

## 120W/175W DC-DC CONVERTERS FAMILY

Type	V <sub>i</sub>	V <sub>o</sub>	I <sub>o</sub>
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<sub>DC</sub> 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)

## GS120/175T48 FAMILY

### GS120T48-3.3 ELECTRICAL CHARACTERISTICS (T<sub>amb</sub> = 25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V <sub>i</sub>	Input Voltage	V <sub>o</sub> = 3.35V I <sub>o</sub> = 0 to 35A (Operating Conditions)	38	48	60	VDC
V <sub>iuv</sub>	Input Undervoltage Lockout	V <sub>o</sub> = 3.35V I <sub>o</sub> = 0 to 35A	32	34	36	VDC
I <sub>i</sub>	Average Input Current	V <sub>i</sub> = 0 to 60V I <sub>o</sub> = 35A			4.2	A
I <sub>ipk</sub>	Inrush Transient Peak Current	V <sub>i</sub> = 60V I <sub>o</sub> = 35A			0.2	A <sup>2</sup> s
I <sub>ir</sub>	Reflected Input Current	V <sub>i</sub> = 38 to 60V BW = 5Hz to 20MHz I <sub>o</sub> = 35A (See fig. 2)			20	mApp
V <sub>ien</sub>	Enable Input Voltage	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 0 to 35A	0		1.2	V
I <sub>ien</sub>	Enable Input Current	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 0 to 35A V <sub>ien</sub> = 0V			-1	mA
V <sub>iinh</sub>	Inhibit Voltage	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 0 to 35A V <sub>ien</sub> = open	8		18	V
P <sub>i</sub>	Input Power	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 0A (No Load)		1.5	2	W
V <sub>o</sub>	Total Output Voltage Regulation	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 0 to 35A	3.25	3.35	3.45	V
V <sub>ost</sub>	Short-term Output Voltage Regulation	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 0 to 35A	3.30	3.35	3.40	V
V <sub>ots</sub>	Total Static Tolerance	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 0 to 35A	3.28	3.35	3.42	V
V <sub>ol</sub>	Output Overvoltage Limit Initiation	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 0 to 35A	4	4.5	5.2	VDC
V <sub>or</sub>	Output Ripple Voltage	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 35A		20	30	mVpp
V <sub>on</sub>	Output Noise Voltage	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 35A		50	80	mVpp
ΔV <sub>o</sub>	Total Remote Sense Compensation	V <sub>i</sub> = 38 to 60V			0.6	V
δV <sub>o</sub>	Peak Load Transient Response	V <sub>i</sub> = 48V δI <sub>o</sub> = 5A slope = 0.1A/μs			60	mVp
I <sub>o</sub>	Output Current	V <sub>i</sub> = 38 to 60V V <sub>o</sub> = 3.35V	0		35	A
I <sub>ol</sub>	Overcurrent Limit Initiation	V <sub>i</sub> = 48V	36		39	A
I <sub>osc</sub>	Shortcircuit Output Current	V <sub>i</sub> = 48V V <sub>o</sub> = 0.2 to 0.5V			51	A
t <sub>s</sub>	Load Transient Settling Time	V <sub>i</sub> = 48V δI <sub>o</sub> = 5A slope = 0.1A/μs			200	μs
t <sub>on</sub>	Turn-on Time	V <sub>i</sub> = 48V I <sub>o</sub> = 35A V <sub>ien</sub> = from high to low			5	ms
		V <sub>i</sub> = 0 to 60V I <sub>o</sub> = 35A V <sub>ien</sub> = low	3		10	
V <sub>is</sub>	Isolation Voltage		500			V
f <sub>s</sub>	Switching Frequency	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 0 to 35A	160	175	200	kHz
η	Efficiency	V <sub>i</sub> = 38 to 60V I <sub>o</sub> = 35A	76	77		%
R <sub>th</sub>	Thermal Resistance	Case to Ambient		5.2		°C/W
T <sub>cop</sub>	Operating Case Temperature Range		-10		+85	°C
T <sub>stg</sub>	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 $35\text{A}$ (Operating Conditions)	38	48	60	VDC
$V_{iuv}$	Input Undervoltage Lockout	$V_o = 5.075\text{V}$ $I_o = 0$ to $35\text{A}$	32	34	36	VDC
$I_i$	Average Input Current	$V_i = 0$ to $60\text{V}$ $I_o = 35\text{A}$			6.1	A
$I_{ipk}$	Inrush Transient Peak Current	$V_i = 60\text{V}$ $I_o = 35\text{A}$			0.2	$\text{A}^2\text{s}$
$I_{ir}$	Reflected Input Current	$V_i = 38$ to $60\text{V}$ $\text{BW} = 5\text{Hz}$ to $20\text{MHz}$ $I_o = 35\text{A}$ (See fig. 2)			30	mApp
$V_{ien}$	Enable Input Voltage	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $35\text{A}$	0		1.2	V
$I_{ien}$	Enable Input Current	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $35\text{A}$ $V_{ien} = 0\text{V}$			-1	mA
$V_{iinh}$	Inhibit Voltage	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $35\text{A}$ $V_{ien} = \text{open}$	8		18	V
$P_i$	Input Power	$V_i = 38$ to $60\text{V}$ $I_o = 0\text{A}$ (No Load)		1.5	2	W
$V_o$	Total Output Voltage Regulation	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $35\text{A}$	4.94	5.075	5.21	V
$V_{ost}$	Short-term Output Voltage Regulation	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $35\text{A}$	5.002	5.075	5.148	V
$V_{ots}$	Total Static Tolerance	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $35\text{A}$	4.97	5.075	5.18	V
$V_{ol}$	Output Overvoltage Limit Initiation	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $35\text{A}$	6	6.3	7	VDC
$V_{or}$	Output Ripple Voltage	$V_i = 38$ to $60\text{V}$ $I_o = 35\text{A}$		20	30	mVpp
$V_{on}$	Output Noise Voltage	$V_i = 38$ to $60\text{V}$ $I_o = 35\text{A}$		50	80	mVpp
$\Delta V_o$	Total Remote Sense Compensation	$V_i = 38$ to $60\text{V}$			0.6	V
$\delta V_o$	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 $60\text{V}$ $V_o = 5.075\text{V}$	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 $0.5\text{V}$			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	$\mu\text{s}$
$t_{on}$	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 $60\text{V}$ $I_o = 35\text{A}$ $V_{ien} = \text{low}$	3		10	
$V_{is}$	Isolation Voltage		500			V
$f_s$	Switching Frequency	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $35\text{A}$	160	175	200	kHz
$\eta$	Efficiency	$V_i = 38$ to $60\text{V}$ $I_o = 35\text{A}$	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	$^{\circ}\text{C}$

