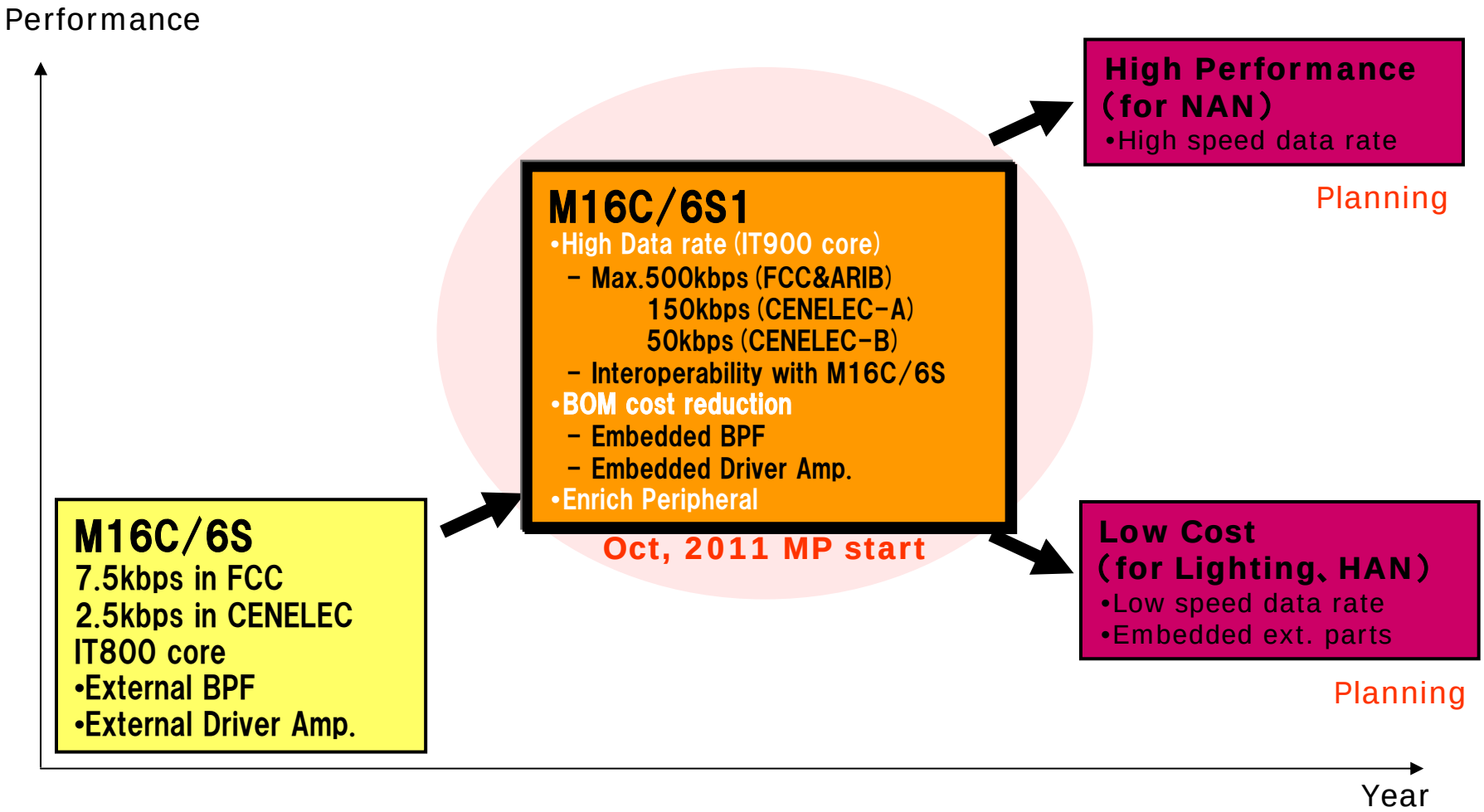
PLC microcomputer for Smart Application
- M16C/6S1 Group –
(Digest)

Renesas Electronics Corporation

2012/8/27 Rev. 1.00

MCU Roadmap for PLC

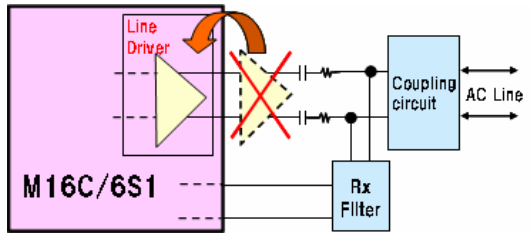


NAN:Neighborhood Area Network
HAN : Home Area Network

M16C/6S1 features

- **High speed and robust communication**
  - DCSK technology (*) enables extremely robust communication
  - Newly developed IT900 enables max. 500Kbps
  - Robust modes interoperable with M16C/6S

