

### **DESIGN GUIDE** | Planar Transformers & Inductors

### **WHAT WE DO**

Our team has been providing solutions through high-performing products since the 1950's. Through growth, acquisition, strategically partnering with customers, and applying the latest engineering designs to the needs of our ever-changing world, our technology has infused transforming results into an array of customer's needs – ultimately providing quality results to the end-user. Our approach that fuels this is achieved by:

- 1. Partnering with the customer
- 2. Confronting a challenge to solve
- 3. Delivering solutions and products that address your needs as a business.

### WHAT WE BELIEVE

Our values and what we believe align to the **partner**, **solve**, **and deliver** approach. We produce parts but we are more than that. Connecting with your team as a strategic partner, listening to your challenges, and arriving at ways to solve your complex problems through our solutions are why we exist. Whether it's custom or standard we have capabilities that address your needs. Our team leverages our dynamic and diverse engineering expertise and other resources such as our global facilities for logistics and production.

### **CAPABILITIES**

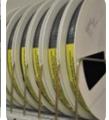
Standex-Meder Electronics has a commitment to absolute customer satisfaction and customer-driven innovation, with a global organization that offers premier sales support, engineering capabilities, and technical resources worldwide. At Standex-Meder Electronics, customer-specific product development has never been a problem. With our expert engineering staff and cutting-edge manufacturing capabilities, we are well-equipped to produce unique solutions for just about any environment or application.

### **MANUFACTURING**

Auto AT Switch Sorting
Bobbin and Toroidal Winding
Auto Termination
Coil Molding & Packaging
Insert and Thermoset Molding
Laser Welding
Low Pressure Molding (Hot Melt)
Pick & Place – Vision & Camera System
Plasma Surface Treatment
Plastic Injection Molding
Potting - 2 Component
Progressive Stamping
Reflow Oven – Multiple Zone Convection
Reed Switch Manufacturing
Reed Relay Design and Manufacturing - SMD,
Low Thermal, High Insulation, High Voltage,
High Frequency, Latching and ATEX, Selective
Soldering







### **QUALITY / LAB CAPABILITIES**

TS16949, IP67
SPC Data Collection
Fully Equipped Certified Test Labs
Burn-in and Life Testing
Complete In-House Machine Shop
Corona Discharge Testing Capabilities
Mechanical and Thermal Shock
Microscopic Investigation / DPA
Moisture Resistance and Seal Testing
Radiographic Salt Fog and Solderability
Scott T Angular Accuracy
Terminal Strength
Thermal Cycling
Temperature Rise and Vibration



### **TESTING & TOOLING**

Automated Assembly and Test Systems
Environmental and Durability Testing
Life Testing
Specialized Lab Testing Equipment including
but not limited to: Network Analyzers Flux-

but not limited to: Network Analyzers, Fluxmeters, Nanovoltmeters, Picoammeters, Destructive Pull Testers, Gauss / Teslameters







### **ENGINEERING**

Electronic sensor engineering
Circuit Design and PCB Layout
Patented Conductivity Sensors
Patented Inductive Sensors
3-D CAD Modeling
3-D Magnetic Sensor Mapping
EMS Software
PCB Prototyper
Quick Turn Samples, 3-D Printing

### **DESIGN GUIDE** | Planar Transformers & Inductors

### "CUSTOM IS STANDARD" - Why SME Planar Transformers & Inductors?

As more and more industries begin to feel the push toward higher efficiency and performance along with miniaturization, the planar transformer continues to emerge as an alternative to wire-wound transformers, making it ideal in certain application "sweet spots". This solution makes so much sense for today's applications, and when you combine planar transformers with excellent engineering, you can get a solution that not only saves you space, time, and costs, but suits your needs uniquely and specifically. We are your "Application Engineering Experts".

The unique P025 - P1100 product line of planar transformers come in **standard sizes** and with hundreds of lead frames and PCB windings in stock, they can be **quickly customized often without start-up or tooling costs** for many power topologies, including soft switching, single or multiple outputs, different switching frequencies, and different input/output voltages as well as multi-winding inductors. Refer to the below Custom Design Guide Overview.

### STANDEX-MEDER UNIQUE ADVANTAGES

- Patented (U.S. PAT. 7,129,809) header and terminal (U.S. PAT. 7,460,002) design yielding superior thermal management
- Direct thermal contact between bottom of ferrite core and heat dissipating substrate
- · Can attach to a substrate/heatsink with controlled temperature
- · Stable and precise co-planarity of terminals on both sides
- · Excellent solderability characteristics
- Planar turn surface in direct contact core backwall, thus greatly improving thermal conductivity and reducing EMI
- · Flexible, low impedance terminations
- · Able operate without any air flow for cooling
- · Meets required min. 8mm clearance and creepage

### **ELECTRICAL & MECHANICAL SPECS**

- · Height low profile
- · Low leakage inductance
- · Repeatable leakage inductance, capacitance
- · Volumetric efficiency (small size)
- · Low turns count improves Cu loss
- Optimized core cross section lowers core loss

- · Large core surface promotes heat transfer
- · Low loss, reliable PCB construction
- · AC Resistance and Proximity Cu Loss Minimized

### **APPLICATIONS**

- AC-DC resonant designs
- · Aerospace & Military (high reliability/repeatability)
- Appliance
- · Automotive, Electric and Hybrid Vehicles
- Battery Charging (12V, 24V, 48V, 1-10 KW)
- DC-DC Converters (100W-1200W) in distributed power systems
- · Distributed Isolated Power
- · Feedback Control
- · High Current POL Converters
- · High Power LED Lighting, Industrial Power, Welding
- · Isolated Inverters
- Isolated (non-regulated) Bus Converter (Vout 9-12V)
- · Renewable Energy Wind & Photovoltaic Power System
- Server Data Centers (400VDC)
- Telecom Applications ("Sweet Spot" 36-72 Vin 40-250W)
- · Welding, Lasers, Test Equipment

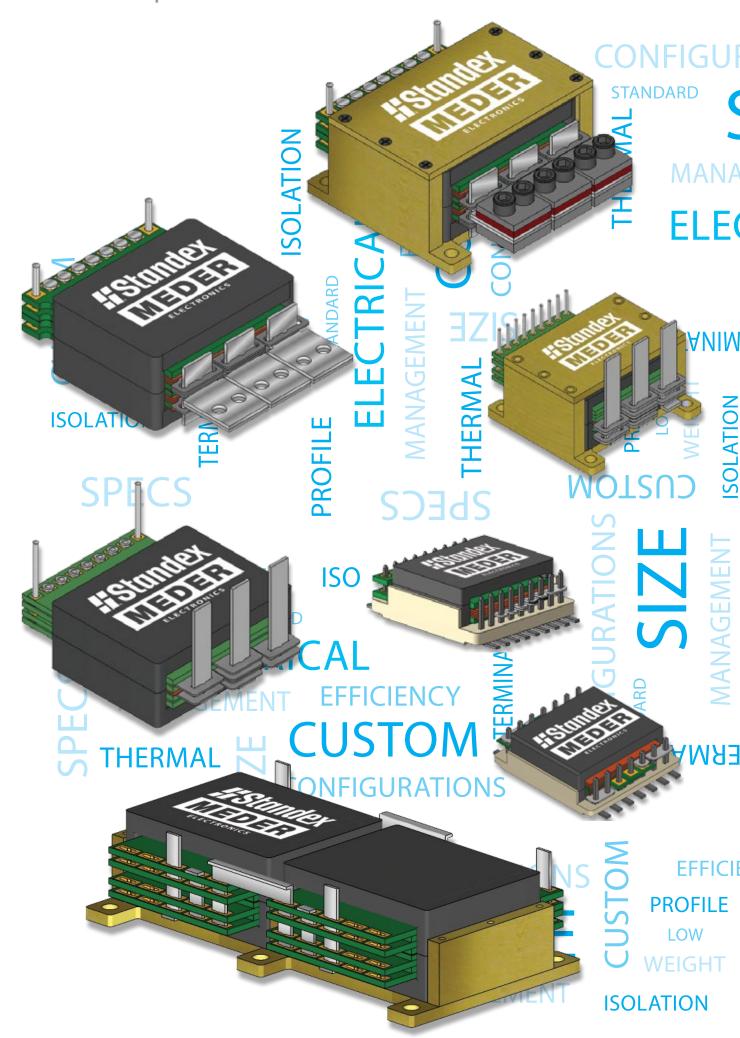
### **Planar Magnetics Custom Design Guide**

