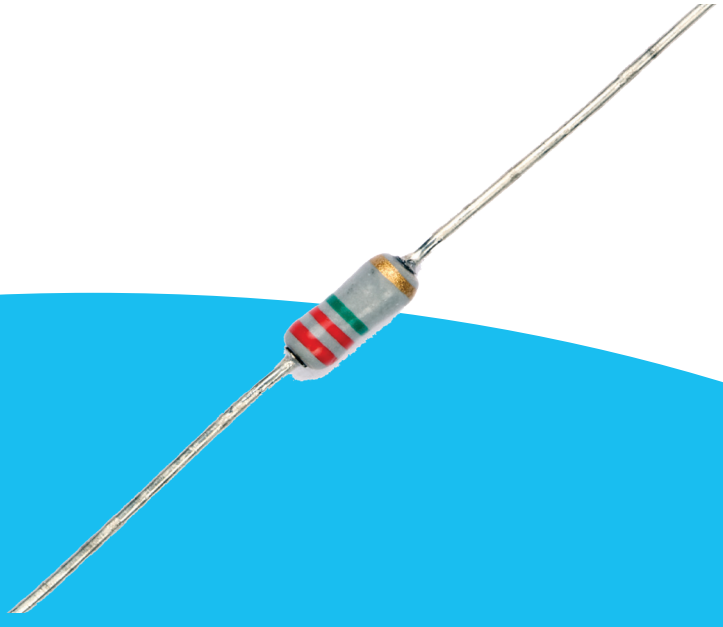
TT Electronics

Lighting Circuits Application Note

Resistors

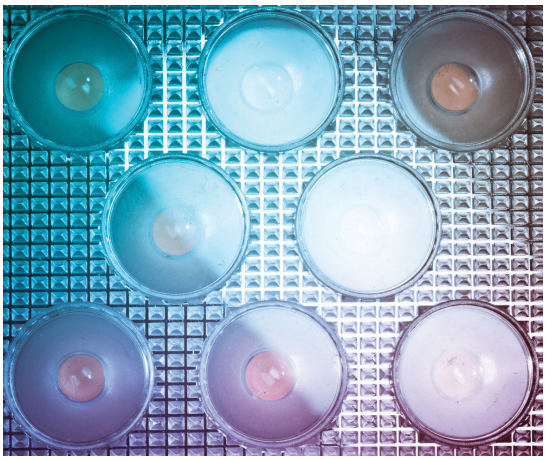
BI Technologies IRC Welwyn



Resistors

Application Note

Resistors for Lighting Applications



Increasing safety standards and the growing trend towards more efficient lighting methods have greatly increased the complexity of lighting circuits and placed new stresses upon components.

In a market where customers demand low prices, small physical size, plus the latest safety standards, designers are faced with a difficult task. TT Electronics has worked closely with lighting designers and manufacturers to make this task easier.

TT Electronics can provide not only standard Metal Film/Oxide and Wirewound resistors, for general non-critical circuitry, but also fusible resistors for circuit protection and pulse withstand resistors capable of withstanding the high surges present during tube start up or strike. TT Electronics can also design and manufacture custom resistors to meet specific circuit requirements,

Applications are not limited to fluorescent light ballast circuits, TT Electronics can provide resistors for use in any lighting application. Some of the more common applications are detailed below.

- High intensity discharge
- Mercury Vapour
- Metal Halide
- High Pressure Sodium
- LED
- UL1412 Recognised

Resistor selected and designed to customer specifications.

Available features include:

