

Customer Presentation

CoolSET™ System in Package (SiP)

Nov 2025

public

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What is auxiliary power supply?

Aux power supplies ...

– Convert AC input (i.e., 230 V AC) into DC output (i.e. 12 V DC) to power electronic circuitries e.g. MCUs, LV BLDC motors, fans, WLAN, etc.

Can be found everywhere ...

– Houses
– Offices
– Commercial and industrial buildings
– Data centers

Future trends ...

– Lower component count
– Higher power delivery
– Higher efficiency
– Lower standby power



Home appliance

Heating

Server

Industrial SMPS

Home & building automation

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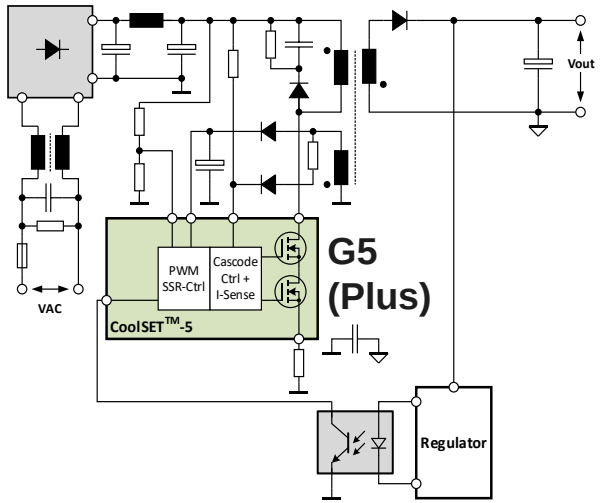
5 Summary of key features and benefits 24

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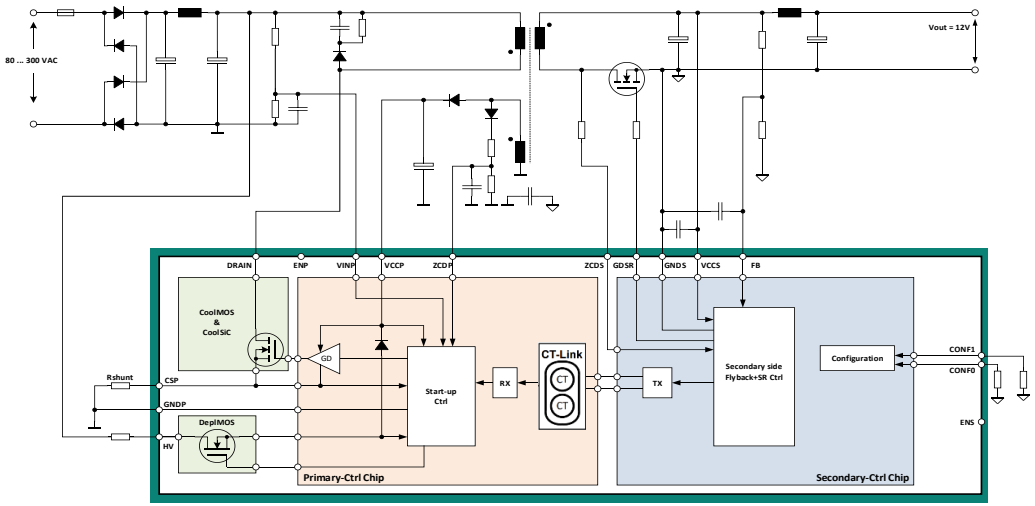
CoolSET™ System in Package (SiP)

New CoolSET™ family to meet higher power and efficiency demands

CoolSET™ Switch IC family (existing)



New CoolSET™ System in Package (SiP) family



Integrated power switch - primary side

- CoolMOS™ + PWM controller
- Aux power supply up to **42 W**
- Topology: QR/FF flyback
- Selectable entry/exit ABM profile

System in package (SiP) - primary and secondary side integration

- CoolMOS™ P7 + PWM controller + CT Link isolated communication + SR controller + secondary-side regulation for **lower component count**
- **Higher power delivery** up to **64 W** (universal input) or **110 W** (385 V DC input)
- Topology: novel ZVS flyback operation with advanced SR control algorithm up to 150 kHz for **higher efficiency**
- **Lower standby power** with optimized low supply currents for hysteretic mode operation

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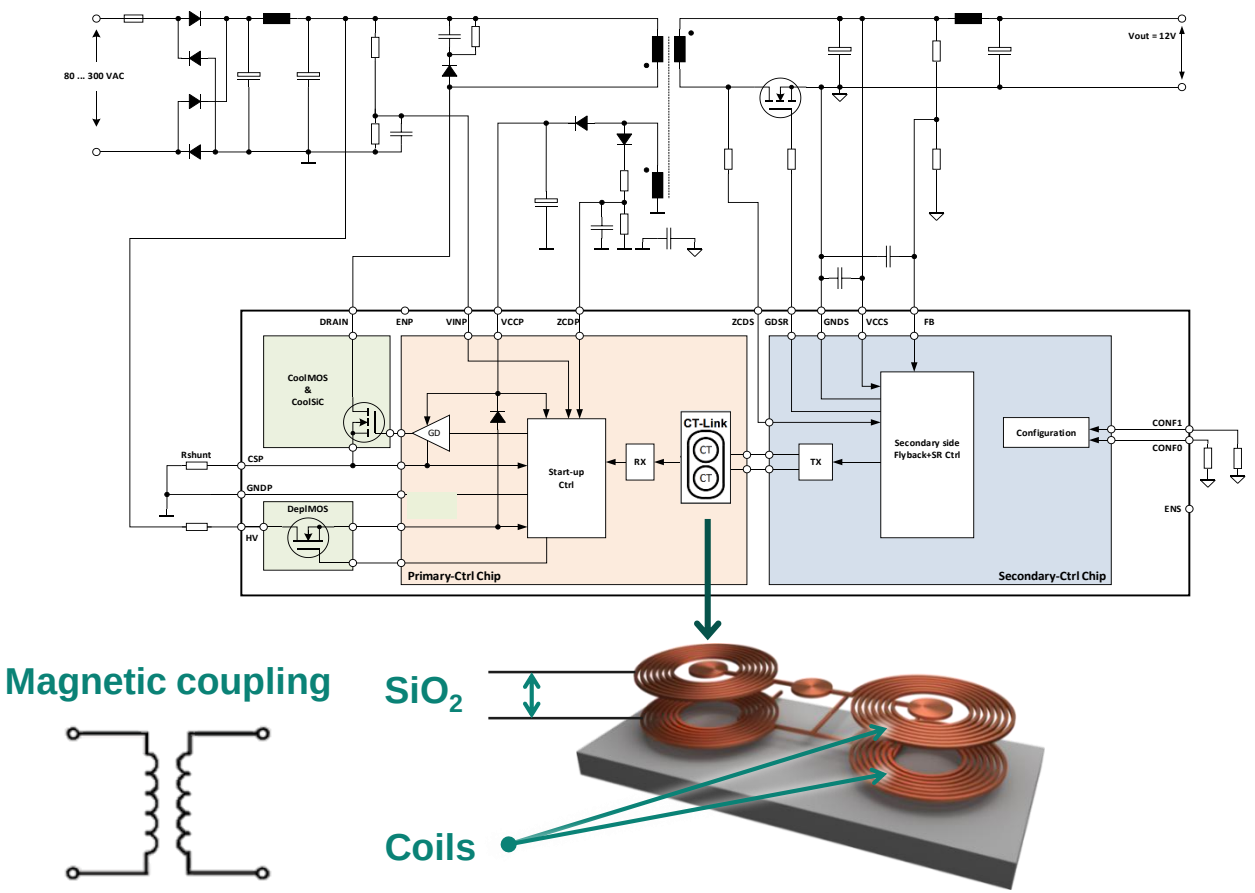
Robust isolated communication inside CoolSET™ SiP

