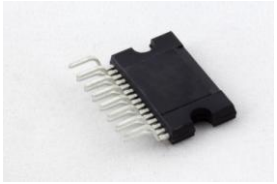
2 x 30WDUAL/QUAD POWER AMPLIFIER FOR CAR RADIO



HZIP-15B

HZIP-15

DESCRIPTION

The UTC7377 is a new technology class AB car radio amplifier able to work either in DUAL BRIDGE or QUAD SINGLE ENDED configuration.

The exclusive fully complementary structure of the output stage and the internally fixed gain guarantees the highest possible power performances with extremely reduced component count. The on-board clip detector simplifies gain compression operation. The fault diagnostics makes it possible to detect mistakes during car radio set assembly and wiring in the car.

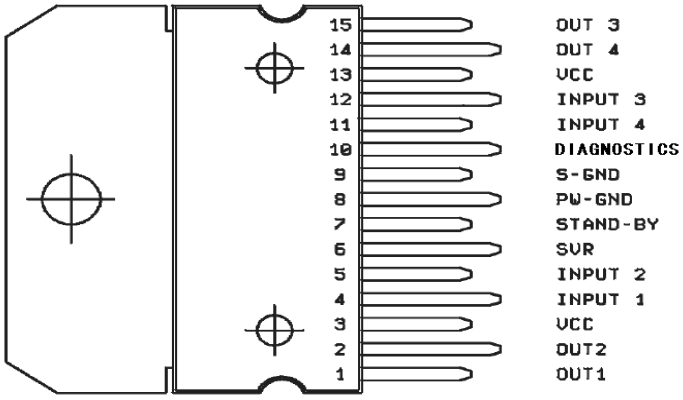
FEATURES

* HIGH OUTPUT POWER CAPABILITY:
  2 x35Wmax./4Ω
  2 x30W/4Ω EIAJ
  2 x30W/4Ω EIAJ
  2 x 20W/4Ω @14.4V, 1KHz, 10%
  4 x 6W/4Ω @14.4V,1KHz, 10%
  4 x 10W/2Ω @14.4V, 1KHz, 10%
* MINIMUM EXTERNAL COMPONENTS COUNT:
  – NO BOOTSTRAP CAPACITORS
  – NO BOUCHEROT CELLS
  – INTERNALLY FIXEDGAIN (26dB BTL)
* ST-BY FUNCTION (CMOS COMPATIBLE)
* NO AUDIBLE POP DURING ST-BY OPERATIONS
* DIAGNOSTICS FACILITY FOR:
  – CLIPPING
  – OUTTO GND SHORT
  – OUTTO VS SHORT
  – SOFTSHORT AT TURN-ON
  – THERMAL SHUTDOWN PROXIMITY

