



GS120/175T48 Family

120W/175W DC-DC CONVERTERS FAMILY

Type	V_i	V_o	I_o
GS120T48-3.3 GS120T48-3.3E	38 to 60 V	3,35 V	35 A
GS175T48-5 GS175T48-5E	38 to 60 V	5,075 V	35 A
GS175T48-12 GS175T48-12E	38 to 60 V	12,0 V	15 A
GS175T48-15 GS175T48-15E	38 to 60 V	15,0 V	12 A

FEATURES

- UL, CSA, TUV approved
- High output power (up to 175W)
- High efficiency (82% typ. on GS175T48-5 module)
- Parallel operation with equal current sharing
- Synchronization pin
- Remote ON/OFF
- Remote load voltage sense compensation
- Output short-circuit protection
- Undervoltage lock-out
- Minimal overshoot during load transients
- Output overvoltage protection
- 500V_{DC} input to output isolation voltage
- Internal input and output filtering
- Softstart
- PCB or chassis mountable
- Optional additional finned heatsink
- Mechanical dimensions 125 • 66,5 • 19 (4,92 • 2,62 • 0,75)



DESCRIPTION

The GS120/175T48 family includes 120/175W DC-DC converters used to generate fixed isolated output voltages with an output current up to 35A from a wide range input voltage (38 to 60V). The suffix E identifies the metric threading on the planar heatsink (see fig. 1).

OPTION

Type Ordering Number	Description	Thermal Resistance	Dimensions L • W • H mm (inches)
HS01	Additional finned heatsink (See fig. 7)	2.8°C/W	125 • 66.5 • 15 (4.92 • 2.62 • 0.59)

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GS120T48-3.3 ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V _i	Input Voltage	V _O = 3.35V I _O = 0 to 35A (Operating Conditions)	38	48	60	VDC
V _{IUV}	Input Undervoltage Lockout	V _O = 3.35V I _O = 0 to 35A	32	34	36	VDC
I _i	Average Input Current	V _i = 0 to 60V I _O = 35A			4.2	A
I _{ipk}	Inrush Transient Peak Current	V _i = 60V I _O = 35A			0.2	A ² s
I _{ir}	Reflected Input Current	V _i = 38 to 60V BW = 5Hz to 20MHz I _O = 35A (See fig. 2)			20	mApp
V _{ien}	Enable Input Voltage	V _i = 38 to 60V I _O = 0 to 35A	0		1.2	V
I _{ien}	Enable Input Current	V _i = 38 to 60V I _O = 0 to 35A V _{ien} = 0V			-1	mA
V _{iinh}	Inhibit Voltage	V _i = 38 to 60V I _O = 0 to 35A V _{ien} = open	8		18	V
P _i	Input Power	V _i = 38 to 60V I _O = 0A (No Load)		1.5	2	W
V _O	Total Output Voltage Regulation	V _i = 38 to 60V I _O = 0 to 35A	3.25	3.35	3.45	V
V _{ost}	Short-term Output Voltage Regulation	V _i = 38 to 60V I _O = 0 to 35A	3.30	3.35	3.40	V
V _{ots}	Total Static Tolerance	V _i = 38 to 60V I _O = 0 to 35A	3.28	3.35	3.42	V
V _{ol}	Output Overvoltage Limit Initiation	V _i = 38 to 60V I _O = 0 to 35A	4	4.5	5.2	VDC
V _{or}	Output Ripple Voltage	V _i = 38 to 60V I _O = 35A		20	30	mVpp
V _{on}	Output Noise Voltage	V _i = 38 to 60V I _O = 35A		50	80	mVpp
ΔV _O	Total Remote Sense Compensation	V _i = 38 to 60V			0.6	V
δV _O	Peak Load Transient Response	V _i = 48V δI _O = 5A slope = 0.1A/μs			60	mVp
I _O	Output Current	V _i = 38 to 60V V _O = 3.35V	0		35	A
I _{ol}	Overcurrent Limit Initiation	V _i = 48V	36		39	A
I _{osc}	Shortcircuit Output Current	V _i = 48V V _O = 0.2 to 0.5V			51	A
t _s	Load Transient Settling Time	V _i = 48V δI _O = 5A slope = 0.1A/μs			200	μs
t _{on}	Turn-on Time	V _i = 48V I _O = 35A V _{ien} = from high to low			5	ms
		V _i = 0 to 60V I _O = 35A V _{ien} = low	3		10	
V _{is}	Isolation Voltage		500			V
f _s	Switching Frequency	V _i = 38 to 60V I _O = 0 to 35A	160	175	200	kHz
η	Efficiency	V _i = 38 to 60V I _O = 35A	76	77		%
R _{th}	Thermal Resistance	Case to Ambient		5.2		°C/W
T _{cop}	Operating Case Temperature Range		-10		+85	°C
T _{stg}	Storage Temperature Range		-40		+105	°C

