Power Supply Reliability Design Checklist

Engineering Review Guide for AC/DC Power Adapters, Battery Chargers and OEM/ODM Power Solutions

YHYadapter

Version 1.0 -- 2026

www.yhypoweradapter.com

Document Control

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Section 1 -- Reliability Design Framework

1.1 Purpose of Reliability Design

Reliability in power supply design is not discovered at the final test station. It is determined by decisions made throughout the entire product development lifecycle. A structured reliability design process helps reduce field failure risk, supports consistent product quality and provides a framework for engineering teams to evaluate design trade-offs systematically.

The goal of reliability design is to identify and address potential failure mechanisms before they reach production or the end customer. This applies across:

- Specification definition
- System architecture
- Component selection
- PCB layout
- Thermal design
- Protection circuit design
- Mechanical construction
- Validation testing
- Production and process control

Each of these stages introduces variables that affect long-term product reliability. A checklist-based review approach helps engineering teams maintain consistency across projects and reduces the likelihood of oversights during schedule pressure.

1.2 Reliability Lifecycle

Power supply failures typically follow a progression through four stages. Understanding this progression supports early detection and corrective action.

Stage	Description	Examples
Initial Stress	Component stress occurs within normal operation but begins to degrade performance margins	Voltage stress, ripple current, thermal cycling, surge exposure,
Measurable Degradation	Component parameters shift measurably from initial values	ESR increase in capacitors, insulation resistance reduction, cor
Early Warning Signs	System behavior begins to show observable indicators	Output ripple increase, efficiency drop, audible noise, output vo
Catastrophic Failure	The power supply ceases to operate within specification	Output shutdown, short circuit, open circuit, smoke or fire, safet

1.3 Bathtub Curve

The well-known bathtub curve describes three phases of failure rate over product lifetime.

Phase	Characteristic	Design Considerations
Infant Mortality	Higher failure rate during early operation, decreasing over time	Burn-in screening, factory aging, incoming inspection
Useful Life	Low, relatively constant failure rate	Proper derating, thermal management, process control, compor
Wear-Out	Failure rate increases as components reach end of life	Capacitor lifetime, mechanical wear, connector cycling, thermal

Design measures that address each phase:

- **Infant mortality:** Controlled burn-in, production screening, thermal cycling during manufacturing
- **Useful life:** Component derating, adequate thermal margins, robust protection circuits, controlled manufacturing processes
- **Wear-out:** Capacitor lifetime calculation, connector cycle ratings, thermal aging estimation, maintainability planning

1.4 Design Review Roles

A reliability design review benefits from cross-functional participation. The following roles are typically involved:

Role	Responsibility
Project Engineering	Overall design coordination, schedule, customer interface
Hardware Engineering	Circuit design, component selection, electrical analysis
Mechanical Engineering	Enclosure, thermal management, connector integration
Quality Assurance	Validation planning, test oversight, data review
Sourcing	Component supply chain, alternative part qualification
Manufacturing Engineering	Production process, test coverage, yield optimization
Compliance	Safety certification, EMC testing, regulatory requirements
Customer Project Owner	Application requirements, acceptance criteria, project specification

Section 2 -- Product Specification Review

2.1 Specification Checklist

A complete and unambiguous product specification is the foundation of reliability. The following items should be reviewed and confirmed before electrical design begins.

#	Requirement	Confirmed Value	Source	Status
1	Input voltage range			
2	Input frequency			
3	Maximum output voltage			
4	Rated output current			
5	Peak current and duration			
6	Continuous rated power			
7	Startup load condition			
8	Dynamic load step and slew rate			

9	No-load input power
10	Efficiency target
11	Output ripple and noise
12	Hold-up time requirement
13	Operating temperature range
14	Storage temperature range
15	Operating humidity
16	Maximum operating altitude
17	Cooling method
18	Enclosure type and dimensions
19	Application category
20	Target market and region
21	Required safety certifications
22	Expected product lifetime
23	Cable length and type
24	Output connector type and polarity
25	Grounding class
26	Indoor or outdoor use
27	Continuous or intermittent duty
28	EMC standard and class

2.2 Specification Risk Review

When specification values are pushed near physical or economic limits, additional risk review is warranted.

Requirement	Confirmed Value	Risk Assessment	Owner	Status
Example: Hold-up time	*20 ms at full load*	*Moderate -- requires large bulk capacitance, PCB space and temperature margin*		

Section 3 -- AC Input Protection Design

3.1 Input Protection Chain

The AC input section must be designed to handle normal operation, transient events and abnormal conditions. The typical protection chain is:

AC Input → Fuse → MOV → Common Mode Choke → NTC Thermistor → Bridge Rectifier → Bulk Capacitor → DC Bus

Each component in this chain has specific reliability considerations.

3.2 Fuse

Check Item	Design Consideration
Voltage rating	Must exceed maximum input voltage including tolerance
Current rating	Must accommodate normal operation including inrush
Breaking capacity	Must exceed prospective short-circuit current
Time-delay or fast-acting	Select based on inrush and overload coordination
Inrush compatibility	Fuse should not open during normal startup
Abnormal test behavior	Fuse must clear safely under fault conditions without enclosure damage
Certification status	Fuse should be certified to the applicable safety standard

3.3 MOV (Metal Oxide Varistor)

Check Item	Design Consideration
Maximum continuous operating voltage	Must exceed maximum line voltage with tolerance
Clamping voltage	Must protect downstream components within their ratings
Surge energy capability	Must accommodate the expected surge environment
End-of-life behavior	MOV failure mode (short or open) should be coordinated with upstream fuse
Thermal protection consideration	Thermally protected MOVs reduce fire risk at end of life
Placement	MOV should be placed close to the input terminals
Spacing	Adequate spacing from heat-sensitive components and PCB edges

3.4 Common Mode Choke

Check Item	Design Consideration
Current rating	Must accommodate maximum input current with margin
Saturation risk	Saturation reduces inductance and degrades EMI performance
Temperature rise	Core loss and copper loss should be verified
EMI effectiveness	Impedance at switching frequency and harmonics should meet design targets
Insulation system	Winding insulation must withstand applicable voltage

3.5 NTC Thermistor

Check Item	Design Consideration
Cold resistance	Determines peak inrush current
Steady-state current rating	NTC must not overheat under continuous load
Thermal recovery time	If power is cycled rapidly, the NTC may not have recovered
Restart interval	Consider whether the load side bleeds down before reconnection
Inrush reduction effectiveness	Verify against rectifier and capacitor surge ratings

3.6 Bridge Rectifier

Check Item	Design Consideration
Reverse voltage rating	PIV should include margin above peak input voltage
Forward current rating	Average and peak current should be within ratings
Surge current rating	Must withstand capacitor inrush
Thermal dissipation	Heatsinking requirement should be verified at worst-case input and load
Junction temperature	Operating junction temperature should allow adequate margin below maximum

