

QUARTER-BRICK SERIES

24V Input, Single Output

Embedded Power for
Business-Critical Continuity

QUARTER-BRICK SERIES

Total Power: 54-99W
Input Voltage: 18-36Vdc
of Outputs: Single Output

Special Features

- High efficiency topology, 89.5% @ 3.3 V and 91% @ 1.8 V
- High output current
- Low profile, 0.300 inch (7.62 mm) height
- Unprecedented useable output power levels
- Wide operating temperature range, -40 °C to +85 °C (ambient temperature)
- 80% to 110% output trim
- Basic insulation
- Overvoltage and overtemperature protection
- Remote ON/OFF
- Approvals to EN60950-1 VDE and UL/cUL60950
- 50 V, 100 ms input voltage transient rated
- Monotonic startup behavior in normal and prebiased loads
- Available RoHS compliant
- 2 year warranty



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.

This is a new high efficiency, open frame, isolated 30 A converter series in an industry standard Quarter-Brick package. The Typhoon™ Quarter-Brick Series delivers very high output current at low voltages, which provides an excellent amount of useable output power for today's high-end applications. The design takes advantage of open-frame construction to provide a low mass, low thermal impedance single board design. This version of the Typhoon Quarter-Brick series features an input voltage range of 18 Vdc to 36 Vdc and output voltages of 1.8 V and 3.3 V. The output voltage on each model is adjustable from 80% to 110% of the nominal value. Typical full load efficiency for the 1.8 V model is 91%. This converter also has a remote ON/OFF capability. Overcurrent and overvoltage protection features are included as standard. With full international safety approval including EN60950-1 VDE and UL/cUL60950, the Quarter-Brick converter reduces compliance costs and time to market.

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quarter-brick series
1 of 16

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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		120	°C	Measured at hotspot
Storage temperature	$T_{storage}$	-55		125	°C	
Output power (1.8 V)	$P_{out} (max)$			54	W	
Output power (3.3 V)	$P_{out} (max)$			99	W	

All specifications are typical at nominal input $V_{in} = 24 V$, and output full 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	
Input current - no load	I_{in}			100	mAdc	$V_{in} (min) - V_{in} (max)$, enabled
Input current - quiescent	$I_{in} (off)$			5	mAdc	Converter disabled
Inrush current (i^2t)	I_{inrush}		0.03		A ² s	
Inrush current ratio	I_t/I_m		22			
Input ripple rejection			50		dB	Frequency <1 kHz
Input fuse				10	A	Slow blow/antisurge HRC recommended 63 V Rating. See Application Note 141

Turn On/Off

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - turn on	$V_{in} (on)$		17.5	18	Vdc	
Input voltage - turn off	$V_{in} (off)$	15	16.5		Vdc	
Turn on delay - enabled, then power applied	$T_{delay} (power)$		8	15	ms	With the Remote ON/OFF signal asserted, time from when $V_{in} > V_{in} (oper)$ until V_{out} is within total regulation band
Turn on delay - power applied, then enabled	$T_{delay} (enable)$		7	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	4	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	5	V	$I_{ih} = 0 \mu\text{A}$; open circuit voltage
High level input voltage	V_{ih}	2.4			V	Converter guaranteed ON when control pin is greater than $V_{ih}(\text{min})$
High level input current	I_{ih}			10	μA	Current flowing into control pin when pin is pulled high (max. at $V_{ih} = 36\text{V}$)
Acceptable high level leakage current	$I_{ih}(\text{leakage})$			-10	μA	Acceptable leakage current from signal pin into the open collector driver (neg = from converter)
Low level input voltage	V_{il}			0.4	V	Converter guaranteed off when control pin is less than $V_{il}(\text{max})$
Low level input current	$I_{il}(\text{max})$		-0.4	-0.5	mA	$V_{il} = 0.0\text{V}$, 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	$^{\circ}\text{C}$	Hotspot temperature, non-latching shutdown protection
Remote sense compensation				10	%	% of $V_o(\text{nom})$, compensation includes trim. See Application Note 141

Reliability and Service Life

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Mean time between failure	MTBF		4,570,000		Hours	Telcordia Tech. SR-332 Issue 3, ground benign, temp. = 40°C , $V_{in} = V_{in}(\text{nom})$, $I_{out} = I_{out}(\text{max})$

