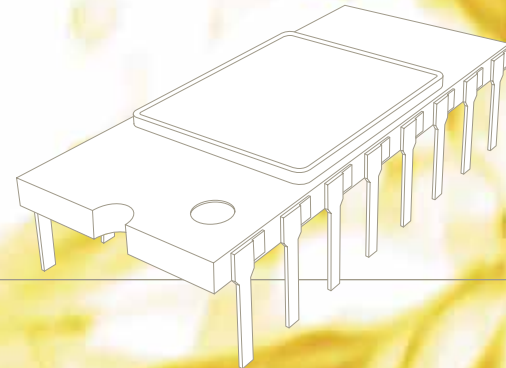




CISSOID

HIGH-TEMPERATURE
& EXTENDED LIFETIME SEMICONDUCTORS

HIGH-RELIABILITY SOLUTION GUIDE



OIL & GAS



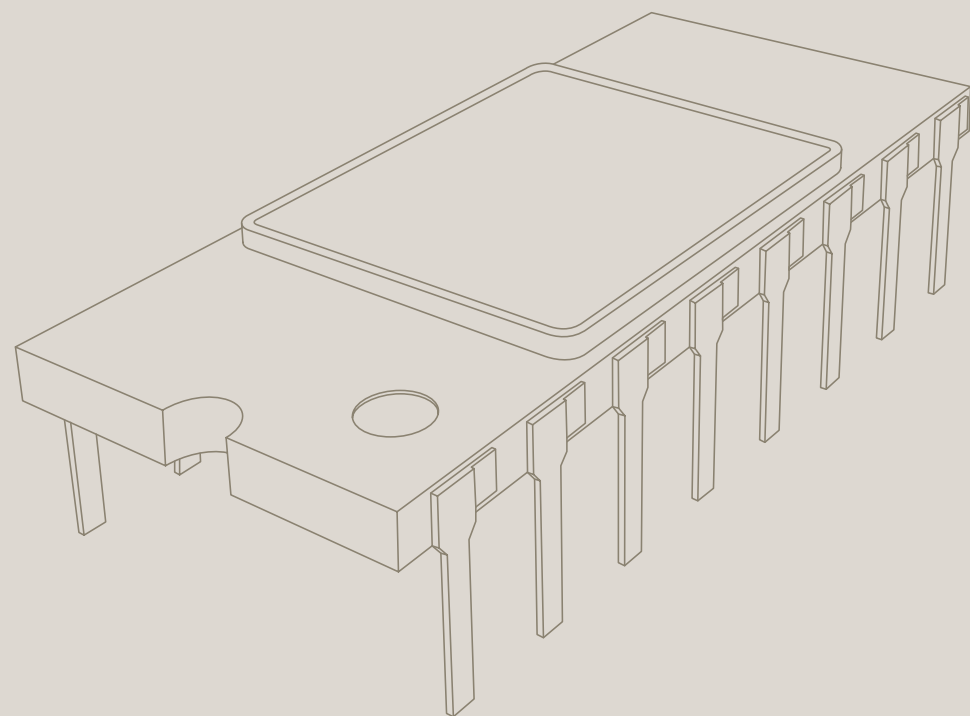
AVIONICS



SPACE



DEFENSE



WHY CISSOID?

Since 2000, CISSOID is the supplier of choice for high-temperature & extended lifetime semiconductors. CISSOID accumulated know-how and technologies outperform standard semiconductors commonly used in automotive:

CISSOID unique technology outperforms standard traditional silicon products and bring ultimate performance for unique differentiation in high-reliability applications:

- **Temperature ratings are increased up to 175°C, 225°C and above,**
- **Lifetime is increased by more than a decade.**

Where the ambient temperature is low but the power dissipation heats up the chips (e.g. power converters & intelligent power modules), or in high temperature environments (e.g. gas sensors in boilers and gas turbines), CISSOID products enable simpler electronics, with reliable solutions for power supply, power conversion, actuation control and sensors.



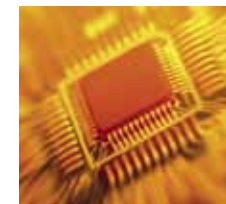
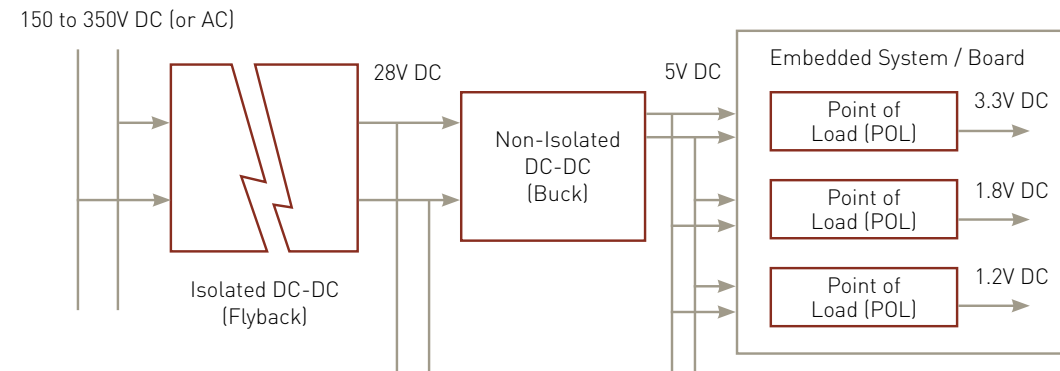
CISSOID is proud to mention NASA, who have completed extreme tests on a number of standard CISSOID products, that demonstrated reliable operation from -195°C to +400°C.

