



Power Supply & Power Adapter Solutions



Products and solutions enabling high active-mode efficiency, low standby-mode consumption, and power factor correction, for efficient, compact power supplies from ON Semiconductor.



ON Semiconductor Provides Expertise, Solutions, and Products that Enable Designers to Quickly Improve System Efficiency

Evolving Efficiency Standards

Evolving regulations and incentives, targeted towards improving energy efficiency, are intended to limit global climate change. Enhancing power supply efficiency alone can save over 2% of global energy consumption. Many organizations worldwide (such as China Energy Conservation Project, Japan Top Runner, USA Environmental Protection Agency, European Code of Conduct) now develop regulations and incentives for power supply efficiency, like DoE VI, CoC Tier 2, ENERGY STAR® and 80 PLUS®. ON Semiconductor actively participates in standards organizations and working groups, so that we can provide solutions to the market that meet all of the relevant specifications, worldwide.

Power Supply Expertise

ON Semiconductor provides products and solutions that save power from line to load, enabling quick deployment of cost-effective power supplies that meet evolving global efficiency standards. Our expertise in high-efficiency power supplies helps solve your challenges in all focus areas for efficiency enhancement:

Low standby-mode power consumption

High active-mode power efficiency

Power factor correction

And since we provide a full range of power supply semiconductors – from highly integrated power factor controllers, ac-dc controllers, and dc-dc controllers, to discrete MOSFETs, rectifiers, diodes, and transistors – we can help you design complete power supply solutions, with all active components sourced from and supported by a single supplier.

Reference Designs & Design Notes

ON Semiconductor provides reference designs and design notes for selected types of internal and external power supplies. These open designs provide roadmaps for the design of highly efficient power supplies, helping you get to market quickly by providing documentation that includes schematics, BOMs, Gerber files, design descriptions, and test results.

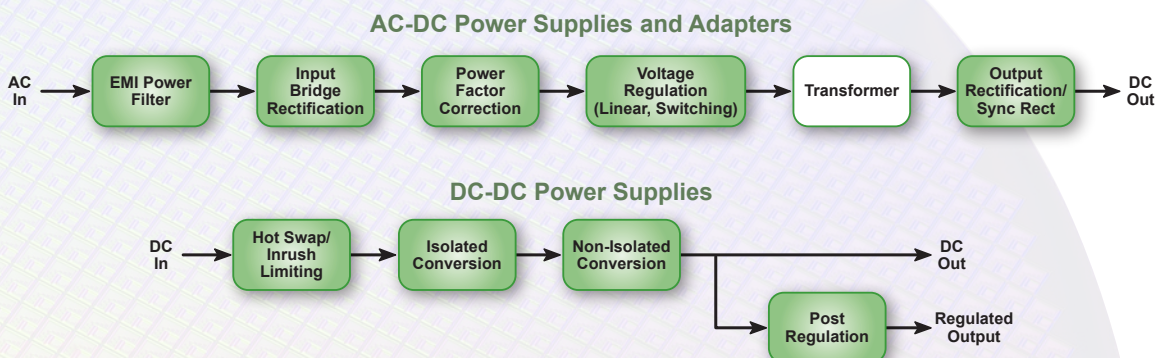
Global Power Supply Presence

ON Semiconductor maintains a broad, global network of design and applications resources, including resources devoted to power supplies.

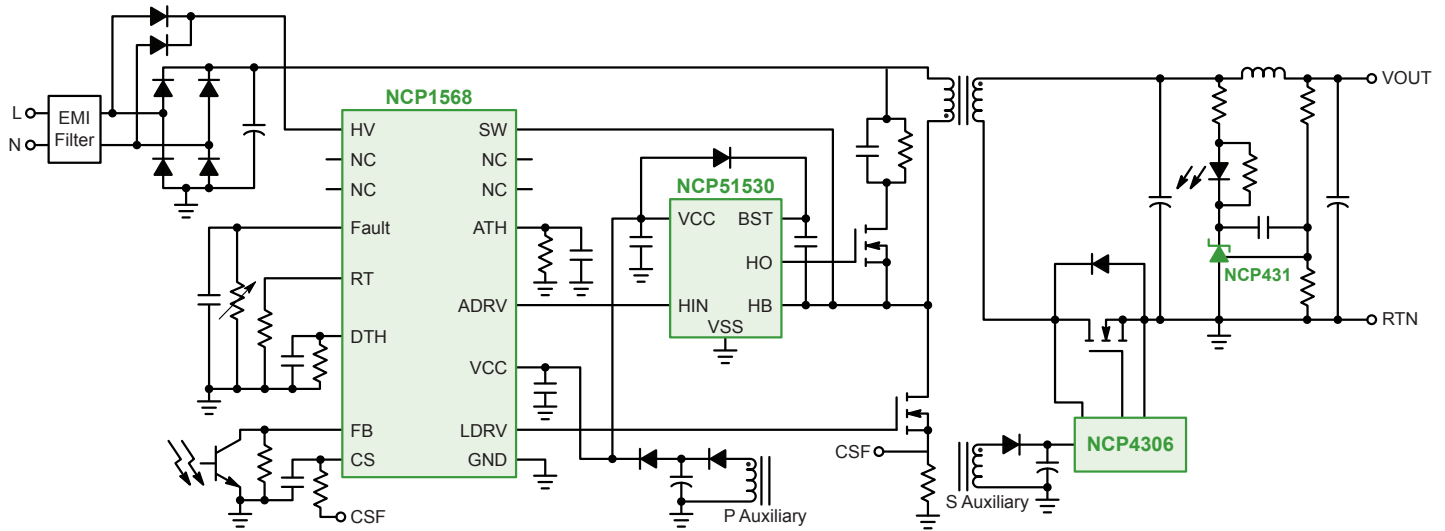
Our Product Design Centers define and develop advanced power management integrated circuits, utilizing the latest architectures and development tools. Products are targeted for a range of process technologies, including analog CMOS, Bi-CMOS, and Very High Voltage (VHV).

Our Solutions Engineering Centers focus on developing value-added total solutions for specific end market applications. These centers are staffed with applications engineers with design experience, and are equipped with all of the resources necessary for local manufacturers to benefit from the vast power management experience of ON Semiconductor.

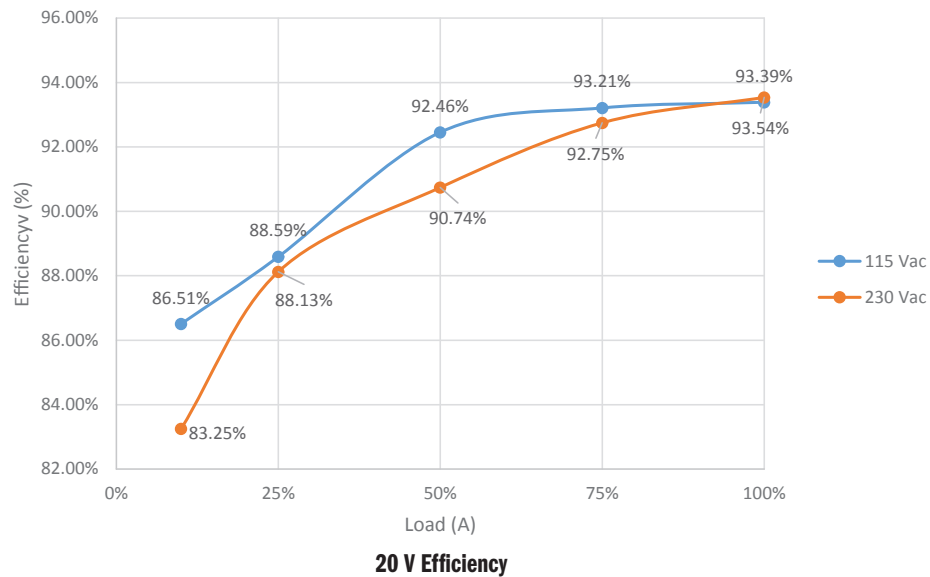
A global network of Field Applications Engineers provides truly customer-specific support. These local resources can help you optimize your power supply designs, by contributing their experience and training, with both applications and specific components, to your design location.



High Efficiency Conversion with Active Clamp Flyback



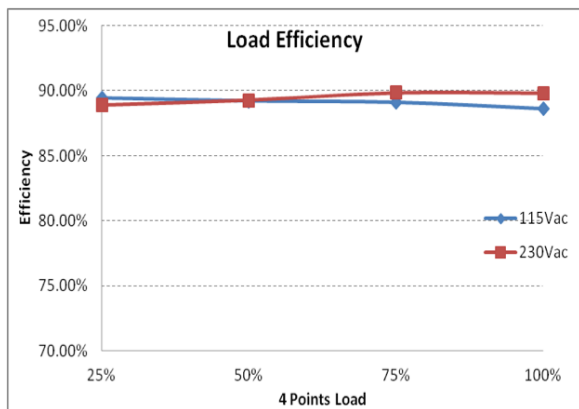
Typical Application for NCP1568 Active Clamp Flyback



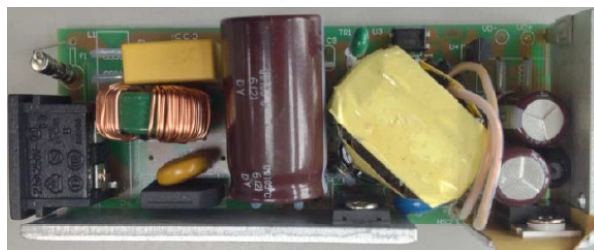
65 W Low Standby-Power Adapter

No Load Input Power Consumption

Input Voltage	Input Power (mW)
85 V; 60 Hz	31
115 V; 60 Hz	31
230 V; 60 Hz	39
265 V; 60 Hz	47

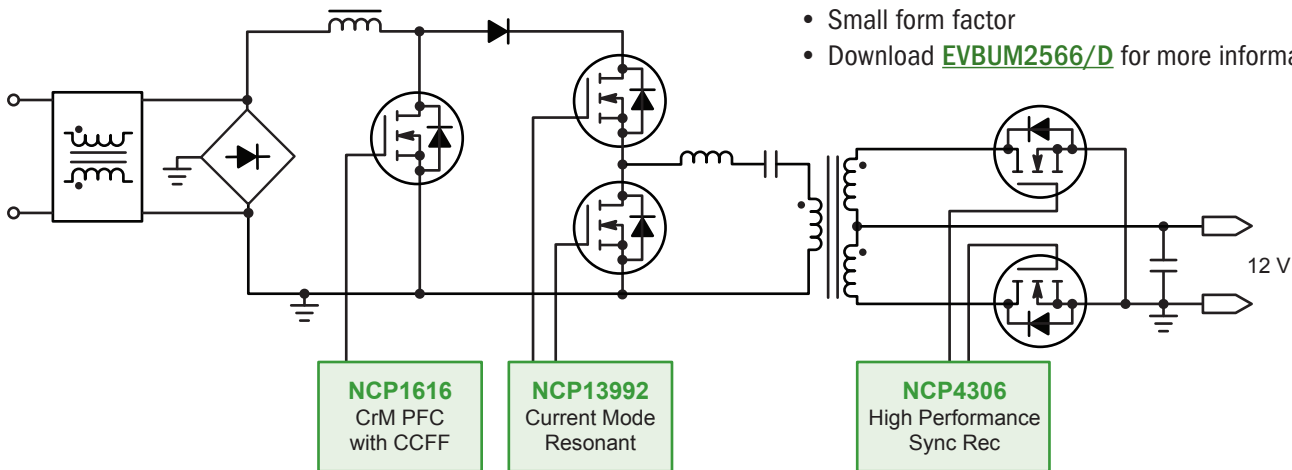


- NCP12400 enables a fixed-frequency adapter with low system cost
- Compatible with CoC Tier 2 Standard
- No-Load power consumption <75 mW
- Average efficiency >88%
- Frequency modulation for softened EMI signature
- Frequency Foldback, then Skip Mode for maximum performance in light load and standby condition
- Integrated HV start-up and X2 discharge

