RENEWABLE ENERGY SOLUTIONS

Energy Efficient Components for PV Solar Systems

IGBTs MOSFETs Diodes Drivers

As global demand for electrical energy continues to grow, so has the need for alternative energy sources that minimize impact on the environment. The generation of clean ("green") energy has become increasingly viable due to the latest process technology, system topologies and components.

Photovoltaic power generation is forecasted to have a significant impact in the global power equation, and has been demonstrated to be economically viable and technologically feasible. Recent advances in photovoltaic cell technology, coupled with the recent availability of high efficiency, high performance, and low cost semiconductor devices, will facilitate the implementation of renewable energy systems which are efficient, affordable and reliable.

Continued innovation in process technology, system topologies and component performance will satisfy the demands of future renewable energy systems, and Fairchild Semiconductor leads the way with its broad product portfolio.

Fairchild's Product Solutions for Renewable Energy Applications

Fairchild Semiconductor's high efficiency solutions for renewable energy applications include a broad portfolio of components, that have been specifically designed and manufactured to fill the needs of the next-generation power systems. Fairchild's deep expertise in process technology, coupled with innovative topologies, result in complete solutions to your design challenges and offer you high performance, high efficiency and unparalleled reliability at an affordable cost. Our family of building blocks for renewable energy includes:

- IGBTs and MOSFETs featuring high current handling capability and low conduction and switching loss
- Optically isolated gate drivers with wide operating voltage range and high common-mode transient immunity
- High-voltage gate drivers with excellent noise immunity, high dv/dt and low power consumption

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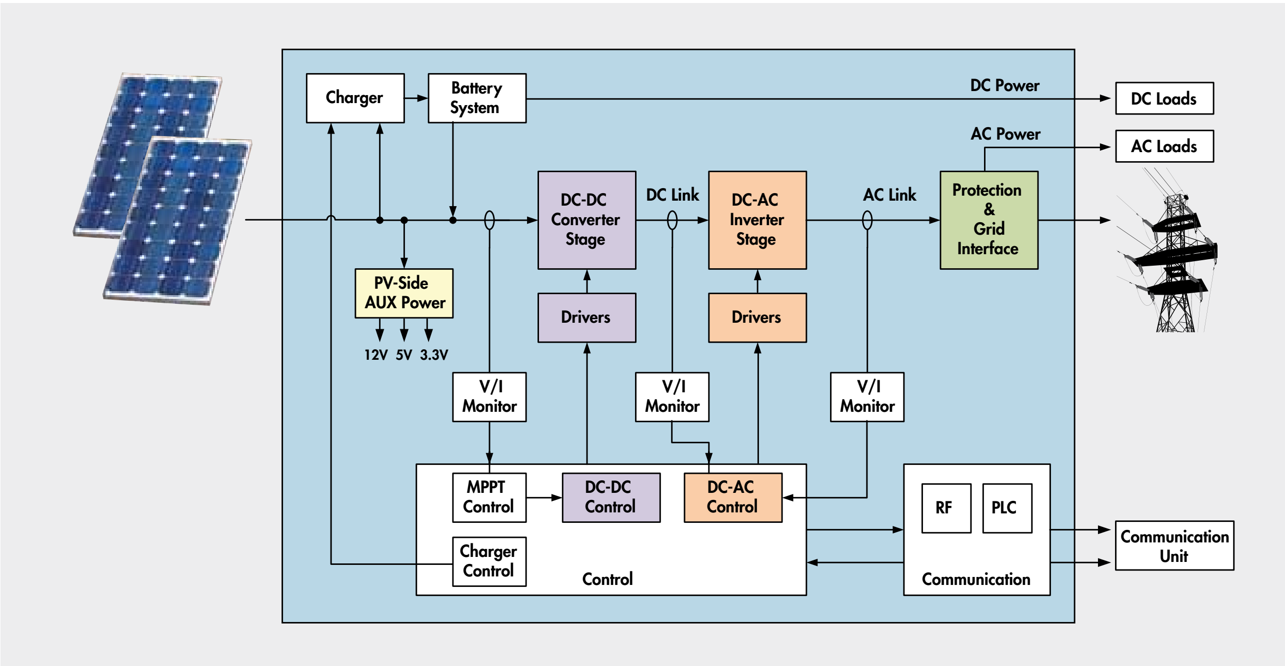
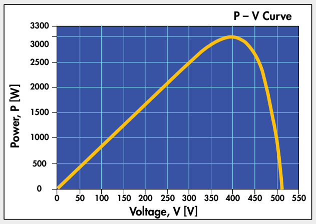
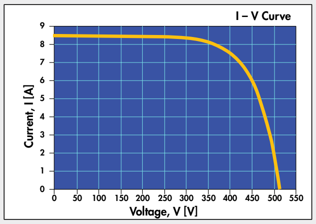
Central Inverter

Central inverters convert the DC voltage from "strings" of photovoltaic (PV) panels to AC voltage. They are residential, commercial and utility scale systems with a power level of 1kW or higher. The *maximum power point tracking (MPPT) for the PV panels is performed centrally at the DC-AC inverter stage.



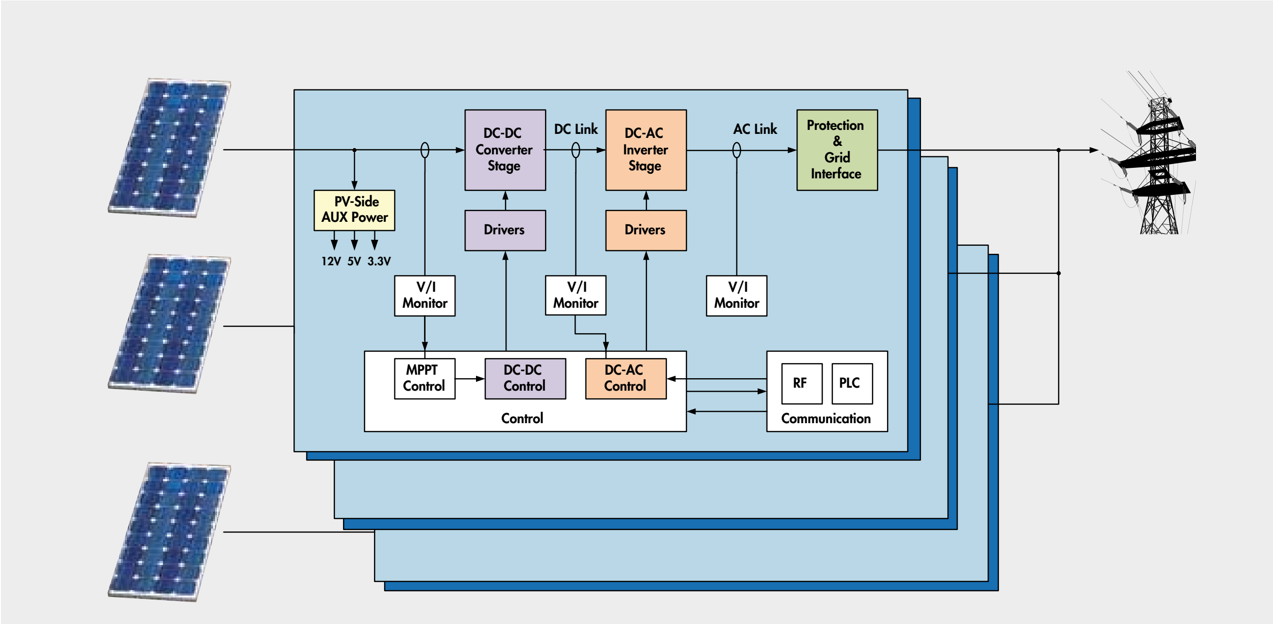




***Maximum power point tracking** (MPPT) is a technique which solar power systems use in order to achieve the maximum possible power from the PV array. Solar cells have a complex relationship between solar irradiation, temperature and total resistance which results in a non-linear output characteristic. The MPPT system samples the output of the PV cells and applies a resistance (load) in order to obtain the maximum output power for any given environmental (shading) condition. Essentially, this defines the current that the inverter should draw from the PV cell in order to get the maximum possible power. The MPPT plays an important role in PV power system to maximize system yielding efficiency, consequently the MPPT makes it possible to minimize the overall PV system cost.*

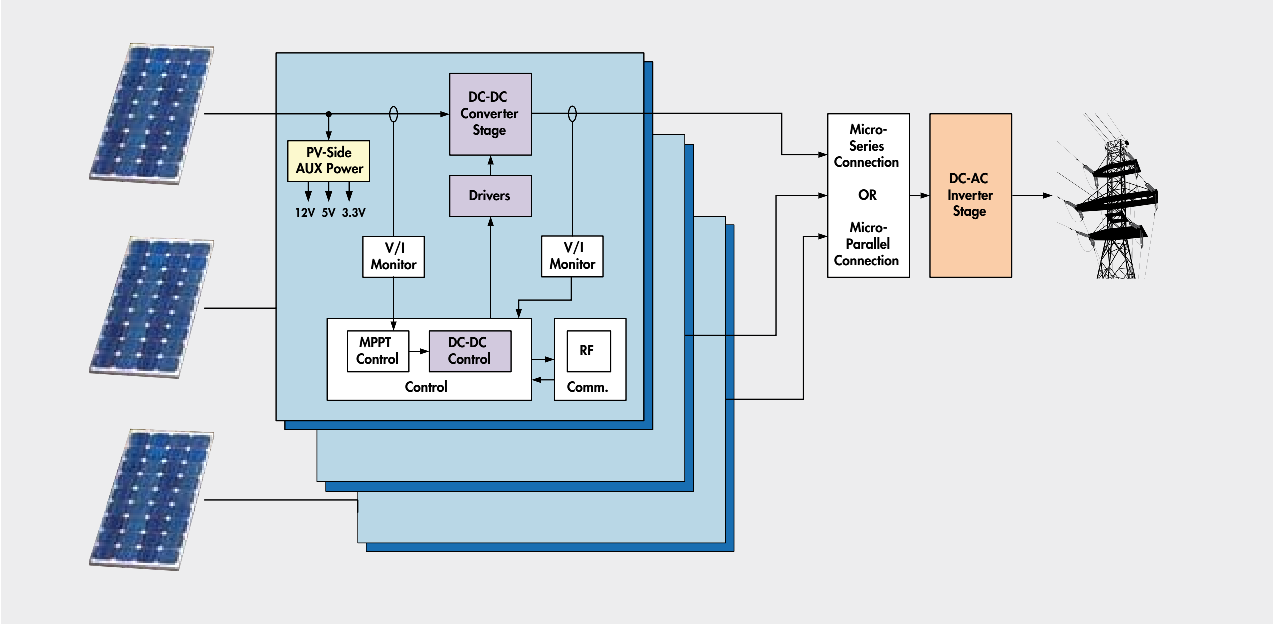
Micro Inverter

Installed on each PV panel, micro inverters process power for one panel only (typically less than 300W). Each micro inverter includes both the DC-DC and DC-AC inverter stage. The advantages of this configuration include scalability as well as distributed MPPT to optimize each PV panel. The MPPT for the PV panels is performed centrally at the inverter stage.



Micro Converter (DC-Optimizer)

Similar to the micro inverters, the micro converters are used in lower power applications and installed on each PV panel. This approach provides the advantage of individual optimized MPPT (hence this configuration is also called DC-optimizers). The DC-DC converter converts the PV panel output DC voltage up or down and it is then fed to a "central" DC-AC inverter stage.



