

Burnwing Rev 3.0

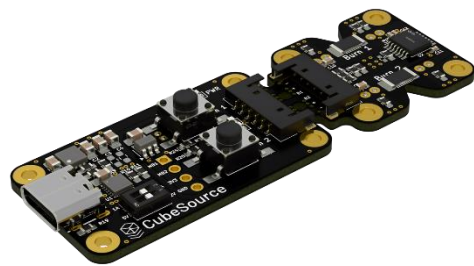
Technical Datasheet

(Version 1.1 – 2026-10-22)

1. Product Overview

The Burnwing Rev 3.0 is a dual-channel thermal knife release mechanism for CubeSats and small satellites. It ships as a single panel carrying two sections joined by mouse bites: a Flight Model that integrates into the spacecraft, and a break-away Engineering Model that powers and triggers it on the bench.

Both burn channels are switched on the high side, so the elements stay unenergized until they are commanded.



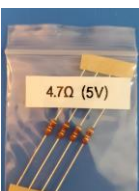
Applications:

- Deployable Solar Panels
- Antenna Deployments
- Sensor Deployments
- Boom and Hatch Deployments

2. Key Features

- Redundant Burn Channels with Independent Control
- High-Side Switching – Burn Elements Unenergized Until Triggered
- 3.3 V or 5 V Logic Level Control Inputs, Held Off by On-Board Pull-Downs
- Reversible 6-pin Pinout – Accepts Unmodified COTS Molex Harnesses
- Overcurrent, Over Temperature, Reverse Polarity and ESD Protection
- Break-Away Engineering Model - USB-C Power Delivery, Test Switches & LEDs
- PicoBlade or Pico-Lock Gold Plated 6-pin Connectors
- Surface Mount or Through-Hole Pulse Withstanding Resistors
- 5 V or 12 V Power Input

Parts List - Burnwing Rev3 Kit

Part	
Burnwing Rev3 Engineering Driver + Flight Model	
Molex Pico-Lock Cables 6-way, 300 mm (15132-0603)	
UHMWPE (Dyneema)	
4.7 Ω Burn Resistors (5 V)	
36 Ω Burn Resistors (12 V)	
Hardware Set Brass standoffs, screws, nuts, springs	
USB-C Charger, 45 W with USB-C to USB-C Cable	

3. Product Specifications

Parameter	Value	Unit
Required Power	5.3	W
Release Time*	10	sec
Resistor Cycle Life	50	x 10 sec
Supply Voltage	5.0 to 15.0	V
Control Input Voltage	3.3 or 5.0	V
Dimensions: Panel	68.8 x 22.9 x 6.5	mm
Dimensions: Flight Model**	23.4 x 22.9 x 4.1	mm
Mass, Panel	8	g
Mass, Flight Model	3	g
Operating Temperature	-40 to +85	°C

* Release time measured as time to cut 1mm diameter Dyneema line in atmosphere.

Approximately 4.0 W in the 12 V configuration and 5.3 W in the 5 V configuration; the cut time is the same for both.

**Heights are measured from the underside of the board. The through-hole burn resistor leads extend a further 1.40mm below the board.

4. Functional Description

The Burnwing operates as a thermal knife release mechanism. Dyneema hold down line is used to secure a deployable subsystem in place. When ready for release, a trigger signal (BurnCTRL1) is sent for 10 seconds causing the (R12) Burn Resistor to heat to a temperature >150°C cutting the hold down line. If the first attempt was unsuccessful this can be repeated multiple times. Allow 60 seconds between attempts. (BurnCTRL1) can be active for longer than 10 seconds if necessary but this may reduce cycle life. The (R13) burn resistor is a redundant backup controlled by (BurnCTRL2) which can be used in the event (R12) has failed. Using (R12) and (R13) simultaneously is not recommended. Standoffs or spacers should be used when mounting to prevent the resistors from shorting against a frame.

