



STMicroelectronics IPD Release to Market - Italy

July 2012

Agenda

- Power Conversion & Lighting
 - VIPer+ Family Extension: VIPer06, VIPer37, VIPerA16
 - New Resonant Controller: L6699
 - DC-DC Converters: ST1S40/1, ST1S31/2
 - HVLED Family Extension: HVLED815PF
 - DC-DC LED Drivers: LED2000
- Motor Control & Factory Automation
 - dSPIN & easySPIN
 - IOLink Master: L6360
- Discretes
 - LED Bypass: LBP01 Family
 - SiC Diodes - 2nd Generation
 - SuperMESH 5



VIPer06, VIPer37 & VIPerA16

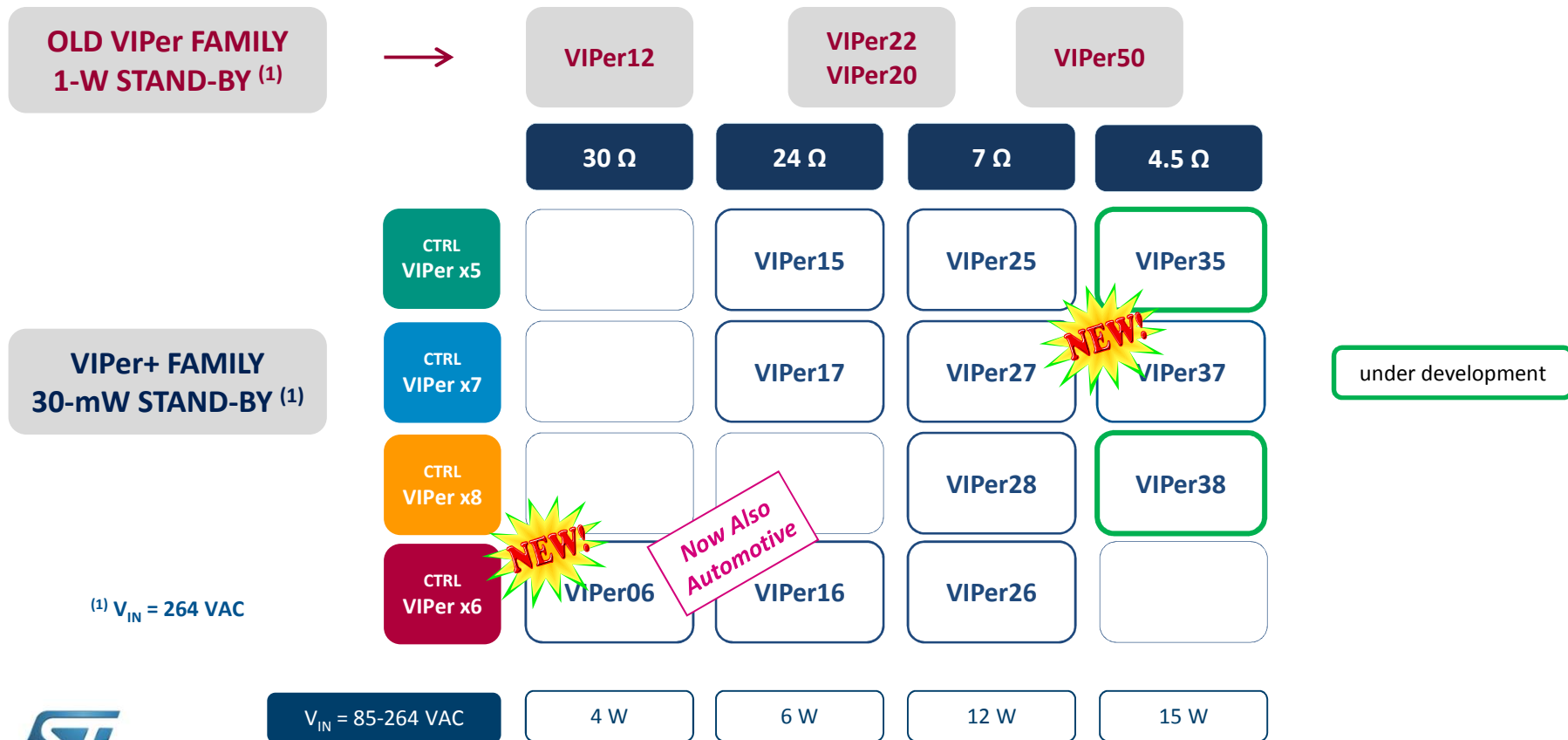
New 800-V Offline Converters

VIPer Family Extension

RtM, H1 2012

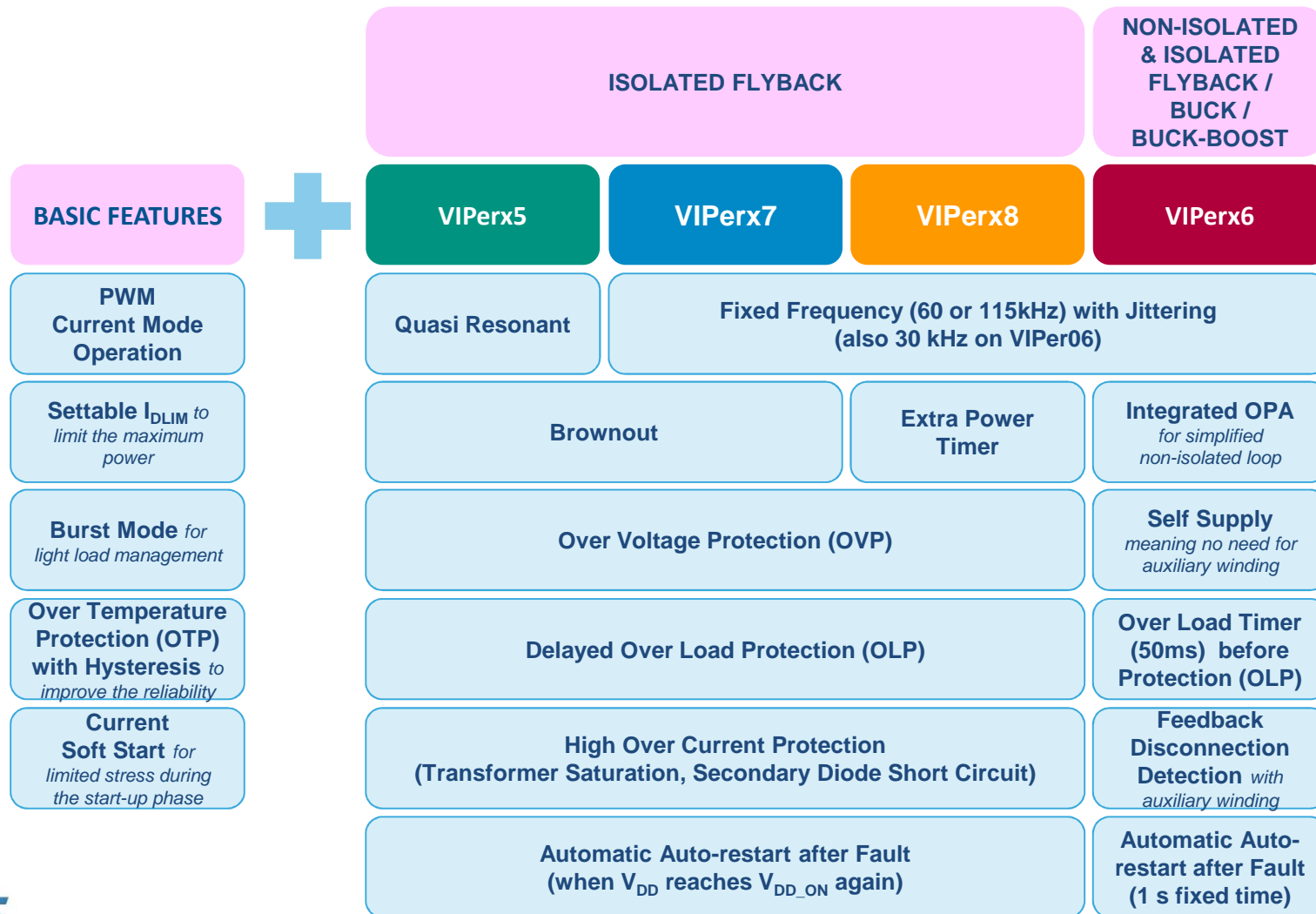
Refresh on VIPer+ Family: Portfolio

- VIPer xy :
 - x identifies the size of the Power MOS (hence, the Power Range)
 - y identifies the kind of Controller (hence, the Features)



⁽¹⁾ $V_{IN} = 264 \text{ VAC}$

VIPer+ Family: Features



VIPer+: Family Extension

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- VIPer06

- Up to 4 W
- Replacement of capacitive power supplies

- VIPer37

- Up to 15 W

- VIPerA16

- Automotive Grade version of VIPer16
- Born for Hybrid & Electric Vehicles
- Suitable for StreetLighting (-40 °C)



VIPer06: Positioning

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Auxiliary AC-DC power supplies up to 4W for

- White goods
- Small appliances and power tools
- E-meters
- Industrial (Home/Building Automation, Motor control...)



800V avalanche-rugged integrated MOSFET
and low standby



Operating frequencies for different needs

30kHz for VIPer06Xx

60kHz for VIPer06Lx

115kHz for VIPer06Hx

now available also on eDesignSuite !!!

www.st.com/edesignsuite

FROM FEATURES TO BENEFITS

Common to all VIPer Family

800V avalanche rugged MOSFET

- Market benchmark
- Application cost reduction
- Superior reliability

Common to all VIPer Family

Internal R_{SENSE} for Current Sensing

- No Need of External R_{SENSE}
- Lower Dissipation

Small internal MOSFET

- Cost-effective **replacement of capacitive power supplies** (SMPS in refrigerators, dimmers, home automation...)

Available op-amp

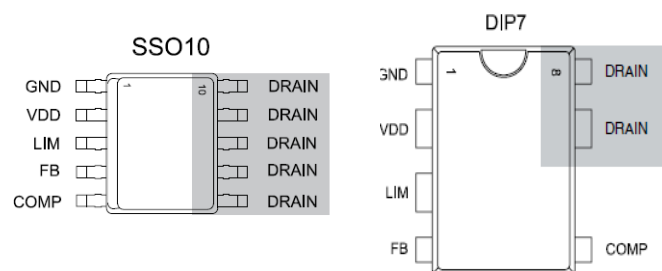
- Versatile solution for both isolated / not isolated topologies

Multiple switching frequencies (also 30 kHz)

- **Noise-free** solution for applications where PLM communication is used (**e-meters**)

VIPer06: Product Description

- 800-V avalanche rugged power MOSFET
- PWM controller with drain current limit I_{Dlim}
- Adjustable current limit, I_{Dlim}
- Fixed frequency with Jittering
- High performance for stand-by & efficiency
- No need of auxiliary winding
- Automatic auto restart after faults
- Hysteretic thermal shutdown
- Direct feedback for non isolated SMPS
- Open loop protection



MAIN PARAMETERS	Power MOSFET (SuperMESH)	CONTROLLER (BCD6S)
Break down voltage [V]	800	
R_{DSon} [Ohm] (resp Viper 06 / 16 / 26)	32	
V_{DD} [V]		9 ÷ 23
F_{OSC} [KHz]		30 / 60 / 115
Max I_{Dlim} [mA]		400
R_{THJA} [° C/W]		80
P_{OUT} [W] @ 85-265 V_{AC}		4

- **GND**
controller ground / power MOSFET Source
- **VDD**
controller supply voltage / I_{CHARGE} output current
- **LIM**
Current limit set-up, I_{Dlim}
- **FB**
direct voltage feedback (in case of non isolated SMPS or for primary regulation)
- **COMP**
Compensation network.
Current loop feedback in case of isolated SMPS

VIPer06: Tools and Support

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- Datasheet
- Available at **eDesignSuite**
- Spreadsheet under Development
- Evaluations Boards:

VIPer 37	Order code	Topology	Input VAC	Output	Output	Relevant AN	Reference
VIPER06LS	STEVAL-ISA096V1 Available	Buck-boost	85-265	1W	-12V	UM1470	Small appliances, Industrial
VIPER06HS	V06HS4W-12VFN Available\	Non-Isolated Fly-back	85-265	4W	12V	N.A.	Appliances
VIPER06HN	V06HN4W-12VFN Available	Non-Isolated Fly-back	85-265	4W	12V	N.A.	Appliances
VIPER06XS	V06XS1W-5VB Coming Soon	Buck	85-265	1W	5V	N.A.	Small appliances, Industrial
VIPER06LS	V06LS2W-12VB Coming Soon	Buck	85-265	2W	12V	N.A.	Small appliances, Industrial

...and other coming soon

VIPer06 benchmark

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Device	Mosfet BV [V]	Rds(on) [Ω]	Max pk current [mA]	Device consumption (μ A)	Fsw [kHz]	Output Accuracy [%]	Topol	Package
<u>Viper06</u>	800	32	350	1300	30, 60, 115	5	Flyback Buck BuckBoost	Dip7, SS010
LNK623	700	28	400	520	100	5	Flyback	Dip7, SO8
LNK304	700	28	275	260	66	8	Buck BuckBoost	Dip7, SO8
LNK305	700	14	401	280	66	8	Buck BuckBoost	Dip7, SO8
LNK56x	700	55	136	260	66, 83, 100	10	Flyback	Dip7, SO8
NCP1011	700	35	250	950	65, 100, 130	N.A.	Flyback	Dip7, SOT223

These devices are often in competition
Comparison (green cells) done only on parameters where the benchmark is fair ("apple-by-apple")

VIPer37: Tools and Support

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- Datasheet
- Available on **eDesignSuite**
- Spreadsheet under Development
- Evaluations Boards:

VIPer 37	Order code	Topology	Input VAC	Output	Output	Relevant AN	Reference
VIPER37LE	EVLVIP37L-5V3A Coming soon	Isolated Fly-back	85-265	15W	5V / 3A	AN4007 draft	ATX, USB charger
VIPER37LE	Under development	Isolated Fly-back	230±15%	15W	12V / 1.7A	N.A.	Consumer, Industrial
VIPER37HE	Under development	Isolated Fly-back	85-265	15W	12V / 0.75A 5V / 1.2A	N.A.	Consumer, Industrial

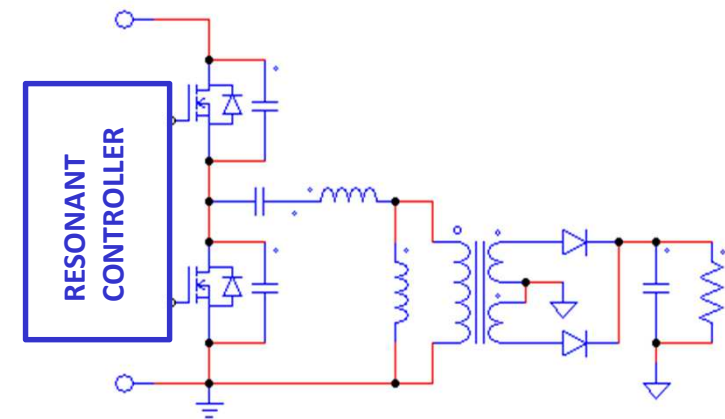


L6699

High Performance Resonant Controller
with High Efficiency at Light Load

RtM, Q4 2011

- L6699 is a HV controller for LLC resonant topologies for power levels starting from around 50/60W
- Suitable for AC-DC SMPS (with or w/o upfront PFC stage) requiring:
 - High efficiency, at full load as well as at lighter load levels
 - Low standby without an auxiliary stage
- Application Examples:
 - SMPS for LV Motors
 - SMPS for LED Lighting
 - General Industrial SMPS