Isolation

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input to output test voltage				2250	Vdc	Test duration 1 s
Input to output capacitance			1200		pF	
Input to output resistance		10			$\text{M}\Omega$	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 IEC 680068-2-2 Bb/Bd: dry heat IEC 68-2-14 Nb: Rate of change	-40 °C, 16 h +70 °C, 16 h -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 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 Input transients	DC power DC power	EN61000-4-6	10 V 50 V, 100 ms	With recommended Class B external filter, no load, 10 J (output remains within ±9%)

Standards Compliance List

Characteristic	
IEC/EN60950-1	1st edition
UL/cUL60950	3rd edition
VDE	

Safety Agency Approvals

Standard	Category
UL/cUL60950 File Number	E135734/60950
VDE Certificate No.	10401-3336-0197 licence 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
LQS30A24-1V8J	18-36 Vdc	1.8 V	2.15 V	30 A	91.0%
LQS30A24-3V3J	18-36 Vdc	3.3 V	4 V	30 A	89.5%

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.

LQS30A24-1V8J Model

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating	I_{in}		2.50		Adc	$V_{in} = V_{in} (nom)$; $I_{out} = I_{out} (max)$; $V_o = V_o (nom)$
Input current - maximum	$I_{in} (max.)$			3.4	Adc	$V_{in} = V_{in} (min)$; $I_{out} = I_{out} (max)$; $V_o = V_o (nom)$, measured at converter
Input Capacitor ripple current	$I_{in} (ripple)$		45 150		mA rms mA pk-pk	$I_{out} = I_{out} (max)$, measured without standard filter. See Application Note 141
Reflected ripple current	$I_{in} (refl)$		1.2 4		mA rms mA pk-pk	$I_{out} = I_{out} (max)$, measured with standard filter. See Application Note 141
Input capacitance - Internal	C_{input}		11.6		μF	Internal to converter
Input capacitance - External bypass	C_{bypass}		220		μF	Recommended customer added capacitance

LQS30A24-1V8J 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	1.74		1.86	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		30	Adc	
Output current - short circuit	I_{sc}		15		A rms	Continuous, unit auto recovers from short, $V_o < 100$ mV
Load transient response - peak deviation	$V_{dynamic}/V_o (nom)$		70		mV	Peak deviation for 50% to 75% step load, $di/dt = 100$ mA/ μs , % of $V_o (nom)$
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		30,000	μF	Higher load capacitance values may be possible. Contact Artesyn Technologies for details
Output voltage - noise	V_{p-p} V_{rms}		20 10	60 20	mV pk-pk mV rms	Measurement bandwidth 20 MHz See Application Note 141 for test set-up details

LQS30A24-1V8J Model

Protection and Control Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Overvoltage setpoint	V_{OV}	2.07		2.25	Vdc	Non-latching. See Application Note 141 for details
Overcurrent limit inception	I_{OC}	31.5	34.5	37.5	Adc	$V_O = 90\%$ of V_O (nom)
Output voltage trim range				110	%	Trim up (% of V_O nom)
		80			%	Limit output to 54 Watts Trim down (% of V_O nom) See Application Note 141 for details of trim equations and trim curves
Open sense voltage			1.80		Vdc	

LQS30A24-1V8J Model

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency	h		91		%	$I_{out} = 100\% I_{out} (max)$, $V_{in} = V_{in} (nom)$
Efficiency	h		92		%	$I_{out} = 50\% I_{out} (max)$, $V_{in} = V_{in} (nom)$

LQS30A24-3V3J Model

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating	I_{in}		4.3		Adc	$V_{in} = V_{in} (nom); I_{out} = I_{out} (max); V_o = V_o (nom)$
Input current - maximum	$I_{in} (max.)$			6.50	Adc	$V_{in} = V_{in} (min); I_{out} = I_{out} (max); V_o = V_o (nom)$, measured at converter
Input Capacitor ripple current	$I_{in} (ripple)$		90 200		mA rms mA pk-pk	$I_{out} = I_{out} (max)$, measured without standard filter. See Application Note 141
Reflected ripple current	$I_{in} (refl)$		1.2 4		mA rms mA pk-pk	$I_{out} = I_{out} (max)$, measured with standard filter. See Application Note 141
Input capacitance - Internal	C_{input}		11.6		μF	Internal to converter
Input capacitance - External bypass	C_{bypass}		220		μF	Recommended customer added capacitance

LQS30A24-3V3J 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		30	Adc	
Output current - short circuit	I_{sc}		15		A rms	Continuous, unit auto recovers from short, $V_o < 100$ mV
Load transient response - peak deviation	$V_{dynamic}/V_o (nom)$		120		mV	Peak deviation for 50% to 75% step load, $di/dt = 100$ mA/ μs , % of $V_o (nom)$
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}		20 10	60 20	mV pk-pk mV rms	Measurement bandwidth 20 MHz See Application Note 141 for test set-up details

