SQE48T20120

Eighth-Brick DC-DC Converter

The new high performance 20 A **SQE48T20120** DC-DC converter provides a high efficiency single output, in a 1/8th brick package that is only 62% the size of the industry-standard quarter-brick. Specifically designed for operation in systems that have limited airflow and increased ambient temperatures, the SQE48T20120 converter utilizes the same pinout and Input/Output functionality of the industry-standard quarter-bricks. In addition, a heat-spreader (baseplate) feature is available (-xDxBx suffix) that provides an effective thermal interface for coldplate and heat sinking options.

The SQE48T20120 converter thermal performance is accomplished through the use advanced circuits, packaging, and processing techniques to achieve ultra-high efficiency, excellent thermal management, and a low-body profile.

Operating from a wide-range 36-75 V input, the SQE48T20120 converter provides a fully regulated 12V output voltage. Employing a standard power pinout, the SQE48T20120 converter is an ideal drop-in replacement for existing high current quarter-brick designs. Inclusion of this converter in a new design can result in significant board space and cost savings. The designer can expect reliability improvement over other available converters because of the SQE48T20120's optimized thermal efficiency.

RoHS Compliant

Key Features & Benefits

- 36-75 VDC Input; 12.0 VDC @ 20 A Output
- Industry-standard quarter-brick pinout
- Delivers 240W at 94.2% efficiency
- Withstands 100V input transient for 100ms
- Fixed-frequency operation
- On-board input differential LC-filter
- Start-up into pre-biased load
- No minimum load required
- Meets Basic Insulation requirements
- Fully protected (OTP, OCP, OVP, UVLO)
- Positive or negative logic ON/OFF option
- Low height of 0.44" (11.18 mm)
- Weight: 32 g w/o baseplate, 40 g with baseplate
- High reliability: MTBF = 14.3 million hours, calculated per Telcordia SR-332, Method I Case 1
- Approved to the latest edition of the following standards:
- UL/CSA60950-1, IEC60950-1 and EN60950-1.
- Designed to meet Class B conducted emissions per FCC and EN55022 when used with external filter
- All materials meet UL94, V-0 flammability rating

Applications

- Intermediate Bus Architectures
- Data communications/processing
- LAN/WAN
- Servers, Workstations

1. ELECTRICAL SPECIFICATIONS

Conditions: T_A = 25 °C, Airflow = 300 LFM (1.5 m/s), Vin = 48 VDC, Cin=100 µF, unless otherwise specified.

PARAMETER	NOTES	MIN	TYP	MAX	UNITS
Absolute Maximum Ratings					
Input Voltage	Continuous	-0.3		80	VDC
	Transient (100ms)			100	VDC
Operating Temperature	Ambient (T_A)	-40		85	°C
	Component (T_C)[1]	-40		125	°C
(See Derating Curves)	Baseplate (T_B)	-40		105	°C
Storage Temperature		-55		125	°C
Isolation Characteristics					
I/O Isolation	Dielectric strength UL/CSA60950-1, EN60950-1, and IEC60950-1. Basic Insulation	2,250			VDC
Isolation Capacitance			1200		pF
Isolation Resistance		10			MΩ
Input to Baseplate		1,500			VDC
Output to Baseplate		1,500			VDC
Feature Characteristics					
Switching Frequency		428	450	502	kHz
Output Voltage Trim Range[2]			n/a		%
Remote Sense Compensation[2]			n/a		%
Output Overvoltage Protection	Non-latching	110	120	130	%
Over Temperature Shutdown	Non-latching, Component (T_C)[2]		130		°C
Auto-Restart Period	Applies to all protection features		250		ms
Turn-On Time from Vin	Time from UVLO to Vo = 90% V_{OUT}(NOM) Resistive load		22	25	ms
Turn-On Time from ON/OFF Control	Time from ON to Vo = 90%V_{OUT}(NOM) Resistive load		12	15	ms
Turn-On Time from Vin (w/ Co max.)	Time from UVLO to Vo = 90% V_{OUT}(NOM) Resistive load, C_{EXT} = 10,000 µF load		22	25	ms
Turn-On Time from ON/OFF Control (w/ Co max.)	Time from ON to Vo = 90% V_{OUT}(NOM) Resistive load, C_{EXT} = 10,000 µF load		12	15	ms
ON/OFF Control (Positive Logic)	Converter Off (logic low)	-20		0.8	VDC
	Converter On (logic high)	2.4		20	VDC
ON/OFF Control (Negative Logic)	Converter Off (logic low)	2.4		20	VDC
	Converter On (logic high)	-20		0.8	VDC
Input Characteristics					
Operating Input Voltage Range		36	48	75	VDC
Input Undervoltage Lockout	Turn-on Threshold	31.5	34.5	35.5	VDC
	Turn-off Threshold	30	32	34.0	VDC
Lockout Hysteresis Voltage		1.5	2.0	2.5	VDC
Maximum Input Current	Po = 240W @ 36 VDC In			7.3	ADC
Input Standby Current	Vin = 48V, converter disabled		3	5	mA
Input No Load Current (No load on the output)	Vin = 48V, converter enabled	50	70	130	mA

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[1] Reference Figure E for component (T_C and T_B) locations.

[2] This functionality not provided, however the unit is fully regulated.

Input Reflected-Ripple Current, ic	Vin = 48V, 25 MHz bandwidth, Po = 240 W (Figs. 19, 20, 21)			760	900	mA_{PK-PK}
				265	325	mA_{RMS}
Input Reflected-Ripple Current, i_S				8	14	mA_{PK-PK}
				2	5	mA_{RMS}
Input Voltage Ripple Rejection	120 Hz			45		dB
Output Characteristics						
Output Voltage Setpoint	V_{IN} = 48 V, I_{OUT} = 0 Amps, T_A = 25°C		11.76	12.00	12.24	VDC
Output Regulation						
Over Line	I_{OUT} = 20 Amps, T_A = 25°C			±12	±24	mV
Over Load	V_{IN} = 48 V, , T_A = 25°C			±6	±12	mV
Output Voltage Range	Over line, load and temperature		11.64		12.36	VDC
Output Ripple and Noise – 25 MHz bandwidth	I_{OUT} = 20 Amps, C_{EXT} =10 µF tantalum + 1 µF ceramic			50	100	mV_{PK-PK}
				25	50	V_{RMS}
Admissible External Load Capacitance	I_{OUT} = 20 Amps (resistive)	C_{EXT}	0[3]		10,000	µF
		ESR	1			mOhm
Output Current Range			0		20	ADC
Current Limit Inception	Non-latching		22	25	29	ADC
RMS Short-Circuit Current	Non-latching Short = 10 mΩ			2.4	5	A_{RMS}
Dynamic Response						
Load Change 50%-75%-50% of I_{OUT} Max (di/dt = 0.1 A/µs)	C_{EXT} = 10µF tantalum + 1 µF ceramic			75	140	mV
Settling Time to 1% of V_{OUT}				30	50	µs
Efficiency						
@ 100% Load	$48V_{IN}$, T_A = 25°C, 300LFM			94.2		%
@ 60% Load				94		%
Environmental						
Operating Humidity	Non-condensing				95	%
Storage Humidity	Non-condensing				95	%
Mechanical						
Weight	Without baseplate			32		g
	With baseplate			40		g
Vibration	GR-63-CORE, Sect. 5.4.2		1			g
Shocks	Half Sinewave, 3-axis		50			g
Reliability						
MTBF	Telcordia SR-332, Method I Case 1 50% electrical stress, 40°C components			14.3		MHrs
EMI and Regulatory Compliance						
Conducted Emissions	CISPR 22 B with external EMI filter network					