Infineon's proprietary CT Link technology

Features and functions

- **High magnetic field immunity galvanic isolation** communication from secondary to primary
- Chip's **metal layers used for coils**
- **Silicon dioxide (SiO_2) to isolate** primary and secondary windings
- Coils designed to **maximize magnetic flux in vertical direction**
- **Peripheral seal-ring for EMI and MFI robustness**
- **20+ years** in volume **production**
- **4th generation** in production, today
- Pending isolation certifications for CoolSET™ SiP to target applications:
  - IEC 60747-17 (VDE 0884-11)
  - UL 1577
  - CSA
  - CQC per GB4943.1-2011

CT Link communication technology inside CoolSET™ SiP



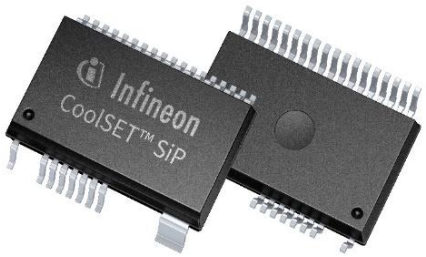
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CoolSET™ System in Package (SiP)

Product portfolio

Type	V_{BRDSS}	85 to 320 V_{AC}	230 V_{AC} ± 15%	Variant	Switching Frequency	Topology	Isolation
ICE183**EM**	800V	30 W	46 W	Enable pin	Quasi-resonant up to 150 kHz	Zero Voltage Switching (ZVS) Flyback	CT Link up to 5700V
ICE184**EM**		48 W	73 W				
ICE186**EM**		64 W	95 W				
ICE183**XM**		30 W	46 W	X-Cap discharge & Enable pin			
ICE184**XM**		48 W	73 W				
ICE186**XM**		64 W	95 W				
ICE183**ZCM**		30 W	46 W	AC Zero Cross Detection & X-Cap discharge			
ICE184**ZCM**		48 W	73 W				
ICE186**ZCM**		64 W	95 W				
ICE183**LM**		30 W	46 W	Lite			
ICE184**LM**		48 W	73 W				
ICE186**LM**		64 W	95 W				
ICE193**LM**	950V	28 W	42 W				

EM, XM, ZCM, LM



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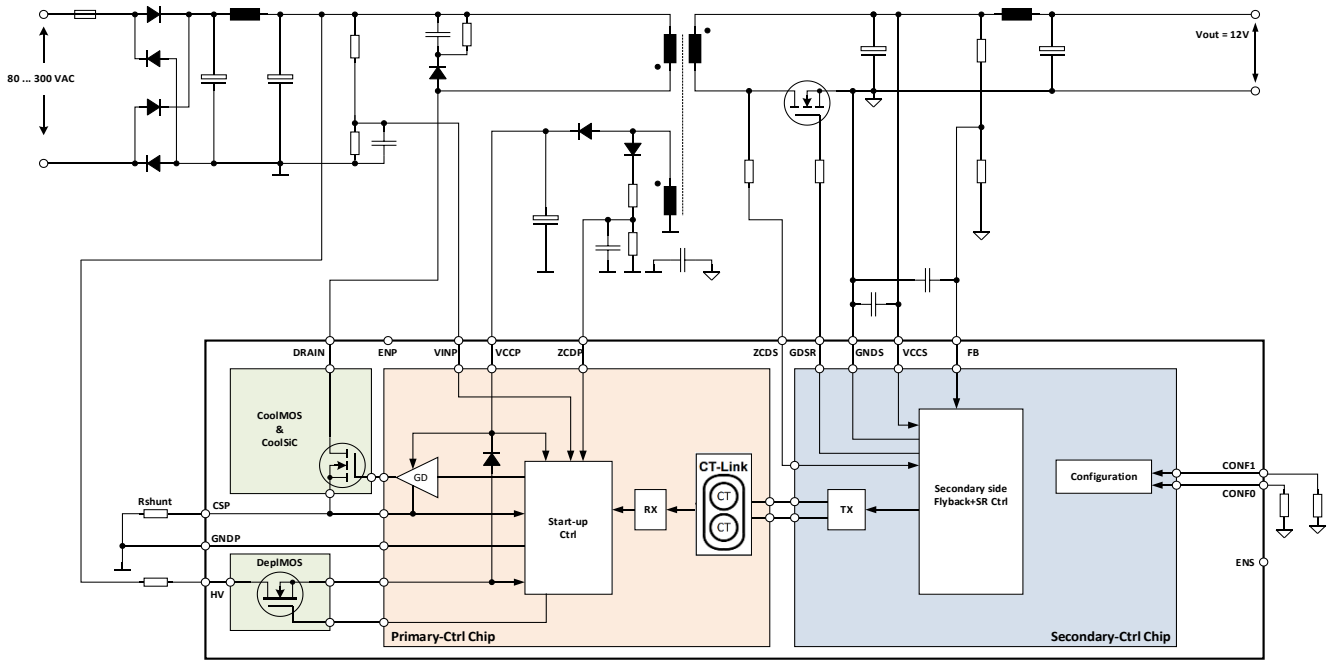
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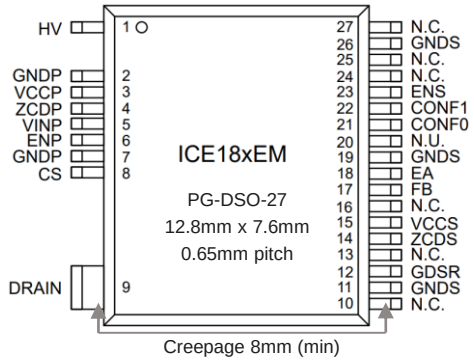
CoolSET™ SiP – ICE18x
System features and functions

Features and functions

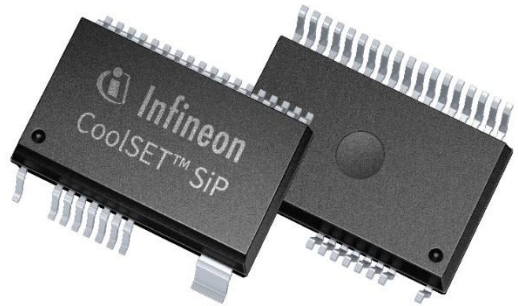
- Integrated **800 V avalanche rugged** CoolMOS™ P7
- Fast start up with integrated **950 V start-up cell**
- Integrated **synchronous rectification (SR) driver** with a typical **10 V output to drive normal level MOSFET**
- Integrated **reinforced isolated communication** from secondary to primary side
- **Novel zero voltage switching (ZVS) flyback** operation up to 150 kHz **with jittering for the lowest switching losses and low EMI signature**
- **Reliable PWM switching** operation by synchronized timing of primary and secondary side SR switch
- **Optimized low supply currents for hysteretic mode** operation to achieve **stand-by power < 30 mW**
- **Multi-mode control** for **optimized efficiency across the entire load range**
- **Minimum switching frequency variation** between low and high line to **ease design-in**

