

Half- Brick MI-270N Series DC/DC Converter

1 Features

- Input voltage range: 220~320V
- Typical input direct voltage: 270V
- Output voltage: 10V、12V、28V
- Output power: 400W
- Output voltage regulation range: -20%~10%
- Output over-current/over-voltage protection
- Thermal protection
- Working temperature (T_c) :-55~100°C
- Fix-frequency PWM control method
- Standard-brick size
- Pins function: compatibility with similar products of SynQor



63.64×61.10×12.9mm³

Weight: ≤139g

table 1 product category

MI-270N-10-HT-N-M-F
MI-270N-12-HT-N-M-F
MI-270N-10-HT-N-M-FB
MI-270N-28-HT-N-M-FB

2 Scope of application

For high reliability electronic systems in aviation, aerospace, etc.

3 Descriptions

Half- Brick MI-270N Series DC/DC Converters use two stages circuit topology, the first stage is voltage regulation stage, the second stage is input-output isolation stage. Output voltage produce error amplifying signal by error amplifier. This signal is use for control the duty ratio of PWM waveform thus controlling the output voltage of the whole module.

These series products has module circuits structure with PCB surface mounted technology, inside the products, using conductivity material for embedding and alu

minum baseboard for cooling. The products' outlines are compatible with similar products' of SynQor, and their pins can be replacement.

4 Technical Specifications

Table 2: Rated conditions and Operating conditions

Absolute maximum rating	Operating conditions
Input Voltage: 350V Output Power: 440W Storage temperature: -55~125°C Lead welding temperature (10s) : 300°C Junction Temperature: <150°C	Input voltage: 220~320V Working temperature (Tc) : -55~100°C

Table 3a electrical characteristics (MI-270N-10-HT-N-M-F)

No.	Character		Symbol	Conditions (Unless otherwise specified (MI-270N-10-HT-N-M-F) , -55°C≤Tc≤125°C, VIN=270V)	Limit value		Unit	
					min	max		
1	Input Transient voltage ^a /V		Vis	TA=25°C, Less 100ms	200	350	V	
2	Input under-voltage/ V	turn-on voltage	V _{INL-ON} T	TA=25°C	185	195	V	
		Turn-off voltage	V _{INL-OFF} F	TA=25°C	170	179	V	
3	Output Voltage		Vo	Full-load	TA=25°C	9.90	10.10	V
					Tc=-55°C Tc=100°C	9.75	10.25	
4	Output Current		Io	Vin=220V~320V	-	40	A	
5	Voltage Regulation		Sv	220V 320V, Full-load TA=25°C、Tc=-55°C and Tc=100°C	-	±0.30	%	
6	Load Regulation		S1	No-load Full-load TA=25°C、Tc=-55°C and Tc=100°C	-	±0.30	%	
7	Output voltage regulation range ^a		V _{TR}	TA=25°C, Full-load	-20	10	%	
8	Output ripple voltage		V _{PP}	BW≤20MHz, full-load, peak-peak TA=25°C、Tc=-55°C和	-	100	mV	

			T _C =100℃				
9	Output over-voltage protection point	V _{OVp}	T _A =25℃, design guarantee	11.25	13.75	V	
10	Output current for over-current protection	I _{imax}	T _A =25℃	43.2	52.8	A	
11	Output load respond recovery voltage		50%to100%to50% I _{omax} (0.1A/μs) T _A =25℃	-	6	%Vo	
12	Output load respond recovery time		50%to100%to50% I _{omax} (0.1A/μs) T _A =25℃	-	5	mS	
13	Capacitive Load	C _o	Full-load, T _A =25℃	-	4000	μF	
14	Efficiency a	η	V _{in} =240V, Full-load or half-load, T _A =25℃	91	-	%	
			V _{in} =280V, Full-load or half-load, T _A =25℃	91	-	%	
	Efficiency		V _{in} =220V, Full-load or half-load, T _A =25℃	89	-	%	
			V _{in} =320V, Full-load or half-load, T _A =25℃	89	-	%	
15	Output Voltage Temperature rate	av	Full-load	-	±0.04	%/℃	
16	Input reflect ripple voltage		Full-load, T _A =25℃, Peak-Peak	-	5	V	
17	Isolation voltage	Viso	T _A =25℃, 10s, 1mA Between input and output	1500	-	VDC	
18	Isolation Resistance/MΩ	Riso	T _A =25℃ 500vdc	Between input ground and output ground	100	-	MΩ
				Between Input ground and Metal package	100	-	MΩ
				Between Output ground and Metal package	100	-	MΩ
19	Over-heat protection	T _{OTP}	Temperature of package	100	110	℃	
20	Parallel power distributing precision	P _E	Full-load, T _A =25℃	-	5	%	
21	Parallel power distributing precision a		Full-load, T _C =-55℃, T _C =100℃	-	5	%	
22	Parallel power distributing		Half-load, T _A =25℃	-	8	%	

