

Automotive Electronics

Product Information

CG147 – Integrated Airbag System IC



BOSCH
Invented for life



Customer benefits:

- ▶ System supply and peripheral functions integrated on one chip
- ▶ Smart system safety concept
- ▶ Enhanced diagnosis concept
- ▶ Advanced TQFP100_ePad Package

General description

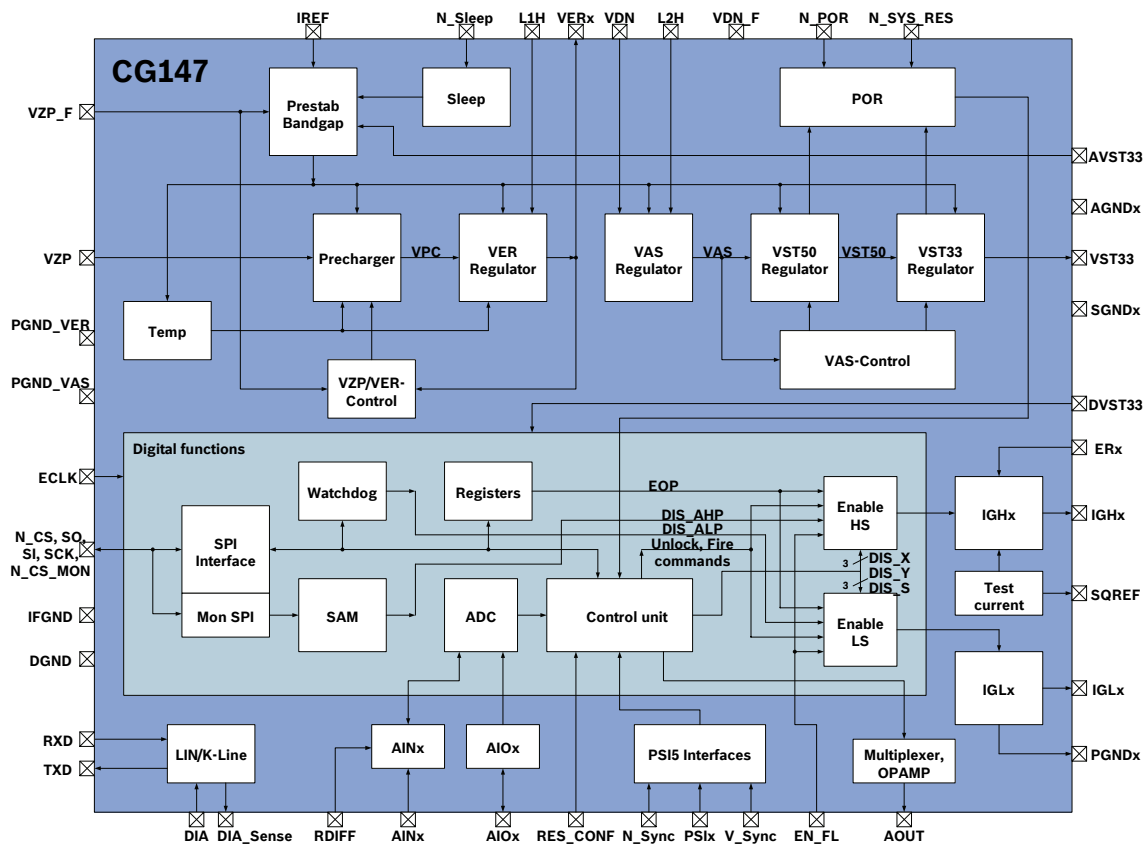
The CG147 is an integrated system IC for Airbag applications with the possibility to realise a highly compact, two chip Airbag ECU consisting of a micro-controller and the system IC.

The CG147 combines power module, firing loop module, sensor interface module and a sophisticated safety module on a single chip.

