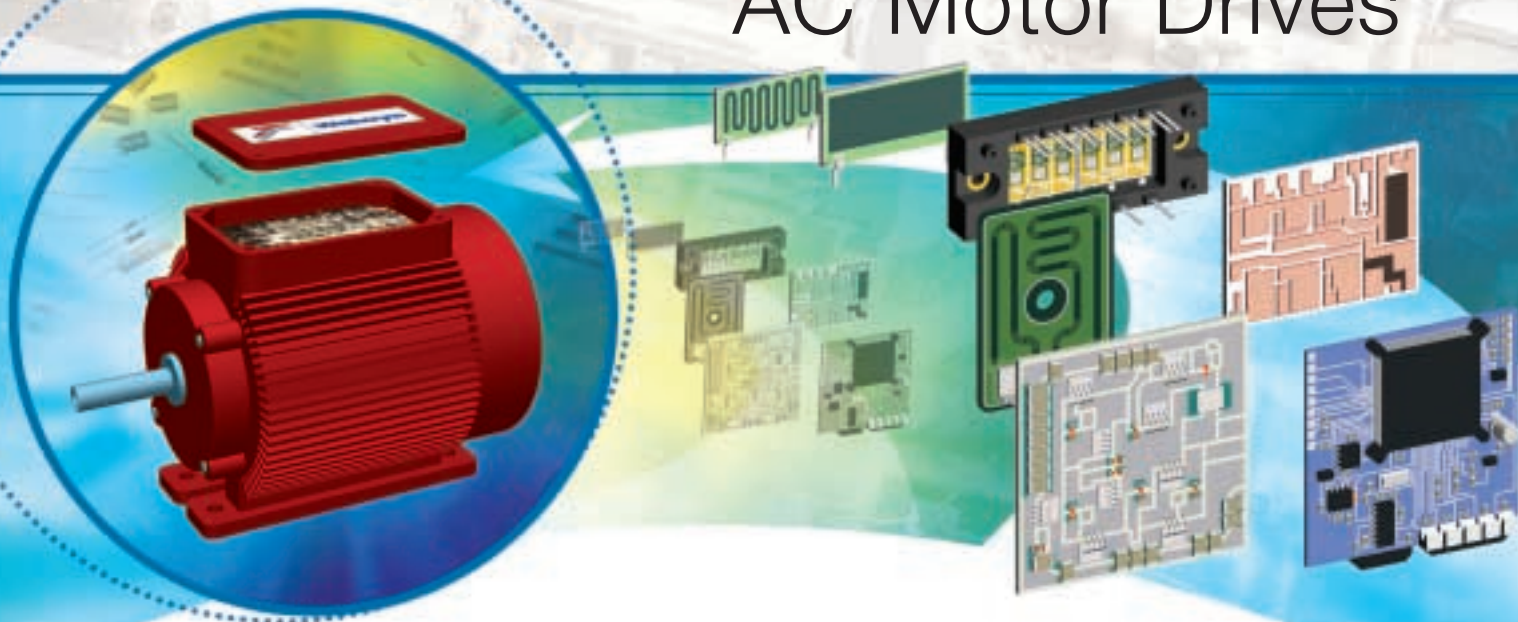


Integration of Power, Control and Dynamic Braking in AC Motor Drives



Increased energy cost is undoubtedly one of the major problems facing industry today. Since almost every product is manufactured with the utilisation of motors - it is not surprising that the AC induction motor is the world's single biggest consumer of energy. In reality, the cost of running motors is a significant cost element of every product we purchase.

A reduction in the cost of power semiconductor components has seen more and more circuit designers

incorporating control into every day power / motor applications.

Welwyn's strength lies in its broad technology base which is capable of giving the circuit designer an integrated custom packaging solution to controlling the power of AC motors.

Utilising a variety of technologies and material systems, Welwyn can be the complete supplier of integrated control for AC motor drives.

