

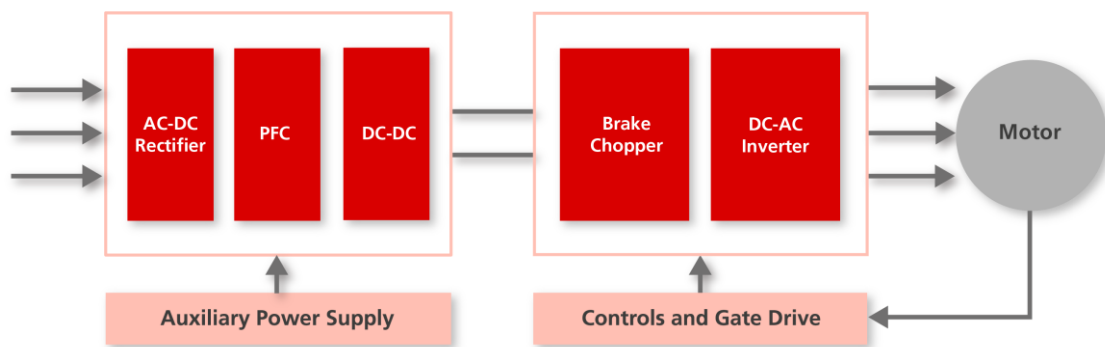
## Industrial Motor Control and Drives

Electric motors are ubiquitous all over world. Almost every mechanical action taking place around the factory is induced by an AC or DC electrical motor. These motors are used in a broad range of applications such as fans, pumps, forklifts, pick and place machines, compressors, elevators, conveyor belts and many other devices that utilize a motor drive. In battery powered tools there is the trend towards the use of brushless DC motors, which are saving energy and therefore offer increased working cycles.

It is a fact that semiconductors technology and the components play a vital role in electric motors for minimizing the power losses, increased robustness against voltage transients and for improving the overall performance. Electronic designs with discrete components give the added advantage of allowing the flexibility of selecting the best suitable components for each function.

Discover our wide range of silicon based, power discrete components like diodes and bridge rectifiers. Additionally, Diotec also offers a new product portfolio of MOSFETs and linear voltage regulators fitting perfectly into a broad range of industrial applications.

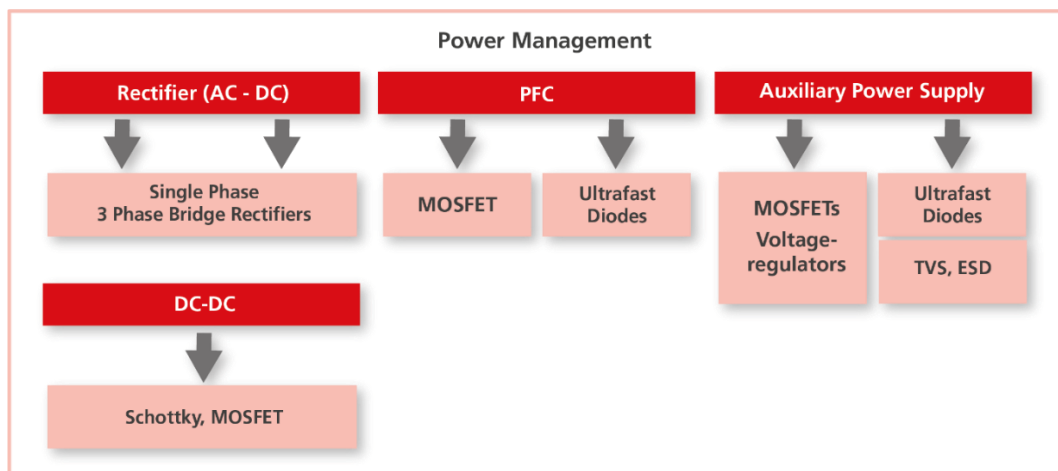
The following block diagram shows energy alteration procedure from a fixed AC voltage to a variable AC voltage:



Block diagram for industrial motor control and drives applications

The overall function of the electrical motors can be classified into two groups:

- 1) Power management system, which has different stages such as AC-DC rectification, power factor correction, DC-DC conversion. While auxiliary power supply can be arranged as an alternative/additional external source in parallel to the power supply.
- 2) Controls and gate drive: In order to control motion of the motor, the proper signals must be generated, by using the feedback from the motor. This function is done by controls and gate drive circuit.



