

# ORCY-F0S10

## Isolated DC-DC Converter

The ORCY-F0S10 is an isolated DC/DC converter that operate from a nominal 50 V/54 V source. This converter is intended to provide isolation and step down to generate a regulated intermediate bus for the purpose of powering non-isolated Point-of-Load (POL) converters.

This unit will provide up to 500 W of output power from a nominal 50 V /54 V input. The output of the converter has the droop function which allow the modules operating in parallel with high output current sharing precision.

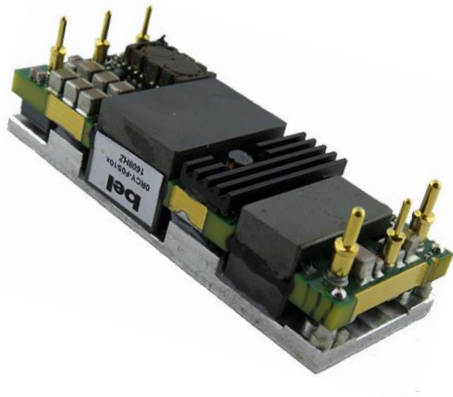
These converters are provided in an industry standard 1/8th brick package.

### Key Features & Benefits

- 45 - 56 VDC Input
- 10.2 VDC @ 49 A Output
- 1/8th Brick Converter
- Isolated
- Fixed Frequency (300 kHz)
- High Efficiency
- High Power Density
- Input Under Voltage Lockout
- OCP/SCP
- Output Over-voltage Protection
- Over Temperature Protection
- Remote On/Off
- Parallel Operation
- Low Cost
- Approved to IEC/EN 62368-1
- Approved to UL/CSA 62368-1
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

### Applications

- Networking
- Computers and Peripherals
- Telecommunications



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## 1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
ORCY-F0S10LG	10.2 VDC	45 – 56 VDC	49 A	500 W	97%
ORCY-F0S10BG					

### PART NUMBER EXPLANATION

0	R	CY	-	F0	S	10	x	G
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic	Package Type
Through Hole Mount	RoHS	1/8th Brick		500 W	45 – 56 V	10.2 V	L – Active Low, Open Frame B – Active Low, with Baseplate	Tray Package

## 2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.3	-	60	V
Remote On/Off		-0.3	-	16	V
Ambient temperature, Long-Term Operating	The components on the Unit meet IPC-9592 derating guidelines	-5	-	85	°C
Ambient temperature, Short-Term Operating (96 hours/year)	The component temperatures might exceed IPC-9592 derating guidelines but not exceed component temperature ratings	-20	-	90	°C
Altitude		-	-	4000	m
Storage Temperature		-40	-	100	°C

**NOTE:** Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

## 3. INPUT SPECIFICATIONS

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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage		45	50/54	56	V
Input Current (full load)		-	-	12	A
Input Current (no load)		-	100	120	mA
Remote Off Input Current		-	20	30	mA
Input Reflected Ripple Current (rms)	Vin = 45 – 56 V, Io = 100% load, With simulated source impedance of 10 μH, 5 Hz to 20 MHz. Use a 470 μF/80 V electrolytic capacitor.	-	5	10	mA
Input Reflected Ripple Current (pk-pk)		-	18	30	mA
I <sup>2</sup> t Inrush Current Transient	Vin = 50 V, with a 100 μF/100 V input electrolytic capacitor	-	-	1	A <sup>2</sup> s
Turn-on Voltage Threshold		42.5	44	45.0	V
Turn-off Voltage Threshold		39.0	41	42.5	V
Over-voltage Shutdown Threshold	Output shuts down after 20 ms delay.	58	-	61	V
	Output shuts down immediately.	61	-	64	V

**CAUTION: This converter is not internally fused. An input line fuse must be used in application.** Recommend a fast-acting fuse with maximum rating of 15 A on system board. Refer to the fuse manufacture’s datasheet for further information.

## 4. OUTPUT SPECIFICATIONS

All specifications are typical at nominal input, full load at 25°C unless otherwise stated.