- **Increased reliability with fewer interconnections**
- **Turnkey solution - reducing customer assembly costs**
- **Compact footprint**
- **Reduced weight dimensions**



Subsidiaries of TT electronics plc



Excellence in Technology

Integration of Power & Control in AC Motor Drives

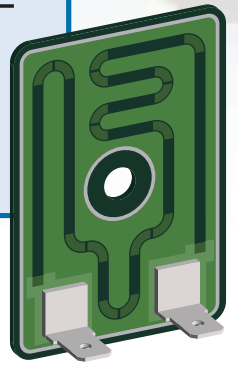
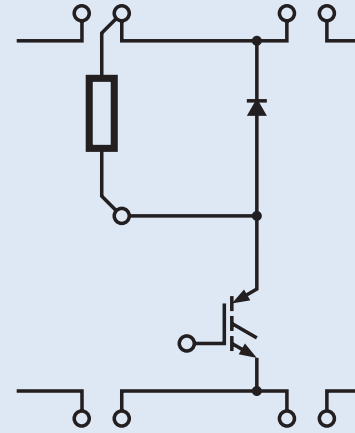
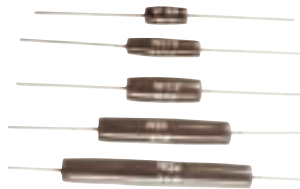
Braking Resistor

Thick Film on Steel Substrate

- 300W, continuous power
- Maximum pulse power 5kW
- Designed for fail safe operation - open circuit on overload
- Ability to mount on integral heatsink
- Can be used in series/parallel combinations for higher power applications

W20 Vitreous Enamelled Wirewound Resistors

- Power rating @ 25°C 3W to 14W
- High overload capability
- Predictable pulse handling



Pre-charge Resistor

Thick Film on Ceramic Substrate

- 373V peak, 60J, 20 seconds between charge cycles
- Low inductance
- Fail safe operation - open circuit on overload
- Through-hole/surface mount, low profile
- Can be used in series/parallel configurations for higher energy applications

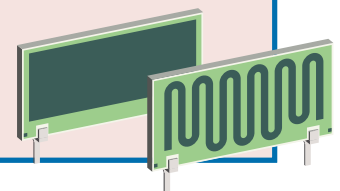
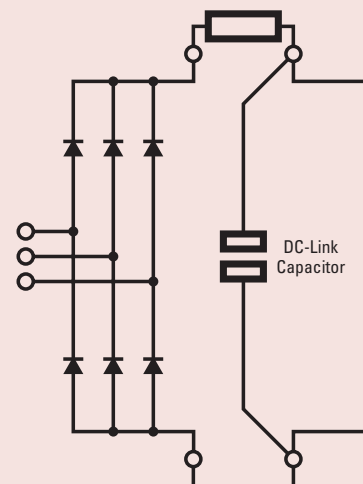
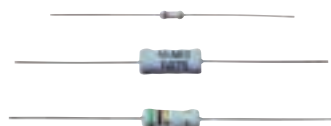
MO-S Power Metal Oxide Film Resistors

- Power rating 0.5W to 5W
- Good pulse absorbing capability
- Custom designs available

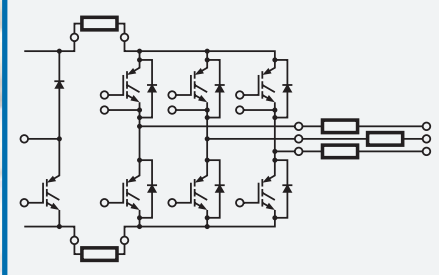


WA80 Cement Coated Wirewound

- Power rating @ 25°C - 1W to 7W
- Predictable pulse handling



Current Sense Resistors



OLV (Shunt)

- Low inductance
- Custom designed
- Values down to 5mΩ



LR/LRF Series

- Resistance values down to 3mΩ
- Power rating up to 2 watts
- Low inductance - less than 0.2nH
- Body sizes 1206, 2010, 2512, 1225



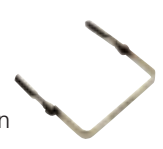
W31 Cement Coated Wirewound Resistors

- Values down to 10mΩ
- Power rating @ 25°C 3W
- Custom built to meet pulse requirements

