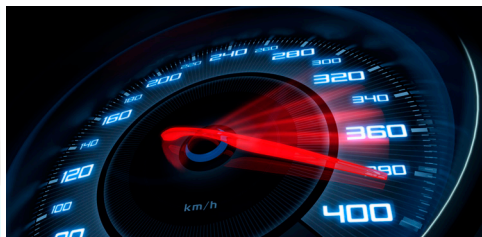




Power Discrete and Module Portfolio



High-Voltage SMPS Transistors

| | |
|--|----|
| Insulated Gate Bipolar Transistors (IGBTs) | 3 |
| IGBTs—Punch-Thru | 4 |
| IGBTs—Non-Punch-Thru | 5 |
| IGBTs—Field Stop | 6 |
| Silicon Carbide (SiC) MOSFETs | 7 |
| Power MOS 8™ MOSFETs/FREDFETs | 8 |
| Ultra-Fast, Low Gate Charge MOSFETs | 10 |
| Super Junction MOSFETs | 11 |
| Linear MOSFETs | 11 |

Diodes

| | |
|---|----|
| SiC Schottky Barrier Diodes | 12 |
| Si Schottky Barrier Diodes, Fast and Ultra-Fast Recovery Diodes | 14 |

RF MOSFETs

| | |
|--|----|
| High-Voltage RF MOSFETs | 16 |
| High-Frequency RF MOSFETs | 16 |
| Drivers and Driver-RF MOSFET Hybrids | 17 |

Power Modules

| | |
|--|----|
| Power Modules Contents | 18 |
| Standard Electrical Configurations | 19 |
| Packaging | 20 |
| Custom Power Modules | 21 |
| Rugged Custom Power Modules | 23 |
| Power Module Part Numbering System | 25 |
| Diode Power Modules | 26 |
| IGBT Power Modules | 27 |
| Intelligent Power Modules | 29 |
| MOSFET Power Modules | 31 |
| Renewable Energy Power Modules | 36 |
| SiC Schottky Diode Power Modules | 37 |
| SiC MOSFETs Power Modules | 39 |
| Power Module Outlines | 42 |

| | |
|-----------------------------|----|
| Gate Driver Solutions | 45 |
|-----------------------------|----|

| | |
|-------------------------|----|
| Reference Designs | 46 |
|-------------------------|----|

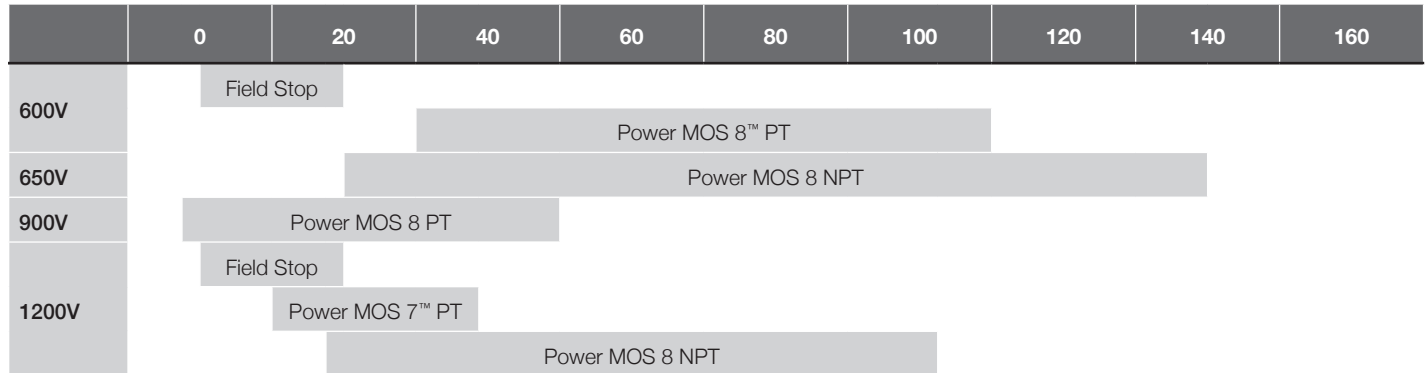
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|-------------------------|----|
| Simulation Models | 47 |
|-------------------------|----|

Insulated Gate Bipolar Transistors (IGBTs)

IGBTs From Microchip

IGBT products from Microchip provide high-quality solutions for a wide range of high-voltage and high-power applications. The switching frequency range spans from DC for minimal conduction loss to 150 kHz for very-high-power-density Switch Mode Power Supply (SMPS) applications. The frequency range for each product type is shown in the following graph. Each IGBT product represents the latest in IGBT technology, providing the best possible performance/cost combination for the targeted application. There are six product series that utilize three different IGBT technologies: Non-Punch-Through (NPT), Punch-Through (PT) and field stop.

IGBT Switching Frequency Ranges (kHz, Hard Switched)



Note: Frequency ranges shown are typical for a 50 A IGBT. Refer to product datasheet maximum frequency versus current graph for more information.

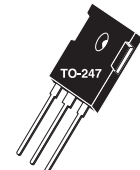
| Standard Series | Voltage Ratings (V) | Technology | Easy to Parallel | Short Circuit Safe Operating Area (SOA) | Parameter |
|------------------------|---------------------|------------|------------------|---|------------------------|
| MOS 7™ | 1200 | PT | | | Ultra-low gate charge |
| MOS 8™ | 600, 650, 900, 1200 | PT, NPT | | | Highest efficiency |
| Field Stop Trench Gate | 600, 1200 | Field Stop | • | • | Lowest conduction loss |

Product Options

All standard IGBT products are available as a single IGBT or as a Combi product packaged with an anti-parallel DQ series diode. Package options include TO-220, TO-247, T-MAX®, TO-264 and SOT-227 (ISOTOP®). Customized products are available; contact the factory for details.

| | $V_{(BR)CES}$ (V) | $V_{CE(ON)}$ (V) Typ 25°C | I_{c2} (A) 100°C | Maximum I_c (A) at Frequency | | Part Number | Package Style | |
|--|-------------------|------------------------------|-----------------------|-----------------------------------|--------|------------------|-----------------|--|
| POWER MOS 7™ | Single | | | 20 kHz | 40 kHz | | | |
| <ul style="list-style-type: none"> • Ultra-low gate charge • Combi with high-speed DQ diode | 1200 | 3.3 | 33 | 19 | 12 | APT25GP120BG | TO-247 | |
| | | 3.3 | 46 | 24 | 15 | APT35GP120BG | TO-247 | |
| | | 3.3 | 54 | 29 | 18 | APT45GP120BG | TO-247 | |
| | | 3.3 | 34 | 28 | 18 | APT45GP120J | SOT-227 | |
| | | 3.3 | 91 | 42 | 24 | APT75GP120B2G | T-MAX® | |
| | | 3.3 | 57 | 40 | 23 | APT75GP120J | SOT-227 | |
| | 1200 | Combi (IGBT & "DQ" FRED) | | | 20 kHz | 40 kHz | | |
| | | 3.3 | 33 | 19 | 12 | APT25GP120BDQ1G | TO-247 | |
| | | 3.3 | 46 | 24 | 15 | APT35GP120B2DQ2G | T-MAX | |
| | | 3.3 | 54 | 29 | 18 | APT45GP120B2DQ2G | T-MAX | |
| | | 3.3 | 34 | 28 | 18 | APT45GP120JDQ2 | SOT-227 | |
| | | 3.3 | 57 | 40 | 23 | APT75GP120JDQ3 | SOT-227 | |
| POWER MOS 8™ | Single | | | 50 kHz | 80 kHz | | | |
| <ul style="list-style-type: none"> • Fast switching • Highest efficiency • Combi with high-speed DQ diode | 600 | 2 | 36 | 21 | 17 | APT36GA60B | TO-247 or D3PAK | |
| | | 2 | 44 | 26 | 20 | APT44GA60B | TO-247 or D3PAK | |
| | | 2 | 54 | 30 | 23 | APT54GA60B | TO-247 or D3PAK | |
| | | 2 | 68 | 35 | 27 | APT68GA60B | TO-247 or D3PAK | |
| | | 2 | 80 | 40 | 31 | APT80GA60B | TO-247 or D3PAK | |
| | | 2 | 102 | 51 | 39 | APT102GA60B2 | T-MAX or TO-264 | |
| | 900 | | | | 25 kHz | 50 kHz | | |
| | | 2.5 | 35 | 17 | 10 | APT35GA90B | TO-247 or D3PAK | |
| | | 2.5 | 43 | 21 | 13 | APT43GA90B | TO-247 or D3PAK | |
| | | 2.5 | 64 | 29 | 19 | APT64GA90B | TO-247 or D3PAK | |
| | 900 | Combi (IGBT & "DQ" FRED) | | | 50 kHz | 80 kHz | | |
| | | 2.5 | 80 | 34 | 23 | APT80GA90B | TO-247 or D3PAK | |
| | 600 | 2 | 36 | 21 | 17 | APT36GA60BD15 | TO-247 or D3PAK | |
| | | 2 | 44 | 26 | 20 | APT44GA60BD30 | TO-247 or D3PAK | |
| | | 2 | 54 | 30 | 23 | APT54GA60BD30 | TO-247 or D3PAK | |
| | | 2 | 60 | 48 | 36 | APT60GA60JD60 | SOT-227 | |
| | | 2 | 68 | 35 | 27 | APT68GA60B2D40 | T-MAX or TO-264 | |
| | | 2 | 80 | 40 | 31 | APT80GA60LD40 | TO-264 | |
| | 900 | | | | 25 kHz | 50 kHz | | |
| | | 2.5 | 27 | 14 | 8 | APT27GA90BD15 | TO-247 or D3PAK | |
| | | 2.5 | 35 | 17 | 10 | APT35GA90BD15 | TO-247 or D3PAK | |
| | | 2.5 | 43 | 21 | 13 | APT43GA90BD30 | TO-247 or D3PAK | |
| | | 2.5 | 46 | 33 | 21 | APT46GA90JD40 | SOT-227 | |
| | | 2.5 | 64 | 29 | 19 | APT64GA90B2D30 | T-MAX or TO-264 | |
| | | 2.5 | 80 | 34 | 23 | APT80GA90LD40 | TO-264 | |

Part numbers for D3PAK packages—replace "B" with "S" in part number.
 Part numbers for TO-264 packages—replace "B2" with "L" in part number.



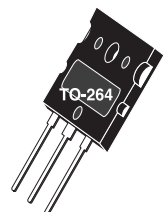
TO-247[B]



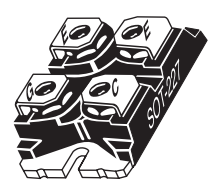
D3PAK



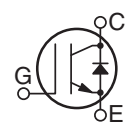
T-MAX®[B2]



TO-264[L]



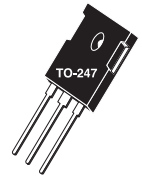
SOT-227



Current at frequency test conditions: $T_J = 125^\circ\text{C}$, $T_c = 100^\circ\text{C}$ except SOT-227 where $T_c = 80^\circ\text{C}$, $V_{cc} = 67\%$ rated voltage hard switch.

IGBTs—Non-Punch-Thru

| | V _{(BR)CES} (V) | V _{CE(ON)} (V) Typ 25°C | I _{c2} (A) 100°C | Maximum I _c (A) at Frequency | | Part Number | Package Style | | |
|--|--------------------------|-------------------------------------|------------------------------|--|-------------------|------------------|------------------|--------|--|
| | | | | 150 kHz | 200 kHz | | | | |
| POWER MOS 8™ | Single | | | 150 kHz | 200 kHz | | | | |
| <ul style="list-style-type: none"> • High-speed switching • Low switching losses • Easy to parallel | 650 | 1.9 | 45 | 31 | 25 | APT45GR65B | TO-247 | | |
| | | | | 100 kHz | 150 kHz | | | | |
| | | 1.9 | 70 | 52 | 39 | APT70GR65B | TO-247 | | |
| | | | | 50 kHz | 100 kHz | | | | |
| | 1.9 | 95 | 69 | 41 | APT95GR65B2 | T-MAX® | | | |
| | | | | | 50 kHz | 80 kHz | | | |
| | 1200 | 2.5 | 25 | 25 | 21 | APT25GR120B | TO-247 | | |
| | | | | | | APT25GR120S | D3PAK | | |
| | | 2.5 | 40 | 38 | 28 | APT40GR120B | TO-247 | | |
| | | | | | | APT40GR120S | D3PAK | | |
| | | 2.5 | 50 | 48 | 36 | APT50GR120B2 | T-MAX | | |
| | | | | | | APT50GR120L | TO-264 | | |
| | | 2.5 | 50 | 48 | 36 | | 25 kHz | 50 kHz | |
| | | | | | | | | | |
| | | 2.5 | 70 | 66 | 42 | APT70GR120B2 | T-MAX | | |
| | | | | | | APT70GR120L | TO-264 | | |
| | | 2.5 | 70* | 42 | 30 | APT70GR120J | SOT-227 | | |
| | | | | | | | | | |
| | 2.5 | 85 | 72 | 46 | APT85GR120B2 | T-MAX | | | |
| | | | | | APT85GR120L | TO-264 | | | |
| | 2.5 | 85* | 46 | 31 | APT85GR120J | SOT-227 | | | |
| | | | | | | | | | |
| | Combi (IGBT & Diode) | | | | 150 kHz | 200 kHz | | | |
| | 650 | 1.9 | 45 | 31 | 25 | APT45GR65BSCD10 | TO-247 (SiC SBD) | | |
| 100 kHz | | | | | | 150 kHz | | | |
| 1.9 | 70 | 52 | 39 | APT70GR65B2SCD30 | T-MAX (SiC SBD) | | | | |
| | | | | 50 kHz | 80 kHz | | | | |
| 1200 | 2.5 | 25 | 25 | 21 | APT25GR120BD15 | TO-247 (DQ) | | | |
| | | | | | APT25GR120SD15 | D3PAK (DQ) | | | |
| | 2.5 | 25 | 25 | 21 | APT25GR120BSCD10 | TO-247 (SiC SBD) | | | |
| | | | | | APT25GR120SSCD10 | D3PAK (SiC SBD) | | | |
| | 2.5 | 40 | 38 | 28 | APT40GR120B2D30 | T-MAX (DQ) | | | |
| | | | | | APT40GR120B2SCD10 | T-MAX (SiC SBD) | | | |
| | 2.5 | 50* | 42 | 32 | APT50GR120JD30 | SOT-227 (DQ) | | | |
| | | | | | 25 kHz | 50 kHz | | | |
| | 2.5 | 70* | 42 | 30 | APT70GR120JD60 | SOT-227 (DQ) | | | |
| | | | | | | | | | |
| 2.5 | 85* | 46 | 31 | APT85GR120JD60 | SOT-227 (DQ) | | | | |
| | | | | | | | | | |



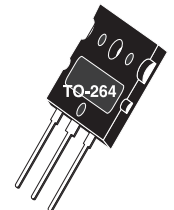
TO-247[B]



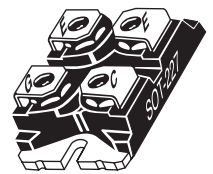
D3PAK



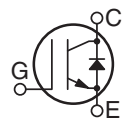
T-MAX®[B2]



TO-264[L]

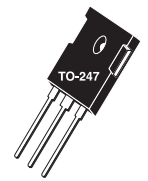


SOT-227



Current at frequency test conditions: T_J = 125°C, T_c = 100°C except SOT-227 where T_c = 80°C, V_{cc} = 67% rated voltage hard switch.

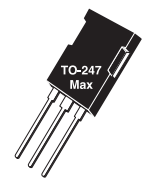
| Field Stop | V _{(BR)CES} (V) | V _{CE(ON)} (V) Typ 25°C | I _{c2} (A) 100°C | Maximum I _c (A) at Frequency | | Part Number | Package Style | | | |
|--|--------------------------|-------------------------------------|------------------------------|--|--------|----------------|------------------|---------|------------------|-----------------|
| | | | | 15 kHz | 30 kHz | | | | | |
| <ul style="list-style-type: none"> • Trench technology • Short circuit rated • Lowest conduction loss • Easy paralleling • Combi with high-speed DQ diode | Single | 600 | 1.5 | 24 | 15 | 10 | APT20GN60BG | TO-247 | | |
| | | | 1.5 | 37 | 20 | 14 | APT30GN60BG | TO-247 | | |
| | | | 1.5 | 64 | 30 | 21 | APT50GN60BG | TO-247 | | |
| | | | 1.5 | 93 | 42 | 30 | APT75GN60BG | TO-247 | | |
| | | | 1.5 | 123 | 75 | 47 | APT150GN60J | SOT-227 | | |
| | | | 1.5 | 135 | 54 | 39 | APT100GN60B2G | T-MAX® | | |
| | | | 1.5 | 190 | 79 | 57 | APT150GN60B2G | T-MAX | | |
| | | | 1.5 | 230 | 103 | 75 | APT200GN60B2G | T-MAX | | |
| | 1200 | Combi (IGBT & "DQ" FRED) | 15 kHz | 30 kHz | 10 kHz | 20 kHz | | | | |
| | | | | | 1.7 | 33 | 19 | 13 | APT25GN120BG | TO-247 or D3PAK |
| | | | | | 1.7 | 46 | 24 | 17 | APT35GN120BG | TO-247 |
| | | | | | 1.7 | 66 | 32 | 22 | APT50GN120B2G | T-MAX |
| | | | | | 1.7 | 70 | 44 | 27 | APT100GN120J | SOT-227 |
| | | | | | 1.7 | 99 | 45 | 30 | APT75GN120B2G | T-MAX or TO-264 |
| | | | | | 1.7 | 120 | 58 | 38 | APT100GN120B2G | T-MAX |
| | | | | | 1.7 | 99 | 60 | 36 | APT150GN120J | SOT-227 |
| | 600 | Single | 1.5 | 24 | 15 | 10 | APT20GN60BDQ1G | TO-247 | | |
| | | | 1.5 | 37 | 20 | 14 | APT30GN60BDQ2G | TO-247 | | |
| | | | 1.5 | 64 | 30 | 21 | APT50GN60BDQ2G | TO-247 | | |
| | | | 1.5 | 93 | 42 | 30 | APT75GN60LDQ3G | TO-264 | | |
| | | | 1.5 | 123 | 75 | 47 | APT150GN60JDQ4 | SOT-227 | | |
| | | | 1.5 | 135 | 54 | 39 | APT100GN60LDQ4G | TO-264 | | |
| | | | 1.5 | 190 | 79 | 57 | APT150GN60LDQ4G | TO-264 | | |
| | | | 1.5 | 158 | 100 | 66 | APT200GN60JDQ4 | SOT-227 | | |
| | 1200 | Combi (IGBT & "DQ" FRED) | 10 kHz | 20 kHz | 1.7 | 22 | 14 | 10 | APT15GN120BDQ1G | TO-247 or D3PAK |
| | | | | | 1.7 | 33 | 19 | 13 | APT25GN120B2DQ2G | T-MAX |
| | | | | | 1.7 | 46 | 24 | 17 | APT35GN120L2DQ2G | 264-MAX™ |
| | | | | | 1.7 | 57 | 36 | 22 | APT75GN120JDQ3 | SOT-227 |
| | | | | | 1.7 | 66 | 32 | 22 | APT50GN120L2DQ2G | 264-MAX |
| | | | | | 1.7 | 70 | 44 | 27 | APT100GN120JDQ4 | SOT-227 |
| | | | | | 1.7 | 99 | 60 | 36 | APT150GN120JDQ4 | SOT-227 |



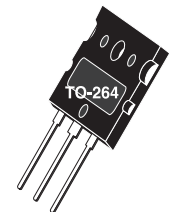
TO-247[B]



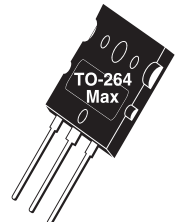
D3PAK



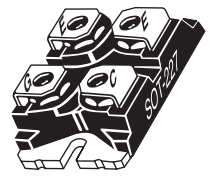
T-MAX®[B2]



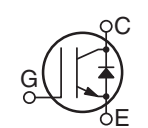
TO-264[L]



264-MAX™[L2]



SOT-227



Part numbers for D3PAK packages—replace “B” with “S” in part number.
Part numbers for TO-264 packages—replace “B2” with “L” in part number.

Current at frequency test conditions: T_J = 125°C, T_c = 100°C except SOT-227 where T_c = 80°C, V_{cc} = 67% rated voltage hard switch.