3.7 Bulk Capacitor

Check Item	Design Consideration
Rated voltage	Must exceed peak DC bus voltage during normal and transient conditions
Capacitance tolerance	Minimum capacitance must still meet hold-up requirement
Ripple current rating	Ripple current should be within capacitor rating with margin
Temperature rating	105degC grade preferred for high-temperature locations
Hold-up time verification	Calculate based on minimum capacitance and discharge
Lifetime estimation	Evaluate based on hot-spot temperature and ripple current
Surge voltage margin	Capacitor should not see voltage exceeding its rated voltage

3.8 AC Input Protection Review Table

Item	Design Requirement	Evidence	Status	Action
Fuse -- voltage rating				
Fuse -- current rating				
Fuse -- breaking capacity				
MOV -- continuous voltage				
MOV -- energy rating				
CM Choke -- current rating				
NTC -- cold resistance				
NTC -- steady-state current				
Bridge -- voltage rating				
Bridge -- thermal				
Bulk cap -- voltage				
Bulk cap -- ripple current				
Bulk cap -- lifetime				

Section 4 -- Component Selection and Derating

4.1 Derating Principles

Component derating is a fundamental reliability practice. Operating a component below its rated maximum reduces stress-related failure risk and extends useful life. Derating recommendations should be evaluated based on:

- Application duty cycle
- Operating temperature and enclosure environment
- Airflow availability
- Expected product lifetime
- Customer reliability requirements
- Manufacturer reliability data

The values in this section represent typical engineering practice and should be adjusted based on specific project requirements and component manufacturer recommendations. They do not replace detailed analysis.

4.2 Electrolytic Capacitors

Check Item	Design Consideration
Temperature rating	105degC grade preferred for high-temperature or enclosed environments
Voltage derating	Operating voltage should allow margin below rated voltage, especially at high ambient te
Ripple current margin	Ripple current rating should exceed calculated ripple with margin
ESR	Higher ESR increases internal heating and reduces ripple current capability
Hot-spot temperature	Estimated core temperature should be within capacitor rating
Lifetime calculation	Evaluate using manufacturer data at expected operating conditions
Manufacturer reliability data	Prefer capacitors from established manufacturers with published lifetime data
Vent orientation	Pressure vent should not face heat sources or sensitive components
Distance from heat sources	Capacitors should not be placed adjacent to high-temperature components
Mechanical support	Large capacitors should be secured against vibration

Capacitor Lifetime Estimation

A commonly used simplified temperature-based lifetime estimation:

$L = L_0 \times 2^{((T_0 - T) / 10)}$

Where:

L_0 = Rated lifetime at maximum rated temperature

T0 = Rated maximum core temperature (degC)

T = Estimated operating core temperature (degC)

Calculation example:

Parameter	Value
Rated lifetime (L0)	5,000 hours at 105degC
Estimated operating core temperature (T)	75degC
Temperature difference (T0 − T)	30degC
Approximate multiplier (2^3)	8
Estimated lifetime	5,000 x 8 = 40,000 hours

Important note: This simplified formula provides a rough engineering estimate only. Actual lifetime depends on ripple current, ambient temperature variation, enclosure airflow, manufacturing tolerance and converter topology. Final lifetime evaluation should use the capacitor manufacturer's published lifetime calculation method for the specific series.

4.3 MOSFETs

Check Item	Design Consideration
VDS voltage margin	Maximum drain-source voltage including spikes should be within rating
ID current rating	Peak and RMS drain current should be within safe operating area
RDS(on)	Conduction losses drive junction temperature; verify at worst-case temperature
Switching loss	Switching losses should be calculated based on gate charge, voltage and frequency
Conduction loss	Verify at maximum load and worst-case input voltage
Gate drive voltage	Gate drive should fully enhance the MOSFET to minimize RDS(on)
Avalanche capability	Verify single-pulse and repetitive avalanche ratings for the application
Junction temperature	Maximum junction temperature should allow adequate margin
Heat sinking	Thermal resistance of the heatsinking path must be adequate
Layout parasitics	Gate drive loop and power loop inductance should be minimized

4.4 Rectifiers and Diodes

Check Item	Design Consideration
Reverse voltage rating	PIV rating must include margin above maximum reverse voltage
Forward current rating	Average and peak current must be within ratings
Surge current rating	Non-repetitive surge should be verified
Reverse recovery	Recovery losses increase with temperature and frequency
Thermal rise	Junction temperature should be calculated for worst-case conditions
Switching frequency suitability	Fast recovery or Schottky as required by topology and frequency

4.5 Transformer

Check Item	Design Consideration
Core material	Select for operating frequency, flux density and temperature stability
Flux density	Operating flux density should allow margin to saturation
Temperature rise	Core and copper losses should be verified within insulation class
Winding current density	Copper loss should be balanced across windings
Insulation system	Primary-secondary insulation must meet applicable safety standard
Margin tape	Required for reinforced insulation in many standards
Triple-insulated wire	Consider for secondary windings when space is constrained and reinforced insulation is r
Leakage inductance	Should be minimized or accounted for in snubber and efficiency design
Audible noise	Core gaps, frequency and flux density affect audible noise

Manufacturing consistency	Winding process, core assembly and testing should be controlled

4.6 Optocoupler

Check Item	Design Consideration
CTR range	Design for minimum CTR over lifetime and temperature
CTR aging	CTR degrades over time; allow margin
Temperature behavior	CTR varies with temperature; verify over operating range
Isolation rating	Must meet applicable safety standard requirements
Supplier quality	Prefer components from established manufacturers
Control loop margin	Verify loop stability across CTR range and temperature

4.7 Resistors and Current-Sense Components

Check Item	Design Consideration
Voltage rating	Maximum applied voltage including transients
Power dissipation	Operating power should include derating margin
Pulse capability	Verify for surge and inrush applications
Tolerance	Select based on circuit accuracy requirements
Temperature coefficient	Verify drift over operating temperature range
Flameproof requirements	Safety-critical locations may require flameproof resistors
Parallel sharing	When paralleling, ensure equal current sharing through matching or individual series resi

Section 5 -- Thermal Reliability Design

5.1 Thermal Design Principles

Temperature is a primary driver of power supply failure rates. Effective thermal management requires understanding the difference between measurement points and ratings.

- **Ambient temperature is not component temperature.** The local air temperature around each component may be significantly higher than the external ambient.
- **Enclosure surface temperature is not junction temperature.** Internal airflow, component placement and enclosure material all affect internal temperatures.
- **Hot-spot measurement is necessary.** Single-point monitoring may miss the highest-temperature location.
- **Full-load testing should consider worst-case input.** Minimum input voltage typically produces the highest input current and therefore the highest conduction losses.
- **Thermal testing should consider orientation and airflow.** A power supply that passes in a bench test may overheat when enclosed or mounted in a different orientation.

