DC/DC Converter
KCR4812QBO-860WA

MORNSUN®

860W, isolated DC-DC converter
Wide input and regulated single output

Patent Protection RoHS

FEATURES

- Wide input voltage range：40-60VDC
- High efficiency up to 98.0% (60%Io)
- Operating ambient temperature range：-40℃ to +85℃
- Input under-voltage protection, over–voltage. over-current protection, output short-circuit, over-temperature protection
- Droop current sharing, bus current sharing
- Built-in PMBus communication function
- Industry standard package: 1/4 brick, reflow through hole
- Peak-current 100A, peak output power: 1200W, lasts 1000ms
- Moisture Sensitivity Level (MSL) 3

KCR4812QBO-860WA is a high-performance product designed for the field of communication power supply. It features with output power up to 860W, High efficiency up to 98%, 40-60VDC wide voltage input, allowable operating temperature up to 85℃, with input under-voltage protection, output over-voltage protection, output over-current protection, output short-circuit protection, over-temperature protection, remote control, output voltage regulation, current sharing, PMBus communication and other functions.They are widely used in communications and other fields.

Selection Guide

Certification	Part No.	ON/OFF①	Current sharing type②	Input Voltage (VDC)		Output		Nominal Efficiency(%) 50%Io/100%Io	Capacitance Load(μF)⑥	
				Nominal (Range)	Max.③	Voltage (VDC)④	Current (mA) 50%Io/100%Io.		Min.⑤	Max.
--	KCR4812QBO-860WA	N	ACS	48/54 (40-60)	70	12.24	36000/72000	97.8%/97.5%	4000	20000

Notes:
① "A" stands for bus current sharing
②" N" indicates negative logic;
③ The input voltage cannot exceed this value, otherwise it may cause permanent irreversible damage, in order to improve product reliability. By default, if Vin exceeds 63VDC (Typ.) product will shut down the power output;
④ The output voltage is tested under the conditions of nominal input and no-load output;
⑤ In order to ensure the stability of the output voltage, at least one minimum capacitive load must be externally connected to the output side of the product,
⑥ Capacitive load test conditions: room temperature, Vin = 40-60V, 100%Io;

Input Specifications

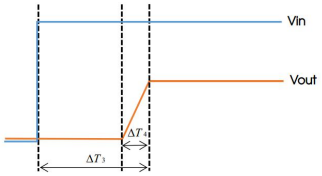
Item		Operating Conditions	Min.	Typ.	Max.	Unit
Input Current (full load)		Room temperature, Vin = 40 V	--	--	24	A
Input Loss (no load)		Room temperature, Vin = 48 V	--	6.3	--	W
Surge Voltage		Room temperature	--	--	70	VDC
Max Input Voltage		Room temperature	--	--	60	
Input Start-up Voltage③		Output voltage enabled level	37.3	38	38.7	
Input Under-voltage Protection		Output voltage disable level	35.0	36	36.7	
Input Filter			Pi filter			
Hot Plug			Unavailable, it is necessary to ensure that the input and output capacitors without voltage before loading and unloading the product			
ON/OFF①	Module turn-on	Room temperature	0	--	0.8	VDC
	Module turn-off	Room temperature	2.4	--	20	
	ON/OFF pin floating voltage	Room temperature	--	3.3	--	
	ON/OFF start up delay time	Room temperature, ON/OFF=ON to Vo=10%Vo.nom	--	--	40	mS
	Input current when turning off	Room temperature, Vin = 48 V	--	15	--	mA

Notes:
①ON/OFF control pin voltage is relative to input pin -VIN; The input voltage cannot exceed 20VDC, otherwise it may cause permanent damage;
②CTRL enables the required external circuit current capability。
③The input start-up voltage and undervoltage protection voltage are typical values measured under 10%Io. Under full-load conditions, it is necessary to ensure that the input voltage is stable and does not jitter.

Output Specifications

Item	Operating Conditions①	Min.	Typ.	Max.	Unit
Calibrated output voltage	Room temperature, Vin = 48 V, 0%Io	12.18	12.24	12.30	V
Output Current Range	See the working temperature derating curve	0	--	100	%Io
Maximum transient output current	Vin = 40-60 V, time of duration 1000ms	72	--	100	A
Output voltage Range	Room temperature, Vin = 40-60 V，0%-100%Io	11.7	--	12.4	V
Linear Regulation	Room temperature, Vin = 42-60 V, 100%Io	--	3	12	mV
	Room temperature, Vin = 40-42 V, 100%Io	--	50	200	
Load Regulation	Room temperature, Vin = 48 V, 0%-100%Io	--	94	145	mV
Transient Recovery Time	Vin = 48 V, 25-75-25% Io	--	50	--	μs
Transient Response Deviation	Vin = 48 V, 25-75-25% Io	--	±100	±300	mV
Ripple & Noise②	Room temperature, Vin = 40-60 V, 0%-100%Io	--	50	78	mVp-p
Over-temperature Protection	Product surface max. temperature	--	125	--	℃
Over-voltage Protection	Vin = 48 V, 10%Io	--	14.2	--	V
	Response type	Hiccup, continuous, self-recovery			
Over-current Protection	Vin = 40-60 V, Room temperature(product temperature)	--	120	--	%
	Response type	Hiccup, continuous, self-recovery			
Short-circuit Protection	Vin = 40-60 V	Hiccup, continuous, self-recovery			
Start-up Time ΔT_3 ④	Vin = 54 V	--	40	--	ms
Output voltage rise time ΔT_4 ④	Room temperature, 0%-100%Io	--	10	--	

