TET3600-48-104xA

AC-DC Front End Power Supply

The TET3600-48-104xA is a 3600 W AC to DC power-factor-corrected (PFC) front end power supply that converts standard AC or HVDC power into a main output of 40 – 57 VDC for powering intermediate bus architectures (IBA) in high performance and reliability servers, routers, network switches and broadcast applications.

RoHS Compliant

Key Features & Benefits

- Very high efficiency, typ. 97% at half load
- Universal input voltage range: 90 – 264 VAC
- Adjustable output voltage 40 – 57 VDC
- AC input with power factor correction (PFC)
- 12 VDC standby output (model dependent)
- Hot-plug capable
- Parallel operation with active current sharing
- Digital controls for improved performance
- High density design: 56 W/in^3
- Small form factor (W x H x L): 104 x 40 x 266 mm (4.09 x 1.57 x 10.47 in)
- I2C communication interface for control, programming and monitoring with Power Management Bus protocol
- Over temperature, output over voltage and overcurrent protection
- 2 Status LEDs: OK and FAIL with fault signaling
- Black Box recorder available

Applications

- High Performance Servers
- Routers
- Switches
- Broadcast Applications

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1. ORDERING INFORMATION

TET	3600	-	48	-	104	x	A	Option Code
Product Family	**Power Level**	**Dash**	**V1 Output**	**Dash**	**Width**	**Airflow**	**Input**	
TET Front-End	3600 W		48 V		104 mm	N: Normal R: Reverse[1)]	A: AC	Blank: Standard model

[1)] Front to Rear

2. OVERVIEW

The TET3600-48-104xA Series AC/DC power supply is combination of analog and DSP control, highly efficient front-end power supply. It incorporates resonance-soft-switching technology and interleaved power trains to reduce component stresses, providing increased system reliability and very high efficiency. With a wide input and output operational voltage range and minimal derating of output power with input voltage and temperature, the TET3600 power supply maximizes power availability in demanding server, network, and other high availability applications. The supply is fan cooled and ideally suited for integration with a matching airflow path.

The PFC stage is an analogue solution; MCU is used to communicate with DSP chip on secondary side. The DC/DC stage uses soft switching resonant techniques in conjunction with synchronous rectification. An active OR-ing device on the output ensures no reverse load current and renders the supply ideally suited for operation in redundant power systems. The always-on standby output, provides power to external power distribution and management controllers. It is protected with an active OR-ing device for maximum reliability. Status information is provided with front-panel LEDs.

In addition, the power supply can be controlled and the fan speed set via the I2C bus. The I2C bus allows full monitoring of the supply, including input and output voltage, current, power, and inside temperatures. The fan speed is adjusted automatically depending on the actual power demand and supply temperature and can be overridden through the I2C bus.

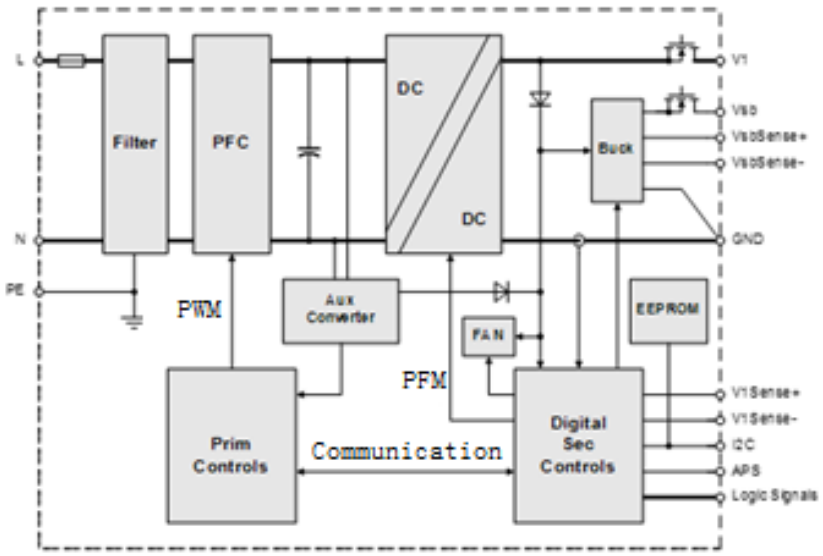

Figure 1. TET3600 Series Block Diagram

3. INPUT SPECIFICATIONS

General Condition: T_A = 0… 45°C unless otherwise specified.

