

CHT-PLUTO-C1220

Datasheet

High Temperature 1200V/20A

Asynchronous Buck/Boost Module

Version: 1.2
14-Dec-23
(Last Modification Date)

General description

CHT-PLUTO-C1220 is a high temperature 1200V/20A Silicon Carbide module including one MOSFET switch and one Schottky diode in a single hermetic package. It is suitable to implement an asynchronous buck converter or a boost converter.. This product is guaranteed for normal operation on the full range -55°C to +210°C (Tj). Each MOSFET or diode has a breakdown voltage in excess of 1200V and is capable of switching current up to 20A. The MOSFET have a on-resistance of 90mΩ at 25°C and 200mΩ at 210°C at VGS=20V. The MOSFET has an intrinsic body diode.

Benefits

- High power density converters (support of high-frequency switching and reduced cooling)
- Extended lifetime and high reliability
- Harsh environments and high temperature power converters
- Seamless driving with HADES® gate driver solutions

Applications

- DC motor drives and actuator control
- DC-DC converters

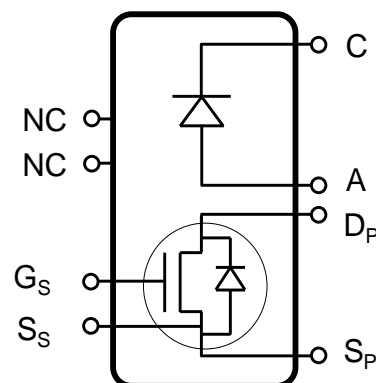
Features (MOSFET)

- Specified from -55 to +210°C (Tj)
- V_{DS} Max: 1200V
- Max Continuous Current:
 - 20A @ T_c≤160°C
 - 17A @ T_c=175°C
- Max Pulsed Current: 25A
- Typical MOSFET On-resistance:
 - R_{DSon}= 40 mΩ @ T_j=25°C
 - R_{DSon}= 120 mΩ @ T_j=210°C
- High Speed Switching
- Voltage control: V_{GS}=-5V/20V
- Low gate charge: Q_{GS}: 22nC

Features (DIODE)

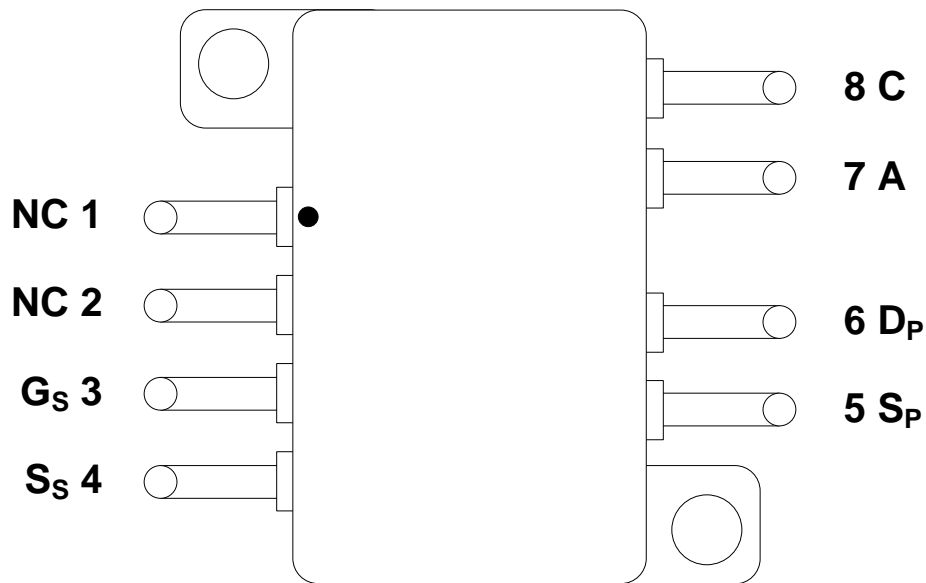
- Typ. Forward Voltage @20A : 1.5V
- Max Continuous Current: 20A
- Max Peak Rep Fwd Surge Current: 35A
- Hermetic package with isolated case