LQS30A24-3V3J Model

Protection and Control Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Overvoltage setpoint	V_{OV}	3.63		3.96	Vdc	Non-latching. See Application Note 141 for details
Overcurrent limit inception	I_{OC}	31.5	34.5	37.5	Adc	$V_O = 90\%$ of V_O (nom)
Output voltage trim range				110	%	Trim up (% of V_O nom)
		80			%	Limit output to 99 Watts Trim down (% of V_O nom) See Application Note 141 for details of trim equations and trim curves
Open sense voltage			3.30		V DC	

LQS30A24-3V3J Model

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency	h	88.5	89.5		%	$I_{out} = 100\% I_{out} (max)$, $V_{in} = V_{in} (nom)$
Efficiency	h		91		%	$I_{out} = 50\% I_{out} (max)$, $V_{in} = V_{in} (nom)$

LQS30A24-1V8J Model

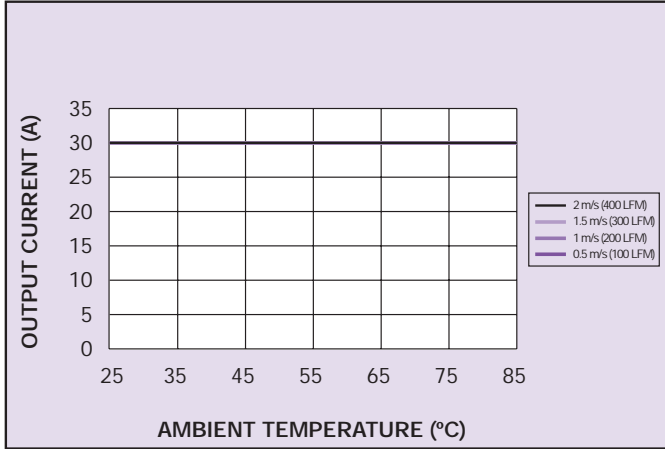


Figure 1: Derating Curve with Forced Air
 Note: No Derating to 85 °C with Minimum 100 LFM Airflow

