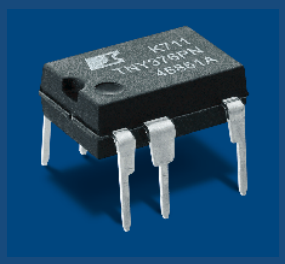
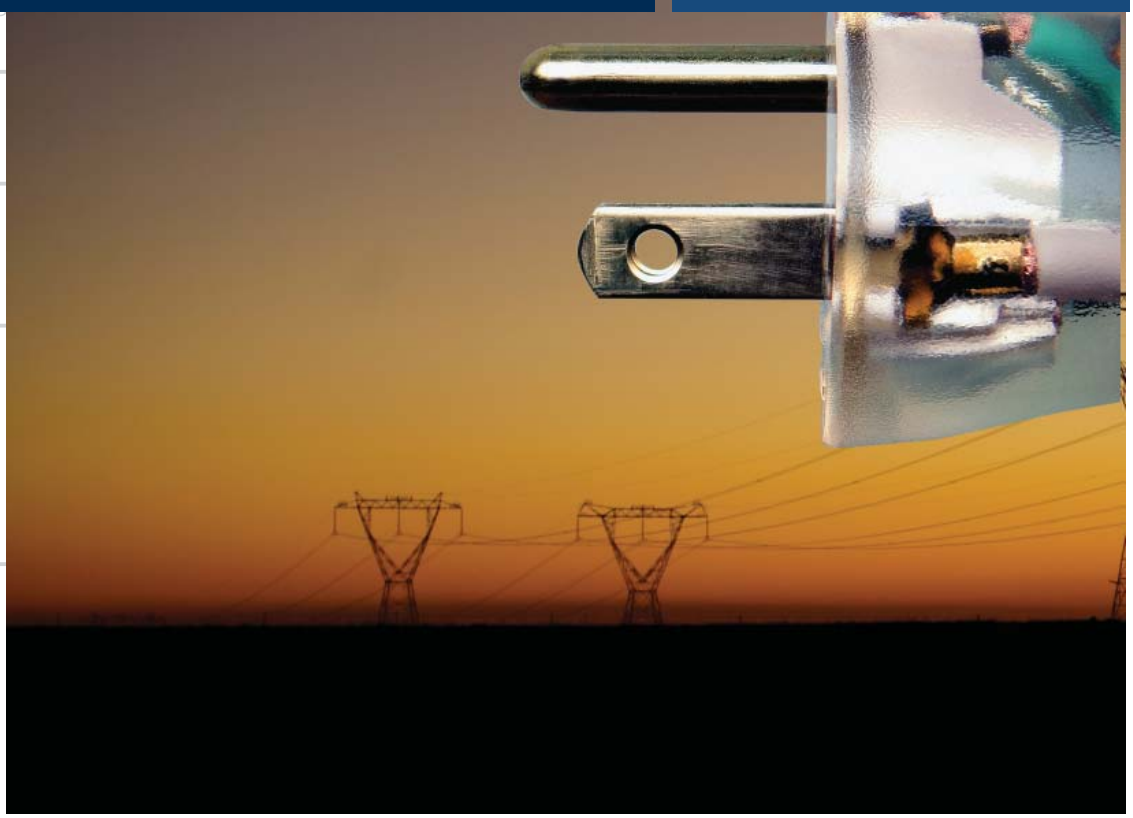
Innovation in power conversion

Product Selector Guide
AC-DC Products

July 2008





Product Selector Guide
AC-DC Products

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Design Tools

Total Product Support

The total product support kit includes the following materials:
– Data Book and Design Guide
– Application Notes
– Data Sheets
– Design Ideas
– PI Expert
– Design Example Reports
– Reference Design Reports

You can also find more information on the link shown below
www.powerint.com/designsupport

Applications

Comprehensive Microsites

Power Integrations' power conversion ICs cover power ranges from a fraction of a watt to over 200 watts to address a wide range of applications. For details, visit our applications microsites:

Audio Chargers/Adapters:
http://www.powerint.com/applications/audio.htm

Cell Phone Chargers/Adapters:
http://www.powerint.com/applications/cell_phones.htm

Cordless Phone Chargers/Adapters and Base Stations:
http://www.powerint.com/applications/cordless_phones.htm

DVD Player Power Supplies:
http://www.powerint.com/applications/dvds.htm

Offline LED Power Supplies:
http://www.powerint.com/applications/ledlighting.htm

Major Appliance Power Supplies:
http://www.powerint.com/applications/major_appliances.htm

Motor Control Power Supplies:
http://www.powerint.com/applications/motors.htm

Standby Power Supplies:
http://www.powerint.com/applications/pc_standby.htm

Power over Ethernet Powered Devices:
http://www.powerint.com/applications/poe.htm

Set Top Box Power Supplies:
http://www.powerint.com/applications/set_top_boxes.htm

Small Appliance Power Supplies:
http://www.powerint.com/applications/small_appliances.htm

Utility and Power Meter Power Supplies:
http://www.powerint.com/applications/meters.htm

Industrial:
http://www.powerint.com/applications/industrial.htm

LCD TV/Monitor:
http://www.powerint.com/applications/lcdmonitortvs.htm

Design Simplification

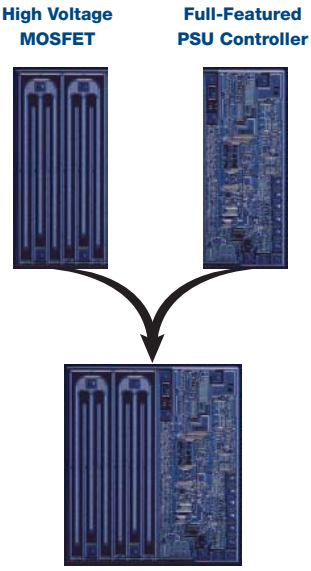
Enabling Predictable Success

Power Integrations helps designers reduce the complexity of their power supply design and achieve more predictable success.

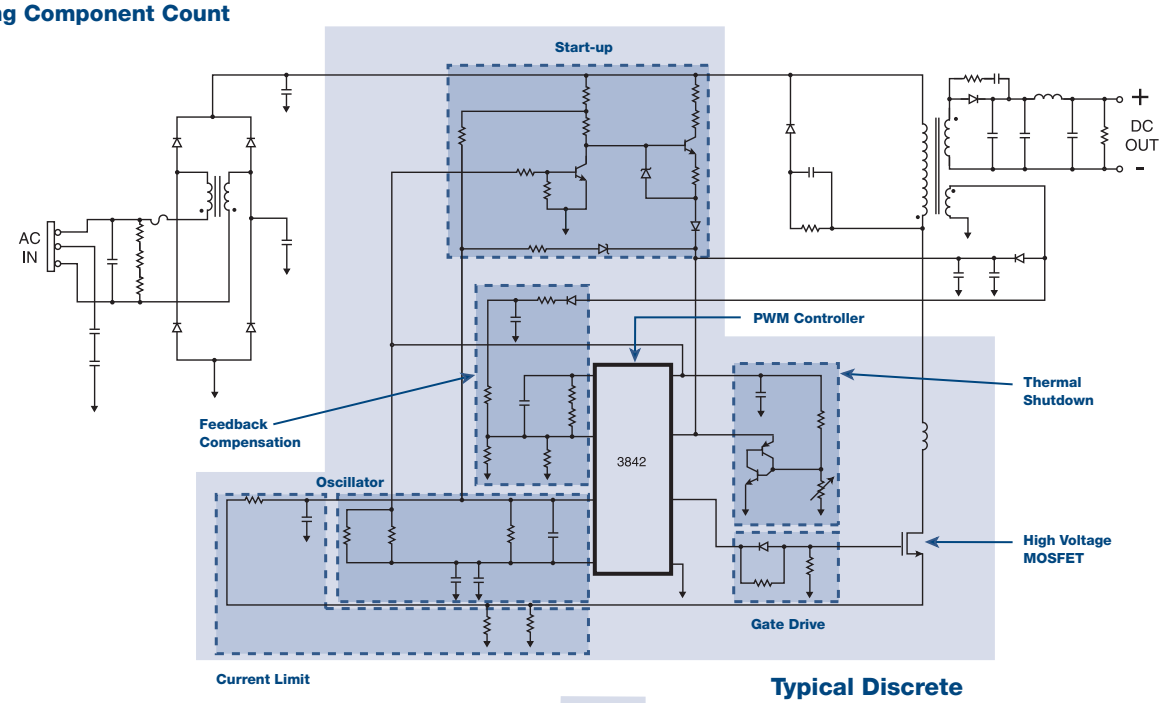
Our highly integrated ICs eliminate components from power supply designs reducing board, layout and assembly costs and improving reliability.