Design Options for Energy Harvesting

Designers of energy harvesting systems have many options and have to make many critical design tradeoffs when defining the architecture of their system. The decision as to whether the MPPT function will be performed in a central or distributed manner is fundamental and often dictated by efficiency, complexity and cost considerations. This choice also has implications on whether the DC-AC conversion will be performed centrally or distributed. And finally, various cell serial or parallel configurations are also possible.

Central inverter topologies offer a broad set of choices and challenges for the designer. Of primary importance is the decision on whether to use an isolated or non-isolated topology. Other design choices include whether a boost stage is required, the use of a multi-tap transformer is also an important consideration and whether the inverter will be required to handle reactive power will also have an impact on the topology and component selection.

The design of the micro inverter is based on whether a series or parallel configuration is used. Component selection is highly dependent on this choice, primarily due to the voltage being handled by the stage.

The evaluation of all of the design choices can be a daunting task—Fairchild Semiconductor has deep expertise in this area, and we offer you superior technical and logistical support in order to help you achieve a successful implementation.

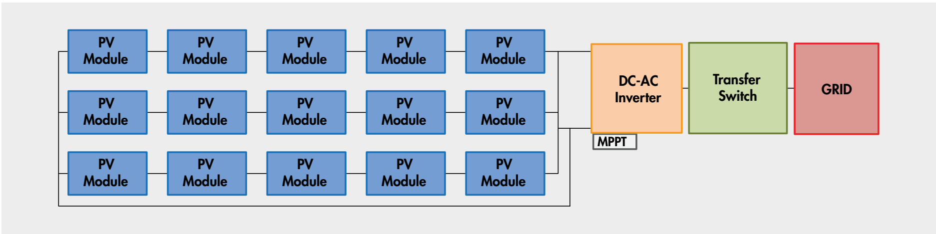
Central-Maximum Power Point Tracking System (C-MPPT)

In the central-MPPT systems, PV modules are connected in combinations of series and parallel configurations.

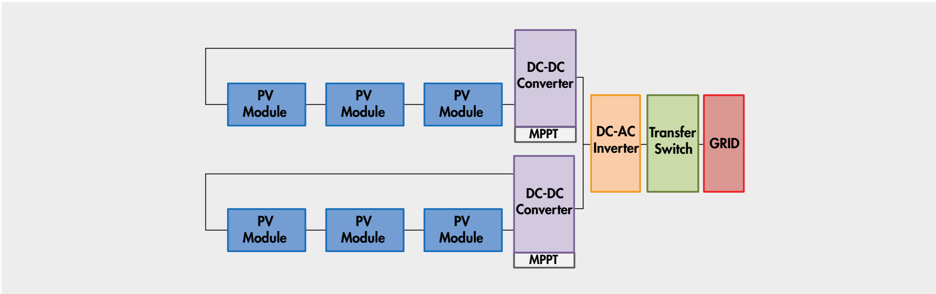
The PV modules connected in series are called "strings." MPPT can be performed at the system level or at the string level. The output voltage of each string can be between 150V and 1000V_{DC}. In order to generate the peak grid voltage, these systems need a boost step (converter or transformer), which is performed at the output of the string. Single-stage inverters (using full-bridge or neutral-point clamp topologies) achieve higher efficiency, less system cost, better efficiency and longer lifetime.

Design advantages include:

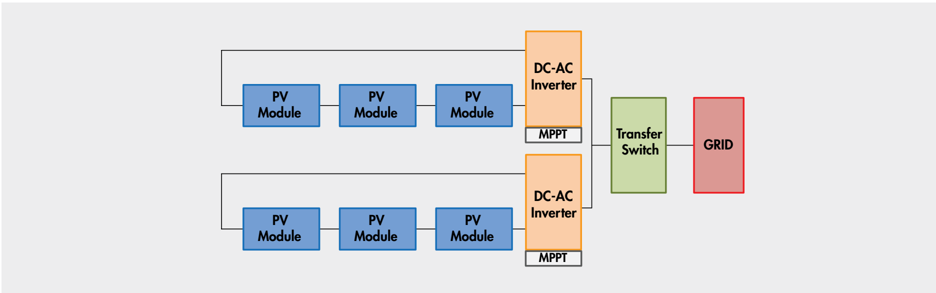
- One MPPT per one string can be performed at DC-DC stage right in front of central inverter
- MPPT can be performed in the central inverter
- Single-point failure can cause an entire system failure
- Maintenance at the string or inverter level is possible
- High DC voltage
- Low current in string
- Less interconnects per string



Central System



String System 1



String System 2

Distributed-Maximum Power Point Tracking System (D-MPPT)

In low power (190W~380W) distributed-MPPT systems, such as the micro inverter and micro converter architectures, the MPPT is performed at each PV module. These low power systems can be integrated into the frame of the PV module. The micro inverter is often called an "AC-module" and the micro converter is often called a "DC-Optimizer."

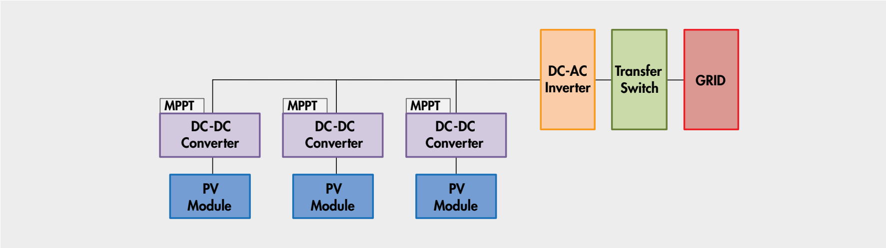
D-MPPT Options

The on-demand D-MPPT function is performed only for shaded PV modules. The output voltage of the shaded PV modules is reduced and the DC current is kept the same as in the non-shaded PV module. Therefore, only the input voltage to the inverter is varied, and the total current is kept constant.

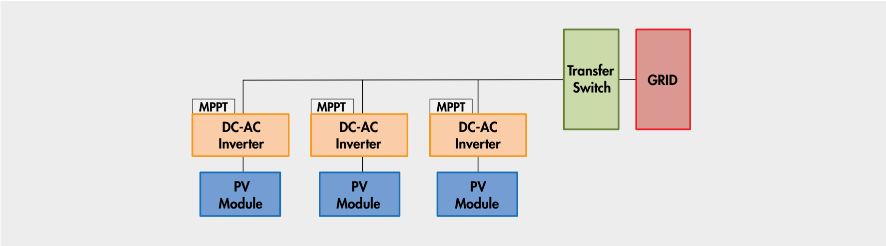
The permanent D-MPPT is performed at each PV module. The voltage and current of the DC-DC stage of the shaded PV modules are reduced. The DC voltage at the inverter input is kept constant by increasing the DC voltage of the each DC-DC stage.

Design advantages include:

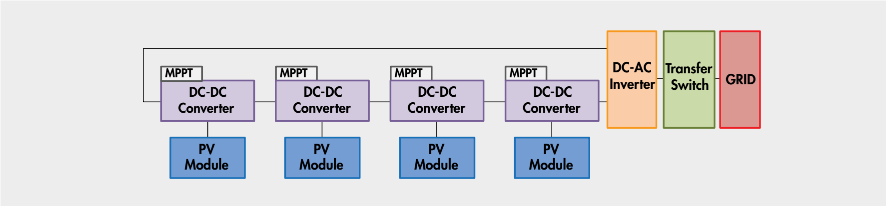
- MPPT performed at each module
- Single-point failure causes only partial system failure
- Maintenance of each module is possible



Micro Parallel System 1



Micro Parallel System 2

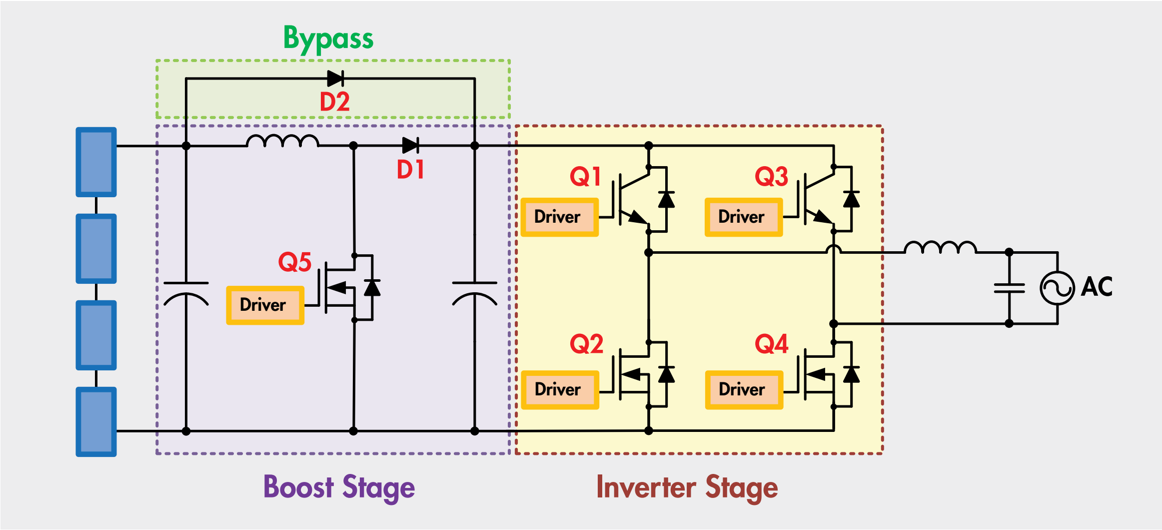


Micro Series System

Boost Converter and Full-Bridge Inverter (Topology 1)

This non-isolated topology can handle a wide MPPT range by using a boost converter stage paired with a single-stage inverter.

If the input voltage is higher than DC-link voltage, the boost converter stage will not operate. Instead, the bypass diode will conduct to provide input power to inverter stage. This topology can achieve higher efficiency than the isolated inverter.



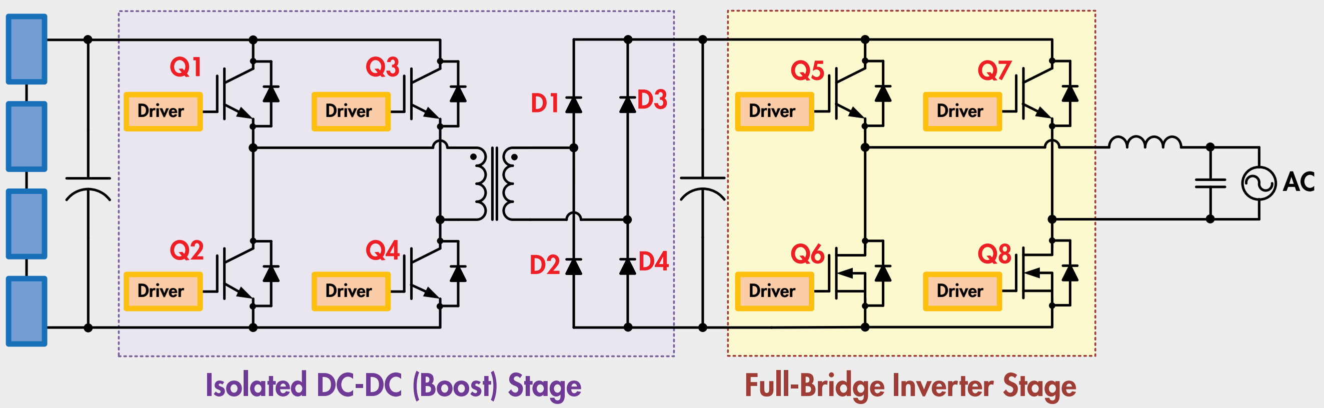
Requirements			
Q1, Q3	• Line frequency switching • Low $V_{CE(sat)}$ • Fast recovery	**Q5**	• High frequency switching • Fast switching
Q2, Q4	• High frequency switching • Fast switching • Fast recovery	**D1**	• Fast recovery, low I_{rr}
		D2	• Low V_F (Bypass)
Drivers	• High-voltage gate drivers • High-speed, low-side drivers for DC-DC stage • Opto drivers above $800V_{AC}$ (peak) insulation working voltage for $208\sim240V_{AC}$ grid-connected inverters	**AUX Power**	• Low standby power • Light-load efficiency

Q2, Q4 and Q5 can be replaced with IGBTs.
Fairchild's solutions meet these requirements; see pages 17-27 for further information.