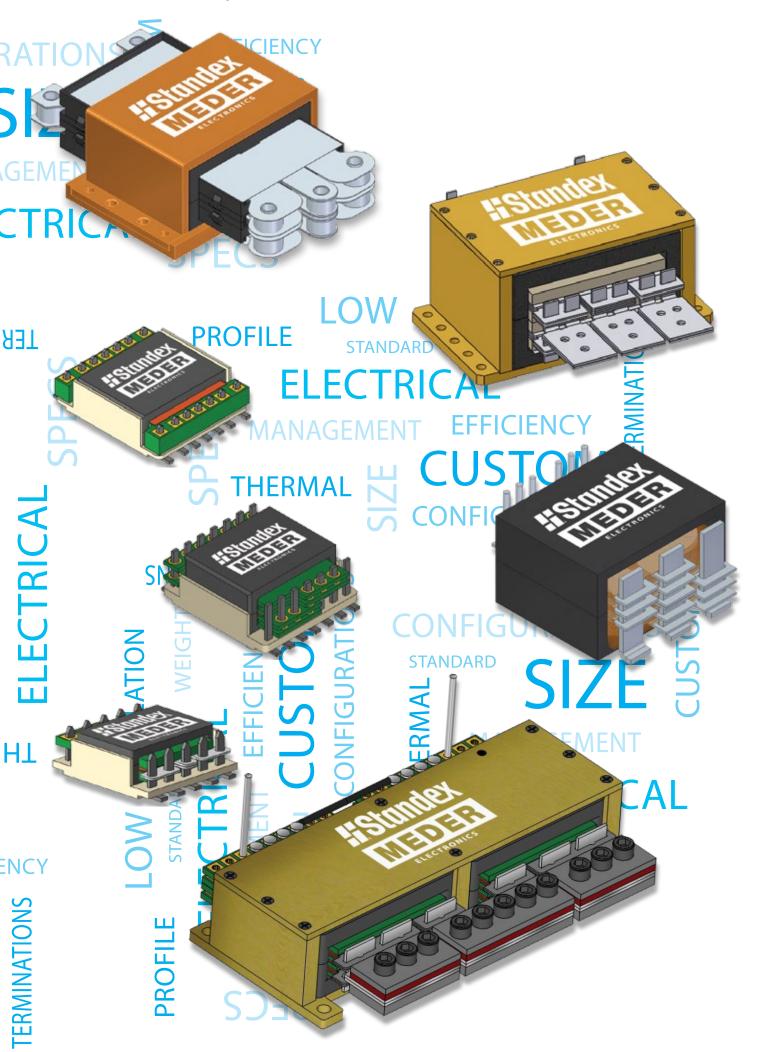
Size	Page #	Optimum Power Range	Max Current Rating	Typical Topology	Optimum Frequency Range kHZ	Typical Dimensions L x W x H (1) mm	Isolation Voltage Pri - Sec (VDC) Pri - Core (VDC)
P025 (3)	6	10W - 50W	20A (2)	Forward, Flyback	300 - 500	17.0 x 15.7 x 6.3	500 - 2000 VDC
P035 (3)	7	20W - 150W	30A (2)	Half Bridge, Forward, Flyback	200 - 400	22.9 x 19.8 x 7.6	500 - 2000 VDC
P055 (3)	8	50W - 200W	50A	Half Bridge, Forward, Flyback	175 - 300	24.1 x 21.8 x 9.1	500 - 2000 VDC
P075 (3)	9	100W - 500W	50A (2)	Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull, Flyback	150 - 300	35.0 x 26.3 x 10.2 28.7 x 26.3 x 10.2	5000 VDC 500 - 2000 VDC
P110 (3)	10	150W - 700W	60A (2)	Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull	100 - 250	39.9 x 28.4 x 12.7 33.5 x 28.4 x 12.7	5000 VDC 500 - 2000 VDC
P135	11-12	300W - 1.2kW	100A	Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull	100 - 250	44.4 x 32.0 x 15.2 38.1 x 32.0 x 12.7	5000 VDC 500 - 2000 VDC
P220	13-14	1kW - 3.0kW	250A	Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull	60 - 200	50.8 x 40.6 x 20.3 45.7 x 40.6 x 17.8	5000 VDC 500 - 2000 VDC
P350	15-16	2kW - 6kW	300A	Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull	40 - 150	58.4 x 50.8 x 25.4 53.3 x 50.8 x 21.6	5000 VDC 500 - 2000 VDC
P560	17-18	3kW - 10kW	400A	Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull	40 - 125	71.1 x 64.0 x 30.5 66.0 x 64.0 x 25.4	5000 VDC 500 - 2000 VDC
P900	19-20	10kW - 20kW	500A	Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull	40 - 125	118.1 x 110.7 x 43.9	5000 VDC
P1100	21	10kW - 30kW	600A	Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull	20 - 125	144.8 x 94.0 x 38.1	5000 VDC

<sup>1)</sup> Length (L) may vary depending on terminals. Height (H) may vary depending on input / output requirements

<sup>2)</sup> Current rating is 30% higher for through hole applications

<sup>3)</sup> Available in both SMD and through hole versions







**DESIGN EXAMPLES** 

### SIZE P025

### **Power Range 10W-50W**

"Application Engineering Experts"

# CUSTOM IS STANDARD

Design Example Part #	•	Pri. Np Turns (Pins)	Ns1	Max (2)	Sec. Ns1 Turns (Pins)	Ns2	Sec. Ns2 Turns	mm (in) (1)
1125-1	36 - 75	12 (1-5)	3	30	2 (6,7-9,10)	-	-	6.4 (0.250")
1125-2	18 - 36	6 (1-3)	3	30	2 (6,7-9,10)	-	-	6.4 (0.250")
1125-3	36 - 75	12 (1-5)	5	20	3 (6-10)	-	-	6.4 (0.250")
1125-4	18 - 36	6 (1-3)	5	20	3 (6-10)	-	-	6.4 (0.250")
1125-5	36 - 75	12 (1-5)	12	2.5	8 (7-9)	-	-	6.4 (0.250")
1125-6	18 - 36	6 (1-3)	12	2.5	8 (7-9)	-	-	6.4 (0.250")

Notes: Full electrical, thermal, and efficiency calculations available upon request 1) Length (L) may vary depending on terminals. Height (H) may vary depending on input / output requirements. 2) Estimated value for normal conditions. Current rating can be up to 30% higher for through hole applications.

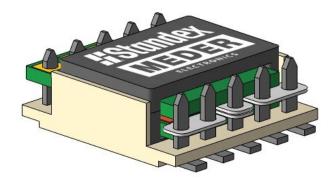
### Highlights

- Patented (U.S. PAT. 7,129,809) design with superior thermal management
- · High efficiency (low losses), ultra compact, low-profile
- Great co-planarity of terminals due to patented header offering repeatable height
- Excellent solderability (Pb-free or Pb/Sn Solder)
- Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages

### **Customize beyond these examples!**

Rated power 10W-50W / Frequency range 300-500kHZ Surface mount (SMD) or through hole (TH) Topology - Forward (w/active rest), Flyback Current rating max. SMD=20A, TH = +30% Isolation voltage pri-sec/pri-core 500-2,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1- 8 (no fractions) Thermal solutions heat sinks, etc.

### SURFACE MOUNT DESIGN

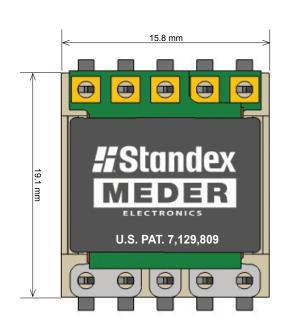




# PCB Pad Layout All Pad dimensions tolerance +/- 0.1 19.0 19.0 2.3 3.0 C/L 3.0 6.0 2.7

### Notes

- Dimensions are in mm
- 4. Header: LCP, natural color
- 2. Drawing not to scale 5. Pins: Copper
- 3. Tolerance +/- 2% unless noted 6. Pin Finish: Tin (Sn) over Nickel (Ni)





**DESIGN EXAMPLES** 

### SIZE P035

### Power Range 20W-150W

"Application Engineering Experts"

# OM IS STANDARD

Design Example Part #	Input Voltage VDC	Pri. Np Turns (Pins)	Ns1	I Out. Max (2) ADC	Sec. Ns1 Turns (Pins)	Ns2	Sec. Ns2 Turns	Height mm (in) (1) Typ.
1124-1	36 - 75	12	3	30	2	-	-	7.6 (0.300")
1124-2	18 - 36	6	3	30	2	-	-	7.6 (0.300")
1124-3	36 - 75	12	3	30	2	12	8	8.1 (0.320")
1124-4	18 - 36	6	3	30	2	12	8	8.1 (0.320")
1124-5	36 - 75	12	5	20	3	-	-	7.6 (0.300")
1124-6	18 - 36	6	5	20	3	-	-	7.6 (0.300")
1124-7	36 - 75	12	5	20	3	12	8	8.1 (0.320")
1124-8	18 - 36	6	5	20	3	12	8	8.1 (0.320")
1124-9	36 - 75	12	12	8	8			7.6 (0.300")
1124-10	18 - 36	6	12	8	8	-	-	7.6 (0.300")
1124-11	36 - 75	12	12	8	8	12	8	8.1 (0.320")
1124-12	18 - 36	6	12	8	8	12	8	8.1 (0.320")

Notes: Full electrical, thermal, and efficiency calculations available upon request 1) Length (L) may vary depending on terminals. Height (H) may vary depending on input / output requirements. 2) Estimated value for normal conditions. Current rating can be up to 30% higher for through hole applications.