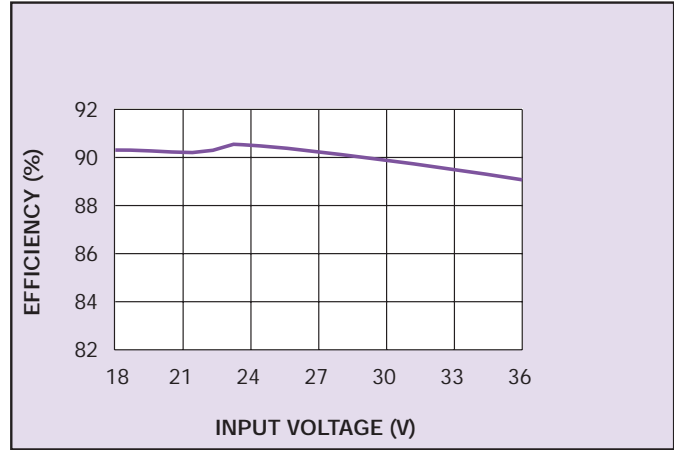


Figure 2: Efficiency vs. Line

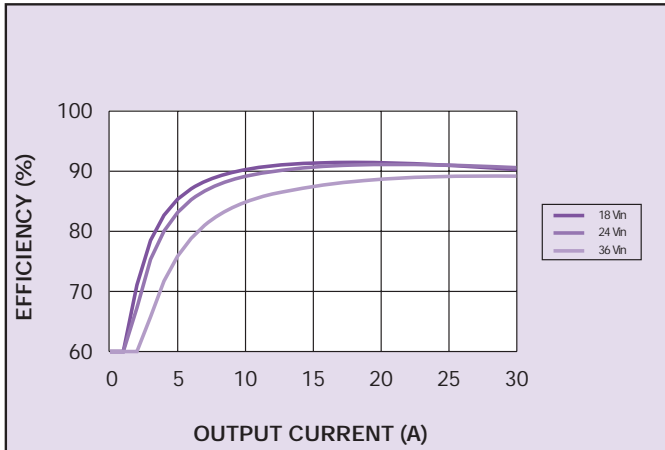


Figure 3: Efficiency vs. Load

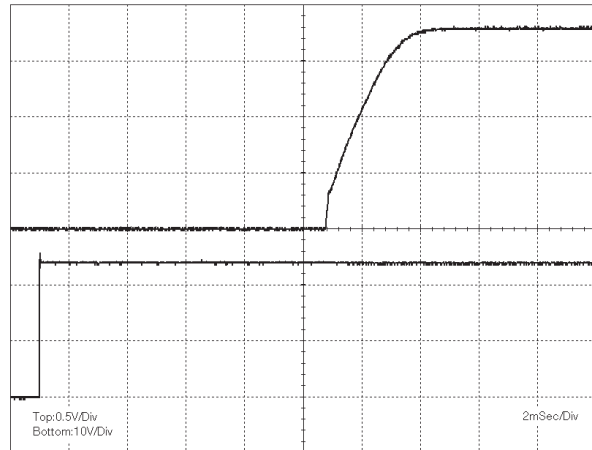


Figure 4: Turn-On Characteristic,
 Top (Vout), Bottom (Vin)

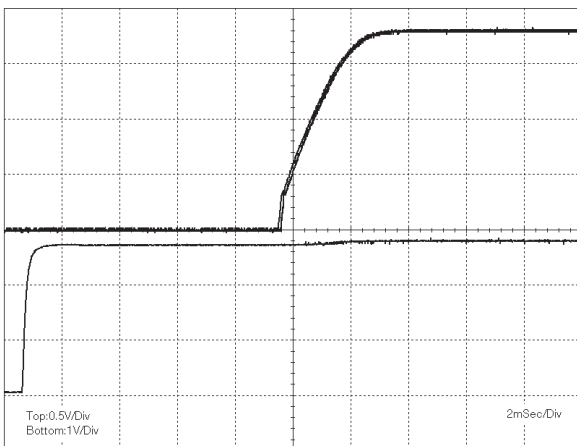


Figure 5: Control On/Off Characteristic,
 Top (Vout), Bottom (-Vin to Remote ON/OFF)

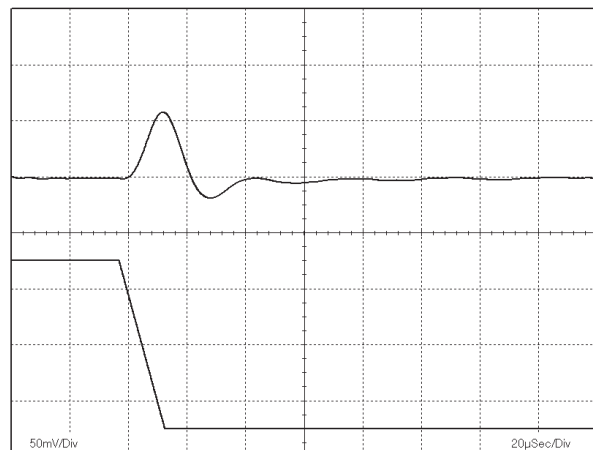


Figure 6: Typical Transient Response 75-50%
 Step Load Change (1 A/µs), Top (Vout), Bottom (Iout)

LQS30A24-1V8J Model

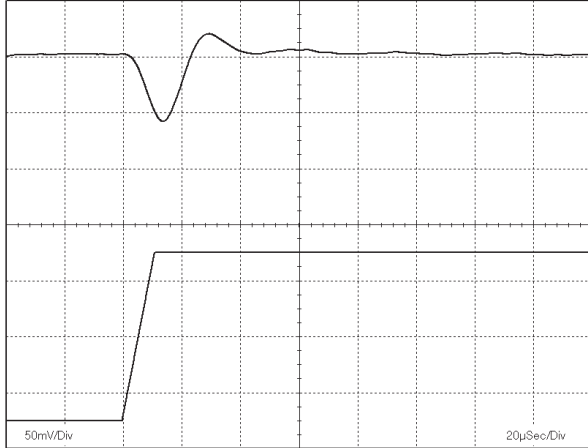


Figure 7: Typical Transient Response 50-75% Step Load Change (1 A/ μ s), Top (Vout), Bottom (Iout)

