RENESAS

The "Smart" in Smart Lighting
Advanced dedicated semiconductor solutions for lighting

Renesas System Solution for LED Lighting

We are committed to continue providing dedicated ASSP solutions for intelligent LED Lighting systems implementing integrated features to allow:

> Low power
> Low BOM cost
> High Intelligence and Performance

LED Lighting
Energy Saving
High Efficiency
Low Bom Cost
Common Platform

Low Power	Power Stage Control	Analog	Connectivity

Best Quality

Lighting ASSPs

New! RENESAS RL78

Product of the Year for 2008 "Smart Lighting Product"

World's 1rst MCU with integrated LED drivers

Lighting ASSP

LED ASSP

Driver ICs

PFC+LED IC

1-ch LED DRIVER IC

4-ch LED DRIVER IC

Discrete

World's No 2 vendor of Optocouplers

World's No 1 Low Power MOSFETs

Optocoupler

MOSFET

Lighting Communications

KNX

Active member of DALI consortium

DMX-512.com

D A L I

VLC

Active member of ZigBee Alliance

Lighting Dedicated Protocol Support

World's most robust PLC solution

RDM

ZigBee Pro

Powerline

Renesas is an active member of the relevant major consortiums

D A L I · ZigBee Alliance Wireless Control That Simply Works · HOMEPLUG POWERLINE ALLIANCE · TAHI INTEROPERABILITY FOR SMART HOMES AND COMMUNITIES · CENELEC

Architectural & Entertainment Lighting

High level of colour mixing and flashing sequences

µPD78F802x – LED ASSP

The world's first microcontroller with integrated 4-channel LED drivers

µPD78F8024

High Integration

> 8-bit microcontroller with integrated 4 channels of LED drivers in a single package reducing PCB space and system cost
> Dedicated peripherals enable driving LED's with no CPU involvement and minimum BOM
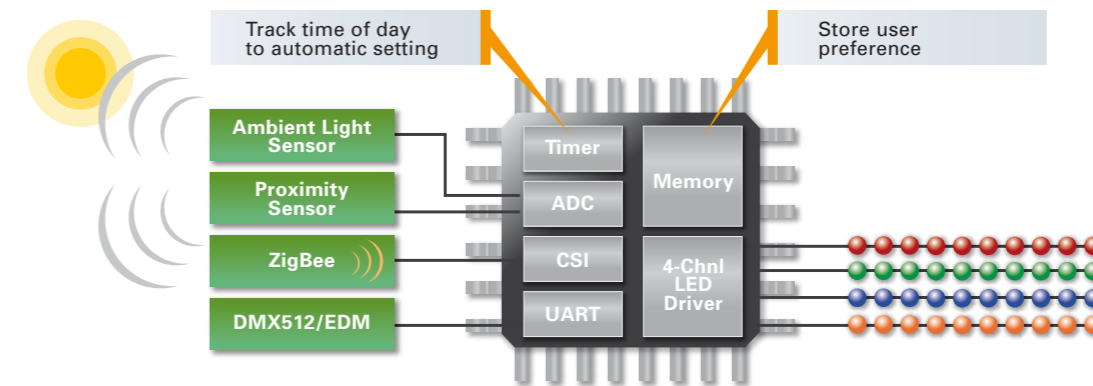> Built-in specialised protection and soft-start circuits

High Intelligence

> Independent flashing sequences and dimming in each of all 4 channels
> Thermal management
> DMX512 and RDM communications

High Efficiency

> 1 MHz switching frequency by internal oscillator Reduced inductor size in each LED channel

High Flexibility

> Up to 1.5 A drive per channel
> Step-up (boost) or step-down (buck) topologies supported
> Programmable 32 K Flash microcontroller with up to 1 KB of SRAM, CSI, I²C, UART serial interfaces and 4 channel 10-bit ADCs

