

EIGHTH-BRICK SERIES

24 V Input, Single Output

Embedded Power for
Business-Critical Continuity

EIGHTH-BRICK SERIES

Total Power: 66 W
Input Voltage: 18 - 36 VDC
of Outputs: Single

Special Features

- High efficiency topology and high output current
- Low profile, 0.300 in (7.62 mm) height
- Industry standard eighth-brick footprint (identical to quarter-brick pinout)
- 38% savings in space over industry standard quarter-brick converters
- Wide operating ambient temperature range, -40 °C to +85 °C
- 80% to 110% output trim
- Basic insulation, 2250 Vdc
- Overvoltage and overtemperature protection
- Remote ON/OFF
- Approvals to EN60950-1 VDE and UL/cUL60950
- 50 V, 100 ms input voltage transients rated
- Monotonic startup into normal and prebiased loads
- Secondary side control, no optocouplers, fast transient response
- Available RoHS compliant
- 2 year warranty



Rev.09.07.07
eighth-brick series
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NOTICE SOME MODELS LISTED IN THIS DOCUMENT HAVE BEEN DISCONTINUED

Please contact your local Artesyn representative or use the on line model number search tool at <http://www.artesyn.com/powergroup/products.htm> to find a suitable alternative.

The Typhoon™ Eighth-Brick 24 V input, single output series is a new 20 A, low cost, high efficiency, open-frame, isolated converter in an industry standard eighth-brick footprint and operates from a 18 Vdc to 36 Vdc supply. This new series elevates the power density threshold for high-end application design requirements where high output current at low voltages are required. The converter architecture takes advantage of open-frame construction to provide low mass and a low thermal impedance for a single board design.

Additionally, a patent-pending, full-wave coupled inductor topology yields some of the highest full-load efficiencies in the industry. All Eighth-Brick converters have, as standard features, remote ON/OFF capability, adjustable output voltage trim from 80% to 110% of nominal, overcurrent/undervoltage protection, and full international safety approval including EN60950-1 VDE and cUL60950.



Stresses in excess of the maximum ratings can cause permanent damage to the device. Operation of the device is not implied at these or any other conditions in excess of those given in the specification. Exposure to absolute maximum ratings can adversely affect device reliability.

Absolute Maximum Ratings

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - continuous	$V_{in} (cont)$	-0.3		36	Vdc	$V_{in(+)} - V_{in(-)}$
Input voltage - peak/surge	$V_{in} (peak)$	-0.3		50	Vdc	Transients of 100 ms or less, in duration
Input voltage - remote pin	$V_{rem} (peak)$	-0.3		36	Vdc	Peaks of any duration
Operating temperature	T_{op}	-40		85	°C	Measured at ambient
Storage temperature	$T_{storage}$	-55		125	°C	
Output power (LES20A24-1V8J)	$P_{out} (max)$			36	W	
Output power (LES20A24-3V3J)	$P_{out} (max)$			66	W	

All specifications are typical at nominal input $V_{in} = 24$ V and full rated resistive load at 25°C ambient unless otherwise specified.

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - operating	$V_{in} (oper)$	18	24	36	Vdc	$V_{in} (min) - V_{in} (max)$, enabled Converter disabled
Input current - no load	I_{in}		70		mAdc	
Input current - Quiescent	$I_{in} (off)$			6	mAdc	
Inrush current (i^2t)	I_{inrush}		0.01		A ² s	
Inrush current ratio	I_t/I_m		22			Frequency <1 kHz Slow Blow/Antisurge HRC recommended 63 V Rating. See Application Note 138
Input ripple rejection			50		dB	
Input fuse				10	A	

Turn On/Off

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - turn on	$V_{in} (on)$		17.5	18	Vdc	With the Remote ON/OFF signal asserted, time from when $V_{in} > V_{in} (oper)$ until V_{out} is within total regulation band
Input voltage - turn off	$V_{in} (off)$	15	16.5		Vdc	
Turn on delay - enabled, then power applied	$T_{delay} (power)$		9	15	ms	
Turn on delay - power applied, then enabled	$T_{delay} (enable)$		8	15	ms	With $V_{in} = V_{in} (nom)$, then Remote ON/OFF asserted, time until V_o is within total error band
Rise time	T_{rise}	2.5	3	5	ms	From 10% to 90%, full resistive load, no external capacitance

Signal Electrical Interface

Characteristic - Signal Name	Symbol	Min	Typ	Max	Units	Notes and Conditions
At remote ON/OFF (control) pin Open collector or equivalent compatible						See Notes 1 and 2
Control pin open circuit voltage	V_{ih}		3.0	5.0	V	$I_{ih} = 0 \mu A$; open circuit voltage
High level input voltage	V_{ih}	2.4			V	Converter guaranteed ON when control pin is greater than V_{ih} (min)
High level input current	I_{ih}			10	μA	Current flowing into control pin when pin is pulled high (max. at $V_{ih} = 36 V$)
Acceptable high level leakage current	I_{ih} (leakage)			-10	μA	Acceptable leakage current from signal pin into the open collector driver (neg = from converter)
Low level input voltage	V_{il}	-0.3		0.4	V	Converter guaranteed off when control pin is less than V_{il} (max)
Low level input current	I_{il} (max)		-0.4	-0.5	mA	$V_{il} = 0.0 V$, maximum source current from converter with short circuit

Common Protection/Control

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Overtemperature shutdown threshold	Tots	120	125	130	$^{\circ}C$	Hotspot temperature, non-latching shutdown protection. See Application Note 138
Remote sense compensation				10	%	% of V_o (nom), compensation includes trim.