## GS120/175T48 FAMILY

### GS175T48-12 ELECTRICAL CHARACTERISTICS (T<sub>amb</sub> = 25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V <sub>i</sub>	Input Voltage	V <sub>O</sub> = 12V I <sub>O</sub> = 0 to 15A (Operating Conditions)	38	48	60	VDC
V <sub>iuv</sub>	Input Undervoltage Lockout	V <sub>O</sub> = 12V I <sub>O</sub> = 0 to 15A	32	34	36	VDC
I <sub>i</sub>	Average Input Current	V <sub>i</sub> = 0 to 60V I <sub>O</sub> = 15A			5.5	A
I <sub>ipk</sub>	Inrush Transient Peak Current	V <sub>i</sub> = 60V I <sub>O</sub> = 15A			0.2	A <sup>2</sup> s
I <sub>ir</sub>	Reflected Input Current	V <sub>i</sub> = 38 to 60V BW = 5Hz to 20MHz I <sub>O</sub> = 15A (See fig. 2)			20	mApp
V <sub>ien</sub>	Enable Input Voltage	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 0 to 15A	0		1.2	V
I <sub>ien</sub>	Enable Input Current	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 0 to 15A V <sub>ien</sub> = 0V			-1	mA
V <sub>iinh</sub>	Inhibit Voltage	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 0 to 15A V <sub>ien</sub> = open	8		18	V
P <sub>i</sub>	Input Power	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 0A (No Load)		1.5	2	W
V <sub>O</sub>	Total Output Voltage Regulation	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 0 to 15A	11.4	12.0	12.6	V
V <sub>ost</sub>	Short-term Output Voltage Regulation	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 0 to 15A	11.76	12.0	12.24	V
V <sub>ots</sub>	Total Static Tolerance	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 0 to 15A	11.64	12.0	12.36	V
V <sub>ol</sub>	Output Overvoltage Limit Initiation	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 0 to 15A	13.2	14	15	VDC
V <sub>or</sub>	Output Ripple Voltage	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 15A		35	70	mVpp
V <sub>on</sub>	Output Noise Voltage	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 15A		60	120	mVpp
ΔV <sub>O</sub>	Total Remote Sense Compensation	V <sub>i</sub> = 38 to 60V			0.6	V
δV <sub>O</sub>	Peak Load Transient Response	V <sub>i</sub> = 48V δI <sub>O</sub> = 3A slope = 0.2A/μs			200	mVp
I <sub>O</sub>	Output Current	V <sub>i</sub> = 38 to 60V V <sub>O</sub> = 12V	0		15	A
I <sub>ol</sub>	Overcurrent Limit Initiation	V <sub>i</sub> = 48V	16		19	A
I <sub>osc</sub>	Shortcircuit Output Current	V <sub>i</sub> = 48V			25	A
t <sub>s</sub>	Load Transient Setting Time	V <sub>i</sub> = 48V δI <sub>O</sub> = 3A slope = 0.2A/μs			300	μs
t <sub>on</sub>	Turn-on Time	V <sub>i</sub> = 48V I <sub>O</sub> = 15A V <sub>ien</sub> = from high to low			5	ms
		V <sub>i</sub> = 0 to 60V I <sub>O</sub> = 15A V <sub>ien</sub> = low	3		10	
V <sub>is</sub>	Isolation Voltage		500			V
f <sub>s</sub>	Switching Frequency	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 0 to 15A	160	175	200	kHz
η	Efficiency	V <sub>i</sub> = 38 to 60V I <sub>O</sub> = 15A	84	86		%
R <sub>th</sub>	Thermal Resistance	Case to Ambient		5.2		°C/W
T <sub>cop</sub>	Operating Case Temperature Range		-10		+85	°C
T <sub>stg</sub>	Storage Temperature Range		-40		+105	°C