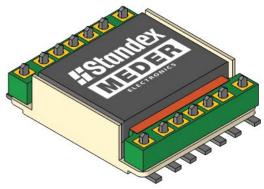
### **Highlights**

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- Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- Inductors available for design in all packages

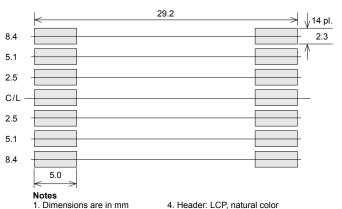
### Customize beyond these examples!

Rated power 20W-150W / Frequency range 200-400kHZ Surface mount (SMD) or through hole (TH) Topology - Half-Bridge, Forward (w/active rest), Flyback Current rating max. SMD=20A, TH = +30% Isolation voltage pri-sec/pri-core 500-2,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1-8 (no fractions) Thermal solutions heat sinks, etc.

### SURFACE MOUNT DESIGN

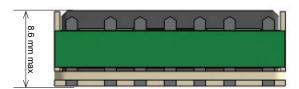


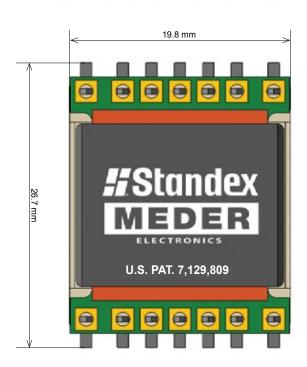
**PCB Pad Layout** All Pad dimensions tolerance +/- 0.1



5. Pins: Copper 2. Drawing not to scale

3. Tolerance +/- 2% unless noted 6. Pin Finish: Tin (Sn) over Nickel (Ni)







:: DESIGN EXAMPLES

### SIZE P055

### Power Range 50W-200W

"Application Engineering Experts"

Design Example Part #	Input Voltage VDC	Pri. Np Turns (Pins)	Ns1	I Out. Max (2) ADC	Sec. Ns1 Turns (Pins)	Ns2	Sec. Ns2 (3) Turns	Height mm (in) <mark>(1)</mark> Typ.
1250-1	36 - 75	8	2.2	50	1	-	-	9.1 (0.360")
1250-2	18 - 36	4	2.2	50	1	-	-	9.1 (0.360")
1250-3	36 - 75	12	3.3	35	2	-		9.6 (0.380")
1250-4	18 - 36	6	3.3	40	2	-	-	9.6 (0.380")
1250-5	36 - 75	8	5	30	2	-	-	9.6 (0.380")
1250-6	18 - 36	4	5	30	2	-	-	9.6 (0.380")
1250-7	36 - 75	8	12	12.5	5	-	-	9.6 (0.380")
1250-8	18 - 36	4	12	12.5	5	-	-	9.6 (0.380")
1250-9	200-350	48	28	5	12	-	-	10.7 (0.420")
1250-10	200-350	48	48	2.5	24	-	-	10.7 (0.420")
P055 AL	<b>TERNATE</b>	DESIG	NS					
1284-1	36 - 75	10	-	15	2	-	-	-
1284-2	18 - 36	5	<b>-</b>	15	2			-

Notes: Full electrical, thermal, and efficiency calculations available upon request 1) Length (L) may vary depending on terminals. Height (H) may vary depending on input / output requirements. 2) Estimated value for normal conditions. Current rating can be up to 30% higher for through hole applications. 3) Ns2 / Ns3 max. load current output after rectification by (turns) as follows: (8) = 2.5 A each, (7) = 3.0 A each, (6) = 3.5 A each, (5) = 4.5 A each, (4) = 5.75 A each, (3) = 7.5 A each, (2) = 10.0 A each

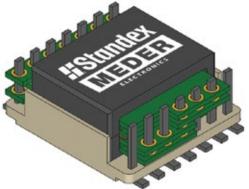
### **Highlights**

- Patented (U.S. PAT. 7,129,809) design with superior thermal management
- · High efficiency (low losses), ultra compact, low-profile
- · Great co-planarity of terminals due to patented header offering repeatable height
- Excellent solderability (Pb-free or Pb/Sn Solder)
- · Standard sizes / customer configurations
- · Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages

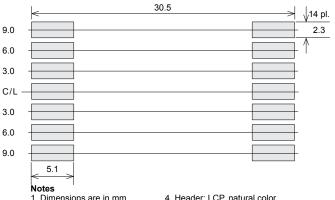
### Customize beyond these examples!

Rated power 50W-200W / Frequency range 175-300kHZ Surface mount (SMD) or through hole (TH) Topology - Half Bridge, Forward (w/active rest), Flyback Current rating max. SMD=20A, TH = +30% Isolation voltage pri-sec/pri-core 500-2,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1-8 (no fractions) Thermal solutions heat sinks, etc.

### SURFACE MOUNT DESIGN

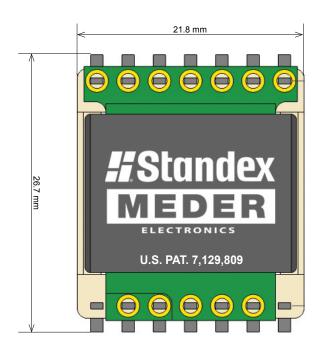


**PCB Pad Layout** All Pad dimensions tolerance +/- 0.1



- 1. Dimensions are in mm
- 4. Header: LCP, natural color
- 2. Drawing not to scale 5. Pins: Copper
  - Tolerance +/- 2% unless noted 6. Pin Finish: Tin (Sn) over Nickel (Ni)

11.2 mm max





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SIGN EXAMPLES

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### **SIZE P075**

### **Power Range 100W-500W**

### "Application Engineering Experts"

# CUSTOM IS STANDARD

Design Example Part #	Input Voltage VDC		Ns1	I Out. Max (2) ADC		Ns2		Height mm (in) (1) Typ.
1235-1	36 - 75	6	3.3	30²	1	15	5	10.2 (0.400")
1235-2	36 - 75	6	5	26²	2	15	6	10.2 (0.400")
1235-3	36 - 75	6	12	10²	4	15	5	10.2 (0.400")
1235-4	36 - 75	6	15	7.8 <sup>2</sup>	5	15	5	10.2 (0.400")

Notes: Full electrical, thermal, and efficiency calculations available upon request 1) Length (L) may vary depending on terminals. Height (H) may vary depending on input / output requirements. 2) Estimated value for normal conditions. Current rating can be up to 30% higher for through hole applications.

### Highlights

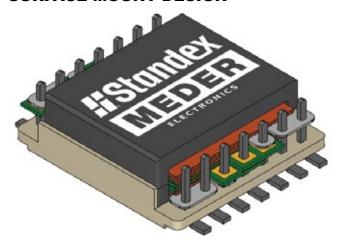
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- · Inductors available for design in all packages

### Customize beyond these examples!

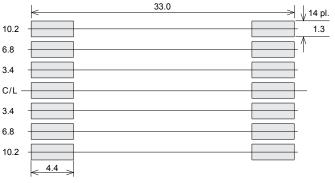
Rated power 100W-500W / Frequency range 150-300kHZ Surface mount (SMD) or through hole (TH) Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull, Flyback Current rating max. SMD=20A, TH = +30% Isolation voltage pri-sec/pri-core 500-5,000VDC Soft switching, single or multiple outputs

Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1- 8 (no fractions) Thermal solutions heat sinks, etc.