Both channels are switched on the high side. The burn elements sit at ground potential until a channel is commanded, and both control inputs are held low by on-board pull-down resistors, so a floating or undriven control line cannot fire a channel. With both controls low the driver enters sleep mode, and the board draws well under a milliamp. Recommended burn element values are 4.7 Ω at 5 V and 36 Ω at 12 V.



The Burnwing Thermal Knife can cause burns if handled during operation. Use extreme care. During normal operation it can reach >150 °C in seconds. It should not be touched while powered on or for 30 seconds after triggering. We don't recommend triggering the burn resistors for longer than 15 seconds at a time or operating both channels simultaneously. This may reduce the cycle life of the device.

Engineering Model Power Selection

The Engineering Model negotiates its supply over USB-C Power Delivery. A two-position DIP switch sets the requested voltage and current limit:

DIP Position	ON	OFF
1 – Voltage	5 V	12 V
2 – Current	1 A	2 A

The voltage legends are exact. The current legends read 1 A and 2 A; the values requested over USB-PD are 1.25 A and 2.25 A, because the current-select resistor decodes to the nearest tabulated step. That is a ceiling negotiated with the supply rather than a current the board draws, and the board requires 1.0 A per channel, so neither setting undersupplies it. 12 V operation requires a USB-C source that supports USB Power Delivery at 12 V; power may instead be supplied through the VDC pins, with USB disconnected first.

Caution: Set DIP position 1 to match the fitted burn elements (resistors) before applying power:
 OFF (12 V) for 36 Ω elements, ON (5 V) for 4.7 Ω elements.

External Control Header (MB1, MB2, 3V3, GND):

A 2.54 mm (0.1") through-hole header provides benchtop test connections. MB1 and MB2 are trigger inputs that accept 3.3 V or 5 V logic signals from an external microcontroller. 3V3 is an output powered by the on-board LDO regulator (used to supply pushbutton trigger logic), and GND provides common ground.

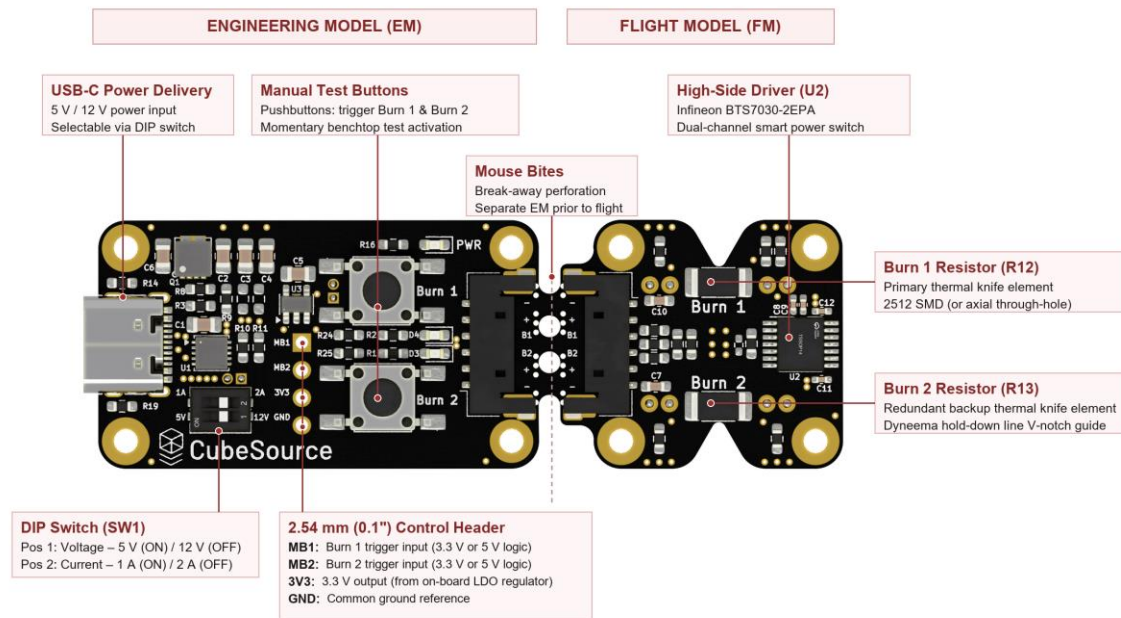
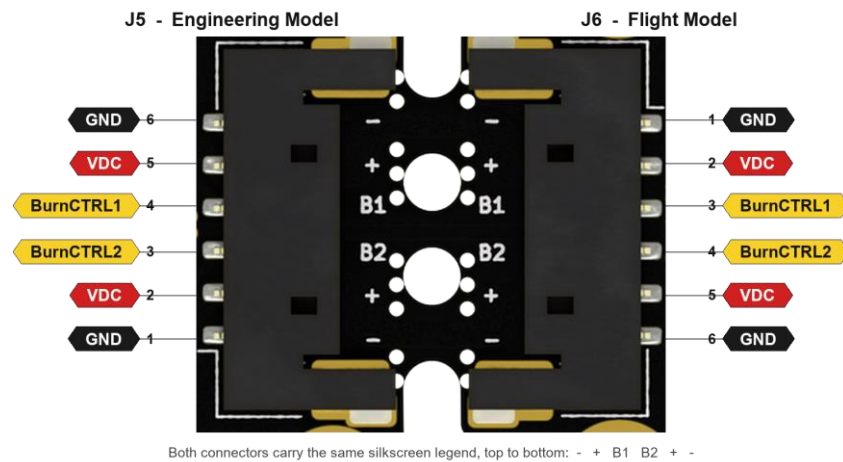