Silicon Carbide (SiC) MOSFETs

Silicon Carbide (SiC) MOSFETs

Silicon Carbide (SiC) is the ideal technology for higher switching frequency, higher efficiency, and higher power (>650V) applications. Target markets and applications include:

- Commercial aviation: actuation, air conditioning, power distribution
- Industrial: Motor drives, welding, Uninterruptible Power Supply (UPS), SMPS, induction heating
- Transportation/automotive: Electric Vehicle (EV) battery charger, Hybrid Electric Vehicle (HEV) powertrain, DC–DC converter, energy recovery

SiC MOSFET Devices

| Part Number | Voltage (V) | $R_{DS(on)}$ (m Ω) | Package |
|----------------|-------------|----------------------------|-----------|
| MSC090SMA070B | 700 | 90 | TO-247 |
| MSC090SMA070S | | | D3PAK |
| MSC060SMA070B | | 60 | TO-247 |
| MSC060SMA070B4 | | | TO-247-4L |
| MSC060SMA070S | | | D3PAK |
| MSC035SMA070B | | | TO-247 |
| MSC035SMA070B4 | | 35 | TO-247-4L |
| MSC035SMA070S | | | D3PAK |
| MSC015SMA070B | | | TO-247 |
| MSC015SMA070B4 | | 15 | TO-247-4L |
| MSC015SMA070S | | | D3PAK |
| MSC080SMA120B | | 1200 | 80 |
| MSC080SMA120B4 | TO-247-4L | | |
| MSC080SMA120S | D3PAK | | |
| MSC080SMA120J | SOT-227 | | |
| MSC040SMA120B | 40 | | TO-247 |
| MSC040SMA120B4 | | | TO-247-4L |
| MSC040SMA120S | | | D3PAK |
| MSC040SMA120J | | | SOT-227 |
| MSC025SMA120B | 25 | | TO-247 |
| MSC025SMA120B4 | | | TO-247-4L |
| MSC025SMA120S | | | D3PAK |
| MSC025SMA120J | | | SOT-227 |
| MSC750SMA170B | 1700 | 750 | TO-247 |
| MSC750SMA170B4 | | | TO-247-4L |
| MSC750SMA170S | | | D3PAK |
| MSC035SMA170B | | 35 | TO-247 |
| MSC035SMA170B4 | | | TO-247-4L |
| MSC035SMA170S | | | D3PAK |



TO-247-4L



TO-247-3L



D3PAK



SOT-227

- Smart energy: PhotoVoltaic (PV) inverter, wind turbine
- Medical: MRI power supply, x-Ray power supply
- Defense and oil drilling: motor drives, auxiliary power supplies
- Data center: UPS, PDU, PSU (PFC/LLC) power supplies

SiC MOSFET and SiC Schottky barrier diode product lines from Microchip increase your system efficiency over silicon MOSFET and IGBT solutions while lowering your total cost of ownership by enabling downsized systems and smaller/lower cost cooling.

SiC MOSFET Features and Benefits

| Characteristics | Results | Benefits |
|----------------------------------|-----------------------------|-----------------------------|
| Breakdown field (MV/cm) | Lower on-resistance | Higher efficiency |
| Electron sat. velocity (cm/s) | Faster switching | Size reduction |
| Bandgap energy (ev) | Higher junction temperature | Improved cooling |
| Thermal conductivity (W/m.K) | Higher power density | Higher current capabilities |
| Positive temperature coefficient | Self regulation | Easy paralleling |

Advantages Versus Competition: Quality, Supply, Support (QSS)

Quality

- $R_{DS(on)}$ stability over temperature
- High avalanche performance – UIS and repetitive UIS
- Long short circuit withstand time
- No lifetime degradation of the internal body diode

Supply

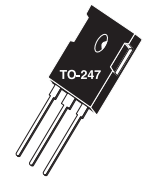
- Multiple qualified sources of substrate and epitaxy material
- Dual fabrication capability
- No EOL policy
- Competitive lead times

Support

- Broad power switching portfolio – Discretes, die and modules
- Microchip's Total System Solution (TSS) – Power stage, gate driver and control solutions
- Expertise and support infrastructure in Aerospace, Defense, Industrial and Automotive

www.microchip.com/SiC

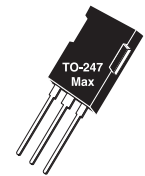
| V_{DSS} (V) | $R_{\text{DS(ON) Max}}$ (Ω) | I_{D} (A) | MOSFET Part Number | I_{D} (A) | FREDFET Part Number | Package Style |
|----------------------|--------------------------------------|--------------------|--------------------|--------------------|---------------------|------------------|
| 1200 | 2.40 | | | 7 | APT7F120B | TO-247 or D3PAK |
| | 2.10 | 8 | APT7M120B | | | TO-247 |
| | 1.20 | | | 14 | APT13F120B | TO-247 or D3PAK |
| | 1.10 | 14 | APT14M120B | | | TO-247 |
| | 0.70 | | | 23 | APT22F120B2 | T-MAX® or TO-264 |
| | 0.63 | 24 | APT24M120B2 | | | T-MAX or TO-264 |
| | 0.58 | | | 27 | APT26F120B2 | T-MAX or TO-264 |
| | 0.58 | | | 18 | APT17F120J | SOT-227 |
| | 0.53 | 29 | APT28M120B2 | | | T-MAX or TO-264 |
| | 0.53 | 19 | APT19M120J | | | SOT-227 |
| | 0.32 | | | 33 | APT32F120J | SOT-227 |
| | 0.29 | 35 | APT34M120J | | | SOT-227 |
| 1000 | 2.00 | | | 7 | APT7F100B | TO-247 |
| | 1.80 | 8 | APT8M100B | | | TO-247 |
| | 1.60 | | | 9 | APT9F100B | TO-247 or D3PAK |
| | 1.40 | 9 | APT9M100B | | | TO-247 |
| | 0.98 | | | 14 | APT14F100B | TO-247 or D3PAK |
| | 0.88 | 14 | APT14M100B | | | TO-247 or D3PAK |
| | 0.78 | | | 17 | APT17F100B | TO-247 or D3PAK |
| | 0.70 | 18 | APT18M100B | | | TO-247 |
| | 0.44 | | | 30 | APT29F100B2 | T-MAX or TO-264 |
| | 0.44 | | | 20 | APT19F100J | SOT-227 |
| | 0.38 | 32 | APT31M100B2 | 35 | APT34F100B2 | T-MAX or TO-264 |
| | 0.38 | 21 | APT21M100J | 23 | APT22F100J | SOT-227 |
| | 0.33 | 37 | APT37M100B2 | | | T-MAX or TO-264 |
| | 0.33 | 25 | APT25M100J | | | SOT-227 |
| | 0.20 | | | 42 | APT41F100J | SOT-227 |
| 0.18 | 45 | APT45M100J | | | SOT-227 | |
| 800 | 0.90 | | | 12 | APT11F80B | TO-247 or D3PAK |
| | 0.80 | 13 | APT12M80B | | | TO-247 |
| | 0.58 | | | 18 | APT17F80B | TO-247 or D3PAK |
| | 0.53 | 19 | APT18M80B | | | TO-247 or D3PAK |
| | 0.43 | | | 23 | APT22F80B | TO-247 or D3PAK |
| | 0.39 | 25 | APT24M80B | | | TO-247 or D3PAK |
| | 0.24 | | | 41 | APT38F80B2 | T-MAX or TO-264 |
| | 0.21 | 43 | APT41M80B2 | 47 | APT44F80B2 | T-MAX or TO-264 |
| | 0.21 | | | 31 | APT29F80J | SOT-227 |
| | 0.19 | 49 | APT48M80B2 | | | T-MAX or TO-264 |
| | 0.19 | 33 | APT32M80J | | | SOT-227 |
| | 0.11 | | | 57 | APT53F80J | SOT-227 |
| | 0.10 | 60 | APT58M80J | | | SOT-227 |



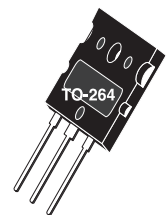
TO-247[B]



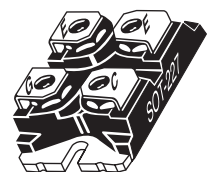
D3PAK



T-MAX® [B2]



TO-264[L]

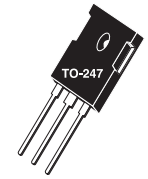


SOT-227
(Isolated Base)

Part numbers for D3PAK packages—replace “B” with “S” in part number.
Part numbers for TO-264 packages—replace “B2” with “L” in part number.

Power MOS 8 MOSFETs/FREDFETs

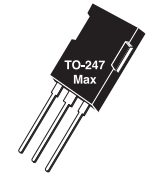
| B_{VDS} (V) | $R_{DS(ON)}$ Max (Ω) | I_D (A) | MOSFET Part Number | I_D (A) | FREDFET Part Number | Package Style |
|---------------|-------------------------------|-----------|--------------------|-----------|---------------------|------------------|
| 600 | 0.37 | | | 19 | APT18F60B | TO-247 or D3PAK |
| | 0.29 | | | 24 | APT23F60B | TO-247 or D3PAK |
| | 0.19 | 36 | APT34M60B | 36 | APT34F60B | TO-247 |
| | 0.15 | 45 | APT43M60B2 | 45 | APT43F60B2 | T-MAX® or TO-264 |
| | 0.15 | 31 | APT30M60J | 31 | APT30F60J | SOT-227 |
| | 0.11 | 60 | APT56M60B2 | 60 | APT56F60B2 | T-MAX or TO-264 |
| | 0.11 | 42 | APT39M60J | 42 | APT39F60J | SOT-227 |
| | 0.09 | 70 | APT66M60B2 | 70 | APT66F60B2 | T-MAX or TO-264 |
| | 0.09 | 49 | APT47M60J | 49 | APT47F60J | SOT-227 |
| | 0.055 | 84 | APT80M60J | 84 | APT80F60J | SOT-227 |
| 500 | 0.24 | | | 24 | APT24F50B | TO-247 or D3PAK |
| | 0.19 | | | 30 | APT30F50B | TO-247 or D3PAK |
| | 0.15 | | | 37 | APT37F50B | TO-247 or D3PAK |
| | 0.13 | | | 43 | APT42F50B | TO-247 or D3PAK |
| | 0.10 | 56 | APT56M50B2 | 56 | APT56F50B2 | T-MAX or TO-264 |
| | 0.10 | 38 | APT38M50J | 38 | APT38F50J | SOT-227 |
| | 0.075 | 75 | APT75M50B2 | 75 | APT75F50B2 | T-MAX or TO-264 |
| | 0.075 | 51 | APT51M50J | 51 | APT51F50J | SOT-227 |
| | 0.062 | 84 | APT84M50B2 | 84 | APT84F50B2 | T-MAX or TO-264 |
| | 0.062 | 58 | APT58M50J | 58 | APT58F50J | SOT-227 |
| | 0.036 | 103 | APT100M50J | 103 | APT100F50J | SOT-227 |



TO-247[B]



D3PAK

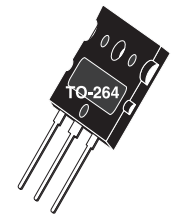


T-MAX [B2]

Part numbers for D3PAK packages—replace “B” with “S” in part number.
Part numbers for TO-264 packages—replace “B2” with “L” in part number.

Low-Voltage Power MOS V[®] MOSFETs/FREDFETs

| B_{VDS} (V) | $R_{DS(ON)}$ Max (Ω) | I_D (A) | MOSFET Part Number | I_D (A) | FREDFET Part Number | Package Style |
|---------------|-------------------------------|-----------|--------------------|-----------|---------------------|------------------|
| 300 | 0.085 | 40 | APT30M85BVRG | | | TO-247 |
| | 0.070 | 48 | APT30M70BVRG | 48 | APT30M70BVFRG | TO-247 or D3PAK |
| | 0.040 | 70 | APT30M40JVR | 70 | APT30M40JVFR | SOT-227 |
| | 0.019 | 130 | APT30M19JVR | 130 | APT30M19JVFR | SOT-227 |
| 200 | 0.045 | 56 | APT20M45BVRG | 56 | APT20M45BVFRG | TO-247 |
| | 0.038 | 67 | APT20M38BVRG | | | TO-247 or D3PAK |
| | 0.022 | 100 | APT20M22B2VRG | | | T-MAX® or TO-264 |
| | 0.011 | 175 | APT20M11JVR | 175 | APT20M11JVFR | SOT-227 |



TO-264[L]



SOT-227
(Isolated Base)

Part numbers for D3PAK packages—replace “B” with “S” in part number.
Part numbers for TO-264 packages—replace “B2” with “L” in part number.

For 250 kHz–2 MHz Switching Applications

The ultra-fast, low gate charge MOSFET family combines the lowest gate charge available in the industry with Microchip’s proprietary self-aligned aluminum metal gate structure. The result is a MOSFET capable of extremely fast switching speeds and very-low switching losses. The metal gate structure and the layout of these chips provide an internal Series Gate Resistance (EGR) an order of magnitude lower than competitive devices built with a polysilicon gate.

These devices are ideally suited for high-frequency and pulsed high-voltage applications.

Typical Applications

- Class D amplifiers up to 2 MHz
- High-voltage pulsed DC
- AM transmitters
- Plasma deposition/etch

Features

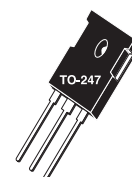
- Series gate resistance (RG) <0.1Ω
- TR and TF times of <10 ns
- Industry’s lowest gate charge

Benefits

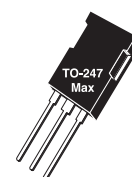
- Fast switching, uniform signal propagation
- Pulse power applications
- Fast switching, reduced gate drive power

| V _{DSS} (V) | R _{DS(on)} Max (Ω) | I _D (A) | MOSFET Part Number | FREDFET Part Number | Package Style |
|----------------------|-----------------------------|--------------------|--------------------|---------------------|------------------|
| 1200 | 4.700 | 3.5 | | APT1204R7BFLLG | TO-247 or D3PAK |
| | 1.400 | 9 | | APT1201R4BFLLG | TO-247 |
| | 0.570 | 22 | APT12057B2LLG | | T-MAX® |
| 1000 | 0.900 | 12 | APT10090BLLG | | TO-247 |
| | 0.780 | 14 | APT10078BLLG | | TO-247 or D3PAK |
| | 0.450 | 23 | APT10045B2LLG | | T-MAX or TO-264 |
| | 0.450 | 21 | APT10045JLL | | SOT-227 |
| | 0.350 | 28 | APT10035B2LLG | | T-MAX |
| | 0.350 | 25 | APT10035JLL | | SOT-227 |
| | 0.260 | 38 | | APT10026L2FLLG | TO-264 MAX |
| | 0.260 | 30 | APT10026JLL | APT10026JFLL | SOT-227 |
| | 0.210 | 37 | APT10021JLL | APT10021JFLL | SOT-227 |
| 800 | 0.140 | 52 | APT8014L2LLG | APT8014L2FLLG | TO-264 MAX |
| | 0.110 | 51 | APT8011JLL | APT8011JFLL | T-MAX or TO-264 |
| | 0.200 | 38 | APT8020B2LL | | T-MAX |
| | 0.200 | 33 | APT8020JLL | | SOT-227 or D3PAK |
| 500 | 0.140 | 35 | APT5014BLLG | | TO-247 |
| | 0.100 | 46 | APT5010B2LLG | APT5010B2FLLG | T-MAX or TO-264 |
| | 0.065 | 67 | APT50M65B2LLG | APT50M65B2FLLG | T-MAX or TO-264 |
| | 0.065 | 58 | APT50M65JLL | APT50M65JFLL | SOT-227 |
| | 0.075 | 51 | APT50M75JLL | APT50M75JFLL | SOT-227 |
| | 0.075 | 57 | APT50M75B2LLG | | T-MAX or TO-264 |
| | 0.050 | 71 | APT50M50JLL | | SOT-227 |
| | 0.038 | 88 | APT50M38JLL | | SOT-227 |

Part numbers for D3PAK packages—replace “B” with “S” in part number.
Part numbers for TO-264 packages—replace “B2” with “L” in part number.



TO-247[B]



T-MAX®[B2]

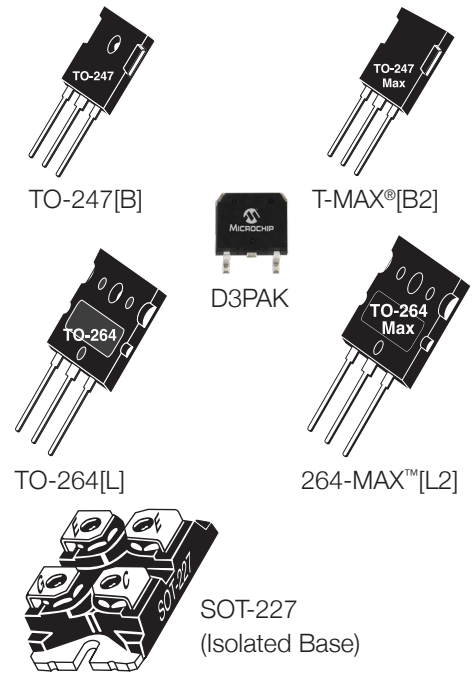


SOT-227
(Isolated Base)

Super Junction MOSFETs

| V_{DS} (V) | $R_{DS(on)}$ (Ω) | $I_{D(CONT)}$ (A) | Part Number | Package Style |
|--------------|---------------------------|-------------------|---------------|------------------|
| 900 | C3 Technology | | | |
| | 0.120 | 36 | APT36N90BC3G | TO-247 |
| 800 | 0.450 | 11 | APT11N80BC3G | TO-247 |
| | 0.145 | 34 | APT34N80B2C3G | T-MAX® or TO-264 |
| | 0.145 | 34 | APT34N80LC3G | TO-264 |
| | 0.035 | 94 | APT94N65B2C3G | T-MAX or TO-264 |
| 650 | 0.070 | 47 | APT47N65BC3G | TO-247 or D3PAK |
| | 0.070 | 47 | APT47N60BC3G | TO-247 or D3PAK |
| 600 | 0.035 | 77 | APT77N60JC3 | SOT-227 |
| | 0.042 | 94 | APT94N60L2C3G | 264-MAX™ |
| 600 | Server Series | | | |
| | 0.045 | 60 | APT60N60BCSG | TO-247 or D3PAK |
| 600 | C6 Technology | | | |
| | 0.041 | 77 | APT77N60BC6 | TO-247 or D3PAK |
| | 0.070 | 53 | APT53N60BC6 | TO-247 or D3PAK |
| | 0.099 | 38 | APT38N60BC6 | TO-247 or D3PAK |
| | 0.125 | 30 | APT30N60BC6 | TO-247 or D3PAK |
| | 0.035 | 106 | APT106N60B2C6 | T-MAX or TO-264 |
| 650 | 0.041 | 85 | APT97N65B2C6 | T-MAX or TO-264 |
| | 0.035 | 94 | APT94N65B2C6 | T-MAX |

Part numbers for D3PAK packages—replace “B” with “S” in part number.
Part numbers for TO-264 packages—replace “B2” with “L” in part number.



Linear MOSFETs

What is a Linear MOSFET?

A MOSFET specifically designed to be more robust than a standard MOSFET when operated with both high voltage and high current near DC conditions (>100 msecs).

The Problem with SMPS MOSFETs

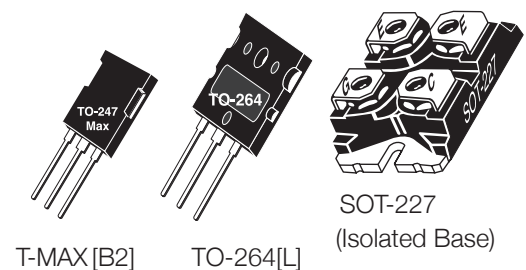
MOSFETs optimized for high-frequency SMPS applications have poor high voltage DC SOA. Most SMPS-type MOSFETs overstate SOA capability at high voltage on the datasheets. Above ~30V and DC conditions, SOA drops faster than is indicated by Power Dissipation (PD) limited operation. For pulsed loads ($t < 10$ ms), there is generally no problem using a standard MOSFET.

Technology Innovation

Introduced in 1999, Microchip modified its proprietary patented self-aligned metal gate MOSFET technology for enhanced performance in high voltage, linear applications.

| V_{DS} (V) | $R_{DS(on)}$ (Ω) | $I_{D(CONT)}$ (A) | SOA (W) | Part Number |
|--------------|---------------------------|-------------------|---------|-------------|
| 600 | 0.125 | 49 | 325 | APL602B2G |
| | 0.125 | 43 | 325 | APL602J |
| 500 | 0.090 | 58 | 325 | APL502B2G |
| | 0.090 | 52 | 325 | APL502J |

Part numbers for D3PAK packages—replace “B” with “S” in part number.
Part numbers for TO-264 packages—replace “B2” with “L” in part number.



These linear MOSFETs typically provide 1.5–2.0 times the DC SOA capability at high voltage compared to other MOSFET technologies optimized for switching applications.

A Design Will Need Linear MOSFETs in the Following Situations

- High current and less than 200 volts at less than 100 milliseconds
- Used as a variable power resistor
- Soft start application (limit surge currents)
- Linear amplifier circuit

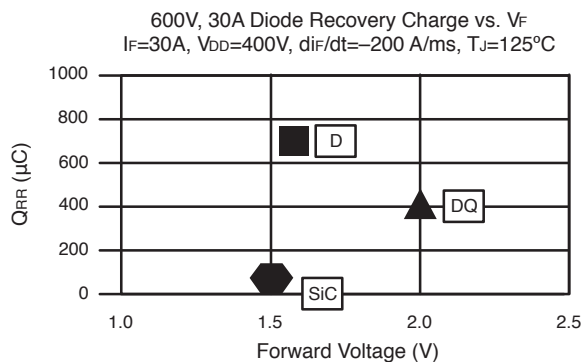
Typical Applications

- Active loads above 200 volts, such as DC dynamic loads for testing power supplies, batteries, fuel cells, etc.
- High voltage, high current, constant current sources

Schottky Barrier Diodes, Fast and Ultra-Fast Recovery Diodes

Microchip offers four series of discrete diode products: the medium-speed medium V_F D series, the high-speed DQ series, the silicon Schottky S series and the SiC Schottky MSCxxxSDxxxx series. These series of diodes are designed to provide high-quality solutions to a wide range of high-voltage, high-power application requirements, ranging from fast recovery for continuous conduction mode power factor correction to low conduction loss for output rectification. The following table summarizes each product family's distinguishing features and potential applications.

The following graph shows the relative recovery speed and forward voltage positions of 600V, D and DQ series diodes.



