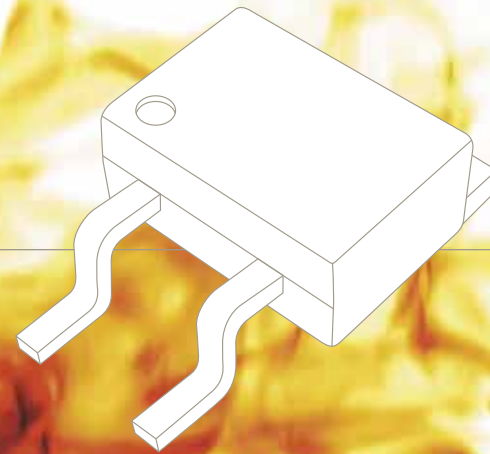




HIGH-TEMPERATURE  
& EXTENDED LIFETIME SEMICONDUCTORS

# AUTOMOTIVE SOLUTION GUIDE



START-STOP & MICRO HYBRID



HIGH VOLTAGE POWER  
CONVERSION IN MILD / FULL  
HYBRID & ELECTRIC VEHICLES



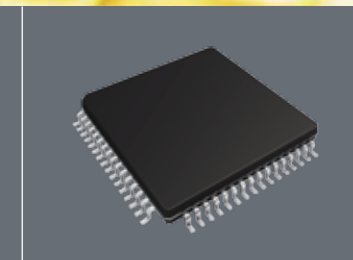
LIGHTING & LOW VOLTAGE  
ACTUATION



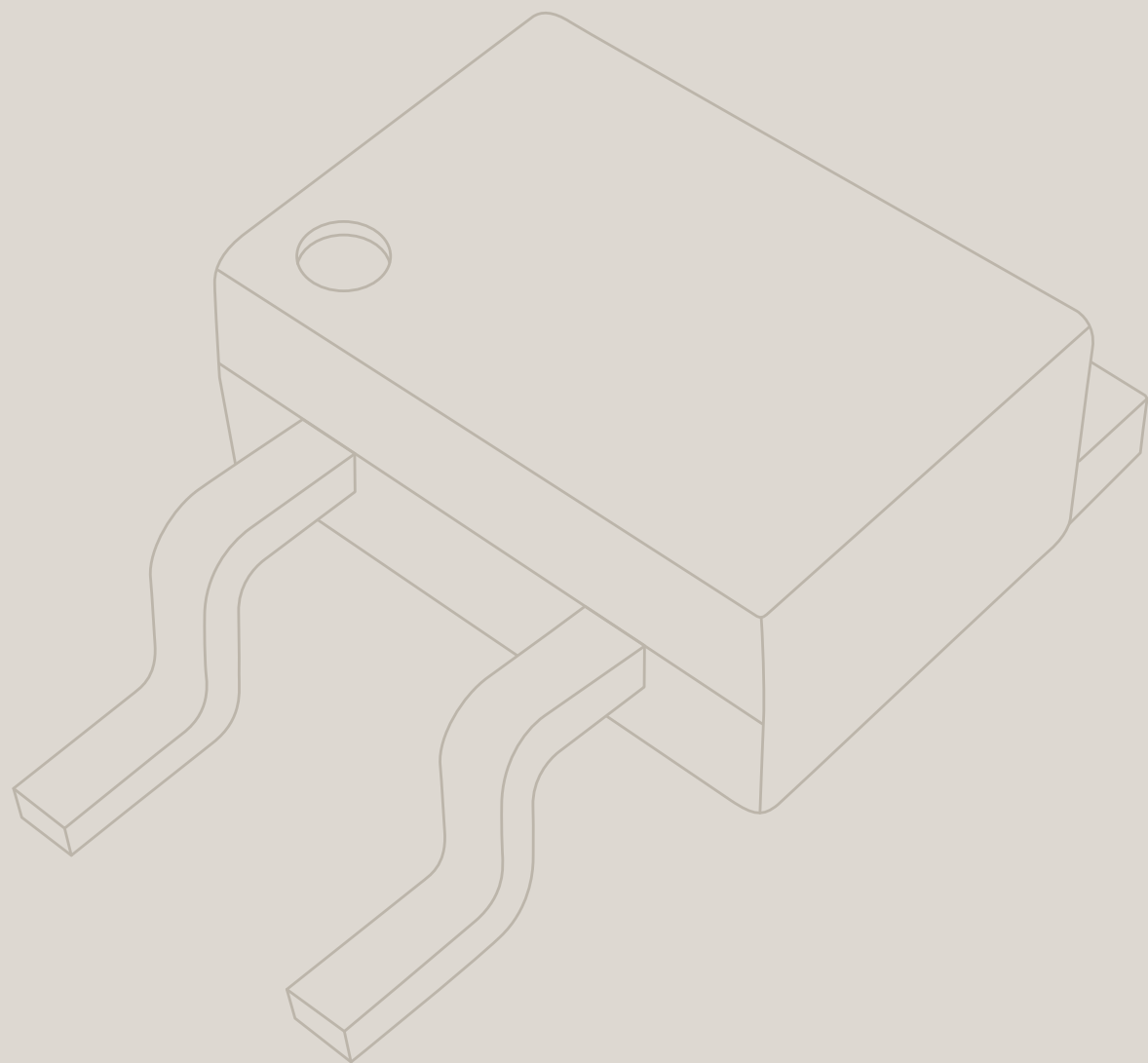
