

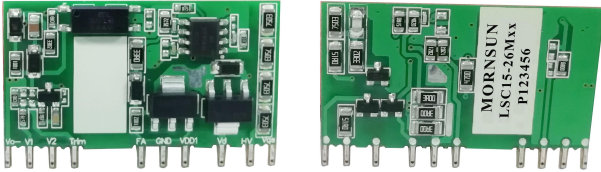
LSC15-26Mxx Series Technical Manual

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1. Core board

Core board solution dedicated for three-phase four-wire power supply



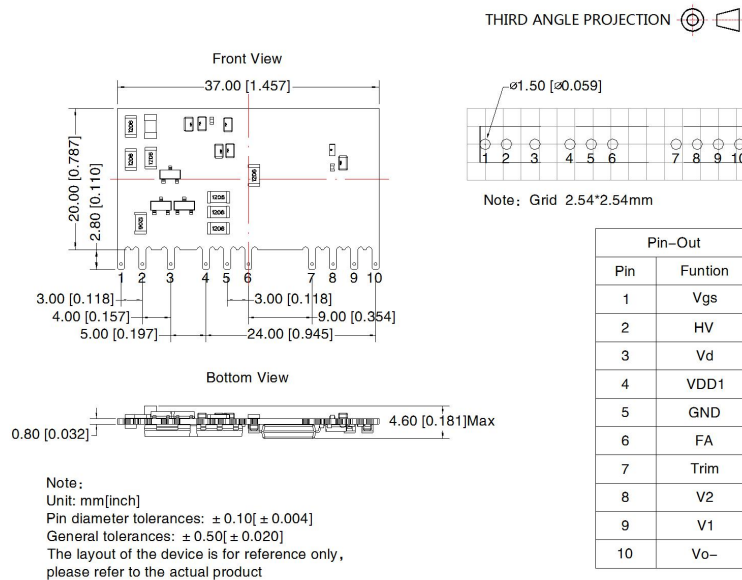
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CORE BOARD FEATURES

- Integrate 2 MOSFET inside, withstand voltage up to 1300V
- Integrate dedicated high-voltage start controller
- Cost controllable, flexibly selection of external components based on actual requirements
- Flexible design, meets multi-output requirements
- High quality and reliability guarantee
- 5 years warranty

LSC15-26Mxx series—dedicated for electricity with ultra wide input voltage core board solution. It is particularly suitable for applications of electricity, industry control, smart home. The power supply for the core board features ultra wide input voltage, output short circuit, over-current protection, over-voltage protection, low power consumption, high efficiency and high reliability.

1.1 Core Board Dimensions And Pin Definition



1.2 Core Board Pin Function Description

Pin	Pin	Function	Description
1	Vgs	High Voltage Midpoint	Midpoint of the input capacitor voltage, providing a reference voltage for the module
2	HV	High Voltage Input	High voltage input terminal, provide power to VDD shunt capacitor to start the controller, from the input voltage
3	Vd	Drain terminal	Drain terminal of power MOSFET
4	VDD1	VCC	Provide power to Chip terminal from the by-pass capacitor
5	GND	Primary Side	Primary Side GND
6	FA	Input Voltage Detection	To provide voltage and timing feedback to the controller. The pin is connected to a voltage divider between an auxiliary winding and GND. The upper resistance value of the voltage divider can be used to adjust the line voltage compensation strength of the power supply, the ratio of upper and lower resistors can be used to adjust the output voltage stability.
7	Trim	Trim	Output voltage adjustable
8	V2	Input Feedback	Optocoupler and 431 power supply pin
9	V1	Output Sampling	Output feedback sampling pin

10	Vo-	Secondary Side	Secondary Side GND
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1.3 Core Board Electrical Characteristic Parameters

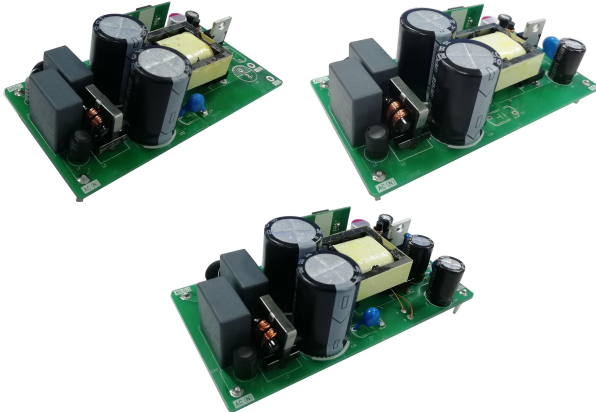
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Chip power supply terminal (VDD1)						
Offset power vol	VDD1	--	--	--	25	V
VDD1 by-pass cap	--	--	--	--	20	uF
VUVLO_ON	VDD UVLO cancel (ON)	VDD low-to-high	--	16.1	--	V
VUVLO_OFF	VDD UVLO	VDD high-to-low	--	7.4	--	
VOVP_ON	VDD OVP trigger voltage	VDD 15V-to-21V	--	24.2	--	
VOVP_OFF	VDD OVP recovery voltage	VDD 21V-to-10V	--	16.1	--	
VOVP_Hys	VDD OVP backlash voltage		--	8.1	--	
VClamp	VDD clamp voltage	VDD current increases	--	35	40	
ISTL	VDD low limit charging current	VIN=40, VDD=0V	250	400	550	uA
ISTH	VDD high limit charging current	VIN=40, VDD=3.5V	0.8	2.5	4	mA
IVIN(OFF)	VIN shut off current	VIN=40, VDD=22V, delay 88ms	--	--	5	uA
IVDD	Operating current	IVIN=0, VDD=10V	40	--	150	uA
VCM	Limited charge voltage	CVDD=47nF	--	22	--	V
VDD (start)	Oscillator starting voltage		--	4.3	--	V
VDD (reset)	Startup circuit reset voltage		--	3.1	--	V
TOSC	Oscillator oscillating period	VDD=4.3V	--	22	--	us
		VDD=18V	--	3.1	--	
		VDD=22V	--	1.5	--	
TCH	High voltage power supply duration		--	49152	--	TOSC
IUVIN_ON	Input under voltage trigger current	RI=24K	--	167	--	uA
TUVIN1	Input under voltage protection trigger voltage retention time, startup	After trigger OVP	--	3	--	Pulses
TUVIN2	Input undervoltage protection trigger voltage retention time, working		--	2 ¹¹	--	Pulses
Analog signal basic reference (Vgs)						
Vgs	Analog signal basic reference		20	--	--	V
Startup circuit input terminal (HV)						
V _{HV}			85	--	745	V
Drain voltage (Vd)						
Vd	Drain voltage		--	--	1300	V
Output voltage adjustable pin						
Trim	Output voltage adjustable pin		--	2.5	--	V