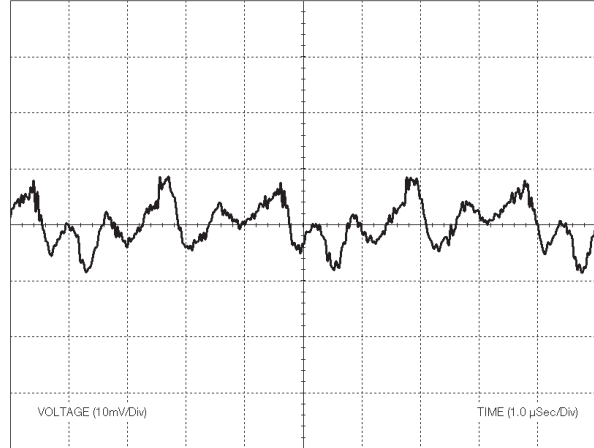


Figure 8: Typical Output Ripple and Noise Measurement

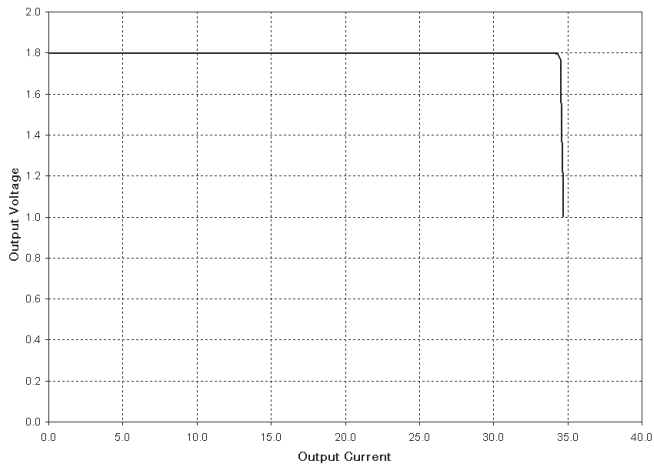


Figure 9: Current Limit Characteristic

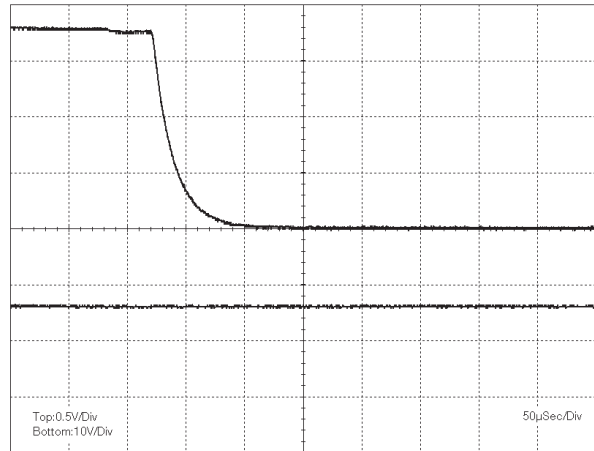


Figure 10: Turn-Off Characteristic

LQS30A24-3V3J Model

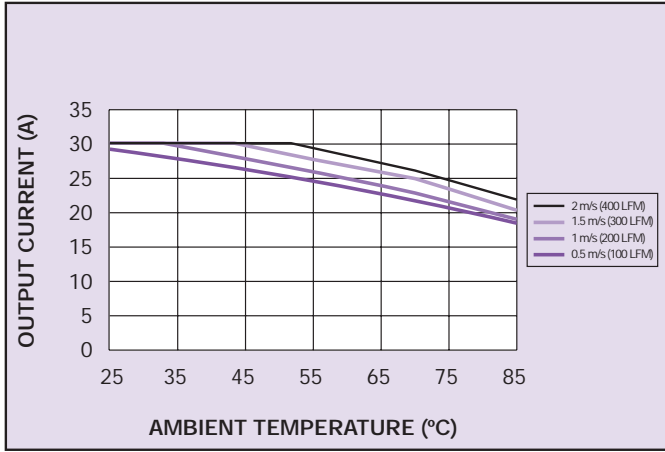


Figure 11: Derating Curve with Forced Air

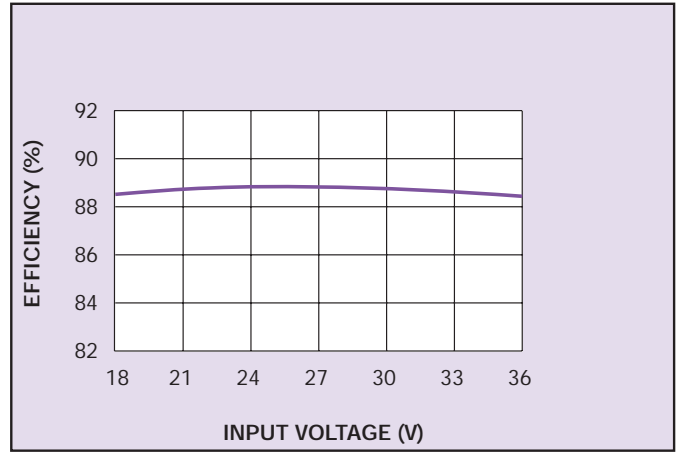


Figure 12: Efficiency vs. Line