Schematic





Creepage 8mm (min)



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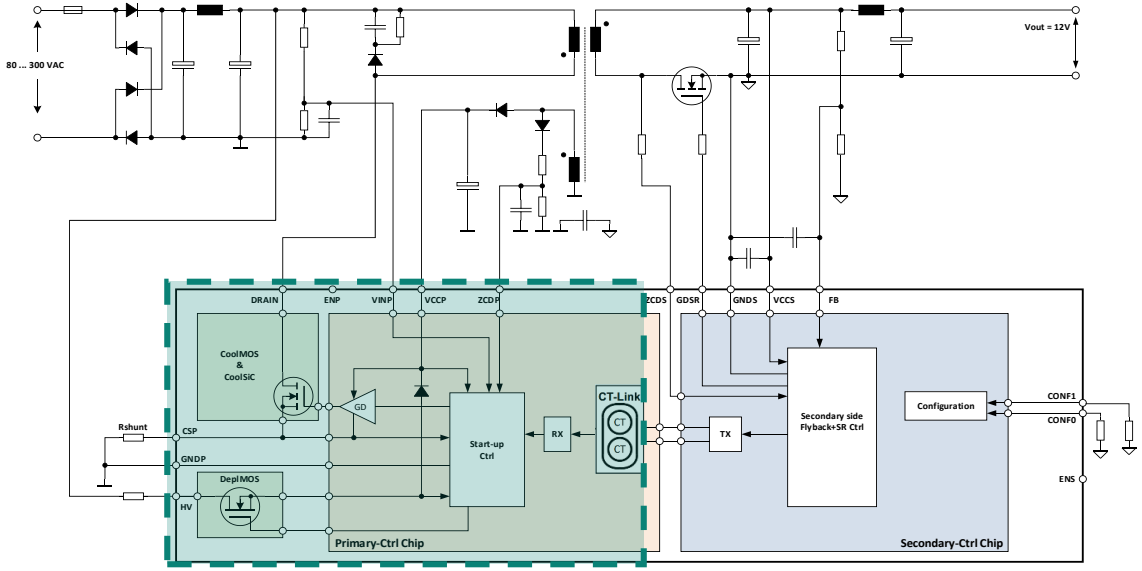
CoolSET™ System in Package (SiP) – ICE18x

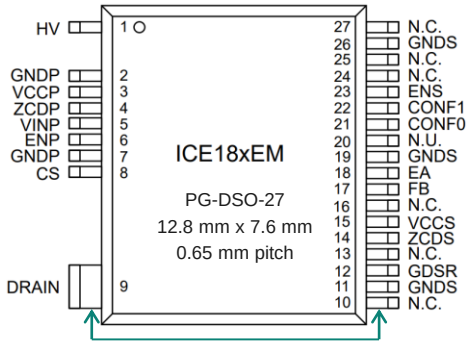
Primary controller features and functions

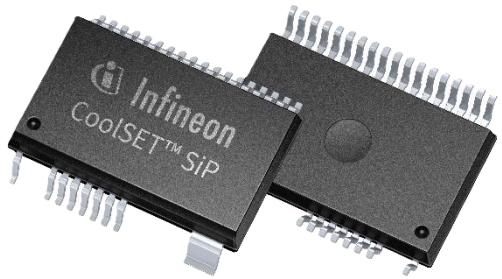
Features and functions

- Supports wide **V_{CC} operating range up to 32 V**
- Built-in digital quasi-resonant (QR) **soft-start**
- Cost-effective disable function via ENP pin to **disable/enable primary-side LDO (ICE18xEM)**
- **Reduces external bus voltage sensing resistor losses** via ENP pin **(ICE18xLM)**
- **Comprehensive primary-side protection features**:
  - AC line OVP by sensing bus capacitor voltage through VINP pin
  - VCCP OVP and UVP
  - VCCP short to GNDP protection
  - Primary peak current limitation OCP1 and OCP2
  - CS pin floating and short-to-GND protection
  - Primary controller overtemperature protection
  - Brown-in and brown-out protection via HV pin
  - Output over/undervoltage protection via ZCDP pin
  - ZCDP pin short-to-GNDP protection
  - Primary close-loop timeout protection

Schematic







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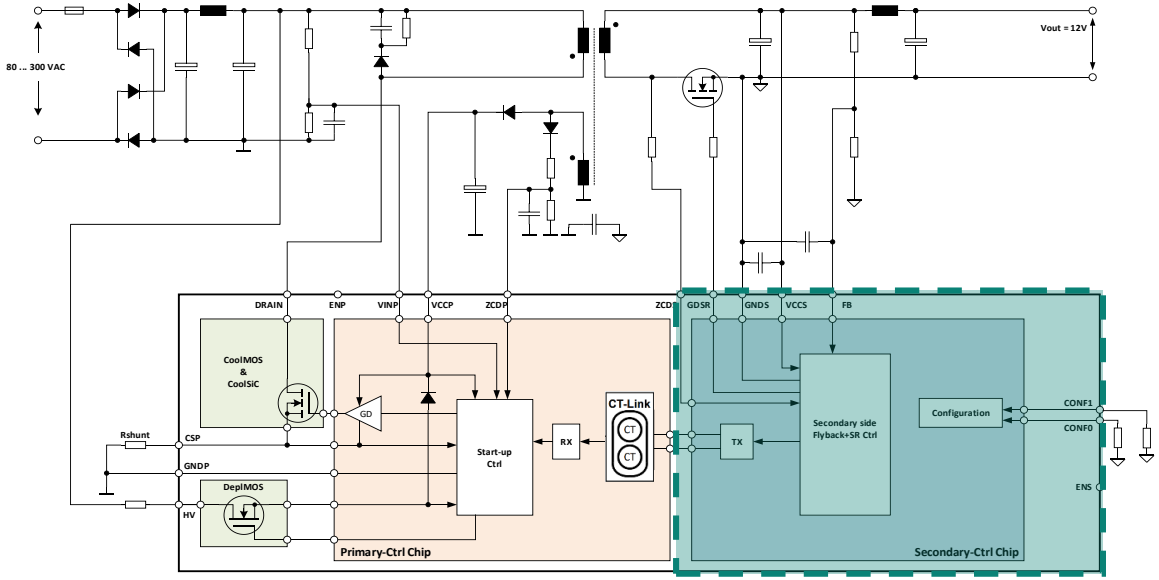
CoolSET™ System in Package (SiP) – ICE18x

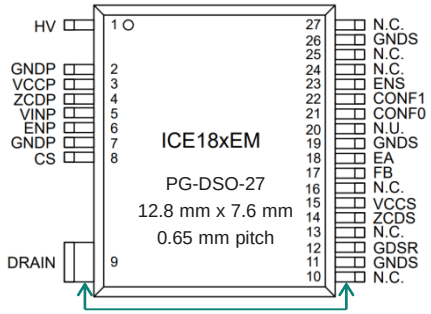
Secondary controller features and functions

