

Photovoltaic Inverters

- > 97% efficiency
- Battery management
- Wide voltage range 250 VDC to 450 VDC
- Low harmonics (<3%)
- Remote monitoring
- Multi-protocol support
- Safety protections
- Thermal management
- Modular design
- LED indicators
- Standards compliant

Photovoltaic (PV) inverters are electronic devices that **convert the direct current (DC) electricity generated by PV solar panels into alternating current (AC) electricity**, which is the standard form used by most home appliances and the electrical grid.

There is significant growth in the inverter market due to the following factors.

Rising demand for solutions offering energy independence and reducing reliance on unstable grid systems or expensive diesel generators, which is particularly crucial in areas prone to power outages or those affected by natural disasters.

Strong emphasis by governments on renewable and sustainable energy sources through subsidies, favorable policies, and incentives to reduce carbon emissions.

Increase in adoption of off-grid devices by industries and businesses to cut operational costs and enhance sustainability credentials.

Reducing cost of solar panels and associated components ensuring affordability and market reach to lower-income households and small businesses.

Innovations to offer advanced features like monitoring systems, better battery management, and higher conversion efficiencies to improve efficiency, reliability, and affordability of the PV inverters.

PV Inverter Classification

	Advantages	Limitations
 String Inverter Multiple solar panels are connected in series (a “string”), and the inverter converts the combined DC power from all panels. It is ideal for residential and small to medium commercial installations.	Cost-effective Easy to install & maintain	Performance can be affected if one panel underperforms
 Central Inverter Large-scale inverter handling multiple strings of panels, typically used in utility-scale projects.	High efficiency Suitable for large installations Lower cost per watt.	Less flexible A single point of failure can affect the entire system.

Figure 1:
Classification of PV inverter systems..

“String inverters hold the largest global market share, accounting for approximately 52% of the market”

	Advantages	Limitations
 Microinverter Installed on each individual solar panel converting DC to AC at the panel level. It can be more efficient in systems where panels are shaded or oriented differently. Usually deployed for residential rooftops with shading issues or complex layouts.	Maximizes energy harvest Allows panel-level monitoring Mitigates shading effects	Higher initial cost More components to maintain
 Hybrid Inverter It combines solar inverter and battery inverter functionalities, managing both solar panels and energy storage systems. Ideal for residential and commercial systems with energy storage needs.	Facilitates energy storage integration Offers backup power Enhances energy independence	More complex More expensive than standard inverters
 Smart Inverter Advanced inverter equipped with communication and control capabilities for grid support. It is deployed for grid-tied systems requiring advanced grid services.	Provides grid stability features Remote monitoring Compliance with grid codes.	Higher cost & complexity

Based on Phase, the market is categorized into single phase and three phase.

- Single-phase standalone PV inverters are primarily used in residential and small-scale commercial installations. These inverters are designed to handle the output from a single string of solar panels and convert it into a single-phase AC output, typically at 120V or 240V. They are widely popular due to their simplicity, cost-effectiveness, and suitability for low-power applications
- Three-phase PV inverter market has witnessed significant growth, driven by the increasing demand for utility-scale solar projects and the need for higher power output. These inverters are designed to handle the output from multiple strings of solar panels and convert it into a three-phase AC output, typically at 380V/ 400V in Asia (except Japan 200V)/ Europe or 208V/ 480V in North America. The products offer higher power handling capabilities and are more efficient for larger installations.

Functional Description

Based on market demand and trends, we will explain in detail architecture and functionality of each block for three-phase string PV inverter.

Core Functions

1. Maximum Power Point Tracking (MPPT) using Boost Converter

Equipped with one or more independent MPPT channels, this block continuously tracks the optimal voltage and current point of the PV array to maximize energy harvest under varying solar irradiance and temperature conditions. This configuration uses a DC-DC boost converter controlled by an MPPT algorithm on microcontroller or Digital Signal Processor (DSP) to regulate the PV array voltage and current, maximizing power output delivered to the DC to AC inverter stage.