PARAMETER		DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
$V_{i\,nom}$	Nominal Input Voltage		100		240	VAC
V_i	Input Voltage Range	Normal operating ($V_{i\,min}$ to $V_{i\,max}$)	90		264	VAC
$V_{i\,red}$	Derating Input Voltage Range		90		180	VAC
$I_{i\,max}$	Max Input Current				22	A_{rms}
$I_{i\,p}$	Inrush Current Limitation	$V_{i\,min}$ to $V_{i\,max}$, T_{NTC} = 25°C			40	A_p
F_i	Input Frequency		47	50/60	64	Hz
PF	Power Factor	$V_{i\,nom}$, 50 Hz, > 0.3 $I_{i\,nom}$	0.96			W/VA
$V_{i\,on}$	Turn-on Input Voltage[1]	Ramping up	80 169	84 174	89 180	VAC VDC
$V_{i\,off}$	Turn-off Input Voltage	Ramping down	75 166	80 171	85 176	VAC VDC
η	Efficiency	$V_{i\,nom}$, 0.1·$I_{x\,nom}$, $V_{x\,nom}$, T_A = 25°C $V_{i\,nom}$, 0.2·$I_{x\,nom}$, $V_{x\,nom}$, T_A = 25°C $V_{i\,nom}$, 0.5·$I_{x\,nom}$, $V_{x\,nom}$, T_A = 25°C $V_{i\,nom}$, $I_{x\,nom}$, $V_{x\,nom}$, T_A = 25°C		91 95 97 96		%
T_{hold}	Hold-up Time			12		ms

[1] The Front-End is provided with a minimum hysteresis of 3 V during turn-on and turn-off within the ranges.

4. OUTPUT SPECIFICATIONS

General Condition: Ta = 0… 45°C unless otherwise specified.

PARAMETER		DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
Main Output V_1						
$V_{1\ nom}$	Nominal Output Voltage	0.5 ·$I_{1\ nom}$, T_{amb} = 25 °C	40	54	57	VDC
$V_{1\ set}$	Output Setpoint Accuracy		-0.5		+0.5	% $V_{1\ nom}$
$dV_{1\ tot}$	Total Regulation	$V_{i\ min}$ to $V_{i\ max}$, 0 to 100% $I_{1\ nom}$, $T_{a\ min}$ to $T_{a\ max}$	-2		+2	% $V_{1\ nom}$
$P_{1\ nom}$	Nominal Output Power	264 VAC > V_{in} ≥ 180 VAC, V_1 = 54 VDC		3600		W
	Refer to derating curves	180 VAC > V_{in} ≥ 90 VAC, V_1 = 54 VDC		1800		W
$I_{1\ nom}$	Nominal Output Current	264 VAC > V_{in} ≥180 VAC, V_1 = 54 VDC		67		ADC
	Refer to derating curves	180 VAC > V_{in} ≥ 90 VAC, V_1 = 12 VDC		TBD		ADC
$v_{1\ pp}$	Output Ripple Voltage	$V_{1\ nom}$, $I_{1\ nom}$, 20 MHz BW			120	mVpp
$dV_{1\ Load}$	Load Regulation	V_i = $V_{i\ nom}$, 0 - 100 % $I_{1\ nom}$		300		mV
$dV_{1\ Line}$	Line Regulation	V_i =$V_{i\ min}$... $V_{i\ max}$		0		mV
dI_{share}	Current Sharing	Deviation from $I_{1\ tot}$ / N, I_1 > 10%	-2		+2	A
dV_{dyn}	Dynamic Load Regulation	ΔI_1 = 50% $I_{1\ nom}$, I_1 = 5 … 100% $I_{1\ nom}$, dI_1/dt = 1A/µs	-2.0		2.0	V
T_{rec}	Recovery Time	ΔI_1 = 50% $I_{1\ nom}$, I_1 = 5 … 100% $I_{1\ nom}$, dI_1/dt = 1A/µs, recovery within 1% of $V_{1\ nom}$			1.5	ms
$t_{AC\ V1}$	Start-up Time from AC				3	sec
$t_{V1\ rise}$	Rise Time	V_1 = 10…90% $V_{1\ nom}$	0.5		10	ms
C_{Load}	Capacitive Loading	T_a = 25°C			30000	µF
Standby Output V_{SB}						
$V_{SB\ nom}$	Nominal Output Voltage	0.5 ·$I_{SB\ nom}$, T_{amb} = 25°C		12		VDC
$V_{SB\ set}$	Output Setpoint Accuracy		-1		+1	% $V_{SB\ nom}$
$dV_{SB\ tot}$	Total Regulation	$V_{i\ min}$ to $V_{i\ max}$, 0 to 100% $I_{SB\ nom}$, $T_{a\ min}$ to $T_{a\ max}$	-3		+3	% $V_{SB\ nom}$
$P_{SB\ nom}$	Nominal Output Power	V_{SB} = 12 VDC		36		W
$I_{SB\ nom}$	Nominal Output Current	V_{SB} = 12 VDC		2.5		A
$V_{SB\ pp}$	Output Ripple Voltage	$V_{SB\ nom}$, $I_{SB\ nom}$, 20 MHz BW		6		mVpp
dV_{SB}	Droop	0 - 100 % $I_{SB\ nom}$		100		mV
dV_{SBdyn}	Dynamic Load Regulation	ΔI_{SB} = 50% $I_{SB\ nom}$, I_{SB} = 5 … 100% $I_{SB\ nom}$, dI_o/dt = 1 A/µs, recovery within 1% of $V_{1\ nom}$	-0.25		0.25	*V*
T_{rec}	Recovery Time				0.5	ms
$t_{AC\ VSB}$	Start-up Time from AC	V_{SB} = 90% $V_{SB\ nom}$			2	s
$t_{VSB\ rise}$	Rise Time	V_{SB} = 10…90% $V_{SB\ nom}$			20	ms
C_{Load}	Capacitive Loading	T_{amb} = 25°C			1500	µF

