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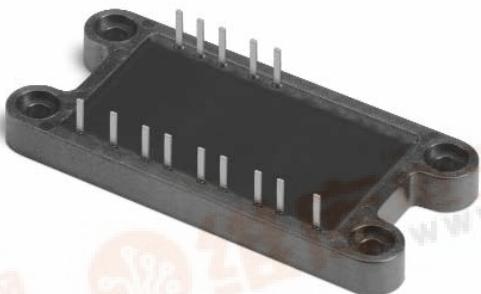
急出货

MODEL 7700 SERIES

Power Factor Correction

Power Module

NEW HIGHER POWER VERSION



MODELS/RANGE

7700B	1,500 Watts / 3,000 Watts
7700-2A	2,000 Watts / 4,000 Watts

FEATURES AND BENEFITS

- Module contains all power components necessary to provide power factor correction in a switching power supply.
 - Rectifier bridge with SCRs for inrush current limiting
 - Ultrafast platinum output diode
 - 500V .1Ω Max. FET (7700B)
 - Low gate charge, 500V, .0675Ω max. FET (7700-2A)
- Provides optimum use of available line current
- Allows power supply to meet harmonic requirement
- Module design reduces cost of heat sink
- Saves significant space and assembly time
- Low cost
- Internal temperature sensing
- Replaces up to 10 each TO-220 or TO-247 discrete power semiconductors
- Custom module versions available to meet specific requirements such as:
 - Motor drives
 - Power servo amplifiers
 - Solenoid drivers
 - Solid state relays
 - 3 phase rectifier bridges

APPLICATIONS

Designed to optimally facilitate a boost type power factor correction (PFC) system for designs with up to 36A rms input current.

Standard applications include switching power supplies from 1,000 watts to 4,000 watts with line voltages up to 300 V rms.

Specifications subject to change without notice.

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions ¹	Model	Min.	Typ.	Max.	Units
MOS FET							
Continuous Drain Current	I _D	T _C = 25°C	B		56	A	
			-2A		80	A	
		T _C = 100°C	B		34.8	A	
			-2A		48	A	
Pulsed Drain Current	I _{DM}		B		224	A	
			-2A		320	A	
Single Pulse Avalanche Energy	E _{AS}		B		760	mJ	
			-2A		960	mJ	
Repetitive Avalanche Energy	E _{AR}		B		19	mJ	
			-2A		28	mJ	
Avalanche Current	I _{AR}		B		8.7	A	
			-2A		20	A	
Gate to Source Voltage	V _{GS}		B, -2A		±30	V	
Leakage Current	I _{DSS}	V _{GS} = 0V, V _{DS} = 500V	B, -2A		100	µA	
Drain to Source ON Voltage	V _{DS(ON)}	I _C = 28A, V _{GS} = 10V	B	1.5	2.8	V	
			-2A	1.0	2.7	V	
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 1mA	B, -2A	2.0	4.0	V	
Gate Leakage Current	I _{GSS}	V _{GS} ±20V	B, -2A		±400	nA	
Total Gate Charge	Q _g	I _D = 56A, V _{DS} = 400V	B		600	nC	
Gate Source Charge	Q _{gs}	V _{GS} = 10V	B		80	nC	
Gate Drain (Miller) Charge	Q _{gd}		B		320	nC	
Total Gate Charge	Q _g	I _D = 80A, V _{DS} = 400V	-2A		480	nC	
Gate Source Charge	Q _{gs}	V _{GS} = 10V	-2A		128	nC	
Gate Drain (Miller) Charge	Q _{gd}		-2A		196	nC	
Continous Source Current (Body Diode)	I _S		B		56	A	
			-2A		80	A	
Pulsed Source Current (Body Diode)	I _{SM}		B		224	A	
			-2A		320	A	
Body Diode Forward Voltage	V _{SD}	I _S = 56A, V _{GS} = 0V	B	0.4	1.4	V	
		I _S = 80A, V _{GS} = 0V	-2A	0.5	1.8	V	
Reverse Recovery Time (Body Diode)	t _{rr}	I _F = 56A, di/dt = 400A/µs	B		810	ns	
		I _F = 80A, di/dt = 400A/µs	-2A		860	ns	
Reverse Recovery Charge (Body Diode)	Q _{rr}	I _F = 56A, di/dt = 400A/µs	B		28.8	ns	
		I _F = 80A, di/dt = 400A/µs	-2A		39.6	ns	
Internal Gate Resistor	R _G		B	1.25		Ω	
			-2A	0.25		Ω	
Junction Temperature	T _J		B, -2A		150	°C	
Thermal Resistance	R _{THJC}		B	0.20	.025	°C/W	
			-2A	.15	.20	°C/W	