Test reports are available from NASA website.

Distributed Power Supplies in Aerospace and Oil & Gas applications: STAR & VOLCANO Families

The “More electrical aircraft”, space launchers and satellites, down-hole drilling tools all implement distributed power architectures that combine high-voltage input bus down to low-voltage Point-of-Loads. These architectures usually require a first isolated power converter stage that lowers the high-voltage bus (AC or DC) into a 48V or 28VDC typical DC voltage. An intermediary power converter would then generate a 12V or 5V DC voltage. Finally, and at each board / module level, dedicated “Point of loads” generate necessary voltages with throughputs tailored to match the specific regulation & power needs of each board / module.

Meeting these needs, the VOLCANO family of products includes PWM controller, SMPS ICs together with turnkey reference designs for Flyback and Buck DC-DC converters. The STAR family includes linear voltage regulators. CISSOID “CHT” ICs are all packaged in hermetic metal or ceramic packages, and are rated -55°C to +225°C, while “CMT” products are guaranteed up to +175°C. They all ensure best-in-class performance against temperature, extreme mission profiles and radiation intensive environment.



FPGAs, μ Controllers...

Ref Design :
STROMBOLI®
ICs: **CHT-MAGMA /**
CHT-BASALT

Ref Design :
VESUVIO® / EREBUS®
ICs: **CHT-MAGMA /**
CHT-TECTONIC

Linear voltage regulators:
- **CHT-VEGA**: VIN=5V±10% IOU_T : 500mA max
- **CHT-RIGEL** : VIN=4.5V to 30V; IOU_T : 100mA max

Switched-mode power supplies:
- **CHT-YELLOWSTONE**: POL VIN=3.0V to 5.5V; VOUT=+0.9V to +3.3V; IOU_T : 500mA max
- **EVK-FUJI**: Customizable Flyback Ref Design with triple VOUT 5V; 3.3V; 1.8V ; POUT=3.5W

TABLE 1 STAR: Linear Voltage Regulator ICs

Product-Name	Description	V _{OUT}	V _{IN} Max	I _{OUT} Max	Total Accuracy	Package	Pmax @ 150°C Ambient *	Temperature Range
CHT-BG3M	Voltage Reference	6 values from +2.5V to +12V	25V	3mA	±2%	T039	N/A	-55° to +225°C
CHT-LDOS CHT-LDOP	Positive, fixed voltage - Linear regulator	9 values from +2.5V to +15V	30V	1A	±4%	T0254	~10W	-55° to +225°C
CHT-LDNS-xxx	Negative, fixed voltage - Linear regulator	9 values from -2.5V to -15V	-30V	1A	±5%			
CHT-VEGA CHT-RIGEL	Adjustable voltage - Linear regulator	+1.2V to +3.3V (Adjustable) +1.8V to +28V (Adjustable)	5.5V 30V	500mA 100mA	±5% ±5%	TDFP16	~1W	-55° to +225°C
CMT / CHT-ANTARES	Positive, fixed voltage - Linear regulator	7 values from +1.2V to +15V	30V	200mA	±5%			

(*): Estimated typical power dissipation figures assuming T0254/257 are equipped with suitable heatsinks and TDFP / T0263 are soldered on PCB with copper thermal pad.

TABLE 2 VOLCANO: DC-DC Converter Technologies -55°C to +225°C

Product Name	V _{OUT}	VIN Range	I _{OUT} Max	P _{OUT} Max	Efficiency	Switching frequency	Line Regulation	Topology	Isolation	Soft Start	UVLO	Sync. Mode	S.C. Protection	Eval. Board Standard Configuration
VESUVIO®	1.2V to 0.9xVin	6V to 30V	2A [1]	50W	Up to 93%	230kHz	<1.5mV/V	Buck		X		X		5V / 2A Output
EREBUS®		12V to 40V	2A / 4A / 8A [2]	100W	Up to 90%	230kHz	<1.5mV/V	Buck		X		X	X	5V / 2A Output
EREBUS®		12V to 50V	2A / 4A / 8A [2]	75W	Up to 90%	230kHz	<1.5mV/V	Buck		X		X	X	5V / 2A Output
STROMBOLI®	Up to 25V (single or symmetrical ±)	15V to 40V	3A	50W [3]	Up to 82%	150kHz	-20ppm/V	Flyback	X		X		X	±12V / 1A Outputs
STROMBOLI®		150V to 350V	3A	150W [3]	Up to 82%	150kHz	-20ppm/V	Flyback	X		X		X	±12V / 1A Outputs

