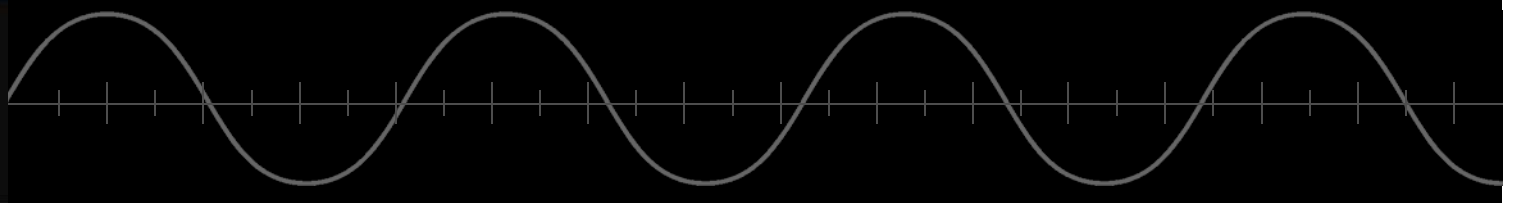




Linear Technology Corporation

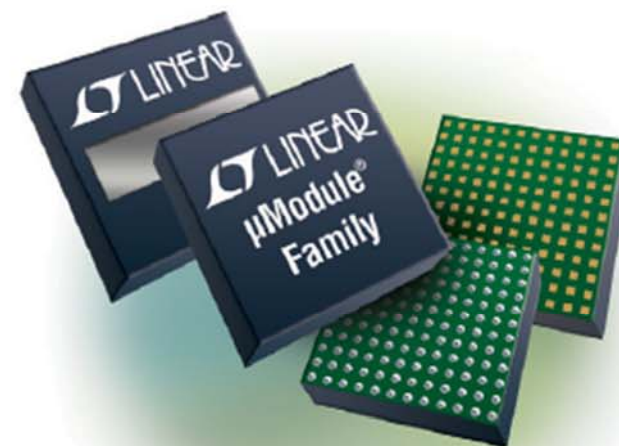
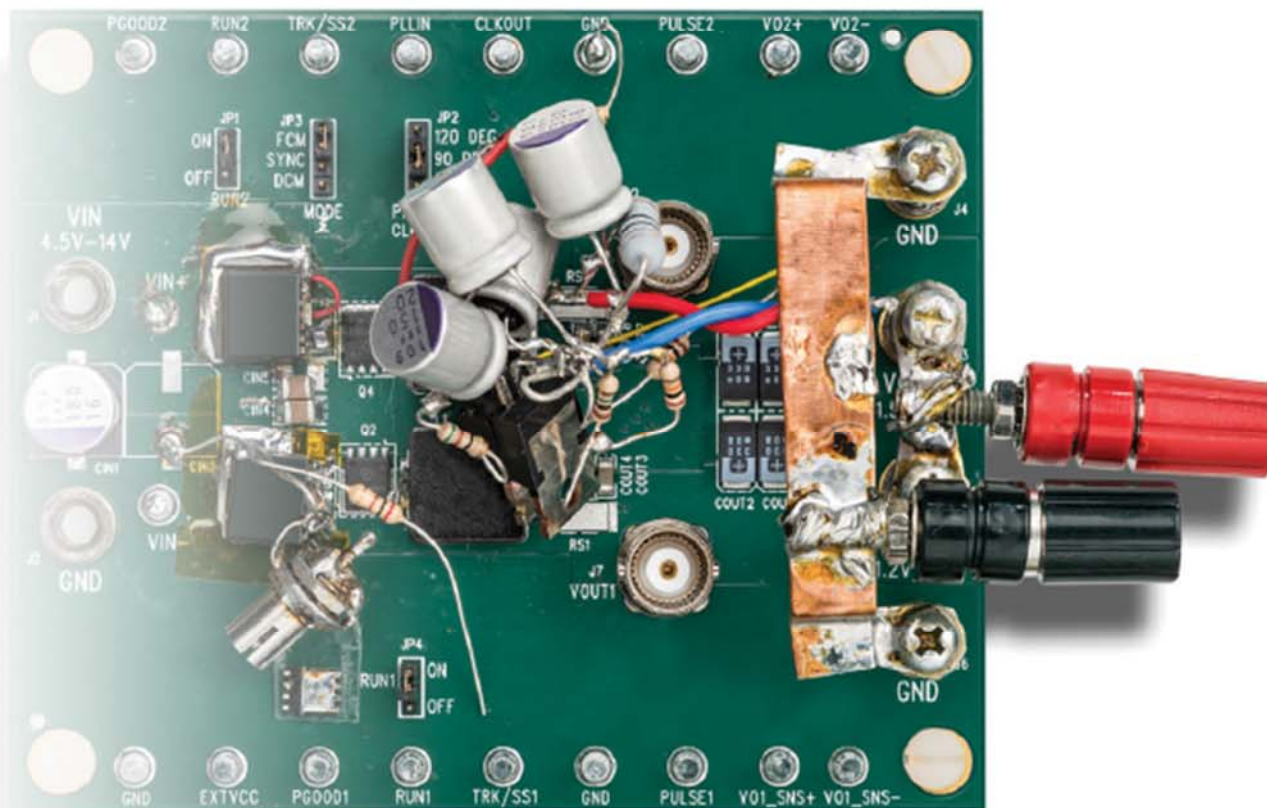
아날로그 IC의 변화와 혁신 (두번째 이야기)



Analog vs Digital IC

uModule

Simple & Done



Complete Power System-in-a-Package

uModule



μModule Regulators »
 μModule LED Drivers
 μModule Battery Chargers
 μModule Isolated Transceivers
 Signal Chain μModule Receivers

uModule

μ Module® Power Products Simplify Implementation, Verification and Manufacturing of Power Circuits by Integrating Power Functions in a Compact Package.



Digital Power
System Management
(Page 21)



Inverting
(Page 7)



LED Driver
(Page 10)



Step-Down
(Pages 8 & 9)



Step-Up & Down
(Page 11)



EN55022 Class B
Certified
(Page 11)



Isolated
(Page 11)



Battery Charger
(Page 11)



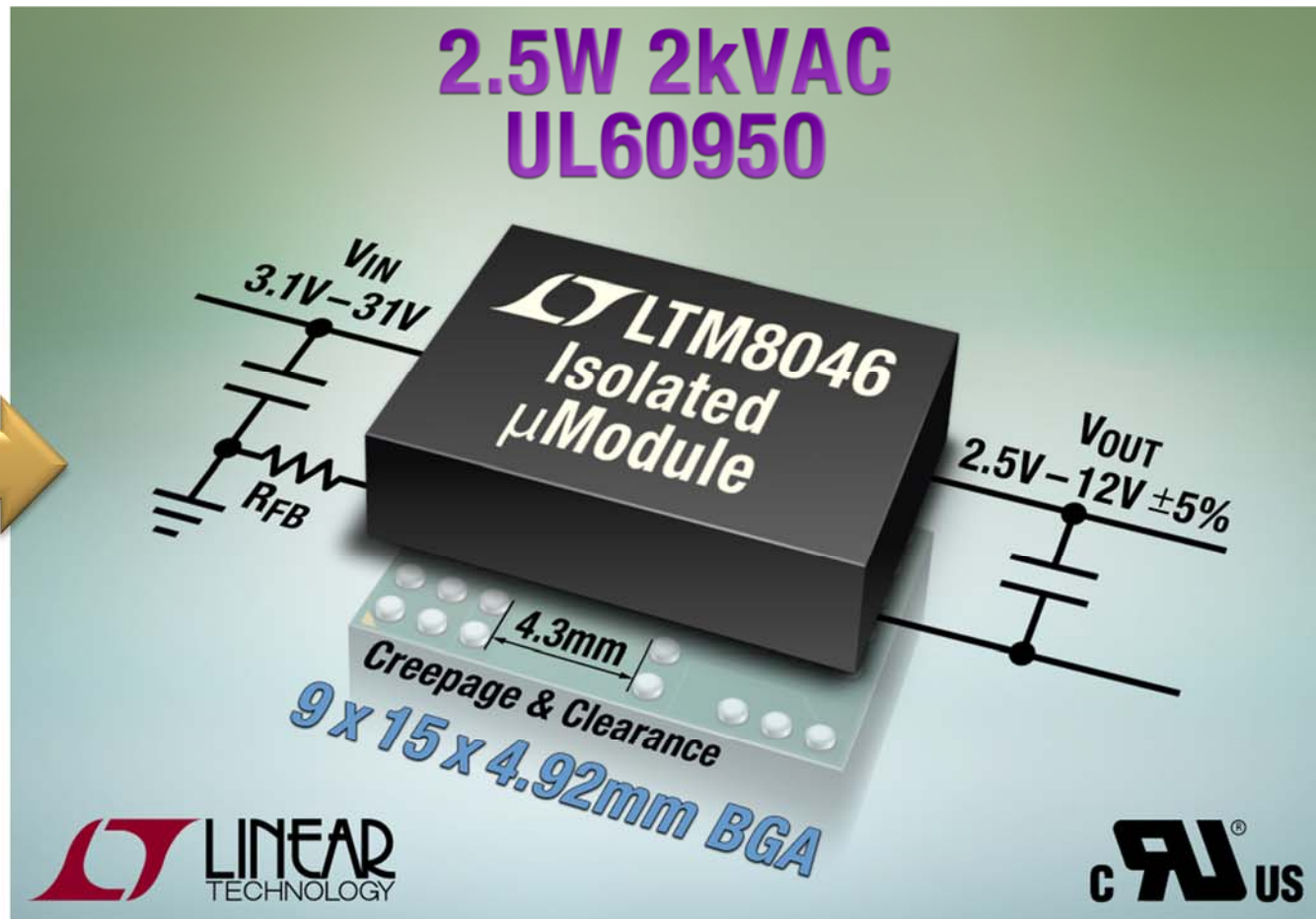
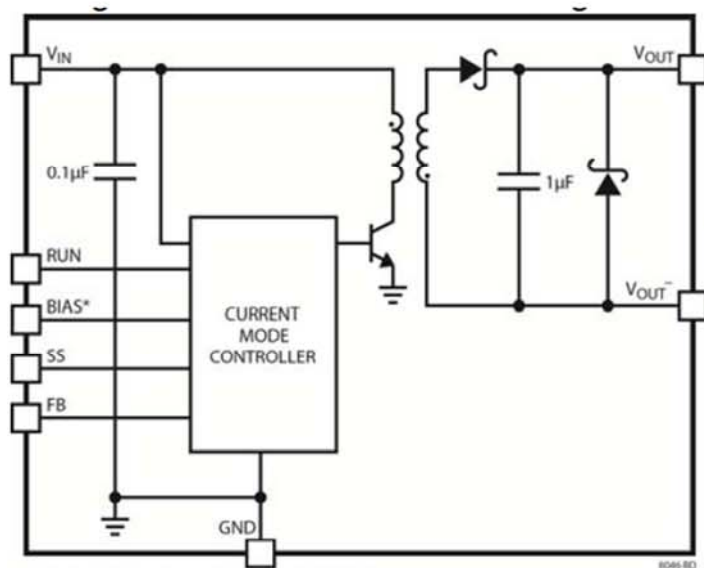
Ultrathin
(Page 25)



Tune-a- μ Module
Regulator
(Page 22)

uModule (3KVdc Isolation)

725Vdc, 1.5W



uModule (4-SW Buck-Boost)

DISCRETE

Cheapest but Complex

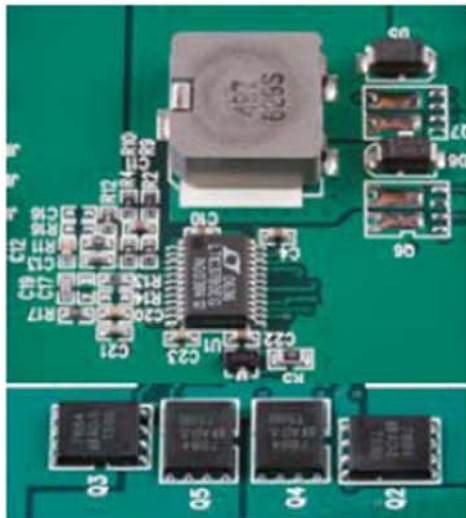


Figure 1- Discrete buck-boost circuit requires many components and good understanding of layout and design.