1.4 Core Board Mechanical Specifications

Dimension	37.00 x 20.00 x 4.60 mm
Weight	2.2g (Typ.)
Cooling method	Free air convection

2. Power Supply Demo Board

Power Supply Demo Board



RoHS

Power Supply Demo Board Features

- Ultra wide input voltage range: 45 - 528VAC/65-745VDC
- Circuit can be powered by three-phase four-wire, or any two wires of them
- Output short circuit, over-current, over-voltage protection
- High efficiency, high reliability
- Low ripple & noise, low standby power consumption

The Demo board was based on the latest National Grid Standards and dedicated designed for public change terminals, special-purpose terminals, large customer terminals, and substation terminals. It features ultra-wide input voltage of 45-528VAC/65-745VDC, in line with rated voltage: 380/220VAC (three-phase four-wire) power supply requirements, input to output isolation voltage up to 4000VAC, in accordance with IEC/EN61000 standard "EFT(4KV)", applicable to a variety of terminal applications requiring high isolation voltage and strict electromagnetic compatibility. For extremely harsh EMC environment, we recommend using the application circuit show in Design Reference of this datasheet.

2.1 Selection Guide

Core Board Part No.	Recommended Peripheral Part No.	Output Power	Nominal Output Voltage and Current (Vo/Io)			Efficiency at 230VAC (%) Typ.	Capacitive Load (μF)Max.	
			Vo1/Io1	Vo2/Io2	Vo3/Io3		≥90VAC	45 ~ 90VAC
LSC15-26M05	LSC15-26B05	15W	5VDC/3A	--	--	76	10000	5000
LSC15-26M09	LSC15-26B09		9VDC/1.667A	--	--	78	5000	2500
LSC15-26M12	LSC15-26B12		12VDC/1.25A	--	--	80	3000	1500
LSC15-26M15	LSC15-26B15		15VDC/1A	--	--	80	2000	1000
LSC15-26M24	LSC15-26B24		24VDC/0.625A	--	--	83	800	400
LSC15-26M05	LSC15-26D0505-08	14W	5VDC/2A	5VDC/0.8A	--	76	9000/3000	4500/1500
LSC15-26M05	LSC15-26D0524-04	14.6W	5VDC/1A	24DC/0.4A	--	78	3000/1500	1500/800
LSC15-26M05	LSC15-26C0505-05	15W	5VDC/2A	5VDC/0.5A	5VDC/0.5A	75	9000/2000/2000	4500/1000/1000
LSC15-26M05	LSC15-26C0512-02	14.8W	5VDC/2A	12VDC/0.2A	12VDC/0.2A	77	9000/800/800	4500/1500
LSC15-26M05	LSC15-26C0515-02	15W	5VDC/1.8A	15VDC/0.2A	15VDC/0.2A	78	5000/370/370	1500/800
LSC15-26M12	LSC15-26D1212-03	15W	12VDC/0.95A	12VDC/0.3A	--	78	3000/1200	1500/600

2.2 Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	AC input	45	--	528	VAC
	DC input	65	--	745	VDC
Input Frequency		47	--	63	Hz
Input Current	115VAC	--	--	0.5	A
	230VAC	--	--	0.23	
Inrush Current	115VAC	--	25	--	
	230VAC	--	40	--	