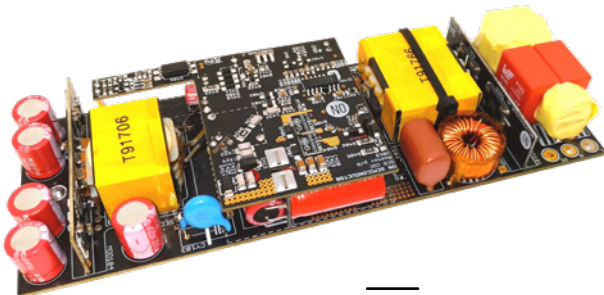


CrM PFC + LLC Solution for 240 W All-In-One PC Power

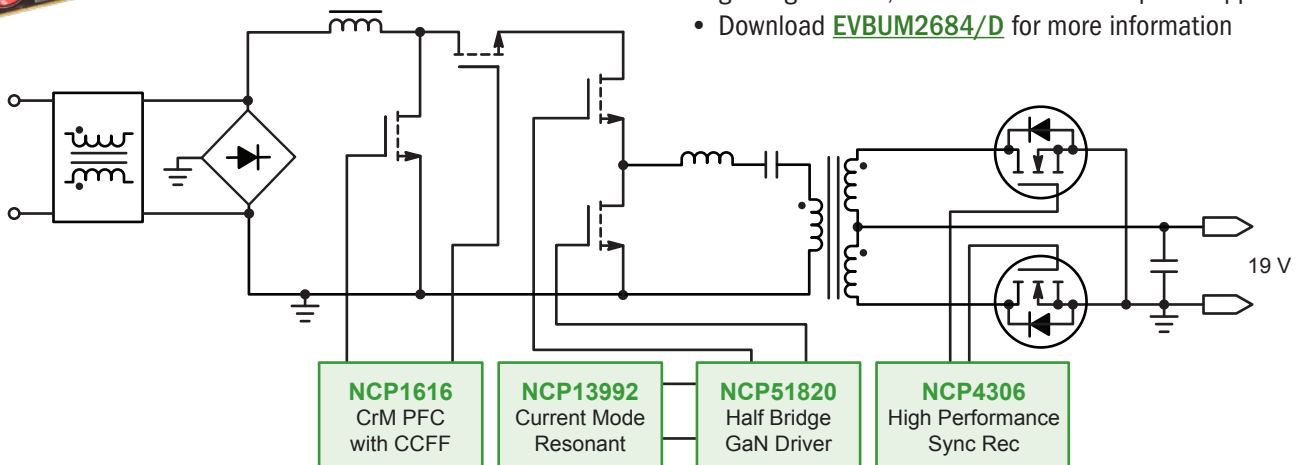
- High efficiency meeting 80 PLUS®
- No auxiliary SMPS
- Near unity power factor
- Excellent load and line transient response
- Small form factor
- Download [EVBUM2566/D](#) for more information



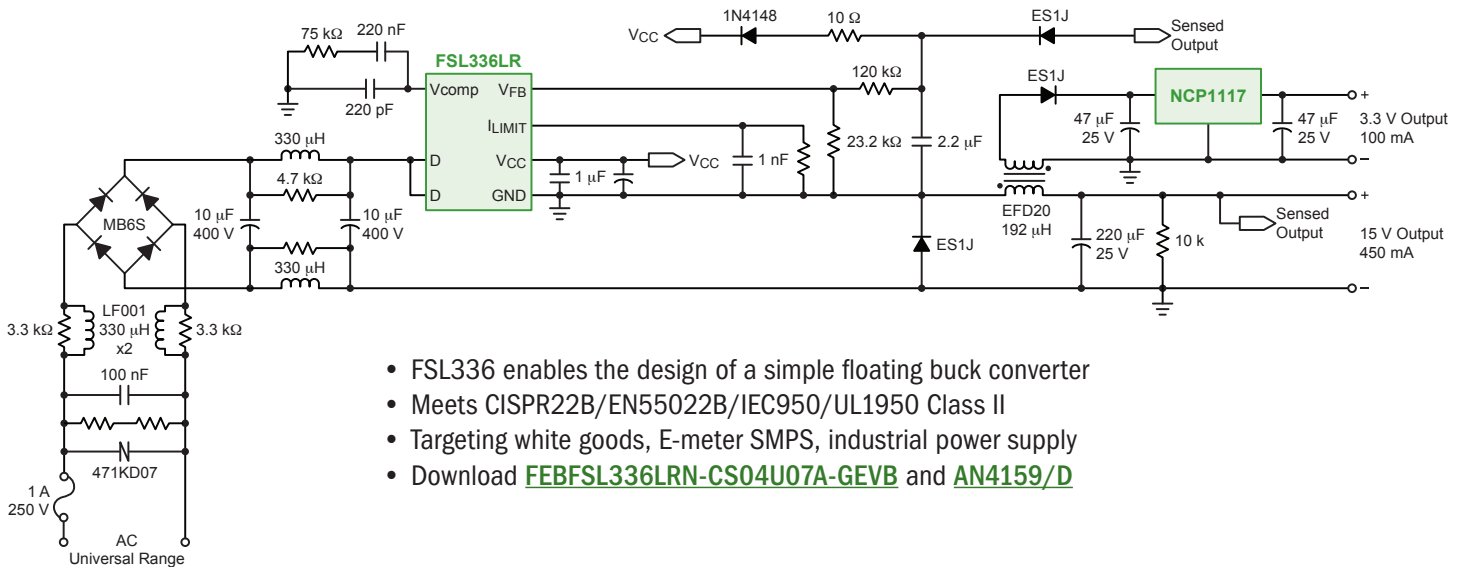
GaN Ultra High Density 300 W Adapter



- Power density up to 32 W/in³
- Fixed output voltage 19 V peak power up to 340 W
- Synchronous boost PFC using CrM PFC controller NCP1616
- 500 kHz LLC stage implementation using 650 V GaN half bridge driver NCP51820, and current mode LLC controller NCP13992
- Scalable design suitable for high power gaming adapter, gaming console, AIO PC and industrial power application
- Download [EVBUM2684/D](#) for more information



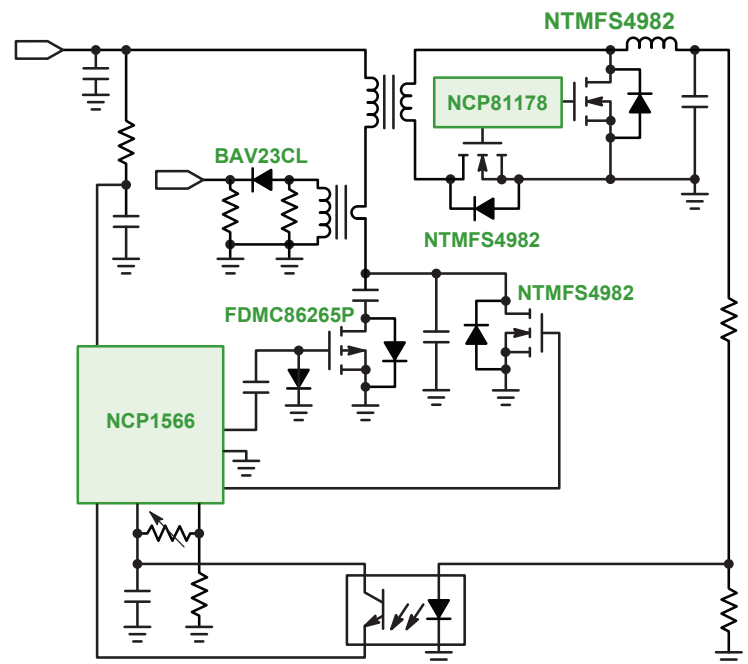
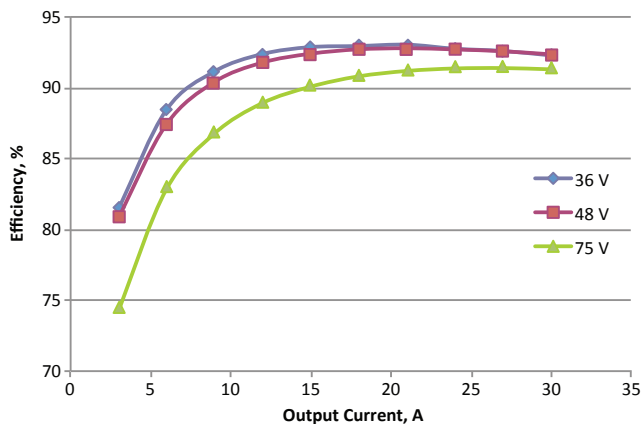
Non-Isolated Multi Output 7.08 W Buck Converter with FSL336 – the Lowest $R_{DS(ON)}$ Switcher



Active Clamp Forward DC-DC Converter

Dual Mode Active Clamp PWM Controller

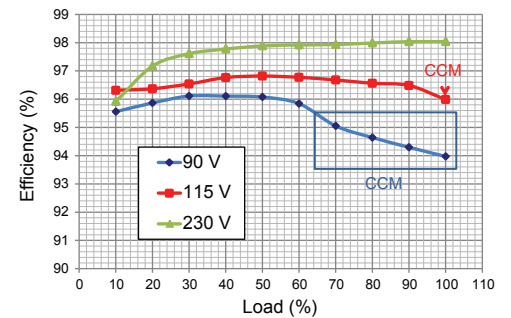
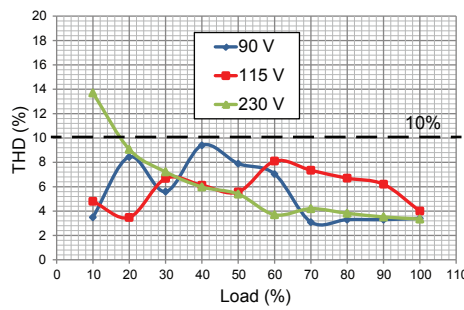
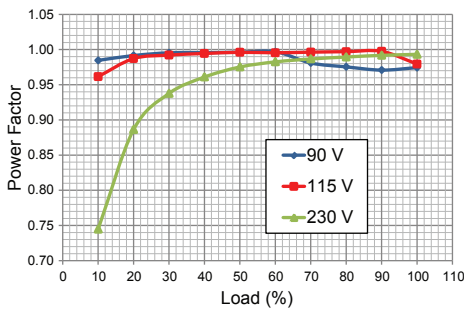
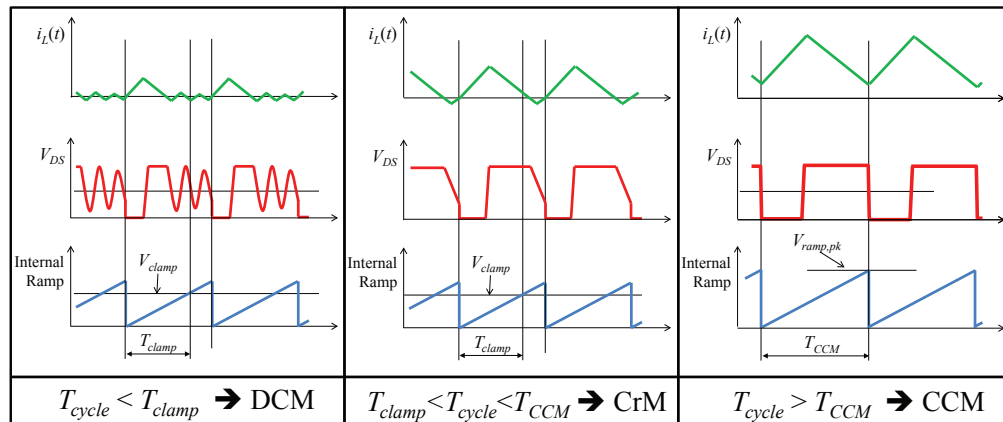
- Supports both Voltage Mode and Current Mode
- >92% Efficiency @ +48 V input
- Enables >100 W, 1/16 brick solutions