Track time of day to automatic setting

Store user preference

Ambient Light Sensor | Timer

Proximity Sensor | ADC | Memory

ZigBee | CSI | 4-Chnl LED Driver

DMX512/EDM | UART

And also for CRI & dimming resolution improvements…

µPD168804

µPD168804
4-channel high-current LED driver IC

µPD168830

µPD168830
Single-channel high-current LED driver IC

AC Powered Single-channel LED Drivers with PFC

Low cost single chip solution for PFC and LED control with DALI

78K0/Ix2 – Lighting ASSP

Award winning single chip solution with 14 variants for driving LEDs & PFC control

EN-Genius
N E T W O R K
Product of the Year

Constant Current Control
> Low cost solution to drive 1-4 channels HB-LEDs directly with constant current controlled by advanced internal architecture of the 78K0/Ix2 MCU

PFC Control
> Critical Conduction Mode PFC control only using the internal peripherals

High Efficiency
> 16-bit PWM timers running at 40 MHz generate up to 4 PWM outputs

Dimming
> PWM and current dimming
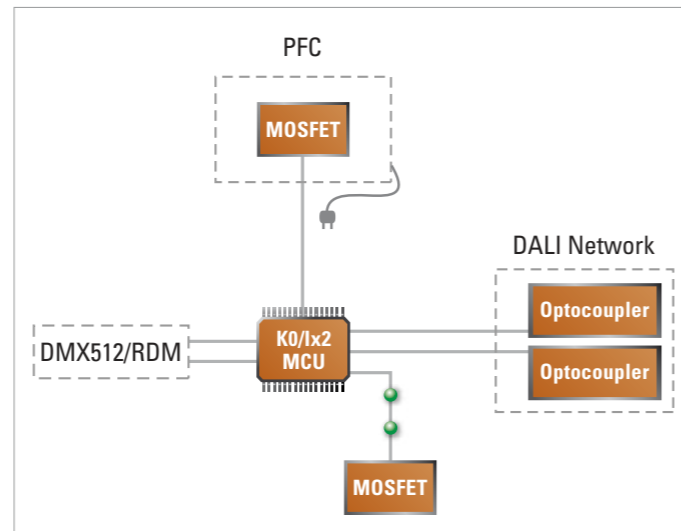
Lighting Communications
> Integrated DALI, DMX512, RDM

Low Power: 0.3 µA in STOP mode

Flexible input voltage range

Protection and PWM emergency shut down

Temperature support up to 105°

> 4 channels of 40 MHz 16-bit PWM outputs
> Integrated high and low speed oscillators
> Integrated Manchester code generator for DALI
> Enhanced analogue capabilities
  - 10 channels of 10-bit ADC
  - 3 comparator channels
  - Op-amp
> Advanced internal architecture
  - Comparators interlocked with PWM timers
  - ADC's synchronised with PWM timers
  - Op-Amp interconnected with ADC's
> Communications
  - DALI, DMX, RDM, I²C, SPI

PFC

MOSFET

DMX512/RDM — K0/Ix2 MCU

DALI Network

Optocoupler

Optocoupler

MOSFET

RENESAS LIGHTING ASSP

The Ultimate Lighting Intelligence

High intelligence & efficiency for LED Drivers with DALI

RL78/I1A – New Lighting ASSP!

Makes the future of lighting a reality

RENESAS RL78 LIGHTING ASSP

Constant Current Control
> 64 MHz 16-bit PWM timers generate up to 6 outputs
> 11 channels of ADCs interlocked with PWM timers
> Fast PI Processing in HW with integrated MAC
> Integrated Dithering function allows 0.97 nS resolution
> Integrated soft-start function

Survival Capabilities

Over-current Protection
Integrated 6 channel analogue comparators interlocked with PWM timers for immediate HW reaction

Thermal Management
Integrated temperature sensor

High Temperatures Support
Guaranteed operation at up to 125°

PFC Control
> Critical Conduction Mode
> Continuous Conduction Mode
> Discontinuous Conduction Mode
> Digital Interleaved PFC control supported

Fine Dimming
6 channels of integrated 16-bit PWM timer gating function provides individual 16-bit dimming for each LED channel

Extended DALI
Selectable 16, 17, 24 bit frame for reception and 8, 16, 24 bit frame for transmission of DALI communications supported on chip. DMX512 and RDM also supported