### **SURFACE MOUNT DESIGN**



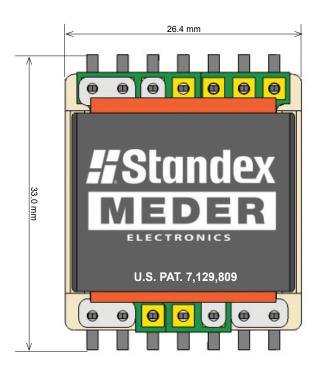
# PCB Pad Layout All Pad dimensions tolerance +/- 0.1



### Notes

- Dimensions are in mm
- 4. Header: LCP, natural color
- 2. Drawing not to scale
- 5. Pins: Copper
- 3. Tolerance +/- 2% unless noted 6. Pin Finish: Tin (Sn) over Nickel (Ni)

10.7 mm max





**DESIGN EXAMPLES** 

### **SIZE P110**

### Power Range 150W-700W

"Application Engineering Experts"

# CUSTOM IS STANDARD

Design Example Part #	Input Voltage VDC	Pri. Np Turns (Pins)	Ns1	Max (2)	Sec. Ns1 Turns (Pins)	Ns2	Sec. Ns2 Turns	\ / \ /
1240-1	190-350	16	2.2	15²	3	-	-	12.7(0.500")
1240-2	190-350	24	2.2	27 <sup>2</sup>	2	24	4	12.7(0.500")
1240-3	190-350	28	3.3	46²	1	15	3	12.7(0.500")
1240-4	190-350	16	3.3	10 <sup>2</sup>	5	-	-	12.7(0.500")
1240-5	190-350	20	5	27 <mark>2</mark>	2	15	2	12.7(0.500")

Notes: Full electrical, thermal, and efficiency calculations available upon request 1) Length (L) may vary depending on terminals. Height (H) may vary depending on input / output requirements. 2) Estimated value for normal conditions. Current rating can be up to 30% higher for through hole applications.

### Highlights

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- Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages

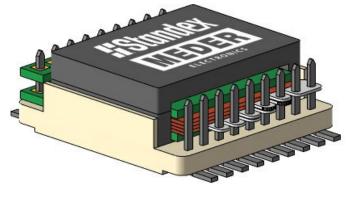
### **Customize beyond these examples!**

Thermal solutions heat sinks, etc.

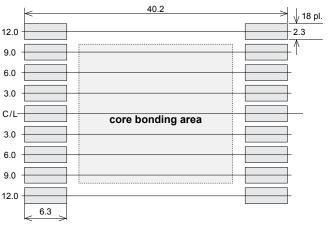
Rated power 150W-700W / Frequency range 175-300kHZ Surface mount (SMD) or through hole (TH) Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull, Flyback Current rating max. SMD=20A, TH = +30% Isolation voltage pri-sec/pri-core 500-5,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions)

Secondary Ns1, Ns2 / Ns3 turns 1-8 (no fractions)

### SURFACE MOUNT DESIGN

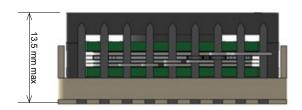


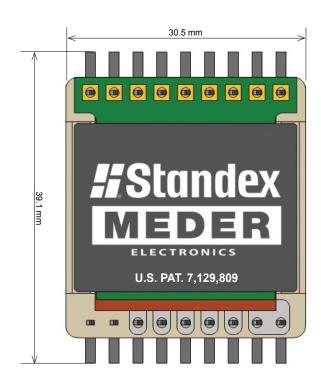
PCB Pad Layout
All Pad dimensions tolerance +/- 0.1



### Notes

- Dimensions are in mm
   Header: LCP, natural color
- 2. Drawing not to scale 5. Pins: Copper
- 3. Tolerance +/- 2% unless noted 6. Pin Finish: Tin (Sn) over Nickel (Ni)







### Power Range 300W-1.2kW

### "Application Engineering Experts"

# CUSTOM IS STANDARD

Total output power (12VDC@50A)	600W	Pri-sec turns ratio	20:1+1
Operating frequency	200 kHz	Dielectric strength	
Input voltage range	370-410 VDC	Pri-sec/pri-core	4,000 VDC
Topology	Full Bridge ZVS	Isolation sec-core	500 VDC
Max volt-µsec product	1216	Ambient temperature	60 °C
Duty cycle	66 %	Total losses	6.0 W
Primary current	2.9 Arms	Hot spot temperature	108 °C
Secondary current	35.4 Arms	Approx. Weight	100 grams
•			•

Notes: Assumes transformer is cooled by airflow only @ 200  $^{\circ}\text{C LFM}$ 

### :: DESIGN EXAMPLE ::

### Highlights

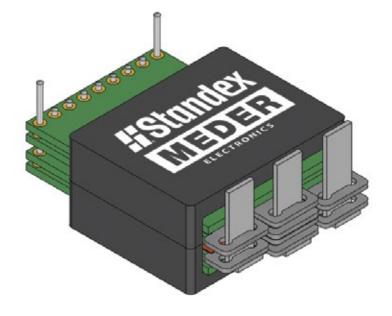
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- Excellent solderability (Pb-free or Pb/Sn Solder)
- · Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages
- Large secondary pins reduce temperature rise on terminals

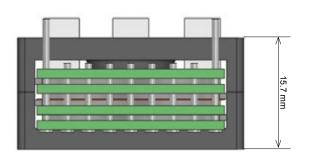
### **Customize beyond these examples!**

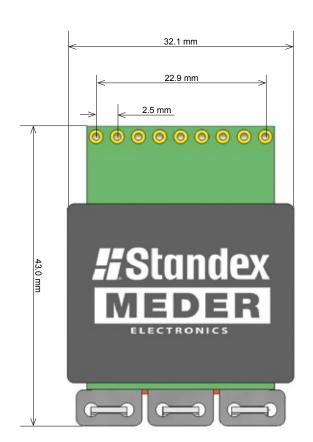
Rated power 300W-1.2kW / Frequency range 100-250kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull

Current rating max. SMD=20A, TH = +30% Isolation voltage pri-sec/pri-core 500-5,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1-8 (no fractions) Thermal solutions heat sinks, etc.

### THROUGH HOLE / J-HOOK MOUNT









### Power Range 300W-1.2kW

### "Application Engineering Experts"

# CUSTOM IS STANDARD

Total output power (12VDC@100A)	1.2kW	Pri-sec turns ratio	24:1+1
Operating frequency	120 kHz	Dielectric strength	
Input voltage range	380-410 VDC	Pri-sec/pri-core	4,000 VDC
Topology	Full Bridge	Isolation sec-core	500 VDC
Max volt-µsec product	2564	Ambient temperature	600 °C
Duty cycle	82 %	Total losses	11 W
Primary current	4.1 Arms	Hot spot temperature	98 °C
Secondary current	70.7 Arms	Approx. Weight	130 grams

Notes: Assumes transformer is cooled by a coldplate @ 75°C max.

### :: DESIGN EXAMPLE ::

### Highlights

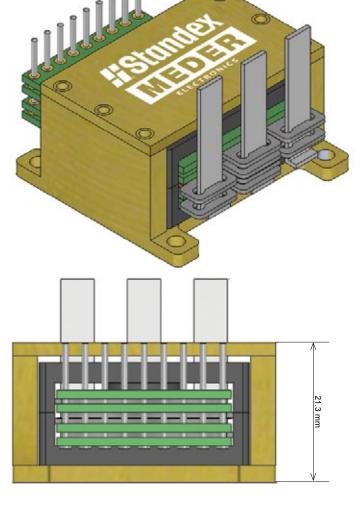
- Anodized aluminum heatsinks offering high thermal conductivity and removing heat from windings
- · High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages
- Large secondary pins reduce temperature rise on terminals

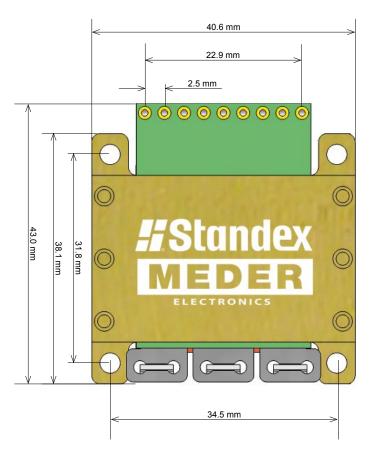
### Customize beyond these examples!