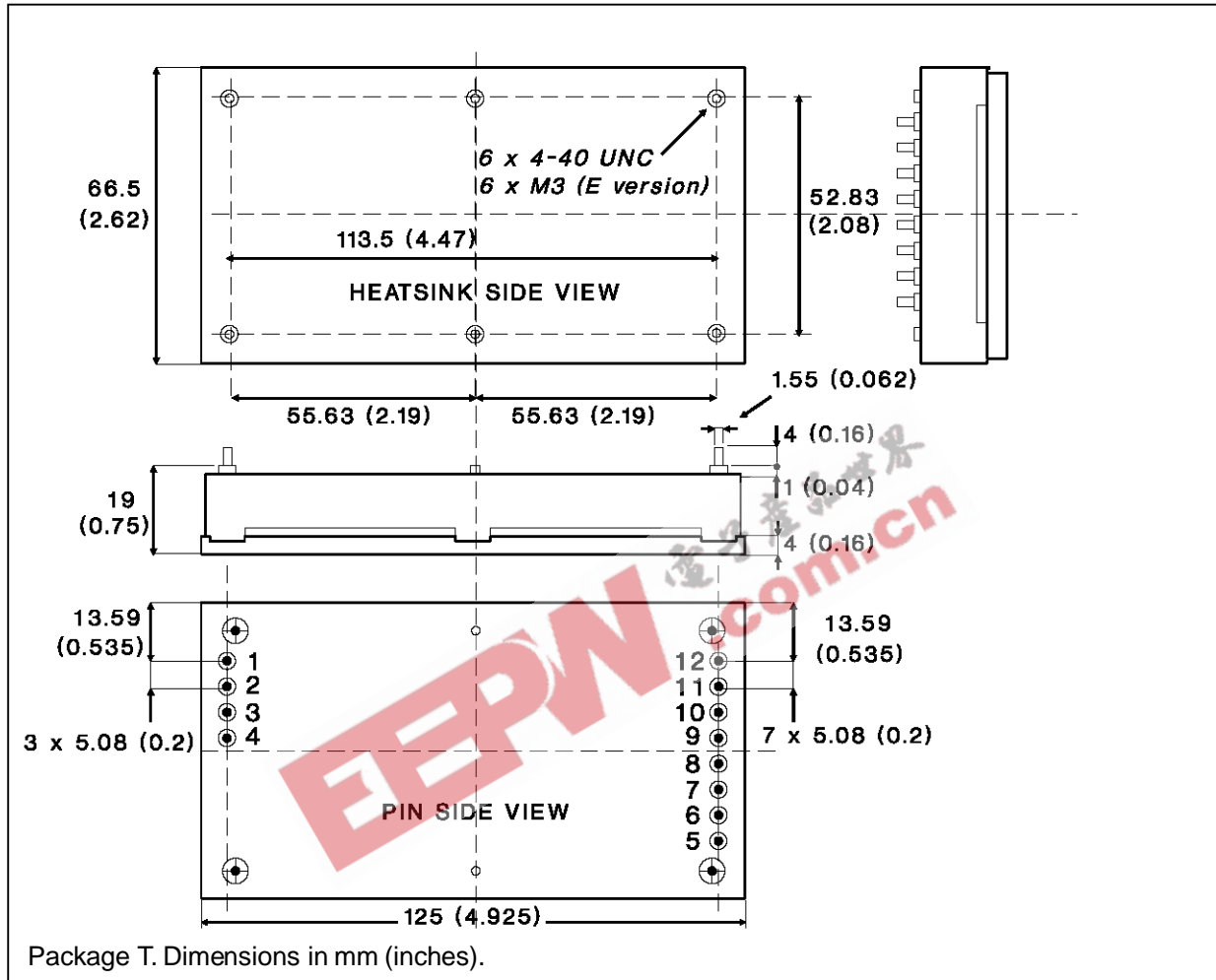
GS175T48-15 ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25^{\circ}\text{C}$  unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_i$	Input Voltage	$V_o = 15\text{V}$ $I_o = 0$ to $12\text{A}$ (Operating Conditions)	38	48	60	VDC
$V_{iuv}$	Input Undervoltage Lockout	$V_o = 15\text{V}$ $I_o = 0$ to $12\text{A}$	32	34	36	VDC
$I_i$	Average Input Current	$V_i = 0$ to $60\text{V}$ $I_o = 12\text{A}$			5.5	A
$I_{ipk}$	Inrush Transient Peak Current	$V_i = 60\text{V}$ $I_o = 12\text{A}$			0.2	$\text{A}^2\text{s}$
$I_{ir}$	Reflected Input Current	$V_i = 38$ to $60\text{V}$ $I_o = 12\text{A}$			20	mApp
$V_{ien}$	Enable Input Voltage	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $12\text{A}$	0		1.2	V
$I_{ien}$	Enable Input Current	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $12\text{A}$ $V_{ien} = 0\text{V}$			-1	mA
$V_{iinh}$	Inhibit Voltage	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $12\text{A}$ $V_{ien} = \text{open}$	8		18	V
$P_i$	Input Power	$V_i = 38$ to $60\text{V}$ $I_o = 0\text{A}$ (No Load)		1.5	2	W
$V_o$	Total Output Voltage Regulation	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $12\text{A}$	14.25	15.0	15.75	V