Functional Block Diagram



Note: the schematic shows the intrinsic body diode of the MOSFET

Package configuration and Pin Description



Pin ID	Pin Name	Pin Description	Pin Finish
1	NC	Not connected Pin	Nickel
2	NC	Not connected Pin	Nickel
3	G _S	Gate of MOSFET (Signal Pin)	Nickel
4	S _S	Source of MOSFET (Signal Pin)	Nickel
5	S _P	Source of MOSFET (Power Pin)	Nickel
6	D _P	Drain of MOSFET (Power Pin)	Gold
7	A	Anode of Diode (Power Pin)	Nickel
8	C	Cathode of Diode (Power Pin)	Gold
	Body	Package body (isolated from Pins)	Nickel

MOSFET

Absolute Maximum Ratings

Gate-to-Source voltage V_{GS}	-5V to 22V
Drain-to-Source voltage V_{DS}	1200V
Max DC Drain current I_{DS}	20A
Max Junction temperature T_{jmax}	210°C
Power dissipation at $T_c=175^\circ\text{C}$ (*)	45W

Operating Conditions

Gate-to-Source voltage V_{GS}	-5V to 20V
Drain-to-Source voltage V_{DS}	1200V
Max DC drain current I_{DS} ($T_c=175^\circ\text{C}$)	17A
Max DC drain current I_{DS} ($T_c\leq 160^\circ\text{C}$)	20A
Max pulsed drain current	25A
Junction temperature	-55°C to +210°C

ESD Rating

Human Body Model	>1kV
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DIODE

Absolute Maximum Ratings

DC Blocking Voltage	1200V
Continuous Forward Current	20A
Max Junction temperature T_{jmax}	210°C
Power dissipation at $T_c=175^\circ\text{C}$ (*)	45W

Operating Conditions

DC Blocking Voltage	1200V
Continuous Forward Current	20A
Rep. Peak Fwd Surge Current	35A
Junction temperature	-55°C to +210°C

ESD Rating

Human Body Model	>2kV
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Electrical characteristics MOSFET

Unless otherwise stated, $T_j = 25^\circ\text{C}$. **Bold** figures point out values valid over the whole temperature range ($T_j = -55^\circ\text{C}$ to $+210^\circ\text{C}$).

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Threshold voltage	V_{TH}	$T_j = 25^\circ\text{C}$; $I_D = 1\text{mA}$; $V_{DS} = 20\text{V}$		4.45		V
		$T_j = 210^\circ\text{C}$; $I_D = 1\text{mA}$; $V_{DS} = 20\text{V}$		3.28		V
Drain cut-off current (includes diode reverse current)	I_{DSS}	$V_{GS} = 0\text{V}$, $V_{DS} = 1200\text{V}$, $T_j = 25^\circ\text{C}$		20		nA
		$V_{GS} = 0\text{V}$, $V_{DS} = 1200\text{V}$, $T_j = 210^\circ\text{C}$		10		μA
Gate leakage current	I_{GSS}	$V_{GS} = 20\text{V}$, $V_{DS} = 1200\text{V}$, $T_j = 25^\circ\text{C}$		5		nA
		$V_{GS} = 20\text{V}$, $V_{DS} = 1200\text{V}$, $T_j = 210^\circ\text{C}$		20		nA
Static drain-to-source resistance	$R_{DS(on)}$	$V_{GS} = 20\text{V}$, $I_D = 25\text{A}$, $T_j = 25^\circ\text{C}$		40		$\text{m}\Omega$
		$V_{GS} = 20\text{V}$, $I_D = 25\text{A}$, $T_j = 210^\circ\text{C}$		120		$\text{m}\Omega$
Breakdown drain-to-source voltage (DC characterization)	V_{BRDS}	$V_{GS} = 0\text{V}$; $I_D = 1\text{mA}$	1200			V
Input capacitance	C_{ISS}	$V_{GS} = 0\text{V}_{DC}$, $V_{DS} = 600\text{V}$ $f = 1\text{MHz}$ $V_{AC} = 25\text{mV}$		1337		pF
Output capacitance (includes diode capacitance)	C_{OSS}			76		pF
Feedback capacitance	C_{RSS}			27		pF
Turn-on delay time	$T_{d(ON)}$			21		ns
Fall time	T_r	$V_{DD} = 600\text{V}$; $V_{GS} = -4/20\text{V}$ $I_D = 20\text{A}$ $RG = 6.8\Omega$; $L = 856\mu\text{H}$		39		ns
Turn-off delay time	$T_{d(OFF)}$			49		ns
Rise time	T_f			24		ns
Turn-On Switching Loss	E_{on}			240		μJ
Turn-Off Switching Loss	E_{off}			140		μJ
Internal gate resistance	R_G		$V_{GS} = 0\text{V}_{DC}$; $f = 1\text{MHz}$; $V_{AC} = 25\text{mV}$		7	
Gate to Source Charge	Q_{GS}	$T_j = 25^\circ\text{C}$; $V_{DD} = 800\text{V}$; $I_D = 20\text{A}$; $V_{GS} = -4/20\text{V}$		22		nC
Gate to Drain Charge	Q_{GD}			41		nC
Total Gate Charge	Q_G			107		nC
Body Diode forward voltage	V_F	$T_j = 25^\circ\text{C}$; $I_F = 20\text{A}$; $V_{GS} = -5\text{V}$		3.7		V
		$T_j = 210^\circ\text{C}$; $I_F = 20\text{A}$; $V_{GS} = -5\text{V}$		3.2		V
Total Body Diode Capacitive Charge	Q_C	$I_{SD} = 30\text{A}$, $V_{DS} = 600\text{V}$, $T_j = 25^\circ\text{C}$, $di/dt = 3\text{kA}/\mu\text{s}$, $V_{GS} = -5\text{V}$		61		nC
Body Diode Reverse recovery time		$T_j = 25^\circ\text{C}$; $V_{DS} = 300\text{V}$; $V_{GS} = -5\text{V}$;		220		ns
Body Diode Peak reverse recovery current		$I_F = 20\text{A}$; $di/dt = 100\text{A}/\mu\text{s}$		2.3		A