Reliability and Service Life

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Mean time between failure	MTBF		5,000,000		Hours	Telcordia Tech. SR-332 $T_{amb} = 40^{\circ}C$, $V_{in} = V_{in}$ (nom), $I_{out} = 50\% I_{out}$ (max)

Isolation

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input to output test voltage				2250	Vdc	Test duration 1s
Input to output capacitance			1200		pF	
Input to output resistance		10			M Ω	Measured with 500 Vdc
Input to output insulation system			Basic			

Other Specifications

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Switching frequency	f_{sw}		480		kHz	Fixed frequency (all models)

Environmental Requirements

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Thermal performance		-40		120	°C	Hotspot temperature
Altitude				3000	m	Derate total max. output current by 20%
				9843	ft	Derate total max. output current by 20%
				10000	m	Derate total max. output current by 50%
				32808	ft	Derate total max. output current by 50%
Type	Parameter	Reference		Test Level		
Air temperature		IEC 60068-2-1 Ab/Ad: Cold		-40 °C, 16 h		
		IEC 680068-2-2 Bb/Bd: Dry heat		+70 °C, 16 h		
		IEC 68-2-14 Nb: Rate of change		-5 °C/+45 °C, 0.5 °C/min 2 cycles, 3 h each		
Relative humidity		IEC60068-2-56 Cb: damp heat, steady state		+35 °C, 93% RH, 4 days 50% of samples powered at 10% load and 50% unpowered		
Vibration		IEC60068-2-6 Fc: sinusoidal		3 axes, 5 sweeps per axis unpowered on test card Freq. range and displacement 5-9 Hz, 1.2 mm. Freq. range and acceleration 9-200 Hz, 10 m/s ²		
Shock and bump		IEC 60068-2-29 Eb: bump		100 bumps each of 6 directions, mounted on powered on test card, shock spectrum half-sine, duration		

EMC Electromagnetic Compatibility

Phenomenon	Port	Standard	Test level	Notes and conditions
Immunity:				
ESD	Enclosure	EN61000-4-2	6 kV contact 8 kV air	Level 3 (output within specification) Level 3 (output within specification)
Radiated field	Enclosure	EN61000-4-3	10 V/m	Level 3 (output within specification) X and Y axes
Conducted	dc power	EN61000-4-6	10 V	With recommended Class B external filter, no load, 10J (output remains within ±9%)
Input transients	dc power		50 V 100 ms	

Standards Compliance List

Characteristic	
IEC/EN60950-1	1st edition
UL/cUL 60950	3rd edition
VDE	

Safety Agency Approvals

Standard	Category
UL/cUL 60950 File Number	E135734/60950
VDE Certificate No.	40005017

Material Ratings

Characteristic - Signal Name	Notes and Conditions
Flammability rating	UL94V-0
Material type	FR4 PCB

Model Numbers

Model Number	Input Voltage	Output Voltage	Overvoltage Protection	Output Current (Max.)	Typical Efficiency
LES20A24-1V8J	18-36 Vdc	1.8 V	2.16 V	20 A	91%
LES20A24-3V3J	18-36 Vdc	3.3 V	4.0 V	20 A	90%

RoHS Compliance Ordering Information



The 'J' at the end of the Partnumber indicates that the Part is Pb-free (RoHS 6/6 compliant). TSE RoHS 5/6 (non Pb-free) compliant versions may be available on special request, please contact your local sales representative for details.

LES20A24-1V8J Model

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating	I_{in}		1.65		Adc	$V_{in} = V_{in} (nom)$; $I_{out} = I_{out} (max)$; $V_o = V_o (nom)$
Input current - maximum	$I_{in} (max.)$			2.40	Adc	$V_{in} = V_{in} (min)$; $I_{out} = I_{out} (max)$; $V_o = V_o (nom)$, measured at converter
Input Capacitor ripple current	$I_{in} (ripple)$		17 50		mA RMS mA pk-pk	$I_{out} = I_{out} (max)$, measured without standard filter. See Application Note 138
Reflected ripple current	$I_{in} (refl)$		1.0 3.0		mA RMS mA pk-pk	$I_{out} = I_{out} (max)$, measured with standard filter. See Application Note 138
Input capacitance - Internal	C_{input}		5.65		μF	Internal to converter
Input capacitance - External bypass	C_{bypass}		220		μF	Recommended customer added capacitance, $<0.7 \Omega$ ESR