Notes：
① All output characteristics are tested in accordance with Design Reference Fig. 2;
② The ripple & noise is tested in accordance with Design Reference Fig. 3, 4000μF/16V(300μF MLCC+3700μF Oscon);
③④ ΔT_3 and ΔT_4 see the picture below;



General Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Operating Temperature			-40	--	+85	℃
Storage Temperature			-55	--	+125	
Storage Humidity	Non-condensing		5	--	95	%RH
Pin Soldering Resistance Temperature*	Wave soldering welding, Max. 10 seconds		--	--	260	℃
	Reflow soldering, 10 seconds, MSL 3		--	--	260	
	Soldering spot is 1.5mm away from case for 10 seconds		--	--	300	
Shock And Vibration			10-500Hz, 5g 0.75mm 90min. along X, Y and Z			
Switching Frequency	Switching frequency setting value	Room temperature, Vin = 40-60 V, 0%-100%Io	--	150	--	kHz %
MTBF	Telcordia SR-332@25℃		--	2000	--	k hours

Note:
①Product use and control in accordance with IPCJ-STD-033 standard.
②The soldering temperature that the pin can withstand is not the actual set temperature of the soldering iron, but the temperature required for a good solder joint. The actual set temperature by the customer needs to be comprehensively set based on the thickness of the PCB, the size of the copper cladding, the power of the soldering iron, and the selection of the soldering iron tip.

Mechanical Specifications

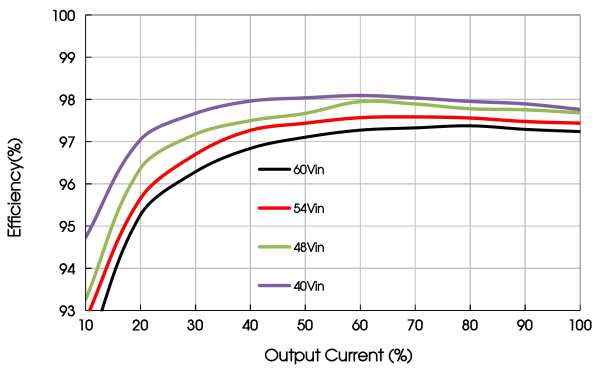
Case Material	Aluminum alloy case
Dimension	58.4x36.8x11.95 mm
Weight	87g(Typ.)
Cooling Method	Free air convection cooling or forced air cooling

Electromagnetic Compatibility (EMC)

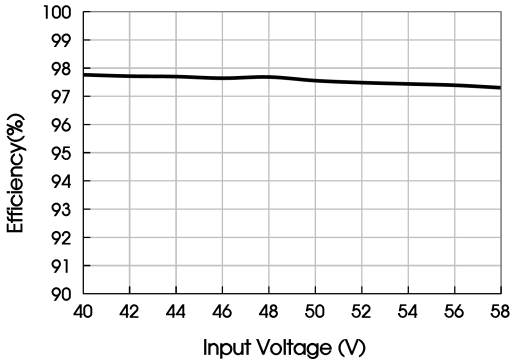
EMI	CE	CISPR32/EN55032 CLASS A（see Fig. 4 for recommended circuit）
	RE	CISPR32/EN55032 CLASS A（see Fig. 4 for recommended circuit）

Typical Characteristic Curve

Efficiency Vs Output Load



Efficiency Vs Input Voltage (Full Load)



Design Reference

1. Typical application circuit

The input voltage ranges from 40 to 60VDC. When the input voltage exceeds 60VDC, the power loss is higher than the normal input voltage.

If the customer does not use our EMC recommended circuit, the input must be connected with at least 2*470μF electrolytic capacitors to suppress the possible surge voltage at the input and ensure that the transient voltage does not exceed the specified value of the input surge voltage.

In addition, the impedance of both the input source and the load will interact with the impedance of the product, requiring the input source to have a low impedance characteristic, and it is recommended that the minimum capacitance of the external input can be guaranteed at low temperatures as 2*470 μF. In some applications, performance can be enhanced by adding external capacitors. If the input voltage source contains significant inductance, a low ESR ceramic capacitor of 22-100 μF needs to be added to the input of the product to ensure stable operation. The minimum required capacitance depends on the output power and input voltage. The higher the output power, the larger the input capacitance.

The output end must be connected with an electrolytic capacitor larger than the minimum capacitive load capacity to stabilize the output working state of the product.

If it is required to further reduce the input and output ripple, the input and output external capacitors Cin and Cout can be increased or a capacitor with a small series equivalent impedance value can be selected, but the capacitance value cannot be greater than the maximum capacitive load of the product.

