2013 Sales Updating Analog & Power

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DC DC Converter

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DEVICE	V_{IN} (V)	V_{OUT} (V)	Max I_{OUT} (A)	Other Topologies[I] Supported	Automotive Grade (AG)/ Temperature Version	Specific Purpose (other than Voltage Regulator)
ST1S30I	2.7 to 5.5	0.8 to V_{IN}	3	NO, BUCK ONLY	NO	/
ST1S31 ST1S32	2.8 to 5.5	0.8 to V_{IN}	3 4	NO, BUCK ONLY	NO	/
ST1S03	3 to 16	0.8 to 87% V_{IN}	1.5	NO, BUCK ONLY	NO	/
ST1S10	2.5 to 18	0.8 to 90% V_{IN}	3	NO, BUCK ONLY	NO	/
L598x	2.9 to 18	0.6 to V_{IN}	up to 3	YES	NO	/
L5988D/9D	2.9 to 18	0.6 to V_{IN}	4	YES	NO	/
ST1S40I	4 to 18	0.8 to V_{IN}	3	NO, BUCK ONLY	NO	/
ST1CC40	4 to 18	0.1 to V_{IN}	3	NO, BUCK ONLY	NO	LED DRIVER
ST1S41	4 to 18	0.8 to V_{IN}	4	NO, BUCK ONLY	NO	/
L7980/0A L7981/1A	4.5 to 28	0.6 to V_{IN}	2 3	YES	NO	/
L597x	4.4 to 36	0.5 to V_{IN}	up to 3	YES	A597x, B5973D[II]	/
L6902D	8 to 36	1.235 to V_{IN} - 2[III]	1	YES	A6902D	BATTERY CHARGER / LED DRIVER
L7985/5A L7986/6A	4.5 to 38	0.6 to V_{IN}	2 3	YES	A7985A L7986TA[IV], A7986A	/
ST1S14	5.5 to 48	1.22 to 90% V_{IN}	3	NO, BUCK ONLY	NO	/
LED2000	3 to 18	0.8 to V_{IN}	3	NO, BUCK ONLY	NO	LED DRIVER
L497x	8 to 55	0.5 to 90% V_{IN}	up to 3.5	YES	NO	/

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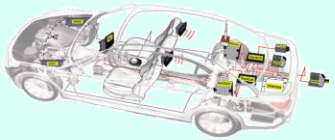
DC DC AUTOMOTIVE A7985 A7986A

Product Info

- ✓BCD6s 45V technology
- ✓Up to 3A in a small HSOP8 package
- ✓ P-channel power MOS
- ✓Wide input voltage range (4.5V up to 38V)
- ✓High Fsw (adj. up to 1MHz
- ✓All Parameters tested over the -40°C to + 125°C junction temperature range (grade 1)
- ✓Qualified following AEC-Q100



Key Applications

AUTOMOTIVE/INDUSTRIAL

- •Body/ (Int./ext. lighting, junction box, dashboard)
- •Car infotainment (car audio, Navigation, telematics box)

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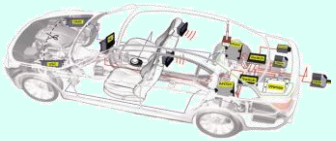
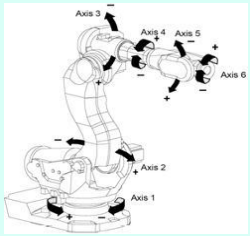
L6986 A6986(Automotive) prod 2013

- ✓BCD8 40V technology
- ✓Up to 2A in a small HTSSOP16 package
- ✓Synchronous rectification
- ✓High efficiency or constant switching frequency at light load with low Iq (30µA)
- ✓Wide input voltage range (4V up to 38V)
- ✓High Fsw (adj. up to 2MHz)
- ✓Qualified following AEC-Q100 (A6986)

Product Info





Key Applications

AUTOMOTIVE/INDUSTRIAL

- •Body/ (Int./ext. lighting, junction box, dashboard)
- •PLC, factory automation
- •Car infotainment (car audio, Navigation, telematics box)

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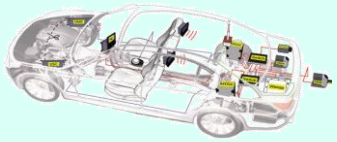
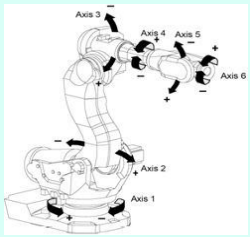
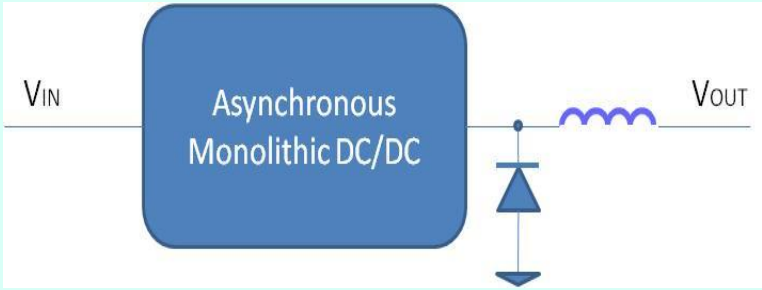
L7987(prod 2013)

Product Info

- ✓BCD6s 70V technology
- ✓Up to 3A in a small HTSSOP16 package
- ✓Vbias improves Eff at light load
- ✓Adjustable current limit
- ✓Wide input voltage range (4V up to 61V)
- ✓High Fsw (adj. up to 1.5MHz)







Key Applications

INDUSTRIAL

- •Industrial (PLC, factory automation)
- •Automotive (extended load dump, Truck vehicles)

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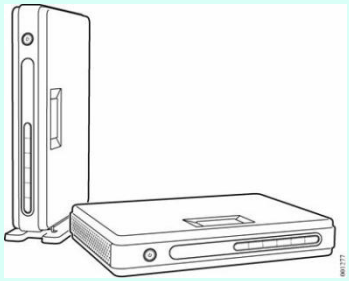
ST1S50(prod 2013)

- ✓BCD6s 20V technology
- ✓Up to 4A in a small DFN 3x3 package
- ✓High Eff at light load
- ✓Wide input voltage range (4V up to 18V)
- ✓High Fsw

Product Info



Key Applications

CONSUMER

- •STB
- •LCD TV set
- •Low STBY requirements

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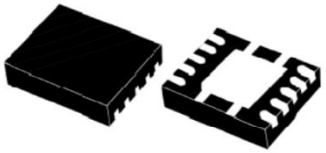
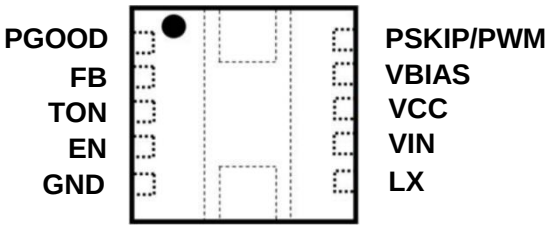
L6984 350 m A synchronous buck converter (prod 2013)

- AEC-Q100 COMPLIANT
- 4.5V TO 36V INPUT VOLTAGE
- SYNCHRONOUS RECTIFICATION
- UP TO 350mA DC OUTPUT CURRENT
- 100µA IQ (VIN 12V – VOUT 3.3V – PSKIP - SWO)
- PULSE SKIPPING OR FORCED PWM AT LIGHT LOAD
- PROGRAMMABLE SWITCHING FREQUENCY: 200KHz – 600KHz
- PREBIAS START-UP CAPABILITY
- VBIAS MAXIMIZES EFFICIENCY AT LIGHT LOAD (PSKIP)
- PGOOD OUTPUT
- NO VOLTAGE DIVIDER REQUIRED FOR VOUT 3V3
- COT ARCHITECTURE IMPLEMENTS FREQUENCY FF OVER VIN RANGE
- MLCC OUTPUT CAPACITOR COMPLIANT
- THERMAL SHUTDOWN
- OVERVOLTAGE AND OVERCURRENT PROTECTION

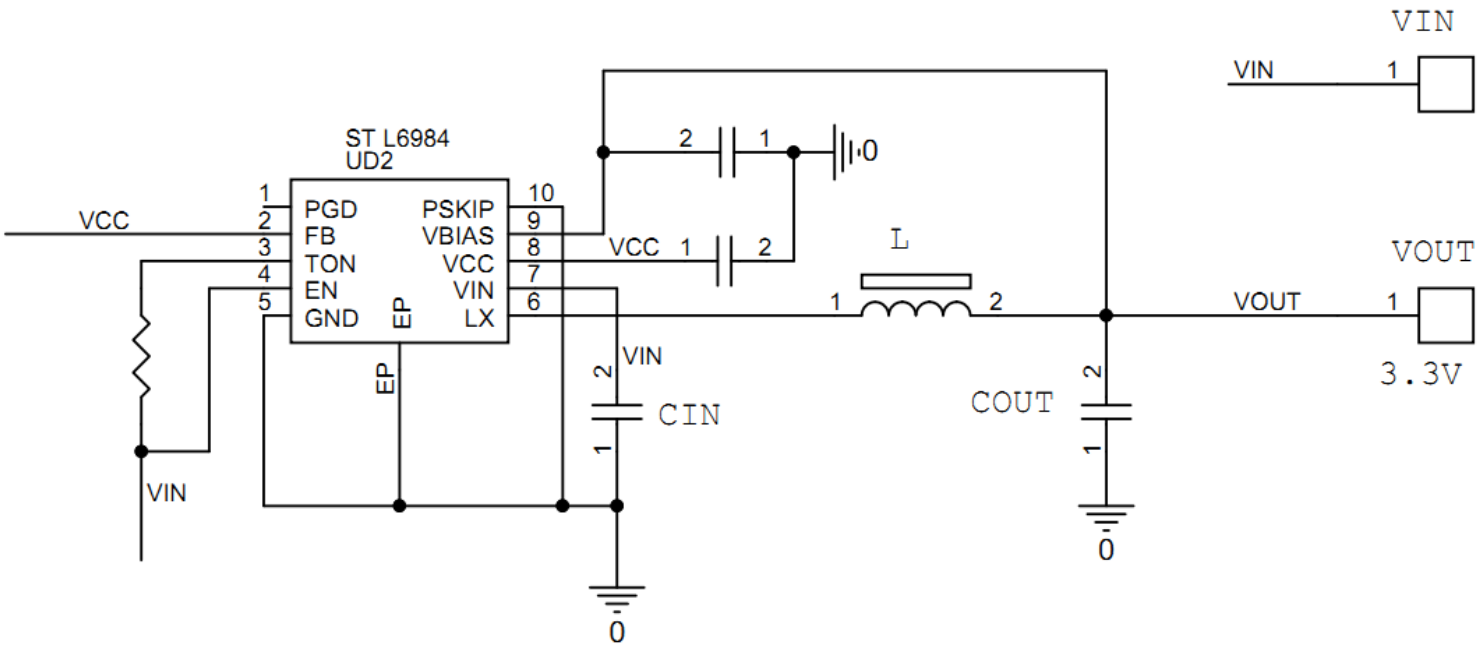




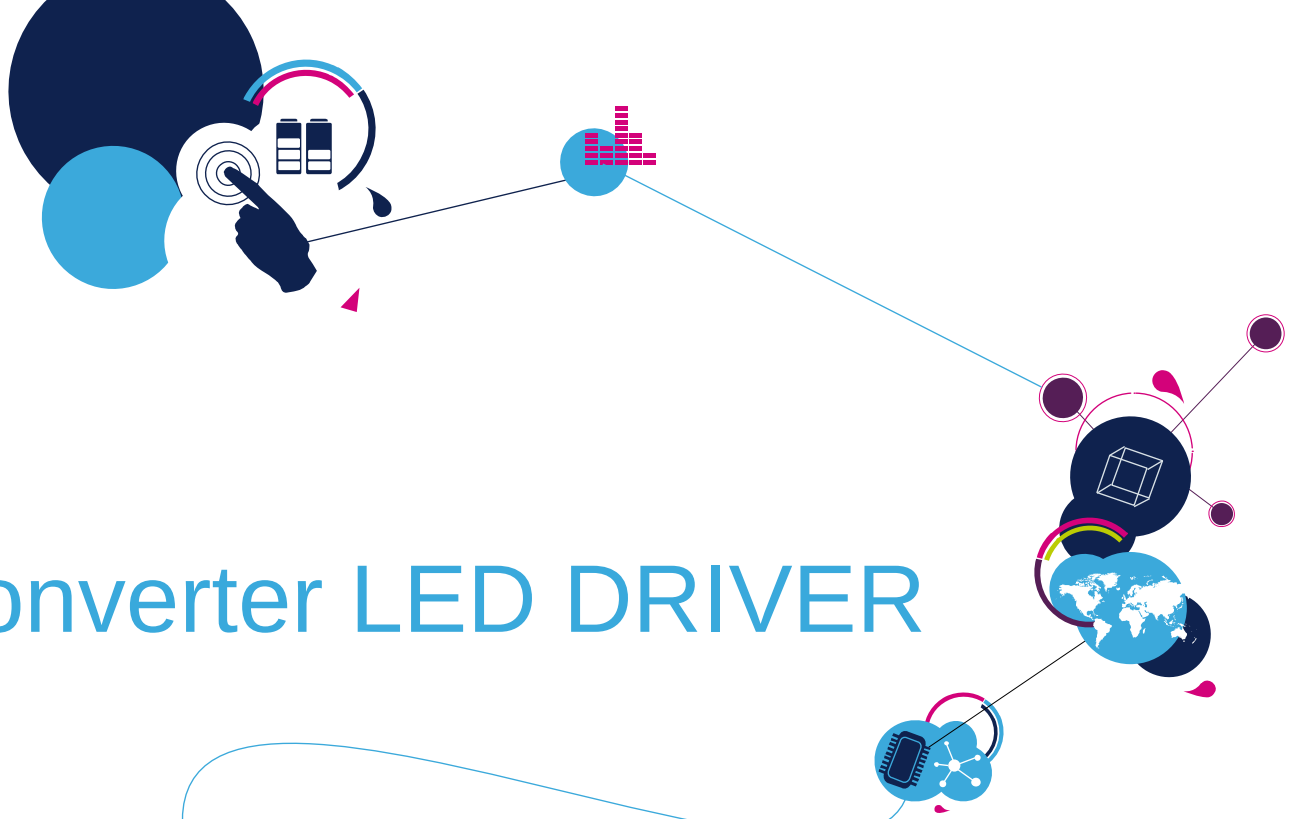
Low current optimized buck converter

L6984 350 m A synchronous buck converter (prod 2013)

L6984 test circuit (V_{OUT} 3.3V):



Low current optimized buck converter



DC DC Converter LED DRIVER

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LED2000

- ✓BCD6s 20V technology
- ✓Up to 3A in a small DFN 4x4 and HSOP8 packages
- ✓Low FB voltage for low power losses
- ✓PWM Dimming pin
- ✓Wide input voltage range (4V up to 18V)
- ✓High Fsw

Product Info

Key Applications

LED LIGHTING

- •STREET LIGHT
- •GENERAL LIGHTING
- •TORCH

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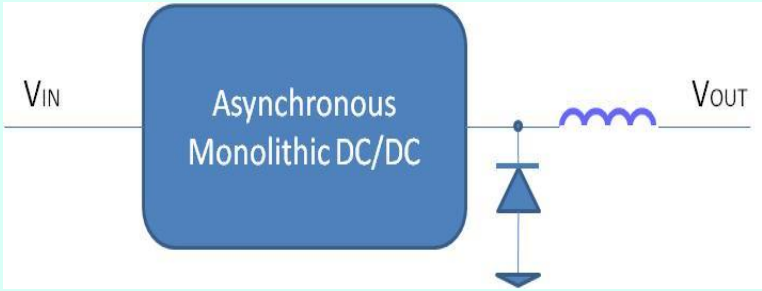
LED5000(prod 2013)

- ✓BCD6s 55V technology
- ✓Up to 3A in a small HSOP8 package
- ✓Wide input voltage range (5V up to 48V)
- ✓Buck / Boost / Buck boost topologies supported
- ✓200mV sensing voltage
- ✓Features PWM dimming

Product Info



Key Applications

LED LIGHTING

- •STREET LIGHT
- •GENERAL LIGHTING
- •AUTOMOTIVE

LED6000(prod 2013)

- ✓BCD6s 70V technology
- ✓Up to 3A in a small HTSSOP16 package
- ✓FB voltage of 150mV
- ✓PWM Dimming pin
- ✓Wide input voltage range (4V up to 61V)
- ✓High Fsw (up to 1.5MHz)

Product Info

Key Applications

LED LIGHTING

- •STREET LIGHT
- •GENERAL LIGHTING
- •AUTOMOTIVE

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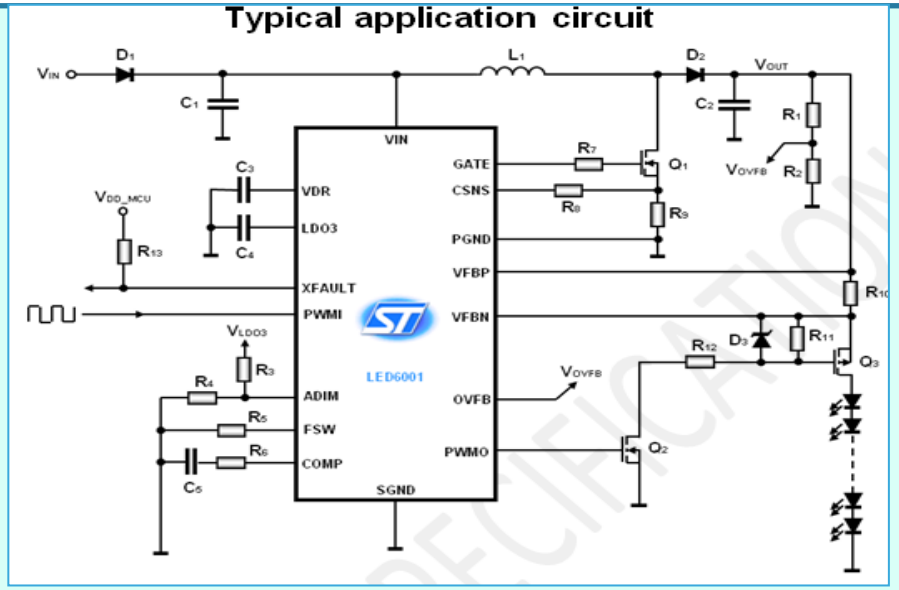
LED6001(prod 2013)