Fast, Ultra-Fast and Schottky Diodes

| Series | Voltage Ratings | Features | Applications | Comment |
|--------------|--------------------------------|-------------------------------|---|---|
| D | 200, 300, 400, 600, 1000, 1200 | Medium V_F Medium speed | Freewheeling diode Output rectifier DC-DC converter | Proprietary platinum process |
| DQ | 600, 1000, 1200 | High speed Avalanche rated | PFC Freewheeling diode DC-DC converter | Stepped EPI improves softness Proprietary platinum process |
| Schottky | 200 | Low V_F Avalanche rated | Output rectifier Freewheeling diode DC-DC converter | |
| SiC Schottky | 700, 1200, 1700 | Zero reverse recovery | PFC Freewheeling diode DC-DC converter | Low switching losses, high power density and high-temperature operation |

SiC Schottky Barrier Diodes

SiC Schottky Barrier Diode (SBD) Devices

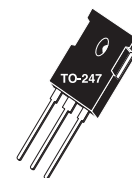
| Part Number | Voltage (V) | I_F (A) | Package |
|---------------------|--|-----------|---------|
| MSC010SDA070B | 700 | 10 | TO-247 |
| MSC010SDA070K | | 10 | TO-220 |
| MSC030SDA070B | | 30 | TO-247 |
| MSC030SDA070K | | 30 | TO-220 |
| MSC050SDA070B | | 50 | TO-247 |
| MSC010SDA120B | 1200 | 10 | TO-247 |
| MSC010SDA120K | | 10 | TO-220 |
| MSC015SDA120B | | 15 | TO-247 |
| MSC015SDA120K | | 15 | TO-220 |
| MSC030SDA120B | | 30 | TO-247 |
| MSC030SDA120K | | 30 | TO-220 |
| MSC030SDA120S | | 30 | D3PAK |
| MSC050SDA120B | | 50 | TO-247 |
| MSC050SDA120S | | 50 | D3PAK |
| MSC010SDA170B | | 1700 | 10 |
| MSC030SDA170B | 30 | | TO-247 |
| MSC050SDA170B | 50 | | TO-247 |
| MSC030SDA070BCT | 700 Dual Diode (Common Cathode) | 2 × 30 | TO-247 |
| MSC050SDA070BCT | 700 Dual Diode (Common Cathode) | 2 × 50 | TO-247 |
| MSC030SDA120BCT | 1200 Dual Diode (Common Cathode) | 2 × 30 | TO-247 |
| MSC050SDA120BCT | 1200 Dual Diode (Common Cathode) | 2 × 50 | TO-247 |
| MSC2X30/31SDA070J | 700 Dual Diode (Anti-parallel/parallel) | 2 × 30 | SOT-227 |
| MSC2X50/51SDA070J | | 2 × 50 | SOT-227 |
| MSC2X100/101SDA070J | | 2 × 100 | SOT-227 |
| MSC2X30/31SDA120J | 1200 Dual Diode (Anti-parallel/parallel) | 2 × 30 | SOT-227 |
| MSC2X50/51SDA120J | | 2 × 50 | SOT-227 |
| MSC2X100/101SDA120J | | 2 × 100 | SOT-227 |



| Volts | I (A) | Volts Typ 25°C | t(ns) Typ 25°C | Q(nC) RR Typ 125°C at I _F = I _F (avg) | Diode Series | Part Number | Package |
|---------------|-------|-------------------|-------------------|--|-----------------|----------------|-----------------|
| Single | | | | | | | |
| 1200 | 15 | 2.8 | 21 | 960 | DQ | APT15DQ120BG | TO-247 |
| | 15 | 2.8 | 21 | 960 | DQ | APT15DQ120KG | TO-220 |
| | 15 | 2.0 | 32 | 1300 | D | APT15D120BG | TO-247 |
| | 15 | 2.0 | 32 | 1300 | D | APT15D120KG | TO-220 |
| | 30 | 2.8 | 24 | 1800 | DQ | APT30DQ120BG | TO-247 |
| | 30 | 2.8 | 24 | 1800 | DQ | APT30DQ120KG | TO-220 |
| | 30 | 2.0 | 31 | 3450 | D | APT30D120BG | TO-247 |
| | 40 | 2.8 | 26 | 2200 | DQ | APT40DQ120BG | TO-247 |
| | 60 | 2.8 | 30 | 2800 | DQ | APT60DQ120BG | TO-247 |
| | 60 | 2.0 | 38 | 4000 | D | APT60D120BG | TO-247 or D3PAK |
| | 75 | 2.8 | 32 | 3340 | DQ | APT75DQ120BG | TO-247 |
| 1000 | 15 | 2.5 | 20 | 810 | DQ | APT15DQ100BG | TO-247 |
| | 15 | 2.5 | 20 | 810 | DQ | APT15DQ100KG | TO-220 |
| | 15 | 1.9 | 28 | 1550 | D | APT15D100KG | TO-220 |
| | 30 | 2.5 | 22 | 1250 | DQ | APT30DQ100BG | TO-247 |
| | 30 | 2.5 | 22 | 1250 | DQ | APT30DQ100KG | TO-247 |
| | 30 | 1.9 | 29 | 2350 | D | APT30D100BG | TO-247 |
| | 40 | 2.5 | 24 | 1430 | DQ | APT40DQ100BG | TO-247 |
| | 60 | 2.5 | 29 | 2325 | DQ | APT60DQ100BG | TO-247 |
| | 60 | 1.9 | 34 | 3600 | D | APT60D100BG | TO-247 or D3PAK |
| | 75 | 2.5 | 33 | 2660 | DQ | APT75DQ100BG | TO-247 |
| 600 | 15 | 2.0 | 16 | 250 | DQ | APT15DQ60BG | TO-247 |
| | 15 | 2.0 | 16 | 250 | DQ | APT15DQ60KG | TO-220 |
| | 15 | 1.6 | 21 | 520 | D | APT15D60BG | TO-247 |
| | 15 | 1.6 | 21 | 520 | D | APT15D60KG | TO-220 |
| | 30 | 2.0 | 19 | 400 | DQ | APT30DQ60BG | TO-247 |
| | 30 | 2.0 | 19 | 400 | DQ | APT30DQ60KG | TO-220 |
| | 30 | 1.6 | 23 | 700 | D | APT30D60BG | TO-247 |
| | 40 | 2.0 | 22 | 480 | DQ | APT40DQ60BG | TO-247 |
| | 60 | 2.0 | 26 | 640 | DQ | APT60DQ60BG | TO-247 |
| | 60 | 1.6 | 40 | 920 | D | APT60D60BG | TO-247 or D3PAK |
| | 75 | 2.0 | 29 | 650 | DQ | APT75DQ60BG | TO-247 |
| 400 | 30 | 1.3 | 22 | 360 | D | APT30D40BG | TO-247 |
| | 60 | 1.3 | 30 | 540 | D | APT60D40BG | TO-247 |
| 200 | 30 | 1.1 | 21 | 150 | D | APT30D20BG | TO-247 |
| | 30 | 0.83 | 25 | 448 | Schottky | APT30S20BG | TO-247 or D3PAK |
| | 60 | 1.1 | 30 | 250 | D | APT60D20BG | TO-247 |
| | 60 | 0.83 | 35 | 490 | Schottky | APT60S20BG | TO-247 or D3PAK |
| | 100 | 0.89 | 40 | 690 | Schottky | APT100S20BG | TO-247 |



D3PAK



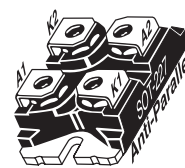
TO-247[B]

Part numbers for D3PAK—replace “B” with “S” in part number.

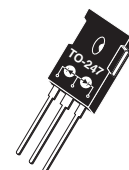
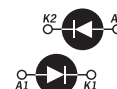
Si Schottky Barrier Diodes, Fast and Ultra-Fast Recovery Diodes

| Volts | I (A) | Volts Typ 25°C | t(ns) Typ 25°C | Q(nC) RR Typ 125°C at I _F = I _F (avg) | Diode Series | Part Number | Package |
|-------------|-------|-------------------|-------------------|--|--------------|----------------|---------------|
| Dual | | | | | | | |
| 1200 | 2x27 | 2 | 31 | 3450 | D | APT2X30D120J | SOT-227 |
| | 2x30 | 2.6 | 25 | 1800 | DQ | APT2X30DQ120J | SOT-227 |
| | 2x53 | 2.0 | 38 | 4000 | D | APT2X60D120J | SOT-227 |
| | 2x60 | 2.5 | 30 | 2890 | DQ | APT2X60DQ120J | SOT-227 |
| | 2x93 | 2.0 | 47 | 5350 | D | APT2X100D120J | SOT-227 |
| | 2x100 | 2.4 | 45 | 5240 | DQ | APT2X100DQ120J | SOT-227 |
| 1000 | 2x28 | 1.9 | 29 | 2350 | D | APT2X30D100J | SOT-227 |
| | 2x55 | 1.9 | 34 | 3600 | D | APT2X60D100J | SOT-227 |
| | 2x60 | 2.2 | 30 | 2350 | DQ | APT2X60DQ100J | SOT-227 |
| | 2x95 | 1.9 | 43 | 4050 | D | APT2X100D100J | SOT-227 |
| | 2x100 | 2.1 | 45 | 3645 | DQ | APT2X100DQ100J | SOT-227 |
| 600 | 2x30 | 1.8 | 20 | 400 | DQ | APT2X30DQ60J | SOT-227 |
| | 2x30 | 1.6 | 23 | 700 | D | APT2X30D60J | SOT-227 |
| | 2x60 | 1.7 | 27 | 650 | DQ | APT2X60DQ60J | SOT-227 |
| | 2x60 | 1.6 | 40 | 920 | D | APT2X60D60J | SOT-227 |
| | 2x100 | 1.6 | 30 | 980 | DQ | APT2X100DQ60J | SOT-227 |
| | 2x100 | 1.6 | 34 | 1450 | D | APT2X100D60J | SOT-227 |
| 400 | 2x30 | 1.3 | 22 | 360 | D | APT2X30D40J | SOT-227 |
| | 2x60 | 1.3 | 30 | 540 | D | APT2X60D40J | SOT-227 |
| | 2x100 | 1.3 | 37 | 1050 | D | APT2X100D40J | SOT-227 |
| 300 | 2x100 | 1.2 | 36 | 650 | D | APT2X101D30J | SOT-227 |
| 200 | 2x30 | 0.80 | 25 | 448 | Schottky | APT2X31S20J | SOT-227 |
| | 2x60 | 0.83 | 35 | 490 | Schottky | APT2X61S20J | SOT-227 |
| | 2x100 | 1.1 | 39 | 840 | D | APT2X100D20J | SOT-227 |
| | 2x100 | 0.89 | 40 | 690 | Schottky | APT2X101S20J | SOT-227 |
| 1000 | 2x30 | 2.8 | 26 | 2100 | DQ | APT30DQ120BCTG | TO-247 [BCT] |
| | 2x15 | 2.5 | 20 | 810 | DQ | APT15DQ100BCTG | TO-247 [BCT] |
| | 2x15 | 1.9 | 28 | 1550 | D | APT15D100BCTG | TO-247 [BHB] |
| | 2x30 | 1.9 | 29 | 2360 | D | APT30D100BCTG | TO-247 [BHB] |
| | 2x30 | 1.9 | 30 | 2350 | D | APT30D100BHBG | TO-247 [BCA] |
| | 2x60 | 2.5 | 29 | 2325 | DQ | APT60DQ100LCTG | TO-264 [LCT] |
| | 2x60 | 1.9 | 35 | 3600 | D | APT60D100LCTG | TO-264 [LCT] |
| | 2x15 | 1.6 | 21 | 520 | D | APT15D60BCTG | TO-247 |
| 600 | 2x15 | 2.0 | 15 | 250 | DQ | APT15DQ60BCTG | TO-247 [BCT] |
| | 2x15 | 1.6 | 20 | 520 | D | APT15D60BCAG | TO-247 [BCA] |
| | 2x30 | 2.0 | 22 | 480 | DQ | APT30DQ60BHBG | TO-247 [BHB] |
| | 2x30 | 2.0 | 19 | 400 | DQ | APT30DQ60BCTG | TO-247 [BCT] |
| | 2x30 | 1.6 | 23 | 700 | D | APT30D60BCTG | TO-247 [BCT] |
| | 2x30 | 1.6 | 25 | 700 | D | APT30D60BHBG | TO-247 [BHB] |
| | 2x30 | 1.6 | 25 | 700 | D | APT30D60BCAG | TO-247 [BCA] |
| | 2x40 | 2.0 | 22 | 480 | DQ | APT40DQ60BCTG | TO-247 [BCT] |
| | 2x60 | 2.0 | 26 | 640 | DQ | APT60DQ60BCTG | TO-247 [BCT] |
| | 2x60 | 1.6 | 30 | 920 | D | APT60D60LCTG | TO-264 [LCT] |
| 400 | 2x30 | 1.3 | 22 | 360 | D | APT30D40BCTG | TO-247 [BCT] |
| | 2x60 | 1.3 | 30 | 540 | D | APT60D40LCTG | TO-264 [LCT] |
| 300 | 2x30 | 1.2 | 25 | 1300 | D | APT30D30BCTG | TO-247 [BCT] |
| 200 | 2x30 | 1.1 | 21 | 150 | D | APT30D20BCTG | TO-247 [BCT] |
| | 2x30 | 1.1 | 21 | 150 | D | APT30D20BCAG | TO-247 [BCA] |
| | 2x30 | 0.80 | 25 | 448 | Schottky | APT30S20BCTG | TO-247 [BCT] |
| | 2x60 | 0.83 | 35 | 490 | Schottky | APT60S20B2CTG | T-MAX® [B2CT] |
| | 2x100 | 0.89 | 40 | 690 | Schottky | APT100S20LCTG | TO-264 [LCT] |

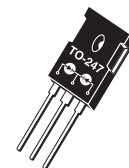
Part numbers for parallel configuration: replace 30, 60, or 100 with 31, 61, or 101, unless Schottky.
Example: 2X30D120J becomes 2X31D120J.



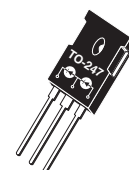
SOT-227
Antiparallel
Configuration
(Isolated Base)



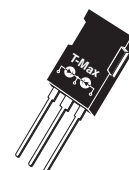
TO-247[BCA]
Common anode



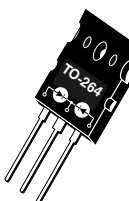
TO-247[BCT]
Common cathode



TO-247[BHB]
Half-bridge



T-MAX® [B2CT]
Common cathode



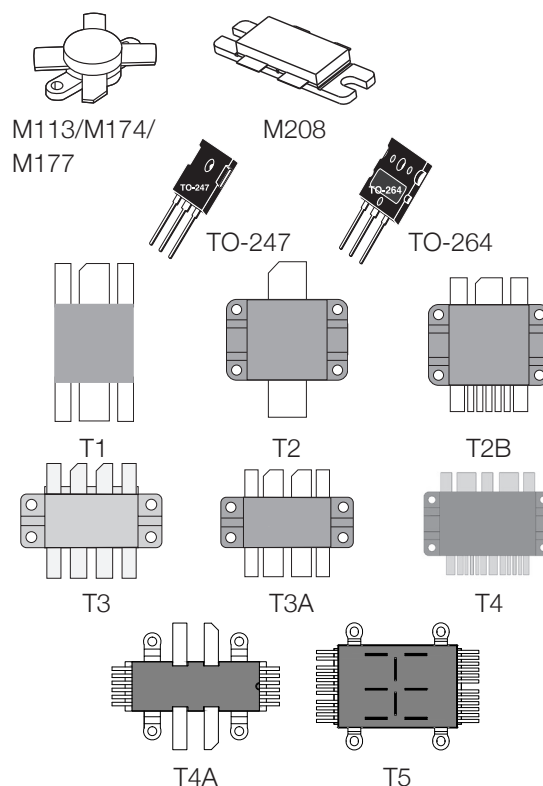
TO-264[LCT]
Common cathode

The ARF family of RF power MOSFETs is optimized for applications requiring frequencies as high as 150 MHz and operating voltages as high as 400V. Historically, RF power MOSFETs were limited to applications of 50V or less. This limitation has been removed by combining Microchip's high-voltage MOSFET technology with RF-specific die geometries.

Higher V_{DD} means higher load impedance. For 150W output from a 50V supply, the load impedance is only 8Ω . At 125V, the load impedance is 50Ω . The higher impedance allows

simpler transformers and combiners. Paralleled devices can still operate into reasonable and convenient impedances. The increased operating voltage also lowers the DC current required for any given power output, increasing efficiency and reducing the size, weight and cost of other system components. High breakdown voltage is a necessity in high-efficiency switchmode amplifiers, such as class C-E, which can see peak drain voltages of over 4x the applied V_{DD} .

| Part Number | P _{OUT} (W) | Freq. (MHz) | V _{DD} /B _V DSS (V) | R _{thJC} (°C/W) | Package Style | Class of Operation |
|-----------------|----------------------|-------------|---|--------------------------|---------------|--------------------|
| ARF449AG/BG | 90 | 120 | 150/450 | 0.76 | TO-247 | A-E |
| ARF463AG/BG | 100 | 100 | 125/500 | 0.7 | TO-247 | A-E |
| ARF463AP1G/BP1G | 100 | 100 | 125/500 | 0.7 | TO-247 | A-E |
| ARF446G/ARF447G | 140 | 65 | 250/900 | 0.55 | TO-247 | A-E |
| ARF460AG/BG | 150 | 65 | 125/500 | 0.5 | TO-247 | A-E |
| ARF461AG/BG | 150 | 65 | 250/1000 | 0.5 | TO-247 | A-E |
| ARF465AG/BG | 150 | 60 | 300/1200 | 0.5 | TO-247 | A-E |
| ARF468AG/BG | 270 | 45 | 165/500 | 0.38 | TO-264 | A-E |
| ARF475FL | 300 | 150 | 165/500 | 0.31 | T3A | A-E |
| ARF476FL | 300 | 150 | 165/500 | 0.31 | T3 | A-E |
| ARF466AG/BG | 300 | 45 | 200/1000 | 0.35 | TO-264 | A-E |
| ARF466FL | 300 | 45 | 200/1000 | 0.13 | T3A | A-E |
| ARF469AG/BG | 350 | 45 | 165/500 | 0.28 | TO-264 | A-E |
| ARF477FL | 400 | 65 | 165/500 | 0.18 | T3A | A-E |
| ARF1500 | 750 | 40 | 125/500 | 0.12 | T1 | A-E |
| ARF1501 | 750 | 40 | 250/1000 | 0.12 | T1 | A-E |
| ARF1510 | 750 | 40 | 700/1000 | 0.12 | T1 | D |
| ARF1511 | 750 | 40 | 380/500 | 0.12 | T1 | D |
| ARF1519 | 750 | 25 | 250/1000 | 0.13 | T2 | A-E |



High-Frequency RF MOSFETs

The VRF family of RF MOSFETs includes improved replacements for industry-standard RF transistors. They provide improved ruggedness by increasing the B_{VDSS} over 30 percent from the industry-standard 125V to 170V minimum. Low-cost flangeless packages are another improvement that shows Microchip's dedication to optimizing performance, reducing cost and improving reliability. We will continue to offer more products with the new reduced-cost flangeless packages.

| Part Number | P _{OUT} (W) | Freq. (MHz) | Gain Typ (dB) | Eff. Typ (%) | V _{DD} /B _V DSS (V) | R _{thJC} (°C/W) | Package Style |
|-------------|----------------------|-------------|---------------|--------------|---|--------------------------|---------------|
| VRF141 | 150 | 175 | 13 | 45 | 28/80 | 0.60 | M174 |
| VRF151 | 150 | 175 | 14 | 50 | 65/170 | 0.60 | M174 |
| VRF152 | 150 | 175 | 14 | 50 | 50/140 | 0.60 | M174 |
| VRF150 | 150 | 150 | 11 | 50 | 65/170 | 0.60 | M174 |
| VRF161 | 200 | 175 | 25 | 50 | 65/170 | 0.50 | M177 |
| VRF151G | 300 | 175 | 16 | 55 | 65/170 | 0.30 | M208 |
| VRF2933 | 300 | 150 | 25 | 50 | 65/170 | 0.27 | M177 |
| VRF2944 | 400 | 150 | 25 | 50 | 65/170 | 0.22 | M177 |
| VRF154FL | 600 | 30 | 17 | 45 | 65/170 | 0.13 | T2 |
| VRF157FL | 600 | 30 | 21 | 45 | 65/170 | 0.13 | T2 |
| VRF164FL | 600 | 30 | 21 | 45 | 65/170 | 0.10 | T2 |

Drivers and Driver-RF MOSFET Hybrids

The DRF1200/01 hybrids integrate drivers, bypass capacitors and RF MOSFETs into a single package. Integration maximizes amplifier performance by minimizing transmission line parasitics between the driver and the MOSFET. The DRF1300 and DRF1301 have two independent channels, each containing a driver and RF MOSFET in a push-pull configuration. The DRF1400 is a half-bridge hybrid with symmetrically oriented leads that can be easily configured into a full-bridge converter. The DRF1510 is a full bridge product optimized for maximum efficiency in class D amplifiers. All DRF parts feature a proprietary anti-ring function to eliminate cross conduction in bridge or push-pull topologies. All DRF parts can be externally selected in either an inverting or non-inverting configuration.

| Part Number | P _{OUT} (W) | Freq. (MHz) | V _{DD} /B _{VDDSS} (V) | Package Style | Class of Operation |
|-------------|----------------------|-------------|---|---------------|--------------------|
| DRF1200 | 400 | 30 | 15/1000 | T2B | D-E |
| DRF1201 | 600 | 30 | 15/1000 | T2B | D-E |
| DRF1300 | 1000 | 30 | 15/500 | T4 | D-E |
| DRF1301 | 1000 | 30 | 15/1000 | T4 | D-E |
| DRF1400 | 1000 | 30 | 15/500 | T4 | D-E |
| DRF1211 | 600 | 30 | 15/500 | T2B | D-E |
| DRF1410 | 1000 | 30 | 15/500 | T4A | D-E |
| DRF1510 | 2000 | 30 | 15/500 | T5 | D-E |

RF Reference Designs

DRF1200/CLASS-E, 13.56 MHz DRF1200/CLASS-E, 27.12 MHz

The DRF1200/Class-E single-ended RF generator is a reference design that allows the designer to evaluate an 85 percent efficient 1000 W Class-E RF generator.