LES20A24-1V8J Model

Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Nominal set-point voltage	$V_o (nom)$	1.77	1.80	1.83	Vdc	$V_{in} = V_{in} (nom)$; $I_{out} = I_{out} (nom)$
Total regulation band	V_o	1.75		1.85	Vdc	For all line, static load and temperature until end of life
Line regulation			0.01	0.1	%	$I_{out} = I_{out} (nom)$, $V_{in} (min)$ to $V_{in} (max)$
Load regulation			0.02	0.2	%	$V_{in} = V_{in} (nom)$, $I_{out} (min)$ to $I_{out} (max)$
Temperature regulation				0.02	$\pm\%/^{\circ}C$	$V_{in} = V_{in} (nom)$, $I_{out} = I_{out} (max)$
Output current continuous	I_{out}	0		20	Adc	
Output current - short circuit	I_{sc}		7		A rms	Continuous, unit auto recovers from short, $V_o < 100$ mV
Load transient response - peak deviation	$V_{dynamic}$		20 70		mV mV	Peak deviation for 50% to 75% step load, $di/dt = 100$ mA/ μs , step load, $di/dt = 1$ A/ μs
Load transient response - recovery	$T_{recovery}$		20		μs	Settling time to within 1% of output set point voltage for 50% to 75% load step
External load capacitance	C_{ext}	0		20,000	μF	Higher load capacitance values may be possible. Contact Artesyn Technologies for details
Output voltage - noise	V_{p-p} V_{rms}		35 10	60 20	mV pk-pk mV rms	Measurement bandwidth 20 MHz See Application Note 138 for test set-up

LES20A24-1V8j Model

Protection and Control Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Overvoltage setpoint	V _{OV}	2.07		2.25	V _{dc}	Non-latching. See Application Note 138 for details
Overcurrent limit inception	I _{OC}	21	23	25	A _{dc}	V _O = 90% of V _O (nom)
Output voltage trim range		80		110	%	Trim up (% of V _O nom) Limit O/P to 36 Watts
					%	Trim down (% of V _O nom) See Application Note 138 for details of trim equations and trim curves
Open sense voltage			1.80		V _{dc}	

LES20A24-1V8j Model

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency	h		91.0		%	I _{out} = 100% I _{out} (max), V _{in} = V _{in} (nom)
Efficiency	h		91.5		%	I _{out} = 50% I _{out} (max), V _{in} = V _{in} (nom)

LES20A24-3V3J Model

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating	I_{in}		3.09		Adc	$V_{in} = V_{in} (nom)$; $I_{out} = I_{out} (max)$; $V_o = V_o (nom)$
Input current - maximum	$I_{in} (max.)$			4.25	Adc	$V_{in} = V_{in} (min)$; $I_{out} = I_{out} (max)$; $V_o = V_o (nom)$, measured at converter
Input Capacitor ripple current	$I_{in} (ripple)$		57 150		mA RMS mA pk-pk	$I_{out} = I_{out} (max)$, measured without standard filter. See Application Note 138
Reflected ripple current	$I_{in} (refl)$		2 5		mA RMS mA pk-pk	$I_{out} = I_{out} (max)$, measured with standard filter. See Application Note 138
Input capacitance - Internal	C_{input}		5.65		μF	Internal to converter
Input capacitance - External bypass	C_{bypass}		220		μF	Recommended customer added capacitance, $<0.7 \Omega$ ESR

LES20A24-3V3J Model

Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Nominal set-point voltage	$V_o (nom)$	3.25	3.30	3.35	Vdc	$V_{in} = V_{in} (nom)$; $I_{out} = I_{out} (nom)$
Total regulation band	V_o	3.20		3.40	Vdc	For all line, static load and temperature until end of life
Line regulation			0.01	0.1	%	$I_{out} = I_{out} (nom)$, $V_{in} (min)$ to $V_{in} (max)$
Load regulation			0.02	0.2	%	$V_{in} = V_{in} (nom)$, $I_{out} (min)$ to $I_{out} (max)$
Temperature regulation				0.02	$\pm\%/^{\circ}C$	$V_{in} = V_{in} (nom)$, $I_{out} = I_{out} (max)$
Output current continuous	I_{out}	0		20	Adc	
Output current - short circuit	I_{sc}		7		A rms	Continuous, unit auto recovers from short, $V_o < 100$ mV
Load transient response - peak deviation	$V_{dynamic}$		40 130		mV mV	Peak deviation for 50% to 75% step load, $di/dt = 100$ mA/ μs , step load, $di/dt = 1$ A/ μs
Load transient response - recovery	$T_{recovery}$		20		μs	Settling time to within 1% of output set point voltage for 50% to 75% load step
External load capacitance	C_{ext}	0		10,000	μF	Higher load capacitance values may be possible. Contact Artesyn Technologies for details
Output voltage - noise	V_{p-p} V_{rms}		35 10	60 20	mV pk-pk mV rms	Measurement bandwidth 20 MHz See Application Note 138 for test set-up

LES20A24-3V3J Model

Protection and Control Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Overvoltage setpoint	V _{OV}	3.80		4.13	Vdc	Non-latching. See Application Note 138 for details
Overcurrent limit inception	I _{OC}	21	23	25	Adc	V _O = 90% of V _O (nom)
Output voltage trim range		80		110	%	Trim up (% of V _O nom) Limit O/P to 66 Watts
					%	Trim down (% of V _O nom) See Application Note 138 for details of trim equations and trim curves
Open sense voltage			3.30		Vdc	