System Architectural Block Diagram

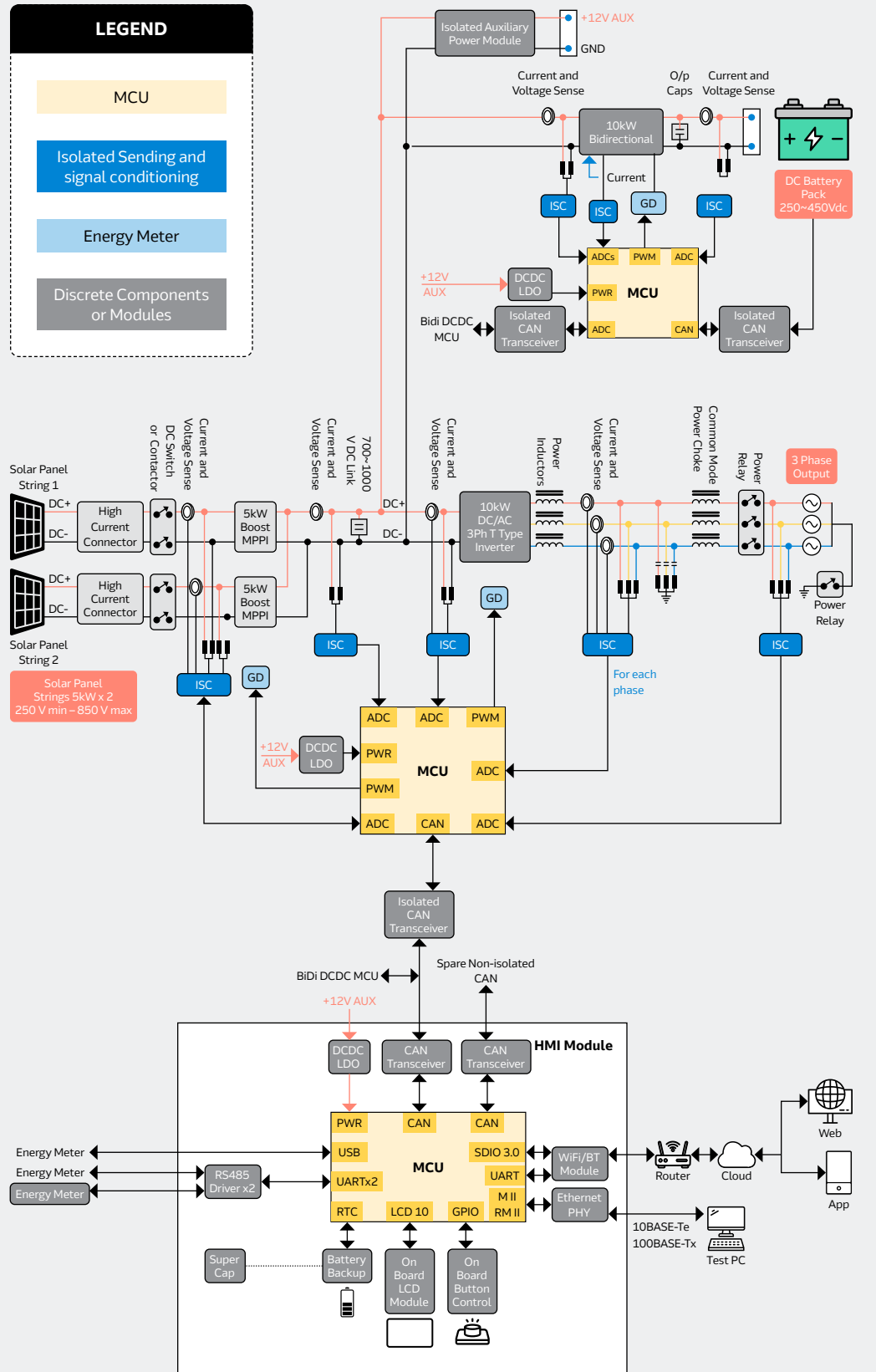


Figure 1:
10 kW Three-Phase String PV
Inverter Architecture

Common MPPT Algorithms:

- Perturb and Observe (P&O)
- Incremental Conductance (INC)
- Constant Voltage (CV) – for simpler systems

Key power components

Inductors, Power MOSFETs or IGBTs, Diodes, and Output DC link capacitors.

Key functional blocks

Photovoltaic Array Interface, Boost Converter, MPPT Controller, Sensor Feedback and Control System, and various protections.

Advantages of Boost Converter-Based MPPT

High efficiency, Voltage step-up, Fast dynamic response, and Scalability.

2. DC to AC conversion using Three-Phase T-type NPC Inverter

This stage is responsible for converting the regulated DC power—typically from the output of a boost converter and MPPT stage—into high-quality, grid-synchronized AC power. It ensures optimal energy transfer from the solar array to the utility grid or local electrical load with robust control, protection, and monitoring features with proper synchronization with the grid voltage and frequency.

Common Modulation Techniques:

- Space Vector PWM (SVPWM)
- Sinusoidal PWM (SPWM)

Key functional components

Boost Inductor and AC EMI filter, Power MOSFETs or IGBTs, Pre-charge relays and DSP.

Key functional blocks

Three-level Inverter Bridge, EMI filter, Sensor Feedback and Control System, and various protections.

Advantages of T-type inverter

Improved voltage stress on switching devices (lower dV/dt), Reduced size and cost of filters and EMI components, Lower THD, and Lower conduction losses.

3. DC to DC conversion using bidirectional CLLC based Battery Charger

The bidirectional DC-DC converter serves as a crucial power stage in solar energy systems with battery storage. It interfaces between the DC output of the MPPT boost converter (which extracts maximum power from the PV array) and the battery pack, enabling controlled charging and discharging of the battery.

This converter allows power flow in both directions due to typical arrangement of full bridge with symmetrical LC tank on both primary and secondary side:

- **Forward direction (Battery Charging):**
Transfers energy from the MPPT output to the battery.
- **Reverse direction (Battery Discharging):**
Supplies energy from the battery back to the DC bus for grid feeding or local loads.

Key power components

Resonant LC tank, Power MOSFETs or IGBTs, Isolation transformers, and Output capacitors, and Battery pack.

Key functional blocks

Battery Interface, Full Bridge with LC Resonant, DSP, Sensor Feedback and Control System, and various protections.

Advantages of Bidirectional CLLC Converters

High efficiency due to soft-switching of power switches, Wide output voltage range, Galvanic isolation, Bidirectional power flow, and Compact size.

4. Grid Compliance and Synchronization

The inverter ensures full compliance with local grid codes and standards (e.g. IEEE 1547, V/DE-AR-N 4105). It synchronizes seamlessly with the utility grid and provides features such as anti-islanding protection, voltage and frequency ride-through, and reactive power control ($Q(V)$, $Q(f)$).

5. Monitoring and Communication/HMI Module

Real-time monitoring and data logging are supported via integrated communication interfaces such as RS485, Wi-Fi, Ethernet, or Modbus. The inverter transmits data to on-site monitoring systems or remote

For any questions regarding component selection for photovoltaic, energy storage, and power conversion applications, please contact Arrow engineering.

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platforms, enabling performance analysis, fault detection, and system diagnostics.

User Interface

A built-in LCD or LED display (or mobile app/web interface) provides real-time status updates, system information, and configuration capabilities.

6. Thermal Management

The inverter employs high-efficiency cooling strategies (forced air or natural convection) to maintain optimal operating temperatures, thereby extending system lifespan and ensuring performance stability in harsh environments.

7. Safety and Protection Features

- DC reverse polarity protection
- AC and DC over/under voltage protection
- AC and DC overcurrent protection
- Over-temperature shutdown
- Ground fault monitoring and interruption
- Isolation monitoring
- Regulatory compliances and safety standards:

- IEC 62109-1: General safety standard for all types of PV converters
- IEC 62109-2 for specific safety standard for PV inverters
- UL 1741 for safety standard for inverters mandatory for North America
- IEC 61000-6-2 for EMC Immunity
- IEC 61000-6-4 for EMC emissions
- RoHS and REACH

8. Compact and Robust Design

Designed for outdoor (IP65 or better) or indoor installations, the inverter features a compact enclosure with easy mounting and wiring access, facilitating installation and maintenance.