ELECTRICAL CHARACTERISTICS

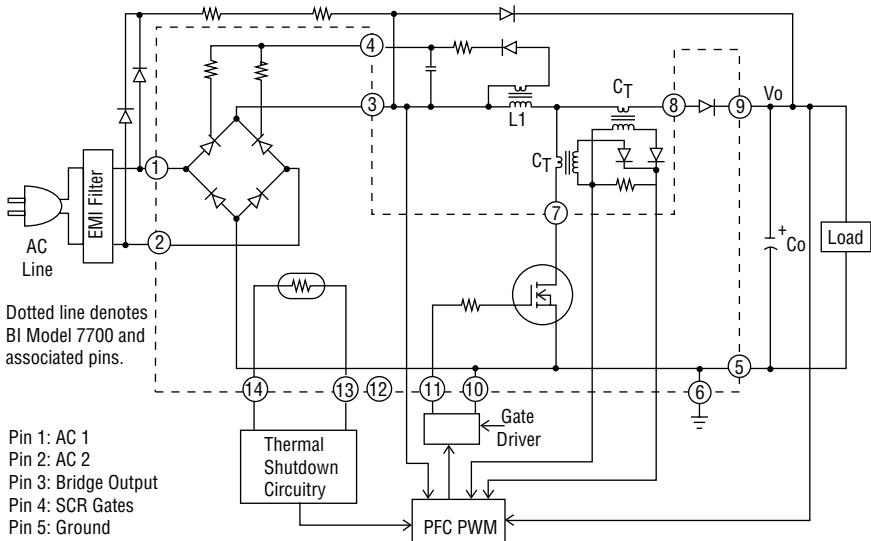
Parameter	Symbol	Conditions ¹	Model	Min.	Typ.	Max.	Units
SCRs							
Average On Current	I _{T(AV)}	T _C = 75°C, 180° half sine wave	B -2A	20 35	A A		
RMS On Current (As AC switch)	I _{RMS}		B -2A	30 55	A A		
Peak Repetitive Off Voltage	V _{RRM} / V _{DRM}		B -2A	600 800	V V		
Peak One Cycle Non-Repetitive Surge Current	I _{FSM}	T _J = T _J Max., t = 10ms (50 Hz), sine	B -2A	300 400	A A		
Reverse and Direct Leakage Current	I _R /I _D	V _R = V _{RRM} , V _D = V _{DRM}	B -2A	25 300	μA μA		
On Voltage	V _T	I _T = 25A I _T = 45A	B -2A	0.5 0.5	1.6 1.6	V V	
Gate Trigger Voltage (Includes drop across R _G)	V _{GT}	V _D = 6V, 22Ω V _D = 6V, 22Ω, T _J = -40°C V _D = 6V, 22Ω, T _J = 125°C	B, -2A B, -2A B, -2A	0.2 0.3 0.1	3.5 1.5 1.5	V V V	
Gate Trigger Current (Each SCR Individually)	V _{GT}	V _D = 6V, 22Ω V _D = 6V, 22Ω, T _J = -40°C V _D = 6V, 22Ω, T _J = 125°C	B, -2A B, -2A B, -2A	5 10 2	60 120 35	mA mA mA	
Holding Current	I _H	(Each SCR Individually)	B -2A	100 100	mA mA		
Internal Gate Resistor	R _G	Connected to each SCR	B -2A	10 10	Ω Ω		
Junction Temperature	T _J		B, -2A	150	°C		
Thermal Resistance	R _{thjc}		B -2A	1.4 0.7	2.0 1.0	°C/W °C/W	
Bridge Diodes							
Average Forward Current	I _{F(AV)}	T _C = 105°C, 180°, half sine wave	B -2A	20 40	A A		
Peak Repetitive Reverse Voltage	V _{RRM}		B -2A	600 800	V V		
Peak One Cycle Non-Repetitive Surge Current	I _{FSM}	T _J = T _J Max., t = 10ms (50 Hz), sine	B -2A	300 400	A A		
Reverse Leakage Current	I _R /	V _R = V _{RRM}	B -2A	100 300	μA μA		
Forward Voltage	V _F	I _F = 25A I _F = 40A	B -2A	0.5 0.5	1.2 1.2	V V	
Junction Temperature	T _J		B, -2A	150	°C		
Thermal Resistance	R _{THJC}		B -2A	1.5 1.0	1.8 1.2	°C/W °C/W	