Based on Renesas' brand new 16-bit core RL78

High Performance CPU
32 MHz with 3-stage pipeline
40.6 DMIPS @32MHz

Lowest Power
66 µA/MHz
Snooze Mode: < 1 µA standby with DALI
0.2 µA in STOP mode
32 MHz Integrated Oscillator +-1% accuracy
4 KB Data Flash supporting background operation
Integrated HW Multiplier/Divider and MAC

RENESAS RL78

Integrated Safety Functions
> Flash Memory CRC Calculation
> RAM Parity Bit Error Detection
> Illegal Access Detection
> RAM/SFR Guard Protection
> Clock Frequency Detection
> A/D Test Function – IEC60730 compliance

LED Retrofit Lamps

Reducing the cost and increasing efficiency of AC powered LED retrofit lamps

R2A2013x PFC LED Driver IC

a dedicated solution for LED retrofit bulbs and tubes

High Integration

PWM and TRIAC dimming
Thermal Shutdown Function
Over-current protection and more...

Reduced BOM cost

High-side step-down control
Allows using low voltage MOSFETs with high speed switching

Isolation

Supports both, Isolation and Non-isolation type of applications while PFC is still supported

High efficiency of 92%

Reduced switching looses using Critical Conduction Mode with Zero Current Switching and low voltage MOSFETs

High Power Factor of over 0.9

Integrated Power Factor improvement control function
High system efficiency
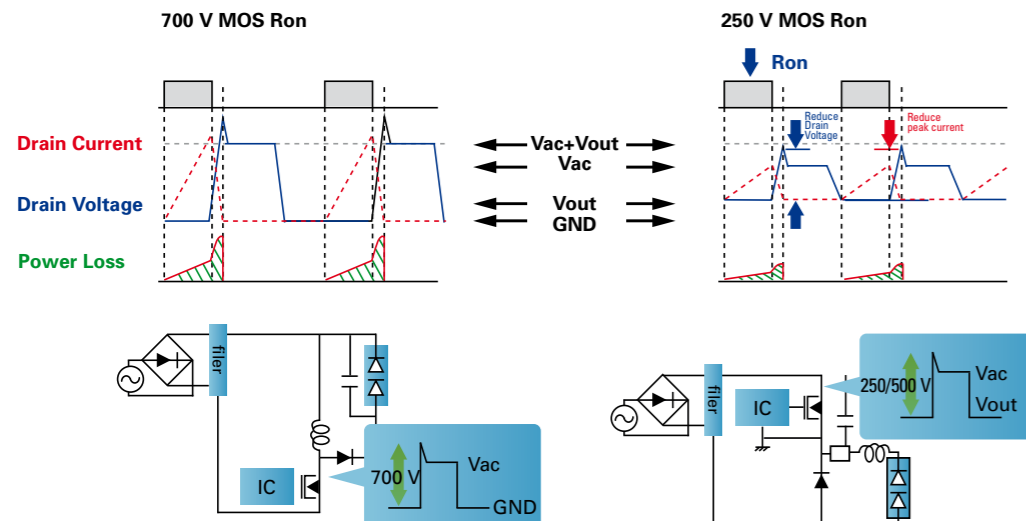Reduced EMI
Regulations compliance

Design flexibility & common platform approach – design for various LED bulb types using the same driver IC

Topology

> High-side step-down
> Low-side buck-boost
> Low side step down
> High-side buck-boost
> Flyback topology
> Peak current
> Average current
> Constant input-power control

Flexibility

Adjustable frequency 25 KHz - 250 KHz
Wide choice of inductors for the application
BOM cost reduction accordingly

Fixed and variable frequency switching allowing CRM and Peak current control

Integrated over voltage protection
High temperature support of up to 150 °C
Small package: SOP-8

700 V MOS Ron

250 V MOS Ron

Common low-side buck-boost control

High-side step-down control

Isolation in lighting

High performance Optocouplers to match any type of lighting system requirements

Features

> Renesas is the World's No 1 supplier of standard optocouplers
> High isolation for high and low voltages with safety certification
> High quality and reliability – less than 5ppm
> 8mm creepage
> World's smallest package for space saving isolation
  - (SOP4, SOP5, SO8, SSOP, DIP, Flat-Lead, Ultra SSOP)
> High temperatures support of up to 110°