LTM4605, LTM4607, LTM4609

Simpler, Higher Power μ Module



Figure 2- First uModule buck-boost regulators allowed novice system designer easy access to complicated design.

4 FETs + Controller
inside

LTM8054, LTM8055, LTM8056

Simplest, Higher Voltage μ Module

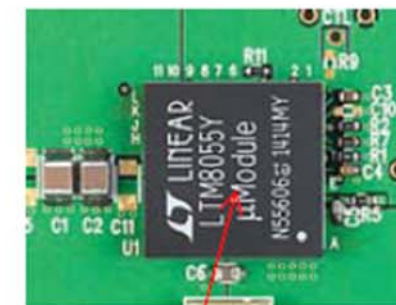
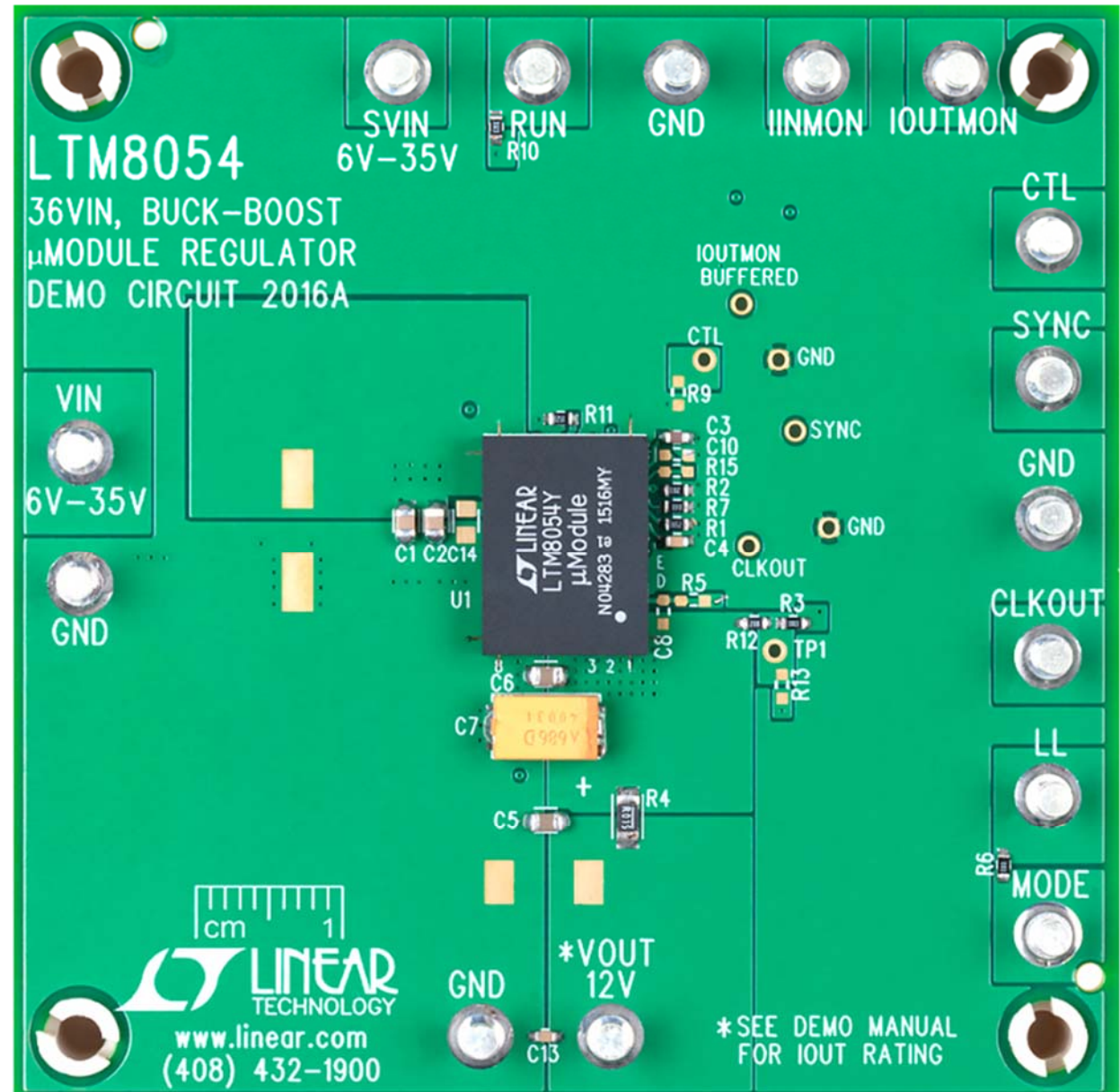
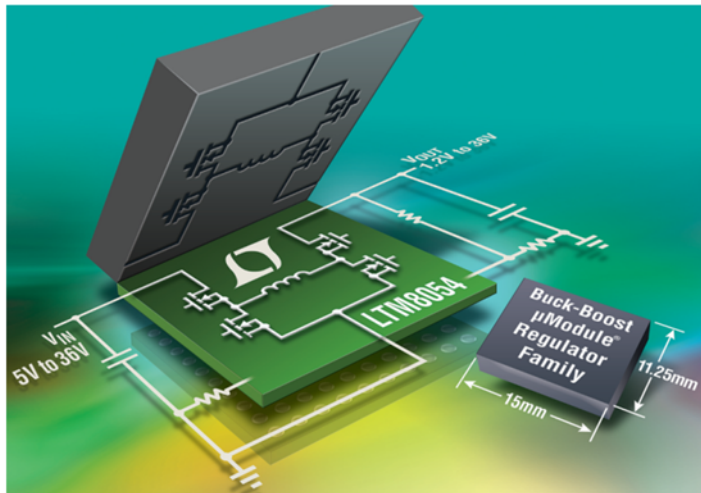


Figure 3- The new family of buck-boost uModule regulators have the inductor on-board and operate from higher input voltage.

인덕터까지 내장된
신제품

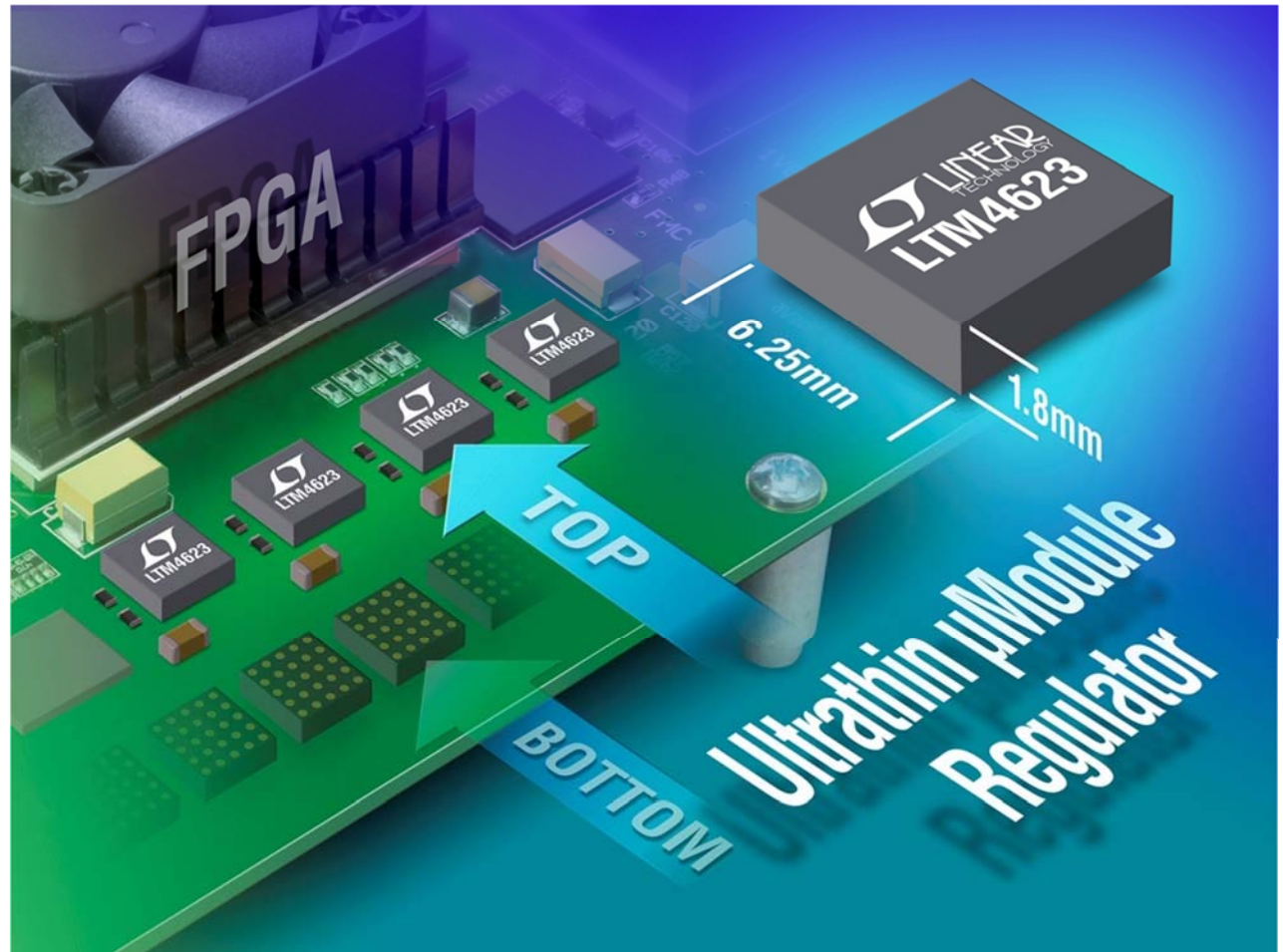
uModule (4-SW Buck-Boost)



uModule (ultra Thin)