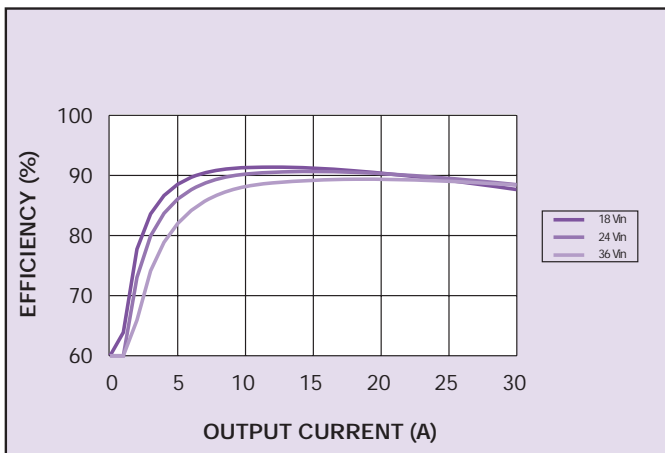


Figure 13: Efficiency vs. Load

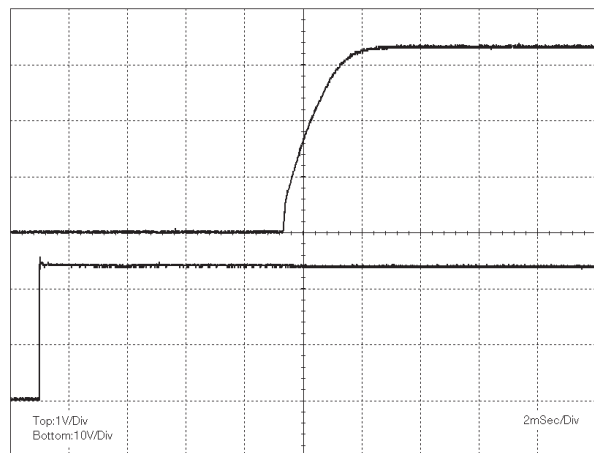


Figure 14: Turn-On Characteristic,
 Top (V_{out}), Bottom (V_{in})

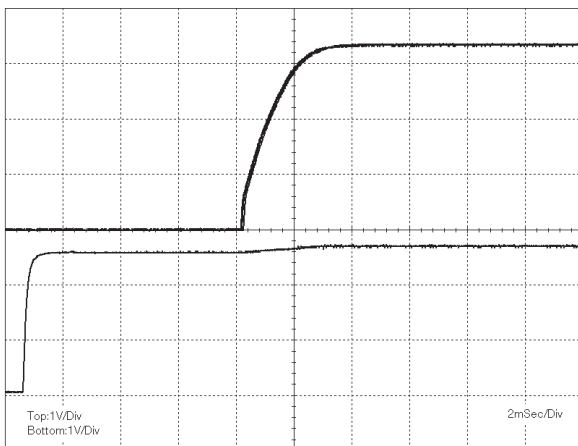


Figure 15: Control On/Off Characteristic,
 Top (V_{out}), Bottom (-V_{in} to Remote ON/OFF)

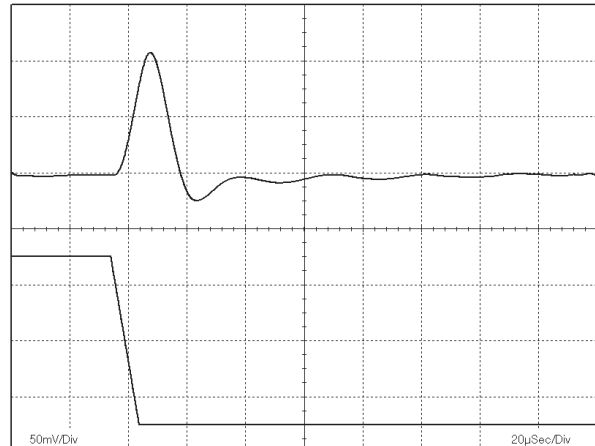


Figure 16: Typical Transient Response 75-50%
 Step Load Change (1 A/µs), Top (V_{out}), Bottom (I_{out})

