SENT "New sensor interface" Allows data-transmission at low cost

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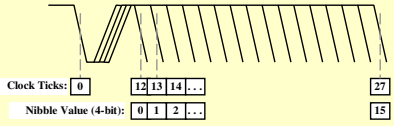
What is SENT?

-Sensor-interface:

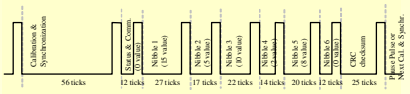
- Digital data-transmission at 30 kbits/s
- Low-cost: No receiver, Integrated transmitter
- Uni-directional: only from sensor to ECU
- Point-to-point: no bus
- 3 wires: 5V, GND, SENT
- J2716 SAE-standard

-SENT: Single Edge Nibble Transmission for Automotive applications

- Data transmitted as nibbles (4 bits). Maximum of 6 nibbles per message.



- Time measured between falling edges (single edges)
- Frame-format:



-Calibration or synchronization pulse: Fixed length for synchronization of receiver (56 clock-ticks).
- Status & Comm. Nibble defines message format:
  - No Serial Protocol
  - Short Serial Protocol
  - Enhanced Serial Protocol
- Checksum-Nibble: 4 bit CRC
- Pause-Pulse: to fill-up message to a fixed length (less than 1ms).

Goal of SENT?

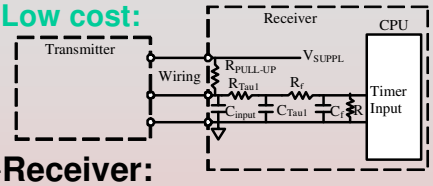
-Low cost

-Digital precision: advantage over analog or semi-analog PWM int.

-Higher baudrate than LIN.

Challenges: !!!

-Low cost:



-Receiver:

- Only passive components at receiver-side
- Digital input at CPU

-Timing requirements:

- Clock-drift* error < 0,05us

*Clock-drift = variation of nibble length over a message-period at a 3 µs clock tick.

-Automotive requirements:

- Wiring problems:
  - Wiring short to supply (➔ reverse battery)
  - Wiring short to ground (➔ output-prot.)
- Automotive transients:
  - For supply-line and signal-line.
- ESD-immunity:
  - System ESD (8kV contact, 15kV air: C = 330pF, R = 2kΩ)

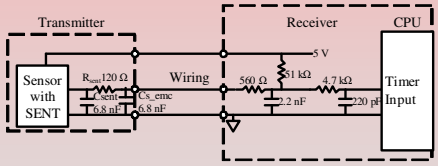
-EMC-requirements:

- Susceptibility: conducted and radiated
  class A under 200mA BCI;
  4W PDI to supply or SENT wire;
  200V/m TEM cell
- Emission: conducted and radiated

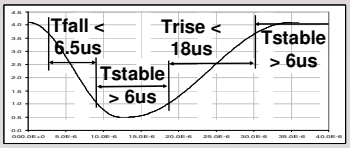
Contribution of ON Semiconductor:

-Participation to SAE- SENT task-force leaded by GM:

- Transmitter-def.: push-pull driver.
- Proposal for external components:



- Check feasibility of emission requirements at maximum baudrate:



ON Semi's SENT IP:

-Meeting all automotive requirements.

- In production as part of sensor-ASIC.

Emission requirement:

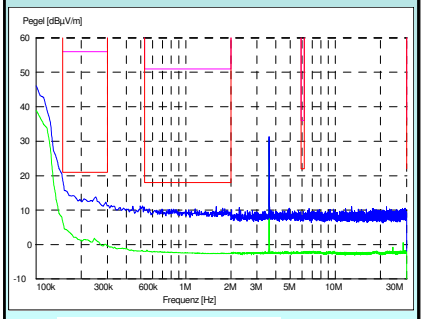
Signal freq. content:
- Min. pulse-width: 36us – 20% = 29us
➔ Corresponding freq. ~ 35 kHz
- Falling edge: from 3.8V to 1.1V <6.5us
➔ Corresponding freq. ~ 66 kHz

Absorber-lined chamber limits: CISPR 25
<21dBµV 150kHz .. 300kHz

Implementation:

Signal shaping to suppress higher harmonics without impacting:
- Pulse-shape
- Timing requirements
- Signal amplitude

Measurement results:
- Radiated Emission, Absorber-lined Chamber



blue: peak detector
green: average detector

References:

-SAE J2716 – Information Report FEB2008

Acknowledgements:

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