DRF1300/CLASS-D, 13.56 MHz

The DRF1300/Class-D push-pull RF generator is a reference design that allows the designer to evaluate an 80-percent efficient 2000 W Class-D RF generator.

DRF1400/Class-D, 13.56 MHz

The DRF1400/Class-D half-bridge RF generator is a reference design that allows the designer to evaluate an 85-percent efficient 2500 W Class-D RF generator.

Microchip combines a formidable array of technologies in semiconductors, packaging and automated manufacturing to produce a wide range of high-quality modules optimized for the following traits:

- Reliability
- Efficiency and electrical performance
- Low cost
- Space savings
- Reduced assembly time

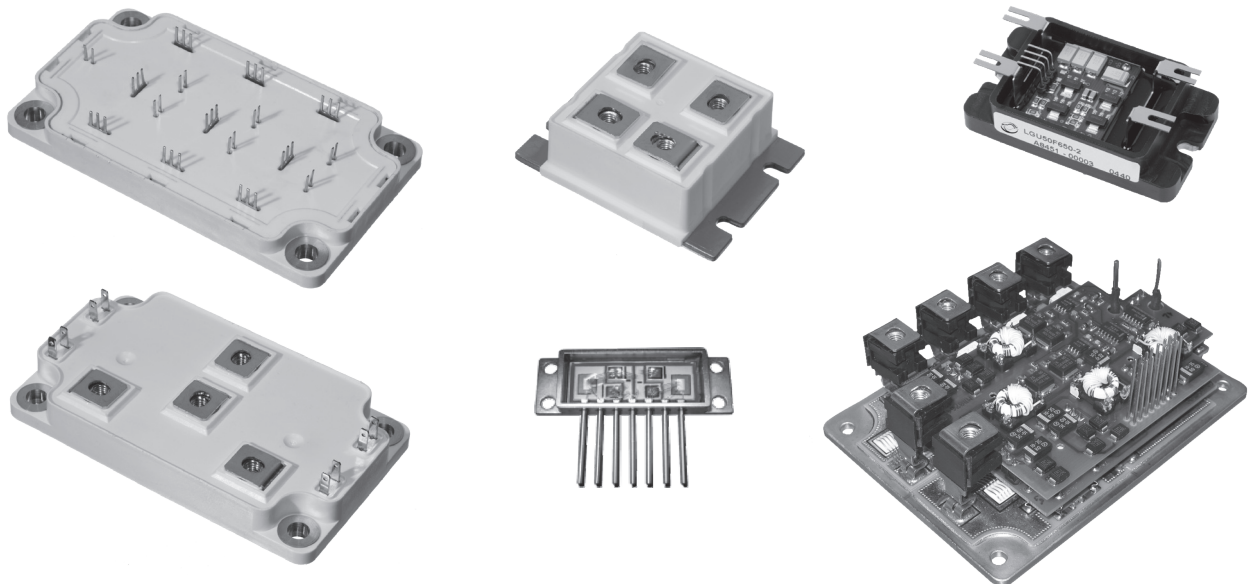
The readily available standard module product line spans a wide selection of semiconductor (including Silicon Carbide) circuit topologies, voltage and current ratings, and packages. If you need even more flexibility or intellectual property protection, we can customize a standard module with a low setup cost and short lead time. Unique requirements can be met with Application Specific Power Modules (ASPM).

Microchip serves a broad spectrum of industrial applications for welding, solar, induction heating, medical, UPS, motor control and SMPS markets as well as high-reliability applications for semicap, defense and aerospace markets. A wide selection of construction materials enables Microchip to manufacture modules with the following features:

- Extended temperature range: -60°C to 200°C
- High-reliability
- Reduced size and weight
- High-reliability testing and screening options
- Short lead times

Microchip's experience and expertise in power electronic conversion brings the most effective technical support for your new development.

- Isolated gate driver
- Snubbers
- Mix-and-match semiconductors
- Short-circuit protection
- Temperature and current sensing
- Parameter binning



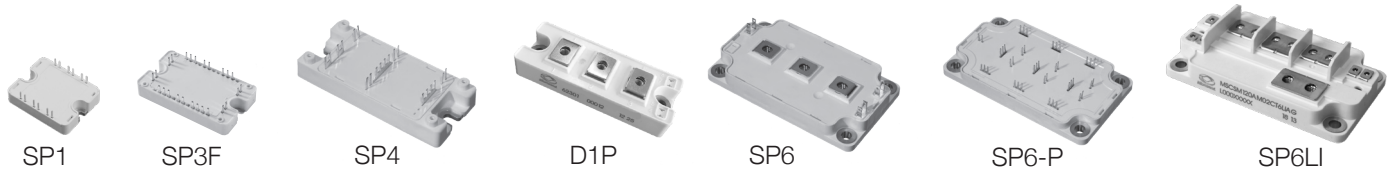
Standard Electrical Configurations

Microchip offers a wide range of standard electrical configurations housed in a variety of packages to match your specific needs for high power-density and performance. Various semiconductor types are offered in the same topology.

| Electrical Topology | IGBT 600V–1700V | MOSFET 75V–1200V | Diode 200V–1700V | Mix Si-SiC 600V–1200V | Full SiC 600V–1700V |
|--|--------------------|--------------------------|---------------------|--------------------------|------------------------|
| Asymmetrical bridge | • | • | | | |
| Boost buck | • | • | | | |
| Boost and buck chopper | • | • | | • | • |
| Common anode | | | • | | |
| Common cathode | | | • | | |
| Dual boost and buck chopper | • | • | | • | |
| Dual common source | • | • | | | |
| Dual diode | | | | | • |
| Full bridge | • | • | • | | • |
| Full bridge with PFC | • | • | | • | |
| Full bridge with secondary fast rectifier bridge | • | • | | • | |
| Full bridge with series and parallel diodes | | • | | • | |
| Interleaved PFC | • | • | | | |
| Linear single and dual switch | | • | | | |
| Phase leg | • | • | • | | • |
| Phase leg intelligent | • | | | | |
| Phase leg with PFC | | • | | • | |
| Phase leg with series and parallel diodes | | • | | • | |
| Single switch | • | • | • | | |
| Single switch with series and parallel diodes | | • | | • | |
| Single switch with series diodes | • | • | | | |
| 3-Level NPC inverter | • | | | | • |
| 3-Level T-Type inverter | • | | | • | • |
| 3-Phase bridge | • | | • | | |
| Triple dual common source | • | • | | | |
| Triple phase leg | • | • | | • | • |
| | Trench3 | MOSFET | FRED | IGBT | Diode |
| | Trench4 | FREDFET | Std Rectifier | MOSFET | MOSFET |
| | Trench4 Fast | Super Junction MOSFET | | Diode | |
| | Trench5 | | | | |

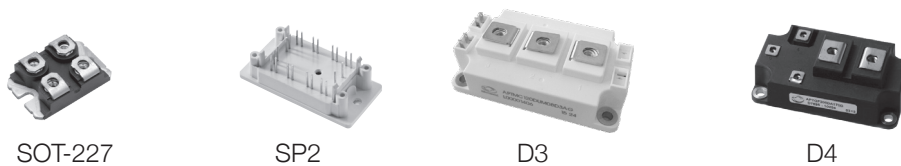
Improved Low-Profile Packages

- SP1 (12 mm)
- SP3F (12 mm)
- SP4 (17 mm)
- SP6 (17 mm)
- SP6-P (12 mm)
- SP6LI (17 mm)

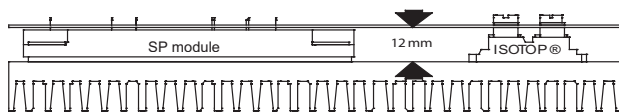


Industry-Standard Packages

- SOT-227 (ISOTOP®)
- SP2 (17 mm)
- D3 (62 mm wide)
- D4 (62 mm wide)



Package Advantages



SP1 package

- Replaces two SOT-227 parts
- Improved assembly time and cost
- Height compatible with SOT-227
- Copper base plate

SP3F package

- Replaces up to four SOT-227 parts
- Reduced assembly time and cost
- Height compatible with SOT-227
- Copper base plate

SP6 package

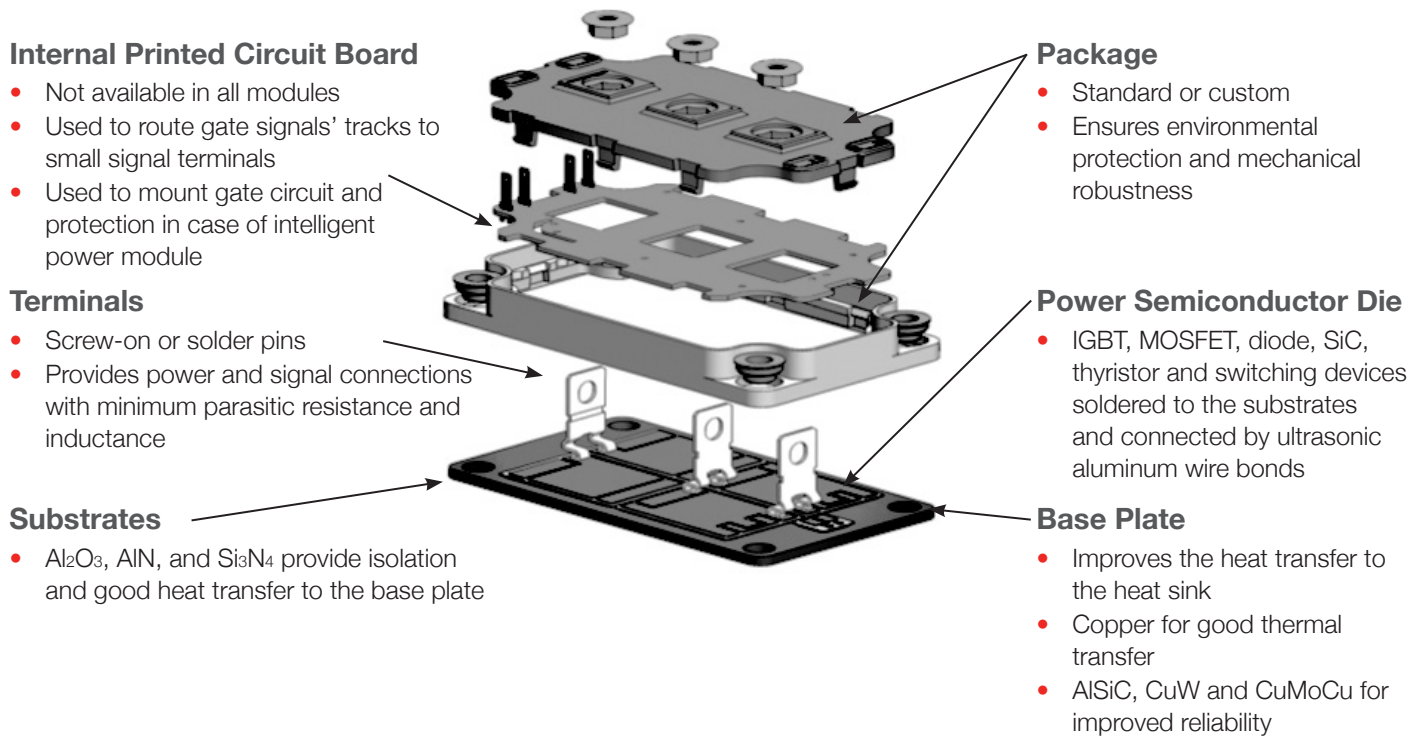
- Offers the same footprint and the same pinout location as the popular 62 mm package but with lower height, giving it the following advantages:
 - Reduced stray inductance
 - Reduced parasitic resistance
 - Higher efficiency at high frequency

SP6-P package

- Replaces up to six SOT-227 parts
- Height compatible with SOT-227
- Low-inductance solder pins
- High current capability

Custom Power Modules

Microchip created the ASPM concept, and has been offering customized power modules since 1983. We offer a complete engineered solution with mix-and-match capabilities in term of package, configuration, performance and cost.



The following table shows the three customization levels

| Change Options: | Die | Substrate | Base Plate | Plastic Lid | Terminals | NRE Level | MOQ |
|--|---------|---------------------|--------------------|--------------------|-----------|----------------|----------------|
| Electrical/thermal performance | Die P/N | Material | Material | | | None to low | |
| Electrical/thermal performance and electrical configuration | Die P/N | Material and layout | Material | | | Low to medium | 5 to 10 pieces |
| Electrical/thermal performance, and electrical configuration, and module housing | Die P/N | Material and layout | Material and shape | Material and shape | Shape | Medium to high | |

Microchip power modules are made of different sub-elements. Most of them are standard and can be reused to build infinite solutions for the end user. Microchip offers optimum development cost and cycle time thanks to long-term experience and a wide range of available technologies.

Power Modules Features

- High power density
- Isolated and highly thermally-conductive substrate
- Internal wiring
- Minimum parasitics
- Minimum output terminals
- Mix-and-match components
- Fully engineered solutions

Customer Benefits

- Size and cost reduction
- Excellent thermal management
- Reduced external hardware
- Improved performance
- Reduced assembly time
- Optimizes losses
- Easy to upgrade, lower part count, shorter time to market and IP protection

Flexibility

- Great level of integration
- Mix of silicon within the same package
- No quantity limitation

Technology

- Application oriented

Packaging Capability

- Standard and custom packages
- Standard and custom terminals
- Various substrate technologies

Reliability

- Coefficient of thermal expansion matching

Applications

- Solar, welding, plasma cutting, semicap, MRI and X-ray, EV/HEV, induction heating, UPS, motor control, data communication

Rugged Custom Power Modules

Microchip has acquired much experience and know-how in module customization that addresses rugged and wide temperature range applications, offering solutions to meet the expectations of next-generation integrated power systems for the following attributes:

- Improved reliability
- Wider operating temperatures
- Higher power
- Higher efficiency
- Lower weight and size
- Lower cost

Applications

- Avionics actuation system
- Avionics lift and pump
- Military ground vehicle
- Power supply and motor control
- Navy ship auxiliary power supply
- Down hole drilling

Test Capabilities

- X-Ray inspection
- Dielectric test (up to 6 kV)
- Electrical testing at specified temperature
- Burn-in
- Acoustic imaging

Reliability Testing Capabilities

- Power cycling
- Hermetic sealing
- Moisture
- Salt atmosphere
- HTGB
- Temperature shock
- HAST
- H3TRB
- Altitude
- Mechanical shock, vibration

Expertise Capabilities

- Cross-sectioning
- Structural analysis

All tests can be conducted upon demand by sampling or at 100 percent. Tests can be performed in-house or in an external lab.

Our Core Competencies

- Extensive experience with rugged solutions for harsh environments
- Wide range of silicon technologies
- Wafer fab capabilities
- Mix of assembly technologies
- Hermetic and robust plastic packages
- Custom test and burn-in solutions
- ISO9001-certified
- End-of-life (obsolescence) management
- Thermal management
- Material expertise
- Product life management and risk analysis

Various proposed solutions offer different costs and low volume of entry

| | Industrial Application | Extended Temp. Application | Harsh Environment Application | |
|--------------------------|------------------------|----------------------------|-------------------------------|--|
| Standard module | • | | | No NRE Low-volume entry |
| Modified standard module | • | • | | Low NRE Low-volume entry |
| Custom module | • | • | • | Medium to high NRE Low-volume entry |

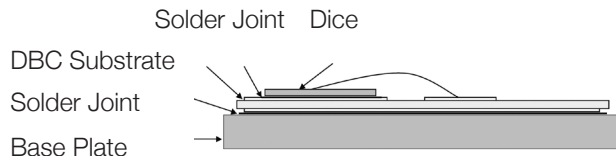
Module performance and reliability depends on the choice of assembly materials

Temperature Coefficients of Expansion (TCEs) with more closely matched materials increase the module's lifetime by reducing the stress at both the interface and interior of the materials.

The higher the thermal conductivity, the lower the junction-to-case thermal resistance and the lower the delta of junction temperature of the device during operation. This will minimize the effect of power cycling on the dice.

Another important feature is the material density, particularly for the baseplate. Taking copper as the reference, AlSiC has a density of 1/3, while CuW has twice the density. Therefore, AlSiC will provide substantial weight reduction while increasing reliability.

| | CTE (ppm/K) | Thermal Conductivity (W/m.K) | R _{θJC} or R _{THJC} (K/W) |
|--------------------------------------|-------------|------------------------------|---|
| Silicon die (120 mm ²) | 4 | 136 | |
| Cu/Al ₂ O ₃ | 17/7 | 390/25 | 0.35 |
| AlSiC/Al ₂ O ₃ | 7/7 | 170/25 | 0.38 |
| Cu/AlN | 17/5 | 390/170 | 0.28 |
| AlSiC/AlN | 7/5 | 170/170 | 0.31 |
| AlSiC/Si ₃ N ₄ | 7/3 | 170/60 | 0.31 |



| | Material | CTE (ppm/K) (W/m.K) | Thermal Conductivity | Density (g/cc) |
|------------|--------------------------------|---------------------|----------------------|----------------|
| Base plate | CuW | 6.5 | 190 | 17 |
| | AlSiC | 7 | 170 | 2.9 |
| | Cu | 17 | 390 | 8.9 |
| Substrate | Al ₂ O ₃ | 7 | 25 | |
| | AlN | 5 | 170 | |
| | Si ₃ N ₄ | 3 | 60 | |
| Die | Si | 4 | 136 | |
| | SiC | 2.6 | 270 | |

Power Module Part Numbering System

IGBT Modules

| APT MSC | GL | 475 | A | 120 | T | D3 | G |
|------------|----|-----|----|-----|----|-----|------|
| I | II | III | IV | V | VI | VII | VIII |

| | |
|------|--|
| I | TradeMark |
| II | IGBT Type: GL = TRENCH 4 GLQ = High-speed TRENCH 4 GT = TRENCH 3 GTQ = TRENCH 5 GV = Mix NPT/TRENCH CV = Mix TRENCH/Super Junction MOSFET |
| III | Current: I_c at $T_c = 80^\circ\text{C}$ |
| IV | Topology: A = Phase Leg BB = Boost Buck DA = Boost Chopper DDA = Double Boost Chopper DH = Asymmetrical Bridge DSK = Double Buck Chopper DU = Dual Common Source H = Full Bridge HR = T-Type 3-Level SDA = Double Boost + Bypass Diode SK = Buck Chopper TA = Triple Phase Leg TDU = Triple Dual Common Source TL = Three Level U = Single Switch VDA = Interleaved PFC X = Three Phase Bridge |
| V | Blocking Voltage: 60 = 600V 120 = 1200V 170 = 1700V |
| VI | Option: A = AlN Substrate C = SiC Diode D = Series Diode T = Temperature Sensor W = Clamping Parallel Diode |
| VII | Package: 1 = SP1 2 = SP2 3 = SP3F P = SP6-P D3 = D3 (62 mm) D4 = D4 (62 mm) |
| VIII | G = RoHS-compliant |

MOSFET Modules

| APT MSC | C | 60 | DA | M24 | T | 1 | G |
|------------|----|-----|----|-----|----|-----|------|
| I | II | III | IV | V | VI | VII | VIII |

| | |
|------|--|
| I | TradeMark |
| II | MOSFET Type: SM = SiC MOSFET M = MOSFET C = Super Junction MOSFET |
| III | Blocking Voltage: 08 = 75V 10 = 100V 20 = 200V 50 = 500V 60 = 600V 70 = 700V 80 = 800V 100 = 1000V 120 = 1200V 170 = 1700V |
| IV | Topology: A = Phase Leg BB = Boost Buck DA = Boost Chopper DDA = Double Boost Chopper DH = Asymmetrical Bridge DSK = Double Buck Chopper DU = Dual Common Source H = Full Bridge HR = T-Type 3-Level SDA = Double Boost and Bypass Diode SK = Buck Chopper TA = Triple Phase Leg TDU = Triple Dual Common Source TL = Three Level NPC U = Single Switch VDA = Interleaved PFC |
| V | $R_{DS(on)}$ at $T_c = 25^\circ\text{C}$ 240 = 2400 m Ω 24 = 240 m Ω M24 = 24 m Ω |
| VI | Option: A = AlN Substrate C = SiC Diode D = Series Diode F = FREDFET S = Series and Parallel Diodes T = Temperature Sensor U = Ultra-fast FREDFET |
| VII | Package: 1 = SP1, SP1F 2 = SP2 3 = SP3F P = SP6-P LI = SP6LI |
| VIII | G = RoHS-compliant |

Diode Modules

| APT MSC | DR | 90 | X | 160 | 1 | G |
|------------|----|-----|----|-----|----|-----|
| I | II | III | IV | V | VI | VII |

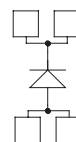
| | |
|-----|---|
| I | TradeMark |
| II | Diode Type: DF = FRED DR = Standard Rectifier DC = SiC DSK = Schottky |
| III | Current: I_f at $T_c = 80^\circ\text{C}$ |
| IV | Topology: AA = Dual Common Anode BB = Boost Buck AK = Dual Series KK = Dual Common Cathode H = Single Phase Bridge U = Single Switch X = Three Phase Bridge |
| V | Blocking Voltage: 20 = 200V 40 = 400V 60 = 600V 70 = 700V 100 = 1000V 120 = 1200V 160 = 1600V 170 = 1700V |
| VI | Package: 1 = SP1 3 = SP3F D1P = D1P |
| VII | G = RoHS-compliant |

Optional Materials

Optional materials are available upon demand for most of the listed standard power modules. Options are indicated with a letter in the suffix of the module part number. The temperature sensor option is listed as "YES" or "OPTION" when available for a standard part or on-demand.