Phase Shifted Full-Bridge Converter and Full-Bridge Inverter (Topology 2)

The high voltage gain transformer provides a wide MPPT range and isolation between the PV module and the grid. This topology typically has lower efficiency, compared to the boost converter and full-bridge inverter topology.

In order to achieve higher efficiency some systems utilize "tapped transformers." Depending on the input voltage, the turns ratio of the transformer can be adjusted in order to achieve higher efficiency.



Requirements			
Q1-Q4	• Fast switching • Fast recovery • Low cross	**Q6, Q8**	• High frequency switching • Fast switching • Fast recovery
D1-D4	• Fast recovery	**Q5, Q7**	• Line frequency switching • Low $V_{CE(sat)}$ • Fast recovery
Drivers	• High-voltage gate drivers • High-speed, low-side drivers for DC-DC stage • Opto drivers above $800V_{AC}$ (peak) insulation working voltage for 208~$240V_{AC}$ grid-connected inverters	**AUX Power**	• Low standby power • Light-load efficiency

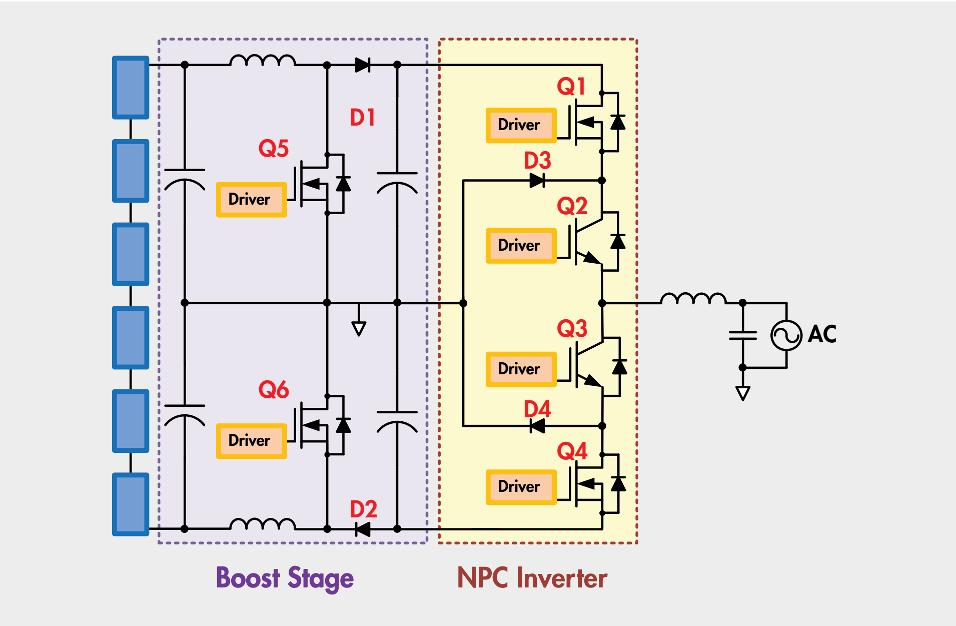
Q1-Q4 can be replaced with Fast Recovery MOSFETs like Q6 and Q8.
Fairchild's solutions meet these requirements; see pages 17-27 for further information.

Boost Converter and Three-Level Inverter Neutral Point Clamped (NPC) for Non-Reactive Power Control (Topology 3-1)

The three-level inverter is often called "Neutral Point Clamped" (NPC) because the output voltage is clamped to the neutral point level by diodes D3 and D4, thus the inverter delivers a three-level PWM waveform.

Compared to a two-level inverter having the same input voltage, the NPC inverter generates lower harmonics. Therefore, this inverter requires a smaller output filter and can be implemented at a lower cost. Reduced harmonics also minimizes the inverter loss and increases its efficiency.

Three of these circuits across a positive and negative Bus voltage will constitute a three-phase NPC PWM inverter. The boost converter stage is added for a wider MPPT range.

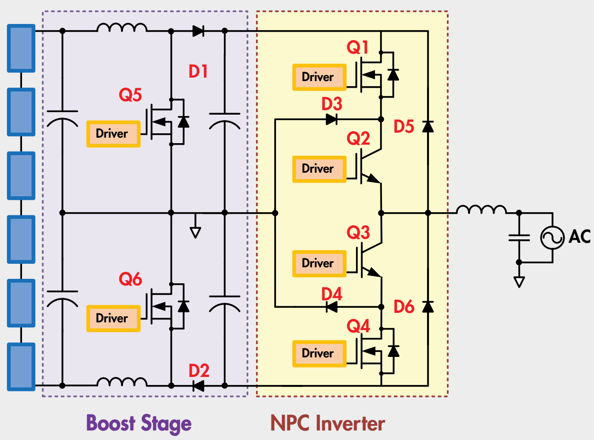


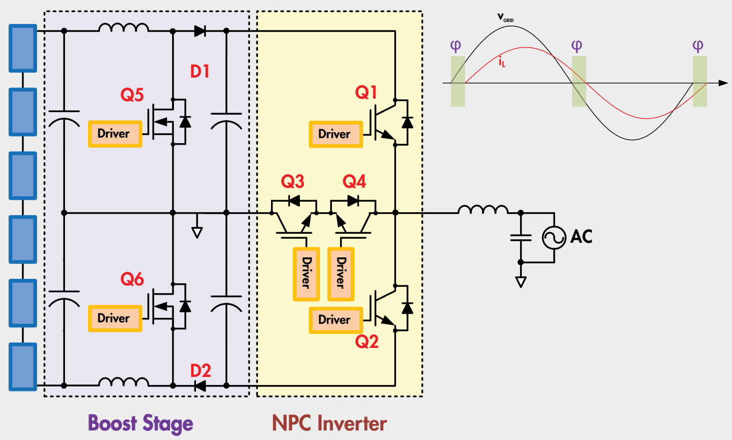
Requirements			
Q1, Q4	• High frequency switching • Fast switching	**D1-D4**	• Fast recovery
Q2, Q3	• Line frequency switching • Low $V_{CE(sat)}$	**Q5, Q6**	• High frequency switching • Fast switching
Drivers	• High-voltage gate drivers • High-speed, low-side drivers for DC-DC stage • Opto drivers above $800V_{AC}$ (peak) insulation working voltage for $208\sim240V_{AC}$ grid-connected inverters	**AUX Power**	• Low standby power • Light-load efficiency

Q1, Q4, Q5 and Q6 can be replaced with IGBTs.
Fairchild's solutions meet these requirements; see pages 17-27 for further information.

Boost Converter and Three-Level Inverter Neutral Point Clamped (NPC) for Reactive Power Control (Topology 3-2)

This three-level inverter can handle reactive power with the use of diodes D5, D6 (left diagram) or Q3, Q4 (right diagram).





Requirements (Left Diagram)

Q1, Q4	• High frequency switching • Fast switching	**Q5, Q6**	• High frequency switching • Fast switching
Q2, Q3	• Line frequency switching • Low $V_{CE(sat)}$	**D1-D4**	• Fast recovery
		D5, D6	• Fast recovery • Double voltage rating is needed
Drivers	• High-voltage gate drivers • High-speed, low-side drivers for DC-DC stage • Opto drivers above $800V_{AC}$ (peak) insulation working voltage for $208\sim240V_{AC}$ grid-connected inverters	**AUX Power**	• Low standby power • Light-load efficiency

- When V_{GRID} is positive and I_L is negative, Q3, D4 (powering) and D5 (freewheeling) provide a current path.
- When V_{GRID} is negative and I_L is positive, Q2, D3 (powering) and D6 (freewheeling) provide a current path.

Q1, Q4, Q5 and Q6 can be replaced with IGBTs.
Fairchild's solutions meet these requirements;
see pages 17-27 for further information.

Requirements (Right Diagram)

Q1, Q2	• High frequency switching • Fast switching • Fast recovery • Double voltage rating is needed	**Q3, Q4**	• High frequency switching • Fast switching • Fast recovery
Q5, Q6	• High frequency switching • Fast switching	**D1, D2**	• Fast recovery
Drivers	• High-voltage gate drivers • High-speed, low-side drivers for DC-DC stage • Opto drivers above $800V_{AC}$ (peak) insulation working voltage for $208\sim240V_{AC}$ grid-connected inverters	**AUX Power**	• Low standby power • Light-load efficiency

- When V_{GRID} is positive and I_L is negative, Q4, co-pack diode of Q3 (powering) and co-pack diode of Q1 (freewheeling) provide a current path.
- When V_{GRID} is negative and I_L is positive, Q3, co-pack diode of Q4 (powering) and co-pack diode of Q2 (freewheeling) provide a current path.

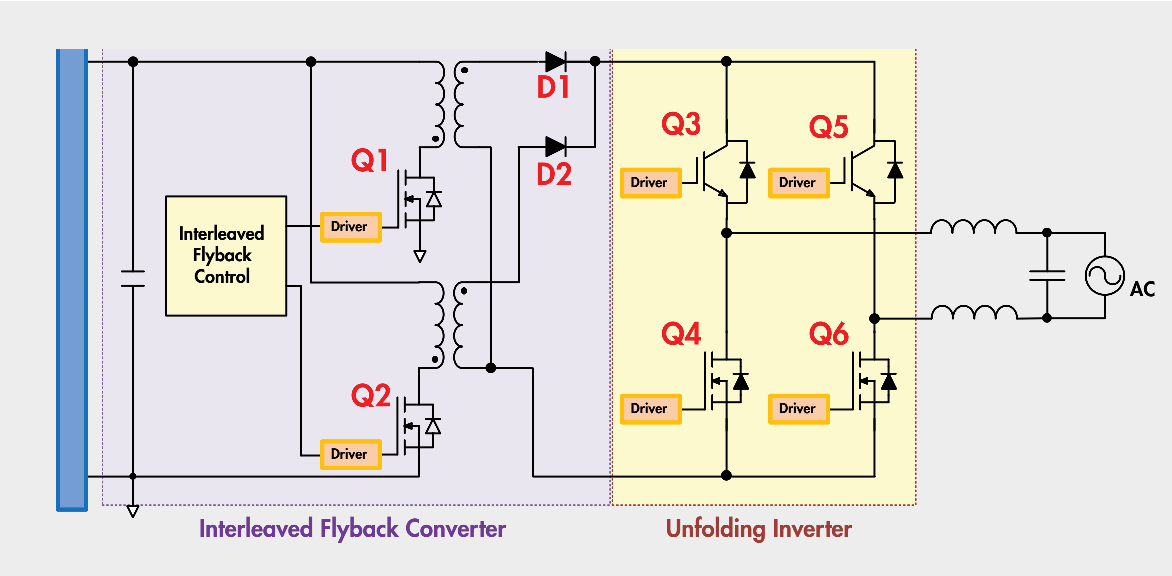
Q5 and Q6 can be replaced with IGBTs.
Fairchild's solutions meet these requirements;
see pages 17-27 for further information.