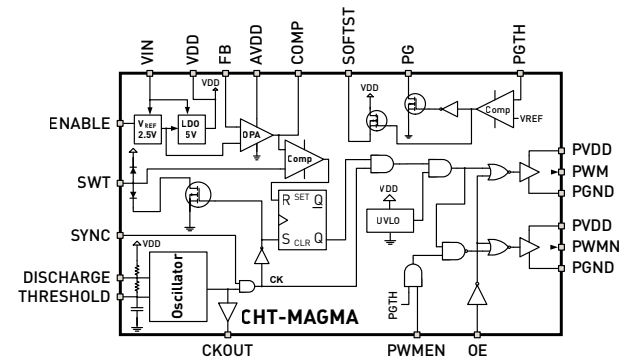
[1]: Higher currents: Contact CISSOID. - [2]: Erebus output current is scalable to 4A and 8A. - [3] : For Stromboli with Pout > 25W, a different transformer will be required.; impact on size should be expected.

VOLCANO: CHT-MAGMA (PWM Controller)



MAGMA is a single chip, high-temperature Pulse Width Modulation (PWM) controller with voltage mode control and maximum duty cycle up to 90%.

CHT-MAGMA has been awarded one of the "100-hot products of the year" (EDN, 2009), and became an industry standard for high temperature power converter designs.



- Junction temperature: -55°C to 225°C
- Input voltage feedforward compensation
- V_{IN} : 6V to 30V
- Voltage reference: 2.5V with 0.5mV/V line regulation and 0.25mV/°C drift
- Clock: 50 to 500KHz Internal or external
- Power good, output enable, stand-by (150µA@225°C)
- Companion chip: CHT-HYPERION (half-bridge driver)
- Packages: CDIL28 & CSOIC28
- Applications: SMPS, PoL and DC/DC converters

VOLCANO: EVK-FUJI (Triple Output, 3.5W DCM Flyback DC-DC Converter)



- Based on CHT-MAGMA PWM Controller
- Non-isolated topology (Flyback)
- Vin range: +10V to +28V
- Triple output voltage : +5V; +3.3V; +1.8V (customizable)
- 2 Flavors: With or without regulated outputs
- Output Power: up to 3.5W
- Suitable for integration into its own PCB or MCM module up to 225°C operation
- Eval Board dimensions: 1" x 3"

POWER CONVERSION: DC-DC, AC-DC and Power Inverters : Ranging from kW to MW... TITAN & PLANET Families



Motor drives and power converters require smaller, lighter, faster, and more energy-efficient solutions. Newest power switches like SiC and GaN are disruptive technologies enabling a dramatic increase of the power density, by carrying more current per mm² of semiconductor material, but also by allowing dramatically higher switching frequency with very little switching losses. Adequate driving of these power switches is a must to achieve high performance. CISSOID was first to market with CHT-THEMIS and CHT-ATLAS, a

power driver chipset dedicated to SiC devices (MOSFET, JFET and BJT). With HADES®, Cissoïd brings a complete 1,200V isolated half bridge drive integrated solution. Combined with CHT-NEPTUNE, the first truly 225°C power MOSFET, CISSOID brings a complete portfolio of highly advanced semiconductor solutions that perform highest performance in terms of power density, switching frequency, without having to worry about the operating temperature that is entirely sustained and managed by CISSOID products, with no detriment to the reliability.

Silicon Carbide (SiC) and Gallium Nitride (GaN) are disruptive technologies.

CISSOID bring the most advanced solutions – power switches and dedicated gate drivers

for your power converter needs:

- Smaller & lighter
- More efficient
- Higher temperature capability = reduced cooling
- and always the best reliability & lifetime in the market...

TABLES 3 SiC Power MOSFET & modules

	CHT-NEPTUNE	POWER MODULES
	-55°C ~ +225°C High Voltage, Silicon Carbide MOSFET	
VDS Max	1200V	
IDS Max (DC)	10A	Contact CISSOID
RDSon	90 mΩ @ 25°C ; 150 mΩ @ 225°C	
VGS	-2V / +20V	
Package	T0257	Contact CISSOID



SMALL ACTUATORS: Stepper motor and DC motor control TITAN & PLANET Families



Eval Board EVK-THEMIS-ATLAS

Small actuators - solenoids, DC motors and stepper motors - are widely used in the high-reliability industry. For instance applications like well completion in oil exploitation, fluid control in aeronautics and industrial, implements such electrical actuators.