Applications

> Isolation specified by DALI communications protocol
> Power supply stage isolation in mains-powered LED drivers
> Isolation for a lighting control system from LED drivers
> Isolation for mains failure or battery failure detection in emergency lighting applications

Huge range of standard optocouplers for isolation and high-speed optocouplers for communications available at: **www.renesas.eu/opto**

Switching mode constant current and dimming control

MOSFET's for LED lighting

> Renesas is the World's No 1 low voltage Power MOSFET supplier
> Wide range of supported currents up to 180 A
> Minimum switching losses
> AEC-Q101 qualified on selected devices
> RoHS compliant
> Up to Tchmax = 175° on selected devices
> Lowest Rdson
> Wide range of package options
> Quality and reliability
> Logic level drive available for selected devices

Huge range of single & dual N- / P- / Complimentary Power MOSFET's available at:
www.renesas.eu/mosfet

RENESAS

Add intelligence with lighting communications

> Renesas is an active member of the DALI AG
> DALI communications protocol supported by Applilet EZ application code generator, dedicated graphics-based design tool
> DALI application notes and source code also available at www.renesas.eu/lighting

> DMX512 and RDM communications protocol supported by Applilet EZ application code generator, dedicated graphics-based design tool
> Application notes and source code also available at www.renesas.eu/lighting

DMX-512.com
RDM

> Renesas is a founding member of ZigBee™ Alliance
> Variety of complete hardware & software ZigBee™ Professional certified platforms including single-chip and flex ulti-chip solutions
> Supporting the ZigBee™ Professional Smart Energy and Home Automation profiles with dedicated functions for lighting (e.g. clusters for turning lights on and off or setting light dimming levels)

ZigBee®Alliance
Wireless Control That Simply Works

> Offering World's most robust single-chip DCSK Powerline Modem supporting global standards
> Configurable to support worldwide standards
> Integrates Analog Front End functions

> Offering smart interoperability in Building Automation with certified KNX stack for RL78 and a hardware demo for evaluation

KNX®

DALI Wireless Networking

Lighting wireless communications make easy DALI adoption

Easy & robust DALI connectivity through walls, glass, floors and across buildings with high performance wireless mesh technology