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	Vin = 45 – 56 V, Pout = 250 W	10.45	10.5	10.55	V
	Vin = 45 – 56 V	10.15	-	10.88	V
Load Regulation	Vin = 50 V, Io = 0~100% load.	-	0.60	0.73	V
Line Regulation	Vin = 45 ~ 56 V, Io = 100% load	-	25	40	mV
Regulation Over Temperature		-	±30	±60	mV
Ripple and Noise (pk-pk)	Vin = 50 V, Io = 100% load, 0 – 20 MHz BW, with 3 * 22 μF ceramic capacitor at output.	-	45	90	mV
Ripple and Noise (rms)		-	12	25	mV
Output Ripple and Noise under worst case	Over entire operating input voltage range, load and ambient temperature condition	-	-	150	mV <sub>pk-pk</sub>
Output Current Range		0	-	49	A
Output DC Current Limit		55	61	68	A
Current Share Accuracy	Vin = 50 V, Io = 20% -100% full load, two units paralleling operation	-	-	±5	%
Rise Time		-	-	15	ms
Turn on Time	Enable from Vin to 10% of Vout	20	-	30	ms
	Enable from ON/OFF to 10% of Vout	-	-	5	ms
Overshoot at Turn on	Overshoot at turn on	0	-	3	%
Output Capacitance	50% ceramic + 50% Oscon	0	-	3125	μF
<b>Transient Response</b>					
ΔV 50%~75% of Max Load		-	160	350	mV
Settling Time	di/dt = 1 A/μs, Vin = 50 VDC, with 8 * 22 μF ceramic capacitor and 1940 μF AL. cap at output.	-	100	200	μs
ΔV 75%~50% of Max Load		-	160	350	mV
Settling Time		-	100	200	μs



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## 5. OUTPUT PLOT VS INPUT

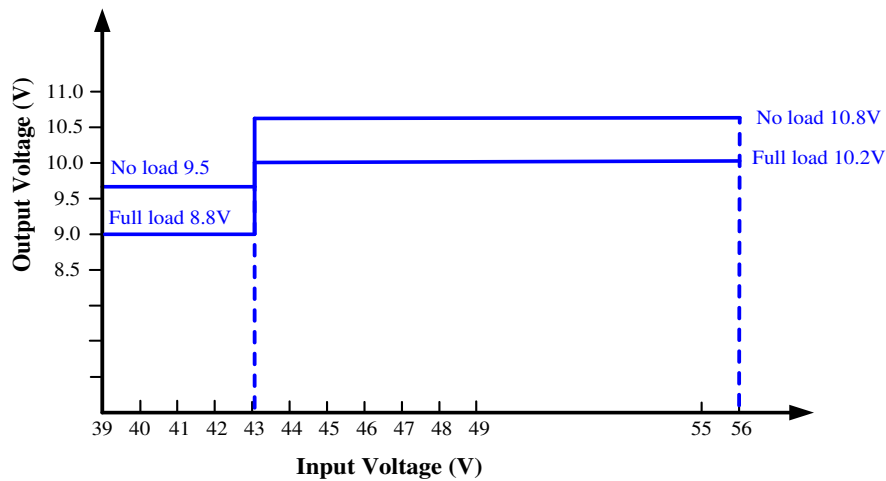


Figure 1. Output plot vs input

PARAMETER	MIN	TYP	MAX	UNITS
Turn-on Voltage Threshold	42.5	44	45	V
Turn-off Voltage Threshold	39	41	42.5	V

## 6. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Vin = 50 V, full load	95	97	-	%
Switching Frequency		280	300	320	kHz
Over Temperature Protection		-	130	-	°C
Output Over Voltage Protection		-	-	15	V
Weight	ORCY-F0S10L	-	41.7	-	g
	ORCY-F0S10B	-	52.4	-	g
MTBF	Calculated Per Telcordia SR-332, Issue 3 (Vin = 50 V, Po = 500 W, Ta = 25°C)	2.0	-	-	Mhrs
Dimensions (L × W × H)	ORCY-F0S10L	2.30 × 0.90 × 0.48			inch
		58.42 × 22.86 × 12.20			mm
	ORCY-F0S10B	2.30 × 0.90 × 0.57			inch
		58.42 × 22.86 × 14.50			mm
<b>Isolation Characteristics</b>					
Input to Output		-	-	500	V
Input to Case		-	-	500	V
Output to Case		-	-	500	V
Isolation Resistance		10M	-	-	Ohm
Isolation Capacitance		-	1000	-	pF