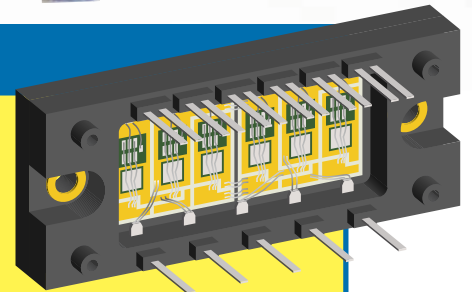
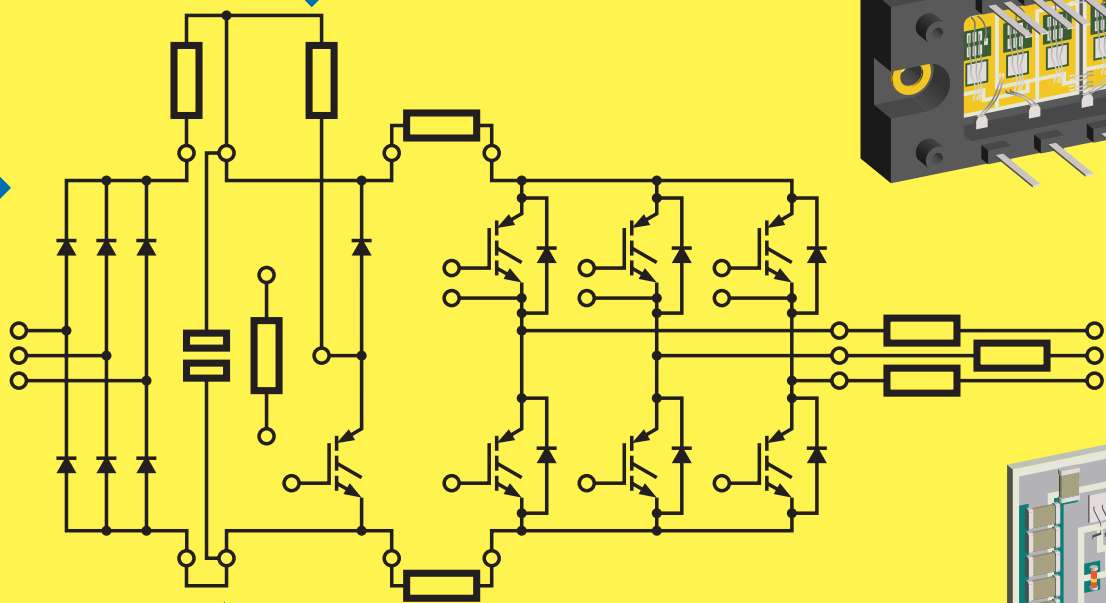


OAR Series

- Perfect match for higher current application



Power Module

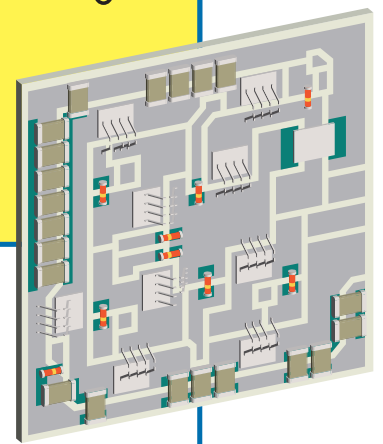


Available Technologies

- Packaged discrete components on PCB
- Packaged discrete components on PCB with thermal vias
- Naked DIE with aluminium wirebonds soldered to IMS attached to a heatsink
- Naked DIE on thick film copper/alumina with thermal vias
- Naked DIE with metal tape connections soldered to DBC attached to heatsink with heatpipes or water cooling