VOLTAGE REGULATORS, DC-DC &  
POWER MANAGEMENT



EGR VALVES ELECTRONICS,  
ACTUATION & SENSORS



ASSPS



## WHY CISSOID?

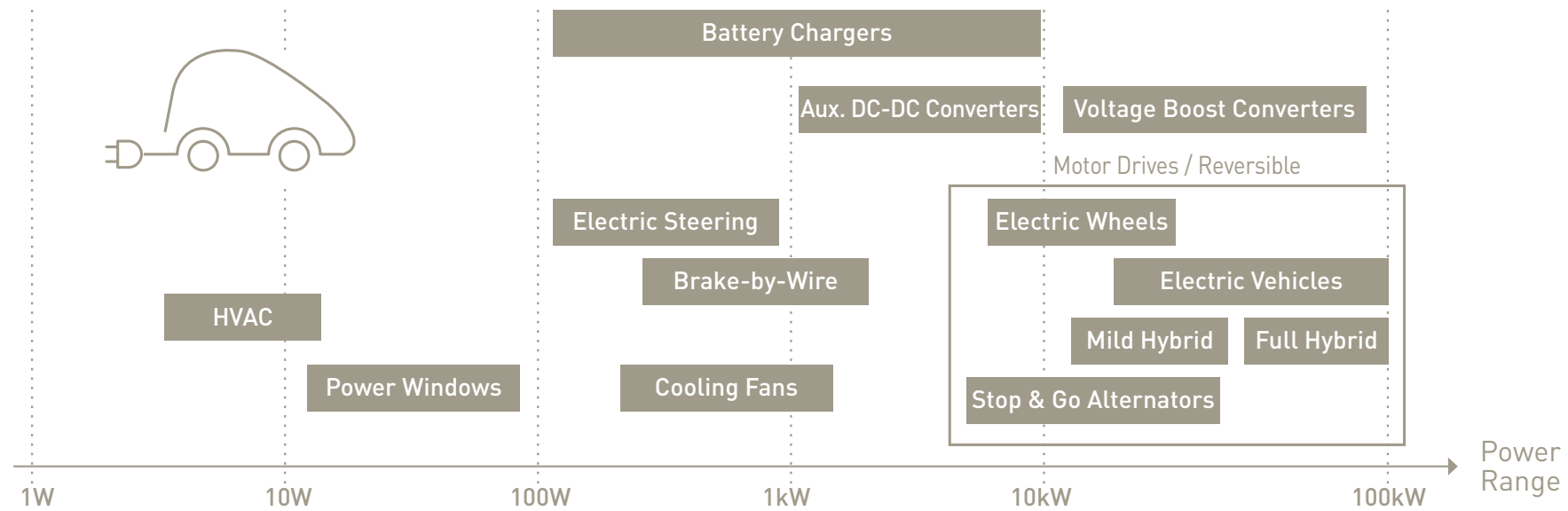
Since 2000, CISSOID is the supplier of choice for high-temperature & extended lifetime semiconductors. CISSOID accumulated know-how and technologies outperform standard semiconductors commonly used in automotive:

