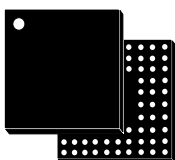


# 16 channels $\pm 100$ V, $\pm 2/4$ A, 5/3-level RTZ, high-speed ultrasound pulser with integrated transmit beamformer



BGA144 ball (10x10x1 mm)

## Features

- 0 to 200 V peak-to-peak output signal
- Up to 30 MHz operating frequency
- Power-up/down sequence free
- Gate driver self-biased architecture; no filtering capacitors required
- Pulsed wave (PW) mode operation:
  - 5/3 level output
  - $\pm 2$  A /  $\pm 4$  A source and sink current
- Continuous wave (CW) mode operation:
  - 150 mW power consumption/channel
  - 270 fs RMS jitter (100 Hz-20 kHz)
  - -147 dBc/Hz @ 1 kHz phase noise
- Elastography mode operation
- Programmable fine-tuning delays to minimize second harmonic distortion
- Fully integrated real clamping-to-ground function
  - 11  $\Omega$  synchronous active clamp
  - $\pm 2$  A source and sink current
- Fully integrated T/R switch
  - 9  $\Omega$  ON resistance
  - 28 pF parasitic capacitance
  - Compliant with receiver multiplexing function
- Auxiliary integrated circuits
  - Noise blocking diode function
  - Recirculation current protection
  - Anti-memory feature
  - Thermal protection
  - Undervoltage protection and bias supply checks
- Programmable power management to optimize the performance into a probe
- TX Beamforming in transmission mode
  - Programmable single-channel delay for beam steering and beam focusing
  - Clock frequency up to 200 MHz
  - Delay from 0 to 327  $\mu$ s with 5 ns of minimum resolution
  - 425 ns minimum delay table writing time
- Embedded memory to store transmission patterns
  - 65 kbits
  - Waveform compression algorithm
  - Up to 256 non repetitive states
  - Up to 4 states sequence repetition up to  $2^{18}$  times
- Easy driving control
  - Control through serial interface
  - Few input signals to drive several devices
  - Single interrupt as alert signal
  - Fully automatic and programmable single trigger to manage TX/RX phases

Product status link	
<a href="#">STHV1600</a>	
Product summary	
Order code	<a href="#">STHV1600</a>
Package	BGA-144
Packing	Tray

- Anti-glitch on trigger signal during TX phase
- Checksum and parity check
- Very low package thermal resistance
- Latch-up free due to HV SOI technology
- Only a few passive components required
- LVDS/CMOS digital inputs

## Applications

- Medical ultrasound imaging
- Pulse waveform generators
- NDT ultrasound transmission
- Piezoelectric transducer drivers

## Description

This monolithic, high-voltage, high-speed pulse generator features 16 independent channels and integrates a 16-channel beamformer for pulse generation in multi-channel medical ultrasound applications targeted at low power portable systems.

A pure analog section provides each channel with voltage level translators, noise blocking diode function, two identical high voltage P-channel and two identical high voltage N-channel MOSFETs as the output stage (the two half bridges are called TX0 and TX1), clamping to-ground circuitry, anti-leakage, anti-memory block, thermal sensor, recirculation current protection and a T/R switch structure which guarantees effective isolation during the transmission phase.

Each channel can support up to five output levels with two independent half bridges. Both PW output stages (TX0 and TX1) are able to provide up to  $\pm 2$  A peak output current, independent from the HV power supply pins. The two half bridges can be driven in parallel with a current capability up to  $\pm 4$  A. The clamp circuit, used to carry the output pin XDCR to GND with a resistance of 11  $\Omega$ , has a current capability of up to 2 A during the transition. Each channel is provided with strong recirculation protection on the high voltage output node (XDCR) to preserve the device using inductive load without any external diode protection. The 16 independent T/R switches comprise an active circuit that can be used in both a dedicated RX chain per channel or in a multiplexing configuration.

The STHV1600 also includes some global blocks, thermal protection, undervoltage on VDDP3V3, VDDM3V3 and DVDD, POR on DVDD, global self-biased high-voltage MOSFET gate drivers with internal check of the correct value, and a check of the HV supply values. Twelve low voltage capacitors are included in the package. Ceramic capacitors are mandatory on the HV supplies and VDDP3V3 and VDDM3V3 on the PCB. The ball-out is designed to simplify application board routing and to prevent unexpected coupling between HV and LV.

All functions of the STHV1600 are managed by a digital core logic working at a maximum clock frequency of 200 MHz. This block is responsible for managing channel delay transmission used in beamformer, waveform generation and compression algorithm, store setting and data, managing all device operations in the correct sequence.

Starting from an IDLE state in which device can be configured by SPI interface and channels are in CLAMP state, transmission TX starts after the rising edge of the external trigger signal is provided. When transmission ends, a RX\_WAIT state is performed, forcing channels in CLAMP state to clean signals from previous pulsing. The automatic receiving state, RX, starts and persists until a falling edge of the external trigger signal is provided, putting the device in the initial IDLE state. It also sets all configurations to perform transmission in continuous mode (CW) when a pulse sequence must be repeated indefinitely (until the falling edge of the trigger is provided) or pulse waves (PW) when a finite pulse sequence must be performed.

## Revision history

**Table 1. Document revision history**

Date	Version	Changes
05-Jul-2018	1	Initial release.

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