BIAS	15	laser bias current output
GND	16	ground
GND	17	ground
$V_{CC(R)}$	18	supply voltage; note 1
DLOOP	19	loop mode data input
DLOOPQ	20	loop mode inverted data input
$V_{CC(R)}$	21	supply voltage; note 1
ONE	22	optical ONE reference level input
ZERO	23	optical ZERO reference level input
GND	24	ground
GND	25	ground
ENL	26	loop mode enable input
$V_{CC(R)}$	27	supply voltage; note 1
DIN	28	data input
DINQ	29	inverted data input
$V_{CC(R)}$	30	supply voltage; note 1
ALS	31	automatic laser shutdown input
GND	32	ground

Note to Tables TZA3001AHL and TZA3001BHL

1. See Section “Power supply connections”.

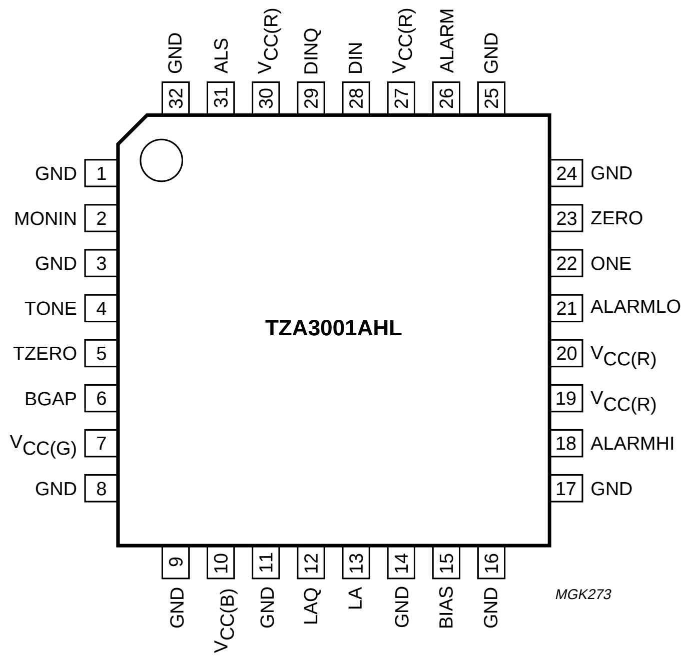


Fig.3 Pin configuration: TZA3001AHL.

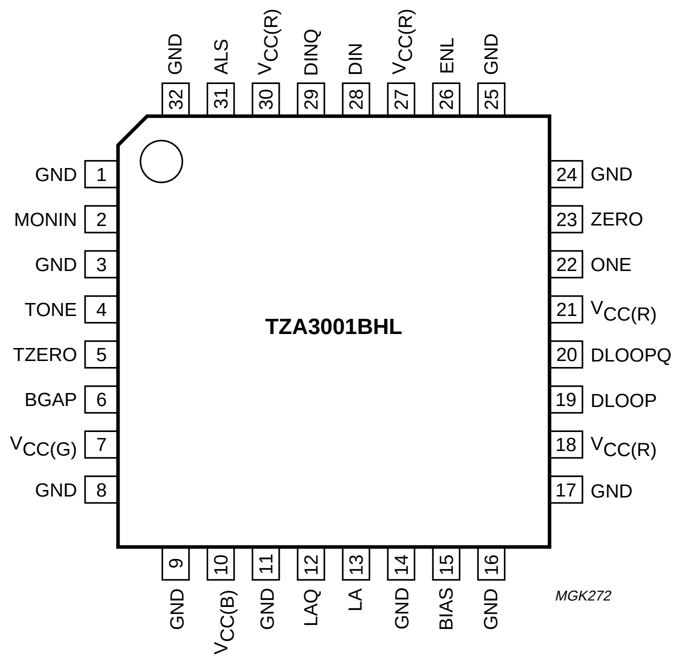


Fig.4 Pin configuration: TZA3001BHL.

PAD CONFIGURATION

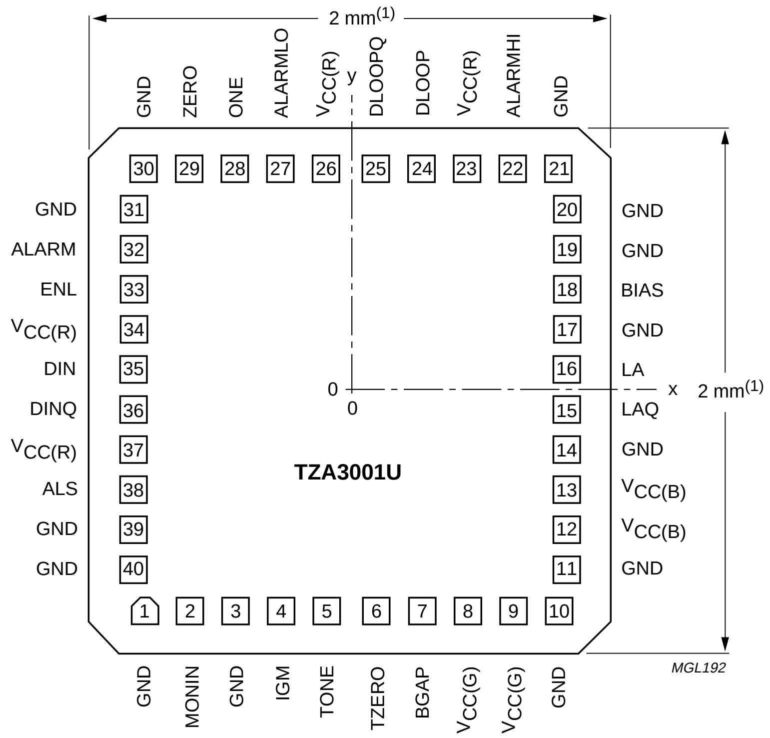
TZA3001U (naked die)