GS175T48-5 ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_i	Input Voltage	$V_O = 5.075\text{V}$ $I_O = 0$ to 35A (Operating Conditions)	38	48	60	VDC
V_{iuv}	Input Undervoltage Lockout	$V_O = 5.075\text{V}$ $I_O = 0$ to 35A	32	34	36	VDC
I_i	Average Input Current	$V_i = 0$ to 60V $I_O = 35\text{A}$			6.1	A
I_{ipk}	Inrush Transient Peak Current	$V_i = 60\text{V}$ $I_O = 35\text{A}$			0.2	A^2s
I_{ir}	Reflected Input Current	$V_i = 38$ to 60V BW = 5Hz to 20MHz $I_O = 35\text{A}$ (See fig. 2)			30	mApp
V_{ien}	Enable Input Voltage	$V_i = 38$ to 60V $I_O = 0$ to 35A	0		1.2	V
I_{ien}	Enable Input Current	$V_i = 38$ to 60V $I_O = 0$ to 35A $V_{ien} = 0\text{V}$			-1	mA
V_{inh}	Inhibit Voltage	$V_i = 38$ to 60V $I_O = 0$ to 35A $V_{ien} = \text{open}$	8		18	V
P_i	Input Power	$V_i = 38$ to 60V $I_O = 0\text{A}$ (No Load)		1.5	2	W
V_O	Total Output Voltage Regulation	$V_i = 38$ to 60V $I_O = 0$ to 35A	4.94	5.075	5.21	V
V_{ost}	Short-term Output Voltage Regulation	$V_i = 38$ to 60V $I_O = 0$ to 35A	5.002	5.075	5.148	V
V_{ots}	Total Static Tolerance	$V_i = 38$ to 60V $I_O = 0$ to 35A	4.97	5.075	5.18	V
V_{ol}	Output Overvoltage Limit Initiation	$V_i = 38$ to 60V $I_O = 0$ to 35A	6	6.3	7	VDC
V_{or}	Output Ripple Voltage	$V_i = 38$ to 60V $I_O = 35\text{A}$		20	30	mVpp
V_{on}	Output Noise Voltage	$V_i = 38$ to 60V $I_O = 35\text{A}$		50	80	mVpp
ΔV_O	Total Remote Sense Compensation	$V_i = 38$ to 60V			0.6	V
δV_O	Peak Load Transient Response	$V_i = 48\text{V}$ $\delta I_O = 5\text{A}$ slope = $0.1\text{A}/\mu\text{s}$			100	mVp
I_O	Output Current	$V_i = 38$ to 60V $V_O = 5.075\text{V}$	0		35	A
I_{ol}	Overcurrent Limit Initiation	$V_i = 48\text{V}$	36		39	A
I_{osc}	Shortcircuit Output Current	$V_i = 48\text{V}$ $V_O = 0.2$ to 0.5V			51	A
t_s	Load Transient Settling Time	$V_i = 48\text{V}$ $\delta I_O = 5\text{A}$ slope = $0.1\text{A}/\mu\text{s}$			250	μs
t_{on}	Turn-on Time	$V_i = 48\text{V}$ $I_O = 35\text{A}$ $V_{ien} = \text{from high to low}$			5	ms
		$V_i = 0$ to 60V $I_O = 35\text{A}$ $V_{ien} = \text{low}$	3		10	
V_{is}	Isolation Voltage		500			V
f_s	Switching Frequency	$V_i = 38$ to 60V $I_O = 0$ to 35A	160	175	200	kHz
η	Efficiency	$V_i = 38$ to 60V $I_O = 35\text{A}$	81	82		%
R_{th}	Thermal Resistance	Case to Ambient		5.2		$^{\circ}\text{C}/\text{W}$
T_{cop}	Operating Case Temperature Range		-10		+85	$^{\circ}\text{C}$
T_{stg}	Storage Temperature Range		-40		+105	$^{\circ}\text{C}$