LES20A24-3V3J Model

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency	h		90.0		%	I _{out} = 100% I _{out} (max), V _{in} = V _{in} (nom)
Efficiency	h		90.8		%	I _{out} = 50% I _{out} (max), V _{in} = V _{in} (nom)

LES20A24-1V8J Model

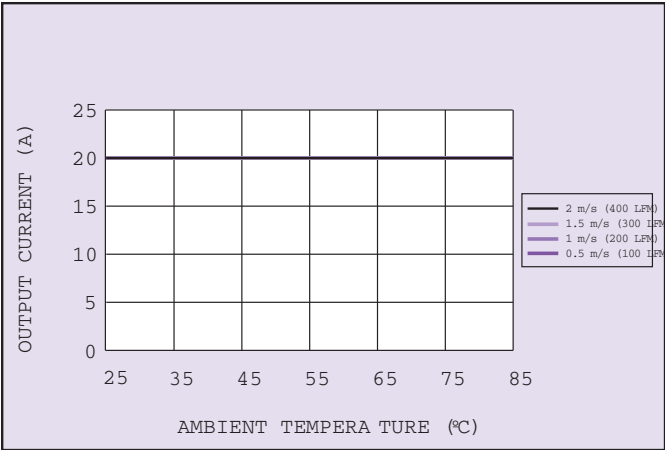


Figure 1: Derating Curve with Forced Air
Note: No Derating to 85 °C with Minimum 100 LFM Airflow

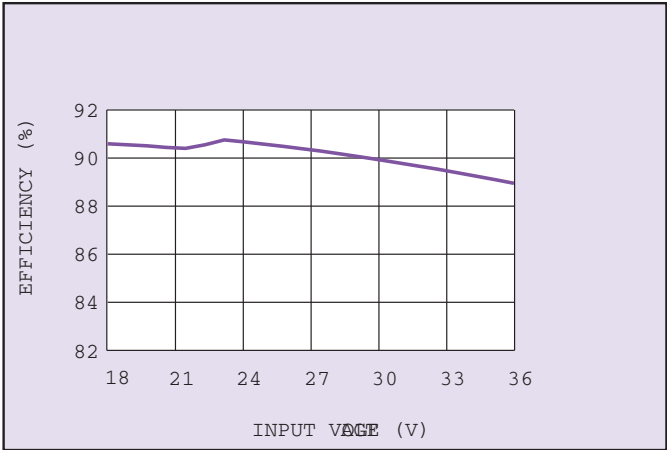


Figure 2: Efficiency vs. Line

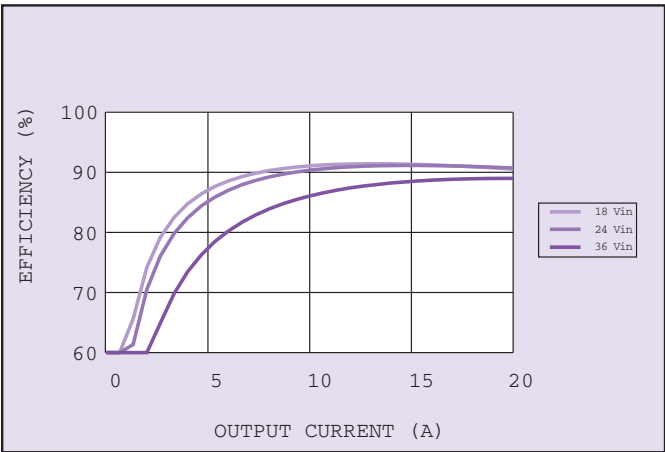


Figure 3: Efficiency vs. Load

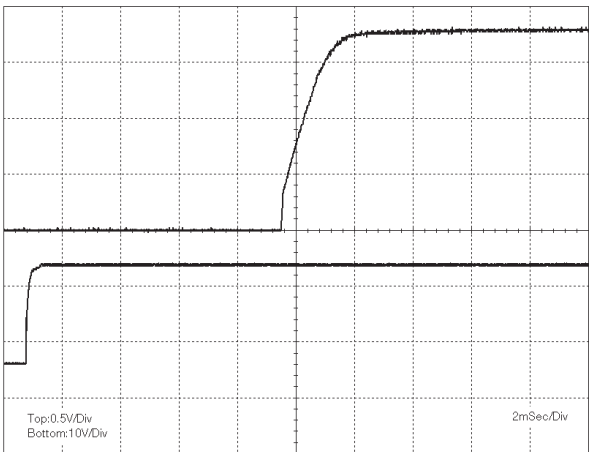


Figure 4: Turn-On Characteristic,
Top (Vout), Bottom (Vin)

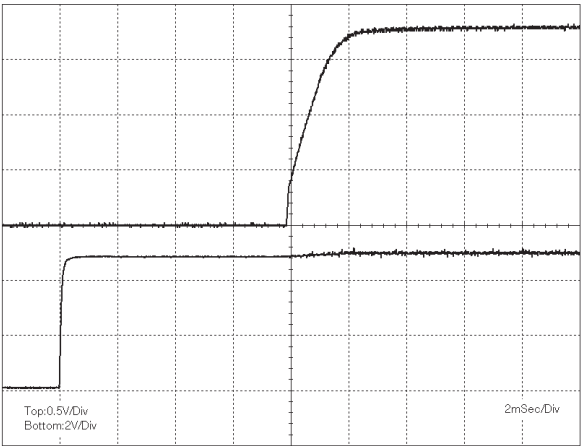


Figure 5: Control On/Off Characteristic,
Top (Vout), Bottom (Remote ON/OFF)