- ➢BCD6s 70V technology
- ➢Switching controller :
- - boost, Buck-boost and SEPIC topologies
- -4.4V to 36V input voltage
- -Multi-device sync
- -Gate Driver for ext. MOSFET
- -Ouput short detection
- ➢LED Control :
- -Up to 60V output voltage
- -Analog and PWM dimming
- -Constant current control loop

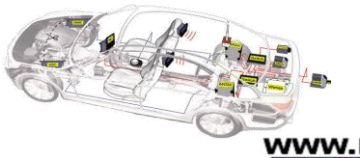


Key Applications

AUTOMOTIVE- Exterior lighting

- **Front L. (DTRL, HB, LB)**
- **Blinkers**
- **Rear Lighting**

Industrial: General Lighting



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AC DC Converter

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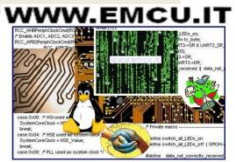
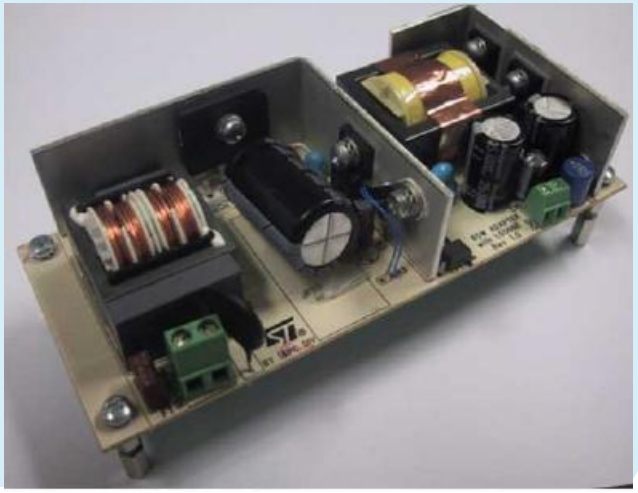
AC DC Road map

	Typ output Power range	ST's Differentiations
Viperxx	*High Voltage Converters Flyback 0-25W*	Robust power section, high efficiency under all load conditions, ultra-low standby consumption
L6562A L6564,L6563H	*Power Factor Correctors 0-400W*	Meeting energy efficiency regulations, mains harmonics in compliance with EN61000-3-2 and EIDA-MITI specifications
L6566A/B	Pwm controller Flyback 25W 100W	High efficiency under all load conditions, design flexibility, high voltage capability
L6599A, L6699	*Resonant Primary PWM Controllers 50W -400W*	High efficiency under all load conditions, allowing ultra-thin form factor, EMI reduction
ALTAIRxx HVLED8xx	*All Primary Sensing PWM Controllers Flyback 0- 15W*	Robust power section, optoless, reduced components count and increased MTBF, very low standby consumption
SEA05, TSM10xx	*Constant Voltage & Current Controllers*	Very low quiescent current and extended operating range, few external components, precise internal voltage reference
SRK2000	*Resonant Synchronous Rectification*	High efficiency under all load conditions, safe management of load transient, simple design with few external components

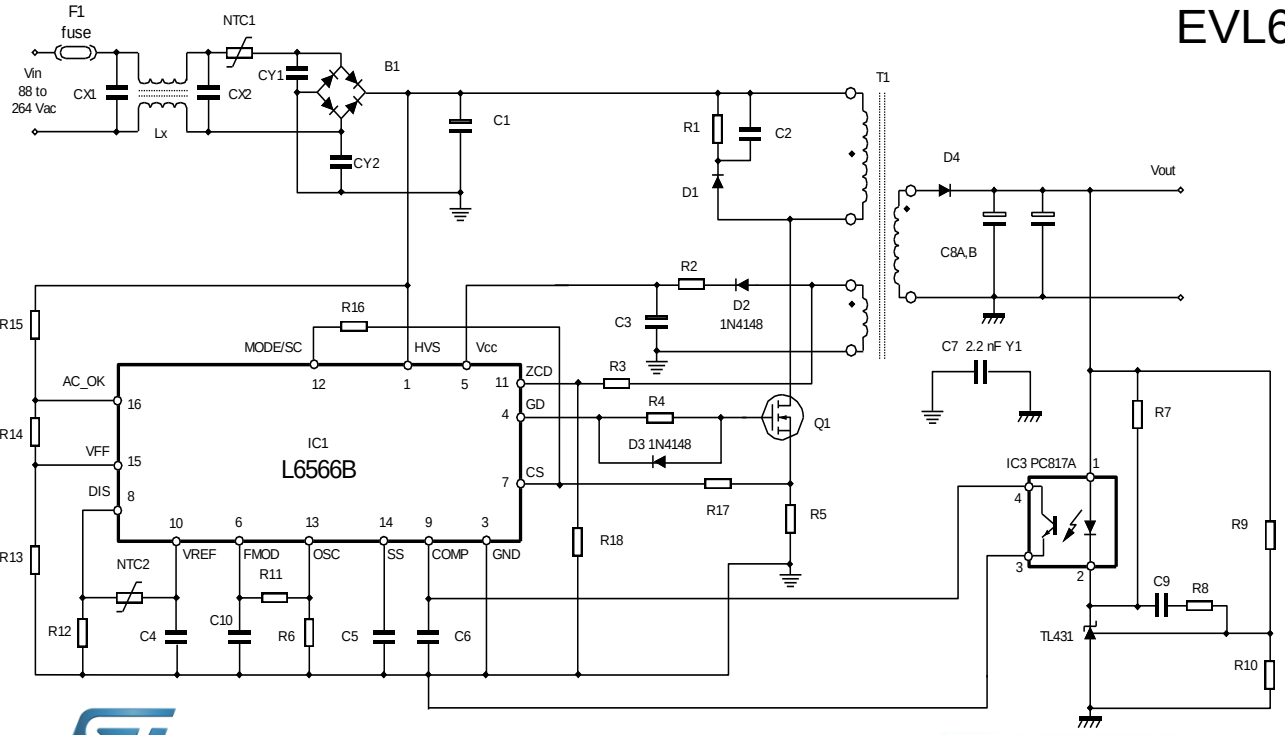


L6566B L6566A L6566BH Pwm flyback 20W-100W

- Selectable multi-mode operation: fixed frequency or quasi-resonant
- On-board 700 V high-voltage start-up
- Advanced light load management
- Low quiescent current (< 3 mA)
- Adaptive UVLO
- Line feedforward for constant power capability vs. mains voltage
- Pulse-by-pulse OCP, shutdown on overload (latched or autorestart)
- Transformer saturation detection
- Programmable frequency modulation for EMI reduction
- Latched or autorestart OVP
- Brownout protection
- -600/+800 mA totem pole gate driver with active pull-down during UVLO
- SO16N package



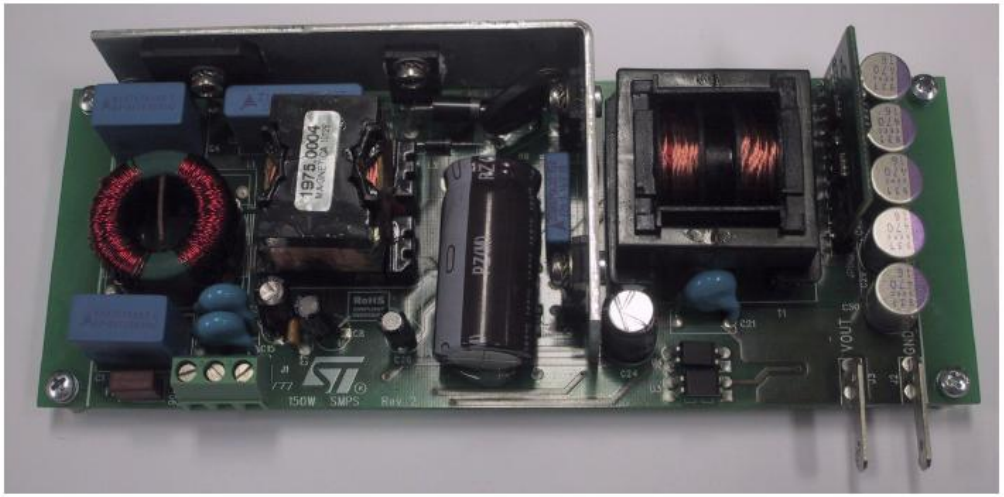
EVL6566B-65W-QR

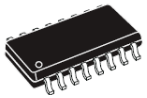


EVL6565B-40WSTB
EVL6566A-75WES4
EVL6566A-75WADP

L6599A Resonant Controller 50W 400W

50% duty cycle, variable frequency control of resonant half-bridge
High-accuracy oscillator
Up to 500 kHz operating frequency
Two-level OCP: frequency-shift and latched shutdown
Interface with PFC controller
Latched disable input
Burst-mode operation at light load
Input for power-ON/OFF sequencing or brownout protection
Non-linear soft-start for monotonic output voltage rise
600 V-rail compatible high-side gate driver with integrated bootstrap diode and high dv/dt immunity
-300/800 mA high-side and low-side gate drivers with UVLO pull-down
DIP16, SO16N package

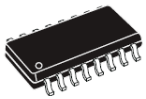


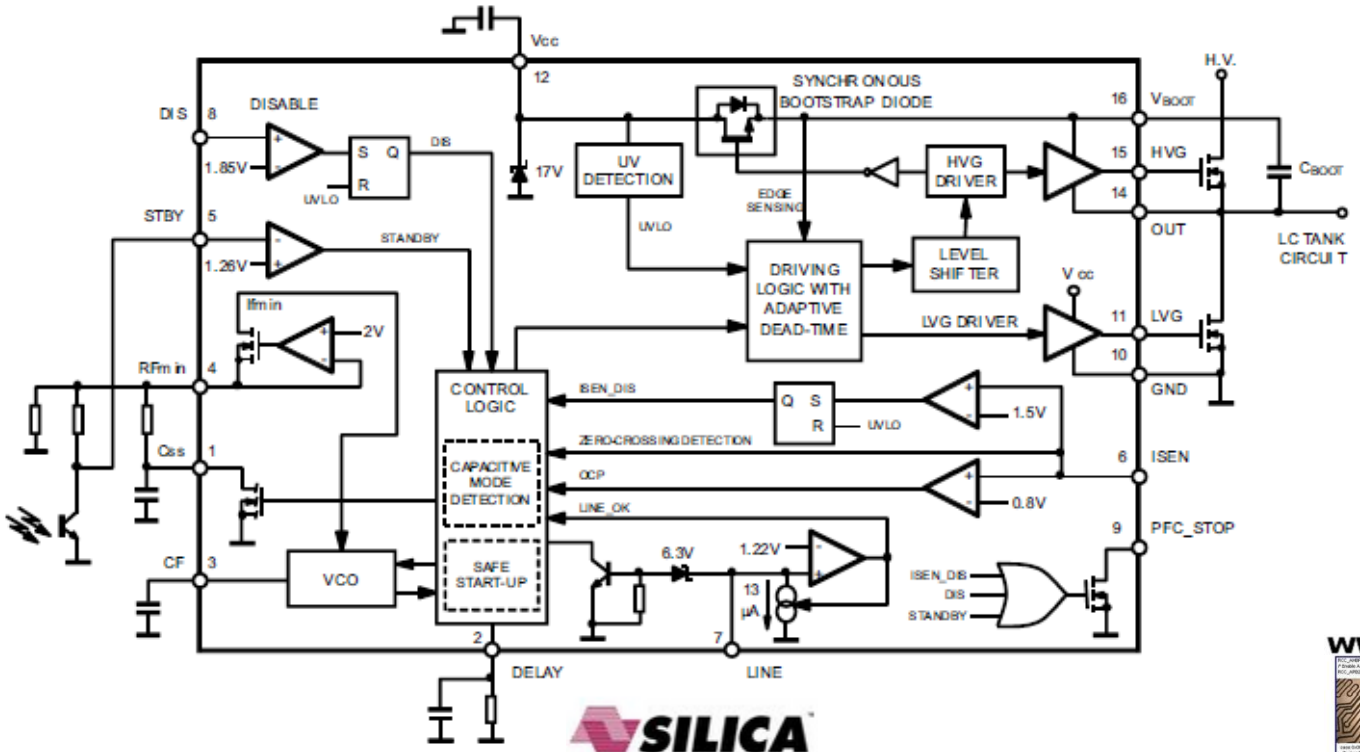


EVL150W-ADP-SR 150W With secondary synchronous rectification using L6599A + L6563H +SRK2000

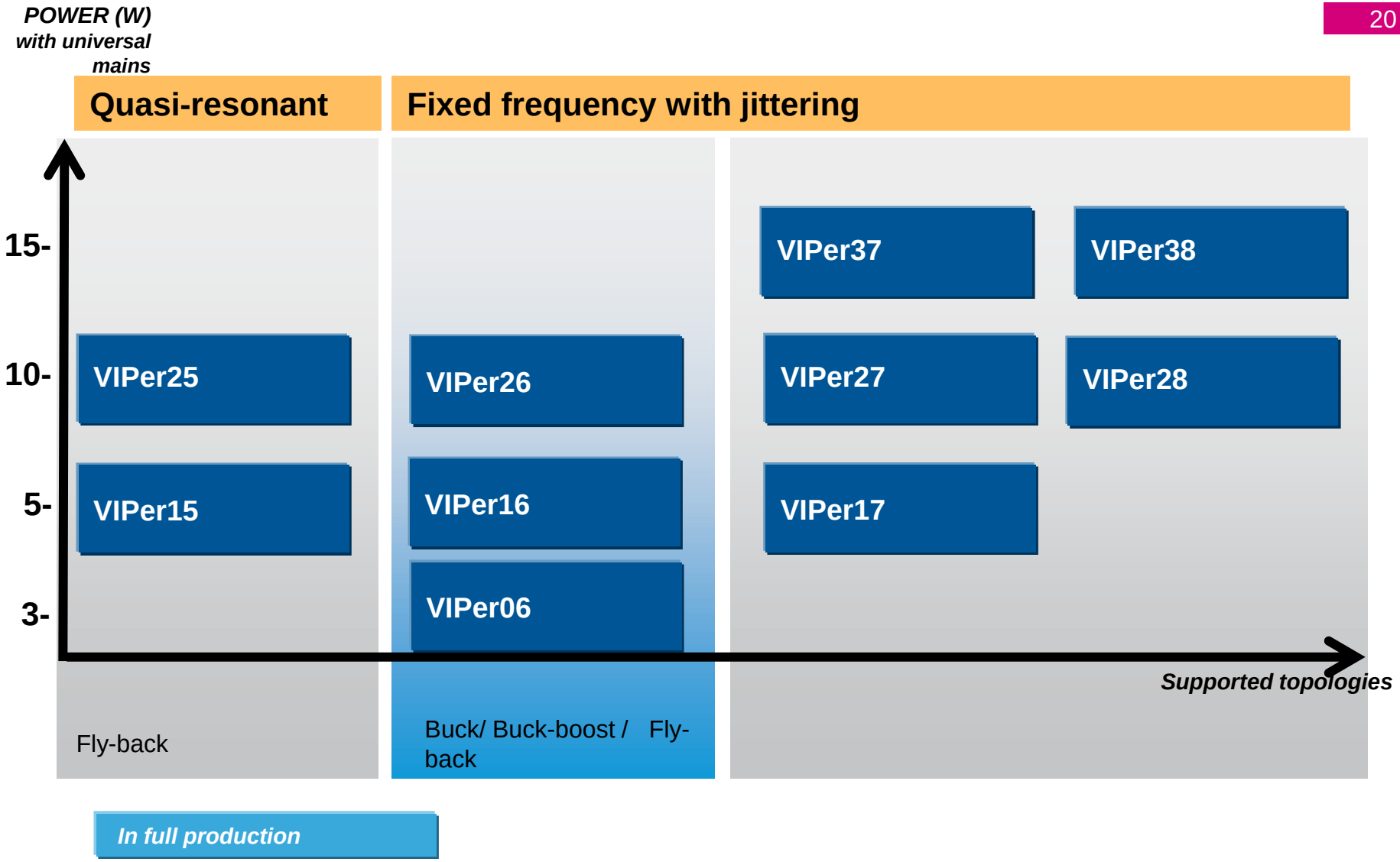
L6699 NEW Resonant Controller 50W 400W

Symmetrical duty cycle, variable frequency control of resonant half bridge
Self-adjusting adaptive deadtime
High-accuracy oscillator
2-level OCP: frequency-shift and immediate shutdown
Interface with PFC controller
Anti-capacitive-mode protection
Burst-mode operation at light load
Input for brownout protection or power-on/off sequencing
“Safe-start” procedure prevents hard switching at startup
600 V rail compatible high-side gate driver with integrated bootstrap diode and high dv/dt immunity
-300/800 mA high-side and low-side gate drivers with UVLO pull-down
SO16N package