	precision					
23	Input supply ripple current a		8-parallel, full-load, single output ripple current peak-peak, T _A =25°C	-	2	A
24	Input reflect ripple current a		8-parallel, full-load, single input reflect ripple current peak-peak, T _A =25°C	-	800	mA
25	Output Overshoot Amplitude		Full-load, T _A =25°C	-	1	%
26	Output Overshoot time		Full-load, T _A =25°C	-	10	ms

a test only be needed when identified inspection or parameters are effected by changing process;
b design guarantee, do not require test;
c design guarantee, random testing 2pcs from final electric testing products, qualification inspection and quality consistency testing or testing for status change.

Table 3b function characteristics (MI-270N-10-HT-N-M-F)

characteristics	conditions (Unless otherwise specified , -55°C≤T _c ≤125°C, V _{IN} =270V±10V)	criteria
Parallel Capacity	Full-load, T _A =25°C	Max 8pcs
Using function	ON/OFF voltage is over 2.4V, T _A =25°C	No output
	ON/OFF voltage is lower than 0.7V or hung in the air, T _A =25°C	Normal Output

Table 3c electrical characteristics (MI-270N-10-HT-N-M-FB)

No.	characteristics	Symbol	Condition (Unless otherwise specified , -55°C≤T _c ≤125°C, V _{IN} =270V)	Limit value		Unit	
				min	max		
1	Input Transient voltage ^a /V	Vis	T _A =25°C, less 100ms	200	350	V	
2	Input under-voltage/ V	turn-on voltage	V _{INL-ON} T _A =25°C	185	195	V	
		Turn-off voltage	V _{INL-OFF} T _A =25°C	173	183	V	
3	Output Voltage	Vo	Full-load	T _A =25°C	9.90	10.10	V
				T _c =-55°C	9.75	10.25	
				T _c =100°C			

4	Output Current	I _o	V _{in} =220V~320V	-	40	A	
5	Voltage Regulation	S _v	220V 320V, Full-load T _A =25°C、T _c =-55°C和 T _C =100°C	-	±0.30	%	
6	Load Regulation	S _I	No-load Full-load T _A =25°C、T _c =-55°C和 T _C =100°C	-	±0.30	%	
7	Output voltage regulation range ^a	V _{TR}	T _A =25°C, Full-load	-20	10	%	
8	Output ripple voltage	V _{PP}	BW≤20MHz, full-load, peak-peak T _A =25°C、T _c =-55°C和 T _C =100°C	-	520	mV	
9	Output over-voltage protection point	V _{OVp}	T _A =25°C, design guarantee	11.25	13.75	V	
10	Output current for over-current protection	I _{imax}	T _A =25°C	43.2	52.8	A	
11	Output load respond recovery voltage		50%to100%to50% I _{omax} (0.1A/μs) T _A =25°C	-	6	%V _o	
12	Output load respond recovery time		50%to100%to50% I _{omax} (0.1A/μs) T _A =25°C	-	5	mS	
13	Capacitive Load	C _o	Full Load, T _A =25°C	-	4000	μF	
14	Efficiency a	η	V _{in} =240V, Full-load or half-load, T _A =25°C	89	-	%	
			V _{in} =280V, Full-load or half-load, T _A =25°C	89	-	%	
	Efficiency		V _{in} =220V, Full-load or half-load, T _A =25°C	87	-	%	
			V _{in} =320V, Full-load or half-load, T _A =25°C	87	-	%	
15	Output Voltage Temperature rate	av	Full-load	-	±0.04	%/°C	
16	Input reflect ripple voltage		Full-load, T _A =25°C, peak-peak	-	5	V	
17	Isolation voltage	Viso	T _A =25°C, 10s, 1mA Between input and output	1500	-	VDC	
18	Isolation Resistance/MΩ	Riso	T _A =25°C 500vdc	Between input ground and output ground	100	-	MΩ
				Between Input ground and Metal package	100	-	MΩ
				Between Output ground and Metal	100	-	MΩ

			package			
19	Over-heat protection	T _{OTP}	Temperature of package	100	125	°C
20	Parallel power distributing precision	P _E	Full-load, T _A =25°C	-	5	%
21	Parallel power distributing precision a		Full-load, T _C =-55°C, T _C =100°C	-	5	%
22	Parallel power distributing precision		Half-load, T _A =25°C	-	8	%
23	Input supply ripple current a		8-parallel, full-load, single output ripple current peak-peak, T _A =25°C	-	2	A
24	Input reflect ripple current a		8-parallel, full-load, single input reflect ripple current peak-peak, T _A =25°C	-	800	mA
25	Output Overshoot Amplitude		Full-load, T _A =25°C	-	1	%
26	Output Overshoot time		Full-load, T _A =25°C	-	10	ms

a test only be needed when identified inspection or parameters are effected by changing process;
b design guarantee, do not require test;
c design guarantee, random testing 2pcs from final electric testing products, qualification inspection and quality consistency testing or testing for status change.