$V_{ost}$	Short-term Output Voltage Regulation	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $12\text{A}$	14.7	15.0	15.3	V
$V_{ots}$	Total Static Tolerance	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $12\text{A}$	14.55	15.0	15.45	V
$V_{ol}$	Output Overvoltage Limit Initiation	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $12\text{A}$	16.5	17	18	VDC
$V_{or}$	Output Ripple Voltage	$V_i = 38$ to $60\text{V}$ $I_o = 12\text{A}$		45	90	mVpp
$V_{on}$	Output Noise Voltage	$V_i = 38$ to $60\text{V}$ $I_o = 12\text{A}$		75	150	mVpp
$\Delta V_o$	Total Remote Sense Compensation	$V_i = 38$ to $60\text{V}$			0.6	V
$\delta V_o$	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 $60\text{V}$ $V_o = 15\text{V}$	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 $0.5\text{V}$			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	$\mu\text{s}$
$t_{on}$	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 $60\text{V}$ $I_o = 12\text{A}$ $V_{ien} = \text{low}$	3		10	
$V_{is}$	Isolation Voltage		500			V
$f_s$	Switching Frequency	$V_i = 38$ to $60\text{V}$ $I_o = 0$ to $12\text{A}$	160	175	200	kHz
$\eta$	Efficiency	$V_i = 38$ to $60\text{V}$ $I_o = 12\text{A}$	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	$^{\circ}\text{C}$

## GS120/175T48 FAMILY

### CONNECTION DIAGRAM AND MECHANICAL DATA

Figure 1.

