SRBL-C4A1A0

Non-Isolated DC-DC Converter

The SRBL-C4A1A0 is a non-isolated Power Block. It contains the input filtering, power train, and current monitoring of a typical DC/DC converter minus the controller.

The Power Block can be used to provide 4-phase 0.6 VDC to 3.3 VDC output voltage and 35 A maximum output current per phase.

The module is available in a pick-and-place surface mount package. More than 95% efficiency can be achieved at a higher output voltage.

Key Features & Benefits

- 13.2 VDC Max Input
- 4-Phase Output, 0.6 – 3.3 VDC / 35 A per phase
- Non-Isolated
- Low Cost
- High Efficiency
- High Power Density
- Class II, Category 2, Non-Isolated DC/DC Converter (refer to IPC-9592B)

RoHS Compliant

Applications

- Computers and Peripherals
- Networking
- Telecommunications

1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT POWER	MAX. OUTPUT CURRENT	TYPICAL EFFICIENCY
SRBL-C4A1A0G SRBL-C4A1A0R	0.6 - 3.3 VDC	7 - 13.2 VDC	297 W	140 A	90.3% (11 Vin,1.0 V / 140 A out)

PART NUMBER EXPLANATION

S	R	BL	-	C4	A	1A	0	x
Mounting type	RoHS status	Series name		Output current	Input range	Output voltage	Customer Option	Package
Surface Mount	RoHS	Power Block		140 A	7 - 13.2 V	0.6 - 3.3 V	0	G – Tray Package R – Tape and Reel Package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous Input Voltage		-	-	15	V
7 V		-	-	9.5	V
PWM		-	-	3.6	V
Operating Temperature		-40	-	85	°C
Temperature, Short-Term Operating (96 hrs)		-40	-	90	°C
Storage Temperature		-40	-	125	°C
Altitude		-500	-	10000	Feet
Relative Humidity, Operating, Non-Condensing		10	-	90	%

NOTE: All specifications are typical at 25°C unless otherwise stated.

3. INPUT SPECIFICATIONS

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage			7	-	13.2	V
Input Current		Vin = 7.0 V, Vout = 3.3 V, Iout = 90 A, fsw = 500 kHz, TAmb = 55°C, 200 LFM	-	-	46	A
Input Capacitance		26*10 µF/16 V/X7S on power block.	-	260	-	µF
+7 V	Operating		6.7	7	7.3	V
	Under-voltage lockout, rising		-	-	6.7	V
	Under-voltage lockout, falling		4.5	-	-	V
	Hysteresis		-	0.5	-	V
	Current (switching at 500 kHz)		-	-	200	mA
PWM	Operating		-	3.3	-	V
	High		2.4	-	-	V
	Low		-	-	0.8	V
	Tri-state Voltage		1.2	-	2	V

Note: The Analog Device LTC7851 was used to verify this Power Blocks operation and functions. It was chosen due to its popularity. Other controllers like the Renesas ISL69127 have also been shown to be compatible. When using this block with any chosen controller, special attention should be paid to the turn on and off sequencing of +Vin, +7V, and the soft started PWM signals. The recommended timing is to have +Vin followed by +7V followed by the PWM signals. This recommendation will ensure proper sequencing and inrush current control. All specifications are typical at 25°C unless otherwise stated.

4. OUTPUT SPECIFICATIONS

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Output Current Range		Vo = 0.6 V to 1.0 V (per phase)	0	-	35	A
		Vo = 0.6 V to 1.0 V (total)	0	-	140	A
		Vo = 1.8 V (per phase)	0	-	32.5	A
		Vo = 1.8 V (total)	0	-	130	A
		Vo = 2.5 V (per phase)	0	-	25	A
		Vo = 2.5 V (total)	0	-	100	A
		Vo = 3.3 V (per phase)	0	-	22.5	A
		Vo = 3.3 V (total)	0	-	90	A
Output Capacitance		Output capacitors (internal).	-	0	-	µF
Output-to-GND Resistor		0402 resistor per phase.	-	402	-	Ω
Inductor	inductance		-	160	-	nH
	Isat (125 °C)	Peak value for each phase.	44	-	-	A
Current Sense Resistor		With current-sense common-mode voltage = 1.5 V, 0.25 A ≤ Iout ≤ 35 A per phase, current-sense gain is (equivalent)	-	3.31	-	mΩ
Max Current-Sense Differential Voltage		Differential Voltage between +CS and -CS, Iout = 35 A per phase, -CS need to connect to a fixed +1.2 V reference voltage	103	107.5	112	mV
Current-Sense Accuracy (Ta = 25 °C ~125 °C)		Tamb = 25 °C to 125 °C, 25 A ≤ Iout ≤ 35 A per phase	-4	-	4	%
Current-Sense Accuracy (Ta = 25 °C ~125 °C)		Tamb = 25 °C to 125 °C, 0 A ≤ Iout ≤ 25 A per phase	-1	-	1	A

NOTES: All specifications are typical at nominal input, 25°C unless otherwise stated.