5.2 Thermal Measurement Points

The following components should be monitored during thermal validation:

#	Measurement Point	Rationale
1	Bulk capacitor case or core	Lifetime directly affected by temperature
2	Primary MOSFET case and heatsink	Junction temperature estimation
3	Secondary rectifier case	Junction and thermal margin
4	Transformer core center	Core loss heating
5	Transformer winding (accessible)	Copper loss and insulation stress
6	Current-sense resistor body	Local heating from dissipation
7	Bridge rectifier case	Inrush and conduction heating
8	Output capacitor case	Ripple current heating

9	Control IC case	Internal regulator and driver dissipation
10	Optocoupler body	Ambient temperature and CTR margin
11	Enclosure internal hot spot	Internal ambient estimate
12	Cable exit point	Connector and wire heating
13	Output connector	Contact resistance and load current

5.3 Thermal Test Conditions

Thermal validation should include the following conditions:

Condition	Purpose
Minimum input voltage, full load	Highest input current, worst-case conduction losses
Maximum input voltage, full load	Highest switching losses, highest rectifier stress
Full load at maximum rated ambient	Worst-case operating scenario
Peak load (where specified)	Verify thermal margin under transient loading
Enclosed in customer-representative housing	Simulates real installation
Worst-case orientation	Orient to minimize natural convection
No external airflow	Unless customer specifies forced air
Stabilized condition	Allow sufficient time for thermal equilibrium

5.4 Thermal Review Table

Component	Rated Maximum	Measured Temperature	Estimated Junction / Hot-Spot	Margin	Status	Corrective Action
Primary MOSFET	*per datasheet*					
Secondary diode	*per datasheet*					
Transformer core	*per core spec*					
Bulk capacitor	*per datasheet*					
Output capacitor	*per datasheet*					
Bridge rectifier	*per datasheet*					
Control IC	*per datasheet*					
Cable / connector	*per connector spec*					

Review guidelines:

- Compare measured temperatures against component manufacturer ratings
- Compare estimated hot-spot / junction temperatures against derating targets
- Include suitable engineering margin above maximum allowed temperature
- Verify against applicable safety standard temperature limits for insulation class, enclosure and accessible surfaces

Section 6 -- PCB Layout and Insulation Reliability

6.1 Creepage and Clearance

Creepage and clearance distances must be determined based on the specific design conditions and applicable safety standard. Factors that affect required distances include:

Factor	Effect on Required Distance
Working voltage	Higher voltage increases required creepage and clearance
Pollution degree	Higher pollution levels reduce effective insulation
Material group (CTI)	Lower comparative tracking index requires larger creepage
Overvoltage category	Higher category requires larger clearance
Insulation type (basic, supplementary, reinforced)	Reinforced insulation requires approximately double basic distances
Altitude	Higher altitude reduces air dielectric strength, requiring larger clearance
Applicable standard	IEC 62368, IEC 60950, IEC 60601 and others have different requirements

Important: Final creepage and clearance values must be verified against the applicable safety standard, working voltage, pollution degree, material group, insulation category and target market. Generic distance tables are not sufficient for compliance.

6.2 Isolation Barrier

Check Item	Design Consideration
Clear primary-secondary boundary	Physical separation zone should be clearly defined on the PCB
No copper crossing isolation zone	Maintain void area under the isolation barrier
Transformer pin spacing	Primary-secondary pin spacing should meet requirements
Optocoupler pin spacing	Creepage distance between input and output pins
Y-capacitor placement	Should bridge the isolation barrier with appropriate spacing
Slot or groove use	PCB slots increase effective creepage distance
Solder mask limitations	Solder mask is not credited for creepage distance
Contamination path	PCB surface contamination can reduce effective creepage
Manufacturing tolerance	Production variation reduces nominal clearance; design for worst case

6.3 Conformal Coating

Check Item	Design Consideration
Coverage definition	Areas to be coated and excluded must be clearly specified
Masked zones	Connectors, test points and adjustment points must be protected
Pinhole risk	Coating must be applied without voids or pinholes
Edge coverage	Component edges and leads must be fully covered
Connector exclusion	Connector pins must remain clean for reliable contact
Rework process	Coating removal and reapplication must be controlled
Coating material compatibility	Must not attack components or degrade insulation
Cure validation	Cure time, temperature and thickness must be verified
Inspection method	UV inspection typically used for coverage verification

Important note: Conformal coating must not be used as an automatic substitute for required creepage and clearance distances unless specifically allowed by the applicable design standard and validated process.

6.4 High-Current PCB Paths

Check Item	Design Consideration
Copper width	Should be sized for current with acceptable temperature rise
Copper thickness	2 oz or heavier copper may be needed for high-current paths
Temperature rise	Verify using IPC-2152 or similar
Via current capacity	Multiple vias in parallel reduce resistance and heating
Solder reinforcement	High-current paths may benefit from solder reinforcement
Connector current path	Ensure adequate copper at connector pins
Current sharing	Parallel paths should share current evenly
Hot-spot prevention	Avoid abrupt width changes and neck-down points

6.5 Solder Reliability

Check Item	Design Consideration
Large component support	Heavy components need additional mechanical fixation beyond solder
Heavy component anchoring	Use adhesive or mechanical mounting for large transformers and capacitors
Thermal cycling risk	Coefficient of thermal expansion mismatch between PCB and components
Cold solder risk	Wave or reflow process parameters must be validated
Voiding	Large vias or ground planes can cause solder voids
Lead-free process	Most production now uses lead-free solder; process must be qualified
Hand-solder control	Hand-soldered joints require visual inspection and process control
Rework limits	Excessive rework degrades PCB pads and component reliability

Section 7 -- Protection Circuit Checklist

7.1 OVP -- Over Voltage Protection

Check Item	Design Consideration
Trigger level	Should be set above normal regulation range but below downstream device limits
Response time	Protection should activate fast enough to prevent output capacitor or load damage
Failure behavior	OVP should still protect if the feedback loop fails open
Independent protection	Critical applications may benefit from secondary, independent protection
Load safety	Verify the output voltage cannot exceed the load's maximum rating

7.2 OCP -- Over Current Protection

Check Item	Design Consideration
Trigger current	Set above rated output but low enough to protect cables and connectors
Protection mode	Constant-current limiting, fold-back or hiccup mode
Cable and connector protection	OCP trigger should prevent cable overheating
Startup compatibility	Protection should not trigger during normal startup into rated load
Recovery behavior	Verify automatic recovery or latch behavior is suitable for the application