Features and functions

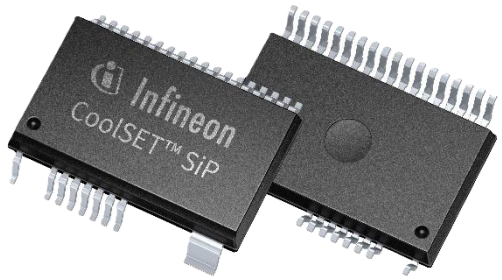
- **Synchronous rectification** controller **sensing SR MOSFET drain** via ZCDS pin to **achieve optimum efficiency**
- Primary MOSFET **valley switching with secondary-side peak detection** via ZCDS pin
- **Disable SR operation during hysteretic mode**
- **Self-adapting current injection** by additional SR MOSFET turn-on pulse to **achieve ZVS operation**
- Integrated reference and error amplifier
- **Configurable hysteretic mode** operation via CONF1 pin
- High gate drive **voltage clamp to 10 V enables use of normal-level SR MOSFET**
- **Isolated communication input** via ENS pin **(ICE18xEM)**
- **Secondary-side protection features**
  - VCCS OVP and UVP
  - Secondary-side overload/open-loop protection

Schematic





Creepage 8 mm (min)



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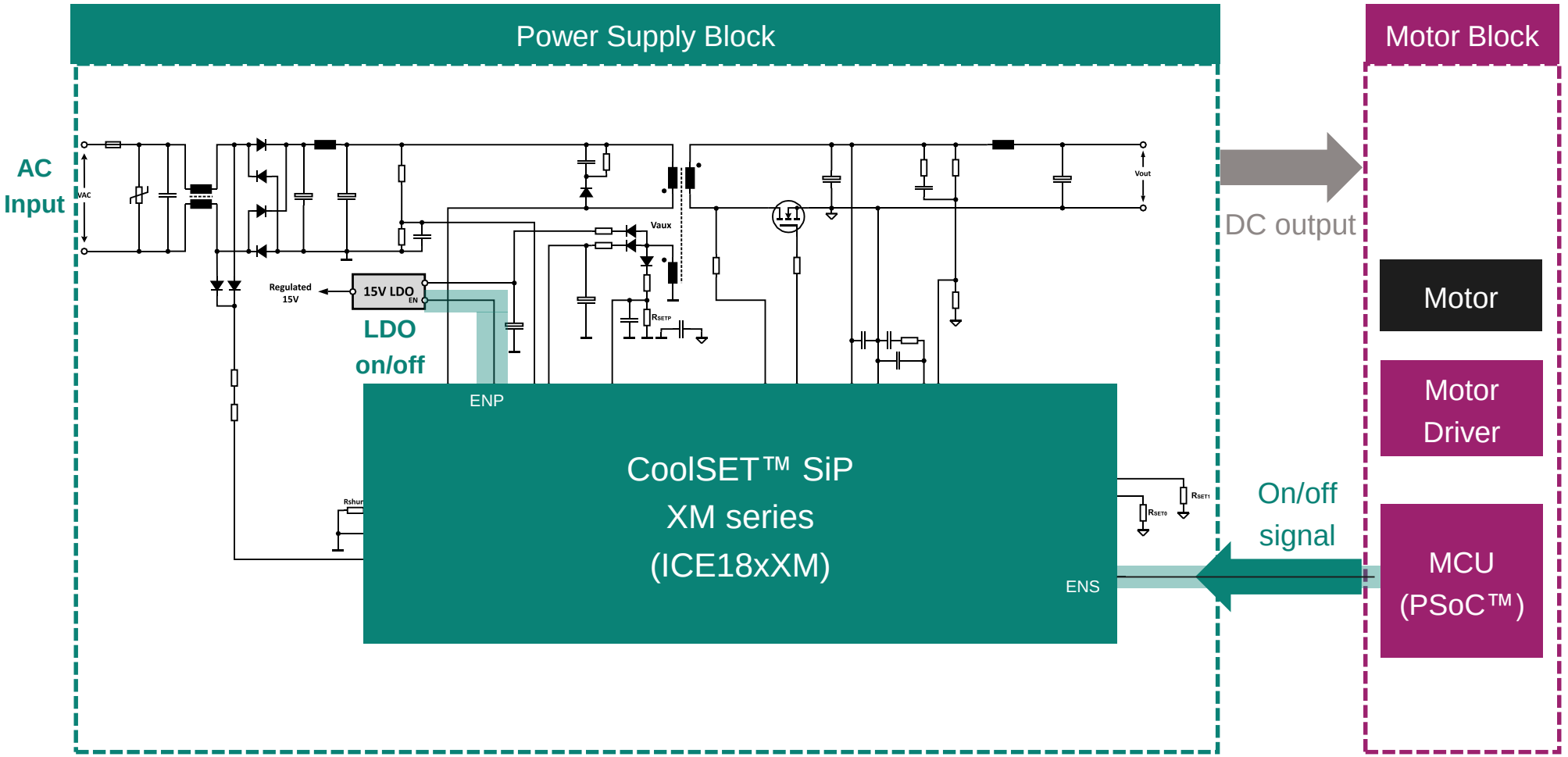
XM series: ICE18xXM

Major Home Appliances

X-cap discharge and primary-side LDO on/off control from secondary MCU for low standby power



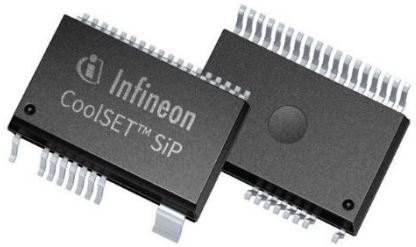
Home appliance | Induction | Aircon | Heat pump