table 3d function characteristics (MI-270N-10-HT-N-M-FB)

characteristics	Conditions (Unless otherwise specified , -55°C≤T _c ≤125°C, V _{IN} =270V±10V)	criteria
Parallel Capacity	Full-load, T _A =25°C	Max 8pcs
Using function	ON/OFF voltage is over 2.4V, T _A =25°C	No output
	ON/OFF voltage is lower than 0.7V or hung in the air, T _A =25°C	Normal Output

Table 3e electrical characteristics (MI-270N-12-HT-N-M-F)

No.	characteristics		symbol	Conditions (Unless otherwise specified , -55°C≤T _c ≤125°C, V _{IN} =270V)	Limit value		Unit
					min	max	
1	Input Transient voltage ^a /V		Vis	T _A =25°C, less 100ms	200	350	V
2	Input under-voltage/	turn-on voltage	V _{INL-ONT}	T _A =25°C	185	195	V

	V	Turn-off voltage	$V_{INL-OFF}$	$T_A=25^{\circ}\text{C}$	170	179	V	
3	Output Voltage		V_o	Full-load	$T_A=25^{\circ}\text{C}$	11.90	12.10	V
					$T_c=-55^{\circ}\text{C}$ $T_c=100^{\circ}\text{C}$	11.75	12.25	
4	Output Current		I_o	$V_{in}=220\text{V}\sim 320\text{V}$	-	34	A	
5	Voltage Regulation		S_v	220V 320V, Full-load $T_A=25^{\circ}\text{C}$ 、 $T_c=-55^{\circ}\text{C}$ 和 $T_c=100^{\circ}\text{C}$	-	± 0.30	%	
6	Load Regulation		S_I	No-load Full-load $T_A=25^{\circ}\text{C}$ 、 $T_c=-55^{\circ}\text{C}$ 和 $T_c=100^{\circ}\text{C}$	-	± 0.30	%	
7	Output voltage regulation range ^a		V_{TR}	$T_A=25^{\circ}\text{C}$ ， Full-load	-20	10	%	
8	Output ripple voltage		V_{PP}	BW $\leq 20\text{MHz}$ ， full-load, peak-peak $T_A=25^{\circ}\text{C}$ 、 $T_c=-55^{\circ}\text{C}$ 和 $T_c=100^{\circ}\text{C}$	-	100	mV	
9	Output over-voltage protection point		V_{OVP}	$T_A=25^{\circ}\text{C}$ ， design guarantee	13.25	15.75	V	
10	Output current for over-current protection		I_{imax}	$T_A=25^{\circ}\text{C}$	36	44	A	
11	Output load respond recovery voltage			50%to100%to50% I_{omax} (0.1A/ μs) $T_A=25^{\circ}\text{C}$	-	6	% V_o	
12	Output load respond recovery time			50%to100%to50% I_{omax} (0.1A/ μs) $T_A=25^{\circ}\text{C}$	-	5	mS	
13	Capacitive Load		C_o	Full Load, $T_A=25^{\circ}\text{C}$	-	4000	μF	
14	Efficiency a		η	$V_{in}=240\text{V}$ ， Full-load or half-load , $T_A=25^{\circ}\text{C}$	92	-	%	
				$V_{in}=280\text{V}$ ， Full-load or half-load , $T_A=25^{\circ}\text{C}$	92	-	%	
	Efficiency			$V_{in}=220\text{V}$ ， Full-load or half-load , $T_A=25^{\circ}\text{C}$	91	-	%	
				$V_{in}=320\text{V}$ ， Full-load or half-load , $T_A=25^{\circ}\text{C}$	91	-	%	
15	Output Voltage Temperature rate		av	Full-load	-	± 0.04	%/ $^{\circ}\text{C}$	
16	Input reflect ripple voltage			Full-load , $T_A=25^{\circ}\text{C}$, peak-peak	-	5	V	
17	Isolation voltage		V_{iso}	$T_A=25^{\circ}\text{C}$ ， 10s, 1mA Between input and output	1500	-	VDC	