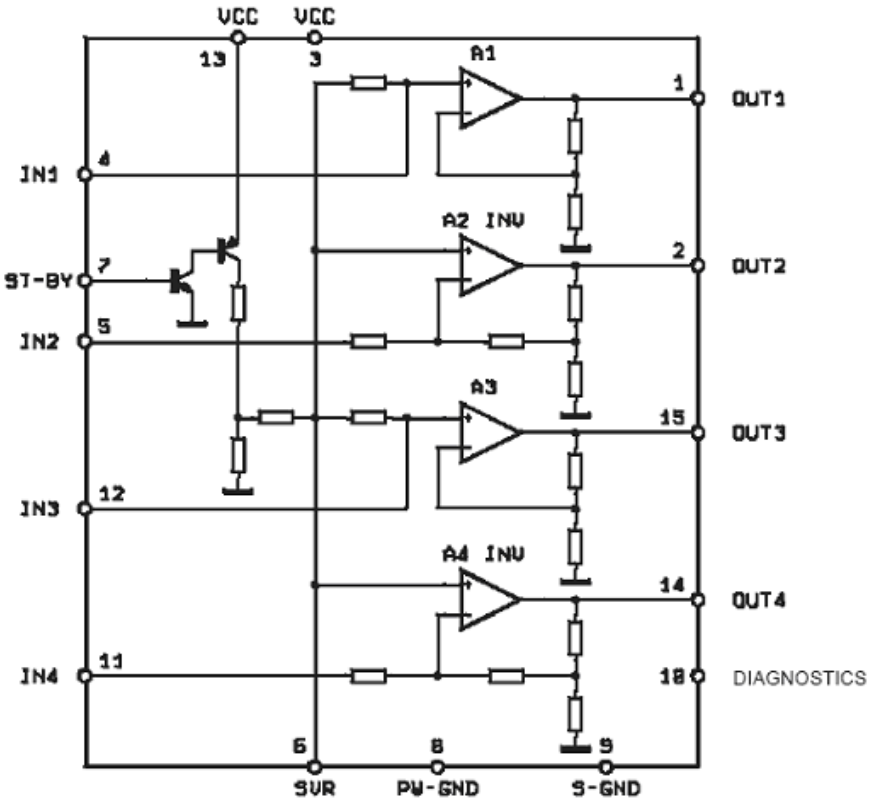
PROTECTIONS

* OUPUT AC/DC SHORT CIRCUIT
  – TO GND
  – TO Vs
  – ACROSS THE LOAD
* SOFT SHORT AT TURN-ON
* OVERRATING CHIP TEMPERATURE WITH SOFT THERMAL LIMITER
* LOAD DUMP VOLTAGE SURGE
* VERY INDUCTIVE LOADS
* FORTUITOUS OPEN GND
* REVERSED BATTERY
* ESD

PIN CONNECTION (TOP VIEW)



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS(Ta=25°C)

Parameter	Symbol	Value	Unit
Operating Supply Voltage	Vop	18	V
DC Supply Voltage	Vs	28	V
Peak Supply Voltage (for t = 50ms)	Vpeak	50	V
Output Peak Current (not repetitive t = 100⌠s)	Io	4.5	A
Output Peak Current (repetitive f > 10Hz)	Io	3.5	A
Power Dissipation (T_{case}= 85°C)	Ptot	36	W
Storage and Junction Temperature	Tstg，Tj	-40 to 150	℃

THERMAL DATA

Symbol	Description		Value	Unit
Rth j-case	Thermal Resistance Junction-case	Max	1.8	℃/W

ELECTRICAL CHARACTERISTICS

(Refer to the test circuit, Vs=14.4V; RL=4Ω ; f=1KHz; Tamb=25℃, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Voltage Range	V_S		8		18	V
Total Quiescent Drain Current	I_d	$R_L = \infty$			150	mA
Output Offset Voltage	V_{OS}				150	mV
Output Power	P_O	THD = 10%; R_L = 4Ω Bridge Single Ended Single Ended, R_L = 2Ω	18 5.5	20 6 10		W W W
Max. Output Power (***)	$P_{O\ max}$	Vs = 14.4V, Bridge	31	35		W
EIAJ Output Power (***)	$P_{O\ EIAJ}$	V_S = 13.7V, Bridge	27	30		W
Distortion	THD	R_L = 4Ω Single Ended, P_O = 0.1 to 4W Bridge, P_O = 0.1 to 10W		0.02 0.03	 0.3	% %
Cross Talk	CT	f = 1KHz Single Ended f = 10KHz Single Ended		70 60		dB dB
		f = 1KHz Bridge f = 10KHz Bridge	55	 60		dB dB
Input Impedance	R_{IN}	Single Ended Bridge	20 10	30 15		KΩ KΩ
Voltage Gain	G_V	Single Ended Bridge	19 25	20 26	21 27	dB dB
Voltage Gain Match	G_V				0.5	dB
Input Noise Voltage	E_{IN}	R_g = 0; ”A” weighted, S.E. Non Inverting Channels Inverting Channels		 2 5		 μV μV
		Bridge Rg = 0; 22Hz to 22KHz		 3.5		 μV
Supply Voltage Rejection	SVR	R_g = 0; f = 300Hz	50			dB
Stand-by Attenuation	A_{SB}	P_O = 1W	80	90		dB
ST-BY Current Consumption	I_{SB}	V_{ST-BY} = 0 to 1.5V			100	μA
ST-BY In Threshold Voltage	V_{SB}				1.5	V
ST-BY Out Threshold Voltage	V_{SB}		3.5			V
ST-BY Pin Current	I_{pin7}	Play Mode V_{pin7} = 5V			50	μA
		Max Driving Current Under Fault (*)			5	mA

Clipping Detector Output Average Current	$I_{cd\ off}$	d = 1% (**)		90		μA
Clipping Detector Output Average Current	$I_{cd\ on}$	d = 5% (**)		160		μA
Voltage Saturation on pin 10	$V_{sat\ pin10}$	Sink Current at Pin 10 = 1mA			0.7	V

(*) See built-in S/C protection description
(**) Pin 10 Pulled-up to 5V with 10KΩ ; R_L = 4Ω
(***) Saturated square wave output.