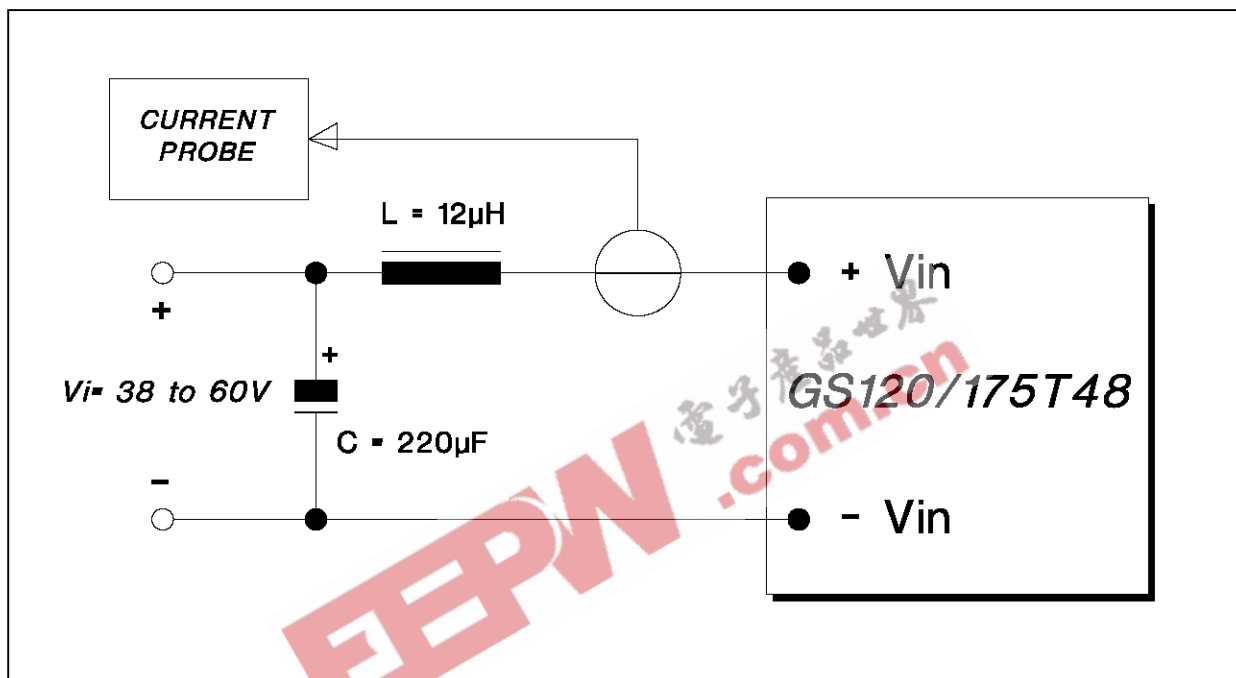


### PIN DESCRIPTION

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 $V_{in}$ ). 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 ( $I_{ir}$ , 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<sub>ien</sub> on Electrical Characteristics).

The converter is OFF (Inhibit) for a control voltage in the range of 8 to 18V (see V<sub>iinh</sub>).

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.

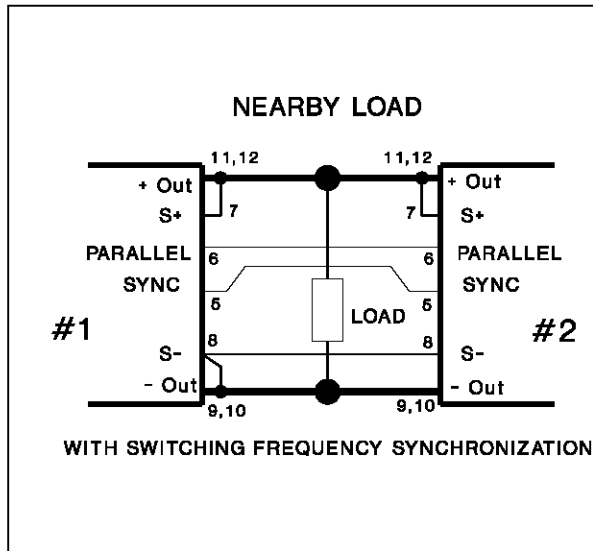


Figure 4.