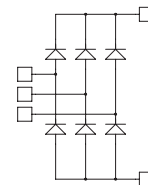
The following tables list the options available for our product categories.

- A** AlN substrate for higher thermal conductivity
- M** AlSiC base plate material for improved temperature cycling capabilities
- T** Temperature sensor (NTC or PTC) for case temperature information
- C** SiC diode for higher efficiency
- N** Si₃N₄ substrate
- E** Press fit terminals (for SP3F package only)
- X** Gold pin terminals (SP1 only)
- L** Phase change material option



Diode Power Modules

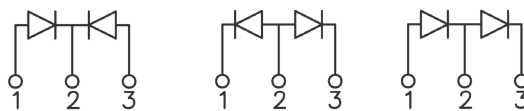
| V_{RRM} (V) | Diode Type | I_F (A) $T_C = 80^\circ\text{C}$ | V_F (V) $T_C = 80^\circ\text{C}$ | Package (see page 20) | Part Number |
|---------------|------------|------------------------------------|------------------------------------|-----------------------|---------------|
| 200 | FRED | 500 | 1.1 | LP4 | APTDF500U20G |
| 400 | | 500 | 1.5 | | APTDF500U40G |
| 600 | | 450 | 1.8 | | APTDF450U60G |
| 1000 | | 430 | 2.3 | | APTDF430U100G |
| 1200 | | 400 | 2.5 | | APTDF400U120G |



Single Diode

| V_{RRM} (V) | Diode Type | I_F (A) $T_C = 80^\circ\text{C}$ | V_F (V) $T_J = 25^\circ\text{C}$ | Package (see page 20) | Part Number |
|---------------|------------|------------------------------------|------------------------------------|-----------------------|---------------|
| 1600 | Rectifier | 40 | 1.3 | SP1 | APTDR40X1601G |
| | | 90 | 1.3 | SP1 | APTDR90X1601G |

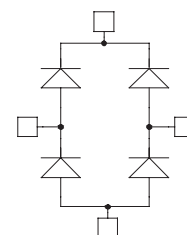
Common Cathode– Common Anode–Doubler

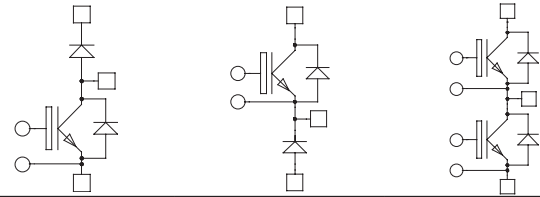


| V_{RRM} (V) | Diode Type | I_F (A) per Diode | V_F (V) $T_J = 25^\circ\text{C}$ | Package (see page 20) | Common Cathode | Common Anode | Doubler |
|---------------|------------|---------------------|------------------------------------|-----------------------|----------------|----------------|----------------|
| 200 | FRED | 400 | 1 | SP6 | APTDF400KK20G | APTDF400AA20G | APTDF400AK20G |
| 600 | | | 1.6 | | APTDF400KK60G | APTDF400AA60G | APTDF400AK60G |
| 1000 | | | 2.1 | | APTDF400KK100G | APTDF400AA100G | APTDF400AK100G |
| 1200 | | | 2.4 | | APTDF400KK120G | APTDF400AA120G | APTDF400AK120G |
| 1700 | | | 2.2 | | APTDF400KK170G | APTDF400AA170G | APTDF400AK170G |

Full Bridge

| V_{RRM} (V) | Diode Type | I_F (A) $T_C = 80^\circ\text{C}$ | V_F (V) $T_C = 80^\circ\text{C}$ | Package (see page 20) | Part Number |
|---------------|------------|------------------------------------|------------------------------------|-----------------------|---------------|
| 200 | FRED | 30 | 1 | SOT-227 | APT30DF20HJ |
| | | 60 | 1 | SOT-227 | APT60DF20HJ |
| | | 100 | 1 | SP4 | APTDF100H20G |
| 600 | | 30 | 1.8 | SP1 | APTDF30H601G |
| | | 30 | 1.8 | SOT-227 | APT30DF60HJ |
| | | 60 | 1.8 | SOT-227 | APT60DF60HJ |
| | | 60 | 1.8 | SP1 | APTDF60H601G |
| | | 100 | 1.6 | SOT-227 | APT100DL60HJ |
| | | 100 | 1.6 | SP1 | APTDF100H601G |
| 1000 | | 200 | 1.6 | SP6 | APTDF200H60G |
| | | 30 | 2.1 | SOT-227 | APT30DF100HJ |
| | | 100 | 2.1 | SP4 | APTDF100H100G |
| 1200 | | 200 | 2.1 | SP6 | APTDF200H100G |
| | | 30 | 2.6 | SP1 | APTDF30H1201G |
| | | 60 | 2.6 | SP1 | APTDF60H1201G |
| | 75 | 1.6 | SOT-227 | APT75DL120HJ | |
| 1700 | 200 | 2.4 | SP6 | APTDF200H120G | |
| | 50 | 1.8 | SOT-227 | APT50DF170HJ | |
| 1600 | RECTIFIER | 75 | 1.8 | SOT-227 | APT75DF170HJ |
| | | 40 | 1.3 | SOT-227 | APT40DR160HJ |
| | | 90 | 1.3 | SOT-227 | APT90DR160HJ |



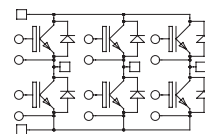


Chopper and Phase Leg

| V _{(BR)CES} (V) | IGBT Type | I _c (A) T _c = 80°C | V _{CE (on)} (V) at Rated I _c | Package (see page 19) | NTC | ...DA... or ...U2 | ...SK... or ...U3 | ...A... |
|--------------------------|---------------|---|---|--------------------------|-----------------|-------------------|-------------------|-------------------|
| 600 | TRENCH 3 | 75 | 1.5 | SP1 | YES | APTGT75DA60T1G | | APTGT75A60T1G |
| | | 100 | 1.5 | SP1 | YES | APTGT100DA60T1G | | APTGT100A60T1G |
| | | 150 | 1.5 | SP1 | YES | APTGT150DA60T1G | APTGT150SK60T1G | APTGT150A60T1G |
| | | 150 | 1.5 | SP3F | YES | | | APTGT150A60T3AG |
| | | 200 | 1.5 | SP2 | - | | | APTGT200A602G |
| | | 200 | 1.5 | SP3F | YES | APTGT200DA60T3AG | APTGT200SK60T3AG | APTGT200A60T3AG |
| | | 300 | 1.5 | SP4 | YES | | | APTGT300A60TG |
| | | 300 | 1.5 | SP6 | OPTION | APTGT300DA60G | APTGT300SK60G | APTGT300A60G |
| | | 300 | 1.5 | D3 | OPTION | APTGT300DA60D3G | APTGT300SK60D3G | APTGT300A60D3G |
| | | 400 | 1.5 | D3 | OPTION | APTGT400DA60D3G | | APTGT400A60D3G |
| | | 450 | 1.5 | SP6 | OPTION | APTGT450DA60G | APTGT450SK60G | APTGT450A60G |
| | | 600 | 1.5 | SP6 | OPTION | APTGT600DA60G | APTGT600SK60G | APTGT600A60G |
| 650 | TRENCH 4 FAST | 50 | 1.85 | SOT227 | - | APT50GLQ65JU2 | | |
| | | 50 | 1.85 | SOT227 | - | APT100GLQ65JU2 | APT100GLQ65JU3 | |
| | | 100 | 1.85 | SP1 | YES | | | APTGLQ100A65T1G |
| | | 600 | 1.85 | SP6 | YES | | | APTGLQ600A65T6G |
| 650 | TRENCH 5 | 60 | 1.65 | SP1 | YES | APTGTQ100DA65T1G | APTGTQ100SK65T1G | APTGTQ100A65T1G |
| | | 120 | 1.65 | SP3F | YES | APTGTQ200DA65T3G | APTGTQ200SK65T3G | APTGTQ200A65T3G |
| 1200 | TRENCH 3 | 35 | 1.7 | SP1 | YES | | | APTGT35A120T1G |
| | | 35 | 1.7 | SOT227 | - | APT35GT120JU2 | APT35GT120JU3 | |
| | | 50 | 1.7 | SOT227 | - | APT50GT120JU2 | APT50GT120JU3 | |
| | | 50 | 1.7 | SP1 | YES | | | APTGT50A120T1G |
| | | 50 | 1.7 | SP4 | YES | APTGT50DA120TG | APTGT50SK120TG | |
| | | 75 | 1.7 | SOT227 | - | APT75GT120JU2 | APT75GT120JU3 | |
| | | 75 | 1.7 | SP1 | YES | | | APTGT75A120T1G |
| | | 75 | 1.7 | SP4 | YES | APTGT75DA120TG | APTGT75SK120TG | |
| | | 100 | 1.7 | SP1 | YES | APTGT100DA120T1G | | |
| | | 100 | 1.7 | SOT227 | - | APT100GT120JU2 | APT100GT120JU3 | |
| | | 100 | 1.7 | SP3F | YES | | | APTGT100A120T3AG |
| | | 100 | 1.7 | SP4 | YES | | | APTGT100A120TG |
| | | 150 | 1.7 | SP6 | OPTION | APTGT150DA120G | APTGT150SK120G | APTGT150A120G |
| | | 150 | 1.7 | SP3F | YES | | | APTGT150A120T3AG |
| | | 150 | 1.7 | SP4 | YES | | | APTGT150A120TG |
| | | 200 | 1.7 | SP6 | OPTION | APTGT200DA120G | APTGT200SK120G | APTGT200A120G |
| | | 200 | 1.7 | D3 | OPTION | APTGT200DA120D3G | | APTGT200A120D3G |
| | | 300 | 1.7 | SP6 | OPTION | APTGT300DA120G | APTGT300SK120G | APTGT300A120G |
| 300 | 1.7 | D3 | OPTION | | | APTGT300A120D3G | | |
| 400 | 1.7 | SP6 | OPTION | APTGT400DA120G | APTGT400SK120G | APTGT400A120G | | |
| 400 | 1.7 | D3 | OPTION | | | APTGT400A120D3G | | |
| 1200 | TRENCH 4 | 40 | 1.85 | SOT227 | - | APT40GL120JU2 | APT40GL120JU3 | |
| | | 90 | 1.85 | SP1 | YES | APTGL90DA120T1G | | APTGL90A120T1G |
| | | 180 | 1.85 | SP2 | - | | | APTGL180A1202G |
| | | 180 | 1.85 | SP3F | YES | | | APTGL180A120T3AG |
| | | 325 | 1.85 | D3 | OPTION | | | APTGL325A120D3G |
| | | 475 | 1.85 | D3 | OPTION | APTGL475DA120D3G | APTGL475SK120D3G | APTGL475A120D3G |
| | TRENCH 4 FAST | 700 | 1.85 | D3 | OPTION | APTGL700DA120D3G | APTGL700SK120D3G | |
| | | 100 | 2.05 | SP3F | YES | | | APTGLQ100A120T3AG |
| | | 100 | 2.05 | SP1 | YES | APTGLQ100DA120T1G | | |
| | | 100 | 2.05 | SP4 | YES | | | APTGLQ100A120TG |
| 150 | 2.05 | SP4 | YES | | | APTGLQ150A120TG | | |
| 200 | 2.05 | SP3F | YES | | | APTGLQ200A120T3AG | | |
| 300 | 2.05 | SP6C | | | APTGLQ300SK120G | APTGLQ300A120G | | |
| 400 | 2.05 | SP6 | YES | | | APTGLQ400A120T6G | | |
| 1700 | TRENCH 3 | 30 | 2 | SP1 | YES | | | APTGT30A170T1G |
| | | 50 | 2 | SP1 | YES | | APTGT50SK170T1G | APTGT50A170T1G |
| | | 50 | 2 | SP4 | YES | | APTGT50SK170TG | APTGT50A170TG |
| | | 100 | 2 | SP4 | YES | | APTGT100SK170TG | APTGT100A170TG |
| | | 150 | 2 | SP6 | OPTION | | APTGT150SK170G | |
| | | 200 | 2 | D3 | OPTION | | | APTGT200A170D3G |
| | | 225 | 2 | SP6 | OPTION | | APTGT225SK170G | APTGT225A170G |
| | | 300 | 2 | SP6 | OPTION | APTGT300DA170G | APTGT300SK170G | APTGT300A170G |
| 300 | 2 | D3 | OPTION | APTGT300DA170D3G | | APTGT300A170D3G | | |

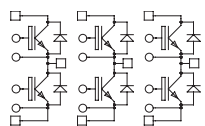
Three-Phase Bridge

| $V_{(BR)CES}$ (V) | IGBT Type | I_c (A) $T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V) at Rated I_c | Package (see page 20) | NTC | Part Number |
|-------------------|-----------|---------------------------------------|------------------------------------|--------------------------|-----|-----------------|
| 600 | TRENCH 3 | 30 | 1.5 | SP3F | Yes | APTGT30X60T3G |
| | | 50 | 1.5 | SP3F | Yes | APTGT50X60T3G |
| | | 75 | 1.5 | SP3F | Yes | APTGT75X60T3G |
| 1200 | TRENCH 3 | 25 | 1.7 | SP3F | Yes | APTGT25X120T3G |
| | | 35 | 1.7 | SP3F | Yes | APTGT35X120T3G |
| | TRENCH 4 | 40 | 1.85 | SP3F | Yes | MSCGL40X120T3AG |
| | | 40 | 1.85 | SP3F | Yes | APTGL40X120T3G |



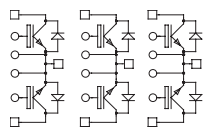
Three-Phase Leg

| $V_{(BR)CES}$ (V) | IGBT Type | I_c (A) $T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V) at Rated I_c | Package (see page 20) | NTC | Part Number |
|-------------------|-----------|---------------------------------------|------------------------------------|--------------------------|--------|------------------|
| 600 | TRENCH 3 | 50 | 1.5 | SP6-P | Option | APTGT50TA60PG |
| | | 150 | 1.5 | SP6-P | Option | APTGT150TA60PG |
| 650 | TRENCH 5 | 30 | 1.65 | SP3F | Yes | APTGTQ50TA65T3G |
| | | 90 | 1.65 | SP6-P | Yes | APTGTQ150TA65TPG |
| 1200 | TRENCH 3 | 75 | 1.7 | SP6-P | Option | APTGT75TA120PG |
| | | 100 | 1.7 | SP6-P | Yes | APTGT100TA120TPG |
| | TRENCH 4 | 120 | 1.85 | SP6-P | Yes | APTGL120TA120TPG |



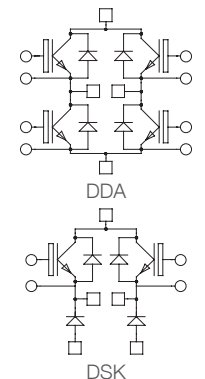
Triple Dual Common Source

| $V_{(BR)CES}$ (V) | IGBT Type | I_c (A) $T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V) at Rated I_c | Package (see page 20) | NTC | Part Number |
|-------------------|-----------|---------------------------------------|------------------------------------|--------------------------|--------|-------------------|
| 600 | TRENCH 3 | 50 | 1.5 | SP6-P | Option | APTGT50TDU60PG |
| | | 75 | 1.5 | SP6-P | Option | APTGT75TDU60PG |
| | | 100 | 1.5 | SP6-P | Option | APTGT100TDU60PG |
| | | 150 | 1.5 | SP6-P | Option | APTGT150TDU60PG |
| 1200 | TRENCH 3 | 75 | 1.7 | SP6-P | Option | APTGT75TDU120PG |
| | TRENCH 4 | 120 | 1.85 | SP6-P | Yes | APTGL120TDU120TPG |
| 1700 | TRENCH 3 | 50 | 2 | SP6-P | Option | APTGT50TDU170PG |

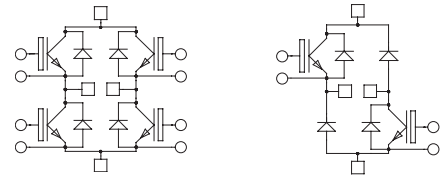


Dual Chopper

| $V_{(BR)CES}$ (V) | IGBT Type | I_c (A) $T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V) at Rated I_c | Package | NTC | ...DDA... | ...DSK... |
|-------------------|---------------|---------------------------------------|------------------------------------|---------|-----|-------------------|------------------|
| 600 | TRENCH 3 | 50 | 1.5 | SP3F | Yes | APTGT50DDA60T3G | |
| | | 75 | 1.5 | SP3F | Yes | APTGT75DDA60T3G | |
| 650 | TRENCH 5 | 60 | 1.65 | SP3F | Yes | APTGTQ100DDA65T3G | |
| | TRENCH 4 FAST | 50 | 1.85 | SP3F | Yes | APTGLQ50DDA65T3G | |
| | TRENCH 4 FAST | 50 | 1.85 | SP3F | Yes | APTGLQ50VDA65T3G | |
| 1200 | TRENCH 3 | 50 | 1.7 | SP3F | Yes | APTGT50DDA120T3G | |
| | TRENCH 4 | 60 | 1.85 | SP3F | Yes | APTGL60DDA120T3G | |
| | | 90 | 1.85 | SP3F | Yes | APTGL90DDA120T3G | APTGL90DSK120T3G |



IGBT Power Modules

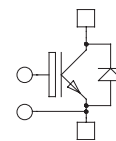


Full and Asymmetrical

| $V_{(BR)CES}$ (V) | IGBT Type | I_c (A) $T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V) at Rated I_c | Package (see page 20) | NTC | ...H... | ...DH... |
|-------------------|------------------|---------------------------------------|------------------------------------|--------------------------|---------------|-----------------|-----------------|
| 600 | TRENCH 3 | 20 | 1.5 | SP1 | YES | APTGT20H60T1G | |
| | | 30 | 1.5 | SP1 | YES | APTGT30H60T1G | |
| | | 50 | 1.5 | SP1 | YES | APTGT50H60T1G | APTGT50DH60T1G |
| | | 50 | 1.5 | SP3F | YES | APTGT50H60T3G | |
| | | 75 | 1.5 | SP1 | YES | APTGT75H60T1G | |
| | | 75 | 1.5 | SP2 | YES | APTGT75H60T2G | |
| | | 75 | 1.5 | SP3F | YES | APTGT75H60T3G | |
| | | 100 | 1.5 | SP4 | YES | APTGT100H60TG | APTGT100DH60TG |
| | | 100 | 1.5 | SP3F | YES | APTGT100H60T3G | |
| | | 150 | 1.5 | SP4 | YES | APTGT150H60TG | APTGT150DH60TG |
| | | 200 | 1.5 | SP6 | | APTGT200H60G | APTGT200DH60G |
| 300 | 1.5 | SP6 | | APTGT300H60G | APTGT300DH60G | | |
| 650 | TRENCH 4 FAST | 30 | 1.95 | SP3F | YES | APTGLQ30H65T3G | |
| | | 50 | 1.85 | SP1 | YES | APTGLQ50H65T1G | |
| | | 50 | 1.85 | SP3F | YES | APTGLQ50H65T3G | |
| | | 75 | 1.85 | SP1 | YES | APTGLQ75H65T1G | |
| | | 100 | 1.85 | SP3F | YES | APTGLQ100H65T3G | |
| | | 200 | 1.85 | SP6C | | APTGLQ200H65G | |
| | | 300 | 1.85 | SP6 | OPTION | APTGLQ300H65G | |
| 650 | TRENCH 5 | 60 | 1.65 | SP3F | YES | APTGTQ100H65T3G | |
| 1200 | TRENCH 3 | 35 | 1.7 | SP3F | YES | APTGT35H120T3G | |
| | | 50 | 1.7 | SP3F | YES | APTGT50H120T3G | |
| | | 50 | 1.7 | SP4 | YES | | APTGT50DH120TG |
| | | 75 | 1.7 | SP3F | YES | | APTGT75DH120T3G |
| | | 75 | 1.7 | SP4 | YES | APTGT75H120TG | |
| | | 100 | 1.7 | SP4 | YES | | APTGT100DH120TG |
| | | 100 | 1.7 | SP6 | | APTGT100H120G | |
| | | 150 | 1.7 | SP6 | | APTGT150H120G | APTGT150DH120G |
| | 200 | 1.7 | SP6 | | APTGT200H120G | APTGT200DH120G | |
| | TRENCH 4 | 40 | 1.85 | SP1 | YES | APTGL40H120T1G | |
| | | 60 | 1.85 | SP3F | YES | APTGL60H120T3G | |
| | | 90 | 1.85 | SP3F | YES | APTGL90H120T3G | |
| | TRENCH 4 FAST | 25 | 2.05 | SP1 | YES | APTGLQ25H120T1G | |
| | | 25 | 2.05 | SP2 | YES | APTGLQ25H120T2G | |
| | | 40 | 2.05 | SP1 | YES | APTGLQ40H120T1G | |
| | | 75 | 2.05 | SP3F | YES | APTGLQ75H120T3G | |
| | | 75 | 2.05 | SP4 | YES | APTGLQ75H120TG | |
| | | 150 | 2.05 | SP6C | | APTGLQ150H120G | |
| | | 200 | 2.05 | SP6 | OPTION | APTGLQ200H120G | |
| | 1700 | TRENCH 3 | 30 | 2 | SP3F | YES | APTGT30H170T3G |
| 50 | | | 2 | SP4 | YES | APTGT50H170TG | APTGT50DH170TG |
| 100 | | | 2 | SP6 | | APTGT100H170G | |
| 150 | | | 2 | SP6 | | | APTGT150DH170G |