We combine a high-voltage MOSFET switch with a controller on a single chip to provide key power supply functions, such as:

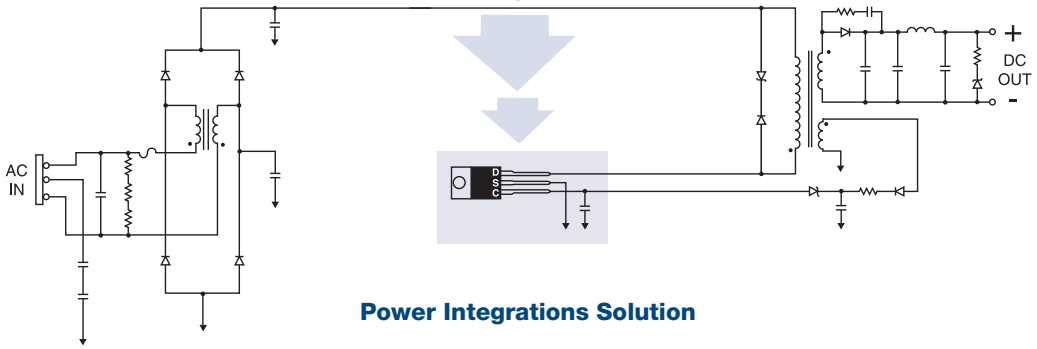
- High-voltage start-up
- Short-circuit and open-loop protection
- Programmable current limit
- Line undervoltage and overvoltage protection
- Output overvoltage protection
- Accurate overtemperature and overpower protection
- Soft-start
- Feedback compensation
- Remote on/off



Reducing Component Count



Typical Discrete PWM Implementation



Power Integrations Solution

EcoSmart Innovation

Enabling Energy-Efficient Power Supply Design

Using the IC products from Power Integrations, manufacturers are able to offer highly energy-efficient products which meet all current and proposed standards for standby energy consumption around the world.

Our ICs with EcoSmart® technology dramatically reduce standby and no-load energy waste by up to 95 percent.

As of January 2008 products based on our ICs have saved consumers more than $2.8 billion and continue to save at a rate of more than $1 million every day.

The Green Room

Visit the Green Room at www.powerint.com/greenroom for the latest in energy-efficient design including:

– Energy efficiency regulations: searchable by product, geographic region or regulation name
– Application specific design tools: data sheets, application notes and reference designs

EcoSmart: Saving More Than $1 Million Every Day in Applications Worldwide

Technology Innovation

Sample Reference Designs With Low Standby and No-load Energy Consumption

Application	Reference Design	Output		P_{OUT} at 1 W Input (W)		P_{IN} at No-load (W)		Energy Star EPS v2.0	Meets 1 Watt Standby	Meets EU No-load Spec*	Meets Current CEC Spec**
		Power	Voltage(s)	115 V	230 V	115 V	230 V				
AC Adapter	EP-89	2 W	6.2 V	0.62	0.57	0.067	0.11		✓	✓	✓
AC Charger	EP-85	2 W	6.0 V	0.62	0.57	0.12	0.17		✓	✓	✓
AC Charger/Adapter	RD-157	2.78 W	5 V	0.73	0.72	0.028	0.032	✓	✓	✓	✓
AC Charger/Adapter	RD-158	5 W	5 V	0.73	0.720	0.042	0.046	✓	✓	✓	✓
AC Charger/Adapter	RD-159	2.4 W	8.0 V	0.75	0.72	0.023	0.028	✓	✓	✓	✓
AC-DC Power Supply	RD-91	12 W	12 V	0.75	0.65	0.085	0.14		✓	✓	✓
AC-DC Power Supply	EP-34	30 W	12 V	0.67	0.59	0.18	0.29		✓	✓	✓
Appliance/White Goods	EP-48	1.44 W	12 V	0.75	0.70	0.105	0.15	N/A	✓	N/A	N/A
Cordless Phone Adapter	RD-83	1.6 W	7.7 V	0.62	0.57	0.16	0.22		✓	✓	✓
DVD Player	EP-29	11 W	3.3 V, 5 V, ±12 V	0.73	0.69	0.02	0.028	N/A	✓	N/A	N/A
DVD Player/Set-Top Box	EP-32	25 W	3.3 V, 5 V, 12 V, 24 V	0.66	0.63	0.065	0.078	N/A	✓	N/A	N/A
DVD Player/Set-Top Box	RD-115	7.5 W / 13 W PK	3.3 V, 5 V, 12 V, -12 V	0.7	0.66	0.06	0.11	N/A	✓	✓	N/A
Inkjet Printer	EP-93	32 W / 81 W PK	30 V	0.72	0.69	0.1	0.16		✓	✓	✓
LED Bulb	RD-131	3 W	10 V_{TYP} (9-15 V)	0.492	0.422	0.321	0.397	N/A	N/A	N/A	N/A
LCD Monitor/TV Adapter	EP-33	45 W	12 V	0.67	0.56	0.17	0.23		✓	✓	✓
LCD Monitor	RD-142	35 W	5 V, 12 V	0.41	0.40	0.15	0.20	N/A	✓	✓	N/A
Meters	RD-138	1.2 W	5 V, 12 V	0.54	0.52	0.125	0.160	N/A	✓	✓	N/A
Motor Drive	RD-128	36 W	12 V	0.748	0.682	0.125	0.28	N/A	✓	N/A	N/A

**Code of Conduct on Efficiency of External Power Supplies **California Energy Commission N/A = Not Applicable*

An extensive list of tested, energy-efficient reference designs and circuit examples are available on-line:
Design Examples - www.powerint.com/appcircuits.htm

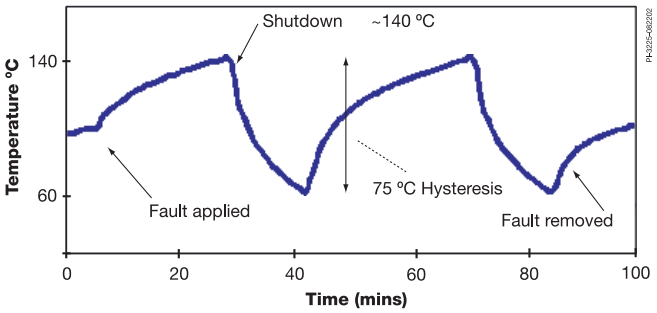
PI Expert

PI Expert software takes a user's power supply specification and automatically determines critical components (including transformer specifications) needed to generate a working power supply design. Optimization choices for cost or efficiency are included to deliver designs that address specific needs. The PI Expert software is available for download at: www.powerint.com/designsoftware.htm.

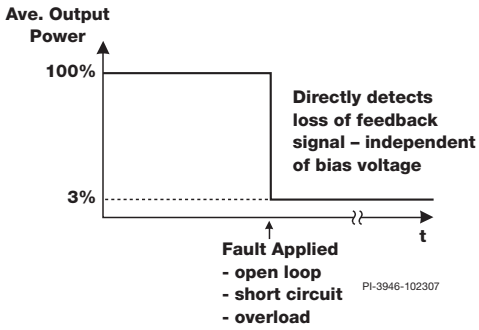
Product Features and Benefits

Comprehensive Fault Protection – Simplifies Design and Improves Reliability

– On-chip hysteretic thermal shutdown with auto-recovery
– Control loop fault protection is independent of bias voltage
– Protects entire system: device, PC board, magnetics and output rectifiers



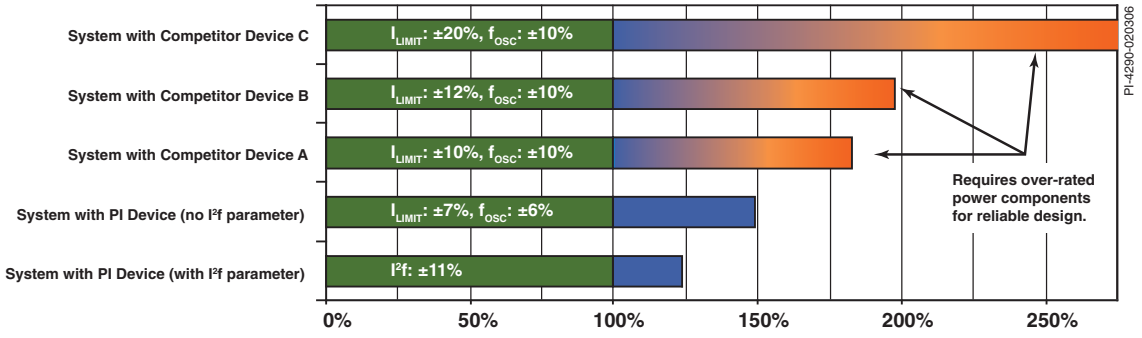
Hysteretic Thermal Shutdown



Output Power During Loss of Feedback

Tight Device Tolerances – Reduce System Cost

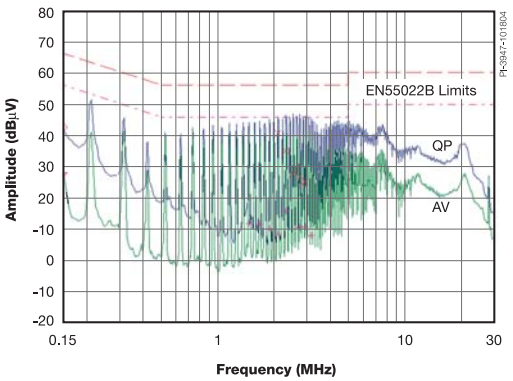
– PI ICs have tight tolerances for current limit and switching frequency. This reduces the output overload power and therefore the power rating, size and cost for the output rectifiers, transformer and clamp components.