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[3] See *“Input Output Impedance”*, Page 4

2. OPERATIONS

2.1 INPUT AND OUTPUT IMPEDANCE

These power converters have been designed to be stable with no external capacitors when used in low inductance input and output circuits.

However, in some applications, the inductance associated with the distribution from the power source to the input of the converter can affect the stability of the converter. A 100 µF electrolytic capacitor with adequate ESR based on input impedance is recommended to ensure stability of the converter.

In many end applications, a high capacitance value is applied to the converter's output via distributed capacitors. The power converter will exhibit stable operation with external load capacitance up to 10,000 µF.

2.2 ON/OFF (Pin 2)

The ON/OFF pin is used to turn the power converter on or off remotely via a system signal. There are two remote control options available, positive and negative logic, with both referenced to Vin(-). A typical connection is shown in Figure A.
The positive logic version turns on when the ON/OFF pin is at a logic high or left open and turns off when it is at a logic low. See the Electrical Specifications for logic high/low definitions.

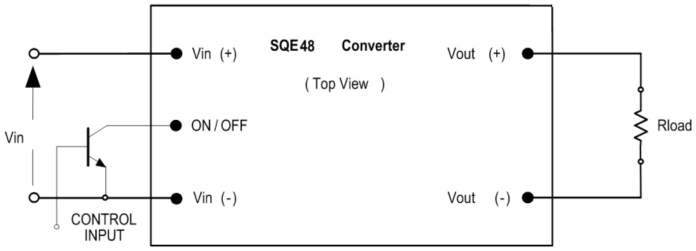


Figure A. Circuit configuration for ON/OFF function.

The negative logic version turns on when the ON/OFF pin is at a logic low and turns off when the pin is at logic high. To enable automatic power up of the converter without the need of an external control signal the ON/OFF pin can be hard wired directly to Vin(-) for N and left open for P version.

The ON/OFF pin is internally pulled up to 5V through a resistor. A properly de-bounced mechanical switch, open-collector transistor, or FET can be used to drive the input of the ON/OFF pin. The device must be capable of sinking up to 0.2 mA at a low level voltage of ≤ 0.8 V. An external voltage source (±20 V maximum) may be connected directly to the ON/OFF input, in which case it must be capable of sourcing or sinking up to 1 mA depending on the signal polarity. See the Startup Information section for system timing waveforms associated with use of the ON/OFF pin.

3. PROTECTION FEATURES

3.1 INPUT UNDERVOLTAGE LOCKOUT

Input undervoltage lockout is standard with this converter. The converter will shut down when the input voltage drops below a pre-determined voltage.

The input voltage must be typically 35V for the converter to turn on. Once the converter has been turned on, it will shut off when the input voltage drops typically below 33V. This feature is beneficial in preventing deep discharging of batteries used in telecom applications.

3.2 OUTPUT OVERCURRENT PROTECTION (OCP)

The converter is protected against overcurrent or short circuit conditions. Upon sensing an overcurrent condition, the converter will shut down after entering the constant current mode of operation, regardless of the value of the output voltage.

Once the converter has shut down, it will enter hiccup mode with attempt to restart every 260ms until the overload or short circuit conditions are removed.

3.3 OUTPUT OVERVOLTAGE PROTECTION (OVP)

The converter will shut down if the output voltage across Vout(+) and Vout(-) exceeds the threshold of the OVP circuitry. The OVP circuitry contains its own reference, independent of the output voltage regulation loop. Once the converter has shut down, it will attempt to restart every 260 ms until the OVP condition is removed.

3.4 OVERTEMPERATURE PROTECTION (OTP)

The converter will shut down under an overtemperature condition to protect itself from overheating caused by operation outside the thermal derating curves, or operation in abnormal conditions. The converter will automatically restart after it has cooled to a safe operating temperature.

3.5 SAFETY REQUIREMENTS

The converters are safety approved to UL/CSA60950-1, EN60950-1, and IEC60950-1. Basic Insulation is provided between input and output.

The converters have no internal fuse. To comply with safety agencies requirements, an input line fuse must be used external to the converter. A 10 A fuse is recommended for use with this product. The fuse must not be placed in the grounded input line. The SQE48 converter is UL approved for a maximum fuse rating of 15Amps**.**

3.6 ELECTROMAGNETIC COMPATIBILITY (EMC)

EMC requirements must be met at the end-product system level, as no specific standards dedicated to EMC characteristics of board mounted component dc-dc converters exist. However, Bel Power Solutions tests its converters to several system level standards, primary of which is the more stringent EN55022, Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.

An effective internal LC differential filter significantly reduces input reflected ripple current, and improves EMC.

With the addition of an external filter, the SQE48T20120 converter will pass the requirements of Class B conducted emissions per EN55022 and FCC requirements. Refer to Figures 18 – 19 for typical performance with external filter.

3.7 STARTUP INFORMATION (USING NEGATIVE ON/OFF)

Scenario #1: Initial Startup From Bulk Supply

ON/OFF function enabled, converter started via application of V_{IN}. See Figure. B.

Time	**Comments**
t_0	ON/OFF pin is ON; system front end power is toggled on, V_{IN} to converter begins to rise.
t_1	V_{IN} crosses Undervoltage Lockout protection circuit threshold; converter enabled.
t_2	Converter begins to respond to turn-on command (converter turn-on delay).
t_3	Converter V_{OUT} reaches 100% of nominal value.

For this example, the total converter startup time **(t_3 - t_1)** is typically 22 ms.