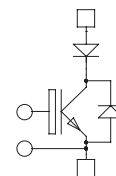
Single Switch

| V _{CES} (V) | IGBT Type | I _C (A) T _C = 80°C | V _{CE (ON)} (V) at Rated I _C | Package (see page 20) | NTC | Part Number |
|----------------------|-----------|---|--|--------------------------|-----|-----------------|
| 600 | TRENCH 3 | 750 | 1.5 | D4 | No | APTGT750U60D4G |
| 1200 | TRENCH 3 | 400 | 1.7 | D4 | No | APTGT400U120D4G |
| | | 600 | 1.7 | D4 | No | APTGT600U120D4G |
| | TRENCH 4 | 475 | 1.85 | D4 | No | APTGL475U120D4G |
| | | 700 | 1.85 | D4 | No | APTGL700U120D4G |
| 1700 | TRENCH 3 | 400 | 2 | D4 | No | APTGT400U170D4G |
| | | 600 | 2 | D4 | No | APTGT600U170D4G |



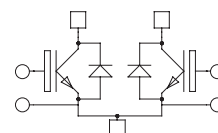
Single Switch + Series Diode

| V _{CES} (V) | IGBT Type | I _C (A) T _C = 80°C | V _{CE (ON)} (V) at Rated I _C | Package (see page 20) | NTC | Part Number |
|----------------------|-----------|---|--|--------------------------|-----|-----------------|
| 1200 | TRENCH 4 | 475 | 1.85 | SP6 | No | APTGL475U120DAG |



Dual Common Source

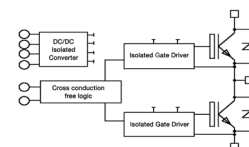
| V _{CES} (V) | IGBT Type | I _C (A) T _C = 80°C | V _{CE (ON)} (V) at Rated I _C | Package (see page 20) | NTC | Part Number |
|----------------------|-----------|---|--|--------------------------|-----|-----------------|
| 600 | TRENCH 3 | 100 | 1.5 | SP4 | Yes | APTGT100DU60TG |
| | | 200 | 1.5 | SP4 | Yes | APTGT200DU60TG |
| | | 300 | 1.4 | SP6 | No | APTGT300DU60G |
| | | 600 | 1.4 | SP6 | No | APTGT600DU60G |
| 1200 | TRENCH 3 | 50 | 1.7 | SP4 | Yes | APTGT50DU120TG |
| | | 75 | 1.7 | SP4 | Yes | APTGT75DU120TG |
| | | 100 | 1.7 | SP4 | Yes | APTGT100DU120TG |
| | | 150 | 1.7 | SP6 | No | APTGT150DU120G |
| | | 150 | 1.7 | SP4 | Yes | APTGT150DU120TG |
| | | 200 | 1.7 | SP6 | No | APTGT200DU120G |
| | | 300 | 1.7 | SP6 | No | APTGT300DU120G |
| | | 400 | 1.7 | SP6 | No | APTGT400DU120G |
| 1700 | TRENCH 3 | 100 | 2 | SP4 | Yes | APTGT100DU170TG |
| | | 225 | 2 | SP6 | No | APTGT225DU170G |
| | | 300 | 2 | SP6 | No | APTGT300DU170G |



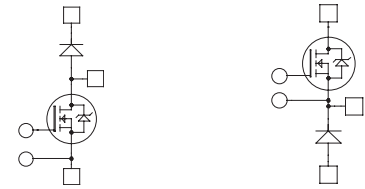
Intelligent Power Modules

Phase Leg

| V _{CES} (V) | IGBT Type | I _C (A) T _C = 80°C | V _{CE (ON)} (V) at Rated I _C | Package (see page 20) | NTC | Part Number |
|----------------------|-----------|---|--|--------------------------|-----|-----------------|
| 600 | TRENCH 3 | 400 | 1.5 | LP8 | No | APTLGT400A608G |
| 1200 | TRENCH 3 | 300 | 1.7 | LP8 | No | APTLGT300A1208G |
| | TRENCH 4 | 325 | 1.8 | LP8 | No | APTLGL325A1208G |

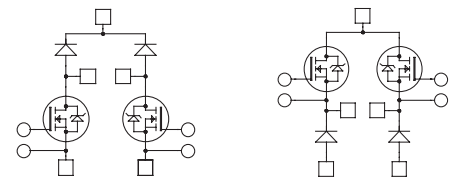


MOSFET Power Modules



Chopper

| V _{DSS} (V) | MOSFET Type | R _{Ds(on)} (mΩ) | I _D (A) T _c = 80°C | Package (see page 20) | NTC | DA...or...U2 | SK...or...U3 |
|----------------------|-----------------------|--------------------------|---|--------------------------|----------------|-----------------|-----------------|
| 100 | MOS 5 | 11 | 100 | SOT-227 | No | APT10M11JV RU2 | APT10M11JV RU3 |
| | | 4.5 | 207 | SP4 | Yes | APT M10DAM05TG | APT M10SKM05TG |
| | | 2.25 | 370 | SP6 | No | APT M10DAM02G | APT M10SKM02G |
| 200 | MOS 5 | 22 | 71 | SOT-227 | No | APT20M22JV RU2 | APT20M22JV RU3 |
| | MOS 7™ | 8 | 147 | SP4 | Yes | APT M20DAM08TG | APT M20SKM08TG |
| | | 5 | 250 | SP6 | Option | APT M20DAM05G | |
| | | 4 | 300 | SP6 | Option | APT M20DAM04G | APT M20SKM04G |
| 500 | MOS 5 | 100 | 30 | SOT-227 | No | APT5010JV RU2 | APT5010JV RU3 |
| | MOS 7 | 100 | 30 | SOT-227 | No | APT5010JLLU2 | APT5010JLLU3 |
| | | 75 | 32 | SOT-227 | No | APT50M75JLLU2 | APT50M75JLLU3 |
| | | 19 | 125 | SP6 | Option | APT M50DAM19G | APT M50SKM19G |
| | | 17 | 140 | SP6 | Option | APT M50DAM17G | APT M50SKM17G |
| MOS 8™ | 65 | 43 | SOT-227 | No | APT58M50JU2 | APT58M50JU3 | |
| 600 | Super Junction MOSFET | 70 | 40 | SOT-227 | No | APT40N60JCU2 | APT40N60JCU3 |
| 24 | | 70 | SP1 | Yes | | APT C60SKM24T1G | |
| 120 | | 25 | SOT-227 | No | APT33N90JCU2 | APT33N90JCU3 | |
| 900 | | 60 | 44 | SP1 | Yes | APT C90DAM60T1G | APT C90SKM60T1G |
| 180 | | 33 | SP4 | Yes | APT M100DA18TG | | |
| 1000 | MOS 7 | 90 | 59 | SP6 | Option | APT M100DAM90G | |
| | MOS 8 | 330 | 17 | SP1 | Yes | | APT M100SK33T1G |
| 1200 | MOS 8 | 300 | 23 | SP1 | Yes | APT M120DA30T1G | |

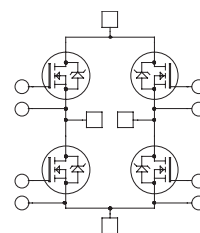


Dual Chopper

| V _{DSS} (V) | MOSFET Type | R _{Ds(on)} (mΩ) | I _D (A) T _c = 80°C | Package (see page 20) | NTC | ...DDA... | ...DSK... |
|----------------------|-----------------------|--------------------------|---|--------------------------|-----|------------------|------------------|
| 100 | MOS 5 | 19 | 50 | SP3F | Yes | | APT M10DSKM19T3G |
| | | 9 | 100 | SP3F | Yes | | APT M10DSKM09T3G |
| 500 | MOS 7™ | 100 | 24 | SP3F | Yes | APT M50DDA10T3G | |
| | | 65 | 37 | SP3F | Yes | APT M50DDAM65T3G | |
| 600 | Super Junction MOSFET | 45 | 38 | SP1 | Yes | APT C60DDAM45T1G | |
| | | 70 | 29 | SP1 | Yes | APT C60DDAM70T1G | |
| | | 35 | 54 | SP3F | Yes | APT C60DDAM35T3G | |
| | | 24 | 70 | SP3F | Yes | APT C60DDAM24T3G | APT C60DSKM24T3G |
| 800 | | 150 | 21 | SP3F | Yes | APT C80DDA15T3G | |
| 1000 | MOS 7 | 350 | 17 | SP3F | Yes | | APT M100DSK35T3G |

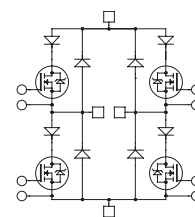
Full Bridge

| V _{DSS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | I _D (A) T _c = 80°C | Package | NTC | Part Number |
|----------------------|-----------------------|--------------------------|---|---------|---------------|-----------------|
| 100 | FREDFET 5 | 4.5 | 207 | SP6 | No | APTM10HM05FG |
| | | 19 | 50 | SP3F | Yes | APTM10HM19FT3G |
| | | 9 | 100 | SP3F | Yes | APTM10HM09FT3G |
| 200 | FREDFET 7 | 20 | 62 | SP4 | Yes | APTM20HM20FTG |
| | | 16 | 74 | SP4 | Yes | APTM20HM16FTG |
| | | 10 | 125 | SP6 | No | APTM20HM10FG |
| | | 8 | 147 | SP6 | No | APTM20HM08FG |
| 500 | FREDFET 7 | 140 | 18 | SP3F | Yes | APTM50H14FT3G |
| | | 100 | 24 | SP3F | Yes | APTM50H10FT3G |
| | | 75 | 32 | SP4 | Yes | APTM50HM75FTG |
| | | 75 | 32 | SP3F | Yes | APTM50HM75FT3G |
| | | 65 | 37 | SP4 | Yes | APTM50HM65FTG |
| | | 65 | 37 | SP3F | Yes | APTM50HM65FT3G |
| | | 38 | 64 | SP6 | No | APTM50HM38FG |
| | 35 | 70 | SP6 | No | APTM50HM35FG | |
| 600 | Super Junction MOSFET | 150 | 19 | SP1 | Yes | APTM50H15FT1G |
| | | 70 | 29 | SP1 | Yes | APTC60HM70T1G |
| | | 45 | 38 | SP1 | Yes | APTC60HM45T1G |
| | | 83 | 21 | SP2 | Yes | APTC60HM83FT2G |
| | | 70 | 29 | SP3F | Yes | APTC60HM70T3G |
| | | 35 | 54 | SP3F | Yes | APTC60HM35T3G |
| | 24 | 70 | SP3F | Yes | APTC60HM24T3G | |
| 800 | Super Junction MOSFET | 230 | 15 | SP1 | Yes | APTM60H23FT1G |
| | | 150 | 21 | SP1 | Yes | APTC80H15T1G |
| | | 290 | 11 | SP3F | Yes | APTC80H29T3G |
| 900 | Super Junction MOSFET | 150 | 21 | SP3F | Yes | APTC80H15T3G |
| | | 120 | 23 | SP1 | Yes | APTC90H12T1G |
| 1000 | FREDFET 7 | 60 | 44 | SP3F | Yes | APTC90HM60T3G |
| | | 450 | 14 | SP3F | Yes | APTM100H45FT3G |
| | | 350 | 17 | SP4 | Yes | APTM100H35FTG |
| | | 350 | 17 | SP3F | Yes | APTM100H35FT3G |
| | 1200 | FREDFET 8 | 180 | 33 | SP6 | No |
| 460 | | | 14 | SP3F | Yes | APTM100H46FT3G |
| 1200 | FREDFET 7 | 290 | 25 | SP6 | No | APTM120H29FG |
| | FREDFET 8 | 1400 | 6 | SP1 | Yes | APTM120H140FT1G |



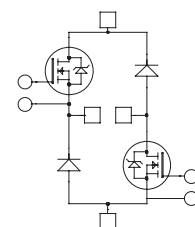
Full Bridge + Series and Parallel

| V _{DSS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | I _D (A) T _c = 80°C | Package | NTC | Part Number |
|----------------------|-------------|--------------------------|---|---------|-----|---------------|
| 200 | MOS 7™ | 20 | 62 | SP4 | Yes | APTM20HM20STG |
| 500 | MOS 7 | 75 | 32 | SP4 | Yes | APTM50HM75STG |
| 1000 | MOS 7 | 450 | 13 | SP4 | Yes | APTM100H45STG |



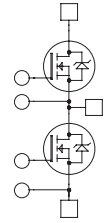
Asymmetrical Bridge

| V _{DSS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | I _D (A) T _c = 80°C | Package | NTC | Part Number |
|----------------------|-----------------------|--------------------------|---|---------|-----|----------------|
| 100 | MOS 5 | 4.5 | 207 | SP6 | No | APTM10DHM05G |
| 500 | MOS 7™ | 38 | 64 | SP6 | No | APTM50DHM38G |
| 600 | Super Junction MOSFET | 24 | 70 | SP3F | Yes | APTC60DHM24T3G |



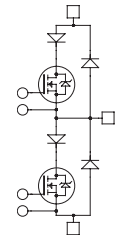
Phase Leg

| V _{DSS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | I _D (A) T _c = 80°C | Package (see page 20) | NTC | Part Number |
|----------------------|-----------------------|--------------------------|---|--------------------------|--------------|---------------|
| 100 | FREDFET 5 | 4.5 | 207 | SP4 | Yes | APTM10AM05FTG |
| | | 2.25 | 370 | SP6 | Option | APTM10AM02FG |
| 200 | FREDFET 7 | 10 | 125 | SP4 | Yes | APTM20AM10FTG |
| | | 8 | 147 | SP4 | Yes | APTM20AM08FTG |
| | | 5 | 250 | SP6 | Option | APTM20AM05FG |
| | | 5 | 280 | LP8 | | MSCM20AM058G |
| | | 4 | 300 | SP6 | Option | APTM20AM04FG |
| 500 | FREDFET 7 | 38 | 64 | SP4 | Yes | APTM50AM38FTG |
| | | 35 | 70 | SP4 | Yes | APTM50AM35FTG |
| | | 19 | 125 | SP6 | Option | APTM50AM19FG |
| | | 17 | 140 | SP6 | Option | APTM50AM17FG |
| 600 | Super Junction MOSFET | 45 | 38 | SP1 | Yes | APTC60AM45T1G |
| | | 35 | 54 | SP1 | Yes | APTC60AM35T1G |
| | | 24 | 70 | SP1 | Yes | APTC60AM24T1G |
| | 24 | 70 | SP2 | No | APTC60AM242G | |
| | FREDFET 8 | 110 | 30 | SP1 | Yes | APTM60A11FT1G |
| 900 | Super Junction MOSFET | 60 | 44 | SP1 | Yes | APTC90AM60T1G |
| 1000 | FREDFET 7 | 180 | 33 | SP4 | Yes | APTM100A18FTG |
| | | 90 | 59 | SP6 | Option | APTM100AM90FG |
| 1200 | FREDFET 7 | 290 | 25 | SP4 | Yes | APTM120A29FTG |
| | | 150 | 45 | SP6 | Option | APTM120A15FG |



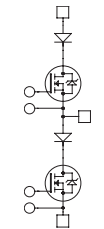
Phase Leg + Series and Parallel

| V _{DSS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | I _D (A) T _c = 80°C | Package (see page 20) | NTC | Part Number |
|----------------------|-------------|--------------------------|---|--------------------------|-----|---------------|
| 200 | MOS 7™ | 10 | 125 | SP4 | Yes | APTM20AM10STG |
| | | 6 | 225 | SP6 | No | APTM20AM06SG |
| 500 | MOS 7 | 38 | 64 | SP4 | Yes | APTM50AM38STG |
| | | 24 | 110 | SP6 | No | APTM50AM24SG |
| 1000 | MOS 7 | 230 | 26 | SP4 | Yes | APTM100A23STG |
| | | 130 | 49 | SP6 | No | APTM100A13SG |
| 1200 | MOS 7 | 200 | 37 | SP6 | No | APTM120A20SG |



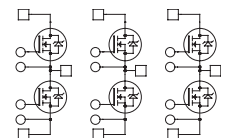
Phase Leg + Series Diodes

| V _{DSS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | I _D (A) T _c = 80°C | Package (see page 20) | NTC | Part Number |
|----------------------|-------------|--------------------------|---|--------------------------|-----|--------------|
| 1000 | MOS 7™ | 130 | 49 | SP6 | No | APTM100A13DG |
| 1200 | MOS 7 | 200 | 37 | SP6 | No | APTM120A20DG |



Triple Phase Leg

| V _{DSS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | I _D (A) T _c = 80°C | Package (see page 20) | NTC | Part Number |
|----------------------|-----------------------|--------------------------|---|--------------------------|--------|----------------|
| 75 | MOSFET | 4.2 | 90 | SP6-P | Option | APTM08TAM04PG |
| 100 | FREDFET 5 | 19 | 50 | SP6-P | Option | APTM10TAM19FPG |
| | | 9 | 100 | SP6-P | Option | APTM10TAM09FPG |
| 200 | FREDFET 7 | 16 | 74 | SP6-P | Option | APTM20TAM16FPG |
| 500 | FREDFET 7 | 65 | 37 | SP6-P | Option | APTM50TAM65FPG |
| 600 | Super Junction MOSFET | 35 | 54 | SP6-P | Option | APTC60TAM35PG |
| | | 24 | 70 | SP6-P | Yes | APTC60TAM24TPG |
| 800 | MOSFET | 150 | 21 | SP6-P | Option | APTC80TA15PG |
| 900 | | 60 | 44 | SP6-P | Yes | APTC90TAM60TPG |
| 1000 | FREDFET 7 | 350 | 17 | SP6-P | Option | APTM100TA35FPG |

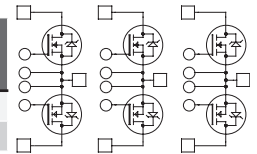


Three-Phase Bridge

| V_{DSS} (V) | MOSFET Type | $R_{DS(on)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package | NTC | Part Number |
|---------------|-------------|----------------------------|------------------------------------|---------|-----|----------------|
| 200 | FREDFET 5 | 16 | 77 | SP4 | | MSCM20XM16F4G |
| | FREDFET 5 | 10 | 84 | SP3X | | MSCM20XM10T3XG |

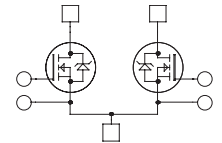
Triple Dual Common Source

| V_{DSS} (V) | MOSFET Type | $R_{DS(on)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package (see page 20) | NTC | Part Number |
|---------------|----------------|----------------------------|------------------------------------|-----------------------|--------|----------------|
| 600 | Super Junction | 35 | 54 | SP6-P | Option | APTC60TDUM35PG |
| 800 | MOSFET | 150 | 21 | SP6-P | Option | APTC80TDU15PG |



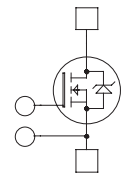
Dual Common Source

| V_{DSS} (V) | MOSFET Type | $R_{DS(on)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package (see page 20) | NTC | Part Number |
|---------------|-------------|----------------------------|------------------------------------|-----------------------|-----|---------------|
| 100 | MOS 5 | 2.25 | 370 | SP6 | No | APTM10DUM02G |
| 200 | MOS 7™ | 8 | 147 | SP4 | Yes | APTM20DUM08TG |
| | | 5 | 250 | SP6 | No | APTM20DUM05G |
| | | 4 | 300 | SP6 | No | APTM20DUM04G |
| 1200 | MOS 7 | 150 | 45 | SP6 | No | APTM120DU15G |



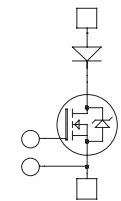
Single Switch

| V_{DSS} (V) | MOSFET Type | $R_{DS(on)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package (see page 20) | NTC | Part Number |
|---------------|-------------|----------------------------|------------------------------------|-----------------------|--------|----------------|
| 100 | FREDFET 5 | 2.25 | 430 | SP6 | Option | APTM10UM02FAG |
| | | 1.5 | 640 | SP6 | Option | APTM10UM01FAG |
| 200 | FREDFET 7 | 3 | 434 | SP6 | Option | APTM20UM03FAG |
| 500 | FREDFET 7 | 9 | 371 | SP6 | Option | APTM50UM09FAG |
| 1000 | FREDFET 7 | 60 | 97 | SP6 | Option | APTM100UM60FAG |
| | | 45 | 160 | SP6 | Option | APTM100UM45FAG |
| 1200 | FREDFET 7 | 70 | 126 | SP6 | Option | APTM120UM70FAG |



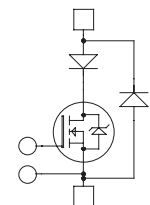
Single Switch + Series Diode

| V_{DSS} (V) | MOSFET Type | $R_{DS(on)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package (see page 20) | NTC | Part Number |
|---------------|-------------|----------------------------|------------------------------------|-----------------------|-----|----------------|
| 1000 | MOS 7™ | 65 | 110 | SP6 | No | APTM100UM65DAG |
| | | 45 | 160 | SP6 | No | APTM100UM45DAG |
| 1200 | MOS 7 | 70 | 126 | SP6 | No | APTM120UM70DAG |



