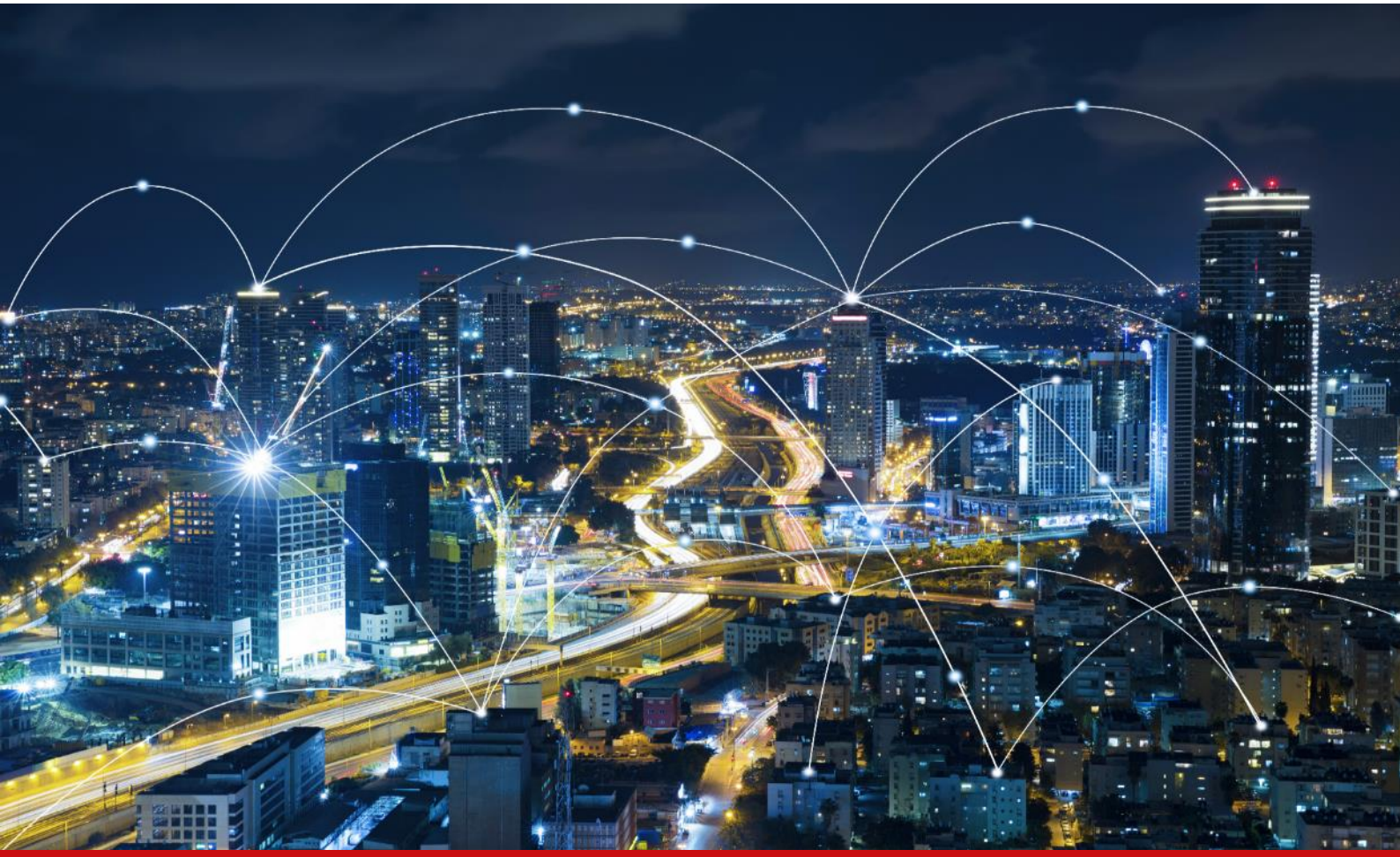
APPLICATION NOTE

Diotec Semiconductor



Industrial Lighting Solutions

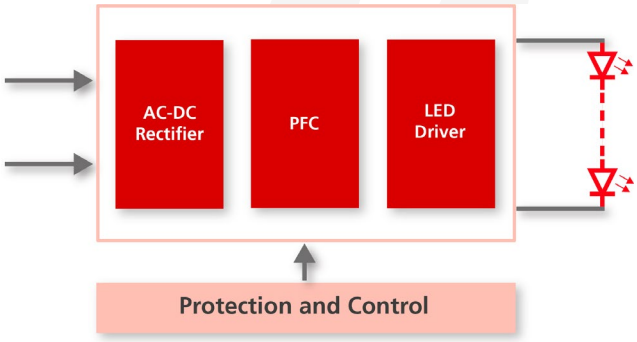
Lighting is an essential element in our present world. It plays a decisive role in our daily lives, right from low power indoor lighting at home or offices, to mid and high-power outdoor lighting, industrial and horticulture lighting systems. Lighting accounts for about 15% of global electricity consumption.