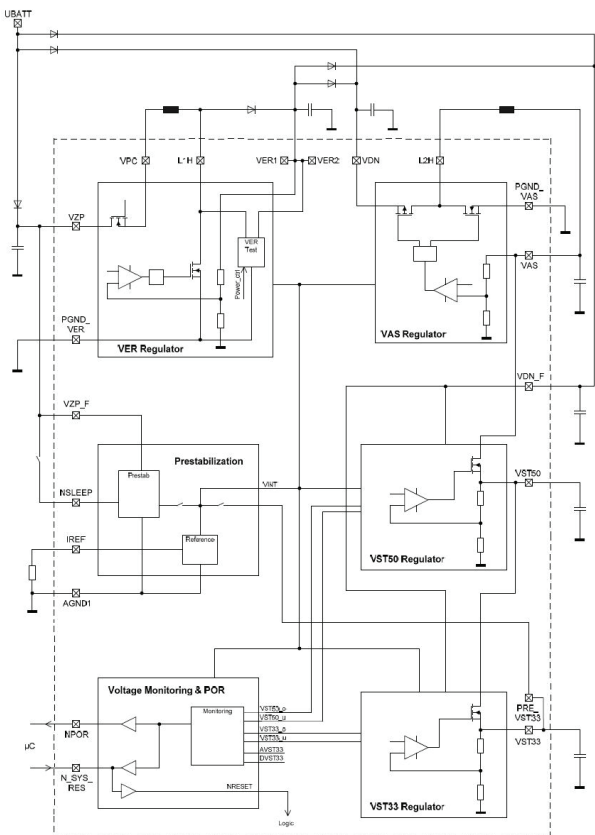
Power module

- ▶ Inrush current limitation
- ▶ Precharging of energy reserve with different current levels (350mA and 700mA) depending on ramp up condition
- ▶ Programmable boost converter current limitation
- ▶ High efficiency energy reserve dc/dc up-converter with selectable ER voltage 24.4V / 33V
- ▶ High efficiency dc/dc down-converter VAS 6.7V
- ▶ 5.0V linear voltage regulator VST50
- ▶ 3.3V linear voltage regulator VST33
- ▶ High Current capability
 - 650mA @ VAS = 6.7V (including I_{VST50} , I_{VST33})
 - 315mA @ VST50 = 5.0V (including I_{VST33})
 - 270mA @ VST33 = 3.3V
- ▶ Separated ground and supply pins for power, analog and digital supply
- ▶ Integrated test functionality for energy reserve capacitor and polarity protection diode
- ▶ Overtemperature control with automatic up-converter switch-off and temperature hysteresis
- ▶ Current limitation of all supply voltages
- ▶ Sleep mode with quiescent current < 60uA
- ▶ Over- and under voltage control of supply voltages VSTx
- ▶ Power-on reset and delay
- ▶ High precision band gap voltage reference
- ▶ Redundant band gap for reference voltage monitoring

Block Diagram



Power Module (continued)



Firing Loop Module

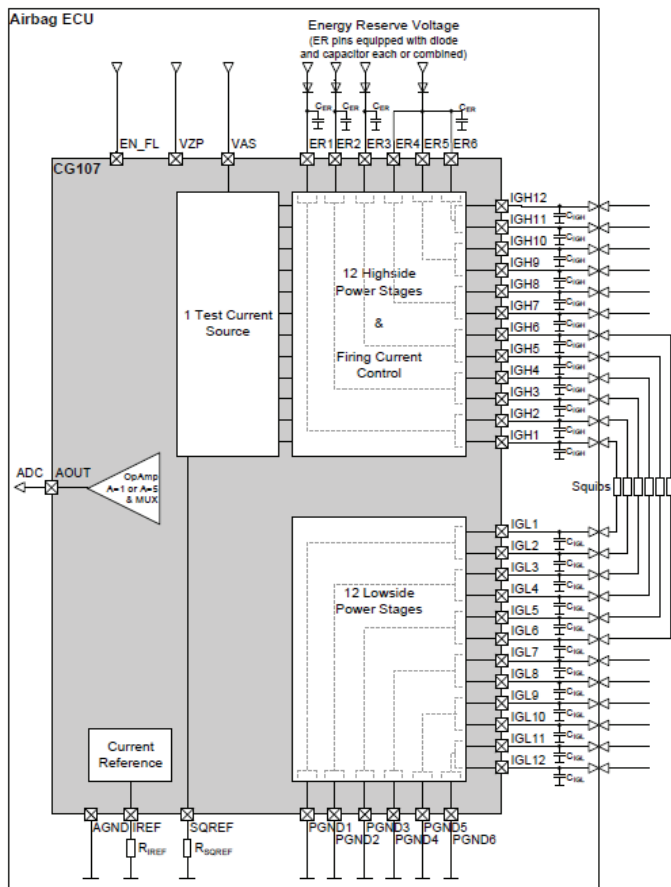
- ▶ Different firing modes, programmable by SPI
 - 2A @ 0.5ms
 - 2A @ 0.7ms
 - 2A @ 1ms
 - 1.5A @ 2ms
 - 2A @ 0.7ms, automatic extension 1.4A @ 2ms possible
- ▶ Energy reserve maximum rating of 36V
- ▶ Firing voltage up to 25V
- ▶ High side and low side power stage short circuit protected
- ▶ Separated power supply and control of high-side and low-side power stages
- ▶ Separated input for additional enabling signal/path from microcontroller to firing power stages
- ▶ Hardware or software controlled firing duration
- ▶ 2 independent high resolution firing current counter (40kHz, 7bit), one for each current level
- ▶ High precision loop diagnostics for shorts, leakage currents and squib resistances
- ▶ Monitoring of squib pins and supply voltages via analog output AOUT
- ▶ Special disable of dedicated power stage groups