18	Isolation Resistance	Riso	T _A =25°C 500vdc	Between input ground and output ground	100	-	MΩ
				Between Input ground and Metal package	100	-	MΩ
				Between Output ground and Metal package	100	-	MΩ
19	Over-heat protection	T _{OTP}	壳温 Temperature of package	100	110	°C	
20	Parallel power distributing precision	P _E	Full-load, T _A =25°C	-	5	%	
21	Parallel power distributing precision a		Full-load , T _C =-55°C, T _C =100°C	-	5	%	
22	Parallel power distributing precision		Half-load, T _A =25°C	-	8	%	
23	Input supply ripple current a		8-parallel, full-load, single output ripple current peak-peak, T _A =25°C	-	2	A	
24	Input reflect ripple current a		8-parallel, full-load, single input reflect ripple current peak-peak, T _A =25°C	-	800	mA	
25	Output Overshoot Amplitude		Full-load, T _A =25°C	-	1	%	
26	Output Overshoot time		Full-load, T _A =25°C	-	10	ms	
<p>a test only be needed when identified inspection or parameters are effected by changing process; b design guarantee, do not require test; c design guarantee, random testing 2pcs from final electric testing products, qualification inspection and quality consistency testing or testing for status change.</p>							

table 3h function characteristics (MI-270N-12-HT-N-M-F)

characteristics	Conditions (Unless otherwise specified , -55°C≤T _C ≤125°C, V _{IN} =270V±10V)	criteria
Parallel Capacity	Full-load, T _A =25°C	Max 8pcs
Using function	ON/OFF voltage is over 2.4V, T _A =25°C	No output
	ON/OFF voltage is lower than 0.7V or hung in the air, T _A =25°C	Normal Output

table 3g electrical characteristic (MI-270N-28-HT-N-M-FB)

No.	characteristics	Symbol	Conditions (Unless otherwise specified , $-55^{\circ}\text{C}\leq T_c\leq 125^{\circ}\text{C}$, $V_{IN}=270\text{V}$)	Limit value		Unit	
				Min	Max		
1	Input Transient voltage ^a /V	Vis	$T_A=25^{\circ}\text{C}$, less 100ms	200	350	V	
2	Input under-voltage/V	turn-on voltage	$V_{INL-ONT}$	$T_A=25^{\circ}\text{C}$	185	195	V
		Turn-off voltage	$V_{INL-OFF}$	$T_A=25^{\circ}\text{C}$	173	183	V
3	Output Voltage	Vo	Full-load	$T_A=25^{\circ}\text{C}$	27.72	28.28	V
				$T_c=-55^{\circ}\text{C}$ $T_c=100^{\circ}\text{C}$	27.60	28.40	
4	Output Current	Io	$V_{in}=220\text{V}\sim 320\text{V}$	-	14.5	A	
5	Voltage Regulation	Sv	220V 320V, Full-load $T_A=25^{\circ}\text{C}$ 、 $T_c=-55^{\circ}\text{C}$ 和 $T_c=100^{\circ}\text{C}$	-	± 0.30	%	
6	Load Regulation	S1	No-load Full-load , $T_A=25^{\circ}\text{C}$ 、 $T_c=-55^{\circ}\text{C}$ 和 $T_c=100^{\circ}\text{C}$	-	± 0.30	%	
7	Output voltage regulation range ^a	V_{TR}	$T_A=25^{\circ}\text{C}$, Full-load	-20	10	%	
8	Output ripple voltage	V_{PP}	$BW\leq 20\text{MHz}$, full-load, peak-peak $T_A=25^{\circ}\text{C}$ 、 $T_c=-55^{\circ}\text{C}$ 和 $T_c=100^{\circ}\text{C}$	-	460	mV	
9	Output over-voltage protection point	V_{OVP}	$T_A=25$	31.5	28.5	V	
10	Output current for over-current protection	I_{imax}	$T_A=25^{\circ}\text{C}$	16.0	20.3	A	
11	Output load respond recovery voltage		50%to100%to50% I_{omax} (0.1A/ μs) $T_A=25^{\circ}\text{C}$	-	6	%Vo	
12	Output load respond recovery time		50%to100%to50% I_{omax} (0.1A/ μs) $T_A=25^{\circ}\text{C}$	-	5	mS	
13	Capacitive Load	Co	Full-load, $T_A=25^{\circ}\text{C}$	-	4000	μF	
14	Efficiency a	η	$V_{in}=240\text{V}$, Full-load or Half Load, $T_A=25^{\circ}\text{C}$	89	-	%	
			$V_{in}=280\text{V}$, Full-load or Half Load , $T_A=25^{\circ}\text{C}$	89	-	%	