AC-DC SMPS: Resonant Topology

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- High efficiency @ full load but
 - Low efficiency @ light load
 - More external components required → Suitable for high power applications (typically in combination with PFC)
- High efficiency is obtained if Soft Switching occurs (ZVS operation)
- Hard Switching may occur:
 - In case of not proper application circuit design at High Load (Capacitive Mode)
→ DANGEROUS
 - At Light Load
→ LOW EFFICIENCY
 - At Start-up

- **Self Adjustable Dead Time**
 - Dead Time is Longer at Light Load
→ IMPROVED EFFICIENCY AT LIGHT LOAD
- **Anti-capacitive Mode**
 - Rugged Protection that avoids Hard Switching even in case of Not Proper Application Circuit Design
→ HIGHER RELIABILITY
- **Extra Smooth Start-up**
 - Enhanced Soft-Start (in addition to the traditional Frequency-Shift Soft-Start) that avoids Hard Switching at Start-up
→ HIGHER RELIABILITY

L6699 vs. L6599A

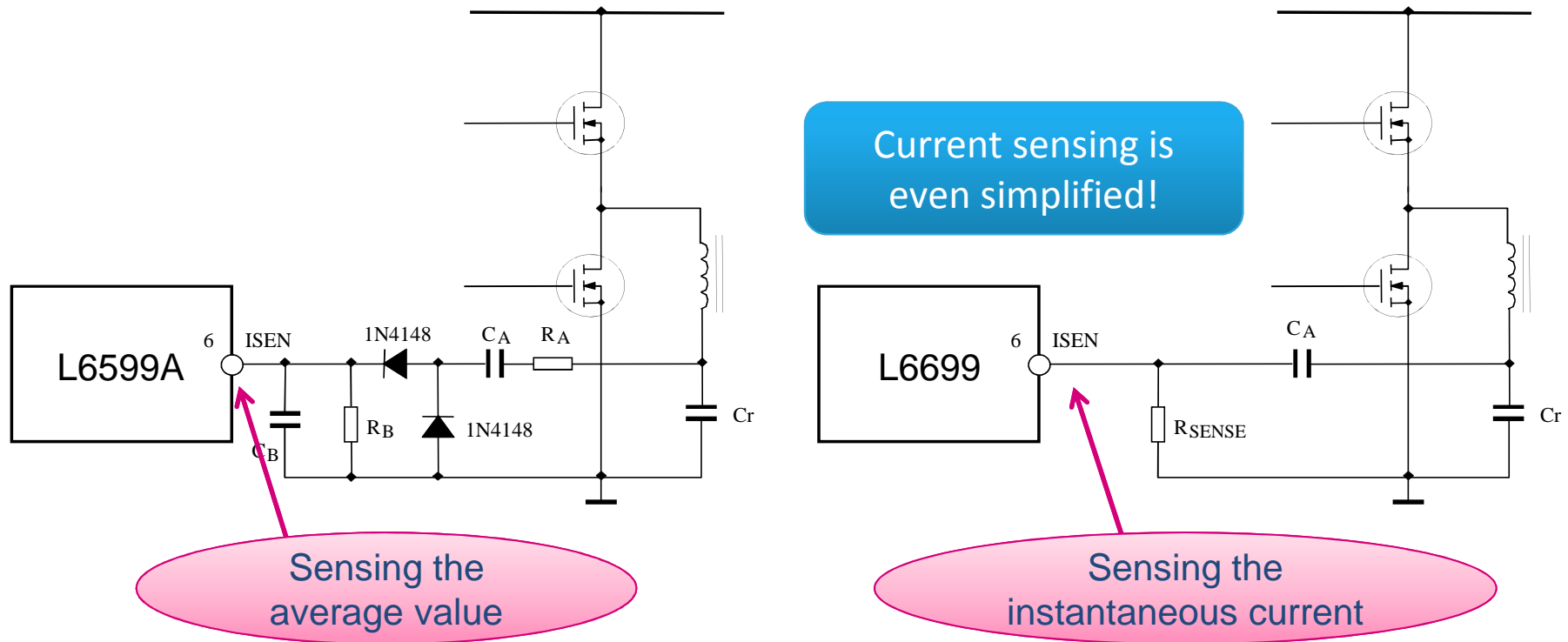
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Feature	L6699	L6599A
Anti-capacitive protection*	YES	NO
Smooth Start-up*	YES	NO
Dead-time*	Self adjusting between 200ns and 700ns	Internally fixed at 350ns (typ)
Over Current Protection	Autorestart or Latch-mode	Latch-mode
Soft burst-mode*	YES	NO
MAX Quiescent Current (I_{Q_MAX})	1.3 mA	2.5 mA
Suggested Max F_{SW}	300 kHz	> 500 kHz

L6699 Additional Features	Benefits
Self-adjustable Dead Time	Improved Efficiency even at Light Load Optimized Transformer Design
Anti-capacitive Protection	Higher System Reliability
Extra-smooth Startup	Higher System Reliability
Soft Burst Mode	No Audible Noise at Light Load

L6699 vs. L6599A: Anti-Capacitive Protection

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- IC checks that tank current is lagging behind applied voltage (positive phase-shift)
- Pushes frequency up if phase-shift gets too close to zero
- Stops switching for 50 μ s and then soft-restarts if phase-shift suddenly becomes negative
- During this idle period the PFC_STOP pin is pulled low to stop the PFC stage as well.

L6699 vs. Competition

L6699 includes *all Advanced Functionalities*

LEADING ROLE IN THE HIGH-END MARKET

PARTS		L6599A	L6699	Comp1	Comp2	Comp3
	Source/Sink Drive Capability	-300/800mA	-300/800mA	-78/107mA	-0.5/1A	-300/480mA
	Adjustable Dead Time	No	0.23~0.7uS	0.5~2.45uS	100nS~2uS	Yes/0.63uS Typ.
	Start-up Current (max)	250uA	300uA	1.2mA	300uA	310uA
	Burst Mode Operation	Yes	Yes	Yes	No	No
	Interface with PFC	Yes	Yes	No	Yes	No
	Internal Bootstrap Diode	Yes	Yes	No	No	Yes
	Operating Temperature (°C)	-40 ~ 150	-40 ~ 150	-20 ~ 85	-40 ~ 140	-25 ~ 70
PROTECTIONS	Delay for OLP	Yes	Yes	Yes	No	No
	2 nd level OCP	Yes	Yes	No	No	No
	Extra Latch protection function	Yes	Yes	No	Yes	Yes
	OTP	No	No	Yes (150° C)	Yes (140° C)	Yes (120° C~150° C)
	Brown-out function	Yes	Yes	Yes	Yes	No
PACKAGE		SO16/DIP16	SO16	DIP16	SO16	SO20

L6699 allows to:

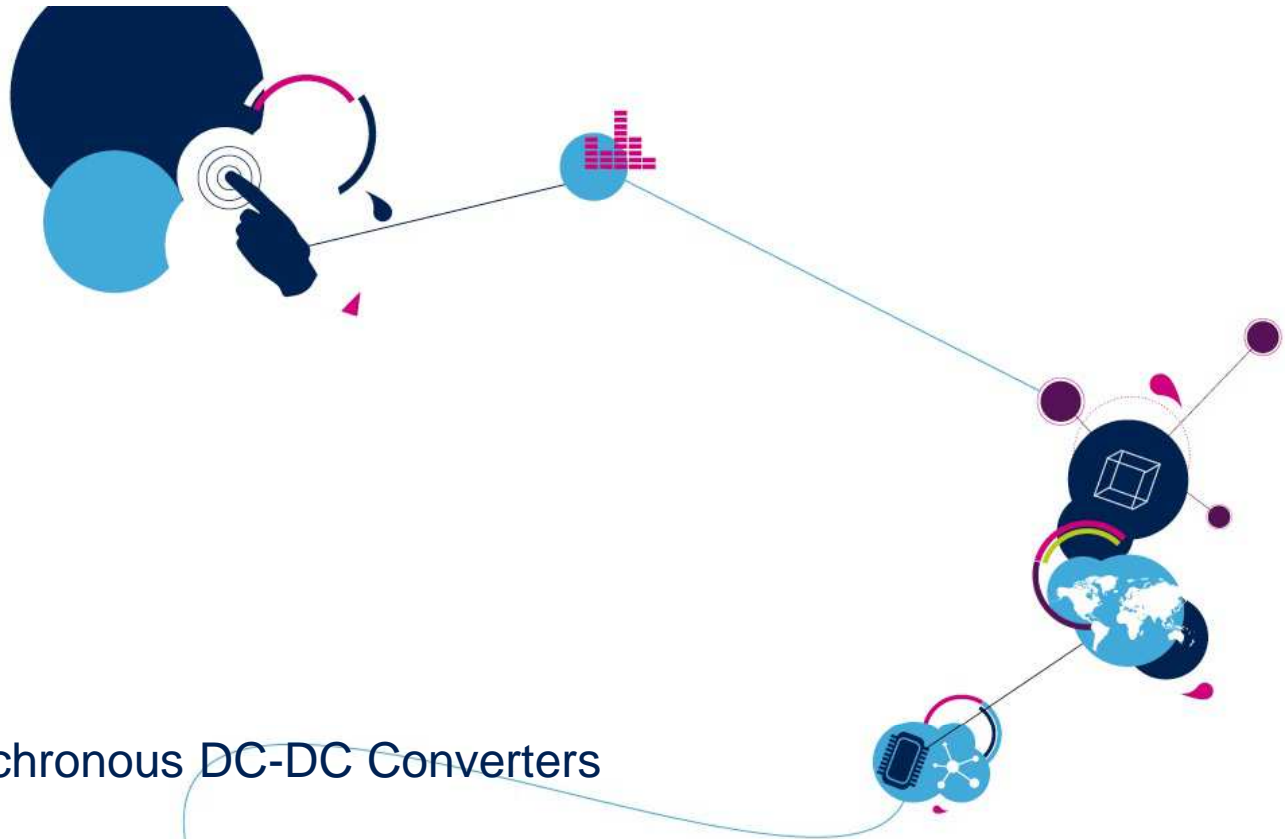
- Approach Sockets where Light Load Management is Too Challenging for a Standard LLC Controller
- Remove the Auxiliary Flyback Stage, in Systems where it is used to Manage Stand-by

- High Efficiency at Light Load
- Improved System Reliability & Lifetime
- No Audible Noise at Light Load
- Demoboards
 - EVL6699-90WADP: 90W/19V SMPS with PFC L6563H
 - EVL6699-150W-SR: 150W/12V SMPS with PFC L6563H & Synchronous Rectification SRK2000
- L6699 design worksheet in progress

ST1S40/1

New 18-V 3/4 A Synchronous DC-DC Converters
for Buck Topologies

RtM, H1 2012



As the ST1S10, the ST1S40 is a 18-V, 3-A Synchronous DC-DC, suitable for Consumer and General Industrial Applications

DIFFERENTIATION WITH RESPECT OF THE ST1S10

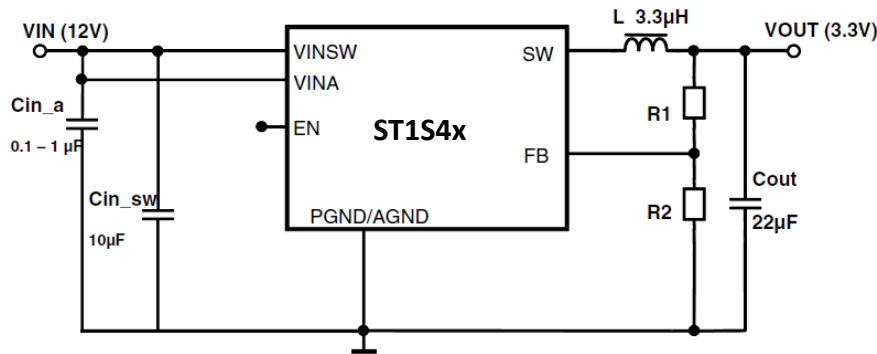
- Realized with a New / More Performing Technology
 - [Performance / Price Optimization](#)
 - [Lower \$R_{DS_ON}\$ \(20/30% reduction\) → Lower Conduction Losses](#)
- No Synchronization Capability
 - Switching Frequency: 850 kHz
- Available also in SO-8L Package
 - SO-8L, HSOP-8L, DFN4X4-8L

Device	LS R_{DS_ON} (m Ω)	HS R_{DS_ON} (m Ω)
ST1S10	100	120
ST1S40	70	95
Reduction	-30%	-20%

3-A and 4-A versions: ST1S40/1

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- V_{IN} : 4 V – 18 V
- V_{OUT} : 0.8 V – V_{IN}
- I_{OUT}
 - 3 A (ST1S40)
 - 4 A (ST1S41)
- **Synchronous Rectification**
(HS: 95 m Ω ; LS: 70 m Ω)
- Switching Frequency: **850 kHz**
- **Internal Compensation**
- Enable
- Internal Soft Start
- **Ceramic C_{OUT} allowed**
- Over Current and Thermal Protections



Typical Application Circuit

Order Code	Package
ST1S40IDR	SO-8L
ST1S40IPHR	HSOP-8L
ST1S40IPUR	DFN4X4-8L
ST1S41IPHR	HSOP-8L
ST1S41IPUR	DFN4X4-8L

ST1S41: Positioning vs. Competition

Feature	ST1S41	COMP. 1	COMP. 1	COMP. 2	COMP. 3
Input Voltage (V)	4 to 18	4.5 to 18	4.5 to 18	4.5 to 21	4.5 to 21
Output current (A)	4	4	4	4	4
Synchronous	Yes	Yes	Yes	Yes	Yes
High Side MOS	95	63	70	120	120
Low Side MOS	69	55	53	40	20
FSW (kHz)	850	~ 700 (Constant ON Time)	~ 650 (Constant ON Time)	500	300 to 2000
Iq SHDN/ OPER (A)	2u/ 1.5m	1.8u/ 0.85m	3u/ 0.95	1u/ 0.7m	< 10u/ 0.7m
Efficiency at Light Load (< 100 mA)	No	Yes	Yes	No	No
Package	QFN4x4-8L / HSOP-8L	HTSSOP-14L	DDA-8L (HSOP-8L)	HSOP-8L	HSOP-8L
N# ext components	6	8	8	8	8
Operating Temperature Range (°C)	From -40 to 125	From -40 to 85	From -40 to 85	From -40 to 125	From -20 to 85