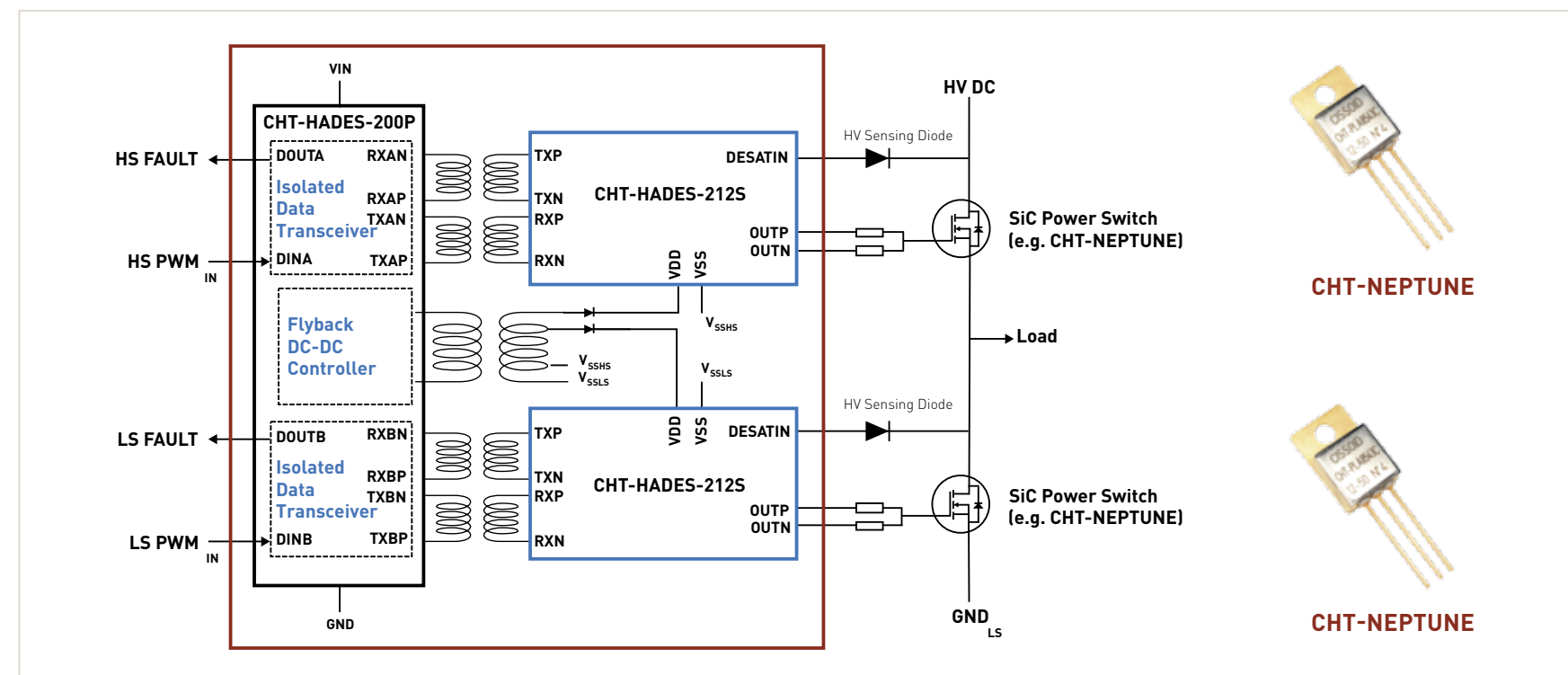
CISSOID power driver ICs like CHT-ATLAS are well suited for driving directly low-power inductive loads up to 30V / 2A peak / 600mA DC. Combined with external discrete components from the PLANET family, they can meet higher power requirements. Applications Notes and additional information can be obtained from CISSOID under request.

TABLE 4 TITAN: gate driver, power driver and DC motor driver ICs & Eval Kits

	CMT / CHT-PALLAS	CMT / CHT-HYPERION	CMT / CHT-ATLAS	HADES® (EVK-HADES: Eval. Kit)	DC & STEPPER MOTOR COMING SOON
Description	Full-Bridge N-channel MOSFET driver IC	Half-Bridge N-channel MOSFET driver IC	Dual Channel Power Driver IC	Half-Bridge Isolated Gate-Driver chipset & Eval Kit	ATLAS-based H-Bridge - Application Note (Eval Kit: Contact CISSOID)
Max bus voltage	50V DC	52V	30V DC	1200V DC	30V DC
Gate output current	20/80mA	1A	2 x ±2A	±4A	±600mA
Operating tempertaure (Tj)	-55° to +175°C / +225°C	-55° to +175°C / +225°C	-55° to +175°C / +225°C	-55° to +175°C / +225°C	-55° to +175°C / +225°C
Package	Depends on temperature rating: Contact CISSOID			Eval Board	CxT-ATLAS-Based Eval board
Isolation (primary - secondary)	N/A	N/A	N/A	2,500VAC @50Hz (for 1mn)	N/A
Common mode transient immunity	N/A	N/A	N/A	>100MΩ @ 500VDC	N/A
Gate voltage (customizable)	0 / 10V			MOSFET support: 20V / -5V Other devices: Contact CISSOID	N/A
Power supply	+5V ±5% & +8V-10V	+5V ±10% & +4V-50V	+5V ±5% & +5V-30V	+12V ±10%	+5V-30V
Other features		UVLO; output enable control; adaptive non-overlap circuit; integrated High-Side Bootstrap Diode	2 channels with separate logic level control inputs; soft-shut down & High Impedance mode	UVLO; Active Miller clamping; Desaturation protection; Isolated fault outputs ...	Soft-shut down; high-impedance mode...