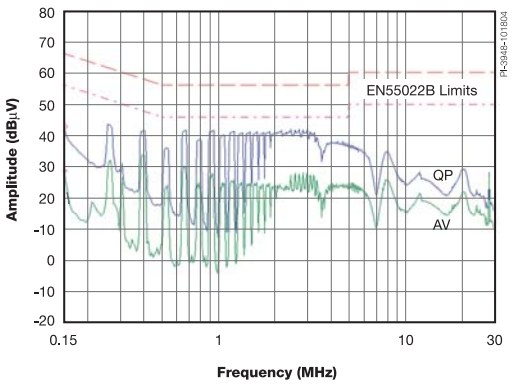
Variation in Flyback Converter Output Power Capability Over Device Tolerance Range (Normalized to Rated Output Power)

Frequency Jittering – Reduces EMI and EMI Filtering Costs

– Enables smaller, lower cost filter components



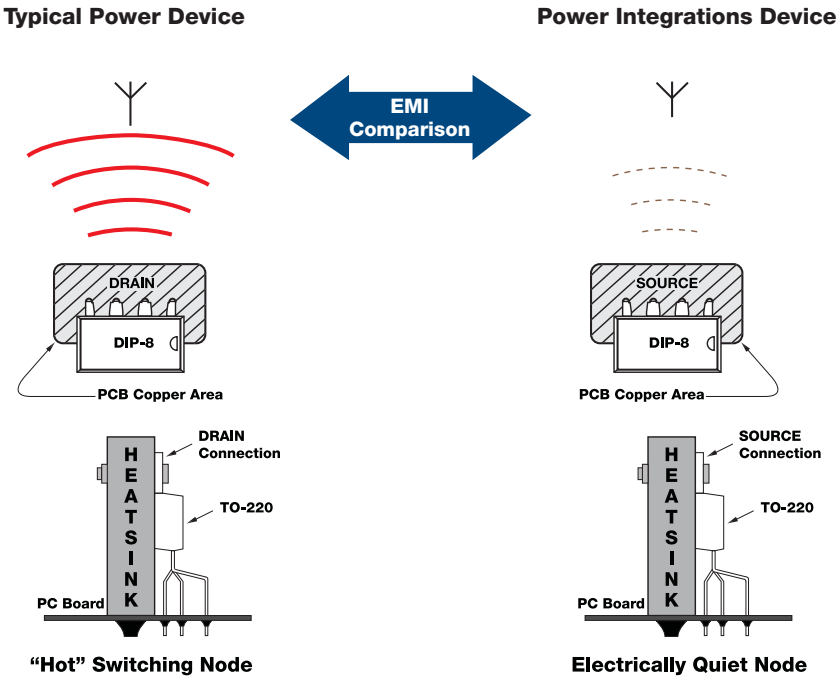
Conducted EMI without Jitter



Conducted EMI with Jitter

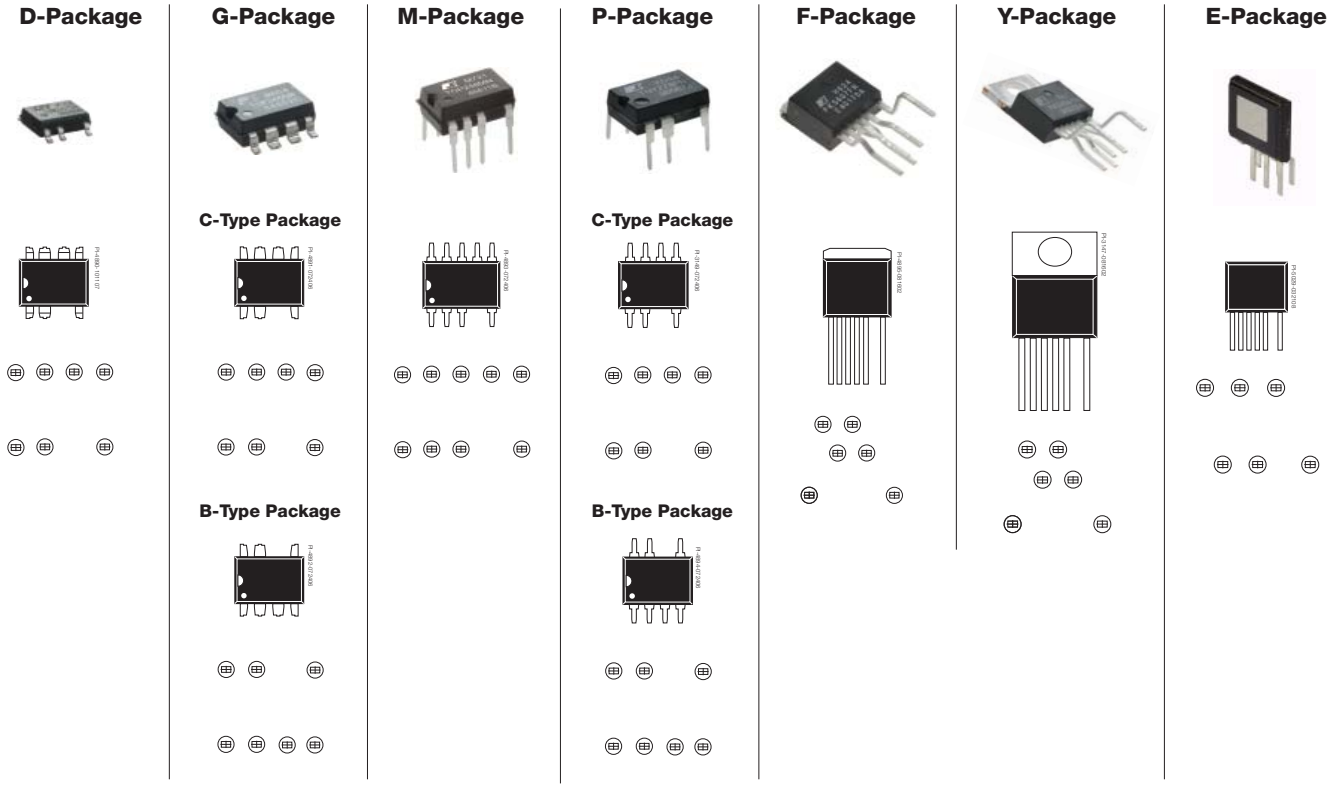
Source Heatsinking – For Low Radiated EMI

– Heatsink connected to SOURCE for low radiated EMI

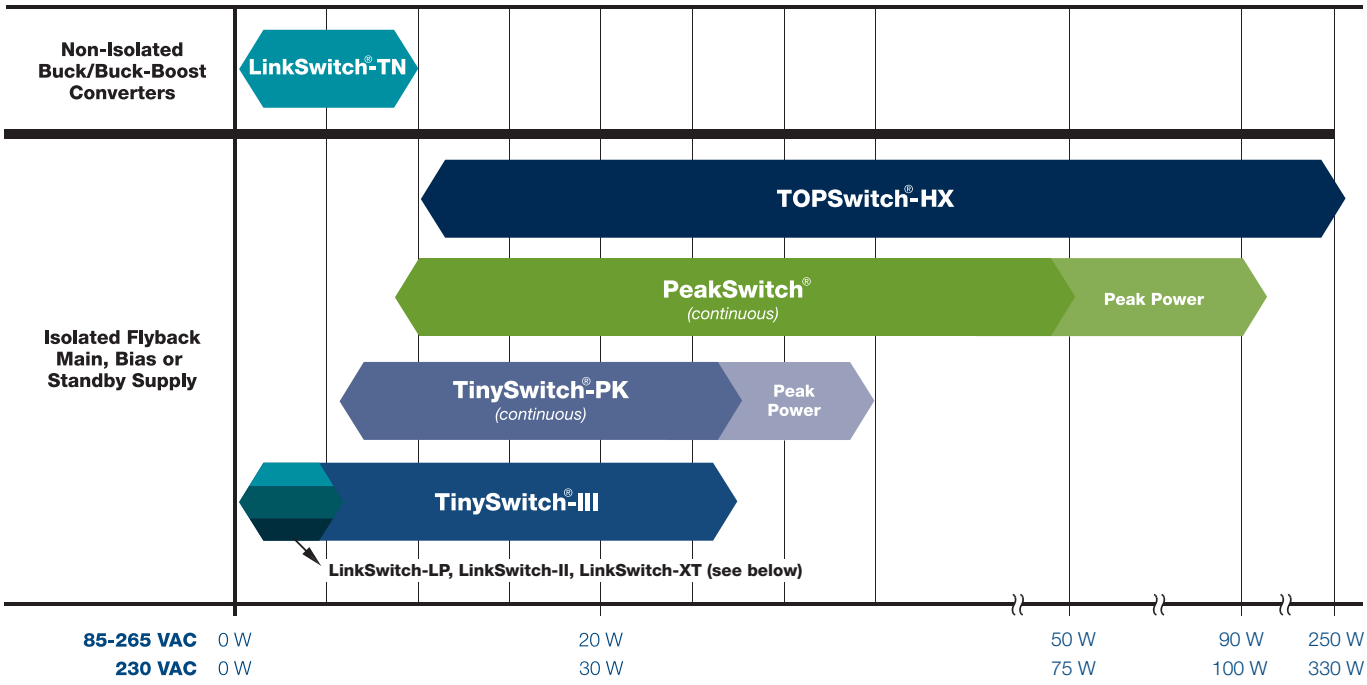


Package Design/Pin Layout – Improves Reliability

– Wide package DRAIN – SOURCE creepage reduces probability of arcing
– Important for high pollution degree environments and forced air cooling
– Optimal pin arrangement allows compliance with safety agency adjacent pin short-circuit test
– Packages below are RoHS compliant