STANDARD TEST AND APPLICATION CIRCUIT

Figure 1: Quad Stereo

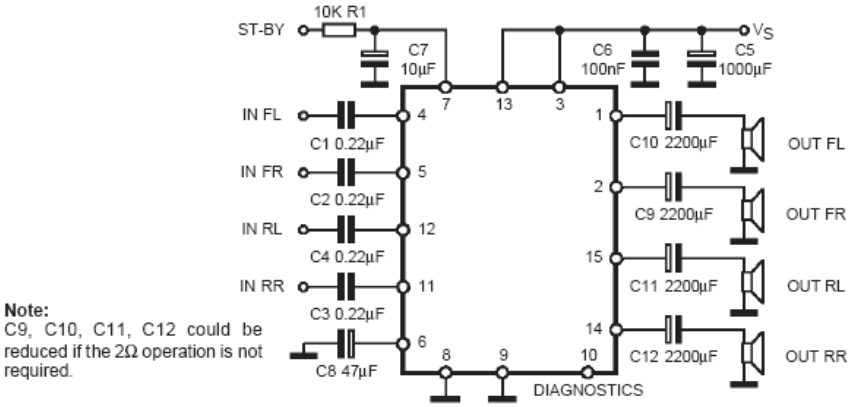


Figure 2: Double Bridge

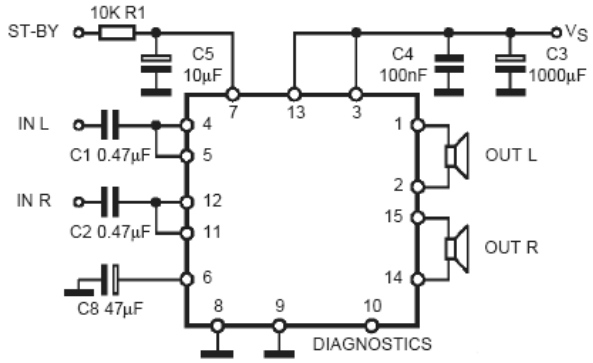
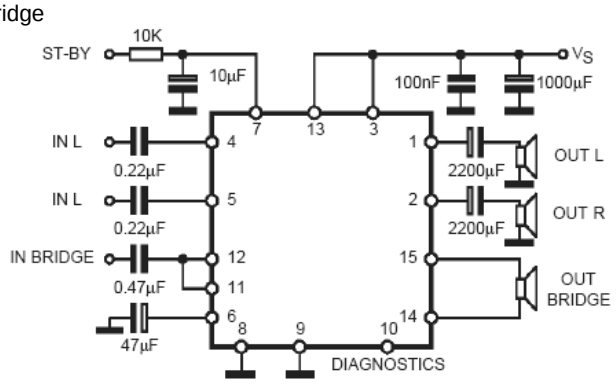


Figure 3: Stereo/Bridge



High Application Flexibility

The availability of 4 independent channels makes it possible to accomplish several kinds of applications ranging from 4 speakers stereo (F/R) to 2 speakers bridge solutions. In case of working in single ended conditions the polarity of the speakers driven by the inverting amplifier must be reversed respect to those driven by non inverting channels. This is to avoid phase inconveniences causing sound alterations especially during the reproduction of low frequencies.

Easy Single Ended to Bridge Transition

The change from single ended to bridge configurations is made simply by means of a short circuit across the inputs, that is no need of further external components.

Gain Internally Fixed to 20dB in Single Ended, 26dB in Bridge

Advantages of this design choice are in terms of:

■componentsand space saving

■output noise, supply voltage rejection and distortion optimization.

Silent Turn On/Off and Muting/Stand-by Function

The stand-by can be easily activated by means of a CMOS level applied to pin 7 through a RC filter. Under stand-by condition the device is turned off completely (supply current = 1µA typ.; output attenuation= 80dB min.).
Every ON/OFF operation is virtually pop free. Furthemore, at turn-on the device stays in muting condition for a time determined by the value assigned to the SVR capacitor.
While in muting the device outputs becomes insensitive to any kinds of signal that may be present at the input terminals. In other words every transient coming from previous stages produces no unplesantacoustic effect to the speakers.

STAND-BY DRIVING (pin 7)

Some precautions have to be taken in the definition of stand-by driving networks: pin 7 cannot be directly driven by a voltage source whose current capability is higher than 5mA. In practical cases a series resistance has always to be inserted, having it the double purpose of limiting the current at pin 7 and to smooth down the stand-by ON/OFF transitions - in combination with a capacitor - for output pop prevention.
In any case, a capacitor of at least 100nF from pin 7 to S-GND, with no resistance in between, is necessary to ensure correct turn-on.