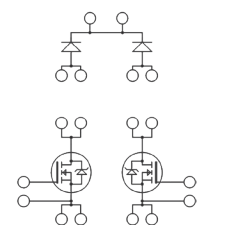
Single Switch + Series and Parallel

| V_{DSS} (V) | MOSFET Type | $R_{DS(on)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package (see page 20) | NTC | Part Number |
|---------------|-------------|----------------------------|------------------------------------|-----------------------|--------|----------------|
| 200 | MOS 7™ | 4 | 310 | SP6 | Option | APTM20UM04SAG |
| 500 | MOS 7 | 13 | 250 | SP6 | Option | APTM50UM13SAG |
| 1000 | MOS 7 | 65 | 110 | SP6 | Option | APTM100UM65SAG |
| 1200 | MOS 7 | 100 | 86 | SP6 | Option | APTM120U10SAG |



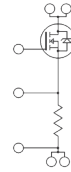
Interleaved PFC

| V_{DSS} (V) | MOSFET Type | $R_{DS(on)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package (see page 20) | NTC | Part Number |
|---------------|-----------------------|----------------------------|------------------------------------|-----------------------|-----|-----------------|
| 600 | Super Junction MOSFET | 45 | 38 | SP1 | Yes | APTC60VDAM45T1G |
| | | 24 | 70 | SP3F | Yes | APTC60VDAM24T3G |



Single and Dual Linear MOSFET

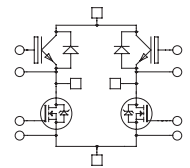
| V _{DS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | Shunt Resistor (mΩ) | Package (see page 20) | NTC | Part Number |
|---------------------|-------------|--------------------------|---------------------|-----------------------|-----|---------------------|
| 600 | MOS4 Linear | 125 | 20 | SP3F | Yes | APTML602U12R020T3AG |
| 1000 | MOS4 Linear | 600 | 20 | SP1 | Yes | APTML100U60R020T1AG |



Renewable Energy Power Modules

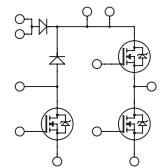
Full Bridge

| V _{CEs} (V) | Technology | I _c (A) T _c = 80°C | V _{CE(on)} (V) at Rated I _c | Package (see page 20) | NTC | Part Number |
|----------------------|---|---|--|--------------------------|-----|----------------|
| 600 | Mix Trench IGBT & Super Junction MOSFET | 50 | 83 mΩ/1.5 | SP1 | Yes | APTCV40H60CT1G |
| | | 50 | 45 mΩ/1.5 | SP3F | Yes | APTCV50H60T3G |



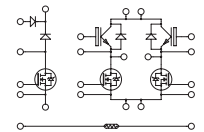
PFC + Bypass Diode + Phase Leg

| V _{CEs} (V) | Technology | I _D (A) T _c = 80°C | R _{DS(on)} (mΩ) at Rated I _D | Package (see page 20) | NTC | Special | Part Number |
|----------------------|-----------------------|---|---|--------------------------|-----|-------------------|----------------|
| 600 | Super Junction MOSFET | 38 | 45 mΩ | SP1 | N/A | 10A PFC SiC Diode | APTC60AM45BC1G |
| | | 38 | 45 mΩ | SP1 | N/A | | APTC60AM45B1G |
| | | 27 | 83 mΩ | SP1 | N/A | 10A PFC SiC Diode | |



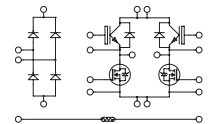
PFC + Bypass Diode + Full Bridge

| V _{CEs} (V) | Technology | I _c (A) T _c = 80°C | V _{CE(on)} (V) at Rated I _c | Package (see page 20) | NTC | Special | Part Number |
|----------------------|---|---|--|--------------------------|-----|--------------------|--------------------|
| 600 | Mix Trench IGBT & Super Junction MOSFET | 38 | 1.5/45 mΩ | SP3F | Yes | 20 A PFC SiC Diode | APTCV60HM45BC20T3G |
| | | 38 | 1.5/45 mΩ | SP3F | Yes | | APTCV60HM45BT3G |
| | Super Junction MOSFET | 29 | 70 mΩ | SP3F | Yes | | APTC60HM70BT3G |



Secondary Fast Rectifier + Full Bridge

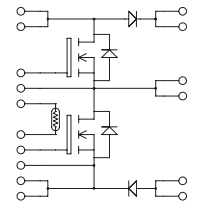
| V _{CEs} (V) | Technology | I _c (A) T _c = 80°C | V _{CE(on)} (V) at Rated I _c | Package (see page 20) | NTC | Special | Part Number |
|----------------------|---|---|--|--------------------------|-----|----------------------------|------------------|
| 600 | Mix Trench IGBT & Super Junction MOSFET | 38 | 1.5/45 mΩ | SP3F | Yes | 20A SiC Antiparallel Diode | APTCV60HM45RCT3G |
| | | 38 | 1.5/45 mΩ | SP3F | Yes | | APTCV60HM45RT3G |
| | Super Junction MOSFET | 29 | 70 mΩ | SP3F | Yes | | APTC60HM70RT3G |
| | Trench 3 | 50 | 1.5 | SP3F | Yes | | APTGT50H60RT3G |



R_{DS(on)} value for the MOSFETs in mΩ and V_{CE(on)} value for the IGBTs in Volts

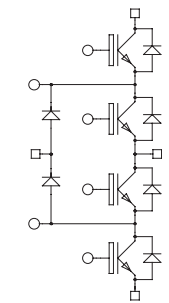
Boost Buck

| V _{CES} (V) | Technology | I _c (A) T _c = 80°C | V _{CE} (on) (V) at Rated I _c | Package (see page 20) | NTC | Part Number |
|----------------------|-----------------------|---|---|--------------------------|-----|-----------------|
| 600 | Super Junction MOSFET | 70 | 24 mΩ | SP3F | Yes | APTC60BBM24T3G |
| | Trench 3 | 100 | 1.5 | SP3F | Yes | APTGT100BB60T3G |

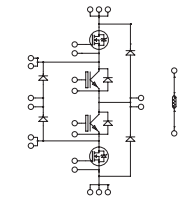


Three-Level NPC Inverter

| V _{CES} (V) | Technology | I _c (A) T _c = 80°C | V _{CE} (on) (V) at Rated I _c | Package (see page 20) | NTC | Part Number |
|----------------------|---------------|---|---|--------------------------|-----|-----------------|
| 600 | Trench 3 | 20 | 1.5 | SP1 | No | APTGT20TL601G |
| | | 30 | 1.5 | SP1 | No | APTGT30TL601G |
| | | 50 | 1.5 | SP3F | Yes | APTGT50TL60T3G |
| | | 50 | 1.5 | SP1 | No | APTGT50TL601G |
| | | 75 | 1.5 | SP3F | Yes | APTGT75TL60T3G |
| | | 100 | 1.5 | SP3F | Yes | APTGT100TL60T3G |
| | | 150 | 1.5 | SP6 | No | APTGT150TL60G |
| | | 200 | 1.5 | SP6 | No | APTGT200TL60G |
| 650 | Trench 3 | 300 | 1.5 | SP6 | No | APTGT300TL65G |
| | | 400 | 1.5 | SP6 | No | APTGT400TL65G |
| | Trench 4 Fast | 50 | 1.85 | SP3F | Yes | APTGLQ50TL65T3G |
| 1200 | Trench 4 | 60 | 1.85 | SP3F | Yes | APTGL60TL120T3G |
| | | 240 | 1.8 | SP6 | No | APTGL240TL120G |
| 1700 | Trench 3 | 100 | 2 | SP6 | No | APTGT100TL170G |

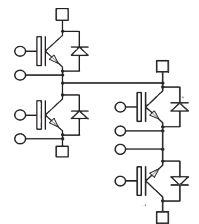


| V _{CES} (V) | Technology | R _{DS} (on) Super Junction MOSFET (mΩ) | V _{CE} (on) IGBT (V)/ I _c (A) | Package (see page 20) | NTC | Part Number |
|----------------------|---|---|--|--------------------------|-----|-----------------|
| 600 | Mix Trench IGBT and Super Junction MOSFET | 24 | 1.5/75 | SP3F | Yes | APTCV60TLM24T3G |
| | | 45 | 1.5/75 | SP3F | Yes | APTCV60TLM45T3G |
| | | 70 | 1.5/50 | SP3F | Yes | APTCV60TLM70T3G |
| | | 99 | 1.5/30 | SP3F | Yes | APTCV60TLM99T3G |
| 900 | | 120 | 1.85/50 | SP3F | Yes | APTCV90TL12T3G |



T-Type 3-Level Inverter

| V _{CES} (V) | Technology | I _c (A) T _c = 80°C | V _{CE} (on) (V) at Rated I _c | Package (see page 20) | NTC | Special | Part Number |
|----------------------|---------------|---|---|--------------------------|-----|---------------|-------------------|
| 600/1200 | Trench 4 Fast | 40 | 2.05 | SP3F | Yes | 10A/600 V SiC | APTGLQ40HR120CT3G |
| | | 80 | 2.05 | SP3F | Yes | 30A/600 V SiC | APTGLQ80HR120CT3G |
| | | 200 | 2.05 | SP6 | No | | APTGLQ200HR120G |



Vienna Rectifier

| V _{CES} (V) | IGBT Type | I _c (A) TC = 80°C | V _{CE} (on) (V) at Rated I _c | Package (see page 19) | NTC | Part Number |
|----------------------|-----------------------|------------------------------|---|--------------------------|-----|-------------------|
| 600 | Super Junction MOSFET | 19 | 99 mΩ | SP3F | YES | MSCC60VRM99CT3AG |
| | | 40 | 45 mΩ | SP6-P | YES | MSCC60VRM45TAPG |
| | | 81 | 23 mΩ | SP4 | | MSCC60AM23C4AG |
| 650 | TRENCH 5 | 80 | 1.65 | SP1 | | MSCGTQ100HD65C1AG |

R_{DS(on)} value for the MOSFETs in mΩ and V_{CE(on)} value for the IGBTs in Volts

Power Module Advantages

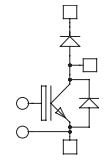
- High-speed switching
- Low switching losses
- Low-input capacitance
- High-power density
- Low-profile packages
- Minimum parasitic inductance
- Lower system cost
- Standard and custom modules
- 30+ years design experience

SiC Diode Power Modules

| Part Number | Type | Electrical Topology | Voltage (V) | RDSon (mΩ) | Current (A) Tc = 80°C | Package (see page 19) | |
|--------------------|------------------|---------------------|---------------------|------------|--------------------------|--------------------------|------|
| MSCDC50H701AG | SiC Diode Module | Full bridge | 700 | - | 50 | SP1 | |
| MSC50DC70HJ | | | | - | 50 | SOT-227 | |
| MSCDC100H70AG | | | | - | 100 | SP6 | |
| MSCDC200H70AG | | | | - | 200 | SP6 | |
| MSCDC50H1201AG | | | 1200 | - | 50 | SP1 | |
| MSC50DC120HJ | | | | - | 50 | SOT-227 | |
| MSCDC100H120AG | | | | - | 100 | SP6 | |
| MSCDC200H120AG | | | | - | 200 | SP6 | |
| MSCDC100H170AG | | | 1700 | - | 100 | SP6C | |
| MSCDC200H170AG | | | | - | 200 | SP6C | |
| MSCDC50H1701AG | | | | - | 50 | SP1 | |
| MSC50DC170HJ | | | | - | 50 | SOT-227 | |
| MSCDC100A70D1PAG | | Phase leg | 700 | - | 100 | D1P | |
| MSCDC150A70D1PAG | | | | - | 150 | D1P | |
| MSCDC200A70D1PAG | | | | - | 200 | D1P | |
| MSCDC300A70AG | | | | - | 300 | SP6 | |
| MSCDC450A70AG | | | | - | 450 | SP6 | |
| MSCDC600A70AG | | | | - | 600 | SP6 | |
| MSCDC100A120D1PAG | | | 1200 | - | 100 | D1P | |
| MSCDC150A120D1PAG | | | | - | 150 | D1P | |
| MSCDC200A120D1PAG | | | | - | 200 | D1P | |
| MSCDC300A120AG | | | | - | 300 | SP6 | |
| MSCDC450A120AG | | | | - | 450 | SP6 | |
| MSCDC600A120AG | | | | - | 600 | SP6 | |
| MSCDC300A170AG | | | | 1700 | - | 300 | SP6C |
| MSCDC450A170AG | | | | | - | 450 | SP6C |
| MSCDC600A170AG | | | | | - | 600 | SP6C |
| MSCDC100A170D1PAG | | | | | - | 100 | D1P |
| MSCDC150A170D1PAG | | | | | - | 150 | D1P |
| MSCDC200A170D1PAG | | | | | - | 200 | D1P |
| MSCDC100KK70D1PAG | | | Dual common cathode | 700 | - | 100 | D1P |
| MSCDC150KK70D1PAG | | | | | - | 150 | D1P |
| MSCDC200KK70D1PAG | | | | | - | 200 | D1P |
| MSCDC100KK120D1PAG | | | | 1200 | - | 100 | D1P |
| MSCDC150KK120D1PAG | | | | | - | 150 | D1P |
| MSCDC200KK120D1PAG | | | | | - | 200 | D1P |
| MSCDC100KK170D1PAG | | | 1700 | - | 100 | D1P | |
| MSCDC150KK170D1PAG | | | | - | 150 | D1P | |
| MSCDC200KK170D1PAG | | | | - | 200 | D1P | |
| MSCDC50X701AG | | | Three phase bridge | 1200 | - | 50 | SP1 |
| MSCDC50X1201AG | | | | | - | 50 | SP1 |
| MSCDC50X1701AG | | | | | - | 50 | SP1 |

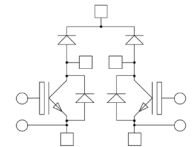
Boost Chopper

| V_{RRM} (V) | IGBT Type | I_D (A) $T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V) at Rated I_c | Package (see page 20) | NTC | Part Number |
|---------------|---------------|---------------------------------------|------------------------------------|--------------------------|-----|-----------------|
| 1200 | Trench 4 Fast | 25 | 2.05 | SOT-227 | No | APT25GLQ120JCU2 |
| | | 40 | 2.05 | SOT-227 | No | APT40GLQ120JCU2 |



Dual Chopper

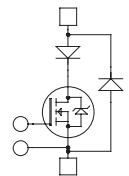
| V_{RRM} (V) | IGBT Type | I_D (A) $T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V) at Rated I_c | Package (see page 20) | NTC | Part Number |
|---------------|---------------|---------------------------------------|------------------------------------|--------------------------|-----|--------------------|
| 1200 | Trench 4 Fast | 40 | 2.05 | SP3F | Yes | APTGLQ40DDA120CT3G |



MOSFETs and Super Junction MOSFET Power Modules With SiC Diodes

Single Switch + Series FRED and SiC Parallel Diodes

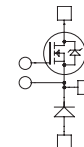
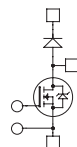
| V_{DSS} (V) | MOSFET Type | $R_{DS(ON)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package (see page 20) | NTC | Part Number |
|---------------|-------------|----------------------------|---------------------------------------|--------------------------|--------|------------------|
| 1000 | MOS 7 | 65 | 110 | SP6 | Option | APTM100UM65SCAVG |
| 1200 | MOS 7 | 100 | 86 | SP6 | Option | APTM120U10SCAVG |



Power Modules With SiC Schottky Diodes

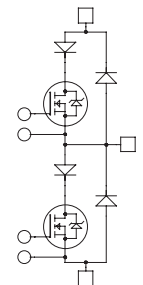
Chopper

| V_{DSS} (V) | MOSFET Type | $R_{DS(ON)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package (see page 20) | NTC | ...DA... or U2 | ...SK... or U3 |
|---------------|-----------------------|----------------------------|---------------------------------------|--------------------------|-----|-----------------|-----------------|
| 500 | MOS 8 | 65 | 43 | SOT-227 | No | APT58M50JCU2 | |
| | | 45 | 38 | SOT-227 | No | APT50N60JCCU2 | |
| 600 | Super Junction MOSFET | 24 | 70 | SP1 | Yes | | APTC60SKM24CT1G |
| | | 18 | 107 | SP4 | Yes | APTC60DAM18CTG | |
| 900 | Super Junction MOSFET | 120 | 25 | SOT-227 | No | APT33N90JCCU2 | |
| | | 60 | 44 | SP1 | Yes | APTC90DAM60CT1G | APTC90SKM60CT1G |
| 1000 | MOS 8 | 330 | 20 | SOT-227 | No | APT26M100JCU2 | APT26M100JCU3 |
| 1200 | MOS 8 | 560 | 15 | SOT-227 | No | APT20M120JCU2 | APT20M120JCU3 |
| | | 300 | 23 | SP1 | Yes | APTM120DA30CT1G | |



Phase Leg + Series FRED and SiC Parallel Diodes

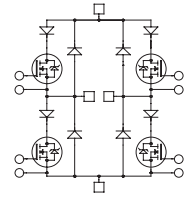
| V_{DSS} (V) | MOSFET Type | $R_{DS(ON)}$ (m Ω) | I_D (A) $T_c = 80^\circ\text{C}$ | Package (see page 20) | NTC | Part Number |
|---------------|-----------------------|----------------------------|---------------------------------------|--------------------------|---------------|----------------|
| 500 | MOS 7 | 38 | 67 | SP4 | Yes | APTM50AM38SCTG |
| | | 24 | 110 | SP6 | No | APTM50AM24SCG |
| 600 | Super Junction MOSFET | 35 | 54 | SP4 | Yes | APTC60AM35SCTG |
| | | 24 | 70 | SP4 | Yes | APTC60AM24SCTG |
| | | 18 | 107 | SP6 | No | APTC60AM18SCG |
| 900 | Super Junction MOSFET | 60 | 44 | SP4 | Yes | APTC90AM60SCTG |
| 150 | | 21 | SP4 | Yes | APTC80A15SCTG | |
| 800 | Super Junction MOSFET | 100 | 32 | SP4 | Yes | APTC80A10SCTG |
| | | 75 | 43 | SP6 | No | APTC80AM75SCG |
| 1000 | MOS 7 | 130 | 49 | SP6 | No | APTM100A13SCG |



Power Modules with SiC Schottky Diodes

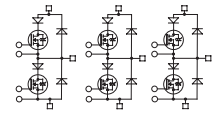
Full Bridge + Series FRED and SiC Parallel Diodes

| V _{DSS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | I _D (A) T _c = 80°C | Package (see page 20) | NTC | Part Number |
|----------------------|--------------------------|--------------------------|---|--------------------------|---------------|----------------|
| 500 | MOS 7 | 75 | 34 | SP4 | Yes | APTM50HM75SCTG |
| 600 | Super Junction MOSFET | 70 | 29 | SP4 | Yes | APTC60HM70SCTG |
| | | 45 | 38 | SP4 | Yes | APTC60HM45SCTG |
| 290 | | 11 | SP4 | Yes | APTC80H29SCTG | |
| 120 | | 23 | SP4 | Yes | APTC90H12SCTG | |
| 1000 | MOS 7 | 450 | 14 | SP4 | Yes | APTM100H45SCTG |



Triple Phase Leg

| V _{DSS} (V) | MOSFET Type | R _{DS(on)} (mΩ) | I _D (A) T _c = 80°C | Package (see page 20) | NTC | Part Number |
|----------------------|--------------------------|--------------------------|---|--------------------------|-----|-------------------|
| 600 | Super Junction MOSFET | 24 | 87 | SP6-P | Yes | APTC60TAM21SCTPAG |
| 1000 | MOS 7 | 350 | 50 | SP6-P | Yes | APTM100TA35SCTPG |