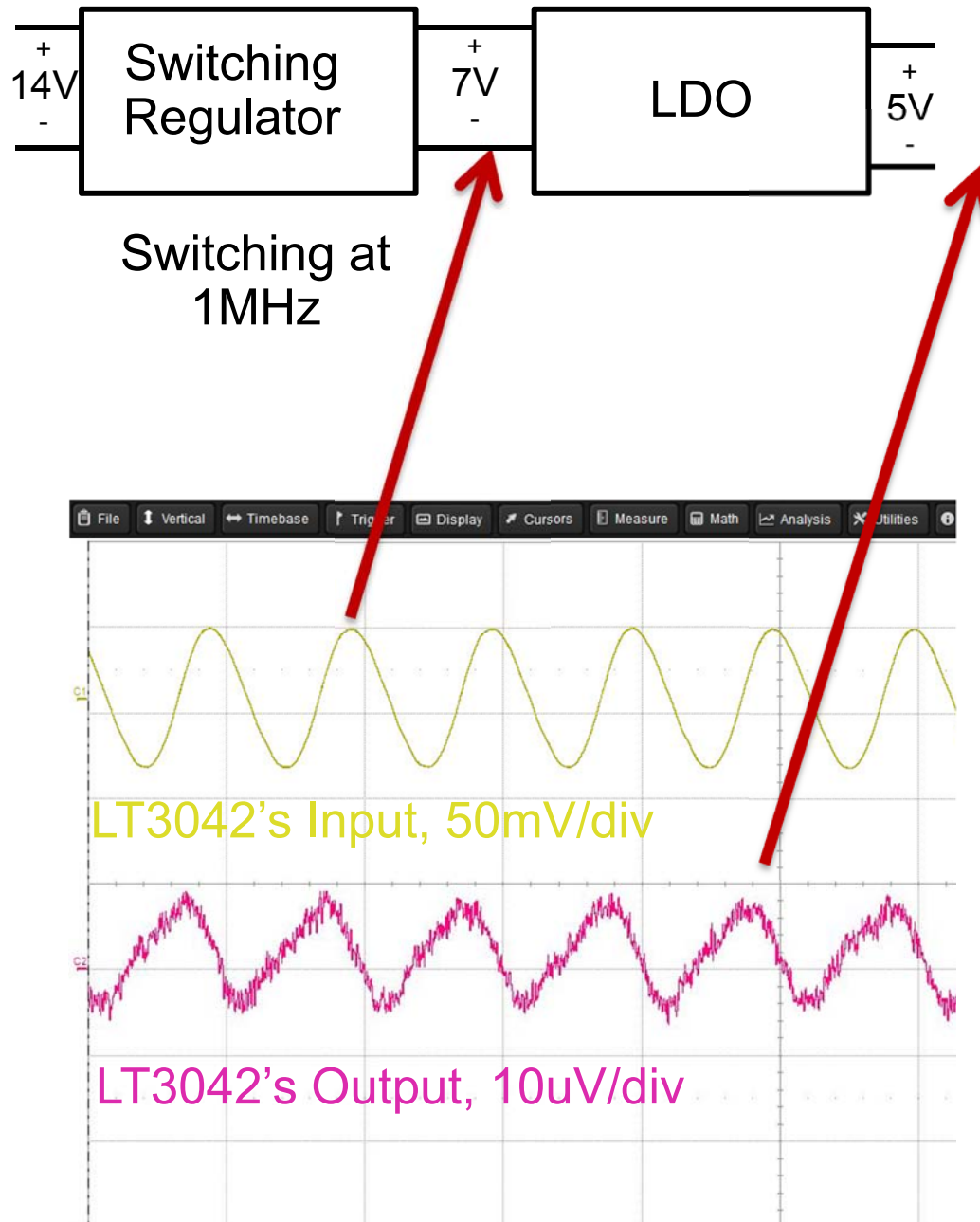
2.8~5.0mm



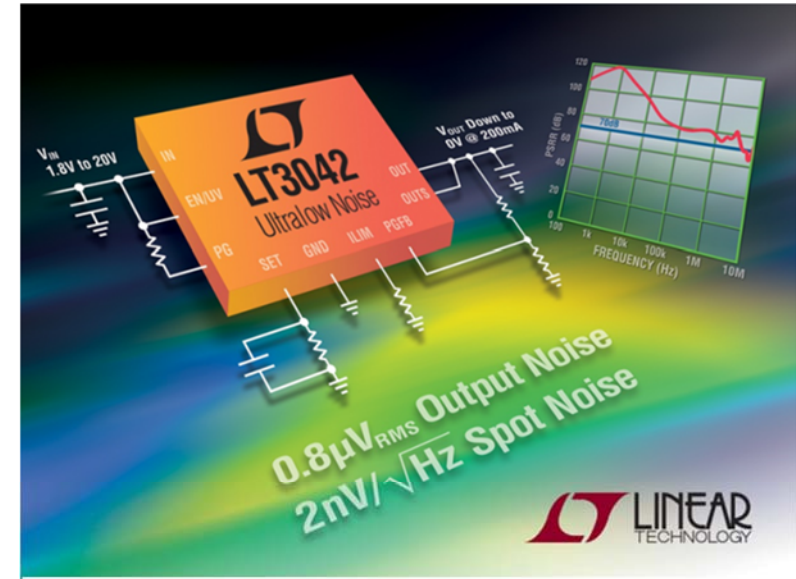
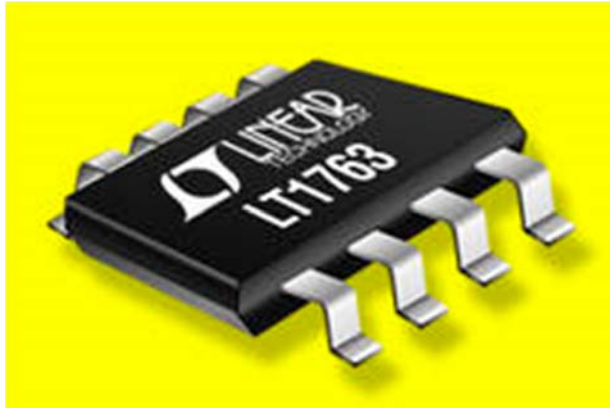
1.82mm height

Low EMI solution: EN55022B Class B compliant
3A output current

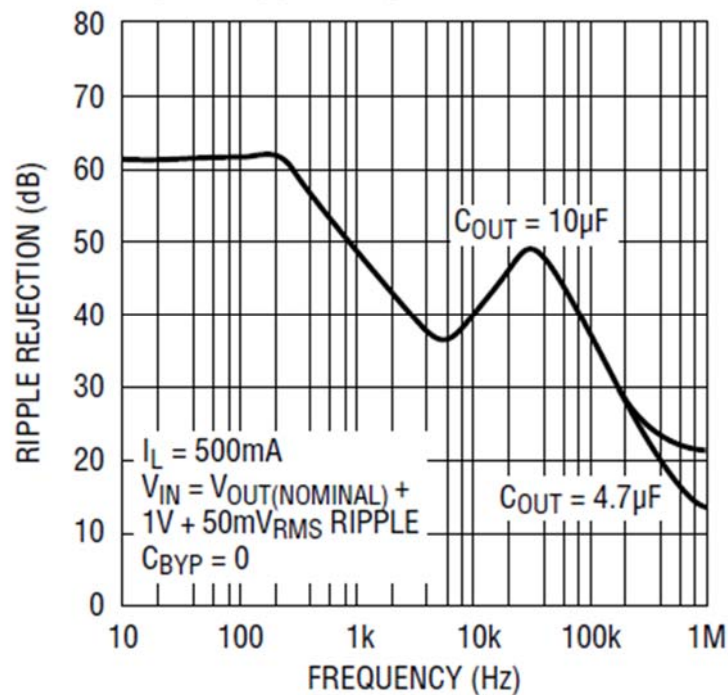
New LDO (RF LDO)



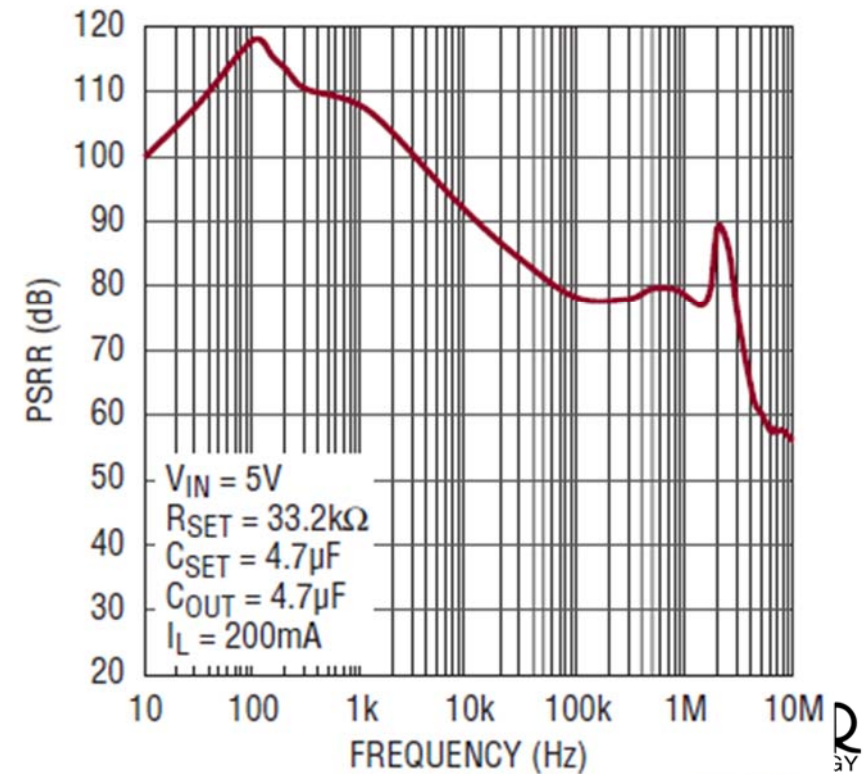
New LDO (RF LDO)