5. PROTECTION SPECIFICATIONS

PARAMETER		DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
F	Input Fuse (L)	Not user accessible, quick-acting (F)		30		A
$V_{1\ OV}$	OV Threshold V_1		60		62	VDC
$t_{OV\ V1}$	OV Latch Off Time V_1				1	ms
$V_{SB\ OV}$	OV Threshold V_{SB}		13		13.5	% V_{SB}
$t_{OV\ VSB}$	OV Latch Off Time V_{SB}				1	ms
$I_{V1\ lim}$	Over Current Limitation V_1	V_1 > 180 VAC, T_a < 45°C V_1 > 90 VAC, T_a < 45°C	69 36		72 37.5	A
$I_{VSB\ lim}$	Over Current Limitation V_{SB}	T_a < 45°C for 12 V_{SB}	3		3..2	A
$I_{V1\ SC}$	Max Short Circuit Current V_1	V_1 < 3 V			200	A
$t_{V1\ SC}$	Short Circuit Regulation Time	V_1 < 3 V, time until I_{V1} is limited to < $I_{V1\ sc}$			2	ms
T_{SD}	Over Temperature on Heat Sinks	Automatic shut-down		115	120	°C

6. MONITORING

PARAMETER		DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
$V_{I\ mon}$	Input RMS Voltage	$V_{I\ min} \leq V_I \leq V_{I\ max}$	-2.5		+2.5	%
$I_{I\ mon}$	Input RMS Current	I_I > 2 A_{rms}	-5		+5	%
$P_{I\ mon}$	True Input Power	I_I > 2 A_{rms}	-5		+5	%
$V_{1\ mon}$	V_1 Voltage		-2		+2	%
$I_{1\ mon}$	V_1 Current	I1 > 25 A	-2		+2	%
		I1 ≤ 25 A	-1		+1	A
$P_{o\ nom}$	Total Output Power	Po > 120 W	-5		+5	%
		Po ≤ 120 W	-12		+12	W
$V_{SB\ mon}$	Standby Voltage		-0.5		+0.5	V
$I_{SB\ mon}$	Standby Current	$I_{SB} \leq I_{SB\ nom}$	-0.5		+0.5	A

7. SAFETY APPROVALS

Maximum electric strength testing is performed in the factory according to IEC/EN 60950, and UL 60950. Input-to-output electric strength tests should not be repeated in the field. Bel Power Solutions will not honor any warranty claims resulting from electric strength field tests.

PARAMETER		DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
	Agency Approvals	UL 60950-1 Second Edition CAN/CSA-C22.2 No. 60950-1-07 Second Edition IEC 60950-1:2005 EN 60950-1:2006 EN 62368-1: 2014		Approved by independent body (see CE Declaration)		
	Isolation Strength	Input (L/N) to case (PE) Input (L/N) to output Output to case (PE)		Basic Reinforced Functional		
d_C	Creepage / Clearance	Primary (L/N) to protective earth (PE) Primary to secondary		According to safety standard		mm
	Electrical Strength Test	Input to case Input to output Output and Signals to case		According to safety standard		kVAC

8. ELECTROMAGNETIC COMPATIBILITY

8.1 IMMUNITY

NOTE: Most of the immunity requirements are derived from EN 55024:1998/A2:2003.