OUTPUT STAGE

The fully complementary output stage was made possible by the development of a new component: the ST exclusive power ICV PNP.
A novel design based upon the connection shown in fig. 20 has then allowed the full exploitation of its possibilities. The clear advantagesthis new approach has over classical output stages are as follows:

■Rail-to-Rail Output Voltage Swing With No Need of Bootstrap Capacitors.

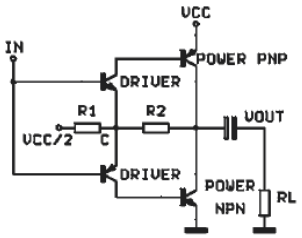
The output swing is limited only by the VCEsat of the output transistors, which is in the range of 0.3Ω (Rsat) each. Classical solutions adopting composite PNPNPN for the upper output stage have higher saturation loss on the top side of the waveform.
This unbalanced saturation causes a significant power reduction. The only way to recover power consists of the addition of expensive bootstrap capacitors.

■Absolute Stability Without Any External Compensation.

Referring to the circuit of fig. 20 the gain VOut/VIn is greater than unity, approximately 1+
R2/R1. The DC output (VCC/2) is fixed by an auxiliary amplifier common to all the channels. By controlling the amount of this local feedbackit is possible to force the loop gain (A*□) to lessthan unity at frequency for which the phase shift is 180□ . This means that the output buffer is intrinsicallystableand not prone to oscillation. Most remarkably, the above feature has been achieved in spite of the very low closed loop gain of the amplifier.
In contrast, with the classical PNP-NPN stage, the solution adopted for reducing the gain at high frequencies makes use of external RC networks, namely the Boucherot cells.

BUILT–IN SHORTCIRCUIT PROTECTION

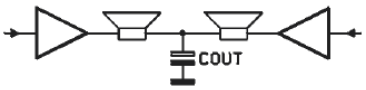
TheNew Output Stage



Reliable and safe operation, in presence of all kinds of short circuit involving the outputs is assured by BUILT-IN protectors. Additionally to the AC/DC short circuit to GND, to VS, across the speaker, a SOFT SHORT condition is signaled out during the TURN-ON PHASE so assuring correct operation for the device itself and for the loudspeaker.

This particular kind of protection acts in a way to avoid that the device is turned on (by ST-BY) when a resistive path (less than 16 ohms) is present between the output and GND. As the involved circuitry is normally disabled when a current higher than 5mA is flowing into the ST-BY pin, it is important, in order not to disable it, to have the external current source driving the STBY pin limited to 5mA.

This extra function becomes particularly attractive when, in the single ended configuration, one capacitor is shared between two outputs.



Supposing that the output capacitor Cout for anyreason is shorted, the loudspeaker will not be damaged being this soft short circuit condition revealed.

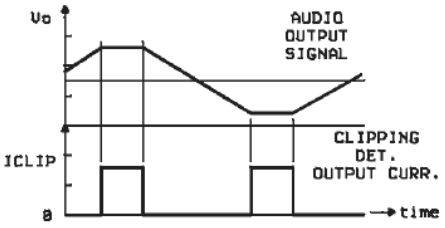
Diagnostics Facility

The UTC7377 is equipped with a diagnostic circuitry able to detect the following events:

- ■Clipping in the output signal
- ■Thermal shutdown
- ■Output fault:
  - – short to GND
  - – short to VS
  - – soft short at turn on

  The information is available across an open collector output (pin 10) through a current sinking when the event is detected.

Clipping Detection Waveforms



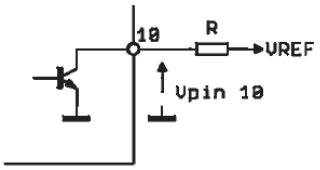
A current sinking at pin 10 is triggered when a certain distortion level is reached at any of the outputs. This function allows gain compression possibility whenever the amplifier is overdriven.

