

Data Sheet: iJB Series – Non Isolated Digital POL module

Ordering information

Product Identifier	Platform	Input Voltage	Output Current	Output Unit	Output Range	# of Output		Safety Class	Feature Set	RoHS Indicator
i	J B	12	060	A	006	V	-	0	01	-R
TDK-Lambda Dallas Technical Center	Digital POL 1.05inch X 0.95inch	8 -14.0V	60	Amps	0.6 to 2.0V	Single	-	-	See below	RoHS Compliant

Feature Table

Feature Set	Output Voltage Set method	On/Off logic	OCP	OVP	Transient Response
00	TRIM-pin	Positive	Auto Recovery	Auto Recovery	Standard
01	TRIM-pin	Negative	Auto Recovery	Auto Recovery	Standard
02	TRIM-pin	Positive	Auto Recovery	Auto Recovery	Enhanced
03	TRIM-pin	Negative	Auto Recovery	Auto Recovery	Enhanced

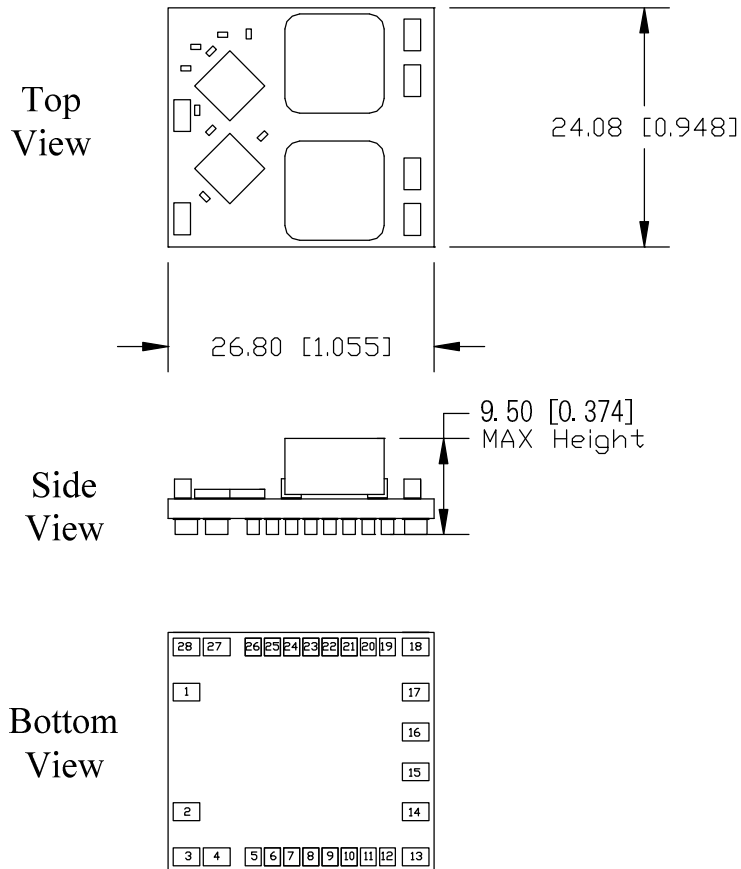
Product offering

Code	Input Voltage	Output Voltage	Output Current	Maximum Output Power	Efficiency
iJB12060A006V	8-14.0V	0.6 – 2.0V	60A	120W	93.0%(@Vin:12V)

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Mechanical Specification

Dimensions are in mm [inch]. Unless otherwise specified tolerance are $x.x \pm 0.5$ [0.2], $x.xx \pm 0.25$ [0.010]