Recommended External Input	3.15A/500VAC slow-blow required
Hot Plug	Unavailable

2.3 Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy	Balancing load	Main circuit (Vo1)	--	±2	--	
		Auxiliary circuit(Vo2/Vo3) (Multiple circuit)	--	±10	--	
Line Regulation	Full load	Main circuit (Vo1)	--	±0.5	--	
		Auxiliary circuit(Vo2/Vo3) (Multiple circuit)	--	±1.5	--	
Load Regulation	0%-100% load(Single circuit)		--	±1	--	
	10%-100% load(Multiple circuit)	Main circuit (Vo1)	--	±2	--	
		Auxiliary circuit (Vo2/Vo3)	--	±5	--	
Ripple & Noise*	20MHz bandwidth (peak-to-peak value)	Main circuit (Vo1)	--	--	120	mV
		Auxiliary circuit(Vo2/Vo3) (Multiple circuit)	--	--	200	
Temperature Coefficient			--	±0.02	--	%/°C
Stand-by Power Consumption	230VAC		--	--	0.5	W
Short Circuit Protection	Hiccup, continuous, self-recovery					
Over-current Protection	≥130% Io, self-recovery					
Over-voltage Protection	5VDC Output		≤7.5V (Output voltage clamp or hiccup)			
	9VDC Output		≤15V(Output voltage clamp or hiccup)			
	12VDC Output		≤20V(Output voltage clamp or hiccup)			
	15VDC Output		≤22V(Output voltage clamp or hiccup)			
	24VDC Output		≤30V(Output voltage clamp or hiccup)			
Minimum Load	Single circuit		0	--	--	%
	Multiple circuit		10	--	--	
Hold-up Time	230VAC input, Io=100% (-25°C Peripheral circuit)		--	20	--	ms
	380VAC input, Io=100% (-25°C Peripheral circuit)		--	80	--	
	230VAC input, Io=100% (-40°C Peripheral circuit)		--	50	--	
	380VAC input, Io=100% (-40°C Peripheral circuit)		--	110	--	

Note: * The "parallel cable" method is used for ripple and noise test, please refer to AC-DC Converter Application Notes for specific information.

2.4 General Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Isolation	Input-Output	Electric Strength Test for 1min., leakage current <5mA	4000	--	--	VAC
	Output-Output (Multiple circuit)		4000	--	--	
Operating Temperature			-40	--	+70	°C
Storage Temperature			-40	--	+105	
Storage Humidity			--	--	95	%RH
Altitude			--	--	2000	m
Soldering Temperature	Wave-soldering	260 ± 5°C; time: 5 - 10s				
	Manual-welding	360 ± 10°C; time: 3 - 5s				
Switching Frequency			--	65	--	kHz
Power Derating	-40°C to -25°C(-40°C Peripheral circuit)		2.00	--	--	% / °C
	-25°C to -10°C(-25°C Peripheral circuit)					
	+55°C to +70°C		3.00	--	--	
	45VAC - 110VAC		1.13	--	--	%/VAC

	45VAC - 110VAC (LSC15-26D1212-03)	1.15	--	--	
	480VAC - 528VAC	0.83	--	--	
Safety Class		CLASS II			
MTBF		MIL-HDBK-217F@25°C > 300,000 h			

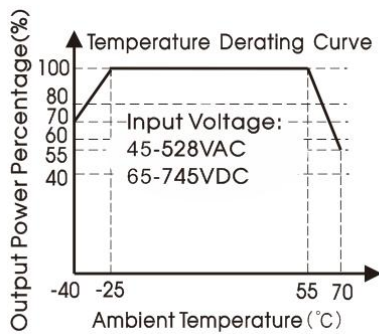
2.5 Mechanical Specifications

Dimension	100.00 x 50.00 x 35.00 mm
Cooling method	Free air convection

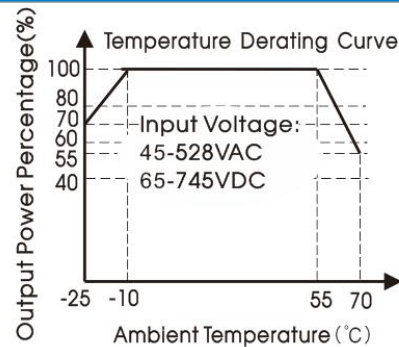
2.6 Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS A (CLASS A Peripheral circuit)	
		CISPR32/EN55032	CLASS B (CLASS B Peripheral circuit)	
	RE	CISPR32/EN55032	CLASS A (CLASS A Peripheral circuit)	
		CISPR32/EN55032	CLASS B (CLASS B Peripheral circuit)	
Immunity	ESD	IEC/EN61000-4-2	Contact ±8KV	Perf. Criteria B
	RS	IEC/EN61000-4-3	10V/m	perf. Criteria A
	EFT	IEC/EN61000-4-4	±4KV	perf. Criteria B
	Surge	IEC/EN61000-4-5	line to line ±2KV	perf. Criteria B
	CS	IEC/EN61000-4-6	10Vr.m.s	perf. Criteria A
	Voltage dip, short interruption and voltage variation	IEC/EN61000-4-11	0%, 70%	perf. Criteria B

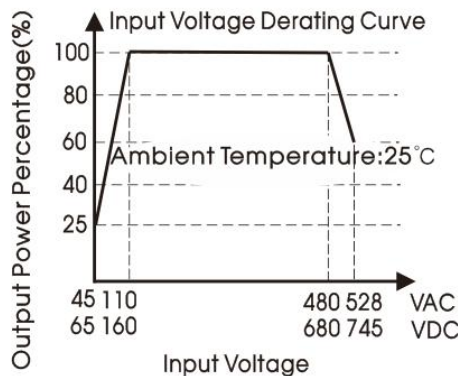
2.7 Product Characteristic Curve



(-40°C Power supply Demo board peripheral circuit)