Power Factor Correction

NCP1618 Features

- Controller naturally selects the optimal operation mode from CCM, CrM, or DCM with frequency foldback for an optimal efficiency over the line/load range
- The circuit enters soft skip mode at very light load condition to meet most stringent standby power specifications
- Near unity power factor in all modes CCM/CrM/DCM
- Integrated HV circuit for start up and also fast line / load transient compensation
- PFC OK signal for sequencing control of downstream isolated DC-DC stage



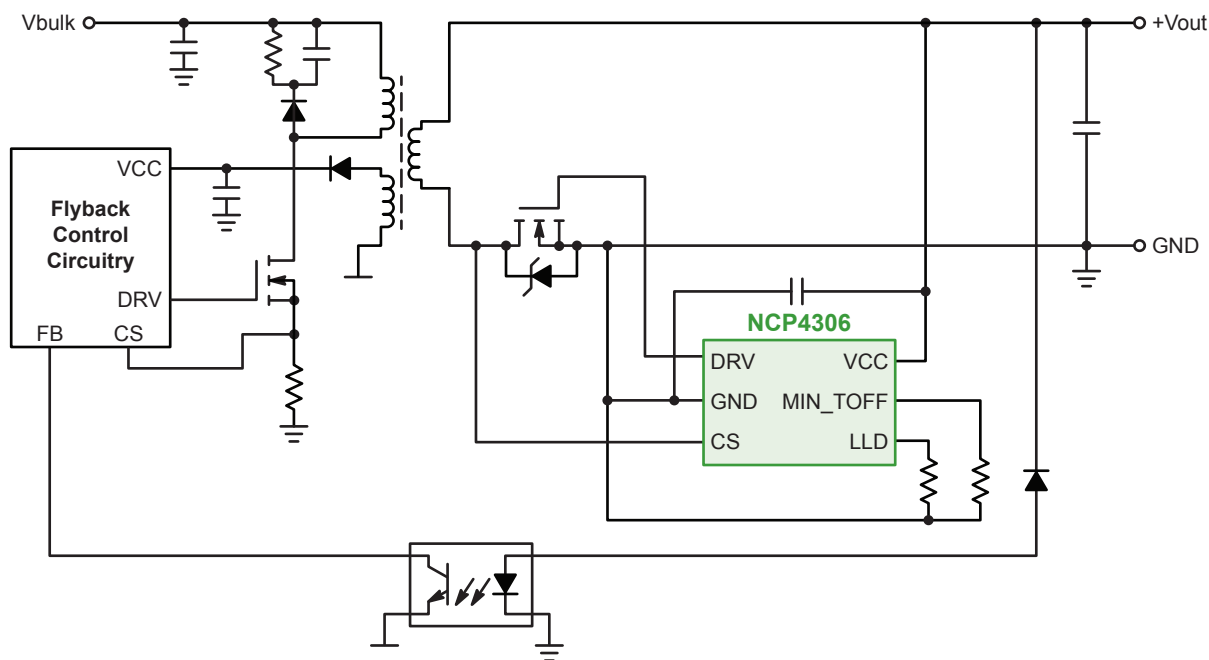
Multi-Mode Boost PFC Performance in a Wide Main 240 W Design

Device	Control Mode	Conduction Mode	Frequency	Package
NCP1654	Current	Continuous	Fixed	SOIC-8
FAN9672/3	Current	Continuous (Interleaved)	Fixed	LQFP-32
NCP1631	Current	Critical, Discontinuous (Interleaved)	Variable and/or Fixed	SOIC-16
NCP1632	Current	Critical, Discontinuous (Interleaved)	Variable and/or Fixed	SOIC-16
NCP1608	Voltage	Critical	Variable	SOIC-8
NCP1611	Voltage	Critical	Variable	SOIC-8
NCP1612	Voltage	Critical	Variable	SOIC-10
NCP1615	Voltage	Critical	Variable	SOIC-14, SOIC-16
NCP1616	Voltage	Critical	Variable	SOIC-9 NB
NCP1618	Voltage	Critical, Continuous	Variable and/or Fixed	SOIC-9
NCP1622	Voltage	Critical, Discontinuous	Variable	TSOP-6

Secondary Side Controllers

NCP4306 Features

- Self-Contained Control of Synchronous Rectifier in CCM, DCM and QR for Flyback or LLC Applications
- Precise True Secondary Zero Current Detection
- Typically 12 ns Turn-off Delay from Current Sense Input to Driver
- Rugged Current Sense Pin (up to 200 V)
- Adjustable or Fixed Minimum ON-Time
- Adjustable Minimum OFF-Time with Ringing Detection
- 7 A/2 A Peak Current Sink/Source Drive Capability
- Operating Voltage Range up to Vcc = 35 V
- Automatic Light-Load & Disable Mode
- GaN Transistor Driving Capability
- Maximum Operation Frequency up to 1 MHz
- Download [EVBUM2522/D](#) for more information



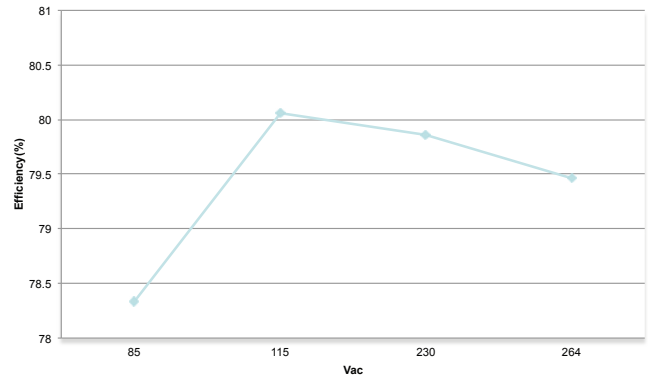
NCP4306 Typical Application

Device	Function	Package
NCP43080	Secondary Side Synchronous Rectification Driver	SOIC-8, DFN-8, WDFN-8
NCP4305/8	High Performance Secondary Side Synchronous Rectification Driver	SOIC-8, DFN-8, WDFN-8
NCP81178	High Performance Secondary Side Synchronous Rectification Driver	DFN-10
NCP4306	High Performance Secondary Side Synchronous Rectification Driver	TSOP-6, SOIC-8, DFN-8
FAN6248	High Performance LLC Synchronous Rectification Driver	SOIC-8
NCP4328	Secondary Side CC/CV Controller	TSOP-5, TSOP-6
NCP4353	Sleep Mode Controller for Low Standby Power	TSOP-6

New Generation of High Voltage Switcher

NCP1075A/B~79A/B Features

- Built-in 700 V FET
- Dynamic Self Supply: no need for auxiliary winding
- VCC OVP management
- 2nd level OCP
- Adjustable Brown-Out & AC Line Over Voltage Protection
- Over Power Protection
- Frequency foldback and skip-mode with jittering
 - Improved light load efficiency
 - Improved EMI over the entire range
- No load power <50 mW

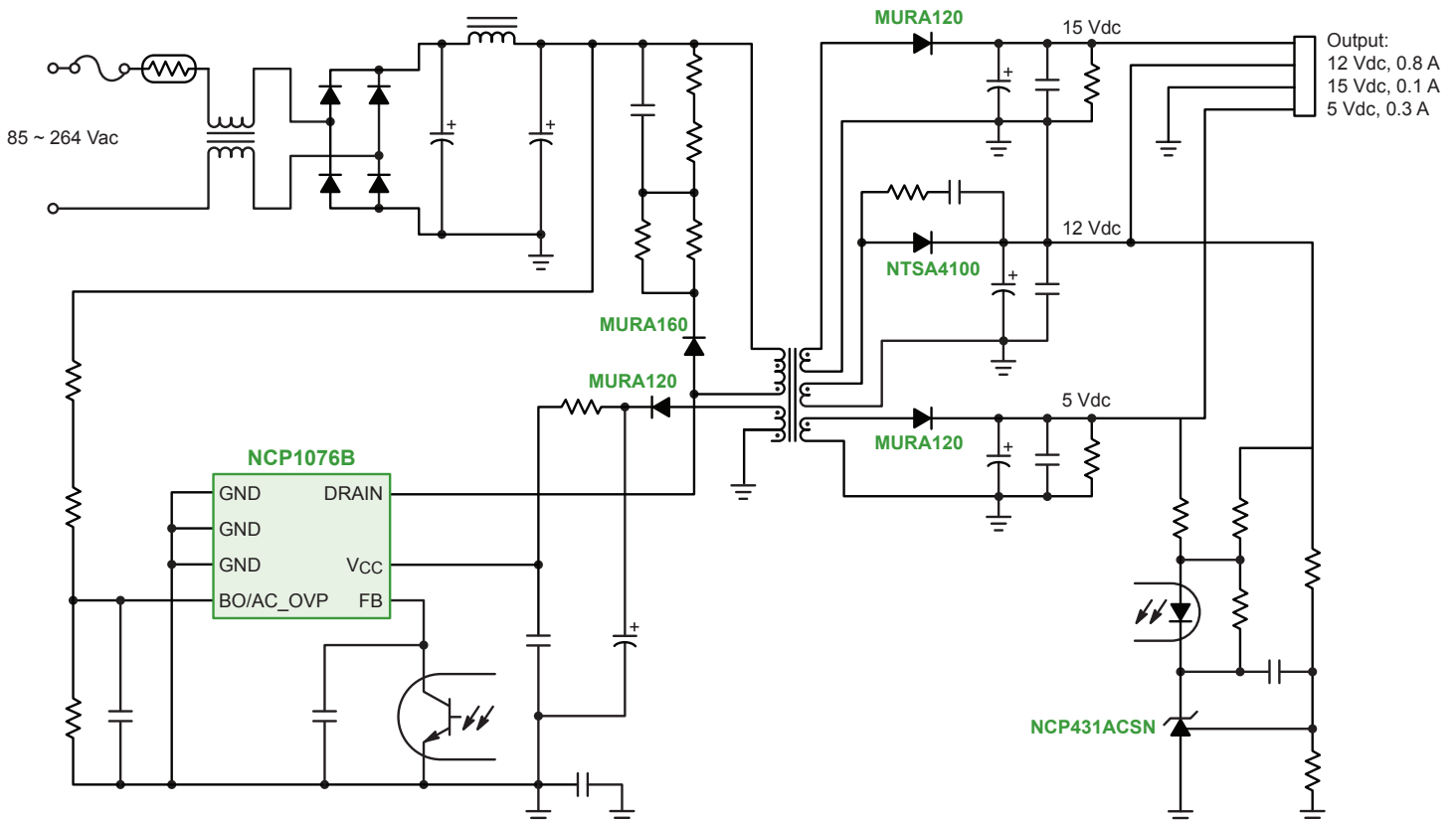


Full Load Efficiency

(Test condition: all efficiency are tested at board end)

	NCP1070			NCP1071			NCP1072			NCP1075A/B			NCP1076A/B			NCP1077A/B			NCP1079A/B		
R_{DS(ON)} (Ω)	22						11						4.7						2.7		
I_{peak} (mA)	250			350			250			450			650			800			1050		
Frequency (kHz)	65	100	130	65	100	130	65	100	130	65	100	130*	65	100	130*	65	100	130*	65	100	130*

* Upon request for B-type package.