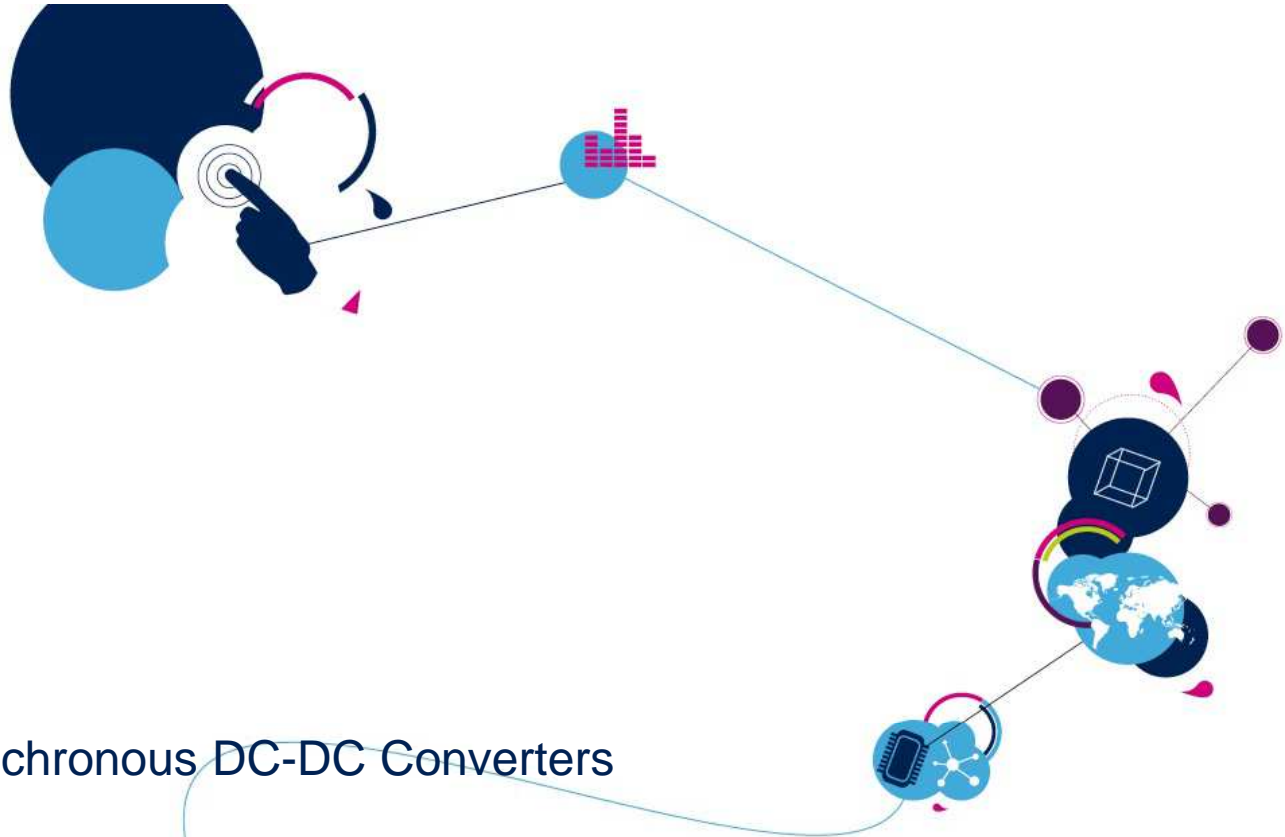
ST1S40/1: Key Messages

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- Compactness
 - Minimum Component Count
 - Available also in DFN Package
- Wide Operating Temperature Range (-40 °C to 125 °C)
- Performance / Price
 - Available also in SO Package (ST1S40) and HSOP Package (both ST1S40/1)
- Demoboards: Available for ST1S40...
 - STEVAL-ISA084V1 (STS40IDR)
 - STEVAL-ISA082V1 (STS40IPHR)
 - STEVAL-ISA083V1 (ST1S40IPUR)



- Demoboards: Coming Soon for ST1S41



ST1S31/2

New 5.5-V 3/4 A Synchronous DC-DC Converters
for Buck Topologies

RtM, Q1 2012

ST1S31 vs. ST1S30

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As the ST1S30, the ST1S31 is a 5.5-V, 3-A Synchronous DC-DC, suitable for Consumer and General Industrial Applications

DIFFERENTIATION WITH RESPECT OF THE ST1S30

- Realized with a New / More Performing Technology
 - Performance / Price Optimization
 - Lower R_{DS_ON} (~50% reduction) → Lower Conduction Losses

- Power Good Pin Also

- Sequencing Allowed

- Package

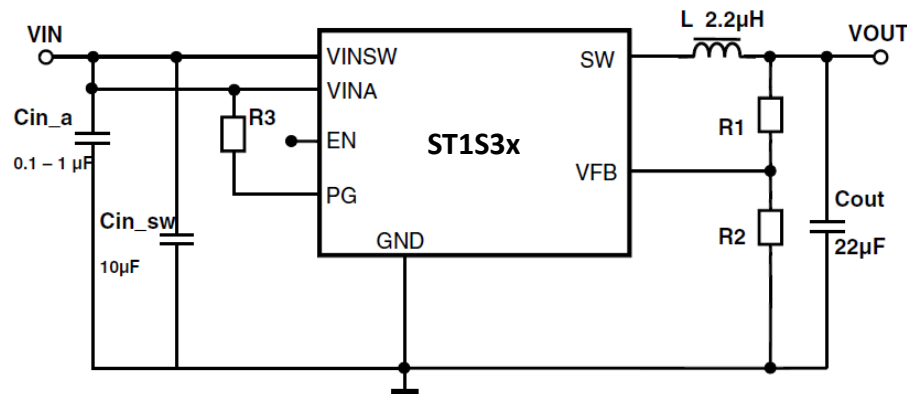
- Smaller Package at Same Current (DFN3X3-8L instead of DFN4X4-8L)

- Available also in SO-8L

Device	LS R_{DS_ON} (mΩ)	HS R_{DS_ON} (mΩ)
ST1S30	100	100
ST1S31	45	60
Reduction	-55%	-40%

3-A and 4-A versions: ST1S31/2

- V_{IN} : 4 V – 5.5 V
- V_{OUT} : 0.8 V – V_{IN}
- I_{OUT}
 - 3 A (ST1S31)
 - 4 A (ST1S32)
- **Synchronous Rectification**
(HS: 60 m Ω ; LS: 45 m Ω)
- Switching Frequency: **1.5 MHz**
- **Internal Compensation**
- Enable
- Internal Soft Start
- **Ceramic C_{OUT} allowed**
- Over Current and Thermal Protections



Typical Application Circuit



Order Code	Package
ST1S31DR	SO-8L
ST1S31PUR	DFN3X3-8L
ST1S32PUR	DFN4X4-8L

ST1S31/2: Positioning vs. Competition

Feature	ST1S31/2	COMP. 1	COMP. 2	COMP. 3
Input Voltage (V)	2.8 to 5.5	2.6 to 5.5	2.7 to 5.5	2.9 to 6
Output Current (A)	3/4	2	3	3
Synchronous Rectification	YES	YES	YES	YES
Switching Frequency (MHz)	1.5	1	1	1.1 Synchr. $\pm 20\%$
HS R _{DS_ON} (m Ω)	60	142	60	19
LS R _{DS_ON} (m Ω)	45	56	N.A.	N.A.
I _Q (A)	220 μ	340 μ	630 μ	2.2 m
Package	DFN3x3-8L SO-8	WQFN3x3-16L	HSOP-8L	DFN4x4-8L
Power Good	YES	NO	NO	YES

ST1S31/2: Key Messages

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- Compactness
 - Minimum Component Count
 - Available also DFN Package (both ST1S31/2)
- Wide Operating Temperature Range (-40 °C to 125 °C)
- Performance / Price
 - ST1S31 available also in SO Package
- Demoboards Available
 - STEVAL-ISA070V1 (STS31D-R)
 - STEVAL-ISA069V1 (STS31PUR)
 - STEVAL-ISA068V1 (ST1S32PUR)



A7985/6

New 38-V 2/3-A DC-DC Converters for Automotive
AEC-Q of L7985/6

RtM, Q4 2011

A7985/6: Product Overview

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KEY FEATURES

- V_{IN} : 4.5 V to **38 V**
- V_{OUT} : 0.6 V to V_{IN}
- I_{OUT} : **2/3 A DC**

• Adjustable F_{SW} : 250 kHz to 1 MHz →

• Synchronization Capability
with 180° Phase Shift →

• P-channel MOS →

• Internal Soft-start →

• Ceramic C_{OUT} Allowed →

• **AEQ100 Qualification**

PACKAGE: HSOP-8L



BENEFITS

High Flexibility

- High F_{SW} : Smaller Components
- Low F_{SW} : Lower Switching Losses

→ Easier to Filter Noise / Less Dissipation
when 2 devices are supplied together

→ No Need for Bootstrap Capacitor

→ No Inrush Currents

→ Smaller/Cheaper/More Reliable C_{OUT}

→ **Suitable in Automotive Applications**

A7985/6: Typical Applications

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- Dashboard

- μ C / Digital Devices
- Warning Lights



- Car Infotainment

- μ C / Digital Devices
- Climate Control
- Audio



- Gateway



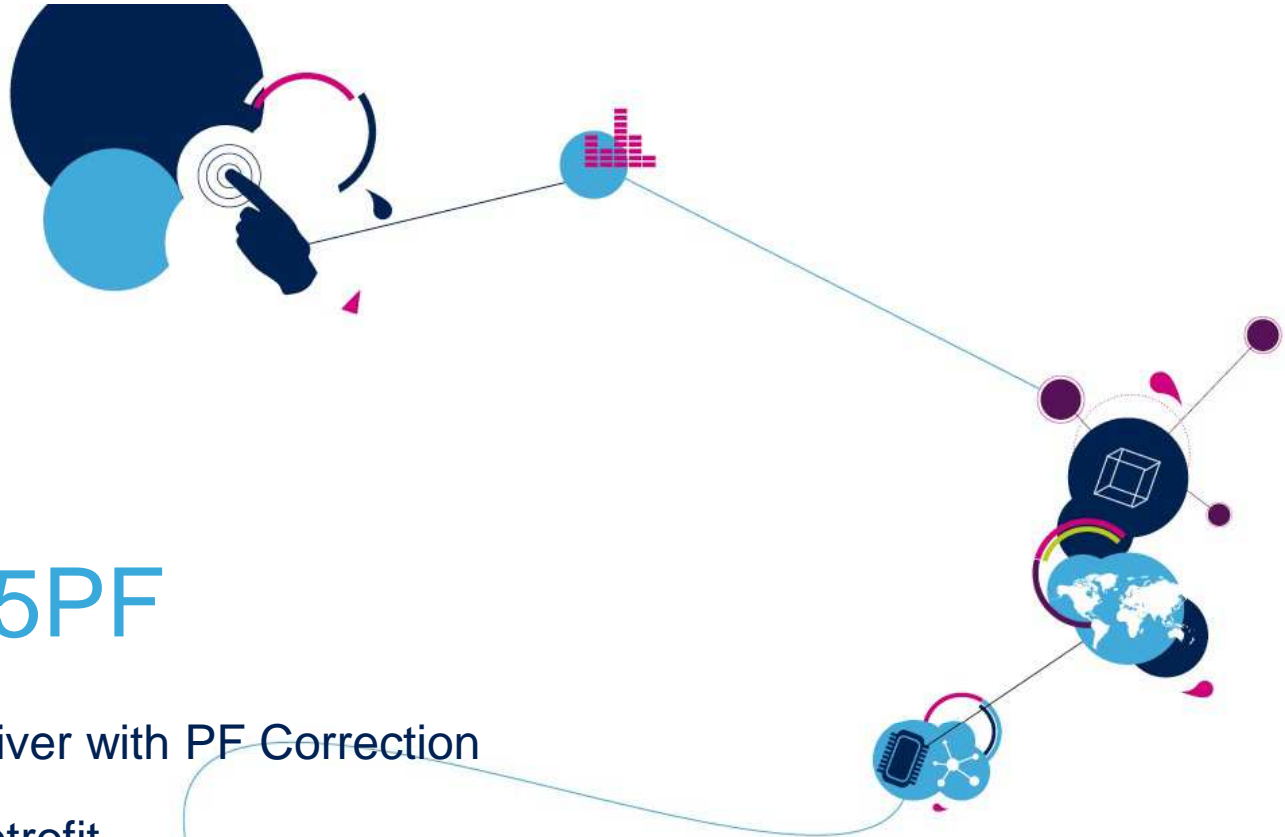
Positioning in ST Portfolio for Automotive

Feature	A7985A/6A	L7986TA	A597x	B5973D	A6902D
AUTOMOTIVE QUALIFICATION	YES, AEQ100	NO, Temperature Testing Only *	YES, AEQ100	YES, AEQ100 + BURN IN **	YES, AEQ100
V_{IN} (V)	4.5 to 38	4.5 to 38	4.4 to 36	4.4 to 36	8 to 36
I_{OUT} (A)	2/3	3	Up to 3	2	1
R_{DS_ON} (m Ω)	200	200	250	250	250
F_{SW} (kHz)	250 Adj. up to 1000	250 Adj. up to 1000	250	250	250
Soft Start	Internal	Internal	NO	NO	NO
Synchronization Capability	YES, 180° Phase Shift	YES, 180° Phase Shift	YES, no Phase Shift	YES, no Phase Shift	NO
Ceramic C_{OUT}	YES	YES	Not Recommended	Not Recommended	YES
EN / INH	YES, Enable	YES, Enable	YES, Inhibit	YES, Inhibit	NO
Package	HSOP-8L	HSOP-8L	HSOP-8L	HSOP-8L	SO-8L

A7985/6: Key Messages

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- New DC-DC for Automotive with:
 - Improved Performance / Features
 - Improved BOM (Less / Smaller / More Reliable External Components)
- Competitive *Performance-Price* Ratio
- Recommended for New Designs vs. A597x
- Demo-boards on Request



HVLED815PF

New Off-line LED Driver with PF Correction

for Isolated Lamp Retrofit

HVLED Family Extension

RtM, Q2 2012

Refresh on HVLED805...

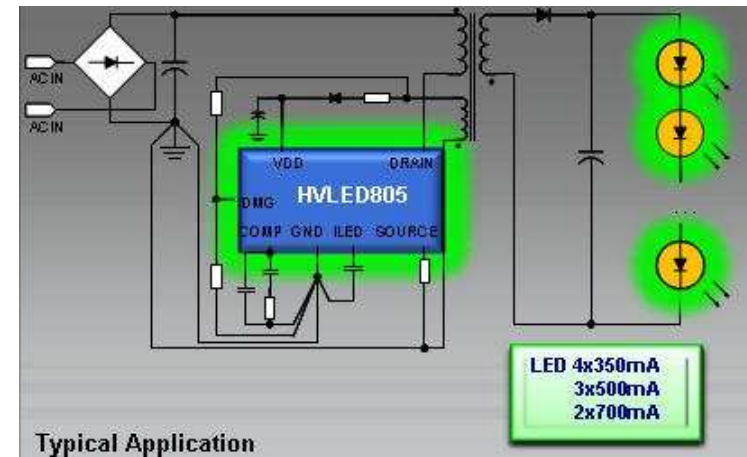
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- Offline LED Driver - dual-chip:
 - 800-V Avalanche Rugged MOS
 - High Performance Controller



- Applications

- Fixed-Light Lamp Retrofit for Power up to 5 W *



- **5% Current ACCURACY** → **State-of-the-Art LED Current Precision**
- **No Opto-coupler & CC controller** → **Low BOM**
- **Internal 800-V MOSFET** → **High Reliability (Market Benchmark)**
- **Adjustable Over Voltage Protection** → **Protection against LED String Open**
- **Quasi-Resonant OM** → **High Efficiency**
- **Automatic Self Supply** → **Operation with variable number of LEDs**

- EVALHVLED805: Up to 4.2 W, 350 mA
- STEVAL-ILL037V1: 3.2 W, 200 mA

...now up to 15 W and with PF Correction: HVLED815PF

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All benefits of HVLED805 and...

- **Extended Power Range** (up to 15 W)
- **Power Factor Correction** Available
- First Results of **Dimmability with Triac-Dimmers**: already Available Boards in US V_{IN}



Power Factor > 0.9 !