- **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. linear voltage regulator & power management ICs), or in high temperature environments (e.g. in the engine compartment or in the exhaust pipe system), CISSOID products enable simpler electronics, with reliable solutions for power supply, power conversion, actuation control and sensors. CISSOID provides cost-effective solutions; AEC-Q10x qualification and PPAP approval as required.



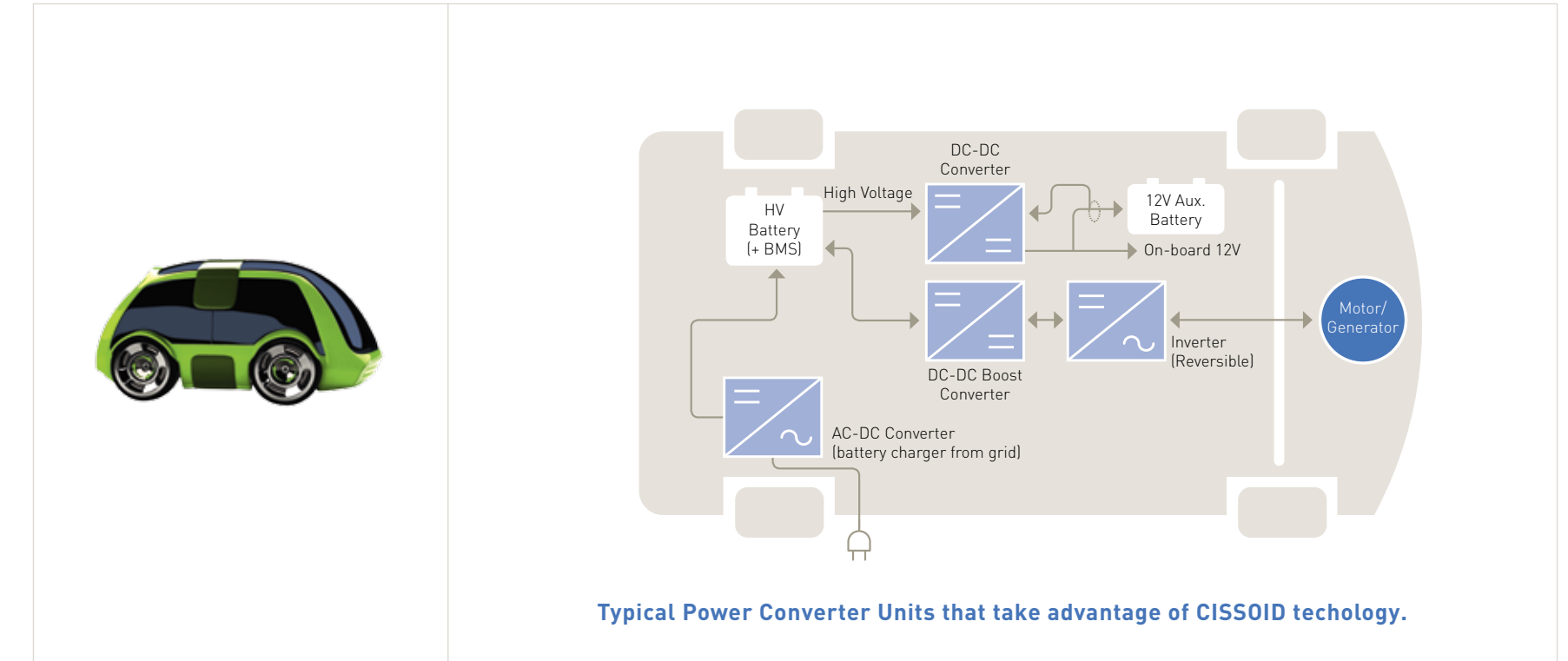
## CISSOID enables compact & cooling-free power converters in traditional automotive, EV and HEV