PARAMETER	DESCRIPTION / CONDITION	CRITERION
ESD Contact Discharge	IEC / EN 61000-4-2, ±8 kV, 25+25 discharges per test point (metallic case, LEDs, connector body)	A
ESD Air Discharge	IEC / EN 61000-4-2, ±15 kV, 25+25 discharges per test point (non-metallic user accessible surfaces)	A
Radiated Electromagnetic Field	IEC / EN 61000-4-3, 10 V/m, 1 kHz/80% Amplitude Modulation, 1 µs Pulse Modulation, 10 kHz…2 GHz	A
Burst	IEC / EN 61000-4-4, level 3 AC port ±2 kV, 1 minute DC port ±1 kV, 1 minute	A
Surge	IEC / EN 61000-4-5 Line to PE level 3, ±2 kV Line to line: level 2, ±1 kV NEBS GR-1089-CORE Line to PE and line to line ±2 kV/2Ω	A
RF Conducted Immunity	IEC/EN 61000-4-6, Level 3, 10 Vrms, CW, 0.1 … 80 MHz	A
Voltage Dips and Interruptions	IEC/EN 61000-4-11 1: Vi 230 V, 100% Load, Phase 0 °, Dip 100%, Duration 10 ms 2: Vi 230 V, 100% Load, Phase 0 °, Dip 100%, Duration 20 ms 3: Vi 230 V, 100% Load, Phase 0 °, Dip 100%, Duration >20 ms	A V_{SB}: A, V_1: B B

8.2 EMISSION

PARAMETER	DESCRIPTION / CONDITION	CRITERION
Conducted Emission	EN55032/ CISPR 22: 0.15 … 30 MHz, QP and AVG,	Class A
Radiated Emission	EN55032/ CISPR 22: 30 MHz … 1 GHz, QP,	Class A
Harmonic Emissions	IEC61000-3-2, Vin = 115 VAC / 60 Hz, & Vin = 230 VAC/ 50 Hz, 100% Load	Class A
AC Flicker	IEC61000-3-3, Vin = 230 VAC / 60 Hz, 100% Load	Pass

9. ENVIRONMENTAL SPECIFICATIONS

PARAMETER		DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
T_A	Ambient Temperature	$V_{i\,min}$ to $V_{i\,max}$, $I_{o\,nom}$, $I_{SB\,nom}$ below 6000 feet Altitude	0		+50	°C
		$V_{i\,min}$ to $V_{i\,max}$, $I_{o\,nom}$, $I_{SB\,nom}$ below 15000 feet Altitude	0		+40	°C
T_{Aext}	Extended Temp. Range	Derating output			+65	°C
T_S	Storage Temperature	Non-operational	-20		+70	°C
	Altitude	Operational, above Sea Level, refer derating to T_A	-		15000	Feet
N_a	Audible Noise	V_i nom, 50% Io nom, T_A = 25°C measured at bystander position		62		dBA

10. MECHANICAL SPECIFICATIONS

PARAMETER		DESCRIPTION / CONDITION	MIN	NOM	MAX	UNIT
	Dimensions (W x H x L)			104 x 40 x 266 4.09 x 1.57 x 10.47		mm in
M	Weight			TBD		kg

11. CONNECTIONS

AC INPUT, DC OUTPUT AND SIGNALS CONNECTOR:

PSU side: FCI Pwr Blade ULTRA # TBD

Receptacle: FCI Pwr Blade ULTRA #TBD

	POWER OUTPUT				SIGNALS								POWER INPUT		
	P1	P2	P3	P4	1	2	3	4	5	6	7	8	P5	P6	P7
C	54 V		54 V Return										PE	N	L
B															
A															

PIN NUMBER	SIGNAL NAME	COMMENTS
P1-P2	Positive Power	54Vdc Power
P3-P4	Negative Power	54Vdc Power return
A1	PSON_L	Low=54Vdc main output is ON, High=OFF
A2	Logic GND	Logic GND
A3	SCL_0	I2C Clock 0
A4	SDA_0	I2C Data 0
A5	Logic GND	Logic GND
A6	PS_KILL	If High or Open both outputs are OFF.
A7	12VSB return	12Vstby return
A8	12VSB	12Vstby output
B1		Reserved
B2	PRESENT_L	Connected to logic GND inside. Short pin informs system of PSU being inserted.
B3		Reserved
B4	A0	I2C Address
B5	A1	I2C Address
B6	A1	I2C Address
B7	12VSB return	12Vstby return
B8	12VSB	12Vstby output
C1	Current share	54Vdc main current share signal
C2	SMB_ALERT_L	SMB Alert
C3		Reserved
C4	Logic GND	12vstby return
C5	PW_OK	Both outputs are ON and within regulation
C6	IN_OK	Input voltage OK signal output, active High
C7	12VSB return	12Vstby return
C8	12VSB	12Vstby output

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

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