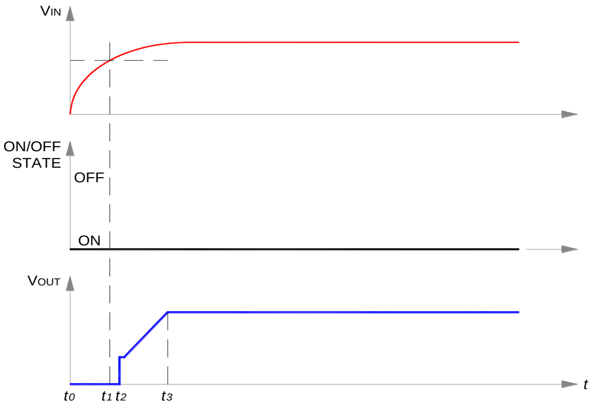


Figure B. Startup scenario #1.

Scenario #2: Initial Startup Using ON/OFF Pin
With V_{IN} previously powered, converter started via ON/OFF pin. See Figure C.

Time	Comments
t_0	V_{INPUT} at nominal value.
t_1	Arbitrary time when ON/OFF pin is enabled (converter enabled).
t_2	End of converter turn-on delay.
t_3	Converter V_{OUT} reaches 100% of nominal value.

For this example, the total converter startup time **(t_3- t_1)** is typically 12 ms.

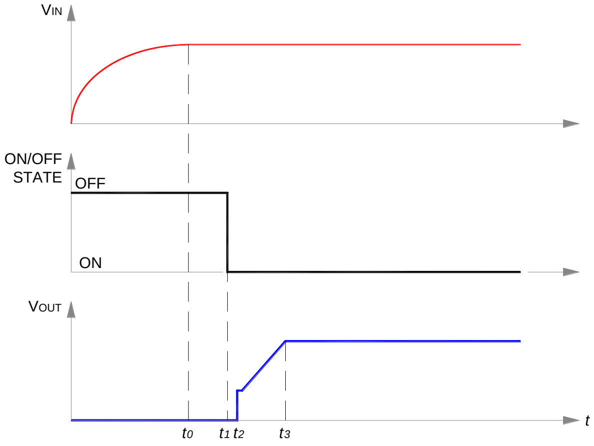


Figure C. Startup scenario #2.

Scenario #3: Turn-off and Restart Using ON/OFF Pin
With V_{IN} previously powered, converter is disabled and then enabled via ON/OFF pin. See Figure D.

Time	Comments
t_0	V_{IN} and V_{OUT} are at nominal values; ON/OFF pin ON.
t_1	ON/OFF pin arbitrarily disabled; converter output falls to zero; turn-on inhibit delay period (300 ms typical) is initiated, and ON/OFF pin action is internally inhibited.
t_2	ON/OFF pin is externally re-enabled. **If (t_2 - t_1) ≤ 250 ms**, external action of ON/OFF pin is locked out by startup inhibit timer. **If (t_2 - t_1) > 250 ms**, ON/OFF pin action is internally enabled.
t_3	Turn-on inhibit delay period ends. If ON/OFF pin is ON, converter begins turn-on; if off, converter awaits ON/OFF pin ON signal; see Figure F.
t_4	End of converter turn-on delay.
t_5	Converter V_{OUT} reaches 100% of nominal value.

For the condition **(t_2-t_1) ≤ 250 ms**, the total converter startup time **(t_5-t_2)** is typically 272 ms. For **(t_2-t_1) > 250 ms**, startup will be typically 22 ms after release of ON/OFF pin.

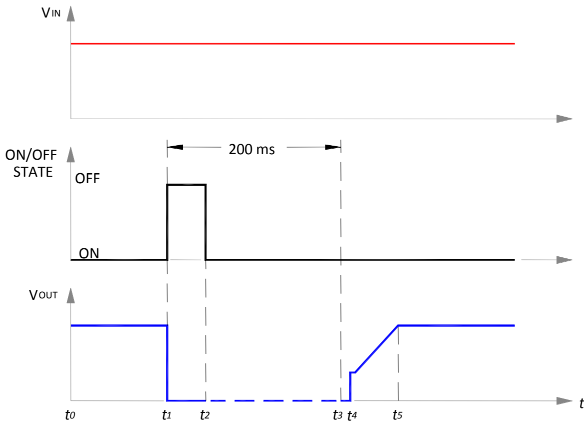


Figure D. Startup scenario #3.

4. CHARACTERIZATION

4.1 GENERAL INFORMATION

The converter has been characterized for many operational aspects, to include thermal derating (maximum load current as a function of ambient temperature and airflow), efficiency, startup and shutdown parameters, output ripple and noise, transient response to load step-change, overcurrent, and short circuit.

The following pages contain specific plots or waveforms associated with the converter. Additional comments for specific data are provided below.

4.2 TEST CONDITIONS

All data presented were taken with the converter soldered to a test board, specifically a 0.060” thick printed wiring board (PWB) with four layers. The top and bottom layers were not metalized. The two inner layers, comprised of two-ounce copper, were used to provide traces for connectivity to the converter.

The lack of metallization on the outer layers as well as the limited thermal connection ensured that heat transfer from the converter to the PWB was minimized. This provides a worst-case but consistent scenario for thermal derating purposes.

All measurements requiring airflow were made in the vertical and horizontal wind tunnel using Infrared (IR) thermography and thermocouples for thermometry.

Ensuring components on the converter do not exceed their ratings is important to maintaining high reliability. If one anticipates operating the converter at or close to the maximum loads specified in the derating curves, it is prudent to check actual operating temperatures in the application. Thermographic imaging is preferable; if this capability is not available, then thermocouples may be used. The use of AWG #40 gauge thermocouples is recommended to ensure measurement accuracy. Careful routing of the thermocouple leads will further minimize measurement error. Refer to Figure E for the optimum measuring thermocouple location.

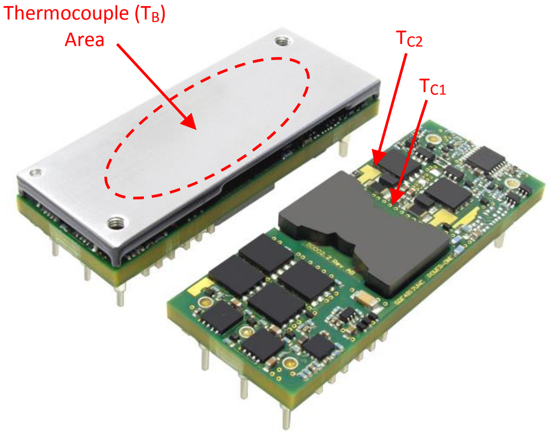


Fig. E: Location of the thermocouple for thermal testing.