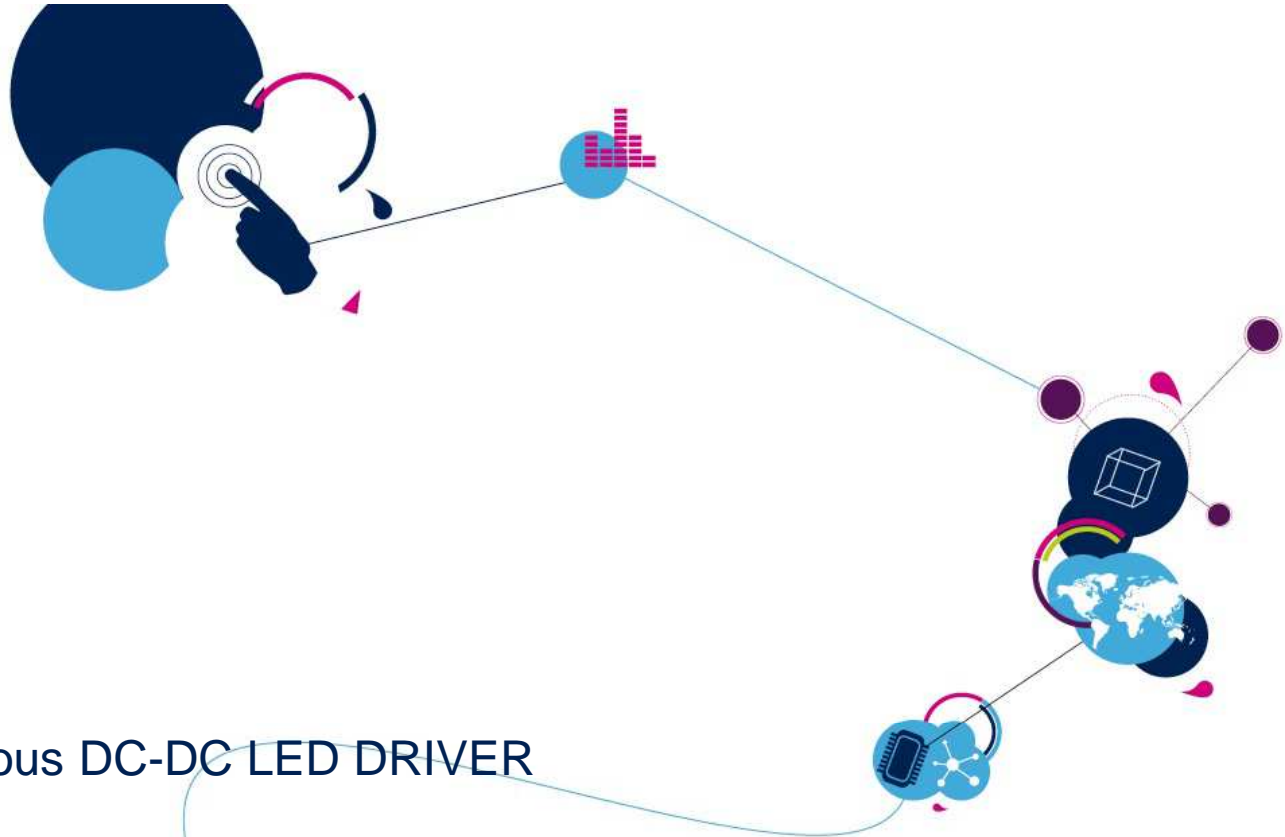
...compliant with



HVLED815PF: Key Messages

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- Offline LED Driver with Extended Power Range
- Low BOM
 - No Opto-Coupler
 - No Current Controller
- Power Factor Correction
 - $PF > 0.9$ → To Meet Present & Future Regulations
- First Results of Dimmability with Triac-Dimmers
- ...and the 7-W version to come: HVLED807PF



LED2000

New 18-V Synchronous DC-DC LED DRIVER

With Superior Dimming Capability

RtM, Q2 2012

LED2000: Positioning vs. ST1CC40

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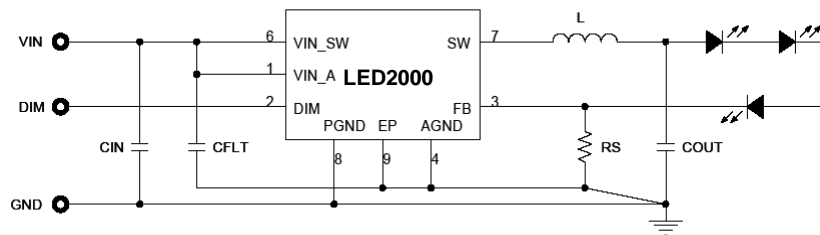
As the ST1CC40, the LED2000 is a 18-V DC-DC LED Driver for High-Brightness (HB) Lighting Applications (up to 3 A)

- Common Features:
 - Very low sensing voltage for low dissipation: **100 mV**
- Specific Features:
 - **ST1CC40:**
 - INHIBIT PIN: when Low Consumption at Stand-by is required
 - **LED2000:**
 - PWM PIN: when High Frequency Dimming is required
- Applications:
 - Torches, Flash Lights, Home Appliances, General Lighting

LED2000: Product Overview

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- V_{IN} : 4 V – 18 V
- I_{OUT} : 3 A
- **Sensing Voltage: 100 V**
- **PWM Dimming Capability**
- Switching Frequency: 850 kHz
- Synchronous Rectification
(HS: 95 m Ω ; LS: 70 m Ω)
- Internal Compensation
- Enable
- Internal Soft Start
- Ceramic C_{OUT} allowed
- Over Current and Thermal Protections
- Packages
 - SO-8L
 - DFN4x4-8L



Order Code	Package
LED2000PUR	DFN4X4-8L
LED2000DR	SO-8L

LED2000: Key Messages

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- **Dedicated to LED Driving**
 - Very low Sensing Voltage for Low Dissipation
 - PWM Dimming
- **High Efficiency**
 - Very low Sensing Voltage for Low Dissipation
 - Low R_{DS_ON} → Low Conduction Losses
 - Synchronous Rectification
- **Compactness**
 - Minimum Component Count (Synchronous Rectification + Internal Compensation)
 - Reduced External Components Dimensions (High F_{SW} + Ceramic C_{OUT} allowed)
 - Available also in DFN Package
- **Interesting Price**
 - Available also in SO Package

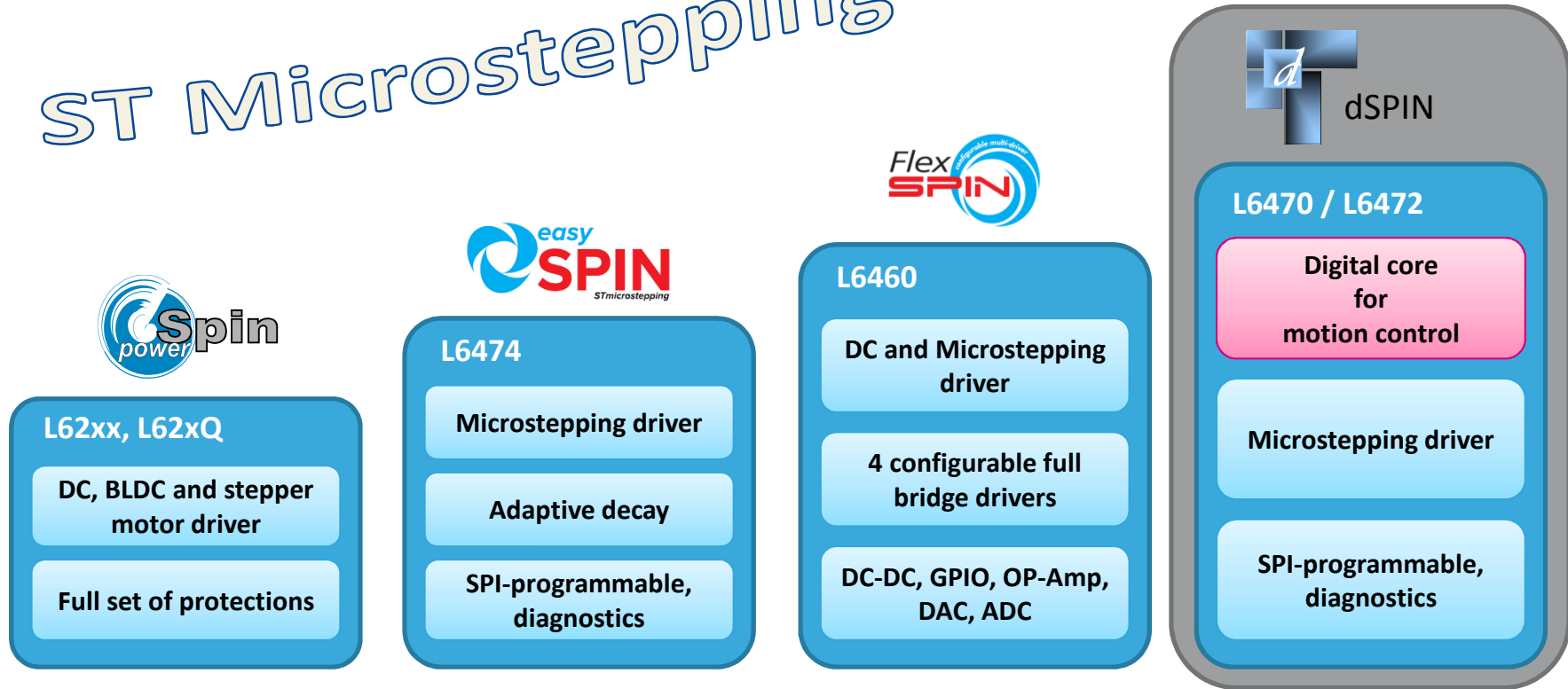


L6472 dSPIN & L6474 easySPIN

LV Motor Drivers for Microstepping
xSpin Family Extension
RtM, H1 2012

xSPIN Product Family Overview

ST Microstepping

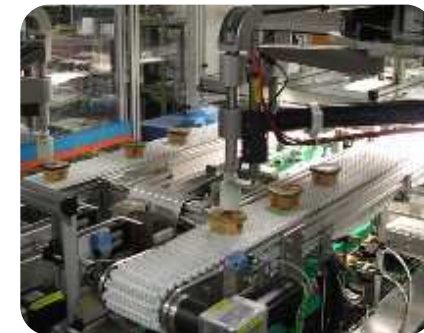


Performance and integration

Microstepping motors applications

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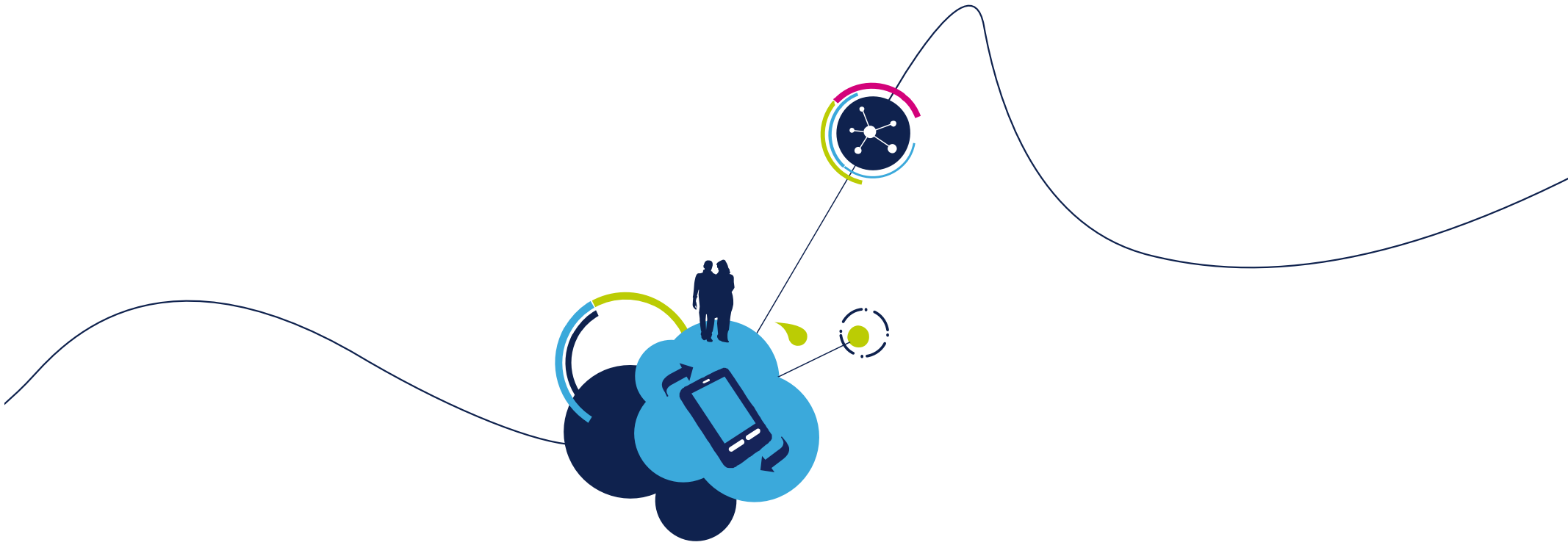
- Microstepping motors allow precise angular positioning and show non-zero (holding) torque of the motor shaft when stationary
- Holding torque maintains desired position while under external load
- Wide applications area:
 - Industrial (NC machines, robotics, PCB assembly...)
 - Office/POS equipment (printers, ticket machines, bill counters, camera positioning...)
 - Medical (diagnostic equipment, pumps...)