LQS30A24-3V3J Model

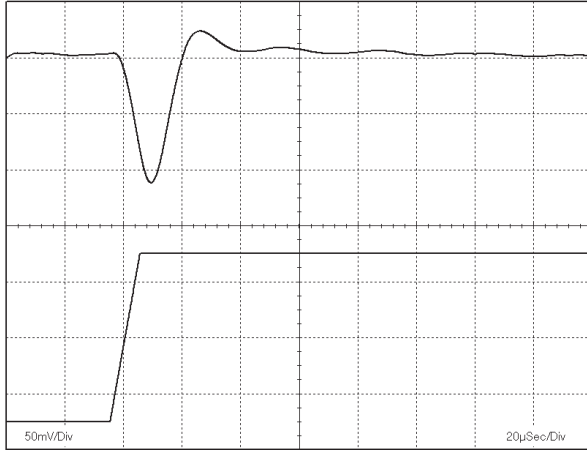


Figure 17: Typical Transient Response 50-75% Step Load Change (1 A/ μ s), Top (Vout), Bottom (Iout)

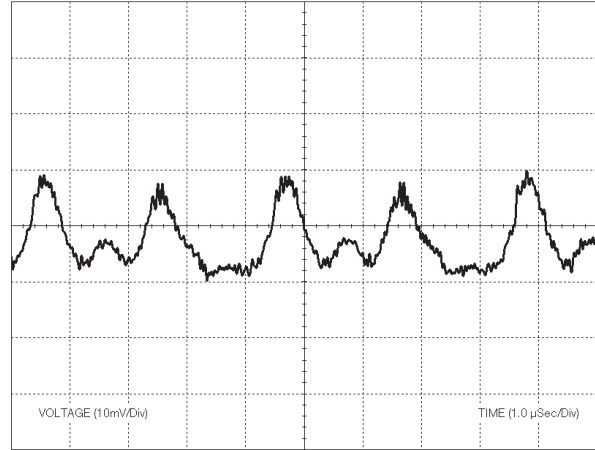


Figure 18: Typical Output Ripple and Noise Measurement

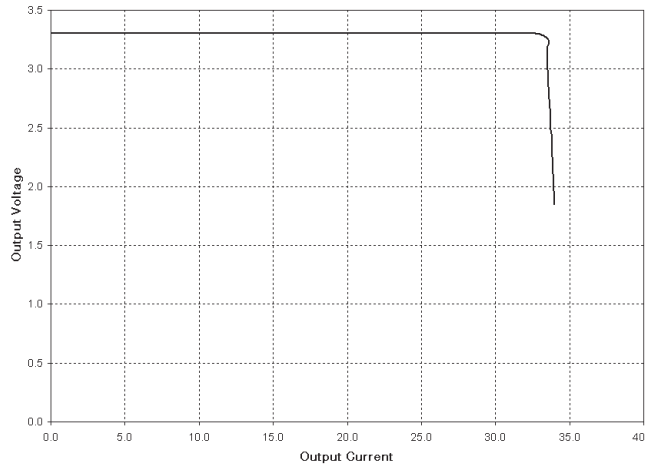


Figure 19: Current Limit Characteristic

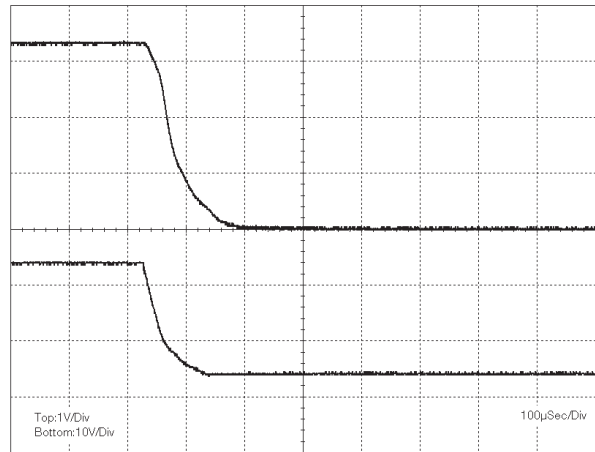
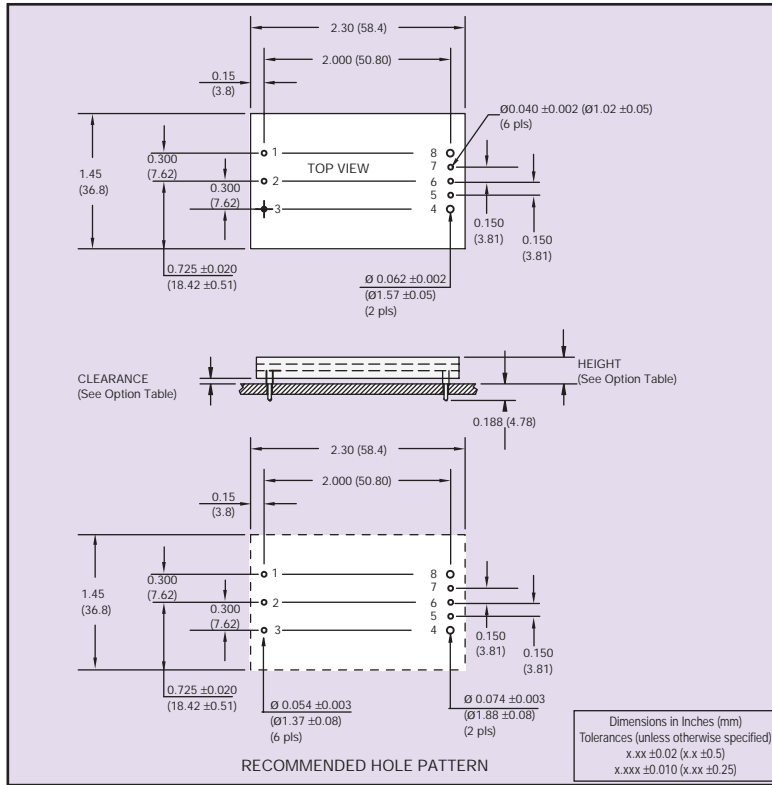