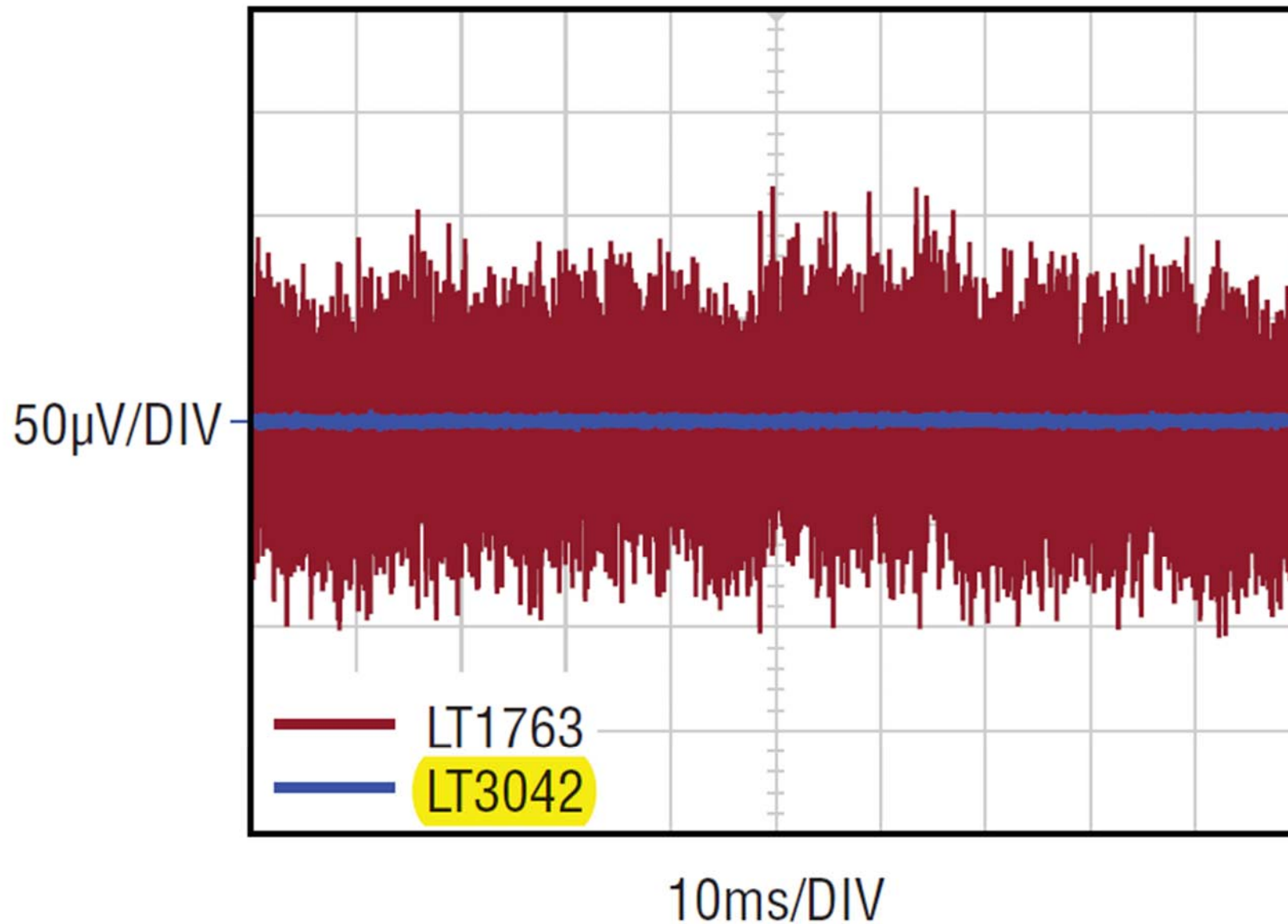
Input Ripple Rejection



Power Supply Ripple Rejection

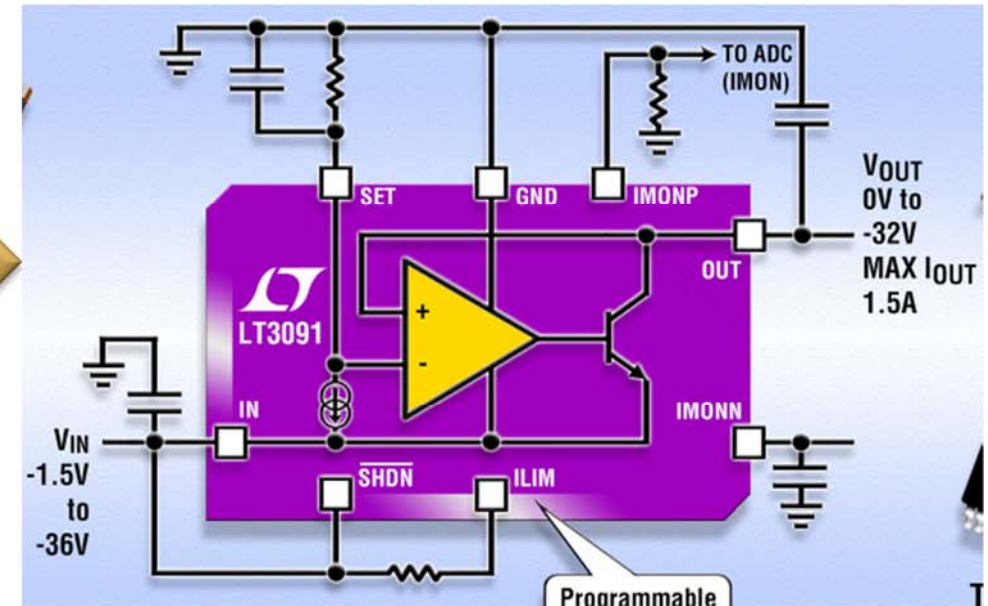
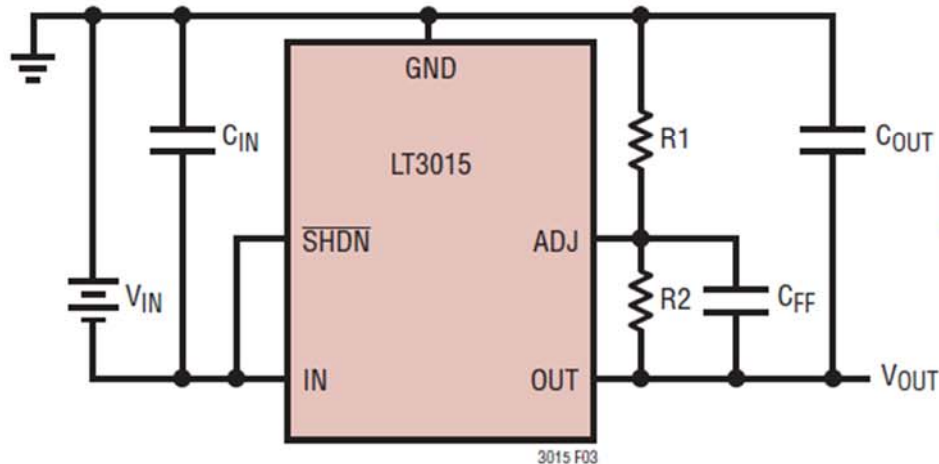


New LDO (RF LDO)



More new parts coming!

New LDO (Negative output)



구분

Resistor Divider
Min Vout
Ripple

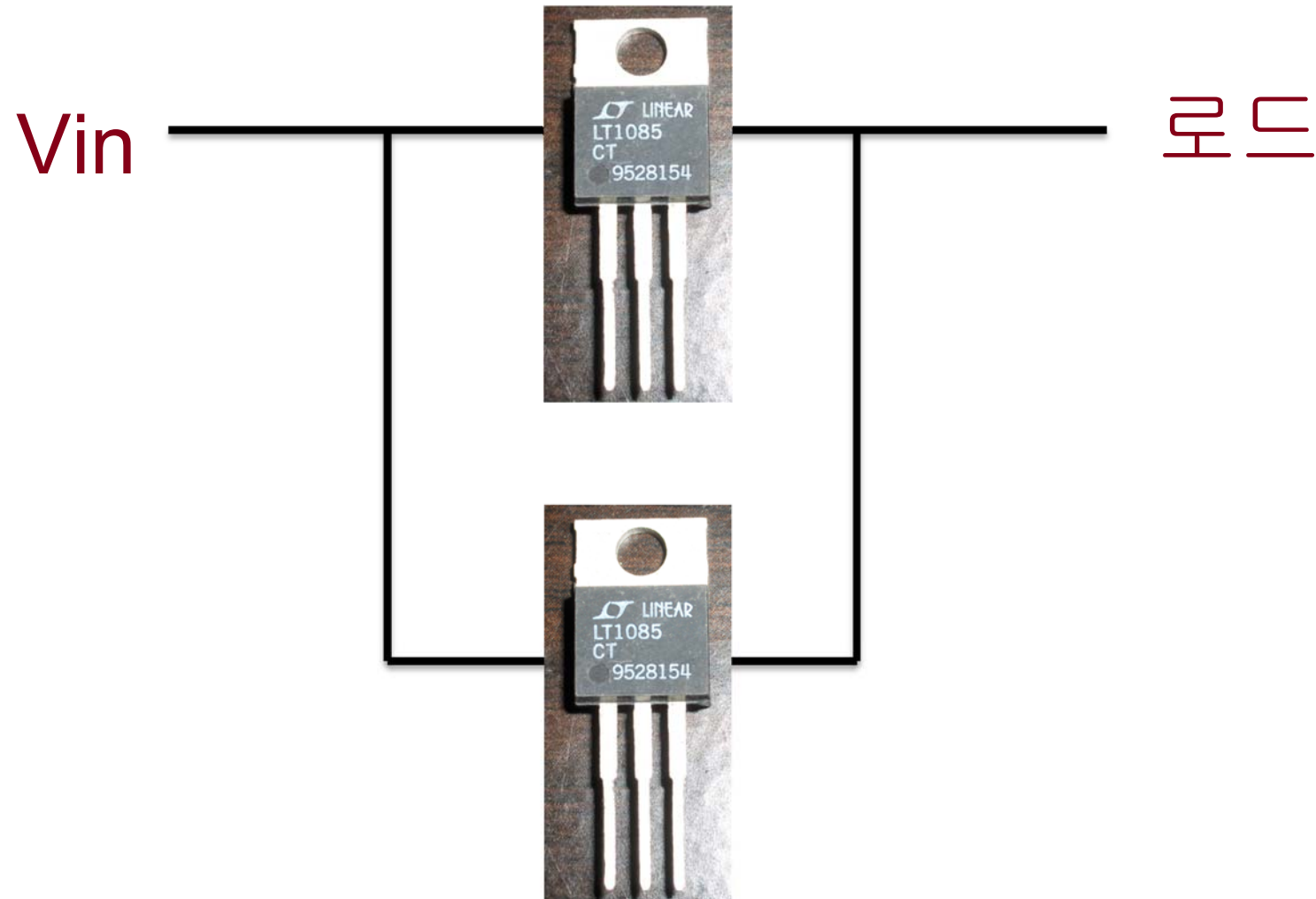
기존 LDO

저항2개
Over Vref
60uV

New LDO

저항1개
0V~
18uV

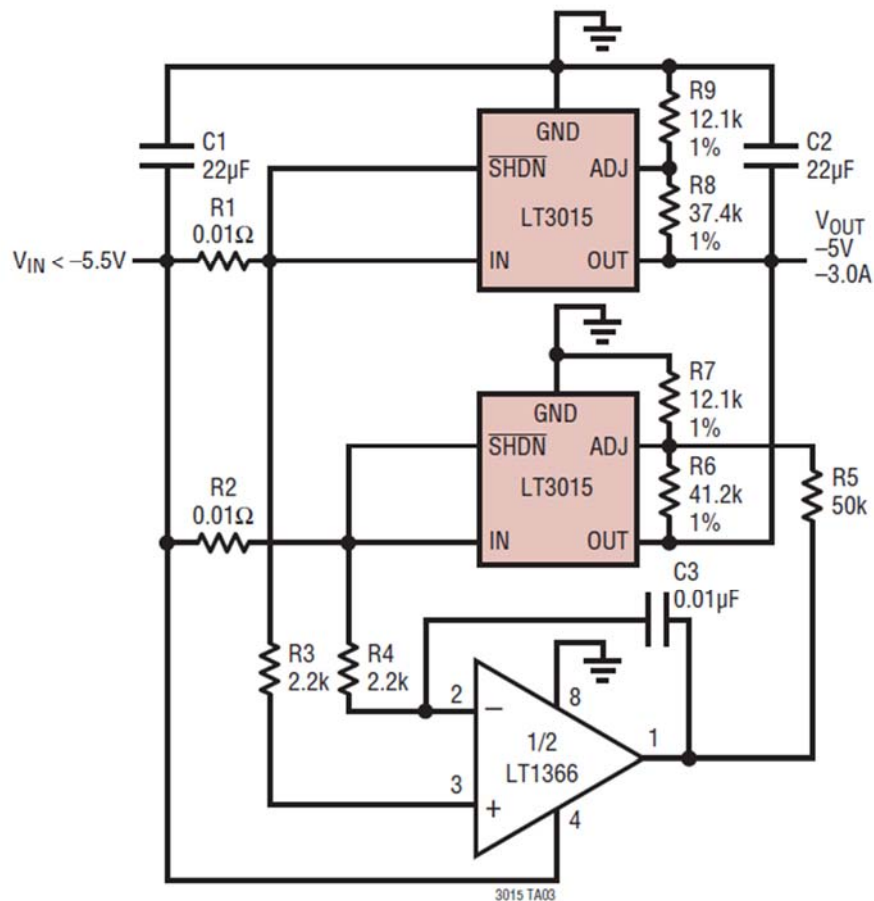
병렬 동작?



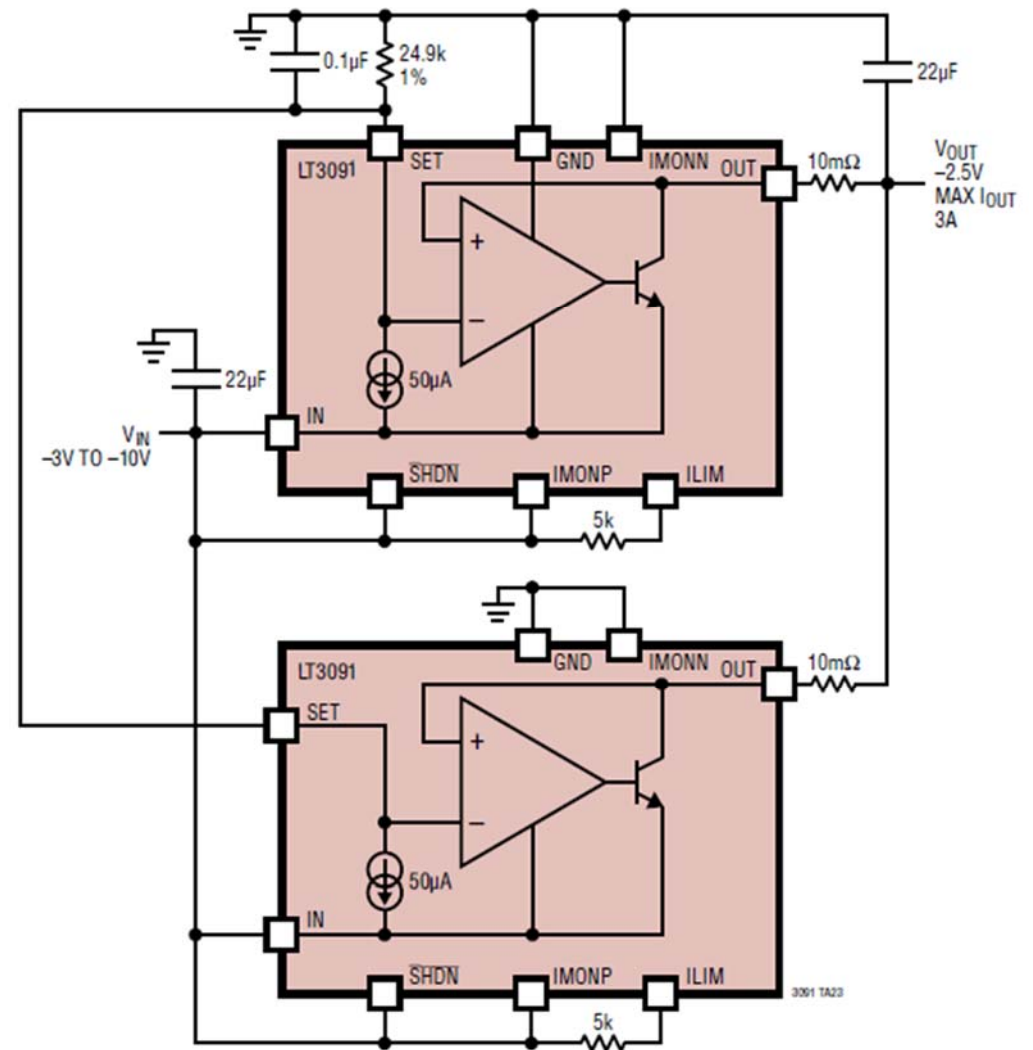
New LDO (Negative output)