- **System cost and area reduction by embedding external parts**
  - Embedded line driver amplifier
  - Embedded band-pass filter



- **Big user application can be implemented**
  - Big size flash memory (max. 256KB)
  - Rich peripheral functions of M16C

- **Development tools available**
  - Evaluation board
  - Free data link layer library


for FCC/Asia

for EU

M16C/6S1 evaluation kit EV10

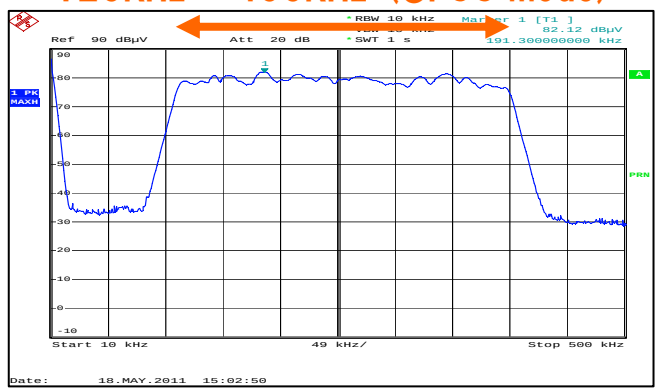
(*) DCSK : Differential Code Shift Keying
(YITRAN's technology)

M16C/6S1 key features (PLC)

- **Dual PHY implemented and analogue frontend integrated**
  - IT900 (DCSK-turbo mode) : New designed high speed modem
  - IT700 (DCSK mode) : Support all the legacy modes of 16C/6S
  - On-chip analogue signal processing block (Analogue Front End)
    - Embedded line driver & band pass filters

- **Functions for robustness**
  - Spectrum spread symbol for robustness
  - Various transmission modes from fast to slow robust mode with auto rate control option
  - CW (*) noise rejection circuit
  - Time Diversity function for burst noise

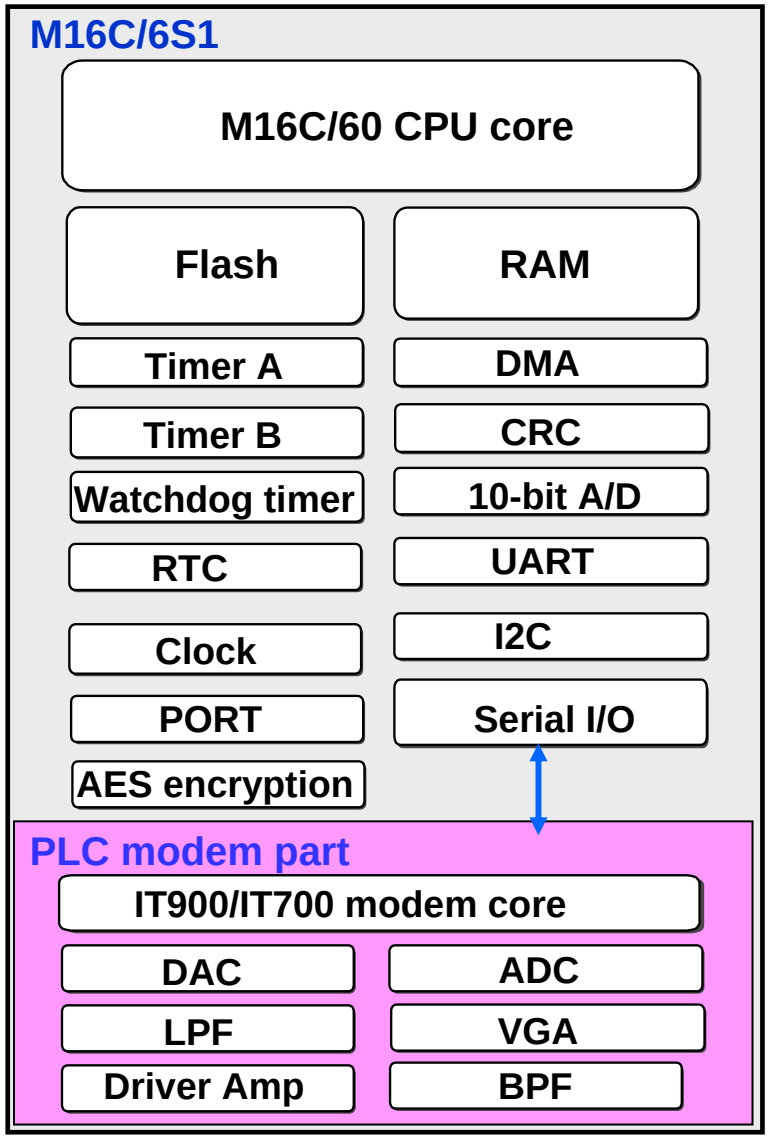
120KHz - 400KHz (@FCC mode)