AC-DC Controllers and Regulators

Features

- Comprehensive, versatile portfolio supports:
 - Fixed frequency and variable frequency
 - Different topologies, from the classical flyback, to the half bridge resonant via the forward active clamp
 - Broad range of price-performance options, from cost effective devices to highly integrated controllers and regulators
- Embedded features ease compliance with stringent efficiency requirements: frequency foldback, Quiet-Skip mode
- Functions reduce EMI signatures and facilitate compliance with safety standards

AC-DC Controllers and Regulators

Device	Topology	Type	Frequency	Control Mode	Package
NCP1060/63	Buck/Non-Isolated Flyback	700 V Switcher	Fixed	Current	SOIC-10, PDIP-7, SOIC-16
NCP10670~72	Buck/Non-Isolated Flyback	700 V Switcher	Fixed	Current	SOIC-7
FSL306/336/337	Buck/Non-Isolated Flyback	650 V Switcher	Fixed	Current	PDIP-7, LSOP-7
NCP1910	Combo CCM PFC + LLC 1/2 Bridge	Controller	Fixed PFC, Variable LLC	Current	SOIC-24
NCP1937	Combo CRM PFC + QR Flyback	Controller	Variable PFC, Variable Flyback	Current	SOIC-20
NCP1075A/B~79A/B	Flyback	700 V Switcher	Fixed	Current	PDIP-7
FSL518/538	Flyback/Non-Isolated Flyback	800 V Switcher	Fixed	Current	PDIP-7
FSL117/137	Flyback/Non-Isolated Flyback	700 V Switcher	Fixed	Current	PDIP-7
NCP10970	Buck/Non-Isolated Flyback	670 V Switcher	Fixed	Current	SOIC-16
FSL4110	Flyback	1000 V Switcher	Fixed	Current	PDIP-7, LSOP-7
FSL1x6, 1x8	Flyback	600/800 V Switcher	Fixed	Current	PDIP-7, LSOP-7, T022-F6
NCP1239	Flyback	Controller	Fixed	Current	SOIC-7
NCP12400	Flyback	Controller	Fixed	Current	SOIC-7
NCP1256	Flyback	Controller	Fixed	Current	TSOP-6
NCP12510	Flyback	Controller	Fixed	Current	TSOP-6
NCP1252	Flyback/Forward	Controller	Fixed	Current	SOIC-8
NCL30125	2SW Forward	Controller	Fixed	Current	SOIC-16
NCP1399	Half-Bridge Resonant	Controller	Variable	Current	SOIC-16
FAN7688	Half-Bridge Resonant	Controller	Variable	Current	SOIC-16
NCP4390	Half-Bridge Resonant	Controller	Variable	Current	SOIC-16
NCP13992	Half-Bridge Resonant	Controller	Variable	Current	SOIC-16
NCP1360/65	PSR Flyback	Controller	Variable	Current	TSOP-6
NCP1361/66	PSR Flyback	Controller	Variable	Current	SOIC-7
NCP1362	PSR Flyback	Controller	Variable	Current	SOIC-8
NCP1339	QR Flyback	Controller	Variable	Current	SOIC-14
NCP1340/41	QR Flyback	Controller	Variable	Current	SOIC-8, SOIC-9 NB
NCP1379/80	QR Flyback	Controller	Variable	Current	SOIC-8
NCP1342	QR Flyback	Controller	Variable	Current	SOIC-8, SOIC-9 NB
NCP1568	Active Clamp Flyback	Controller	Variable	Current	TSSOP-16

DC-DC Controllers and Regulators

DC-DC Regulators

Device	V _{in} (V)		Topology	Frequency (kHz)	Output Current (A)	Package
	Min	Max				
LM2574	4.75	40	Buck	52	0.5	D2PAK, TO-220
LM2594	4.75	40	Buck	150	0.5	SOIC-8, PDIP-8
NCP1030	10	200	Buck, Boost	300	1.0	Micro8
LM2575	4.75	40	Buck	52	1.0	D2PAK, TO-220
LM2595	4.75	40	Buck	150	1.0	D2PAK, TO-220
CS51414	4.5	40	Buck	260	1.5	SOIC-8
NCP3063	3	40	Buck, Boost, Inverting, Buck/Boost	up to 250	1.5	DFN-8, SOIC-8, PDIP-8
NCP3064	3	40	Buck, Boost, Inverting, Buck/Boost	up to 250	1.5	DFN-8, SOIC-8, PDIP-8
NCP3065	3	40	Buck, Boost, Inverting, Buck/Boost	up to 250	1.5	DFN-8, SOIC-8, PDIP-8
NCP3066	3	40	Buck, Boost, Inverting, Buck/Boost	up to 250	1.5	DFN-8, SOIC-8, PDIP-8
MC34063A	3	40	Buck, Boost, Inverting, Buck/Boost	up to 100	1.5	DFN-8, SOIC-8, PDIP-8
CS5171/2/3	2.7	30	Boost	280/560	1.5	SOIC-8
NCP1595	4	5.5	Buck	1200	1.5	DFN-6
NCP1031	10	200	Buck, Boost	300	2.0	Micro8
NCP1597	4	5.5	Buck	1200	2.0	DFN-6
MC34166	7.5	40	Step-up/Step-down	72	3.0	D2PAK, TO-220
LM2576	4.75	40	Buck	52	3.0	D2PAK, TO-220
LM2596	4.75	40	Buck	150	3.0	D2PAK, TO-220
NCP3170	4.5	18	Buck	500 / 1000	3.0	SOIC-8
NCP1599	2.7	5.5	Buck	1200	3.0	DFN-6, DFN-10
NCP1593	4	5.5	Buck	1000	3.0	DFN-10
NCP3133	2.9	5.5	Buck	1100	3.0	QFN-16
MC34163	2.5	40	Buck, Boost, Inverting, Buck/Boost	up to 100	3.4	SOIC-16, PDIP-16
NCP3163	2.5	40	Buck, Boost, Inverting, Buck/Boost	up to 300	3.4	SOIC-16WB, DFN-18
FAN23SV04TA	7	18	Buck	200 - 1000	4.0	PQFN-34
NCP1594A	2.9	6.0	Buck	500 - 2000	4.0	WQFN-24
MC34167	7	40	PWM Step-down	72	5.0	D2PAK, TO-220
NCP3135	2.9	5.5	Buck	1100	5.0	QFN-16
NCP3136	2.9	5.5	Buck	1100	5.0	QFN-16
NCP4060	16	80	Buck	100 - 500	6.0	QFN-20
FAN65004B	4.5	65	Buck	100 - 1000	6.0	PQFN-35
FAN2356A	4.5	24	Buck	200 - 1000	6.0	PQFN-34
FAN23SV56A	7	24	Buck	200 - 1000	6.0	PQFN-34
NCP1592	3	6	Buck	350/550/280/700	6.0	TSSOP-28 EP
FAN65005A	4.5	65	Buck	100 - 1000	8.0	PQFN-35
FAN65008B	4.5	65	Buck	100 - 1000	10	PQFN-35
FAN2360A	4.5	24	Buck	200 - 1000	10	PQFN-34
FAN23SV60A	7	24	Buck	200 - 1000	10	PQFN-34
FAN2310A	4.5	18	Buck	200 - 1000	10	PQFN-34
FAN23SV10MA	7	18	Buck	200 - 1000	10	PQFN-34

DC-DC Controllers and Regulators

DC-DC Regulators (cont.)

Device	V _{in} (V)		Topology	Frequency (kHz)	Output Current (A)	Package
	Min	Max				
FAN2365A	4.5	24	Buck	200 - 1000	15	PQFN-34
FAN23SV65A	7	24	Buck	200 - 1000	15	PQFN-34
NCP3232	4.5	21	Buck	500	15	QFN-40
NCP3235	4	20	Buck	550	15	QFN-40
FAN2315A	4.5	18	Buck	200 - 1000	15	PQFN-34
FAN23SV15MA	7	18	Buck	200 - 1000	15	PQFN-34
FAN23SV70A	7	24	Buck	200 - 1000	20	PQFN-34
FAN23SV20MA	7	18	Buck	200 - 1000	20	PQFN-34
NCP3233	3	16	Buck	500	20	QFN-40
NCP3231	4.5	18	Buck	500	25	QFN-40
NCP3230	4.5	18	Buck	500	30	QFN-40

DC-DC Controllers

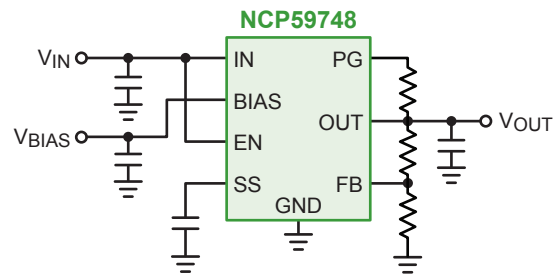
Device	V _{in} (V)		Isolated	Frequency (kHz)	Control Mode	Package
	Min	Max				
NCP12700	9	200	Yes	100 - 1000	Current	MSOP-10, WQFN-10
NCP1566	15	120	Yes	Up to 1000	Current/Voltage	QFN-24
NCP1034	8	100	No	25 - 500	Voltage	SOIC-16
CS5124	7.7	75	Yes	400	Current	SOIC-8
CS51022	3.3	72	Yes	200 - 1000	Current	SOIC-16, TSSOP-16
CS51221	3.3	72	Yes	200 - 1000	Voltage	SOIC-16, TSSOP-16
NCP1294	3.3	72	Yes	200 - 1000	Voltage	SOIC-16, TSSOP-16
TL494	7	40	No	40 - 200	Voltage	SOIC-16, PDIP-16
TL594	7	40	No	40 - 300	Voltage	SOIC-16, PDIP-16, TSSOP-16
SG3525	8	35	No	100 - 400	Voltage	SOIC-16, PDIP-16
NCP3011	4.5	28	No	400	Voltage	TSSOP-14
NCP3020A/B	4.5	28	No	300/600	Voltage	SOIC-8
NCP3030	4.7	28	No	1200/2400	Voltage	SOIC-8
NCP81231	4.5	28	No	150 - 1200	Current	QFN-32
NCP81239	4.5	28	No	150 - 1200	Current	QFN-32
NCP1587	4.5	13.2	No	275	Voltage	SOIC-8