Electrical characteristics Schottky Diode

Unless otherwise stated, $T_j = 25^\circ\text{C}$. **Bold** figures point out values valid over the whole temperature range ($T_j = -55^\circ\text{C}$ to $+210^\circ\text{C}$).

Parameter	Symbol	Condition	Min	Typ	Max	Unit
DC Blocking Voltage	V_{DC}		1200			V
Forward Voltage	V_F	$T_j = 25^\circ\text{C}$; $I_F = 20\text{A}$		1.5		V
		$T_j = 210^\circ\text{C}$; $I_F = 20\text{A}$		2.7		V
Reverse Current	I_R	$T_j = 25^\circ\text{C}$; $V_R = 1200\text{A}$		20		μA
		$T_j = 210^\circ\text{C}$; $V_R = 1200\text{A}$		500		μA
Total Capacitive Charge	Q_C	$I = 20\text{A}$, $V_R = 600\text{V}$, $T_j = 25^\circ\text{C}$, $di/dt = 500\text{A}/\mu\text{s}$		61		nC
Total Capacitance	C	$T_j = 25^\circ\text{C}$; $V_R = 0\text{V}$; $f = 1\text{MHz}$		TBD		pF
		$T_j = 25^\circ\text{C}$; $V_R = 200\text{V}$; $f = 1\text{MHz}$		TBD		pF
		$T_j = 25^\circ\text{C}$; $V_R = 400\text{V}$; $f = 1\text{MHz}$		TBD		pF

Thermal Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Junction-to-Case Thermal resistance MOSFET	$R_{\theta JC}$			1.1		$^\circ\text{C}/\text{W}$
Junction-to-Case Thermal resistance DIODE	$R_{\theta JC}$			1.1		$^\circ\text{C}/\text{W}$

Typical performances (MOSFET)

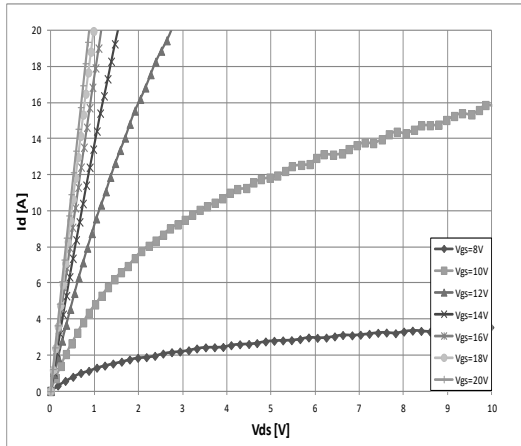


Figure 1: Drain current vs V_{DS} ($T_j= 25^\circ\text{C}$)