Firing Loop Module (continued)

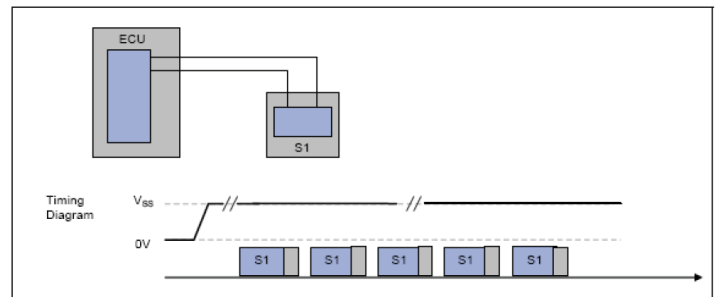
- ▶ Cross coupling on chip
 - Independent and separated control of high side and low side power stages
 - Maximum geometrical distance between high side and low side power stages
 - Free combination of high side and low side power stage
- ▶ Direct disable path for microcontroller control of power stages

Interface Module (continued)

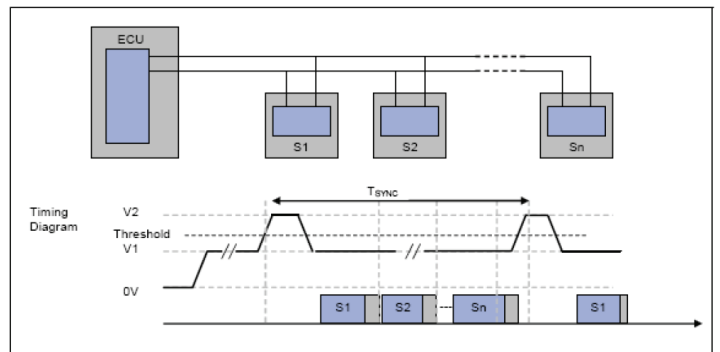
- ▶ Analog output amplifier with low offset, high bandwidth, tri-state output and selectable amplification range
- ▶ K-Line/LIN 2.0 conform
- ▶ 16bit SPI, 8MHz
- ▶ 2MHz external system clock input
- ▶ 3.3V CMOS I/O interface



PSI Data Register Mapping (asynchronous mode)



PSI Data Register Mapping (synchronous mode)