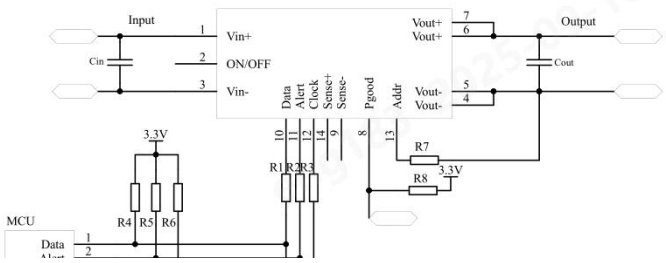


Fig. 1

Output voltage \ Capacitor value	Cout(typ.)	Cin
12V	4000μF/16V① (300uF MLCC+3700uF Oscon)	2*470 μF/100V

2. Ripple noise test circuit

In addition to the "1. Typical Application Circuit" capacitors, 10μF/35V tantalum capacitors and 0.1μF/25V ceramic capacitors should be added to the ripple noise test. It is recommended to use the following recommended peripheral circuit, and set the probe bandwidth to 20MHz during the test.

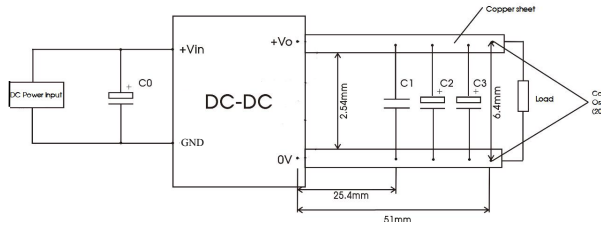


Fig. 3

Components	Recommended Component
C0	470μF/100V*2 electrolytic capacitors
C1	0.1μF/25V ceramic capacitance
C2	10μF/25V Tantalum capacitor
C3	4000μF/16V① (300μF MLCC+3700μF Oscon)

3. EMC compliance circuit

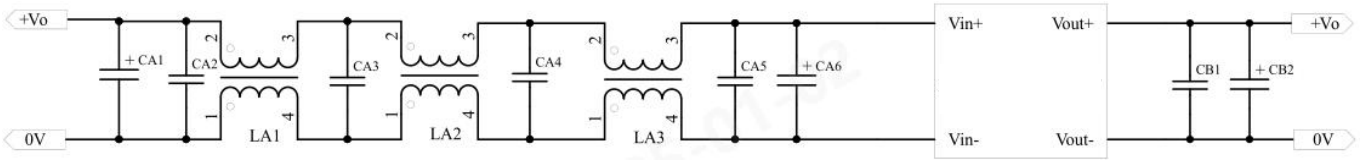
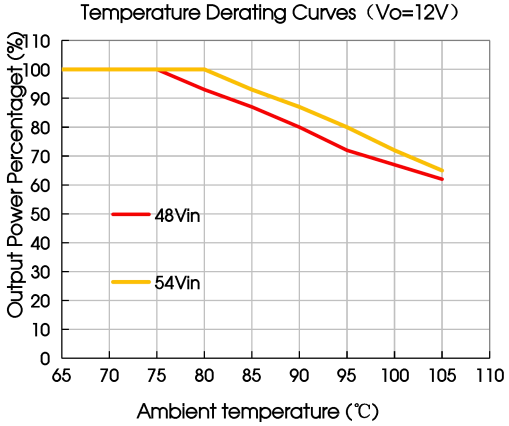


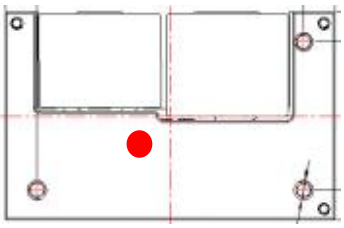
Fig. 4

Components	Recommended Component
CA1	2*560μF/100V electrolytic capacitors
CA2、CA3、CA4、CA5	2.2μF/100V ceramic capacitance
CA6	560μF/100V electrolytic capacitors
LA1	1mH, recommended to use MORNSUN P/N: FL2D-D0-102
LA2	1.5mH, recommended to use MORNSUN P/N: FL2D-D0-152
LA3	0.56mH, recommended to use MORNSUN P/N: FL2D-D0-561
CB1	1μF/25V ceramic capacitance
CB2	3*1000μF/100V electrolytic capacitors

4. High temperature design reference

In the process of application, product thermal design can be evaluated by combining product temperature derating curve, or determine the stable working range of the product by testing the temperature of each temperature test point of ABCDEFG in Fig 6. When the temperature of each point is lower than 125℃, it is the stable working range of the product. The C is the internal temperature sampling point of the product. F and G are the temperature test points of the shell surface directly above the transformer core and the inductor core respectively.



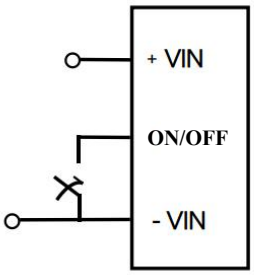


5. Input start/off voltage

The product contains an input voltage sampling circuit, which has been set to sample the input voltage, and set the input starting voltage and undervoltage turn-off voltage. Generally, in order to avoid repeated startup of the product caused by input voltage disturbance, the input startup voltage is set slightly higher than the undervoltage turn-off voltage, and there is a hysteretic voltage difference of about 2VDC.