Key Features
> Supports all DALI commands
> Penetration through obstacles.
> Easy implementation & maintenance
> Plug n' Play: adding, removing and moving lamps & switches on the go
> Fast response – low latency
> Cost efficient with ISM/SRD frequency bands
> Low Power and high range & mobility
> Flexible configuration
> Up to 64 wireless DALI nodes
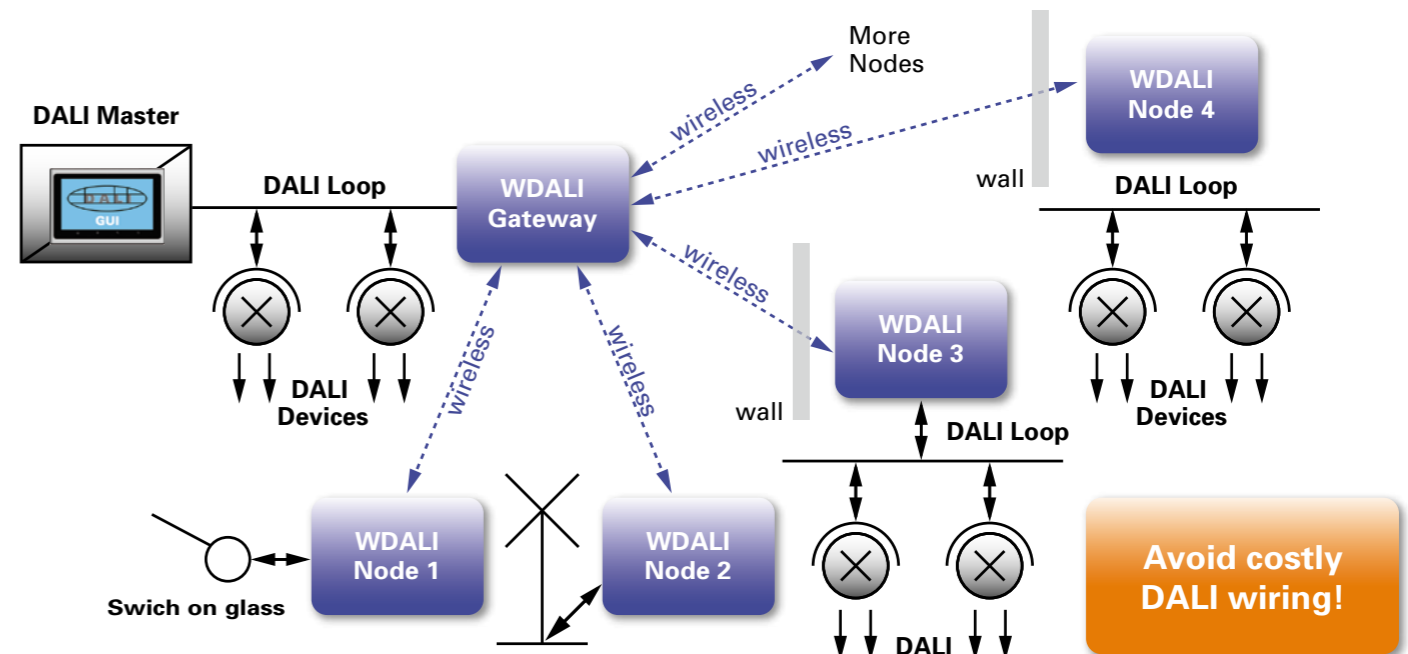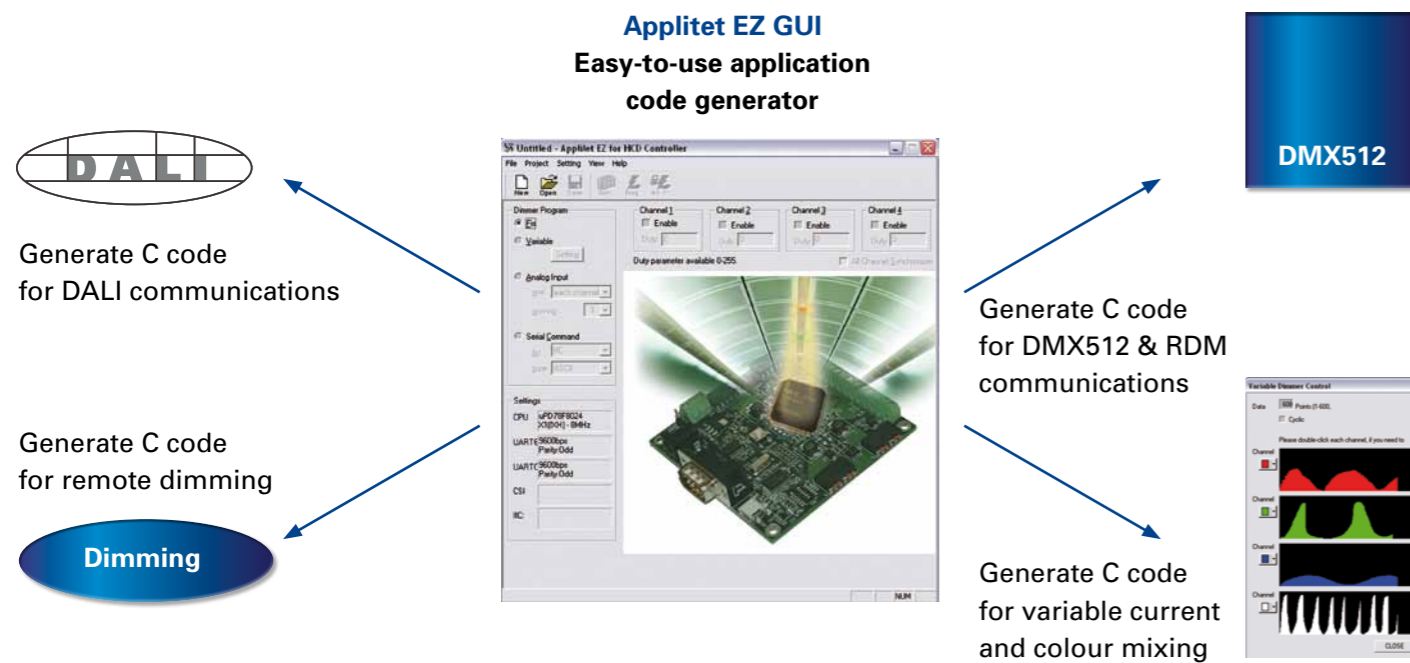> Up to 64 DALI devices per wireless DALI node