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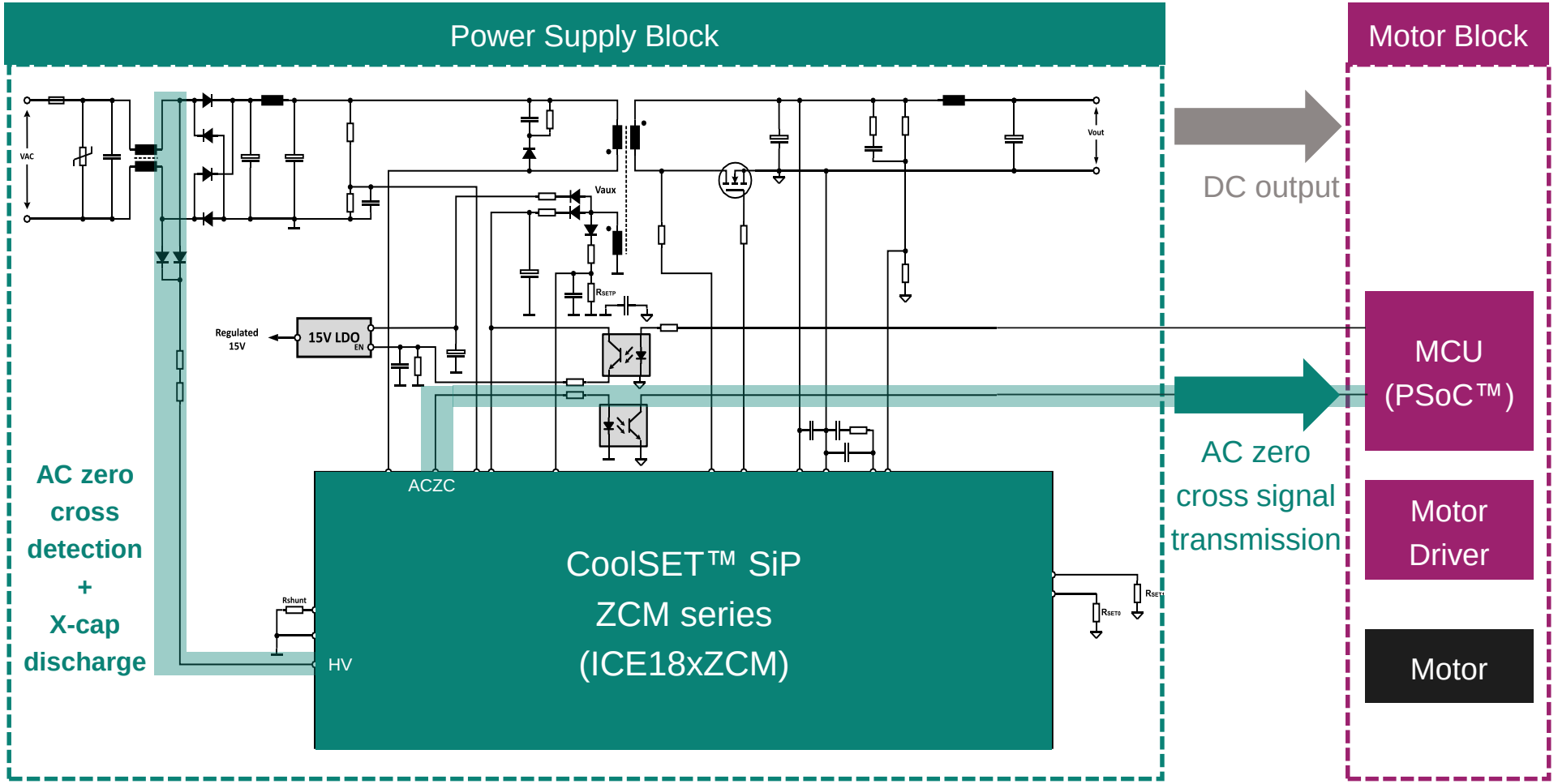
ZCM series: ICE18xZCM

Major Home Appliances



Home appliance | Induction | Aircon | Heat pump

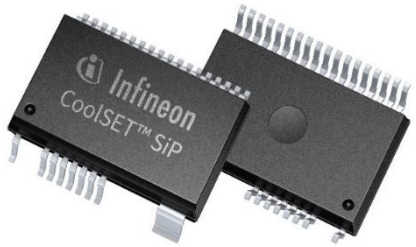
X-cap discharge and AC zero cross detect for motor control with low standby power



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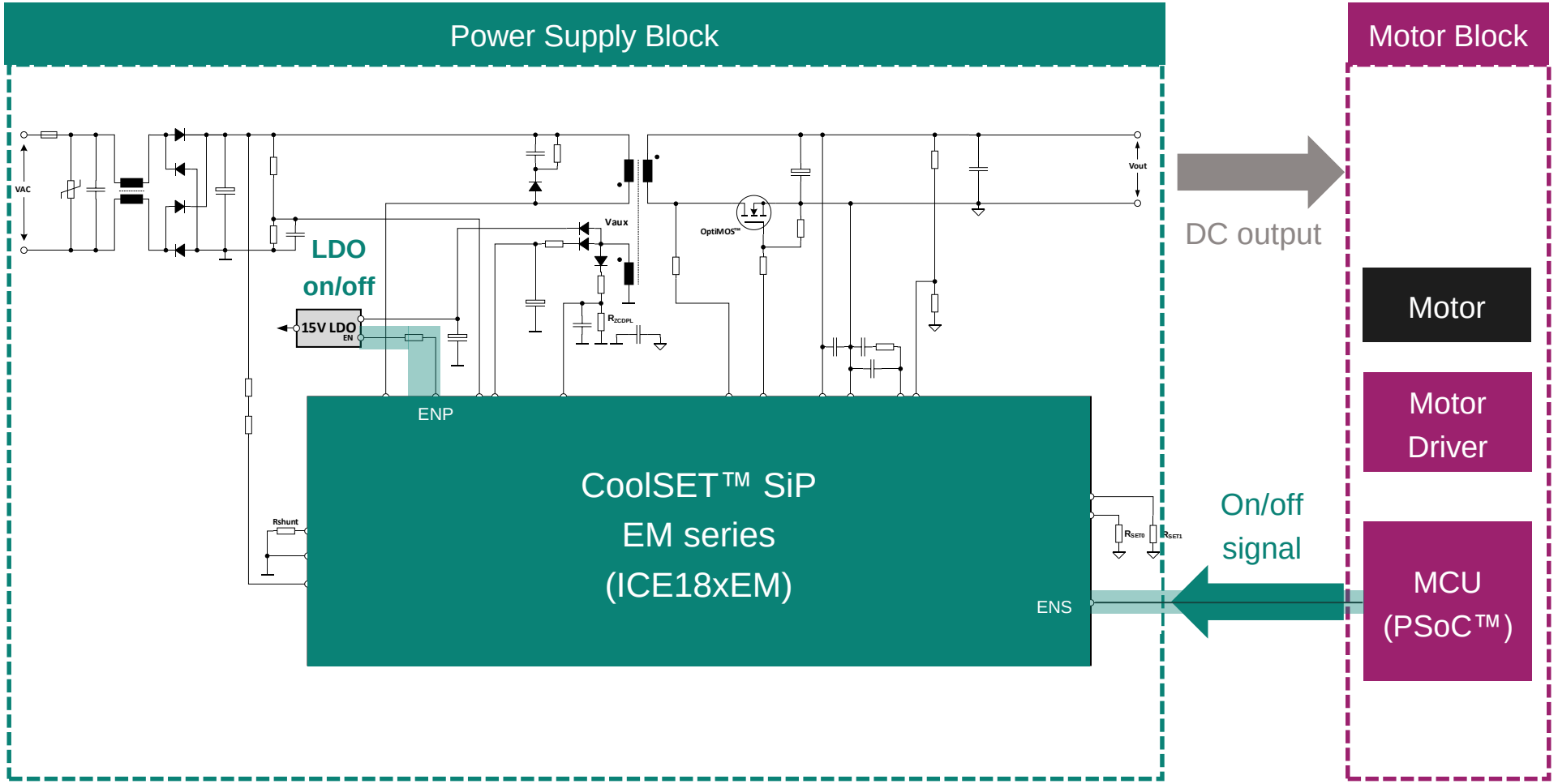
EM series: ICE18xEM