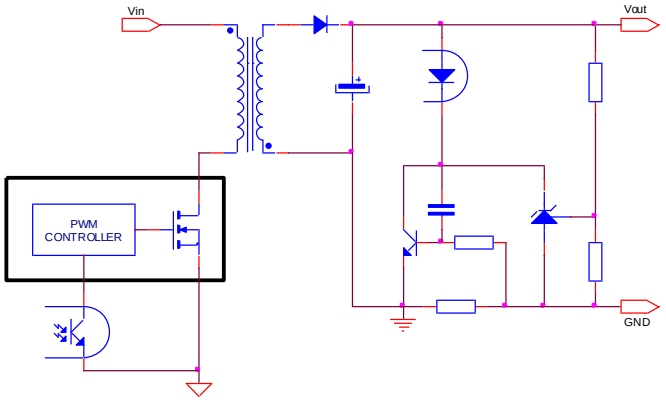


VIPER FAMILY 0W-25W European range

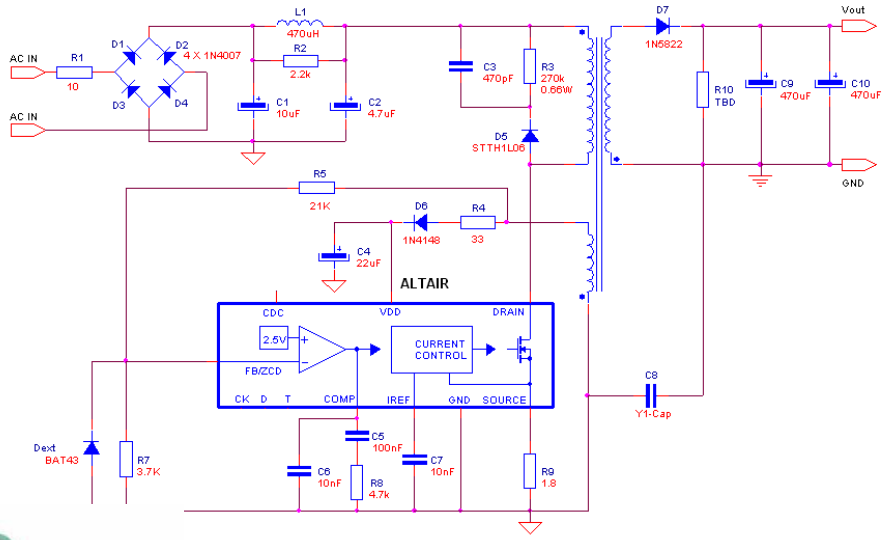


ALTAIR05T-800 ALTAIR04-900 Flyback with current and voltage primary control

Conventional flyback with Secondary current and voltage control



Altair flyback with Primary current and voltage control



EVLALTAIR900-M1(7.5W double output wide range for PLM)

EVLALTAIR05T-5W(5W 5V Single output wide range)

- **Control of output voltage and current entirely from primary side**
- **Accuracy 5% the best in primary control**
- **Benefit: Save all secondary regulation components (voltage reference, error amplifier(s), optocoupler, sense resistor)**

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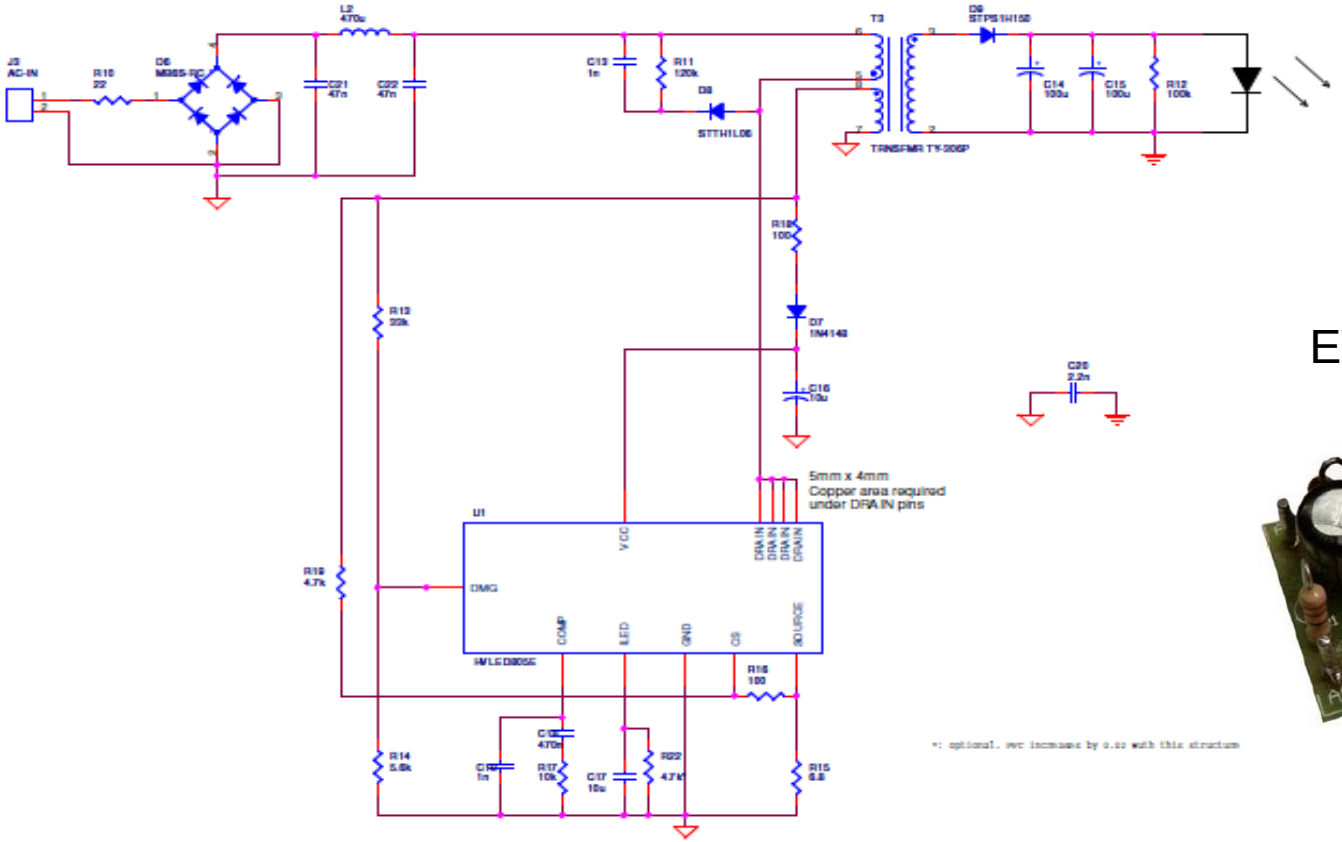
HVLED805 HVLED807 HVLED815 Flyback with current and voltage primary control for LED APPLICATIONS



EVALHVLED805

- Control of output voltage and current entirely from primary side
- Accuracy 5% the best in primary control
- Benefit: Save all secondary regulation components (voltage reference, error amplifier(s), optocoupler, sense resistor)
- HVLED807 & HVLED815 working without Electrolitic imput capacitors performing HIGH PF >0.9

Signal Conditioning

Operational Amplifiers / Comparators

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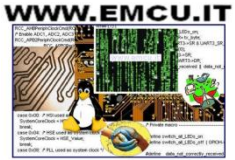

Signal Conditioning Product Product Portfolio

		ST 's Differentiations	Key Products
Comparator	*Standard*	Broad portfolio of general purpose products. **Automotive quality.**	**LM393, LM339**
	Low power	From low to micro power High performance Battery friendly	**LMV331, TS331** **TS86x**
	High Speed	Excellent Speed/power Ratio Highly stable Resp time over Temp range	**TS3021, TS3011**
Operational amplifier	*Standard*	Broad portfolio of general purpose products. **Automotive quality, Tiny package**	**LM358,LM324, LM290x,**
	Low Power	Extend battery life Shutdown option	**LMV3x, LMV82x**
	Micro power	Extend battery life, Shutdown option High accuracy and reliability	**TSV6x, TSV85x**
	Precision	Vio < 100µV (max.) Low noise	**TSV7x , TSZ1x**
	Current sensing	Wide supply voltage range Highly rugged Low current consumption	**TSC101, TSC102, TSC103**
Battery monitoring		Easy-to-build & Smallest Gas Gauge solution Extended battery life	**STC3100, STC3105**

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Standard Amplifiers

General purpose

LM201A/301A	(single)
LM224/324(A)	(quad, Icc=400µA)
LM146/246/346	(quad, CMR=110dB)
LM148/248/348	(quad, SVR=100dB)
LM258/358(A)	(dual, Avd=100V/mV)
LM2902	(quad, temp=-40/+125°c)
LM2904	(dual, temp=-40/+125°c)
LM2902H	(quad, temp=-40/+150°c)
LM2904H	(dual, temp=-40/+150°c)
MC1458	(dual, Avd=200V/mV)
MC3303/3403	(quad, SVR=90dB)
TS321	(single of LM324 in sot23-5)

Medium Speed

LF247/347	(quad, GBP=4MHz)
LF251/351	(single, GBP=4Mhz)
LF253/353	(dual, GBP=4Mhz)
LF255/355	(single, GBP=2.5Mhz)
LF256/356	(single, GBP=5Mhz)
LF257/357	(single, GBP=20Mhz)
TL071	(single, SR=16V/µs)
TL072	(dual, SR=16V/µs)
TL074	(quad, SR=16V/µs)
TL081	(single, Zin=12Mohms)
TL082	(dual, Zin=12Mohms)
TL084	(quad, Zin=12Mohms)
TSH22	(dual, GBP=25Mhz)
TSH24	(qual, GBP=25Mhz)

Precision op-Amp

OP07	(single, Vio=150µV)
TS512I	(dual, Vio=500µV)
TS514I	(quad, Vio=500µV)
TS522I	(dual, Vio=850µV)
TS524I	(quad, Vio=950µV)

Low noise

LM833	(dual, en=4.5nV/VHz)
MC33078	(dual, en=4.5nV/VHz)
MC33079	(quad, en=4.5nV/VHz)
MC4558	(dual, en=12nV/Vhz)
LS204	(dual, en=8nV/VHz)
LS404	(quad, en=8nV/VHz)

Low Power

MC33171	(single, Icc=200µA, Vcc=+/-22V)
MC33172	(dual, Icc=200µA, Vcc=+/-22V)
MC33174	(quad, Icc=200µA, Vcc=+/-22V)
TS272	(dual, Icc=1mA)
TS274	(quad, Icc=1mA)
TS27L1	(single, Icc=10µA)
TS27L2	(dual, Icc=10µA)
TS27L4	(quad, Icc=10µA)
TL061	(single, Icc=200µA)
TL062	(dual, Icc=200µA)
TL064	(quad, Icc=200µA)

Temp range: -55°c to +150°c
Supply range: 2.5 V to 44V
Pin to pin compatible
Wide range of applications
DIp, SO, TSSOP, SOT23

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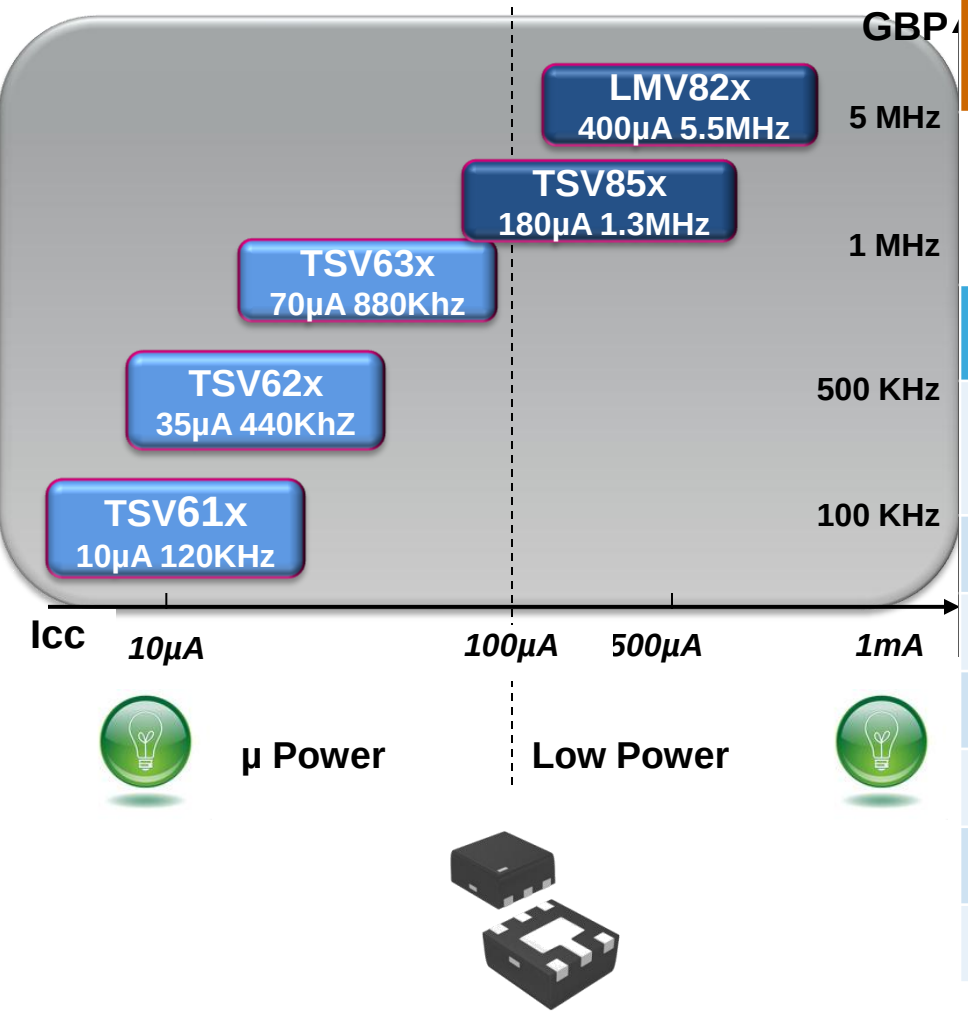
LMV/TSV8 Series:Low Power Op amps

When Icc versus Frequency matters



LMV82x (NS&TI)	LMV321/358/324 (NS&TI)
General purpose families Well-Known in the market	

offering

LMV82x	TSV85x
Drop in Solution Enhanced performances	
Wider Vcc range from 2.5V to 6V	
Stand by function	
DFN 2x2 package for dual	
Precision Vio 0.8mV	
4KV ESD	
Automotive grade in 2012	

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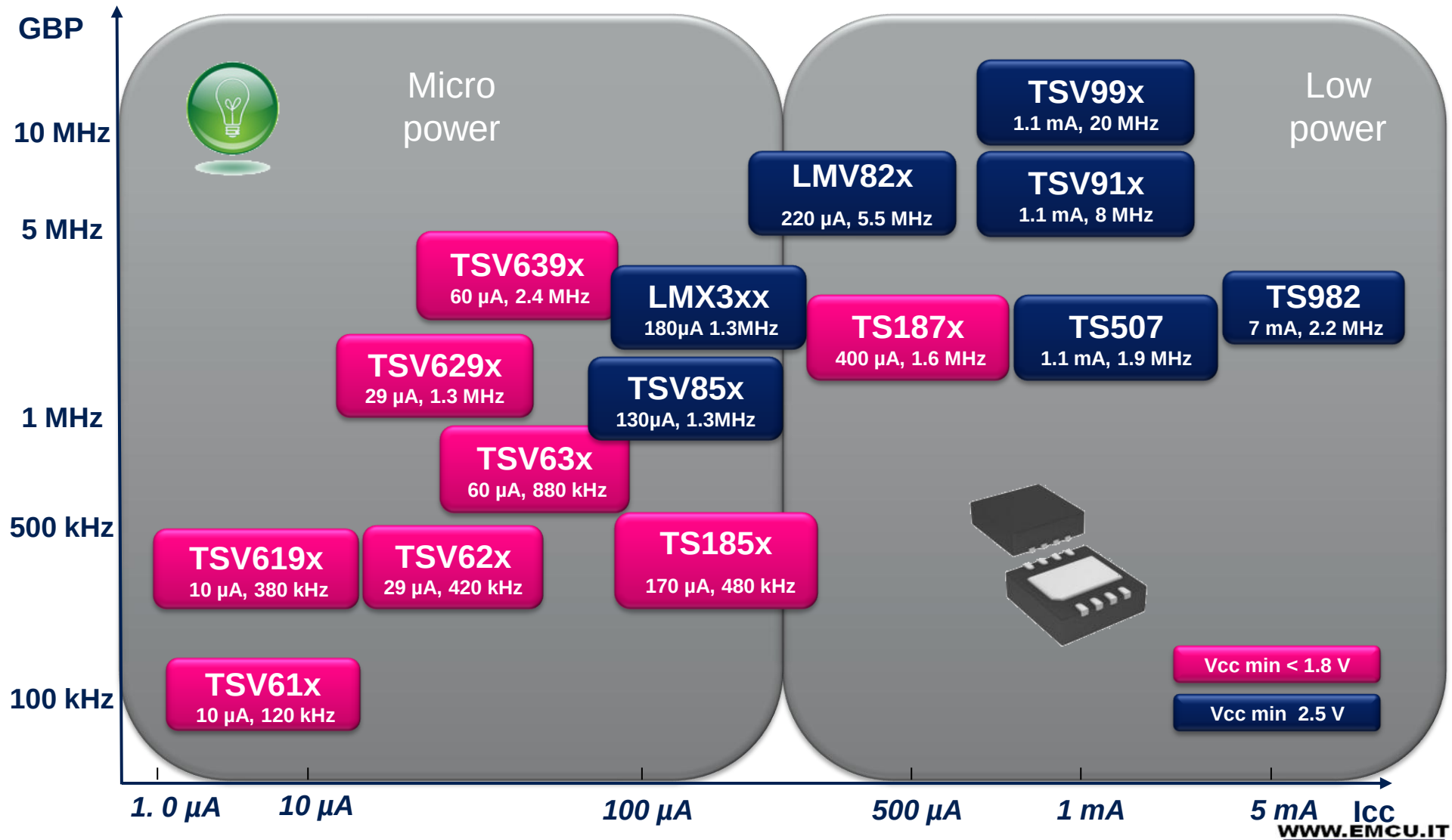
ST op-amp portfolio: low –voltage (6V)