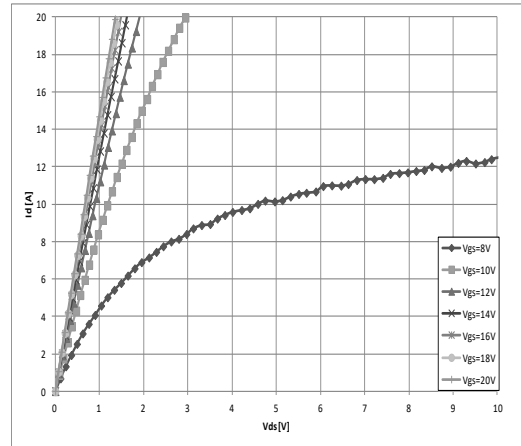


Figure 2: Drain current vs V_{DS} ($T_j= 125^\circ\text{C}$)

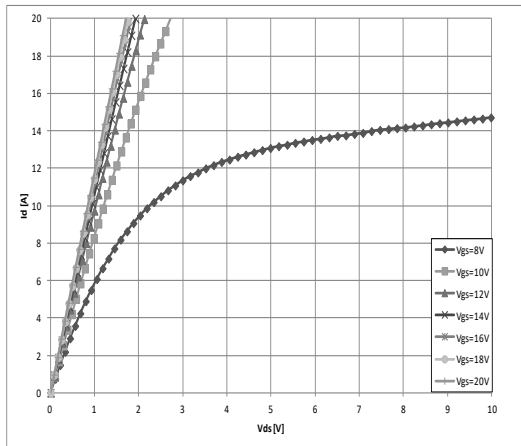


Figure 3: Drain current vs V_{DS} ($T_j= 175^\circ\text{C}$)

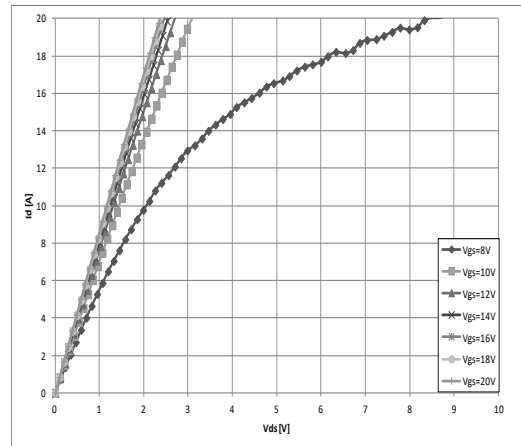


Figure 4: Drain current vs V_{DS} ($T_j= 210^\circ\text{C}$)

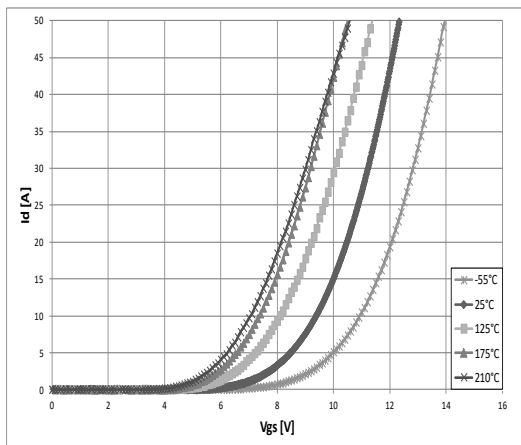


Figure 5: Drain current vs V_{GS} voltage

Typical performances (cnt'd)