7.3 SCP -- Short Circuit Protection

Check Item	Design Consideration
Continuous short capability	Power supply should survive sustained output short circuit
Auto-recovery	Most adapters use auto-recovery; confirm behavior with application
Latch-off behavior	If latch-off is used, confirm restart method and user interface
Thermal stress	Verify no component exceeds its rating during short circuit
Output cable stress	Short circuit current should not damage cable or connector
Repeated short test	Verify protection cycles without degradation over multiple events

7.4 OTP -- Over Temperature Protection

Check Item	Design Consideration
Sensor location	Sensor should be placed at the expected hot spot
Trigger temperature	Set below component or enclosure temperature limits
Recovery temperature	Hysteresis should prevent rapid on-off cycling
Thermal runaway prevention	OTP should prevent cascading thermal failure

7.5 Input Surge Protection

Check Item	Design Consideration
Differential surge	Line-to-line surge: MOV selection and PCB layout
Common-mode surge	Line-to-ground surge: Y-capacitor and isolation coordination
MOV selection	Energy rating and clamping voltage
Fuse coordination	MOV failure should clear safely through upstream fuse
Layout	Input traces should minimize inductance between MOV and protected components
Post-test condition	Verify MOV and other components remain functional after surge test

7.6 Brownout and Abnormal Input

Check Item	Design Consideration
Low-line behavior	Control IC should not oscillate or lose regulation
Repeated restart	Repeated AC cycling at brownout voltage should not cause stress accumulation
Transformer saturation risk	Low-line startup at high load can saturate the transformer
Control IC stability	Verify under-voltage lockout (UVLO) hysteresis
Audible noise	Low-line heavy-load operation can cause audible transformer noise
Output instability	Output should not exhibit oscillation at low input voltage

7.7 Protection Circuit Summary Table

Protection	Required	Trigger Target	Validation Method	Result	Notes
OVP	□ Yes □ No				
OCP	□ Yes □ No				
SCP	□ Yes □ No				
OTP	□ Yes □ No				
Input Surge	□ Yes □ No				
Brownout	□ Yes □ No				

Section 8 -- Control Loop and Output Stability

8.1 Stability Review

Check Item	Design Consideration
Startup behavior	Output should rise monotonically without excessive overshoot
Overshoot at turn-on	Output should not exceed regulation limits during startup
Undershoot at turn-off	Output should not dip below regulation during load-on events
Dynamic load response	Output recovery time and deviation should meet specification
Minimum load stability	Power supply should remain stable with no load or rated minimum load
No-load stability	Output should not oscillate at no load
Loop compensation	Bode plot phase and gain margin should be adequate
Output ripple	Ripple should meet specification under all steady-state conditions
Burst mode / skip mode	Should not produce unacceptable ripple or audible noise
Audible noise	No audible transformer or capacitor noise under rated conditions
Cable voltage drop	Output regulation at the load end should account for cable drop
Remote sense behavior	If remote sense is used, stability must be re-verified
Long cable stability	Long cables add inductance and capacitance; verify stability
Capacitive load range	Output should start and remain stable within specified capacitive load
Inductive load behavior	Output should handle specified inductive load
Battery charging behavior	For charger applications, confirm CC/CV transition stability

8.2 Test Conditions

Test Condition	Load Profile	Notes
10% to 100% load step	Step between 10% and 100% rated load	Measure overshoot / undershoot and recovery
100% to 10% load step	Step from 100% down to 10% rated	Output should not ring or oscillate
Startup at full load	Apply full load before or during startup	Measure any overshoot
Startup with capacitive load	Connect max rated capacitive load	Verify monotonic rise
Hot plug/unplug load	Connect and disconnect load while powered	Observe any instability
Long cable at load end	Test with customer-specified cable	Verify voltage drop and stability
Minimum input voltage	Test at Vmin and full load	Worst-case for loop stability
Maximum input voltage	Test at Vmax and no load	Verify burst mode stability

Section 9 -- Connector, Cable and Mechanical Reliability

9.1 DC Connector Selection

Check Item	Design Consideration
Voltage rating	Connector voltage rating must exceed output voltage
Current rating	Current rating should allow margin, especially for continuous use
Contact resistance	Lower contact resistance reduces heating and voltage drop
Mating cycles	Select connector rated for expected mating cycles
Retention force	Should be sufficient to prevent accidental disconnection
Polarity	Center positive or center negative must be clearly marked
Locking requirement	Locking connectors recommended for vibration or high-reliability applications
Vibration resistance	Connector should maintain contact under expected vibration
Application environment	Dust, moisture and chemical exposure affect connector selection
Customer compatibility	Customer-preferred or standard connector types

Common DC Connector Types

Connector Type	Typical Application	Notes
Barrel connector (5.5x2.1mm, 5.5x2.5mm)	General-purpose adapters	Most common; moderate retention force
Locking DC connector	Industrial, medical, vibration environments	Prevents accidental disconnection
GX connector	Industrial control, LED lighting	Screw-lock, higher reliability
XLR connector	Audio, professional equipment	Locking, good contact quality
Terminal block	Industrial control panels	Screw-clamp, field wiring
Anderson connector	Battery charging, high current	High current capacity, tool-less
XT connector	Battery, RC, energy storage	High current, low resistance
USB-C	Consumer, PD charging	Requires PD protocol; contact wear consideration
Molex / JST	Internal device connections	Small form factor; verify current rating
Ring terminal	Ground connections, high current	High reliability, requires screw termination

9.2 Cable Design

Check Item	Design Consideration
AWG (wire gauge)	Gauge should be sized for output current with temperature rise margin
Current capacity	Cable temperature rise should be below insulation rating
Cable length	Length affects voltage drop and output regulation
Voltage drop	Calculate IR drop; verify load receives sufficient voltage
Temperature rise	Full-load temperature should be within cable rating
Flexibility	Stranded wire for flexible applications; verify minimum bend radius
Bend radius	Tight bends at cable exit stress conductors and insulation
Jacket material	PVC, rubber, TPE or PUR based on application environment
Strain relief	Cable entry to power supply must include strain relief
Pull force	Strain relief should withstand specified pull force
Repeated bending	Flex-life rated cables for applications with movement

9.3 Mechanical Design

Check Item	Design Consideration
Enclosure strength	Housing must withstand expected handling and use
Screw torque	Assembly torque should be specified and controlled
Ultrasonic weld quality	Weld joints should be verified for strength and consistency
Drop resistance	Should withstand specified drop height without functional damage
Vibration resistance	Internal components should not shift under vibration
Transformer fixation	Transformer should be mechanically secured, not relying on pins alone
Large capacitor fixation	Large capacitors should be glued or clamped
Cable exit geometry	Cable should exit without sharp edge contact
Ventilation	Vent openings should prevent internal heat accumulation
Sharp edges	Internal edges should not contact wiring or components
Label durability	Labels should withstand cleaning, abrasion and temperature
Fire enclosure requirements	Enclosure material should meet applicable flammability rating

Section 10 -- EMC and Immunity Reliability

EMC performance affects both compliance and long-term reliability. Repeated transient stress from surges, EFT and ESD events can accelerate component degradation even when no immediate failure occurs. A well-designed protection and filtering scheme supports both regulatory compliance and field reliability.