Interleaved Flyback Converter and Unfolding Inverter

Q1 and Q2 operate 180° out of phase and implement a PWM to generate a folded AC output.

Q3~Q6 operate at line frequency, and they unfold the AC output.

This kind of interleaved converter is normally used in applications in which there is a low ripple current stress on the input capacitor.



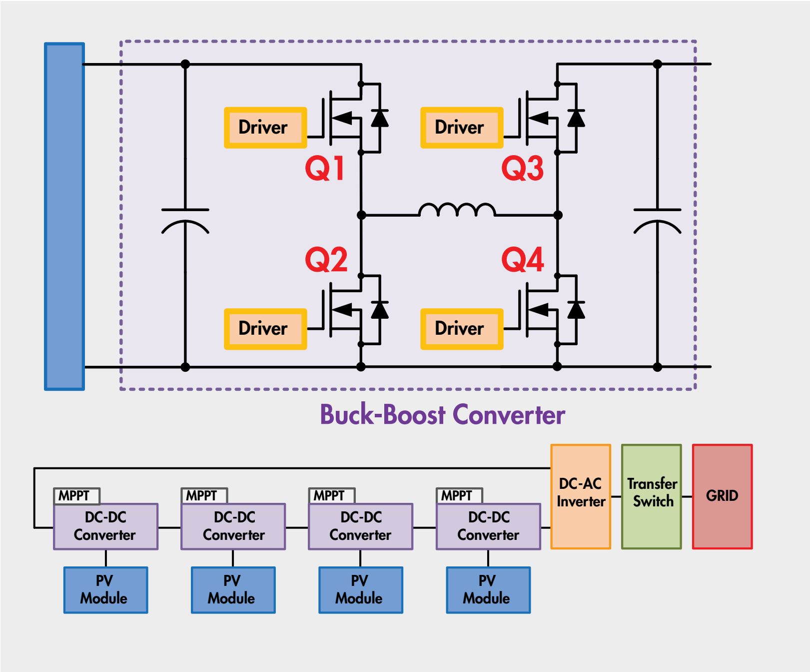
Requirements			
Q1, Q2	• Medium voltage MOSFET • Fast switching	**Q3-Q6**	• Line frequency switching • Low $V_{CE(sat)}$/Low $R_{DS(ON)}$
D1, D2	• Fast recovery, Low Q_{rr}	**AUX Power**	• Low standby power • Light-load efficiency
Drivers	• High-voltage gate drivers • High-speed, low-side drivers for DC-DC stage • Opto drivers above 800V_{AC} (peak) insulation working voltage for 208~240V_{AC} grid-connected inverters	**Controller**	• Interleaved flyback controller (FAN9611)

Fairchild's solutions meet these requirements; *see pages 17-27 for further information.*

Micro DC-DC Converter for Series Connection

The output of the non-isolated converters is connected in a series prior to the DC-AC inverter. Each converter also performs the MPPT function.

An additional switch can be added for the bypass mode between input and output. This type of DC-DC converter is often called "Power Optimizer" because it also fulfills the MPPT function of each module. Unlike the micro inverter, this topology outputs a DC voltage.

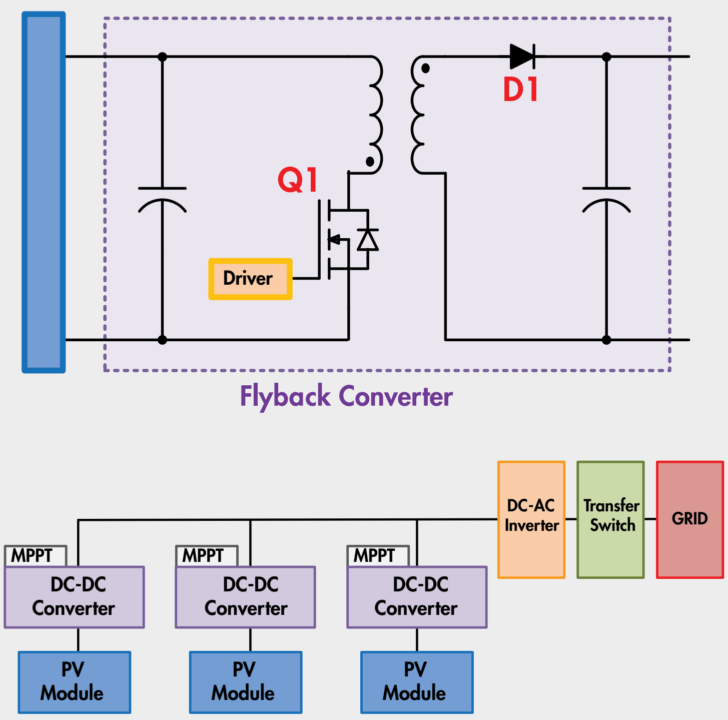


Requirements			
Q1, Q4	• Medium voltage MOSFET • Fast switching • Low $R_{DS(ON)}$	**Q3-Q6**	• Medium voltage MOSFET • High frequency switching • Low $R_{DS(ON)}$, fast recovery
Drivers	• High-voltage gate drivers • High-speed, low-side drivers for DC-DC stage • Opto drivers above 800V_{AC} (peak) insulation working voltage for 208~240V_{AC} grid-connected inverters	**AUX Power**	• Low standby power • Light-load efficiency

Fairchild's solutions meet these requirements; *see pages 17-27 for further information.*

Micro DC-DC Converter for Parallel Connection

The output of these isolated converters is connected in parallel. This configuration has a high output voltage, which can range from 350V~400V per DC-AC inverter. The MPPT function is performed at each module or converter. This type of DC-DC converter is also called "Power Optimizer."



Requirements			
Q1	• Medium voltage MOSFET • Fast switching • Low $R_{DS(ON)}$	D1	• Fast recovery • Low Q_{rr} • High voltage
Drivers	• High-voltage gate drivers • High-speed, low-side drivers for DC-DC stage • Opto drivers above $800V_{AC}$ (peak) insulation working voltage for $208\sim240V_{AC}$ grid-connected inverters	AUX Power	• Low standby power • Light-load efficiency

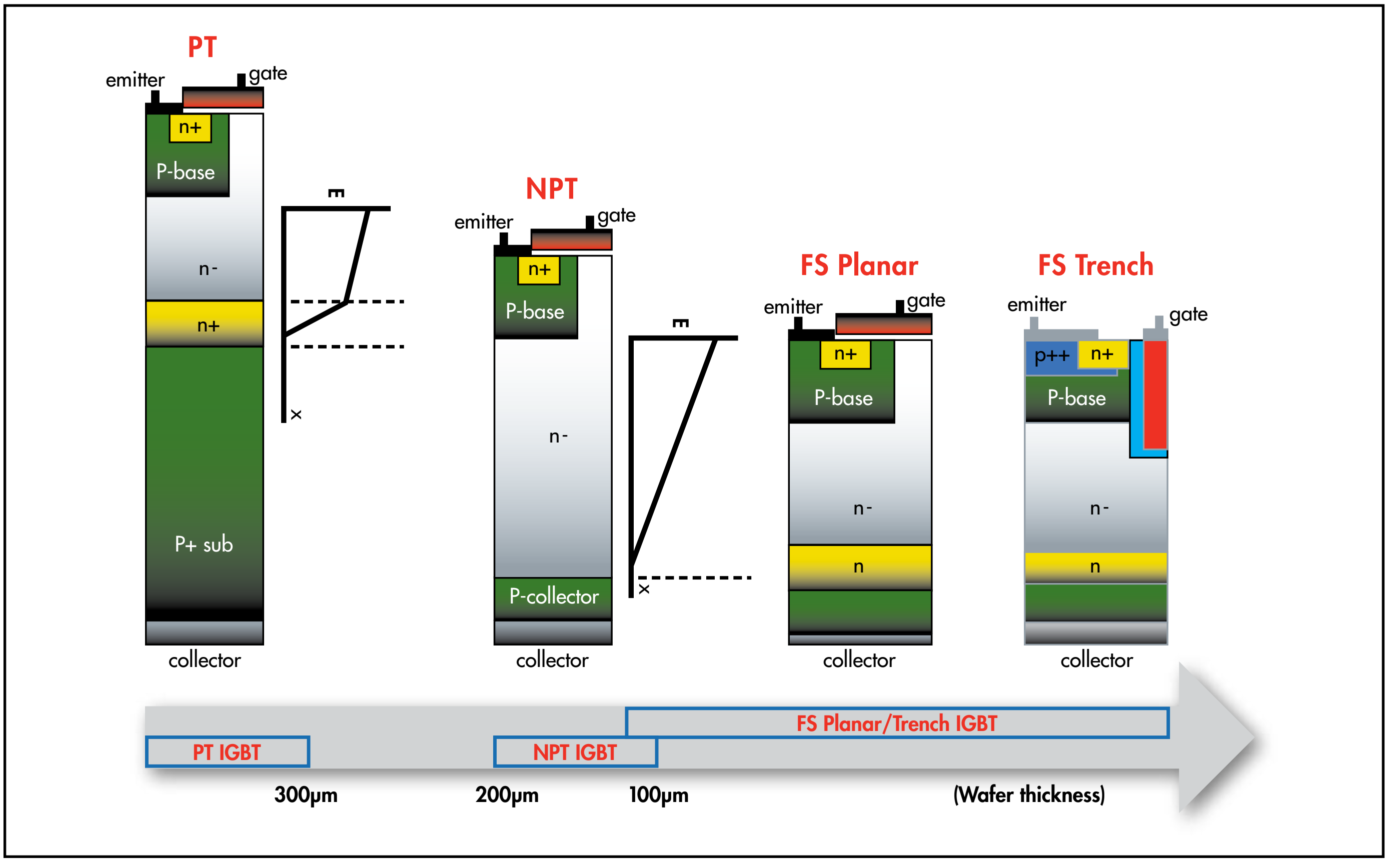
Fairchild's solutions meet these requirements; *see pages 17-27 for further information.*

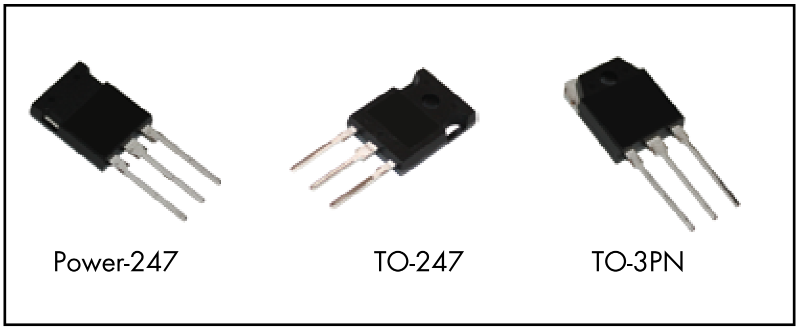
IGBTs: IGBT Technology

Fairchild's extensive IGBT product portfolio is made possible by our many process technologies, which include PT (Punch-Through), NPT (Non Punch-Through), FS (Field Stop) and SA FS (Shorted Anode FS).