6. Remote switch control (ON/OFF)

The product is equipped with remote control function, reference to the input power negative input (-Vin), compatible with the design of negative and positive logic options, the default is negative logic, normal ON/OFF pin suspended voltage of 3.3V; In cases where a control signal or switch is not required and the product is expected to be automatically enabled, the ON/OFF pin should be connected directly to the -Vin. The ON/OFF function allows the product to be turned on/off by an external device, such as a semiconductor or mechanical switch.



The external device must provide the required minimum absorbing current capacity >0.3 mA to ensure that the voltage of the ON/OFF pin meets the enable voltage specification (see Input Characteristics). The ON/OFF input signal is maintained for at least 1ms by enabling or disabling the product with the ON/OFF pin.

7. PMBus addressing

The following address resistor connection diagram and table show the recommended resistance values for hardwired PMBus addresses. (±1% tolerance resistor recommended)

PMBUS Address	R（KΩ）
96	10
97	15
98	21
99	28
100	35.7
101	45.3
102	56.2
103	69.8
104	88.7
105	107
106	130
107	158
108	191
109	232

8. DLS paralleled current sharing

Allows products to be connected in parallel and share current with ±7.5% accuracy at maximum output power. Each module can use up to 90% of the rated current, without current sharing pins, by connecting the Vin (+) and Vout (+) pins of the module together. For better flow sharing effect, the number of parallel modules should not exceed 4

PCB Designers recommend

The inputs must be connected to the same voltage source, and the impedance from the input voltage source to each module must be as equal as possible;

The PCB output to the load is as equal as possible;

For more accurate current-sharing accuracy testing, the module should be welded to avoid contact impedance with the test plate

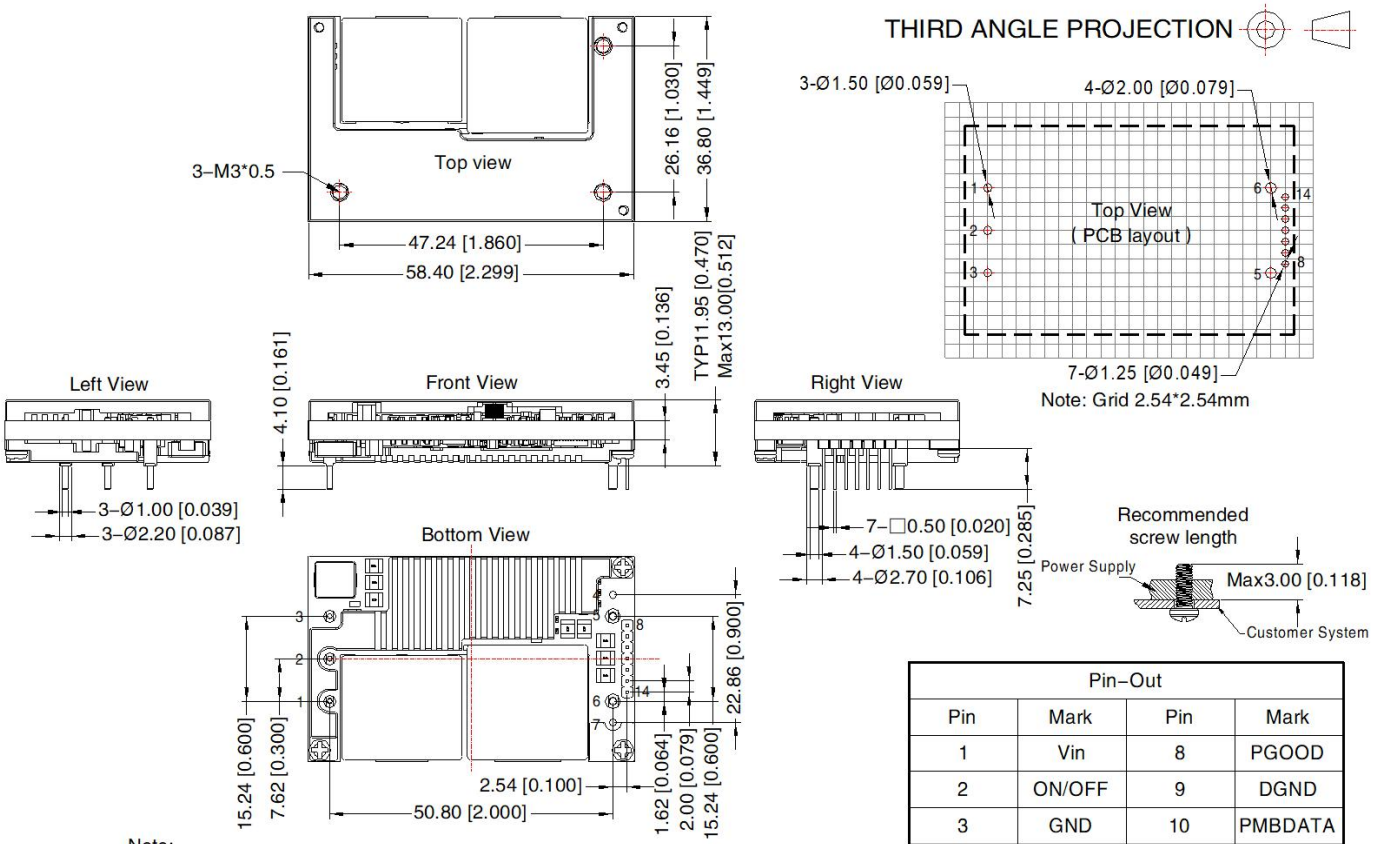
Designers recommend

Before all modules are started, the total load current should be lower than the rated current of one module;