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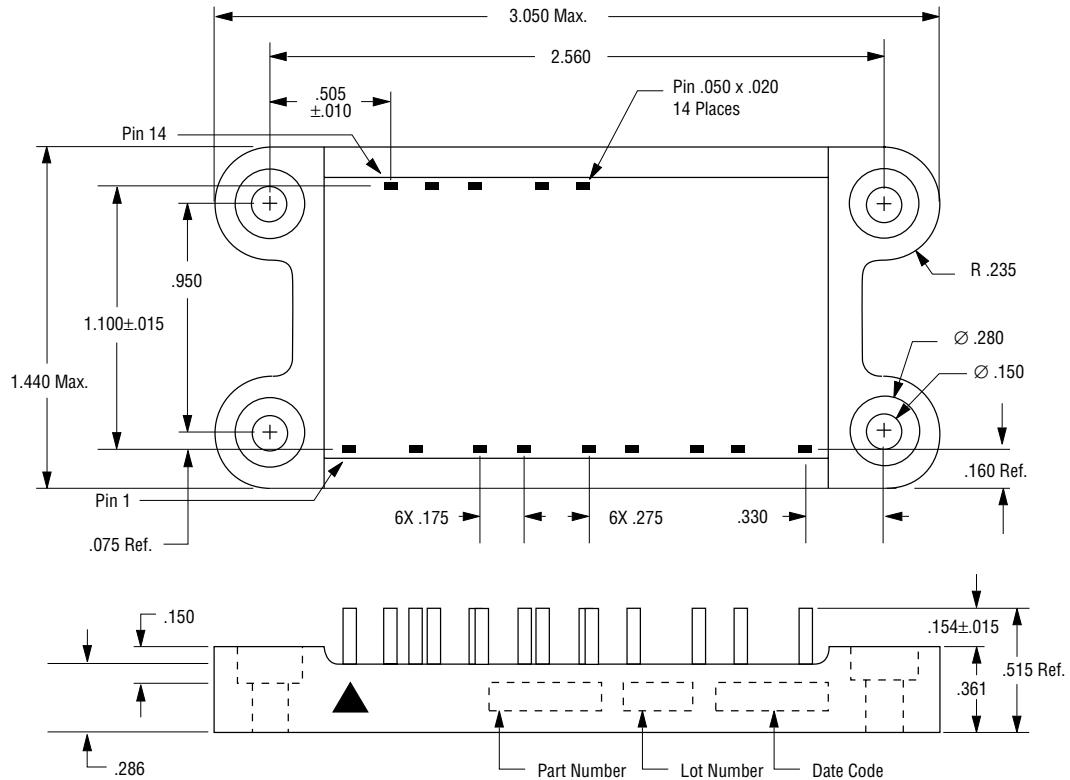
Parameter	Symbol	Conditions ¹	Model	Min.	Typ.	Max.	Units
Output Diode							
Average Forward Current	I _{F(AV)}	T _C = 120°C	B -2A		24 60	A	
Peak Repetitive Reverse Voltage	V _{RRM}		B, -2A		600	V	
Peak One Cycle Non-Repetitive	I _{FSM}	T _J = T _J Max., t = 10ms	B		500	A	
Surge Current		(50 Hz), sine	-2A		500	A	
Reverse Leakage Current	I _R /	V _R = V _{RRM}	B -2A		60 1	μA mA	
Forward Voltage	V _F	I _F = 24A I _F = 50A	B -2A	1.0 0.5	2.8 2.8	V	
Reverse Recovery Time	t _{rr}	I _F = 6A, di/dt = 300A/μs I _F = 2A, di/dt = 200A/μs	B -2A		35 40	ns	
Junction Temperature	T _J		B, -2A		175	°C	
Thermal Resistance	R _{THJC}		B -2A	0.9 0.75	1.0 0.9	°C/W	
TH1 NTC Thermistor							
Resistance	R ₂₅	I = 1mA	B, -2A	22.5	25	27.5	KΩ
Resistance Ratio	R _T /R ₂₅	T = 80°C T = 90°C T = 100°C T = 110°C	B, -2A B, -2A B, -2A B, -2A	.126 .0916 .0679 .0511			
Dissipation Constant	P _D		B, -2A		1.0		mW/°C
Thermal Time Constant	t		B, -2A		10		sec

1 - TCase = 25°C unless otherwise specified.