Technical Overview

Parameter	Value
Rated Output Power	10 kW
Output Voltage Type	Three-Phase 380VL-L
Input Solar Panel Voltage Range	250V- 850V
Number of MPPTs	2 MPPTs
Max Efficiency	≥ 97%
Cooling Method	Natural convection / Fan cooling
Environmental Protection	IP65 or NEMA 4X
Communication Interfaces	RS485, Ethernet, Wi-Fi, 4G, or Modbus
Operating Temperature Range	-25°C to +60°C

Detailed Specifications

- Efficient solar energy harvesting (>97%)
- Seamless battery charging and discharging
- Wide battery voltage support (250 VDC to 450 VDC)
- Lower harmonics three-phase inverter (< 3%)
- User-friendly HMI with remote monitoring and multi-protocol communication, i.e., Ethernet, Wi-Fi, RS-485, 4G.
- Comprehensive built-in safety protection: Overvoltage, Overcurrent, short circuit, and thermal safeguards
- Compact, modular design with high efficiency and reliable thermal management
- LED indications (Power, Fault, Charging, Status)
- Regulatory compliances and safety standards

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PV Inverter Line Card

Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
POWER SUPPLY					
DC to DC Converter	Infineon Technologies AG	IR38165MTRPBF	High efficiency synchronous buck regulator suitable for inverter auxiliary rails	Arrow Link	Datasheet
	Nexperia	NEX40400EDAZ	4.5 V to 40 V, 600 mA, synchronous step-down converter for DC-DC auxiliary converter, optimized for efficiency + EMC. NPI 2025	Arrow Link	Datasheet
	Vishay	SIC471ED-T1-GE3	Highly efficient, Highly configurable	Arrow Link	Datasheet
	STMicroelectronics	DCP3603BCMR	Conv DC-DC 3.3V to 36V Synchronous Step Down Single-Out 0.85V 3A 6-Pin SOT-23 T/R	Arrow Link	Datasheet
	onsemi	NCP13992AFDR2G	AC to DC Switching Converter Off-Line Switcher 10V 750kHz T/R 14-Pin SOIC N	Arrow Link	Datasheet
	Diodes Incorporated	AP62500SJ-7	Conv DC-DC 4.5V to 18V Synchronous Step Down Single-Out 0.6V to 7V 5A 12-Pin VQFN T/R	Arrow Link	Datasheet
	ROHM Semiconductor	BD9E304FP4-LBZTL	Conv DC-DC 4.5V to 36V Synchronous Step Down Single-Out 0.7V to 28.8V 3A 8-Pin TSOT-23 T/R	Arrow Link	Datasheet
Linear Regulator	Infineon Technologies AG	TLE42754GATMA1	LDO Regulator Pos 5V 0.45A Automotive AEC-Q100 6-Pin(5+Tab) TO-263 T/R	Arrow Link	Datasheet
	Nexperia	NEX90230BPA-Q100F	300mA, 40 V ultra-low Iq (5.3 µA) LDO, ideal for MCU cores and digital / analog rails. NPI 2025	Arrow Link	Datasheet
	STMicroelectronics	LD1117S33TR	Widely used stable 3.3V LDO	Arrow Link	Datasheet
	Diodes Incorporated	AP7345D-3318RH4-7	LDO Regulator Pos 3.3V1.8V 0.3A/0.3A 8-Pin X2-DFN EP T/R	Arrow Link	Datasheet
	onsemi	NCV1117ST33T3G	Industrial/automotive robust LDO	Arrow Link	Datasheet
Voltage Reference	Microchip Technology	MCP1501T-20E/CHY	V-Ref Precision 2.048V 20mA 6-Pin SOT-23 T/R	Arrow Link	Datasheet
	STMicroelectronics	TS3431AILT	Adjustable shunt voltage reference	Arrow Link	Datasheet
	Texas Instruments	TL431AQDBZR	Stable precision reference for power regulation loops	Arrow Link	Datasheet
MEASUREMENT					
Current Sensor	Allegro MicroSystems	ACS37002KMABTR-050B5	High accuracy isolated Hall current sensor	Arrow Link	Datasheet
	Infineon Technologies AG	TLI4971A050T5UE0001XUMA1	Current Sensor Current Sensor AC/DC Current 3.3V 8-Pin TISON EP T/R	Arrow Link	Datasheet
	Vishay	WSBE8518L1000JTC3	Power Metal Strip Shunt Resistor	Arrow Link	Datasheet
COMMUNICATION					
Isolated CAN	NXP Semiconductors	TJA1052IT/5Y	CAN 5Mbps Standby 1.8V/3.3V Automotive AEC-Q100 16-Pin SO T/R	Arrow Link	Datasheet
	Infineon Technologies AG	2DIB0400F	Basic Dual-Channel Digital Isolators	Arrow Link	Datasheet
	Vishay	VCAN24A2-HT5-G3-08	The devices' line inductance is very low, allowing fast transients such as an ESD strike to be clamped with minimal over- or undershoots	Arrow Link	Datasheet
	Skyworks Solutions	Si8621BB-B-ISR	Digital isolation for CAN communication path	Arrow Link	Datasheet

PV Inverter Line Card

Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
PROCESSING					
MCU	STMicroelectronics	STM32H745ZIT3	H7 Dual Core - Extended Temp. Range	Arrow Link	Datasheet
	NXP Semiconductors	MKV58F1M0VLL24	Real-time control MCU with DSP capability	Arrow Link	Datasheet
	Microchip Technology	ATSAME70Q21A-AN	High-performance Cortex-M7 controller	Arrow Link	Datasheet
INTEGRATED CIRCUITS					
EEPROM	Microchip Technology	24LC256-I/SN	Reliable non-volatile storage	Arrow Link	Datasheet
	STMicroelectronics	M24M02-DRMN6TP	Industrial EEPROM for parameter storage	Arrow Link	Datasheet
	onsemi	CAT24C256WI-GT3	Automotive-grade EEPROM	Arrow Link	Datasheet
Transceiver	Nexperia	74LVC245APW	High-speed bidirectional transceiver	Arrow Link	Datasheet
	onsemi	MC100EPT23DG	Differential logic transceiver	Arrow Link	Datasheet
	STMicroelectronics	ST3485EIDT	Single Transmitter/Receiver RS-422/RS-485 8-Pin SO N T/R	Arrow Link	Datasheet
	Skyworks Solutions	Si85835D-IS	Half duplex or full duplex options, 1-10MBPS data rate speed, high isolation rating 5kVrms, and Bus fault protection: ± 30 V	Arrow Link	Datasheet
	Diodes Incorporated	PI3HDX1204B1ZHEX	High-speed interface conditioning	Arrow Link	Datasheet
Op Amps	STMicroelectronics	TSV911ILT	Low offset precision amplifier	Arrow Link	Datasheet
	Microchip Technology	MCP6V01T-E/SN	Op Amp Single GP R-R I/O 5.5V 8-Pin SOIC N T/R	Arrow Link	Datasheet
	ROHM Semiconductor	BD87522YFJ-CE2	Op Amp Dual GP R-R I/O ± 7.5 V/15V 8-Pin SOP-J T/R Automotive AEC-Q100	Arrow Link	Datasheet
	onsemi	LM2904DR2G	Industrial dual operational amplifier	Arrow Link	Datasheet
Isolation Amplifier	Skyworks Solutions	Si8931D-IS4	0 - 2.5V input range, Differential output mode, 5kVrms isolation (Wide Body package). Ideal to isolate the high voltage system from the low voltage system.	Arrow Link	Datasheet
	Vishay	VIA0050DD	Suitable for Vishay WSBE shunt and CDMV potential dividers	Arrow Link	Datasheet
	STMicroelectronics	STISO621	High CMTI current sensing isolation	Arrow Link	Datasheet
AC to DC Switching Converters	STMicroelectronics	VIPER35LDTR	High-voltage offline converter	Arrow Link	Datasheet
	Infineon Technologies AG	ICE5QSAGXUMA1	Quasi-resonant converter controller	Arrow Link	Datasheet
	onsemi	NCP1342AMDADGD1R2G	AC to DC Switching Converter Flyback T/R 9-Pin SOIC N	Arrow Link	Datasheet
PWM Controllers	Infineon Technologies AG	ICE3PCS03GXUMA1	Power Factor Correction Controller 1.4mA 100kHz 8-Pin DSO T/R	Arrow Link	Datasheet
	onsemi	NCP1654BD65R2G	Power Factor Correction Controller 0.075mA 72kHz 8-Pin SOIC N T/R	Arrow Link	Datasheet
	ROHM Semiconductor	BD28C55FJ-LBE2	AC to DC Switching Converter PWM 8.82V 39kHz T/R 8-Pin SOP-J	Arrow Link	Datasheet
	STMicroelectronics	L6599ADTR	Resonant half-bridge controller	Arrow Link	Datasheet