For High power? Go parallel

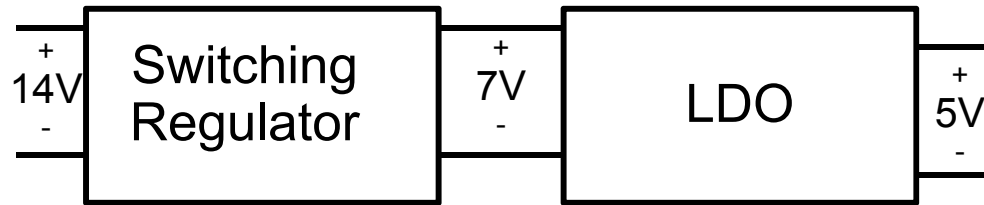
Paralleling Regulators For Higher Output Current



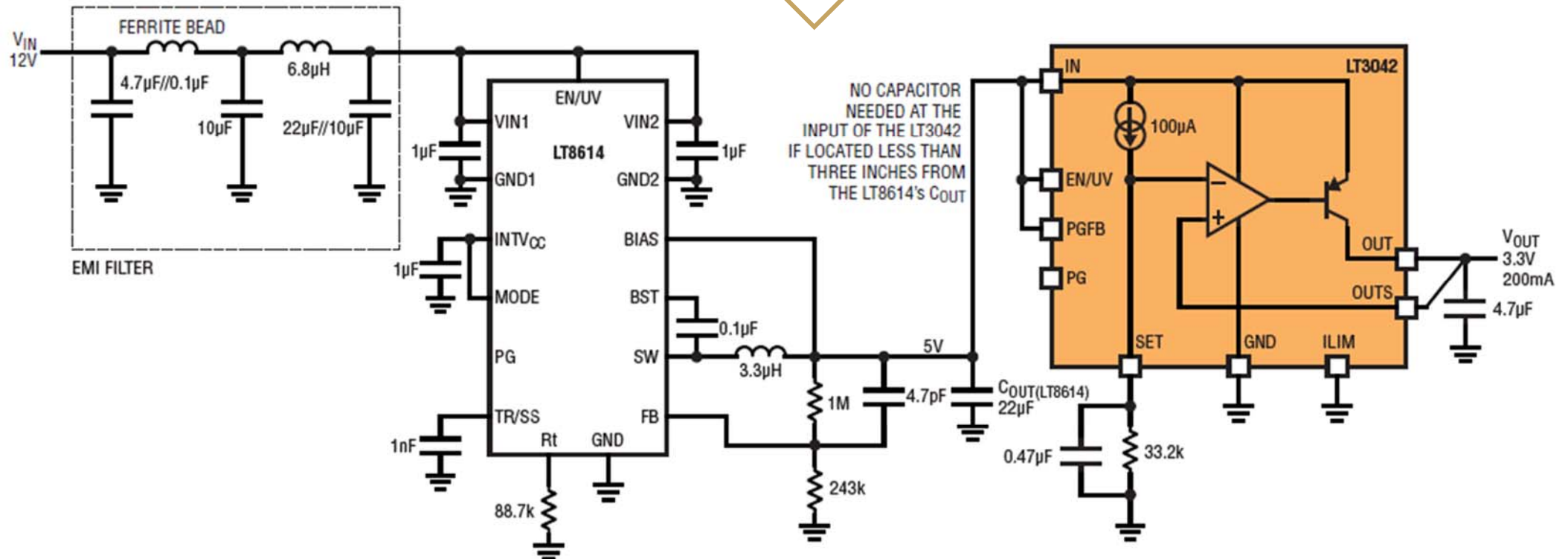
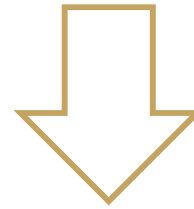
Parallel Devices



Low noise bias

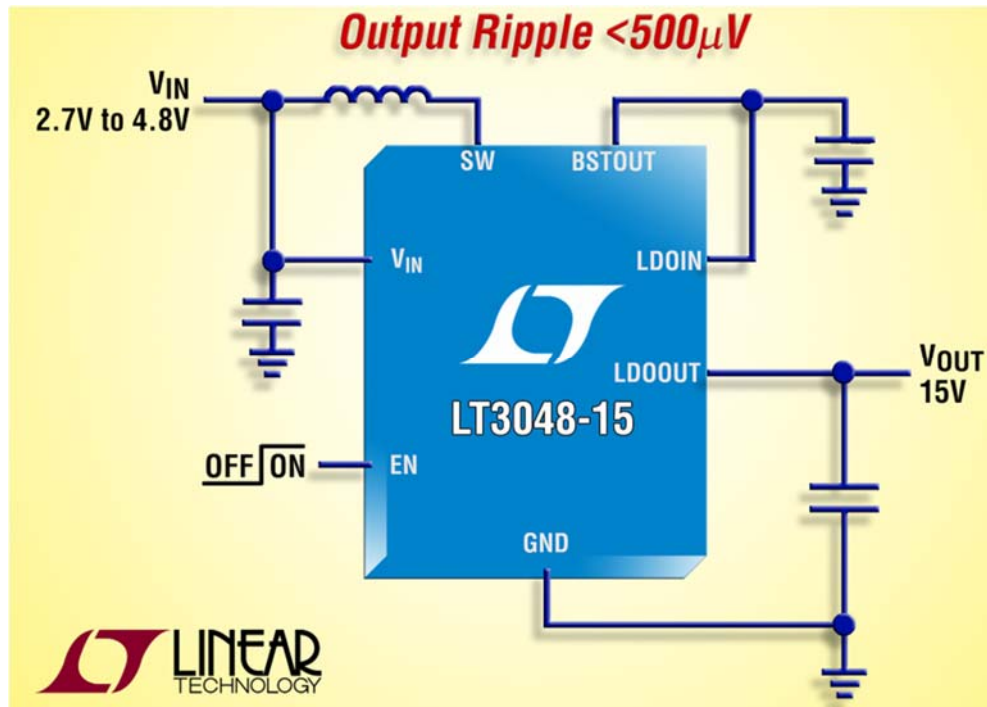


Switching at
1MHz

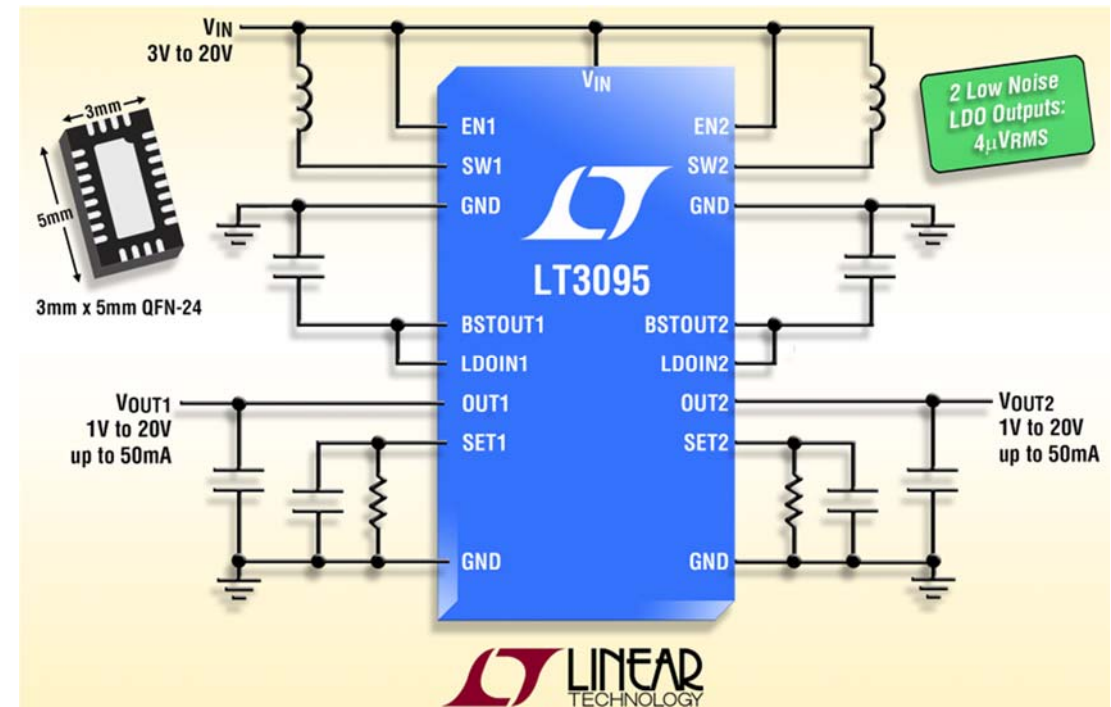


Low noise bias

Single Boost + post LDO



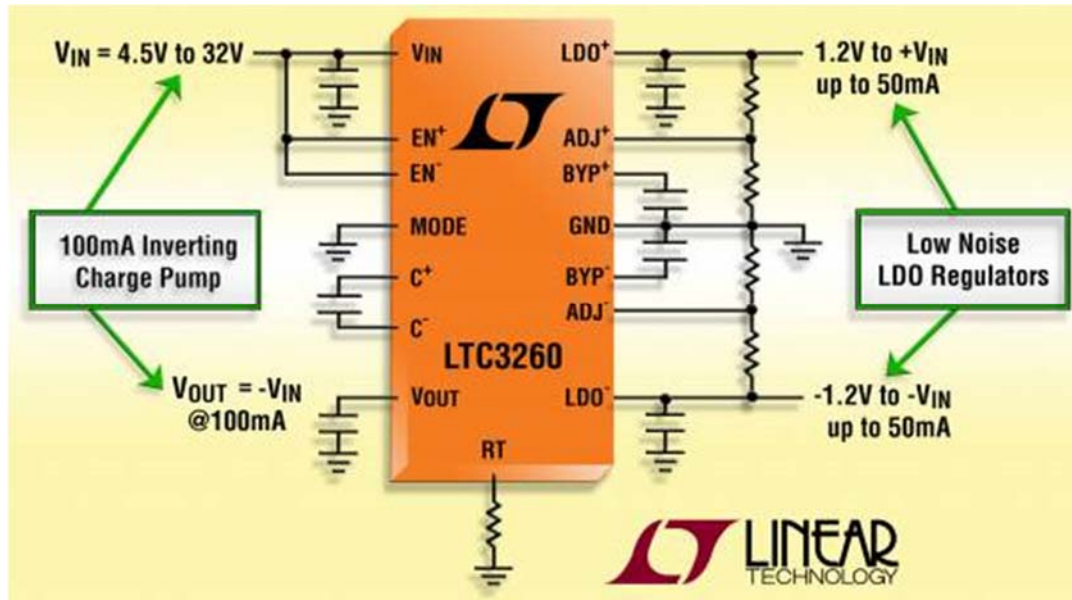
Dual Boost converter + Dual Internal LDO