SYMBOL	PAD	DESCRIPTION	COORDINATES[1]	
			x	y
GND	1	ground	–664	–910
MONIN	2	monitor photo diode current input	–524	–910
GND	3	ground	–367	–910
IGM	4	not used (leave unbonded)	–227	–910
TONE	5	connection for external capacitor to set optical ONE control loop time constant (optional)	–70	–910
TZERO	6	connection for external capacitor to set optical ZERO control loop time constant (optional)	+87	–910
BGAP	7	connection for external band gap decoupling capacitor	+244	–910
$V_{CC(G)}$	8	supply voltage	+384	–910
$V_{CC(G)}$	9	supply voltage	+524	–910
GND	10	ground	+664	–910
GND	11	ground	+910	–630
$V_{CC(B)}$	12	supply voltage	+910	–490
$V_{CC(B)}$	13	supply voltage	+910	–350
GND	14	ground	+910	–210
LAQ	15	inverted laser modulation output	+910	–70
LA	16	laser modulation output	+910	+70
GND	17	ground	+910	+210
BIAS	18	laser bias current output	+910	+350
GND	19	ground	+910	+490
GND	20	ground	+910	+630
GND	21	ground	+681	+910
ALARMHI	22	maximum bias current alarm reference level input	+541	+910
$V_{CC(R)}$	23	supply voltage	+384	+910
DLOOP	24	loop mode data input	+227	+910
DLOOPQ	25	loop mode inverted data input	+87	+910
$V_{CC(R)}$	26	supply voltage	–70	+910
ALARMLO	27	minimum bias current reference level input	–210	+910
ONE	28	optical ONE reference level input	–367	+910
ZERO	29	optical ZERO reference level input	–524	+910
GND	30	ground	–681	+910
GND	31	ground	–910	+681
ALARM	32	alarm output	–910	+541
ENL	26	loop mode enable input	–910	+384
$V_{CC(R)}$	34	supply voltage	–910	+227
DIN	35	data input	–910	+70

SYMBOL	PAD	DESCRIPTION	COORDINATES[1]	
			x	y
DINQ	36	inverted data input	–910	–70
$V_{CC(R)}$	37	supply voltage	–910	–227
ALS	38	automatic laser shutdown input	–910	–367
GND	39	ground	–910	–551
GND	40	ground	–910	–664

Note

1. Coordinates represent the position of the centre of the pad, in µm with respect to the centre of the die.



(1) Typical value.
Pad size: 90 × 90 µm.
Chip area: 4 square mm.
The numbers in the small squares refer to the pad numbers.

Fig.5 Bonding pad locations: TZA3001U.

FUNCTIONAL DESCRIPTION

The TZA3001AHL, TZA3001BHL and TZA3001U laser drivers accept a 622 Mbits/s STM4 input data stream (CML or PECL compatible) and generate an output signal with sufficient current to drive a solid state laser. They also contain control circuitry for stabilizing the laser optical power levels representing logic 1 and logic 0.

The input buffers present a high impedance to the data stream on the DIN and DINQ differential inputs. The input signal can be CML (approximately 200 mV peak-to-peak below the supply voltage) or PECL (up to 800 mV peak-to-peak) compatible. The input can be configured to accept CML signals by connecting external 50 Ω pull-up resistors to $V_{CC(R)}$. If PECL compatibility is required, the usual Thevenin termination can be applied. For ECL signals (negative to ground), the inputs should be AC-coupled to the signal source.

The differential amplifier contains a preamplifier and a main amplifier. The main amplifier is designed to handle the large peak currents required at the output laser driving stage and is insensitive to supply voltage variations. The output signal from the main amplifier drives a current switch which supplies a maximum modulation current of 60 mA through outputs LA and LAQ. The BIAS pin delivers a bias current of up to 90 mA DC for adjusting the laser output to a level above its light emitting threshold.

Automatic laser control

A laser with a Monitor Photo Diode (MPD) is required for the laser control circuit. The MPD current, which is proportional to the laser emission, is fed into the MONIN pin (current range is 100 to 1000 μA peak-to-peak). The input buffer is optimized to cope with MPD capacitances up to 50 pF. To prevent the input buffer breaking into oscillation with a low capacitance MPD, it is advisable to increase the capacitance to at least the minimum specified value (see Chapter “Characteristics”), by connecting extra capacitance to the MONIN pin.

DC reference currents are applied to pins ZERO and ONE to set the MPD reference levels for laser LOW and laser HIGH. A resistor between $V_{CC(R)}$ and the pin is sufficient; the voltage on the ZERO and ONE pins is held constant at a level 1.5 V below $V_{CC(R)}$. The reference current applied to pin ZERO is multiplied by 4, the reference current flowing into pin ONE is multiplied internally by 16.