A new era came with the **light emitting diodes (LED).** They consume little electricity, are long lasting, versatile and contain no toxic substances. LEDs have been successful in replacing the traditional lighting sources like fluorescent, Halogen, HID lamps and many other high density lighting applications. Other intelligent technologies such as digital lighting control systems and smart lighting solutions are emerging in the market, further ensuring an increase in efficiency, greater energy savings and thus lower the carbon emissions.

The discrete components always provide flexibility in choosing the perfect matching based on the circuit requirements. By choosing the **best suited semiconductor components** in the design, **power losses decrease** and **energy savings can be pushed** even further. Hence, the selection of the right components can also boost-up the overall performance.

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 lighting applications.

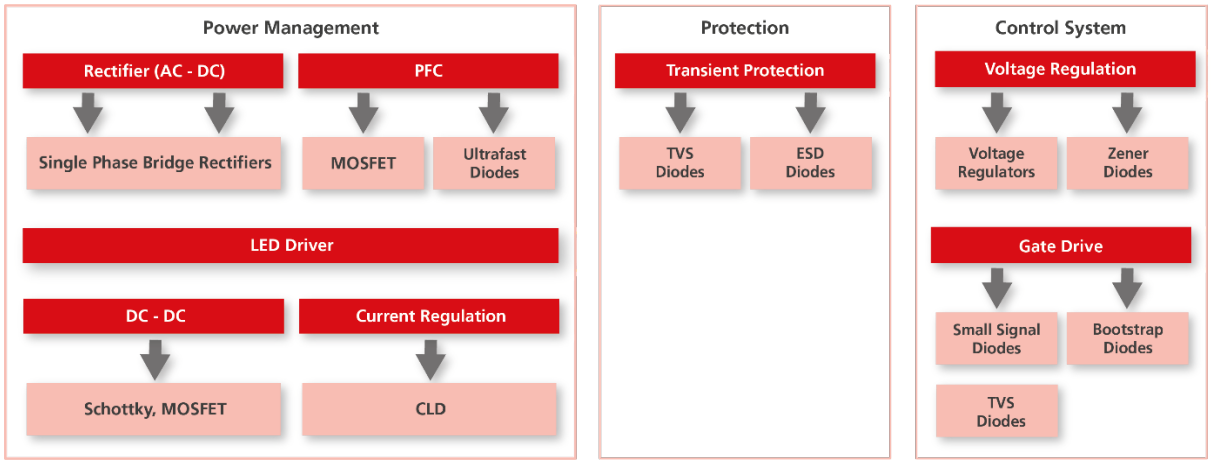
The following block diagram shows energy alteration procedure from an Alternating AC voltage to a Constant output current:



Block diagram for typical industrial lighting applications

The overall function of industrial lighting can be classified into three 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) Protection: Although the modern power supplies are reliable, there is a possibility for voltage transient peaks, induced from the unlikely events like lightning, short-circuit or even from unintended backwards power connection. By adding little extra protection circuitry, it is possible to protect the power supply from such voltage disturbances.
3) Controls and gate drive: Many lighting fixtures are now being integrated by intelligent lighting control systems that have sensors and wireless networked lighting systems. It would facilitate to improve the energy savings, efficiency and helps to optimize the usage. The light control function is performed by control and gate drive circuit.



AC – DC Rectification

Single Phase Bridge Rectifiers

Part No	Package	I_{FAV}	V_{RRM}
MYS250 ... MYS380	MicroDIL	1 A	600 ... 800 V
MB6S ... MB10S	TO-269AA/MiniDIL Slim	0.5 A	600 ... 1000 V
S250 ... S500	TO-269AA/MiniDIL Slim	0.8 A	600 ... 1000 V
S125K, S250K	TO-269AA/MiniDIL Slim	1 A	250 ... 600 V
ABS6 ... ABS10	ABS	0.8 A	600 ... 1000 V
ABS15J ... ABS15M	ABS	1.5 A	600 ... 1000 V
B250S15A ... B500S15A	SO-DIL Slim	1.5 A	600 ... 1000 V
B250S2A ... B380S2A	SO-DIL Slim	2.3 A	600 ... 800 V
B250S ... B500S	SO-DIL Slim	1 A	600 ... 1000 V
B250D ... B500D	DIL	1 A	600 ... 1000 V