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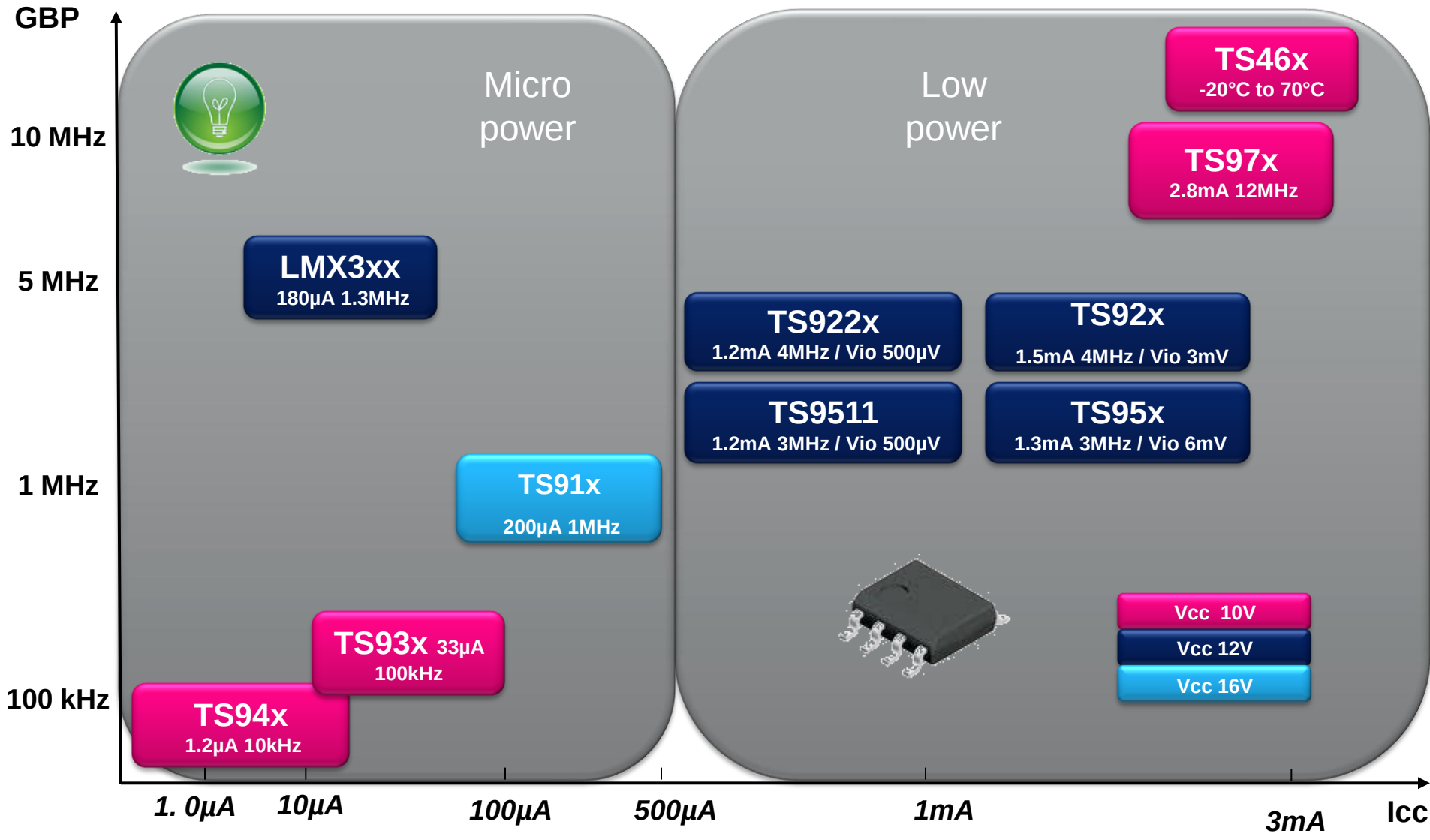
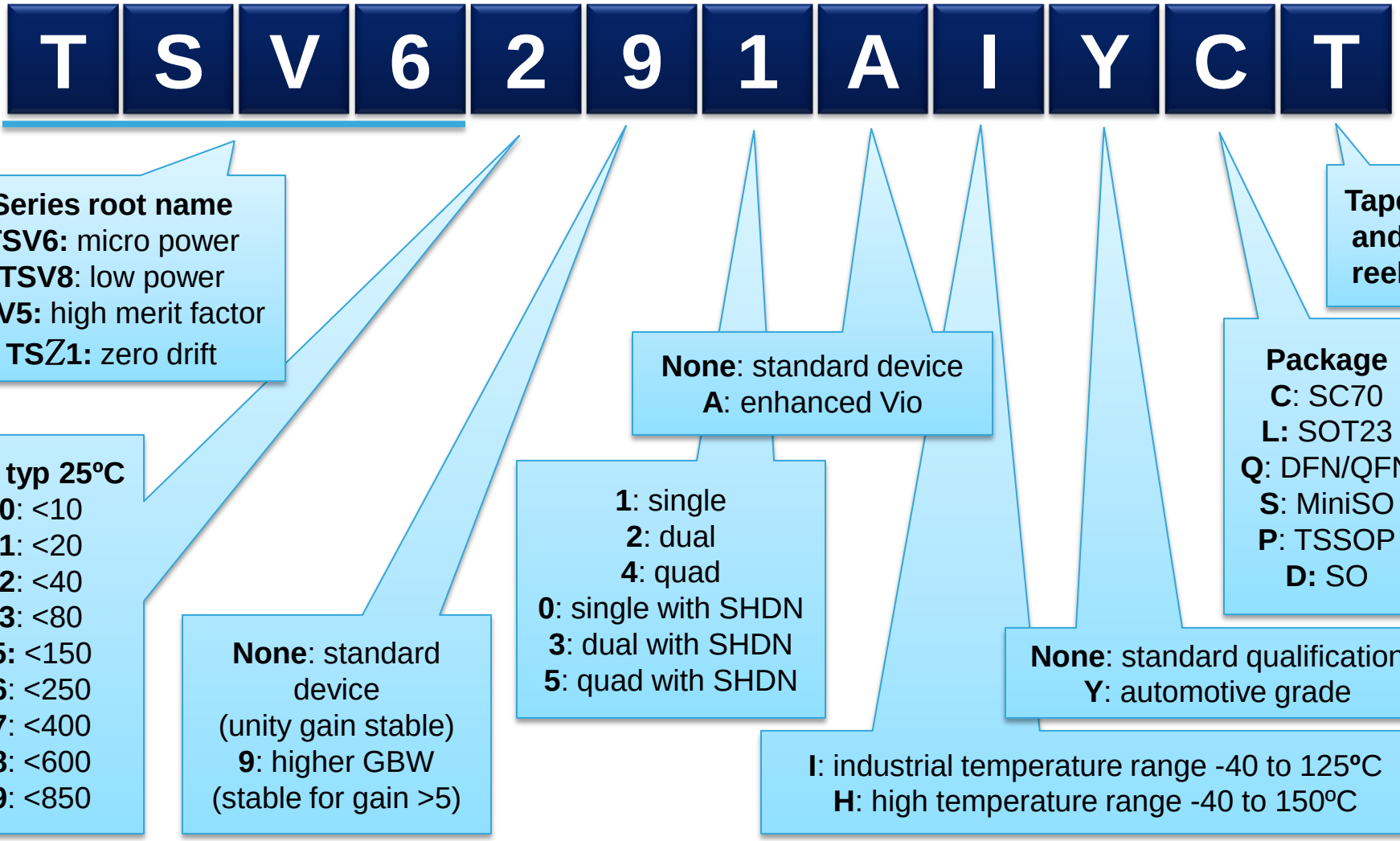
ST op-amp portfolio: high–voltage (10V to 16V)

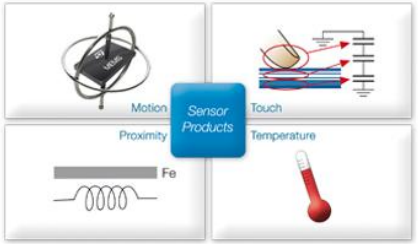


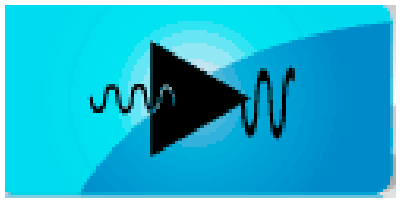
Order Code Rules



ST Signal Conditioning

OPERATIONAL AMPLIFIERS		
Low Power	TSV9x Series	Low power Rail to Rail : Icc=1mA starting 8Mhz to 20Mhz GBW
	LMV82x Series	Standard low power: 400µA/5.5Mhz with Shutdown
Micro power	TSV6x Series	Micro-power Rail to Rail : starting 12µA/120Khz with Shutdown
	TSV85x Series	Micro-power : 180µA/1.3Mhz with Shutdown
Precision	TSV7x Series*	High precision : Vio below 100µV
	TSZx Series*	High precision : Zero Drift Vio below 10µV; 0.1µV/°C
COMPARATORS		
Micro/Nano power	TS331	Micropower 5V,Rail to Rail : 30µA/200ns
	TS881*	Nano Power 1.2v to 5V, Rail to Rail : 500nA/4us
High Speed	TS3021	High speed 5V,Rail to Rail PushPull : 70µA/40ns
	TS3011	High speed 5V, Best power over Response time ratio : 500µA/8ns





*Available Q2.2012

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ST Comparator Portfolio

General purpose

Bipolar

LM2901/3
200µA / Comp
1.3µs resp time
Open collector

LM339/393
200µA / Comp
1.3µs resp time
Open collector

TS391
200µA
1.3µs resp time
Open collector

CMOS

TS372/4
150µA / Comp
0.6µs resp time
Open drain

Micropower

CMOS

TS339/393
9µA / Comp
1.5µs resp time
Open drain

TS3702/3704
9µA / Comp
1.5µs resp time
Push-Pull

BiCMOS

TS86x (R2R)
6µA / Comp
3µs resp time
Push-Pull

TS7211/21 (R2R)
6µA
3µs resp time
Push-Pull & Open drain

High speed

Bipolar

LM311
5mA
200ns resp time
Open E & C

LM319
8mA
80ns resp time
Open Collector

BiCMOS

TS302x (R2R)
64µA
33ns resp time
Push-Pull

Note: R2R stands for "Rail to Rail"

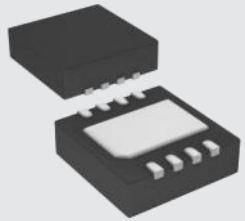
ST Comparator Portfolio

TS339/393 OD
TS3702/3704
7 µA, 1.5 µs PP

LM2901/2903 OD
-40 to +125 °C
TS391 OD
LM393/339
200 µA, 1.3 µs OD

TS7211 PP RR
TS7221 OD RR
TS86x
6 µA, 500 ns PP RR

TS372/374
150 µA, 600 ns OD



TS331/332/334
30 µA (max), 200 ns OD RR

LMV331/393/339
100 µA (max), 200 ns OD

TS3021/3022
70 µA, 40 ns PP RR

TS3011
500 µA, 8 ns PP RR

Response time

1 µs
500 ns
100 ns
10 ns

1. 0 µA
10 µA
50 µA
100 µA
500 µA
Icc

RR: rail-to-rail inputs, OD/PP: open-drain/push-pull output

Vcc 5 V
Vcc 10 V
Vcc 16 V
Vcc 36 V

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TS3011 High Speed Comparator

- Rail to rail inputs
- Push-Pull output
- 2.2 to 5V supply voltage
- Low supply current
  - 0.69mA maximum at Vcc=5V and T=25°C
  - 0.9mA maximum at Vcc=5V within temp. range
- Low bias current
  - 100pA max lib within temp. range
- Fast response time
  - 9ns typical with 50mV overdrive and Vcc=2.7V
  - 13ns maximum with 50mV overdrive and Vcc=2.7V
- Wide temperature range
  - -40° to +125°C
- Small package offer:
  - SOT23-5, SC70-5 and DFN6 1.2x1.3mm coming soon

Highly stable response time over extended temperature range

TS3011, Tiny Package, Best in class on Ratio ICC / Response time !

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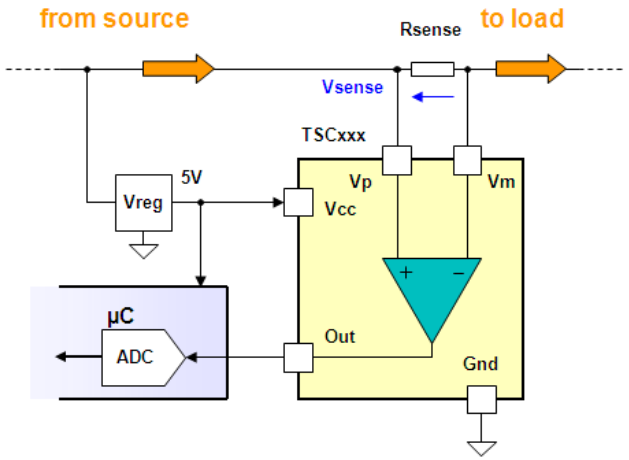
High side current sense basic

TSC10x family: Ideal interface between high voltage analog and low voltage digital

- **Up to 70V line monitoring**
- **Easy** integrated solutions, reduce external components and design time
- **Rugged devices,** remove the need of external protections
- Supply voltage up to 30V
- **Extended Temperature** range -40°C to 125°C
- Automotive grade products



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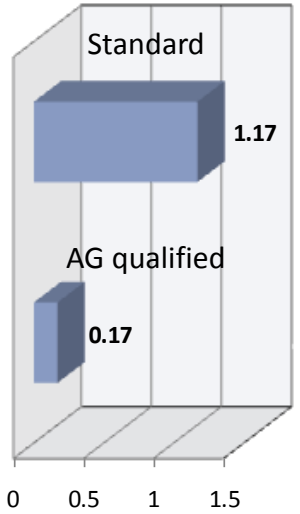
Automotive Parts

Automotive grade parts are emphasized by the Y letter

	Front end			EWS					Assembly	Final test		
	Automotive Flow	Control Process Electrical test (T84)	Visual inspection	Electrical Test	PAT (*)	GPAT (*)	SBL (*)	SYL (*)	Specific « auto flow »	Electrical	Hot test	JVT (*)
Standard	✗	Sampling screening	Sampling	Sampling	✗	✗	✗	✗	✗	✓	✗	✗
AG Qualified "Y"	✓	100% Wafer screening	100% of wafer	✓	✓	✓	✓	✓	✓	✓	✓	✓

FAR/Mu (ppm)
automotive customers
period: 2009/H1-2010
Fars confirmed
including EOS-ESD



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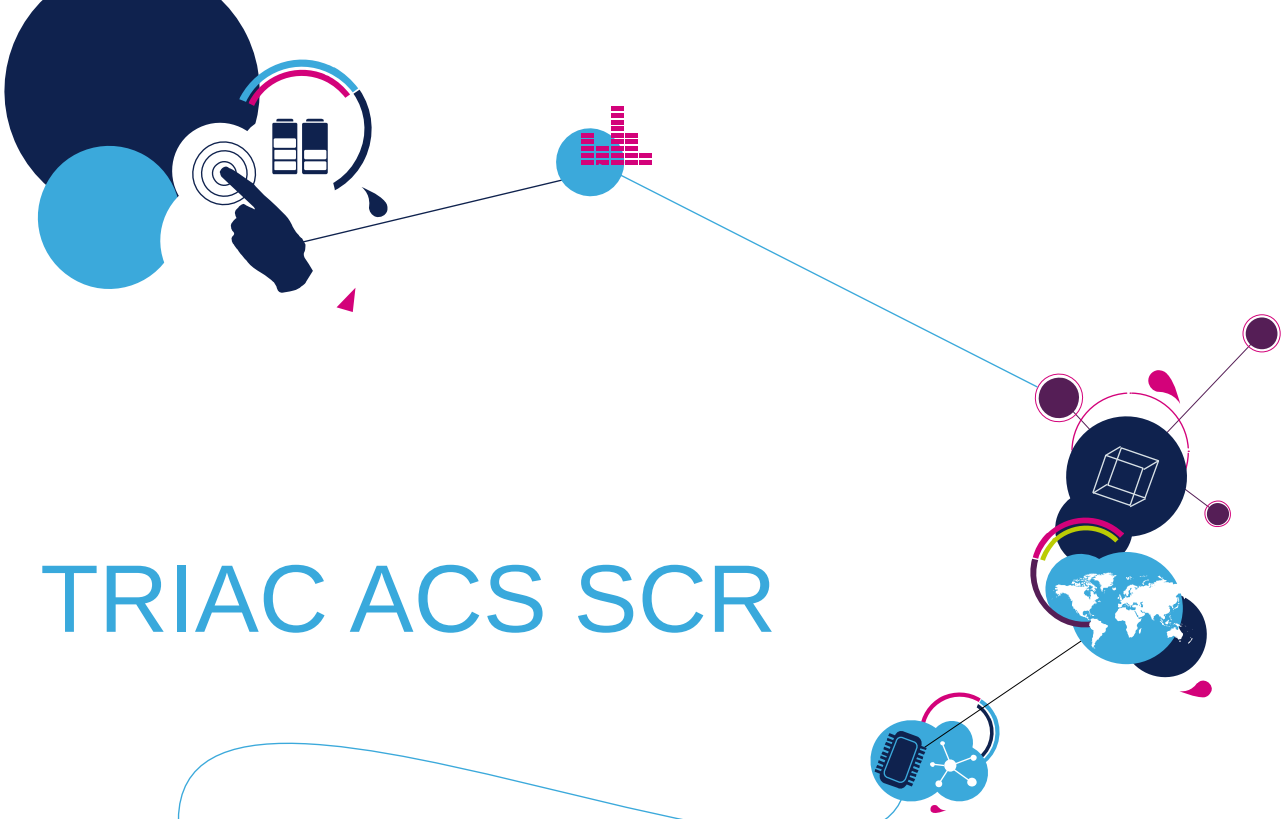