- Metal Film
- Metal Oxide
- Wirewound
- Surface Mount
- Custom Leadforming

BI Technologies IRC Welwyn

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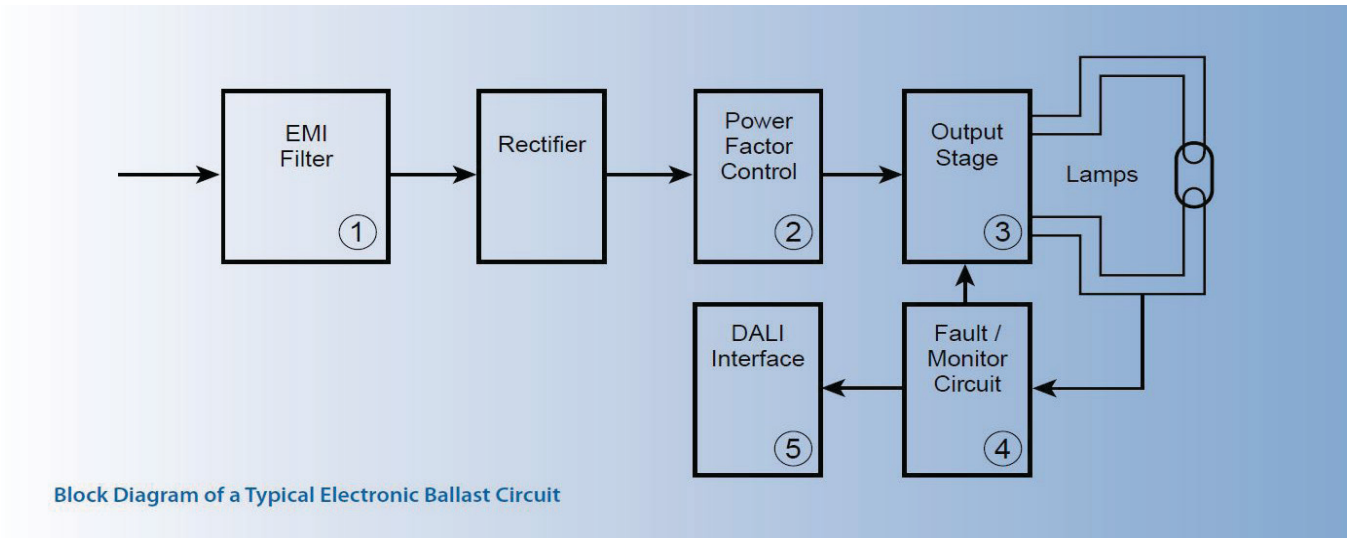
Application Note

Typical Electronic Ballast Circuit

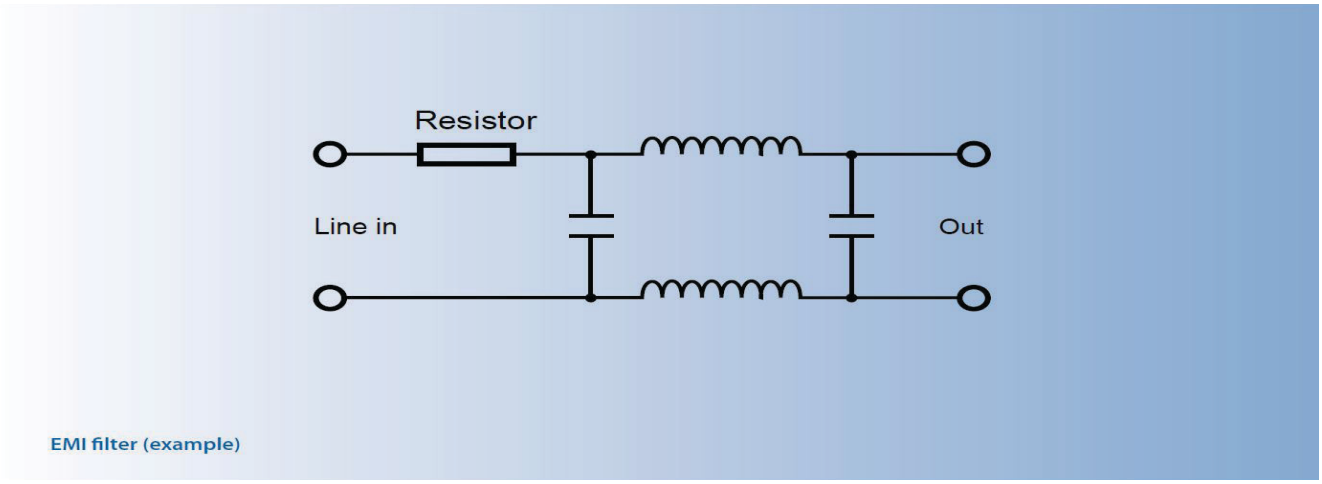


Block Diagram of a Typical Electronic Ballast Circuit

1. EMI Filter

Ballasts have an inrush current during the initial start-up several times greater than their normal operating current and in general electronic ballasts have a higher inrush current than electromagnetic or hybrid ballasts.

Inrush current limiting resistors are designed to withstand these surges but to fuse safety should a fault occur, for example if a capacitor were to go short resulting in a mains short circuit. Typical parts are WP-S, ULW and EMC Series.