	Efficiency		Vin=220V, Full-load or Half Load, TA=25°C	87	-	%	
			Vin=320V, Full-load or Half Load, TA=25°C	87	-	%	
15	Output Voltage Temperature rate	av	Full-load	-	±0.04	%/°C	
16	Input reflect ripple voltage		Full-load, TA=25°C, peak-peak	-	5	V	
17	Isolation voltage	Viso	TA=25°C, 10s, 1mA Between input and output	1500	-	VDC	
18	Isolation Resistance	Riso	TA=25°C 500vdc	Between input ground and output ground	100	-	MΩ
				Between Input ground and Metal package	100	-	MΩ
				Between Output ground and Metal package	100	-	MΩ
19	Over-heat protection	TOTP	Temperature of package	100	125	°C	
20	Parallel power distributing precision	PE	Full-load, TA=25°C	-	5	%	
21	Parallel power distributing precision a		Full-load, TC=-55°C, TC=100°C	-	5	%	
22	Parallel power distributing precision		Half-load, TA=25°C	-	8	%	
23	Input supply ripple current a		8-parallel, full-load, single output ripple current peak-peak, TA=25°C	-	2	A	
24	Input reflect ripple current a		8-parallel, full-load, single input reflect ripple current peak-peak, TA=25°C	-	800	mA	
25	Output Overshoot Amplitude		Full-load, TA=25°C	-	1	%	
26	Output Overshoot time		Full-load, TA=25°C	-	10	ms	

a test only be needed when identified inspection or parameters are effected by changing process;
b design guarantee, do not require test;
c design guarantee, random testing 2pcs from final electric testing products, qualification inspection and quality consistency testing or testing for status change.

table 3h function characteristics (MI-270N-28-HT-N-M-FB)

characteristics	conditions (Unless otherwise specified ,	criteria
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	$-55^{\circ}\text{C} \leq T_c \leq 125^{\circ}\text{C}$, $V_{IN} = 270\text{V} \pm 10\text{V}$	
Parallel Capacity	Full-load, $T_A = 25^{\circ}\text{C}$	Max 8pcs
Using function	ON/OFF voltage is over 2.4V, $T_A = 25^{\circ}\text{C}$	No output
	ON/OFF voltage is lower than 0.7V or hung in the air, $T_A = 25^{\circ}\text{C}$	Normal Output

5 Circuit block diagram

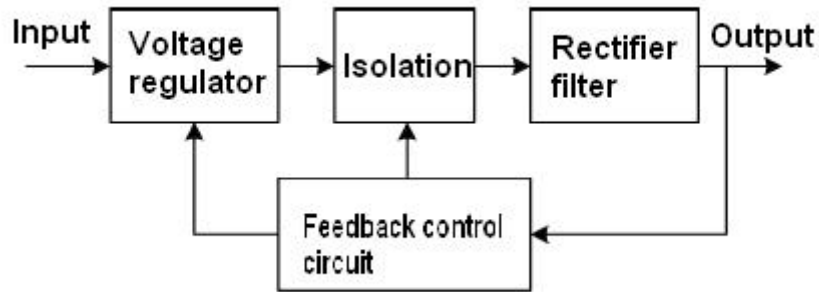


Diagram 2 Product schematic diagram

6 Typical Characteristic Curve

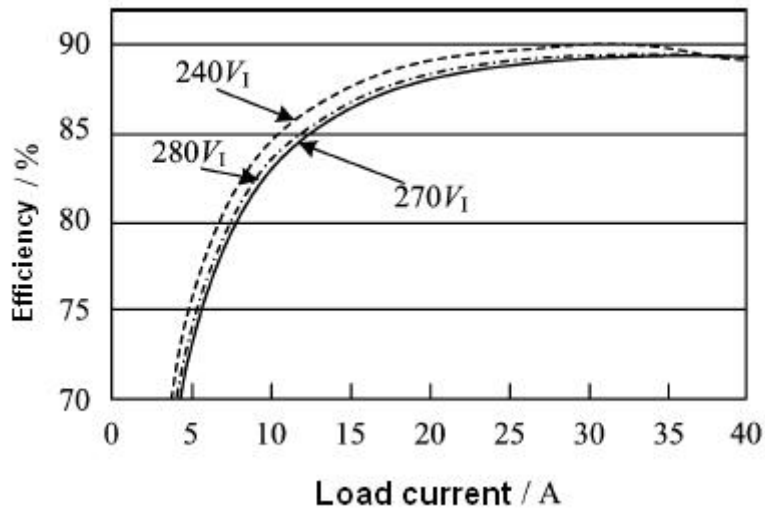


Diagram 3 efficiency (Output Power)