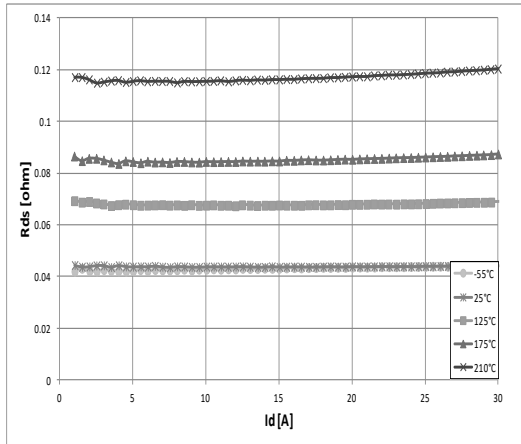


Figure 6: On-state drain source resistance vs. Drain current ($V_{GS} = 20V$)

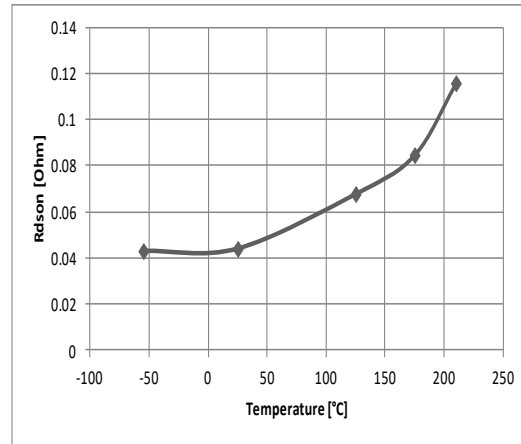


Figure 7: On-state drain source resistance vs. Temperature ($V_{GS} = 20V$; $I_{DS} = 10A$)

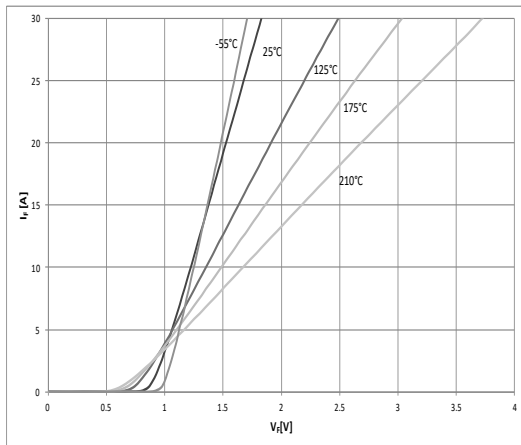


Figure 8: Diode I_{DS} vs V_{DS} (3rd quadrant; $V_{GS} = -5V$)

Typical performances (Diode)

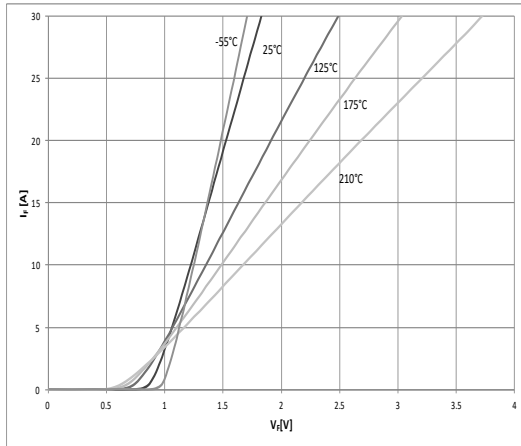


Figure 9: Diode I_F vs V_F

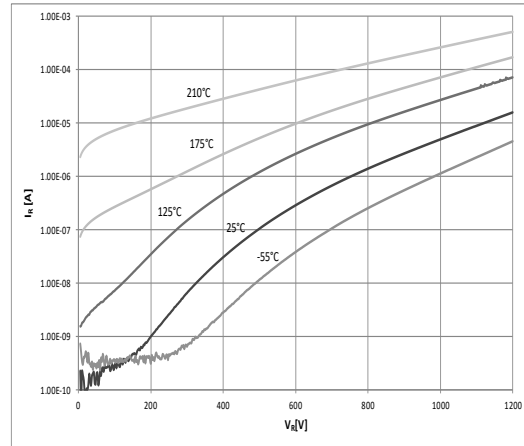
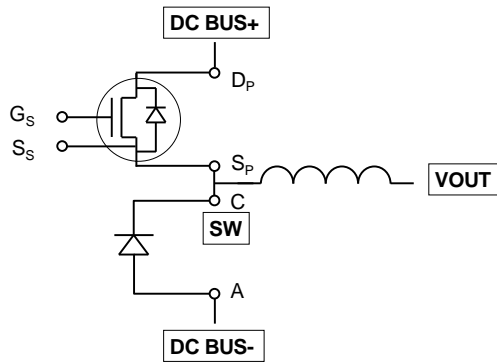