SYSTEM DIAGRAM



OUTLINE DIMENSIONS (Inch)



ORDERING INFORMATION

Model 77 0 0 B
Package _____

Range, Watts:
B = 1,500 to 3,000 Watts
-2A = 2,000 to 4,000 Watts

Circuit Function:
0 = Power Factor Correction

MODEL 7700 APPLICATION NOTES

OUTPUT VOLTAGE

The dc output voltage must be greater than the highest peak line voltage expected:

$$V_0 > V_{IN\ MAX} \times 1.414$$

DISCONTINUOUS CONDUCTION

When the line voltage approaches zero volts the PFC PWM will be forced towards its maximum duty cycle. This will cause the current to become discontinuous, which will result in some distortion. The line voltage at which the current will become discontinuous will be:

$$V_{IN\ discontinuous} = \frac{V_0 \times (1 - DC_{MAX})}{DC_{MAX}}$$

The line voltage at which the PWM will be duty cycle limited will be:

$$V_{IN\ duty\ cycle\ limited} = V_0 \times (1 - DC_{MAX})$$

INDUCTOR L1

The inductor value controls the amplitude of the 100KHz current ripple. This can greatly effect the amount of distortion and thus the amount of EMI filtering required on the input. Ripple current can be calculated for any point along the input sine wave:

$$I_{P-P}(t) = \frac{V_{IN}(t) \times DC(t)}{L \times f}$$

Where: $DC(t) = 1 - V_{IN}(t)/V_0$, L is the inductance of L1, and f is the switching frequency.

A good starting point would be to set I_{P-P} equal to 20% of the 120 Hz peakcurrent, solving for L:

$$L \geq \frac{5 \times V_{IN}^2 \times (1 - \frac{1.414 \times V_{IN}}{V_0})}{P_{IN} \times f}$$

OUTPUT CAPACITOR

The output capacitor size is often limited by the line dropout requirements of the power supply:

$$C_0 \text{ MIN} = \frac{2 \times P_{OUT} \times t_d}{V_0^2 - V_{O\ MIN}^2}$$

Where: P_{OUT} is the output power, t_d is the dropout time, and $V_{O\ MIN}$ is the minimum allowed output voltage.

The 120Hz output voltage ripple can be calculated to insure it meets the system requirements:

$$V_{O\ P-P\ 120} = \left(\frac{2 \times P_0}{V_0} \right) \times \left(\frac{1}{2 \times \pi \times f \times C_0} + ESR \right)$$

The maximum rms 120Hz ripple current will be:

$$I_{RMS\ 120} = \frac{1.414 \times P_0}{V_0}$$

The 100KHz output voltage ripple will be:

$$V_{O\ P-P\ 100K} = \frac{V_{IN} \times (1 - \frac{1.414 \times V_{IN}}{V_0})}{L \times f} \times \left(\frac{1}{2 \times \pi \times f \times C_0} + ESR \right)$$

The maximum rms 100KHz ripple current will be:

$$I_{RMS\ 100K} = \frac{V_{IN} \times (1 - \frac{1.414 \times V_{IN}}{V_0})}{2.828 \times L \times f}$$

GATE DRIVE REQUIREMENTS

FET switching times must be fast enough to insure that the FET turns off when the PWM is at maximum duty cycle. Snubbing circuits across the FET will slow the turn off time and should not be used.

A discrete gate driver circuit will allow the fastest possible switching times. The Unitrode UC3710 or Telcom TC4422 drivers offer a single chip approach

MODEL 7700 APPLICATION NOTES

with only slightly slower switching times. The gate driver must be located as close to the module as possible. Ground sense pin 10 should be used to insure the fastest possible switching times.

HEAT RADIATOR

The heat radiator requirements can be determined by the maximum power dissipated (at low line) and the maximum ambient temperature. The back side of the module should be limited to about 100°C by utilizing the internal thermistor.

$$R_{\Theta} = \frac{100 - T_{MAX\ AMB}}{P_0\ LOWLINE}$$

Care should be used when attaching the module to the heat radiator. The screws must be tightened incrementally in a crisscross pattern. A torque limiting screwdriver should be used.

The high current levels require current sense transformers to maintain a reasonable efficiency. We recommend BI Technologies HM31-20200.

PFC PWM VENDORS

Popular sources are:

Unitrode UC3854
Micro Linear ML4812
Linear Technology LT1248