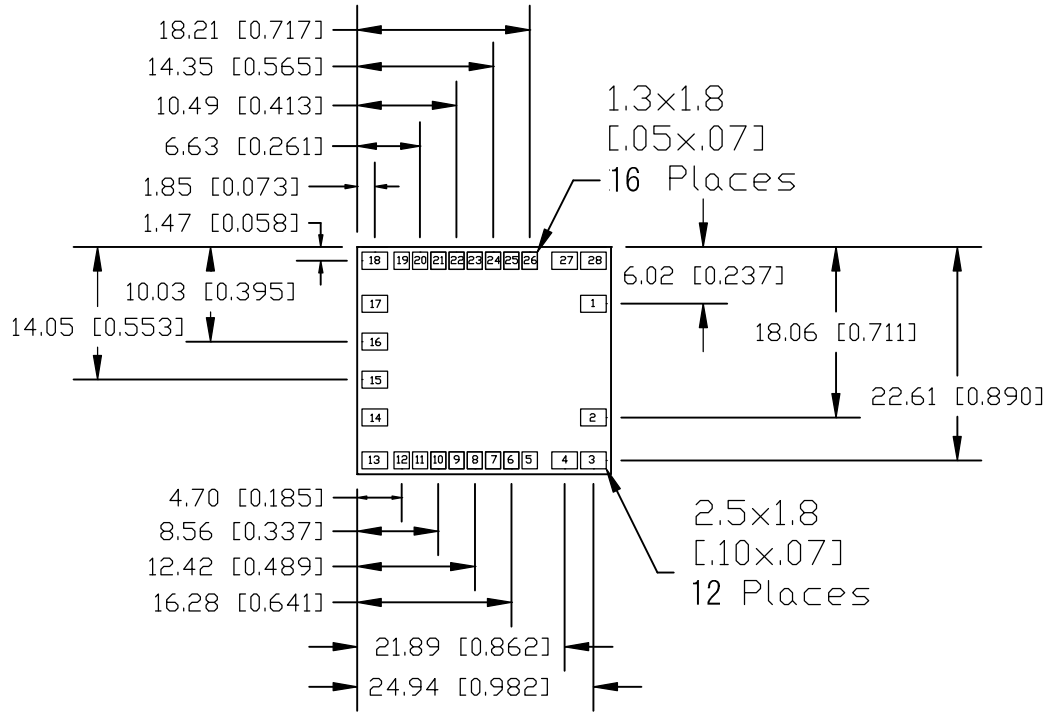


Pin Assignment:

Pin	Function	Note	Pin	Function	Note
1	Vin	Input Voltage	15	Vout	Output Voltage
2	Vin	Input Voltage	16	Vout	Output Voltage
3	GND	Power ground pin	17	Vout	Output Voltage
4	GND	Power ground pin	18	GND	Power ground pin
5	SGND	Signal ground pin	19	SCLK	PMBus
6	NC	Don't connect anywhere	20	SDAT	PMBus
7	TRIM	Set Output voltage	21	SALT	PMBus
8	ADDR	PMBus address	22	EN	Remote ON/OFF
9	NC	Don't connect anywhere	23	FAULT	Fault Management
10	PSET	Set Parallel operation mode	24	PGOOD	Power Good
11	SENSE(+)	Remote sense (+)	25	SHARE	Current Share on Parallel Operation
12	SENSE(-)	Remote sense (-)	26	SYNC	Synchronize on Parallel Operation
13	GND	Power ground pin	27	GND	Power Ground pin
14	Vout	Output Voltage	28	GND	Power Ground pin

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Foot print and pin assignment (Top view)



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Absolute Maximum Rating

Stress in excess of Absolute Maximum Rating may cause permanent damage to the device

Characteristic	Symbol	Min.	Max.	Unit	Note & Condition
Input Voltage	V _{in}	-0.3	16	V	V _{in}
Logic pin Voltage	V _{logic}	-0.3	5.5	V	EN,FAULT,PGOOD,SCLK,SDAT,SALT
Operating Temperature range	T _c	-40	120	°C	Maximum temperature as measured at the location specified in thermal measurement figure varies with output current. See curve in the thermal performance of the data sheet.
Storage Temperature	T _{stg}	-55	125	°C	

Electrical specification

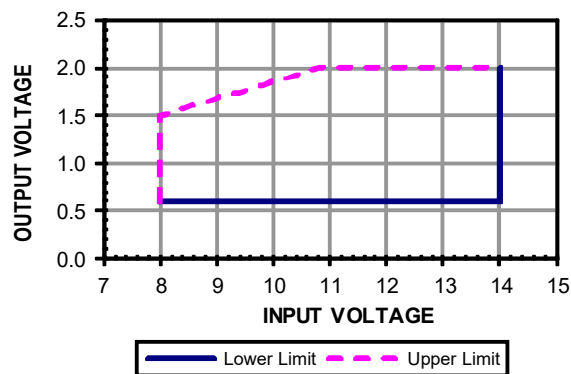
Unless otherwise specified, specifications apply over all Rated Input Voltage, Resistive Load, and Temperature conditions.