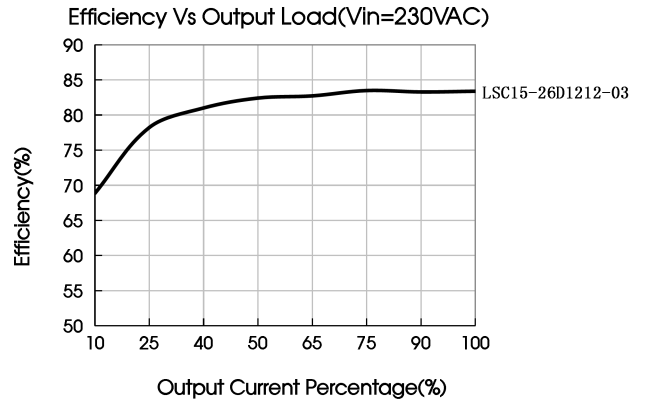
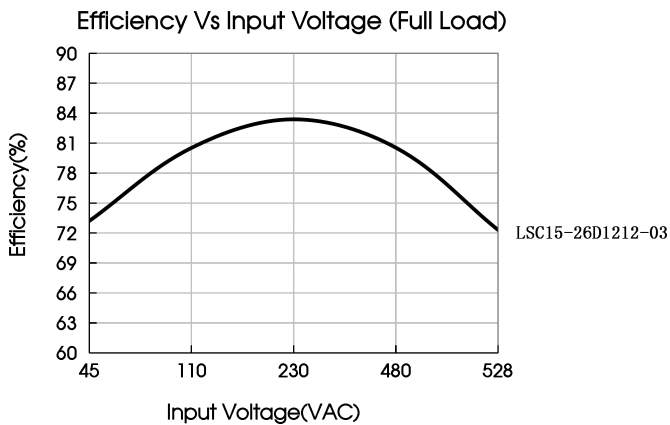
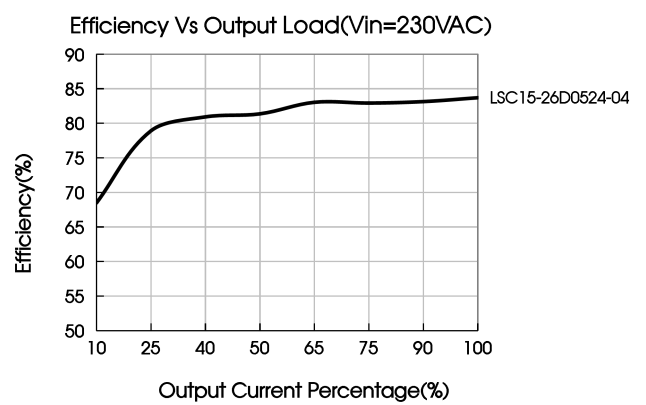
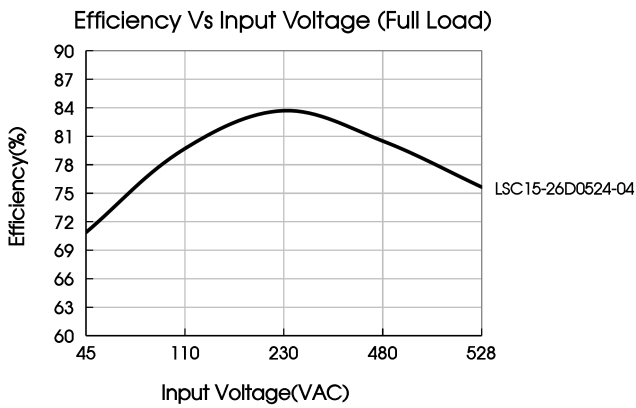
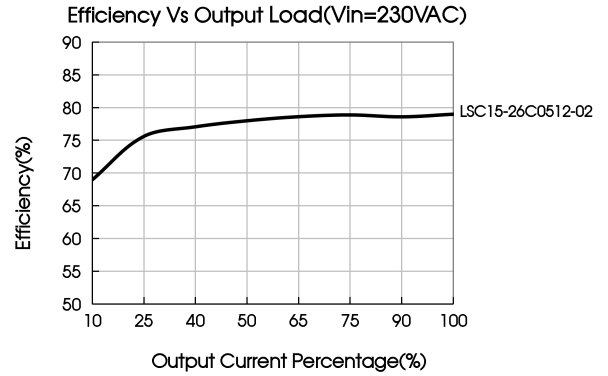
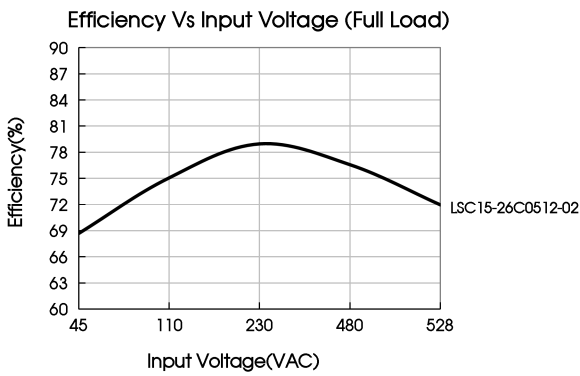
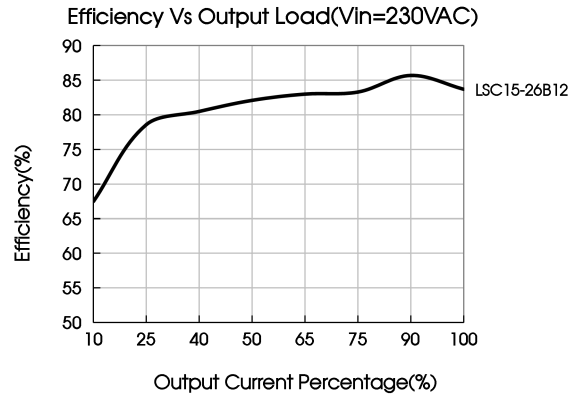
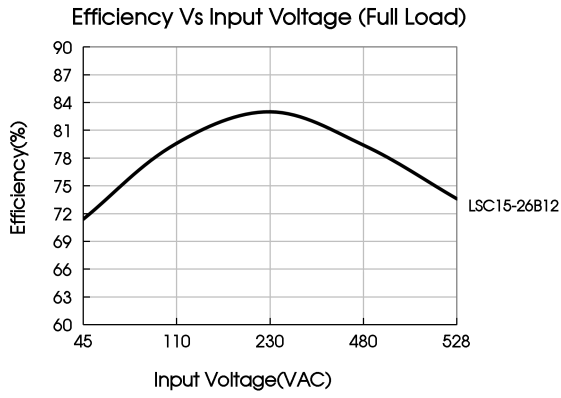