Switching electrical power in automotive requires power components and power electronic sub-systems or modules ranging from a few Watts in small actuators, to kWatt and 100's of kWatt for powertrains in the newest generation of hybrid and electric vehicles.

Thermal management is a major challenge for these converters. CISSOID brings disruptive solutions that make possible the shrinking of the electronics, combined with the possibility to remove the dedicated fluid cooling that currently equip EVs and more especially HEV's.

## Typical EV / P-HEV Architecture



### CISSOID technology bricks & achievements:

- Complete high-voltage isolated gate driver solutions, 175°C and 225°C for SiC and GaN,
- Silicon Carbide Power MOSFETs,
- Intelligent Power modules.

## Start-Stop & Micro Hybrid:



Low & medium voltage power inverters use power switches that operate with junction temperatures largely above 150°C today. The newest generation of SiC and upcoming GaN switches are poised to replace

traditional IGBTs and MOSFETs, leading toward even higher operating temperatures. CISSOID solutions for gate drivers (Table 1) can be placed close to the power switch; they have been designed to take full advantage of SiC & GaN, bringing power density, compactness and reliability to a new standard level.

## Mild / Full Hybrid & Electric Vehicles:



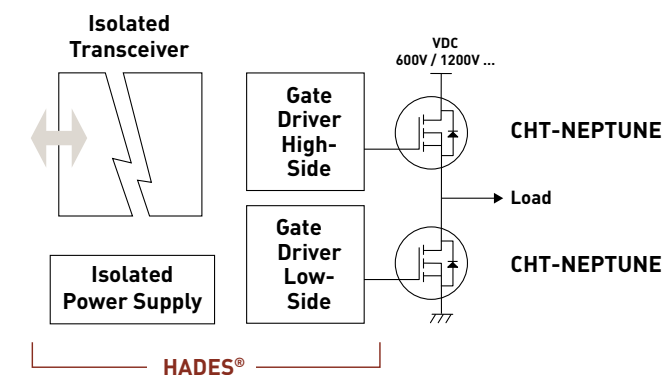
CISSOID has developed HADES®, a turnkey half-bridge gate driver chipset dedicated to high voltage power conversion for EV & HEVs. The highly integrated solution is suitable for power ranging from a few kW to

several 100's of kW. CISSOID also offers advanced SiC power switches and modules (Table 2) for advanced developments and demonstrators, performing very high temperature operation (225°C), high power density and cooling-free systems.

**TABLE 1 TITAN: Gate driver, power driver and DC motor driver ICs & Eval Kits**

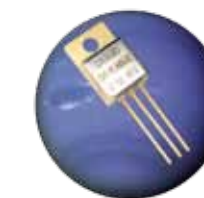
	CMT / CHT-PALLAS	CMT / CHT-HYPERION	CMT / CHT-ATLAS	HADES® (EVK-HADES: Eval. Kit)	DC & STEPPER MOTOR COMING SOON
<b>Description</b>	Full-Bridge N-channel MOSFET driver IC	Half-Bridge N-channel MOSFET driver IC	Dual Channel Power Driver IC	Half-Bridge Isolated Gate-Driver chipset & Eval Kit	ATLAS-based H-Bridge - Application Note (Eval Kit: Contact CISSOID)
<b>Max bus voltage</b>	50V DC	52V	30V DC	1200V DC	30V DC
<b>Gate output current</b>	20/80mA	1A	2 x ±2A	±4A	±600mA
<b>Operating tempertaure (TJ)</b>	-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
<b>Package</b>	Depends on temperature rating: Contact CISSOID			Eval Board	CxT-ATLAS-Based Eval board
<b>Isolation (primary – secondary)</b>	N/A	N/A	N/A	2,500VAC @50Hz (for 1mn)	N/A
<b>Common mode transient immunity</b>	N/A	N/A	N/A	>100MQ @ 500VDC	N/A
<b>Gate voltage (customizable)</b>	0 / 10V			30-50 kV/µs	N/A
<b>Power supply</b>	+5V ±5% & +8V-10V	+5V ±10% & +4V-50V	+5V ±5% & +5V-30V	MOSFET support: 20V / -5V Other devices: Contact CISSOID	N/A
<b>Other features</b>		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® and CHT-NEPTUNE, a complete 1200V / 10A half-bridge IPM solution kit for advanced R&D of high voltage power converters:**