HIGHLIGHT: HADES®, Half-Bridge 1200V Isolated Gate Driver: Chipset & Evaluation Kit

- Optimized for SiC & GaN
- DC Bus up to 1,200V
- Up to ±4A output current per channel
- Customizable gate voltage levels
- High common mode transient immunity: >50kV/μs
- Switching frequency up 100kHz / 200kHz
- Active miller clamping, Desaturation detection, UVLO...
- Guaranteed for -55°C ~ +225°C (Tj)



Instrumentation , general purpose ICs and discrete:

CISSOID offers the most complete range of high-temperature, extended lifetime semiconductors with analog, mixed-signal and discrete products.

Discrete: CISSOID discrete components include a wide range of medium power, 80V & 40V MOSFET transistors and diodes, as well as small signal devices. It also include CHT-NEPTUNE, a silicon carbide (SiC) 1200V MOSFET trully capable of up to 225°C operation.

Amplification: CHT-OPAL and CHT-RUBY are high precision amplifiers and instrumentation amplifiers that will carry out front-end amplification function in harsh environment sensors.

A-to-D converter (CHT-AMAZON), and **voltage comparator** (high-speed CHT-VOLGA and programmable CHT-NILE) are ICs available from CISSOID.

The transceiver CHT-RHEA brings galvanic insulation and it is the most robust in the market. For long-distance transmission, a solution for 2-wire, a **4-20mA transmission loop** is also available from CISSOID based on CHT-OPAL device.

Clock generators CHT-CG50 & CHT-CG50LP are the market standards for robust crystal-based clock generation; a large number of turnkey clock modules in the market are already using these ICs. Popular 555 timer is also available from CISSOID in 2 flavors (CHT / 225°C and CMT / 175°C) for monostable and astable needs.

74xx logic devices are also available from CISSOID in both flavors, CHT / 225°C and CMT / 175°C for medium and high temperature applications.

Refer to the product selection tables in this document and to the datasheets available from CISSOID website for more information.



TABLE 5 PLANET: Small signal, medium power and high voltage discretes

Temperature range: -55°C --+ 225°C

Product Name	Description	V _{DS} Max	I _{DS} Max	R _{DS(ON)}		Package
				@ 25°C	@ 225°C	
EARTH / CHT-NMOS8001	NMOS Medium Power Transistor	80V	1A (3A pulse)	0.76Ω	1.56Ω	TDFP16
EARTH / CHT-NMOS8005	NMOS Medium Power Transistor	80V	5A	0.48Ω	0.99Ω	T0254
EARTH / CHT-NMOS8010	NMOS Medium Power Transistor	80V	10A	0.24Ω	0.46Ω	T0254
SATURN / CHT-NMOS4005	NMOS Medium Power Transistor	40V	5A	0.38Ω	0.65Ω	T0254
SATURN / CHT-NMOS4010	NMOS Medium Power Transistor	40V	10A	0.2Ω	0.36Ω	T0254
SATURN / CHT-NMOS4020	NMOS Medium Power Transistor	40V	20A	0.12Ω	0.25Ω	T0254
MERCURY / CHT-SNMOS80	NMOS Small Signal Transistor	80V	300mA	7.5Ω	15Ω	T039; T018
CHT-MOON	Dual NMOS Medium Power Transistor	40V	4A	0.38Ω	0.65Ω	CSOIC16
VENUS / CHT-PMOS3002	PMOS Medium Power Transistor	30V	2A	2.3Ω	3.9Ω	T0254
VENUS / CHT-PMOS3004	PMOS Medium Power Transistor	30V	4A	1.1Ω	2.0Ω	T0254
VENUS / CHT-PMOS3008	PMOS Medium Power Transistor	30V	8A	0.6Ω	1.0Ω	T0254
MARS / CHT-SPMOS30	PMOS Small Signal Transistor	30V	310mA	15Ω	26Ω	T039; T018
CHT-NEPTUNE	High Voltage Silicon Carbide MOSFET	1200V	10A	0.09Ω	0.15Ω	T0257