Input Specification

Characteristic	Symbol	Min.	Typ.	Max.	Unit	Note & Condition
Operating Input Voltage	V _{in}	8.0	12.0	14.0	V	See Input Voltage vs Output Voltage Derating Curve
Maximum Input Current	I _{in(max)}			20	A	8V _{in} , 2.0V _o , I _o = 60A
Turn-On Input Voltage ⁽¹⁾	V _{in(on)}		7.6		V	
Turn-Off Input Voltage ⁽¹⁾	V _{in(off)}		7.0		V	
Input Over Voltage Protection ⁽¹⁾	V _{in(ov)}		15.0		V	V _{hys} = 1.0V
Turn-On delay time from V _{in} ⁽¹⁾	T _{d(vin,on)}		12		ms	V _o =0 to 0.1*V _{o,set} ; on/off-on, I _o =I _{o,max} , T _c =25°C
Turn-On delay time from EN ⁽¹⁾	T _{d(on)}		2		ms	V _o =0 to 0.1*V _{o,set} ; V _{in} =V _{i,nom} , I _o =I _{o,max} , T _c =25°C
Output Rise time ⁽¹⁾	T _{rise}		3		ms	V _o =0.1 to 0.9*V _{o,set} ; I _o =I _{o,max} , T _c =25°C
In rush Current	I _{rush}			1.0	A ² s	
Input ripple rejection			50		dB	@120Hz

Note ⁽¹⁾: User can change the value by PMBus command. Please contact TDK-Lambda for more detail
Caution: The power modules are not internally fused. An external input line normal blow fuse with a maximum value of 40A is required.

Input Voltage vs. Output Voltage Derating Curve



If operating range below dotted line, the module will regulate output voltage but ripple may increase.

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Output Specification

Characteristic	Symbol	Min.	Typ.	Max.	Unit	Note & Condition
Output Voltage Adjustment Range	Vout	0.6		2.0	V	Contact TDK-Lambda if higher output voltage setting is required
Output Current	Iout	0		60	A	
Efficiency Vo = 0.6V Vo = 1.0V Vo = 1.5V Vo = 2.0V	Eff		85.0 89.5 92.0 93.0		%	12Vin, Io = 0.8*Iout(max), Tc = 25°C
Switching Frequency	fsw		375		kHz	fixed
Remote sense range				0.5	V	
Output Voltage Set point Accuracy	Vset	-0.5		0.5	%	0.6V ≤ Vset ≤ 1.2V and VOUT_SCALE_LOOP = 0x4000
Output Voltage Tolerance			±1.2		%	
Load Regulation (Io = Io, min to Io, max)			4	8	mV	Please see Output Voltage setting on “Operating Information” section for more detail.
Line Regulation (Vin = Vin, min to Vin, max)			4	8	mV	
Output Ripple and Noise (Standard option)				30	mVp-p	
Output Ripple and Noise (enhanced option)				60	mVp-p	Cout = Cout(min) BW = 200MHz
Output Capacitance Range (Standard option)	Cout	600		5000	uF	Please contact TDK-Lambda if higher capacitance is required. Be aware of bias voltage impact when using ceramic capacitors
Output Capacitance Range (enhanced option)	Cout	1000		5000	uF	
Output Voltage Set point Accuracy		-1.0		1.0	%	1.2V < Vset ≤ 2.0V and VOUT_SCALE_LOOP = 0x1249
Output Voltage Tolerance			±1.5		%	
Load Regulation (Io = Io, min to Io, max)			8	12	mV	Please see Output Voltage setting on “Operating Information” section for more detail.
Line Regulation (Vin = Vin, min to Vin, max)			8	12	mV	
Output Ripple and Noise (Standard option)				50	mVp-p	
Output Ripple and Noise (enhanced option)				100	mVp-p	Cout = Cout(min) BW = 200MHz
Output Capacitance Range (standard option)	Cout	1000		5000	uF	Please contact TDK-Lambda if higher capacitance is required Be aware of bias voltage impact when using ceramic capacitors
Output Capacitance Range (enhanced option)	Cout	1500		5000	uF	