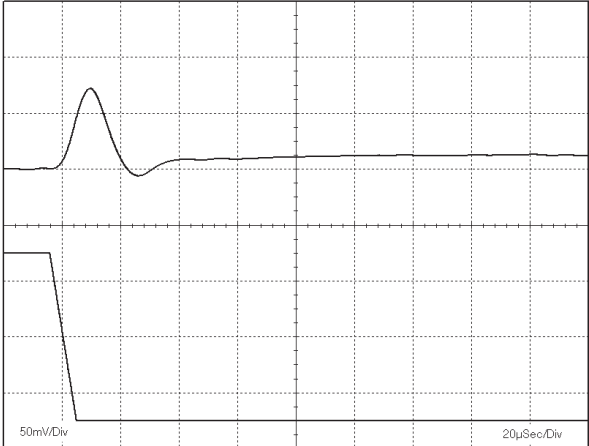


Figure 6: Typical Transient Response 75-50%
Step Load Change (1 A/ μ s), Top (Vout) Bottom (Iout)

LES20A24-1V8J Model

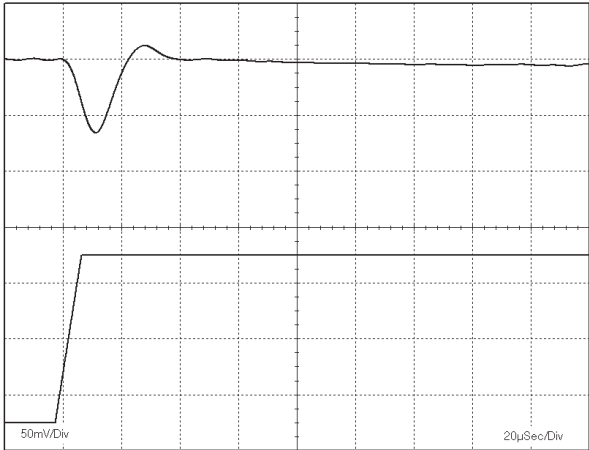


Figure 7: Typical Transient Response 50-75% Step Load Change (1 A/μs), Top (Vout) Bottom (Iout)