Typical Power Rating

- 0.375kW
- 0.375kW/0.75kW
- 0.75kW/1.5kW
- 1.5kW
- 4kW



Alternative Substrates

Thick Film Copper on Ceramic

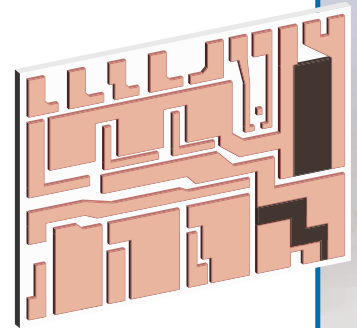
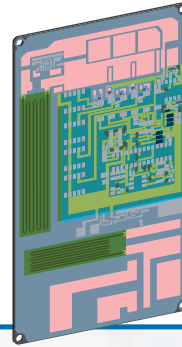
- Variable thickness, allows full integration of power and control
- Printed current sense resistors

Thick Film on Steel

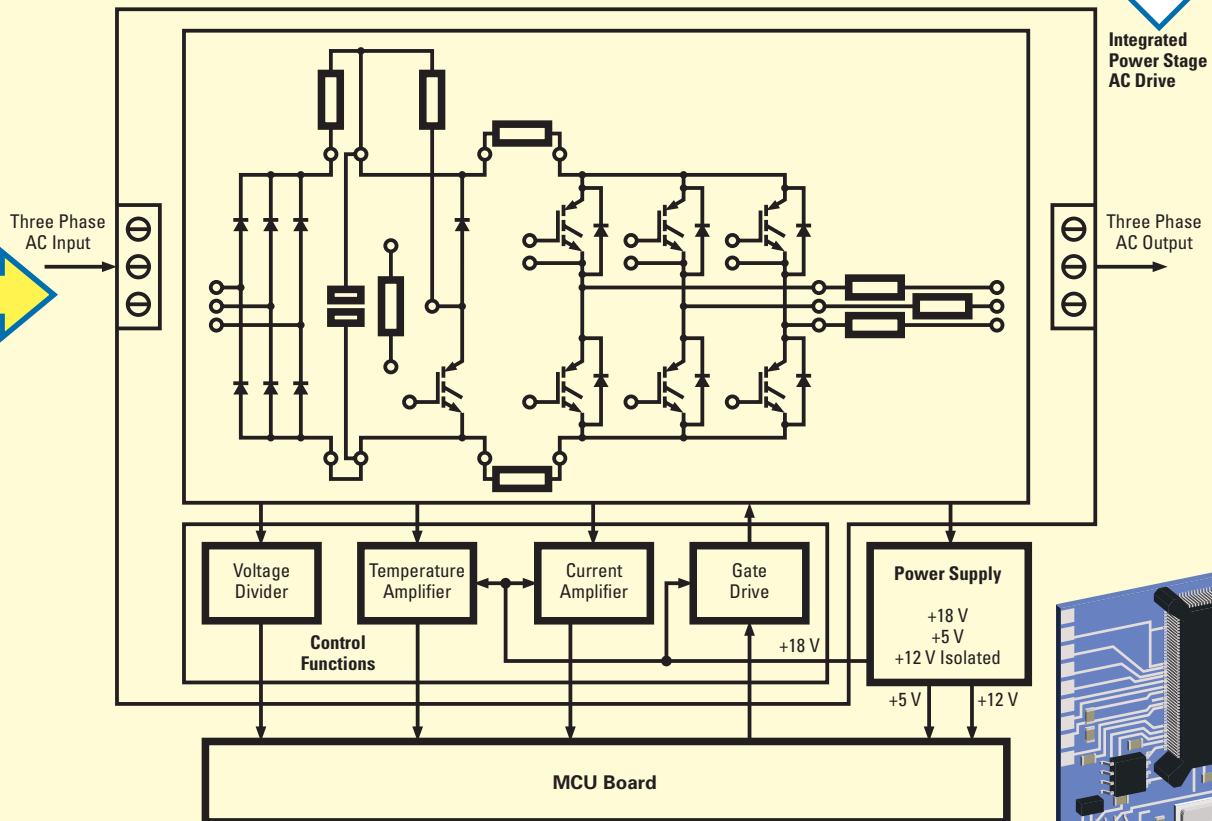
- Robust construction, forms integral heatsink

Polymer on Aluminium

- Excellent thermal capacity with lead free attachment of components



Integrated Power Stage



Benefits of the Integrated Solution

- Control circuits in close proximity to sensing devices
- Input circuits in close proximity to IGBTs
- Reduced noise levels
- Cost effective custom design

Current Sense

Current sense resistors are not only used to measure the voltage drop that allows the control circuitry to provide precise motor control but also allows short circuit and overload protection. Selecting the resistor is a critical part of the design, with Welwyn offering a number of standard and custom parts tailored to suit an individual design.