Rated power 300W-1.2kW / Frequency range 100-250kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull

Current rating max. SMD=20A, TH = +30% Isolation voltage pri-sec/pri-core 500-5,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1- 8 (no fractions) Thermal solutions heat sinks, etc.

### THROUGH HOLE / J-HOOK MOUNT





4,000 VDC

220 grams

500 VDC



### SIZE P220

### **Power Range 1kW-3kW**

### "Application Engineering Experts"

Total output power (24VDC@40A)	1.0kW	Pri-sec turns ratio	12:2+2
Operating frequency	140 kHz	Dielectric strength	
Input voltage range	180-325 VDC	Pri-sec/pri-core	4,000 VI
Topology	Forward	Isolation sec-core	500 VD0
Max volt-µsec product	540	Ambient temperature	50 °C
Duty cycle	84 %	Total losses	12 W
Primary current	9.7 Arms	Hot spot temperature	116 °C
Secondary current	26 Arms	Approx. Weight	220 gra

Notes: Assumes transformer is cooled by a coldplate @ 75°C max.

### :: DESIGN EXAMPLE ::

### **Highlights**

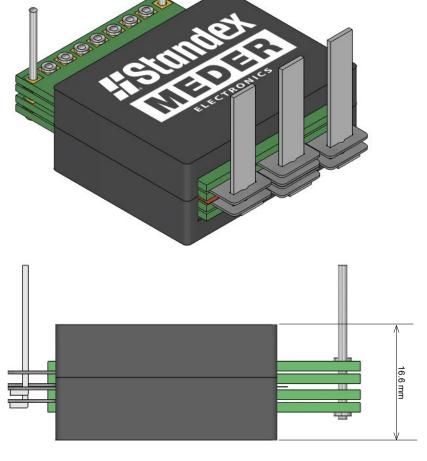
- · High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- · Standard sizes / customer configurations
- · Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages
- · Large secondary pins reduce temperature rise on terminals

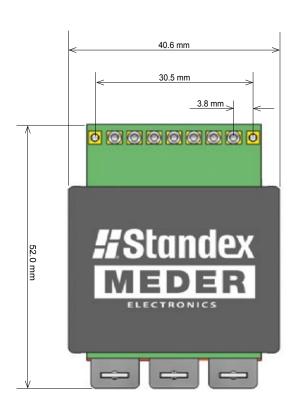
### **Customize beyond these examples!**

Rated power 1KW-3kW / Frequency range 60-200kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS,

Current rating max. 250A Isolation voltage pri-sec/pri-core 500- 5,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1-8 (no fractions) Thermal solutions heat sinks, etc.

### THROUGH HOLE / J-HOOK MOUNT







### **Power Range 1kW-3kW**

"Application Engineering Experts"

# CUSTOM IS STANDARD

Total output power (28VDC@71A)	2.0kW	Pri-sec turns ratio	10:1+1
Operating frequency	200 kHz	Dielectric strength	
Input voltage range	180-300 VDC	Pri-sec/pri-core	4,000 VDC
Topology	Fwd Bridge	Isolation sec-core	500 VDC
Max volt-µsec product	716	Ambient temperature	60 °C
Duty cycle	80 %	Total losses	21.7 W
Primary current	15.1 Arms	Hot spot temperature	112 °C
Secondary current	50.2 Arms	Approx. Weight	250 grams

Notes: Assumes transformer is cooled by a coldplate @ 75°C max.

### :: DESIGN EXAMPLE ::

### Highlights

- Anodized aluminum heatsinks offering high thermal conductivity and removing heat from windings
- · High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- · Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages
- Large secondary pins reduce temperature rise on terminals

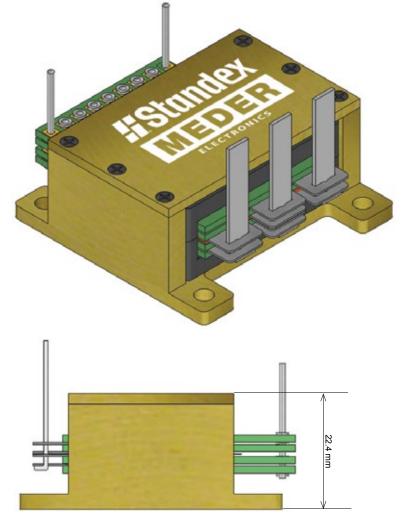
### Customize beyond these examples!

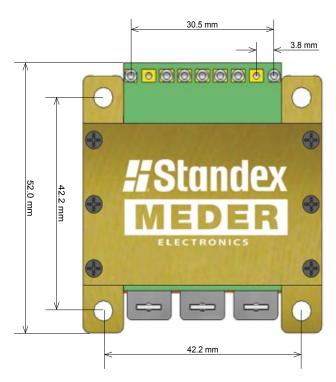
Rated power 1KW-3kW / Frequency range 60-200kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push Pull

Current rating max. 250A

Isolation voltage pri-sec/pri-core 500- 5,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1- 8 (no fractions) Thermal solutions heat sinks, etc.

### THROUGH HOLE / J-HOOK MOUNT







### Power Range 2kW-6kW

"Application Engineering Experts"

# CUSTOM IS STANDARD

Total output power (28VDC@130A)	3.6kW	Secondary current Pri-sec turns ratio	92 Arms 14:1+1
Operating frequency	200 kHz	Dielectric strength	
Input voltage range	500-800 VDC	Pri-sec/pri-core	3,000 VDC
Topology	Full Bridge	Isolation sec-core	1,000 VDC
	LLC Resonant	Ambient temperature	85 °C
Max volt-µsec product	2017	Total losses	23.4 W
Duty cycle	81 %	Hot spot temperature	120 °C
Primary current	9.3 Arms	Approx. Weight	270 grams

Notes: Assumes transformer is cooled by a coldplate @ 75°C max.

### :: DESIGN EXAMPLE ::

### Highlights

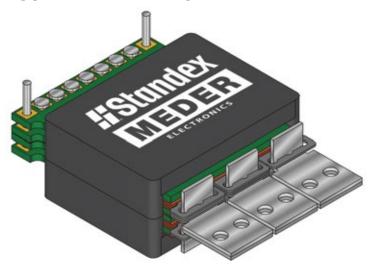
- Anodized aluminum heatsinks offering high thermal conductivity and removing heat from windings
- Patented (U.S. Patent 7,460,002) terminals offer mechanical strength and very low resistance
- High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- · Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- Inductors available for design in all packages
- Large secondary pins reduce temperature rise on terminals
- Various terminal options available (SMD, Thru-hole, screw terminals)

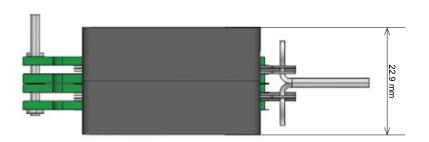
### **Customize beyond these examples!**

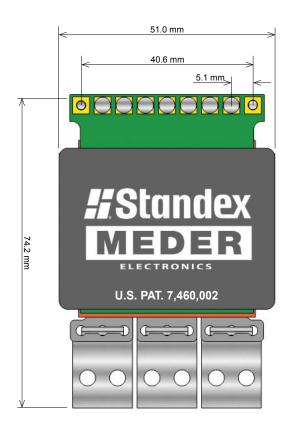
Rated power 2kW-6kW / Frequency range 40-150kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull Current rating max. 300A

Isolation voltage pri-sec/pri-core 500- 5,000VDC
Soft switching, single or multiple outputs
Different switching frequencies, input/output voltages
Primary turns - other number (no fractions)
Secondary Ns1, Ns2 / Ns3 turns 1- 8 (no fractions)
Thermal solutions heat sinks, etc.

### **BUS BAR TERMINATION**









### Power Range 2kW-6kW

"Application Engineering Experts"

# STOM IS STANDARD

Total output power (15VDC@300A)	5.0kW	Pri-sec turns ratio	10:1+1
Operating frequency	50 kHz	Dielectric strength	
Input voltage range	220-320 VDC	Pri-sec/pri-core	3,000 VDC
Topology	Full Bridge	Isolation sec-core	500 VDC
Max volt-µsec product	3085	Ambient temperature	60 °C
Duty cycle	71 %	Total losses	40.2 W
Primary current	29.7 Arms	Hot spot temperature	115°C
Secondary current	196.3 Arms	Approx. Weight	350 grams

Notes: Assumes transformer is cooled by a coldplate @ 75°C max.