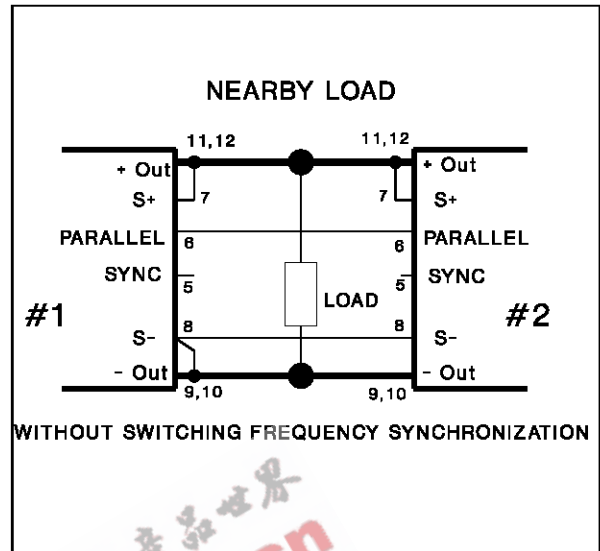


Figure 5.

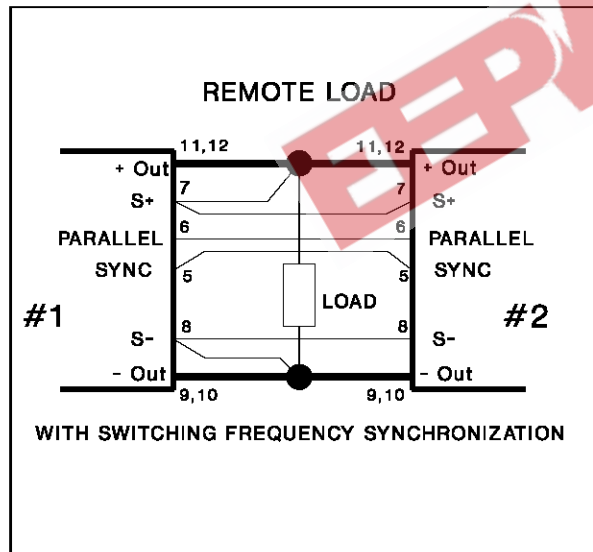
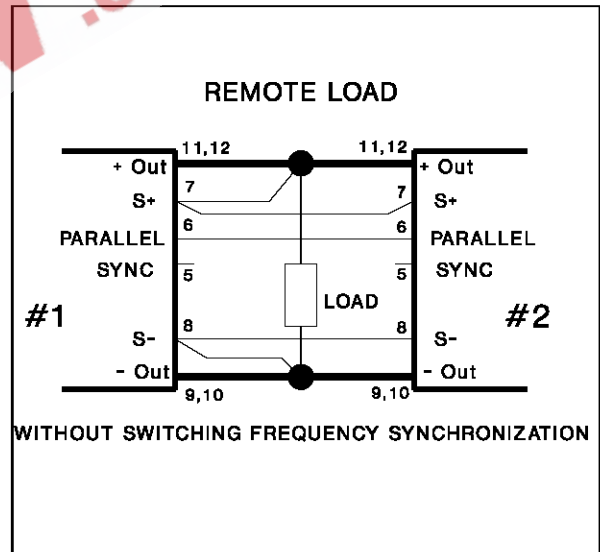


Figure 6.