- **Fully compliant with WW regulations** (FCC, CENELEC_A&B, ARIB)

(*) CW noise : Continuous wave narrow band noise

M16C/6S1 Specifications



LPF: Low Pass Filter
VGA: Variable Gain Amplifier

M16C/6S1

Function: MCU embedded Power Line Communication Modem
Operating Frequency:
X'tal 15.36MHz, Internal 46.08MHz(PLC), 30.72MHz(M16C)
Package: 100 pin HTQFP
Supply Voltage: 3.3V
Supply Current: 66mA (f_{BCLK}=15.36MHz, during PLC reception standby)
Internal Module:
IT800 compatible PLC modem/IT900 PLC modem core
AFE(DAC, ADC, Input Amp, Output Driver Amp)

PLC part
Data rate:
FCC & ARIB 120-400 KHz
High Speed Mode: Up to 500 kbps
Compatible mode: 7.5Kbps (SM), 5.0Kbps (RM), 1.25Kbps (ERM)
CENELEC A : 20-80 KHz
High Speed Mode: Up to 150 kbps
Compatible mode: 2.5 Kbps (RM), 0.625Kbps (ERM)

CENELEC B : 95-125 KHz
High Speed Mode: Up to 50 kbps
Compatible mode: 2.5 Kbps (RM), 0.625Kbps (ERM)

MCU part
Flash Memory: 128/256KByte, RAM : 20/31KByte
Peripheral :
Timer A:16Bit x 5 Timer B:16Bit x 3
WDT : 15Bit x 1
A/D : 10Bit, 18 channels
Interrupt :External 9 , Internal 27 , 7Levels
UART : 5 ch / SIO : 3 ch
I/O pint: 55 pins, Input pin: 1 pin
AES encryption (Key length : 128bits)

M16C/6S1 Development Tools

- **Evaluation Kit EV10**
  - R0K3036S1DU01BR (FCC/Asia version)
  - YEV10-A(-PA) (CENELEC-A version)
  - YEV10-B(-PA) (CENELEC-B version)
- **Data Link Layer Library D3DL**
- **M16C/6S1 Materials Download Site**
  - D3DL
  - EV10 circuit diagram, bill of material, manual
  - Application note
  - Sample program

for FCC/Asia

for EU

Evaluation Kit EV10

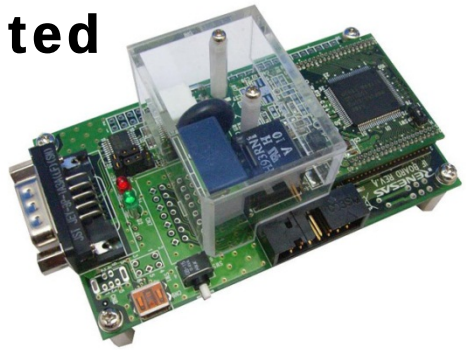
- **General Tools**
  - High-performance Embedded Workshop(IDE)
  - M3T-NC30WA(C Compiler) (use Ver5.45)
  - E8a(On-chip emulator)