Product Name	Description	V _R	I _F	V _F @ I _F Max
CHT-GANYMEDE	Dual Series Small Signal Diode	80V	280mA	1.5V
CHT-CALLISTO	Dual Small Signal Diode (Common Anode)	80V	280mA	1.5V
CHT-AMALTHEA	Dual Diode (Dual Series, Common Anode & Common Cathode)	80V	3A	1.8V
CHT-CERES	Transient Voltage Suppressor	13.4V (break-down voltage; bidirectional)	FEATURES & AVAILABILITY: CONTACT CISSOID	

TABLE 6 GEMSTONE: Amplifiers

Product Name	Description	Power Supply	Max. Current Consumption [1]	Output Voltage Swing	Input Offset Voltage	GBW (Typ.)	Slew Rate [1]	Temperature Range	Packages
CMT / CHT-OPA (TURQUOISE)	Quad Op Amp	4.5V ~20V	2 / 2.2mA	VDD-0.18V; VSS+0.18V	±8mV	1.5MHz	1.6 / 1.7V/μs	-55° to +175°C / +225°C	PSOIC16 CSOIC16 CDIL14
CHT-RUBY	Triple Op Amp + Voltage Reference	6.0V to 20V	1.6mA + 0.7mA (Vref)	VDD-0.18V VSS +0.18V	±8mV	1.3MHz	1.6V / s	-55°C/+225°C	CSOIC16
CHT-OPAL	Dual Precision Op Amp	4.5V to 5.5V	2.8mA	VDD - 0.1V VSS+0.1V	<50μV	2.8MHz	2.7V/μs (@25°C); 3.2V/μs (@225°C)	-55°C/+225°C	TDFP16

[1] Load conditions: RL=2KΩ, CL=30pF and Tj=225°C max

HIGHLIGHT: Sensor Analog Front-End

Typical sensing applications require an instrumentation amplifier stage together with a voltage or current reference for bridge excitation. CISSOID CHT-RUBY combines these functions in a single chip and meet the toughest temperature and lifetime requirements.

Other function blocks such as multiplexing, A-D conversion, transceivers can also be fulfilled by other dedicated CISSOID devices (e.g. CHT-AMAZON or CHT-RHEA), or combined in an ASSP. Contact CISSOID for more information.

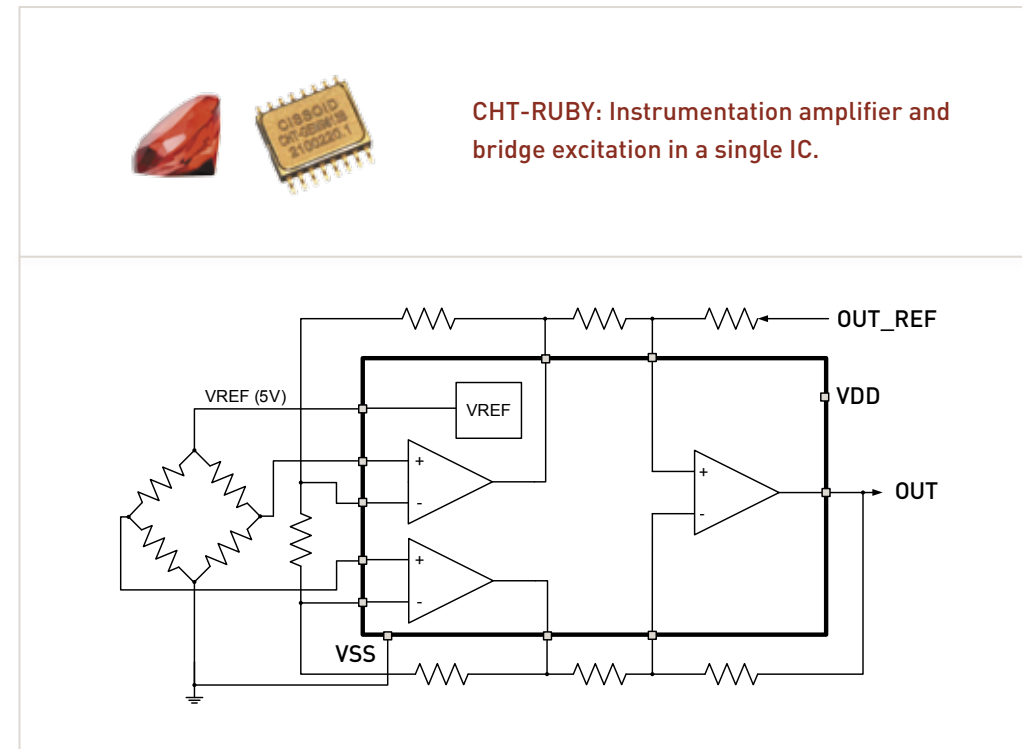
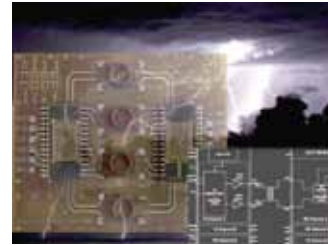