The reference current and resistor for the optical ONE regulation loop (modulation current control) can be calculated using the following formulae:

$$I_{ONE} = \frac{1}{16} \cdot I_{MPD(ONE)} \quad [A] \qquad (1)$$

$$R_{ONE} = \frac{1.5}{I_{ONE}} = \frac{24}{I_{MPD(ONE)}} \quad [\Omega] \qquad (2)$$

The reference current and resistor for the optical ZERO regulation loop (bias current control) can be calculated using the following formulae:

$$I_{ZERO} = \frac{1}{4} \cdot I_{MPD(ZERO)} \quad [A] \qquad (3)$$

$$R_{ZERO} = \frac{1.5}{I_{ZERO}} = \frac{6}{I_{MPD(ZERO)}} \quad [\Omega] \qquad (4)$$

In these formulae, $I_{MPD(ONE)}$ and $I_{MPD(ZERO)}$ represent monitor photo diode current during an optical ONE and an optical ZERO, respectively.

Example: A laser is operating at optical output power levels of 0.3 mW for laser HIGH and 0.03 mW for laser LOW (extinction ratio of 10 dB). Suppose the corresponding MPD currents for this type of laser are 260 μA and 30 μA respectively. In this case, a reference current of $\frac{260\,\mu A}{16} = 16.25\,\mu A$ should flow into pin ONE. This can be set using a current source or simply by connecting a resistor of the appropriate value. The resistor can be connected between $V_{CC(R)}$ and pin ONE. In this example the resistor would be

$R_{ONE} = \frac{1.5\,V}{16.25\,\mu A} = 92.3\,k\Omega$ (the voltage on pin ONE is held constant at 1.5 V below $V_{CC(R)}$).

The reference current at pin ZERO in this example should be $\frac{30\,\mu A}{4} = 7.5\,\mu A$. Again this current should flow into pin ZERO and can be set using a resistor

$R_{ZERO} = \frac{1.5\,V}{7.5\,\mu A} = 200\,k\Omega$ (the voltage on pin ZERO is held constant at 1.5 V below $V_{CC(R)}$).

Note that it is the MPD current that is stabilized, rather than the actual laser optical output power. Deviations between optical output power and MPD current, known as ‘tracking errors’, cannot be corrected for.

Designing the modulation and bias loop

The optical ONE and ZERO regulation loop time constants are determined by on-chip capacitances. If the resulting time constants are found to be too small in a specific application, they can be increased by connecting external capacitors to pins TZERO and TONE, respectively.

The loop time constant and bandwidth can be estimated using the following formulae:

$$\tau_{ONE} = \left(40 \cdot 10^{-12} + C_{TONE}\right) \cdot \frac{80 \cdot 10^{3}}{\eta_{LASER}} \quad [s] \qquad (5)$$

$$B_{ONE} = \frac{1}{2\pi \cdot \tau_{ONE}} \qquad (6)$$

$$= \frac{\eta_{LASER}}{2\pi \cdot \left(40 \cdot 10^{-12} + C_{TONE}\right) \cdot 80 \cdot 10^{3}} \quad [Hz]$$

$$\tau_{ZERO} = \left(40 \cdot 10^{-12} + C_{TZERO}\right) \cdot \frac{50 \cdot 10^{3}}{\eta_{LASER}} \quad [s] \qquad (7)$$

$$B_{ZERO} = \frac{1}{2\pi \cdot \tau_{ZERO}} \qquad (8)$$

$$= \frac{\eta_{LASER}}{2\pi \cdot \left(40 \cdot 10^{-12} + C_{TZERO}\right) \cdot 50 \cdot 10^{3}} \quad [Hz]$$

The term η_{LASER} in the above formulae is the product of two terms: η_{EO}, the electro-optical efficiency, and R, the monitor photo diode responsivity. η_{EO} accounts for the steepness of the laser slope, the amount of extra optical output power in mW per mA of modulation current. R is the responsivity of the monitor photo diode, the amount of extra monitor photo diode current in mA per mW optical output power. The product of these terms yields η_{LASER}, which is dimensionless.

Example: A laser with an MPD has the following specifications: P_O = 1 mW, I_{th} = 25 mA, η_{EO} = 30 mW/A, R = 500 mA/W. The term I_{th} is the threshold current, which is the current required to switch on the laser. If the laser operates just above threshold, it may be assumed that η_{EO} around the optical ZERO level is 50% of η_{EO} around the optical ONE level, due to the decreasing slope near threshold. In this example the resulting bandwidth for the optical ONE regulation loop, without external capacitance, would be:

$$B = \frac{1}{2\pi \cdot \tau_{ONE}} = \frac{30 \cdot 10^{-3} \cdot 500 \cdot 10^{-3}}{2\pi \cdot 40 \cdot 10^{-12} \cdot 80 \cdot 10^{3}} \approx 750 \text{ Hz}.$$

The resulting bandwidth for the optical ZERO regulation loop, without external capacitance, would be:

$$B = \frac{1}{2\pi \cdot \tau_{ZERO}} = \frac{0.5 \cdot 30 \cdot 10^{-3} \cdot 500 \cdot 10^{-3}}{2\pi \cdot 40 \cdot 10^{-12} \cdot 50 \cdot 10^{3}} \approx 600 \text{ Hz}.$$

It is not necessary to add additional capacitance with this type of laser.