(-25°C Power supply Demo board peripheral circuit)



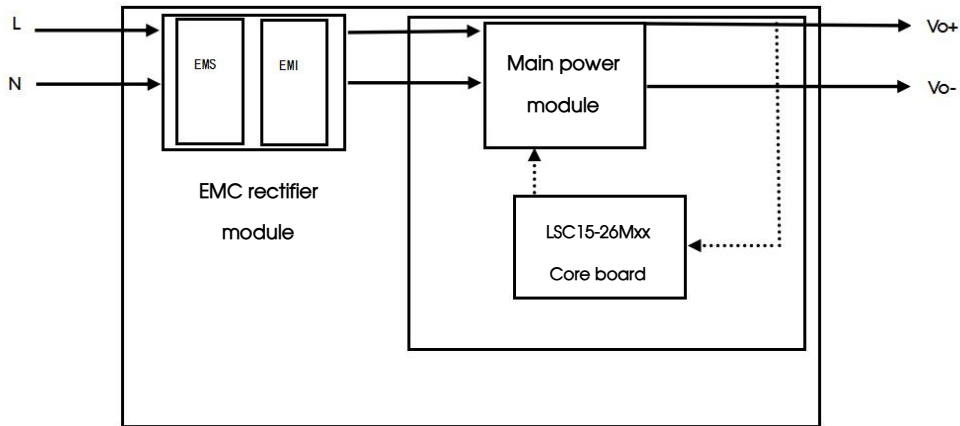
Note: ① With an AC input between 45-110VAC/ 480-528VAC and a DC input between 65-160VDC/680-745VDC , the output power must be derated as per temperature derating curves;

② This product is suitable for applications using natural air cooling; for applications in closed environment please consult factory or one of our FAE.