7. EFFICIENCY DATA

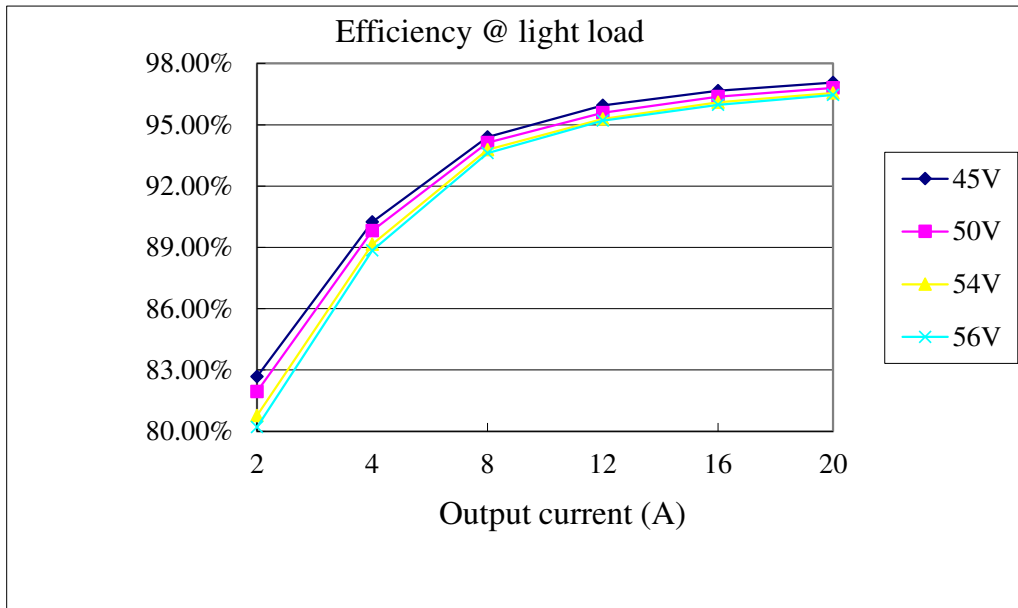


Figure 2. Efficiency data @light load

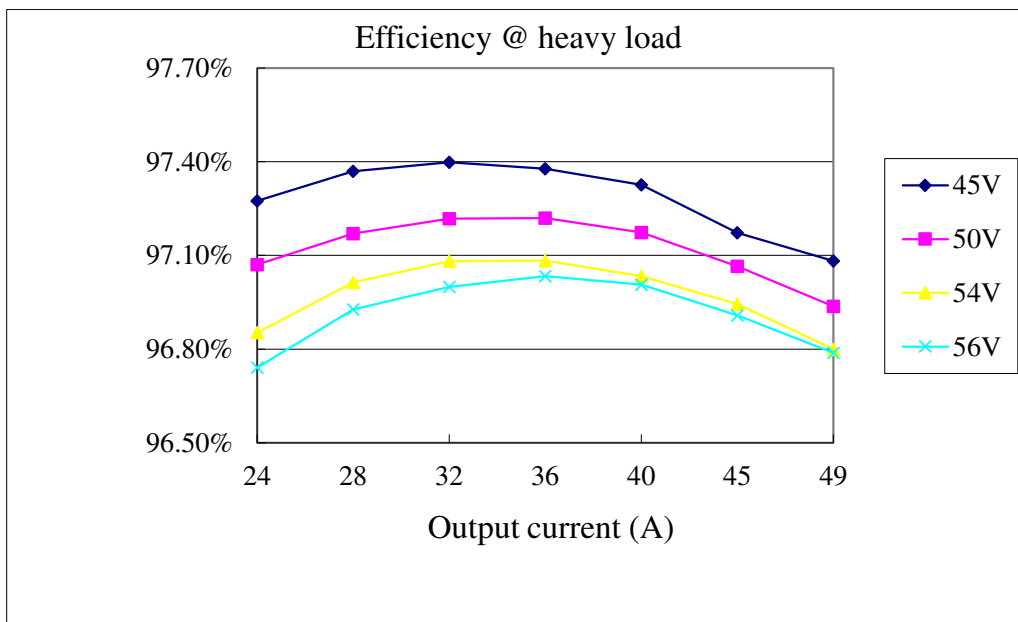


Figure 3. Efficiency data @heavy load

8. REMOTE ON/OFF

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Signal Low (Unit On)	Active Low	Remote On/Off pin is open, the module is off.	-0.3	-	0.8	V
Signal High (Unit Off)			2.4	-	16	V
Current (Out of pin)		Module is on, $V_{enable} = -0.3$ to $0.8$ V	-	-	200	$\mu$ A
		Module is off, $V_{enable} = 2.4$ V	10	-	-	$\mu$ A
Current (into pin)		Remote on/off pin is pulled up to 10 V.	-	-	300	$\mu$ A
		Remote on/off pin is pulled up to 15 V.	-	-	500	$\mu$ A
Open Circuit Voltage			-	-	15	V

Recommended remote on/off circuit for active low