### :: DESIGN EXAMPLE ::

### **Highlights**

- · Anodized aluminum heatsinks offering high thermal conductivity and removing heat from windings
- · Patented (U.S. Patent 7,460,002) terminals offer mechanical strength and very low resistance
- · High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- Standard sizes / customer configurations
- · Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages
- · Large secondary pins reduce temperature rise on
- Various terminal options available (SMD, Thru-hole, screw terminals)

### **Customize beyond these examples!**

Rated power 2kW-6kW / Frequency range 40-150kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS,

Current rating max. 300A

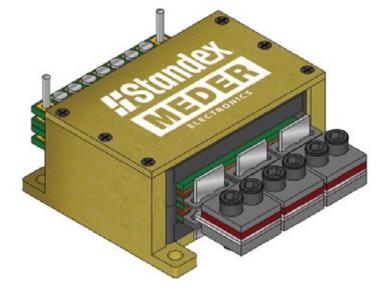
Isolation voltage pri-sec/pri-core 500- 5,000VDC

Soft switching, single or multiple outputs

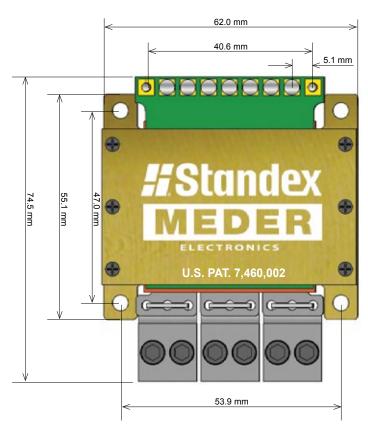
Different switching frequencies, input/output voltages Primary turns - other number (no fractions)

Secondary Ns1, Ns2 / Ns3 turns 1- 8 (no fractions) Thermal solutions heat sinks, etc.

### **BUS BAR TERMINATION**









### Power Range 3kW-10kW

### "Application Engineering Experts"

# CUSTOM IS STANDARD

Total output power (31VDC@100A)	3.1kW	Pri-sec turns ratio	16:2+2
Operating frequency	50 kHz	Dielectric strength	
Input voltage range	405-495 VDC	Pri-sec/pri-core	3,000 VDC
Topology	Full Bridge	Isolation sec-core	500 VDC
Max volt-µsec product	5081	Ambient temperature	60 °C
Duty cycle	63 %	Total losses	15.6 W
Primary current	10.7 Arms	Hot spot temperature	114 °C
Secondary current	56.1 Arms	Approx. Weight	480 grams

Notes: Assumes transformer is cooled by a coldplate @ 75°C max.

### :: DESIGN EXAMPLE ::

### Highlights

- Patented (U.S. Patent 7,460,002) terminals offer mechanical strength and very low resistance
- High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- · Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- Inductors available for design in all packages
- Large secondary pins reduce temperature rise on terminals
- Various terminal options available (SMD, Thru-hole, screw terminals)

### **Customize beyond these examples!**

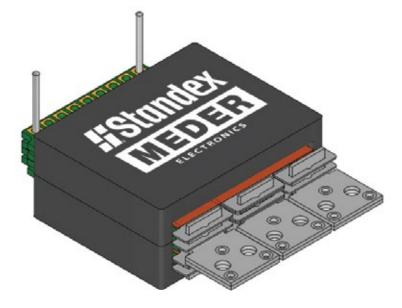
Rated power 3kW-10kW / Frequency range 40-125kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull

Current rating max. 400A

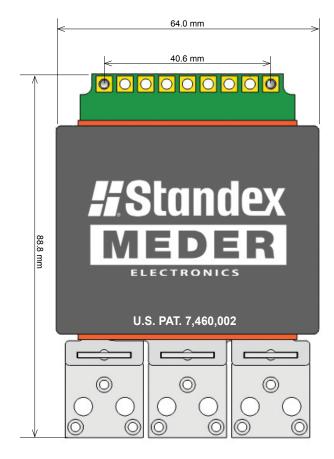
Isolation voltage pri-sec/pri-core 500- 5,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1- 8 (no fractions)

Thermal solutions heat sinks, etc.

### **BUS BAR TERMINATION**









### Power Range 3kW-10kW

# "Application Engineering Experts"

#Standex

**MEDER** 

# STOM IS STANDARD

Total output power (28VDC@300A)	8.4kW	Pri-sec turns ratio	10:1+1
Operating frequency	50 kHz	Dielectric strength	
Input voltage range	380-410 VDC	Pri-sec/pri-core	3,000 VDC
Topology	Full Bridge	Isolation sec-core	500 VDC
Max volt-µsec product	5785	Ambient temperature	60 °C
Duty cycle	77 %	Total losses	40 W
Primary current	28 Arms	Hot spot temperature	115 °C
Secondary current	186 Arms	Approx. Weight	700 grams

Notes: Assumes transformer is cooled by a coldplate @ 75°C max.

### :: DESIGN EXAMPLE ::

### **Highlights**

- · Anodized aluminum heatsinks offering high thermal conductivity and removing heat from windings
- · Patented (U.S. Patent 7,460,002) terminals offer mechanical strength and very low resistance
- High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- · Standard sizes / customer configurations
- · Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages
- · Large secondary pins reduce temperature rise on
- Various terminal options available (SMD, Thru-hole, screw terminals)

### **Customize beyond these examples!**

Rated power 3kW-10kW / Frequency range 40-125kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS,

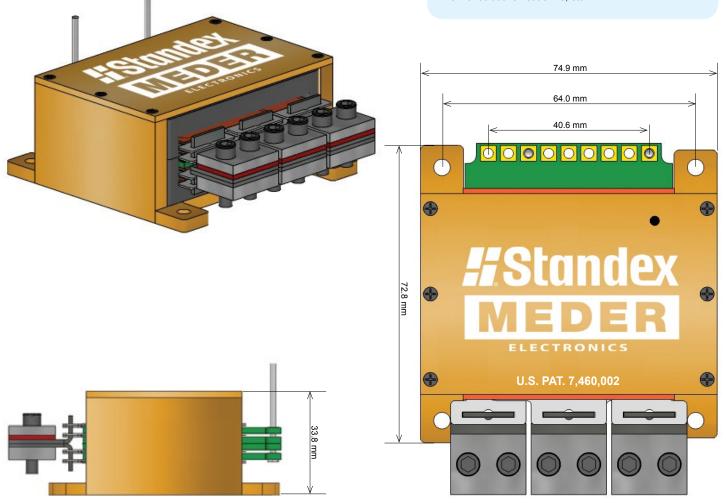
Current rating max. 400A

Isolation voltage pri-sec/pri-core 500- 5,000VDC Soft switching, single or multiple outputs

Different switching frequencies, input/output voltages Primary turns - other number (no fractions)

Secondary Ns1, Ns2 / Ns3 turns 1- 8 (no fractions) Thermal solutions heat sinks, etc.

# **BUS BAR TERMINATION**





### **Power Range 10kW-20kW**

### "Application Engineering Experts"

# CUSTOM IS STANDARD

Total output power (40VDC@250A)	10kW	Pri-sec turns ratio	12:2+2
Operating frequency	30 kHz	Dielectric strength	
Input voltage range	252-308 VDC	Pri-sec/pri-core	4,000 VDC
Topology	Full Bridge ZVS	Isolation sec-core	1,000 VDC
Max volt-µsec product	8236	Ambient temperature	60 °C
Duty cycle	98 %	Total losses	90 W
Primary current	46 Arms	Hot spot temperature	105 °C
Secondary current	177 Arms	Approx. Weight	550 grams

Notes: Assumes transformer is cooled by a heatsink @ 75°C max. and forced airflow

### :: DESIGN EXAMPLE ::

### Highlights

- Patented (U.S. Patent 7,460,002) terminals offer mechanical strength and very low resistance
- High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- · Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- Inductors available for design in all packages
- Large secondary pins reduce temperature rise on terminals
- Various terminal options available (SMD, Thru-hole, screw terminals)

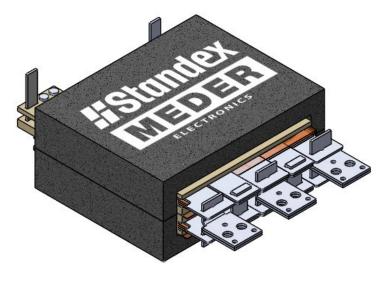
### **Customize beyond these examples!**

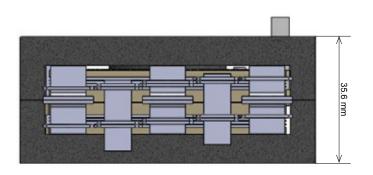
Thermal solutions heat sinks, etc.