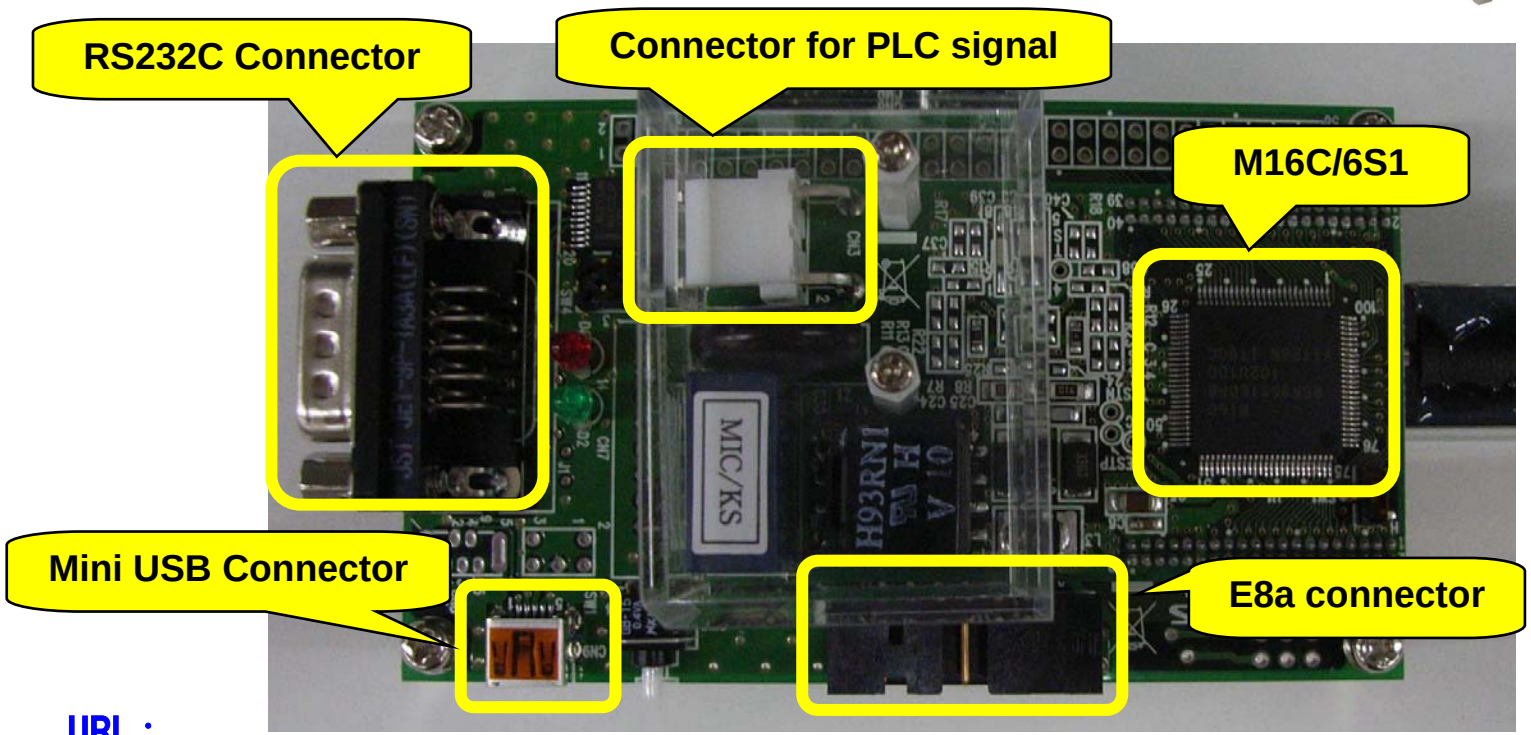
E8a

Tool chain 100% compatible to M16C/6S group development tools.

M16C/6S1 Evaluation Board EV10 (for FCC/Asia)

- **Communication test program is implemented**
  - Communication test is available without S/W development
- **DLL library is provided for customer who purchases EV10**

