

Introduction

Power electronics cover different disciplines ranging from magnetics design, EMI filter design, analog electronics, power semiconductors, circuit protection, and now recently digital signal processing. The objective of a power electronics circuit is to modify energy in the form of voltage and current at different frequencies, or, in other words, to modify the input voltage and current conditions. This circuit conditioning short form brochure provides information on the Bourns® product portfolio for power electronic applications.

A switch mode power supply and drive can be described as a series of building blocks as shown in figure 1, each with the following functions:

- A) Protection
 - a. Protection of the circuit from lightning and switching transients on the AC mains (IEC 61000-4-4 and IEC 61000-4-5)
 - b. Short Circuit Protection
 - i. For agency short circuit testing of low power circuits
 - ii. For prevention of short circuiting of IGBTs on inverter legs
- B) EMI
 - a. Conducted emissions (IEC 61000-4-6)
 - b. Radiated emissions (EN 61000-4-3)
- C) Transformer and Output Filter

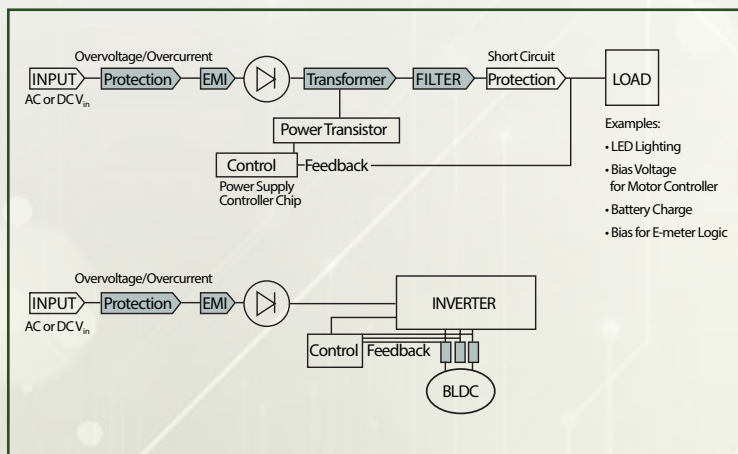


Figure 1 Shaded areas outline where Bourns® Components are used in power applications

CUSTOM TRANSFORMER DESIGN EVALUATION WORKSHEET

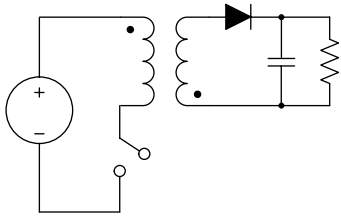
In order to facilitate the initial feasibility study, the design engineer should fill out the appropriate information in the worksheet below. This will allow the Bourns transformer designer to propose the optimum design that will achieve the highest possible efficiency.

Bourns has standard cores, bobbins, enamel and single, double and triple insulated wire in stock for custom transformer and inductor designs.

Transformer Requirements	Specification Notes
Topology <i>(see page 3 topology tables)</i>	
Power	
Primary Inductance	
Leakage Inductance	
Switching Frequency	
Input and Output Voltage(s)	
Interwinding Capacitance	
Sketch of Windings	
Auxiliary Winding Voltage	
Safety Requirements <i>(Reinforced, Single, Functional, Operational)</i>	
Coupling Between Secondaries	
Operating Temperatures	
Name of Controller IC	

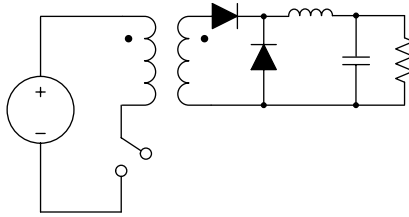
Topologies

Flyback Converter Topology



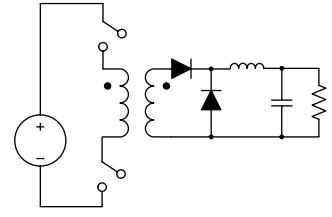
Isolation	Yes
Max. Power (W)	100
Strengths	Ground referenced switch, multiple outputs, fewer components
Weaknesses	Limited to 10 A output, high stress on diode, inefficient (use of ZVS converters improves losses)
Applications	AC/DC, DC/DC appliances, solar inverters, LED lighting, AC adaptors, E-meters, battery charging, automotive, circuit breakers, TVs, STBs, PoE

Forward Topology



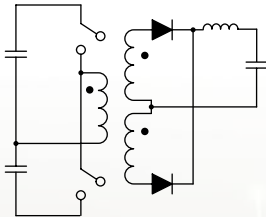
Isolation	Yes
Max Power (W)	200
Strengths	Large step-down ratio
Weaknesses	High voltage on-switch increases power lost
Applications	AC/DC, DC/DC industrial controls