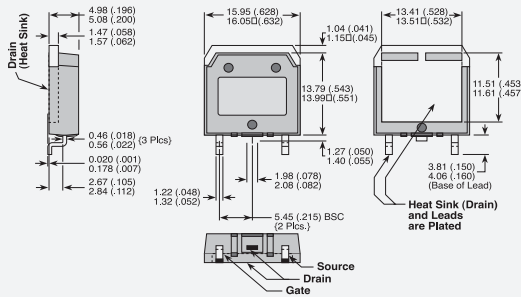
SiC MOSFET Power Modules

| Part Number | Type | Electrical Topology | Voltage (V) | $R_{DS(on)}$ (m Ω) | Current (A) Tc = 80°C | Package (see page 19) | Notes | |
|----------------------|-------------------|--|-------------|----------------------------|--------------------------|--------------------------|-------------|---|
| MSC100SM70JCU2 | SiC MOSFET Module | Boost chopper | 700 | 15 | 97 | SOT-227 | | |
| MSC40SM120JCU2 | | | | 40 | 44 | SOT-227 | | |
| MSC70SM120JCU2 | | | 1200 | 25 | 71 | SOT-227 | | |
| MSC130SM120JCU2 | | | | 12.5 | 138 | SOT-227 | | |
| MSCSM120DAM11CT3AG | | | | 11 | 202 | SP3F | | |
| MSC100SM70JCU3 | | | | 15 | 97 | SOT-227 | | |
| MSC40SM120JCU3 | | Buck chopper | 700 | 40 | 44 | SOT-227 | | |
| MSC70SM120JCU3 | | | | 25 | 71 | SOT-227 | | |
| MSC130SM120JCU3 | | | 1200 | 12.5 | 138 | SOT-227 | | |
| MSCSM120SKM11CT3AG | | | | 11 | 202 | SP3F | | |
| MSCSM70HM19CT3AG | | Full bridge | 700 | 15 | 97 | SP3F | | |
| MSCSM120HM31CT3AG | | | | 1200 | 25 | 71 | SP3F | |
| MSCSM120HM16CT3AG | | | 12.5 | | 138 | SP3F | | |
| MSCSM120HM50CT3AG | | | 40 | | 44 | SP3F | | |
| MSCSM70AM19CT1AG | | Phase leg | 700 | | 15 | 97 | SP1F | |
| MSCSM70AM07CT3AG | | | | 5 | 276 | SP3F | 2ASC-12A1HP | |
| MSCSM70AM10CT3AG | | | | 7.5 | 188 | SP3F | 2ASC-12A1HP | |
| MSCSM70AM025CD3AG | | | | 2.5 | 538 | D3 | 2, 3 | |
| MSCSM70AM025CT6AG | | | | 2.5 | 538 | SP6C | 2, 3 | |
| MSCSM120AM16CT1AG | | | | 1200 | 12.5 | 138 | SP1F | |
| MSCSM120AM31CT1AG | | | 25 | | 71 | SP1F | | |
| MSCSM120AM50CT1AG | | | 40 | | 44 | SP1F | | |
| MSCSM120AM08CT3AG | | | 6.25 | | 268 | SP3F | | |
| MSCSM120AM11CT3AG | | | 8.33 | | 202 | SP3F | 2ASC-12A1HP | |
| MSCSM120AM042CD3AG | | | 4.2 | | 394 | D3 | 2, 3 | |
| MSCSM120AM027CD3AG | | | 2.7 | 584 | D3 | 2, 3 | | |
| MSCSM120AM042CT6AG | | 4.2 | 394 | SP6C | 2, 3 | | | |
| MSCSM120AM027CT6AG | | 2.7 | 584 | SP6C | 2, 3 | | | |
| MSCSM70VM19C3AG | | Vienna phase leg | 700 | 15 | 97 | SP3F | | |
| MSCSM70VM10C4AG | | | | 7.5 | 97 | SP4 | | |
| MSCSM70TAM19CT3AG | | Three phase bridge Triple phase leg | 700 | 15 | 97 | SP3F | | |
| MSCSM70TAM10CTPAG | | | | 7.5 | 186 | SP6P | | |
| MSCSM70TAM05TPAG | | | | 5 | 273 | SP6P | | |
| MSCSM120TAM31CT3AG | | | 1200 | 25 | 71 | SP3F | | |
| MSCSM120TAM16CTPAG | | | | 12.5 | 136 | SP6P | | |
| MSCSM120TAM11CTPAG | | | | 8.33 | 200 | SP6P | | |
| MSCSM70AM025CT6LIAG | | Low Inductance SiC MOSFET Module | Phase leg | 700 | 2.5 | 538 | SP6C LI | 1 |
| MSCSM120AM042CT6LIAG | | | | | 4.2 | 394 | SP6C LI | 1 |
| MSCSM120AM03CT6LIAG | | | 1200 | 2.5 | 641 | SP6C LI | 1 | |
| MSCSM120AM02CT6LIAG | | | | 2.1 | 754 | SP6C LI | 1 | |

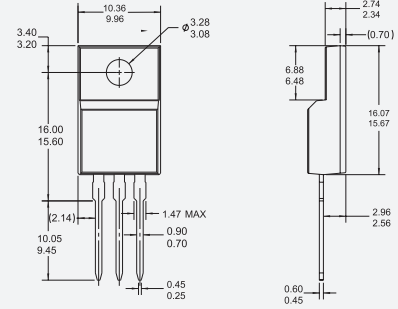
2ASC-12A1HP, 1, 2, 3: Refer to Gate Driver Solutions on page 45

Power Module Outlines

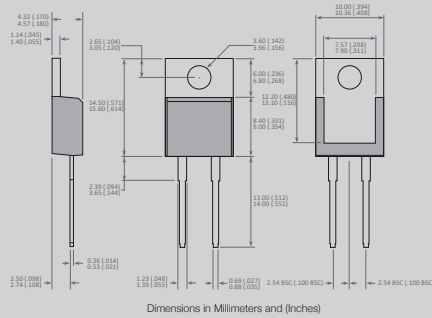
D3PAK
or TO-268



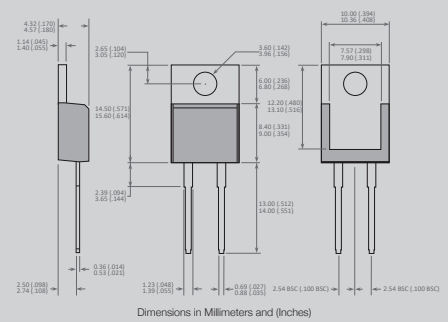
TO-220 [KF]



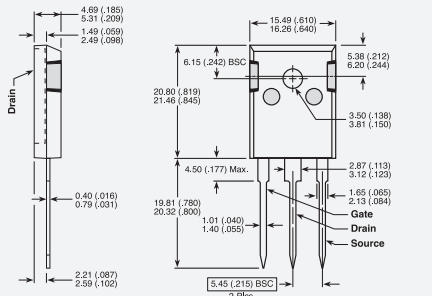
TO-220 2-Lead



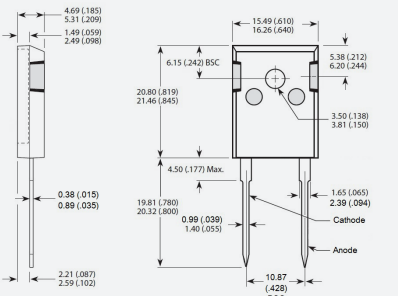
TO-220 3-Lead



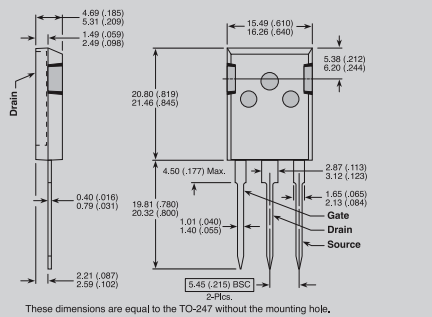
TO-247 3-Lead



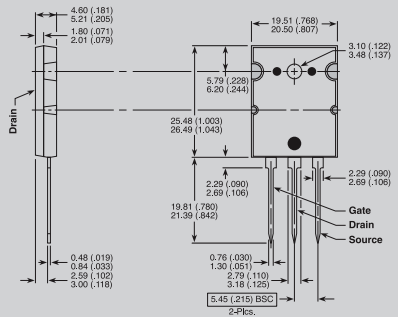
TO-247 2-Lead



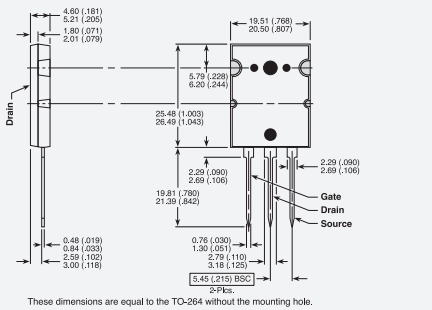
T-MAX®



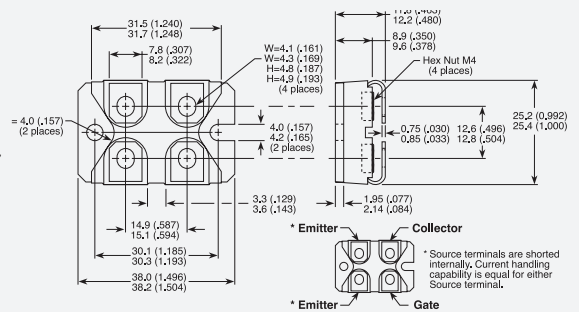
TO-264



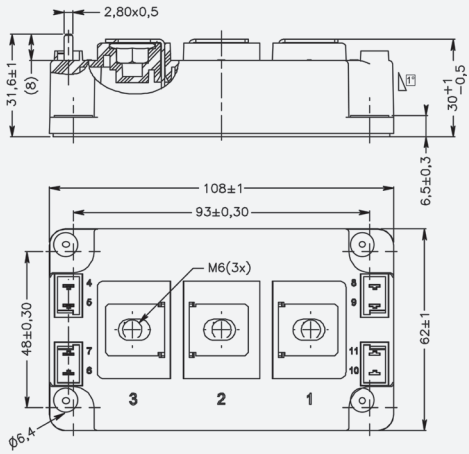
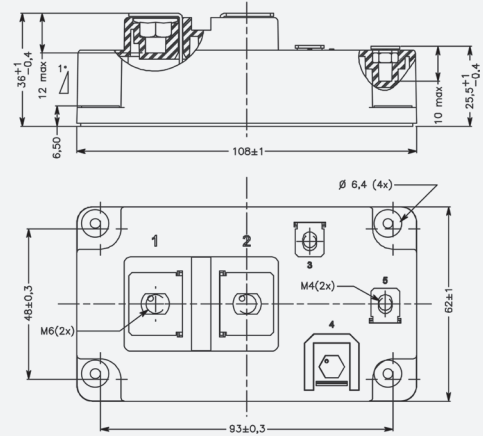
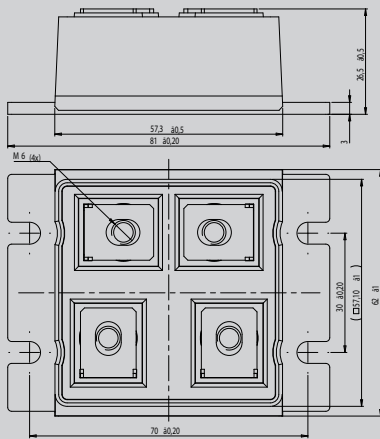
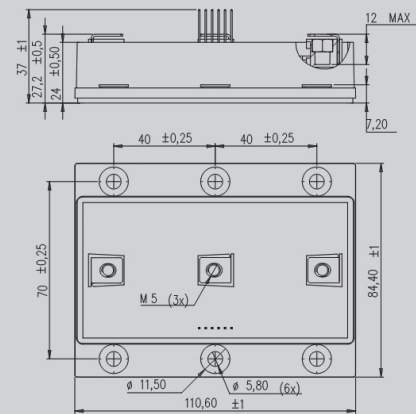
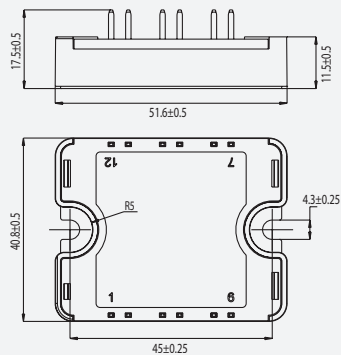
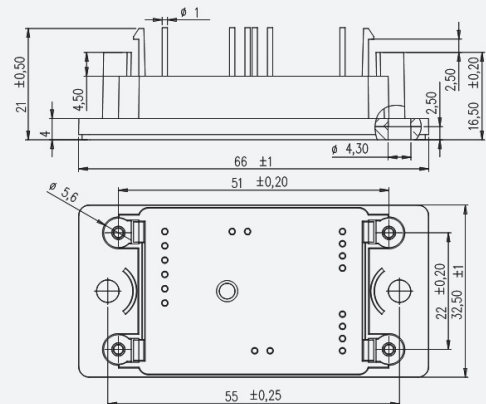
264 MAX™



SOT-227



Pinout location depends on the module configuration. Please refer to the product datasheet for pin assignments. All dimensions in millimeters.

D3

D4

LP4

LP8

SP1

SP2


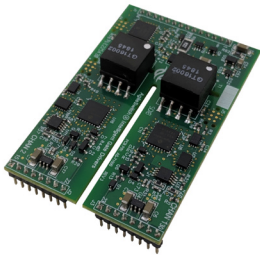
Pinout location depends on the module configuration. Please refer to the product datasheet for pin assignments. All dimensions in millimeters.

AgileSwitch® Gate Driver Solutions

| Gate Driver Reference* | Gate Driver Type | Gate Driver Part Number | Adapter Board Part Number |
|------------------------|------------------|-------------------------|---------------------------|
| 1 | Core | 2ASC-12A1HP | SP6CA1 |
| 2 | Core | 2ASC-12A1HP | 62CA1 |
| 3 | Plug & Play | 62EM1-00001 | Not Applicable |

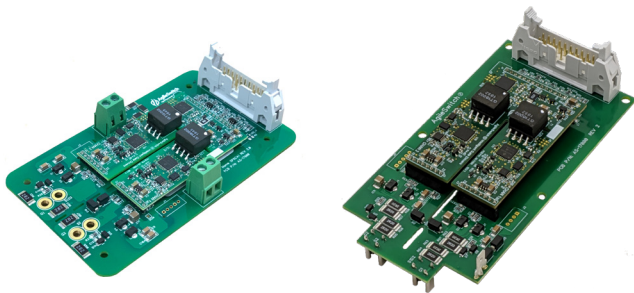
*Refer to footnotes in SiC product tables

2ASC-12A1HP



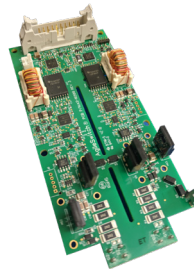
Improve switching efficiency and EMI performance, all while protecting your valuable SiC devices. The AgileSwitch 2ASC dual-channel high performance gate driver cores are designed to take on your SiC implementation challenges.

62CA1 and SP6CA1 (Shown with 2ASC-12A1HP connected)



Compatible with the AgileSwitch 2ASC Gate Driver Cores, the family of Module Adapter Boards provides a platform to rapidly evaluate and optimize new SiC power devices. Standard offerings include a reference design for the 1200V SP6LI (SP6CA1) and 1200V D3 (62CA1).

62EM1



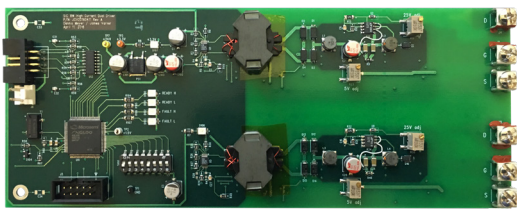
Control, monitor, and protect the latest 62 mm SiC devices using the Plug-and-Play 62EM Gate Driver Boards. Designed for traction applications, the 62EM can drive up to 1.7 kV devices at 100 kHz with configurable fault settings and patented Augmented Switching technology.

User-Friendly Reference Designs

Microchip and our partner ecosystem provide open-source, user-friendly SiC MOSFET reference design solutions that enable faster time to market for customers using our SiC MOSFETs and power modules. You can use isolated dual-gate driver reference designs with our SiC MOSFETs in a number of SiC topologies.

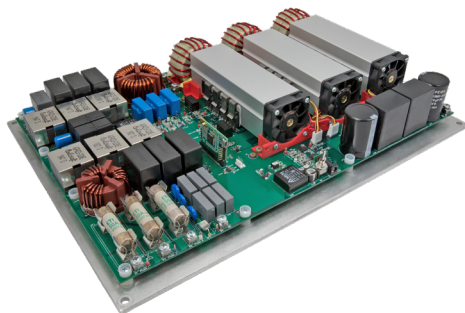
SiC Reference Designs

| Part Number | Gate Drive or Line Voltage | KHz, max | Per Side Drive Power (W) | Description |
|-----------------|----------------------------|----------|--------------------------|--|
| MSCSICMDD/REF | -5 to +20 V | 400 | 8 W | SiC discrete gate driver board |
| MSCSICSP3/REF2 | -5 to +20 V | 400 | 16 W | SiC SP3 module driver board |
| MSCSICSP6L/REF3 | -5 to +20 V | 400 | 16 W | SiC SP6LI module driver board |
| MSCSICPFC/REF5 | In: 400 Vrms, Out: 700 Vdc | 140 | 30 kW | 30 kW 3-phase Vienna PFC (design files only) |



The MSCSICMDD/REF1 is a switch-configurable high/low-side driver with half bridges or independent drive.

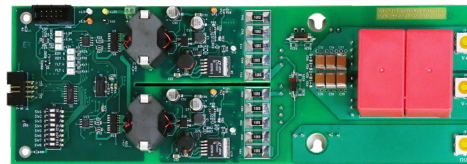
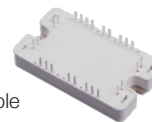
- 400 kHz maximum switching frequency
- 8W of gate drive power per side
- 30A peak output current
- -5V/+20 V gate drive voltage
- ± 100 kV/ μ S capability
- Galvanic isolation of more than 2000V on both gate drivers



The MSCSICPFC/REF5 is a Vienna 3-Phase PFC reference design for Hybrid Electric Vehicle/Electric Vehicle (HEV/ EV) charger and high-power switch mode power supply applications.

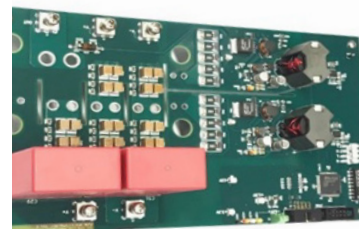
- 30 kW Vienna rectifier topology at 98.6 % peak efficiency
- 380/400 VAC, 50 Hz/60 Hz input voltage with 700V DC output voltage
- 140 kHz pulse-width modulation switching frequency
- < 5% current THD at half and full loads
- 700 V SiC MOSFETs and 1200 V SiC diodes
- dsPIC33CH using 3-level modulation for digital control

SP3F standard
package compatible



The MSCSICSP3/REF2 is a half bridge driver compatible with SP3F standard package modules.

- 400 kHz maximum switching frequency
- 16W of gate drive power per side
- 30A peak output current
- -5 V/+20 V gate drive voltage
- ± 100 kV/ μ S capability
- Galvanic isolation of more than 2000V on both gate drivers



The MSCSICSP6/REF3 is a half bridge driver for the low inductance SP6LI power modules.

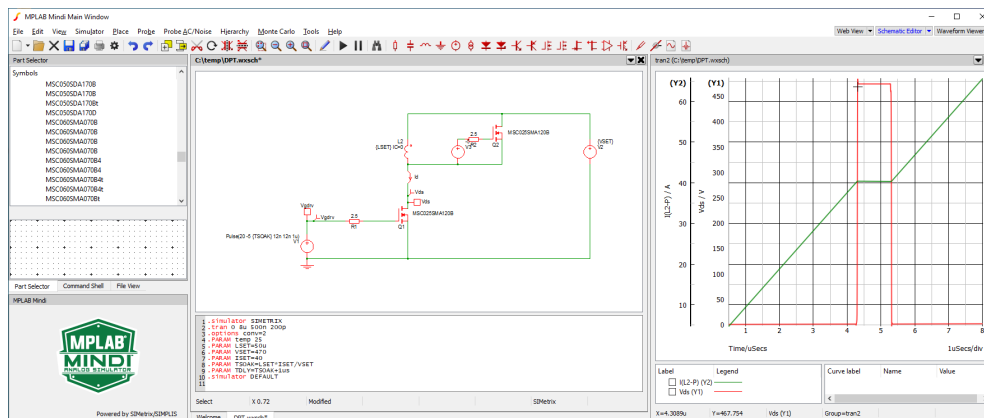
- Stray inductance < 3 nH to fully benefit from SiC
- Designed to be easy to parallel
- Up to 1200 V and 586 A
- Half Bridge Driver
- Up to 400 kHz switching frequency
- 12 V VIN supply
- Capable of 16 W of gate drive power/side
- 30 A Peak Source output current
- Min. 100 KV/ μ S CMTI

Simulation Models

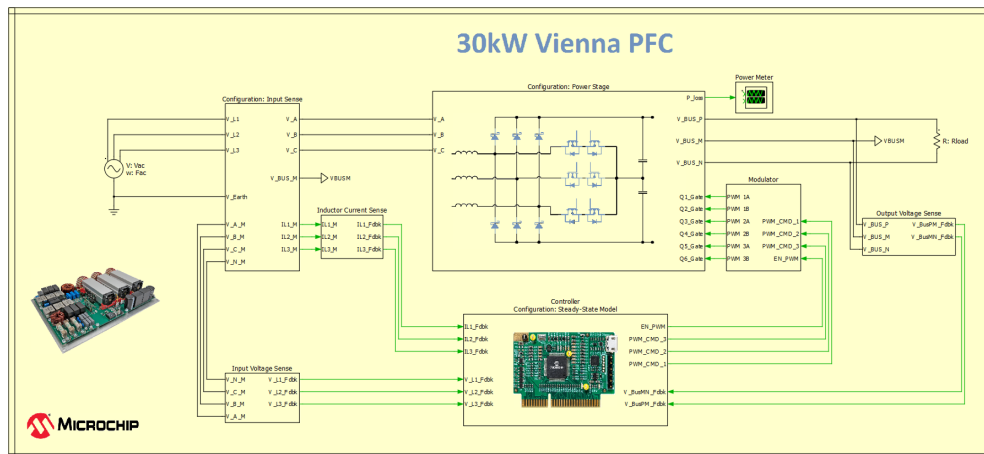
Microchip offers a variety of simulation tools that help designers lower design complexities and shorten design cycle times. Both device and system level tools are available for use in device evaluation, system development and scaling of existing system level models.

- **MPLAB® Mindi™ Analog Simulator**
 - Brief Description: Free SPICE circuit simulation tool that uses a SIMetrix/SIMPLIS simulation environment.
 - What's available: Free MPLAB Mindi Analog Simulator download. SiC Models are available for the 700V, 1200V and 1700V SiC MOSFETs and Schottky Barrier Diodes
 - Relevant links: Simulation tool download at www.microchip.com/mplab/mplab-mindi and SiC models at www.microchip.com/sic
- **SPICE**
 - Brief Description: SPICE is a widely used circuit simulator that provides the ability to evaluate a device within a circuit design. SPICE models support this simulation work by designers.
 - What's available: Microchip provides SPICE models for all of its newest SiC Schottky Barrier Diodes and SiC MOSFETs in 700V, 1200V, and 1700V
 - Relevant links: www.microchip.com/sic
- **PLECS**
 - Brief Description: PLECS models provide device switching and conduction losses as well as thermal characterization for use in PLECS multi-domain simulations.
 - What's available: Vienna 3-Phase Power Factor Correction (PFC) Reference Design PLECS simulation model
 - Relevant links: www.microchip.com/sic

MPLAB® Mindi™ SPICE Circuit Simulation Model



PLECS Simulation Model for 30 kW Vienna PFC



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