7.MTBF Curve

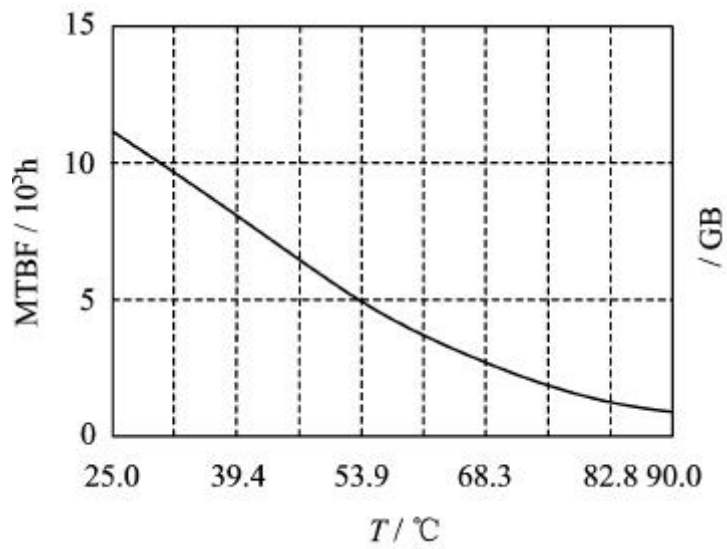


Diagram 4 MTBF Curve

(Predicting the ground is in good condition)

8 Pin Designation

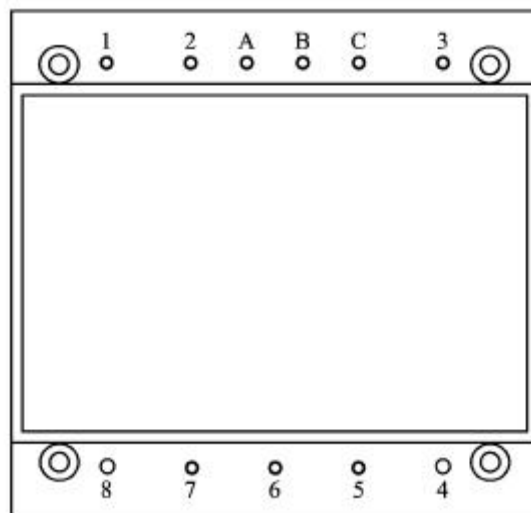


Figure 5 Out Bottom View

Table 4 MI-270-05-FT-N-M-FB Pin Designation

Pin	Symbol	Designation
1	Vin+	Positive Input
2	ON/OFF	Positive Enabling

A	ClockSync	Synchronizing signal
B	StartSync	Synchronizing start
C	Ishare	Paralleled current sharing
3	Vin-	Negative Input
4	Vo-	Negative Output
5	S-	Negative Output Inductio
6	Trim	Output voltage regulatio
7	S+	Positive Output Inductio
8	Vo+	Positive Output