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GS175T48-12 ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_i	Input Voltage	$V_o = 12\text{V}$ $I_o = 0$ to 15A (Operating Conditions)	38	48	60	VDC
V_{iuv}	Input Undervoltage Lockout	$V_o = 12\text{V}$ $I_o = 0$ to 15A	32	34	36	VDC
I_i	Average Input Current	$V_i = 0$ to 60V $I_o = 15\text{A}$			5.5	A
I_{ipk}	Inrush Transient Peak Current	$V_i = 60\text{V}$ $I_o = 15\text{A}$			0.2	A^2s
I_{ir}	Reflected Input Current	$V_i = 38$ to 60V BW = 5Hz to 20MHz $I_o = 15\text{A}$ (See fig. 2)			20	mApp
V_{ien}	Enable Input Voltage	$V_i = 38$ to 60V $I_o = 0$ to 15A	0		1.2	V
I_{ien}	Enable Input Current	$V_i = 38$ to 60V $I_o = 0$ to 15A $V_{ien} = 0\text{V}$			-1	mA
V_{inh}	Inhibit Voltage	$V_i = 38$ to 60V $I_o = 0$ to 15A $V_{ien} = \text{open}$	8		18	V
P_i	Input Power	$V_i = 38$ to 60V $I_o = 0\text{A}$ (No Load)		1.5	2	W
V_o	Total Output Voltage Regulation	$V_i = 38$ to 60V $I_o = 0$ to 15A	11.4	12.0	12.6	V
V_{ost}	Short-term Output Voltage Regulation	$V_i = 38$ to 60V $I_o = 0$ to 15A	11.76	12.0	12.24	V
V_{ots}	Total Static Tolerance	$V_i = 38$ to 60V $I_o = 0$ to 15A	11.64	12.0	12.36	V
V_{ol}	Output Overvoltage Limit Initiation	$V_i = 38$ to 60V $I_o = 0$ to 15A	13.2	14	15	VDC
V_{or}	Output Ripple Voltage	$V_i = 38$ to 60V $I_o = 15\text{A}$		35	70	mVpp
V_{on}	Output Noise Voltage	$V_i = 38$ to 60V $I_o = 15\text{A}$		60	120	mVpp
ΔV_o	Total Remote Sense Compensation	$V_i = 38$ to 60V			0.6	V
δV_o	Peak Load Transient Response	$V_i = 48\text{V}$ $\delta I_o = 3\text{A}$ slope = $0.2\text{A}/\mu\text{s}$			200	mVp
I_o	Output Current	$V_i = 38$ to 60V $V_o = 12\text{V}$	0		15	A
I_{ol}	Overcurrent Limit Initiation	$V_i = 48\text{V}$	16		19	A
I_{osc}	Shortcircuit Output Current	$V_i = 48\text{V}$			25	A
t_s	Load Transient Setting Time	$V_i = 48\text{V}$ $\delta I_o = 3\text{A}$ slope = $0.2\text{A}/\mu\text{s}$			300	μs
t_{on}	Turn-on Time	$V_i = 48\text{V}$ $I_o = 15\text{A}$ $V_{ien} = \text{from high to low}$			5	ms
		$V_i = 0$ to 60V $I_o = 15\text{A}$ $V_{ien} = \text{low}$	3		10	
V_{is}	Isolation Voltage		500			V
f_s	Switching Frequency	$V_i = 38$ to 60V $I_o = 0$ to 15A	160	175	200	kHz
η	Efficiency	$V_i = 38$ to 60V $I_o = 15\text{A}$	84	86		%
R_{th}	Thermal Resistance	Case to Ambient		5.2		$^{\circ}\text{C}/\text{W}$
T_{cop}	Operating Case Temperature Range		-10		+85	$^{\circ}\text{C}$
T_{stg}	Storage Temperature Range		-40		+105	$^{\circ}\text{C}$