ON/OFF between modules should be connected together;

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

Dimensions and Recommended Layout



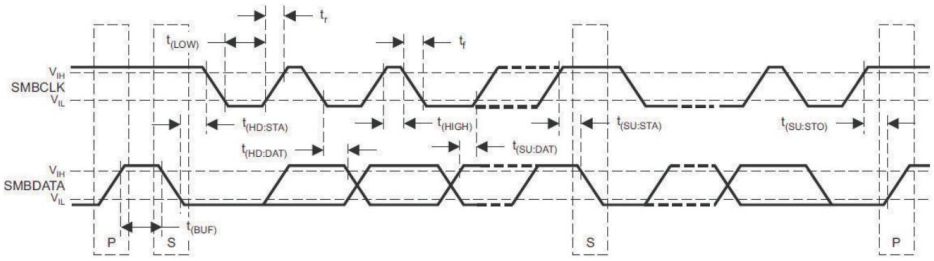
Note:
Unit: mm[inch]
Terminal section tolerances: ±0.10 [±0.004]
General tolerances: ±0.50 [±0.020]
Terminal recommended torque: M3，0.4N・m±10%
The layout of the device is for reference only, please refer to the actual product

Pin-Out			
Pin	Mark	Pin	Mark
1	Vin	8	PGOOD
2	ON/OFF	9	DGND
3	GND	10	PMBDATA
4	No Pin	11	PMBALT
5	0V	12	PMBCLK
6	+Vo	13	PMBADD
7	No Pin	14	IMON

PMBus Electrical specification

Item	Operating Conditions	Range of application	Min.	Typ.	Max.	Unit
Communication rate		Product specification	--	400	--	kHz
Programmable address		Product specification		■YES □NO		
Supported by SALERT		Product specification		■YES □NO		
Communication data storage	Communication data can be saved after power-off	Product specification		■YES □NO		
Meet the specification command	Meet at least one normative command	Product specification		■YES □NO		
Enter the under-voltage command	The upper and lower limits need to be controlled and adjusted	Product specification	30	--	60	V
Enter the overvoltage command		Product specification	30	--	66	V
Output the under-voltage command		Product specification	--	--	--	V
Output overvoltage command		Product specification	0	--	16	V
Output voltage adjustment		Product specification	--	--	--	V
Output voltage bias adjustment		Product specification	--	--	--	V
Output overcurrent adjustment		Product specification	--	--	140	A
Output rise time		Product specification	10	--	--	ms
Over-temperature protection adjustment		Product specification	0	--	120	℃
Output the rising slope		Product specification	0.001	--	1.2	V/ms
Note: 1.Unless otherwise specified, all indicators are measured within the operating temperature range, input voltage range and output load range.						
PMBus Electrical specification						
Logic Output Low Signal Level (VOL)	PMBCLK, PMBDATA, PMBALT, PGOOD, IOH= 4 mA, VDD=3V	Product specification	--	--	DGND +0.25	VDC
Logic Output High Signal level (VOH)		Product specification	VDD-0.6	--	--	
Logic Output High Source current (IOH)		Product specification	--	--	4	mA
Logic Output Low Sink Current (IOL)		Product specification	-4	--	--	
Logic Input High Threshold (VIH)	VDD=3V	Product specification	2.1	--	--	VDC
Logic Input Low Threshold (VIL)		Product specification	--	--	1.1	
Parasitic Capacitance		Product specification	--	--	400	pF
Internal Pull-up Resistance	PMBus ON/OFF	Product specification	--	47	--	kΩ
PMBus Operating Frequency	Operating frequency range; Slave mode: PMBUS 50% duty cycle	Product specification	100	400	1000	kHz
	Default operating frequency; Slave mode: PMBUS 50% duty cycle		--	400	--	
STOP TO START Min Time t(BμF)	See System Management Bus Specification Version 3.0	Product specification	--	1.3	--	μs
START Continue Time t(HD:STA)		Product specification	--	0.6	--	
Repeat START Time t(SU:STA)		Product specification	--	0.6	--	
STOP Continue Time t(SU:STO)		Product specification	--	0.6	--	
Data Continue Time t(HD:DAT)		Product specification	--	0	--	
Data Set Time t(SU:DAT)		Product specification	--	100	--	
Error Signal Time $t_{(TIMEOUT)}$		Product specification	--	--	35	ms
Clock Low Level Time $t_{(LOW)}$		Product specification	--	1.3	--	μs
Clock High Level Time $t_{(HIGH)}$		Product specification	--	0.6	--	
Clock low level accumulated time$t_{(LOW:SEXT)}$		Product specification	--	--	25	ms