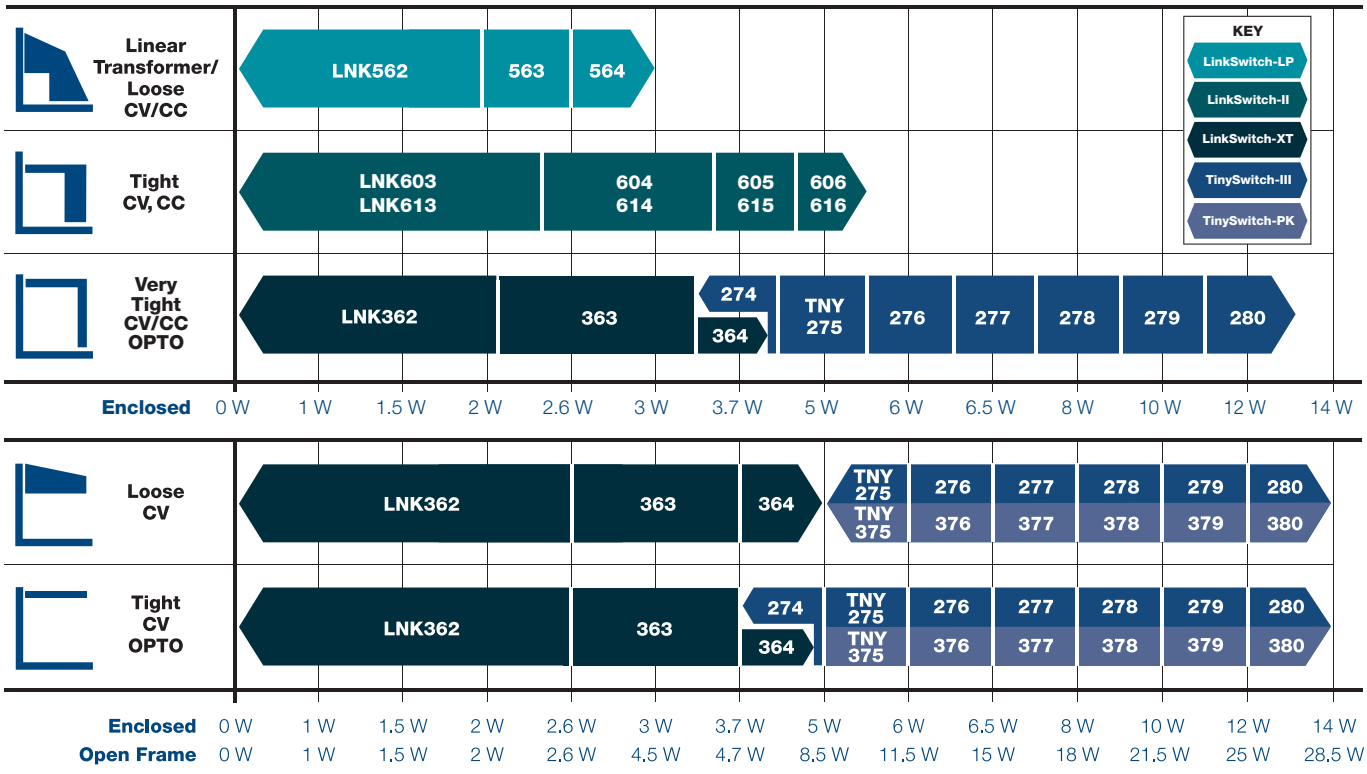


Product Selector Guide



Low Power Products

Output Characteristic Requirements (Wide Input 85 – 265 VAC)



IC Product Tables and Design Examples

Table 1: Very Low Power AC-DC, Non-Isolated Passive Power Supply Replacement (≤360 mA)

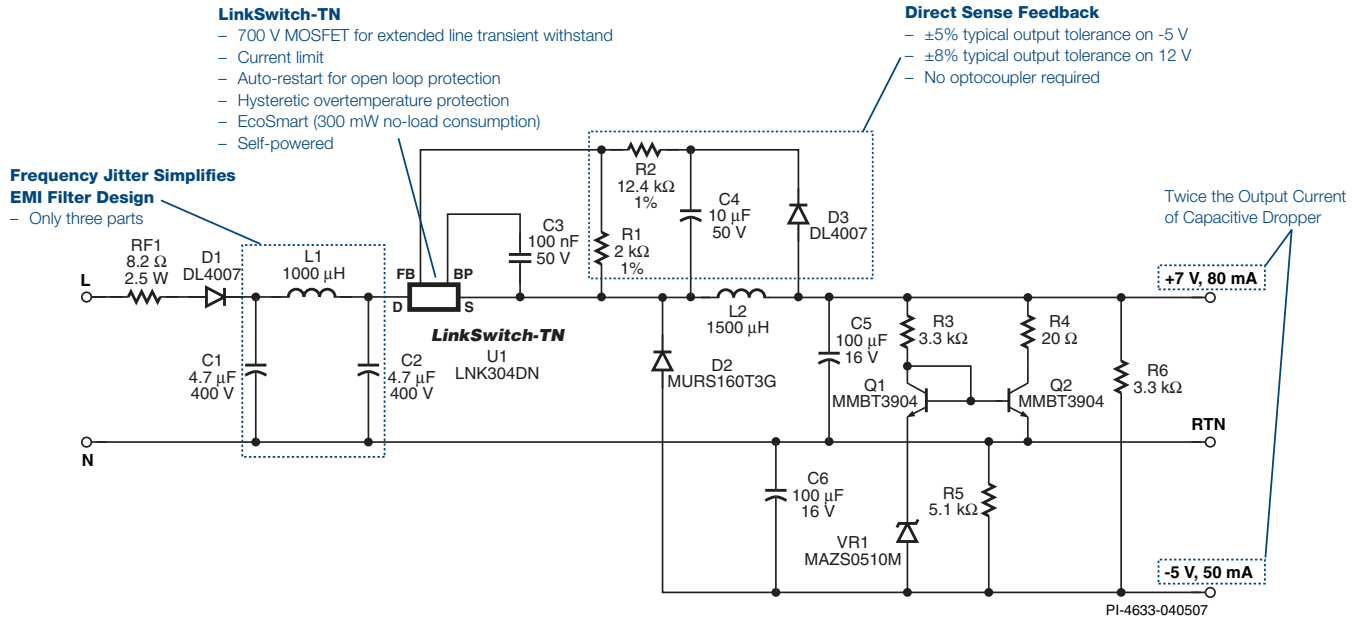
Product[4]	Output Current[1]		Output Current[1]	
	MDCM[2]	CCM[3]	MDCM[2]	CCM[3]
LinkSwitch-TN	230 VAC ± 15%		85-265 VAC	
LNK302 PN/GN/DN	63 mA	80 mA	63 mA	80 mA
LNK304 PN/GN/DN	120 mA	170 mA	120 mA	170 mA
LNK305 PN/GN/DN	175 mA	280 mA	175 mA	280 mA
LNK306 PN/GN/DN	225 mA	360 mA	225 mA	360 mA

Additional Features:
700 V Internal MOSFET Rating
Self-Powered
ON/OFF Control
Hysteretic Thermal Shutdown
Power Limiting
Frequency Jitter Reduces EMI
EcoSmart Low Standby/No-load Power Consumption

Notes:
1. *Typical output current in a non-isolated buck converter. Output power capability depends on respective output voltage. See Key Applications Considerations section for complete description of assumptions, including fully discontinuous conduction mode (DCM) operation.*
2. *Mostly discontinuous conduction mode.*
3. *Continuous conduction mode.*
4. *Packages: PN: DIP-8B, GN: SMD-8B, DN: SO-8C.*

Design Example 1.1: LinkSwitch-TN – Cap Dropper Replacement for Appliance Control