Thyristors TRIAC ACS SCR

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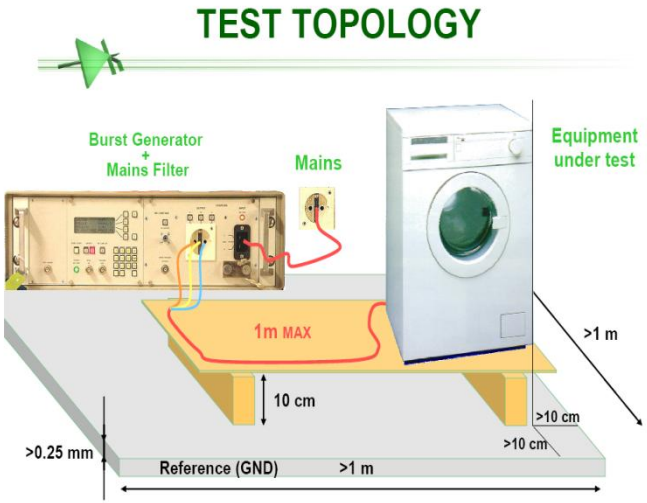
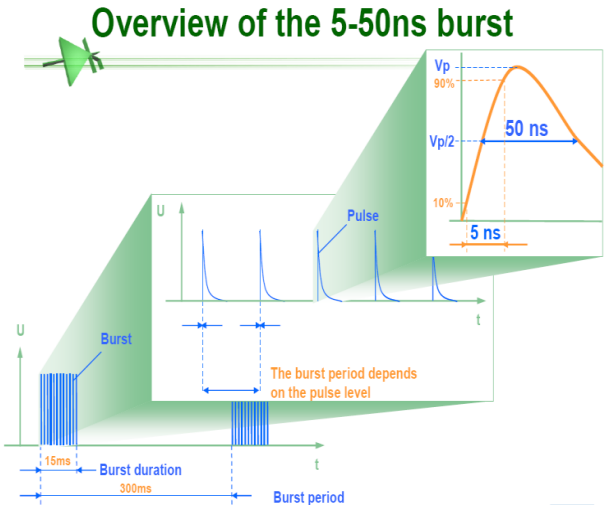
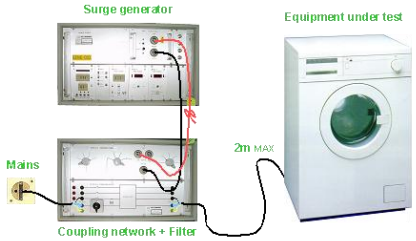
Fast Transient and surge TEST

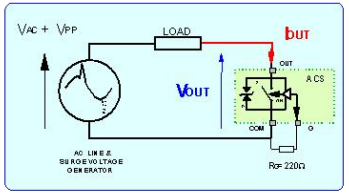
- **IEC 61000-4-4 : electrical fast transient / burst immunity test**

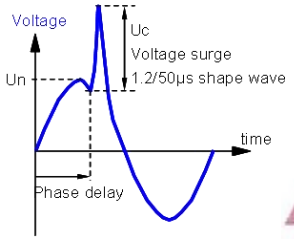




- **IEC 61000-4-5 : surge immunity test**







Voltage applied at the input of the system:
V_{IN} = 2360V

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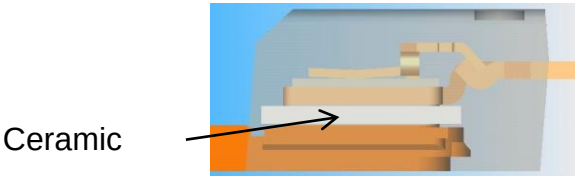
UL Certification

- **UL 1557 : Electrically-isolated semiconductor devices**
  - Test consist in applying 2,500 V_{RMS} between case and leads for 60 s
  - Ceramic insulated packages TO-220AB, TOP3 and RD-91 are UL 1557
  - New H and T series Triacs are now UL 1557
  - See UL file E81734 here



Packages	Voltage (rms)	Product Family
Isolated TO220AB (ceramic)	2500 V ac	Standard (**BTA**, **TXDV**), High T_J (**T**xxyy**H**...), T series (**T**xxyy**T**), SCR (**TXN**), Triac (**TXDV**)
TOP3I (ceramic)	2500 V ac	Triacs (**BTA**, **TPDV**), SCRs (**BTW**)
RD-91 (ceramic)	2500 V ac	Triacs (**BTA**), SCRs (**BTW**)
ISOWATT 220AB (plastic)	1500 V ac	Triacs (**T**xxyy-zzz**W**)

- **UL 94 V-0 : flammability standard**
  - Most Thyristors resins are UL 94 V-0.
  - Yellow cards available on request

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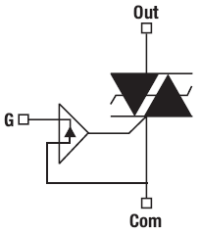
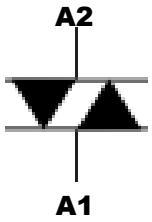
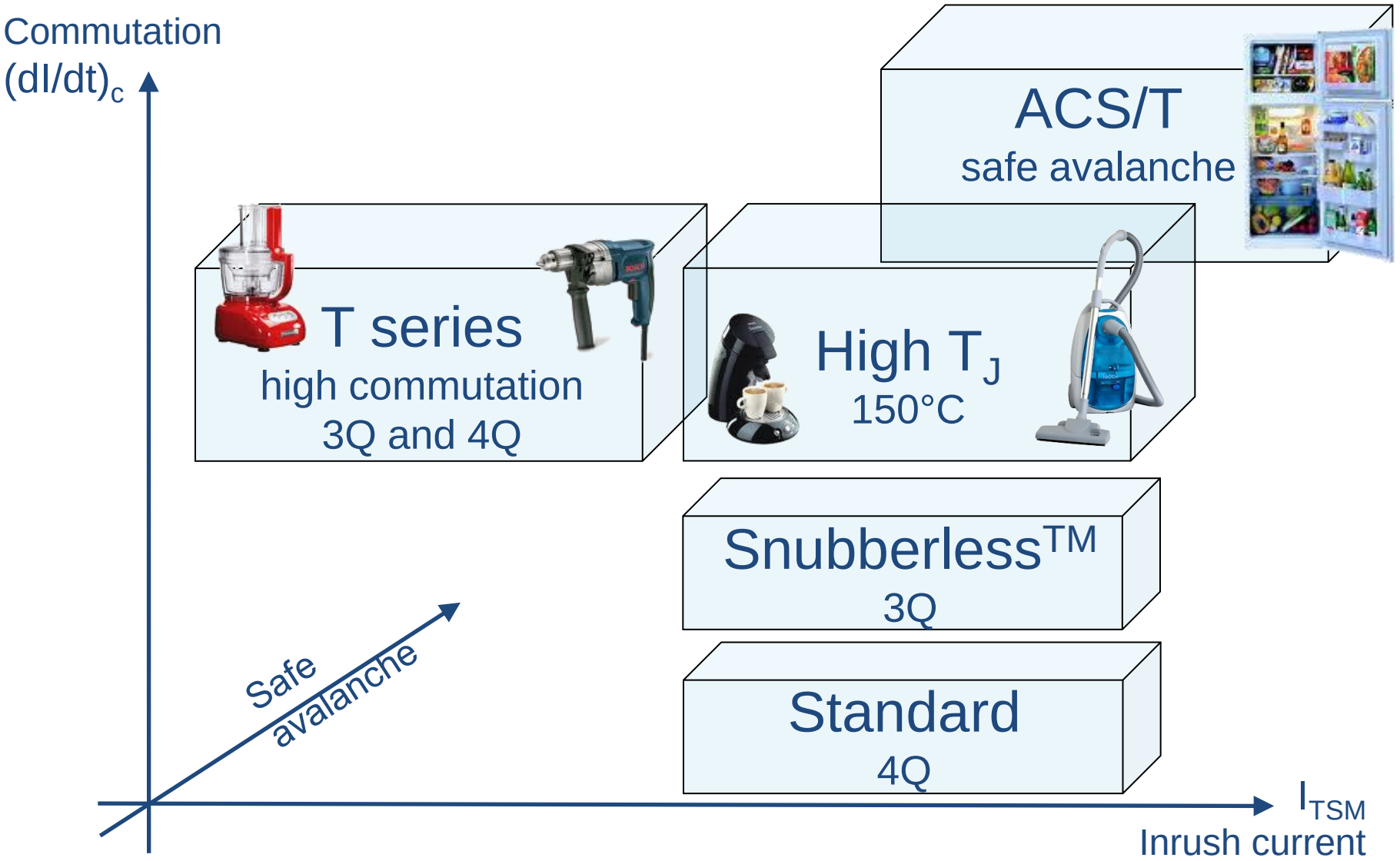
ST Thyristor portfolio

SCR	Triac	ACS	ACST	DB	ASD
					**Application Specific Devices**
Sensitive	Standard (4Q)	Overvoltage protected & level shifter	Overvoltage protected	Diac (DB3, DB4, TMMDB3)	Ignitors for industrial (FLC)
Standard	Snubberless™ (3Q)	Snubberless™ & Logic Level (I_{GT} = 10mA)	Snubberless™ & Logic Level		Ignitors for Lighting (LIC)
	Logic Level	Snubberless™ & Super Logic Level (I_{GT} = 5 mA)	Snubberless™ & Standard		Power Control Circuit (STCC)
	High Tj				

Triac Positioning






Triac Positioning

Symbol	Standard	Snubberless™	T NEW	H	ACS/T
P/Ning	BTA/BTB/T/Z	BTA/BTB/T…**W**	Txxyy**T**	Txxyy**H**	ACS/T
$I_{T(RMS)}$ (A)	1 to 40	4 to 25	8 to 16	4 to 30	0.2 to 12
V_{DRM}/V_{RRM} (V)	600, 800	600, 800	600 to 800	600	600 to 800
I_{GT} (mA)	10, 25, 50	10, 35, 50	10, 20, 25, 35	10, 35, 50	5, 10, 35
dV/dt (V/µs)	up to 500	up to 1000	up to 2000	up to 1500	up to 2000
$(dI/dt)_c$ (A/ms) (@ e.g. 12 A 35 mA)	up to 20 (5.3)	up to 22 (6.5)	up to 16 (12)	up to 44 (16 @ 150° C)	up to 16 (12)
Max T_j (° C)	125	125	125 / 150	150	125 / 150
Appli	4Q 3Q General purpose		High commutation (motor in DIY tool, fan, kitchen top)	150° C full spec and/or high I_{TSM} (Heater, V/C, W/M, coffee machine)	High immunity, safe avalanche (24/7 on mains: fridge, A/C)

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800V T series TRIACS :TxxyyT-8I

- First 800 V T series Triac are being launched :
  - Improved performances (with same gate current) vs. BTA/BTB
    - 4x better noise immunity (dV/dt ≥ 2,000V/µs)
    - 2x better commutation performance
  - 16 A in TO-220 insulated
  - I_{GT} 10, 20 and 35 mA
  - 2 possible working conditions :
    - 600 V / 150°C, or
    - 800 V / 125°C

TO-220AB insulated

- Target applications :
  - Resistive load for I_{GT} 10 mA : water heater, electric heater, W/M heater, coffee machine water heater
  - Inductive load for I_{GT} 20 and 35 mA : motor control in W/M, fridge, blender

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800V T Serie Triac benefits

I_{GT} (mA)	10		35	
P/N	BTA16-800SW	T1610T-8I NEW	BTA16-800CW	T1635T-8I NEW
dV/dt (V/µs)	40 @ 125° C	100 @ 125° C (x 2)	500 @ 125° C	2,000 @ 125° C (x 4)
		50 @ 150° C (+ 25°C)		1,000 @ 150° C (x 2 + 25°C)
$(dI/dt)_c$ (A/ms)	8.5 @ 0.1 V/µs	9	8.5 w/o snubber	16 (x 2)
		3 (+ 25°C)		12 (+ 50% + 25°C)

The 800 V T series enables size and cost reduction of the Triac itself, the heatsink and the power supply.

Improvement is such that 50 mA I_{GT} becomes obsolete.

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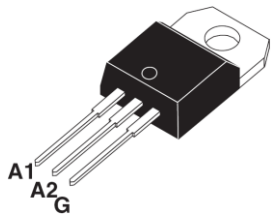
T Serie TRIAC RANGE

1st generation : 600 V 125°C

2nd generation

Symbol	Unit	T8xxT-6I	T12xxT-6I	T16xxT-8I
$I_{T(RMS)}$	A	8	12	16
V_{DRM}/V_{RRM}	V	600		800 @ 125° C 600 @ 150° C
I_{GT}	mA	either 10, 20 or 35		
dV/dt	V/µs	up to 2,000 @ 125° C		2,000 @ 125° C 1,000 @ 150° C
$(dI/dt)_c$	A/ms	up to 8	up to 12	16 @ 125° C 12 @ 150° C



TO-220AB insulated
(TxxyyT-zI)

800 V 125°C
or
600 V 150°C

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HIGH TJ Triac Benefits

OVERPASS POWER DISSIPATION LIMITS

5A RMS / Tamb 55°C

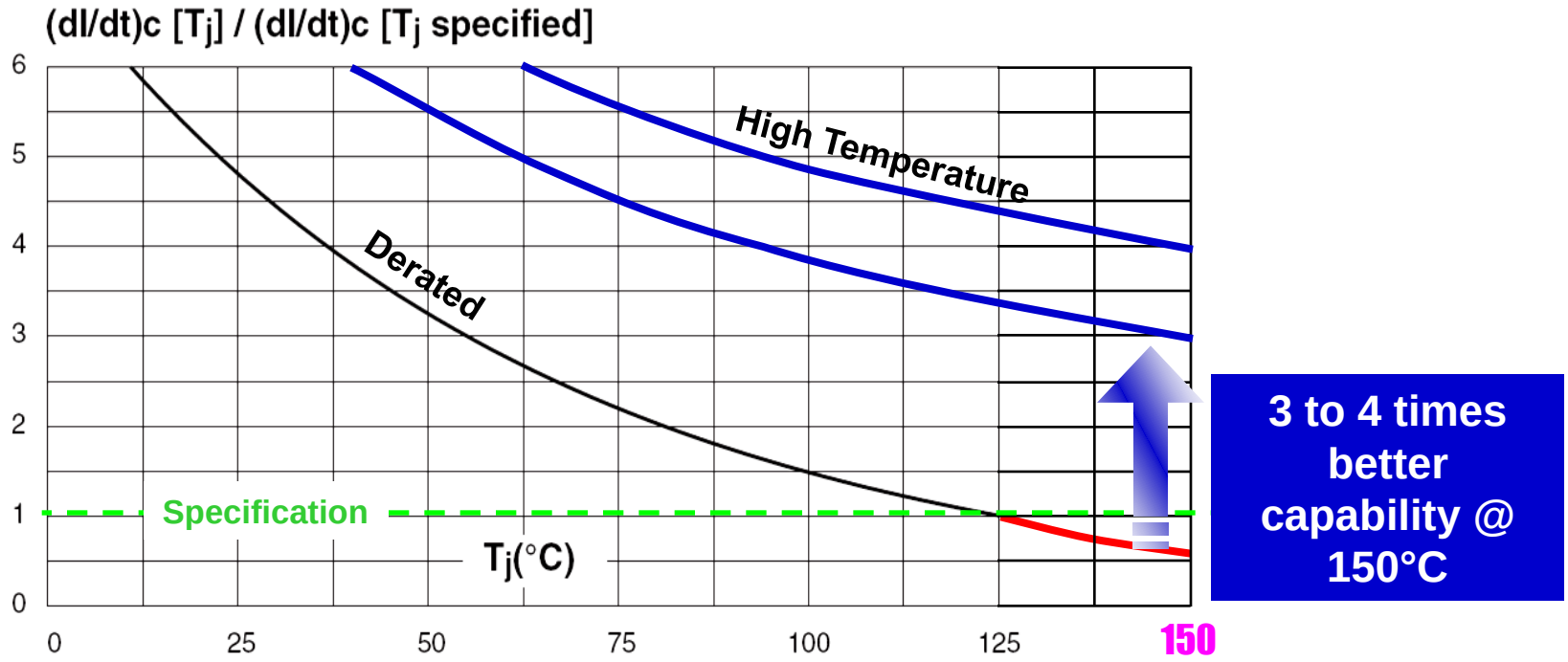
Divide Heatsink Cost by 2

14°C/W
STANDARD 12A TRIAC
BTB12 or BTA12

20°C/W
NEW High Tj
T1235H

Txx35/50H series benefits

- Maximal turn-off capability: depends on the junction temperature…



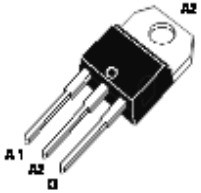
- Increasing by 25°C the junction temperature from 125°C causes a drastic reduction of the maximal turn-off capability by around 40%