Note:
Unless otherwise specified, all indicators are measured in the operating temperature range, input voltage range, output load range。
The data were obtained at 25℃, VCC=3.3V, 400kHz. The test data is applicable to all PMBus functional pins, and the timing diagram is as follows:



PMBus Command

Command word	Command	Function	Transmission class	KCR4812QBO-860WA	
				Default	Default value description
				12Vout	12Vout
0x01	OPERATION	Switch enable	R/W byte	0x88	
0x02	ON_OFF_CONFIG	Switch configuration	R/W Byte	0x1C	
0x03	CLEAR_FAULTS	Clear the fault	W Byte		
0x10	WRITE_PROTECT	Command write protection	R/W Byte	0x00	
0x11	STORE_DEFAULT_ALL	Save to NVM	W Byte		
0x19	CAPABILITY	capacity of equipment	R Byte	0xB0	
0x20	VOUT_MODE	Output voltage data format	R Byte	0x14	Ulinear16, N = -12
0x46	IOUT_OC_FAULT_LIMIT	The overcurrent fault value is displayed	R/W Word	0xF28C	135A
0x4A	IOUT_OC_WARN_LIMIT	Output an overcurrent alert value	R/W Word	0xF258	125A
0x4F	OT_FAULT_LIMIT	Overtemperature fault value	R/W Word	0xEBC0	120℃
0x51	OT_WARN_LIMIT	Overtemperature alarm value	R/W Word	0xEB70	110℃
0x5E	POWER_GOOD_ON	Voltage Good start threshold	R/W Word	0x8000	8V
0x5F	POWER_GOOD_OFF	Voltage good off threshold	R/W Word	0x5000	5V
0x60	TON_DELAY	Output startup delay time	R/W Word	0xBA00	1ms
0x79	STATUS_WORD	Word read total status	R Word		
0x7A	STATUS_VOUT	Read the output voltage status	R Byte		
0x7B	STATUS_IOUT	Read the output current status	R Byte		
0x7C	STATUS_INPUT	Read the input voltage status	R Byte		
0x7D	STATUS_TEMPERATURE	Read temperature status	R Byte		
0x7E	STATUS_CML	Read command/logic status	R Byte		
0x88	READ_VIN	Read input voltage	R Word		
0x8B	READ_VOUT	Read output voltage	R Word		
0x8C	READ_IOUT	Read output current	R Word		
0x8D	READ_TEMPERATURE_1	Read temperature	R Word		
0x98	PMBus_REVISION	Read PMBus version number	R Byte	0x33	
0x99	MFR_ID	Read company name	R/W Block	"MORNSUN"	
0x9A	MFR_MODEL	Reading device type	R/W Block	/	
0x9B	MFR_REVISION	Reading device version	R/W Block	/	
0x9C	MFR_LOCATION	Read company address	R/W Block	"Guangzhou, China"	

0xB5	MFR_HICCUP_COUNT	Set the number of hiccups on the device	R/W Byte	0xFF	Default unlimited burp mode
0xE2	MFR_PGOOD_POLARIT	Voltage good logic	R/W Byte	0x01	Default negative logic

PMBus Command detail

OPERATION (0x01)
Transport type：R/W Byte
Function: switch control and alarm control

Bit	Function	Description	Value	Function	Description	Default
7	Enable	The device output function was enabled	1	Enable	Open output voltage	1
			0	Disable	Off output voltage	
6	Reserved	/	/	/	/	0
5:4	Reserved	/	/	/	/	00
3:2	Enable Fault	Set the fault alarm line	10	Enable SALERT	When a fault occurs, the SALERT line is set	10
			01	Disable SALERT	When a fault occurs, the SALERT line will not operate	
1:0	Reserved	/	/	/	/	00

ON_OFF_CONFIG (0x02)
Transport type：R/W Byte
Function: Start control

Bit	Function	Description	Value	Function	Description	Default
7:5	Reserved	/	/	/	/	000
4	Power-on setting	Set the default power-on configuration. Whether to directly start output after power-on	1	Enable Pin or PMBus	After the device is powered ON, you need to enable the ON/OFF pin signal and the OPERATION command to output	1
			0	Enable Always	Set to start output directly after power-on	
3	OPERATION enabled	Set OPERATION command	1	Enable OPERATION	Enable to start output by using OPERATION commands	1
			0	Disable OPERATION	Disable the ability to start output by OPERATION command	
2	ON/OFF enabled	facilities ON/OFF control	1	Enable ON/OFF control	Enable the ON/OFF control to start output	1
			0	Disable ON/OFF control	Disable ON/OFF control to start output	
1	ON/OFF level	ON/OFFactive level	1	Positive Logic	Active high	0
			0	Negative Logic	Active low	
0	Reserved	/	/	/	/	0

CLEAR_FAULTS (0x03)
Transport type：W Byte
Function: Clear all faults

WRITE_PROTECT (0x10)
Transport type：R/W Byte
Function: PMBus write-protection

Bit	Function	Description	Value	Function	Description	Default
7:0	write-protection	Configure write protection for some PMBus commands	0x80	Disable all	All write protection except the 0x10 command	0x00
			0x40	Enable OPERATION	All commands are write protected except 0x10 and 0x01	
			0x20	Enable control and Vout	All commands are write protected except 0x10, 0x01, 0x02, and 0x21	
			0x00	Enable all	Disable all write protection	