4.3 THERMAL DERATING

AIR COOLED

Load current vs. ambient temperature and airflow rates are given in Figures 1 for converter w/o base plate, and in Figure 7 and 8 for converter with Baseplate and 0.25” and 0.5” tall heatsink, respectively. Ambient temperature was varied between 25°C and 85°C, with airflow rates from 30 to 500LFM (0.15 to 2.5m/s).

For each set of conditions, the maximum load current was defined as the lowest of:

(i) The output current at which any FET junction temperature does not exceed a maximum temperature of 125°C as indicated by the thermal measurement.

(ii) The output current at which the temperature at the thermocouple locations T_{C1} and T_{C2} do not exceed 125°C (Figure E).

(iii) The nominal rating of the converter (20A/240W).

BASEPLATE COLED (P/N: -XGXBX)

The maximum load current rating vs. baseplate temperature is provided in Figure 9. The ambient temperature of the converter was maintained ≤ 85°C, with an airflow rate of ≤ 30LFM (≤ 0.15m/s).
Thermocouple measurements were maximized, as above, to the following limits:
$T_{C1} \leq 125°C$, $T_{C2} \leq 125°C$ & $T_B \leq 105°C$.
The user should design for $T_B \leq 105°C$.
Note that use of baseplate alone without heatsink or attachment to cold plate provides lower power rating then open frame unit due to the present baseplate temperature limitation of 105°C.

4.4 EFFICIENCY

Figure 10 shows the efficiency vs. load current plot for ambient temperature (T_A) of 25ºC, airflow rate of 300LFM (1.5m/s) with vertical mounting and input voltages of 36V, 48V, and 75V.
Efficiency vs. load current and ambient temperature for converter w/o baseplate mounted vertically with Vin = 48 V and air flowing from pin 3 to pin 1 at a rate of 200 LFM (1.0 m/s) is shown in Figure 12.

4.5 POWER DISSIPATION

Figure 11 shows the power dissipation vs. load current for T_A=25°C, airflow rate of 300LFM (1.5m/s) with vertical mounting and input voltages of 36V, 48V, and 75V.

Figure 1 shows the power dissipation vs. load current and ambient temperature for converter w/o baseplate mounted vertically with Vin = 48 V and air flowing from pin 3 to pin 1 at a rate of 200 LFM (1.0 m/s).

4.6 STARTUP

Output voltage waveforms, during the turn-on transient using the ON/OFF pin for full rated load currents (resistive load) are shown with and without external load capacitance in Figure 14 and 15, respectively.

4.7 RIPPLE AND NOISE

Figure 18 shows the output voltage ripple waveform, measured at full rated load current with a 10μF tantalum and a 1μF ceramic capacitor across the output. Note that all output voltage waveforms are measured across the 1μF ceramic capacitor.

The input reflected-ripple current waveforms are obtained using the test setup shown in Figure 19.The corresponding waveforms are shown in Figure 20 and Figure 21.

4.8 THERMAL CONSIDERATIONS

In general, high density power converter modules built with integrated baseplates are selected when they are to interface with the users' cold plate, bulkhead or other physical heat sinking surface. Baseplates alone do not necessarily improve the power converter's power capability when compared to the same module without baseplate.

Output power de-rating charts are provided for modules both with and without an integrated baseplate.

All performance charts below (Fig. 3 thru 9) reflect modules with integrated baseplates.

Figures 3 - 6: Power derating with the baseplate temperature (TBP) maintained ≤ 115°C and TJ ≤ 120°C.

Figures 7 - 9: Power derating with TBP maintained ≤ 105°C and TJ ≤ 110°C.

(with approved Operational insulation (to 2.250 VDC)

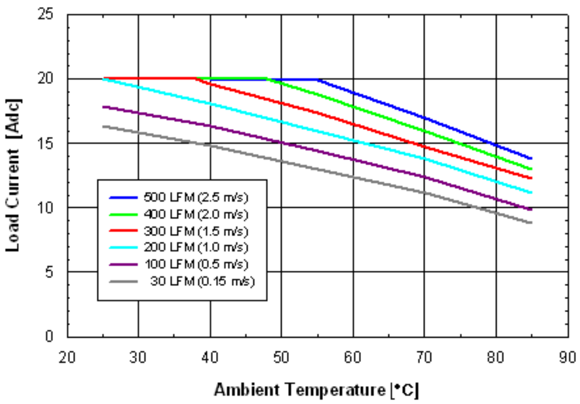


Figure 1: Available load current vs. ambient air temperature and airflow rates for SQE48T20120 converter mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 125°C, Vin = 48 V.[1]

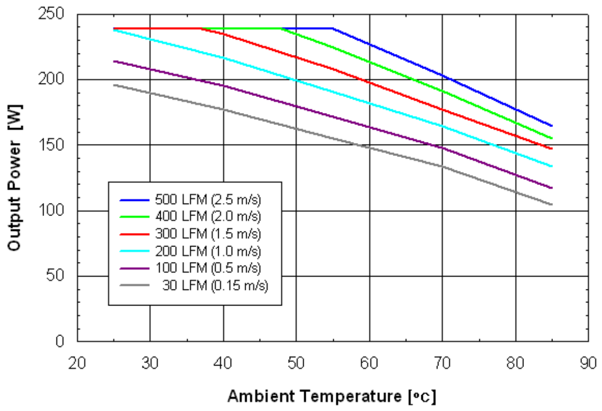


Figure 2: Available output power vs. ambient air temperature and airflow rates for SQE48T20120 converter mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 125°C, Vin = 48 V.[1]

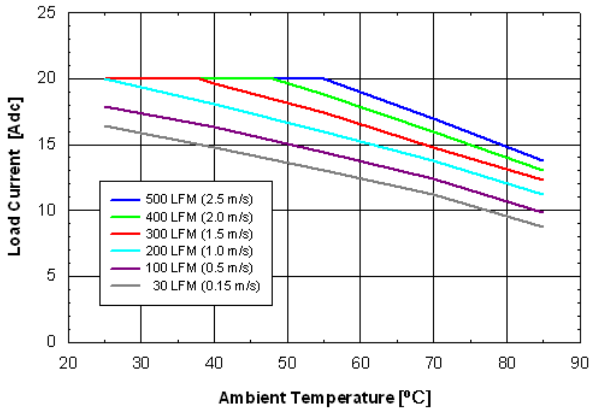


Figure 3: Available load current vs. ambient air temperature and airflow rates for SQE48T20120 converter mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 120°C, Vin = 48 V (nom.).[2]