Low noise bias

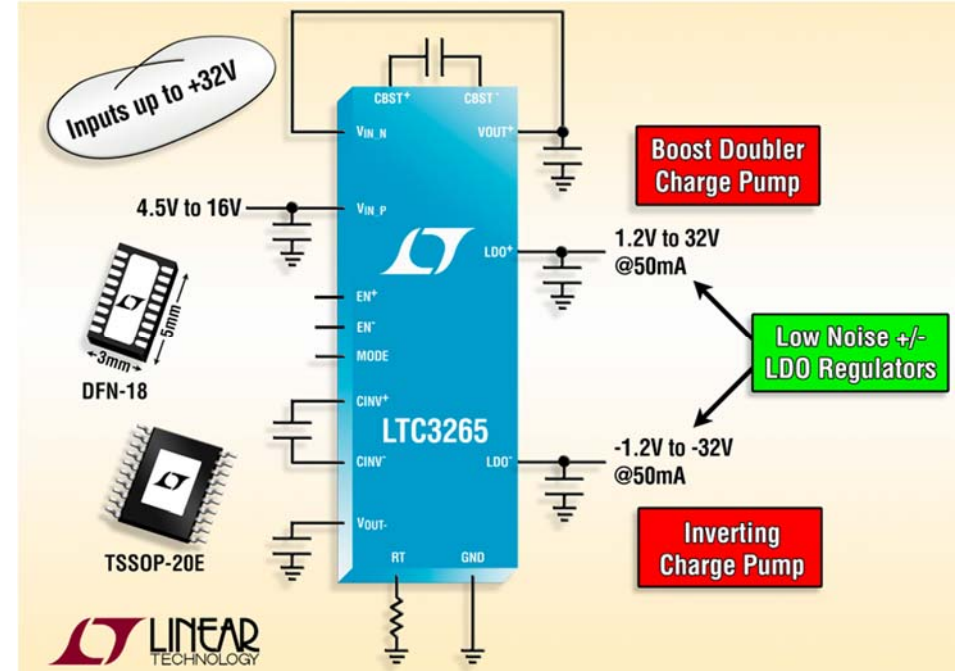
Positive: LDO

Negative: Inverting charge pump + LDO

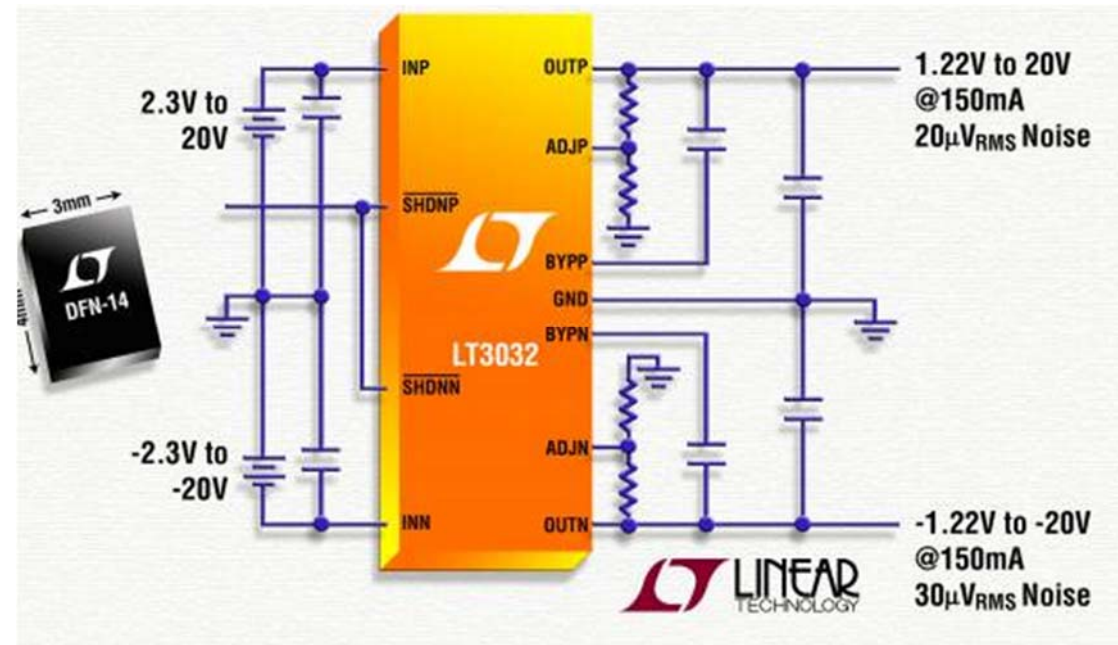
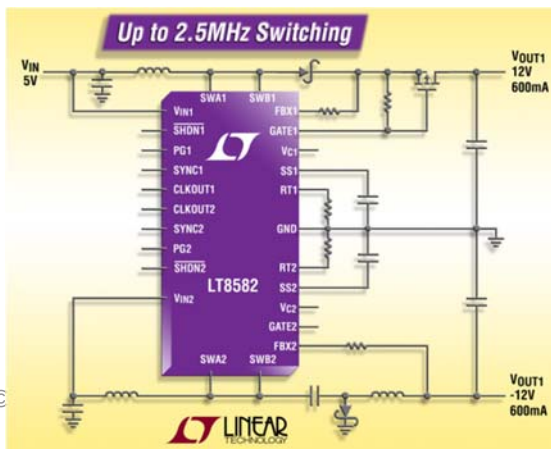
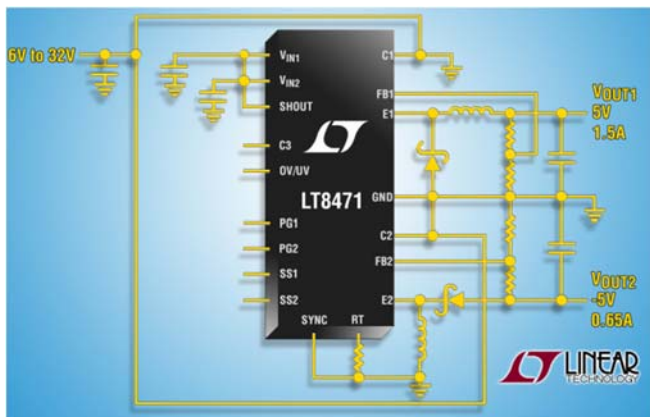
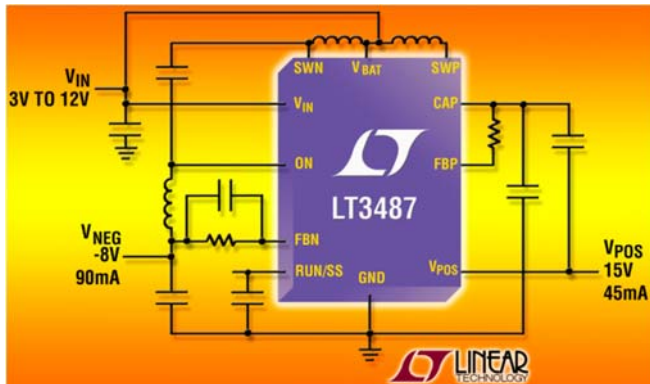


Positive: Boost charge pump + LDO

Negative: Inverting charge pump + LDO



Low noise bias

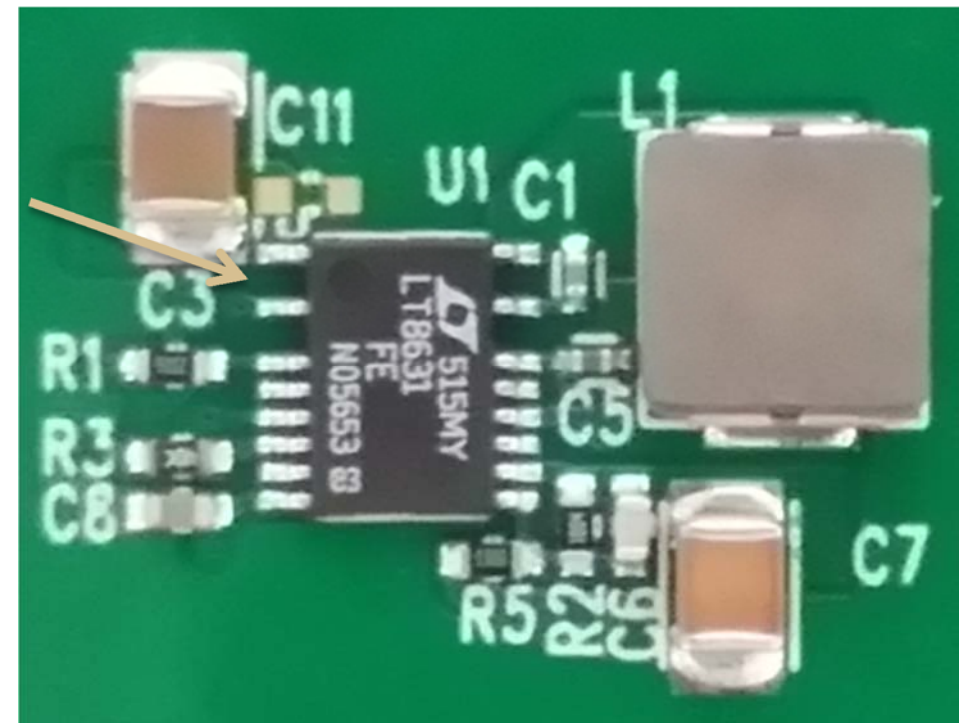
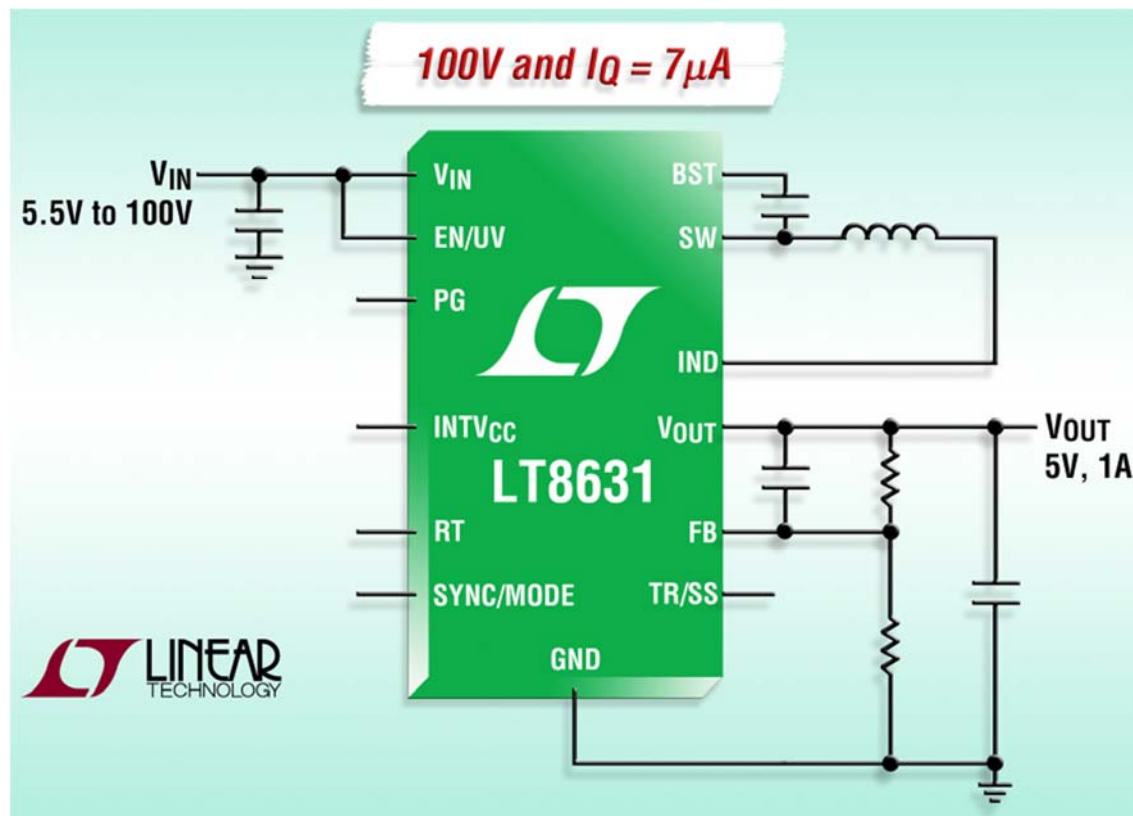