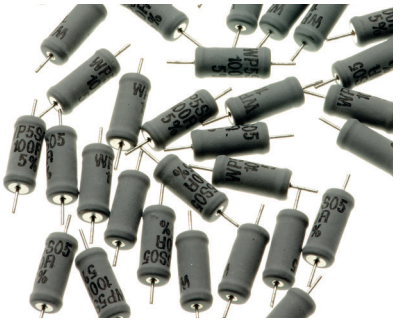


EMI filter (example)

Application Note

Power Wirewound Resistors

WP-S Series
Flameproof protection



Electrical Data

		WP1S	WP2S	WP25S	WP3S	WP4S	WP5S
Power rating at 25°C	watts	1	2	2.5	3	4	5
Overload Rating (5s)	watts	5	10	12.5	15	20	25
Short pulse performance		Available on request					
Resistance range	ohms	R068 to 430 R	R05 to 900R	R05 to 900R	R01 to 2K2	R01 to 10K	R015 to 6K8
Limiting element voltage	volts	50	50	75	100	100	150
TCR	ppm/°C	<1R:350 = 1R:200					
Isolation voltage	volts	250			350	500	
Resistance tolerance	%	<20R: 5 ≥20R: 1, 2, 5				<R10:5 ≥1r10: 1, 2, 5	<20R: 5 ≥20R: 1, 2, 5
Standard values		E24 preferred					
Thermal Impedance	°C/watt	140	110	90	82	62	54
Ambient temp range	°C	-55 to +155					

Datasheet: http://www.ttelectronics.com/sites/default/files/resistors-datasheets/WP-S.pdf

Application Note

Electrical Data

ULW Series

- UL1412 recognised fusible resistor
- Failsafe mains fusing at 120/240 Vrms
- Inrush and surge withstanding

		ULW2	ULW3	ULW4	ULW5
Power rating at 25°C	watts	2	3	4	5
5 second overload rating at 25°C	watts	10	15	20	25
Resistance range	ohms	1R - 100R			
TCR	ppm/°C	±200			
Isolation voltage	volts	250	350	500	
Resistance tolerance	%	5			
Thermal impedance	°C/watt	110	82	62	54
Ambient temperature range	°C	-55 to +155			

Datasheet: http://www.ttelectronics.com/sites/default/files/resistors-datasheets/ULW.pdf

Power Wirewound Resistors

Electrical Data

Pulse Withstanding Fusible Flameproof Metal Film Resistors

EMC Series

- UL1412 recognised*
- Failsafe 240V mains fusing
- Good Pulse handling capability
- Small size for power rating
- UL94-V0 flameproof protection

*Values 22 R and above. UL file number E234469

		EMC2
Power rating at 70°C	watts	2
Resistance range	ohms	4R7 - 68R
TCR (25 to 75°C)	ppm/°C	100
Isolation voltage	volts	500
Resistance tolerance	%	10, 20
Standard values		E12
Thermal impedance	°C/watt	82
Ambient temperature range	°C	-55 to +155

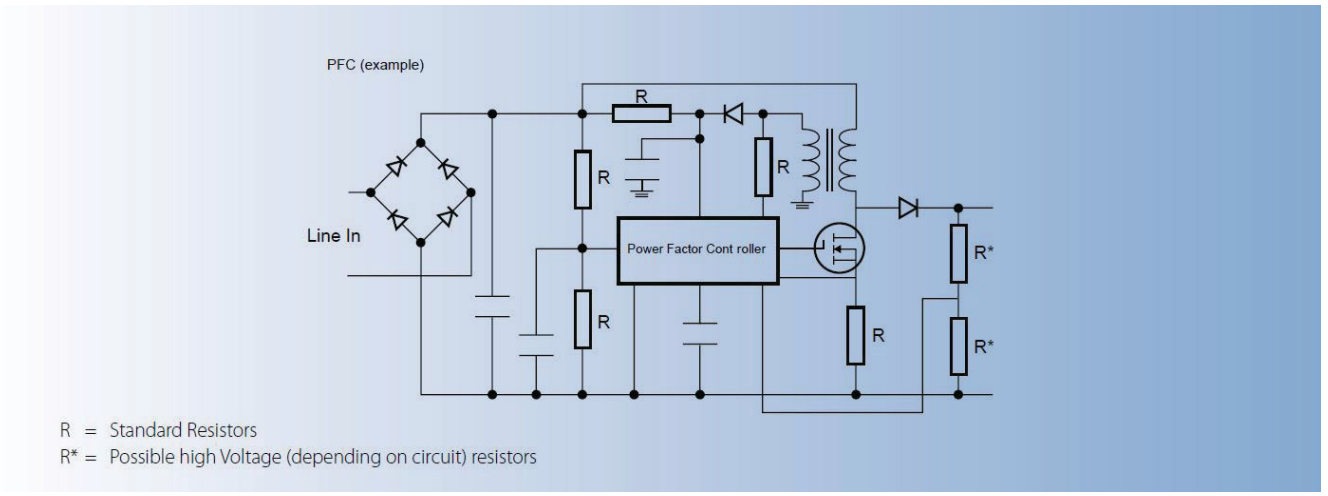
Datasheet: http://www.ttelectronics.com/sites/default/files/resistors-datasheets/EMC.pdf