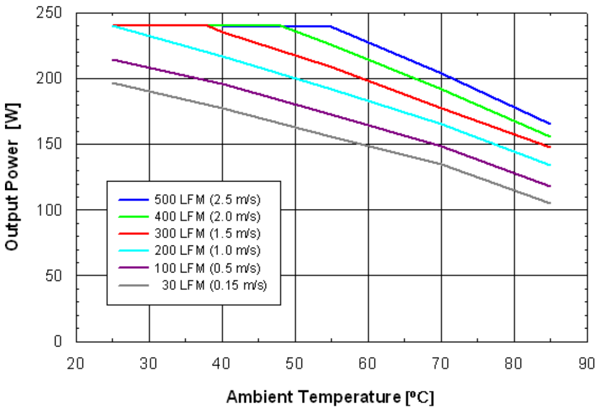


Figure 4: Available output power vs. ambient air temperature and airflow rates for SQE48T20120 converter mounted vertically with air flowing from pin 3 to pin 1, MOSFET temperature ≤ 120 °C, Vin = 48 V (nom.).[2]

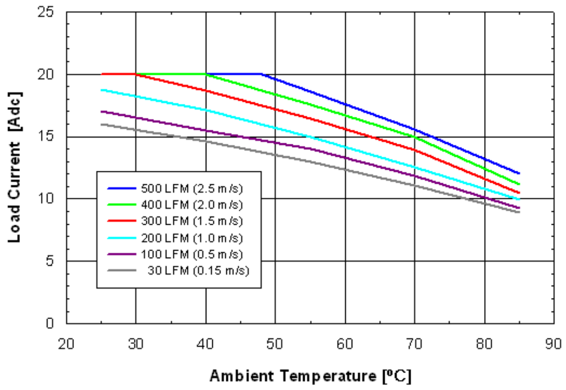


Figure 5: Available load current vs. ambient air temperature and airflow rates for SQE48T20120 converter mounted vertically with air flowing from In/Out, MOSFET temperature ≤ 120 °C, Vin = 48 V (nom.).[3]

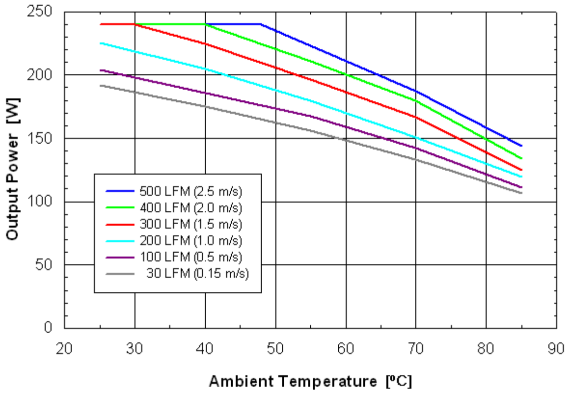


Figure 6: Available output power vs. ambient air temperature and airflow rates for SQE48T20120 converter mounted vertically with air flowing from In/Out, MOSFET temperature ≤ 120 °C,Vin = 48 V (nom.).[3]

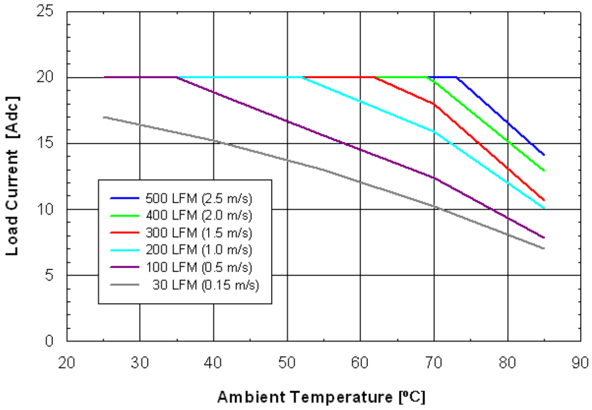


Figure 7: Available load current vs. ambient air temperature and airflow rates for SQE48T20120 converter with baseplate option and 0.25" tall transverse-fin heatsink. Unit mounted vertically with air flowing from pin 3 to pin 1, Vin = 48 V (nom.).[4]

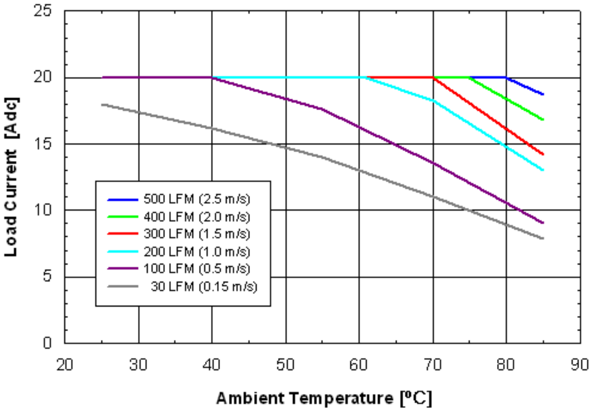


Figure 8: Available load current vs. ambient air temperature and airflow rates for SQE48T20120 converter with baseplate option and 0.5" tall transverse-fin heatsink. Unit mounted vertically with air flowing from pin 3 to pin 1, Vin = 48 V (nom.).[4]

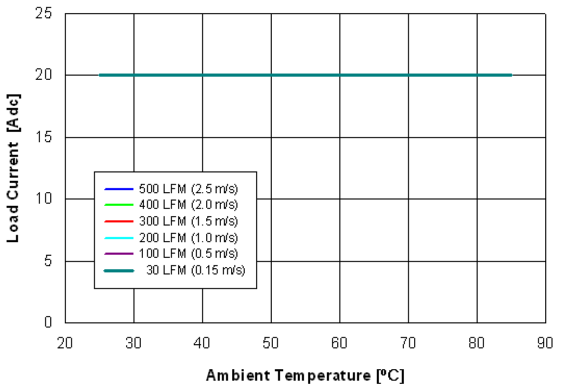


Figure 9: Power derating of SQE48T20120 converter with baseplate option and <u>cold plate cooling</u>. (Conditions: $T_B \leq 105°C$, $T_A \leq 85°C$, Air velocity ≤ 30LFM (≤ 0.15m/s), Vin = 48V.[4]

[1] *Figures 1 & 2 <u>without</u> Baseplate, <u>Transverse</u> airflow, $T_J \leq 125°C$*
[2] *Figures 3 & 4 <u>with</u> Baseplate, <u>Transverse</u> airflow, $T_J \leq 120\ °C$*
[3] *Figures 5 & 6 <u>with</u> Baseplate, <u>Longitudinal</u> airflow, $T_J \leq 120°C$*
[4] *Figures 7 - 9 with baseplate, cold plate, heatsink combinations, <u>$T_J \leq 110\ °C$</u>*

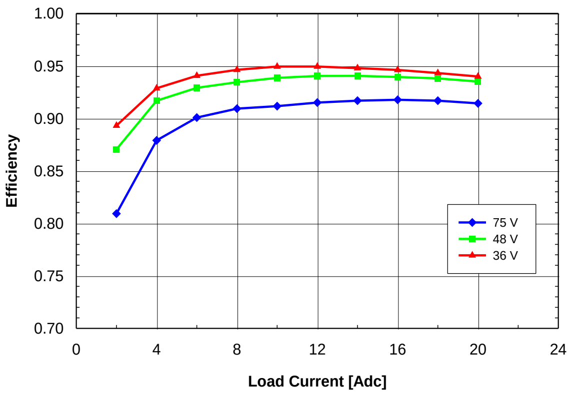


Figure 10: Efficiency vs. load current and input voltage for converter w/o baseplate mounted vertically with air flowing from pin 3 to pin 1 at a rate of 300 LFM (1.5 m/s) and Ta = 25 °C.