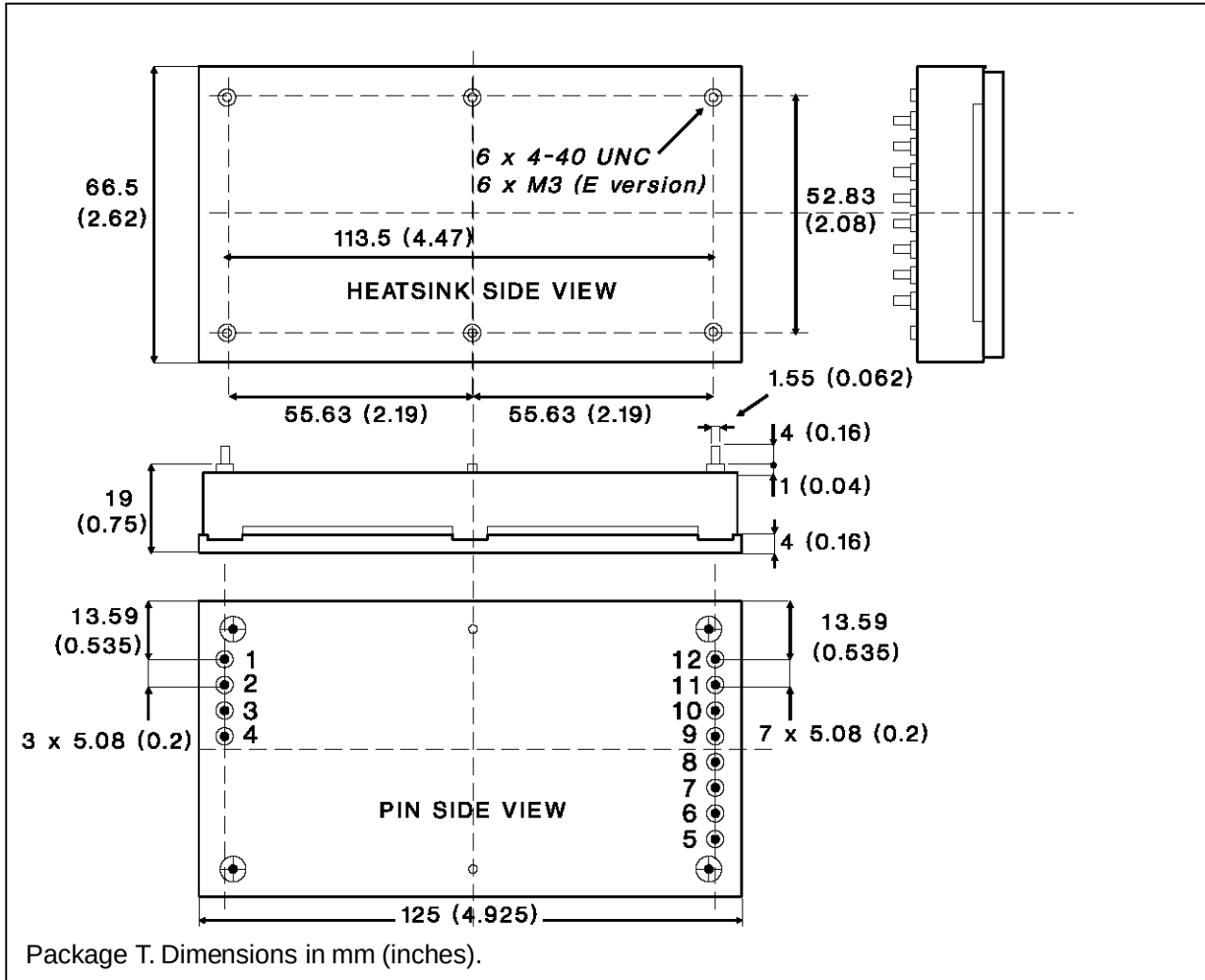
GS175T48-15 ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_i	Input Voltage	$V_o = 15\text{V}$ $I_o = 0$ to 12A (Operating Conditions)	38	48	60	VDC
V_{iuv}	Input Undervoltage Lockout	$V_o = 15\text{V}$ $I_o = 0$ to 12A	32	34	36	VDC
I_i	Average Input Current	$V_i = 0$ to 60V $I_o = 12\text{A}$			5.5	A
I_{ipk}	Inrush Transient Peak Current	$V_i = 60\text{V}$ $I_o = 12\text{A}$			0.2	A^2s
I_{ir}	Reflected Input Current	$V_i = 38$ to 60V $I_o = 12\text{A}$			20	mApp
V_{ien}	Enable Input Voltage	$V_i = 38$ to 60V $I_o = 0$ to 12A	0		1.2	V
I_{ien}	Enable Input Current	$V_i = 38$ to 60V $I_o = 0$ to 12A $V_{ien} = 0\text{V}$			-1	mA
V_{inh}	Inhibit Voltage	$V_i = 38$ to 60V $I_o = 0$ to 12A $V_{ien} = \text{open}$	8		18	V
P_i	Input Power	$V_i = 38$ to 60V $I_o = 0\text{A}$ (No Load)		1.5	2	W
V_o	Total Output Voltage Regulation	$V_i = 38$ to 60V $I_o = 0$ to 12A	14.25	15.0	15.75	V
V_{ost}	Short-term Output Voltage Regulation	$V_i = 38$ to 60V $I_o = 0$ to 12A	14.7	15.0	15.3	V
V_{ots}	Total Static Tolerance	$V_i = 38$ to 60V $I_o = 0$ to 12A	14.55	15.0	15.45	V
V_{ol}	Output Overvoltage Limit Initiation	$V_i = 38$ to 60V $I_o = 0$ to 12A	16.5	17	18	VDC
V_{or}	Output Ripple Voltage	$V_i = 38$ to 60V $I_o = 12\text{A}$		45	90	mVpp
V_{on}	Output Noise Voltage	$V_i = 38$ to 60V $I_o = 12\text{A}$		75	150	mVpp
ΔV_o	Total Remote Sense Compensation	$V_i = 38$ to 60V			0.6	V
δV_o	Peak Load Transient Response	$V_i = 48\text{V}$ $\delta I_o = 3\text{A}$ slope = $0.2\text{A}/\mu\text{s}$			200	mVp
I_o	Output Current	$V_i = 38$ to 60V $V_o = 15\text{V}$	0		12	A
I_{ol}	Overcurrent Limit Initiation	$V_i = 48\text{V}$	13		16	A
I_{osc}	Shortcircuit Output Current	$V_i = 48\text{V}$ $V_o = 0.2$ to 0.5V			21	A
t_s	Load Transient Settling Time	$V_i = 48\text{V}$ $\delta I_o = 3\text{A}$ slope = $0.2\text{A}/\mu\text{s}$			300	μs
t_{on}	Turn-on Time	$V_i = 48\text{V}$ $I_o = 12\text{A}$ $V_{ien} = \text{from high to low}$			5	ms
		$V_i = 0$ to 60V $I_o = 12\text{A}$ $V_{ien} = \text{low}$	3		10	
V_{is}	Isolation Voltage		500			V
f_s	Switching Frequency	$V_i = 38$ to 60V $I_o = 0$ to 12A	160	175	200	kHz
η	Efficiency	$V_i = 38$ to 60V $I_o = 12\text{A}$	86	88		%
R_{th}	Thermal Resistance	Case to Ambient		5.2		$^{\circ}\text{C}/\text{W}$
T_{cop}	Operating Case Temperature Range		-10		+85	$^{\circ}\text{C}$
T_{stg}	Storage Temperature Range		-40		+105	$^{\circ}\text{C}$

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CONNECTION DIAGRAM AND MECHANICAL DATA

Figure 1.