Figure 1. Burnwing Rev 3.0 board architecture and hardware feature callouts.

5. Pinout

Flight Model connector J6. Values are with respect to GND.

Pin	Function	Value
1	GND	N/A
2	VDC	5V or 12V
3	Burn_CTRL_1	3.3V or 5V
4	Burn_CTRL_2	3.3V or 5V
5	VDC	5V or 12V
6	GND	N/A



Both connectors are symmetric about their center: pins 1 and 6 are GND, pins 2 and 5 are VDC, so an unmodified COTS 6-way Molex harness powers the board correctly in either orientation. J5 on the Engineering Model mirrors J6, carrying Burn_CTRL_2 on pin 3 and Burn_CTRL_1 on pin 4, so orientation determines only which control line lands on which channel. The two channels are redundant and independent.

6. Electrical Characteristics

$T_j = -40\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$ unless otherwise noted.

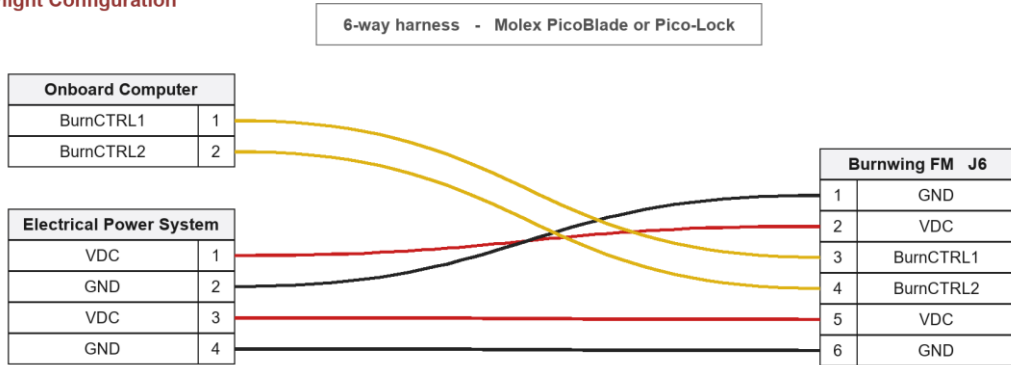
Burn channel figures are those of the BTS7030-2EPA high-side driver.