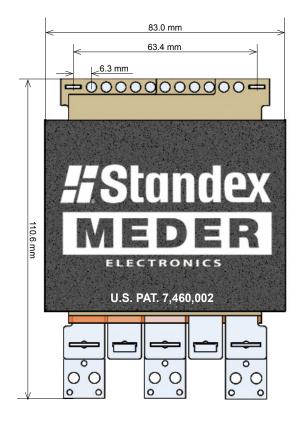
Rated power 10KW-20kW / Frequency range 40-125kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull Current rating max. 500A

solation voltage pri-sec/pri-core 500- 5,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages Primary turns - other number (no fractions) Secondary Ns1 turns 1- 4 (no fractions)

### **BUS BAR TERMINATION**









### Power Range 10kW-20kW

### "Application Engineering Experts"

# CUSTOM IS STANDARD

Total output power (45VDC@330A)	15.0kW	Pri-sec turns ratio	8:1+1
Operating frequency	70 - 100 kHz	Dielectric strength	
Input voltage range	548-743 VDC	Pri-sec/pri-core	4,000 VDC
Topology	Full Bridge ZVS	Isolation sec-core	1,000 VDC
Max volt-µsec product	3884	Ambient temperature	75 °C
Duty cycle	96 %	Total losses	95 W
Primary current	32 Arms	Hot spot temperature	122 °C
Secondary current	330 A	Approx. Weight	950 grams

Notes: Assumes transformer is cooled by a coldplate @ 75°C max. and forced airflow

### :: DESIGN EXAMPLE ::

### **Highlights**

- Anodized aluminum heatsinks offering high thermal conductivity and removing heat from windings
- Patented (U.S. Patent 7,460,002) terminals offer mechanical strength and very low resistance
- · High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages
- Large secondary pins reduce temperature rise on terminals.
- Various terminal options available (SMD, Thru-hole, screw terminals)

### **Customize beyond these examples!**

Rated power 10KW-20kW / Frequency range 40-125kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull

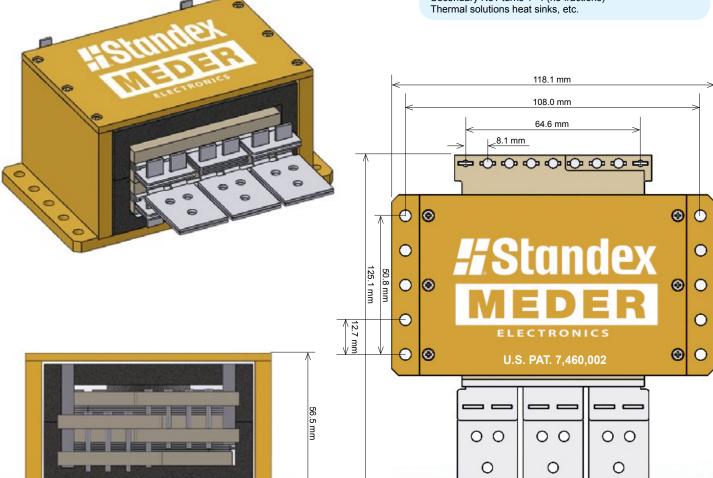
Current rating max. 500A solation voltage pri-sec 5,000VDC

Isolation voltage pri-core 500-2,000VDC Soft switching, single or multiple outputs

Different switching frequencies, input/output voltages

Primary turns - other number (no fractions) Secondary Ns1 turns 1- 4 (no fractions)

## **BUS BAR TERMINATION**



### Power Range 10kW-30kW

# Standex | Custom Engineered Solutions for Tomorrow

"Application Engineering Experts"

# CUSTOM IS STANDARD

Total output power (400VDC@50A)	20.0kW
Operating frequency	40 kHz
Input voltage range	246-286 VDC
Topology	Full-Bridge
Max volt-µsec product	3884
Duty cycle	84 %
Secondary current	50 Arms

**BUS BAR TERMINATION** 

Pri-sec turns ratio 8:8+8

Dielectric strength
Pri-sec/pri-core 4,000 VDC
Isolation sec-core 1,000 VDC
Ambient temperature 60 °C
Total losses 120 W
Hot spot temperature 110 °C
Approx. Weight 3 lbs

Notes: Assumes transformer is cooled by a coldplate @ 60°C max. and forced airflow

### :: DESIGN EXAMPLE ::

### **Highlights**

- Anodized aluminum heatsinks offering high thermal conductivity and removing heat from windings
- Patented (U.S. Patent 7,460,002) terminals offer mechanical strength and very low resistance
- · High efficiency (low losses), ultra compact, low-profile
- Excellent solderability (Pb-free or Pb/Sn Solder)
- · Standard sizes / customer configurations
- Quick custom turn-around often without start-up or tooling costs
- · Inductors available for design in all packages
- Large secondary pins reduce temperature rise on terminals
- Various terminal options available (SMD, Thru-hole, screw terminals)

### **Customize beyond these examples!**

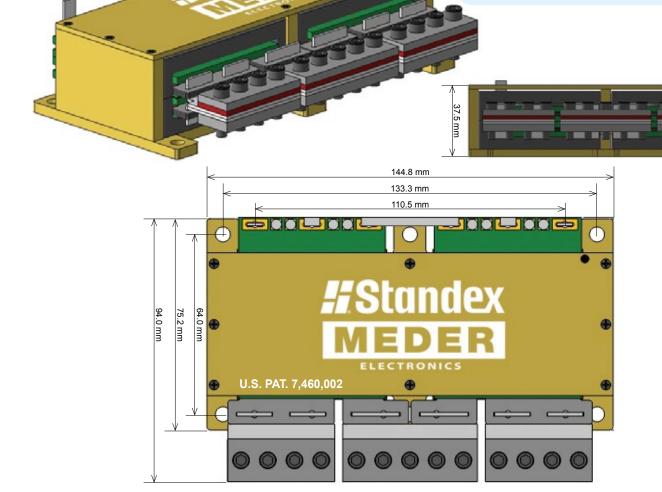
Rated power 10kW-30kW / Frequency range 20-125kHZ Topology - Full Bridge, Half Bridge, Full Bridge ZVS, Push-Pull

Current rating max. 600A

Isolation voltage pri-sec/pri-core 5,000VDC Soft switching, single or multiple outputs Different switching frequencies, input/output voltages

Primary turns - other number (no fractions) Secondary Ns1, Ns2 / Ns3 turns 1- 8 (no fractions)

Thermal solutions heat sinks, etc.





# **PQ STYLE | Planar Inductors** 0.4-6.0µH, 80A max

"Application Engineering Experts"

# STOM IS STANDARD

Standard Part Number "R" = Optional Tape & Reel	Core Style	Height (mm)	Nom. (A)	L (µH)	DCR Nom. (mΩ)	Isat (A 10% Drop	A) typ 20% Drop
PQ2007-0R4-70-G or T -R	PQ20	7	70	0.4	0.7	71	83
PQ2006-1R0-30-G or T -R	PQ20	6	30	1.0	1.0	35	39
PQ2007-2R2-25-G or T -R	PQ20	7	25	2.2	3.5	29	32
PQ2007-4R4-15-G or T -R	PQ20	7	15	4.4	3.6	16	18
PQ2613-1R0-80-G or T -R	PQ26	13	80	1.0	1.2	110	120
PQ3213-0R9-70-G or T -R	PQ32	13	70	0.9	1.0	100	110
PQ3218-3R3-70-G or T -R	PQ32	18	70	3.3	1.1	74	80
PQ3218-6R0-50-G or T -R	PQ32	18	50	6.0	1.5	51	57

Notes: All Electrical Values at 25°C | Pri: Sec'y: Core Isolation 300 Vrms | Maximum Non-Operating Temperatures: -55°C to +180°C | Maximum Operating Rated Temperatures: -30°C to +125°C | Inductance measured 10kHZ, 1.0V

### **Highlights**

- · Fixed power inductor w/ferrite core used in switching power supplies, DC/DC converters, FPGA and low/high profile current, high current POL converters, feedback control, overload sensing, load drop and shut down
- · Applications include but are not limited to: switching power supplies, DC/DC converters in distributed power systems, FPGA and low-profile high-current, high current POL converters, feedback control, overload sensing, load drop and shut down detection