Thermal Shutdown

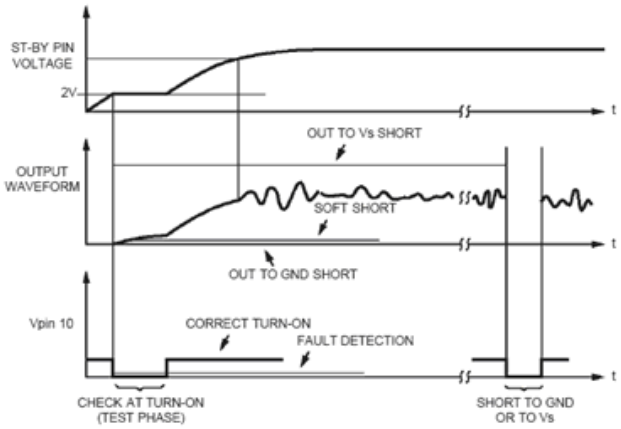
In this case the output 10 will signal the proximity of the junction temperature to the shutdown threshold. Typically current sinking at pin 10 will start ~10° C before the shutdown threshold is reached.

HANDLING OF THE DIAGNOSTICS INFORMATION

Output Fault Waveforms

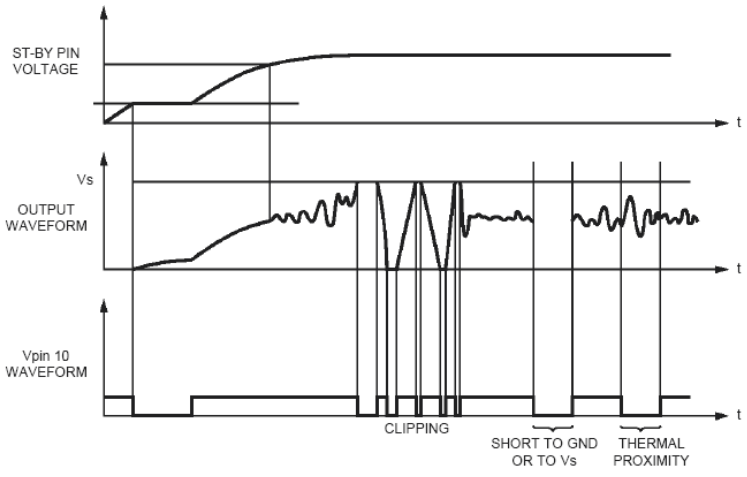


Fault Waveforms

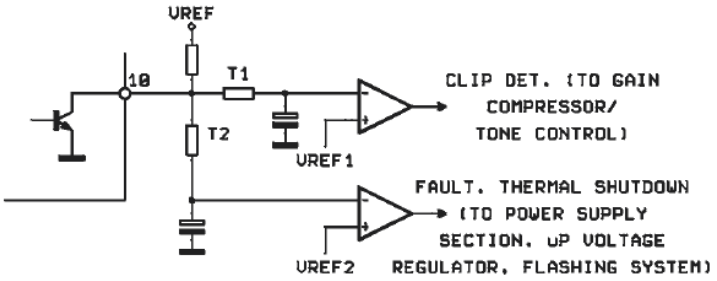


As various kinds of information is available at the same pin (clipping detection, output fault, thermal proximity), this signal must be handled properly in order to discriminate each event.
This could be done by taking into account the different timing of the diagnostic output during each case.

Waveforms



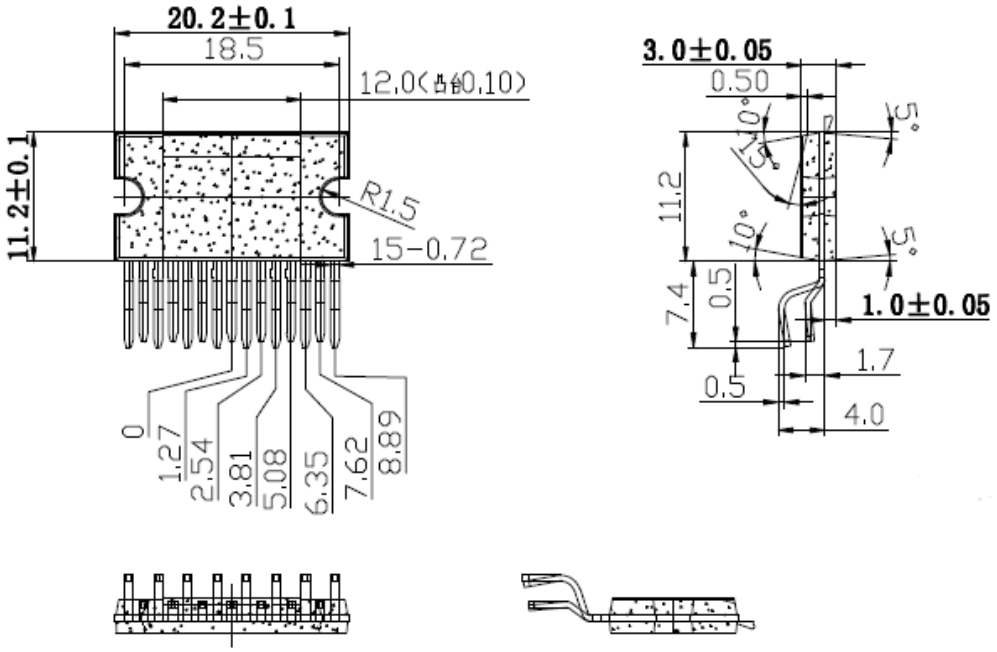
Normally the clip detector signalling produces a low level at pin 10 that is shorter than that present under faulty conditions; based on this assumption an interface circuitry to differentiate the information is represented in the schematic of fig. 26.