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Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
CRYSTAL/OSCILLATOR					
Crystal Oscillator	SiTime	SiT8008BI-71-18E-32.000	Oscillator MEMS 32MHz $\pm$ 20ppm (Stability) 15pF HCMOS/ LVCMOS 55% 1.8V 4-Pin PQFN SMD	Arrow Link	Datasheet
	Microchip Technology	DSC1001CI2-025.0000	Low-jitter oscillator	Arrow Link	Datasheet
	Diodes Incorporated	FL1200112	NPI or Latest Components suggest by supplier	Arrow Link	Datasheet
RF INTERFACES					
Wi-Fi/BT Module	Silicon Labs	SiWx917-PK6031A	SiWG917M111MGTBA Combo Wireless Module Development Kit	Arrow Link	Datasheet
	Murata Manufacturing	LBEE5KL1DX-875	802.11a/b/g/n with Bluetooth 4.0 Combo Module	Arrow Link	Datasheet
	Microchip Technology	ATWINC3400-MR210UA131	WLAN+BT Module 2412MHz to 2484MHz 36-Pin Tray	Arrow Link	Datasheet
PROTECTION DEVICES					
TVS Diodes	Littelfuse	SMCJ440A	High surge suppression capability	Arrow Link	Datasheet
	Diodes Incorporated	SMAJ58A-13-F	Fast transient suppression	Arrow Link	Datasheet
	Nexperia	PTVS24VP1UP	600 W TVS for industrial control rails (24 V), very robust in SOD128 package, good balance between protection strength and clamping performance	Arrow Link	Datasheet
	Vishay	6DFN15A-M3/I	Diode TVS Single Uni-Dir 12.8V 600W 2-Pin DFN3820A T/R	Arrow Link	Datasheet
ELECTROMAGNETIC RELAY					
Relay / DC Contactor	TE Connectivity	EV200AAANA	High-voltage DC contactor for PV battery/DC bus isolation	Arrow Link	Datasheet
	TE Connectivity	EV200H2ANA	High Voltages DC Contactor	Arrow Link	Datasheet
	Vishay	VBT6045CBP-E3/8W	For use in solar cell junction box as a bypass diode for protection, using DC forward current without reverse bias.	Arrow Link	Datasheet
POWER SWITCHING DEVICES					
Power MOSFET	WOLFSPEED, INC	C3M0075120K	Trans MOSFET N-CH SiC 1.2KV 31A 4-Pin(4+Tab) TO-247 Tube	Arrow Link	Datasheet
	Nexperia	NSF030120T2A0J	1200 V, 30 mOhm, N-channel SiC MOSFET in X.PAK package, excellent RDSon temperature stability. NPI 2025, Alternative: NSF030120D7A0J in D2PAK-7 NPI 2024	Arrow Link	Datasheet
	Infineon Technologies AG	IMBG120R045M1HXTMA1	Trans MOSFET N-CH SiC 1.2KV 47A 8-Pin(7+Tab) D2PAK T/R	Arrow Link	Datasheet
	Diodes Incorporated	DMWSH120H18HM4	NPI or Latest Components suggest by supplier	Arrow Link	Datasheet
	Vishay	SIHK045N60E-T1-GE3	Reduced switching and conduction losses	Arrow Link	Datasheet
	Diodes Incorporated	DSC20A065CTL-13	Silicon Carbide Schottky Diode	Arrow Link	Datasheet
	onsemi	NVHL080N120SC1	High-efficiency SiC MOSFET	Arrow Link	Datasheet
Rectifier	onsemi	MUR1560G	Ultrafast rectifier for inverter auxiliary sections	Arrow Link	Datasheet
	Nexperia	PMEG6030EP,115	Diode Schottky 3A 2-Pin CFP5 T/R	Arrow Link	Datasheet
	STMicroelectronics	STTH6012W	High-voltage ultrafast diode	Arrow Link	Datasheet
Transistor	Nexperia	PBSS4350X,115	Trans GP BJT NPN 50V 3A 1600mW 4-Pin(3+Tab) SOT-89 T/R Automotive AEC-Q101	Arrow Link	Datasheet
	onsemi	MMBT3904LT1G	General-purpose switching transistor	Arrow Link	Datasheet
	Diodes Incorporated	DZT5551Q-13	Trans GP BJT NPN 160V 0.6A 2000mW 4-Pin(3+Tab) SOT-223 T/R Automotive AEC-Q101	Arrow Link	Datasheet