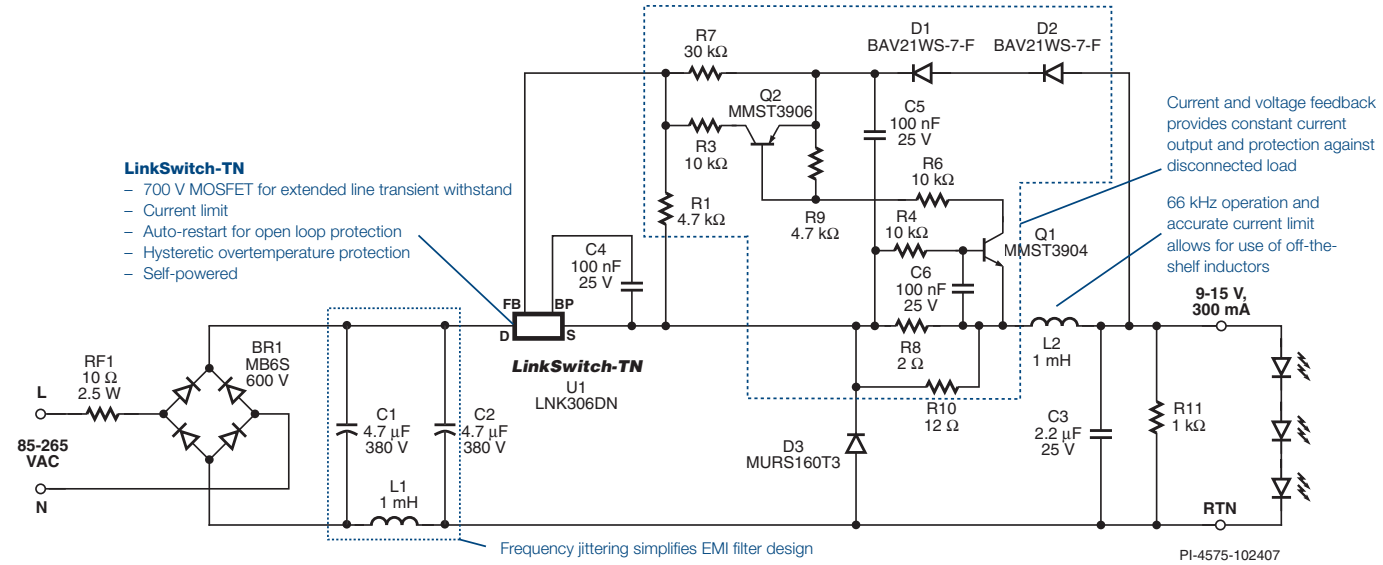
1.2 W, UNIVERSAL INPUT NON-ISOLATED POWER SUPPLY



PI-4633-040507

Design Example 1.2: LinkSwitch-TN LED Light Bulb

3 W, UNIVERSAL INPUT POWER SUPPLY



PI-4575-102407

Table 2: Low Power AC-DC Power Conversion (Up to 9 W)

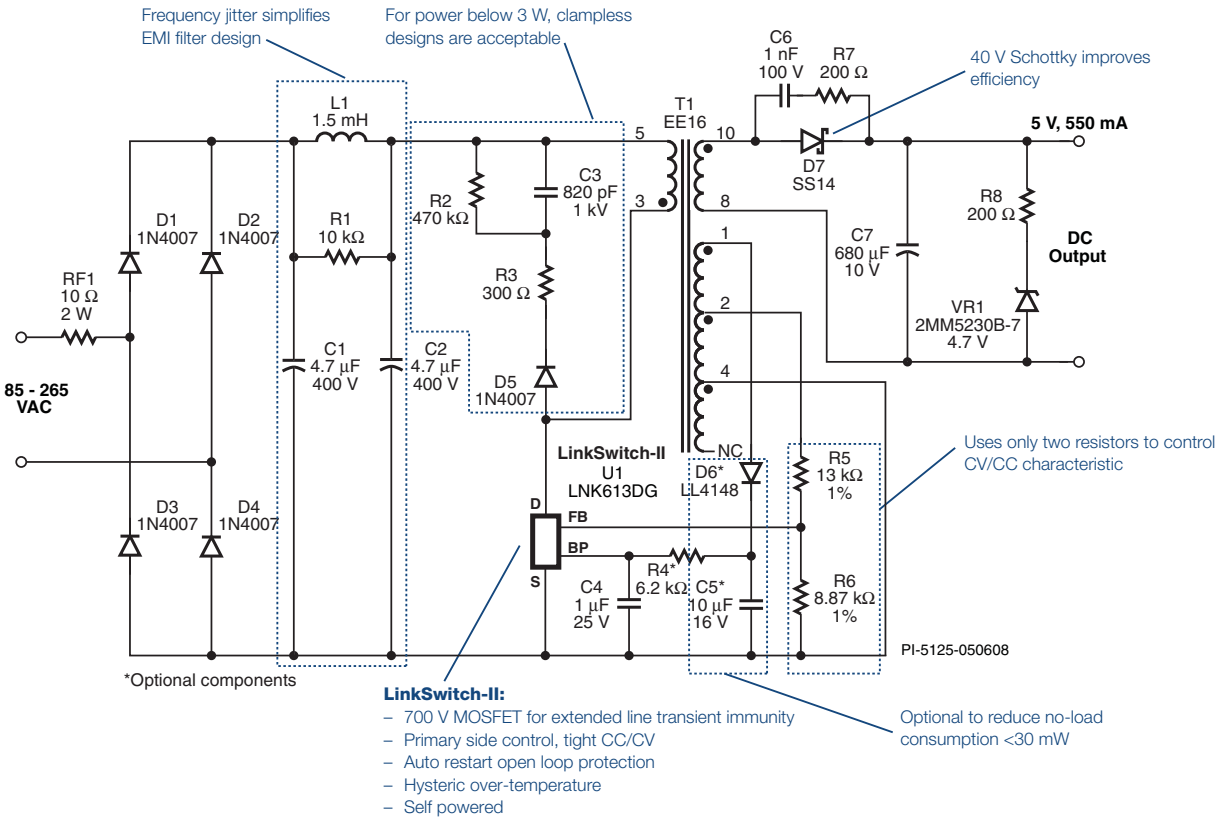
Product[3]	Continuous Output Power		Continuous Output Power	
	Adapter[1]	Open Frame[2]	Adapter[1]	Open Frame[2]
LinkSwitch-II	230 VAC ± 15%		85-265 VAC	
LNK603/613 PG/DG	2.5 W	3.3 W	2.5 W	3.3 W
LNK604/614 PG/DG	3.5 W	4.1 W	3.5 W	4.1 W
LNK605/615 PG/DG	4.5 W	5.1 W	4.5 W	5.1 W
LNK606/616 PG/GG	5.5 W	6.1 W	5.5 W	6.1 W
LinkSwitch-LP	230 VAC ± 15%		85-265 VAC	
LNK562 PN/GN/DN	1.9 W	1.9 W	1.9 W	1.9 W
LNK563 PN/GN/DN	2.5 W	2.5 W	2.5 W	2.5 W
LNK564 PN/GN/DN	3 W	3 W	3 W	3 W
LinkSwitch-XT	230 VAC ± 15%		85-265 VAC	
LNK362 PN/GN/DN	2.8 W	2.8 W	2.6 W	2.6 W
LNK363 PN/GN/DN	5 W	7.5 W	3.7 W	4.7 W
LNK364 PN/GN/DN	5.5 W	9 W	4 W	6 W

Additional Features:
700 V Internal MOSFET Rating
Self-Powered
ON/OFF Control
Hysteretic Overtemperature Protection
Power Limiting
Frequency Jitter Reduces EMI
EcoSmart Low Standby/No-load Power Consumption

Notes:
1. *Minimum continuous power in a typical non-ventilated enclosed adapter measured at 50 °C ambient.*
2. *Minimum practical continuous power in an open frame design with adequate heat sinking, measured at 50 °C ambient.*
3. *Packages: PN: DIP-8B, GN: SMD-8B, DN: SO-8C. Please see Part Ordering Information.*
4. *Packages: PG: DIP-8C, GG: SMD-8C, DG: SO-8C.*

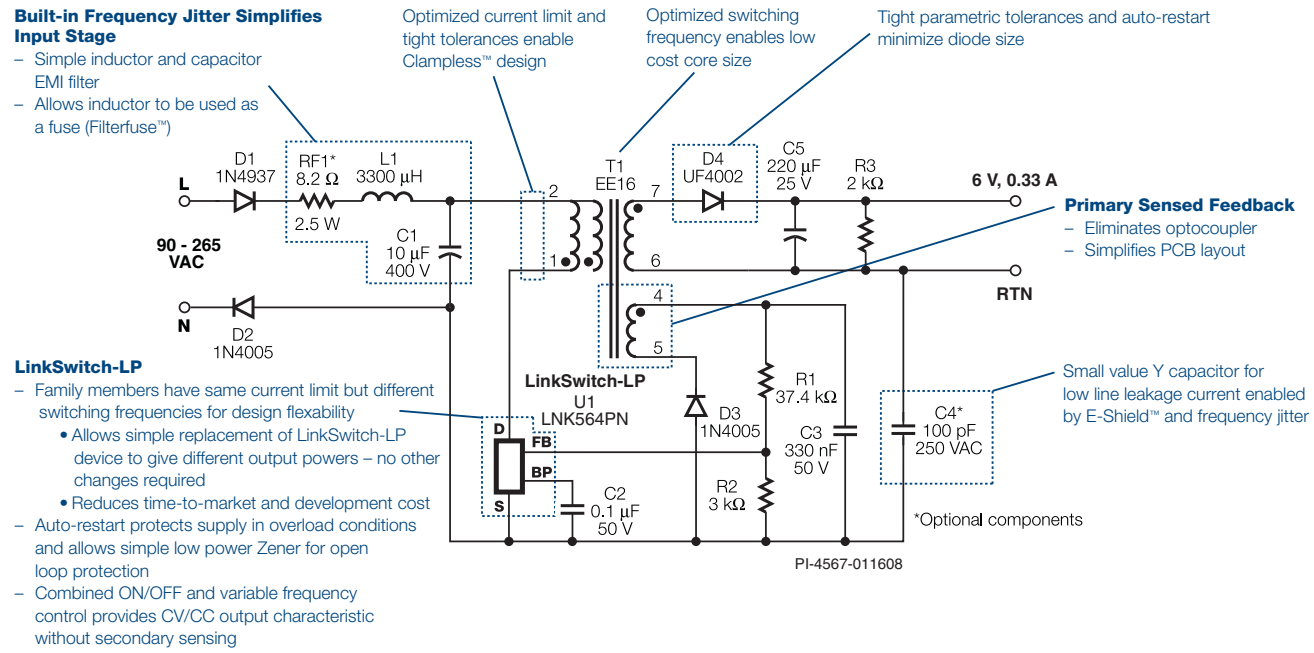
Design Example 2.1: LinkSwitch-II – Low Parts Count Solution for CV/CC Output