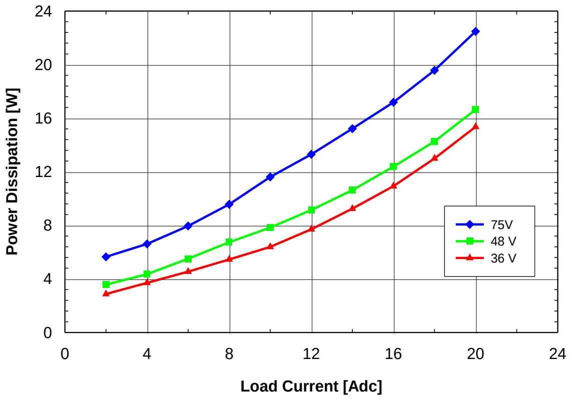


Figure 11: Power dissipation vs. load current and input voltage for converter w/o baseplate mounted vertically with air flowing from pin 3 to pin 1 at a rate of 300 LFM (1.5 m/s) and Ta = 25 °C.

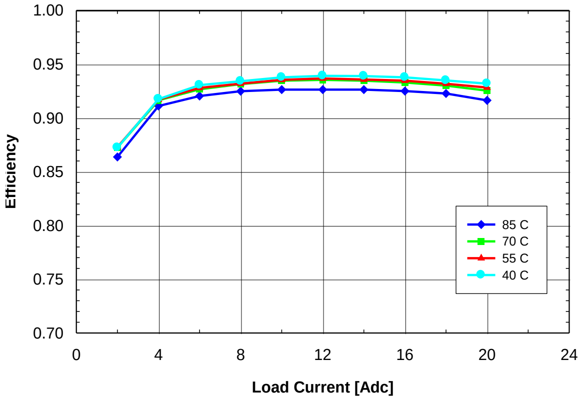


Figure 12: Efficiency vs. load current and ambient temperature for converter w/o baseplate mounted vertically with Vin = 48 V and air flowing from pin 3 to pin 1 at a rate of 200 LFM (1.0 m/s).

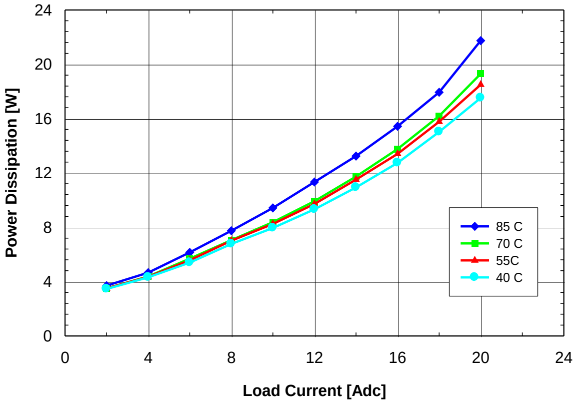


Figure 13: Power dissipation vs. load current and ambient temperature for converter w/o baseplate mounted vertically with Vin = 48 V and air flowing from pin 3 to pin 1 at a rate of 200 LFM (1.0 m/s).

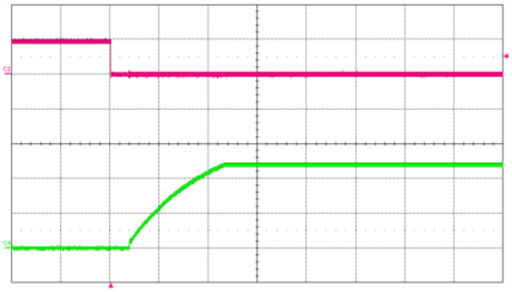


Figure 14: Turn-on transient at full rated load current (resistive) with Cout 10 µF tantalum + 1 µF ceramic at Vin = 48 V, triggered via ON/OFF pin. Top trace: ON/OFF signal (5 V/div.). Bottom trace: output voltage (5 V/div.). Time scale: 5 ms/div.

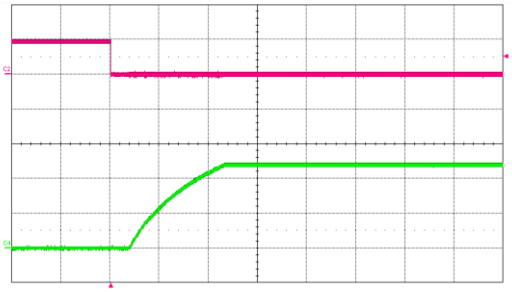


Figure 15: Turn-on transient at full rated load current (resistive) plus 10,000 µF at Vin = 48 V, triggered via ON/OFF pin. Top trace: ON/OFF signal (5 V/div.). Bottom trace: output voltage (5 V/div.). Time scale: 5 ms/div

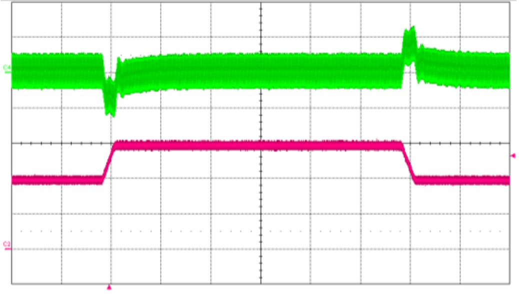


Figure 16: Output voltage response to load current step-change (10 A – 15 A – 10 A) at Vin = 48 V. Top trace: output voltage (100mV/div.). Bottom trace: load current (5 A/div.). Current slew rate: 0.1 A/µs. Co = 1 µF ceramic + 10 µF tantalum. Time scale: 200 µs/div.