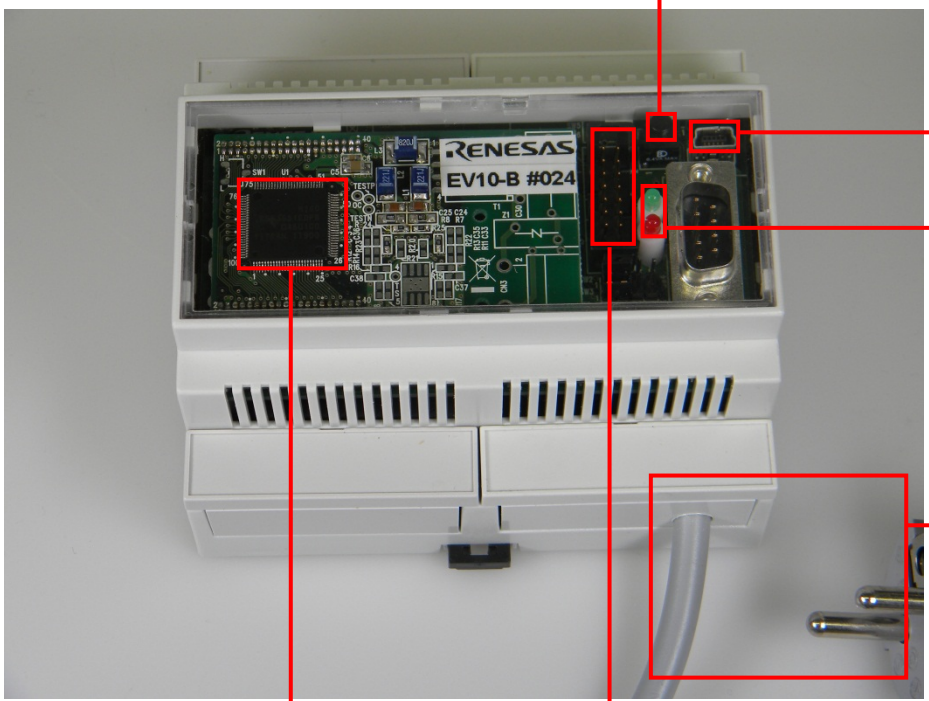




URL :
http://www.renesas.com/products/tools/introductory_evaluation_tools/starterkits_evaluation_boards/ev10/index.jsp

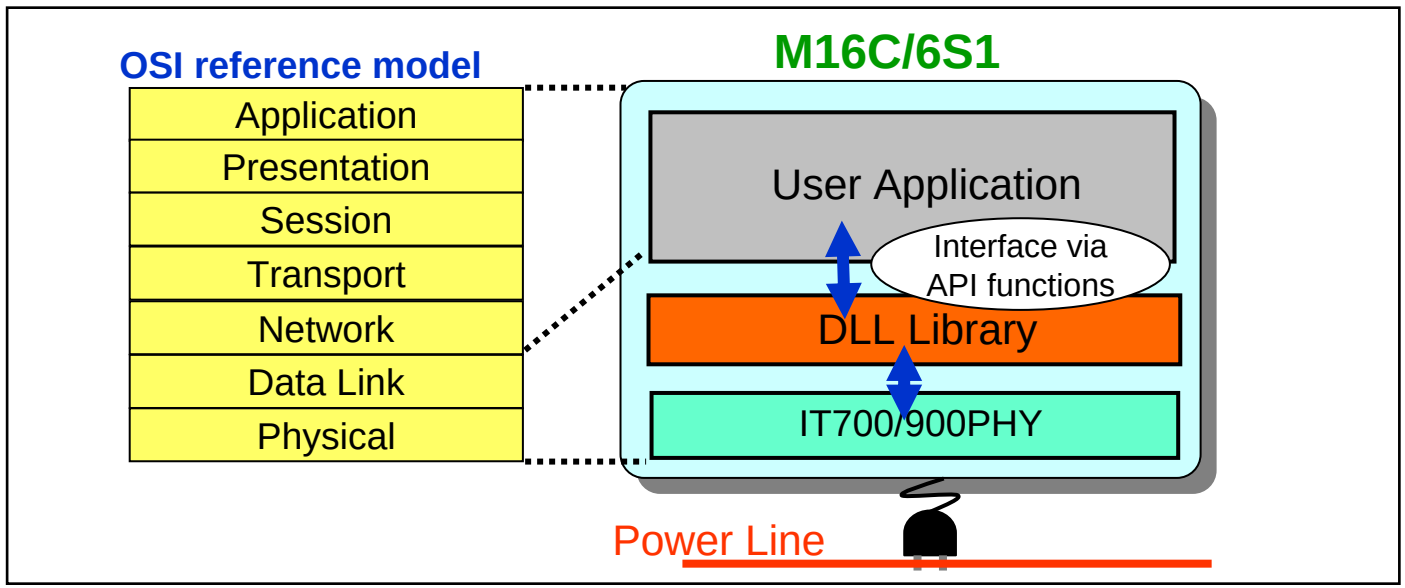
M16C/6S1 Evaluation Board EV10 (for EU)

- **Customized European user application on top of standard DLL**
  - Selection of CENELEC-A or CENELEC-B modes
  - Selection of internal or external Amplifier mode



M16C/6S1 DLL (features)

- Optimize utilization of IT900/700 PHY and overall performance
  - Network Addressing
  - Channel Access
  - Auto Rate Control Option
- Interoperability with M16C/6S DLL
  - Interoperability with M16C/6S device in the field
- API interface with user application
  - Easy to develop application program
- Based on Real Time OS(MR30/4)
  - Multi-task version and single task version available