T1 << T2
VREF > VREF1 >> VREF2

PACKAGE OUTLINE

HZIP-15B UNIT: mm

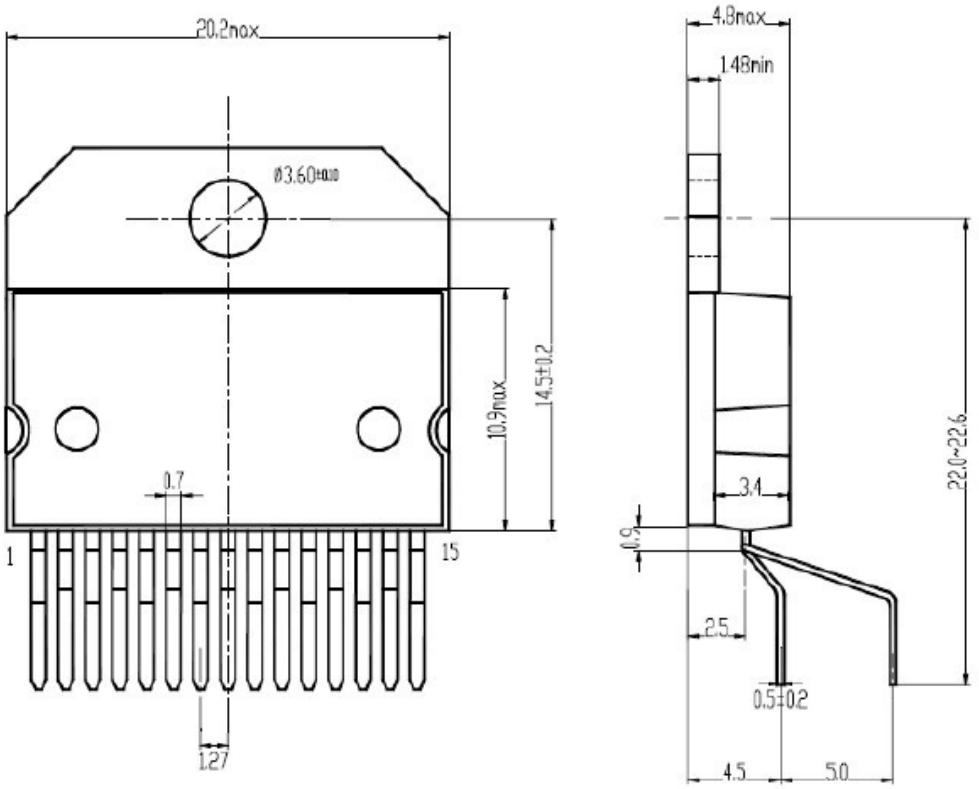


Technical requirements:

1. Sealants body center and lead frame center deviation≤0.05, fluctuation sealants body center deviation≤ 0.05.
2. Sealants body intact loss.
3. Sealants body not note smooth for pitted skin, smooth not note finish for Ra 0.1, pitted skin not note finish for Ra 1.6 ~ 2.0.

Sealants body general tolerance: ± 0.1, not note round R0.15 (Max).

HZIP-15 UNIT: mm



ELECTROSTATIC DISCHARGE CAUTION

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage handing to prevent electrostatic damage to the device.

NOTICE

HANGZHOU YOUWANG ELECTRONICS CO.LTD assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all HANGZHOU YOUWANG ELECTRONICS CO.LTD's products described or contained herein. HANGZHOU YOUWANG ELECTRONICS CO.LTD's products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.

Attach

Revision History

Data	REV	Description	Page
2012.11.29	1.0	Original	
2017.10.10	1.1	Add “Electrostatic Discharge Caution” and “NOTICE”	