Major Home Appliances



Home appliance | Induction | Aircon | Heat pump

Primary-side LDO on/off control from secondary MCU for low standby power



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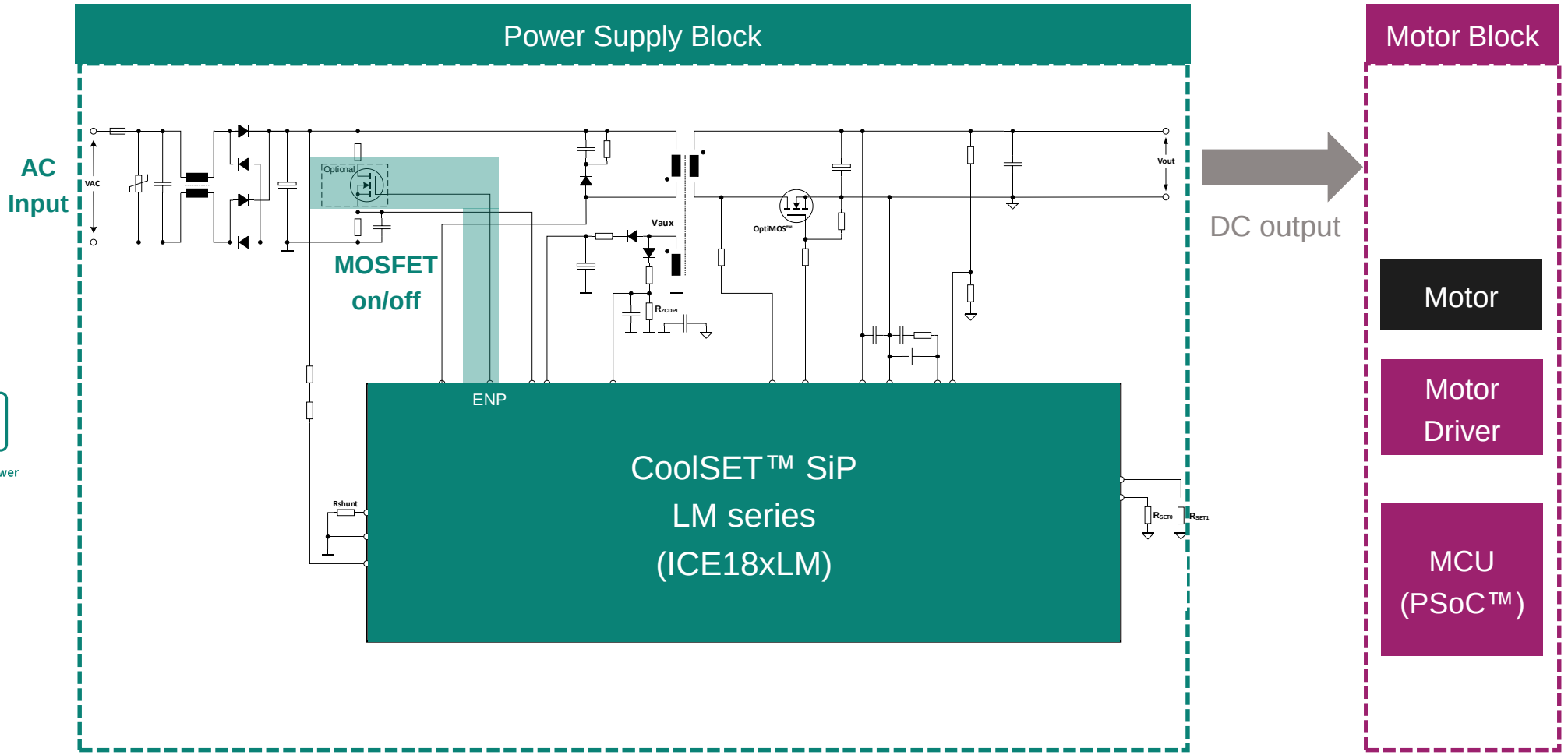
LM series: ICE1xxLM

Server / Tecom / Industrial SMPS



Server | Industrial SMPS | Telecom SMPS | AUX power

Flyback BUS voltage sense turn on/off control for low standby power



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CoolSET™ System in Package (SiP)

Capabilities and Protection Feature Overview

Product highlights

Variant	Switch	HV Start-up Cell	Output Power	ZVS QR	Enable Pin	X-Cap Discharge	AC Zero Cross Detection
ICE18x**ZCM**	800 V	✓	30 W, 45 W, 60 W	✓		✓	✓
ICE18x**XM**	800 V	✓	30 W, 45 W, 60 W	✓	✓	✓	
ICE18x**EM**	800 V	✓	30 W, 45 W, 60 W	✓	✓		
ICE1xx**LM**	800 V 950 V	✓	30 W, 45 W, 60 W	✓			

Features and protections functions

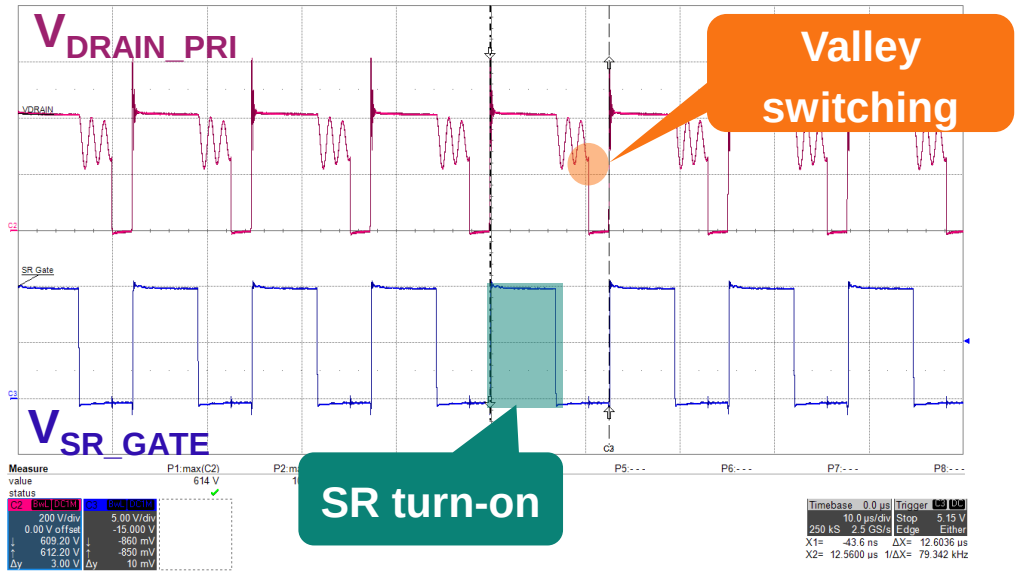
Variant	Switch	Soft start	Frequency Jittering	Hysteretic Mode Operation	Digital frequency reduction	Input OVP	Brown in/out protection	VCCP/ VCCS OVP & UVP	VCCP short to GND protection	OTP	CS, ZCDP pin protection	OCP1/ OCP2	Primary output OVP/UVP	Open-loop/ overload protection
ICE18x**ZCM**	800V	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ICE18x**XM**	800V	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ICE18x**EM**	800V	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ICE1xx**LM**	800V 950V	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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CoolSET™ SiP

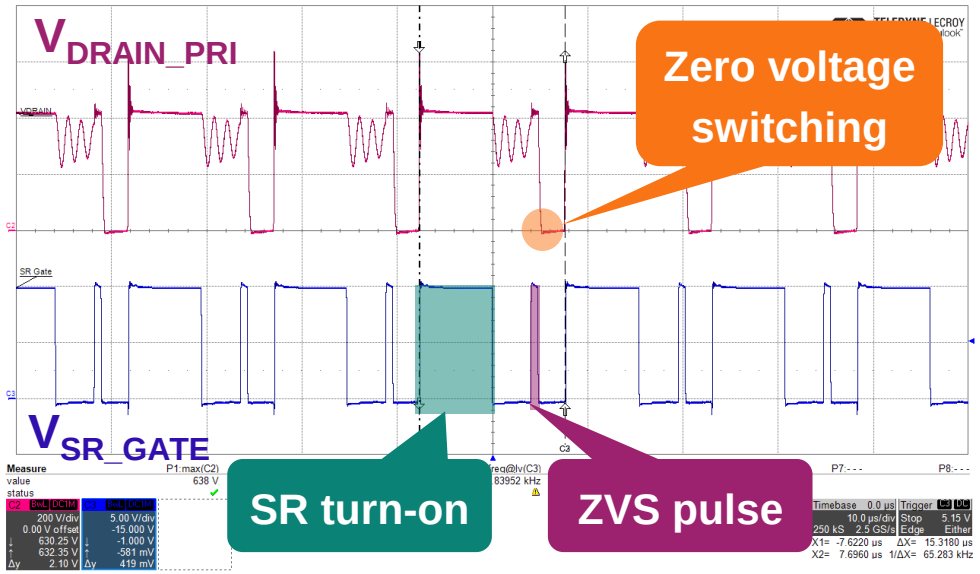
Advantage of novel zero voltage switching (ZVS) flyback