RL78/I1A

enables expanding DALI with wireless mesh networking

Wireless DALI Demonstration Kit

> Wireless mesh gateway
> 8 wireless mesh nodes, each drives 3 channels of LEDs or 1 DALI loop
> LEDs and DALI devices controlled by the DALI master GUI

Dedicated Lighting GUI tools

Applitet EZ GUI
**Easy-to-use application
code generator**

DMX512

Generate C code
for DALI communications

Generate C code
for remote dimming

Dimming

Generate C code
for DMX512 & RDM
communications

Generate C code
for variable current
and colour mixing

Graphically configure your LED lighting system and automatically generate code for Renesas Lighting
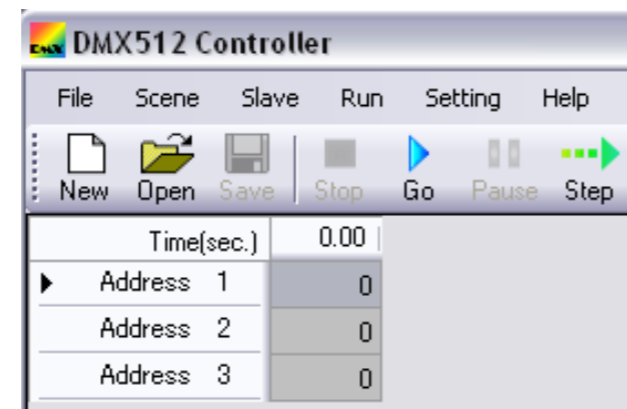microcontrollers (ASSPs).

And also dedicated GUI tools for Lighting Communications.
Easy design of lighting scenes, features and controls using either DALI or DMX512 interfaces.

DALI Master GUI Controller tool

> Real time control of light output
> Power & on/off control, dimming
> control, max/min dimming setting
> Scene design & fade settings
> All done by easy graphical configuration

DMX512 Master GUI Controller tool

> Easy learning and implementation of
> DMX512 protocol
> Graphics-based design of colour mix,
  scenes and flashing sequences
> When the scene is designed, either step through
  or run in real time for easy debugging

Dedicated Lighting GUI tools

Confidence in designing your lighting system with Renesas Electronics
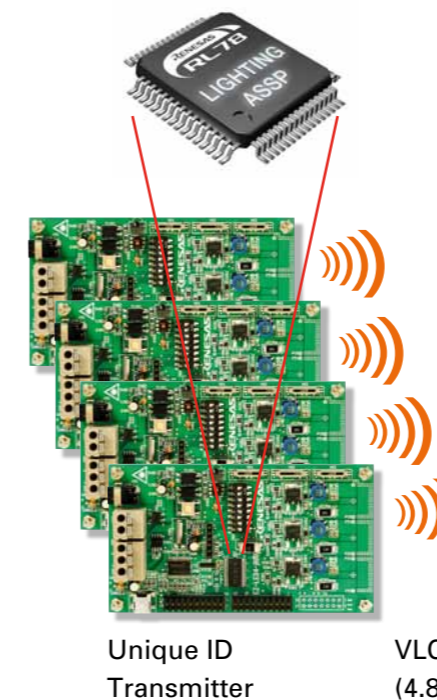
Demonstration kits