9 Typical Connection Diagram

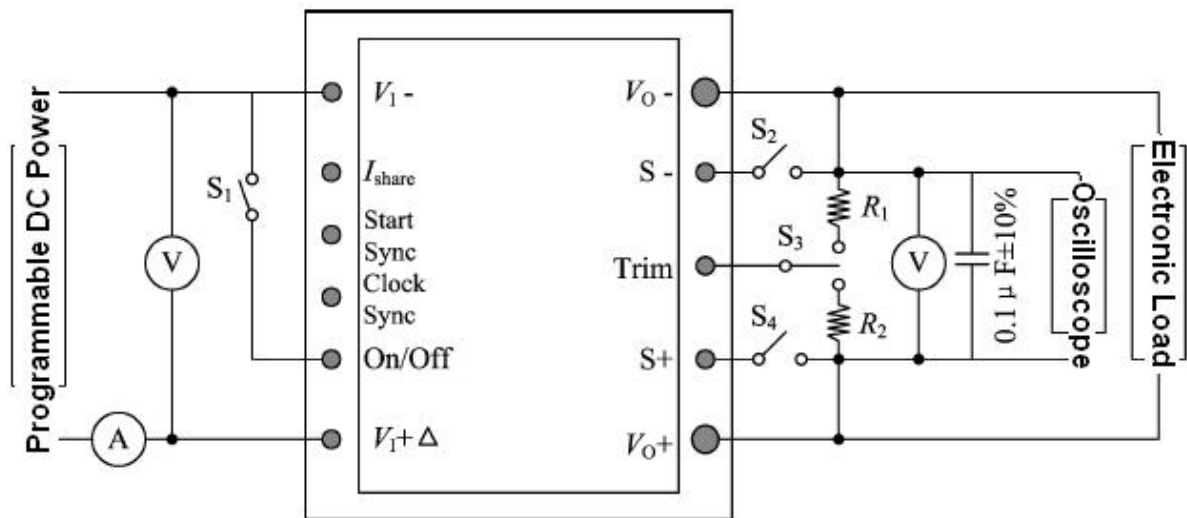


Diagram 6: Electrical testing connection diagram

10. Package Specifications

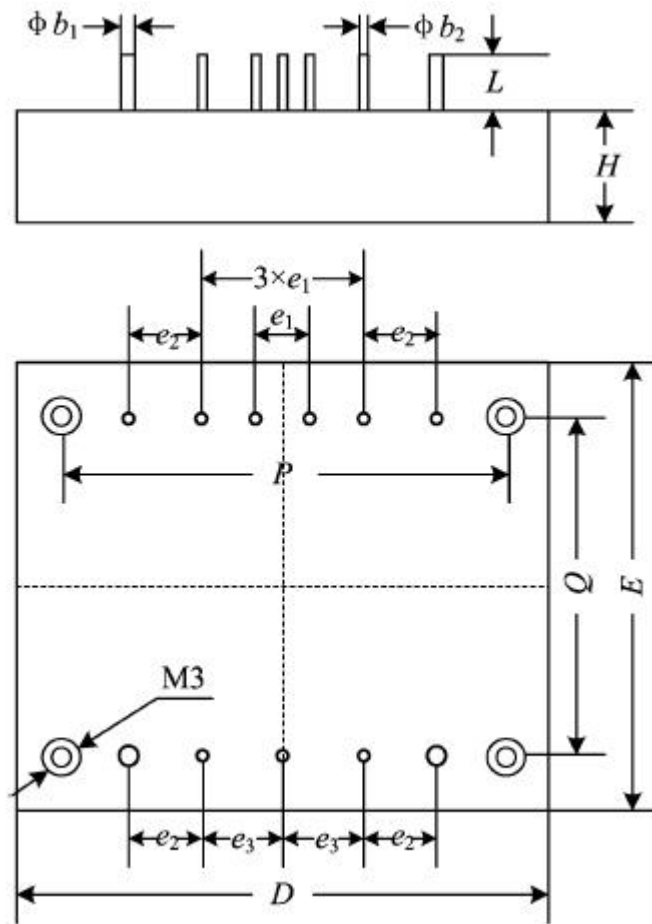


Diagram 7: Package outline drawing (MI-270N-10-HT-N-M-F、MI-270N-12-HT-N-M-F, Upward view)

Table 8 Package Outline

Symbols	Unit/mm		
	Minimum	Typical	Maximum
ϕb_1	1.8	-	2.2
ϕb_2	0.9	-	1.1
D	62.64	-	63.64
E	60.10	-	61.10
E_1	-	5.08	-
E_2	-	10.16	-
E_3	-	7.62	-
H	12.40	12.70	12.90
L	4.05	-	4.55
P	-	50.8	-
Q	-	48.26	-