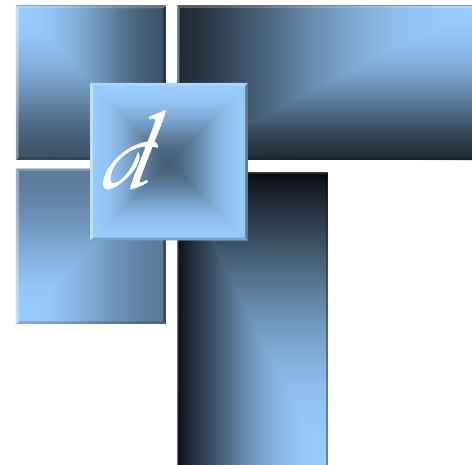
dSPIN & easySPIN: born for Stepper Motors

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- dSPIN and easySPIN: dedicated to 2-phase Bipolar Stepper Motors
 - 2 Full Bridges
 - Complex Motion Control Unit
 - SPI interface for easy configuration
 - Rich Protection Features
- Already Mature
 - **L6470: dDPIN** - Voltage Mode (128 μ steps)
- Now also
 - **L6472: dDPIN** - Current Mode (16 μ steps)
 - **L6470: easySPIN**



L6472 dSPIN



L6472 dSPIN – Feature-Rich and Flexible microstepping motor driver

Integrated ADC

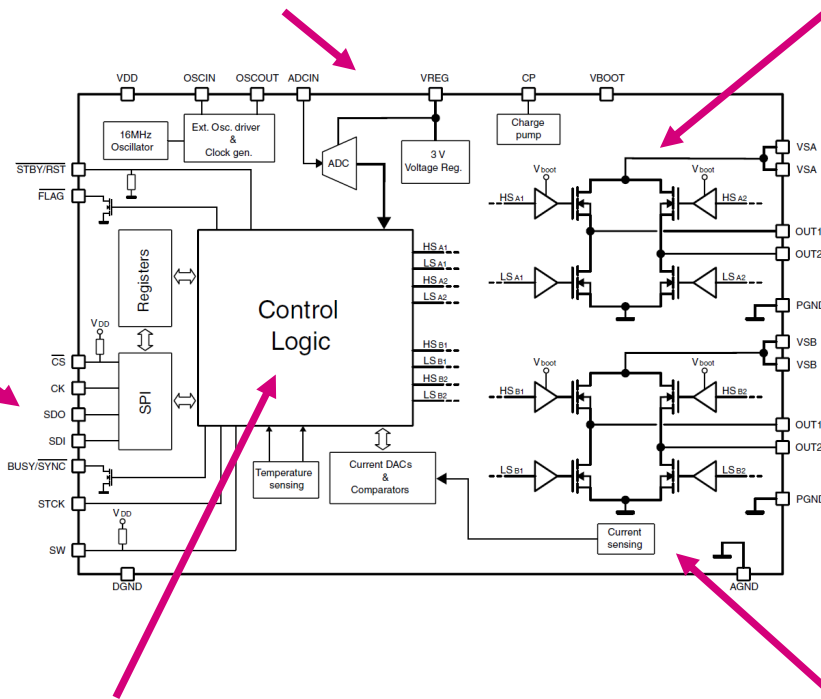
- Optional external torque regulation or
- User-defined function

Dual DMOS full-bridge

- Allows direct connection of two-phase bipolar stepper motor

SPI interface with daisy-chain feature

- Multiple drivers can be controlled by a single microcontroller (STM32)

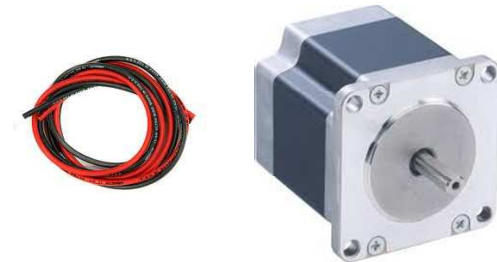


Intelligent Motion Control Logic

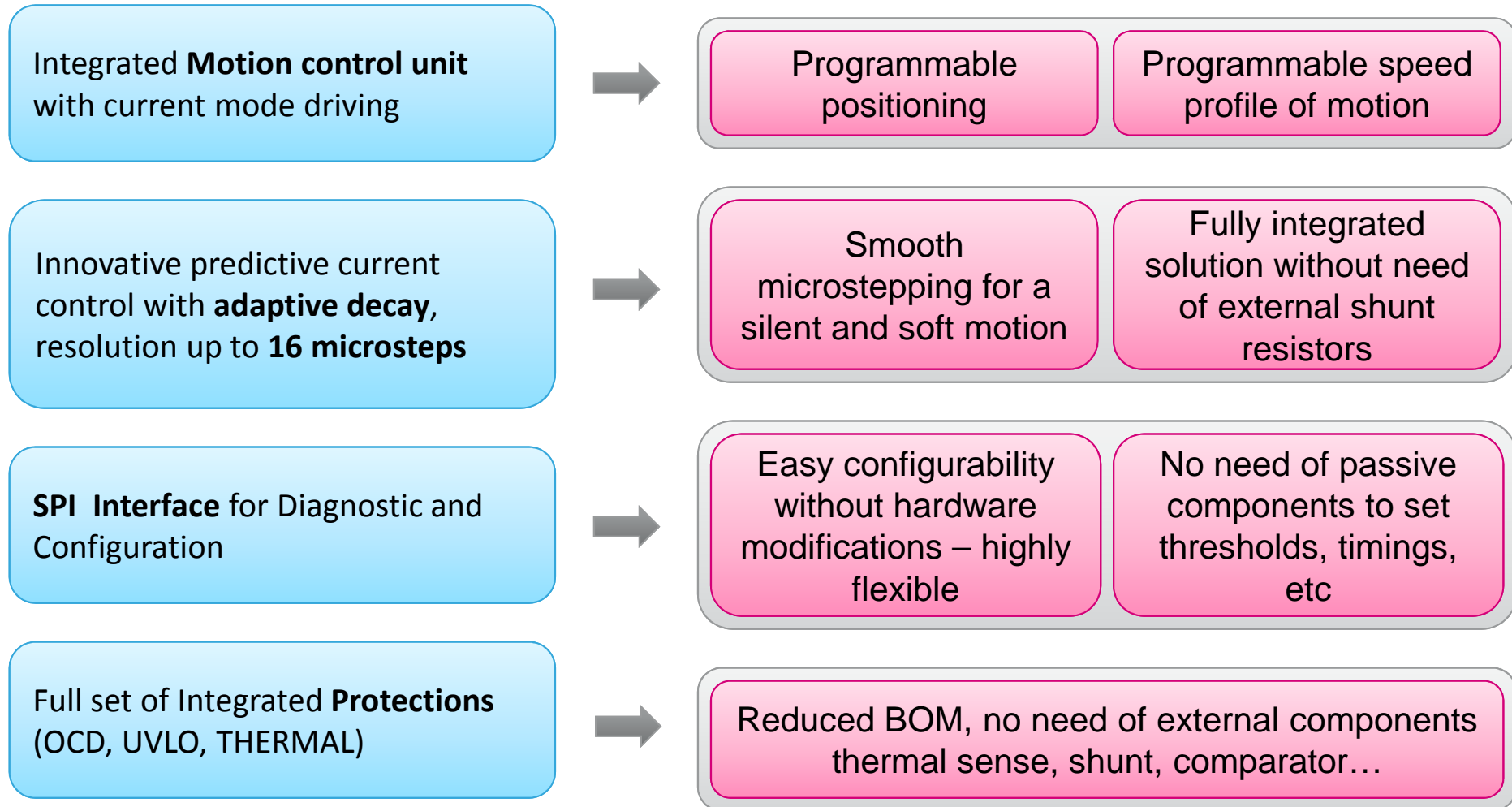
- Predictive current control
- Average phase current is controlled
- Phase current decay is automatically selected to

Non-dissipative current sensing + thermal protection

- No need of external components



Flexible innovative microstepping motor driver



Ordering Information & Available Tools

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- Product page: www.st.com/dspin
- **dSPIN** order codes:
 - L6472H (TR) HTSSOP28, Tube (Tape and reel)
 - L6472PD (TR) POWERSO36, Tube (Tape and reel)
- **dSPIN** price information:
 - L6472 price ranges between the L6474 (easySPIN) and the L6470 (dSPIN Voltage Mode / 128usteps)
- Evaluation boards:
 - dSPIN evaluation board **EVAL6472H**
 - Communication board **STEVAL-PCC009V2**
- PC Application with Graphical User Interface

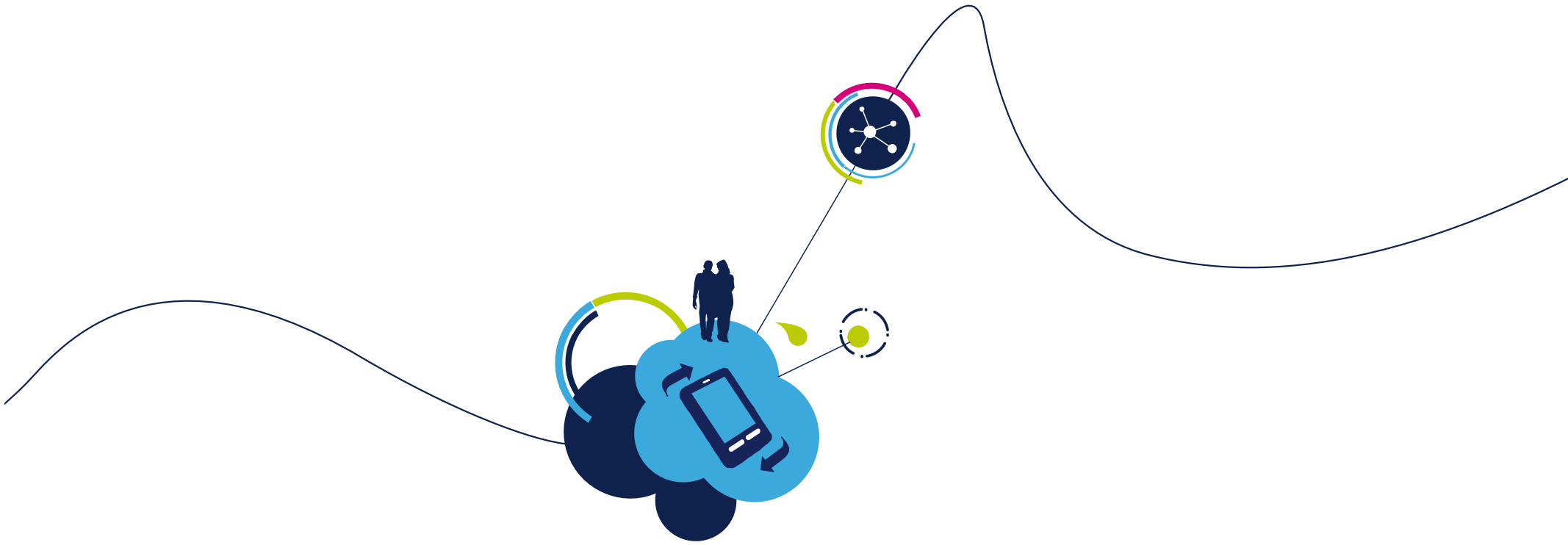


L6472H

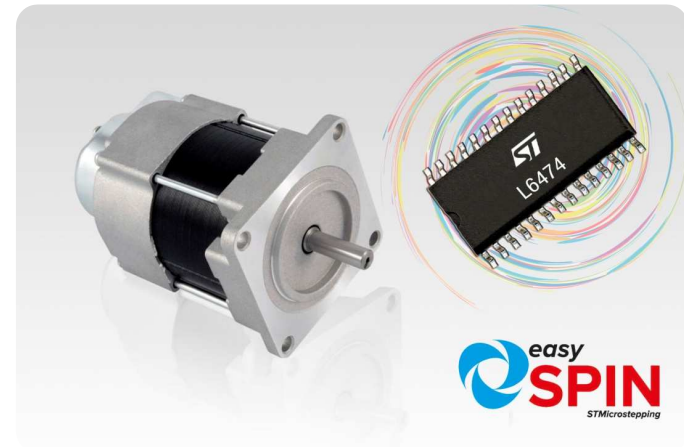


L6472PD





L6474 easySPIN

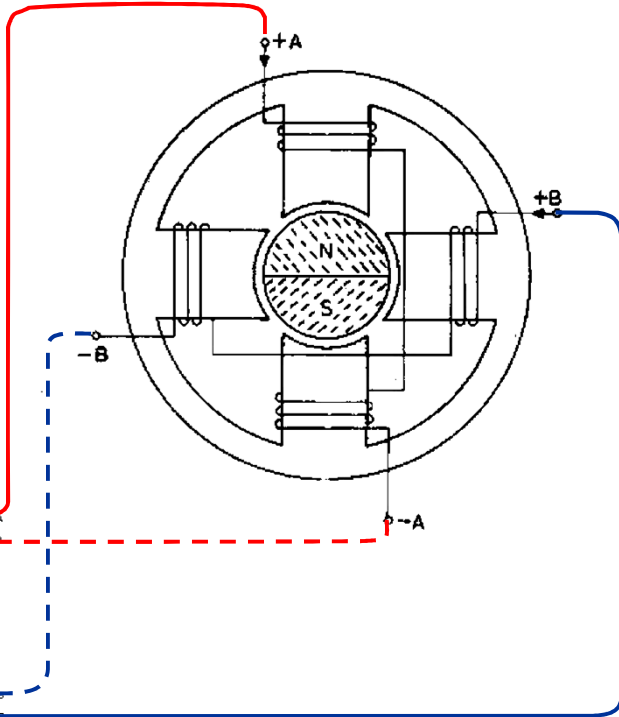
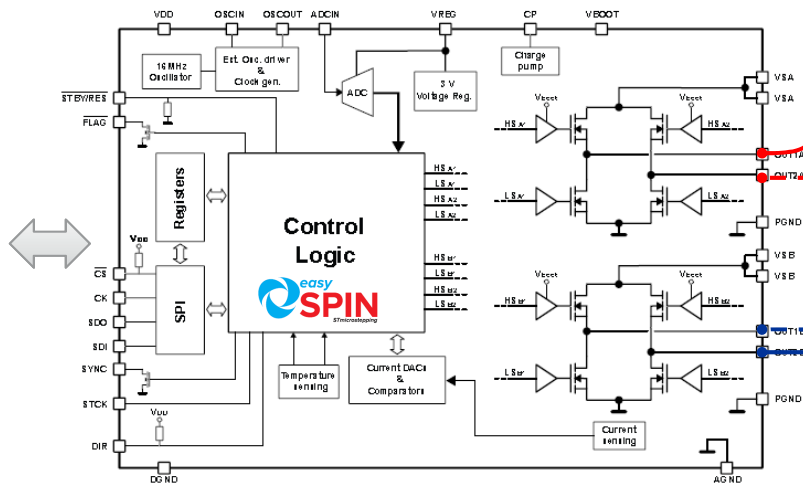


Basic Principle – Bipolar Stepper Motor

- For each phase of the bipolar stepper motor a full bridge driver is necessary
- easySPIN integrates two full bridges including advanced control logic, therefore it is capable to drive both windings of a bipolar stepper motor

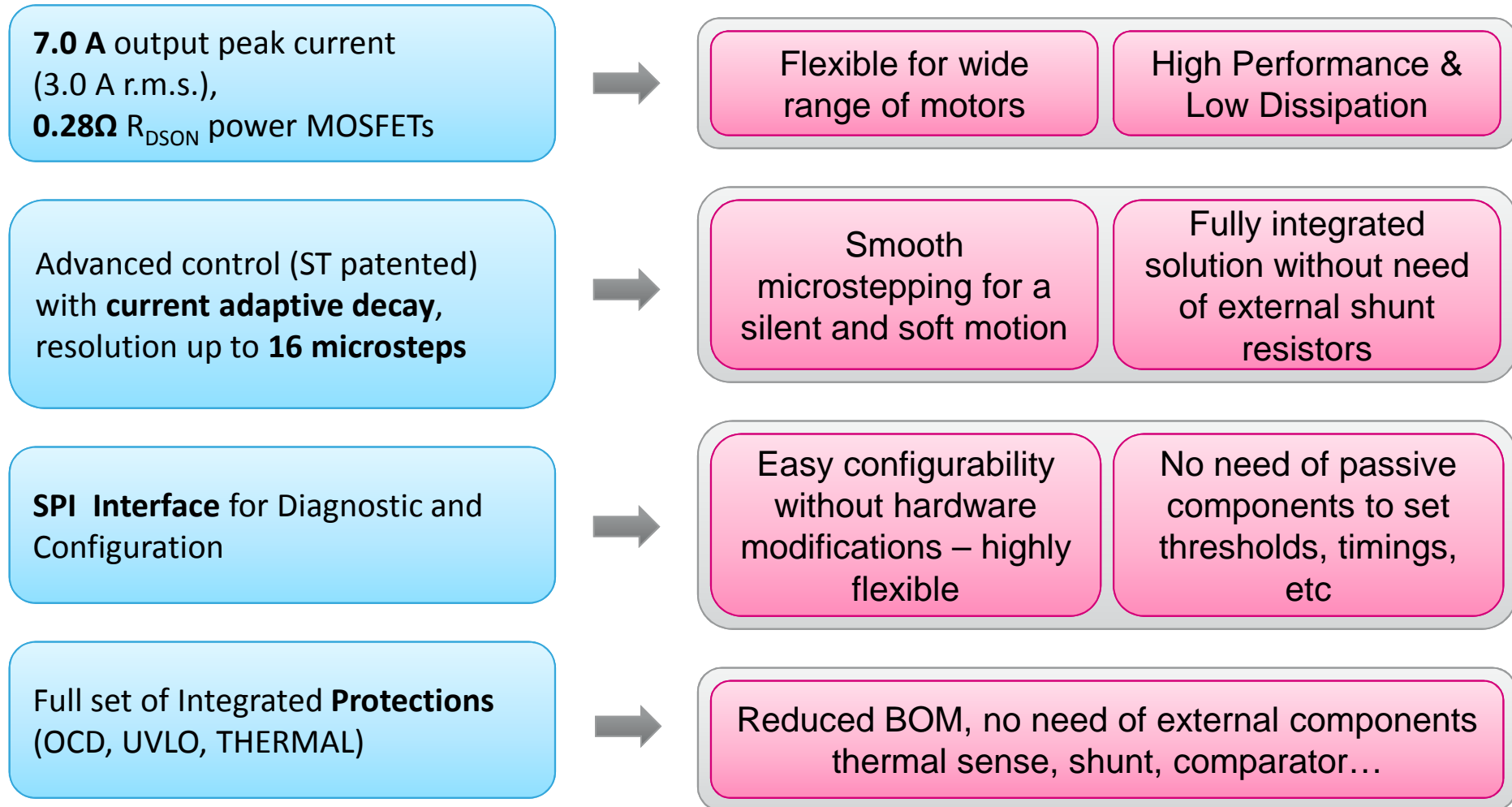
- Also called Variable Reluctance Motors
- Single Stack or Multi Stack
- With or without permanent magnet
- Typical angular motor resolutions 7.2°, 3.6° and 1.8°