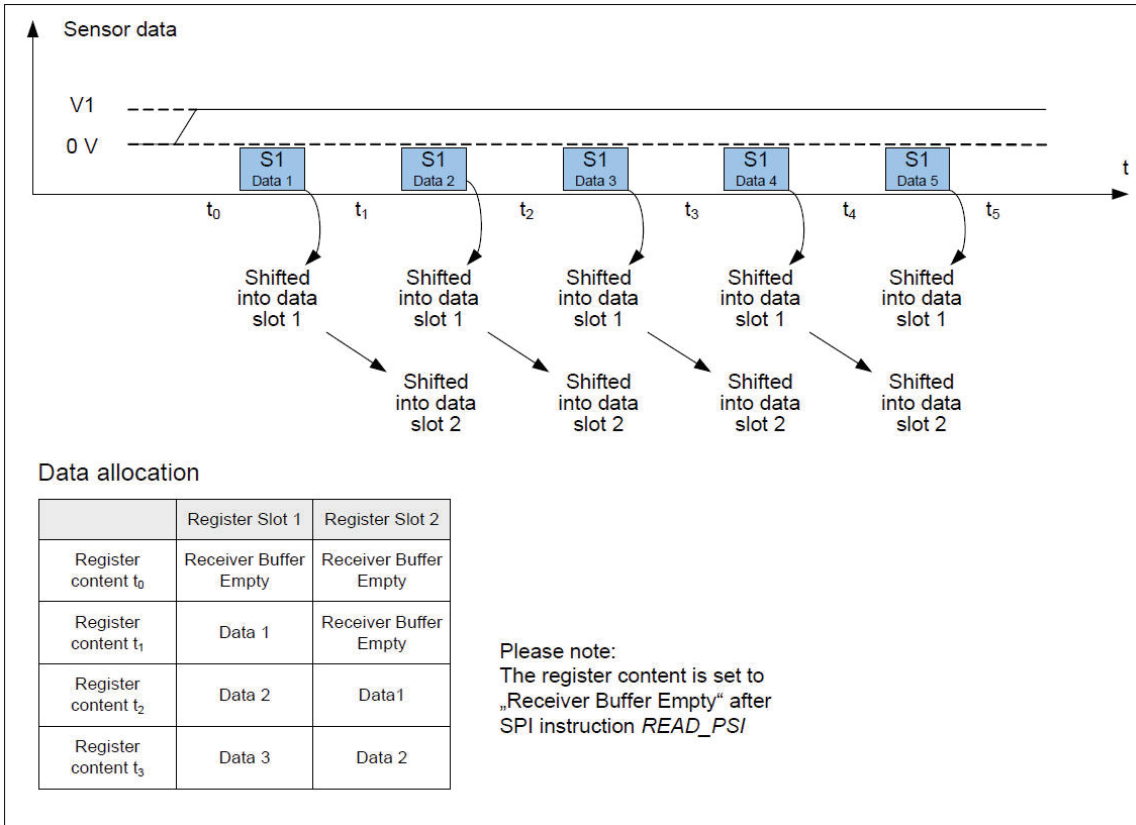


Interface Module

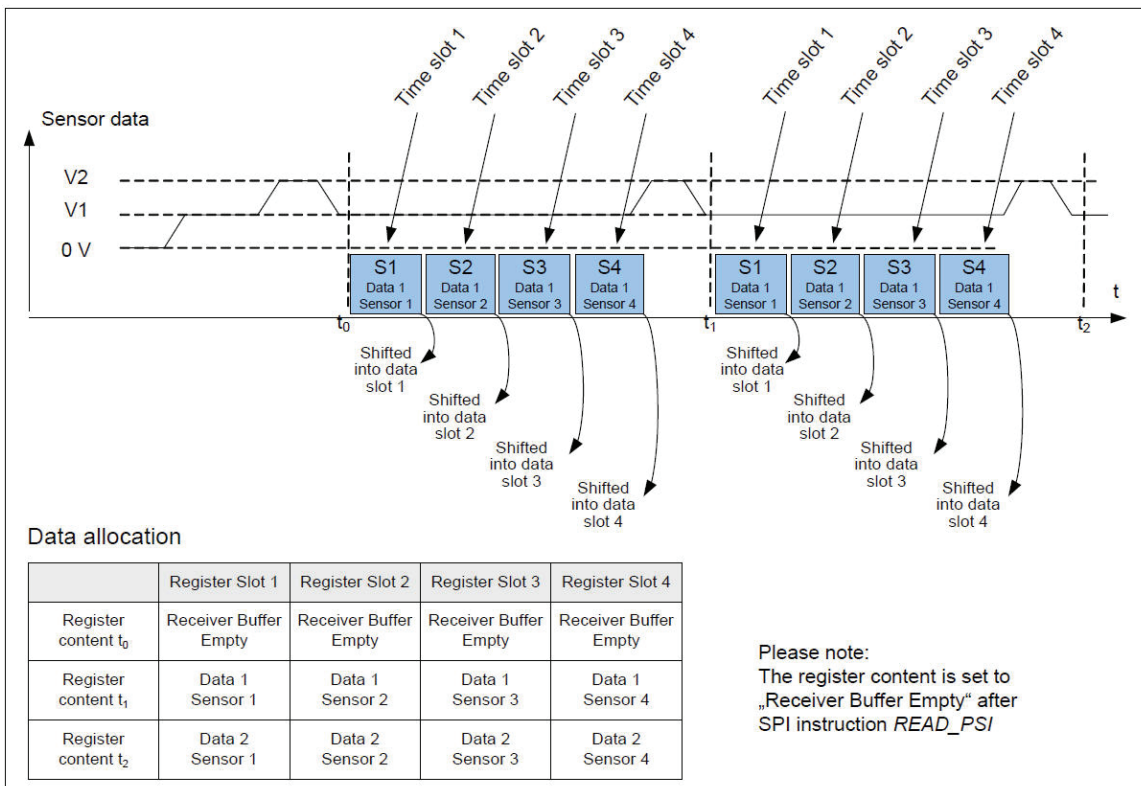
- ▶ PSI5 peripheral sensor interface
 - 4 PSI5 interfaces with up to 4 sensors per channel
 - Asynchronous or synchronous operation, point-to-point or bus mode possible (parallel, serial or daisy chain)
 - Supporting 8bit and 10bit peripheral sensors
 - Manchester coded data with 3 bit CRC or 1 bit parity selectable
 - Uni- and bidirectional communication possible
 - PSI5 sync pulse generation via pin, SPI or automatic timing
 - Automatic sync pulse slew rate control, quiescent current control and comparator threshold control

PSI5 Operation Modes

Asynchronous Point-to-Point Mode



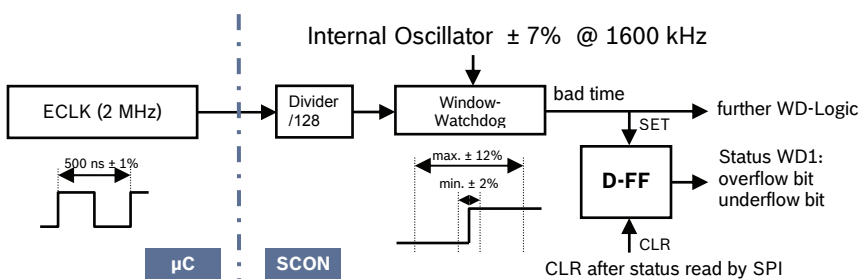
Synchronous Parallel Bus Mode



Safety Module

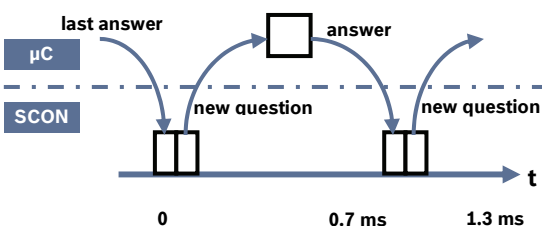
- ▶ 1 watchdog for system clock control
- ▶ 2 watchdogs with question-answer mechanism for software control of foreground and background tasks
- ▶ Disable path for all high side power stages
- ▶ Disable path for all low side power stages
- ▶ Special disable path for dedicated power stage group
- ▶ Warning lamp control
- ▶ Timing control of enable times
- ▶ Configurable reset circuitry with optional control by all watchdogs in case of failure conditions
- ▶ 6 analog input AIN channels with current and voltage supply modes for hall sensors and buckle switches, programmable current capability and short circuit protection
- ▶ 2 analog output AIO low side drivers with programmable current capability and short circuit protection
- ▶ Internal 8bit ADC for AIO and AIN current and voltage measurement
- ▶ Safety controller for plausibility of crash data
- ▶ Monitor SPI for monitor sensor data
- ▶ Safety identifier mechanism for crash relevant data
- ▶ Different enable thresholds for crash relevant data in combination with safety ID mechanism
- ▶ Definition of enable and disable levels for buckle switch data evaluation
- ▶ Programmable register with lock control