Figure 20: Turn-Off Characteristic



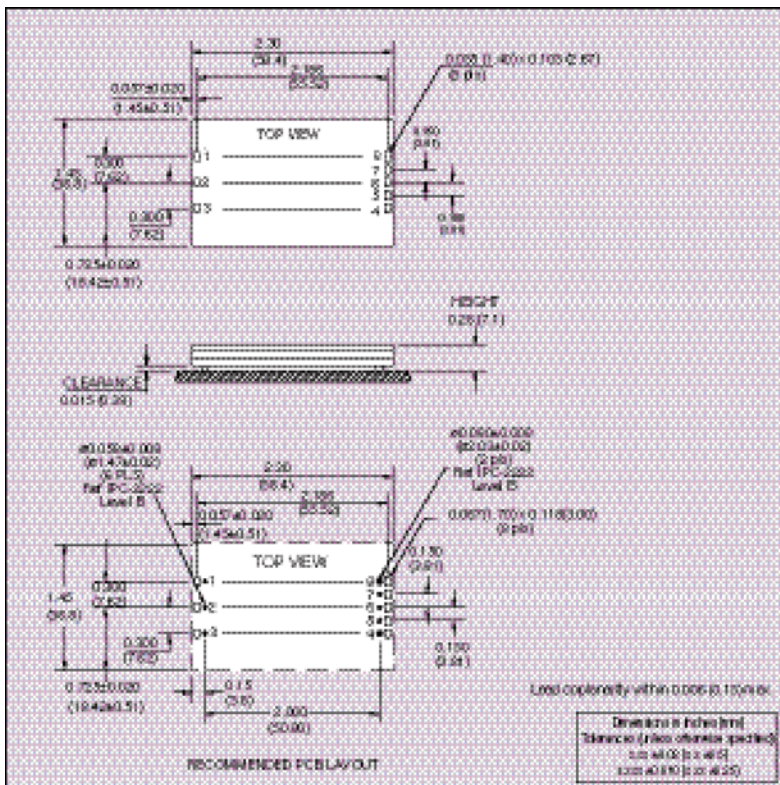
Pin Connections

Pin No.	Function
1	+Vin
2	ON/OFF
3	-Vin
4	-Vout
5	-Sense
6	Trim
7	+Sense
8	+Vout

Dimension Options

Option	Clearance	Height
	±0.016 (0.41)	+0.022 (0.56) -0.030 (0.76)
A	0.030 (0.76)	0.300 (7.62)
E	0.070 (1.78)	0.340 (8.64)

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



Pin Connections

Pin No.	Function
1	+Vin
2	ON/OFF
3	-Vin
4	-Vout
5	-Sense
6	Trim
7	+Sense
8	+Vout

Figure 22: Surface-mount Mechanical Drawing and Pinout Table

Note 1

The remote ON/OFF pin is referenced to Vin-.

Note 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. LQS30A24-3V3RAJ. See Application Note 141 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.

QUARTER-BRICK SERIES

24 Volt Input, Single Output

■ Embedded Power for
Business-Critical Continuity

Rev.10.22.07
quarter-brick series
16 of 16

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