Microcontroller
STM8 or STM32



- Rotor**
- With or without permanent magnet
 - With or without teeth
- Stator**
- Poles provided with windings – usually two phases

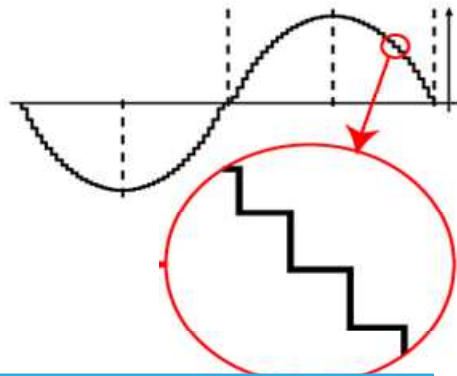
Flexible innovative microstepping motor driver



easySPIN L6474 - Adaptive decay control

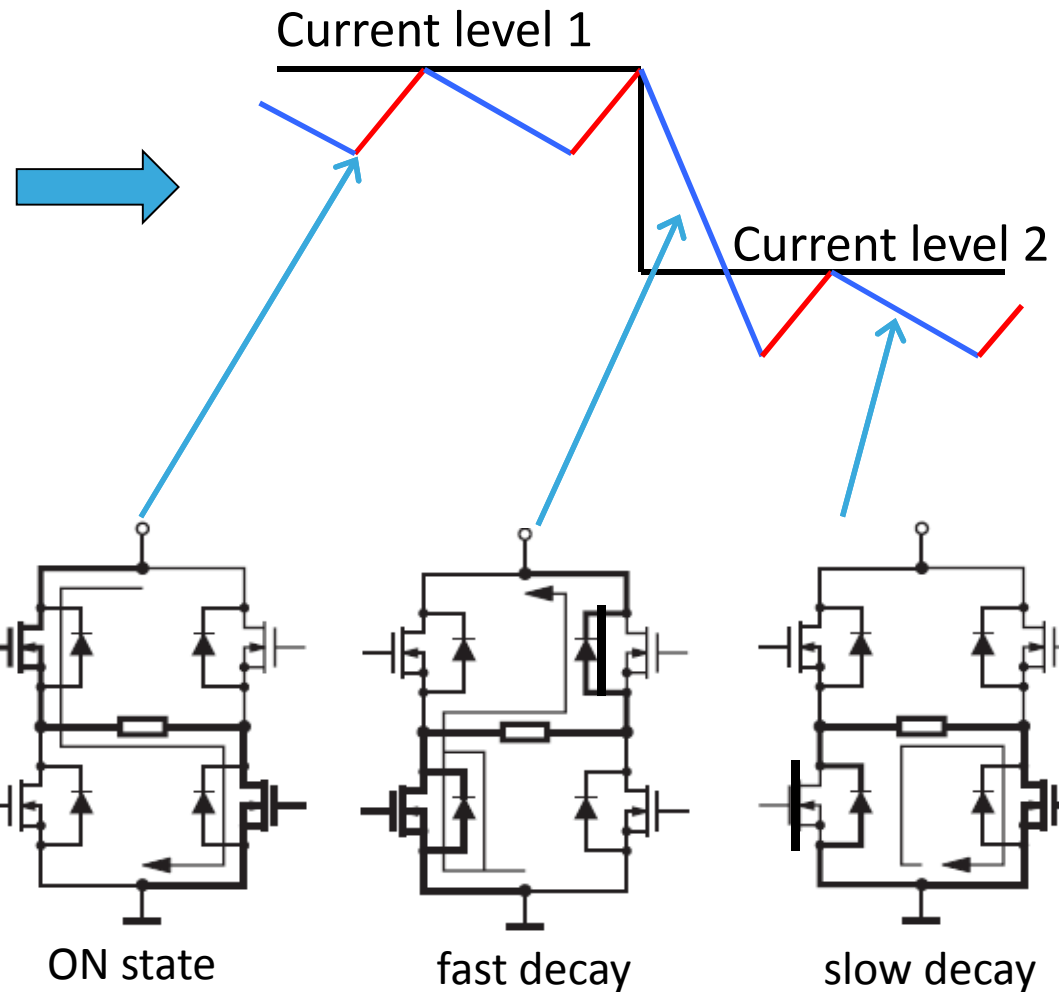
Unique advantage against competition

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easySPIN automatically performs the best decay mode

- Torque ripple reduction
- Soft and silent Motion
- Accurate positioning



Ordering Information & Available Tools

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- Product page: www.st.com/easyspin
- **easySPIN** order codes:
 - L6474H (TR) HTSSOP28, Tube (Tape and reel)
 - L6474PD (TR) POWERSO36, Tube (Tape and reel)
- **easySPIN** price information:
 - L6474 price appears between the PowerSPIN (L6206/7) and the dSPIN L6472
- Evaluation boards:
 - easySPIN evaluation board **EVAL6474H**
 - Communication board **STEVAL-PCC009V2**
- PC Application with Graphical User Interface
- STM32 firmware library for **easySPIN**:
 - Helps to reduce programming effort and development time for **STM32** platform-based applications, all L6474 commands and register definitions implemented



L6474H



L6474PD





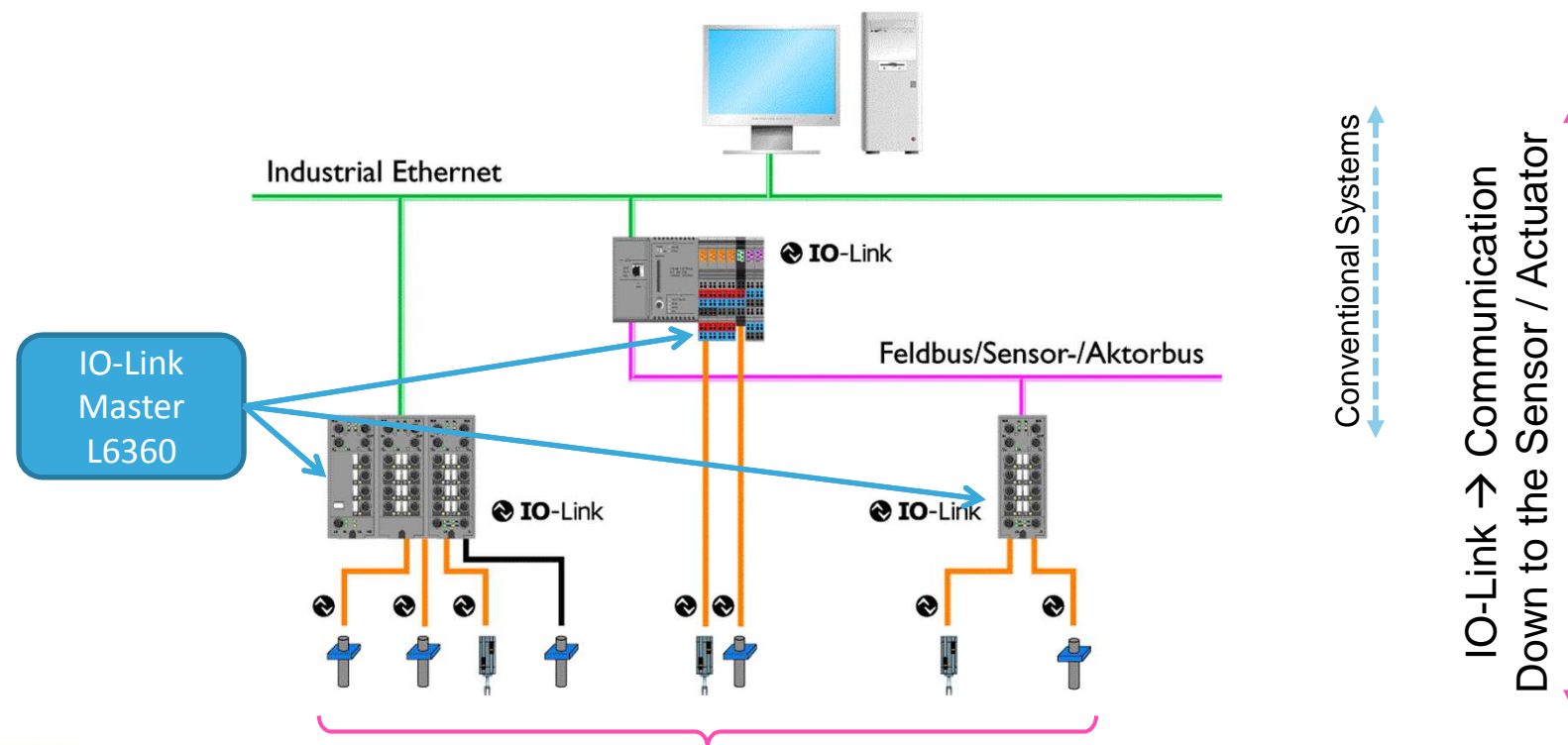
L6360 IO-Link Master

IO-Link Master Physical Layer
General Purpose Transceiver for Industrial Bus
RtM, Q2 2012

IO-Link Communication

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- Main reason to create IO-Link standard was to enable process data, configuration and diagnostics information exchange between sensors / actuators and control system
- It is a simple point – to – point communication topology, one Master communicates to one Slave (called Device in the IO-Link conventions)
- IO-Link uses the same infrastructure like conventional sensors / actuators
- Systems are *backward compatible* means that IO-Link Master works also with non IO-Link Device and vice-versa



IO-Link can be used for **Digital** as well as **Analog Sensors** and **Actuators**

Applications to be covered by L6360

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IO-Link

- IO-Link Master PHY with outperforming features
 - C/Qi: IO-Link Input compliant with embedded 5-6mA current sink (including digital filter)
 - C/Qo: Configurable Push-Pull / HS/ LS power stage up to 500mA
 - Integrated power switch for sensor supplying (L+), 500mA
 - Standard I/O Mode compliant
 - Tiny package: QFN 3.5 x 5 mm
 - Usable for any (1 / 2 / 4 or 8) master port Master granulated applications



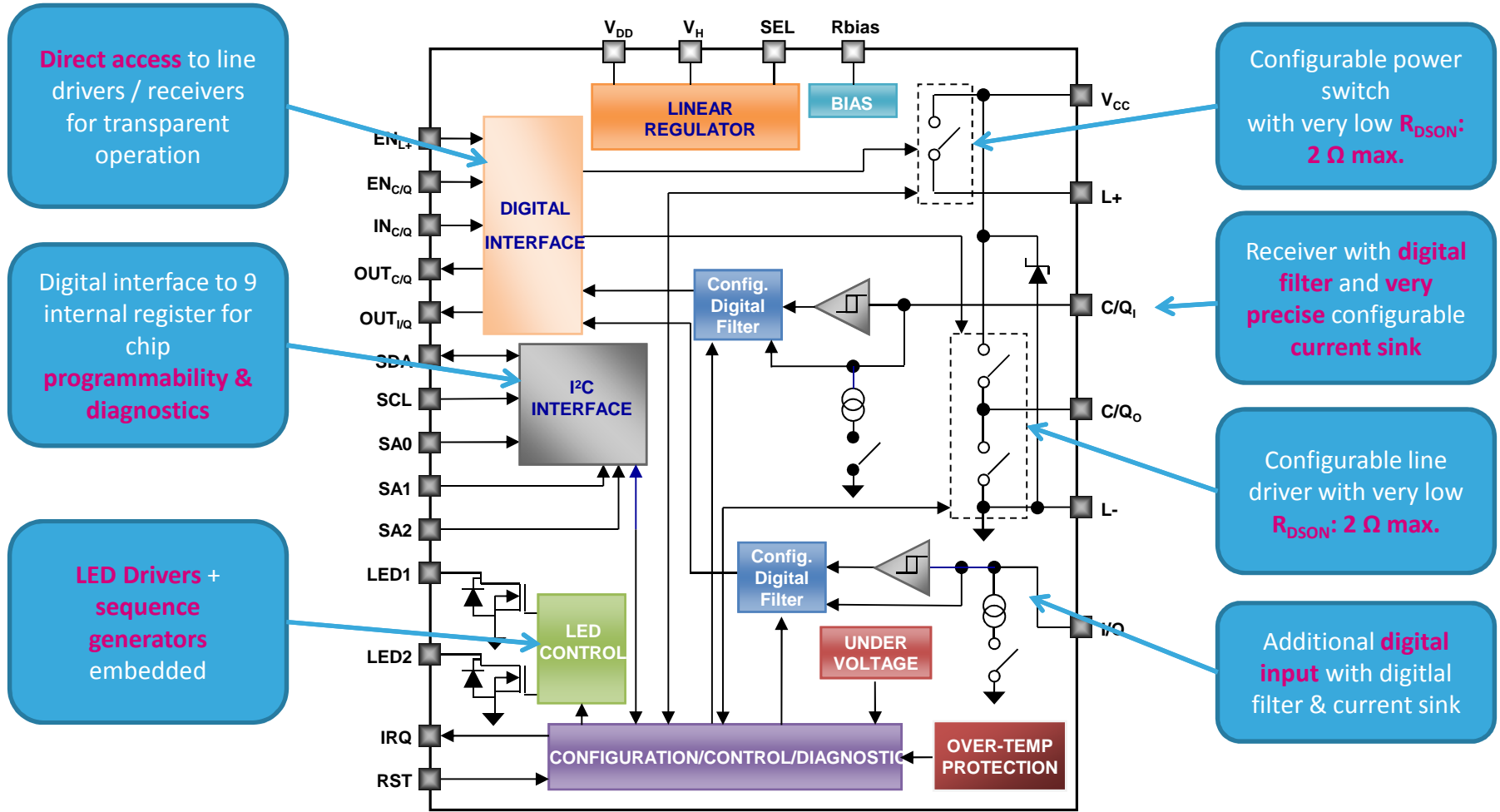
PLC (Programmable Logic Controller) – Digital I/Os

- L+ & C/Qo used as 500mA configurable High Side Drivers
- C/Qi, I/Q inputs used as Type 1 compliant digital inputs, 2-3mA current sink

Line driver

- Single 24V line driver (& receiver) up to 500mA, speed capability >200kHz
- 5V/3.3V to 24V level shifter

Main Advantages Against Competition



Direct access to line drivers / receivers for transparent operation

Digital interface to 9 internal register for chip programmability & diagnostics

LED Drivers + sequence generators embedded

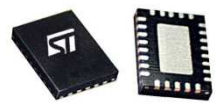
Configurable power switch with very low $R_{DS(on)}$: 2 Ω max.