Linear Voltage Regulators

NCP59748 Features

- Output current in excess of 1.5 A
- V_{IN} range: 0.8 V to 5.5 V
- V_{BIAS} range: 2.7 V to 5.5 V
- Output voltage range: 0.8 V to 3.6 V
- Dropout voltage: 60 mV at 1.5 A
- Programmable Soft-Start
- Open drain Power Good output
- Fast transient response
- Stable with any type of output capacitor ≥ 2.2 F
- Current limit and thermal shutdown protection



NCP59748 Application Diagram

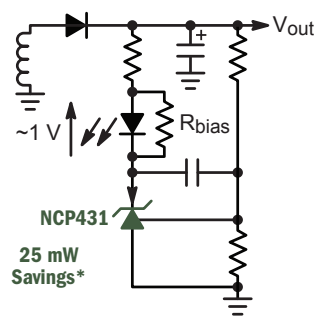
LDO Regulators

Type	Device	V_{IN} (V)	I_{LOAD}	V_{OUT} (V)	I_Q (μ A)	V_{DROP} (V)	PSRR (dB)	Package(s)
High & Wide Input Voltage	NCP502	12	80 mA	1.5 - 5.0	40	0.6 - 1.5	55	SOT-23, SC-70
	NCP623	12	150 mA	2.5 - 5.0	170	0.18	70	DFN-6
	NCP3335A	12	500 mA	1.5 - 5.0, Adj.	31	0.34	55	DFN-10, Micro8
	NCP508	13	50 mA	1.5 - 3.3	145	0.14	70	SC-70, WDFN-6
	NCP5500	18	500 mA	1.5 - 5.0, Adj.	300	0.23	75	DPAK-5, SO-8
	NCP715	24	50 mA	1.2 - 5.0	3.2	0.23	60 @ 100 kHz	SC-88A, XDFN-6
	NCP716	24	80 mA	1.2 - 5.0	3.2	0.35	60 @ 100 kHz	WDFN-6
	NCP716B	24	150 mA	3.0 - 5.0	3.2	0.7	55	TSOP-5, SOT-23
	NCP718	24	300 mA	1.5 - 5.0	4	0.3	60	TSOP-5, WDFN-6
	LP2950	30	100 mA	3.0, 3.3, 5.0	93	0.35	48	DPAK-3, TO-92
	NCP730	38	150 mA	1.2 - 24	1	0.29	80	TSOP-5, WDFN-6
	LM2931	40	100 mA	5.0, Adj.	400	0.16	90	TO-220, DPAK-3, TO-92, SOIC-8
	NCP781	150	100 mA	0.8 - 3.6	—	—	—	DFN-6
	NCP785A	450	10 mA	1.5 - 15	10	—	70	SOT-89
	NCP786L	450	5 mA	1.5 - 15	10	—	70	SOT-223
	NCP786A	450	10 mA	1.27 - 15	10	—	70	DFN-6
High Current	NCP167	1.9 - 5.5	700 mA	1.8 - 5.2	12	0.21	85	WLCSP-4, XDFN-4
	NCP59800	2.2 - 6.0	1 A	0.8 - 5.0	60	0.2	63	DFN-8
	NCP187	105 - 505	1.2 A	0.8 - 5.2	30	—	75	WDFN-6
	NCP59748	0.8 - 5.5	1.5 A	0.8 - 3.6	50	0.06	60	DFN-10, QFN-20
	NCP59150	2.24 - 13.5	1.5 A	1.8 - 5.0	15 mA	0.3	62	D2PAK, DFN-8
	NCP5662	18	2 A	1.2 - 3.3, Adj.	—	1.0	65	D2PAK, DFN-8
	NCP59749	0.8 - 5.5	3 A	0.8 - 3.6	50	0.06	60	QFN-20
	NCP59744	0.8 - 5.5	3 A	0.8 - 3.6	50	0.115	60	DFN-10, QFN-20
	NCP58300	1	3 A	1.24 - 12.9	50 mA	0.37	—	D2PAK

Voltage References

NCP431 Features

- Programmable Precision Reference
- Pin to pin upgrade of the TL431 product
- Reduces no load power consumption in SMPS applications
- Reduced minimum cathode current (40 µA)
- Programmable output voltage to 36 V
- Voltage reference tolerance: 0.5% @ 25°C (NCP431B)
- Integrated temperature compensation



TL431 $I_{bias} = \frac{V_f}{R_{bias}} = \frac{1}{1K} = 1\text{ mA}$

NCP431 $I_{bias} = \frac{V_f}{R_{bias}} = \frac{1}{10K} = 100\text{ }\mu\text{A}$

* for 19 V output adapter

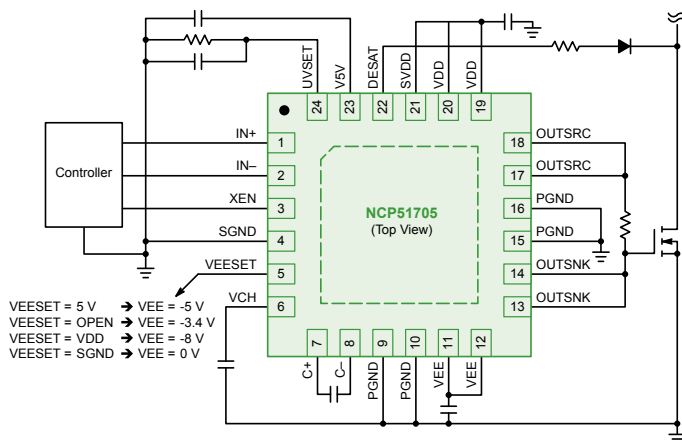
Device	VBR Typ (V)	Tolerance	Package
TL431	2.5	0.4%, 1%, 2.2%	SOIC-8, Micro8, TO-92
NCP431	2.5	0.5%, 1%	SOT-23-3, SOIC-8, TO-92
LM431	2.5	0.5%, 1%, 2%	SOIC-8, TO-92, SOT-23-3, SOT-89
LM285	1.25, 2.5	1%, 1.5%	SOIC-8, TO-92
LM385	1.25, 2.5	1%, 1.5%, 2%, 3%	SOIC-8, TO-92
TLV431	1.25	0.2%, 0.4%, 0.5%, 1%	SOT-23-3, TSOP-5, TO-92
NCP51460	3.3	1%	SOT-23-3

Fully Integrated, 6 A SiC MOSFET Gate Driver

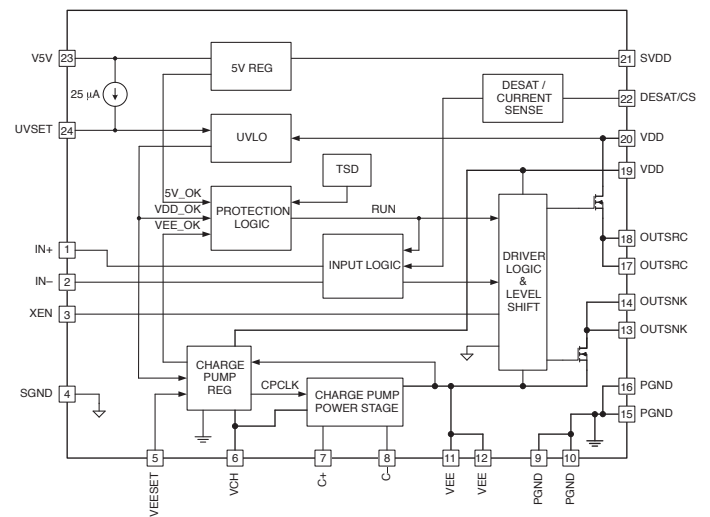
The NCP51705 driver is designed to primarily drive SiC MOSFET transistors. For the lowest possible conduction losses, the driver is capable to deliver the maximum allowable gate voltage to the SiC MOSFET device. For improved reliability, dV/dt immunity and even faster turnoff, the NCP51705 can utilize its on-board charge pump to generate a user selectable negative voltage rail.

Features

- Adjustable, on-board regulated negative charge pump
- Negative voltage drive for fast turn-off
- 5 V reference/bias rail
- Adjustable UVLO levels



Typical Application Diagram



NCP51705 Internal Block Diagram

Device	Output Current		Delay Time		Shutdown	Typical Dead Time (ns)	Package
	Source (mA)	Sink (mA)	T _{on} (ns)	T _{off} (ns)			
NCP51705	6000	6000	25	25	Yes	Variable	QFN-24

Silicon Carbide (SiC) MOSFETs and Diodes

System Benefits

- High efficiency
- Faster operating frequency
- Increased power density
- Reduced EMI

Device Features

- No reverse recovery current
- Temperature independent switching characteristics
- Excellent thermal performance



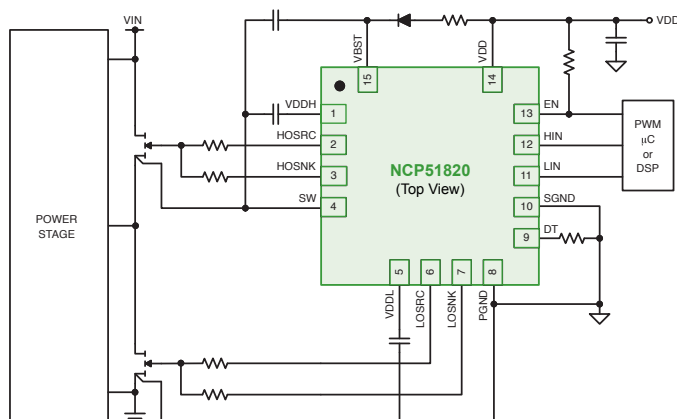
Type	Device	Voltage (V)	Current (A)	Package(s)
SiC Diode	FFSxyy65z	650	4, 6, 8, 10, 12, 16, 20, 30, 40, 50	TO-220, TO-247, DPAK, D2PAK, PQFN-4
	FFSxyy120z	1200	5, 8, 10, 15, 20, 30, 40, 50	TO-220, TO-247, DPAK, D2PAK
	NDSHxx170A	1700	5, 10, 15, 25	TO-247
SiC MOSFET	NTxyyN65SC1*	650	TBD	TO-247, D2PAK
	NTxyyN90SC1	900	20, 30, 40, 55, 90	TO-247, D2PAK
	NTxyyN120SC1	1200	20, 40, 55, 90	TO-247, D2PAK

* Pending 1Q20.

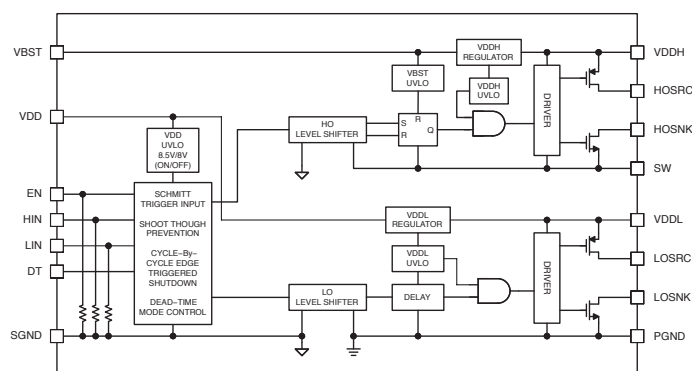
High Voltage GaN Gate Driver

The NCP51820 high speed gate driver is designed to meet the stringent requirements of driving enhancement mode (E-mode) and gate injected transistor (GIT) GaN power switches in offline half bridge power topologies. To fully protect the gate of the GaN power transistor against excessive voltage stress, both high and low side drive stages employ a dedicated voltage regulator to accurately maintain the gate source drive signal amplitude.