2.78 W, UNIVERSAL INPUT POWER SUPPLY



Design Example 2.2: LinkSwitch-LP – Replacement for Unregulated Linear Transformer

2 W, UNIVERSAL INPUT POWER SUPPLY



Design Example 2.3: LinkSwitch-XT – Low Parts Switcher with Accurate Output

2 W, UNIVERSAL INPUT POWER SUPPLY

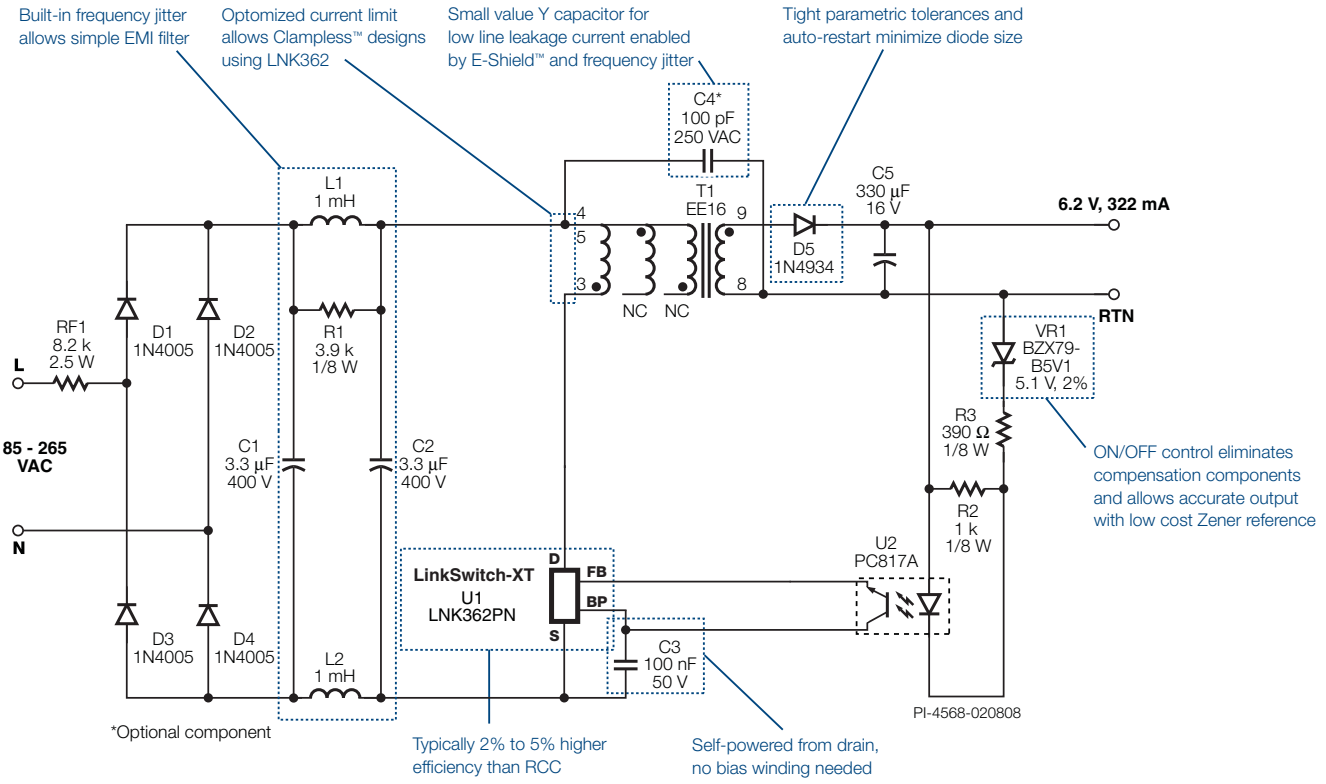


Table 3: Low Power AC-DC Power Conversion (Up to 36.5 W)

Product[3]	Continuous Output Power		Continuous Output Power	
	Adapter[1]	Open Frame[2]	Adapter[1]	Open Frame[2]
TinySwitch-III	230 VAC ± 15%		85-265 VAC	
TNY274 PN/GN	6 W	11 W	5 W	8.5 W
TNY275 PN/GN	8.5 W	15 W	6 W	11.5 W
TNY276 PN/GN	10 W	19 W	7 W	15 W
TNY277 PN/GN	13 W	23.5 W	8 W	18.5 W
TNY278 PN/GN	16 W	28 W	10 W	21.5 W
TNY279 PN/GN	18 W	32 W	12 W	25 W
TNY280 PN/GN	20 W	36.5 W	14 W	28.5 W

Additional Features:
700 V Internal MOSFET Rating
Self-Powered
Hysteretic Overtemperature Protection
Latching Output Overvoltage Protection
Selectable Current Limit
On-time Extension
Frequency Jitter Reduces EMI
Line Undervoltage (UV) Lockout
EcoSmart Low Standby/No-load Power Consumption

Notes:
1. *Minimum continuous power in a typical non-ventilated encased adapter with minimal heat sinking, measured at a device ambient of 50 °C.*
2. *Minimum continuous power in an open frame with adequate heat sinking. TinySwitch-III operates without bias winding.*
3. *Packages: PN: DIP-8C, GN: SMD-8C. Lead-free package options are available for P and G packages.*

Design Example 3.1: TinySwitch-III vs. Discrete Design

12 W, UNIVERSAL INPUT POWER SUPPLY

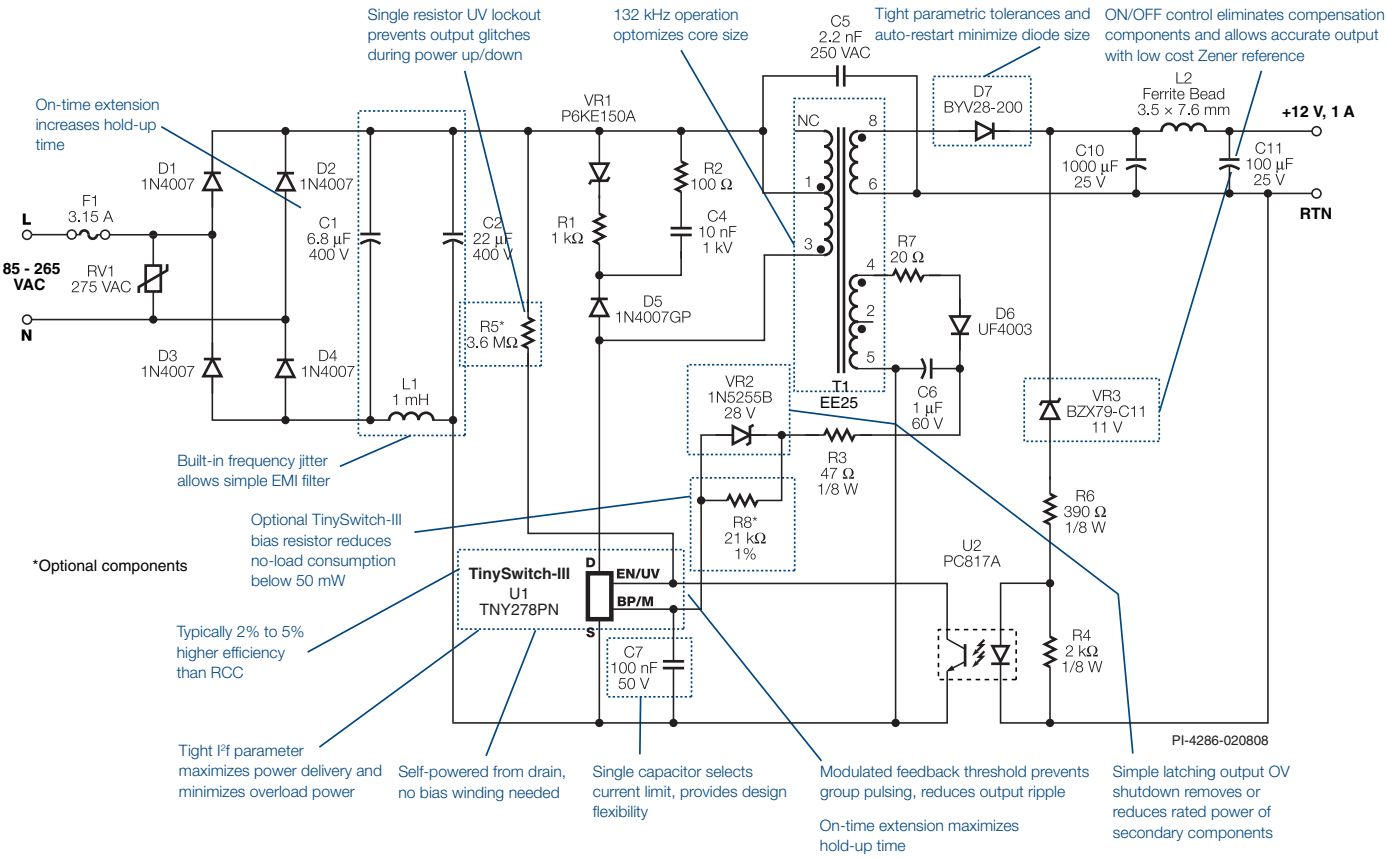


Table 4: Peak AC-DC Conversion (Up to 36.5 W Continuous, 45 W Peak)