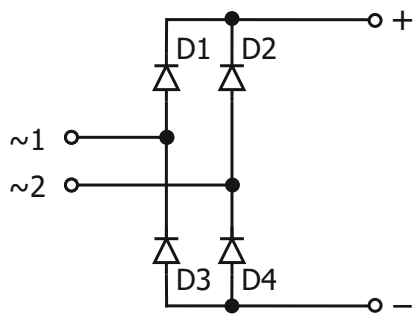
Part No	Package	I_{FAV}	V_{RRM}
B250R ... 500R	D9 x 5.1 (~WOG)	2 A	600 ... 1000 V

Single Rectifiers

Part No	Package	I_{FAV}	V_{RRM}	E_{RSM}
S1J ... S2Y	DO-214AC/SMA	1 A	600 ... 2000 V	N/A
S2J ... S2Y	DO-214AA/SMB	2 A	600 ... 2000 V	N/A
S3J ... S3Y	DO-214AB/SMC	3 A	600 ... 2000 V	N/A
S5J ... S5Y	DO-214AB/SMC	5 A	600 ... 2000 V	N/A
SM4005 .... SM2000	DO-213AB/ Melf	1 A	600 ... 2000 V	N/A
AM2000 [1])	DO-213AB/ Melf	1 A	1600 V	5 mJ
BYG10J ... BYG10M [1])	DO-214AB/SMA	1 A	600 ... 1000 V	20 mJ
AL1J ... AL1M [1])	DO-213AA/MiniMelf	1 A	600 ... 1000 V	20 mJ
GL1J ... GL1M	DO-213AA/MiniMelf	1 A	600 ... 1000 V	N/A
SL1J ... SL1M	SOD-123FL	1 A	600 ... 1000 V	N/A

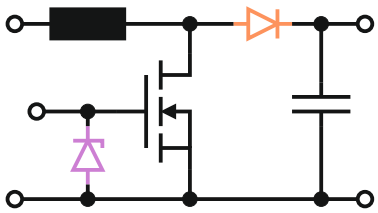
[1]) Controlled Avalanche

Part No	Package	I_{FAV}	V_{RRM}
1N4005 ... 1N4007	DO-41	1 A	600 ... 1000 V
1N5397 ... 1N5399	DO-15	1.5 A	600 ... 1000 V
1N5061 ... 1N5062	DO-15	1.5 A	600 ... 800 V
1N5406K ... 1N5408K	DO-15	1.5 A	600 ... 1000 V
BY253 ... BY255	~DO-201	3 A	600 ... 1300 V



Typical 1~ bridge circuit

Power Factor Correction (PFC)



Required at high power lighting assemblies. Operation frequencies are 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.

MOSFETs*

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

*under development

Superfast Efficient Rectifiers

Part no	Package	I_{FAV}	V_{RRM}	Trr
MUR460	DO-201	4 A	600 V	50 ns
UGB8JT	D2PAK	8 A	600 V	35 ns
UFT800J	TO-220AC	8 A	600 V	35 ns
MUR860	TO-220AC	8 A	600 V	50 ns
MURF2060CT	ITO-220AB	20 A	600 V	25 ns

LED Driver

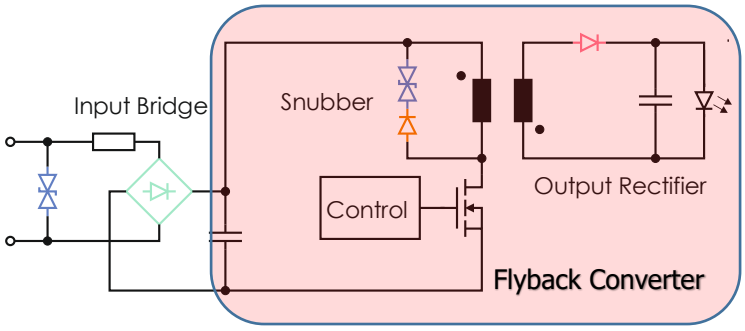


Fig: Typical Flyback circuit for high power applications

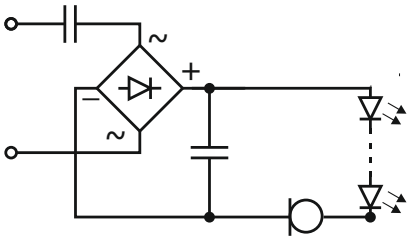


Fig: Typical LED driver circuit for low power applications

Schottky Output Rectifiers

Part no	Package	I_{FAV}	V_{RRM}
SKL34 ... SKL36	SOD-123F	3 A	40 ... 60 V
SK34SMA-3G ... SK315SMA	DO-214AC/SMA	3 A	40 ... 150 V
SK420	DO-214AB/SMC	4 A	200 V
SK54-3G ... SK515	DO-214AA/SMB	5 A	40 ... 150 V
SK84-3G ... SK815	DO-214AB/SMC	8 A	40 ... 150 V