Manual laser override

The automatic laser control function can be overridden by connecting voltage sources to TZERO and TONE to take direct control of, respectively, the bias current source and the modulation current source. The control voltages should be in the range 1.5 to 3.5 V to sweep the modulation current through the range 1 to 60 mA and the bias current through the range 1 to 90 mA. These current ranges are guaranteed. Depending on temperature and manufacturing process spread, current values higher than the specified ranges can be achieved. However, bias and modulation currents in excess of the specified range are not supported and should be avoided.

Automatic laser shut down

The laser modulation and bias currents can be rapidly switched off by means of the active HIGH ALS input (CMOS). This function allows the circuit to be shut down in the event of an optical system malfunction. A 25 kΩ pull-down resistor defaults the ALS input to the non active state.

TZA3001AHL: bias alarm

The bias current alarm circuit detects and flags whenever the bias current falls outside a predefined range. This feature can detect excessive aging and laser malfunctioning. The maximum permitted bias current should be applied to ALARMHI with an attenuation ratio of 1500, the minimum to ALARMLO with an attenuation ratio of 300.

Like the reference currents for the laser current regulation loops, the alarm reference currents can be set using external resistors between $V_{CC(R)}$ and pins ALARMHI and ALARMLO. Resistor values can be calculated using the following formulae:

$$R_{ALARMHI} = \frac{1.5 \cdot 1500}{I_{BIAS_{MAX}}} \quad [\Omega] \qquad (9)$$

$$R_{ALARMLO} = \frac{1.5 \cdot 300}{I_{BIAS_{MIN}}} \quad [\Omega] \qquad (10)$$

Example: The following reference currents would be required to limit the bias current range to between 6 and 90 mA:

$$I_{ALARMLO} = \frac{6 \text{ mA}}{300} = 20\ \mu\text{A} \text{ and}$$

$$I_{ALARMHI} = \frac{90 \text{ mA}}{1500} = 60\ \mu\text{A}$$

The corresponding resistor values would be:

$$R_{ALARMHI} = \frac{1.5\,V \cdot 1500}{90\ mA} = 25\,k\Omega \text{ and}$$

$$R_{ALARMLO} = \frac{1.5\,V \cdot 300}{6\ mA} = 75\,k\Omega$$

If the alarm condition is true, the ALARM output goes HIGH (CMOS level). This signal could be used, for example, to disable the laser driver by driving the ALS input (a latch is needed in between to prevent oscillation).

TZA3001BHL: loop mode

In loop mode, the total system application can be tested. It allows for uninhibited optical transmission through the fibre front end (from the photo diode through the transimpedance stage and the data and clock recovery unit, to the laser driver and via the laser back to the fibre). Note that the optical receiver used in conjunction with theTZA3001BHL must have a loop mode output in order to complete the test loop. A HIGH on pin ENL selects loop mode. By default ENL is pulled LOW by a 25 kΩ pull-down resistor.

Power supply connections

Three separate supply domains (labelled $V_{CC(B)}$, $V_{CC(G)}$ and $V_{CC(R)}$) are used to provide isolation between the high-current outputs, the PECL/CML input, and the monitor photo diode current input. The three domains should be individually filtered before being connected to a central V_{CC} (see Fig.6). The supply levels should be equal and in accordance with the values specified in Chapter “Characteristics”. To maximize power supply isolation, the MPD cathode on the laser should be connected to $V_{CC(G)}$, and the laser diode anode to $V_{CC(B)}$. The inverted laser driver modulation output LAQ is generally not used.
To properly balance the output stage, an equalization network with an impedance comparable to the laser is connected to LAQ. This network is referenced to $V_{CC(B)}$.

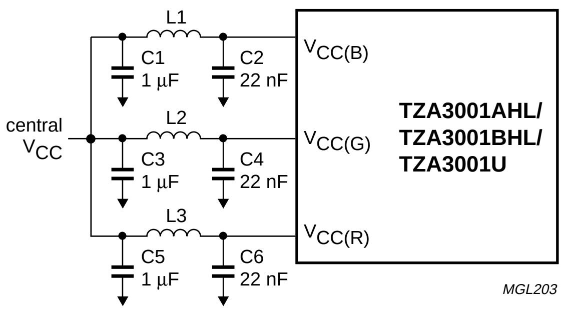


Fig.6 Recommended power supply connections.

Grounding the TZA3001U naked die

In addition to the separate V_{CC} domains, the TZA3001U naked die contains three corresponding ground domains. Isolation between the GND domains is limited due to the finite substrate conductance. Although elaborate tests have still to be done, the following grounding strategy is recommended for optimal performance.