PQ2007 - 0R4 - 70 - G - R Example

### Customize beyond these examples!

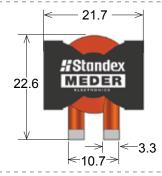
- Core style and size
- Typical height in mm
- 3. Min. inductance in "µH", "R" = decimal point
- Typical Amp rating
  Terminal style "G" = SMT, "T" = Through hole tabs
- 6. Optional packaging "R" = Tape & Reel

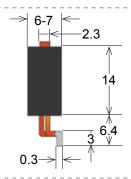
**DESIGN EXAMPLES** 

# Available in Tape & Reel Packaging

### **PQ20** (SMT/THT)

Inductance: 0.4 - 4.4 µH Current Range Typ: 0.7 - 2.5 A 6.0 - 10.0 mm Height Max .: Footprint Max .: 22.6 x 21.7 mm

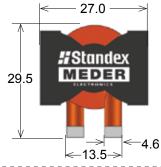


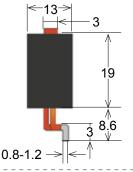




### **PQ26** (SMT/THT)

1.0 µH Inductance: Current Range Typ: 42 A Height Max .: 13.0 mm Footprint Max .: 29.5 x 27.0mm



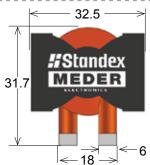


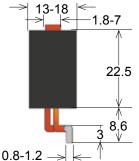


### **PQ32**

0.9 - 6.0 µH Inductance: Current Range Typ: 45 - 60 A Height Max.: 11.0 - 18.0 mm Footprint Max .: 31.7 x 32.5mm

(SMT/THT)







### **Planar Inductor Request Form**

### Fill out a design request today!

We meet each unique need, encompassing our global capabilities to partner, solve, and deliver *custom engineered* solutions for tomorrow. Complete the form below and our engineers and product specialists will review your request and respond with information targeting your application.

### **Planar Inductor Specifications**

\* required fields

Application							
*Operating Frequency		kHz					
Min. Ambient Temperature		°C	M	ax. Ambient Temperature	)		°C
Heatsink Temperature		°C	Ai	rflow			CFM
Dimensions (if needed)	L	mm	W		mm	Н	mm
Target Price		USD					
*Winding 1		μH			Α		
Winding 2		μH			Α		
Winding 3		μH			Α		
Winding 4		μH			Α		
Winding 5		μH			Α		
Max ACpp Ripple Current		А					
Termination Style							
Isolation Requirements		Vdc	:		Vrms		
Clearance/Creepage Requirements (if needed)		mm					

### **Planar Transformer Request Form**

### Fill out a design request today!

We meet each unique need, encompassing our global capabilities to partner, solve, and deliver *custom engineered* solutions for tomorrow. Complete the form below and our engineers and product specialists will review your request and respond with information targeting your application.

### **Planar Transformer Specifications**

\* required fields

Application									
*Topology									
*Total Output Power				W					
*Min. Input Voltage				Vdc	*Ma	x. Input Voltage			Vdc
Min. Duty Cycle				%	Min	. Duty Cycle mm			%
Primary Center Tap		O Yes	No						
Secondary Center Tap		O Yes	No						
*Output 1				Vdc (V)			Idc (A)		
Output 2				Vdc (V)			Idc (A)		
Output 3				Vdc (V)			Idc (A)		
Output 4				Vdc (V)			Idc (A)		
Max ACpp Ripple Current				Vdc	*Iso	lation Pri:Sec			Vms
Ambient Temperature				°C					
Heatsink Temperature				°C	Airfl	ow			CFM
Termination Style									
Dimensions	L			mm	W		mm	Н	mm
*Turn Ratio Np/Nsec1									
Turn Ratio Np/Nsec2									
Turn Ratio Np/Nsec3									
Turn Ratio Np/Nsec4									

# **DESIGN GUIDE** | Planar Transformers & Inductors

### **APPLICATIONS | Smart Home/City & Industrial**

Standex-Meder Electronics dynamic capabilities allows us to strategically partner with customers, solve problems, and deliver reliable high-quality custom or standard solutions to a wide array of markets. Our diverse product families of reed based, magnetics, and fluid level sensing components can play a role in numerous applications such as appliances, security, lighting, HVAC, electronics, and more. Give us a hello@standexelectronics.com

### **HVAC** and Plumbing

**Furnaces** 

Air Conditioning Compressors

Air Conditioning Condensers

Dehumidifiers

Humidifiers

Solar Panels

**Gas Smart Meters** 

**Electric Smart Meters** 

**Instant Water Heaters** 

Standard Water Heaters

Water Meters

Shower Pumps

Pool and Spa Pumps

Sprinkler System Controllers



### **Appliances**

Dishwasher

Range

Oven

Microwave

Coffeemaker

Refrigerator

Ice Maker

Washers & Dryers

### Other

Designer Lighting

Automatic Shades

Tablet Keyboards

Sound Sensors for Toys

**Guitar Amplifiers** 

Microphones

Organs

Fitness Equipment

Garage Door Openers

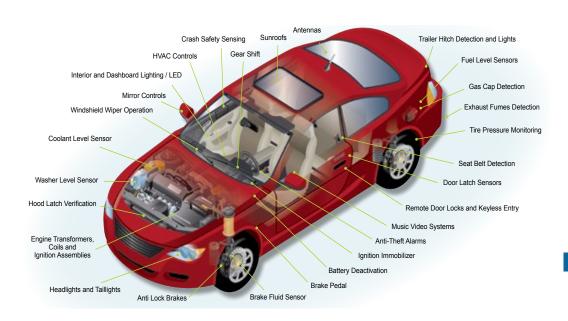
Speakers



# **DESIGN GUIDE** | Planar Transformers & Inductors

### **APPLICATIONS | Automotive Market & Transportation Industry**

Standex-Meder Electronics dynamic capabilities and solutions provide reed switches, relays, and sensors, magnetics, and fluid level sensing products throughout the transportation industry. Think of anything that turns on/off, opens/closes, requires power transfer, lighting, starting, measuring, or detecting – and we can play a role within that application. From read outs on the dashboard to measurement of coolant, brake, windshield, water in fuel, tire pressure, and emissions – our components perform within vital processes within automobiles, heavy-duty trucks, recreational vehicles, airplanes, trains, motorcycles, eCars, eBikes, boats, and more.





### **Transportation**

Washer Level Sensor
Coolant Level Sensor
Keyless Entry
Ignition Immobilizer
Anti Lock Brakes
Dashboard Lighting
Marine Coils
Ignition Assemblies
Hood Latch Verification
Dashboard Lighting

### Security

Security Cameras
Door Sensors
Window Sensors
Security Gates
Control Panels
Smoke Detectors
CO2 Detectors
Sprinkler Systems

**Outside Lighting** 

### Offices & Break Rooms

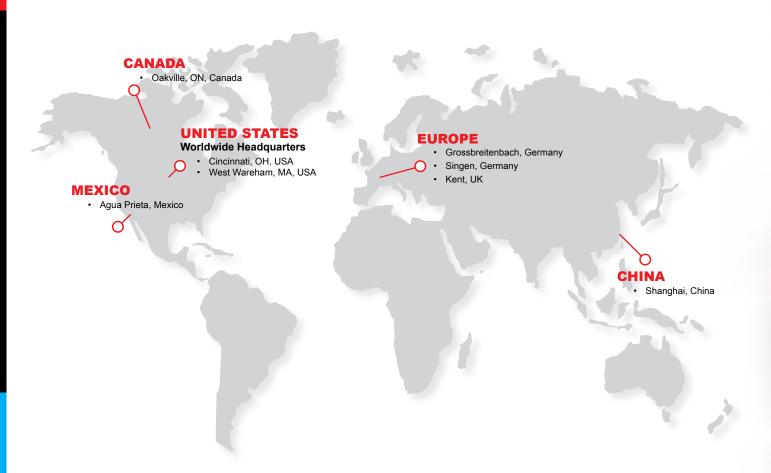
Keyboards
Inkjet printers
Desk lamps
Flashlights
Cable / Broadband
Time clocks
Telephone Systems
Cell phones
Thermostats
Dishwasher
Microwave
Coffeemaker
Refrigerator
Ice Maker

REED SWITCHES • REED RELAYS • REED SENSORS • PROXIMITY SENSORS

MAGNETS • FLUID SENSORS • OPTOCOUPLERS • FLOATS • TRANSFORMERS

INDUCTORS • CURRENT SENSE TRANSFORMERS • PLANAR TRANSFORMERS

ANTENNAS • COILS • HERMETIC CONNECTOR PRODUCTS



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