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Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
POWER SWITCHING DEVICES					
Resistor	Vishay	LTO150F2R200JTE3	Res Thick Film 2.2 Ohm 5% 150W ±350ppm/°C Molded TO-247 RDL Tube Automotive AEC-Q200	Arrow Link	Datasheet
DC CONTACTOR DRIVER					
Isolated Gate Driver	Infineon Technologies AG	1ED3122MU12HXUMA1	Driver 10A 2-OUT High Side Inv/Non-Inv 8-Pin DSO T/R	Arrow Link	Datasheet
	Vishay	VS-GT300YH120N	The best high-current inverter stages solutions: ultra-low VCE(on) or ultrafast switching technologies.	Arrow Link	Datasheet
	Skyworks Solutions	SI82F29ABE-IS3R	Driver 1.5A 2-OUT High Side/Low Side Half Brdg Non-Inv 14-Pin SOIC W	Arrow Link	Datasheet
	onsemi	NCD57000DWR2G	Excellent transient immunity and robust gate drive architecture	Arrow Link	Datasheet
	Diodes Incorporated	API21550BS16B-13	ISOLATION GATE DRIVER Channel	Arrow Link	Datasheet
	STMicroelectronics	STGAP2HSMTR	Driver 1-OUT Half Brdg 8-Pin SO W T/R	Arrow Link	Datasheet
	ROHM Semiconductor	BM61S41RFV-CE2	Driver 1-OUT 10-Pin SSOP-BW T/R Automotive AEC-Q100	Arrow Link	Datasheet
MPPT STAGE					
Gate Driver [MPPT]	Infineon Technologies AG	1EDN7550BXTSA1	Fast switching optimized for SiC/GaN MPPT stages	Arrow Link	Datasheet
	onsemi	NCP81074ADR2G	High peak current and compact synchronous switching support	Arrow Link	Datasheet
	Microchip Technology	MCP14A0602T-E/SN	Driver 6A 1-OUT Low Side Non-Inv 8-Pin SOIC N T/R	Arrow Link	Datasheet
DC LINK					
Voltage Sensor	Honeywell	CSNV700N-355	Current Sensor Current Sensor DC Current 12V Automotive AEC-Q100 4-Pin Box	Arrow Link	Datasheet
	Allegro MicroSystems	ACS37612LLUATR-015U5	Current Sensor Current Sensor AC/DC Current 5V 8-Pin TSSOP T/R Automotive AEC-Q100	Arrow Link	Datasheet
	Infineon Technologies AG	TLI4971A120T5E0001XUMA1	Current Sensor Current Sensor AC/DC Current 3.3V Automotive AEC-Q100 8-Pin TISON EP T/R	Arrow Link	Datasheet
MAIN INVERTER					
Gate Driver [Main Inverter]	Infineon Technologies AG	1EDI3030ASXUMA1	Advanced SiC inverter optimized isolated driver	Arrow Link	Datasheet
	onsemi	NCD57001DWR2G	DESAT protection and strong inverter robustness	Arrow Link	Datasheet
	STMicroelectronics	STGAP3SXS	Functional safety oriented isolated gate driver	Arrow Link	Datasheet
MCU CORE					
External Flash	Macronix International Co., Ltd.	MX25L25645GMI-08G	NOR Flash Serial (SPI, Dual SPI, Quad SPI) 3V/3.3V 256M-bit 256M/128M/64M x 1/2-bit/4-bit 8ns 16-Pin SOP W	Arrow Link	Datasheet
	Winbond Electronics	W25Q256JVFIQ	Widely adopted industrial QSPI flash	Arrow Link	Datasheet
	Microchip Technology	SST26VF040A-80E/SN	NOR Flash Serial (SPI, Dual SPI, Quad SPI) 2.5V/3.3V 4M-bit 4M/2M/1M x 1/2-bit/4-bit 8ns 8-Pin SOIC N Tube	Arrow Link	Datasheet
DDR Memory	Micron Technology	MT41K256M16TW-107	Industrial DDR3 with strong ecosystem support	Arrow Link	Datasheet
	Integrated Silicon Solution Inc	IS43TR16128DL-107MBL	DRAM Chip DDR3L SDRAM 2Gbit 128Mx16 1.35V 96-Pin TW-BGA	Arrow Link	Datasheet
	Micron Technology	MT41K256M16TW-107	DRAM Chip DDR3L SDRAM 4Gbit 256Mx16 1.35V 96-Pin FBGA	Arrow Link	Datasheet

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Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
MCU CORE					
RTC	Microchip Technology	MCP79410T-I/MNYVAO	Real Time Clock Serial 64byte Clock/Calendar/Alarm/Battery Backup 8-Pin TDFN EP T/R Automotive AEC-Q100	Arrow Link	Datasheet
	NXP Semiconductors	PCF85063AT/AY	Real Time Clock Serial Clock/Calendar/Alarm/Timer/Interrupt 8-Pin SO T/R	Arrow Link	Datasheet
	STMicroelectronics	M41T83RQA6F	Real Time Clock Serial 32byte Clock/Calendar/Alarm/Timer/Interrupt 16-Pin VFQFPN EP T/R	Arrow Link	Datasheet
USB INTERFACE					
USB ESD Protection	Littelfuse	AQ7538-08UTG	ESD Suppressor Diode Array Uni-Dir 5V 9-Pin uDFN	Arrow Link	Datasheet
	Nexperia	PESD5Z5.0F	ESD Suppressor TVS Uni-Dir 5V 2-Pin SC-79 T/R	Arrow Link	Datasheet
	Vishay	VBUS05L1-DD1	Compact USB transient suppression	Arrow Link	Datasheet
HMI					
LCD Module	Tianma Microelectronics Co., Ltd	TM101JDHP01-00	10.1 Inch LCD Character Modules	Arrow Link	Datasheet
	Newhaven Display International, Inc	NHD-7.0-800480AF-ASXP	7in TFT WVGA 800x480Pixels 24-bit Parallel/RGB 1000cd/m2 LED Backlight -20°C to 70°C 40-Pin	Arrow Link	Datasheet
	Tianma Microelectronics Co., Ltd	TM035KDH03-79	3.5in TFT 320x480Pixels RGB 1000cd/m2 LED Backlight -20°C to 70°C 39-Pin	Arrow Link	Datasheet
Touch Controller	Microchip Technology	ATMXT641T-CCUR028	Capacitive Touch Screen 32 Key 84-Pin UFBGA T/R	Arrow Link	Datasheet
	STMicroelectronics	STMPE1600QTR	I2C Interface 3.6V 24-Pin QFN EP T/R	Arrow Link	Datasheet
Buzzer	Same Sky	CMT-1203-SMT	Compact SMT audible indicator	Arrow Link	Datasheet
	Murata Manufacturing	PKMCS0909E4000-R1	Reliable piezo buzzer for industrial UI	Arrow Link	Datasheet
	Same Sky	CPT-1404-85T	High reliability buzzer for inverter fault indication	Arrow Link	Datasheet
	Diodes Incorporated	DESD3V3Z1BCSF-7	ESD Suppressor TVS Bi-Dir 3.3V 2-Pin X2-DSN T/R	Arrow Link	Datasheet
THERMAL					
Temperature Sensor	Honeywell	HEL-777-A-T-0	Temp Sensor Analog Serial (2-Wire) 2-Pin SIP	Arrow Link	Datasheet
	Vishay	NTCALUG03A103GCA	Temperature Sensor Overcomes Design Constraints in an Integrated Power Box	Arrow Link	Datasheet
PROTECTION					
Resettable Fuse	Littelfuse	1206L050/15YR	PTC Resettable Fuse 0.5A(hold) 1A(trip) 15VDC 100A 0.6W 0.1s 0.15Ohm SMD Solder Pad 1206 T/R	Arrow Link	Datasheet
	Bourns	MF-R050	Industry standard PPTC protection	Arrow Link	Datasheet
	Littelfuse	RXEF050	Robust telecom/industrial PPTC device	Arrow Link	Datasheet
ISOLATION					
Digital Isolator	Silicon Labs	Si8621BB-IS	Low-Power Single and Dual-Channel Digital Isolators	Arrow Link	Datasheet
	Analog Devices	ADUM141E1BRZ	Digital Isolator CMOS 4-CH 150Mbps 16-Pin SOIC N Tube	Arrow Link	Datasheet