  -> New design provides better performances @ 150°C

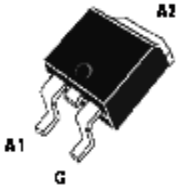
HIGH TJ Triac road map

Symbol	Unit	T4xxH-6y	T6xxH-6y	T8xxH-6y	T10xxH-6y	T12xxH-6y	T16xxH-6y	T20xxH-6y	T30xxH-6y
$I_{T(RMS)}$	A	4	6	8	10	12	16	20	30
V_{DRM}/V_{RRM}	V	600							
I_{GT}	mA	10		10, 35, 50		35, 50			
T_J MAX	° C	150							
TO-220AB		x	x	x	x	x	x	x	x
TO-220AB Ins.				x (35, 50 mA)	x (35, 50 mA)	x	x	x (35 mA)	x
D²PAK				x	x	x	x	x (35 mA)	

NEW

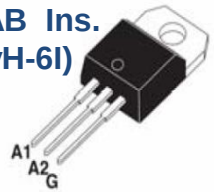


TO-220AB
(TxxyyH-6T)



D²PAK
(TxxyyH-6G)

TO-220AB Ins.
(TxxyyH-6I)



New High T_j Triacs generation :

High turn-off capability : up to 4 times the specified $I_{T(RMS)}$ (nominal)

High immunity @ 150°C : up to 1500V/µs

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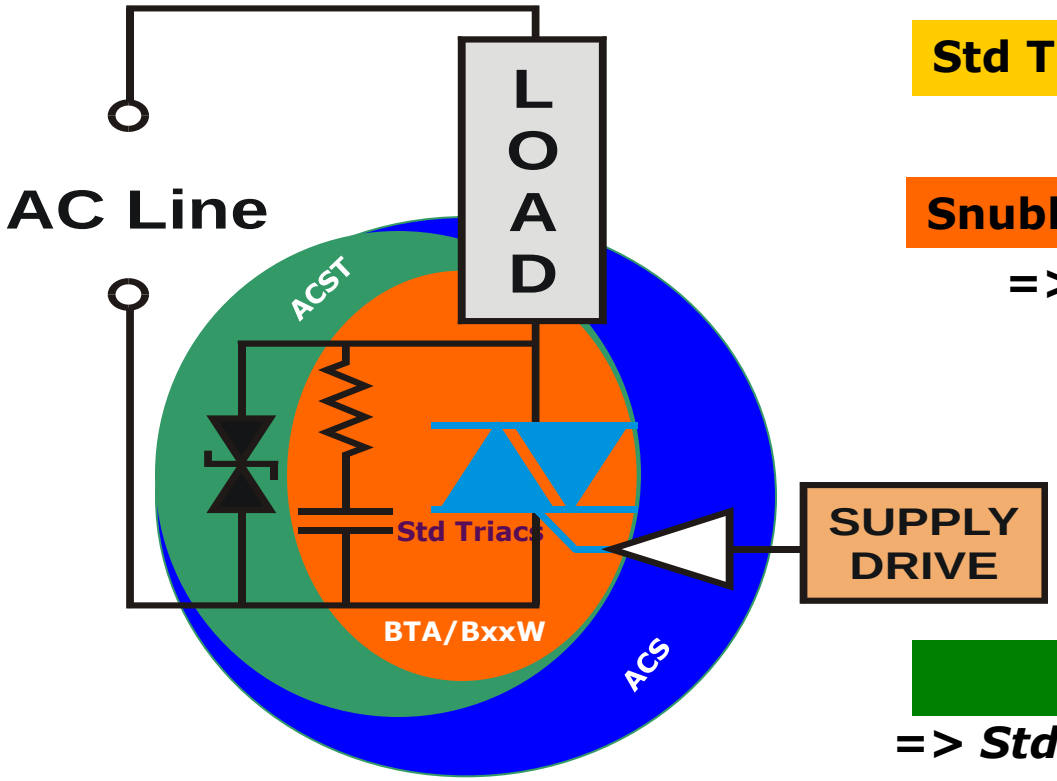
From Triac to ACS



Std Triacs = BTAx/BTBx/Z0x/Txx

Snubberless™ Triacs = BTA/BTB W

=> Std Triacs + RC snubber

ACSTxx

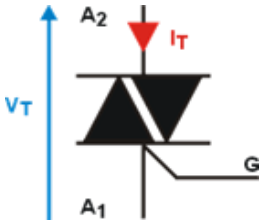
=> Std Triacs + RC snubber + MOV

ACSxx

=> Std Triacs + RC snubber + MOV + Gate interface

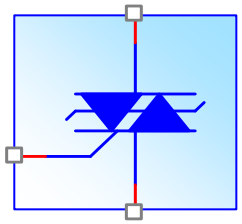
ACS Best Safe Operating Area

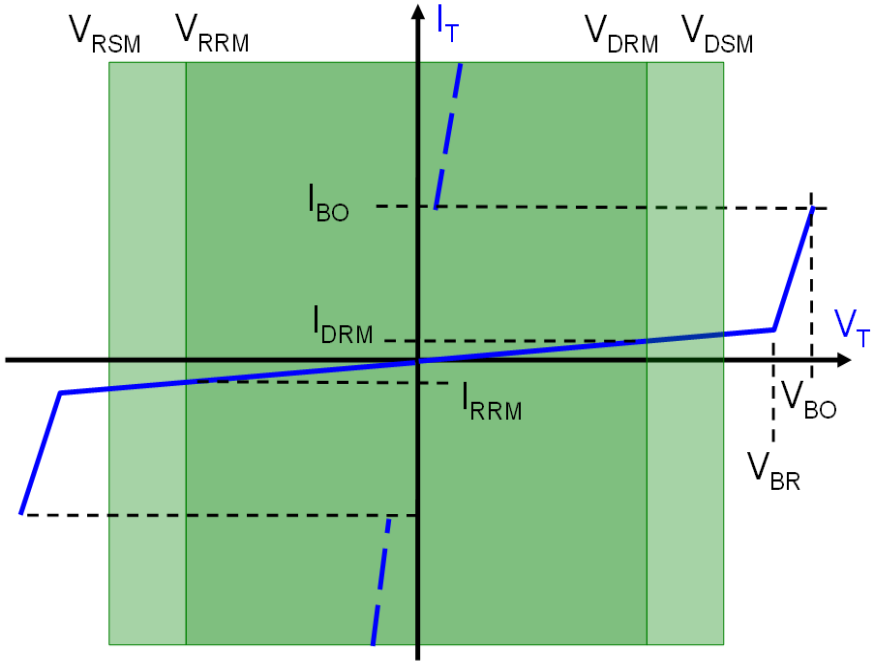
Safe operating areas of triac and ACST



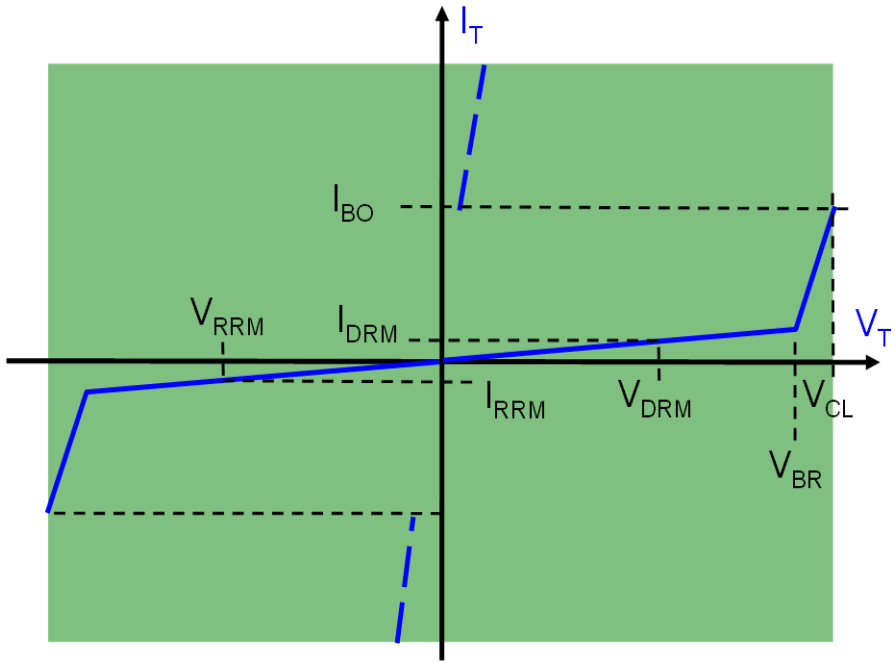
Triac

ACST





Safe Operating Area for triac



Extended Safe Operating Area for ACS & ACST

Safe turn-on by overvoltage extends SOA of ACS & ACST

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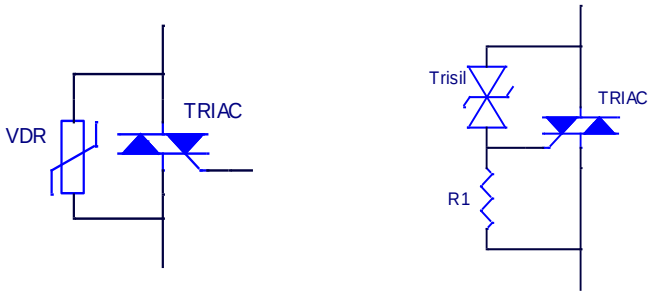
ACS Protection

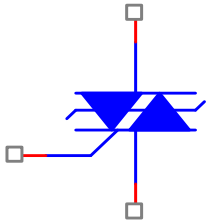
2 product ranges => 2 protection strategies

Triac



- Overvoltage protection is done with additional components (varistor or trisil + R).
- Triac remains off safely.
- Overvoltage energy is absorbed by protection components.

ACST



- Overvoltage protection is built-in
- No need of additional component
- ACST turns-on safely for an half-cycle
- Overvoltage energy is absorbed by the load.

Silicon based solution (ACST) is more reliable and efficient than varistor versus aging and number of overvoltages.

ACST range increases overall reliability of the system constantly plugged on the AC mains

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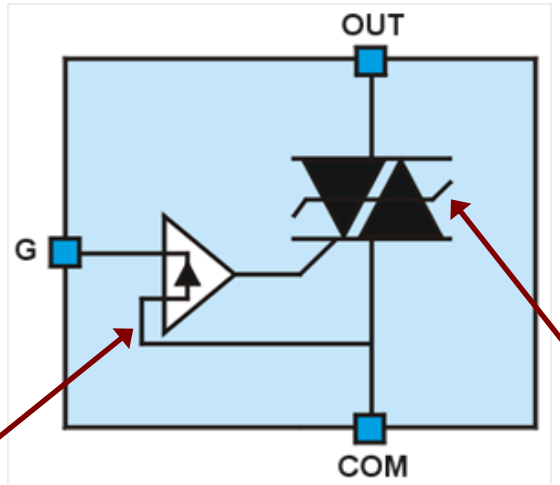
ACS & ACST Comparison

The shortest way to IEC 61000 approval

ACS FOR LOW POWER ACTUATORS

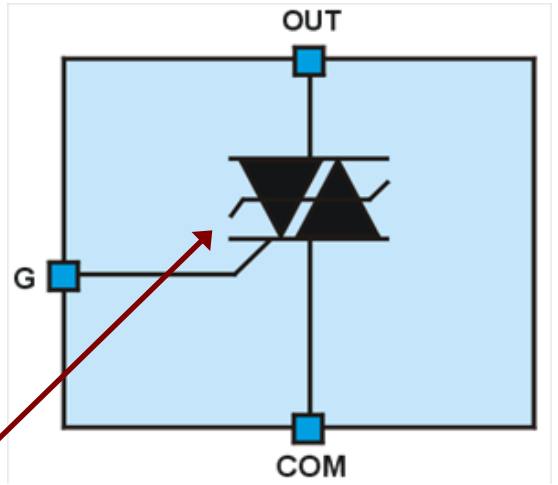


GATE INTERFACE :

- DIRECT MCU DRIVE
- HIGH NOISE IMMUNITY

REFERENCE FOR COMMON TAB

ACST FOR HIGH CURRENTS LOADS



OVERVOLTAGE PROTECTION

Pin to Pin standard TRIAC

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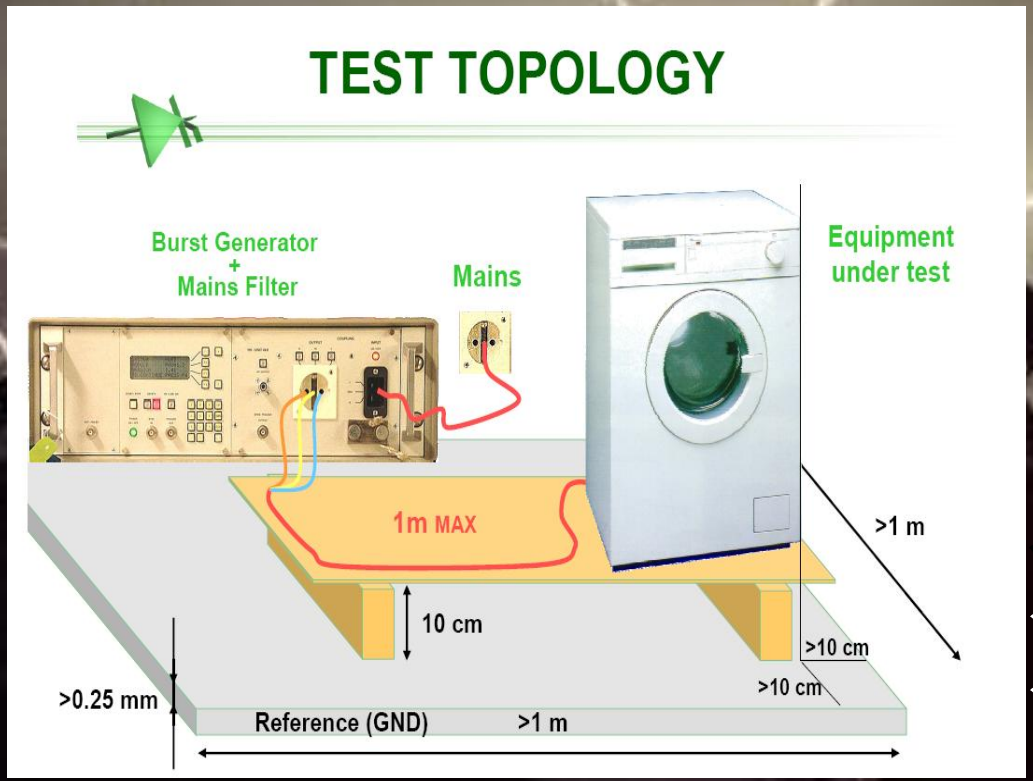
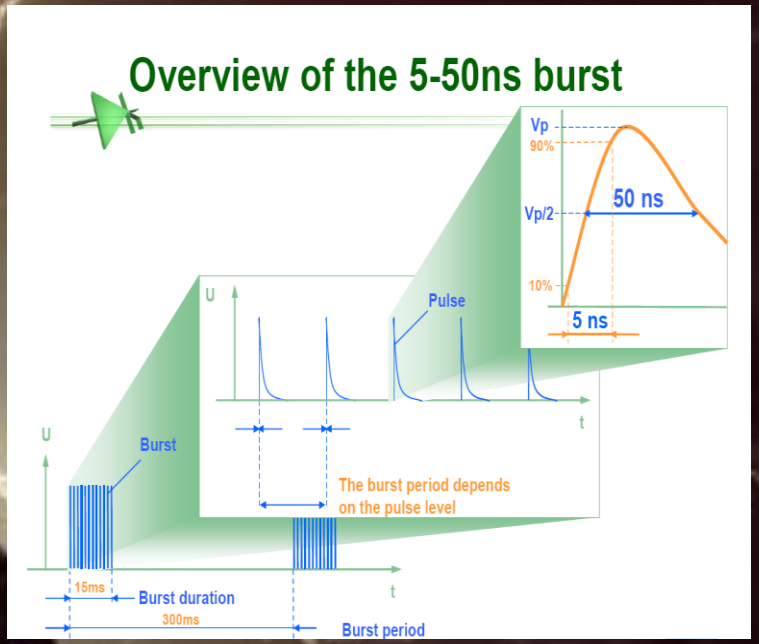
Features: Immunity vs. Igt

- **Higher immunity:**
  - Fast Transient Burst Test **(IEC61000-4-4)**





- ✓ **Best in class trade-off**
- ✓ **Static dV/dt > 500V/us**
- ✓ **Igt < 10mA**

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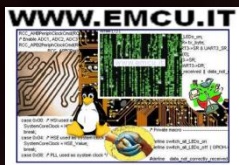
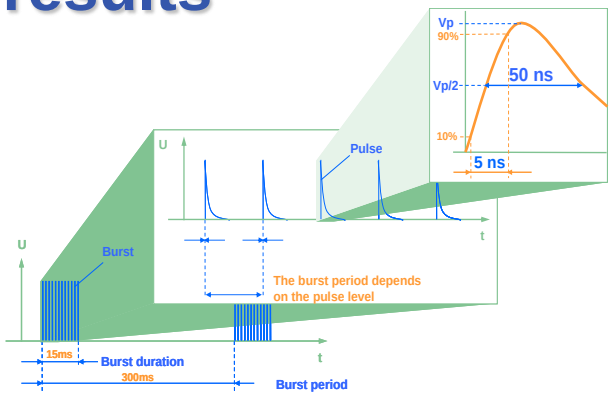


Features: ACST2 immunity results

Reference: IEC61000-4-4, burst test



T410

Symbol	Test Conditions	Quadrant		T4			Unit
				T405	T410	T435	
I_{GT} (1)	V_D = 12 V R_L = 30 Ω	I - II - III	MAX.	5	10	35	mA
dV/dt (2)	V_D = 67 %V_{DRM} gate open T_j = 125°C		MIN.	20	40	400	V/µs
I_H (2)	I_T = 100 mA		MAX	10	15	35	mA

ACST2

Symbol	Test conditions	Quadrant		Value	Unit
I_{GT} (1)	V_{OUT} = 12 V R_L = 33 Ω	I - II - III	MAX	10	mA
dV/dt (2)	V_{OUT} = 67% V_{DRM} gate open T_j = 125° C		MIN	500	V/µs
I_H (2)	I_{OUT} = 100 mA		MAX	10	mA

Sensitive (logic level)

12.5 times better

Lower holding current

RC noise suppressor is no more necessary for compliance to standard

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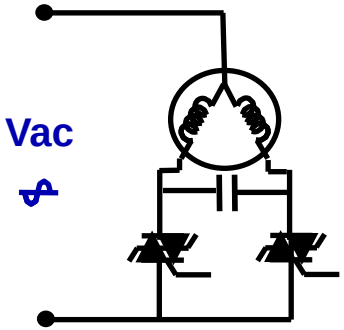
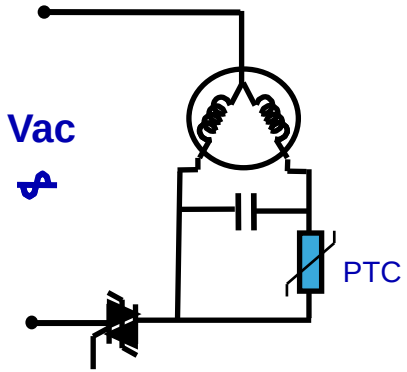
ACS to drive motor

- Environment
  - To improve induction motor starting and efficiency, split-phase capacitor is used. It interacts with motor inductors, which may lead to voltage up to 600 V.