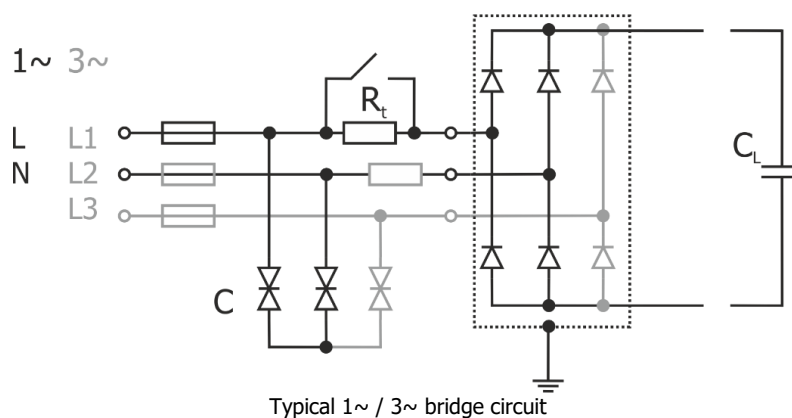
## AC – DC Rectification

### Single Phase Bridge Rectifiers

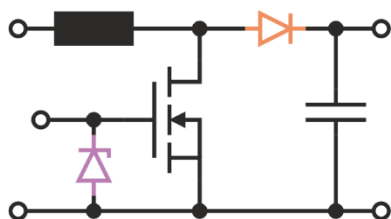
Part No	Package	$I_{FAV}$	$V_{RRM}$
<b>GBI Series</b>	30 x 20 x 3.6	10 ... 40 A	50 ... 1600 V
<b>GBU Series</b>	21.5 x 18.2 x 3.4	4 ... 12 A	50 ... 1000 V
<b>KBPC10/15/25xx Series</b>	28.6 x 28.6 x 7.3	10/15/25 A	100 ... 1600 V
<b>KBPC250xxI Series</b>	28.6 x 28.6 x 7.3	25A	100 ... 100 V
<b>KBPC35xxFP/WP Series</b>	28.6 x 28.6 x 7.3	35 A	100 ... 1600 V
<b>KBPC35xxI Series</b>	28.6 x 28.6 x 7.3	35A	100 ... 1000 V
<b>KBPC50xxFP/WP Series</b>	28.6 x 28.6 x 7.3	50 A	100 ... 1600 V

### Three Phase Bridge Rectifiers

Part No	Package	$I_{FAV}$	$V_{RRM}$
<b>DBI20 Series</b>	35 x 25 x 4	20 A	800 ... 1600 V
<b>DBI25 Series</b>	35 x 25 x 4	25 A	800 ... 1800 V
<b>DB15/25 Series</b>	28.5 x 28.5 x 10	15/25 A	100 ... 1600 V
<b>DB35 Series</b>	28.5 x 28.5 x 10	35 A	100 ... 1600 V



## Power Factor Correction (PFC)



### Superfast Efficient Rectifiers

Operation frequencies are rather high. For reduction of power losses in the switch (affected highly by reverse recovery behaviour of the diode!), the boost diode must have very low reverse recovery but also low forward voltage drop. Superfast Efficient rectifiers fulfil this requirement.