2. Power Factor Control

As a general rule, electronic ballasts use a large reservoir capacitor associated with the bridge rectifier; this results in a low power factor, poor waveshape and harmonic distortion. In order to meet the EN61000 family of standards, designers usually incorporate active or passive circuits to improve the power factor. These circuits contain general purpose parts such as the axial MFP series and surface mount types such as the WCR and PCF series.

The MOSFET source resistor (current sense) would be from the LR family, which has enhanced pulse performance.

Application Note



Flameproof Power Metal Film Resistors

MFP Series

- Smallest size for power rating
- Resistance range 0.1 ohms to 1M ohms
- Flameproof protection

Electrical Data

		MFP1	MFP2
Power rating at 70°C	watts	<1Ω: 0.7 ≥1Ω: 1	2
Resistance range	ohms	0R1 - 1M	1R0 - 1M
Limiting element voltage	ohms	350	
TCR	ppm/°C	<1Ω: 300 1Ω-9.1Ω: 200 ≥10Ω: 50	100
Resistance tolerance	%	1, 2, 5	
Standard values		E24	
Thermal impedance	°C/watt	120	82
Ambient temperature range	°C %	-55 to 155	

3 & 4. Output/Fault Monitoring

The output and fault/monitoring stages of the ballast can subject components to high electrical stresses; for example a typical fluorescent tube has a strike voltage of 1kV or more, depending on size and operating frequency.

In these conditions a standard resistor is unlikely to be suitable. TT Electronics can offer high duty/ high voltage types (VRW series), cement coated wirewound resistors with excellent pulse handling properties (WHS series), as well as specially designed pulse withstanding resistors suitable for these applications.

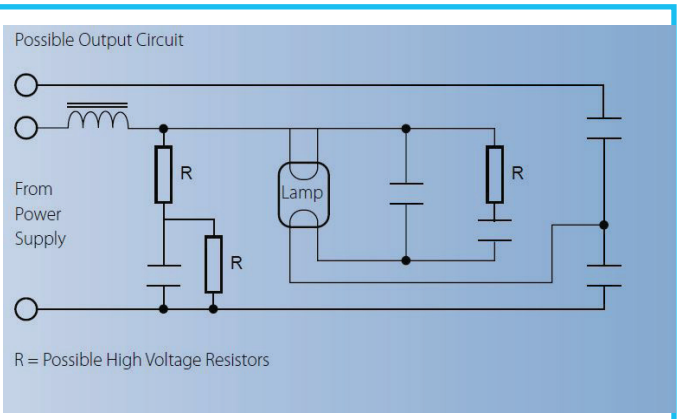
We can also supply surface mount parts with these high performance properties; High Voltage Chip (HVC series), Pulse Withstanding Chip (PWC series).

Application Note

High Voltage Thick Film Resistors

VRW Series

- VRW37 meets the requirements of BS/EN/IEC 60065
- High working voltage to 3.5kV in compact size
- High ohmic range to 30M
- High pulse load capacity
- Robust flameproof coating material
- RoHS compliant



Electrical Data

		VRW25	VRW37
Power rating at 70°C	watts	0.25	0.5
Resistance range	ohms	100K to 30M	
Limiting element voltage	ohms	1600	3500
Isolation voltage	volts	700	
TCR	ppm/°C	200	
Resistance tolerance	%	1, 2, 5	
Standard values		E24 and E96 preferred	
Thermal impedance	°C/watt	140	112
Ambient temperature range	°C	-55 to +155	

Datasheet: http://www.ttelectronics.com/sites/default/files/resistors-datasheets/VRW.pdf

Application Note

Wirewound High Surge Resistors

WHS Series

- Enhanced surge & pulse energy capacity
- UL94-V0 flameproof protection
- Radial taped form available
- Surface mount ZI-form option

		WHS2	WHS3	WHS5	WHS7	WHS10
Power rating at 25°C	watts	2	3	5	7	10
5s overload rating at 25°C	watts	10	15	25	35	50
Energy rating (10R)	joules	3.3	11	33	65	120
Resistance range	ohms	1R0 - 330R				2R2-330R
TCR	ppm/°C	200				
Isolation Voltage	volts	250	350	500	700	1000
Resistance Tolerance	%	<20R:5 ≥20R: 1, 2, 5				
Standard Values		E24 preferred				
Thermal Impedance	°C/watt	110	82	54	35	25
Ambient temperature range	°C	-55 to +155				