PV Inverter Line Card

Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
LEDS					
Status LED Green	Vishay	VLMB1300-GS08	High brightness and industrial longevity	Arrow Link	Datasheet
	Kingbright Company, LLC	KP-1608SGC	Compact SMT status indication LED	Arrow Link	Datasheet
	ROHM Semiconductor	SML-D12M8WT86	Low power industrial LED	Arrow Link	Datasheet
Status LED Red	Vishay	VLMS1300-GS08	Reliable high-visibility red indicator	Arrow Link	Datasheet
	Kingbright Company, LLC	KP-1608SURCK	Bright SMT red LED	Arrow Link	Datasheet
	ROHM Semiconductor	SML-D12U1WT86	Stable luminous performance	Arrow Link	Datasheet
COOLING					
Cooling Fan	Same Sky	CFM-A238BJ-238-564	Industrial airflow and low acoustic profile	Arrow Link	Datasheet
	Delta Electronics	AFB1212SH	High reliability inverter cooling fan	Arrow Link	Datasheet
	Sunonwealth Electric Machine Industry Co., Ltd	8414NHU	DC Fan Axial Ball Bearing 24V 18V to 26V 46.5CFM 37dB 80 X 80 X 25.4mm	Arrow Link	Datasheet
AC OUTPUT					
Zero Crossing Detector	onsemi	H11AA1-M	Industry standard AC line detection	Arrow Link	Datasheet
	Vishay	VO615A	Reliable optically isolated AC sensing	Arrow Link	Datasheet
	Lite-On Technology	LTV-814	Compact AC feedback isolation	Arrow Link	Datasheet
SAFETY					
Optocoupler	Vishay	VO617A	Reinforced isolation and industrial qualification	Arrow Link	Datasheet
	Toshiba	TLP2361	High-speed logic isolation for PWM and protection	Arrow Link	Datasheet
	onsemi	FOD817ASD	Robust industrial safety isolation	Arrow Link	Datasheet
SENSORS					
Ambient Light Sensor	Vishay	VEML7700-TT	High dynamic range ambient sensing	Arrow Link	Datasheet
	ROHM Semiconductor	BH1750FVI	Accurate digital lux sensor	Arrow Link	Datasheet
	ams OSRAM	TSL2591EVM	TSL2591 Ambient Light Sensor Evaluation Board Win OS	Arrow Link	Datasheet
Humidity Sensor	Silicon Labs	Si7021-EB	POSTAGE STAMP DAUGHTER BOARD	Arrow Link	Datasheet
	Texas Instruments	HDC1080DMBR	Humidity/Temperature Sensor Digital Serial (2-Wire, I2C) 6-Pin WSON EP T/R	Arrow Link	Datasheet
	Sensirion AG	SHT41-AD1B-R2	Humidity/Temperature Sensor Digital Serial (I2C) 4-Pin DFN EP T/R	Arrow Link	Datasheet
Pressure Sensor	Honeywell	ABPMANN001PDSA3	Board Mount Pressure Sensor -1psi to 1psi Differential 6-Pin SMD Module	Arrow Link	Datasheet
	STMicroelectronics	MPX5700D	Board Mount Pressure Sensor 0kPa to 700kPa Differential Tray	Arrow Link	Datasheet
	TE Connectivity	MS583702BA01-50	Board Mount Pressure Sensor 0.3bar to 1.2bar Absolute 4-Pin SMD Module T/R	Arrow Link	Datasheet