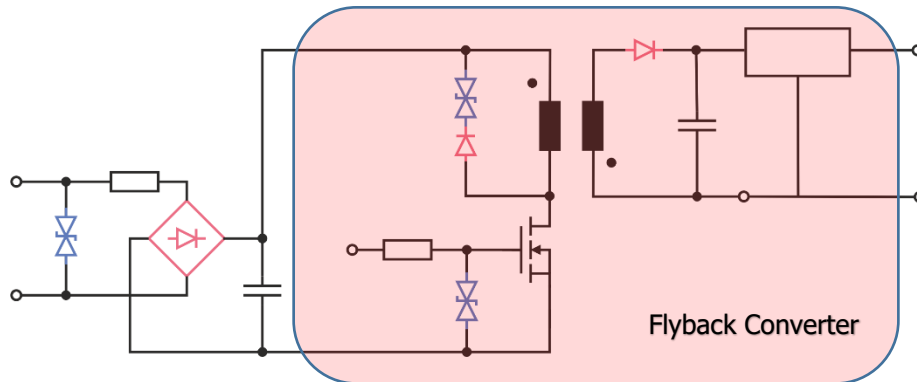
Part No	Package	$I_{FAV}$	$V_{RRM}$	$t_{rr}$
<b>MUR460</b>	DO-201	4 A	600 V	50 ns
<b>UGB8JT</b>	D2PAK	8 A	600 V	35 ns
<b>UFT800J</b>	TO-220AC	8 A	600 V	35 ns
<b>MUR860</b>	TO-220AC	8 A	600 V	50 ns
<b>MURF2060CT</b>	ITO-220AB	20 A	600 V	25 ns

### Power MOSFETs\*

Part No	Package	$I_D$	$V_{DS}$	$R_{DS(on)}$
<b>DI002N66D1</b>	D-PAK	2 A	600 V	3.3 $\Omega$
<b>DIJ004N65</b>	ITO-220AB	4 A	650 V	2.3 $\Omega$
<b>DIJ013N65</b>	ITO-220AB	13 A	650 V	0.28 $\Omega$
<b>DIJ020N60</b>	ITO-220AB	20 A	600 V	0.13 $\Omega$

\*under development

## Auxiliary Power Supply



### Power MOSFETs\*

Part no	Package	$I_D$	$V_{DS}$	$R_{DS(on)}$
<b>DIJ004N80</b>	ITO-220AB	4 A	800 V	2.8 $\Omega$
<b>DIJ006N80</b>	ITO-220AB	6 A	800 V	1.4 $\Omega$
<b>DIJ010N80</b>	ITO-220AB	10 A	800 V	0.9 $\Omega$

\*under development

### Ultrafast Diodes (Snubber)

Part no	Package	$I_{FAV}$	$V_{RRM}$
<b>EGL1J... M</b>	DO-213AA/MiniMelf	1 A	600 ... 1000 V
<b>USL1J ... M</b>	SOD-123F	1 A	600 ... 1000 V
<b>SUF4006 ... 4007</b>	DO-213AB/Melf	1 A	600 ... 1000 V
<b>US1J ... M</b>	DO-214AC/SMA	1 A	600 ... 1000 V
<b>US3J ... M</b>	DO-214AB/SMC	3 A	600 ... 1000 V

### TVS Diodes (Snubber/Gate protection)

Part no	Package	$P_{PPM}$	$V_{WM}$	$V_{BR}$
<b>TGL34-...</b>	DO-213AA/MiniMelf	150 W	5.5 ... 171 V	6.8 ... 200 V
<b>SMF...</b>	SOD-123F	200 W	5.0 ... 220 V	6.8 ... 260 V
<b>TGL41-...</b>	DO-213AB/Melf	400 W	5.5 ... 423 V	6.8 ... 520 V
<b>P4SMA...</b>	DO-214AC/SMA	400 W	5.0 ... 495 V	6.8 ... 550 V
<b>P6SMB...</b>	DO-214AA/SMB	600 W	5.0 ... 495 V	6.8 ... 550 V
<b>1.5SMC...</b>	DO-214AB/SMC	1500 W	5.0 ... 495 V	6.8 ... 550 V

### TVS and Ultrafast (Snubber) in *a single package!*

Part no	Package	$P_{PPM}$	$V_R$	$V_{BR}$
<b>TGL200U06</b>	DO-213AB/Melf	300 W	600 V	200 V
<b>PKC-136</b>	DO-15/ DO-204AC	600 W	700 V	160 V