5. GENERAL SPECIFICATIONS

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	1.0 V / 140 A	11 V input, switching at 500 kHz, with 200 LFM at 55 °C, thermal stable. Gate drive and controller losses are included.	-	90.3	-	%
	1.8 V / 130 A		-	93.3	-	
	2.5 V / 100 A		-	94.8	-	
	3.3 V / 90 A		-	95.5	-	
Output Voltage Range			0.6	-	3.3	V
Weight			-	16	-	g
MTBF		Calculated Per Bell Core SR-332 (Vin = 11 V, Vout = 1.0 V, Io = 80% Iomax, Ta = 40 °C, Airflow = 200 LFM, FIT = 10^9/MTBF)	-	45.28	-	Mhrs
FIT				22.0833		
Dimensions (L × W × H)				1.18 x 0.47 x 0.49		inch
				30.0 x 12.0 x 12.5		mm

NOTES: All specifications are typical at nominal input, 25°C unless otherwise stated.

6. EFFICIENCY DATA

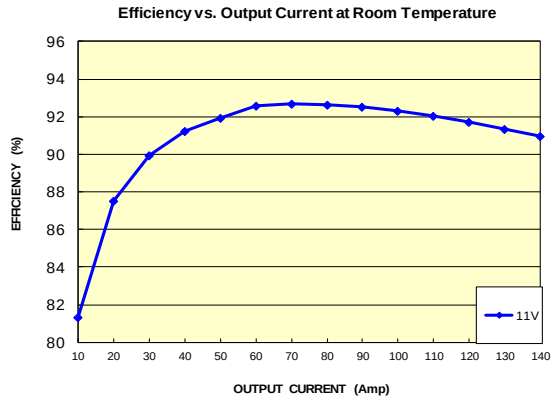


Figure 1. Vin = 11 V, Vo = 1.0 V

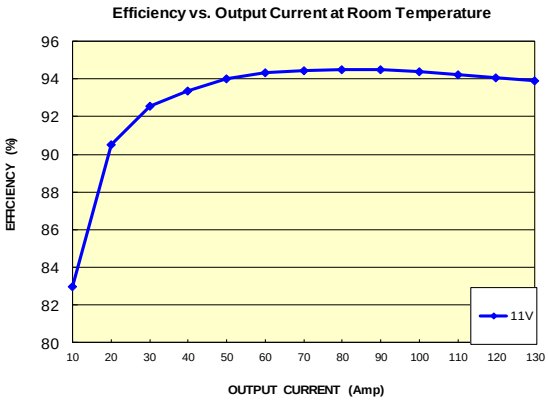


Figure 2. Vin = 11 V, Vo = 1.8 V

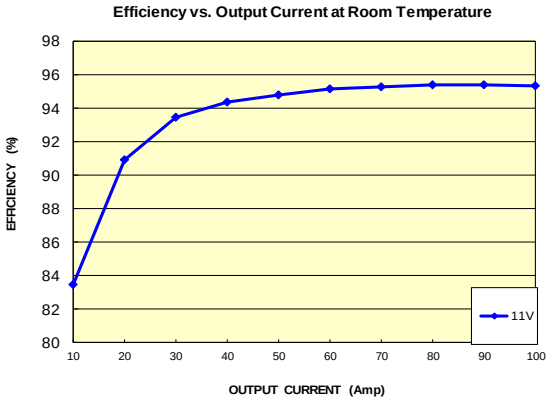


Figure 3. Vin = 11 V, Vo = 2.5 V

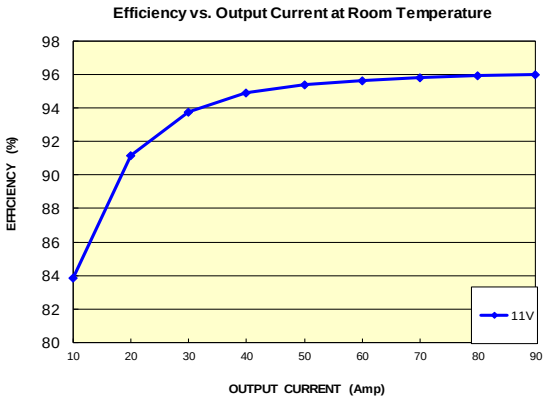


Figure 4. Vin = 11 V, Vo = 3.3 V

7. THERMAL DERATING CURVE

Thermal Considerations

New high power architectures require an accurate thermal design.
Design engineers have to optimize the module working conditions and ensure reliable operation.
Convection cooling is the common mode to cool down the module.
Heat transfer is dependent on a test setup and it is important to characterize the module in an environment similar to existent electronic applications.
Reported thermal data reflects real operating conditions because the values are physically measured in a wind tunnel.

Thermal Test Setup

A module in electronic cards is typically located in a busy area without relevant space around it.
To simulate a real condition and avoid turbulence we add a cover with defined dimensions.
The distance has to be 12.7 mm (0.5 inch) from the top of the module and 12.7 mm (0.5 inch) on the left and right side of the module.
The values reflect most of the real applications and it is a common procedure in the power module market.