Mount the die on a, preferably large and highly conductive, grounded die pad. All GND pads have to be bonded down to the die pad. The external ground is thus optimally combined with the die ground, avoiding ground bouncing problems.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	supply voltage	–0.5	+6	V
V_n	DC voltage			
	pin 2: MONIN	1.3	V_{CC} + 0.5	V
	pins 4 and 5: TONE and TZERO	–0.5	V_{CC} + 0.5	V
	pin 6: BGAP	–0.5	+3.2	V
	pin 15: BIAS	–0.5	V_{CC} + 0.5	V
	pins 12 and 13: LAQ and LA	1.3	V_{CC} + 0.5	V
	pins 18 and 21: ALARMHI and ALARMLO (TZA3001AHL)	–0.5	V_{CC} + 0.5	V
	pins 22 and 23: ONE and ZERO	–0.5	V_{CC} + 0.5	V
	pins 19 and 20: data pins DLOOP and DLOOPQ (TZA3001BHL)	–0.5	V_{CC} + 0.5	V
	pins 28 and 29: data pins DIN and DINQ	–0.5	V_{CC} + 0.5	V
	pin 26: CMOS pin ALARM (TZA3001AHL)	–0.5	V_{CC} + 0.5	V
	pin 26: CMOS pin ENL (TZA3001BHL)	–0.5	V_{CC} + 0.5	V
	pin 31: CMOS pin ALS	–0.5	V_{CC} + 0.5	V
I_n	DC input current			
	pin 2: MONIN	0	10	mA
	pins 4 and 5: TONE and TZERO	–10	+10	mA
	pin 6: BGAP	–2.0	+2.5	mA
	pin 15: BIAS	0	200	mA
	pins 12 and 13: LAQ and LA	0	100	mA
	pins 18 and 21: ALARMHI and ALARMLO (TZA3001AHL)	–10	+0.5	mA
	pins 22 and 23: ONE and ZERO	–10	+0.5	mA
	pins 19 and 20: data pins DLOOP and DLOOPQ (TZA3001BHL)	–10	+10	mA
	pins 28 and 29: data pins DIN and DINQ	–10	+10	mA
	pin 26: CMOS pin ALARM (TZA3001AHL)	–10	+10	mA
	pin 26: CMOS pin ENL (TZA3001BHL)	–0.5	+0.5	mA
	pin 31: CMOS pin ALS	–0.5	+0.5	mA
T_{amb}	ambient temperature	–40	+85	°C
T_j	junction temperature	–40	+125	°C
T_{stg}	storage temperature	–65	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th(j-s)}$	thermal resistance from junction to solder point	15	K/W
$R_{th(j-c)}$	thermal resistance from junction to case	tbf	K/W

CHARACTERISTICS

V_{CC} = 5 V; T_{amb} = –40 to +85 °C; all voltages with respect to GND.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_{CC}	supply voltage		4.75	5	5.25	V
I_{CC}	supply current	note 1	–	65(2)	90(3)	mA
P_{tot}	total power dissipation	note 4	–	430(5)	810(6)	mW
Data inputs: DIN and DINQ (DLOOP and DLOOPQ on TZA3001BHL)						
$V_{i(p-p)}$	input voltage (peak-to-peak value)(7)	50 Ω measurement system	100	250	800	mV
V_{IO}	permitted input offset voltage		–25	–	+25	mV
V_I	input voltage range		V_{CC} – 2000	–	V_{CC} + 250	mV
Z_i	low frequency single ended input impedance		8	10	12	kΩ
CMOS inputs: ALS (ENL on TZA3001BHL)						
V_{IL}	LOW-level input voltage		–	0.4	0.8	V
V_{IH}	HIGH-level input voltage		3.0	4.0	–	V
CMOS output: ALARM on TZA3001AHL only						
V_{OL}	LOW-level output voltage		0	–	0.2	V
V_{OH}	HIGH-level output voltage		4.8	–	5	V
Monitor photo diode input: MONIN						
$I_{i(p-p)}$	monitor photo diode current (peak-to-peak value)		100	–	1000	μA
V_I	DC input voltage		1.5	1.8	2.0	V
C	monitor photo diode capacitance		30(8)	–	50	pF
Control loop reference currents: ONE and ZERO						
$I_{ref(ONE)}$	optical ONE reference current	note 9	6	–	65	μA
$V_{ref(ONE)}$	optical ONE reference voltage	referenced to $V_{CC(R)}$	–1.55	–1.5	–1.45	V
$I_{ref(ZERO)}$	optical ZERO reference current	note 9	6	–	65	μA
$V_{ref(ZERO)}$	optical ZERO reference voltage	referenced to $V_{CC(R)}$	–1.55	–1.5	–1.45	V
Control loop time constants: TONE and TZERO						
V_{TONE}	TONE voltage		1.5	–	3.5	V
$g_{m(TONE)}$	TONE transconductance	note 10	–	50	–	mA/V
V_{TZERO}	TZERO voltage		1.5	–	3.5	V
$g_{m(TZERO)}$	TZERO transconductance	note 11	–	80	–	mA/V
Laser modulation outputs: LA and LAQ						
I_{OL}	LOW-level output current		–	–	2	mA
I_{OH}	HIGH-level output current		1	–	60	mA
$I_{O(ALS)}$	output current during ALS		–	–	10	μA
V_O	output voltage range		2	–	5	V
t_r, t_f	rise/fall time		–	120	300	ps