## Schottky Output Rectifiers

Part no	Package	I <sub>FAV</sub>	V <sub>RRM</sub>
<b>SKL34 ... 36</b>	SOD-123F	3 A	40 ... 60 V
<b>SK34SMA-3G ... 315SMA (-3G)</b>	DO-214AC/SMA	3 A	40 ... 150 V
<b>SK420</b>	DO-214AB/SMC	4 A	200 V
<b>SK54 ... 515 (-3G)</b>	DO-214AA/SMB	5 A	40 ... 150 V
<b>SK84 ... 815 (-3G)</b>	DO-214AB/SMC	8 A	40 ... 150 V

**-3G:** Available in 3rd Generation Schottky Technology with low V<sub>F</sub> and low I<sub>R</sub>

## Voltage Regulators\*

Part no	Package	I <sub>out</sub>	V <sub>out</sub>
<b>LDI1117 Series</b>	SOT-89, SOT-223	0.8 A	Adj, 1.2 ... 5 V
<b>DI78L05 Series</b>	SO-8, SOT-89	0.1 A	3.3 ... 24 V
<b>DI79L Series</b>	TO-92	0.1 A	5 ... 24 V
<b>DI78M Series</b>	SO8, SOT-89	0.5 A	5 ... 24 V
<b>DI6206</b>	SOT-23	0.2 A	1.2 ... 5.0V

\* under development

## DC – DC Converter

### Schottky Output Rectifiers

Part no	Package	I <sub>FAV</sub>	V <sub>RRM</sub>
<b>PPS1040 ... 60 (-3G)</b>	Power SMD	10 A	40 ... 60 V
<b>PPS1540 ... 60 (-3G)</b>	Power SMD	15 A	40 ... 60 V
<b>SK1040...100D1 (-3G)</b>	D-PAK	10A	40... 100 V
<b>SK1040...100D2 (-3G)</b>	D2-PAK single	10A	40... 100 V
<b>SK2040...100CD2 (-3G)</b>	D2-PAK dual	2x 10A	40... 100 V
<b>SK3040...100CD2 (-3G)</b>	D2-PAK dual	2x 15A	40... 100 V
<b>SK4040...45CD2 (-3G)</b>	D2-PAK dual	2x 20A	40... 45 V
<b>SBT1040...100 (-3G)</b>	TO-220AC	10A	40 ... 100 V
<b>SBCT1040...100 (-3G)</b>	TO-220AB dual	2x 5A	40 ... 100 V
<b>SBCT2040...100 (-3G)</b>	TO-220AB dual	2x 10A	40 ... 100 V
<b>SBCT30100...150</b>	TO-220AB dual	2x 15A	100 ... 150 V

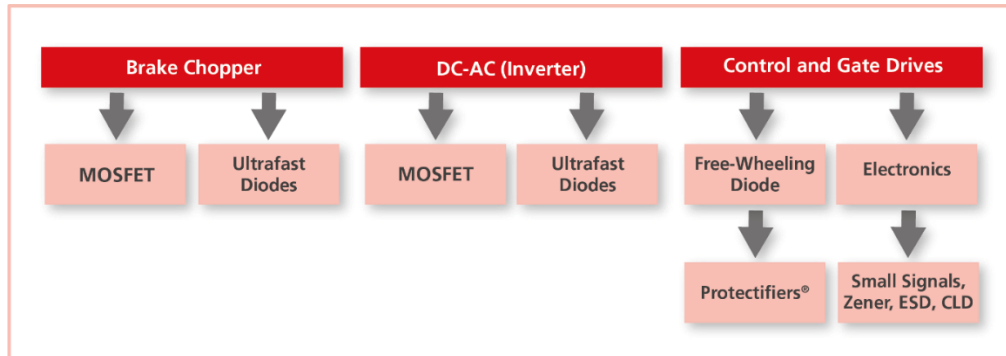
**-3G:** Available in 3rd Generation Schottky Technology with low V<sub>F</sub> and low I<sub>R</sub>