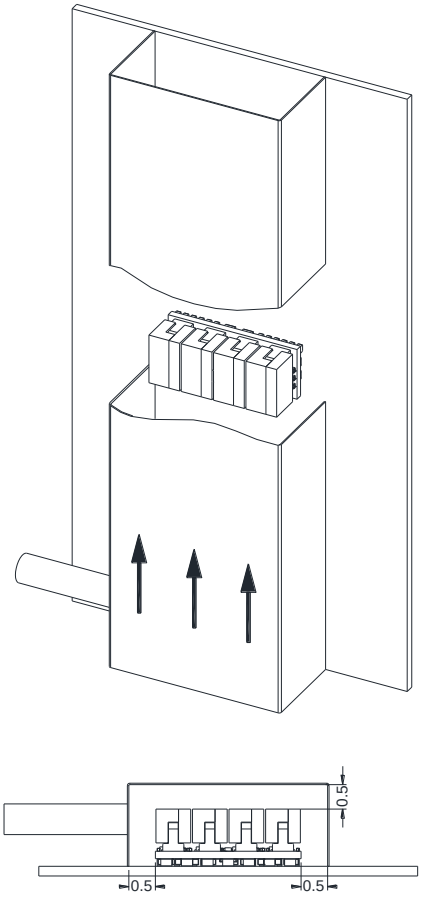


Figure 5. Thermal test setup

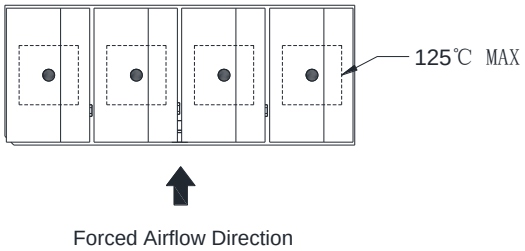


Figure 6. Airflow direction

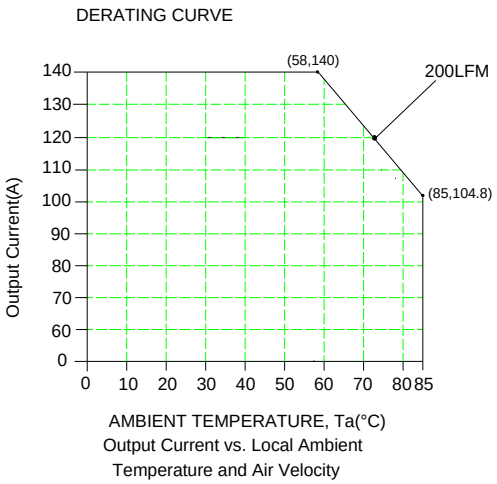


Figure 7. Vin = 11 V, Vout = 1 V

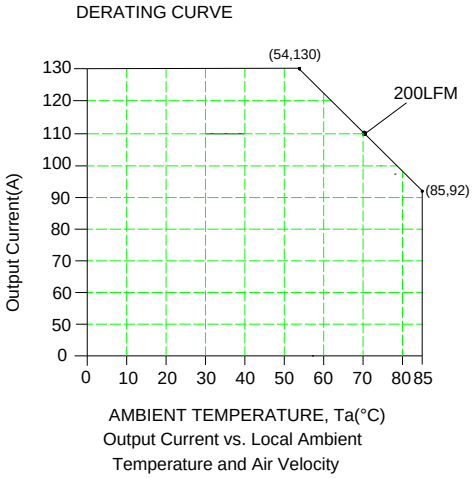


Figure 8. Vin = 11 V, Vout = 1.8 V

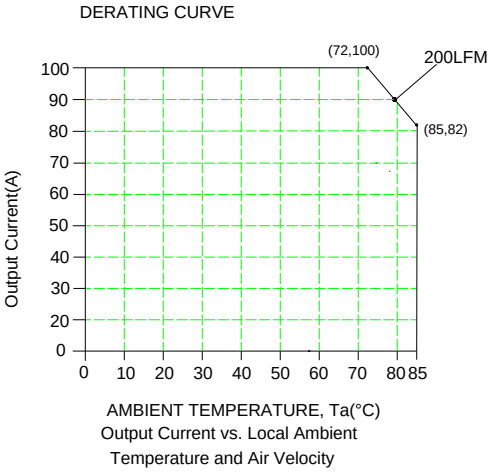


Figure 9. Vin = 11 V, Vout = 2.5 V

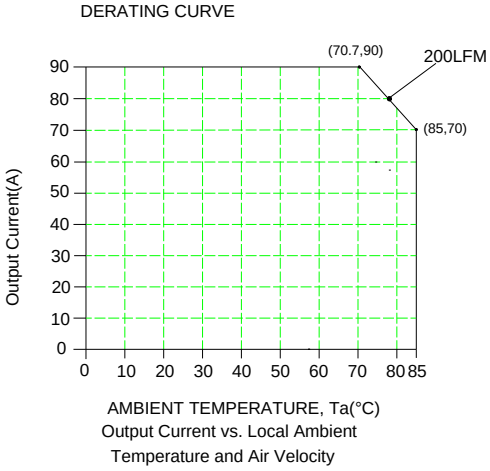


Figure 10. Vin = 11 V, Vout = 3.3 V

8. BLOCK DIAGRAM

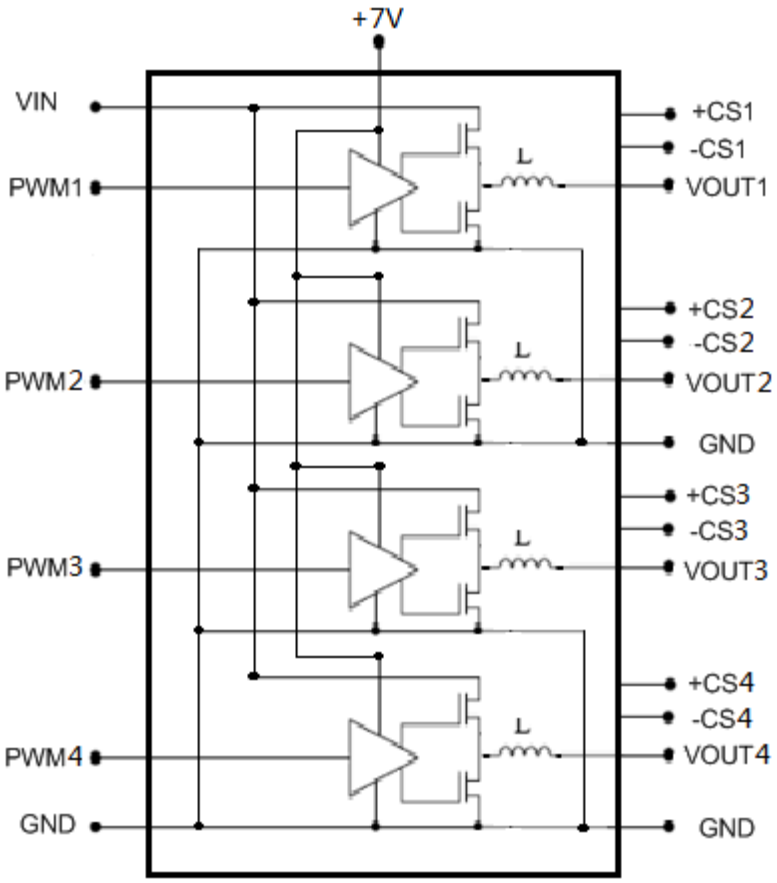


Figure 11. Block diagram

9. SOLDERING INFORMATION

The SRBL-C4A1Ax modules are designed to be compatible with reflow soldering process. The suggested Pb-free solder paste is Sn/Ag/Cu(SAC). The recommended reflow profile using Sn/Ag/Cu solder is shown in the following. Recommended reflow peak temperature is 245°C. while the part can withstand peak temperature of 260°C maximum for 10seconds. This profile should be used only as a guideline. Many other factors influence the success of SMT reflow soldering. Since your production environment may differ, please thoroughly review these guidelines with your process engineers.