10.1 Emissions Testing

Test	Applicable Standard	Target Level	Result
Conducted emissions	Depending on target market		
Radiated emissions	Depending on target market		

10.2 Immunity Testing

Test	Applicable Standard	Target Level	Result	Failure Observation	Corrective Action
ESD	Depending on target market				
EFT / Burst	Depending on target market				
Surge (line-to-line)	Depending on target market				
Surge (line-to-ground)	Depending on target market				
Voltage dips	Depending on target market				
Voltage interruptions	Depending on target market				
RF immunity	Depending on target market				
Ring wave	Depending on target market				
Harmonic current	Depending on target market				
Flicker	Depending on target market				

Important note: EMC standards, applicable limits and test levels vary by product type, target market, application category and power rating. Specific standards and levels must be determined for each project based on the intended market and regulatory requirements.

Section 11 -- Environmental Reliability

11.1 Environmental Test Checklist

Test	Purpose	Typical Condition	Status
High-temperature operation	Verify function at maximum rated ambient	Tmax ambient, full load, stabilized	
Low-temperature startup	Verify startup at minimum rated temperature	Tmin ambient, full load on startup	
Thermal cycling	Detect CTE mismatch failures	Tmin to Tmax, specified cycles	
High-temperature storage	Verify survival at storage maximum	Tstg(max), non-operating, specified duration	
Low-temperature storage	Verify survival at storage minimum	Tstg(min), non-operating, specified duration	
Humidity (steady-state)	Verify moisture resistance	85% RH or higher at specified temperature	
Humidity (cyclic)	Verify condensation resistance	Cyclic humidity with temperature variation	
Condensation risk assessment	Evaluate internal condensation potential	Rapid temperature change in humid environment	
Altitude	Verify operation at specified altitude	Reduced pressure at Tmax ambient	
Dust / particulate	Verify sealing and fan reliability (if applicable)	Dust chamber test	
Salt mist	Verify corrosion resistance (coastal or marine)	Salt spray chamber	
Chemical exposure	Verify resistance to expected chemicals	Cleaning agents, oils, industrial exposure	
UV exposure	External cable or housing degradation	UV chamber, specified duration	
Vibration	Verify mechanical integrity under vibration	Specified frequency range and amplitude	
Drop / impact	Verify survival of handling drop	Drop from specified height, all orientations	
Transportation shock	Verify packaging and product survival	Package drop test per ISTA or equivalent	

11.2 Application-Dependent Environmental Planning

Industrial, medical, household and outdoor applications may require significantly different environmental validation plans. For example:

- **Industrial:** Extended temperature range, vibration, dust, aggressive chemicals
- **Medical:** Controlled environment; focus on leakage, isolation, cleaning
- **Household:** Moderate temperature, humidity, user handling, occasional drop

- **Outdoor/lighting:** Wide temperature range, UV, weather exposure, condensation
- **Battery charging:** Temperature-dependent charging profiles, connector cycling

Section 12 -- Reliability Validation Test Plan

12.1 Validation Test Matrix

The following tests form the basis of a typical reliability validation plan. Specific tests, durations and acceptance criteria should be defined based on the product application, risk level, customer requirements and applicable standards.

Test	Purpose	Typical Condition	Sample Qty	Acceptance Criteria	Result
Full-load burn-in	Screen infant mortality	Rated load, Ta = 40degC or as defined	Per production plan	No functional failure	
High-temperature burn-in	Accelerate early failures	Tmax ambient, full load, specified duration	Per validation plan	No functional parameter drift	
Power cycling	Detect thermal fatigue	Alternating full load and no load at Tmax	Per plan	No solder or component failure	
Input voltage cycling	Verify across line variation	Vmin to Vmax cycling at full load	Per plan	Stable output across range	
Output short circuit	Verify protection durability	Repeated short circuit at Tmax	Per plan	Protection remains functional	
Overload	Verify OCP stability	110-120% rated load, extended duration	Per plan	No damage or instability	
Dynamic load response	Verify transient behavior	10-100% load step	Per plan	Within specified deviation	
Surge immunity	Verify input surge survival	Level per applicable standard	Per plan	No damage, auto-recovery	
EFT immunity	Verify transient immunity	Level per applicable standard	Per plan	No disruption beyond criteria	
ESD immunity	Verify ESD survival	Contact and air discharge	Per plan	No functional degradation	
Hi-pot (dielectric strength)	Verify insulation integrity	Voltage per standard, 60 seconds	Per plan	No breakdown or excessive leakage	
Insulation resistance	Verify insulation quality	500 Vdc, measured after Hi-pot	Per plan	Above minimum resistance	
Ground continuity	Verify protective earth path	Current per standard	Per plan	Low resistance path	
Leakage current	Verify touch current	Per applicable standard	Per plan	Below limit	
Low-temperature startup	Verify cold start	Tmin ambient, rated load	Per plan	Normal startup, stable output	
Thermal cycling	Verify temperature endurance	Tmin to Tmax cycles	Per plan	No failure	
Humidity exposure	Verify moisture resistance	85degC / 85% RH or equivalent	Per plan	No corrosion or insulation failure	
Drop test	Verify handling survival	Specified height, all faces	Per plan	No functional damage	
Vibration	Verify mechanical design	Specified profile	Per plan	No intermittent connections	
Cable bend	Verify cable durability	Specified bend radius and cycles	Per plan	No open or intermittent	
Connector insertion	Verify connector durability	Rated cycles	Per plan	No excessive wear	
Pull force	Verify strain relief	Specified force	Per plan	No cable separation	
Long cable voltage drop	Verify regulation at load end	Customer cable length, full load	Per plan	Voltage within spec	
No-load input power	Verify standby performance	Rated input, no load	Per plan	Within spec	
Efficiency	Verify power conversion	25%, 50%, 75%, 100% load	Per plan	Within spec or target	
Ripple and noise	Verify output quality	Full load, 20 MHz bandwidth	Per plan	Within spec	
Audible noise	Verify acoustics	Rated conditions, quiet room	Per plan	Below limit	
Abnormal operation	Verify fault tolerance	Fan blocked, component failure, blocked ventilation	Per plan	Safe failure mode	
Component temperature rise	Verify thermal design	Full load, Tmax ambient, stabilized	Per plan	Within derating targets	

12.2 Burn-In Considerations

Burn-in duration should be determined based on product risk, production control capability and historical data rather than a fixed time for all products.