RL78/I1A DC/DC LED Control
Based on the RL78/I1A
3 channels of LEDs
DALI & DMX supported
Order Code XXXXXXXXX

78K0/Ix2
LED Control
Using the lighting ASSP
to drive 3 channels of HB-LEDs
with DALI & DMX512
Order Code XXXXXXXXX

Lighting Communication
DALI & DMX master
communications with GUI
Order Code XXXXXXXXX

Shine It!
Using the μPD78F8024 LED
ASSP to drive 4 channels of
RGBW HB-LEDs with DMX512
Order Code XXXXXXXX

Reference designs

LED retrofit bulb for Isolated and
non-isolated designs with PFC.
Based on PFC IC RA20134

85-277VAC Triac dimmable single
channel LED driver with PFC based
on 78K0/Ix2 Lighting ASSP

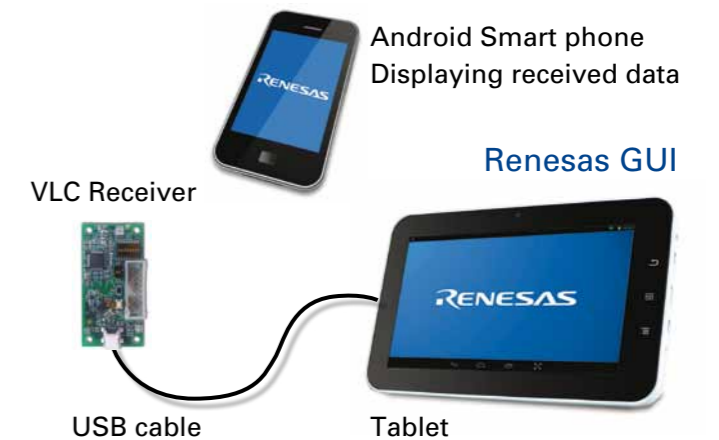AC powered 3 ch LED driver with
PFC based on 78K0/Ix2 Lighting
ASSP

VLC – Visible Light Communications

RL78/I1A based demo

Features
> Communication without light flickering
> No ambient light interference
> Use lights everywhere
> No EMI/EMS, no human health impact
> No conflicts with Radio-restricted areas

Android Smart phone
Displaying received data

Renesas GUI

VLC Receiver

Unique ID
Transmitter

VLC signal
(4.8kbps)

USB cable

Tablet

Application notes & Source codes

Technology	Description	Document Number
RL78/I1A	Lighting Communications Using RL78/I1A	R01AN1115EJ0100
RL78/I1A	LED Control Using RL78/I1A	R01AN1087EJ0100
RL78/I1A	LED Control Using RL78/I1A Timer KB Special Functions	R01AN1382EG0100
78K0/Ix2	LED Lighting System with PFC Control	R01AN0674EJ0100
78K0/Ix2	DMX512	U19885EE1V0AN00
78K0/Ix2	Using integrated DALI function	U19884EE1V0AN00
78K0/Ix2	High Brightness LED Control	U19666EJ1V0AN00
78K0/Ix2	Fluorescent Ballast Control	U19665EJ2V0AN00
78K0/Ix2	Triac Dimmable LED Drive Design	R01AN0520EU0100
78K0/Kx1	Software Controlled DALI	U17333EE1V0AN00

The Renesas Eco System

Online technical community

RenesasRulz.com
Think it. Build it. Post it.

www.renesasrulz.com

3rd Party network

ALLIANCE PARTNER
RENESAS

www.renesas.eu/alliance

Personalised news & services

My Renesas

www.renesas.eu/myrenesas

Online technical training

Renesas INTERACTIVE

www.renesasinteractive.com

Facebook group

f

www.facebook.com/renesaseurope

Latest news

twitter

www.twitter.com/renesas_europe

Renesas Presents video channel

You Tube

www.youtube.com/renesaspresents

Before purchasing or using any Renesas Electronics products listed herein, please refer to the latest product manual and/or data sheet in advance.

RENESAS

FSC
www.fsc.org
MIX
Paper from
responsible sources
FSC® C017894