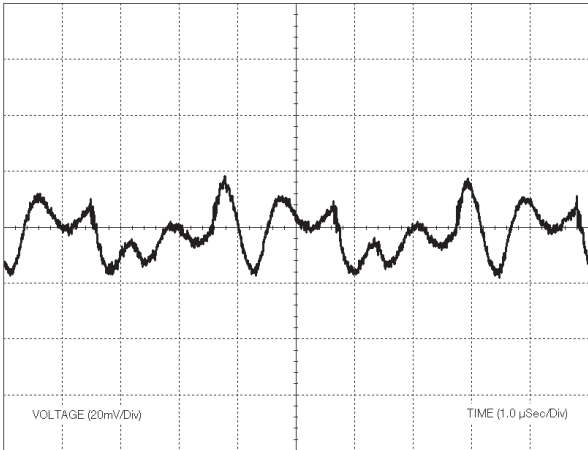


Figure 8: Typical Output Ripple and Noise Measurement

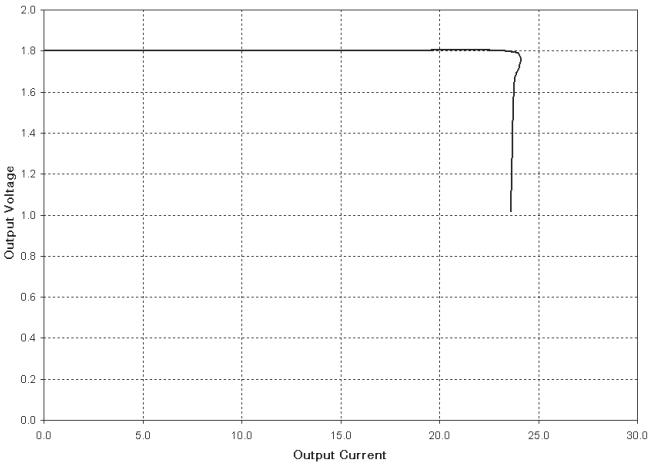


Figure 9: Current Limit Characteristic

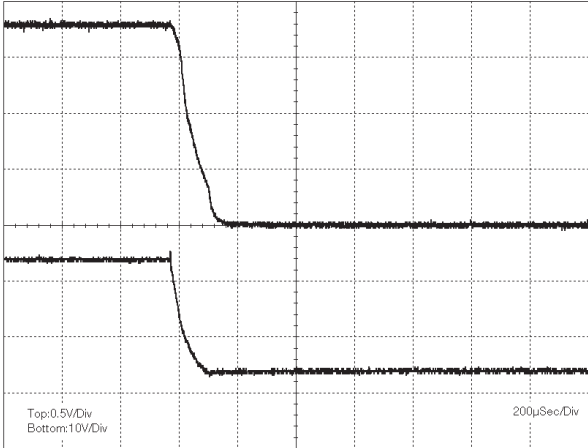


Figure 10: Turn-Off Characteristic

LES20A24-3V3J Model

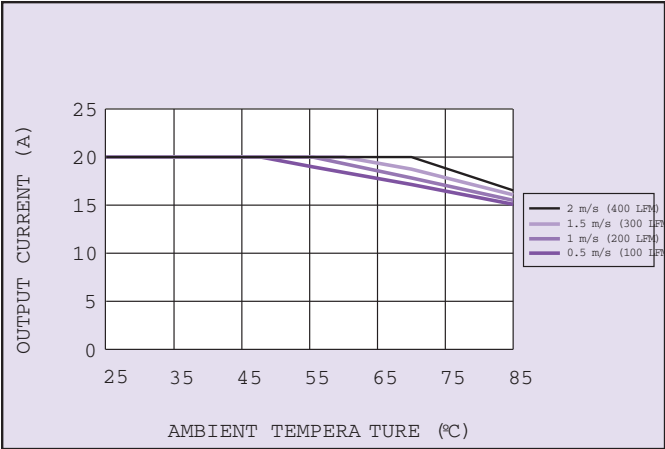


Figure 11: Derating Curve with Forced Air

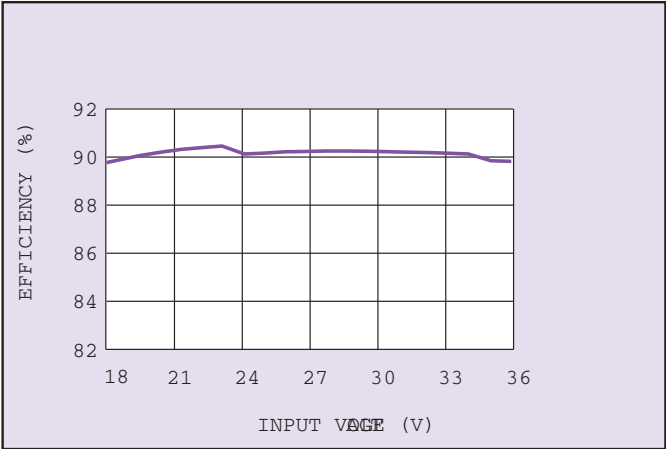


Figure 12: Efficiency vs. Line

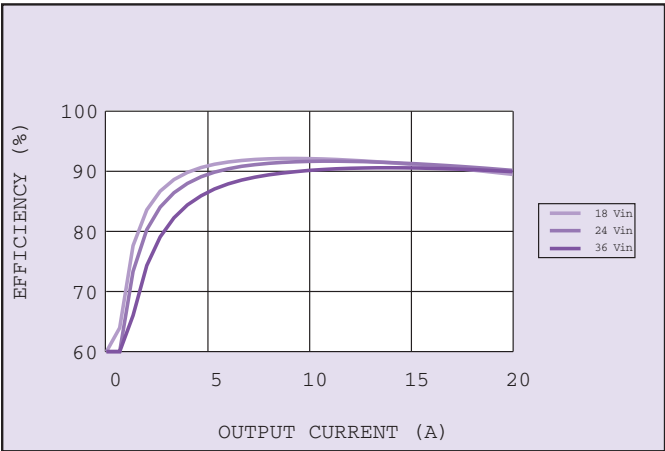


Figure 13: Efficiency vs. Load

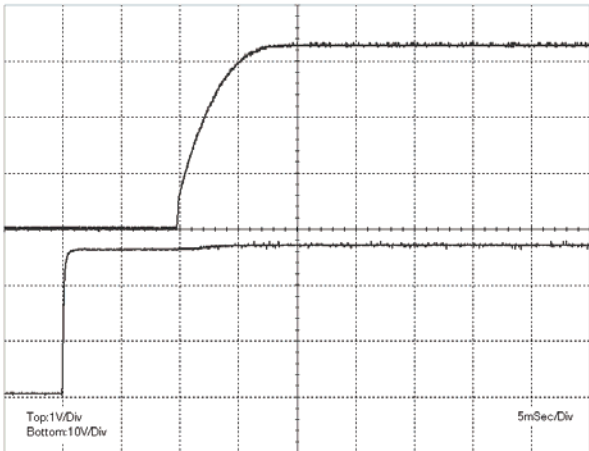


Figure 14: Turn-On Characteristic,
Top (Vout), Bottom (Vin)

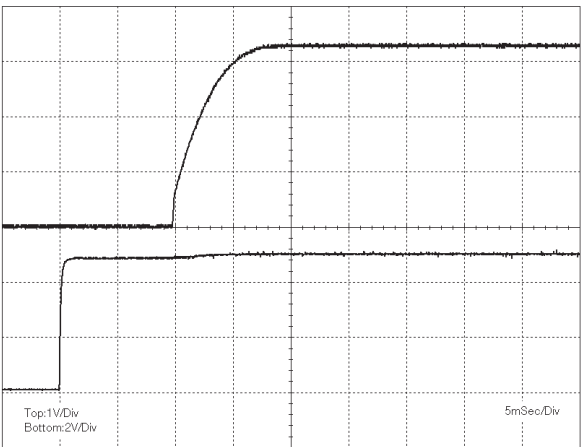


Figure 15: Control On/Off Characteristic,
Top (Vout), Bottom (Remote ON/OFF)