Typical burn-in duration may range from several hours to extended reliability testing depending on:

- Product complexity and power level
- Component maturity and supply chain quality
- Production process stability
- Customer reliability requirements

- Application criticality

Section 13 -- Seven Common Power Supply Failure Modes

Failure Mode 1: Electrolytic Capacitor Degradation

Aspect	Description
Failure mechanism	Electrolyte evaporation, ESR increase, capacitance loss
Typical cause	High operating temperature, excessive ripple current, near-end-of-life operation
Early warning signs	Output ripple increase, unstable output, efficiency reduction, visible bulging
Detection method	ESR measurement, capacitance measurement, thermal imaging, ripple measurement
Prevention method	Proper derating, 105degC grade selection, adequate cooling, lifetime verification
Recommended validation	Accelerated lifetime test, ripple current verification, hot-spot temperature measurement
Risk priority	4 -- High

Failure Mode 2: Semiconductor Electrical Overstress

Aspect	Description
Failure mechanism	Voltage breakdown, current overstress, secondary breakdown
Typical cause	Surge event, inadequate derating, layout parasitic inductance causing voltage spikes
Early warning signs	Intermittent failure, degraded efficiency after surge, parametric shift
Detection method	Curve tracer, functional test after stress, thermal imaging
Prevention method	Adequate voltage and current derating, snubber circuits, robust gate drive, surge protecti
Recommended validation	Surge and EFT testing, switching node voltage measurement, junction temperature verific
Risk priority	5 -- Critical

Failure Mode 3: Transformer Overheating or Insulation Degradation

Aspect	Description
Failure mechanism	Insulation breakdown, inter-turn short, core saturation
Typical cause	High ambient temperature, excessive flux density, inadequate margin tape, poor impregn
Early warning signs	Audible noise, reduced efficiency, hot enclosure, partial discharge
Detection method	Inductance measurement, turns ratio, hi-pot test, thermal imaging
Prevention method	Adequate core margin, proper insulation system, margin tape, thermal verification
Recommended validation	Temperature rise test, hi-pot, insulation resistance, thermal cycling
Risk priority	4 -- High

Failure Mode 4: Solder Joint Cracking

Aspect	Description
Failure mechanism	Crack propagation in solder joint due to thermal or mechanical cycling
Typical cause	CTE mismatch, vibration, large component mass, inadequate process control
Early warning signs	Intermittent operation, output dropout under vibration, failure at temperature extremes
Detection method	X-ray inspection, micro-sectioning, functional vibration test, thermal cycling test
Prevention method	Large component fixation, appropriate pad design, reflow profile validation, AOI
Recommended validation	Thermal cycling, vibration, drop test, power cycling
Risk priority	3 -- Significant

Failure Mode 5: Connector and Cable Failure

Aspect	Description
Failure mechanism	Contact wear, oxidation, cable breakage, strain relief failure
Typical cause	Repeated insertion cycles, inadequate contact force, undersized conductor, sharp bend r
Early warning signs	Intermittent connection, voltage drop increase, connector heating, visible wear
Detection method	Contact resistance measurement, visual inspection, mechanical pull test, thermal imaging
Prevention method	Adequate current rating, strain relief, bend radius compliance, locking connectors where a
Recommended validation	Connector durability test, cable bend test, pull force, temperature rise
Risk priority	3 -- Significant

Failure Mode 6: Surge and Input Protection Failure

Aspect	Description
Failure mechanism	MOV degradation, fuse fatigue, protection circuit overstress
Typical cause	Repeated surge exposure exceeding MOV energy rating, inadequate coordination, poor l
Early warning signs	Increased leakage current, MOV discoloration or cracking, intermittent protection
Detection method	MOV clamping voltage measurement, surge generator test, visual inspection
Prevention method	Adequate MOV energy rating, fuse coordination, thermally protected MOV, proper layout
Recommended validation	Surge test at specified level, post-test MOV condition inspection, extended surge cycling
Risk priority	4 -- High

Failure Mode 7: Thermal Management Failure

Aspect	Description
Failure mechanism	Cumulative temperature overload, heatsink blockage, thermal interface degradation
Typical cause	Inadequate cooling path, dust accumulation, fan failure (where applicable), incorrect orien
Early warning signs	Increasing internal temperature over time, reduced output at high load, OTP activation
Detection method	Temperature monitoring, thermal imaging, airflow measurement, OTP cycle logging
Prevention method	Adequate heatsink sizing, thermal interface material quality, OTP implementation, enclos
Recommended validation	Thermal rise at boundary conditions, OTP cycling, airflow obstruction test
Risk priority	4 -- High

Failure Mode Summary Table

#	Failure Mode	Primary Cause	Warning Signs	Risk Priority
1	Electrolytic Capacitor Degradation	Heat, ripple current	Ripple increase, bulging	4 -- High
2	Semiconductor Electrical Overstress	Surge, inadequate margin	Intermittent failure, parametric shift	5 -- Critical
3	Transformer Overheating / Insulation Failure	Flux density, temperature	Audible noise, efficiency drop	4 -- High
4	Solder Joint Cracking	Thermal cycling, vibration	Intermittent dropout	3 -- Significant
5	Connector / Cable Failure	Wear, undersized conductor	Voltage drop, heating	3 -- Significant
6	Surge / Input Protection Failure	Repeated surge exposure	MOV degradation	4 -- High
7	Thermal Management Failure	Inadequate cooling	OTP cycling, output reduction	4 -- High

Section 14 -- FMEA Review

14.1 FMEA Overview

Failure Mode and Effects Analysis (FMEA) is a structured method for identifying potential failure modes and their impact on system performance. FMEA scoring systems vary by company and industry. The table below provides a practical starting point and should be aligned with the customer's internal quality system.