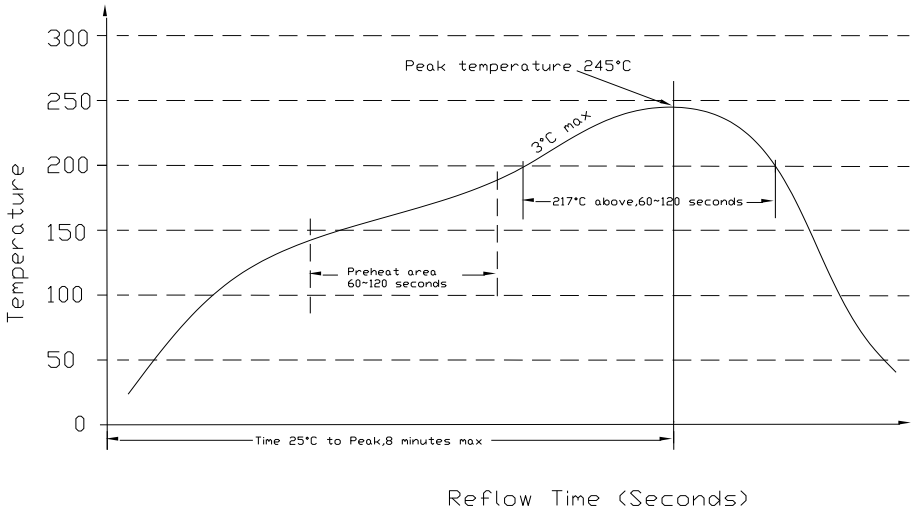


Figure 12. Soldering information

10. MSL RATING

The SRBL-C4A1Ax modules have a MSL rating of 3.

11. STORAGE AND HANDLING

The SRBL-C4A1Ax modules are designed to be compatible with J-STD-033 Rev:A (Handling, Packing, Shipping and Use of Moisture /Reflow Sensitive surface Mount devices). Moisture barrier bags (MBB) with desiccant are applied. The recommended storage environment and handling procedure is detailed in J-STD-033.

12. PRE-BAKING

This component has been designed, handled, and packaged ready for Pb-free reflow soldering. If the assembly shop follows J-STD-033 guidelines, no pre-bake of this component is required before being reflowed to a PCB. Our packaging tray can only withstand temperature of 70°C max.