STORE_DEFAULT_ALL (0x11)
Transport type: Send Byte
Function: Commands the device to store its configuration in the default store

RESTORE_DEFAULT_ALL (0x12)
Transport type: Send Byte
Function: Command the device to restore its configuration from the default storage

CAPABILITY (0x19)
Transport type: R Byte
Function: Used to read the supported functions of the device

Bit	Function	Description	Value	Function	Description	Default
7	PEC	Whether the device supports packet error verification	1	support		1
			0	nonsupport		
6:5	bus speed	Maximum bus speed	11	1mHz		01
			01	400kHz		
			00	100kHz		
4	troubling line	Whether the SALERT fault line function is enabled	1	Have SALERT		1
			0	Without SALERT		
3:0	Reserved	/	/	/	/	0000

VOUT_MODE (0x20)
Transport type: R Byte
Function: Used to read output voltage data format

Bit	Function	Description	Value	Function	Description	Default
7:5	Define formats	Output voltage related commands support only Ulinear16 format	000	Ulinear16	Ulinear16 data format：Y=X*2N	101
4:0	N value	Ulinear16 N value in data	-12			00000

IOUT_OC_FAULT_LIMIT (0x46)
Transport type: R/W Word
Function: Set the fault point of output overcurrent. After the output voltage is soft-started for 8ms (2ms for current-sharing ACS/DLS), the system starts to determine whether the output voltage is overcurrent and take appropriate protection actions.

Bit	Function	Format	Unit	Default
15:0	Set the output overcurrent fault point. When the output current is higher than the voltage value, the SALERT pin detects the fault state and will be set to low. The SALERT pin will keep the low level and make corresponding protection actions	Linear11	A	0xF28C

IOUT_OC_WARN_LIMIT (0x4A)
Transport type: R/W Word
Function: Set the output overcurrent alert point

Bit	Function	Format	Unit	Default
15:0	Set the output overcurrent alarm point, when the output current is higher than this voltage value, the SALERT pin detects the fault state, will be set low, and the SALERT pin will remain low	Linear11	A	0xF258

OT_FAULT_LIMIT (0x4F)
Transport type: R/W Word
Function: After the overtemperature fault point is set, the system determines whether the monitoring point is overtemperature and takes corresponding protection actions.

Bit	Function	Format	Unit	Default
15:0	When the temperature of the sampling point is higher than the temperature value, the SALERT pin detects the fault state and is set to low. The SALERT pin will keep the low level and take corresponding protection actions	Linear11	℃	0xEBC0

OT_WARN_LIMIT (0x51)
Transport type: R/W Word
Function: Set the overtemperature alarm point

Bit	Function	Format	Unit	Default
15:0	When the temperature of the sampling point is higher than the temperature value, the SALERT pin detects the fault state and will be set to low, and the SALERT pin will remain low	Linear11	℃	0xEB70

POWER_GOOD_ON (0x5E)
Transport type: R/W Word
Function: Set the output start point to detect the start delay fault (0X62 TON_MAX_FAULT_LIMIT). If the output voltage is higher than this value, the PG_Sync pin (Power Good) is set to low

Bit	Function	Format	Unit	Default
15:0	Set the output start point	Ulinear16	V	0x8000

POWER_GOOD_OFF (0x5F)
Transport type: R/W Word
Function: If the output voltage is lower than this value, PG_Sync pin (Power Good) is set to a high value. During startup, PG_Sync pin (Power Good) is set to a high value.

Bit	Function	Format	Unit	Default
15:0	Set the output off breakpoint	Ulinear16	V	0x5000

TON_DELAY (0x60)
Transport type: R/W Word
Function: Set the startup delay time. Output ENABLE to the time when VOUT starts to rise. The minimum value is 1ms. The delay is directly equivalent to the delay established by enabling the output signal and output voltage using the "ON/OFF, OPERATION" function. When the system is enabled by restarting the input power supply, the delay is added to the startup delay. The total startup delay is 39ms+TON_DELAY.

Bit	Function	Format	Unit	Default
15:0	Set the startup delay time	Linear11	ms	0xBA00

STATUS_WORD (0x79)
Transport type: R Word
Function: Return device status in WORD

Bit	Function	Description	Function	Description
15	VOUT	An output voltage failure or alarm has occurred	1	fault
			0	fault-free
14	IOUT	An output current failure or alarm has occurred	1	fault
			0	fault-free
13	VIN	An input fault or alarm has occurred	1	fault
			0	fault-free
12:6	Reserved	/	/	/
5	VOUT over-voltage	An output over-voltage fault occurred	1	fault
			0	fault-free
4	IOUT over-current	An output over-current fault occurred	1	fault
			0	fault-free
3	VIN under-voltage	An input under-voltage fault occurred	1	fault
			0	fault-free
2	over-temperature	An over-temperature fault or alarm has occurred	1	fault
			0	fault-free
1	Command/Logic	A command/logic failure has occurred	1	fault
			0	fault-free

STATUS_VOUT (0x7A)
Transport type: R Byte
Function: Returns the output voltage status of the device