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Feature Specification

Characteristic	Symbol	Min.	Typ.	Max.	Unit	Note & Condition
On/Off	Ven(on)			0.8	V	Pulled up to 3.3V by 100kohm inside of the module.
	Ven(off)	2.0			V	
Power Good range	Vpg		±12.5		%	
Over Current Protection Threshold ⁽¹⁾	Iocp		65		A	
Over Current Protection delay	Td(ocp)		1500		us	
Output Over Voltage Protection ⁽¹⁾	Vo(ov)		+20		%	
Over Temperature Warning ⁽¹⁾	Totw		125		°C	Configurable by PMBus command. SALT will be asserted but the module keeps running.
Under Temperature Warning ⁽¹⁾	Tutw		-40		°C	
Over Temperature Protection ⁽¹⁾	Totp		125		°C	Junction Temperature of the Control chip The hysteresis is 15°C (typ).
Critical Over Temperature Protection	Totp_crit		150		°C	Junction Temperature of the MOSFET If critical temperature is exceeded, the module will shut down and input power will need to be recycled in order to restart the module.

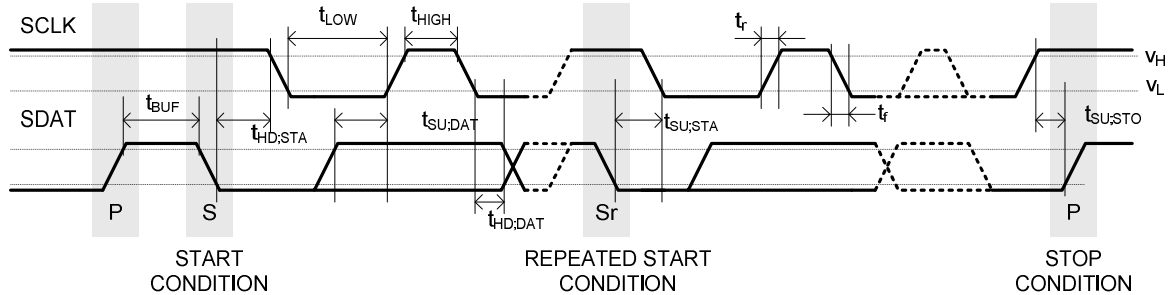
Note ⁽¹⁾: User can change the value by PMBus command. Please contact TDK-Lambda for more detail

PMBus Monitoring accuracy

Characteristic	Symbol	Min.	Typ.	Max.	Unit	Note & Condition
Input Voltage Monitoring Accuracy	Vin(PMB)	-2.0		2.0	%	1.0Vo, Io = 0.5*Iout(max), Tc = 25°C;
Output Voltage Monitoring Accuracy	Vo(PMB)	1.5		1.5	%	12Vin, Io = 0.5*Iout(max), Tc = 25°C;
Output Current Monitoring Accuracy	Io(PMB)	-5.0		5.0	%	12Vin, Io > 0.5*Iout(max), Tc = 25°C; Average of 100 readings
Temperature Monitoring Accuracy	Tj(AMB)	-5		5	°C	Junction Temperature of the Control chip

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PMBus Timing characteristics