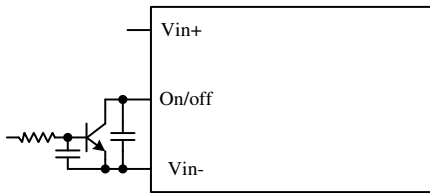


Figure 4. Control with open collector/drain circuit

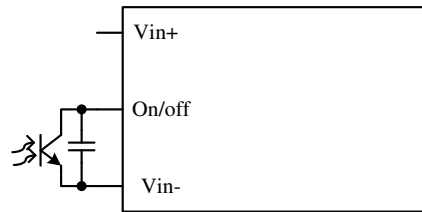


Figure 5. Control with photocoupler circuit

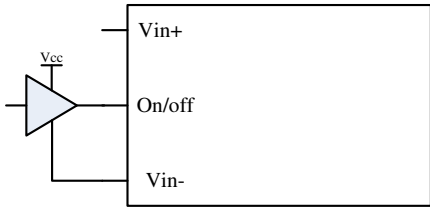


Figure 6. Control with logic circuit

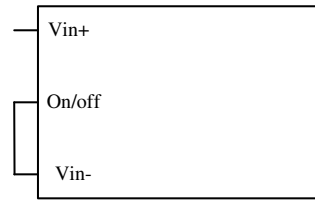


Figure 7. Permanently on

9. INPUT REFLECTED RIPPLE CURRENT

Testing setup:

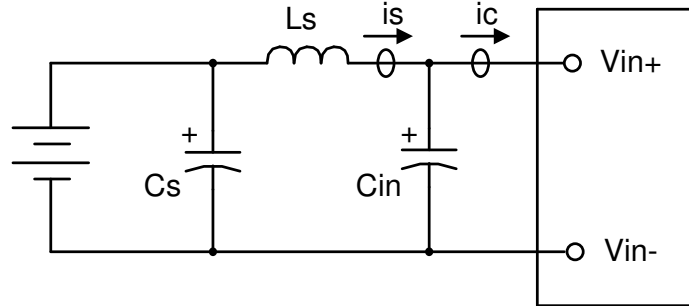


Figure 8. Test setup

Notes and values in testing.

is: Input Reflected Ripple Current

ic: Input Terminal Ripple Current

Ls: Simulated Source Impedance (10  $\mu$ H)

Cs: NIL

Cin: Electrolytic capacitor, should be as closed as possible to the power module to damped ic ripple current and enhance stability.