14.2 Simplified DFMEA Table

Item	Failure Mode	Effect	Cause	Sev	Occ	Det	RPN	Recommended Action	Owner
1	Bulk capacitor overheating	Reduced lifetime, output ripple	High ripple current, inadequate derating	7	5	4	140	Increase capacitor voltage/ripple rating, rel	EE
2	MOSFET voltage overstress	MOSFET short circuit, supply failure	Surge event, inadequate derating, layout inductance	9	4	5	180	Increase VDS margin, improve snubber, op	EE
3	Transformer insulation weakness	Short circuit, safety failure	Inadequate margin tape, poor impregnation	9	3	4	108	Verify insulation system, add margin tape,	EE / MFG
4	Output connector overheating	Connector damage, voltage drop	Undersized connector, high contact resistance	6	5	5	150	Select higher-rated connector, verify conta	ME / EE
5	Cable voltage drop excessive	Load undervoltage, poor performance	Undersized AWG, excessive cable length	5	4	3	60	Calculate IR drop, increase wire gauge	EE / Customer
6	Inadequate clearance/creepage	Arcing, safety failure	PCB layout error, pollution accumulation	9	3	6	162	Review layout per applicable standard, adc	EE / Compliance
7	Short-circuit protection instability	Output instability, audible noise	Control loop design, current limit instability	5	3	5	75	Characterize protection loop, verify over te	EE
8	Solder cracking under vibration	Intermittent output	Large component mass, CTE mismatch	6	4	5	120	Add adhesive, optimize pad design, therma	ME / MFG

Scoring guidelines (example):

Factor	Scale	Guidelines
Severity (Sev)	1-10	1 = No effect; 10 = Safety or regulatory failure
Occurrence (Occ)	1-10	1 = Extremely unlikely; 10 = Certain
Detection (Det)	1-10	1 = Certain detection; 10 = No detection possible
RPN (Risk Priority Number)	Sev x Occ x Det	Higher RPN indicates higher priority for corrective action

RPN thresholds for action should be defined by the project team based on customer requirements and risk acceptance criteria.

Section 15 -- Application-Specific Reliability Review

15.1 Industrial Control

Review Item	Focus Area
24/7 continuous operation	Derating should account for constant load; lifetime calculation assuming continuous opera
High ambient temperature	Industrial enclosures may reach 50-70degC internally; verify cooling and component ratin
Voltage transients	Industrial environments may experience severe line disturbances; input protection must b
Vibration	Locking connectors, component fixation, conformal coating may be needed
Long cables	Output cables up to tens of meters affect regulation and stability; remote sense may be re
Locking connectors	GX, terminal block or locking DC connectors are preferred
Terminal blocks	For field wiring; verify screw torque specification and wire range
GX connectors	Common for industrial LED and control applications; verify pin current rating
Stable 24V output	24V is the most common industrial bus voltage; verify regulation across line and load
Grounding	Protective earth connection should comply with local industrial requirements
Surge and EFT immunity	Higher immunity levels are typically required for industrial equipment

15.2 Medical and Patient-Near Equipment

Important: The following notes describe design considerations for medical-configuration power supplies. Certification availability, safety configuration, leakage current, insulation system and connector options vary by product model and project requirement. Medical-grade configurations and IEC/EN 60601-1 compliance options are available depending on model, application and target market.

Review Item	Focus Area
Low leakage current	Medical adapters typically require lower touch current; design for Y-capacitor optimization
Reinforced insulation	Primary-secondary insulation design should meet 2 MOPP (means of patient protection) v
Isolation review	Creepage, clearance and insulation should be reviewed per IEC/EN 60601-1
IEC/EN 60601-1 options	Certification is available depending on model, application and target market
Connector locking	Locking connectors prevent accidental disconnection during patient use
Shielding	Transformer and enclosure shielding may be needed for low leakage
Home healthcare	Lower energy devices for home use; still requires appropriate isolation
Personal care	Beauty and personal care devices may have patient-near considerations
Portable medical devices	Lightweight, low power; verify drop resistance and cable reliability
Patient-near equipment	Equipment within patient vicinity has stricter leakage and isolation requirements

15.3 Beauty Equipment

Review Item	Focus Area
IPL devices	Intense pulsed light devices require stable pulse power delivery
Hair removal equipment	High peak current during pulse; verify thermal management
Beauty instruments	Low to medium power; verify connector durability
Rechargeable beauty devices	CC/CV charging profile, battery termination accuracy
Continuous and pulse load	Both modes should be stable and within thermal design
Connector durability	Frequent user handling; verify mating cycle rating
Home-use products	User safety, drop resistance, cable flexibility
Salon equipment	Higher duty cycle; extended operating hours
IEC/EN 60601 considerations	Depending on device classification and market

15.4 Audio Equipment

Review Item	Focus Area
Low noise	Switching frequency should not couple into audio path
Ground loop risk	Output configuration and grounding should avoid ground loops
Shielding	Transformer shielding and enclosure design for minimum radiated noise
Ripple control	Output ripple should be low enough to avoid audible artifacts
Connector quality	XLR or locking connectors preferred for professional audio
XLR or locking options	Professional equipment may require locking connectors
Amplifier peak load	Audio amplifiers typically have high peak-to-average ratio
Audible noise	Power supply should not produce audible noise in quiet listening environments

15.5 Household Appliances

Review Item	Focus Area
Continuous operation	Many appliances run for extended periods; thermal design must reflect this
Cable safety	Household use increases cable wear and bend risk
Moisture exposure	Kitchen and bathroom appliances may face humidity and splash
User contact	Accessible parts must meet touch temperature and leakage limits
Thermal stability	Enclosed in small spaces; verify no overheating
Connector misuse	Connector should support foolproof mating; polarity protection
Abnormal load	Household users may attach non-specified loads; protection should be robust

Common household appliance applications:

- Air purifier, humidifier, robot vacuum charging dock, cordless vacuum charger, smart home hub, electric blanket controller, water purifier, pet water fountain

Section 16 -- Supplier and Manufacturing Reliability

16.1 Supply Chain Reliability

Check Item	Design Consideration
Approved vendor list	Components should be sourced from qualified suppliers
Component traceability	Traceability to date code, lot number and manufacturer
Supplier change control	Supplier-initiated changes should be communicated and qualified
Alternative component approval	Second-source components should be qualified before production
Incoming inspection	Critical components should have defined incoming inspection criteria
Transformer consistency	Winding, core and assembly process should be controlled and verified
Capacitor date code	Capacitors should be within recommended freshness window
Solder process	Solder profile should be verified for each PCB assembly
AOI (automated optical inspection)	Post-solder inspection should cover critical joints and components
ICT (in-circuit test)	In-circuit testing should verify key component values and connections
Functional test	Each unit should undergo a functional test per defined criteria
Hi-pot test	Dielectric strength test for production units
Burn-in	Burn-in process should be defined by product risk and production history
Final inspection	Visual, electrical and label inspection before packaging
Label verification	Label content, legibility and adhesion should be verified
Packaging protection	Packaging should protect against ESD, moisture and physical damage
Lot traceability	Each production lot should be traceable to components and process data
NCR process	Non-conformance reporting and corrective action process
Corrective action	Root cause analysis and corrective action for production issues
Engineering change control	Design changes should follow a formal review and notification process