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_s	5.0	12.0	15.0	V
Supply Voltage, absolute maximum	V_s	–	–	18.0	V
Supply Undervoltage Shutdown	$V_s(\text{UV})$	1.8	2.3	3.1	V
Burn Channel ON-Resistance, $T_j = 25\text{ }^{\circ}\text{C}$	R_{on}	–	13.5	–	m Ω
Burn Channel ON-Resistance, $T_j = 150\text{ }^{\circ}\text{C}$	R_{on}	–	–	25	m Ω
Burn Channel Current, per channel	I_l	–	1.0	4.5	A
Control Input Threshold	$V_{\text{in}}(\text{TH})$	0.8	1.3	2.0	V
Control Input Hysteresis	$V_{\text{in}}(\text{HYS})$	–	0.25	–	V
Control Input Series Resistance	R_s	–	3.0	–	k Ω
Control Input Pull-Down	$R_{\text{p}\bar{a}}$	–	22	–	k Ω
Switch-ON Delay	t_{on}	10	35	60	μs
Operating Current, channel active	I_{op}	–	3	4	mA
Quiescent Current, both channels off	I_{sleep}	–	0.03	0.6	μA
Thermal Shutdown Temperature	$T_j(\text{SD})$	150	175	200	$^{\circ}\text{C}$
Thermal Shutdown Hysteresis	ΔT_j	–	30	–	K
Overload Detection Current, $T_j = 25\text{ }^{\circ}\text{C}$	$I_l(\text{OVL})$	52	60	67	A
ESD Susceptibility, all pins (HBM)	V_{esd}	–2	–	2	kV

Quiescent current is measured with both control inputs low, where the driver enters sleep mode. Burn channel current is set by the fitted burn element: 1.1 A with a 4.7 Ω element at 5 V, or 0.33 A with a 36 Ω element at 12 V.

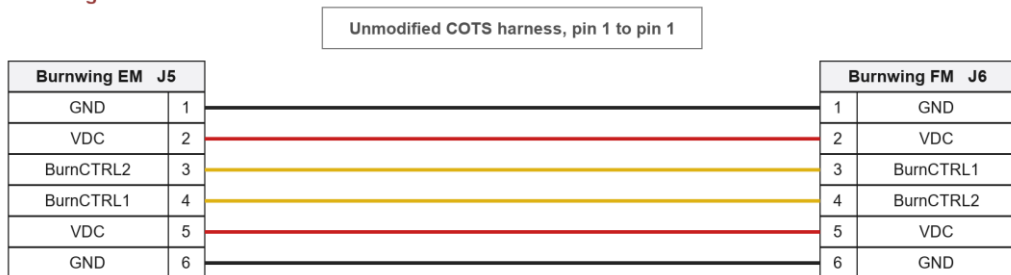
7. Typical Application Circuits

Flight Configuration



Power is doubled up on pins 2 and 5, ground on pins 1 and 6. Either harness orientation supplies the board correctly.

Test Configuration



Shown with a same-side (pin 1 to pin 1) cable, which exchanges the two control channels.
 A reversed (pin 1 to pin 6) cable powers the board just as well; it lands Engineering Model channel 1 on Flight Model channel 1.

Power can be provided either by USB C or the VDC pins.
 Disconnect USB before powering with VDC.

8. Line Tying and Routing Guidelines

Hold-down routing depends on the geometry of the deployable subsystem. The general procedure below applies across solar panel, antenna, boom, and hatch release configurations:

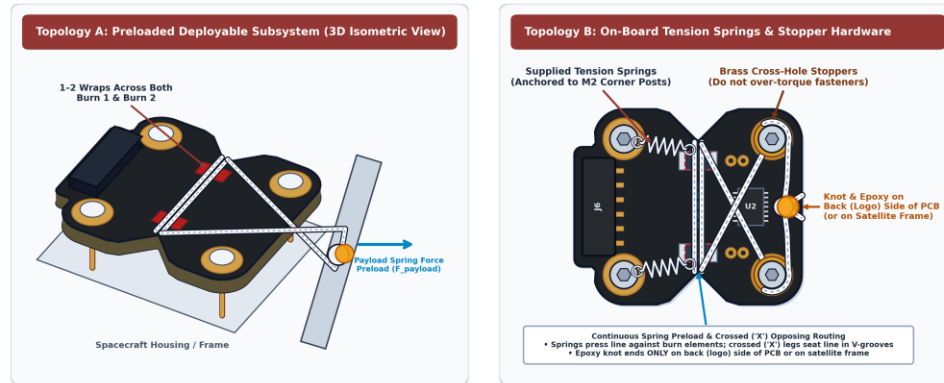
- 1. Wrap burn resistors (1-2×):** Route the 1 mm UHMWPE (Dyneema) hold-down line through the top and bottom PCB V-notches, wrapping over and around both burn resistors (Burn 1 / R12 and Burn 2 / R13) 1 to 2 times so the line sits flush against the heating elements.
- 2. Route in opposing directions:** Lead the two line legs outward in opposing directions toward the payload or anchor hardware, keeping the path clear of board components, connectors, and sharp edges or objects that could snag the line during release.
- 3. Tie preferred knot:** Tension the hold-down line and terminate with a secure knot suited to the application (such as a surgeon's knot or double overhand knot backed by half-hitches).
- 4. Secure loose ends with epoxy:** Apply a small bead of epoxy to the loose knot tails to prevent slip or loosening under vibration and launch loads. Keep epoxy clear of the burn elements.

Stopper hardware can be used to assist with line routing, anchoring, and tensioning. Avoid over-torquing line-securing fasteners, as excessive clamping force can fray or sever the line. If the hold-down path must route around sharp structural corners or metal edges, sleeve the line with PTFE or FEP tubing to increase abrasion resistance.

When securing a payload that does not provide its own spring-force preload, installing the supplied tension springs is recommended. Continuous spring tension ensures optimal conductive heat transfer by holding the line firmly against the burn elements and helps mitigate the effects of line creep and shock loading.

Burnwing Rev 3.0 — Application Routing Topologies & Hardware Configurations

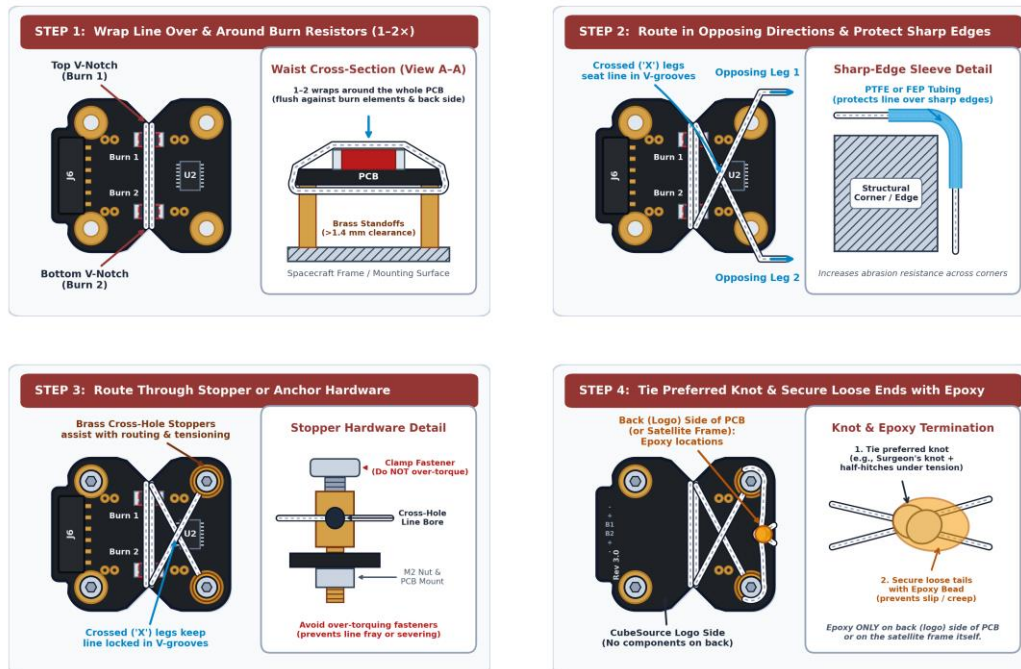
Comparison of direct hold-down routing for spring-preloaded deployables vs. on-board tension spring preload for passive payloads.