New DC/DC converter (High Vin)

Automotive Buck's typ Vin: 36Vin, 42Vin, 60Vin

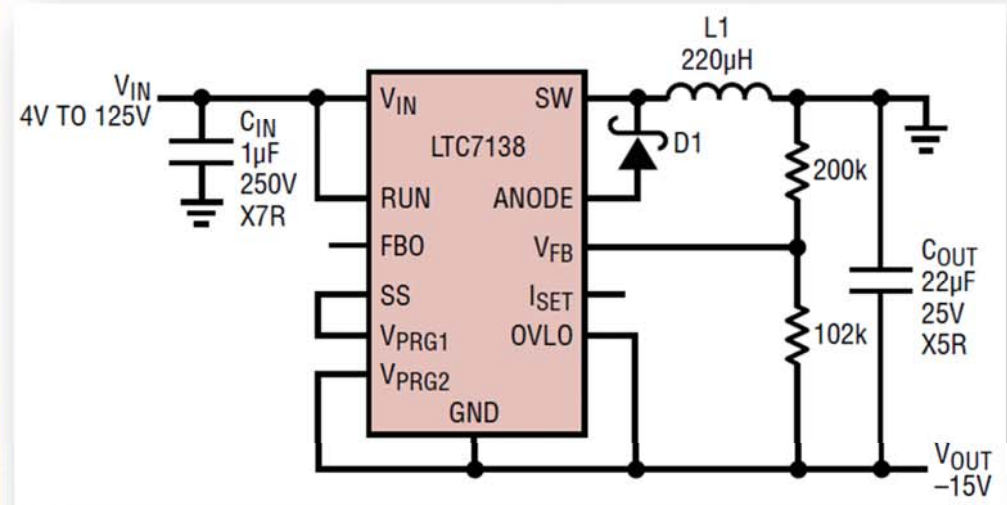
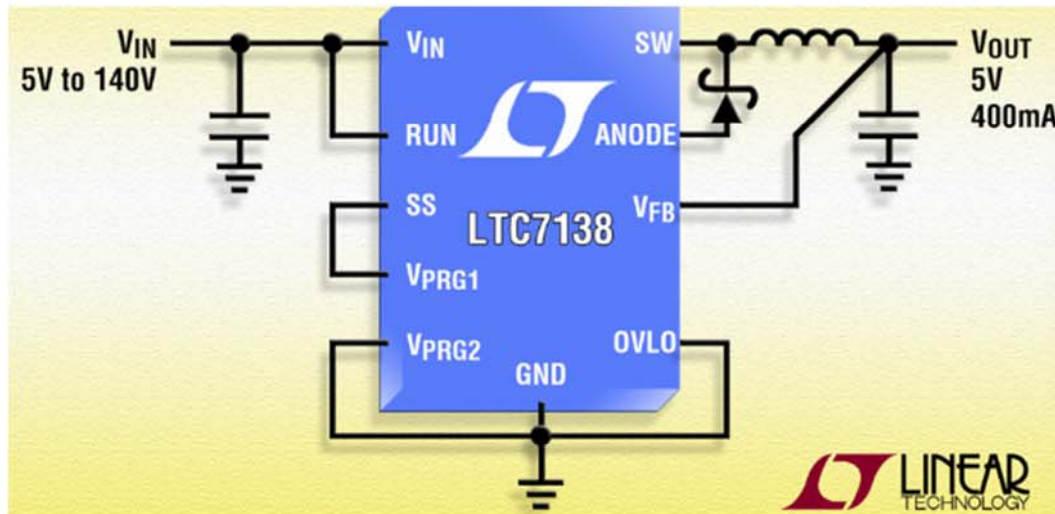
More High Vin Buck?

Use Flyback regardless no need isolation?



New DC/DC converter (High Vin)

More High Vin Buck? 140Vin
Negative output?



Negative output

New DC/DC converter (Any topology, Dual)

Previous application

12V to 5V

Choose Buck converter



Now

5V to 12V

Choose Boost



Future design

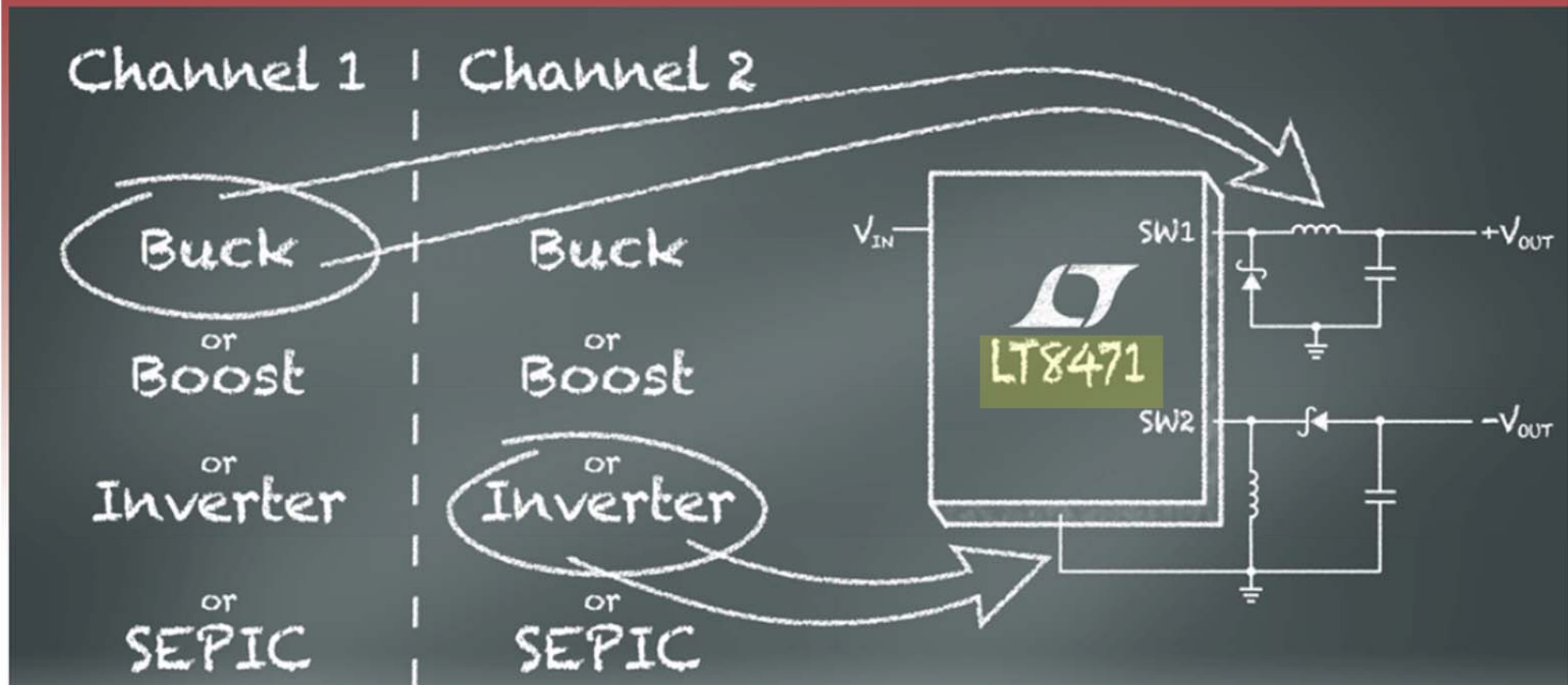
12 to -12V

Choose Inverter

New IC selection may required for every design!

New DC/DC converter (Any topology, Dual)

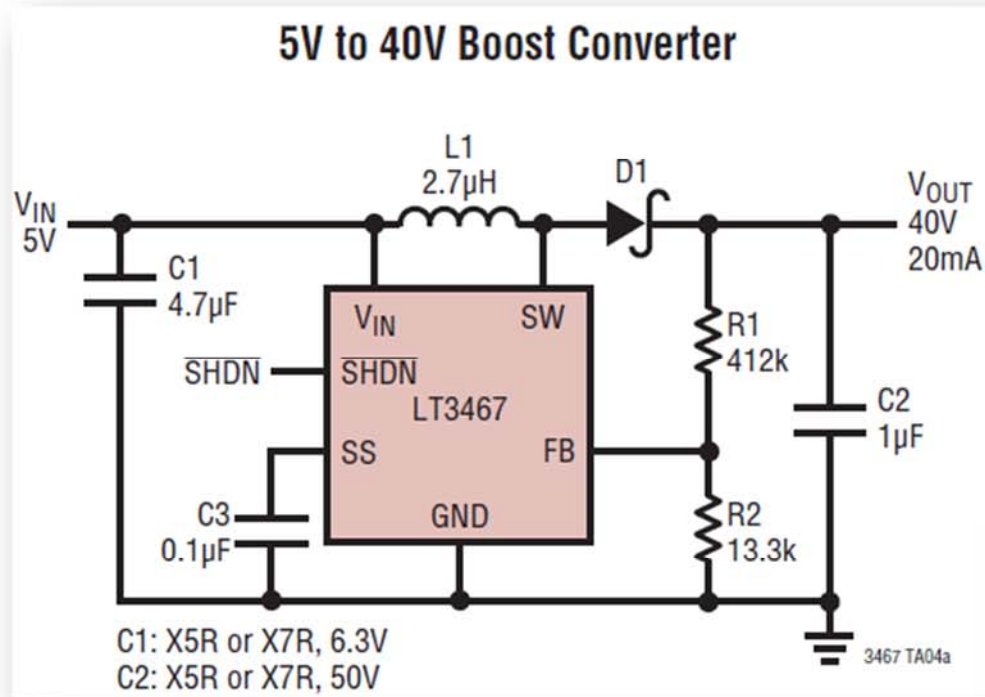
One Switcher Does It All



2.5~50Vin

Dual 2A 50V internal switch

New DC/DC converter (고전압 출력 Boost)



FEATURES

- 1.3MHz Switching Frequency (LT3467)
- 2.1MHz Switching Frequency (LT3467A)
- Low V_{CESAT} Switch: 330mV at 1.1A
- **High Output Voltage: Up to 40V**