Welwyn offer the best features for current sense requirements.

- Low resistance – to minimise power dissipation
- Low inductance – to minimise induced voltage spikes
- Good tolerance – to maintain overall accuracy
- Low TCR – to minimise errors due to self heating

Thick Film Copper - Printed Resistors on Ceramic Substrates

Electrical Data

Power rating	watts	2 to 6
Resistor range	ohms	R0010 to 1R0
Limiting element voltage	volts	250
TCR > 10mR	ppm/°C	±60
Resistor tolerance	%	±2

OLV Series Low Value Sense Resistors

Type	Power (watts)	Res. Range (ohms)	Tolerance %	Max Volts	TCR (ppm/°C)	Dim.(mm) l, dia
OLV	1, 3, 5	OR003 - OR030	5, 10	-	150	-

LRC/LRF Series Low Value Flat Chip Resistor

Type	Power (watts)	Res. Range (ohms)	Tolerance %	Max Volts	TCR (ppm/°C)	Dim.(mm) l, w, h
1206	0.5	OR010 - 1R	1, 2, 5	-	±100	3.2, 1.63, 0.8
2010	1.0	OR003 - 1R	1, 2, 5	-	±100	5.23, 2.64, 0.8
2512	1.5/2.0	OR003 - 1R	1, 2, 5	-	±100	6.5, 3.25, 0.8
1225	2.0	OR003 - OR10	1, 2, 5	-	±100	3.25, 6.5, 0.8

Industrial Power Assemblies

Capability (All assemblies are custom built and will depend on individual customer requirements)

Technology	Thermal Resistance (Typical)	Operating Temp. Range °C	Power Rating	
			IGBT	MOSFET
Packaged discrete components onto PCB	2.5°C / watts	-25 to +85	600V / 10Amp	30V to 50V
Packaged discrete components onto PCB with thermal vias	1.5°C / watts	-25 to +85	600V / 20Amp	60V to 100V
Naked DIE with Aluminium wirebonds soldered to IMS attached to a heatsink	0.75°C / watts	-40 to +85	600V to 1200V / 20Amp	100V to 200V
Naked DIE on thick film copper / Alumina with thermal vias	0.5°C / watts	-55 to +125	600V to 1200V / 30Amp	250V to 400V
Naked DIE with metal tape connections soldered to DBC, attached to heatsink with heatpipes or water cooling	0.1°C / watts	-55 to +125	600V to 1200V / 100Amp	400V to 600V

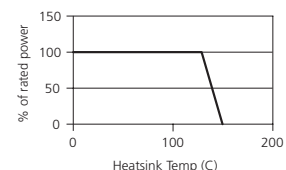
Please contact factory for an engineering appraisal of your requirements

- Online x-ray analysis
- Vacuum re-flow capability
- Thermal imaging
- Good relationship with OEM suppliers without direct ties
- Custom packaging/pinout available

Dynamic Braking

WDBR - Ultra Low Profile Dynamic Braking Resistors Electrical Data

		WDBR	Power derating curve
Resistance range	ohms	5R - 270R E12	
Resistance tolerance Max. AR@ rated pulse load	%	±20%	
Pulse power max. (mon. 50,000 cycles)	Kilowatts	5.0	
Voltage dielectric withstanding min.	volts	2500dc	
Stability (nominal load) after 50,000 cycles		Deviation <±5%	
Maximum temperature rating of resistor	°C	350	
Continuous load capacity	watts	300	