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$J_{o(p-p)}$	intrinsic output jitter (peak-to-peak value)		–	–	50(12)	mUI
Bias current output: BIAS						
I_O	output current		2	–	90	mA
$I_{O(ALS)}$	output current during ALS		–	–	10	μA
$t_{res(ALS)}$	ALS response time	I_{BIAS} = 90 mA; note 13	–	–	1	μs
V_O	output voltage		1	–	5	V
Alarm threshold inputs: ALARMHI and ALARMLO (TZA3001AHL only)						
$I_{ref(ALARMLO)}$	lower alarm threshold reference current	note 14	6	–	65	μA
$V_{ref(ALARMLO)}$	optical ALARMLO reference voltage	referenced to $V_{CC(R)}$	−1.55	−1.5	−1.45	V
$I_{ref(ALARMHI)}$	higher alarm threshold reference current	note 14	6	–	65	μA
$V_{ref(ALARMHI)}$	optical ALARMHI reference voltage	referenced to $V_{CC(R)}$	−1.55	−1.5	−1.45	V

Notes

1. I_{CC} does not include modulation and bias current through pins LA, LAQ and BIAS.
2. Typical value for I_{CC} refers to, but does not include, I_{MOD} = 30 mA and I_{BIAS} = 45mA.
3. The maximum value of I_{CC} refers to, but does not include, I_{MOD} = 60 mA and I_{BIAS} = 90mA.
4. P_{tot} includes modulation and bias current through pins LA, LAQ and BIAS.
5. The typical power dissipation is the on-chip dissipation with I_{MOD} = 30 mA and $V_{LA/LAQ}$ = 2 V, I_{BIAS} = 45 mA and V_{BIAS} = 1 V and typical process parameters.
6. The maximum power dissipation is the on-chip dissipation with I_{MOD} = 60 mA and $V_{LA/LAQ}$ = 2 V, I_{BIAS} = 90 mA and V_{BIAS} = 1 V and worst case process parameters.
7. Measured single ended.
8. A minimum value of capacitance on pin MONIN is required to prevent instability.
9. The reference currents can be set by a resistor between V_{CC} and pin ONE or ZERO. The corresponding ZERO level MPD current range is from 24 to 260 μA. The ONE level MPD current range is from 96 to 1040 μA. See Section “Automatic laser control” for a detailed discussion.
10. The specified transconductance is the ratio of modulation current at LA and LAQ to voltage at pin TONE, under small signal conditions.
11. The specified transconductance is the ratio of biasing current at BIAS to voltage at pin TZERO, under small signal conditions.
12. Measured in a frequency band from 250 kHz to 5 MHz, according to “*ITU-T Recommendation G.813*”. The electrically generated (current) jitter is assumed to be less than 50% of the optical output jitter.
13. The ALS response time is defined as the delay between the onset of the ALS ramp (10% of the HIGH logic level) and the extinction of the bias current (10% of the original value).
14. The reference currents can be set by using a resistor between $V_{CC(R)}$ and pin ALARMLO or ALARMHI. The corresponding range of low-bias thresholds is between 1.8 and 19.5 mA. The high-bias threshold range is from 9 to 97.5 mA. See Section “TZA3001AHL: bias alarm” for detailed information.

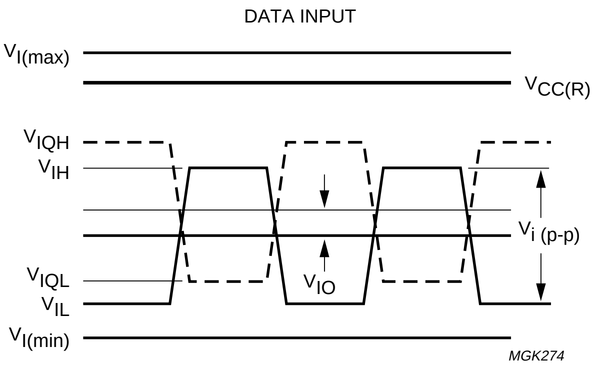
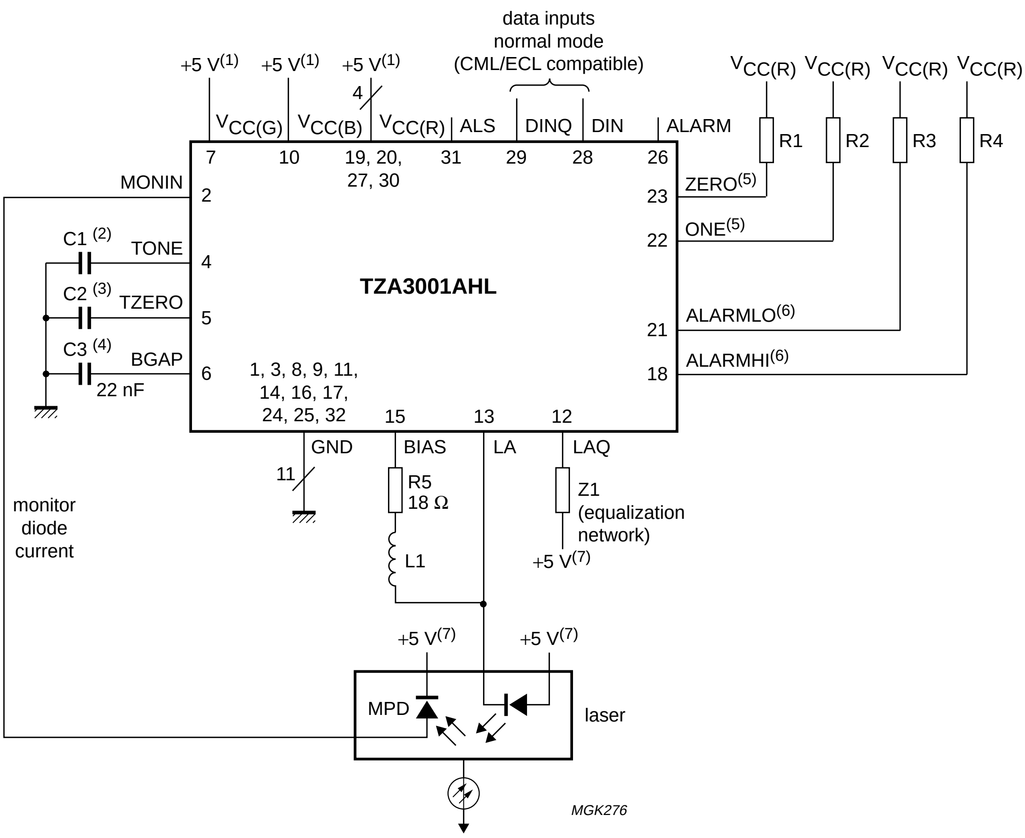