Two-Switch Forward Topology



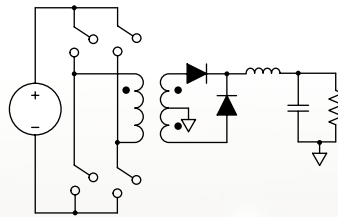
Isolation	Yes
Max. Power (W)	1000
Strengths	Very rugged circuit
Weaknesses	Noisy input
Applications	AC/DC, DC/DC industrial controls

Half Bridge Forward Topology



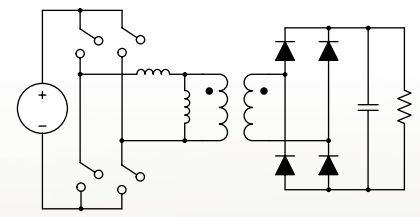
Isolation	Yes
Max. Power (W)	500
Strengths	Reduced core loss
Weaknesses	Does not work well with current mode making it less than ideal for off line power supplies
Applications	DC/DC industrial controls, telecom, data processing

Full Bridge Forward Topology



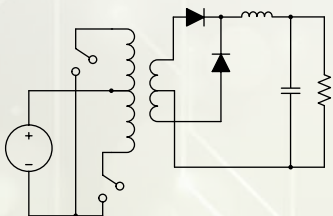
Isolation	Yes
Max. Power (W)	5000
Strengths	Clamped primary switch and minimal switching losses
Weaknesses	Requires experience to get working properly
Applications	AC/DC, DC/DC industrial controls, telecom, data processing, automotive HEV / EV

Full Bridge Resonant Topology



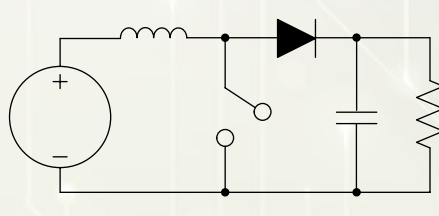
Isolation	Yes
Max. Power (W)	5000
Strengths	Soft switching
Weaknesses	Narrow input range
Applications	Lighting

Push Pull Converter Topology



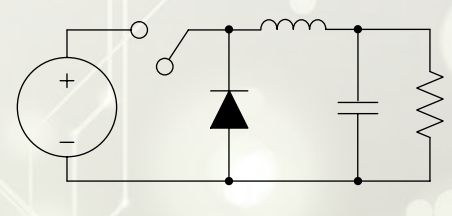
Isolation	Yes
Max. Power (W)	500
Strengths	Ground referenced switches
Weaknesses	Can only tolerate low input voltages
Applications	DC/DC battery charging, servers