-3G: 3rd Generation Schottky Technology with low V_F and low I_R

Part no	Package	I_{FAV}	V_{RRM}
PPS1040-3G ... PPS1060	Power SMD	10 A	40 ... 60 V
PPS1540 ... PPS1560	Power SMD	15 A	40 ... 60 V
SK1040 ... SK10100D1	D-PAK	10A	40 ... 100 V
SK1040D2-3G ... SK100D2	D2-PAK single	10A	40 ... 100 V
SK4040CD2-3G ... SK4045CD2-3G	D2-PAK dual	2x 20A	40 ... 45 V
SBT1040-3G ... SBT10100	TO-220AC	10A	40 ... 100 V
SBCT1040-3G ...SBCT10100	TO-220AB dual	2x 5A	40 ... 100 V

-3G: 3rd Generation Schottky Technology with low V_F and low I_R

MOSFETs*

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

*under development

CLD (Constant Current Regulator)

Part no	Package	I_{Pnom}	V_{AK}
CL10MD ... 30MD	DO-213AA/MiniMelf	20 ... 40 mA	90 V
CL15M35 ... 40M35	DO-214AC/SMA	15 ... 40 mA	90 V
CL15M45 ... 40M45	DO-214AA/SMB	15 ... 40 mA	90 V

Controls and Gate Drive

Voltage Regulators*

Part no	Package	I_{out}	V_{out}
LDI1117 Series	SOT-89, SOT-223	1.0 A	Adj, 1.2 ... 5 V
DI78L05 Series	SO-8, SOT-89	0.1 A	3.3 V ... 24 V
DI79L Series	TO-92	0.1 A	5V ... 24 V
DI78M Series	SO8, SOT-89	0.1 A	5V ... 24 V
DI6206 Series	SOT-23	0.2 A	1.2 V ... 5.0V

Zener Diodes

Part no	Package	P_{tot}	V_Z
MM3Z	SOD-323	300 mW	2.4 ... 47 V
BZT52	SOD-123	500 mW	2.4 ... 75 V
ZMC	Micro Melf	500 mW	2.4 ... 75 V

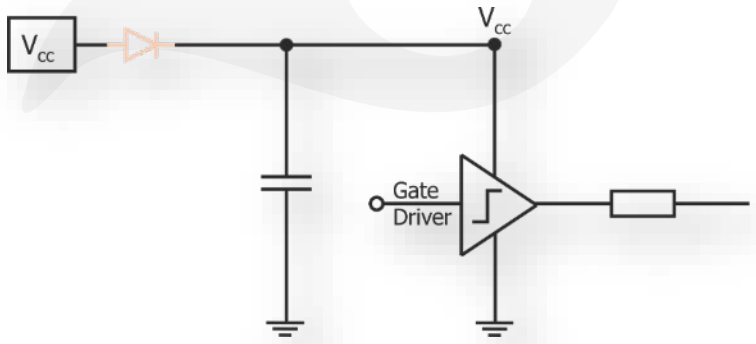
Small Signal Diodes

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

Schottky Diodes

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

Bootstrap Diodes



Part no	Package	I_{FAV}	V_{RRM}
FR2TSMA ... FR2YSMA (Fast)	DO-214AC/SMA	1 A	1300 ... 2000 V
BYG23T (Superfast / Avalanche)	DO-214AC/SMA	1A	1300V

Protection

Ultrafast Diodes (Snubber)

Part no	Package	I_{FAV}	V_{RRM}	V_{RRM}
EGL1J ... EGL1M	DO-213AA/MiniMelf	1 A	600 ... 1000 V	75 ns
USL1J ... USL1M	SOD-123F	1 A	600 ... 1000 V	75 ns
SUF4006 ... SUF4007	DO-213AB/Melf	1 A	600 ... 1000 V	75 ns
US1J ... US1M	DO-214AC/SMA	1 A	600 ... 1000 V	75 ns
US3J ... US3M	DO-214AB/SMC	3 A	600 ... 1000 V	75 ns