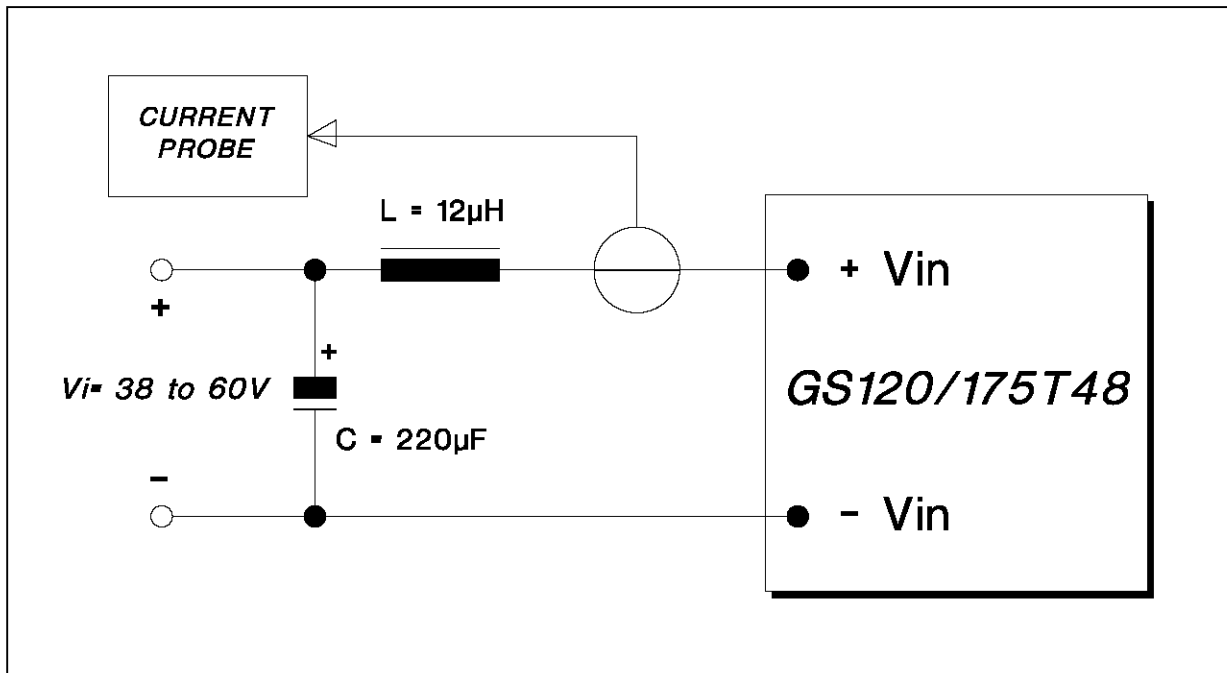


PIN DESCRIPTION

Pin	Function	Description
1	- IN	Negative input voltage.
2	+ IN	Positive input voltage. Unregulated input voltage (typically 48V) must be applied between pin 1-2.
3	ON/OFF	The converter is ON (Enable) when the voltage applied to this pin with reference to pin 1 is lower than 1.2V (see V _{ien}). The converter is OFF (Inhibit) for a control voltage in the range of 8 to 18V. When the pin is unconnected the converter is OFF (Inhibit).
4	CASE	Case connection pin.
5	SYNC	Synchronization pin. See figures 3, 4, 5, 6. Open when not used.
6	PARALLEL	Parallel output. See figures 3, 4, 5, 6. Open when not used.
7	+ SENSE	Senses the remote load high side. To be connected to pin 11,12 when remote sense is not used.
8	- SENSE	Senses the remote load return. To be connected to pin 9,10 when remote sense is not used. In parallel configuration, take care to connect all -S pins together (see figures 3,4,5,6).
9,10	- OUT	Fixed output voltage return.
11,12	+ OUT	Fixed output voltage.

USER NOTES**Reflected Input Current**

The reflected input current measurement (Iir, see Electrical Characteristics) is performed according to the test set-up of fig. 2.

Figure 2.**Softstart**

To avoid heavy inrush current the output voltage rise time is 10ms maximum in any condition of load.

Remote Sensing

The remote voltage sense compensation range is for a total drop of 0.6V equally shared between the load connecting wires.

It is a good practice to shield the sensing wires to avoid oscillations.

See the connection diagram on figures 3, 4, 5, 6.

Remote ON/OFF

The module is controlled by the voltage applied between the ON/OFF pin and -IN pin.