Recommendation: 470  $\mu$ F, ESR < 0.045  $\Omega$  @100 kHz, 20°C

Below measured waveforms are based on above simulated and recommended inductance and capacitance.

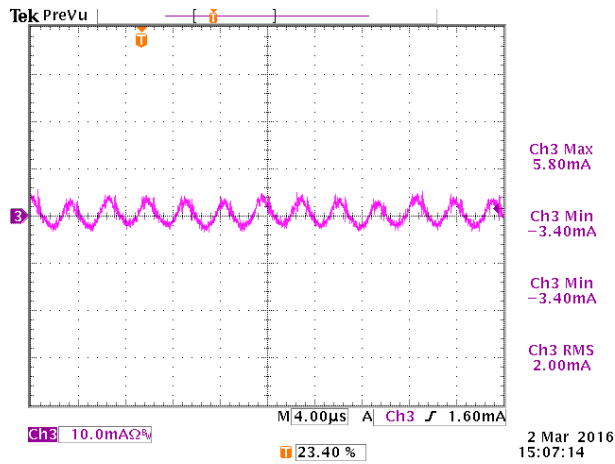


Figure 9. is (input reflected ripple current), AC component

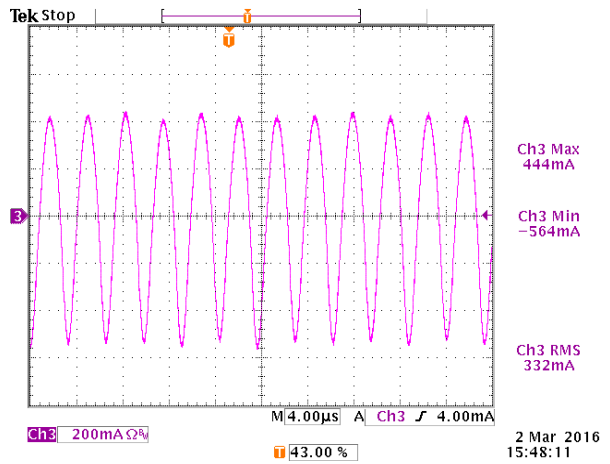


Figure 10. ic (input terminal ripple current), AC component

Test condition: 50 VDC input, 10.2 VDC / 49 A output and Ta = 25 °C, with 8 \* 22  $\mu$ F ceramic capacitor & 1940  $\mu$ F AL. cap at output.

10. RIPPLE AND NOISE WAVEFORM

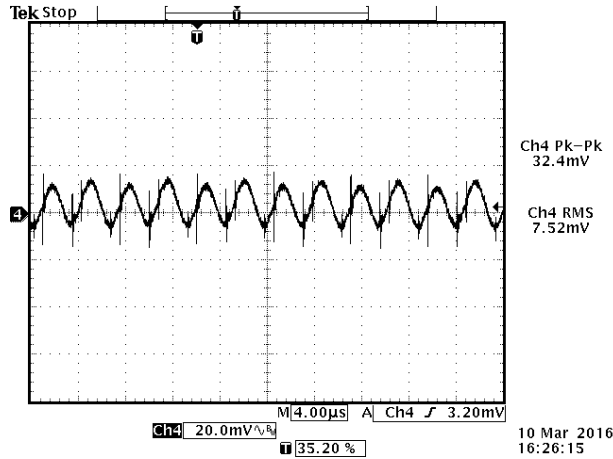


Figure 11. Ripple and noise, 54 VDC input, 500 W output,  $T_a = 25^\circ\text{C}$ , with  $C_{out} = 500 \mu\text{F}$  (50% ceramic, 50% Oscon caps)