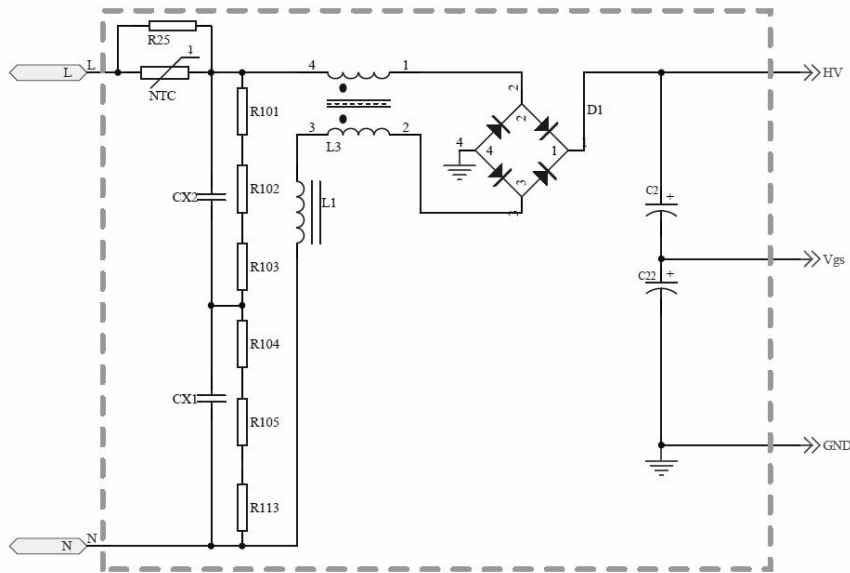
2.8 Design Reference

2.8.1 Overall Solution Application Design Diagram

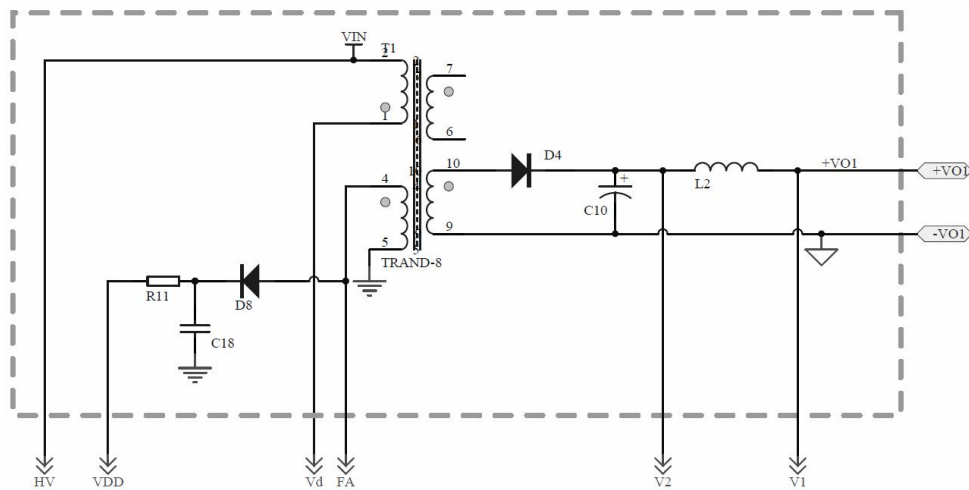


LSC15-26Mxx Series overall solution application design diagram

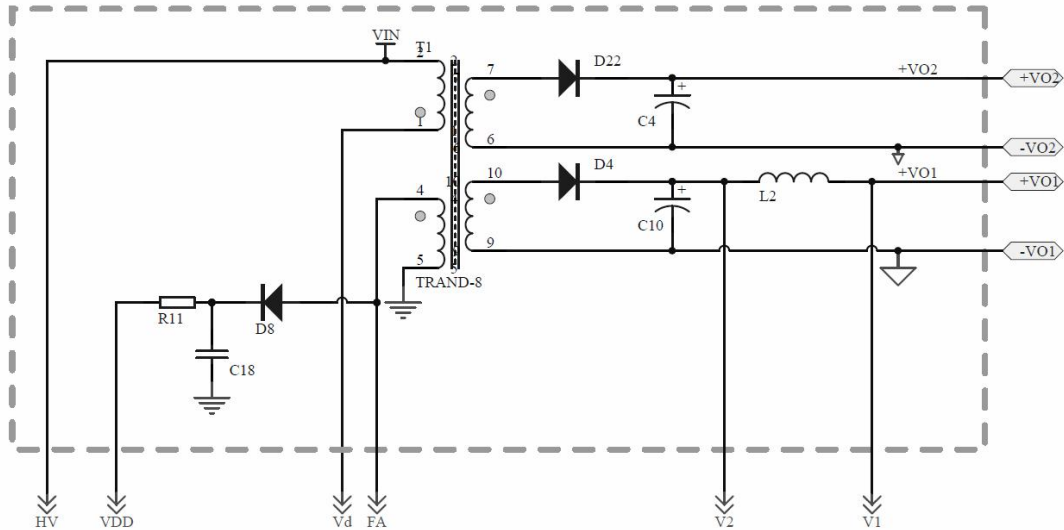
2.8.2 Power Demo Board Design



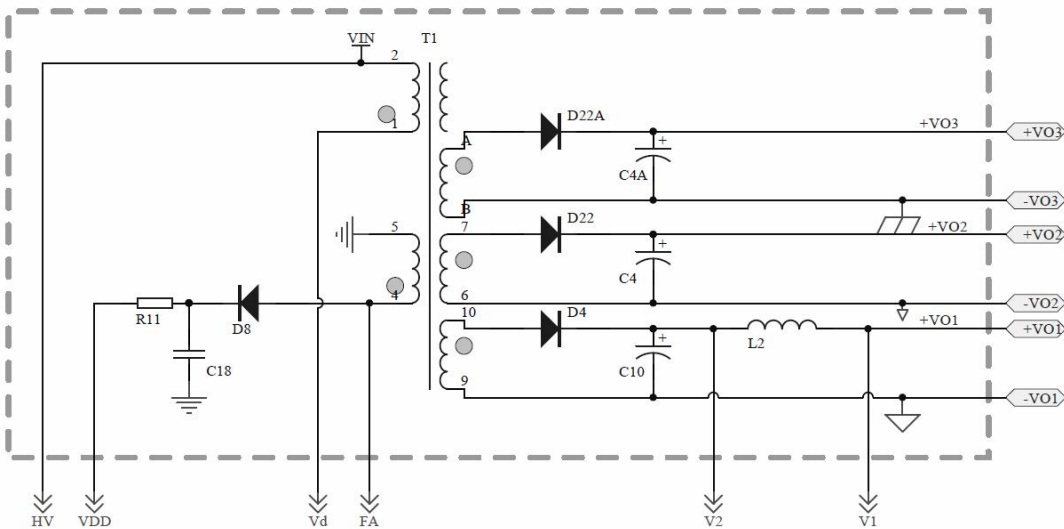
EMC rectifier filtering



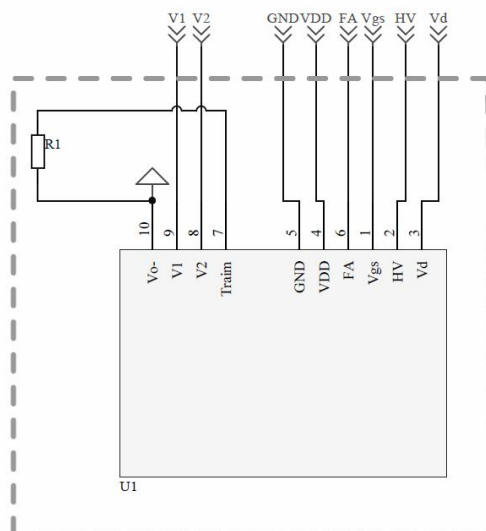
Single Output DC-DC main board part



Multiple Output DC-DC main board part



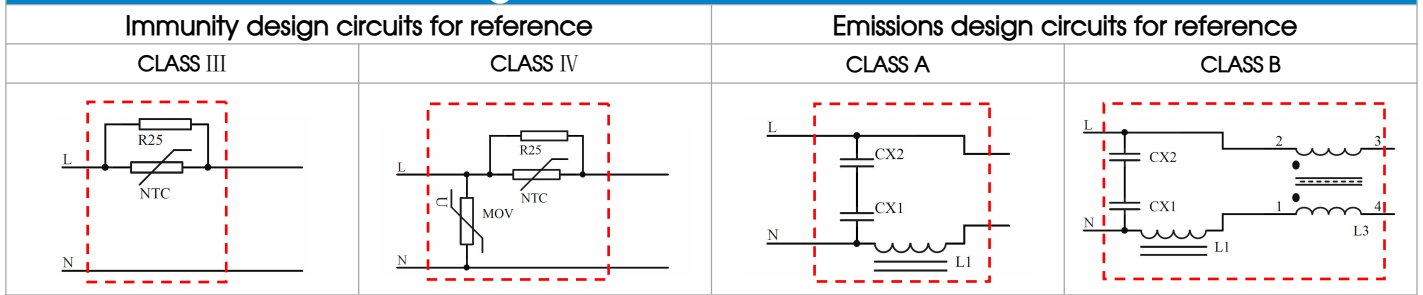
Three Output DC-DC main board part



LSC15-26Mxx core board

More detailed design information, please contact our technicians.

2.9 EMC Filter Circuit Design Reference

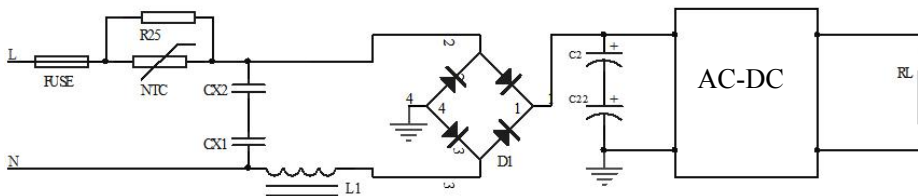


2.9.1 Environmental Application EMC Solution

Recommended circuit	Application environmental	Typical industry	Input voltage range	Operating ambient temperature	EMS	EMI
1	Basic application	None	45~528Vac	-25°C~+70°C	CLASS III	CLASS A
				-40°C~+70°C	CLASS III	CLASS A
2	Indoor civil/Indoor industrial environment general system	Instrumentation		-25°C~+70°C	CLASS III	CLASS B
				-40°C~+70°C	CLASS III	CLASS B
3	Outdoor industrial environment general system	Intelligent traffic / video surveillance / charging pile		-40°C~+70°C	CLASS IV	CLASS A
		Communication/Security and protection		-25°C~+70°C	CLASS IV	CLASS A