## Power MOSFETs\*

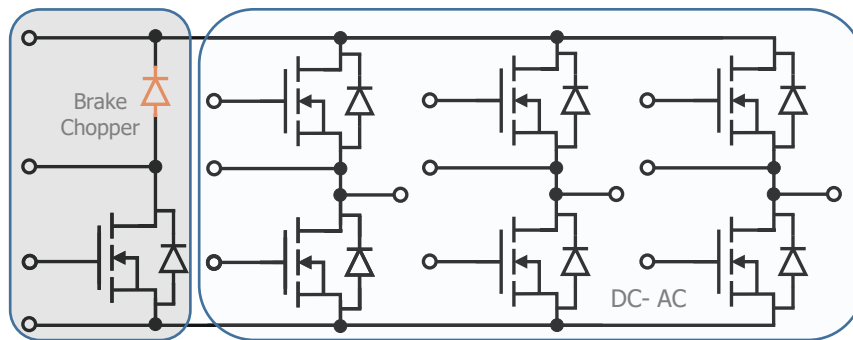
Part no	Package	I <sub>D</sub>	V <sub>DS</sub>	R <sub>DS(on)</sub>
<b>DI015N25D1</b>	D-PAK	15 A	250 V	165 mΩ
<b>DI030N03D1</b>	D-PAK	30 A	30 V	21 mΩ
<b>DIT050N06</b>	TO-220AB	50 A	60 V	16 mΩ
<b>DIT090N06</b>	TO-220AB	90 A	60 V	7 mΩ
<b>DIT095N08</b>	TO-220AB	95 A	80 V	11 mΩ
<b>DIT100N10</b>	TO-220AB	100 A	100 V	2.8 mΩ
<b>DIT120N08</b>	TO-220AB	120 A	80 V	6.5 mΩ
<b>DIT120N08</b>	TO-220AB	150 A	30 V	2.5 mΩ
<b>DIT195N08</b>	TO-220AB	195 A	80 V	3.5 mΩ

\*under development

## Output Stage



### Brake Chopper and DC – AC Inverter



Typical DC-AC inverter circuit

### Superfast Efficient Rectifier

Part no	Package	I <sub>FAV</sub>	V <sub>RRM</sub>	T <sub>rr</sub>
<b>UGB8AD...J</b>	D2PAK	8 A	200 ... 600 V	25...35 ns
<b>UFT800D...J</b>	TO-220AC	8 A	200 ... 600 V	25...35 ns
<b>MUR860</b>	TO-220AC	8 A	600 V	50 ns
<b>MURF2060CT</b>	ITO-220AB	20 A	600 V	25 ns

### Power MOSFETs\*

Part no	Package	I <sub>D</sub>	V <sub>DS</sub>	R <sub>DS(on)</sub>
<b>DIJ004N80</b>	ITO-220AB	4 A	800 V	2.8 Ω
<b>DIJ006N80</b>	ITO-220AB	6 A	800 V	1.4 Ω
<b>DIJ010N80</b>	ITO-220AB	10 A	800 V	0.9 Ω
<b>DI015N25D1</b>	D-PAK	15 A	250 V	165 mΩ
<b>DI030N03D1</b>	D-PAK	30 A	30 V	21 mΩ
<b>DIT050N06</b>	TO-220AB	50 A	60 V	16 mΩ
<b>DIT090N06</b>	TO-220AB	90 A	60 V	7 mΩ
<b>DIT095N08</b>	TO-220AB	95 A	80 V	11 mΩ
<b>DIT100N10</b>	TO-220AB	100 A	100 V	2.8 mΩ
<b>DIT120N08</b>	TO-220AB	120 A	80 V	6.5 mΩ
<b>DIT120N08</b>	TO-220AB	150 A	30 V	2.5 mΩ
<b>DIT195N08</b>	TO-220AB	195 A	80 V	3.5 mΩ

\*under development

## Controls and Gate Drive

### Small Signal Diodes

Part no	Package	$I_{FAV}$	$V_{RRM}$
<b>1N4148WS</b>	SOD-323	150 mA	100 V
<b>BAT54A</b>	SOT-23	200 mA	30 V
<b>BAV99</b>	SOT-23	215 mA	85 V