PV Inverter Line Card

Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
CONNECTOR					
Digital Interface Connectors	TE Connectivity	1-1734248-5	Industrial locking connector, vibration resistant	Arrow Link	Datasheet
	Molex	430250400	Compact wire-to-board interface	Arrow Link	Datasheet
	Amphenol Communications Solutions	10118194-0001LF	High reliability signal connector	Arrow Link	Datasheet
CAPACITORS					
Capacitor	Murata Manufacturing	GRM32ER71H106KA12L	Low ESR ceramic capacitor for power decoupling	Arrow Link	Datasheet
	Vishay	MAL223531013E3	Ruggedized Electrical Double Layer Energy Storage Capacitors Up To 3 V Operating Voltage Automotive AEC-Q200	Arrow Link	Datasheet
	YAGEO Group	CC1210ZKY5VGBB106	Cap Ceramic 10uF 35V Y5V -20% to 80% Pad SMD 1210 85°C T/R	Arrow Link	Datasheet
Capacitor Film	YAGEO Group	C4AQNWB5300M3MJ	Printed Circuit Board Mount Power Film Capacitors Automotive AEC-Q200	Arrow Link	Datasheet
	Vishay	MKP385E51012JPM2T0	Metallized Polypropylene Film Capacitor Automotive AEC-Q200	Arrow Link	Datasheet
	TDK	B32778G4187J000	Metallized Polypropylene Film Capacitor	Arrow Link	Datasheet
MAGNETICS					
Inductor	Coilcraft	SER2918H-103KL	High saturation current power inductor	Arrow Link	Datasheet
	Vishay	IHDF1300AEEH4R7K10	Low loss ferrite core for high performance designs with minimal AC power losses	Arrow Link	Datasheet
	YAGEO Group	PA4340.103NLT	High current inverter inductor	Arrow Link	Datasheet
Transformer	YAGEO Group	PH9400.211NLT	Power Transformer 2:1:1 4000Vrms 8 Terminal Gull Wing SMD Medical	Arrow Link	Datasheet
	TDK	B82725S2103N004	Common Mode Chokes Dual 3300uH 10kHz 10A 0.0135Ohm DCR Thru-Hole Box	Arrow Link	Datasheet
CRYSTAL/OSCILLATOR					
Crystal	SiTime	SiT1602BI-33-33E-24.000000Y	MEMS timing stability and robustness	Arrow Link	Datasheet
	Microchip Technology	DSC1001DI2-024.0000	Low jitter oscillator	Arrow Link	Datasheet
RF INTERFACES					
Connector	Amphenol RF	A-1JB	Conn AMC 0Hz to 6GHz 50Ohm Solder ST SMD RCP Gold T/R	Arrow Link	Datasheet
	Amphenol RF	132134	SMA connector for RF telemetry	Arrow Link	Datasheet
	Amphenol RF	901-10112	Conn SMA 0Hz to 4GHz 50Ohm Solder ST Thru-Hole RCP Gold Over Nickel	Arrow Link	Datasheet
PROTECTION DEVICES					
Varistors	Littelfuse	V575LA40AP	High surge MOV for AC protection	Arrow Link	Datasheet
	Bourns	MOV-20D681K	Industrial MOV surge suppression	Arrow Link	Datasheet
	Vishay	VDRS14T275BSE	High-energy surge protection	Arrow Link	Datasheet

PV Inverter Line Card

Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
SOLAR PV INPUT					
PV Fuse	Littelfuse	SPFJ100.X	Fuse Class J Fast Acting 100A 1000V Bolt Down Flat 38.1 X 76.5mm Melamine CE	Arrow Link	Datasheet
	Eaton	PV-15A10F85L	High-speed PV fuse	Arrow Link	Datasheet
Common Mode Choke	TDK	B82724J2502N001	EMI suppression for PV input	Arrow Link	Datasheet
	YAGEO Group	SCF76X-1100-S4F0A004JH	Better aligned with the three-phase inverter output common-mode choke position. Stronger YAGEO Group replacement opportunity than smaller or generic competitor CMCs.	Arrow Link	Datasheet
	Murata Manufacturing	DLW43MH201XK2L	Common Mode Chokes Dual 200uH 100kHz 0.11A 4.5Ohm DCR SMD T/R Automotive AEC-Q200	Arrow Link	Datasheet
INPUT VOLTAGE SENSE					
Precision Divider Resistor	Vishay	TNPW120610K0BEEN	Precision low-drift resistor	Arrow Link	Datasheet
	Bourns	CRA2512-FZ-R010ELF	High precision shunt/divider use	Arrow Link	Datasheet
DC LINK					
Busbar Capacitor	YAGEO Group	C4AQIBW5220M3JJ	Printed Circuit Board Mount Power Film Capacitors Automotive AEC-Q200	Arrow Link	Datasheet
	Vishay	MKP1848C65090JY5	Long-life inverter bus capacitor	Arrow Link	Datasheet
	Vishay	MKP1848610704K2	Cap Film 10uF 700V PP 5%(32 X 21 X 31mm) Radial Wound 27.5mm 0.007 Ohm 105°C Automotive Bulk	Arrow Link	Datasheet
Pre-Charge Resistor	Vishay	RH05010R00FE02	Aluminum housed power resistor	Arrow Link	Datasheet
	Ohmite Mfg Co	HS5010RJ	High pulse handling capability	Arrow Link	Datasheet
	Bourns	PWR221T-50-10R0F	High energy startup resistor	Arrow Link	Datasheet
Bleeder Resistor	Vishay	PR03000201009JAC00	Res Metal Film 10 Ohm 5% 3W ±250ppm/°C Conformal Coated AXL Ammo Automotive	Arrow Link	Datasheet
	YAGEO Group	SQP500JB-3R	Res Wirewound 3 Ohm 5% 5W ±300ppm/°C Cement AXL Bulk	Arrow Link	Datasheet
	Bourns	PWR263S-35-10R0F	Pulse tolerant resistor	Arrow Link	Datasheet
MAIN INVERTER					
EMI Capacitor	YAGEO Group	R46KI31000001M	Cap Film Suppression X2 0.1uF 275VAC PP 20%(18 X 6 X 12mm) Radial Plastic Rectangular Can 15mm 110°C Bulk	Arrow Link	Datasheet
	Vishay	MKP386M512100JT1	Metallized Polypropylene Film Capacitors	Arrow Link	Datasheet
	TDK	B32924C3105K003	Cap Film Suppression X2 1uF 630VDC/305VAC PP 10% (31.5 X 11 X 19mm) Radial Plastic Rectangular Can 27.5mm 110°C Bulk	Arrow Link	Datasheet
Y Capacitor	Murata Manufacturing	DE2E3SA102MA3BT02F	Cap Ceramic Suppression X1/Y2 0.001uF 250VAC E 20% (6 X 4mm) Radial Disc 7.5mm 125°C Bulk	Arrow Link	Datasheet
	Vishay	VY2103M63Y5US63V0	Certified Y safety capacitor	Arrow Link	Datasheet
	YAGEO Group	R413F1150JH00M	Metallized Polypropylene Film EMI Suppression Capacitors Automotive AEC-Q200	Arrow Link	Datasheet