Fig.7 Logic level symbol definitions for data inputs.

APPLICATION INFORMATION

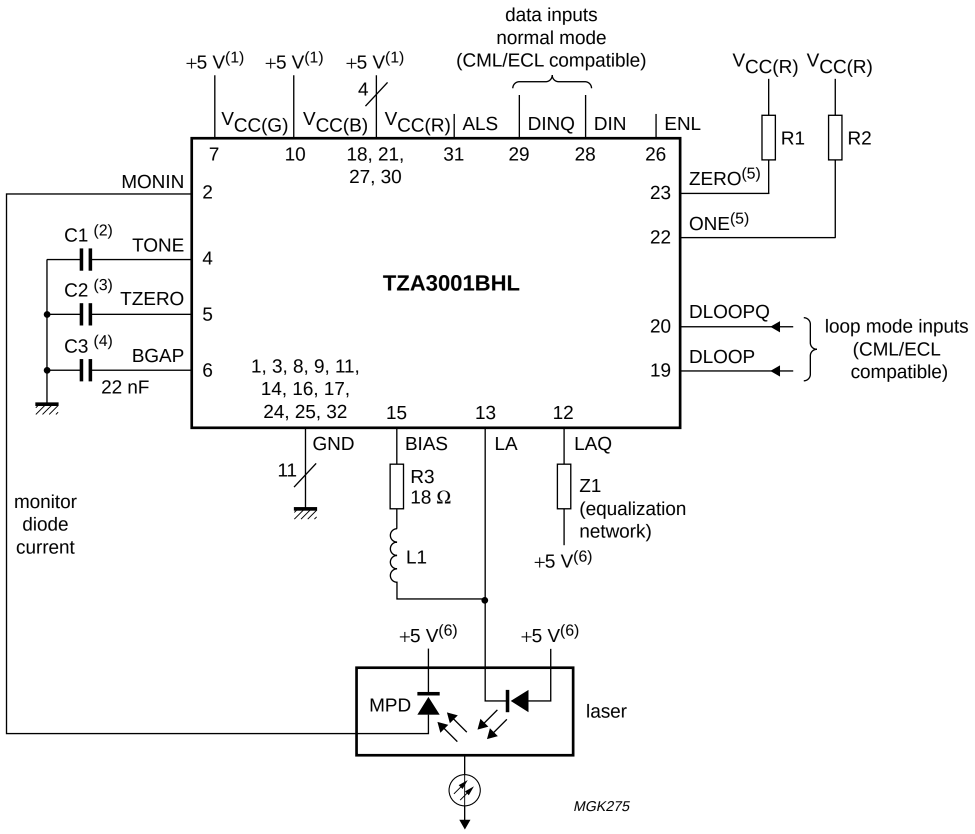
TZA3001AHL



(1) A filter should be connected between the pin and the 5 V supply; see Section “Power supply connections”.
(2) C1 enhances modulation control loop time constant (optional).
(3) C2 enhances bias control loop time constant (optional).
(4) Band gap noise filter.
(5) Optical ZERO and ONE reference currents are set using resistors to $V_{CC(R)}$. See Section “Automatic laser control”.
(6) Minimum and maximum bias currents are set using resistors to $V_{CC(R)}$. See Section “TZA3001AHL: bias alarm”.
(7) See Section “Power supply connections”.

Fig.8 Application diagram showing the TZA3001AHL configured for 622.08 Mbits/s (STM4/OC12).