Table 7 RIVER: Mixed Signal

	CHT-BG3M (POLARIS)	CHT-ADC10 (AMAZON)	CHT-PTC8 (NILE)	CHT-VOLGA
Description	3-pin Voltage Reference Fixed voltage: 2.5V; 3.3V; 5V; 9V; 10V or 12V +/- 2%	10 bit AD Converteur SAR Architecture	Programmable Comparator Comparison of an analog input against an 8-bit resolution portion of a 5V reference voltage	High Speed Comparartor Rail-to-rail I/O
Operating temperature (Tj)	-55°C ~ +225°C	-55°C ~ +225°C	-55°C ~ +225°C	-55°C ~ +225°C
Power Supply	Up to 15V with 1.5V / 2.5V minimum dropout	+5V ±5%	+5V ±5%	+5V ±10%
Speed / Data rate	N/A	25k Samples /s	2.6μs typical delay	29ns typical delay
Highlight	Max. output current: 3mA @225°C	Low total supply current: <250 μA	Selectable analog input range from -15V up to +10V	Shutdown mode (1nA Typ.)
Package	Refer to available datasheet for packages; other options available on request.			
Other features	Quiescent current consumption: 700μA	Serial and parallel output: SPI & x74 'like' μC interface; On-chip Sample-and-hold		Push-Pull CMOS output stage: ±16mA Max

Table 8 Transceivers

	CHT-RHEA	4-20mA Current Loop Transmitter COMING SOON
Description	Dual-Channel Isolated Transceiver (2 x Tx and 2 x Rx) Integrated Circuit & Evaluation Kit	Application Note (Eval Kit: Contact CISSOID)
Isolation	Galvanic isolation thru external pulse transformers	N/A
Operating temperature (Tj)	-55°C ~ +225°C	-55°C ~ +225°C
Power Supply	+5V ±10%	+7V to +30V (loop voltage)
Speed / Data rate	2Mbps	N/A
Highlight	Transmission delay below 100ns; Jitter lower than 21ns	
Package	Refer to available datasheet for packages; other options available on request	
Other features	High common mode transient immunity: 50kV/μs	App Note includes a PT100-based temperature sensor for demonstration purpose



Eval Board EVK-RHEA

TABLE 9 GALAXY: Logic

Product Name	Description	Power Supply	Temperature Range	Packages
CHT/CMT-7400	Quad 2-input NAND	3.0V to 5.5V	-55° to +175°C / +225°C	CDIL 14/16, CSOIC16
CHT/CMT-7404	Hex inverter			
CHT/CMT-7408	Quad 2-Input AND			
CHT/CMT-74021	Quad 2-Input NOR			
CHT/CMT-7432	Quad 2-Input OR			
CHT/CMT-7474	Dual D-type flip-flop			
CHT/CMT-7486	Quad 2-Input XOR			
CHT/CMT-74132	Quad NAND Schmitt Trigger			
CHT/CMT-74-4040	12-stage binary ripple counter			
CHT/CMT-7400	Quad- 2-input NAND			

Packages: PSOIC / CSOIC;
other packages: Contact CISSOID

PULSAR CHT-CG50 / CG50LP Clock Generators & CMT/CHT-555 Timer

PULSAR is the product family dedicated to clock generation and timers.

CISSOID' industry standard CHT-CG50 / CG50LP are recognized as the most robust clock generator devices for crystal-based clock modules in Oil & Gas and Aerospace. They are available in ceramic CDIL and TDFP packages. Under

request, it can be offered in die form for integration into modules. Contact CISSOID for more information.

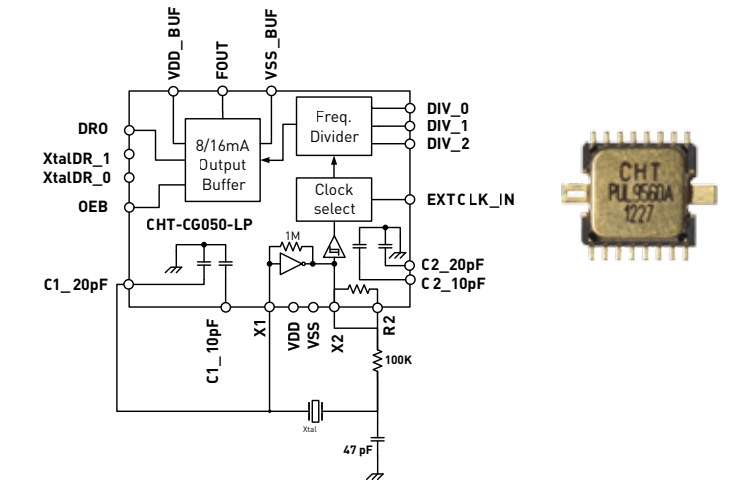
For timing generation - astable and monostable needs - the popular 555 timer is offered by CISSOID in 2 flavors: CHT and CMT, with respective temperature ratings of -55°C~+225°C and of -55°C~+175°C.