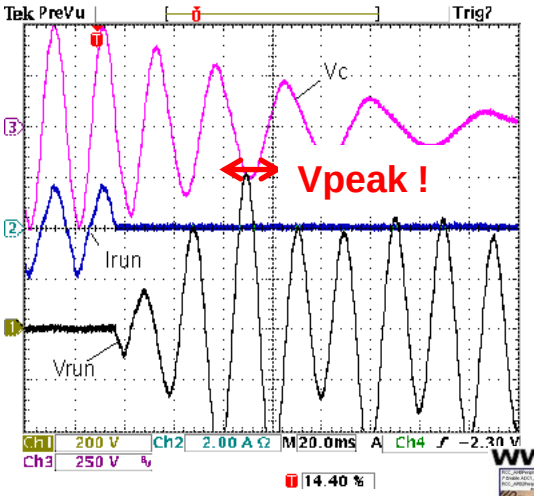


2-way motor



1-way motor

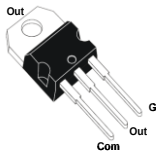
- Applications
  - Two-way motor :
    - Drum in W/M and dryer
    - Rolling store
  - One-way motor
    - Compressor in fridge and HVAC
    - High-power pump

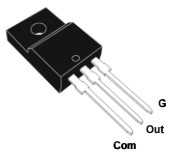


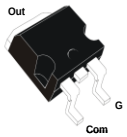
- Benefits
  - 800 V Triac allows 33% margin

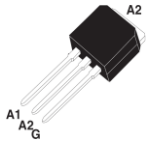
ACS: a full range from 2A to 16A

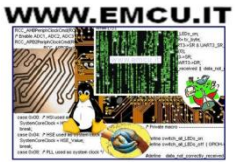
	ACST 210-8x	ACST 410-8x	ACST 435-8x	ACST 610-8x	ACST 830-8x	ACST 1010-7x	ACST 1035-7x	ACST 1210-7x	ACST 1235-7x	ACST 1635T-8FP
$I_{T(RMS)}$ (A)	2	4		6	8	10		12		16
V_{DRM}/V_{RRM} (V)	800 V Self-protection against overvoltage, clamping @ 850 V					700 V Self-protection against overvoltage, clamping @ 850 V				800 V
I_{GT} (mA)	10	10	35	10	30	10	35	10	35	35
dV/dt (V/µs)	500	1,000	500	500	2,000	200	2,000	200	2,000	2,000
$(dI/dt)_c$ (A/ms)	0.5 @ 15 V/µs	2 @ 15 V/µs	5 without snubber	3.5 @ 15V/µs	8 without snubber	4.4 @ 15V/µs	12 without snubber	5.3 @ 15V/µs	14 without snubber	16 without snubber
MAX T_J	125° C									**150° C**
Package	TO-220FP DPAK	TO-220FP DPAK		TO-220 TO-220FP D²PAK I²PAK	TO-220 TO-220FP D²PAK	TO-220 TO-220FP		TO-220 D²PAK		TO-220FP



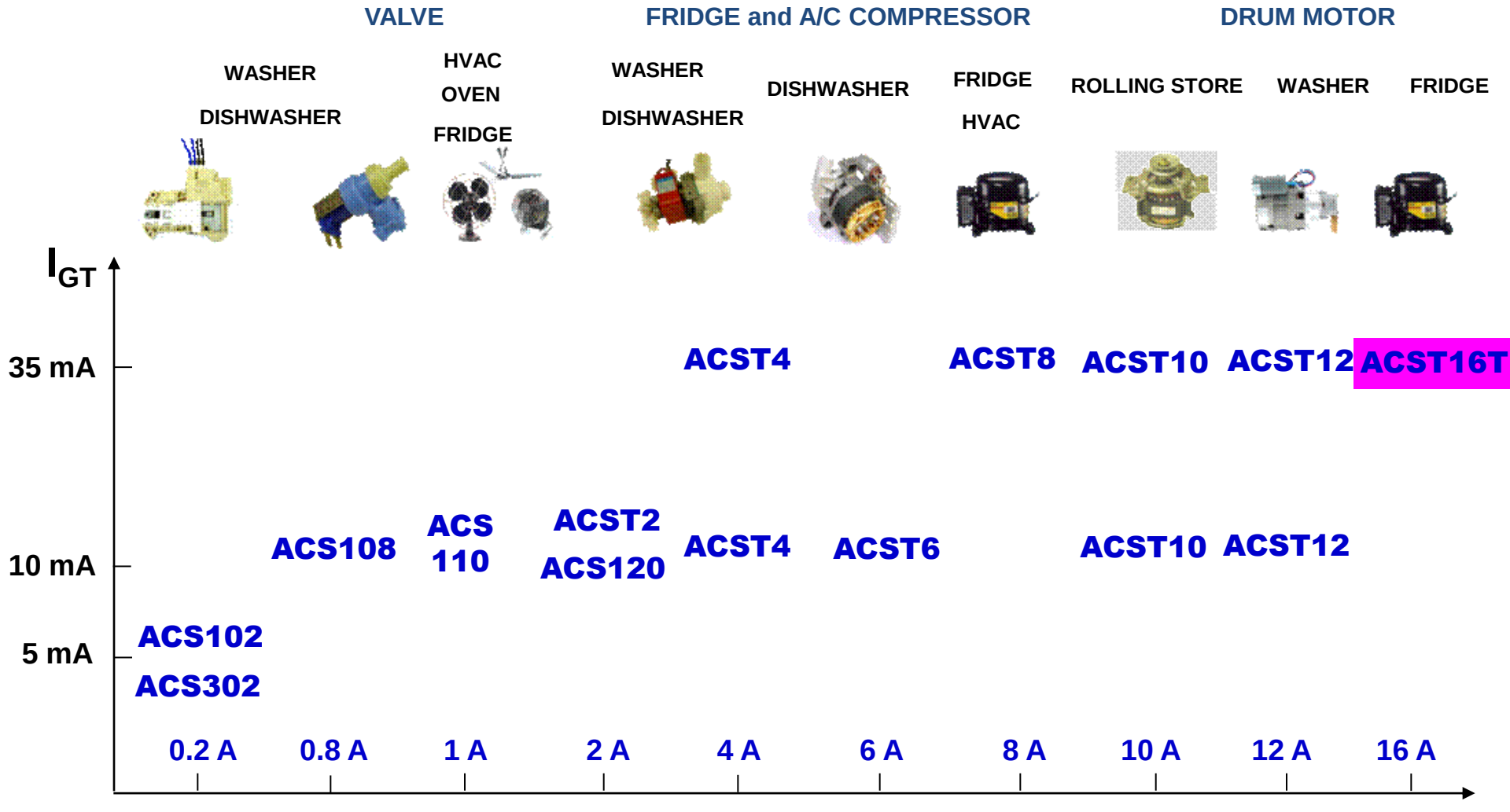








ACS : 1 load 1 switch



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ST Power Line Communication

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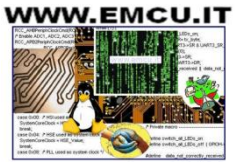
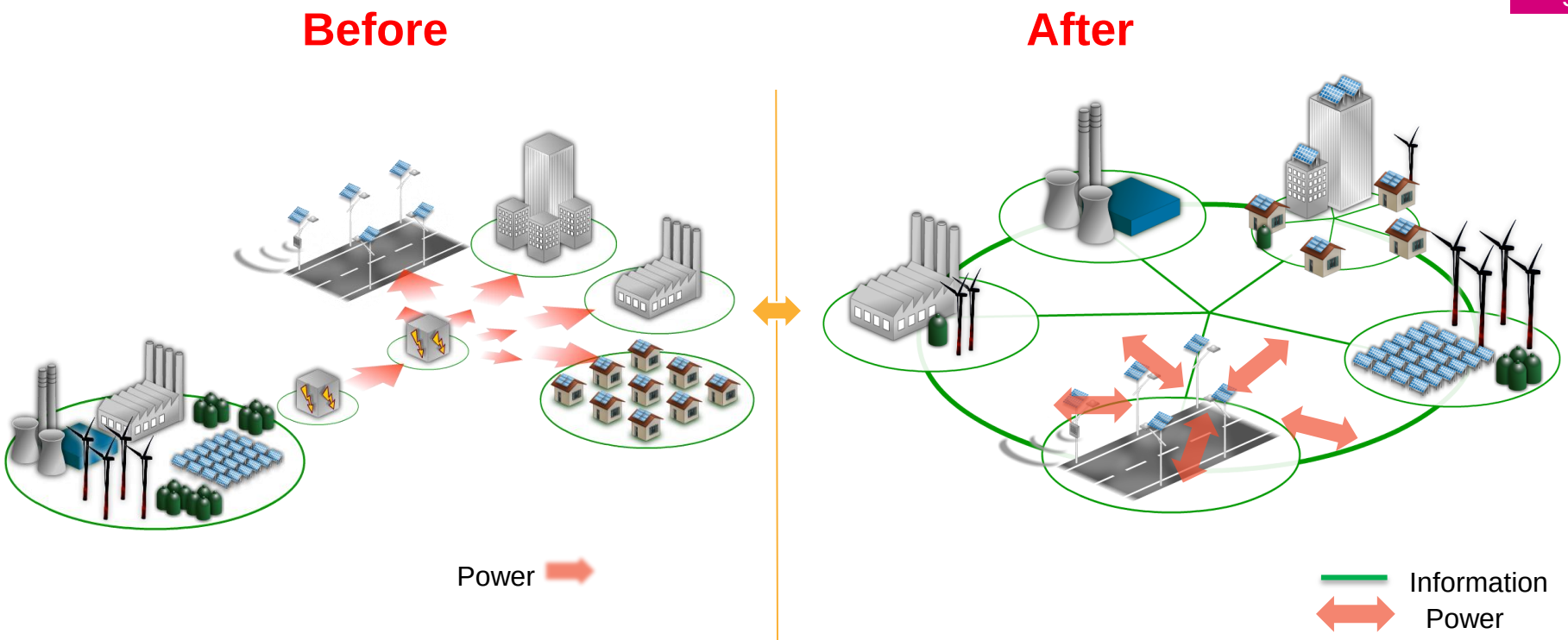


Smart Grid



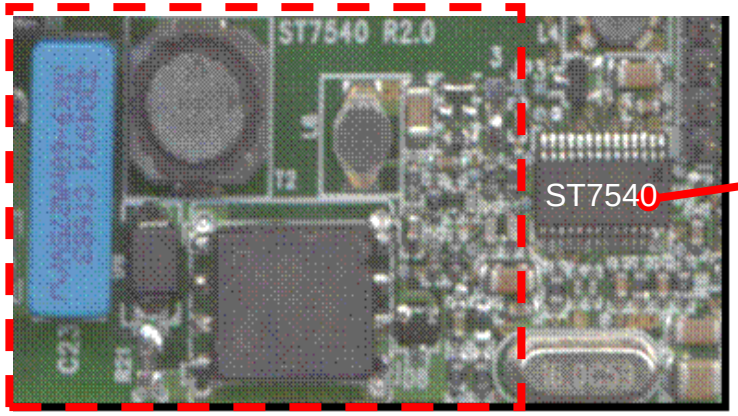
- Accurate power data measurements (metrology) and wide power grid connectivity are the essential elements to enable Smart Grids operation

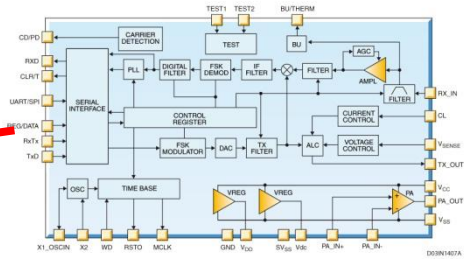
- With more than 20 years experience in power line communication and metering-specific solutions ST pioneered Smart Metering market and is leading major Smart Grid projects

ST7540 Power Line Transceiver

- The pioneer most cost effective and compact PLC solution for simple command & control applications

ST PLC node reference design



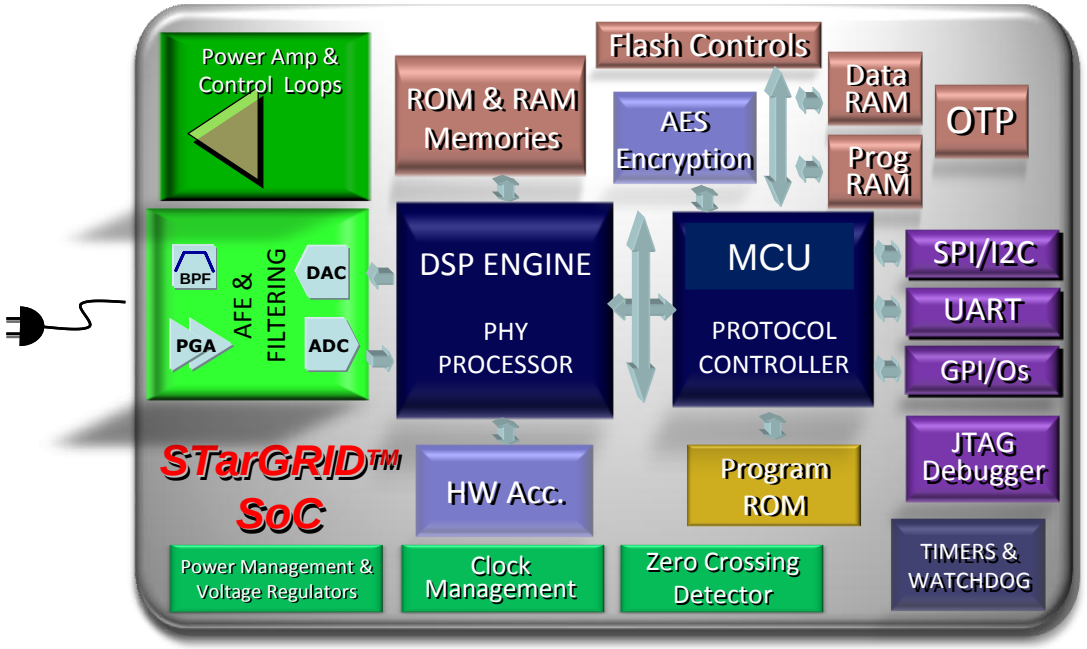


isolated line coupling

ST7540 transceiver

- Suitable for Konnex and proprietary protocols
- FSK modulation up to 4.8Kbps
- Embedded Power Amplifier

PLM Road Map



OPEN meter

Open Public Extended Network metering

COOPERATION

- Scalable pin-to-pin compatible solutions
- Programmable DSP for multiple modulations
- 8-bit core for multiple protocols management
- Suitable for CENELEC and FCC bands
- Integrated AFE & Power Amplifier
- AES Encryption
- Lowest BOM

ST7590

PRIME ALLIANCE

- OFDM modulation
- 128 kbps baud
- PRIME "certified" by KEMA
- Selected by IBERDROLA for STAR PROJECT

IBERDROLA

ST758x

meters AND more OPEN TECHNOLOGIES

- n-PSK modulation
- 28.8 kbps baud
- The only Meters&More compliant (ST7581)
- Deployed in ENEL/ENDESA project (13M meters)

eRDF
ELECTRICITÉ RÉSEAU DISTRIBUTION FRANCE

IEC

ST7570

- S-FSK modulation
- 2.4 kbps baud
- IEC 61334-5-1 + LINKY compliant
- Ready for ERDF G1

endesa
Dirección General de Comunicación

Enel
L'ENERGIA CHE TI ASCOLTA.