**TABLES 2: SiC Power MOSFET & modules**

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



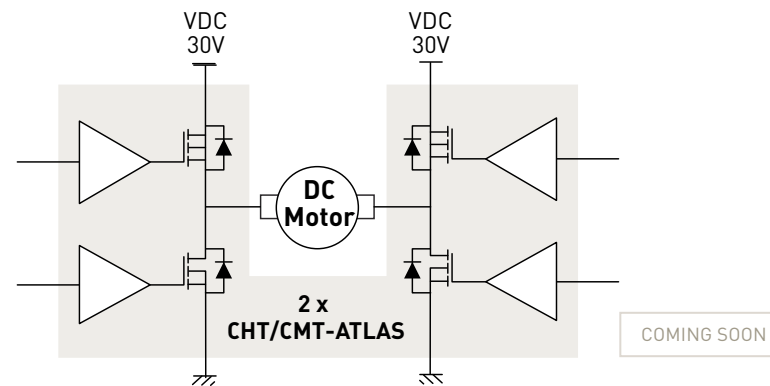
## Lighting & Low Voltage Actuation:



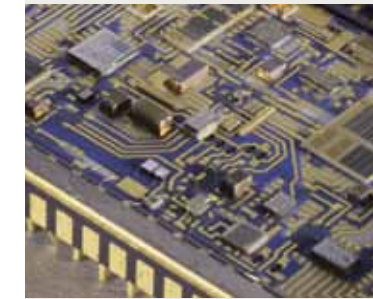
CISSOID provides advanced solutions of low voltage, medium power converter : Either as standalone ICs for low power applications, or combined with newest generation of GaN transistors, CISSOID gate drivers

enable the highest power density with reduced cooling without impacting the reliability. For medium power applications, CISSOID single chip power driver CHT/CMT-ATLAS can be used for DC motor drive (Contact CISSOID for dedicated Application Notes).

### HIGHLIGHT: Stepper and DC Motor Drive Application Note (30V / 600mA) using CISSOID ATLAS integrated circuit:



## Voltage Regulators, DC-DC & Power Management:



Under the hood electronics commonly implement hybrid and compact PCB modules attached to the engine block or to the gear box, that see the operating temperature commonly going up to 150°C / 170°C. As a result, the reliability of their power supply

circuits is often an issue: In particular linear voltage regulators see their junction temperature increasing above the rest of the module because of the self dissipation within the components. With its STAR family of products (Table 3) CISSOID brings solutions of choice with

no risk of untimely thermal shutdown (most of the standard silicon devices have thermal shutdown active above 150°C) and with lifetime that outperforms any standard bulk silicon solution in the market. Moreover, they advantageously replace switched mode power supplies in a number of applications, reducing the component count, the complexity of the circuitry and the noise, whilst keeping a safety margin with regard to the junction temperature with up to 175°C / 225°C.

CISSOID linear voltage regulators are the only devices in the market with a temperature rating of 175°C and 225°C suitable for automotive applications.