4	Outdoor harsh environment general system	Farming and animal husbandry		-25°C~+70°C	CLASS IV	CLASS B
		electric power		-40°C~+70°C	CLASS IV	CLASS B

2.9.2 Demo Board Recommended Circuit

Recommended circuit 1—Basic application(Immunity CLASS III+Emission CLASS A)



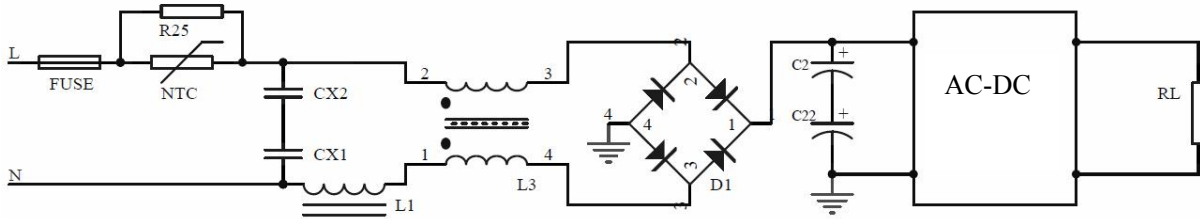
Recommended circuit 1

Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Basic application	-25°C~+70°C/-40°C~+70°C	CLASS III	CLASS A

Component	Recommended value
C2(C22)	68uF/400V (-25°C~+70°C)
	82uF/400V (-40°C~+70°C)
CX1(CX2)	0.22uF/275VAC
L1	1.2mH/4.0Ω /0.34A
NTC	5Ω /2.85A
R25	12Ω 2W ±5%(Winding)
FUSE	3.15A/500VAC, slow-blow, required

Note: Different working temperatures, the values corresponding to C2 and C22 are different.

Recommended circuit 2 — Indoor civil /Universal system recommended circuits for Indoor industrial environment(Immunity CLASS III+Emissions CLASS B)



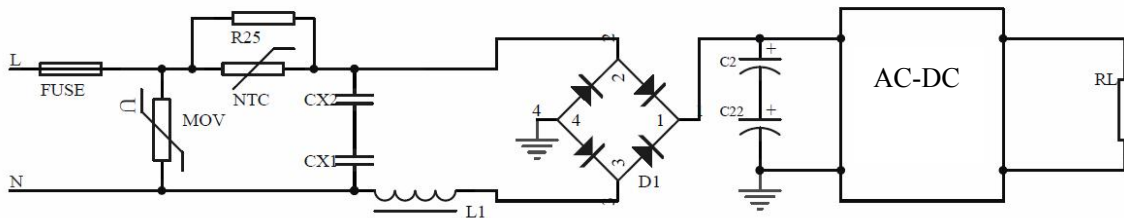
Recommended circuit 2

Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Basic application	-25°C~+70°C/-40°C~+70°C	CLASS III	CLASS B

Component	Recommended value
C2(C22)	68uF/400V (-25°C~+70°C)
	82uF/400V (-40°C~+70°C)
CX1(CX2)	0.47μF/275VAC
L1	1.2mH/4.0Ω /0.34A
L3	20mH
NTC	5Ω /2.85A
R25	12Ω 2W ±5%(Winding)
FUSE	3.15A/500VAC, slow-blow, required

Note: Different working temperatures, the values corresponding to C2 and C22 are different.