Boost Converter Topology



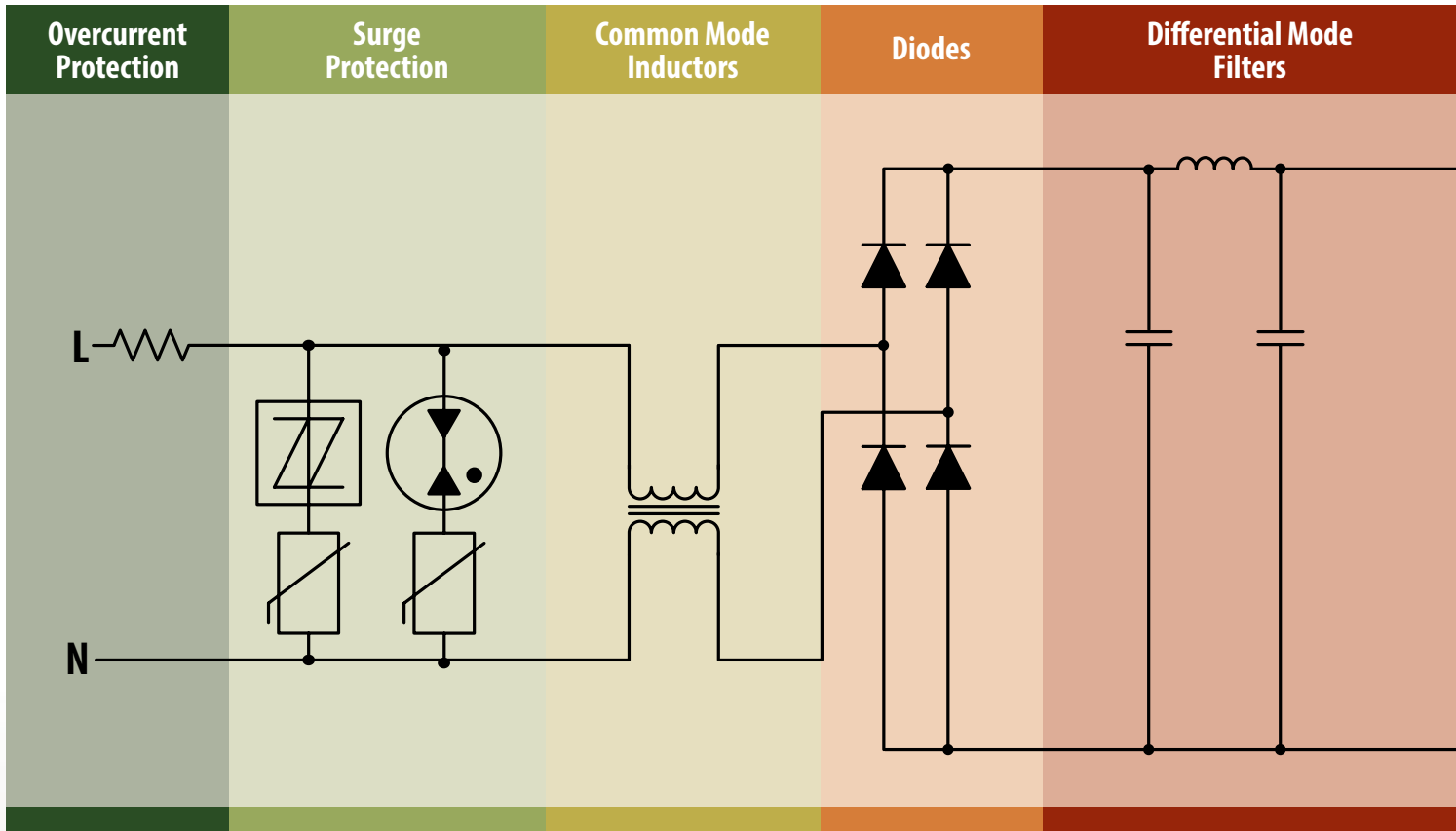
Isolation	No
Max. Power (W)	1000
Strengths	Low noise input
Weaknesses	Requires current mode control and has no isolation
Applications	AC/DC, DC/AC power factor correction circuits, automotive electric vehicles, motor drives (appliances)

Buck Converter Topology



Isolation	No
Max. Power (W)	1000
Strengths	Low noise output
Weaknesses	Optimum input/output ratio must be less than 10; no isolation
Applications	AC/DC, DC/DC notebooks, servers, graphic processors, automotive