Product[3]	Continuous Output Power			Continuous Output Power		
	Adapter[1]	Open Frame[2]	Peak	Adapter[1]	Open Frame[2]	Peak
TinySwitch-PK	230 VAC ± 15%			85-265 VAC		
TNY375 PN/GN	8.5 W	15 W	16.5 W	6 W	11.5 W	12.5 W
TNY376 PN/GN	10 W	19 W	22 W	7 W	15 W	17 W
TNY377 PN/GN	13 W	23.5 W	28 W	8 W	18 W	23 W
TNY378 PN/GN	16 W	28 W	34 W	10 W	21.5 W	27 W
TNY379 PN/GN	18 W	32 W	39 W	12 W	25 W	31 W
TNY380 PN/GN	20 W	36.5 W	45 W	14 W	28.5 W	35 W

Additional Features:
700 V Internal MOSFET Rating
ON/OFF Control
Hysteretic Overtemperature Protection
Frequency Jitter Reduces EMI
EcoSmart Low Standby/No-load Power Consumption
On-time Extension
Latching Shutdown
Latching Output Overvoltage Protection
Selectable Current Limit

Notes:
1. *Minimum continuous power in a typical non-ventilated enclosed adapter measured at 50 °C. Use of an external heat sink will increase power capability.*
2. *Minimum continuous power in an open frame design (see Key Applications Considerations in data sheet).*
3. *Package: PN: DIP-8C, GN: SMD-8C.*

Design Example 4.1: TinySwitch-PK vs. Discrete Design

20 W / 36 W PEAK, HIGH LINE, DVD, SET TOP BOX POWER SUPPLY

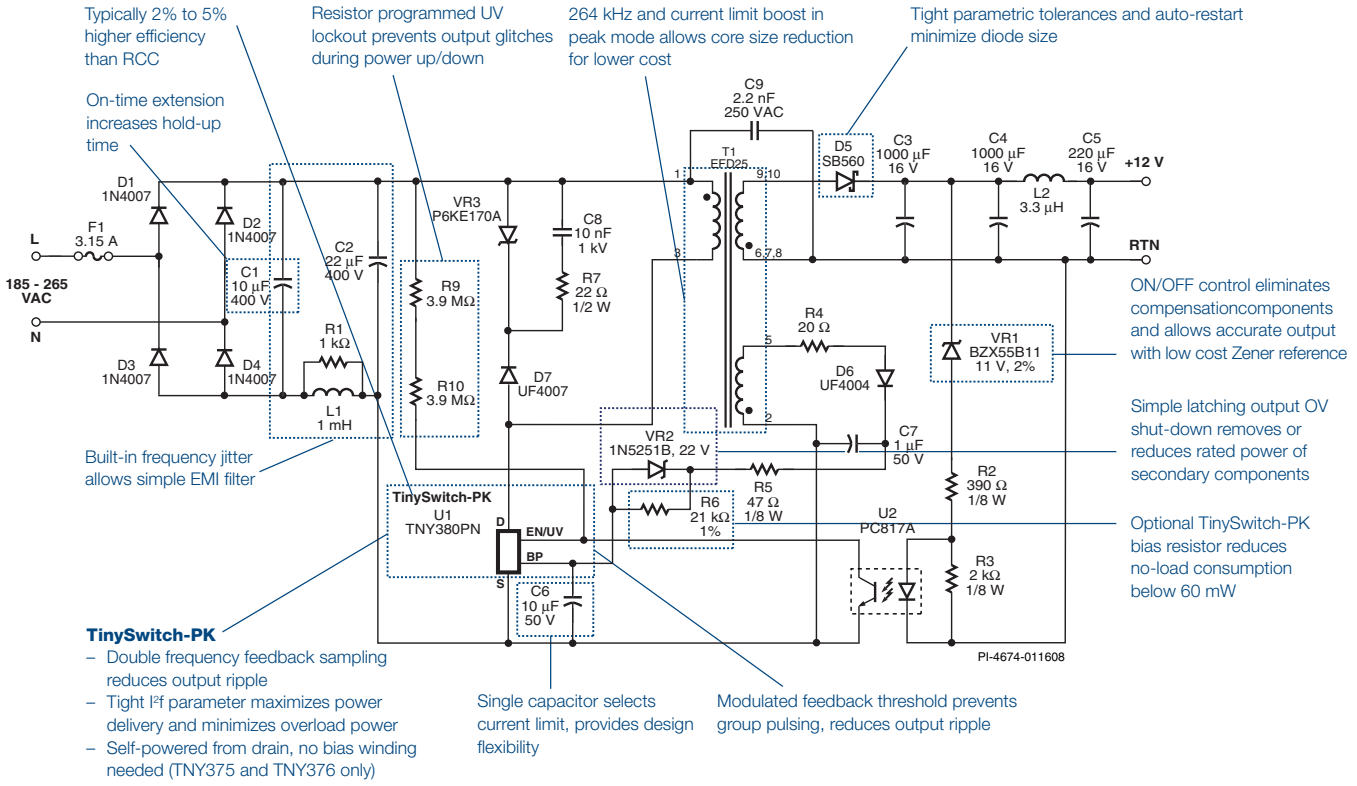


Table 5: Super Peak AC-DC Power Conversion (Up to 75 W Continuous, 126 W Peak)

Product[3]	Continuous Output Power		Continuous Output Power	
	Adapter[1]	Adapter Peak[2]	Adapter[1]	Adapter Peak[2]
PeakSwitch	230 VAC ± 15%		85-265 VAC	
PKS603 PN	13 W	32 W	9 W	25 W
PKS604 PN	23 W	56 W	16 W	44 W
PKS604 YN/FN	35 W	56 W	23 W	44 W
PKS605 PN	31 W	60 W	21 W	44 W
PKS605 YN/FN	46 W	79 W	30 W	58 W
PKS606 PN	35 W	66 W	25 W	46 W
PKS606 YN/FN	68 W	117 W	45 W	86 W
PKS607 YN/FN	75 W	126 W	50 W	93 W

Additional Features:
700 V Internal MOSFET Rating
ON/OFF Control
Hysteretic Thermal Shutdown
Frequency Jitter Reduces EMI
EcoSmart Low Standby/No-load Power Consumption
Adaptive On Time Extension
Adaptive Current Limit
Fast AC Reset
Smart AC Sense With Latching OVP Shutdown

Notes:
1. *Typical continuous power in a non-ventilated enclosed adapter measured at +50 °C ambient.*
2. *Typical peak power for a period of 100 ms and a duty cycle of 10% in a non-ventilated enclosed adapter measured at +50 °C (see Key Applications section in datasheet for details).*
3. *Packages: PN: DIP-8C, YN: TO-220-7C, FN: TO-262-7C.*