- 650 V high and low side gate driver
- Regulated 5.2 V gate driver with independent UVLO for high and low side output stages
- Fast propagation delay of 50 ns max
- 200 V/ns dv/dt rating of SW and PGND referenced circuit



Typical Application Diagram



NCP51820 Internal Block Diagram

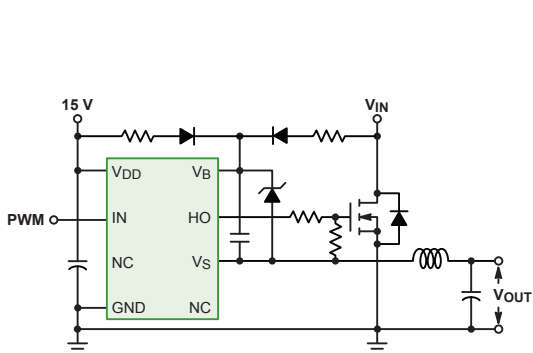
Device	Type	Offset Voltage (V)	Output Current		Delay Time		Shutdown	Typical Dead Time (ns)	Package
			Source (mA)	Sink (mA)	T _{on} (ns)	T _{off} (ns)			
NCP51820	High & Low-Side	600	1000	2000	25	25	Yes	Variable	QFN-15

High Voltage Gate Drivers (HVICs)

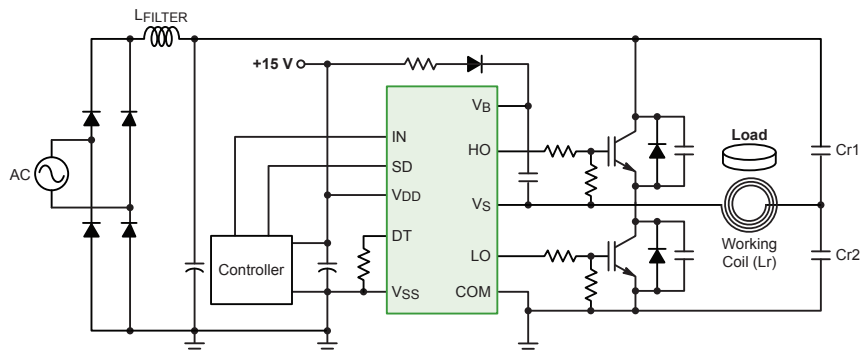
High voltage gate drivers (HVICs) from ON Semiconductor improve system reliability by utilizing an innovative common-mode dv/dt noise canceling circuit that provides excellent noise immunity. With a voltage capability up to 700 V and a very fast switching speed ($dv/dt = 50 \text{ V/ns}$ max), the devices are optimal for driving MOSFETs and IGBTs in a wide array of applications.

Features

- Better noise immunity (due to noise canceling circuit over high dv/dt common-mode noise)
- Low power consumption (IQBS/IQCC are lower than competitor's device)
- dVs/dt transient immunity voltage level (50 V/ns)
- Extended allowable negative V_s swing to -9.8 V for signal propagation @ $V_{CC} = V_{BS} = 15 \text{ V}$
- Matched propagation delay below 50 ns
- UVLO functions
- TTL compatible input threshold levels



High-Side Application Diagram



Half-Bridge Application Diagram

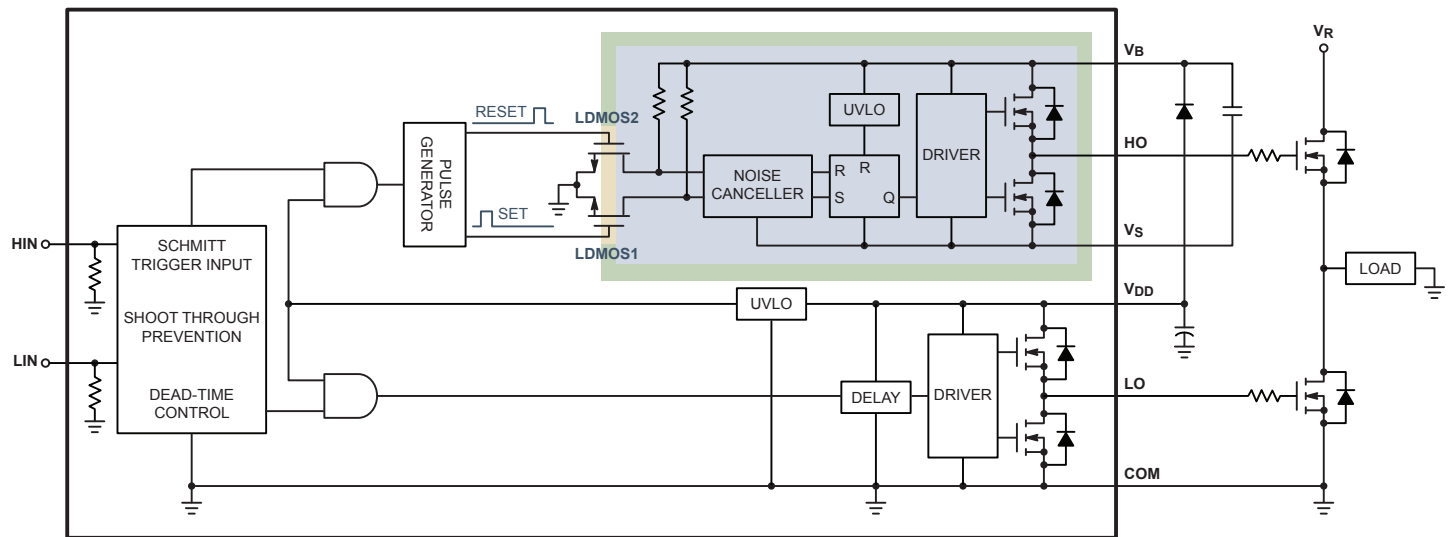
High-Side Drivers

Device	Circuit		Offset Voltage (V)	Output Current		Delay Time		Shut Down	OCP	Typical Dead Time (ns)	Package
	Type	Input to Output		Source (mA)	Sink (mA)	Ton (ns)	Toff (ns)				
FAN7361	High-Side	1 to 1	600	250	500	120	90	No	No	No	SOP-8
FAN73611	High-Side	1 to 1	600	250	500	120	90	No	No	No	SOP-8
FAN7362	High-Side	1 to 1	600	250	500	120	90	No	No	No	SOP-8
FAN7371	High-Side	1 to 1	600	4000	4000	150	150	No	No	No	SOP-8
FAN73711	High-Side	1 to 1	600	4000	4000	150	150	No	No	No	SOP-8
FAN7385	2Ch High side	2 to 2	600	350	650	110	110	No	No	No	SOP-14
TND523SS	High-Side	1 to 1	600	200	400	90	85	No	No	No	SOP-8
TND524VS	High-Side	1 to 1	600	200	400	90	85	No	No	No	VEC-8

High Voltage Gate Drivers (HVICs)

High-Side & Low-Side Drivers

Device	Circuit		Offset Voltage (V)	Output Current		Delay Time		Shut Down	OCP	Typical Dead Time (ns)	Package
	Type	Input to Output		Source (mA)	Sink (mA)	Ton (ns)	Toff (ns)				
FAN7382	High & Low-Side	2 to 2	600	350	650	170	200	No	No	No	DIP-8, SOP-8, SOP-14
FAN7390	High & Low-Side	2 to 2	600	4500	4500	140	140	No	No	No	SOP-8, SOP-14
FAN7390A	High & Low-Side	2 to 2	600	4500	4500	140	140	No	No	No	SOP-14
FAN73901	High & Low-Side	2 to 2	600	2500	2500	140	140	No	No	No	SOP-8
FAN7391	High & Low-Side	2 to 2	600	4500	4500	150	150	No	No	No	SOP-14
FAN7392	High & Low-Side	2 to 2	600	3000	3000	130	150	Yes	No	No	WSOP-16
FAN7842	High & Low-Side	2 to 2	200	350	650	170	200	No	No	No	SOP-8
FAN8811	High & Low-Side	2 to 2	100	3000	6000	30	28	No	No	No	WDFN -10
NCP5106A	High & Low-Side	2 to 2	600	250	500	100	100	No	No	No	DIP-8, SOP-8, DFN-10
NCP5109A	High & Low-Side	2 to 2	200	250	500	100	100	No	No	No	SOP-8, DFN-10
NCP5181	High & Low-Side	2 to 2	600	1400	2200	100	100	No	No	No	DIP-8, SOP-8
NCP5183	High & Low-Side	2 to 2	600	4300	4300	120	120	No	No	No	SOP-8
NCP51530A	High & Low-Side	2 to 2	700	2200	1700	60	60	No	No	No	SOIC-8, DFN-10
NCP51530B	High & Low-Side	2 to 2	700	2200	1700	25	25	No	No	No	SOIC-8, DFN-10
NCP81075	High & Low-Side	2 to 2	180	4000	4000	20	20	No	No	No	SOIC-8, DFN-8, WDFN-10



HVIC Driver Block Diagram

High Voltage Gate Drivers (HVICs)

Half Bridge Drivers

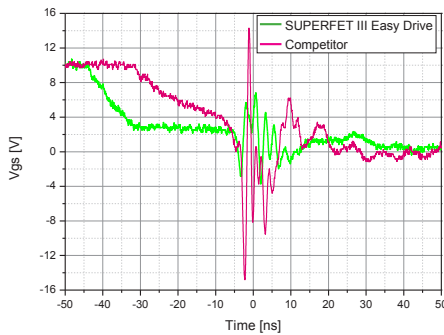
Device	Circuit		Offset Voltage (V)	Output Current		Delay Time		Shut Down	OCP	Typical Dead Time (ns)	Package
	Type	Input to Output		Source (mA)	Sink (mA)	Ton (ns)	Toff (ns)				
FAN7380	Half-Bridge	2 to 2	600	90	180	135	130	No	No	100	SOP-8
FAN7383	Half-Bridge	1 to 2	600	350	650	500	170	Yes	No	Variable	SOP-14
FAN73832	Half-Bridge	1 to 2	600	350	650	580	180	Yes	No	Variable	SOP-8
FAN73833	Half-Bridge	2 to 2	600	350	650	150	140	No	No	450	SOP-8
FAN7384	Half-Bridge	2 to 2	600	250	500	180	170	Yes	Yes	120	SOP-14
FAN7387	Self Osc.	1 to 2	600	350	650	550	160	Yes	No	Variable	SOP-8
FAN7388	3-Phase Half-Bridge	6 to 6	600	350	650	130	150	No	No	270	SOP-20
FAN73893	3-Phase Half-Bridge (MOSFET Target)	6 to 6 (inverting)	600	350	650	500	500	Yes	Yes	320	SOIC-28W
FAN73894	3-Phase Half-Bridge (IGBT Target)	6 to 6 (inverting)	600	350	650	500	500	Yes	Yes	320	SOIC-28W
FAN73895	3-Phase Half-Bridge (MOFET Target)	6 to 6	600	350	650	500	500	Yes	Yes	320	SOIC-28W
FAN73896	3-Phase Half-Bridge (IGBT Target)	6 to 6	600	350	650	500	500	Yes	Yes	320	SOIC-28W
FAN73912	Half Bridge	2 to 2	1200	2000	3000	500	550	Yes	No	330	WSOP-16
FAN7393A	Half Bridge	1 to 2	600	2500	2500	530	130	Yes	No	Variable	SOP-14
FAN73932	Half Bridge	1 to 2	600	2500	2500	600	200	Yes	No	400	SOP-8
FAN73933	Half Bridge	2 to 2	600	2500	2500	160	160	No	No	Variable	SOP-14
FAN7888	3-Phase Half-Bridge	6 to 6	200	350	650	130	150	No	No	270	SOP-20
FL73282	Half Bridge	2 to 2	900	350	650	150	150	No	No	170	SOP-8
NCP1392B	Half Bridge	1 to 2	600	500	1000	N/A	N/A	No	No	610	SOP-8
NCP1392D	Half Bridge	1 to 2	600	500	1000	N/A	N/A	No	No	305	SOP-8
NCP1393B	Half Bridge	1 to 2	600	1000	1500	N/A	N/A	No	No	610	SOP-8
NCP5104	Half Bridge	1 to 2	600	250	500	620	100	Yes	No	520	DIP-8, SOP-8
NCP5106B	Half Bridge	2 to 2	600	250	500	100	100	No	No	100	DIP-8, SOP-8, DFN-10
NCP5109B	Half Bridge	2 to 2	200	250	500	100	100	No	No	100	SOP-8, DFN-10
NCP5111	Half Bridge	1 to 2	600	250	500	750	100	No	No	650	DIP-8, SOP-8
NCP5304	Half Bridge	2 to 2	600	250	500	100	100	No	No	100	DIP-8, SOP-8
NCP81080	Half Bridge	2 to 2	200	500	800	100	100	No	No	135	SOIC-8, DFN-8