13. MECHANICAL OUTLINE

OUTLINE

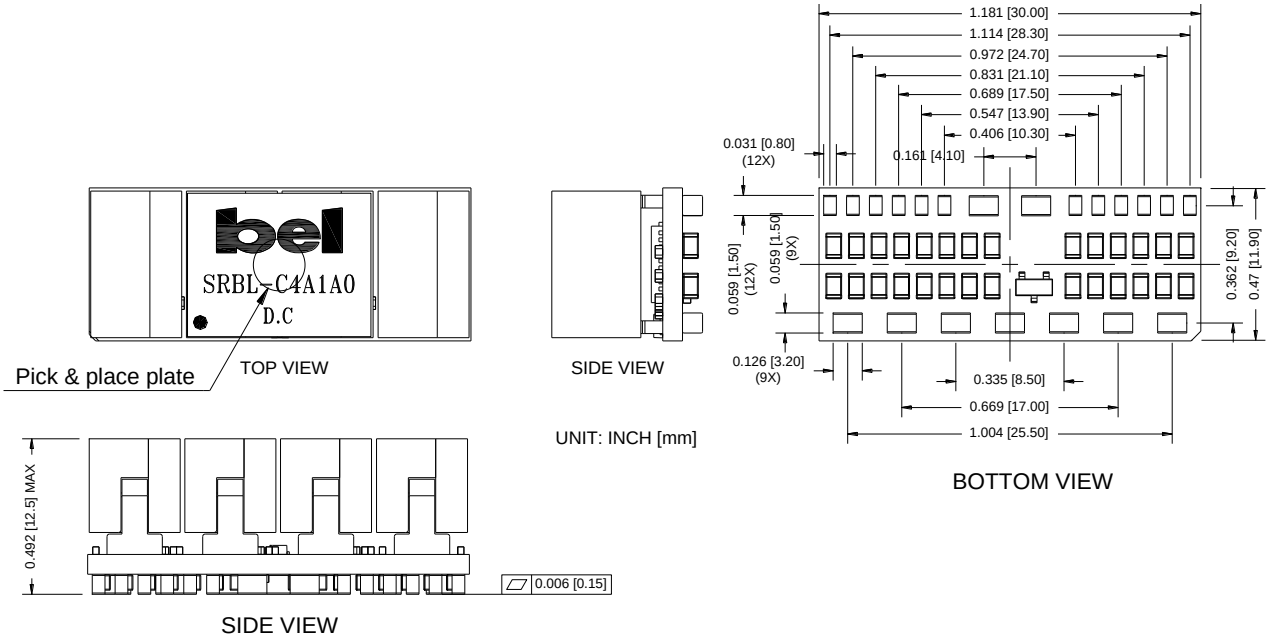
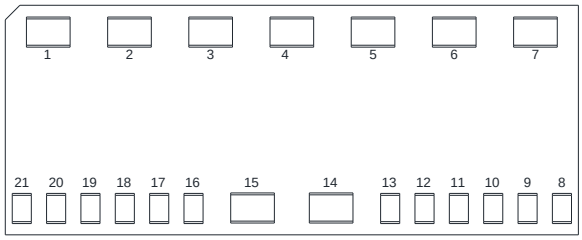


Figure 13. Outline

NOTE:

1) All Pins: Material - Copper Alloy;
   Finish – Tin plated
2) Un-dimensioned components are shown for visual reference only.
3) All dimensions in inch [mm]; Tolerances: x.xx +/-0.02 inch [0.51 mm], x.xxx +/-0.010 inch [0.25 mm].

PIN DEFINITIONS



BOTTOM VIEW

Figure 14. Pins

PIN	FUNCTION	PIN	FUNCTION
1	Vout1	12	+CS3
2	GND	13	-CS3
3	Vout2	14	GND
4	7V	15	Vin
5	Vout3	16	PWM2
6	GND	17	+CS2
7	Vout4	18	-CS2
8	PWM4	19	PWM1
9	+CS4	20	+CS1
10	-CS4	21	-CS1
11	PWM3		

RECOMMENDED PAD LAYOUT

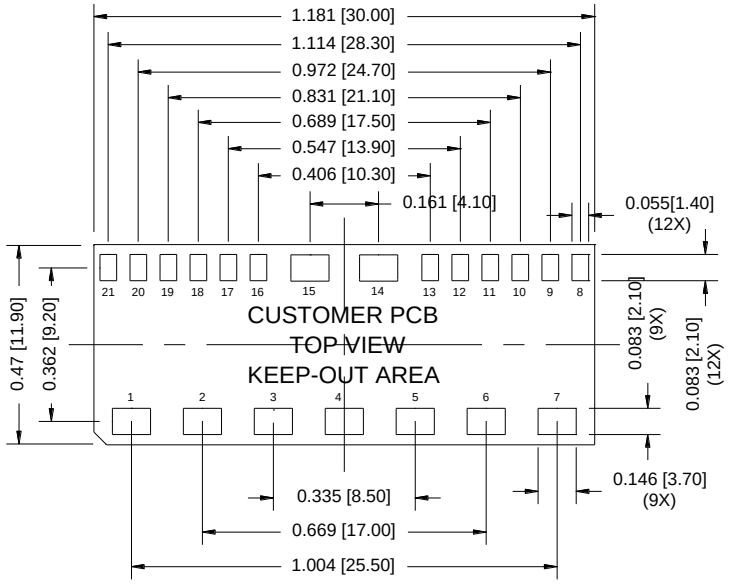


Figure 15. Recommended pad layout

14. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2019-01-23	AA	First Release.	Z.Tang
2019-04-17	AB	Amend description of Output Capacitance.	Z.Tang
2019-06-21	AC	Update mechanical outline.	XF.Jiang
2019-09-24	AD	Update Max Current-Sense Differential Voltage Description.	XF.Jiang
2021-06-25	AE	Add object ID and module photo. Update mechanical outline and recommended pad layout by adjusting the unit conversion.	XF.Jiang

For more information on these products consult: tech.support@psbel.com

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