These leading edge technologies are optimized for solar inverter, UPS, Welder and SMPS applications.

Our IGBTs offer superior $V_{CE(sat)}$ and E_{off}, which result in smoother waveforms and less EMI. Our optimized manufacturing process results in better control and repeatability of the top side structure, resulting in tighter specifications.





Field Stop IGBT Technology

Design advantages include:

- High current capability
- Low conduction and switching losses
- Positive temperature coefficient for easy parallel operation
- Maximum junction temperature: T_J=175°C
- Tight parameter distribution
- Large SOA (Safe Operating Area)

IGBTs

Product Number	BV_{DSS} Min. (V)	IC @ 100°C	$V_{CE(sat)}$ Typ. (V)	t_f Typ. (ns)	Built-in Diode	Package
FGP20N60UFD	600	20	1.8	32	Yes	TO-220
FGH20N60UFD	600	20	1.8	32	Yes	TO-247
FGH20N60SFD	600	20	2.2	24	Yes	TO-247
FGB20N60SFD	600	20	2.2	24	Yes	TO-263 (D2PAK)
FGH30N60LSD	600	30	1.1	1300	Yes	TO-247
FGA30N60LSD	600	30	1.1	1300	Yes	TO-3PN
FGH40N60UFD	600	40	1.8	30	Yes	TO-247
FGH40N60SMD	600	40	1.9	17	Yes	TO-247
FGH40N60SF	600	40	2.3	27	No	TO-247
FGH40N60SFD	600	40	2.3	27	Yes	TO-247
FGH60N60SMD	600	60	1.9	50	Yes	TO-247
FGH60N60UFD	600	60	1.9	40	Yes	TO-247
FGA60N60UFD	600	60	1.9	40	Yes	TO-3PN
FGH60N60SFD	600	60	2.3	31	Yes	TO-247
FGY75N60SMD	600	75	1.9	22	Yes	Power-247
FGH40N65UFD	650	40	1.8	30	Yes	TO-247
FGA40N65SMD	650	40	1.9	13	Yes	TO-3PN
FGA60N65SMD	650	60	1.9	50	Yes	TO-3PN
FGH75T65UPD*	650	75	1.65	–	Yes	TO-247
FGA50N100BNTD2	1000	35	2.5	65	Yes	TO-3PN
FGH40T100SMD*	1000	40	1.8	–	Yes	TO-247
FGH25N120FTDS	1200	25	1.6	102	Yes	TO-247
FGL35N120FTD	1200	35	1.68	107	Yes	TO-264

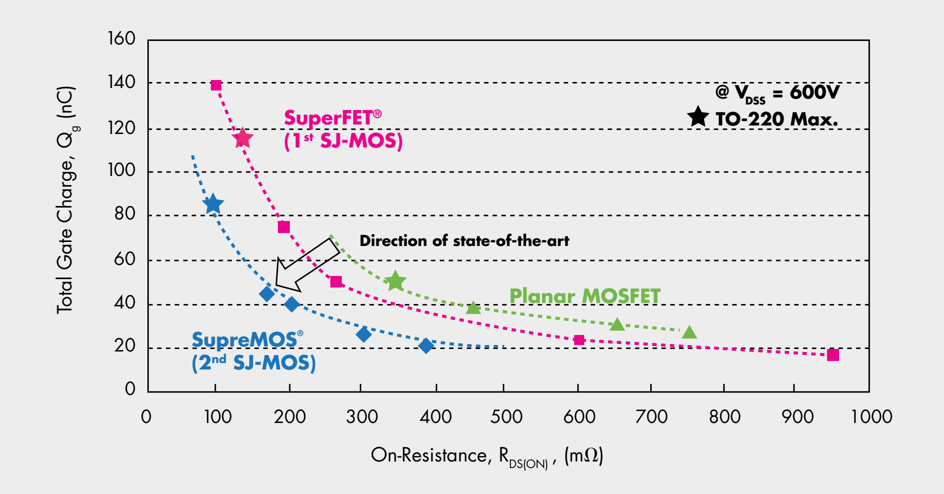
* In development

Super Junction Technology

Fairchild's MOSFET portfolio is one of the industry's broadest with outstanding low on-resistance and low gate charge performance. This is the result of proprietary technologies such as the SupreMOS®, SuperFET, UniFET™ and FRFET® MOSFETs. Our extensive packaging solutions not only feature small sizes, they also provide excellent thermal and electrical performance.

Design advantages include:

- Ultra-low $R_{DS(ON)}$ for low conduction losses and high efficiency
- Best-in-class di/dt rating for high frequency operation, ruggedness and reliability
- Low effective output capacitance ($COSS_{off}$) for low switching losses in high frequency applications



SuperFET® MOSFET: 1st Gen of FSC SJ MOSFET

- High current handling capability (4A~47A) features high efficiency and ease-of-use in applications such as servers, telecom, solar, computing, lighting & motor/industrial
- Outstanding FOM (Figure of Merit)

SupreMOS® MOSFET: 2nd Gen of FSC SJ MOSFET

- Low $R_{DS(ON)}$
- Ideal for high power and high efficiency applications such as solar, server, telecom, and industrial
- Lowest FOM for high efficiency

SuperFET® II MOSFET: 3rd Gen of FSC SJ MOSFET

- Features fast switching for solar power applications
- Low FOM delivers high efficiency and ease-of-use
- 600V FCP190N60 is available
- 600V and 650V line-up is in development

HV MOSFETs Selection Guide

Product Number	Polarity	BV_{DSS} Min. (V)	Configuration	$R_{DS(ON)}$ Max. (Ω) @ V_{GS} = 10V	Qg Typ. (nC)@ V_{GS} = 10V	I_D (A)	P_D (W)	Package
FCH76N60N	N	600	Single	0.036	218	76	543	TO-247
FCA76N60N	N	600	Single	0.036	218	76	543	TO-3PN
FCH76N60NF	N	600	Single	0.038	230	46	543	TO-247
FCH47N60N	N	600	Single	0.062	115	47	368	TO-247
FCH47N60NF	N	600	Single	0.065	121	28.9	368	TO-247
FCH47N60	N	600	Single	0.07	210	47	417	TO-247
FCA47N60_F109	N	600	Single	0.07	210	47	417	TO-3PN
FCH47N60F	N	600	Single	0.073	210	47	417	TO-247
FCA47N60F	N	600	Single	0.073	210	47	417	TO-3PN
FCP36N60N	N	600	Single	0.09	86	36	312	TO-220
FCB36N60N	N	600	Single	0.09	86	36	312	TO-263 (D2PAK)
FCA36N60NF	N	600	Single	0.095	86	22	312	TO-3PN
FCH35N60	N	600	Single	0.098	139	35	312.5	TO-247
FCA35N60	N	600	Single	0.098	139	35	312.5	TO-3PN
FCP190N60	N	600	Single	0.199	57	20.2	208	TO-220
FCB20N60	N	600	Single	0.19	75	20	208	TO-263 (D2PAK)
FCB20N60F	N	600	Single	0.19	75	20	208	TO-263 (D2PAK)
FCP380N60*	N	600	Single	0.38	tbd	10.2	106	TO-220

* In development

PowerTrench® Technology

Designers who need to significantly increase system efficiency and power density in synchronous rectification applications have many options with Fairchild's mid-voltage MOSFETs.

Our 100V, 150V PowerTrench® MOSFETs are optimized power switches combining small gate charge (Qg), small reverse recovery charge (Q_{rr}) and soft reverse recovery body diode that are ideal for synchronous rectification in AC-DC power supplies. The PowerTrench MOSFETs employ shielded-gate structure that provides outstanding charge balance. By utilizing this advanced technology, the FOM (Figure of Merit) (Qg x $R_{DS(ON)}$) of these devices is 66% lower than that of previous generation devices. Soft body diode performance is able to eliminate snubber circuits or replace higher voltage rating MOSFETs.

Fairchild's comprehensive portfolio of MOSFETs offers designers a wide range of breakdown voltages (-500V to 1000V), state-of-the-art packaging and industry-leading FOM to deliver efficient power management anywhere electronic power conversion is needed.

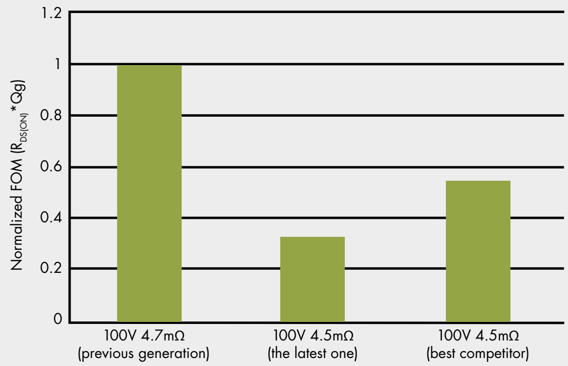
Design advantages include:

- Low FOM $R_{DS(ON)}$ x Qg
- Low reverse recovery charge, Q_{rr}
- Soft reverse recovery body diode
- Enables high efficiency in synchronous rectification
- 100% avalanche tested
- RoHS compliance

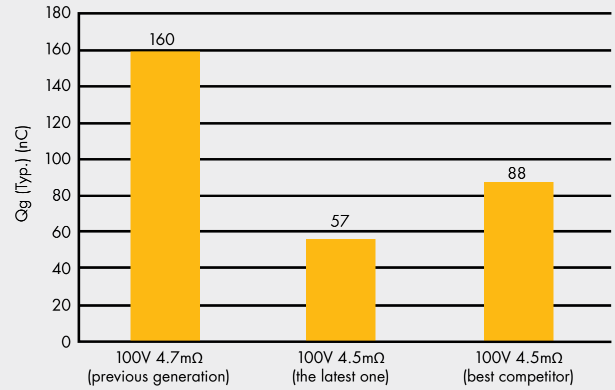
Applications:

- Synchronous rectification for AC-DC power supplies
- Isolated DC-DC converters
- Battery charger and battery protection circuits
- DC motor drives
- Micro solar inverters
- UPS