Wide Selection of High Voltage Power MOSFETs

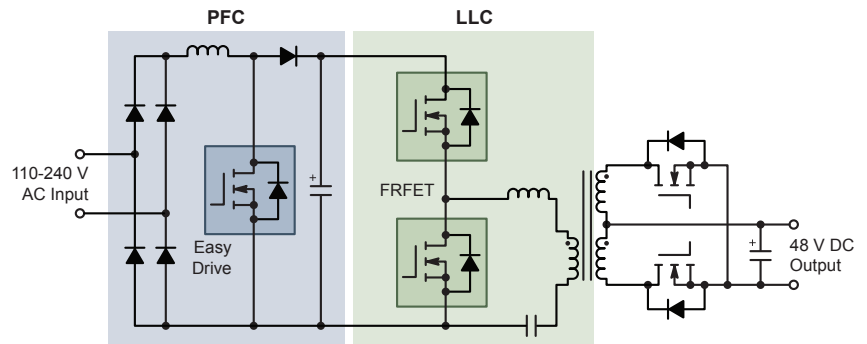
ON Semiconductor offers an expansive portfolio of Power MOSFETs, utilizing advanced SuperJunction technology. Devices enable increased system level efficiency through low switching and low conduction losses, and are available in a range of standard and innovative packages.

Features

- SUPERFET® III Easy Drive
 - Outstanding ease of use and low EMI
 - Excellent Figure-of-Merit ($R_{DS(ON)}$ Max X Q_g Typ)
 - Lower peak V_{DS} and gate oscillation
 - $V_{(BR)DSS}$ of 650 V at $T_j = 25^\circ\text{C}$, 700 V at $T_j = 150^\circ\text{C}$
 - Robust body diode
- SUPERFET III FRFET®
 - No need additional circuit in LLC resonant converter
 - Improving system reliability
 - Best in class body diode performance (lowest TRR and QRR)
 - Lower peak V_{DS} and gate oscillation
 - $V_{(BR)DSS}$ of 650 V at $T_j = 25^\circ\text{C}$, 700 V at $T_j = 150^\circ\text{C}$



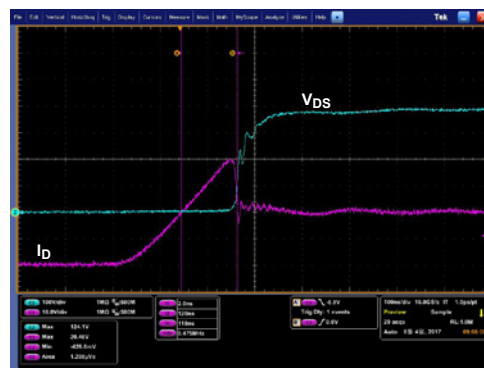
Gate oscillation during turn-off transient



AC-DC Rectifier Typical Block Diagram



SUPERFET III Fast Recovery



Best Competitor

Body Diode Performance

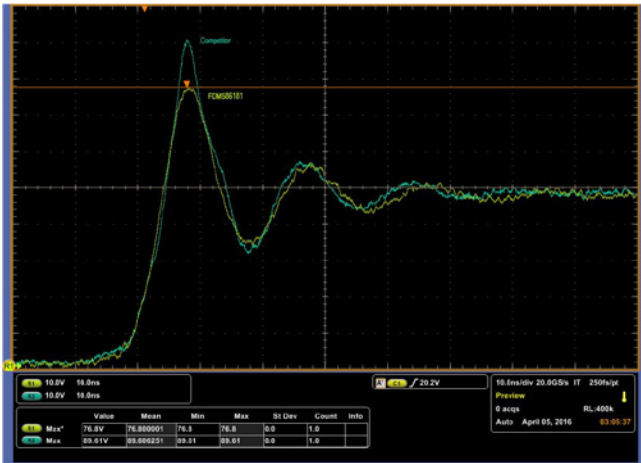
Device	Voltage Range	Current Range	Key Features	Functions	Packages
SuperJunction MOSFET	650 – 800 V	1.6 – 75 A	• Outstanding ease of use and low EMI • Excellent FOM ($R_{DS(ON)}$ max. X Q_g typ.) • Lower peak V_{DS} and gate oscillation • Robust body diode • Lowest TRR and QRR	High voltage switch for industrial power supply	D2PAK, DPAK, IPAK, TO-220, TO-220F, TO-247, Power88

Wide Selection of Medium Voltage Power MOSFETs

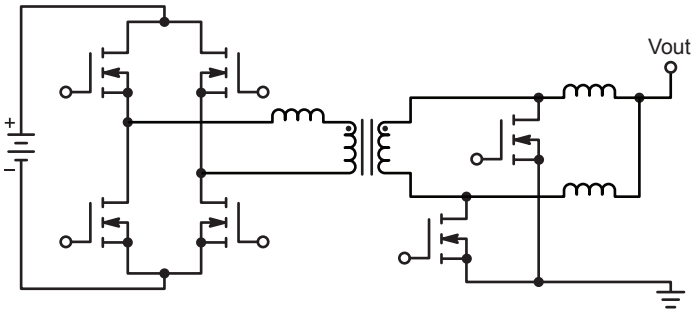
ON Semiconductor offers an expansive portfolio of Power MOSFETs, utilizing advanced shielded gate technology. Devices enable increased system level efficiency through low conduction and low switching losses, and are available in a range of standard and innovative packages.

Features

- T6 and T8, 40 to 80 V technology
- 80 V to 150 V PTNG
 - Optimised low $R_{DS(ON)}$ and Q_g
 - Ultra soft body diode with PTNG
 - Lowest $R_{DS(ON)}$ in SO-8FL with T6
 - Provides low ringing
 - Improved EMI performance
 - Lower conduction losses
 - Lower switching losses
 - Best in class body diode
 - Soft recovery and small Q_{RR}
 - Ultra low gate resistance for fast switching



Overshoot Reduction Enabled by Shielded Gate MOSFET Technology



Isolated DC-DC Schematic

Single MOSFET in 5 mm x 6 mm Footprint

$V_{BR(DSS)}$ (V)	$R_{DS(ON)}$ Max (m Ω)
30	0.55
40	0.7
60	1.2
80	2.1
100	3.2
120	4.0
150	8.8

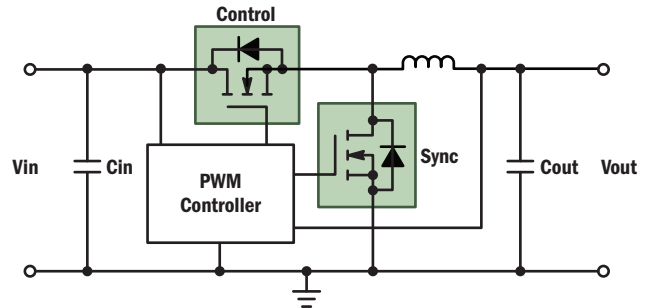
Device	Voltage Range	Current Range	Key Features	Functions	Packages
Medium Voltage MOSFET	40 – 250 V	2 – 52 A	• Outstanding switching performance and low EMI • Excellent FOM ($R_{DS(ON)}$ max. X Q_g typ.) • Well balanced switching behavior • Robust body diode • Soft recovery and small Q_{RR}	Primary and secondary MOSFET for DC-DC power supply	TO-220, D2PAK, DPAK, TOLL, SO-8FL, μ 8FL, Power56, Power33, Power22, SO-8, SSOT-6, SSOT-3

N-Channel MOSFETs for Power Conversion

Non-Isolated Topology "Buck" DC-DC

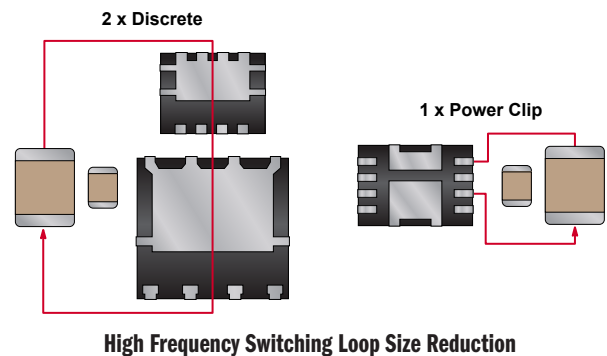
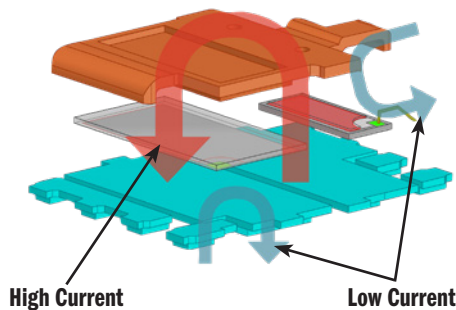
Features

- Low $R_{DS(ON)}$ for low conduction loss
- Low capacitance for low switching loss
- Integrated Schottky for enhanced light load efficiency



Increasing Power Density with PowerClip Dual MOSFETs

- Single optimized clip reduces interconnect parasitics
 - Up to 40 A in 5x6 mm & 25 A in 3x3 mm
- Flipped low side die reduces source inductance & improves thermals