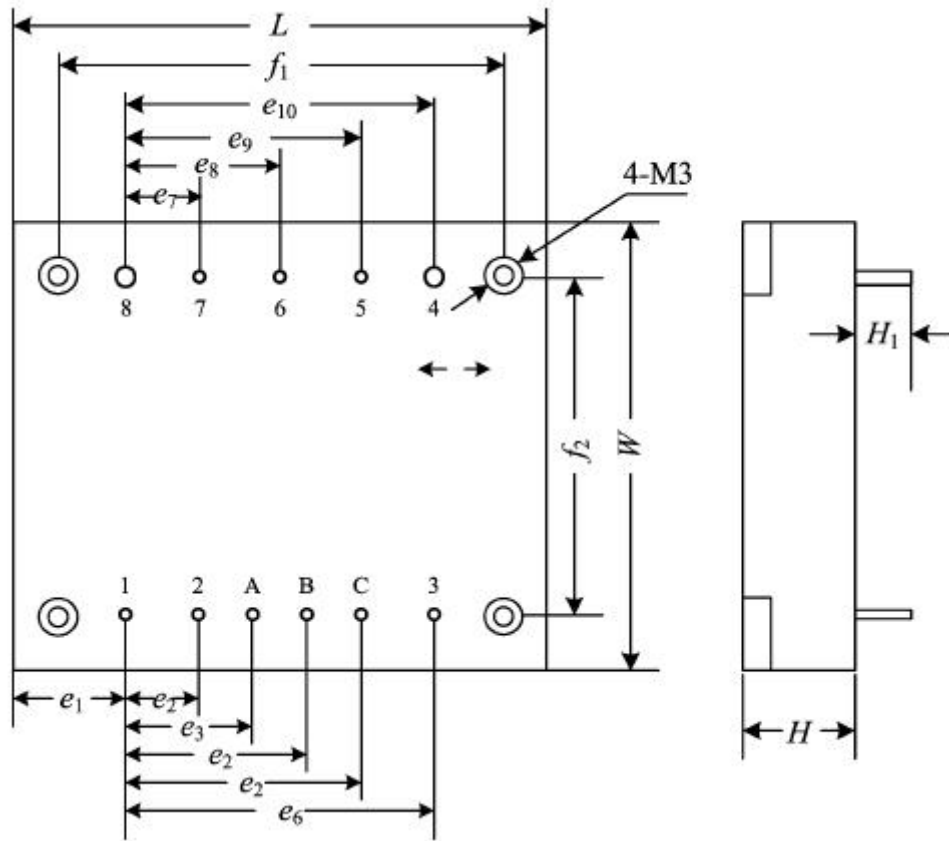


Diagram 8: Package outline drawing (MI-270N-10-HT-N-M-FB、MI-270N-28-HT-N-M-FB，Upward view)

Table 9 Package Outline

Symbols	Unit/mm		
	Minimum	Typical	Maximum
W	60.10	60.60	61.10
L	62.64	63.14	63.64
H	11.94	12.57	13.20
$H1$		4.57	
$f1$	-	50.80	-
$f2$	-	48.30	-
$E7$	-	10.16	-
$E8$	-	17.78	-
$E9$	-	25.40	-
$E10$	-	35.36	-
$E1$	-	13.79	-
$E2$	-	10.16	-
$E3$	-	15.24	-
$E4$	-	20.32	-
$E5$	-	25.40	-
$E6$	-	35.56	-

11 Ordering Information

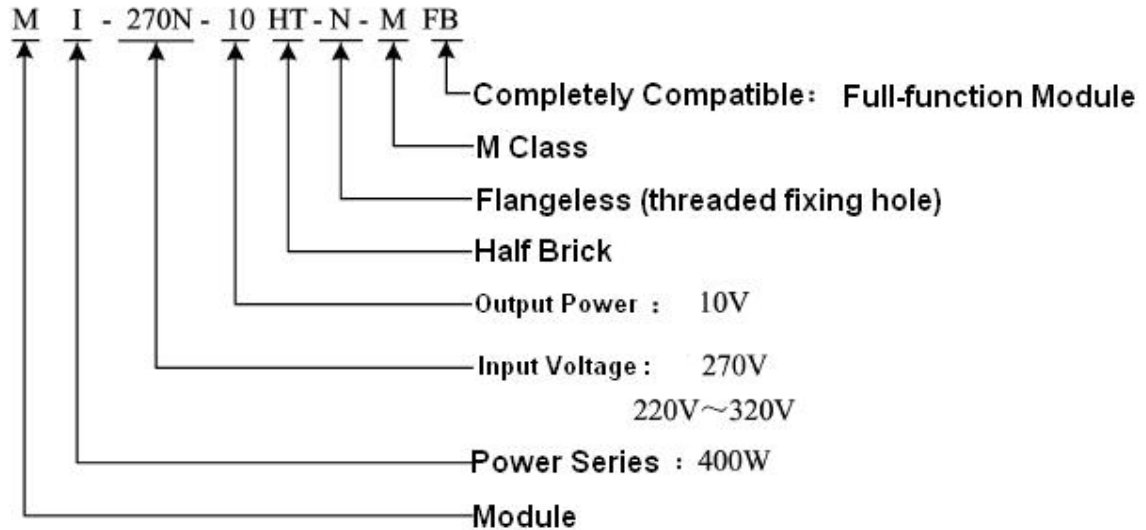


Diagram 9: Ordering Information

Application Notes:

- ☆ The influence of external disturbance on the test accuracy should be avoided.
- ☆ The voltage detection point should be kept at the root of the pin of the testing product.
- ☆ Do not plug the product with electricity.
- ☆ Before power the testing product, you must confirm the polarity of the power supply to avoid damaging products by misconnection. At the same time, please ensure that the power supply voltage and load current does not exceed using limitation of the testing product.
- ☆ Package temperature can not exceed the specified temperature in use, otherwise the heat sink should be needed.
- ☆ When ordering this device , the detailed electrical specifications shall be based on relevant standards.