Testing took place on a heatsink (thermal resistance 0.5°C/W), force cooled at 15 m/s air velocity for 50,000 cycles. See power above for power derating curve of the test duty cycles. Consult factory for applications outside of standard electrical data

Vitreous Enamelled Wirewound Resistors Electrical Data W20 series

Type	Power (watts)	Res. Range (ohms)	Tolerance %	Max Volts	TCR (ppm/°C)	Dim.(mm) l, dia
W21	3.0	0R1 - 10K	1, 2, 5	100	+75 to 200	12.7, 5.6
W215	5.0	0R1 - 15K	1, 2, 5	160	+75 to 200	22, 7
W22	7.0	0R1 - 22K	1, 2, 5	200	+75 to 200	22, 8
W23	10.0	0R15 - 60K	1, 2, 5	500	+75 to 200	38, 8
W24	14.0	0R2 - 100K	1, 2, 5	750	+75 to 200	53.5, 8

Approved to BS CECC 40-201-002

Inrush Current Limiting

Welwyn offer a variety of solutions to the age-old problem of inrush current.

Thick Film on Ceramic Substrates Electrical Data

			Notes
Power rating (30 seconds between pulses)	joules	66 to 95	Can be used in series/parallel for higher current applications
Resistor range	ohms	22 to 100	
Limiting element voltage	volts	800	Failsafe open circuit in fault conditions
TCR	ppm/°C	±100	
Resistor tolerance	%	±20	

MO-S Series Power Metal Oxide Film Resistors

Type	Power (watts)	Res. Range (ohms)	Tolerance %	Max Volts	TCR (ppm/°C)	Dim.(mm) l, dia
MO1/2S	0.5	10R - 50K	5, 10	250	350	6.2, 2.5
MO1S	1.0	10R - 100K	5, 10	350	350	9, 3.6
MO2S	2.0	10R - 100K	5, 10	350	350	12.5, 4.2
MO3S	3.0	10R - 100K	5, 10	350	350	14.5, 5.3
MO4S	4.0	10R - 10K	5, 10	500	350	22, 8.5
MO5S	5.0	10R - 100K	5, 10	500	350	25, 8.5

W30 Series Cement Coated Wirewound Resistors

Type	Power (watts)	Res. Range (ohms)	Tolerance %	Max Volts	TCR (ppm/°C)	Dim.(mm) l, dia
W31	2.5	0R01 - 10K	5, 2, 1	100	100 - 1000	13, 5.6

Control Circuitry

The development of IGBT modules has led to the need for electronics to provide gate drive, feedback and control of the drive electronics to provide regulated speed and direction of AC motors. Although the assembly of electronic components to PCB's has been available to the industry for many years, recent developments at component level have allowed the footprint to be dramatically reduced.

Note: Circuit diagrams shown for example only.

For more detailed product information and data sheets or to discuss your specific requirements, please contact Welwyn Components Ltd.

The need to reduce physical size now requires the use of some novel assembly techniques. The use of ceramic, steel or aluminium as a substrate material in conjunction with surface mounting of components in packaged, die or flip chip form, is set to revolutionise the drives market. The ability to reduce path lengths and provide a planar power and control product is now within the grasp of drives manufacturers.

Welwyn Components Ltd. have over 60 years experience in designing and manufacturing resistive components.

Welwyn Components Limited
Welwyn Electronics Park, Bedlington
Northumberland NE22 7AA, UK

Telephone: +44 (0) 1670 822181
Facsimile: +44 (0) 1670 829465
Email: info@welwyn-tt.com

Website: www.welwyn-tt.com

IRC Inc. (AFD)
4222 South Staples Street
Corpus Christi, Texas 78411, USA

Telephone: +1 361 992 7900
Facsimile: +1 361 992 3377
Email: ircafd@ircctt.com

Website: www.ircctt.com


Excellence in Technology

General Note Welwyn Components reserves the right to make changes in product specification without notice or liability. All information is subject to Welwyn's own data and is considered accurate at time of going to print.

Subsidiaries of TT electronics plc