### Zener Diodes

Part no	Package	$P_{tot}$	$V_z$
<b>MM3Z</b>	SOD-323	300 mW	2.4 ... 47 V
<b>BZT52</b>	SOD-123	500 mW	2.4 ... 75 V
<b>ZMC</b>	Micro Melf	500 mW	2.4 ... 75 V

### Schottky Diodes

Part no	Package	$I_{FAV}$	$V_{RRM}$
<b>BAT54A</b>	SOT-23	200 mA	30 V
<b>BAS40-05</b>	SOT-23	200 mA	40 V

### ESD Protection

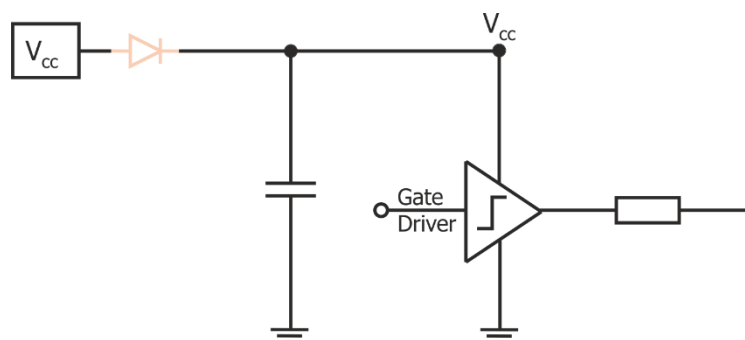
Part no	Package	$P_{PPM}$	$V_{Br Min}$	$C_j$
<b>ESD3Z5V0 ... 12</b>	SOD-323	350 W	6, 13.3 V	350, 150 pF
<b>ESD5Z</b>	SOD-523	158 ... 240 W	3.3 ... 12 V	55 ... 105 pF
<b>ESD3B5V0 ... 24WS</b>	SOD-323	350 W	6.0 ... 26.7 V	50 ... 200 pF
<b>ESD3V3... 36CA</b>	SOT-23	200 W	3.3 ... 36 V	60 ... 600 pF
<b>ESDB3V3 ... 24C</b>	SOT-23	200 ... 350 W	3.3 ... 24 V	11 ... 101 pF

### CLD (Constant Current Regulator)

Part no	Package	$I_{Pnom}$	$V_{AK}$
<b>CL15 ... 40MD</b>	DO-213AA/MiniMelf	15 ... 40 mA	90 V
<b>CL15 ... 40M35</b>	DO-214AC/SMA	15 ... 40 mA	90 V



## Bootstrap Diodes



Part no	Package	$I_{FAV}$	$V_{RRM}$
<b>FR2TSM...</b> <b>FR2YSMA (Fast)</b>	DO-214AC/SMA	1 A	1300 ... 2000 V
<b>BYG23T (Superfast / Avalanche)</b>	DO-214AC/SMA	1A	1300V

## TVS Diodes (Gate Protection/Active Clamping)

Part no	Package	$P_{PPM}$	$V_{WM}$	$V_{BR}$
<b>TGL34-...</b>	DO-213AA/MiniMelf	150 W	5.5 ... 171 V	6.8 ... 200 V
<b>SMF...</b>	SOD-123F	200 W	5.0 ... 220 V	6.8 ... 260 V
<b>TGL41-...</b>	DO-213AB/Melf	400 W	5.5 ... 423 V	6.8 ... 520 V
<b>P4SMA...</b>	DO-214AC/SMA	400 W	5.0 ... 495 V	6.8 ... 550 V
<b>P6SMB...</b>	DO-214AA/SMB	600 W	5.0 ... 495 V	6.8 ... 550 V
<b>1.5SMC...</b>	DO-214AB/SMC	1500 W	5.0 ... 495 V	6.8 ... 550 V

### Disclaimer

This application note describes device proposals and shall not be considered as assured and proven solution for any circuit. No warranty or guarantee, expressed or implied is made regarding the capacity, performance or suitability of any device, circuit etc.