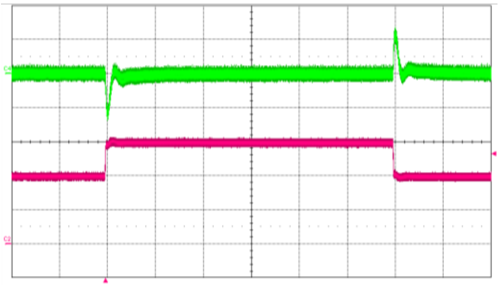


Figure 17: Output voltage response to load current step-change (10 A – 15 A – 10 A) at Vin = 48 V. Top trace: output voltage (200mV/div.). Bottom trace: load current (5 A/div.). Current slew rate: 1 A/µs. Co = 1 µF ceramic + 100 µF POS.Time scale: 200µs/div.

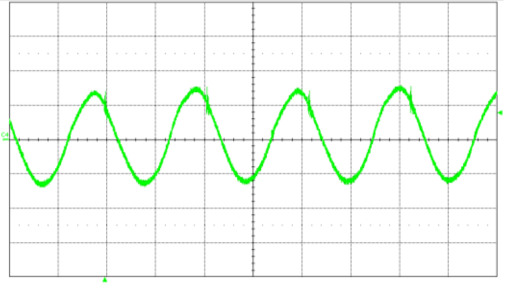


Figure 18: Output voltage ripple (20mV/div.) at full rated load current into a resistive load with Co = 10µF tantalum + 1µF ceramic and Vin = 48V. Time scale: 1µs/div.

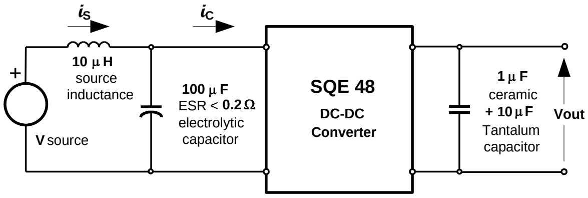


Figure 19: Test setup for measuring input reflected ripple currents, i_c and i_s.

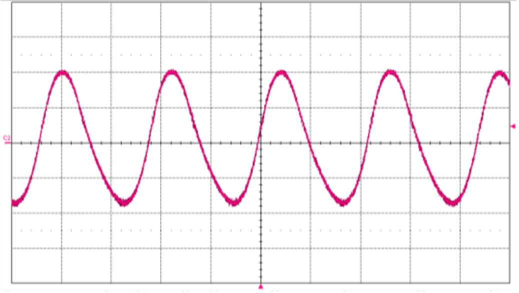


Figure 20: Input reflected ripple current, i_c (200 mA/div.), measured at input terminals at full rated load current and Vin = 48V. Refer to Figure 32 for test setup. Time scale:1µs/div.

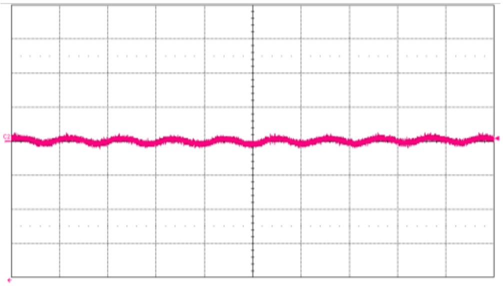


Figure 21: Input reflected ripple current, i_s (20 mA/div.), measured through 1µH at the source at full rated load current and Vin = 48V.Refer to Fig. 14 for test setup. Time scale: 2 µs/div

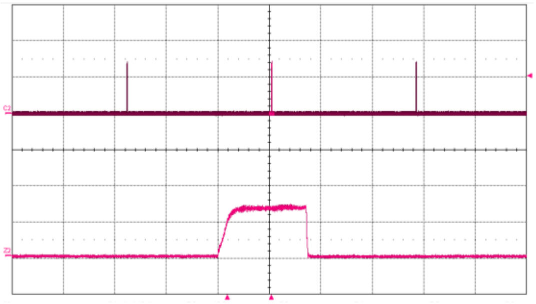


Figure 22: Load current (top trace, 20 A/div., 100 ms/div.) into a 10 mΩ short circuit during restart, at Vin = 48 V. Bottom trace (20 A/div., 1 ms/div.) is an expansion of the on-time portion of the top trace

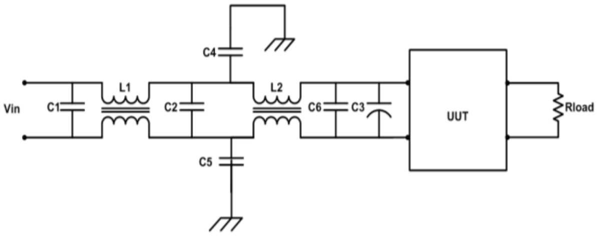


Figure 23: Typical input EMI filter circuit to attenuate conducted emissions

COMP. DES.	DESCRIPTION
C1, C2, C6	(2EA, 6 capacitors) 1 uF, 100 V ceramic cap
C3	33 uF, 100 V electrolytic cap
L1, L2	0.59mH, Pulse P0353NL
C4, C5	4,700 pF, ceramic cap