Product Configuration Chart



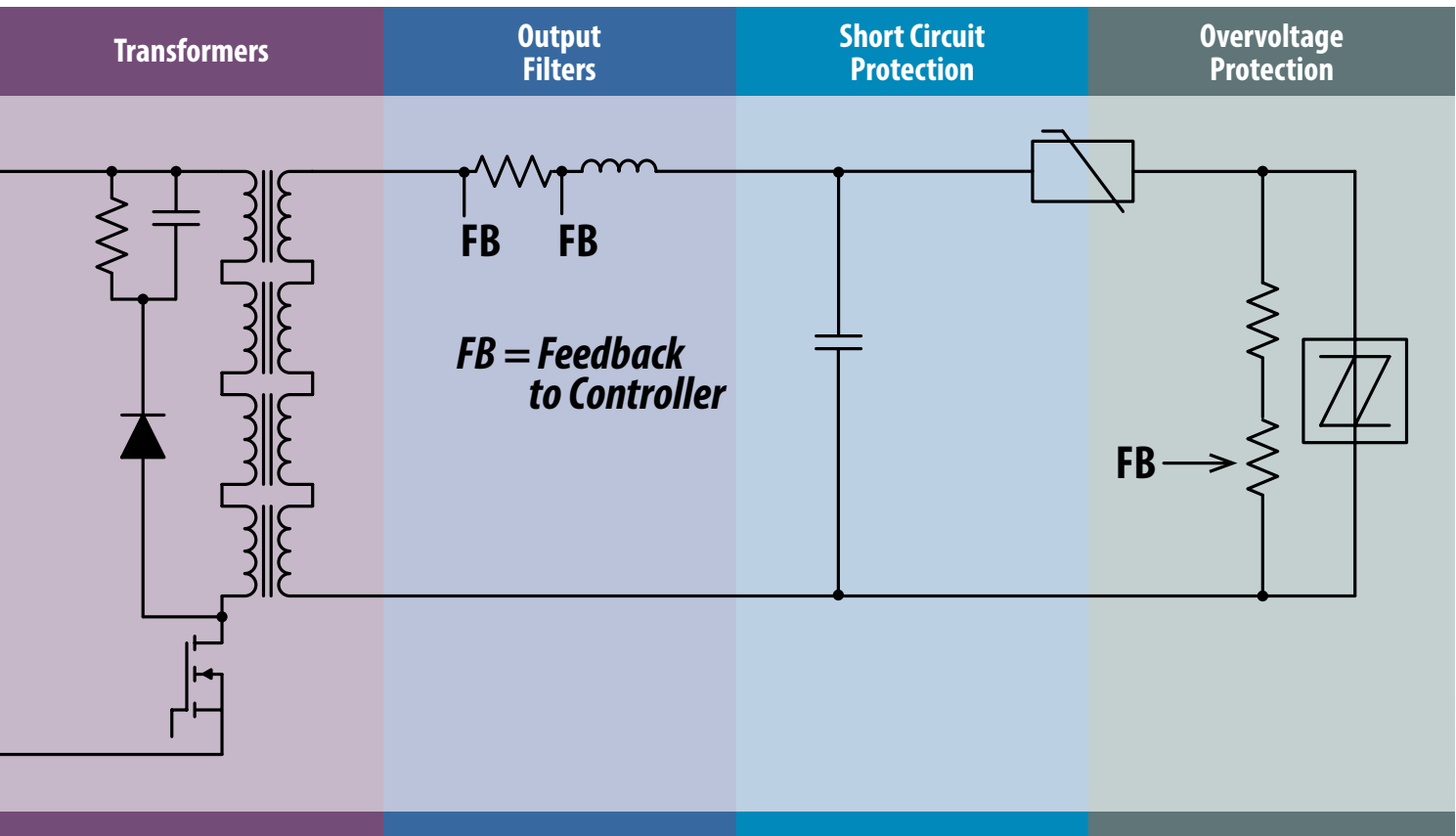
Wirewound Resistors	
Model	Description
FW Series	UL listed fusible resistors
WS Series	Capable of withstanding up to 10 kV

Common Mode Inductors	
Model	Description
7100 Series	Toroid Max 10 A
7300 Series	Split Bobbin Model Max. 1.5 A
7400 Series	Split Bobbin Model Max. 2.8 A
7500 Series	Split Bobbin Model Max. 4.4 A
8100 Series	Toroid Max. 20 A

Inductors	
Model	Description
5300 Series	Axial leaded inductor with 500 Vrms rating
8230 Series	Axial leaded high Q 500 Vrms rating
9250A Series	Axial leaded high Q 1,000 Vrms Up to 125 °C
RLB Series	Radial 5 - 11.7 mm up to 6 A
RLB0912 Series	Radial 9 mm up to 10 A, 125 °C

Surge Arrestors	
Model	Description
ACTP250J1BJ	SMB packaged protector
SA Series	GDT with up to 7,200 V breakover
2017 Series	Ultra-low profile GDT

Diodes	
Model	Description
CDNBS04 Series	Bridge rectifier 800 V VR
CD-MBL1 Series	Bridge rectifier 1,000 V VR
CD1408 Series	Ultra-fast rectifier diode 1,500 V VR



Transformers	
Core Type	Power Capability (W)
EP5, ER7.5	20
EPC10, EFD10, EPC15	50
EP7, EPC20, EE10, EE13	100
EE16, EE19, EE20, EE25, EPC24	150
EPC125, EPC30, PQ26/20	500
EC35, EC29A, EC28B, FED28A, EC40B, RM14	700

Power Inductors	
Model	Description
SRP Series	SMD carbonyl powder inductors
SRR1280	SMD shielded ferrite inductors
SDR1006	SMD non-shielded ferrite inductors
SRN2012	SMD semi shielded ferrite inductors
SRU2013	SMD shielded ferrite inductors

Current Sense Resistors	
Model	Description
CRE2512	3 W 2512 size SMD
CST0612	1 W 0612 4-terminals
CRA2512	3W 2512 size SMD

Multifuse® PPTC Resettable Fuses	
Model	Description
MF-RHT Series	High temperature PPTC (125 °C)
MF-LSMF Series	SMD 2320 size PPTC with 33 V rating
MF-MSMF Series	SMD 1812 size PPTC with 60 V rating


SinglFuse™ Thin Film Chip Fuse	
Model	Description
SF1206	Max. 63 V 1206 size fuse


Trimpot® Trimming Potentiometers	
Model	Description
3296	3/8" Square Trimpot® Trimming Potentiometer
3224	4 mm SMD Trimpot® Trimming Potentiometer
3313	3 mm Trimpot® Trimming Potentiometer
3386	3/8" Square Trimpot® Trimming Potentiometer