The converter is ON (Enable) when the voltage applied is lower than 1.2 V (see V_{ien} on Electrical Characteristics).

The converter is OFF (Inhibit) for a control voltage in the range of 8 to 18V (see V_{iinh}).

When the pin is unconnected the converter is OFF. Maximum sinking current is 1mA.

Module Protection

The module is protected against occasional and permanent shortcircuits of the output pins to ground, as well as against output current overload. It uses a current limiting protection circuitry, avoiding latch-up problems with certain type of loads.

A crowbar output overvoltage protection is activated when the output voltage exceeds the specified values (see Electrical Characteristics).

Parallel Operation

To increase available output regulated power, the module features the parallel connection possibility with equal current sharing and maximum deviation of 10% (two modules in parallel).

See the connection diagram on figures 3, 4, 5, 6.

Figure 3.

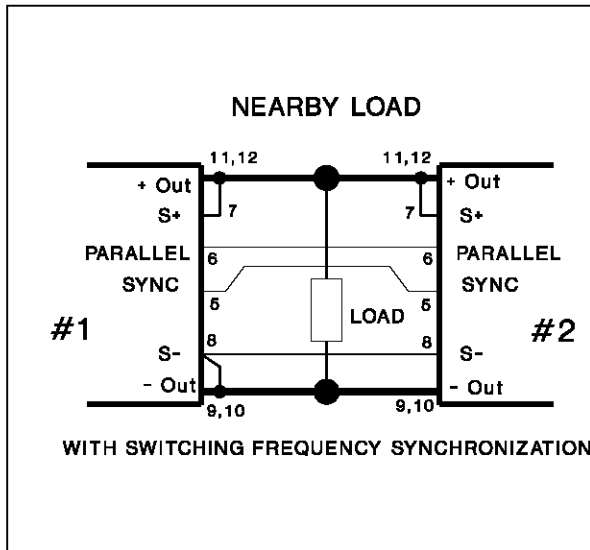


Figure 4.

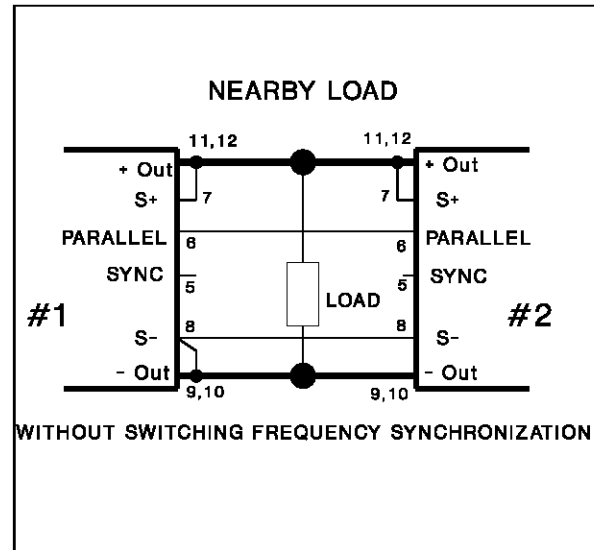


Figure 5.

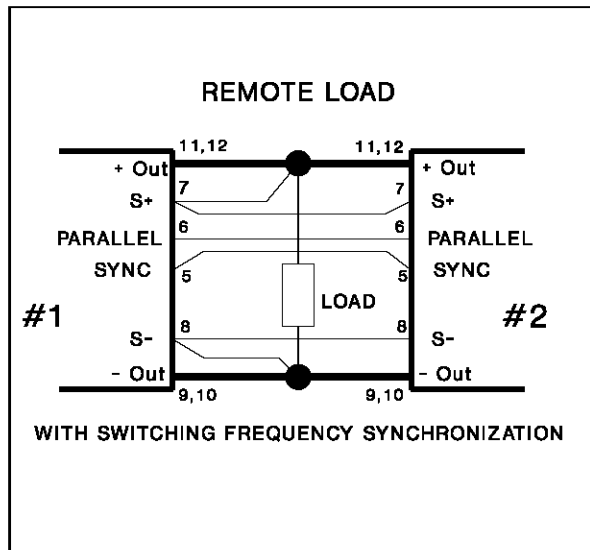
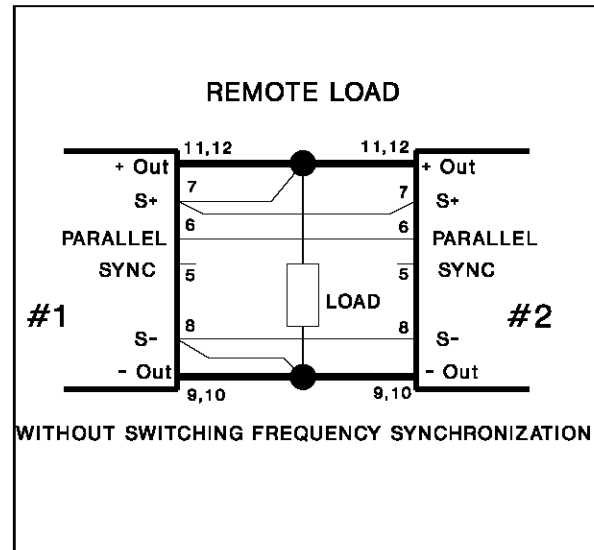


Figure 6.