Product Name	Description	Power Supply	Typ. Current Consumption [1]	Max Frequency	Temperature Drift	Output		Temperature Range	Packages
						Rise Time (Typ.)	Fall Time (Typ.)		
CHT-555	555 Timer	4.5V to 5.5V	350μA	4.2MHz	100ppm	16.1ns	17.2ns	-55°C/+225°C	CDIL14
CMT-555	555 Timer	4.5V to 5.5V	350μA	4.2MHz	100ppm	14ns	14ns	-55°C/+175°C	PSOIC8

[1] Consumption at 1MHz

TABLE 10 Clock Generators

P/N	CHT-CG50	CHT-CG50LP
Power Supply	3.3V ±5% to 5V ±10%	
Operating temperature (Tj)	-55°C to +225°C	
Frequency range	DC to 50MHz	
Supports 32.768kHz crystals for RTC applications	X	X
3-states output buffer	X	X
Programmable output buffer	8/16/24/32mA	8/16mA
Programmable output frequency divider	: 1 to :8	:1 to :512
Programmable crystal driver strength	X	X
Stand-by mode	X	X
Built-in passives components	X	X
ESD (HBM)	<250V	>2kV
Package	CDIL24	TDFP16
Ordering	CHT-CG50-CDIL24-T	CHT-CG50LP-TDFP16-T
Bare Die (*)	X	X



Block diagram - CHT-CG50LP

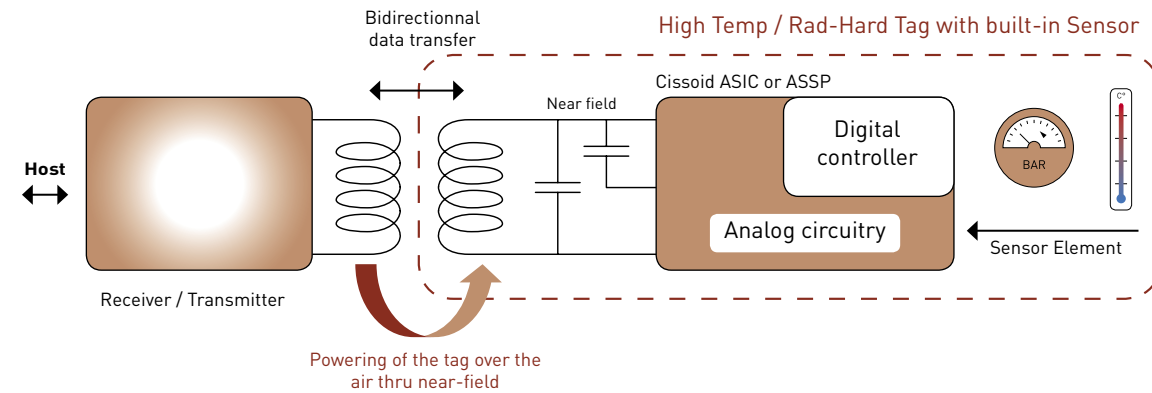


HIGHLIGHT: TELEMETRY AND ELECTRONIC IDENTIFICATION IN HARSH ENVIRONMENTS



CISSOID has developed battery-less telemetry and RFID solutions dedicated to harsh and high-temperature environments (up to 175°C or 225°C, possibly above). Development of standard products, ASICs or ASSPs can be evaluated by CISSOID to match particular requirements. The Technology is based on near-field inductive

coupling, using carrier frequencies of 125kHz or 13.56MHz. Additional analog front-end for sensing and A-to-D conversion can be integrated enabling a battery-less telemetry function with extreme temperature and rad-hard capabilities.



Contact CISSOID for more information about availability.

HIGHLIGHT: About CISSOID Rad-Hard capabilities

- The most common failure mechanism in applications that are subject to radiation exposure – as well as to high temperature operation – is Latch-up
- CISSOID products are intrinsically immune to Latch-up
- As a result, CISSOID products exhibit outstanding performance against radiation, and therefore are solutions of choices for Radhard requirements in aerospace, nuclear, medical and defense applications
- Snapshot of CISSOID IC's typical Radhard capabilities :
 - TOTAL Dose: Successful tests carried out on a number of CISSOID ICs up to 50krads and 96krads, with various dose rates;
 - Single Event Effects (SEE): Heavy Ions SEE tests conducted on various CISSOID products : No SEL, SEU nor SET detected up to 55.9 MeV mg-1cm-2 (Si);
 - Actual performance vary between products; contact CISSOID for more information.



Applications include:

- **Avionics:** Tire pressure sensing
- **Oil & Gas:** Pipe identification & tracking in harsh environments (drilling)
- **Nuclear waste management**
- **Medical:** Identification and telemetry for medical items subject to sterilization (high temperature and irradiation)



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