PV Inverter Line Card

Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
OUTPUT FILTER					
Differential Choke	TDK	B82724J2502U040	Common Mode Chokes Dual 5300uH 10kHz 5A 0.036Ohm DCR Thru-Hole	Arrow Link	Datasheet
	Vishay	IHXL1500VZEBR68M51	High saturation current and low DCR for output ripple suppression	Arrow Link	Datasheet
	Bourns	SRP1770TA-4R7M	High current shielded power choke for inverter output stage	Arrow Link	Datasheet
	Murata Manufacturing	DFE252012F-2R2M=P2	Compact low-loss choke with high EMI performance	Arrow Link	Datasheet
GATE DRIVER					
Gate Resistor	Vishay	CRCW251210R0FKEG	Pulse tolerant thick film resistor for SiC/IGBT gate drive	Arrow Link	Datasheet
	YAGEO Group	RC2512FK-07100KL	Res Thick Film 2512 100K Ohm 1% 1W ±100ppm/°C Pad SMD T/R	Arrow Link	Datasheet
	Bourns	CRM2512-FX-10R0ELF	High pulse capability for fast-switching inverter topologies	Arrow Link	Datasheet
Bootstrap Capacitor	YAGEO Group	C322C104K5R5TA	Low ESR MLCC optimized for gate driver bootstrap supply	Arrow Link	Datasheet
	Murata Manufacturing	GRM31CR71H104KA61L	Chip Multilayer Ceramic Capacitors	Arrow Link	Datasheet
	Vishay	VJ1210Y104KXCAT	Stable capacitance under DC bias and temperature	Arrow Link	Datasheet
Ferrite Bead	Murata Manufacturing	BLM31PG601SN1L	High impedance ferrite bead for gate ringing suppression	Arrow Link	Datasheet
	TDK	IFL16-100NB300X200	EMI Absorbers Sheet 10KOhm	Arrow Link	Datasheet
	Bourns	MH2029-601Y	Compact EMI suppression bead for isolated gate drivers	Arrow Link	Datasheet
MCU POWER					
Decoupling Capacitor	Murata Manufacturing	GRM188R72A104KA35D	Cap Ceramic 0.1uF 100V X7R 10% Pad SMD 0603 125°C T/R	Arrow Link	Datasheet
	YAGEO Group	CC0603JKX7R9BB561	Cap Ceramic 560pF 50V X7R 5% Pad SMD 0603 125°C T/R	Arrow Link	Datasheet
	Vishay	VJ0603Y104KXACW1BC	Stable performance across temperature and voltage	Arrow Link	Datasheet
Bulk Capacitor	Panasonic Industry	EEUFR1E101	Long life low ESR bulk capacitor for logic power rails	Arrow Link	Datasheet
	YAGEO Group	A750MS108M1AAAE013	Cap Aluminum Polymer 1000uF 10VDC 20%(10 X 12mm) Radial 5mm 0.013 Ohm 4.5A 2000h 105°C Bag	Arrow Link	Datasheet
	Nichicon	UHW1E102MPD	Cap Aluminum Lytic 1000uF 25V 20% (10 X 20mm) Radial 5mm 2.5A 10000h 105°C Bulk	Arrow Link	Datasheet
	Vishay	293D107X9010D2TE3	Compact tantalum bulk capacitor with low ESR	Arrow Link	Datasheet
HMI					
Push Button	TE Connectivity	AV2221000Q04	Switch Push Button OFF ON DPDT Flush Round Button 3A 250VAC 36VDC Lock Panel Mount Solder Lug	Arrow Link	Datasheet
	Honeywell	AML24EBA3AA05	Switch Rocker (ON) OFF (ON) SPDT PC Pins/Push-On Rocker	Arrow Link	Datasheet
THERMAL					
NTC Thermistor	Murata Manufacturing	NCP18XH103F03RB	Accurate temperature monitoring for thermal shutdown	Arrow Link	Datasheet
	Vishay	NTCLE100E3103JB0	High stability temperature sensing element	Arrow Link	Datasheet
	Honeywell	135-103LAG-J01	Industrial-grade thermal sensing for heatsink monitoring	Arrow Link	Datasheet

PV Inverter Line Card

Technology / Components	Manufacturers	Part Numbers	Reason For Selection	Arrow Link	Datasheet
PROTECTION					
Input Fuse	Littelfuse	L50S350	High-speed semiconductor fuse for PV DC protection	Arrow Link	Datasheet
AC Fuse	Littelfuse	KLKD030	Industrial AC line protection fuse	Arrow Link	Datasheet
	Schurter	3403.0276.23	Fuse Chip Slow Blow Acting 1.6A 277V SMD Solder Pad 16 X 5.3mm Ceramic T/R UL/VDE Automotive AEC-Q200	Arrow Link	Datasheet
	Bourns	SF-1206S600M-2	Fuse Chip Slow Blow Acting 6A 32V SMD Solder Pad 1206 3.2 X 1.6 X 0.85mm Ceramic T/R	Arrow Link	Datasheet
EMI					
Ferrite Core	Fair-Rite Products Corp	5977006401	Broadband EMI suppression for power cables	Arrow Link	Datasheet
	TDK	ZCAT3035-1330	High-frequency common mode noise suppression	Arrow Link	Datasheet
	Wuerth Elektronik GmbH & Co. KG	74270033	Ferrite Core Bead 3 W 800-Material	Arrow Link	Datasheet
Snap Ferrite	Fair-Rite Products Corp	0443167251	Easy-install EMI suppression for cable harnesses	Arrow Link	Datasheet
	TDK	ZCAT2035-0930	Compact snap ferrite for conducted EMI reduction	Arrow Link	Datasheet
	Wuerth Elektronik GmbH & Co. KG	74271222	Ferrite Core STAR-TEC Snap with Safety Key 4 W 620-Material	Arrow Link	Datasheet
SAFETY					
Safety Capacitor	YAGEO Group	R46KI347000M1K	X2 safety capacitor for EMI filtering	Arrow Link	Datasheet
	Vishay	MKP386M515100JT6	Metallized Polypropylene Film Capacitor Radial Snubber Type	Arrow Link	Datasheet
	YAGEO Group	R413F122050P0K	Cap Film Suppression X1/Y2 0.0022uF 1200VDC/300VAC PP 10%(13 X 4 X 9mm) Radial Plastic Rectangular Can 10mm 125°C Automotive AEC-Q200	Arrow Link	Datasheet
Electrolyte detector	Honeywell	BESL-10100-000	Battery Safety Electrolyte Detector Analog Output 5V	Arrow Link	Datasheet
BACKUP POWER					
Supercapacitor	Eaton	HV0830-2R7605-R	Cap Supercap 6F 2.7V -10% to 30% (8.5 X 31mm) Radial Aluminum Cylindrical Can 3.5mm 20uA 0.04 Ohm 1000h 65°C Bulk	Arrow Link	Datasheet
	Eaton	HB1325-2R5156-R	Cap Supercap 15F 2.5V -10% to 30% (13.5 X 28.4mm) Radial Cylindrical 5.08mm 22uA 0.05 Ohm 70°C Bulk	Arrow Link	Datasheet
	YAGEO Group	FYD0H105ZF	Compact backup capacitor with low leakage	Arrow Link	Datasheet