Without ZVS



- With ZVS disabled, the system operates in normal valley switching
- C_{OSS} charge of the primary MOSFET is discharged across the MOSFET itself and becomes switching loss

With ZVS



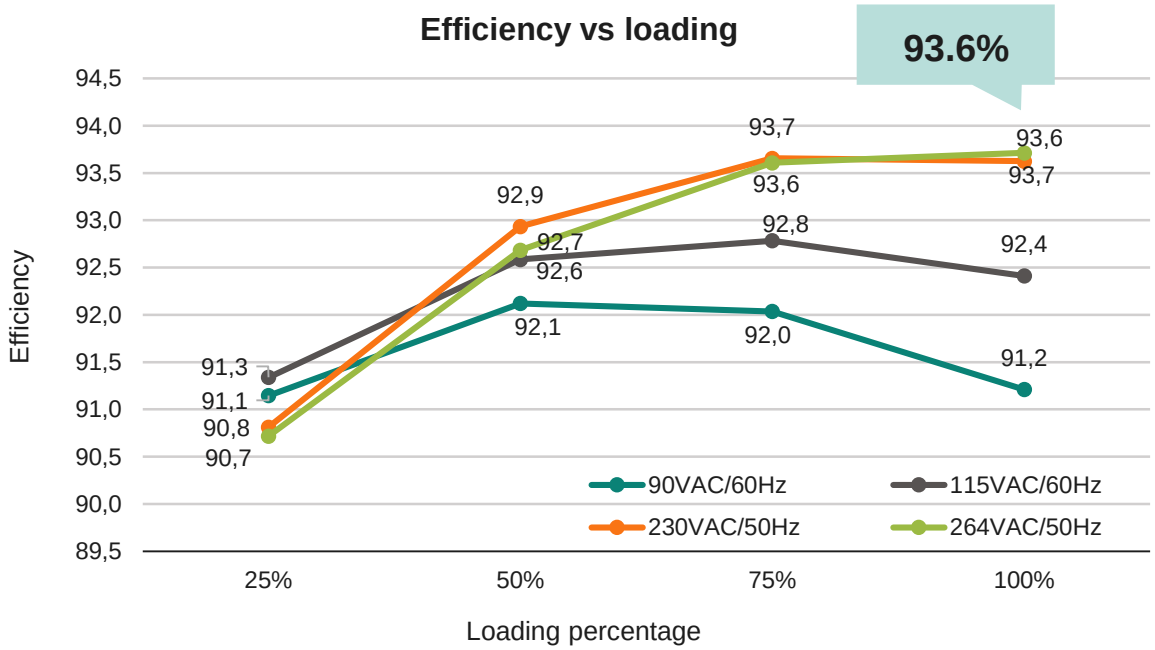
- With ZVS enabled, ZVS pulse is introduced to turn on SR MOSFET to achieve zero voltage switching
- ZVS pulse create a negative current through magnetizing inductance to recycle C_{OSS} charge of the primary MOSFET back to input bulk capacitor

✓ **CoolSET™ SiP's novel ZVS flyback operation recycling C_{OSS} charge to minimize switching loss**

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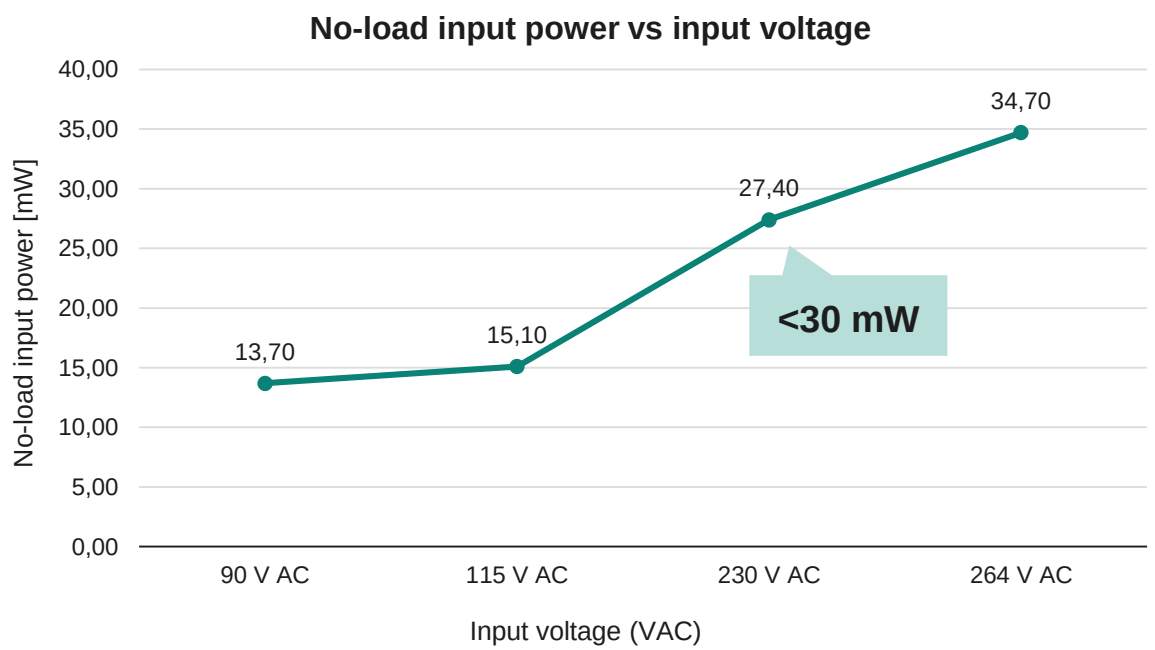
Efficiency curve and no-load input power
(REF_60W1_ZVS_186EM)