Recommended when securing payloads without built-in spring preload: tension springs keep the Dyneema line firmly seated against the burn elements throughout the 10 s burn.

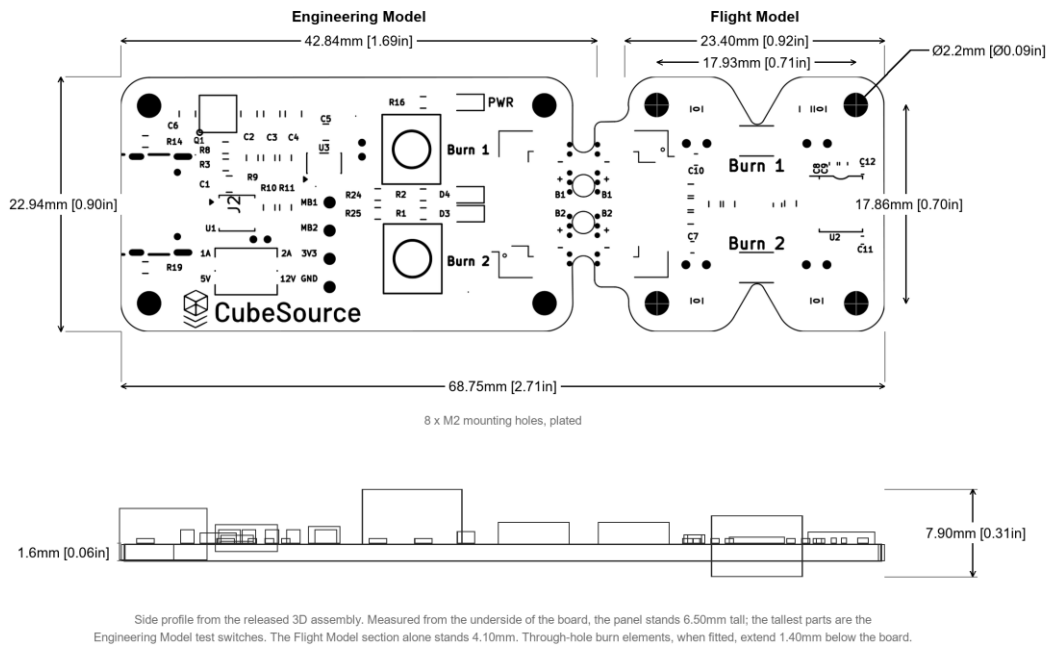
Burnwing Rev 3.0 — Line Tying & Routing Procedure

General guidelines for wrapping, routing, preloading, and terminating 1 mm UHMWPE (Dyneema) hold-down line across the Flight Model burn elements.



UHMWPE (Dyneema) hold-down line has a low coefficient of friction; use 1-2 wraps around the burn elements, maintain preload tension, and lock knot tails with epoxy.

9. Mechanical Specifications



Open Source Files and CAD Models: <https://github.com/CubeSource/Burnwing>

10. Document Revision History

Date	Version	Changes
2026-09-10	0.0	First release for the Rev 3.0 panel
2026-10-01	0.1	USB-PD source wording updated; DIP position caution, release-time power note and burn-hazard warning added.
2026-10-08	0.2	Page layout tightened (Section 6 no longer forced to a new page).
2026-10-21	1.0	First public release
2026-10-22	1.1	Flight Model height corrected from 3.50 mm to 4.10 mm; burn resistor lead-length note added; Panel and Flight Model masses added; required power corrected to 5.3 W to match the 5 V configuration.

Supersedes the Burnwing Flight and Burnwing Engineering Model technical datasheets, which describe the separate Rev 1 and Rev 2 boards.