11. TRANSIENT RESPONSE WAVEFORMS

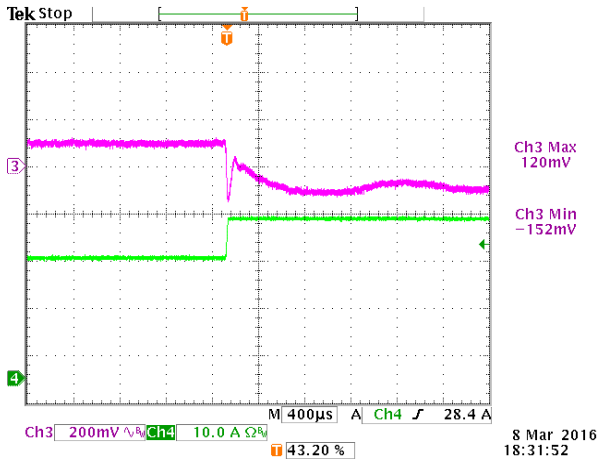


Figure 12. 50%-75% Load Transients at  $V_{in} = 50\text{ V}$  @  $T_a = 25^\circ\text{C}$   
CH3:  $V_o$   
CH4:  $I_o$

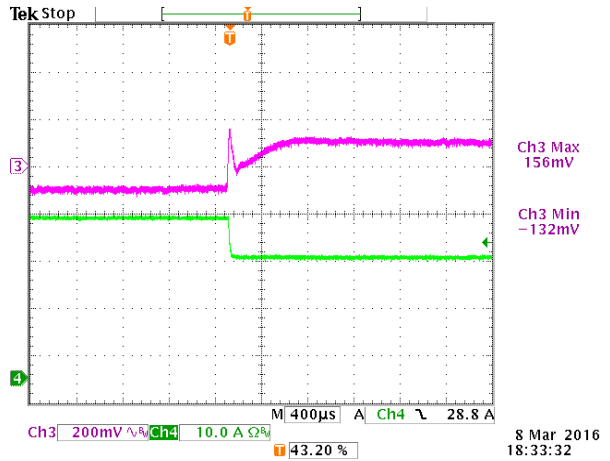


Figure 13. 75%-50% Load Transients at  $V_{in} = 50\text{ V}$  @  $T_a = 25^\circ\text{C}$   
CH3:  $V_o$   
CH4:  $I_o$

**Note:** Transient Response:  $di/dt=1\text{ A}/\mu\text{s}$ , with  $8 \times 22 \mu\text{F}$  ceramic capacitor and  $1940 \mu\text{F}$  AL. cap at output.



## 12. POWER GOOD

**Note:**

1. The Power Good signal is a non-latching open-collector output that is Low during normal operation and is pulled High when any of the following conditions occur:

- Over-Temperature
- Over-Current
- Vout is outside of the DC Output Band while Vin is within the Vin Operating Range
- In Parallel configuration, Vin is within operating range, no Vout due to one of the units not operational.
- Vin is outside of the Vin Operating Range

2. The Power Good signal is referenced to Vout(-).

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Low (trigger limits)		8.2	-	8.6	V
Output Voltage High (trigger limits)		12.6	-	13.1	V
Input Voltage Low (trigger limits) Rising	PG signal indicates good when Vin is within operating range and indicates bad ~20 ms before unit is shut-down due to UV or OV	42.5	-	45	V
Input Voltage High (trigger limits) Rising		58	-	61	V
Hysteresis		-	1	-	V
High State Voltage		0	-	5.5	V
High State Leakage Current (into Pin)		0	-	10	µA
Low State Voltage		0	-	0.8	V
Low State Current (into Pin)		0	-	5	mA
Power Good Signal De-assert Response Time	Duration between the fault occurring and the Power-Good Signal de-asserting	0	-	3	ms
Power Good Signal Assert Response Time	Duration between unit powering up with no faults and the Power Good Signal asserting	0	-	3	ms
Power Good Signal Duration	Duration the Power-Good signal stays de-asserted if a transient fault occurs	200		600	ms
Over Temperature Warning	For OT Warning, the PG signal will toggle as an impulse wave.		10 °C below OTP threshold		°C
OT Warning PG Signal Frequency		90	100	110	kHz
OT Warning PG Signal Duty Cycle		47.5	50	52.5	%



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**13. MECHANICAL DIMENSIONS**  
**ORCY-F0S10L OUTLINE**