Receiver with digital filter and very precise configurable current sink

Configurable line driver with very low $R_{DS(on)}$: 2 Ω max.

Additional digital input with digital filter & current sink

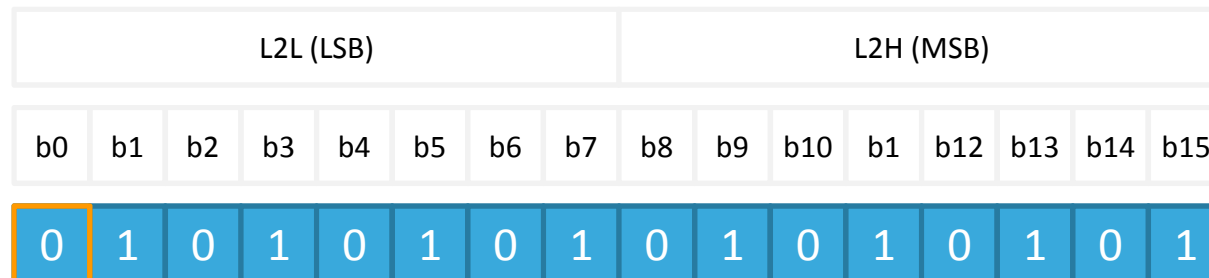
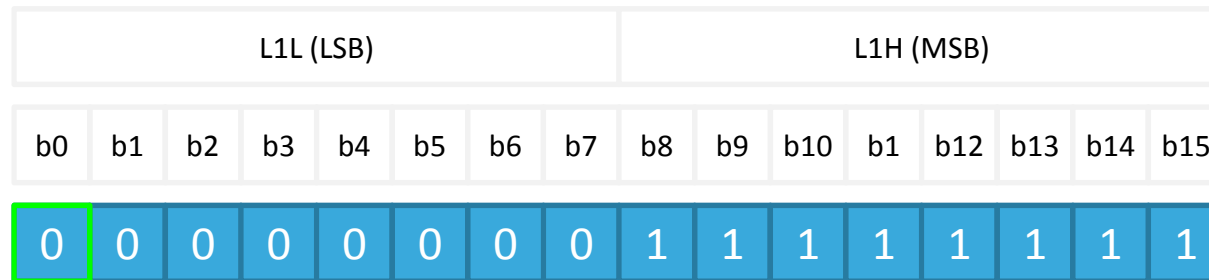
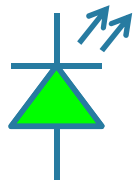
Tiny package:



QFN 3.5 x 5 x 1 mm 26L

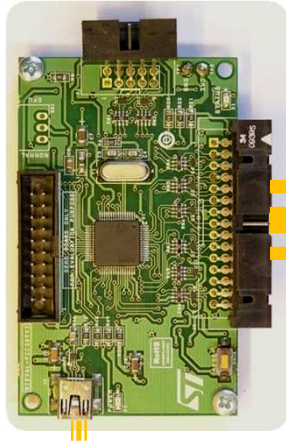
LED Sequence Generator & Driver

- Two indication LEDs sequence generator & driver embedded in the chip
 - Flexible to generate any light sequence according to configuration
 - Based on two 16-bit registers (one per LED channel)



L6360 Ordering Information, Evaluation Tools

Control Board
STEVAL-PCC009V2

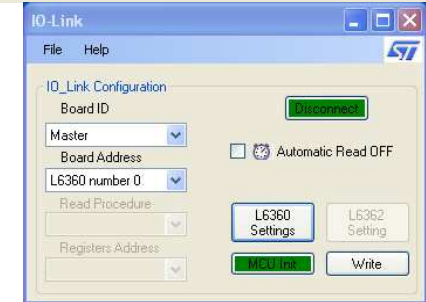
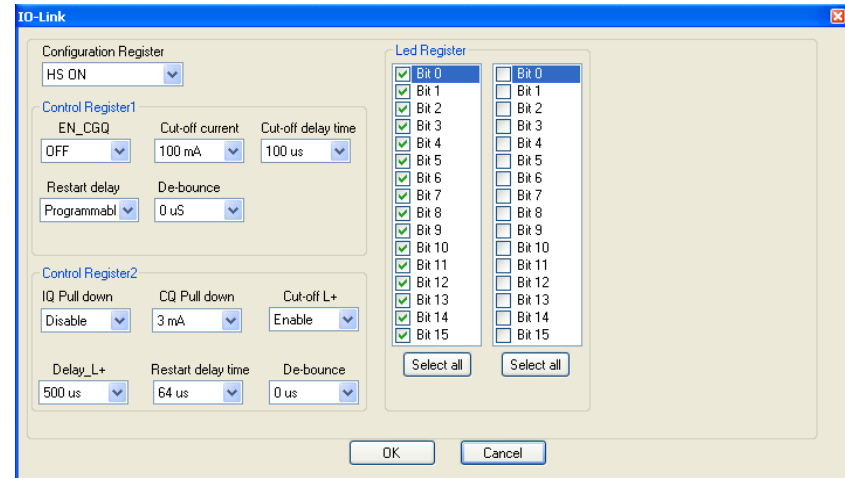


L6360 EvalBoard
STEVAL-IFP016V2



USB Interface to PC
GUI Application available

PC Based Evaluation Software Interface



- Part ordering code: L6360
- Price indication: approx. 12.5% less than VNI4140K
- Evaluation boards ordering codes
 - L6360 Evalboard: STEVAL-IFP016V2
 - Control board: STEVAL-PCC009V2 or STEVAL-PCC009V1
- Application Immunity verified
 - IEC61000-4-2, ESD, Contact / Air, both higher than $\pm 8\text{kV}$
 - IEC61000-4-4, Burst, $> \pm 4\text{kV}$, performance criteria A* (= internal registers stable)
 - IEC61000-4-5, Surge, $42\Omega/0.5\mu\text{F}$, $> \pm 2.5\text{kV CM} / > \pm 1\text{kV DM}$ (common / differential modes)



LBP01 Family

LED Bypass

Protection against LED Failure

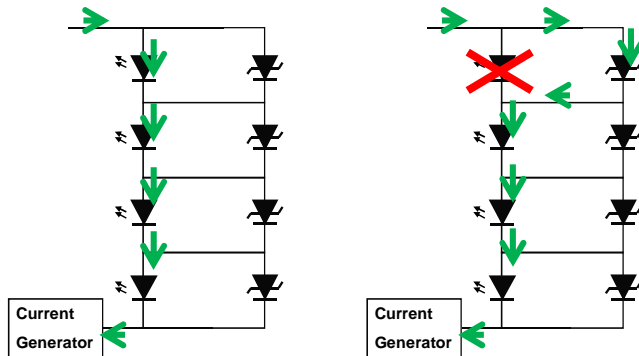
RtM, Q2 2012

LED Bypass: LBP01 Family

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When Reliability is a Must...

...LED failure is no more an issue



APPLICATION EXAMPLE: Emergency Lighting



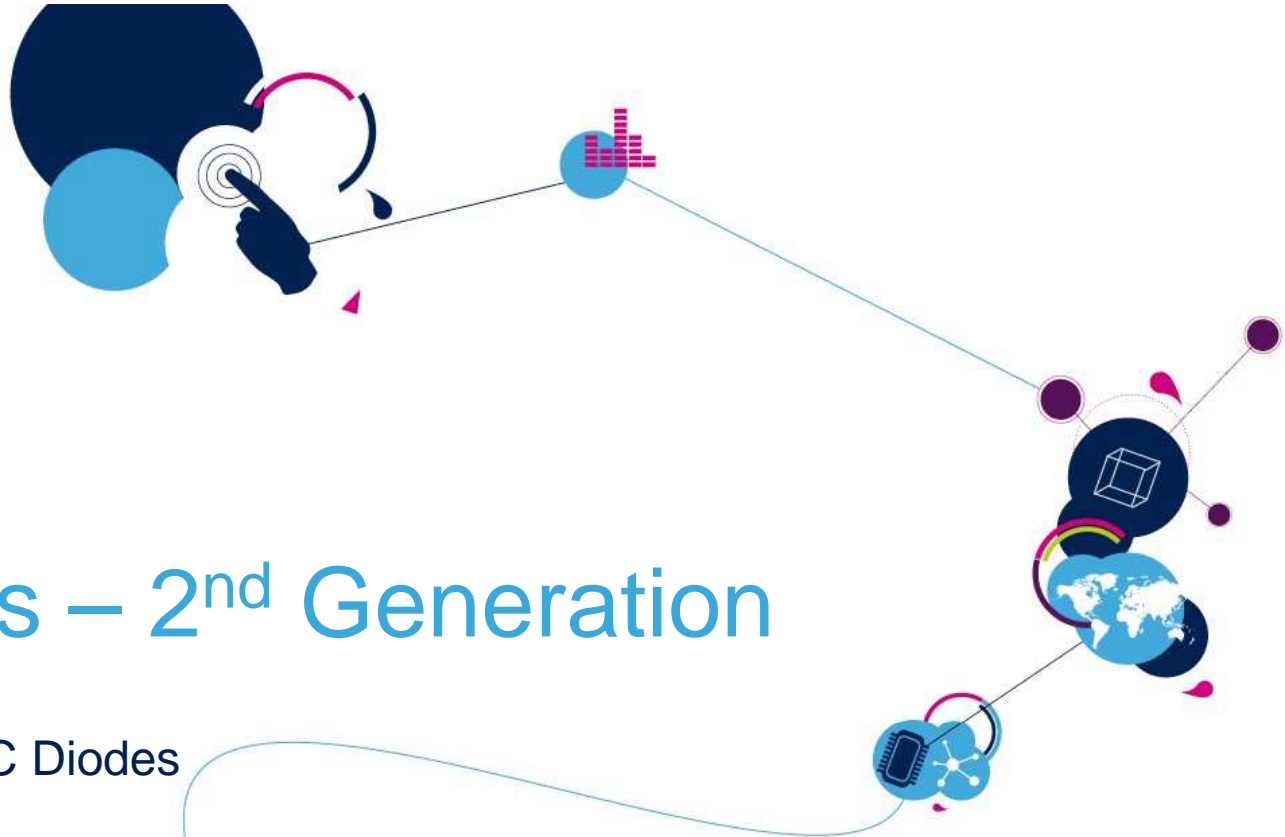
LBP01-0803SC5
350 mA LED bypass

- $T_{jmax} = 150\text{ }^{\circ}\text{C}$
- Negligible leakage LED current
- Voltage compatible with 1 or 2 LED in series
- Compatible with all power supplies



LBP01-0810B
1 A LED bypass

- $T_{jmax} = 150\text{ }^{\circ}\text{C}$
- Negligible leakage current
- Voltage compatible with 1 or 2 LED in series
- Compatible with all power supplies



SiC Diodes – 2nd Generation

2nd Generation of SiC Diodes
650-V Upgrade
RtM, Q2 2012

- SiC main advantages vs Si:

- About 10 times the max electric field of silicon
- Lower specific ON-resistance
- Faster switching times
- 3 times better thermal conductivity
- Higher temperature operation

- Applications

- Solar Inverters
- PFC boost diode in Telecom Server
- Electrical Vehicule charging stations

All these properties make the SiC

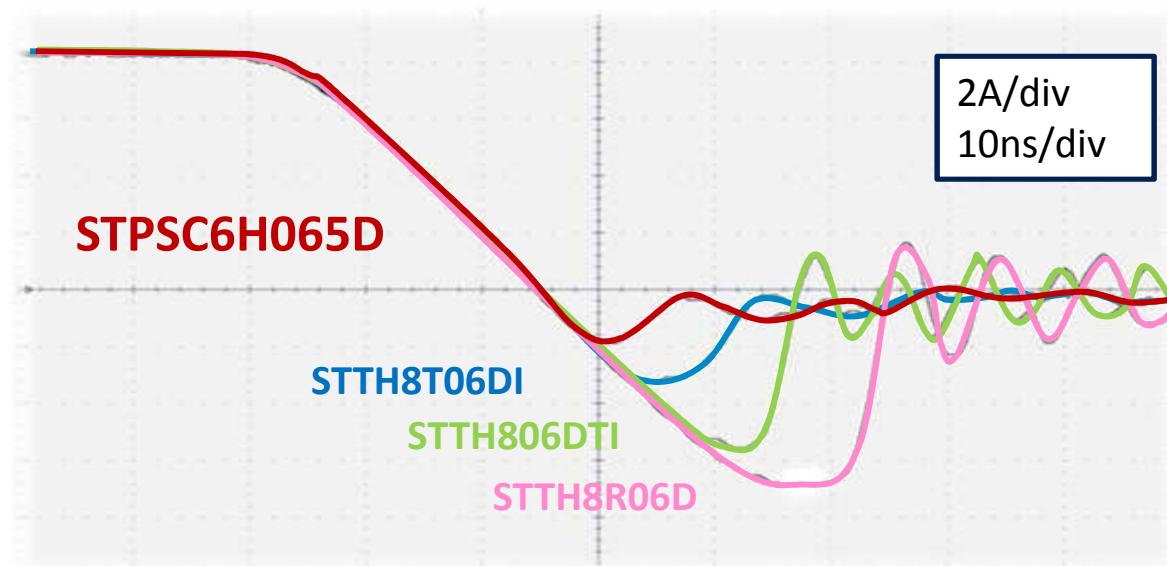
The ideal semiconductor

(as said by transistor inventor

William B. Shockley)



Recovery current is due to junction capacitance charge only (no minority carrier recombinations since SiC Schottkys are unipolar devices)



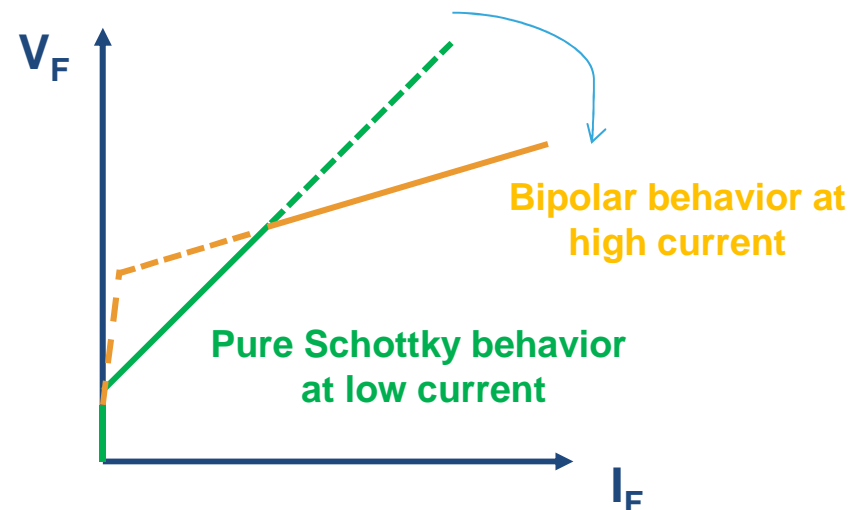
Negligible switching losses with SiC diodes
→ **higher converter's efficiency**

SiC Gen2: positioning versus existing portfolio

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- Higher voltage ratings
 - 650 V vs. 600 V
- Higher surge current capability
 - by a factor 2x to 3x for all pulse shorter than 10ms
 - up to x10 times nominal current at 10ms

JBS (Junction-Barrier Schottky) design → increase the Surge forward current capability while keeping the temperature below the T_j max.