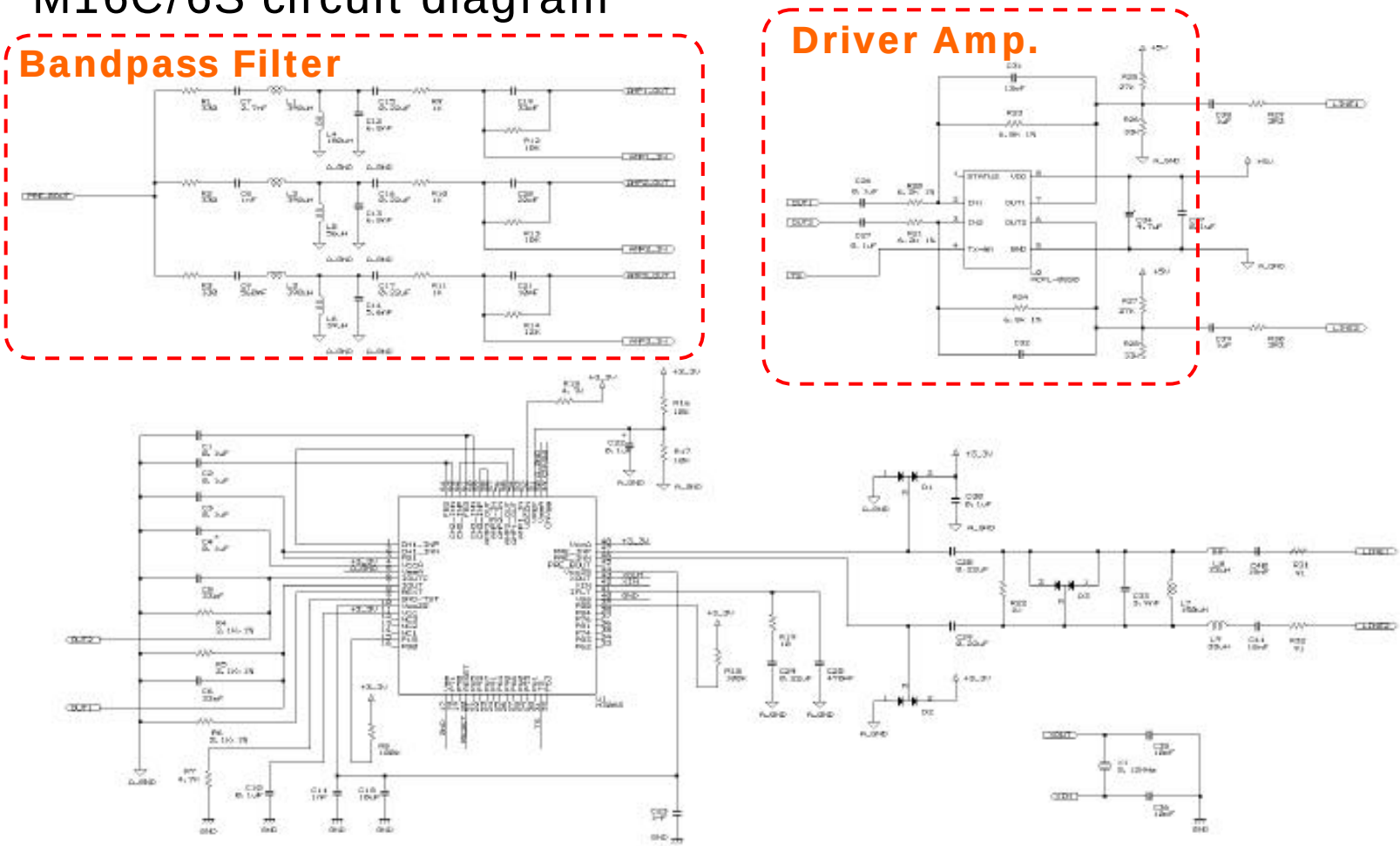


M16C/6S1 Information on Web site

- Renesas Global Web site
  - News release
    - http://www.renesas.com/press/news/2011/news20110804.jsp
  - M16C/6S1 group page
    - http://www.renesas.com/products/mpumcu/plc_mpumcu/m16c60_plc/m16c6s1/index.jsp
  - M16C/6S1 document（User manual ）
    - http://www.renesas.com/products/mpumcu/plc_mpumcu/m16c60_plc/m16c6s1/Documentation.jsp

Appendix : Parts reduction

- M16C/6S circuit diagram



External circuits for Bandpass filter and Driver Amp are not needed.

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