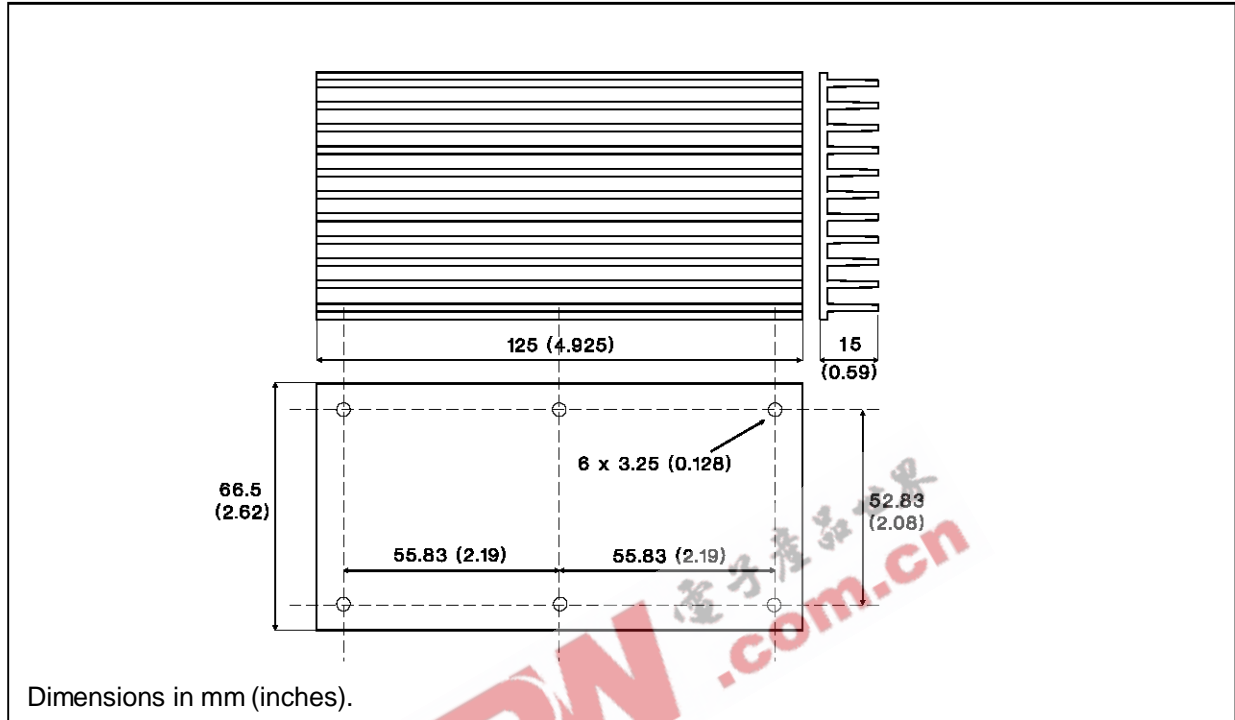
**Finned heatsink option**

An additional finned heatsink is available (type 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.