Efficiency curve



Full-load efficiency at 230 VAC = **93.6%**

No-load input power at 230 VAC



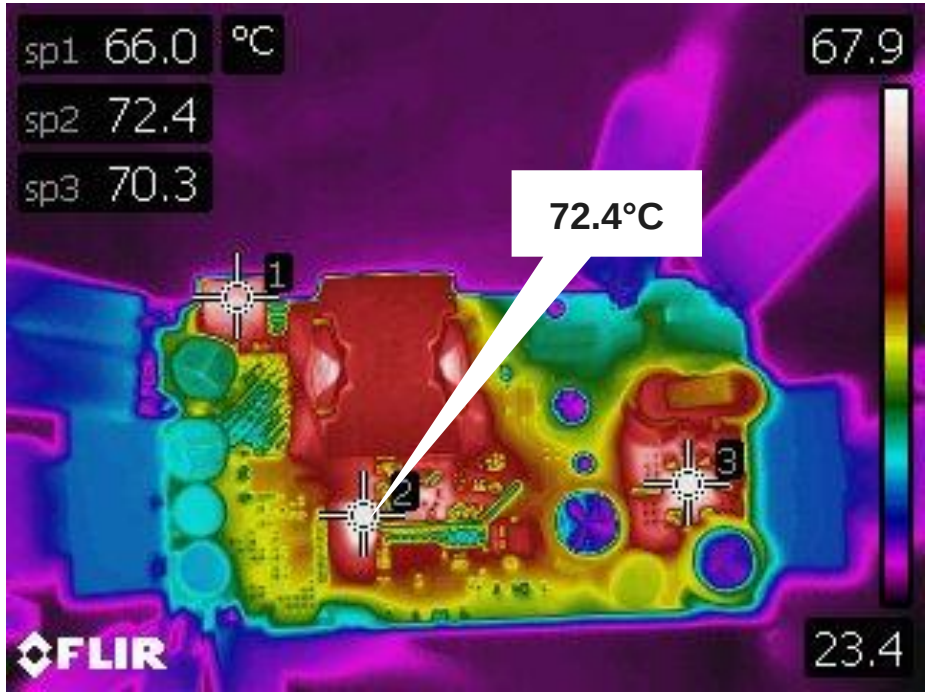
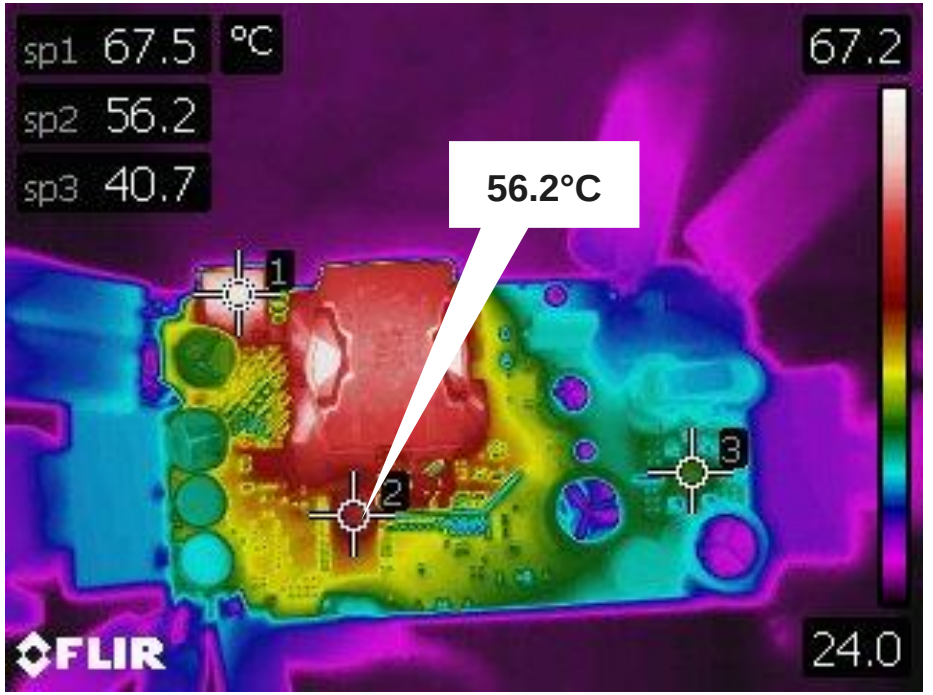
No-load input power at 230 VAC **<30 mW**
(*LDO and discharge resistor removed)

CoolSET™ SiP's optimized operation enables higher efficiency and lower standby power

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60 W reference board thermal performance

(REF_60WD1_ZVS_186EM, open case, T_{amb} = 25°C)

90 VAC	230 VAC
	
CoolSET™ SiP top package temperature = **72.4°C**	CoolSET™ SiP top package temperature = **56.2°C**

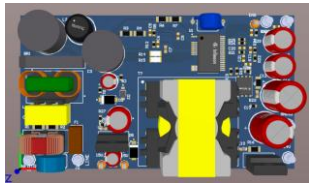
CoolSET™ System in Package (SiP) can deliver higher power in a small PG-DSO-27 SMD package

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CoolSET™ System in Package (SiP)

Reference boards featuring EM, XM and ZCM variants

Marcom: Insert webpage links once available

Board name (CoolSET™ SiP p/n)	Pout	Feature set	V_{in} range	Vout_1	Vout_2	Vout_n on iso	η at 230 VAC full load	
REF_45W1_ZVS_184EM (ICE184EM)	45 W	Enable Pin (ENS / ENP)	90 ~ 264 VAC	12 V / 3.75 A	-	15 V / 0.15 A	>92%	
REF_45W1_ZVS_184ZCM (ICE184ZCM)	45 W	AC Zero Cross Detection + X-Cap Discharge	90 ~ 264 VAC	12 V / 3.75 A	-	15 V / 0.15 A	>92%	
REF_45W1_ZVS_184XM (ICE184XM)	45 W	X-Cap Discharge + Enable pin (ENS / ENP)	90 ~ 264 VAC	12 V / 3.75 A	-	15 V / 0.15 A	>92%	
REF_60W1_ZVS_186EM (ICE186EM)	60 W	Enable Pin (ENS / ENP)	90 ~ 264 VAC	12 V / 5 A	-	15 V / 0.15 A	>93%	
REF_60WD1_ZVS_186EM (ICE186EM)	60 W	Enable Pin (ENS / ENP)	90 ~ 264 VAC	12 V / 2.5 A	24 V / 1.25 A	15 V / 0.15 A	>91%	

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CoolSET™ System in Package (SiP)

Reference boards featuring LM variants

Marcom: Insert webpage links once available

Board name (CoolSET™ SiP p/n)	Pout	Feature Set	V_{in} range	Vout_1	Vout_2	Vout_non iso	η at 230 VAC full load	
REF_45W1_ZVS_184LM (ICE184LM)	45 W	Lite	90 ~ 264 VAC	12 V / 3.75 A	-	-	>92%	
REF_30W1_ZVS_183LM (ICE183LM)	30 W	Lite	90 ~ 264 VAC	12 V / 2.5 A	-	-	>92%	

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CoolSET™ System in Package (SiP)

Key features and benefits

Key features	Key benefits	Value proposition to customer
– **CT Link** technology for primary/secondary isolation – Comprehensive **protection features** – Integrated **800 V / 950 V CoolMOS™ P7**	– High magnetic field immunity – High system robustness – Proven lowest field failure rates	– **High reliability**

– **Integration of primary/secondary functionality**
– **Extra value-added features**
– **Zero-voltage switching** (ZVS)
  – with current injection via SR switch
  – enabling for higher switching frequency
	– Small PCB size and low BOM count
	– Reduced component count
	– Less design-in complexity
	– No extra BOM cost for ZVS
	– Smaller magnetic components
		– **Less complexity**
		– **Reduced space**
		– **Lower system cost**

– **>93%** peak efficiency and **<30 mW** stand-by – **Up to 60 W** without heatsink **in small** SMD **footprint** – **ZVS QR flyback** operation	– Easy to meet energy standards – Future proof solution – High efficiency	– **High performance**

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