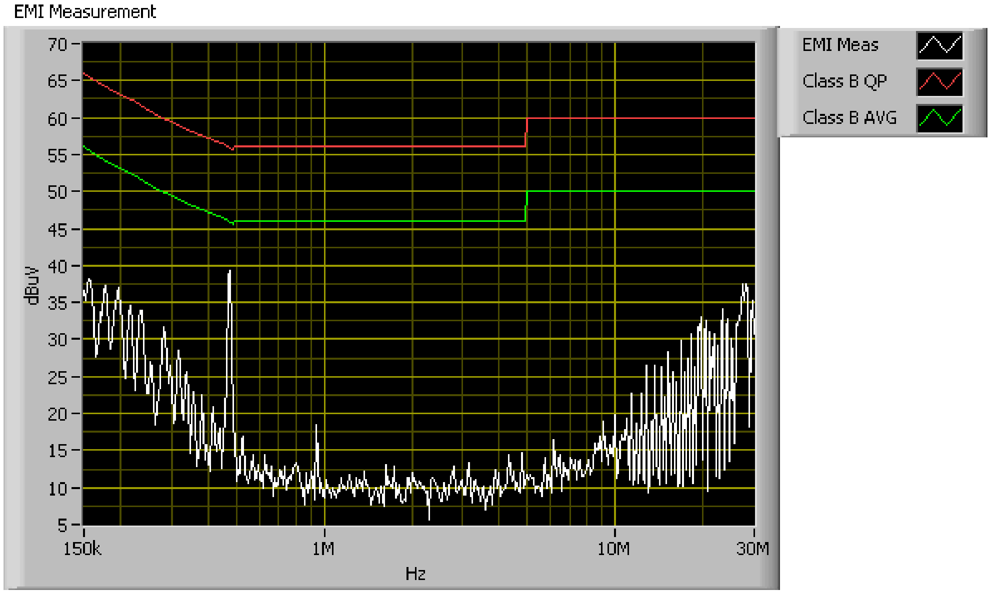
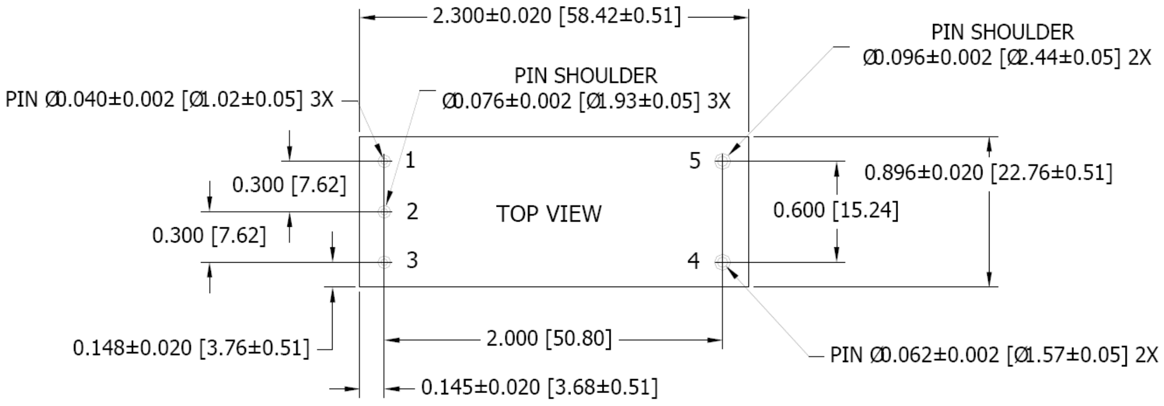


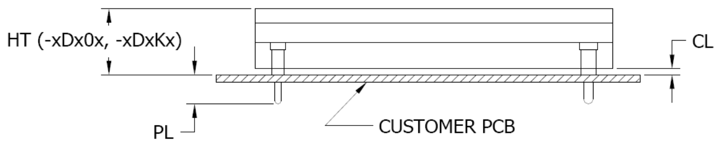
Figure 24: Input conducted emissions measurement (Typ.) of SQE48T20120. Conditions: V_{IN} = 48 VDC, I_{OUT} = 20 AMPS

5. MECHANICAL PARAMETERS

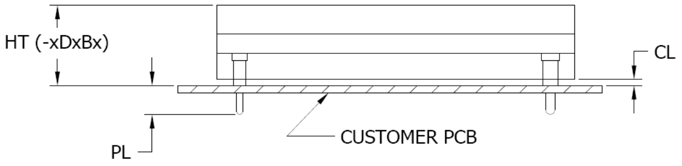
5.1 SQE48T PINOUT (THROUGH-HOLE)



SIDE VIEW
NO HEAT SPREADER



SIDE VIEW
WITH HEAT SPREADER



HEIGHT [HT]		MIN CLEARANCE [CL]	SPECIAL FEATURES
D	0.440” [11.18] Max	0.028” [0.71]	0
	0.500” +/- 0.020 [12.70 +/-0.51]	0.028” [0.71]	B

Pin Option	PL Pin Length ±0.005 [±0.13]
A	0.188 [4.78]
B	0.145 [3.68]

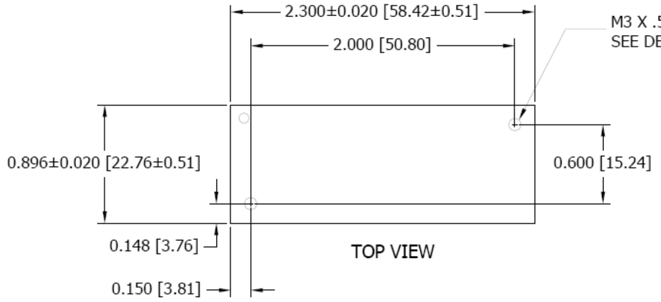
PAD/PIN CONNECTIONS	
Pad/Pin #	Function
1	Vin (+)
2	ON/OFF
3	Vin (-)
4	Vout (-)
6	Vout (+)

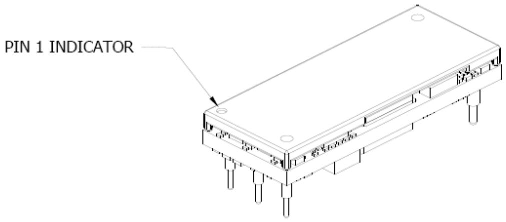
SQE48T Platform Notes

- All dimensions are in inches [mm]
- Pins 1-3 are Ø 0.040” [1.02] with Ø 0.076” [1.93] shoulder
- Pins 4 and 5 are Ø 0.062” [1.57] with are Ø 0.096” [2.44] shoulder
- Pin Material: Brass Alloy 360
- Pin Finish: Tin over Nickel

5.2 HEAT SPREADER INTERFACE INFORMATION

DEPTH NOTE:
SCREW LENGTH MUST BE SELECTED TO LIMIT HEAT
SPREADER PENETRATION TO 0.08 [2.0]





NOTE: Maximum allowable torque on heat spreader screw hole is 8kgF.cm

5.3 ORDERING INFORMATION

PRODUCT SERIES	INPUT VOLTAGE	MOUNTING SCHEME	RATED LOAD CURRENT	OUTPUT VOLTAGE		ON/OFF LOGIC	MAX HEIGHT [HT]	PIN LENGTH [PL]	SPECIAL FEATURES	ROHS
SQE	**48**	**T**	**20**	**120**	**-**	**N**	**D**	**A**	**B**	**G**
1/8th Brick Format	36-75 V	T⇒ Through-hole	20 ⇒ 20 ADC	120 ⇒ 12.0 V		N ⇒ Negative P ⇒ Positive	D ⇒ 0.440" for –xDx0x 0.520" for –xDxBx	Through hole A ⇒ 0.188" B ⇒ 0.145"	0 ⇒ Standard B ⇒ Baseplate option L ⇒ Enhanced input surge ride through	No Suffix ⇒ RoHS lead-solder-exemption compliant G ⇒ RoHS compliant for all six substances

The example above describes P/N SQE48T20120-NDABG: 36-75 V input, through-hole, 20 A @ 12 V output, negative enable (ON/OFF logic), pin length of 0.188", maximum height of 0.52", 2250 VDC isolation, no common mode capacitor, RoHS compliant for all 6 substances and integral heat spreader (Baseplate).

Consult factory for availability of other options.

For more information on these products consult: tech.support@psbel.com