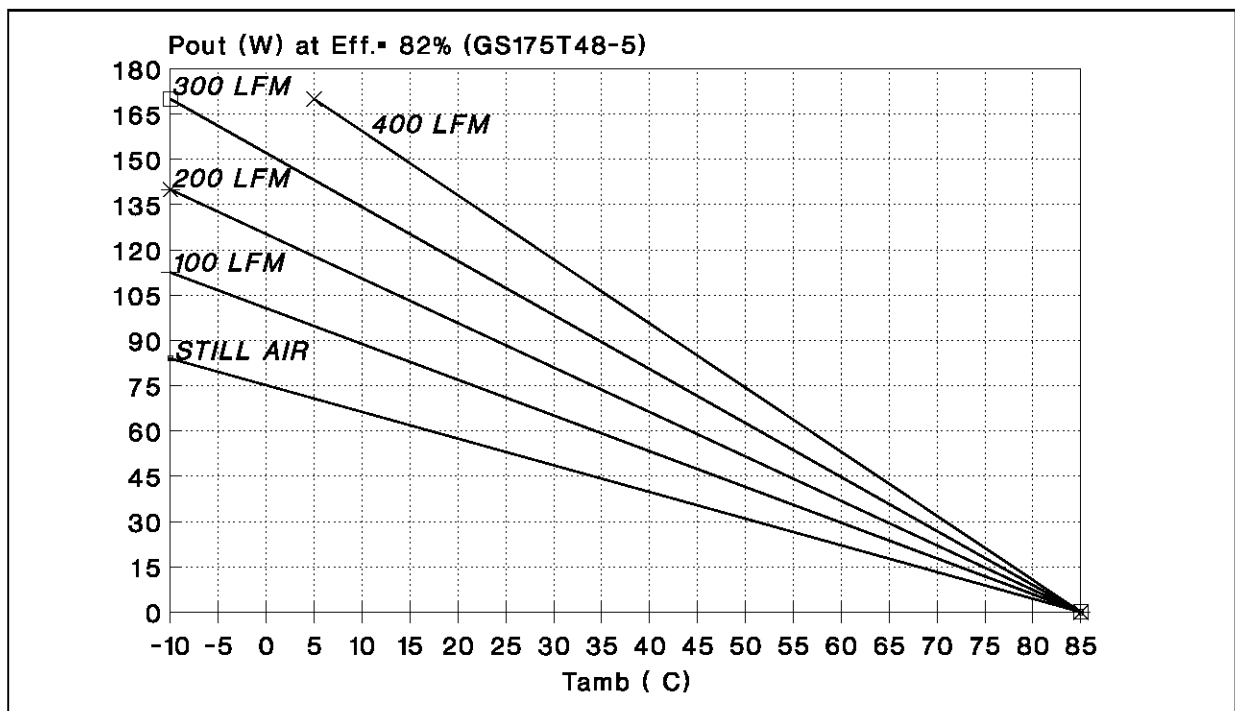


**Thermal Characteristics**

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

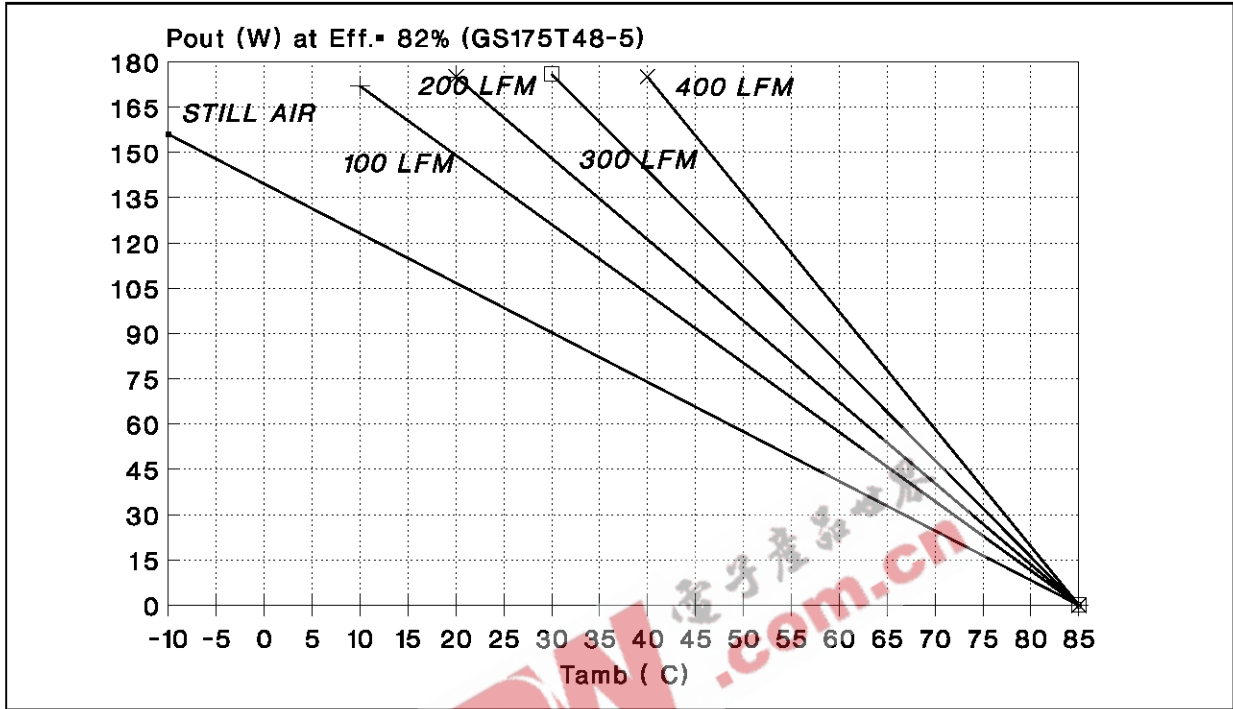
(fig. 8) and with the additional finned HS01 heatsink (fig. 9)

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



## GS120/175T48 FAMILY

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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