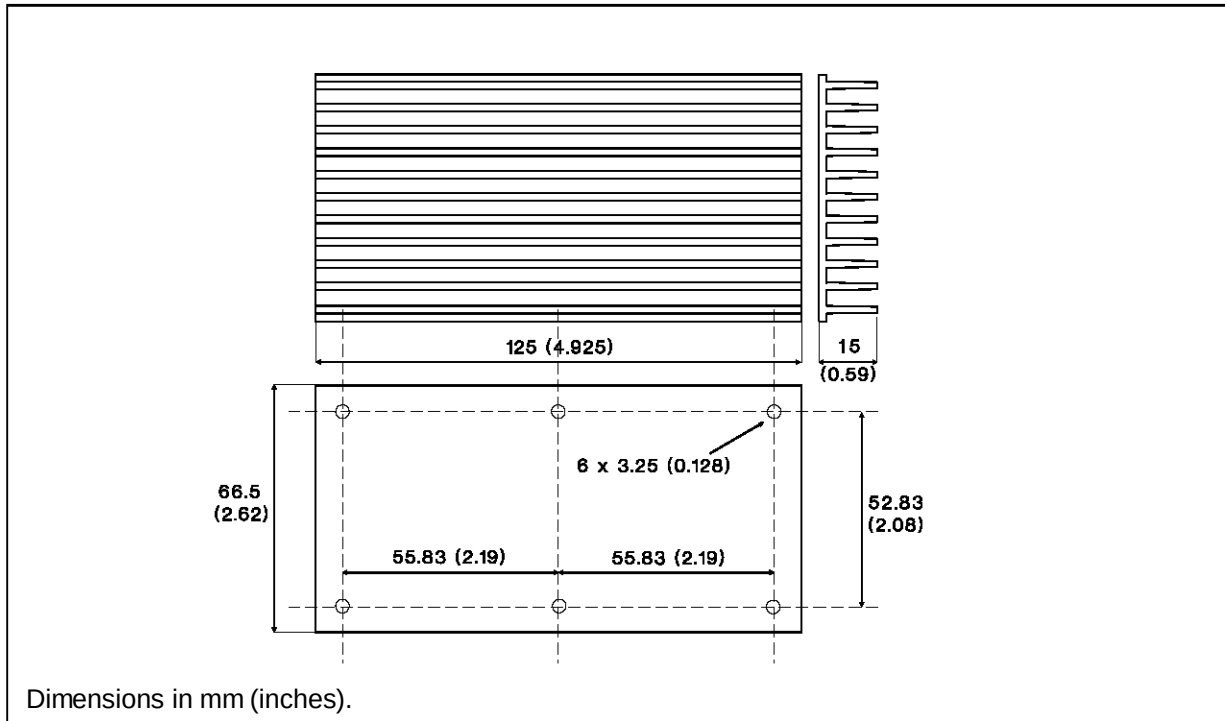


Finned heatsink option

An additional finned heatsink is available (type or ordering number HS01) to allow the user to decrease the total thermal resistance of the module to a

typical value of 2.8 °C/W. The heatsink is suitable both for standard (4-40 UNC threading) and E version (M3 threading); screw length in the range of 6 to 8 mm (0.24 to 0.32"). See fig. 7.

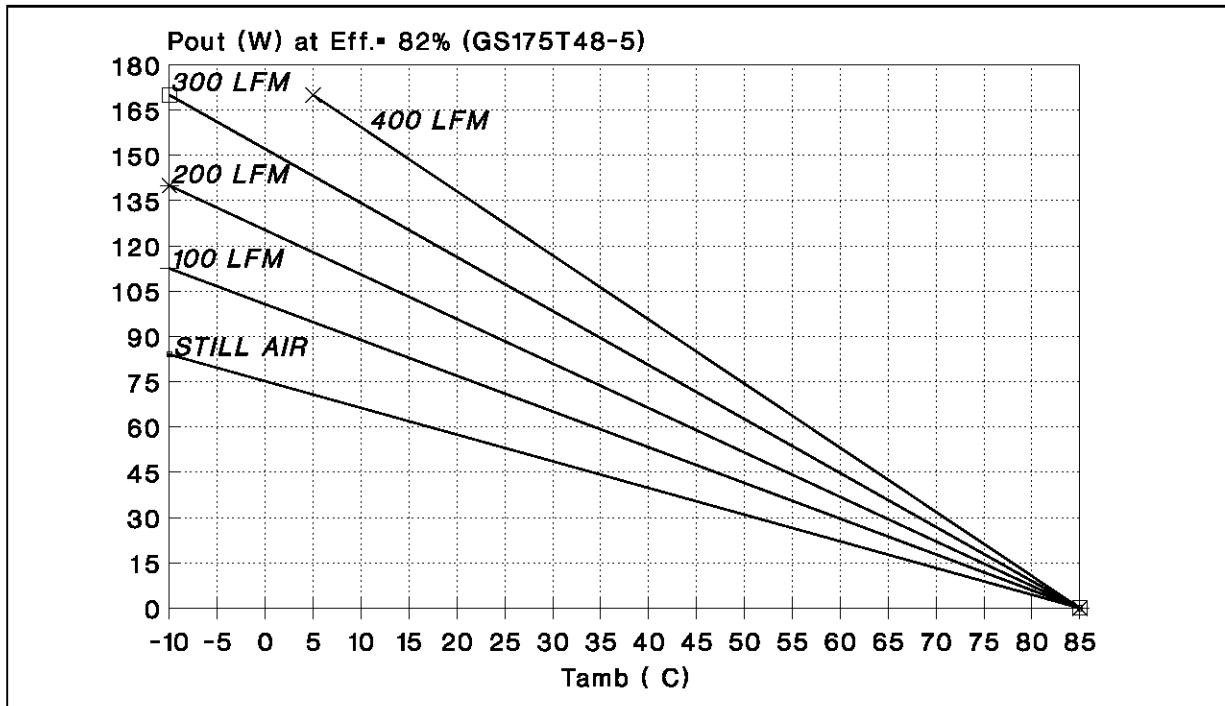
Figure 7. - HS01 Heatsink.