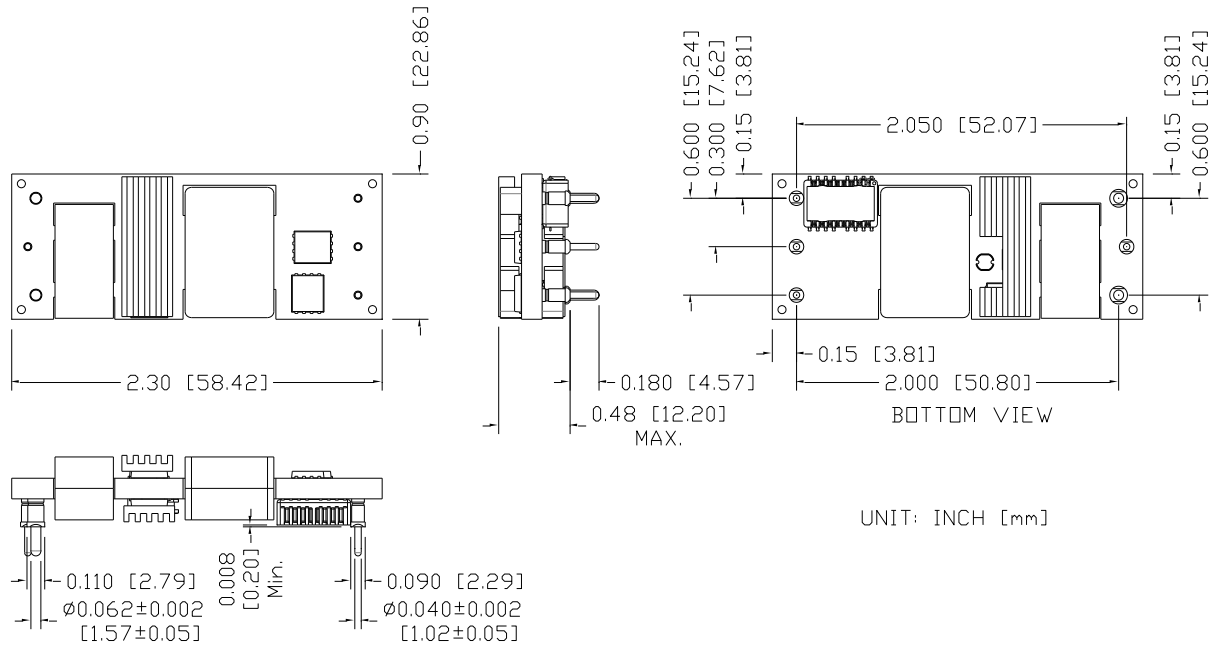


Figure 14. ORCY-F0S10L Outline

**Note:** This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 °C for less than 5 seconds.

**NOTES:**

- 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].