Design Example 5.1: PeakSwitch for Inkjet Printer Applications

32 W CONTINUOUS, 81 W PEAK, UNIVERSAL INPUT POWER SUPPLY

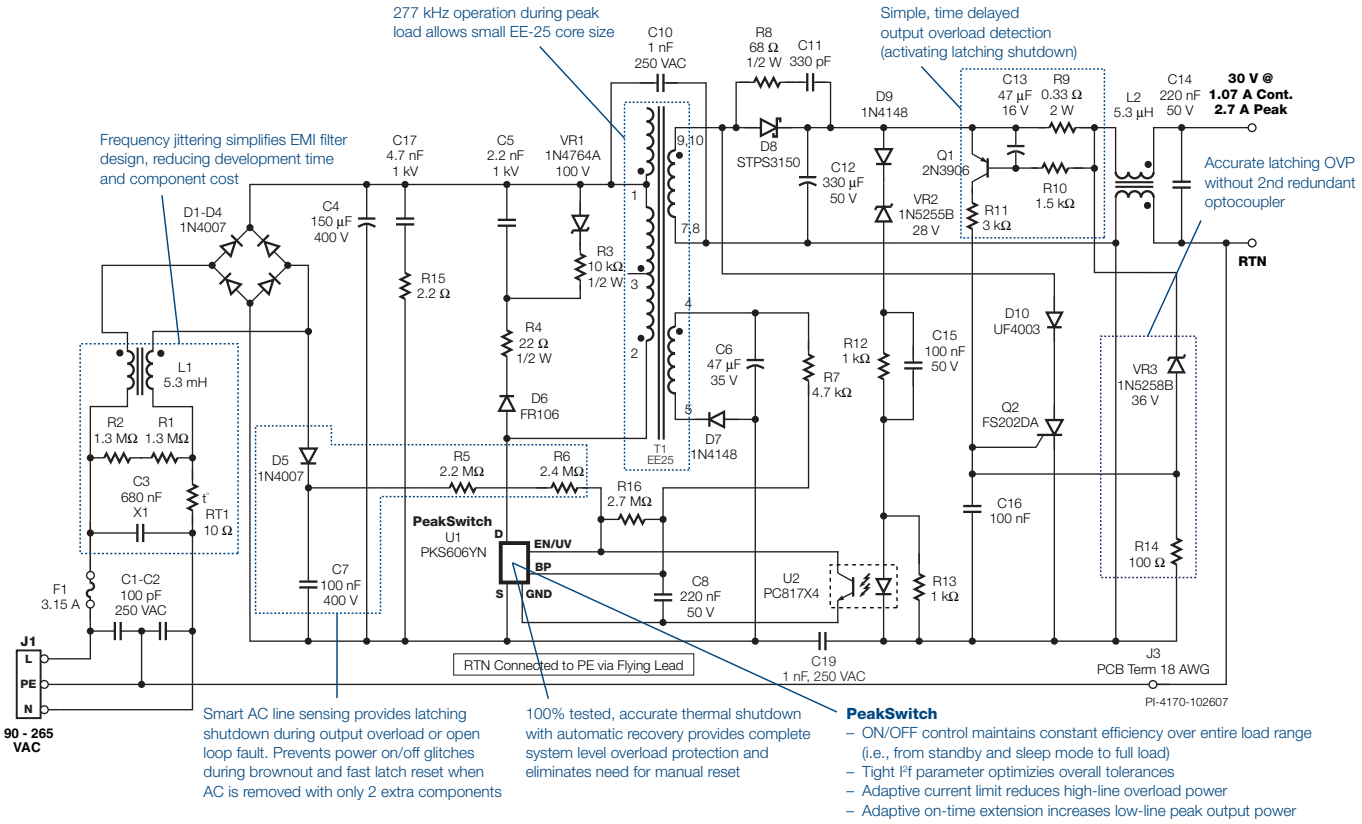


Table 6: High Power AC-DC Power Conversion (Up to 333 W)

Product[5]	Continuous Output Power			Continuous Output Power		
	Adapter[1]	Open Frame[2]	Peak[3]	Adapter[1]	Open Frame[2]	Peak[3]
TOPSwitch-HX	230 VAC ± 15%[4]			85-265 VAC		
TOP252 PN/GN	9 W	15 W	21 W	6 W	10 W	13 W
TOP252 MN						
TOP252 EN	10 W	21 W		6 W	13 W	
TOP253 PN/GN	15 W	25 W	38 W	9 W	15 W	25 W
TOP253 MN			42 W			29 W
TOP253 EN	21 W	43 W		13 W	29 W	
TOP254 PN/GN	16W	28W	47 W	11 W	20 W	30 W
TOP254 MN			62 W			40 W
TOP254 EN/YN	30 W	62 W		20 W	43 W	
TOP255 PN/GN	19 W	30 W	54 W	13 W	22 W	35 W
TOP255 MN			81 W			52 W
TOP255 EN/YN	40 W	81 W		26 W	57 W	
TOP256 PN/GN	21 W	34 W	63 W	15 W	26 W	40 W
TOP256 MN			98 W			64 W
TOP256 EN/YN	60 W	119 W		40 W	86 W	
TOP257 PN/GN	25 W	41 W	70 W	19 W	30 W	45 W
TOP257 MN			119 W			78 W
TOP257 EN/YN	85 W	157 W		55 W	119 W	
TOP258 PN/GN	29 W	48 W	77 W	22 W	35 W	50 W
TOP258 MN			140 W			92 W
TOP258 EN/YN	105 W	195 W		70 W	148 W	
TOP259 EN/YN	128 W	238 W		80 W	171 W	
TOP260 EN/YN	147 W	275 W		93 W	200 W	
TOP261 EN/YN	177 W	333 W		118 W	254 W	

Additional Features:

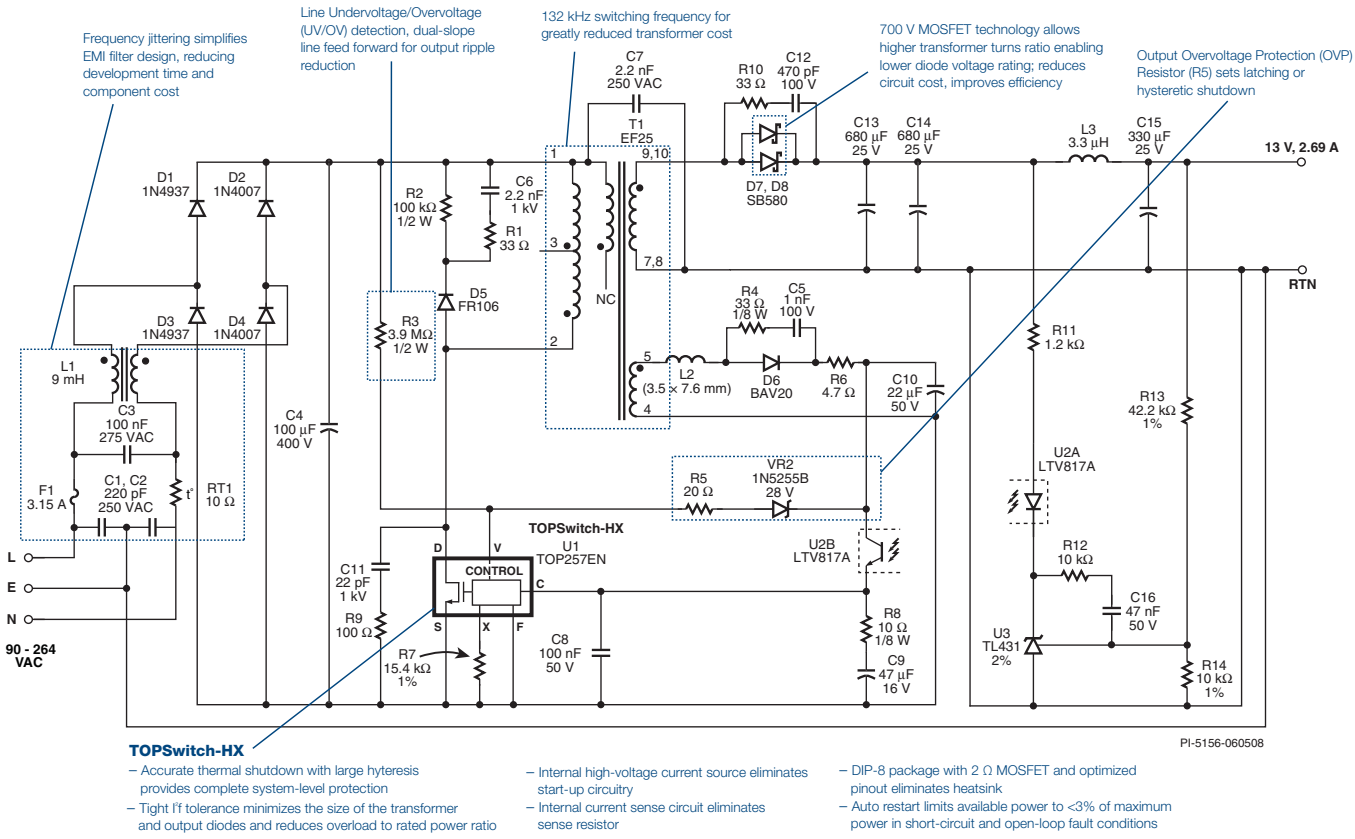
700 V Interal MOSFET Rating
Accurate Programmable Current Limit
Hysteretic Overtemperature Protection
Power Limiting
Multi-mode Operation for Maximum Efficiency Under All Load Conditions
Frequency Jitter Reduces EMI
Line Undervoltage Detection
Line Overvoltage Detection
EcoSmart Low Standby/ No-load Power Consumption
Output Overvoltage Protection (OVP)
- **Programmable for Latching or Hyteresetic Shutdown**

Optimized line feed-forward for line ripple rejection
Fully Integrated Soft-start for Minimum Start-up Stress
Tight I^2f Parameter Tolerances (Reduces System Cost & Overload Power)
Half-frequency Option for Y Package
Auto Restart
- **Limits Power to <3% of Maximum Power During Short-circuit/ Open-loop Fault**

Notes:
1. *Minimum continuous power in a typical non-ventilated enclosed adapter measured at 50 °C ambient. Use of an external heat sink will increase power capability.*
2. *Minimum continuous power in an open frame design at +50 °C ambient.*
3. *Peak power capability in any design at +50 °C ambient.*
4. *230 VAC or 110/115 VAC with doubler.*
5. *Packages - PN: DIP-8C, GN: SMD-8C, MN: SDIP-10C, YN: TO-220-7C, EN: eSIP™-7C.*

Design Example 6.1: TOPSwitch-HX for LCD Monitor Applications

35 W UNIVERSAL INPUT POWER SUPPLY



TOPSwitch-HX
- Accurate thermal shutdown with large hyteresis provides complete system-level protection
- Tight I^2f tolerance minimizes the size of the transformer and output diodes and reduces overload to rated power ratio
- Internal high-voltage current source eliminates start-up circuitry
- Internal current sense circuit eliminates sense resistor
- DIP-8 package with 2 Ω MOSFET and optimized pinout eliminates heatsink
- Auto restart limits available power to <3% of maximum power in short-circuit and open-loop fault conditions

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