**Thermal Characteristics**

Following figures show the behaviour at still air and forced ventilation operation of the GS175T48-5 module (typical efficiency 82%) without

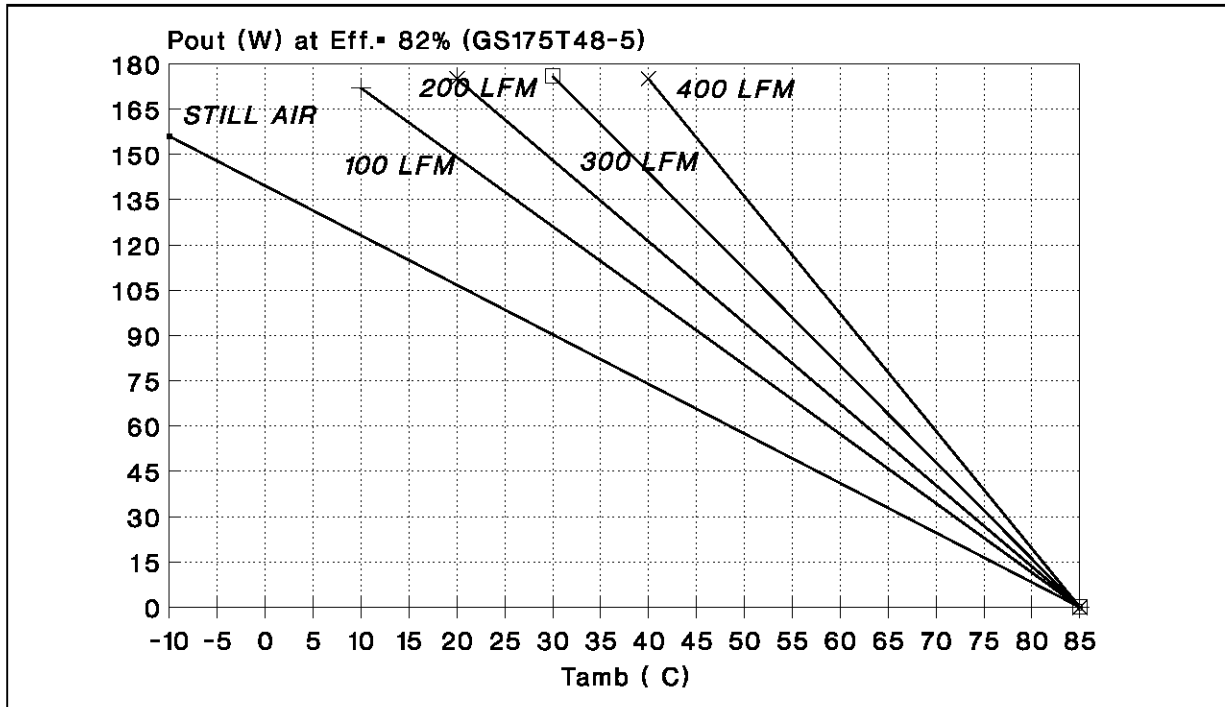
(fig. 8) and with the additional finned HS01 heatsink (fig. 9)

Figure 8. - GS175T48-5 with stadard flat heatsink.



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Figure 9. - GS175T48-5 with additional HS01 finned heatsink



Safety approvals

The converter is agency certified to the following safety requirements.

Agency	Requirements	License Number
UL	UL-STD-1950	E141284
CSA	CSA-STD-C22.2 No.234 (level 3)	LR 99794-2
TUV	EN 60950 DIN VDE 0805	R 9272137

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