PMBus DC and Timing Characteristics

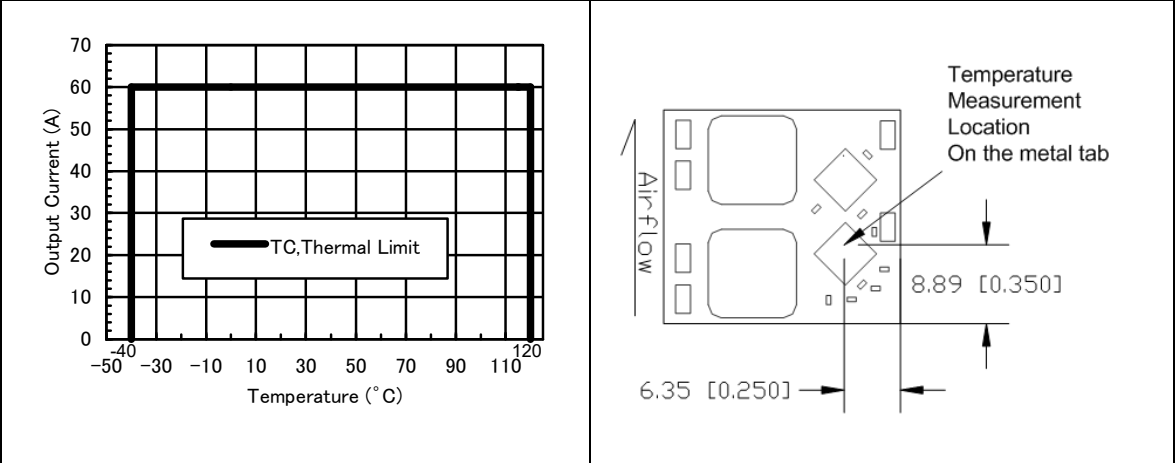
Characteristic	Symbol	Min.	Typ.	Max.	Unit	Note & Condition
Operating Frequency	f_{PMB}	10	100	400	kHz	
Input High Voltage	V_H	2.1			V	SCLK,SDAT
Input Low Voltage	V_L			0.8	V	SCLK,SDAT
Sink current	$I_{S,PMB}$	4			mA	SDAT,SALT current sinking capability
Pin Capacitance	C_{PMB}			10	pF	
Bus Free Time	t_{BUF}	1.3			us	Between Stop and Start Condition
Hold Time	$t_{HD,STA}$	0.6		50	us	Wait time after Start Condition
Repeated Start Condition Setup Time	$t_{SU,STA}$	0.6		50	us	Wait time after Repeated Start Condition
Stop Condition Setup Time	$t_{SU,STO}$	0.6		50	us	
Data Setup Time	$t_{SU,DAT}$	100			ns	
Data Hold Time	$t_{HD,DAT}$	300			ns	
Clock Low Period	t_{LOW}	1.3			us	
Clock High Period	t_{HIGH}	0.6		50	us	
Clock/Data Rise Time	t_R	20		300	ns	
Clock/Data Fall Time	t_F	20		300	ns	

*These specs are guaranteed by design.

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Thermal Performance

Derating curve and measurement point



iJB12060A006V thermal measurement location (top view)

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Supported Standard PMBus command