WD1 (μ C-timing)



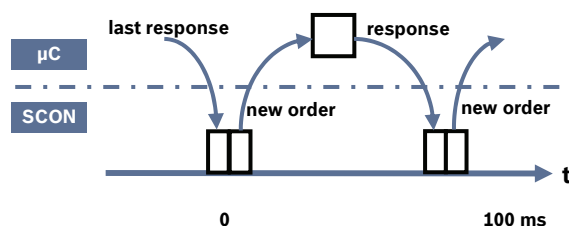
WD2 (μ C realtime tasks)

8 different elementary functions



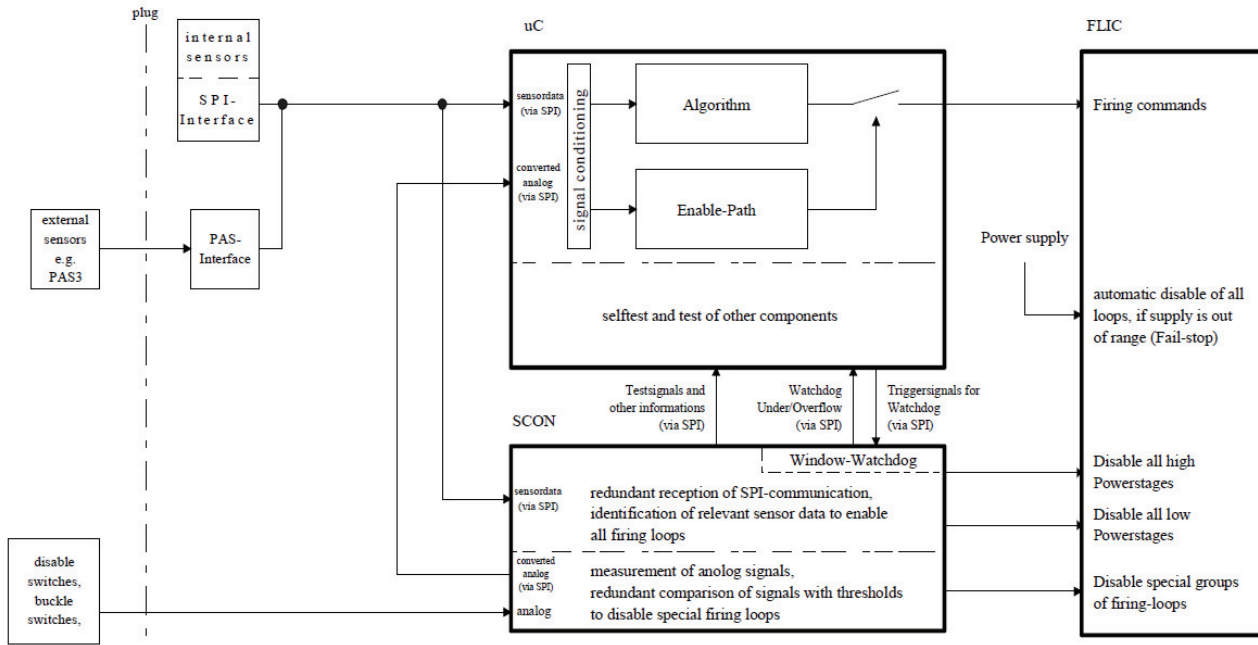
WD3 (μ C background tasks)