TABLE 3 STAR: Linear Voltage Regulator ICs

Product-Name	Description	V <sub>OUT</sub>	V <sub>IN</sub> Max	I <sub>OUT</sub> Max	Total Accuracy	Package	P <sub>max</sub> @ 150°C Ambient *	Temperature Range
CHT-BG3M		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%	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 4 PLANET - Discrete**

Product Name	Description	V <sub>DS</sub> Max	I <sub>DS</sub> Max	R <sub>DS(ON)</sub>		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	TO254
EARTH / CHT-NMOS8010	NMOS Medium Power Transistor	80V	10A	0.24Ω	0.46Ω	TO254
SATURN / CHT-NMOS4005	NMOS Medium Power Transistor	40V	5A	0.38Ω	0.65Ω	TO254
SATURN / CHT-NMOS4010	NMOS Medium Power Transistor	40V	10A	0.2Ω	0.36Ω	TO254
SATURN / CHT-NMOS4020	NMOS Medium Power Transistor	40V	20A	0.12Ω	0.25Ω	TO254
MERCURY / CHT-SNMOS80	NMOS Small Signal Transistor	80V	300mA	7.5Ω	15Ω	TO39; TO18
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	TO254
VENUS / CHT-PMOS3004	PMOS Medium Power Transistor	30V	4A	1.1Ω	2.0Ω	TO254
VENUS / CHT-PMOS3008	PMOS Medium Power Transistor	30V	8A	0.6Ω	1.0Ω	TO254
MARS / CHT-SPMOS30	PMOS Small Signal Transistor	30V	310mA	15Ω	26Ω	TO39; TO18
CHT-NEPTUNE	High Voltage Silicon Carbide MOSFET	1200V	10A	0.09Ω	0.15Ω	TO257

Product Name	Description	V <sub>R</sub>	I <sub>F</sub>	V <sub>F</sub> @ I <sub>F</sub> 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 5 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

**EGR Valves Actuation & Sensors:**



Applications such as EGR valve actuation, low & medium power actuation (e.g. solenoid control, DC motor control etc.) and sensors (e.g. exhaust gas; oil pressure; position sensors...) are implemented in hot locations, where traditionally the electronic circuitry must be remote due to the local temperature of the

sensing element. With CISSOID, it is now possible to implement part or the full electronic circuitry together with the sensing element in the hot area.

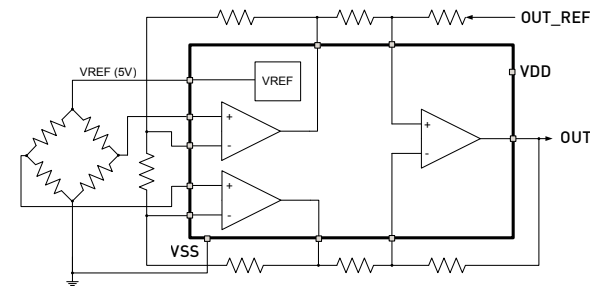
Standard integrated circuits include discrete, logic devices, amplifiers and mixed signal (Tables 4 to 6).

## HIGHLIGHT: Analog front end amplification in sensors




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, isolated transmission can also be fulfilled by other dedicated CISSOID devices (e.g. CHT-AMAZON or CHT-RHEA), or combined in an ASSP.

**CHT-RUBY :**  
Instrumentation amplifier and bridge excitation in a single IC.



**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

## Application Specific Standard Products (ASSPs):

When our standard products do not match the exact customer's requirements, CISSOID can tailor its offering, design and deliver ASSPs that match specific needs.

Contact CISSOID for more information.

### Customer Requirements:

- Power supply: linear regulator or SMPS
- Instrumentation
- Power drivers
- Discrete
- Logic

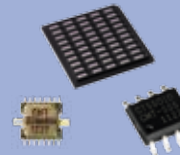
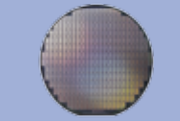
Integration in an ASSP

Chip Design & Simulation  
-55°C~175°C / 225°C

Fabrication & test; delivery of engineering samples

AECQ100 Qual

Delivery





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