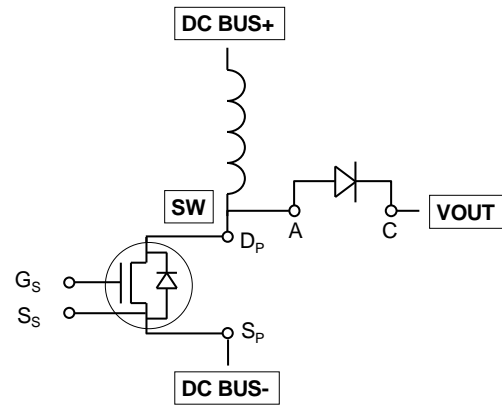
Figure 10: Diode I_R vs V_R

Typical applications

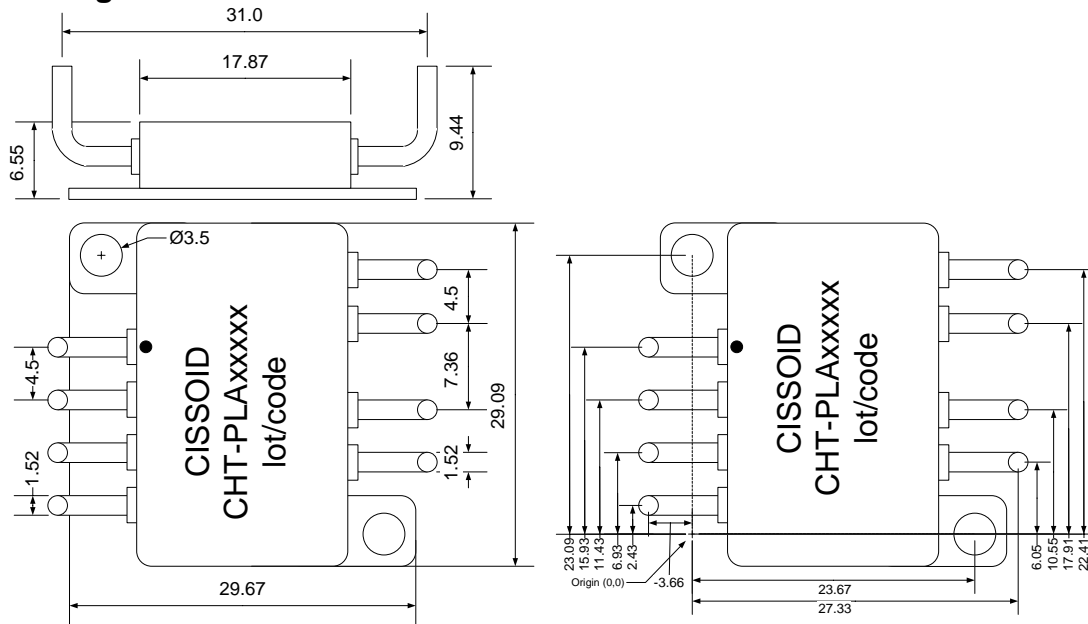
Buck Converter Application



Boost Converter Application



Package Dimensions



HM8A dimensions in mm (+/- 10%)

Ordering Information

Product Name	Ordering Reference	Package	Marking
CHT-PLUTO-C1220	CHT-PLA3777A-HM8A-T	HM8A	CHT-PLA3777A

Related products

Product Name	Function	Ordering Reference
CHT-PLUTO-B1230	Dual 1200V/30A SiC MOSFET Module	CHT-PLA2316A-HM8A-T
CHT-PLUTO-B1220	Dual 1200V/20A SiC MOSFET Module	CHT-PLA8294A-HM8A-T
CHT-PLUTO-C1230	1200V/30A SiC Async Buck or Boost Power Module	CHT-PLA2228A-HM8A-T

Contact & Ordering

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