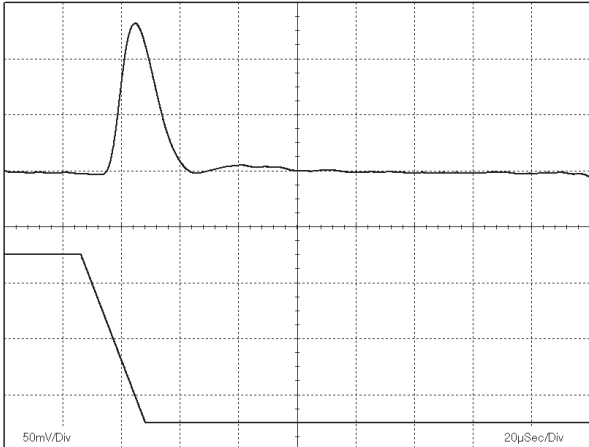


Figure 16: Typical Transient Response 75-50%
Step Load Change (1 A/ s), Top (Vout) Bottom (Iout)

LES20A24-3V3J Model

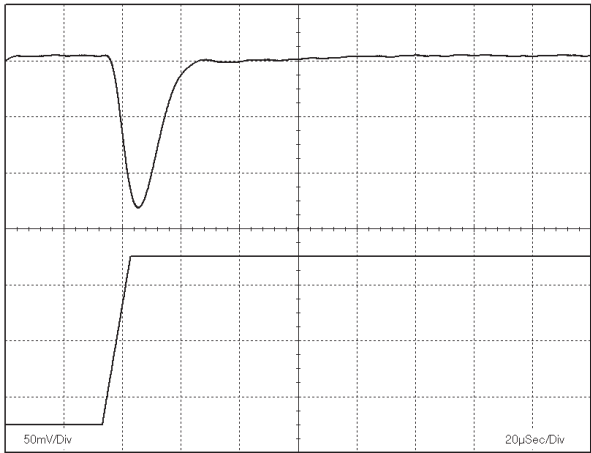


Figure 17: Typical Transient Response 50-75% Step Load Change (1 A/ s), Top (Vout) Bottom (Iout)