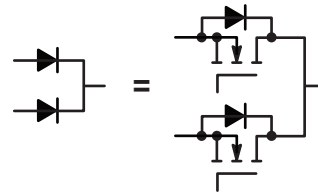


Device	Package	I_{max} (A)	BV_{DSS} (V)	$V_{GS Max}$ (V)	$R_{DS(ON)}$ Max @ $V_{GS} = 4.5 V$ (mΩ)		Q_g Typ @ $V_{GS} = 4.5 V$ (nC)		C_{oss} Typ (pF)
					High Side	Low Side	High Side	Low Side	Low Side
FDPC8012S	Power Clip 33	15-20	25	12	7	2.2	8	25	885
FDPC8013S		10-15	30	20	9.6	2.7	6	21	997
FDPC3D5N025X9D		10	25	12	3.7	3.7	17	17	612
FDPC8016S	Power Clip 56	20-30	25	12	4.7	1.7	11	31	1195
FDPC8014S		>30	25	12	4.7	1.4	11	43	1720
FDPC8014AS		>30	25	12	4.7	1.2	11	44	2170
FDMS001N025DSD		>30	25	16	4	1.1	10	35	1810
FDMS1D2N03DSD		>30	30	16	4	1.2	11	39	1845
FDPC5018SG		25	30	12	6.5	2	8	28	1210
FDPC5030SG		20	30	12	6.5	3	8	18	801
NTMFD0D9N02P1E		>30	25	16	3.8	0.9	13	42	956

ORing MOSFETs

Features

- Ultra low $R_{DS(ON)}$ for low conduction loss
- 25 V and 30 V for IM bus ORing
- 100 V for 48 V bus ORing
- Much more efficient and reliable solution than power diodes



MOSFETs as ORing Diodes

Device	Configuration	V_{DS} (V)	V_{GS} (V)	$R_{DS(ON)}$		Q_g (nC)	Q_{gd} (nC)	Package
				$V_{GS} @ 10\text{ V}$	$V_{GS} @ 4.5\text{ V}$			
				Max (mΩ)	Max (mΩ)			
NTMFS4H01N	Single	25	20	0.7	0.9	39	8.5	S08-FL
NTMFS4H02N	Single	25	20	1.3	1.9	26	5.8	S08-FL
NTMFS4C020N	Single	30	20	0.7	1	63	13	S08-FL
FDMC8010	Single	30	20	1.3	1.8	32	9.5	Power33
NTTFS4C02N	Single	30	20	2.3	3.1	20	4	U8FL
NTMFS5C404NL	Single	40	20	0.67	1	81	23.8	S08-FL
NTMFS5H400NL	Single	40	20	0.8	1.1	54	13	S08-FL
NTMFS5C604NL	Single	60	20	1.2	1.7	52	12.7	S08-FL
NTMFS5H600NL	Single	60	20	1.3	1.7	40	6.5	S08-FL
NTMFS6H800N	Single	80	20	2.1	—	85	16	S08-FL
FDMS86180	Single	100	20	3.2	—	60	12	Power56

Advanced P-Channel MOSFETs for Power Load Switch

Features

- Ultra low $R_{DS(ON)}$ to improve system efficiency
- Advanced package technology for space saving and excellent thermal conduction

Device	Configuration	Polarity	V_{DS} (V)	V_{GS} (V)	$R_{DS(ON)}$		Q_g (nC)	C_{iss} (pF)	Package
					$V_{GS} @ 10\text{ V}$	$V_{GS} @ 4.5\text{ V}$			
					Max (mΩ)	Max (mΩ)			
FDMC610P	Single	P	12	8	—	3.9	71	890	Power33
NTLUS3C18PZ	Single	P	12	10	—	24	16	1570	UDFN-6
FDMC4D9P20X8	Single	P	20	12	—	4.9	78	7535	PQFN-8
FDMA008P20LZ	Single	P	20	8	—	13	28	3131	PQFN-6
FDMA6676PZ	Single	P	30	25	13.5	27	20	1440	PQFN-6
NTLUD3A50PZ	Dual	P	20	8	—	48	10.4	920	UDFN-6

Schottky Rectifiers for Improved Efficiency

Schottky Barrier Diodes

Device	Type	V _{RRM} (V)	I _O (A)	V _F Typ (V)	I _R Typ (μ A)	Package
MBR1045MFS	Planar	45	10	0.5	76	S08-FL
MBRB(D)1045	Planar	45	10	0.5	100	D2PAK, DPAK
NTS1045E	Trench	45	10	0.48	20	S08-FL
NTS1245E	Trench	45	12	0.5	50	S08-FL
MBRB1545CT	Planar	45	7.5 x2	0.57	100	D2PAK
NTS1545E	Trench	45	15	0.5	50	S08-FL
MBRB1645	Planar	45	16	0.63	200	D2PAK
MBR2045EMFS	Planar	45	20	0.51	90	S08-FL
MBRB2545CT	Planar	45	15 x2	0.82	200	D2PAK
NRVBB40L45CT	Planar	45	20 x2	0.63	1.2	D2PAK
NRVTS860EMFS	Trench	60	8	0.55	45	S08-FL
NRTS860PFS	Trench	60	8	0.56	4	TO-277
NRTS1060PFS	Trench	60	10	0.57	7	TO-277
NRVTS1260EMFS	Trench	60	12	0.54	50	S08-FL
NRTS1260PFS	Trench	60	12	0.58	7.5	TO-277
NRTS1560PFS	Trench	60	15	0.61	3	TO-277
MBRB2060CT	Planar	60	10 x2	0.95	150	D2PAK
MBRB30H60CT	Planar	60	15 x2	0.78	300	D2PAK
MBR5H100MFS	Planar	100	5	0.6	3	S08-FL
NTS8100MFS	Trench	100	8	0.64	15	S08-FL
NRTS8100PFS	Trench	100	8	0.76	3	TO-277
NRTS10100PFS	Trench	100	10	0.73	5.6	TO-277
NTS10100EMFS	Trench	100	10	0.65	5	S08-FL
NRTS12100PFS	Trench	100	12	0.75	6	TO-277
NTS12100EMFS	Trench	100	12	0.65	5	S08-FL
NRTS15100PFS	Trench	100	15	0.77	5	TO-277
MBRB20H100CT	Planar	100	10 x2	0.88	4.5	D2PAK
NTSB20100CT	Trench	100	10 x2	0.65	800	D2PAK
MBR30H100MFS	Planar	100	15 x2	0.81	5	S08-FL
NTSB30U100CT	Trench	100	15 x2	0.66	65	D2PAK
MBRB41H100CT	Planar	100	20 x2	0.8	10	D2PAK
NTSB40100CT	Trench	100	20 x2	0.71	20	D2PAK
MBRB60H100CT	Planar	100	30 x2	0.68	1.3	D2PAK
NTSB60100CT	Trench	100	30 x2	0.73	40	D2PAK
FSV10120V	Trench	120	10	0.75	4	TO-277
NTS10120EMFS	Trench	120	10	0.74	3.75	S08-FL
FSV12120V	Trench	120	12	0.74	5.5	TO-277
NTS12120EMFS	Trench	120	12	0.74	3.75	S08-FL
FSV15120V	Trench	120	15	0.74	7.7	TO-277
FSV20120V	Trench	120	20	0.79	20	TO-277
NTSB20120CT	Trench	120	10 x2	0.9	700	D2PAK
NTSB30120CT	Trench	120	15 x2	0.9	800	D2PAK
NTSB40120CT	Trench	120	20 x2	0.78	500	D2PAK
FSV10150V	Trench	150	10	0.84	20	TO-277
FSV12150V	Trench	150	12	0.82	30	TO-277
FSV15150V	Trench	150	15	0.85	7	TO-277
FSV20150V	Trench	150	20	0.84	30	TO-277
MBRB20200CT	Planar	200	10 x2	0.9	1	D2PAK
NTSB40200CT	Trench	200	20 x2	0.84	5	D2PAK
MBRB40250T	Planar	250	20 x2	0.86	250	D2PAK

Ultrafast Recovery Diodes

Device	V _{RRM} (V)	I _O (A)	V _F Typ (V)	T _{RR} Typ (ns)	Package
NHP420LFS	200	4	0.95	50	LFAK
NHP620LFS	200	6	0.95	50	LFAK
NHP820LFS	200	8	1	35	LFAK
MSRD620CT	200	3 x2	1.15	55	DPAK
RURD620CCS9A	200	3 x2	1	30	DPAK
FFD10UP20S	200	10	1.15	35	DPAK
MURB1620CT	200	8 x2	0.975	35	D2PAK
MURD530	300	5	1.05	50	DPAK
FFB20UP30DN	300	10 x2	1.3	45	D2PAK
MURHB840CT	400	4 x2	2.2	28	D2PAK
MUR550PF	520	5	1.15	95	DPAK
FFD04H60S	600	4	2.1	25	DPAK
RURD460S	600	4	1.5	60	DPAK
MURHD560	600	5	2.7	30	DPAK
NHPD660	600	6	2.4	50	DPAK
RHRD660S	600	6	2.1	35	DPAK
RURD660S	600	6	1.5	60	DPAK
ISL9R860S3ST	600	8	2	77	DPAK
MURHB860CT	600	4 x2	2.8	35	D2PAK
ISL9R1560S3S	600	15	1.8	90	D2PAK
RUR1S1560S9A	600	15	1.5	60	D2PAK
MURB1660CT	600	8 x2	1.5	60	D2PAK
ISL9R18120S3S	1200	18	2.7	300	D2PAK

Rectifiers for Surge Bypass and Clamp

Device	Type	V _{RRM} (V)	I _O (A)	V _F Typ (V)	I _{FSM} (A)	Package
MRUS360B	Ultrafast	600	3	1.25	100	SMB
MURS3x0	Ultrafast	200, 400, 600	3	<1.25	100	SMC
ES3x	Ultrafast	50, 100, 150, 200, 600	3	<1.7	100	SMC
S3x	Standard	50, 100, 200, 400, 600, 800, 1000, 1200	3	<1.2	100	SMC
FES10x	Ultrafast	200, 400, 600	10	<1.8	150	TO-277
FS8x	Standard	400, 600, 800, 1000	8	<1.1	230	TO-277
RUR1S1560S9A	Ultrafast	600	15	1.5	200	D2PAK
ISL9R18120S3S	Ultrafast	1200	18	2.7	200	D2PAK

Rectifiers for Snubber Circuits

Device	Type	VRRM (V)	Io (A)	V _F Typ (V)	T _{RR} Typ	Package
S1xFL	Standard	50 - 100	1	1.1	~1.3 μ s	SOD-123
S1xFP	Standard	60 - 100	1.2	1.3	~1.5 μ s	SOD-123
GF1x	Standard	50 - 1000	1	<1.2	~2.0 μ s	SMA
MRA400x	Standard	300 - 1000	1	1.1	~1.5 μ s	SMA
S1x	Standard	50 - 1000	1	1.1	~1.8 μ s	SMA
S2x	Standard	50 - 1000	2	1.15	~2.0 μ s	SMB
S3xB	Standard	50 - 1000	3	1.15	~1.5 μ s	SMB
MRS1504	Standard	400	1.5	1.04	~1.5 μ s	SMB
S3x	Standard	50 - 1200	3	1.15	~2.5 μ s	SMC
FS8x	Standard	400 - 1000	8	<1.1	~3.0 μ s	TO-277
NHP160SF	Ultrafast	600	1	3	50 ns	SOD-123
MURS160	Ultrafast	50 - 600	1	<1.25	50 ns	SMB
NHP260SF	Ultrafast	600	2	3.3	50 ns	SOD-123
MURS260	Ultrafast	600	2	1.45	50 ns	SMB
MURS360/B	Ultrafast	600	3	1.25	75 ns	SMB, SMC
MURS480E	Ultrafast	800	4	1.85	100 ns	SMC
FES6x	Ultrafast	200 - 600	6	<2.2	45 ns	TO-277

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