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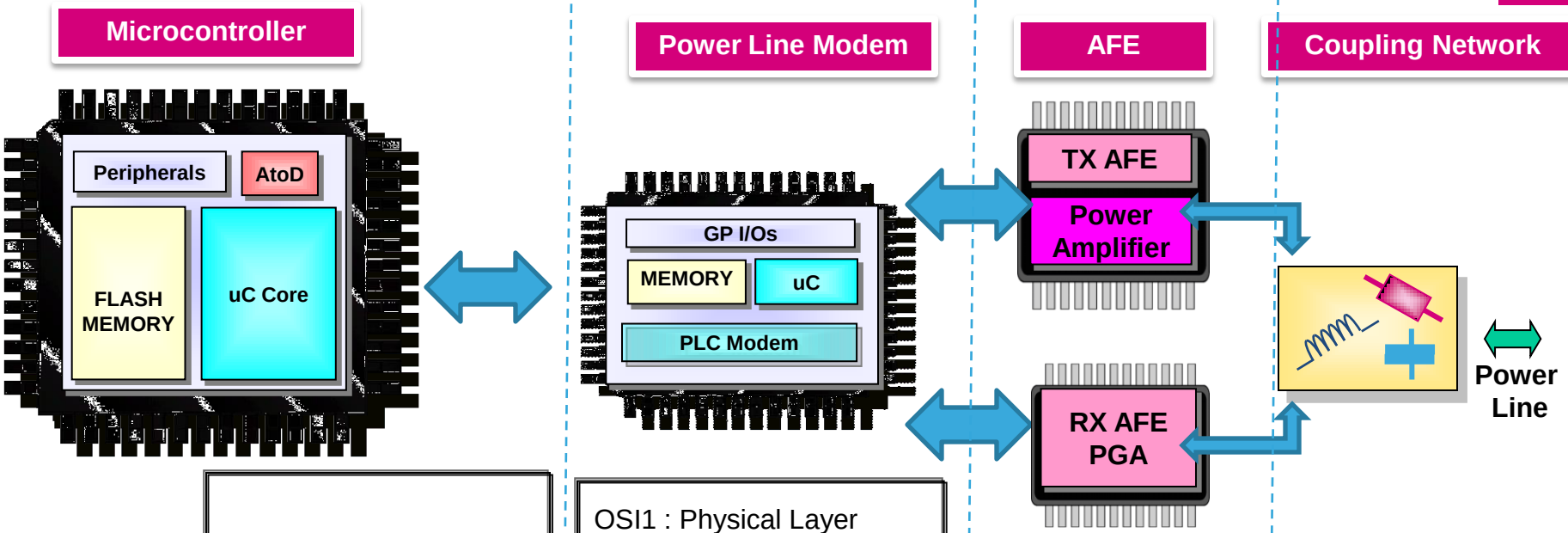
Typical PLC Node Partitioning



Application

Application Process

OSI7: Application Layer

Routes data to different LAN / WAN based on network address

OSI3: Network Layer

Transmission packets from node to node based on networks station (MAC) adress

OSI2 Data Link Layer

OSI1 : Physical Layer
Modulation/demodulation

Electrical signals from/to the medium

Digital to Analog conv
Analog to Digital conv
Filtering
RX signal amplifier
TX Power Amplifier

Line coupling
Signal filtering
Protection

- **High Bill of Material**
- **High cost**
- **High power consumption**
- **Not flexible**

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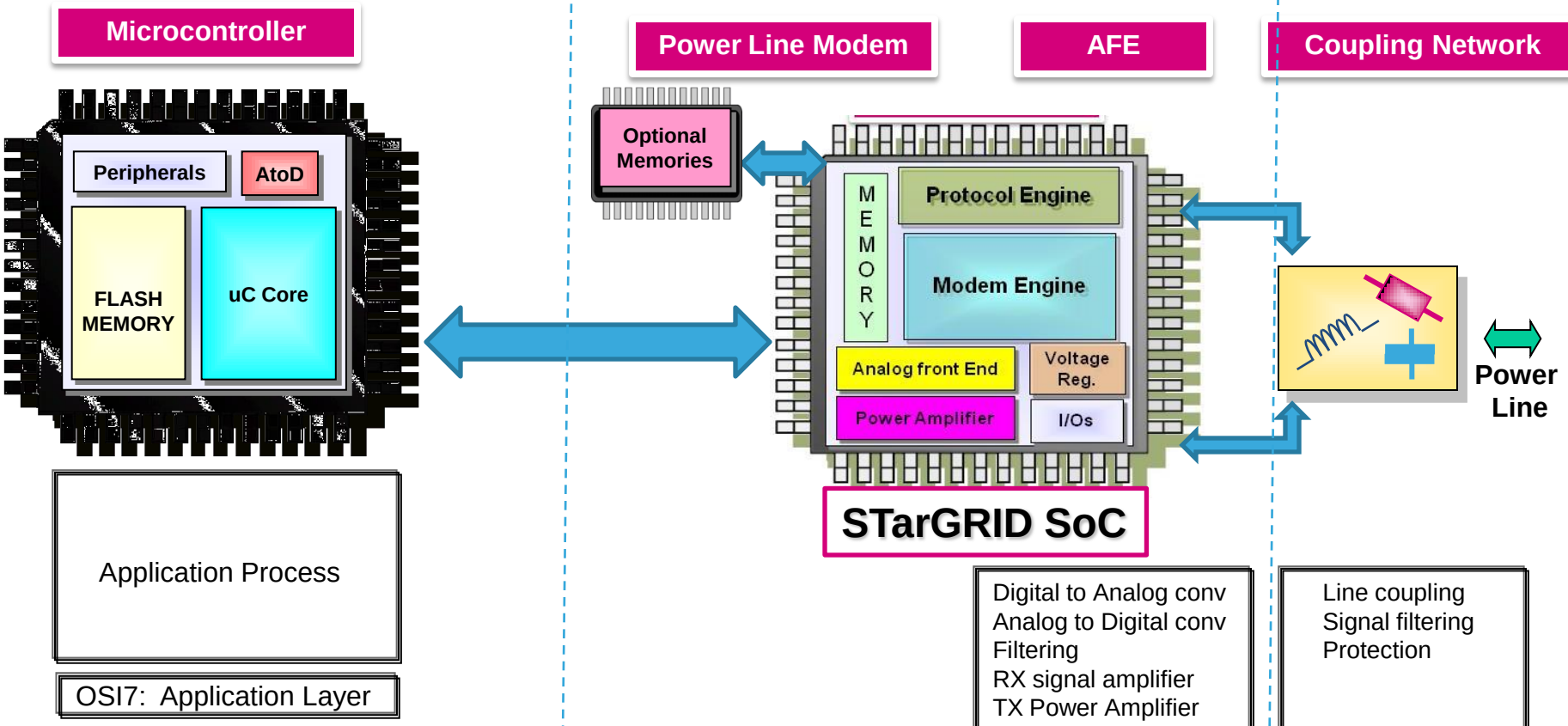
PLC node with STM PLM Devices



- **Low Bill of Material**
- **Low cost**
- **Low power consumption**
- **Flexible**

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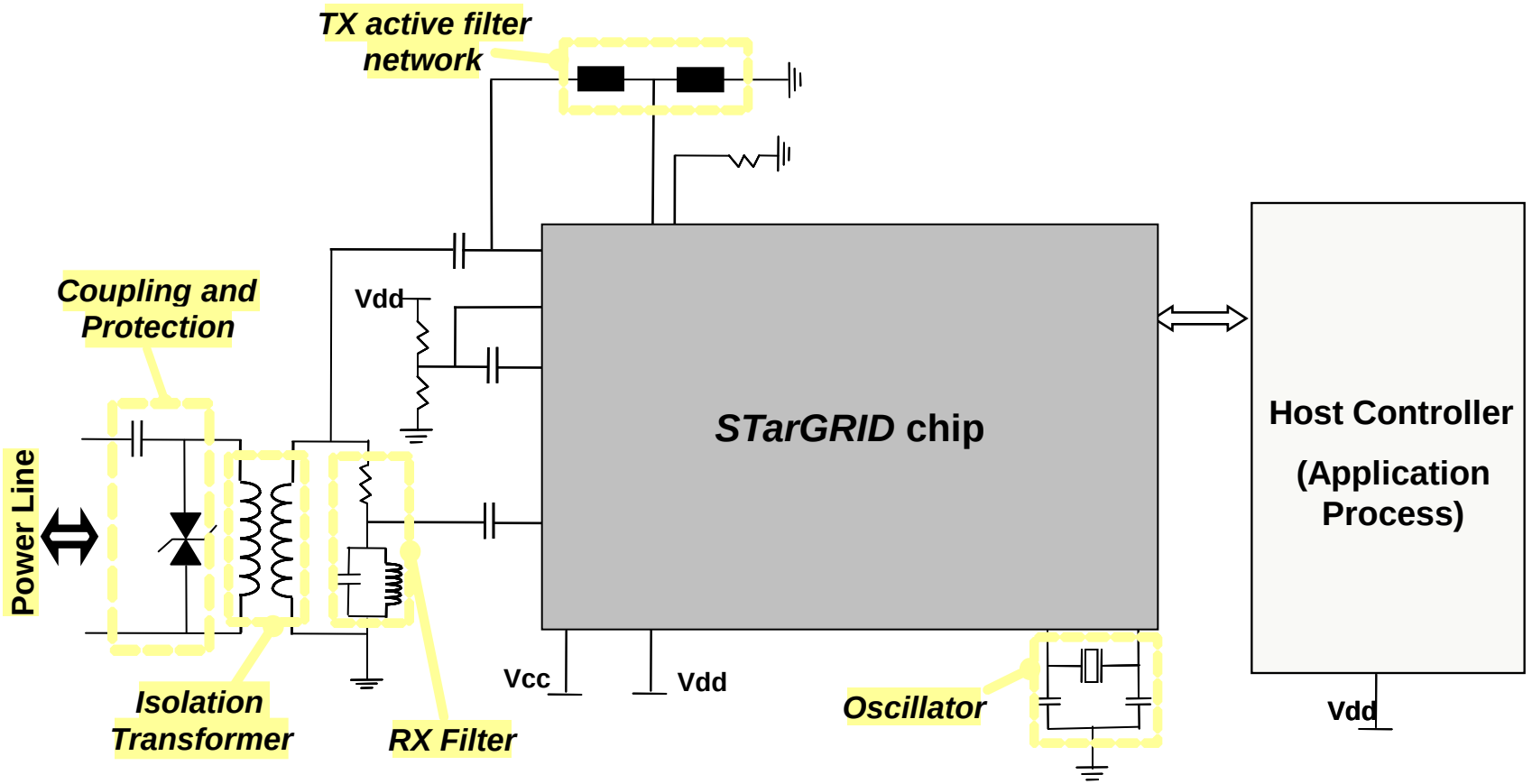
PLC Based Diagram



The most compact, lowest BoM PLC node in the market

ST Narrowband PLC Solutions

	Applications	Bit Rate	Protocol Feature
ST7540	•Simple and cost effective networks •Command & control (AC & DC) • CENELEC A, B and C bands PHY transceiver with basic MAC. Protocol and applic. implemented by the customer in the host MCU	Up to 4.8kbps	• KNX compliant PHY • Ready for point to point communication •Suitable for CTM upper layers implementation in host controller
ST7570	• AC Street lighting • AC Automatic Meter Reading (AMR)and sub-metering • AC solar (micro) Inverters communication •CENELEC A, B and C bands Turn-key standard protocol embedded solution	Up to 2.4kbps	• IEC 61334-5-1 PHY + MAC compliant • Additional communication features (LINKY) • Embedded repeating function • Suitable for DLMS/COSEM application in external host
ST7580	•ST7538/40 backward compatible •Performing command & control (AC&DC) •Solar DC&AC connectivity •Home, Building & factory automation •Smart Energy applications •CENELEC A, B and C bands PHY transceiver with basic MAC. Protocol and application implemented by the customer in the host MCU	Up to 28.8kbps	• Configurable multiple PHY layer • Embedded simple Data Link • Suitable for CTM upper layers
ST7590	•High Performance Smart Metering •Smart Grid applications (AC & DC) •CENELEC A band Turn-key standard protocol embedded solution	Up to 128 kbps	• PRIME protocol compliant • Dynamic Routing • Plug&Play • Suitable for DLMS/COSEM standard applications and future TCP/IP

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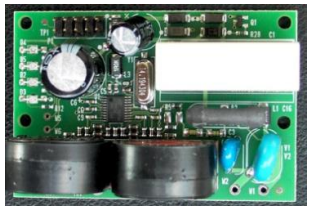
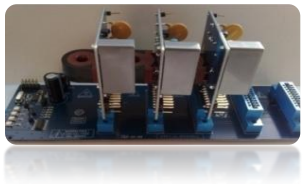
PLC Application Reference Designs: Smart Energy Meter

- 1-ph / poly-phase modular reference design for electricity meter with AMR capability based on “STarGRID PLC SoC”:

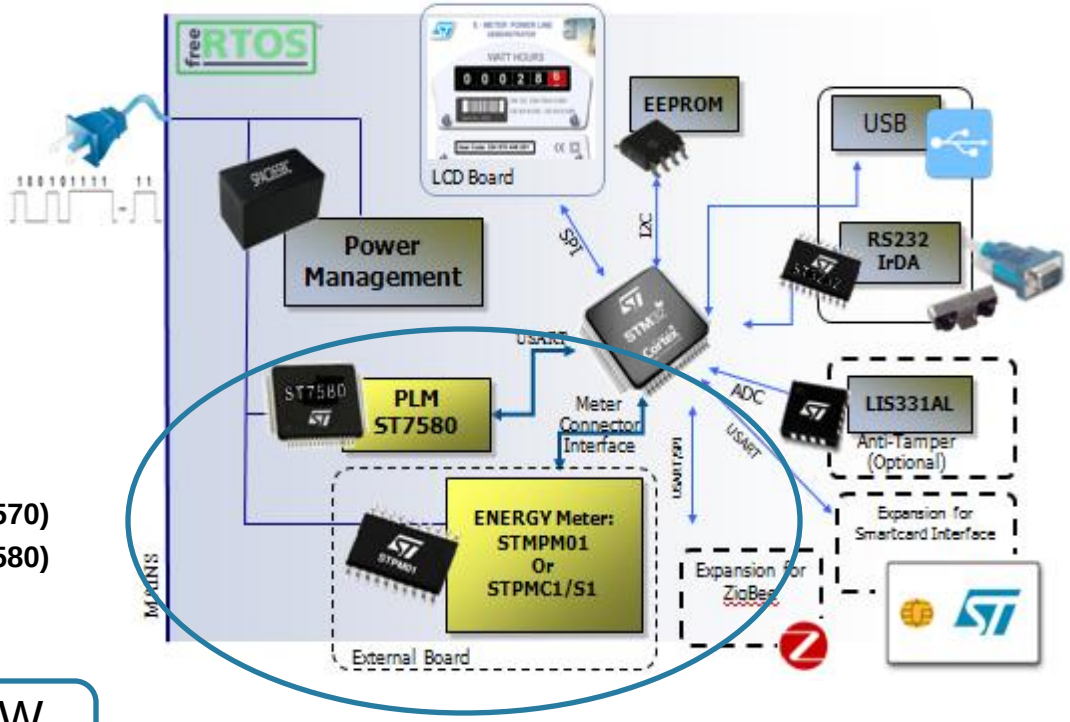


STEVAL-IPE002V1
1-ph metrology



STEVAL-IPE010V1
3-ph metrology

- **STEVAL-IPP001V1 (ST7570)**
- **STEVAL-IPP001V2 (ST7580)**



Master /slave SW demo available

Provided by System Lab

PLC Application Reference Designs: Smart-Plug and Sub-metering

Provided by System Lab

Function

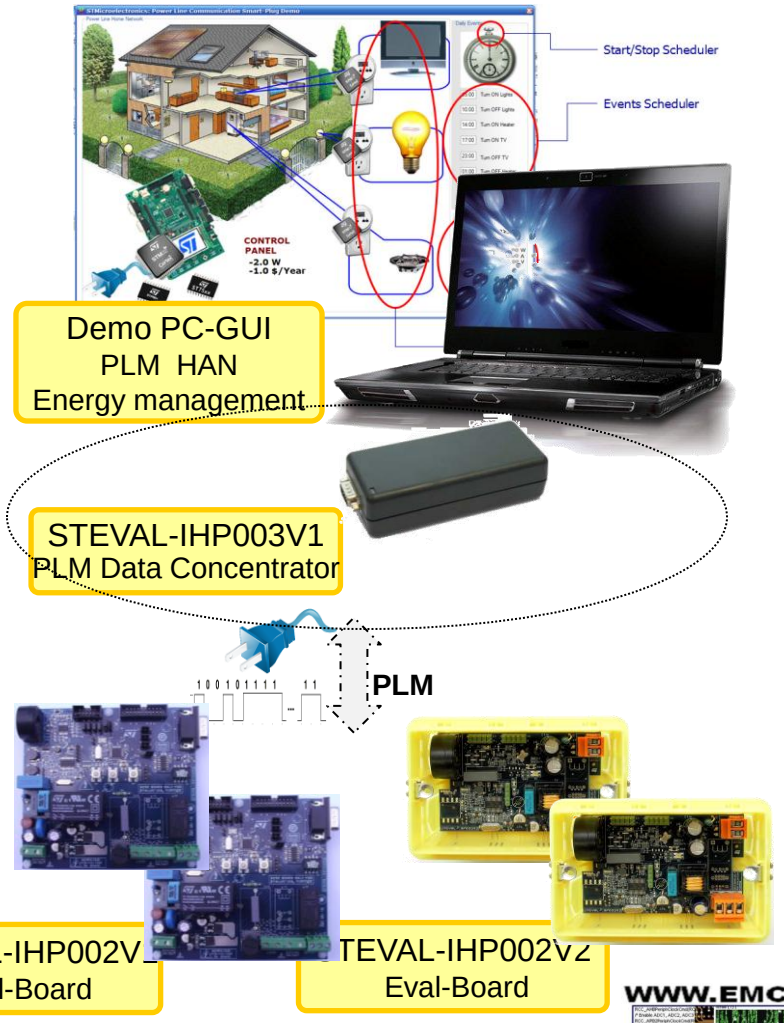
- Energy consumption through **STPM10** and electrical parameters monitoring through **ST7540**
- Relay/Triac modes for On/Off and Dimming features;
- Power network overload prevention and remote load management in a PLM HAN;

Hardware

- STEVAL-IHP002V1 and STEVAL-IHP002V2 to create PLM Home Area Network
- STEVAL-IHP003V1 PLM Data Concentrator connected to a PC RS232

Software

- Demo PC-GUI to manage PLM HANs and energy consumption;
- PLM protocol stack (PHY, MAC and NTW)



Thank you

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