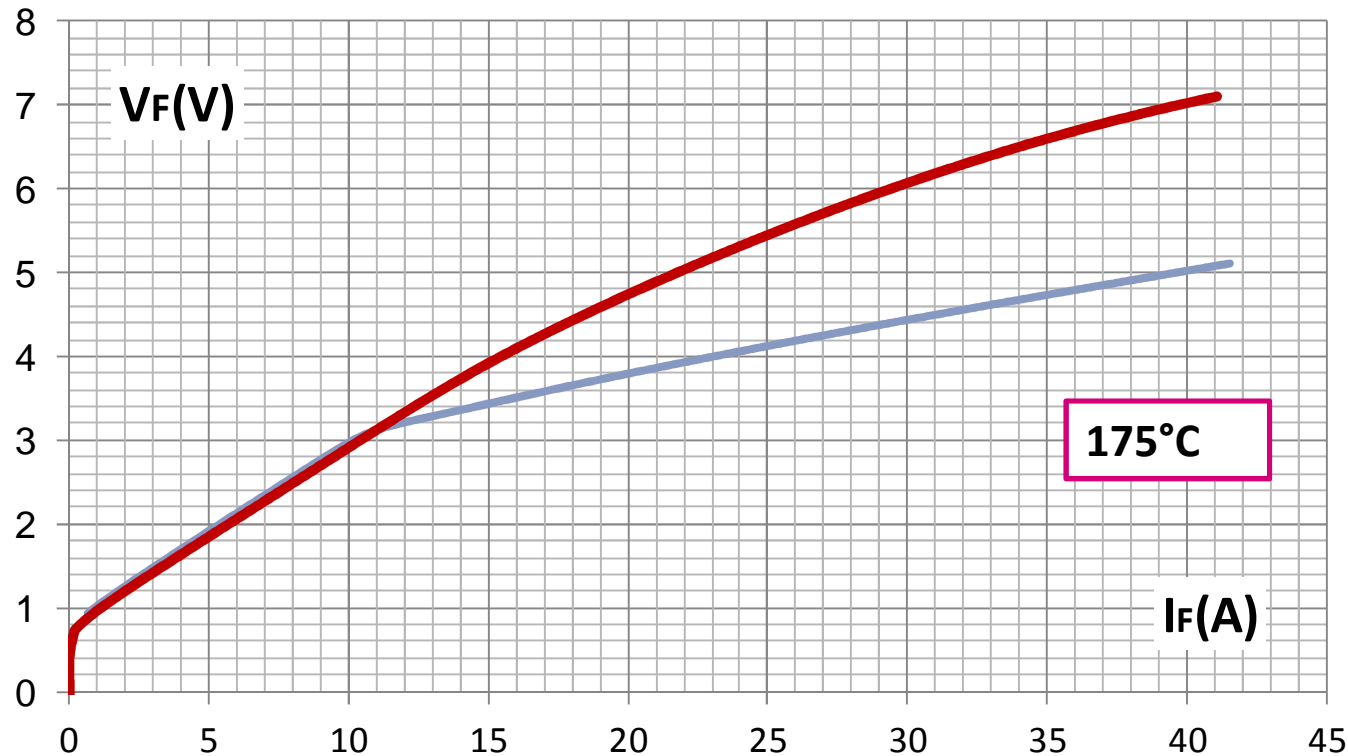


New 650V SiC G2 vs. Competition

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Competition benchmark: 6 A diode

— ST 6A G2
— « compet C » 6A G2



Clamping effect more efficient for ST device → lower temperature increase during forward stress conditions

SiC Diodes Portfolio (22 products)

V _{RRM}	Gen	2A					3A					4A					5A					6A					8A														
		TO-220	D ² PAK	DP AK	FP ACK	die	TO-220	D ² PAK	DP AK	FP ACK	die	TO-220	D ² PAK	DP AK	FP ACK	P Flat	die	TO-220	D ² PAK	DP AK	FP ACK	die	TO-220	D ² PAK	DP AK	FP ACK	P Flat	die	TO-220	D ² PAK	DP AK	FP ACK	P Flat	die							
600	1											X		X													X	X									X	X			
		2																																							
		3																																							
		5																																							
	650	1																																							
		2										X		X								X	X	X								X	X								
		3																																							
		5																																							

V _{RRM}	Gen	9A					10A					12A					16A					20A					30A	40A								
		TO-220	D ² PAK	DP AK	FP ACK	die	TO-220	D ² PAK	DP AK	FP ACK	TO-247	P Flat	die	TO-220	D ² PAK	DP AK	FP ACK	TO-247	die	TO-220	D ² PAK	DP AK	TO-247	die	TO-220	D ² PAK	DP AK	TO-247	die	TO-247	TO-247					
600	1					X	X							X																				X		
	2																																			
	3																																			
	5																																			
650	1																																			
	2					X	X	X																			X					X				
	3																																			
	5																																			

SiC Diodes Gen 2: Key messages

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- Generation2: upgraded to **650V** (more V_R safety margin)
- JBS structure **improved IFSM** (current surge capability) vs. previous generation
- **Lower Vf** vs. JBS technologies competitor
- Temperature reduction → Heat-sink size reduction
- Lower switching losses → F_{SW} increase, so lower magnetic component cost



SuperMESH™ 5

“K5” Family - Breakthrough in Very High Voltage Power MOSFETs

RtM, H1 2012

SuperMESH™5: Very High Voltage MOSFET revolution

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Breakthrough in Very High Voltage

- 800V-1200V Voltage Range
- Designed for Best Efficiency
 - LED & HID Driving
 - High Input Voltage PV Inverter
 - 3-Phase PSU

NOW: first
900V & 950V
K5 devices in
Mass Production!

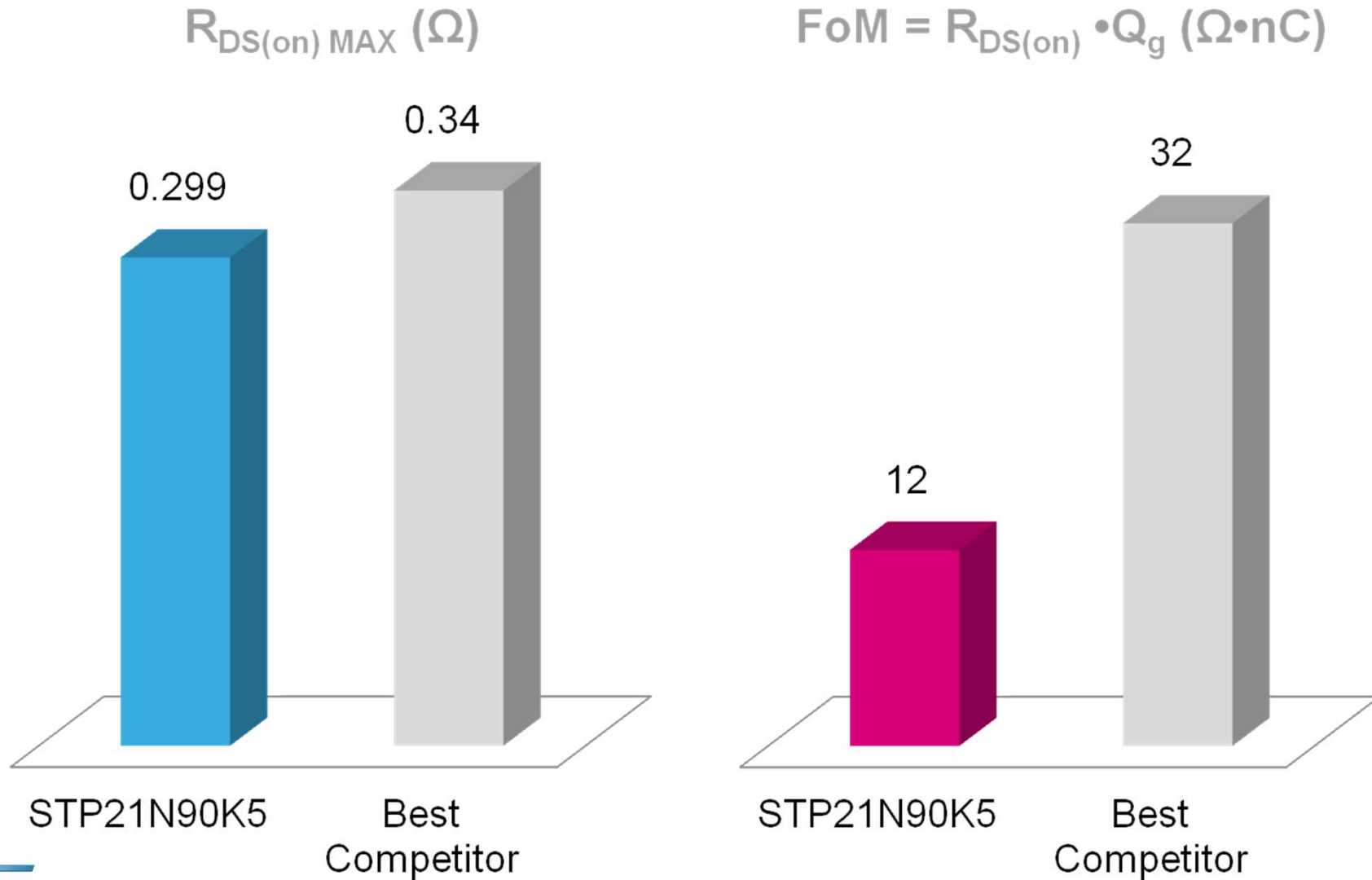
Main Features & Benefits

- Lowest $R_{DS(on)}$ x area
- Lowest FOM ($R_{DS(on)} * Q_g$)
- Increased Safety Margin
- Lowest Power Losses
- Higher Energy Savings
- Faster Switching Speed



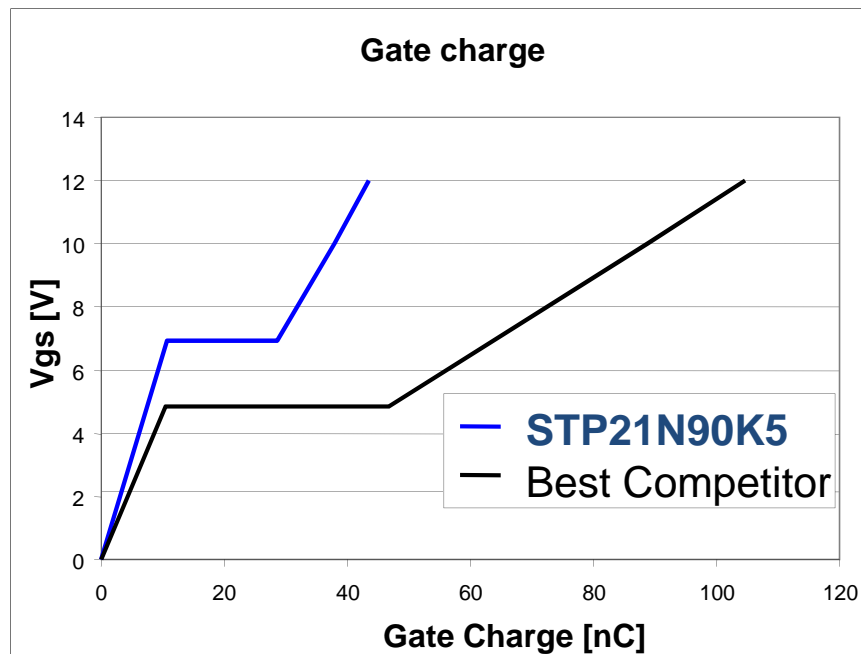
SuperMESH™5: Best-in-Class

75

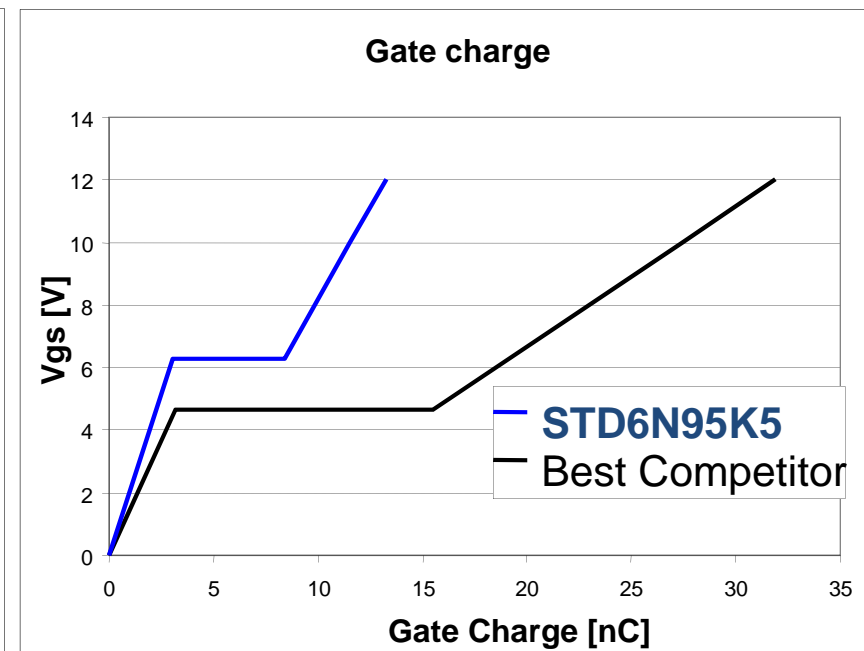


900V in TO-220 Package Benchmark

Minimized Gate Charge gives Superior Switching Performances turning into **Higher Energy Savings** inside the Application



STP21N90K5 vs best Competitor



STD6N95K5 vs best Competitor

SuperMESH™5: Very High Voltage Series

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V _{DS} [V]	P/N	R _{DS(on)} (max) [Ω]	Package	Status
800	STx7N80K5	1.2	TO-220/FP/DPAK / PowerFLAT 5x6 HV	Samples Q3 '12 Production Q4 '12
	STx8N80K5	0.95	TO-220/FP/I2PAKFP/DPAK/ PowerFLAT 5x6 HV	Samples Q3 '12 Production Q4 '12
	STx12N80K5	0.375	TO-220/FP/D2PAK /TO-247	Samples Q3 '12 Production Q4 '12
	STx25N80K5	0.260	TO-220/TO-220FP/TO-247	Samples Q3 '12 Production Q4 '12
850	STx23N85K5	0.275	PowerFLAT 8x8 HV /TO-247	Samples Available Production Q3 '12
900	STx21N90K5	0.299	TO-220/TO-220FP/TO-247/D2PAK	Production
950	STx6N95K5	1.25	DPAK/IPAK/TO-220/ TO-220FP/TO-247	Production
	STx20N95K5	0.330	TO-220/TO-220FP/TO-247/D2PAK	Production
1200	STx12N120K5	0.690	TO-220/TO-3PF/TO-247	Samples Q4 '12

900V & 950V K5 devices now in Mass production and available in different packages

SuperMESH™5: Key Messages

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“Very High Voltage MOSFETs for the Highest Efficiency with the Lowest Power Losses meant for Emerging Applications”

- Lighting

- LED driving and HID High Powers, Outdoor

- Photo Voltaic Inverter

- μ -inverter
- Boost Converter

- SMPS

- LED/LCD TV
- 3-phase input AC/DC converter
- Welding
- HEV charger station