## ORCY-F0S10B OUTLINE

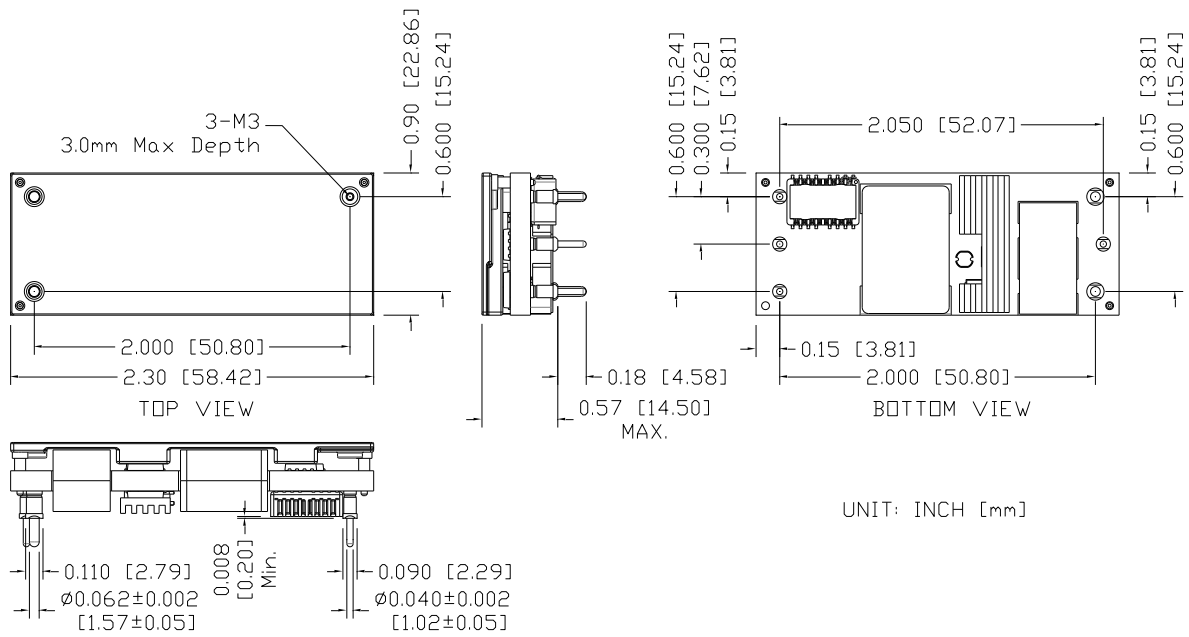


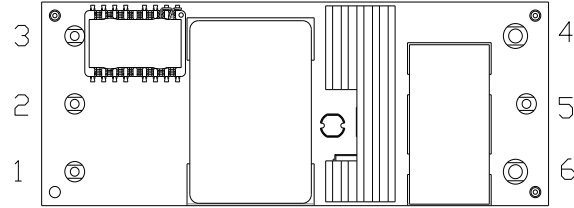
Figure 15. ORCY-F0S10B Outline

**Note:** This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 °C for less than 5 seconds.

### NOTES:

- 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 16. Pins

PIN	FUNCTION	PIN SIZE
1	Vin (+)	0.04"
2	ON/OFF	0.04"
3	Vin (-)	0.04"
4	Vout(-)	0.062"
5	PG	0.04"
6	Vout(+)	0.062"

**RECOMMENDED PAD LAYOUT**

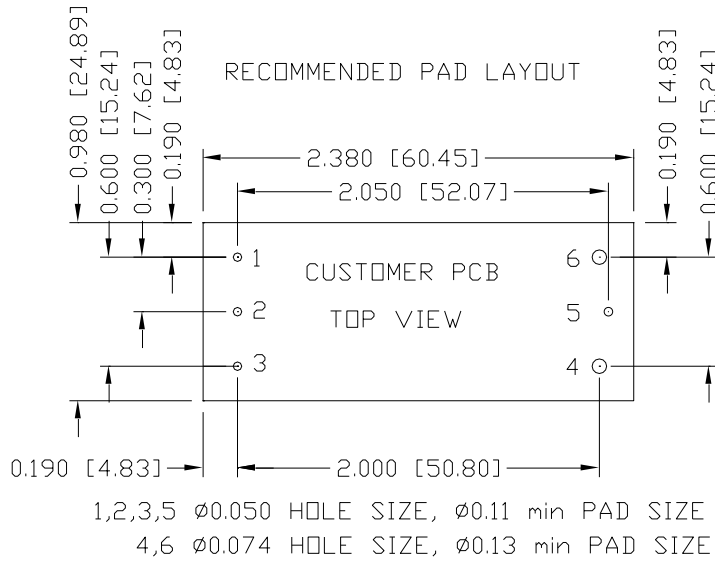


Figure 17. Recommended pad layout

**14. REVISION HISTORY**

DATE	REVISION	CHANGES DETAIL	APPROVAL
2016-03-18	PA	First release	J.Yan
2016-06-27	PB	Update TD curves using another thermal test fixture	J.Yan
2016-08-30	AC	Update TD curves using thermal test fixture with black cover	J.Yan
2017-03-31	AD	Update Outline drawing	J.Yan
2020-10-14	AE	Delete ORCY-F0S10D. Add safety information.	XF.Jiang
2021-05-07	AF	Add object ID.	XF.Jiang

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