TZA3001BHL

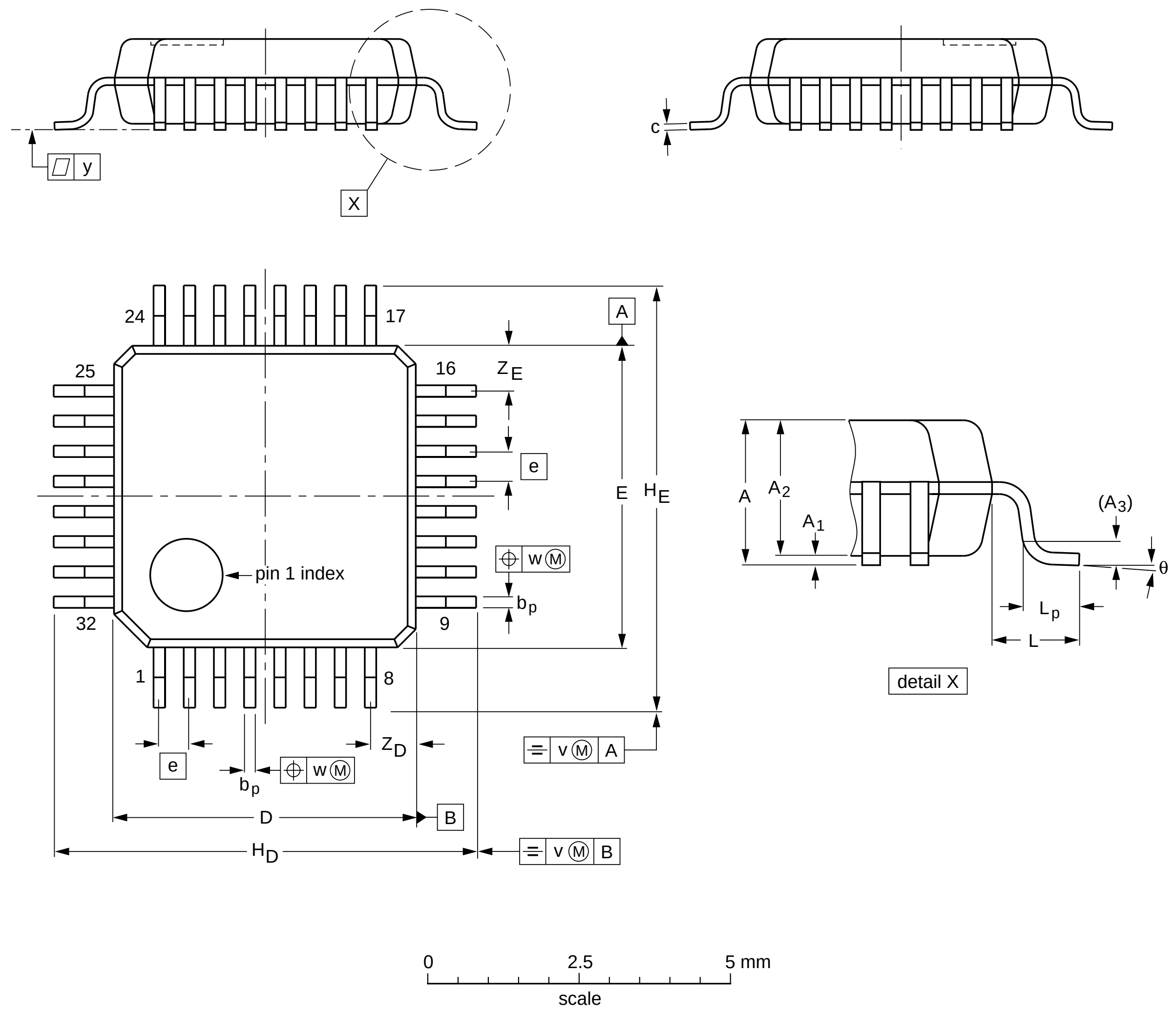


(1) A filter should be connected between the pin and the 5 V supply; see Section “Power supply connections”.
(2) C1 enhances modulation control loop time constant (optional).
(3) C2 enhances bias control loop time constant (optional).
(4) Band gap noise filter.
(5) Optical ZERO and ONE reference currents are set using resistors to V_{CC}. See Section “Automatic laser control”.
(6) See Section “Power supply connections”.

Fig.9 Application diagram showing the TZA3001BHL configured for 622.08 Mbits/s (STM4/OC12).

PACKAGE OUTLINE

LQFP32: plastic low profile quad flat package; 32 leads; body 5 x 5 x 1.4 mm **SOT401-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_D	H_E	L	L_p	v	w	y	$Z_D^{(1)}$	$Z_E^{(1)}$	θ
mm	1.60	0.15 0.05	1.5 1.3	0.25	0.27 0.17	0.18 0.12	5.1 4.9	5.1 4.9	0.5	7.15 6.85	7.15 6.85	1.0	0.75 0.45	0.2	0.12	0.1	0.95 0.55	0.95 0.55	7° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT401-1						~~95-12-19~~ 97-08-04

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

Reflow soldering

Reflow soldering techniques are suitable for all LQFP packages.

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.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

Wave soldering

Wave soldering is **not** recommended for LQFP packages. This is because of the likelihood of solder bridging due to closely-spaced leads and the possibility of incomplete solder penetration in multi-lead devices.

CAUTION
Wave soldering is NOT applicable for all LQFP packages with a pitch (e) equal or less than 0.5 mm.

If wave soldering cannot be avoided, for LQFP packages with a pitch (e) larger than 0.5 mm, the following conditions must be observed:

- **A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.**
- **The footprint must be at an angle of 45° to the board direction and 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.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

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

Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) 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 to 5 seconds between 270 and 320 °C.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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