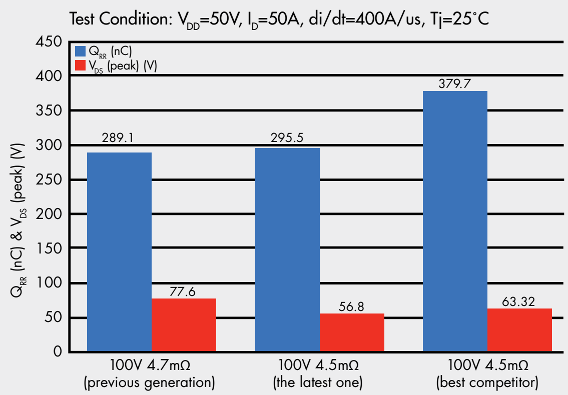
MID-VOLTAGE MOSFETs



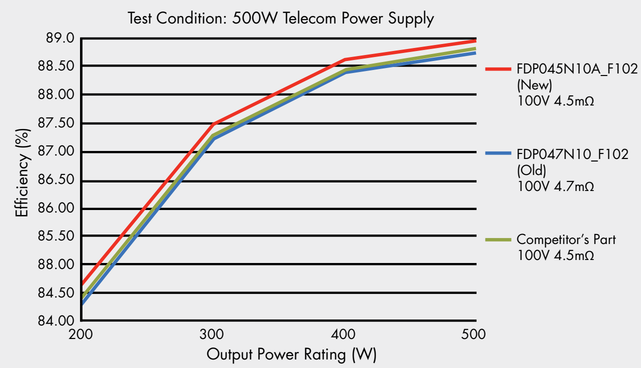
*Normalized Figure of Merit (FOM) ($R_{DS(ON)}$*Qg)*



Gate Charge (Qg) (nC)



Reverse Recovery Charge (Q_{rr}) & V_{DS}(peak)



Higher Efficiency with the Latest PowerTrench® MOSFET

MV MOSFETs Selection Guide

Part Number	BV_{DSS} Min. (V)	$R_{DS(ON)}$ Max (Ω) @ V_{GS} = 10V	Qg Typ. (nC) @ V_{GS}=10V	I_D (A)	P_D (W)	Package
FDB035N10A	100	0.0035	89	120	333	TO-263 (D2PAK)
FDB075N15A	150	0.0075	77	130	333	TO-263 (D2PAK)
FDB082N15A	150	0.0082	65	105	231	TO-263 (D2PAK)
FDB110N15A	150	0.011	47	92	234	TO-263 (D2PAK)
FDB2532	150	0.016	82	79	310	TO-263 (D2PAK)
FDB2552	150	0.036	39	37	150	TO-263 (D2PAK)
FDB2614	200	0.027	76	62	260	TO-263 (D2PAK)
FDB52N20	200	0.049	49	52	357	TO-263 (D2PAK)
FDB2710	250	0.0425	78	50	260	TO-263 (D2PAK)
FDB44N25	250	0.069	47	44	307	TO-263 (D2PAK)
FDB33N25	250	0.094	37	33	235	TO-263 (D2PAK)
FDB28N30TM	300	0.129	39	28	250	TO-263 (D2PAK)

High-Voltage Gate Drivers (HVICs)

Fairchild's HVICs improve system reliability by using an innovative noise canceling circuit that provides excellent noise immunity. HVIC solutions save at least 50% PCB area compared to commonly used optocoupler-based or pulse transformer-based solutions. Fairchild's industry-leading HVICs, which are the optimal solution for driving MOSFETs and IGBTs in a wide array of consumer and industrial applications up to 600V, feature high-side driver operation with negative V_S swings of up to -9.8V (at V_{BS} = 15V) to protect the HVIC against negative noise. Other products must use an additional diode to provide this protection. These HVIC products feature the industry's lowest quiescent currents, resulting in extremely low power consumption, and the market's lowest temperature dependency of electrical characteristics guaranteeing stable operation in a wide range of applications.

Design advantages include:

- Better noise immunity (due to noise canceling circuit over high dv/dt common-mode noise)
- Low power consumption (due to low quiescent current issues, I_{QBS}/I_{QCC} is lower than the competition)
- Extended allowable negative V_S swing to -9.8V for signal propagation @ $V_{CC}=V_{BS}$=15V
- Matched propagation delay below 50nS
- UVLO functions for both channels
- TTL compatible input logic threshold levels

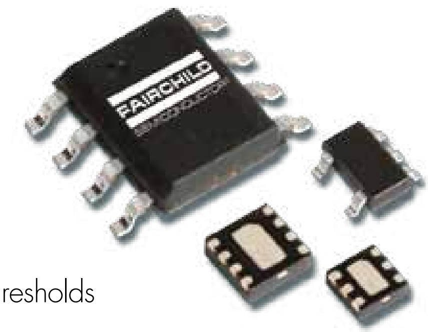
HVICs Selection Guide

Product Number	Circuit		Offset Voltage (V)	Output Current		Delay Time		Shut Down	Dead Time Control
	Type	Input to Output		Source (mA)	Sink (mA)	t_{ON} (ns)	t_{OFF} (ns)		
FAN7361	High Side	1 to 1	600	250	500	120	90	No	No
FAN7362	High Side	1 to 1	600	250	500	120	90	No	No
FAN7371	High Side	1 to 1	600	4000	4000	150	150	No	No
FAN73711	High Side	1 to 1	600	4000	4000	150	150	No	No
FAN7383	Half Bridge	1 to 2	600	350	650	500	170	Yes	Variable
FAN73832	Half Bridge	1 to 2	600	350	650	580	180	Yes	Variable
FAN73932	Half Bridge	1 to 2	600	2000	2000	600	200	Yes	Fixed
FAN7393A	Half Bridge	1 to 2	600	2500	2500	530	130	Yes	Variable
FAN7380	Half Bridge	2 to 2	600	90	180	135	130	No	Fixed
FAN7384	Half Bridge	2 to 2	600	250	500	180	170	Yes	Fixed
FAN73833	Half Bridge	2 to 2	600	350	650	150	140	No	Fixed
FAN73933	Half Bridge	2 to 2	600	2500	2500	160	160	No	Variable
FAN7382	High & Low	2 to 2	600	350	650	170	200	No	No
FAN7392	High & Low Side	2 to 2	600	3000	3000	130	150	Yes	No
FAN7390	High & Low Side	2 to 2	600	4500	4500	140	140	No	No

High-Speed Low-Side Gate Drivers (LVICs)

The FAN31xx and FAN32xx series of high-speed, low-side gate drivers offers an unequaled combination of high performance, small size and flexible input options for driving N-Channel power MOSFETs and IGBTs. This family of drivers provides gate drive strength choices of 1A, 2A, 4A or 9A in single or dual-channel versions. These drivers deliver fast switching and accurate timing to maximize efficiency in high frequency power converter designs.

Design advantages include:



- 1A to 9A high-speed drivers with flexible options to fit every design
- –40°C to +125°C operation
- 18V operating maximum voltage
- Industry's smallest packages (2mm x 2mm and 3mm x 3mm MLP)
- Choice of input thresholds: TTL-compatible or CMOS (proportional to V_{DD}) thresholds
- Design flexibility: two inputs for each channel (dual-input or input + enable)
- Maximize efficiency: MillerDrive™ compound bipolar-MOSFET gate drive architecture for fast switching times through Miller plateau of the switching transition to minimize switching losses
- Short and well-controlled time delays for 1MHz switching, paralleling drivers and optimizing drive timing
- Fail-safe inputs to hold output low if an input signal is absent
- Enable inputs default to ON if not connected
- Lead (Pb)-free finish SOT-23-5, SOIC-8 and thermally-enhanced MLP-6 and MLP-8 packages

LVICs Selection Guide

Type	Single 1A	Single 2A	Dual 2A	Dual 4A	Single 9A
	SOT-23-5	SOT-23-5 2mm x 2mm MLP-6	SO8 3mm x 3mm MLP-8	SO8 3mm x 3mm MLP-8	SO8 3mm x 3mm MLP-8
Single Input + Reference Threshold	FAN3111E				
Complementary Inputs	FAN3111C	FAN3100C/T	FAN3228C FAN3229C/T	FAN3225C/T	
Input + Enable, Inverting Output			FAN3226C/T	FAN3223C/T	FAN3121C/T
Input + Enable, Non-Inverting Output			FAN3227C/T	FAN3224C/T	FAN3122C/T
Input Only Inverting Output			FAN3216T (SO8 Only)	FAN3213T (SO8 Only)	
Input Only Non-Inverting Output			FAN3217T (SO8)	FAN3214T (SO8 Only)	
Input + Enable, One Non-Inverting, One Inverting			FAN3268T (SO8 Only)		
Input + Enable, P/N-Chan Driver Outputs			FAN3278T (SO8 Only)		

High-Speed Low-Side Gate Drivers (LVICs)							
Product Number	**Type**	**Gate Drive (Sink / Source)**	**Input Threshold**	**Logic**	**Package**	**t_{FALL} / t_{RISE} Typ. (ns)**	**t_{PROP} Typ. (ns)**
FAN3111C	Single 1A	+1.1A / -0.9A	CMOS[1]	Single Channel of Dual-Input/Single-Output	SOT-23-5, MLP-6	8ns/9ns (470pF)	15
FAN3111E	Single 1A	+1.1A / -0.9A	External[2]	Single Non-Inverting Channel with External Reference	SOT-23-5, MLP-6	8ns/9ns (470pF)	15
FAN3100C	Single 2A	+2.5A / -1.8A	CMOS	Single Channel of Two-Input/One-Output	SOT-23-5, MLP-6	9ns/13ns (1000pF)	15
FAN3100T	Single 2A	+2.5A / -1.8A	TTL	Single Channel of Two-Input/One-Output	SOT-23-5, MLP-6	9ns/13ns (1000pF)	16
FAN3216T	Dual 2A	+2.4A / -1.6A	TTL	Dual Inverting Channels	SOIC-8	9ns/12ns (1000pF)	19
FAN3217T	Dual 2A	+2.4A / -1.6A	TTL	Dual Non-Inverting Channels	SOIC-8	9ns/12ns (1000pF)	19
FAN3226C	Dual 2A	+2.4A / -1.6A	CMOS	Dual Inverting Channels + Dual Enable	SOIC-8, MLP-8	9ns/13ns (1000pF)	15
FAN3226T	Dual 2A	+2.4A / -1.6A	TTL	Dual Inverting Channels + Dual Enable	SOIC-8, MLP-8	9ns/13ns (1000pF)	16
FAN3227C	Dual 2A	+2.4A / -1.6A	CMOS	Dual Non-Inverting Channels + Dual Enable	SOIC-8, MLP-8	9ns/13ns (1000pF)	15
FAN3227T	Dual 2A	+2.4A / -1.6A	TTL	Dual Non-Inverting Channels + Dual Enable	SOIC-8, MLP-8	9ns/13ns (1000pF)	16
FAN3228C	Dual 2A	+2.4A / -1.6A	CMOS	Dual Channels of Two-Input/ One-Output, Pin Config.1	SOIC-8, MLP-8	9ns/13ns (1000pF)	15
FAN3229C	Dual 2A	+2.4A / -1.6A	CMOS	Dual Channels of Two-Input/ One-Output, Pin Config.2	SOIC-8, MLP-8	9ns/13ns (1000pF)	15
FAN3229T	Dual 2A	+2.4A / -1.6A	TTL	Dual Channels of Two-Input/ One-Output, Pin Config.2	SOIC-8, MLP-8	9ns/13ns (1000pF)	16
FAN3213T	Dual 4A	+4.3A / -2.8A	TTL	Dual Inverting Channels	SOIC-8	9ns/12ns (2200pF)	17
FAN3214T	Dual 4A	+4.3A / -2.8A	TTL	Dual Non-Inverting Channels	SOIC-8	9ns/12ns (2200pF)	17
FAN3223C	Dual 4A	+4.3A / -2.8A	CMOS	Dual Inverting Channels + Dual Enable	SOIC-8, MLP-8	9ns/12ns (2200pF)	18
FAN3223T	Dual 4A	+4.3A / -2.8A	TTL	Dual Inverting Channels + Dual Enable	SOIC-8, MLP-8	9ns/12ns (2200pF)	17
FAN3224C	Dual 4A	+4.3A / -2.8A	CMOS	Dual Non-Inverting Channels + Dual Enable	SOIC-8, MLP-8	9ns/12ns (2200pF)	18
FAN3224T	Dual 4A	+4.3A / -2.8A	TTL	Dual Non-Inverting Channels + Dual Enable	SOIC-8, MLP-8	9ns/12ns (2200pF)	17
FAN3225C	Dual 4A	+4.3A / -2.8A	CMOS	Dual Channels of Two-Input/One-Output	SOIC-8, MLP-8	9ns/12ns (2200pF)	18
FAN3225T	Dual 4A	+4.3A / -2.8A	TTL	Dual Channels of Two-Input/One-Output	SOIC-8, MLP-8	9ns/12ns (2200pF)	17
FAN3121C	Single 9A	+9.7A / -7.1A	CMOS	Single Inverting Channel + Enable	SOIC-8, MLP-8	19ns/23ns (10nF)	18
FAN3121T	Single 9A	+9.7A / -7.1A	TTL	Single Inverting Channel + Enable	SOIC-8, MLP-8	19ns/23ns (10nF)	23
FAN3122C	Single 9A	+9.7A / -7.1A	TTL	Single Non-Inverting Channel + Enable	SOIC-8, MLP-8	19ns/23ns (10nF)	23
FAN3122T	Single 9A	+9.7A / -7.1A	CMOS	Single Non-Inverting Channel + Enable	SOIC-8, MLP-8	19ns/23ns (10nF)	18