TVS Diodes (Snubber/Gate protection)

Part no	Package	P_{PPM}	V_{WM}	V_{BR}
TGL34-6.8 ... TGL34-200CA	DO-213AA/MiniMelf	150 W	5.5 ... 171 V	6.8 ... 200 V
SMF5.0 ... SMF220CA	SOD-123FL	200 W	5.0 ... 220 V	6.8 ... 260 V
TGL41-6.8 ... TGL41-520C	DO-213AB/Melf	400 W	5.5 ... 423 V	6.8 ... 520 V
P4SMAJ5.0 ... P4SMA550CA	DO-214AC/SMA	400 W	5.0 ... 495 V	6.8 ... 550 V
P6SMBJ5.0 ... P6SMB550CA	DO-214AA/SMB	600 W	5.0 ... 495 V	6.8 ... 550 V
1.5SMCJ5.0 ... 1.5SMCJ550CA	DO-214AB/SMC	1500 W	5.0 ... 495 V	6.8 ... 550 V

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

Part no	Package	P_{PPM}	V_R	V_{BR}
TGL200F10	DO-213AB/Melf	300 W	1000 V	200 V
TGL200U06	DO-213AB/Melf	300 W	600 V	200 V
PKC-136	DO-15/ DO-204AC	600 W	700 V	160 V

ESD Protection

Part no	Package	P_{PPM}	$V_{Br\ Min}$	C_j
ESD3Z5V0 ... ESD3Z12	SOD-323	350 W	6, 13.3 V	350, 150 pF
ESD5Z3V3 ... ESD5Z12	SOD-523	158 ... 240 W	3.3 ... 12 V	55 ... 105 pF
ESD3B5V0 ... ESD3B24WS	SOD-323	350 W	6.0 ... 26.7 V	50 ... 200 pF
ESD3V3CA... ESD36CA	SOT-23	200 W	3.3 ... 36 V	60 ... 600 pF
ESDB3V3 ... ESDB24C	SOT-23	200 ... 350 W	3.3 ... 24 V	11 ... 101 pF

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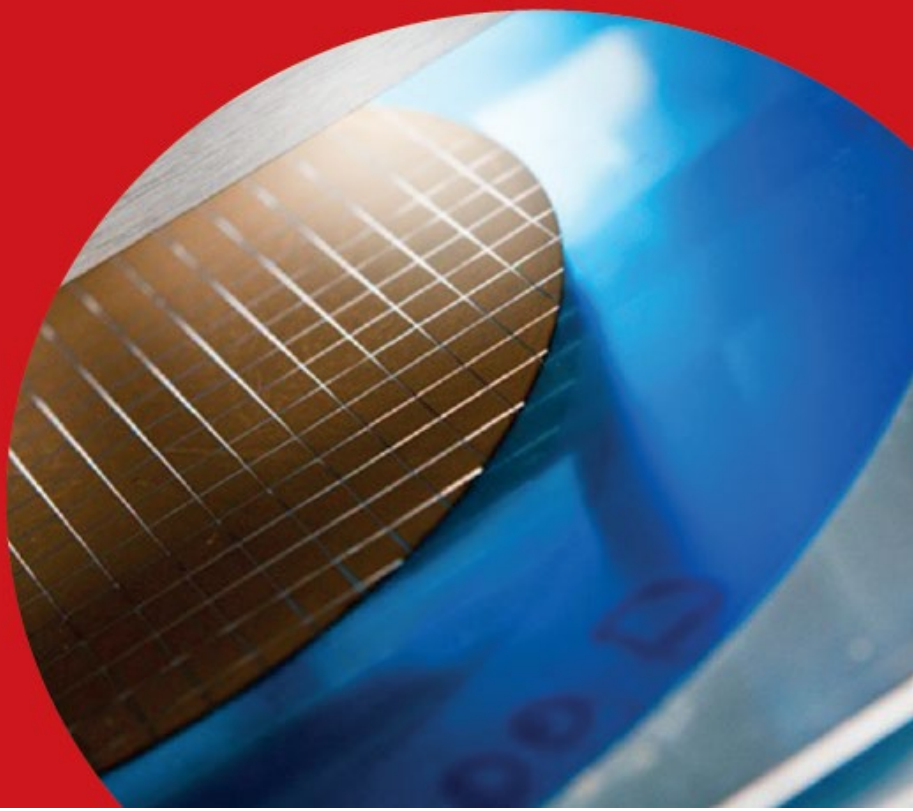

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