8 different test functions

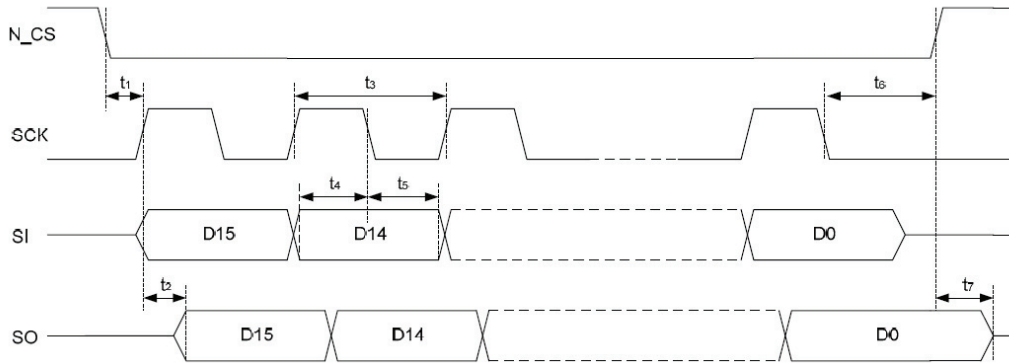


Functional Description Safety Module

Principal data flow



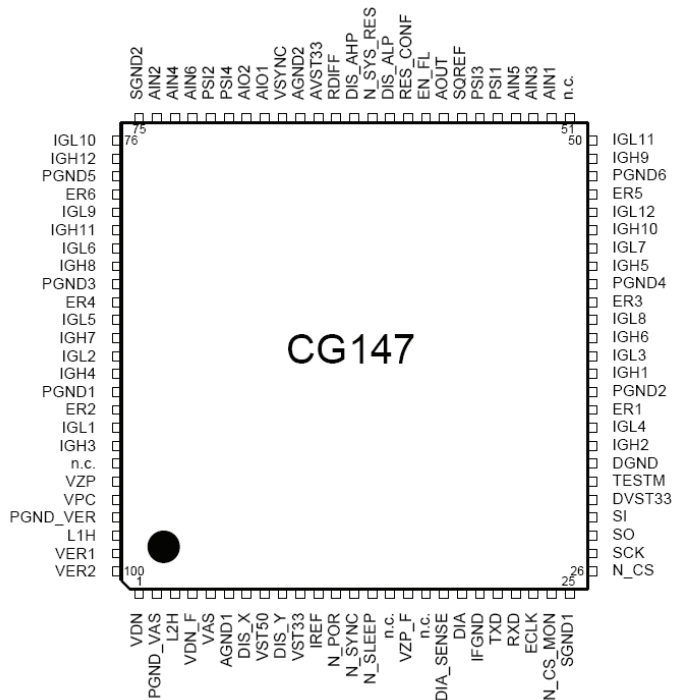
SPI Timing (16bit frame)



- t1: enable lead time
- t2: data valid time
- t3: cycle time
- t4: data setup time
- t5: data hold time
- t6: enable lag time
- t7: disable time

Maximum Ratings

Pin	Module	Parameter	Min	Max	Unit
VZP, VZP_F, VPC, VERx, L1H, VDN, VDN_F, VAS, L2H, N_SLEEP	POM	max voltage	-0.3	+36	V
VST50	POM	max voltage	-0.3	+6.5	V
VST33, AVST33, DVST33	POM	max voltage	-0.3	+3.6	V
IREF, N_POR	POM	max voltage	-0.3	+3.6	V
DIA_SENSE	IM: LIN	max voltage	-20	+36	V
DIA	IM: LIN	max voltage	-0.3	+36	V
TXD, RXD	IM: LIN	max voltage	-0.3	+3.6	V
ECLK, N_SYS_RES, RES_CONF, TESTM	IM: SYS	max voltage	-0.3	+3.6	V
EN_FL, DIS_AHP, DIS_ALP, DIS_X, DIS_Y	IM: SAM	max voltage	-0.3	+3.6	V
N_SYNC	IM: PSI	max voltage	-0.3	+3.6	V
N_CS, N_CS_MON, SCK, SI, SO	IM: SPI	max voltage	-0.3	+3.6	V
IGHx, IGLx, ERx, SQREF	FLM	max voltage	-0.3	+36	V
IGHx, IGLx	FLM	neg. current		-1	A
AINx, PSIx, AIOx, VSYNC	IM	max voltage	-0.3	+36	V
AINx, PSIx, AIOx	IM	neg. current		-1	A
AOUT, RDIFF	IM	max voltage	-0.3	+3.6	V
VZP	POM	dVZP/dt	-5	+10	V/us
PGND1..6	FLM	max voltage	-0.3	+0.3	V
PGND_VER, PGND_VAS	POM	max voltage	-0.3	+0.3	V

Pinout Description (TQFP100_ePad)


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