Recommended circuit 3 — Universal system recommended circuits for outdoor industrial environment (Immunity CLASS IV +Emissions CLASS A)



Recommended circuit 3

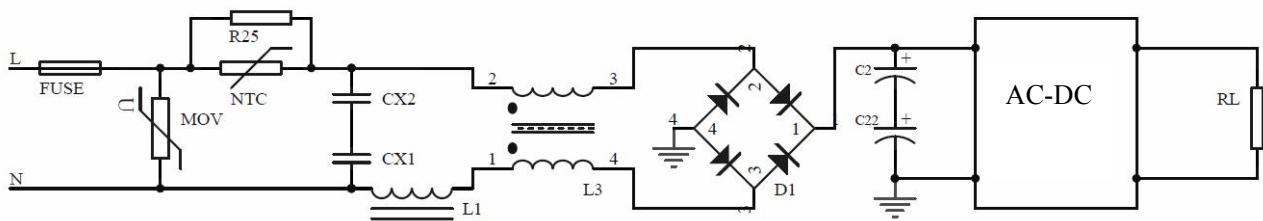
Application environmental	Ambient temperature range	Immunity CLASS	Emissions CLASS
Basic application	-25°C~+70°C/-40°C~+70°C	CLASS IV	CLASS A

Component	Recommended value
C2(C22)	68uF/400V (-25°C~+70°C)
	82uF/400V (-40°C~+70°C)
CX1(CX2)	0.22μF/275VAC
L1	1.2mH/4.0Ω /0.34A
MOV	S20K510
NTC	5Ω /2.85A
R25	12Ω 2W ±5%(Winding)
FUSE	3.15A/500VAC, slow-blow, required

Note: Different working temperatures, the values corresponding to C2 and C22 are different.

Recommended circuit 4 — Universal system recommended circuits for outdoor harsh industrial

environment(Immunity CLASS IV+Emissions CLASS B)



Recommended circuit 4

Application	Ambient temperature range	Immunity CLASS	Emissions CLASS
environmental			
Basic application	-25°C~+70°C/-40°C~+70°C	CLASS IV	CLASS A

Component	Recommended value
C2(C22)	68uF/400V (-25°C~+70°C)
	82uF/400V (-40°C~+70°C)
CX1(CX2)	0.47uF/275VAC
L1	1.2mH/4.0Ω/0.34A
L3	20mH
MOV	S20K510
NTC	5Ω/2.85A
R25	12Ω 2W ±5%(Winding)
FUSE	3.15A/500VAC, slow-blow, required

Note: Different working temperatures, the values corresponding to C2 and C22 are different.

For additional information please refer to application notes on www.mornsun-power.com.

2.9.3 Power Demo Board Three-phase Four-wire input Recommended Circuit

Recommended circuit—Three-phase four-wire input

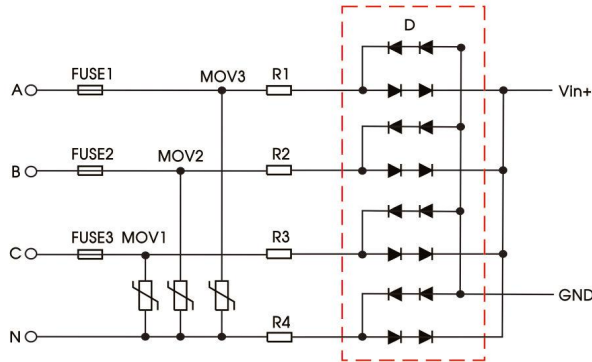


Fig. 5: Recommended circuit for applications which require 4KV differential-mode surge standard (full-wave rectification)

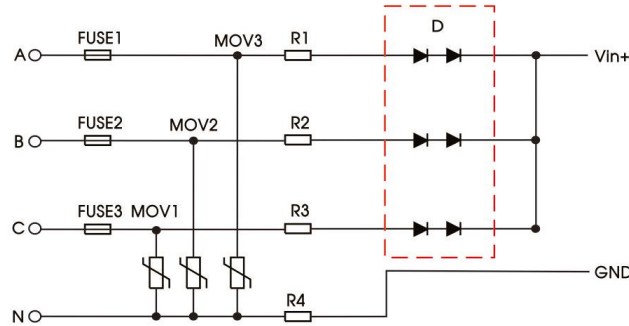


Fig. 6: Recommended circuit for applications which require 4KV differential-mode surge standard (half-wave rectification)

Recommend Parameter For Higher EMC Standard Circuit	
Component	Recommended value
MOV1, MOV2, MOV3	S20K510
D	2A/1000V
R1, R2, R3, R4	10 Ω /5W
FUSE1, FUSE2, FUSE3	3.15A/500VAC, slow-blow, required

For additional information please refer to application notes on www.mornsun-power.com.

Note:

- For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58020024;
- If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet;
- Unless otherwise specified, parameters in this datasheet were measured under the conditions of $T_a=25^\circ\text{C}$, humidity<75% with nominal input voltage and rated output load;
- All index testing methods in this datasheet are based on our company corporate standards;
- We can provide product customization service, please contact our technicians directly for specific information;
- Products are related to laws and regulations: see "Features" and "EMC";
- Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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