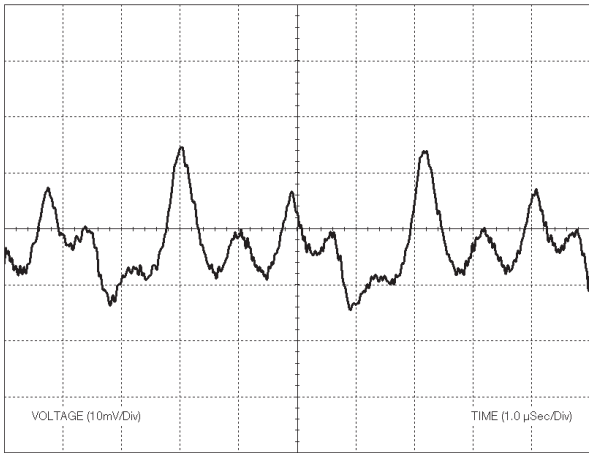


Figure 18: Typical Output Ripple and Noise Measurement

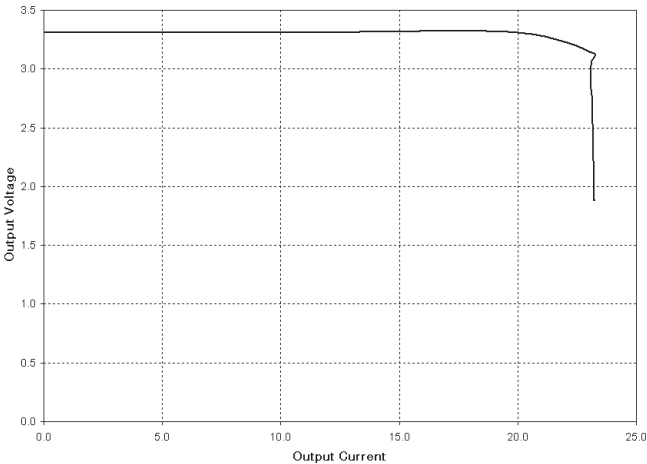


Figure 19: Current Limit Characteristic

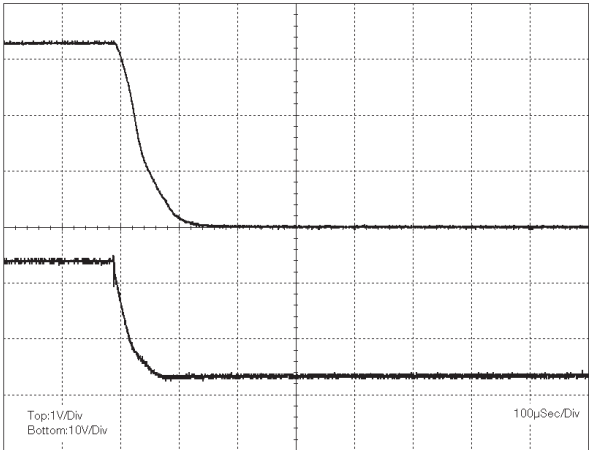


Figure 20: Turn-Off Characteristic

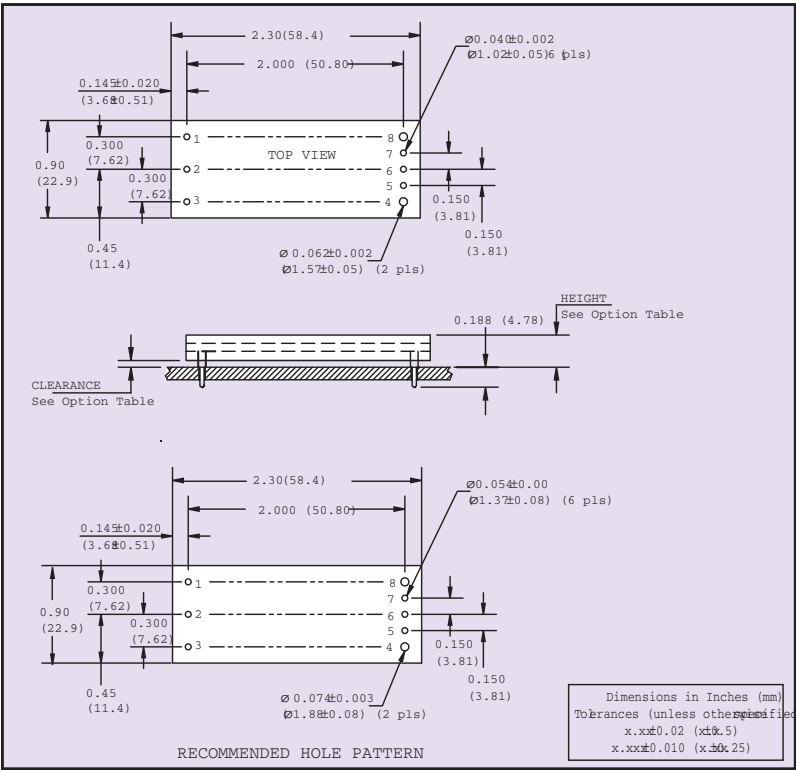


Figure 21 - Through-hole Mechanical Drawing, Dimension Options and Pinout Table

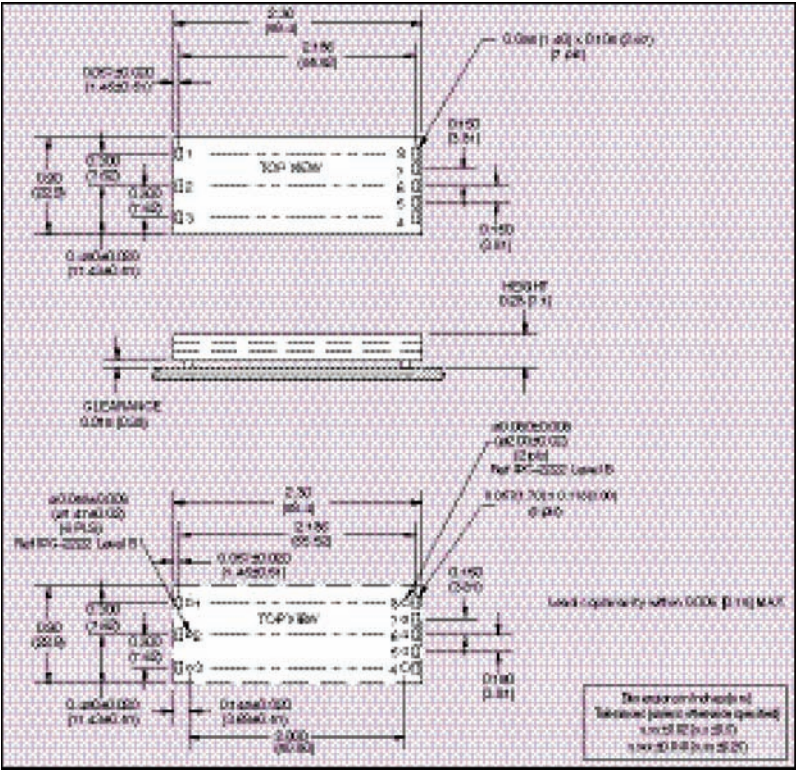


Figure 22: Surface-Mount Mechanical Drawing and Pinout Table

EIGHTH-BRICK SERIES

24 V Input, Single Output

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Notes

- 1 The remote ON/OFF pin is referenced to Vin-.
- 2 Active low Remote ON/OFF is available. Standard product is active high. When ordering active low parts, designate with the Suffix 'R' e.g. LES20A24-1V8RAJ. See Application Note 138 for detailed information regarding ON/OFF control implementation.

CAUTION: Hazardous internal voltages and high temperatures. Ensure that unit is accessible only to trained personnel. The user must provide the recommended fusing in order to comply with safety approvals.

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