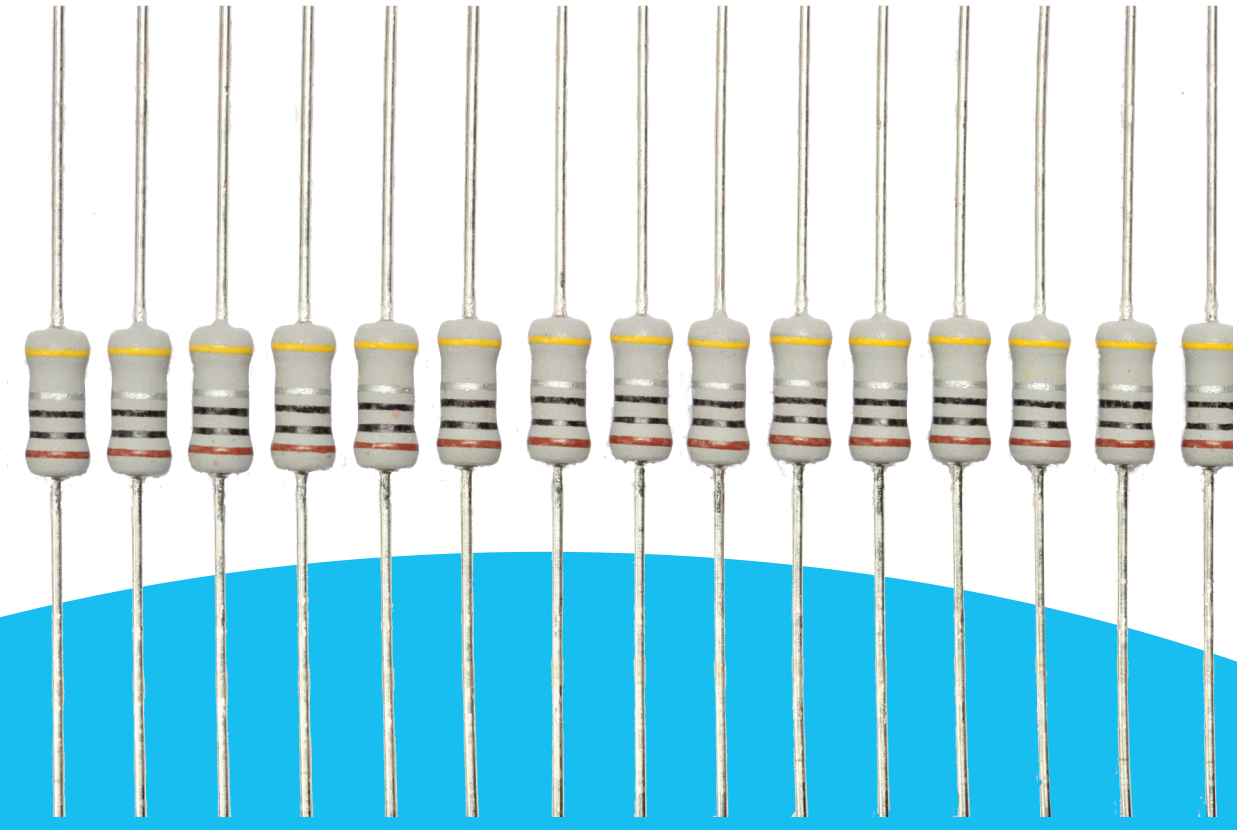
http://www.ttelectronics.com/sites/default/files/resistors-datasheets/WHS.pdf

5. Other Applications

TT Electronics can also provide resistors for specialised lighting applications, such as the increasingly popular energy saving lamps, high intensity discharge (HID) lamps for automotive use, emergency lighting packs and dimmable fluorescent lighting. Dimming ballasts use not only general purpose axial and surface mount resistors as seen in other forms of ballast, but require low value current sense resistors to provide feedback signals for pre-heat, ignition, dimming and fault currents.

TT Electronics can offer low value current sense resistors with enhanced pulse performance for surface mount applications (LR series). For lower current, surface mount pulse applications (such as gate drives), the DSC (double sided chip) should be selected.

LIT-AN-LIGHTING



www.ttelectronics.com/resistors

TT Electronics, 4222 South Staples St., Corpus Christi, TX 78411, USA

TT Electronics, Welwyn Electronics Park, Bedlington, Northumberland, NE22 7AA, UK