Functionality	Command	Code (Hex)	Read/Write	Number of Byte	Coefficient (Decimal)
Control	OPERATION	01	R/W	1	N/A
	ON_OFF_CONFIG	02	R/W	1	N/A
Memory	STORE_DEFAULT_ALL*1	11	W	0	N/A
	RESTORE_DEFAULT_ALL	12	W	0	N/A
Output Voltage	VOUT_MODE	20	R	1	N/A
	VOUT_COMMAND	21	R/W	2	m=5120,R=b=0
	VOUT_TRIM	22	R/W	2	m=5120,R=b=0
	VOUT_MAX	24	R/W	2	m=5120,R=b=0
	VOUT_MARGIN_HIGH	25	R/W	2	m=5120,R=b=0
	VOUT_MARGIN_LOW	26	R/W	2	m=5120,R=b=0
	VOUT_TRANSITION_RATE	27	R/W	2	m=256,R=b=0
	VOUT_SCALE_LOOP	29	R/W	2	m=16384,R=b=0
Fault Management	VOUT_SCALE_MONITOR	2A	R	2	m=16384,R=b=0
	CLEAR_FAULT	03	W	0	N/A
	VIN_ON	35	R/W	2	m=1862,R=b=0
	VIN_OFF	36	R/W	2	m=1862,R=b=0
	VOUT_OV_FAULT_LIMIT	40	R/W	2	m=5120,R=b=0
	VOUT_UV_FAULT_LIMIT	44	R/W	2	m=5120,R=b=0
	IOUT_OC_FAULT_LIMIT	46	R/W	2	m=10.24,R=b=0
	OT_FAULT_LIMIT	4F	R/W	2	m=1,R=b=0
	OT_WARN_LIMIT	51	R/W	2	m=1,R=b=0
	UT_WARN_LIMIT	52	R/W	2	m=1,R=b=0
Vout Sequencing	UT_FAULT_LIMIT	53	R/W	2	m=1,R=b=0
	VIN_OV_FAULT_LIMIT	55	R/W	2	m=1862,R=b=0
	TON_DELAY	60	R/W	2	m=62.56,R=b=0
Vout Sequencing	TON_RISE	61	R/W	2	m=32,R=b=0
	TOFF_DELAY	64	R/W	2	m=62.56,R=b=0
	Status	STATUS_BYTE	78	R	1
STATUS_WORD		79	R	2	N/A
STATUS_VOUT		7A	R	1	N/A
STATUS_IOUT		7B	R	1	N/A
STATUS_INPUT		7C	R	1	N/A
STATUS_TEMPERATURE		7D	R	1	N/A
Telemetry	STATUS_CML	7E	R	1	N/A
	READ_VIN	88	R	2	m=1862,R=b=0
	READ_VOUT	8B	R	2	m=640,R=b=0
	READ_IOUT	8C	R	2	m=10.24,R=b=0
	READ_TEMPERATURE	8D	R	2	m=1,R=b=0
Security	PASSWORD	EA	W	2	N/A
	SECURITY_LEVEL	EB	R/W	1	N/A

*1 The "STORE_DEAFULT_ALL" command can be used 2 times to write to NVM before the memory used up. When using the "STORE_DEFAULT_ALL" command, please allow 3 seconds before powering down or the memory could be corrupted.

For more detail information about use of the supported PMBus commands please contact your TDK-Lambda sales or technical support person.

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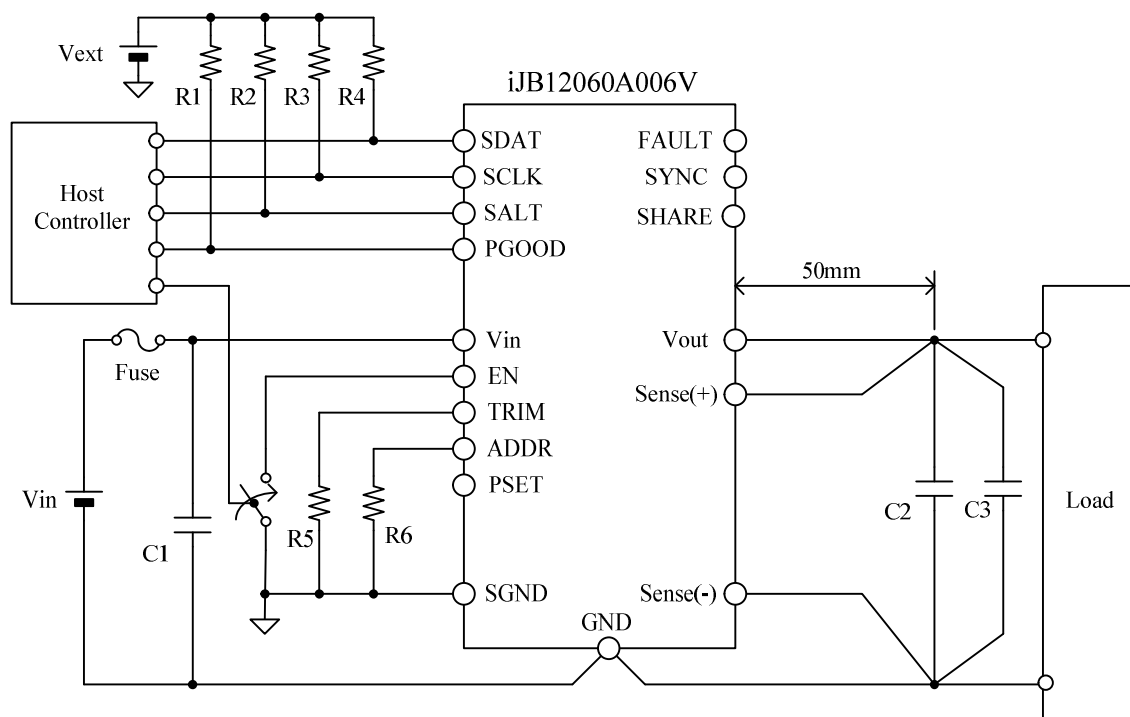
Input Impedance:

The source impedance of the power feeding the DC/DC converter module will interact with the DC/DC converter. To minimize the interaction, 22uF x 6pcs input ceramic capacitor should be present.

Safety Standards:

UL60950-1, CSA60950-1, EN60950-1

Basic Connection :



External Component Values :

Fuse : 40A Normal Blow

Vext : 3.3 - 5V

C1 : 25V, 22uF x 6pcs Ceramic Capacitor

C2 : 6.3V, 10uF x 10pcs Ceramic Capacitor (standard option)
6.3V, 10uF x 15pcs Ceramic Capacitor (enhanced option)

C3 : 10V, 0.1uF

R1,R2,R3,R4 : 10kΩ

R5 : See Table 1

R6 : See Table 2

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Table 1 : Trim resistor configuration table

R _{TRIM}	V _{set}	VOUT_SCALE_LOOP	VOUT_MAX	Note	Other automatically configured parameters*2
0	0.60[V]	0x4000	1.6[V]	Use ±1%,±100ppm/°C resistor.	VOUT_COMMAND = Vset VOUT_MARGIN_HIGH = 1.05 * Vset VOUT_MARGIN_LOW = 0.95 * Vset VOUT_OV_FAULT_LIMIT = 1.20 * Vset VOUT_UV_FAULT_LIMIT = 0.80 * Vset
11.5[kΩ]	0.70[V]				
18.2[kΩ]	0.75[V]				
24.9[kΩ]	0.80[V]				
31.6[kΩ]	0.85[V]				
38.3[kΩ]	0.90[V]				
45.3[kΩ]	0.95[V]				
52.3[kΩ]	1.00[V]				
59.0[kΩ]	1.05[V]				
66.5[kΩ]	1.10[V]				
73.2[kΩ]	1.20[V]				
80.6[kΩ]	1.50[V]	0x1249	3.5[V]	Use ±0.5%,±100ppm/°C resistor.	VOUT_COMMAND = Vset VOUT_MARGIN_HIGH = 1.05 * Vset VOUT_MARGIN_LOW = 0.95 * Vset VOUT_OV_FAULT_LIMIT = 1.20 * Vset VOUT_UV_FAULT_LIMIT = 0.80 * Vset
86.6[kΩ]	1.80[V]				
> 115[kΩ]	0.60[V]*1	0x4000	1.6[V]	-	

*1 No power conversion until PMBus command "OPERATION" is received.

*2 The stored NVM values are ignored if user sets Vout by TRIM pin.

Table 2 : ADDR resistor configuration table

R _{ADDR}	PMBus Address	Note
0[Ω]	0x10	Use ±1%,±100ppm/°C resistor.
10.0[kΩ]	0x11	
13.3[kΩ]	0x12	
17.8[kΩ]	0x13	
21.5[kΩ]	0x14	
26.1[kΩ]	0x15	
31.6[kΩ]	0x16	
34.8[kΩ]	0x17	
38.3[kΩ]	0x18	
42.2[kΩ]	0x19	
46.4[kΩ]	0x1A	
51.1[kΩ]	0x1B	
56.2[kΩ]	0x1C	
61.9[kΩ]	0x1D	
68.1[kΩ]	0x1E	
75.0[kΩ]	0x1F	
82.5[kΩ]	0x20	
90.9[kΩ]	0x21	
100[kΩ]	0x22	
110[kΩ]	0x23	
121[kΩ]	0x24	
133[kΩ]	0x25	
147[kΩ]	0x26	
Open	0x27	