16.2 Production Reliability Control Plan

Process Step	Risk	Control Method	Frequency	Record	Owner
Incoming inspection	Out-of-spec components	Visual check, parameter measurement	Per lot	Inspection report	QA
PCB assembly	Solder defects	AOI, process parameter monitoring	Every board	AOI log	MFG
ICT	Component value errors	In-circuit test	Every board	ICT report	MFG
Functional test	Electrical failure	Test per specification	Every unit	Test record	MFG
Hi-pot test	Insulation weakness	Dielectric strength test	Every unit	Hi-pot log	QA
Burn-in	Infant mortality	Defined profile	Per product plan	Burn-in report	QA
Final inspection	Visual / labeling defects	Checklist inspection	Every unit	Inspection record	QA

Section 17 -- Final Design Review Checklist

17.1 Complete Sign-Off Checklist

Each item below should be reviewed and one of the following statuses assigned:

- **Pass** -- Requirement is met
- **Review** -- Needs further evaluation
- **N/A** -- Not applicable to this project
- **Action Required** -- Must be resolved before design approval

#	Category	Review Item	Status	Owner	Due Date	Comment
	Specification					
1	Spec	Input/output parameters clearly defined				
2	Spec	Application and target market confirmed				
3	Spec	Required certifications listed				
4	Spec	Environmental conditions defined				
	Electrical Design					
5	Electrical	AC input protection chain reviewed				
6	Electrical	Protection circuits (OVP, OCP, SCP, OTP) designed				
7	Electrical	Control loop stability verified				
8	Electrical	Startup behavior acceptable				
9	Electrical	Output ripple meets specification				
10	Electrical	Hold-up time verified				
11	Electrical	Efficiency target achievable				
	Component Selection					
12	Component	All critical components derated per guidelines				
13	Component	Capacitor lifetime calculated				
14	Component	MOSFET / diode junction temperature acceptable				
15	Component	Transformer design validated				
16	Component	Optocoupler CTR margin adequate				
	Thermal					
17	Thermal	Component temperatures measured and within limits				
18	Thermal	Hot-spot identified and addressed				
19	Thermal	Worst-case conditions tested				
20	Thermal	Enclosure ventilation adequate				
	PCB Layout					
21	PCB	Creepage and clearance verified per standard				
22	PCB	Isolation barrier maintained				
23	PCB	High-current paths sized correctly				
24	PCB	Large components mechanically secured				
	Insulation					
25	Insulation	Primary-secondary insulation reviewed				
26	Insulation	Transformer insulation system confirmed				
27	Insulation	Hi-pot and insulation resistance tested				
28	Insulation	Conformal coating (if used) process verified				
	Protection					
29	Protection	OVP trigger and response verified				
30	Protection	OCP / SCP behavior verified				
31	Protection	OTP thermal protection functional				
32	Protection	Surge protection adequate				
	EMC					
33	EMC	Conducted emissions within limits				
34	EMC	Radiated emissions within limits				
35	EMC	Immunity testing (ESD, EFT, surge) passed				
	Mechanical					
36	Mechanical	Enclosure strength and fit confirmed				
37	Mechanical	Drop and vibration tested				

38	Mechanical	Fire enclosure requirements met
	Cable and Connector	
39	Cable	Connector current rating adequate
40	Cable	Cable gauge sized for current and voltage drop
41	Cable	Strain relief tested
42	Cable	Polarity and marking correct
	Validation	
43	Validation	Reliability test plan defined
44	Validation	Burn-in conditions defined
45	Validation	All tests executed per plan
46	Validation	Test results reviewed and acceptable
	Compliance	
47	Compliance	Safety certifications identified for target market
48	Compliance	Applicable standards listed
49	Compliance	EMC standard and class defined
	Manufacturing	
50	MFG	Production test coverage verified
51	MFG	Key component supply confirmed
52	MFG	Lot traceability process in place
	Documentation	
53	Docs	Schematic, BOM and layout reviewed
54	Docs	Datasheet and specifications prepared
55	Docs	Test report complete
	Customer Requirements	
56	Customer	All customer specifications reviewed
57	Customer	Special requirements documented
58	Customer	Customer approval obtained (where required)

Section 18 -- Design Approval Page

18.1 Project Information

Field	Value
Project Name	
Customer	
Product Model	
Output Rating	
Application	
Target Market	
Required Certifications	
Review Date	

18.2 Review Sign-Off

Role	Name	Signature	Date
Hardware Engineer			
Mechanical Engineer			
Quality Engineer			
Compliance Engineer			
Project Manager			
Customer Representative			

18.3 Open Actions

#	Action Item	Owner	Due Date	Status

18.4 Final Result

Result	Selection
Approved	◻
Approved with Conditions	◻
Rework Required	◻
Rejected	◻

Conditions (if approved with conditions):

Section 19 -- Conclusion

Reliable power supply design requires coordinated control of multiple interacting factors: electrical stress, thermal stress, component aging, insulation integrity, PCB layout, mechanical construction, production consistency and validation testing.

No single design activity ensures reliability. It is the cumulative effect of structured engineering review, proper component selection, adequate thermal management, robust protection design and controlled manufacturing that produces a reliable power supply.

YHYadapter applies structured engineering review methods to support OEM/ODM power projects across industrial, medical, beauty, audio, household and other applications. Design review, component selection, thermal analysis and validation planning are adapted to each project's specific requirements.

Certification availability, safety configuration, leakage current, insulation system, environmental rating and connector options vary by product model and project requirement. Each project should confirm these parameters based on:

- Product model and rating
- Application and industry
- Input and output specifications
- Target market and regulatory environment
- Customer project specification

Section 20 -- Disclaimer

This document is intended as a general engineering reference and design review aid. It does not replace applicable safety standards, EMC standards, regulatory requirements, customer specifications, component manufacturer recommendations or qualified engineering judgment. Final design requirements must be verified for the specific product, application, operating environment and target market.

Certification availability, safety configuration, leakage current, insulation system, environmental rating and connector options vary by product model and project requirement.

The component derating values, temperature limits, lifetime formulas and test conditions provided in this document represent typical engineering practice for reference purposes. They should be evaluated against the specific design conditions, component manufacturer data and applicable standards for each project.

YHYadapter makes no representations or warranties regarding the completeness or accuracy of the information in this document for any specific application. Users should exercise their own engineering judgment and consult with qualified professionals for their specific design requirements.

YHYadapter

Power Adapter & Battery Charger Manufacturer

Founded in 2010

OEM/ODM Power Solutions

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Discuss Your Power Supply Project

Bathtub Curve

Failure Progression Timeline

Input Protection Chain

Component Derating Matrix

Thermal Review Diagram

Pcb Isolation Diagram

Protection Matrix

Failure Mode Matrix

Fmea Risk Matrix

Validation Flow

Application Reliability Matrix

Final Design Review Workflow

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