Thyristor Surge Protectors		
Model	Working Voltage (V)	Max. Breakover Voltage (V)
TISP4015H1BJ	5	15
TISP4025H1BJ	12	25


Bourns® Product Offering


INDUCTORS


SRP	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	47 μ H	46 A	150 °C


SDR	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	15,000 μ H	16 A	125 °C


SRU	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	330 μ H	8 A	125 °C


RL	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	100,000 μ H	10 A	105 °C


RLB	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	82,000 μ H	10 A	105 °C

SRR	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	10,000 μ H	20 A	125 °C


SRN	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	470 μ H	10 A	125 °C


SRF1260A	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	4,000 μ H	17.6 A	125 °C


7100	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	2,000 μ H	11 A	105 °C

5300	Inductor		
	Max. Inductance	Max. Current	Max. Temperature
	10,000 μ H	3.3 A	105 °C


SURGE PROTECTORS


ACTP250J1BJ	AC Transient Surge Protector	
	Max. Sparkover Voltage	Peak Surge Current
	Max. 250 V	1,000 A (Indefinite)


2039	Gas Discharge Tube	
	Max. Sparkover Voltage	Peak Surge Current
	1,100 V	5,000 A

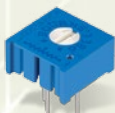
SA2	Gas Discharge Tube	
	Max. Sparkover Voltage	Peak Surge Current
	7,200 V	5,000 A for 10 Strikes

TRIMPOT® TRIMMING POTENTIOMETERS


3296	Multiturn Trimmer	
	Power Rating	Resistance Tolerance
	0.5 W	10 %


3224	Multiturn Trimmer	
	Power Rating	Resistance Tolerance
	0.25 W	10 %


3313	Single-turn Trimmer	
	Power Rating	Resistance Tolerance
	0.125 W	20 %

3386	Single-turn Trimmer	
	Power Rating	Resistance Tolerance
	0.5 W	10 %


Multifuse® PPTC Resettable Fuses


MF-LSMF	Multifuse® PPTC Resettable Fuse		
	Max. Voltage	Max. Hold Current	Max. Temperature
	33V	3 A	85 °C


MF-MSMF	Multifuse® PPTC Resettable Fuse		
	Max. Voltage	Max. Hold Current	Max. Temperature
	60V	2.6 A	85 °C

MF-USMF	Multifuse® PPTC Resettable Fuse		
	Voltage	Max. Hold Current	Max. Temperature
	30V	1.75 A	85 °C


SINGLE BLOW FUSES


SF1206S	SinglFuse™ Slow Blow Fuse		
	Voltage	I ² t	Current
	24V	5.684A ² S	7 A


SF1206F	SinglFuse™ Fast Blow Fuse		
	Voltage	I ² t	Current
	24V	3.25A ² S	7 A


MF-RHT	Multifuse® PPTC Resettable Fuse		
	Voltage	Max. Hold Current	Max. Temperature
	16V	13 A	125 °C

CURRENT SENSE RESISTORS

CRA2512	Current Sense Resistor	
	Power	Min. Resistance
	3 W	0.01 Ω

CRF2512	Current Sense Resistor	
	Power	Min. Resistance
	2 W	0.001 Ω

CRE2512	Current Sense Resistor	
	Power	Min. Resistance
	3 W	0.001 Ω

CST0612	Current Sense Resistor	
	Power	Min. Resistance
	1 W	0.0005 Ω


FUSIBLE WIREWOUND RESISTORS

FW	Fusible Wirewound Resistor	
	Max. Power	Max. Resistance
	7 W	100 Ω


WIREWOUND RESISTORS


WS SERIES	Wirewound Resistor		
	Max. Power	Max. Resistance	Max. Peak Surge Voltage
	8 W	3.3 KΩ	10 kV

POWER RESISTORS

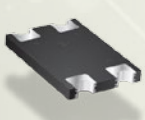
PWR263S	Power Resistor	
	Max. Power	Pulse
	35 W	10 J in 0.1 sec

THYRISTORS

TISP4025H1BJ	Thyristor	
	Max. Breakover Voltage	Voltage Rating
	25V	12V

TISP4015H1BJ	Thyristor	
	Max. Breakover Voltage	Voltage Rating
	15V	5V

RECTIFIER DIODES

CD-MBL1	Rectifier Diode	
	Max. Current	Max. Voltage
	1 A	1,000 V

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Specifications subject to change without notice. Actual performance in specific customer applications may differ due to the influence of other variables. Customers should verify actual device performance in their specific applications.

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