[1] CMOS = Input thresholds proportional to V_{DD}
[2] External = Thresholds proportional to an externally supplied reference voltage

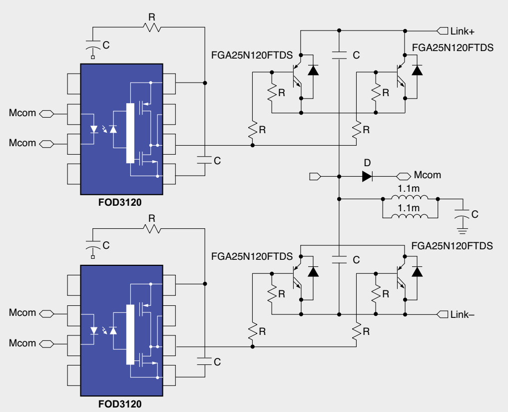
Gate Driver Optocoupler

The FOD31xx IGBT/MOSFET gate drive optocoupler series provides fast switching specifications allowing designers to use smaller filters, thus reducing overall system power consumption. These devices can be found in solar inverters, motor drives and induction heating applications. Fairchild's optocouplers offer best-in-class common-mode rejection (CMR) making the application more immune to noise. With tight pulse-width distortion (65ns) and improved power efficiency, these devices also offer a 1,414V peak working voltage to accommodate switching of 1200V IGBTs. The gate driver output stage comprises of a PMOS and NMOS pair, which facilitates close rail-to-rail output swing. This feature allows a tight control of the gate voltage during on-state and short-circuit conditions.

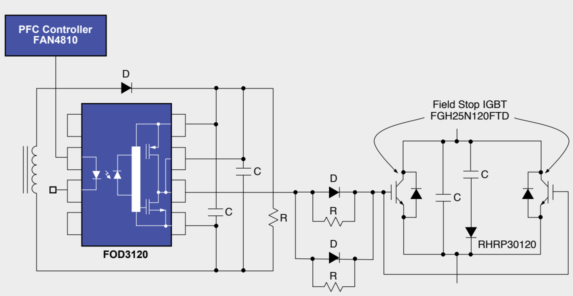
These IGBT/MOSFET gate drive optocouplers complement Fairchild's strong, well-established offering in the discrete power IGBT/MOSFET line of products. Fairchild now offers customers one-stop shopping from the logic control portion of the circuit, to the isolated gate driver, to the power IGBT/MOSFET.

Design advantages include:

- Wide operating voltage range of 15V to 30V, high output current capability up to 3.0A
- Use of P-channel MOSFETs at output stage enables output voltage swing close to the supply rail (rail-to-rail output)
- High common-mode transient immunity, up to 35kV/µs min.
- 5kV isolation voltage rating
- 1,414V (peak) working voltage (UIORM)



Optically Isolating the Inverter Output within the UPS



Optically Isolating the PFC Controller and the IGBTs

Gate Driver Optocoupler Selection Guide

Product Number	Package	Abs Max. Peak Output Current (A)	V_{DD} (V)	V_{DD} (V)	I_{DDH} (mA)	I_{DDL} (mA)	I_{OL} (A)	I_{OH} (A)	T_{PLH} T_{PHL} (ns)	T_{PLH} T_{PHL} (ns)	PWD (ns)	Operating Temp	V_{ISO} (V_{RMS})	Working Voltage (V)	CMH CML (V/µs)
		Max.	Max.	Max.	Max.	Max.	Min.	Min.	Min.	Max.	Max.	Range	Min.	Max.	Min.
FOD3120	DIP-8	3	15	30	3.8	3.8	-2.0	2.0	150	400	100	-40 to 100	5,000	1,414	35,000
FOD3150	DIP-8	1.5	15	30	5.0	5.0	-1.0	1.0	100	500	300	-40 to 100	5,000	890	20,000
FOD3182	DIP-8	3	10	30	4.0	4.0	-2.5	2.5	50	210	65	-40 to 100	5,000	1,414	35,000
FOD3184	DIP-8	3	15	30	3.5	3.5	-2.5	2.5	50	210	65	-40 to 100	5,000	1,414	35,000
FOD8320*	Extended SO-6	3	15	30	3.8	3.8	-2.0	2.0	150	400	100	-40 to 100	5,000	1,414	35,000
FOD8316*	SO-16	3	15	30	17.0	3.0	-2.0	2.0	–	500	300	-40 to 100	3,750	890	35,000
FOD8318* (Miller Clamp)	SO-16	3	15	30	17.0	3.0	-2.0	2.0	–	500	300	-40 to 100	3,750	890	35,000

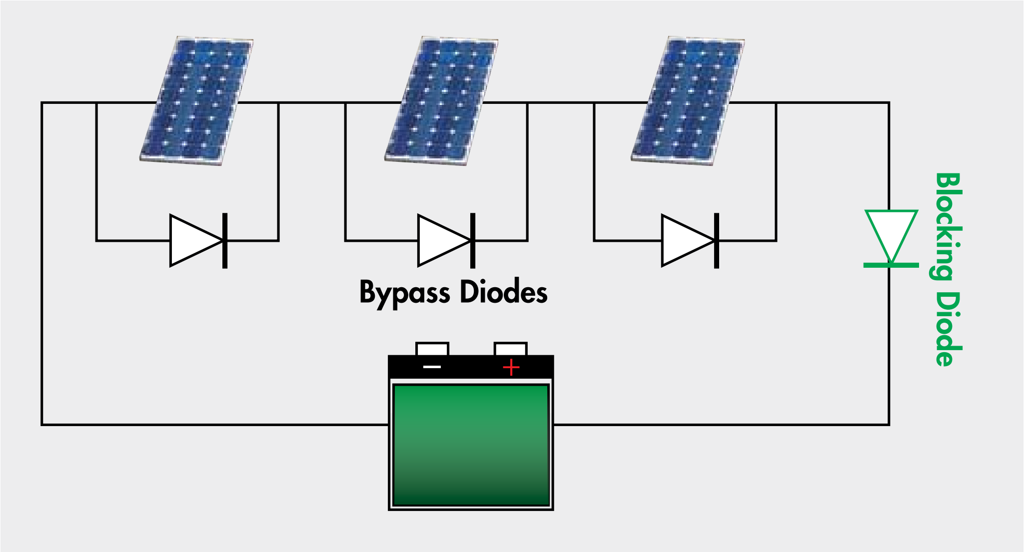
* In development

Bypass and Blocking Diodes

The bypass diode is placed in parallel with each PV cell in systems where PV cells are connected in a series. The bypass diode is reversed biased during normal operation. When a cell is in the shade or damaged, the cell is seen as a load instead of a power generator. The bypass diode allows the current from the rest of the cells in the PV module to pass through it, therefore, maximizing energy output.

In order to maximize efficiency, the bypass diode must have both low leakage current and a low forward voltage in order to minimize power loss in the system. In addition, the bypass diode must be able to operate at high temperatures and withstand power surges.

In systems where the PV modules are charging a battery or battery bank, a blocking diode is placed in series with the battery in order to prevent reverse current flow back through the PV cells during the night when the voltage potential across the cells drops to zero. The blocking diode prevents energy stored in the battery from being lost.



Schottky Diodes/Rectifiers Selection Guide

Product Number	V_{RRM} (V)	I_F (AV) (A)	VFM (V)	I_R (μA)	I_{FSM} (A)	Package
SB1245	45	12	0.55	100	150	DO-201AD
FYD0504SA	40	5	0.55	1000	80	DPAK
MBR1035	35	10	0.84	100	150	TO-220AC
MBR1045	45	10	0.84	100	150	TO-220AC
MBR1050	50	10	0.8	100	150	TO-220AC
MBR1060	60	10	0.8	100	150	TO-220AC
MBR1645	45	16	0.63	200	150	TO-220AC
MBR1660	60	16	0.75	1000	150	TO-220AC

*Die also available for Schottky Diodes/Rectifiers. Please contact Fairchild for more information.

Diodes and Rectifiers

Product Number	Configuration	V_{RRM} (V)	$I_{F(AV)}$ (A)	VFM (V)	$t_{rr(MAX)}$ (ns)
RURP1560	Single	600	15	1.5	60
RHRP1560	Single	600	15	2.1	40
ISL9R1560P2	Single	600	15	2.2	40
ISL9R1560G2	Single	600	15	2.2	40
FFP15S60S	Single	600	15	2.6	30
FFH15S60S	Single	600	15	2.6	30
RURP3060	Single	600	30	1.5	60
RURG3060	Single	600	30	1.5	60
RHRP3060	Single	600	30	2.1	45
RHRG3060	Single	600	30	2.1	45
FFA60UA60DN	Common-cathode	600	30	2.2	90
ISL9R3060P2	Single	600	30	2.4	45
ISL9R3060G2	Single	600	30	2.4	45
FFP30S60S	-	600	30	2.6	35
FFH30S60S	-	600	30	2.6	35
FFH50US60S	Single	600	50	1.54	80
RURG5060	Single	600	50	1.6	75
RHRG5060	Single	600	50	2.1	50
FFH60UP60S	Single	600	60	1.7	80
RURG8060	Single	600	80	1.6	85
RURG80100	Single	1000	80	1.9	200
RHRP8120	Single	1200	8	3.2	70
ISL9R8120P2	Single	1200	8	3.3	44
RHRP15120	Single	1200	15	3.2	75
ISL9R18120G2	Single	1200	18	3.3	70
RHRP30120	Single	1200	30	3	75
RHRG30120	Single	1200	30	3.2	75
ISL9R30120G2	Single	1200	30	3.3	100
RHRG75120	Single	1200	75	3.2	100