Bit	Function	Description	Function	Description
7	The output overvoltage is faulty	Over-voltage Fault	1	fault
			0	fault-free
6	Output overvoltage alarm	Output over-voltage alarm	1	fault
			0	fault-free
5	Output undervoltage alarm	Lack-voltage alarm	1	fault
			0	fault-free
4	The output undervoltage is faulty	Under-voltage fault	1	fault
			0	fault-free
3	Reserved	/	/	/

2	Reserved	/	/	/
1	Reserved	/	/	/

STATUS_IOUT (0x7B)
Transport type: R Byte
Function: Return the output current status of the device

Bit	Function	Description	Function	Description
7	Overcurrent fault	Overcurrent fault	1	fault
			0	fault-free
6	Short fault	Overcurrent and undervoltage faults	1	fault
			0	fault-free
5	Overcurrent alarm	Overcurrent alarm	1	fault
			0	fault-free
4:0	Reserved	/	/	/

STATUS_INPUT (0x7C)
Transport type: R Byte
Function: Returns the input voltage status of the device

Bit	Function	Description	Function	Description
7	The input overvoltage is faulty	The input overvoltage is faulty	1	fault
			0	fault-free
6	Enter an overvoltage alarm	Enter an overvoltage alarm	1	fault
			0	fault-free
5	Enter undervoltage alarm	Enter undervoltage alarm	1	fault
			0	fault-free
4	The input undervoltage is faulty	The input undervoltage is faulty	1	fault
			0	fault-free
3:0	Reserved	/	/	/

STATUS_TEMPERATURE (0x7D)
Transport type: R Byte
Function: Return device Device temperature status

Bit	Function	Description	Function	Description
7	Overtemperature fault	Overtemperature fault	1	fault
			0	fault-free
6	temperature alarm	temperature alarm	1	fault
			0	fault-free
			0	fault-free
4:0	Reserved	/	/	/

STATUS_CML (0x7E)
Transport type: R Byte
Function: Return the communication/logic/storage fault status

Bit	Function	Description	Function	Description
7	command fault	Unsupported command	1	fault
			0	fault-free
6	Data failure	Unsupported command	1	fault
			0	fault-free
5	PEC fault	PEC miscalculation	1	fault
			0	fault-free
4	Memory Failure	Memory Failure	1	fault
			0	fault-free
1	Other communication faults	Other communication faults	1	fault
			0	fault-free
0	logic fault	logic fault	1	fault
			0	fault-free

READ_VIN (0x88)
Transport type: R Word
Function: Return input voltage

Bit	Function	Format	Unit
15:0	Return input voltage	Linear11	V

READ_VOUT (0x8B)
Transport type: R Word
Function: Return output voltage

Bit	Function	Format	Unit
15:0	Return output voltage	Ulinear16	V

READ_IOUT (0x8C)
Transport type: R Word
Function: Return output current

Bit	Function	Format	Unit
15:0	Return output current	Linear11	A

READ_TEMPERATURE_1 (0x8D)
Transport type: R Word
Function: Go back inside the chip and measure the temperature

Bit	Function	Format	Unit
15:0	Go back inside the chip and measure the temperature	Linear11	℃

PMBus_REVISION (0x98)
Transport type: R Byte
Function: Returns the PMBus version supported by this device

Bit	Function	Value	Description
7:4	PMBus Part1 versions	0000	Part 1 Revision 1.0
		0001	Part 1 Revision 1.1
		0010	Part 1 Revision 1.2
		0011	Part 1 Revision 1.3
3:0	PMBus Part 2 versions	0000	Part 2 Revision 1.0
		0001	Part 2 Revision 1.1
		0010	Part 2 Revision 1.2
		0011	Part 2 Revision 1.3

MFR_ID (0x99)
Transport type: R Block
Function: Return company ID

Bit	Function	Format
15:0	Return company ID	ASCII

MFR_MODEL (0x9A)
Transport type: R Block
Function: Return device model

Bit	Function	Format
15:0	Return device model	ASCII

MFR_REVISION (0x9B)
Transport type: R Block
Function: Return the device version number

Bit	Function	Format
15:0	Return the device version number	ASCII

MFR_LOCATION (0x9C)
Transport type: R Block
Function: Return to company address

Bit	Function	Format
15:0	Return to company address	ASCII

MFR_HICCUP_COUNT (0xB5)
Transport type: R/W Byte
Function: Set the number of hiccups

Function	Value	Description	Default
Limited hiccup mode	0~0xFE	Module failure causes limited hiccups	/
Infinite hiccup mode	0xFF	Module faults cause persistent hiccups	/

MFR_CTRL_LEVEL (0xE2)
Transport type: R/W Byte
Function: set POWER GOOD logic

Bit	Function	Value	Description	Default
7:1	Reserved	/	/	
0	set POWER GOOD logic	0	POWER GOOD negative logic, output greater than the threshold, PG low level	1
		1	POWER GOOD positive logic, output greater than the threshold, PG high level	

Notes:
1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58210451;
2. The maximum capacitive load offered were tested at Vin = 45-60 V and full load;
3. Unless otherwise specified, parameters in this data sheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
4. All index testing methods in this data sheet are based on company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. 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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