Rectifiers

Product Number	V_{RRM} (V)	$I_{F(AV)}$ (A)	VFM (V)	I_R (μA)	I_{FSM} (A)	Package
FES16CT	150	16	0.975	10	250	TO-220AC
FES16DT	200	16	0.975	10	250	TO-220AC
FES16FT	300	16	1.3	10	250	TO-220AC
FES16GT	400	16	1.3	10	250	TO-220AC

IGBTs

F G A 40 N 65 S M D x

Option: FRD Option	Blank: Hyper fast / S: Stealth / F: Ultrafast
Existing or Non-existing of Built-in Diode	Blank: without Diode / D: Built-in Diode
Generation	F/FT: Gen1 / M: Gen2 / P: Gen3
Speed & Feature	S: SMPS / U: Ultrafast
	L: Low $V_{CE(sat)}$ / R: Short Circuit Rated
Voltage Rating (x10)	
Technology	N: Planar process
	T: Trench process (cf. 1200V Gen1 : N)
	S: Shorted Anode (only for IH)
Current Ratings	
Package Type	A : TO-3PN AF : TO-3PF
	B :D²-PACK D : D-PACK
	H :TO-247 I : I²-PACK
	L : TO-264
	P : TO-220 PF : TO-220F
	U :I-PACK Y : Power-247
IGBT	
Fairchild Semiconductor	

MOSFET

F C H 76 N 60 N _ _

Forming	Empty: Normal type / T: Potting type
Option	F: Fast recovery (PT900)
	U: Ultrafast recovery (PT930)
Series	Empty: Standard Product (QFET/UniFET™/SJ FET)
	L: Logic Level Product
	F: Fast Recovery MOSFET
	N: New Version (2nd of UniFET, SupreMOS)
	Z: Zener b/w G and S
	C/V2: Advanced QFET C/V2 series
Voltage Rating (x 10)	
Channel Polarity	N: N-Channel P: P-Channel
Current Rating	
Package	A: TO-3P AF: TO-3PF
	B: D²-PAK D: D-PAK
	E: TO-126 G: 8-DIP
	H: TO-247 I: D2-PAK
	L: TO-264
	N: TO-92 NL: TO-92L
	P: TO-220 PF: TO-220F
	S: SOP-8
	T: SOT-223 U: I-PAK
Base Technology	Q: QFET
	C: SuperFET®, SupreMOS® (Super Junction)
	D: UniFET™, UniFET™ II, PowerTrench®, DMOS
Fairchild Semiconductor	

Diode

F F PF 04 F 150 DS

Type
- S: Single
- DN: Dual Cathode Common
- DP: Dual Anode Common
- DS: Dual Series

Voltage Rating (x10)
- 20: 200V ~ 150: 1500V

t_{rr} Characteristics
- A,B,C,E: Modulation
- F: Fast
- U: Ultrafast
- X: Xtra Fast
- S: Stealth
- H: Hyperfast

Current Rating
- 04: 4A

Package
- P: TO-220
- PF: TO-220F
- A: TO-3P
- AF: TP-3PF
- L: TO-264
- B: D2-PAK
- D: D-PAK
- V: SOT-23

Device Type
- F: FRD
- Y: SBD

Fairchild Semiconductor

Fast Rectifier

RHR G 30 60 CC

Options
- CC: Common Cathode
- S: Surface Mount

Voltage Rating/10
- i.e., (600)

Continuous Current Rating

Package Types
- D: 2 & 3 Lead TO-251/TO-252
- 1S: 2 & 3 Lead TO-262/TO263
- P: 2 & 3 Lead TO-220
- G: 2 & 3 Lead TO-247
- H: 2 & 3 Lead TO-218
- Y: 2 & 3 Lead TO-264
- U: 1 Lead TO-218

Recovery Speed
- RHR: Rectifier HYPERFAST Recovery
- RUR: Rectifier Ultrafast Recovery

STEALTH™ Rectifier

ISL 9 R 15 60 G2

Package

P2: TO-220 (2 Lead)	5A3: TO-247ST
G2: TO-247 (2 Lead)	IY3: TO-264
G3: TO-247 (3 Lead)	IN4: SOT-227
S3: TO-263 (D2PAK)	P3: TO-220 (3 Lead)
D3: TO-251/252 (DPAK) (2 Lead)	

Voltage Breakdown/10
- i.e., (600, 1200)

Current Rating

Configuration
- R: Rectifier
- K: Common Cathode

Discrete Power

Fairchild Semiconductor

High-Voltage Gate Drivers

FAN73 XY A

- A: Advanced version
- XY:

	IN-OUT	Current Level	Note
			High & Low
x2 x0	-	-	FAN7362=1CH FAN7380=Half
x32	1-2	-	Shutdown
6y	1-1	Low (mA)	
7y	1-1	High (A)	
8y	2-2	Low	
88,89	6-6	Low	Half
9y	2-2	High	

- FAN73: Fairchild Semiconductor HVIC Devices

Low-Side Gate Drivers

FAN 3 x yyy t zz X

- X: Tape & Reel
- zz: (2) Package Type
- t: (1) Input Threshold
- yyy: Gate Drive and Logic Options
- x: # Channels (1 = Single, 2 = Dual)
- 3: LS Driver Family
- FAN: Fairchild Semiconductor

(1) Input Threshold Type

- **C** = CMOS (Input thresholds proportional to V_{DD})
- **E** = External (Input thresholds proportional to an external reference)
- **T** = TTL (TTL compatible thresholds)

(2) Package Type

- **M** = SOIC
- **MP** = MLP (DFN)

Gate Driver Optocoupler

FOD 3XXX T S Y V

- V: VDE Certification (IEC60747-5-2)
- Y: Tape & Reel Option; "D" or "R2"
- S: Surface Mount Option
- T: 0.4" Wide Lead Spacing
- 3XXX: Device Part ID, DIP Type
- FOD: Fairchild Semiconductor Optocoupler Devices

FOD 83XX R2 V

- V: VDE Certification (IEC60747-5-2)
- R2: Tape & Reel Option
- 83XX: Device Part ID, Small Outline Type
- FOD: Fairchild Semiconductor Optocoupler Devices

PRODUCTS | APPLICATIONS | DESIGN SUPPORT | ABOUT FAIRCHILD

POWER MANAGEMENT

Power Factor Correction
- Continuous Conduction Mode (CCM) PFC Controllers
- Critical/Boundary Conduction Mode (CrCM/BCM) PFC Controllers
- Interleaved PFC Controllers
- PFC + PWM Combination (Combo) Controllers

Off-Line and Isolated DC-DC
- AC-DC Linear Regulators
- Flyback & Forward PWM Controllers
- Flyback & Forward PWM Controllers with Integrated MOSFET
- LLC Resonant & Asymmetric Half Bridge PWM Controllers
- LLC Resonant & Asymmetric Half Bridge PWM Controllers with Integrated MOSFETs
- Primary-Side Regulation CV/CC Controllers
- Primary-Side Regulation CV/CC Controllers with Integrated MOSFET
- Standard PWM Controllers
- Supervisory/Monitor ICs
- Synchronous Rectifier Controllers

Non-Isolated DC-DC
- Charge-pump Converters
- DrMOS FET plus Driver Multi-Chip Modules
- Step-down Controllers (External Switch)
- Step-down Regulators, Non-Synchronous (Integrated Switch)
- Step-down Regulators, Synchronous (Integrated Switch)
- Step-up Regulators (Integrated Switch)

MOSFET and IGBT Gate Drivers
- 3-Phase Drivers
- Half-Bridge Drivers
- High- & Low-Side Drivers
- High-Side Drivers
- Low-Side Drivers

Voltage Regulators
- LDOs
- Positive Voltage Linear Regulators
- Negative Voltage Linear Regulators
- Shunt Regulators
- Voltage Detector
- Voltage Stabilizer
- Voltage to Frequency Converter

Motion Control
- BLDC/PMSM Controller
- Motion-SPM™ (Smart Power Modules)
- PFC SPM® (Smart Power Modules)

Diodes & Rectifiers
- Bridge Rectifiers
- Circuit Protection & Transient Voltage Suppressors (TVS)
- Diacs
- Rectifiers
- Schottky Diodes & Rectifiers
- Small Signal Diodes
- Zener Diodes

IGBTs
- Discrete IGBTs
- Ignition IGBTs

MOSFETs
- Discrete MOSFETs
- Level-Shifted Load Switches
- MOSFET/Schottky Combos

Transistors
- BJTs
- Darlingtons
- Digital/Bias-Resistor Transistors
- JFETs
- RF Transistors
- Small Signal Transistors

Advanced Load Switches
- Advanced Current Limited Load Switches
- Slew Rate Controlled Load Switches

Battery Management
- Battery Charger ICs

Ground Fault Interrupt
- Ground Fault Interrupt (GFI) Controllers

Backlight Unit (BLU)
- CCFL Inverter ICs

SIGNAL PATH ICs

Amplifiers & Comparators
- Comparators
- Operational Amplifiers

Audio Amplifiers
- Audio Subsystems
- Audio Headphone Amplifiers
- Digital Microphone Amplifiers

Battery Protection ICs
- Battery Protection ICs

Interface
- LVDS
- Serializers/Deserializers (μSerDes™)
- USB Transceivers

Signal Conditioning
- Video Filter Drivers
- Video Switch Matrix/Multiplexers

Signaling, Sensing & Timing
- Signaling, Sensing & Timing
- Timing

Switches
- Accessory Switches
- Analog Switches
- Audio Jack Detection Switches
- Audio Switches
- Bus Switches
- MIPI Switches
- Multimedia Switches
- USB Switches
- Video Switches

LOGIC

Buffers, Drivers, Transcievers
- Buffers
- Line Drivers
- Transceivers

Flip Flops, Latches, Registers
- Counters
- Flip Flops
- Inverters
- Latches
- Registers

Gates
- AND Gates
- NAND Gates
- OR Gates
- NOR Gates
- Schmitt Triggers
- Configurable Gates

Multiplexer / Demultiplexer / Decoders
- Decoders
- Demultiplexers
- Multiplexers
- Multivibrators

Voltage Level Translators
- Voltage Level Translators

LIGHTING ICs
- Fluorescent Lamp ICs
- HID ICs
- LED Lighting ICs
- Portable LED Drivers

OPTOELECTRONICS

High Performance Optocouplers
- Low Voltage, High Performance
- High Speed Logic Gate
- High Performance Transistor
- IGBT/MOSFET Gate Driver
- Specific Function

Infrared
- Emitting Diodes
- Photo Sensors
- Photo Sensor – Transistors
- Ambient Light Sensors
- Reflective Sensors
- Optical Interrupt Switches

Phototransistor Optocouplers
- Isolated Error Amplifier
- Phototransistor Output - DC Sensing Input
- Phototransistor Output - AC Sensing Input
- Photo Darlington Output

TRIAC Driver Optocouplers
- Random Phase TRIAC Driver
- Zero Crossing TRIAC Driver

AUTOMOTIVE PRODUCTS

Automotive Discrete Power
- Automotive Ignition IGBTs
- Automotive IGBTs
- Automotive N-Channel MOSFETs
- Automotive P-Channel MOSFETs
- Automotive Rectifiers

Automotive High Voltage Gate Drivers (HVICs)
- Automotive High Voltage Gate Drivers (HVICs)

High Side Smart Switches
- High Side Smart Switches

Solutions for Your Success™