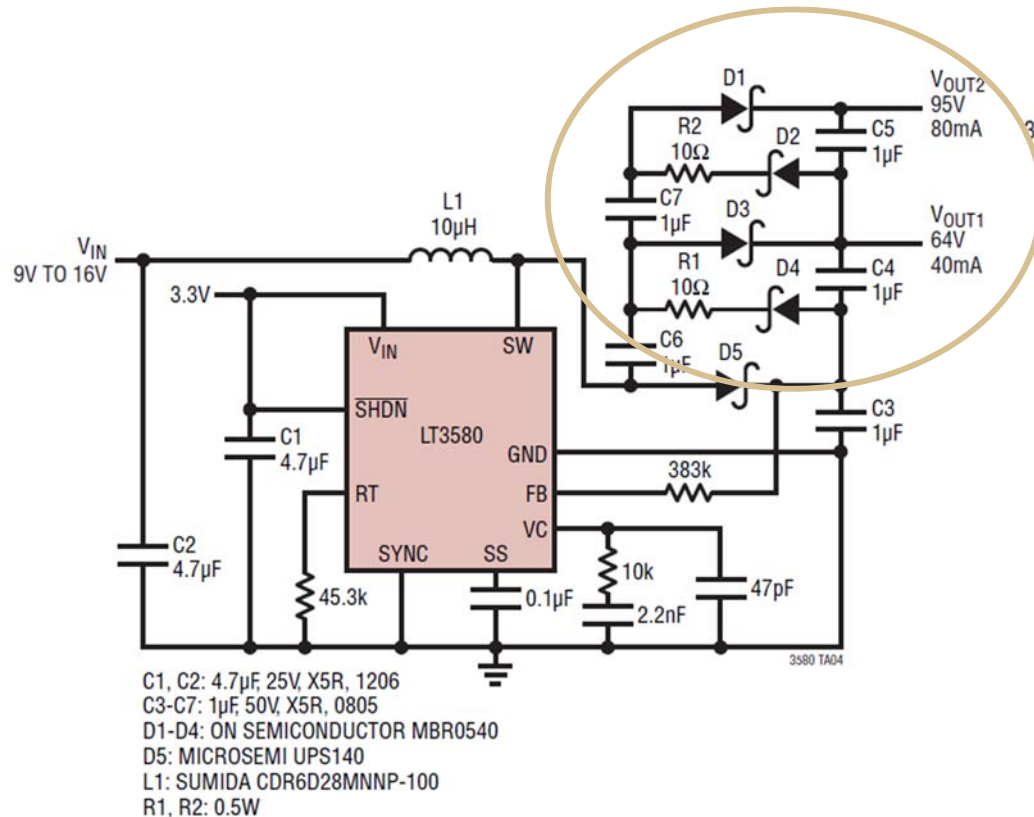
LT3467/LT3467A

ABSOLUTE MAXIMUM RATINGS (Not

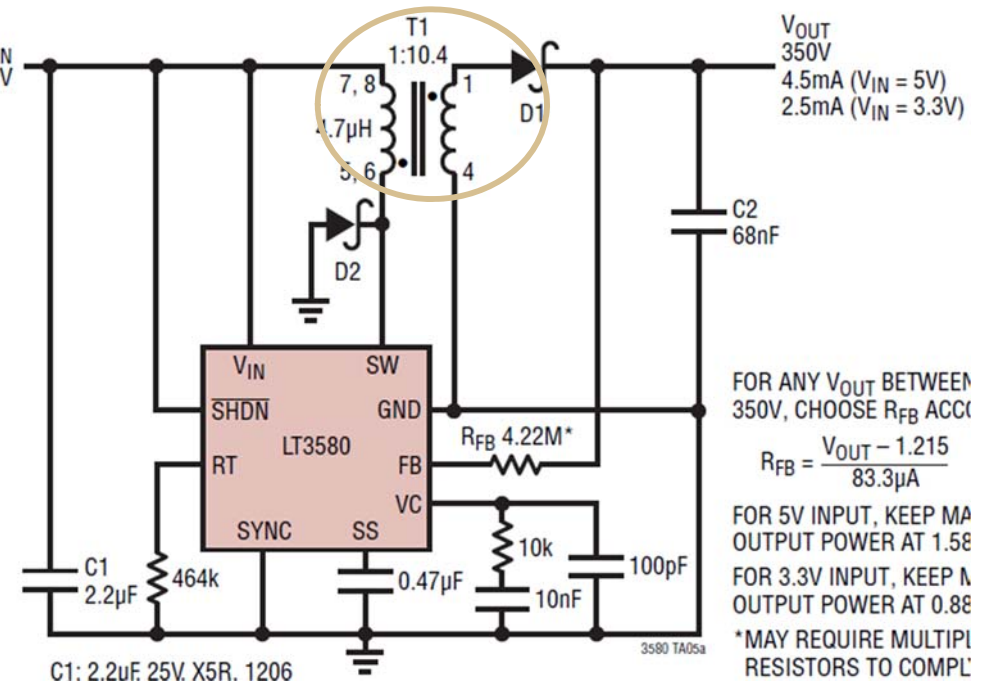
V_{IN} Voltage.....	16V
SW Voltage	-0.4V to 42V

New DC/DC converter (고전압 출력 Boost)

External Charge pump

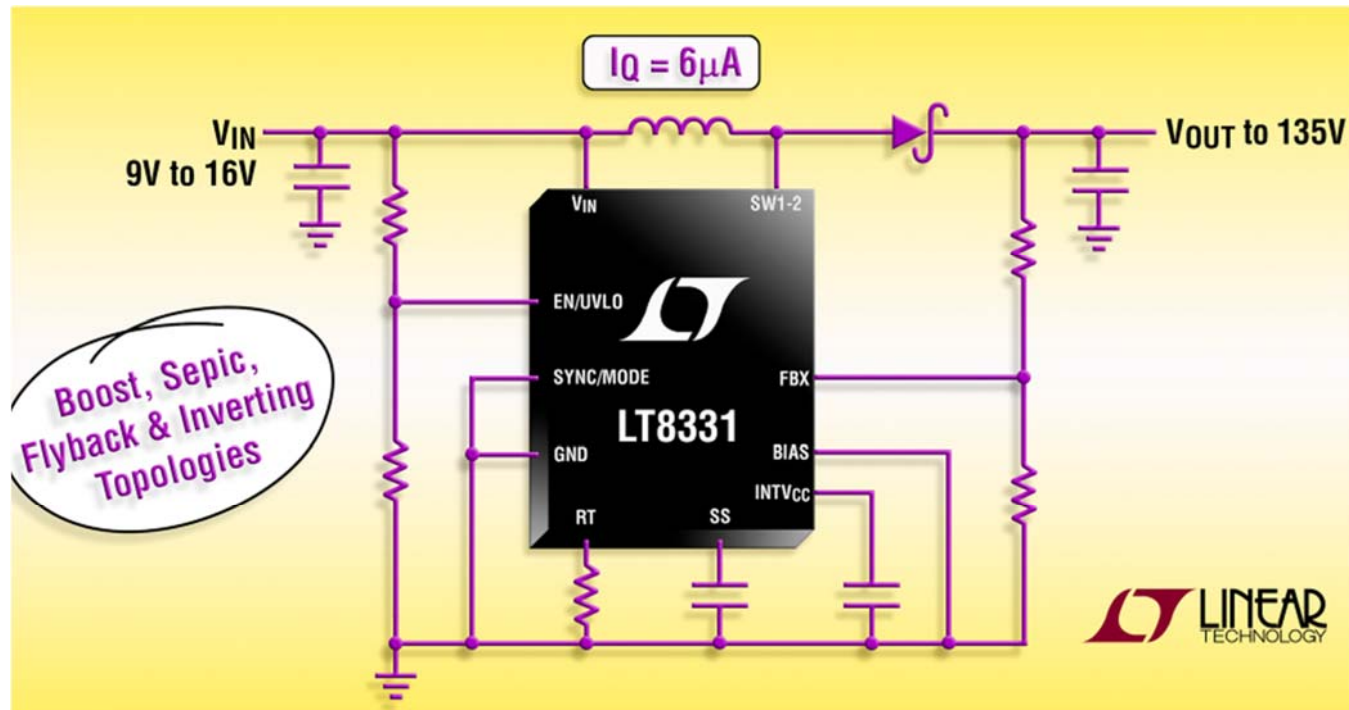


Flyback



New DC/DC converter (고전압 출력 Boost)

Over 40V boost output?

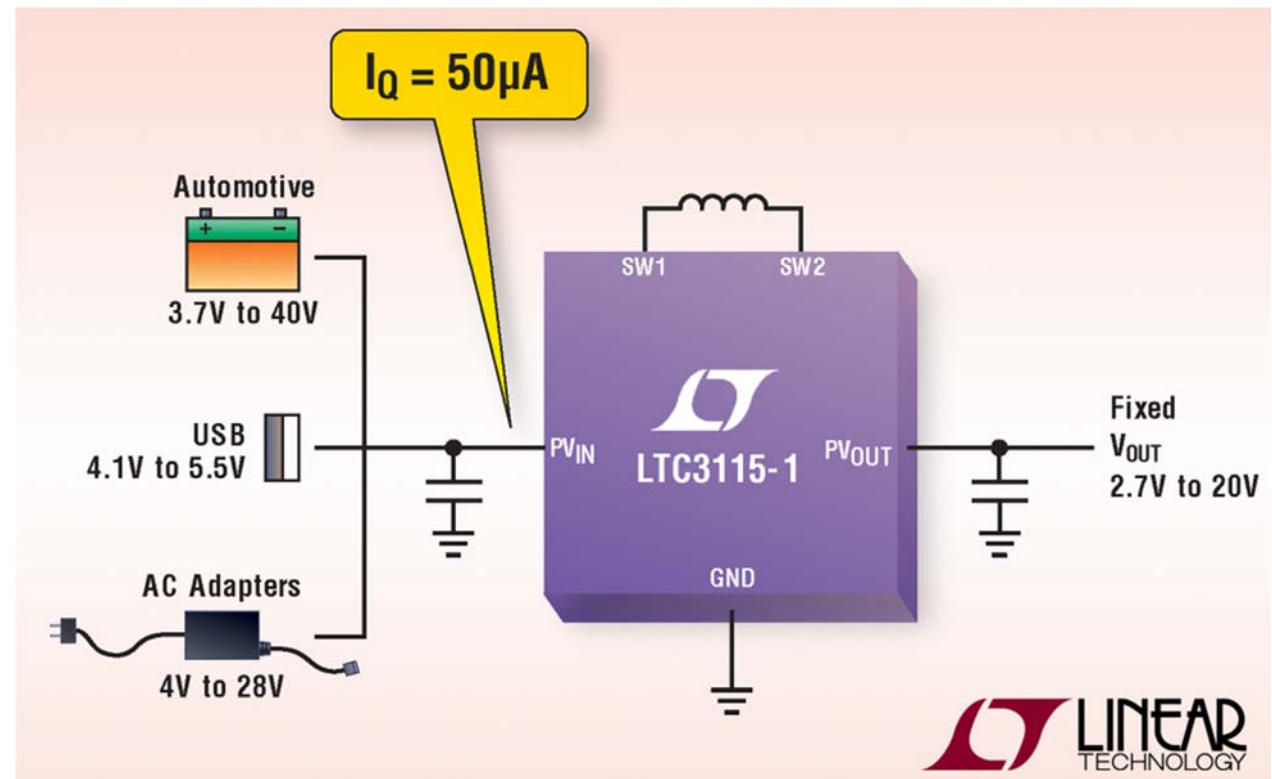
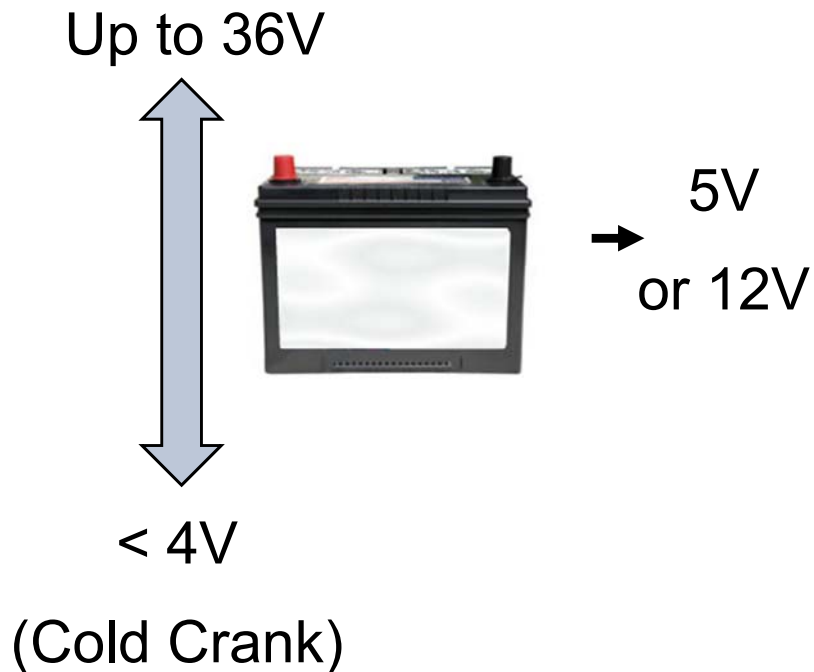


FEATURES

- Wide Input Voltage Range: 4.5V to 100V
- Ultralow Quiescent Current and Low Ripple
Burst Mode® Operation: $I_Q = 6\mu A$
- 0.5A, 140V Power Switch

New DC/DC converter (Buck-Boost)

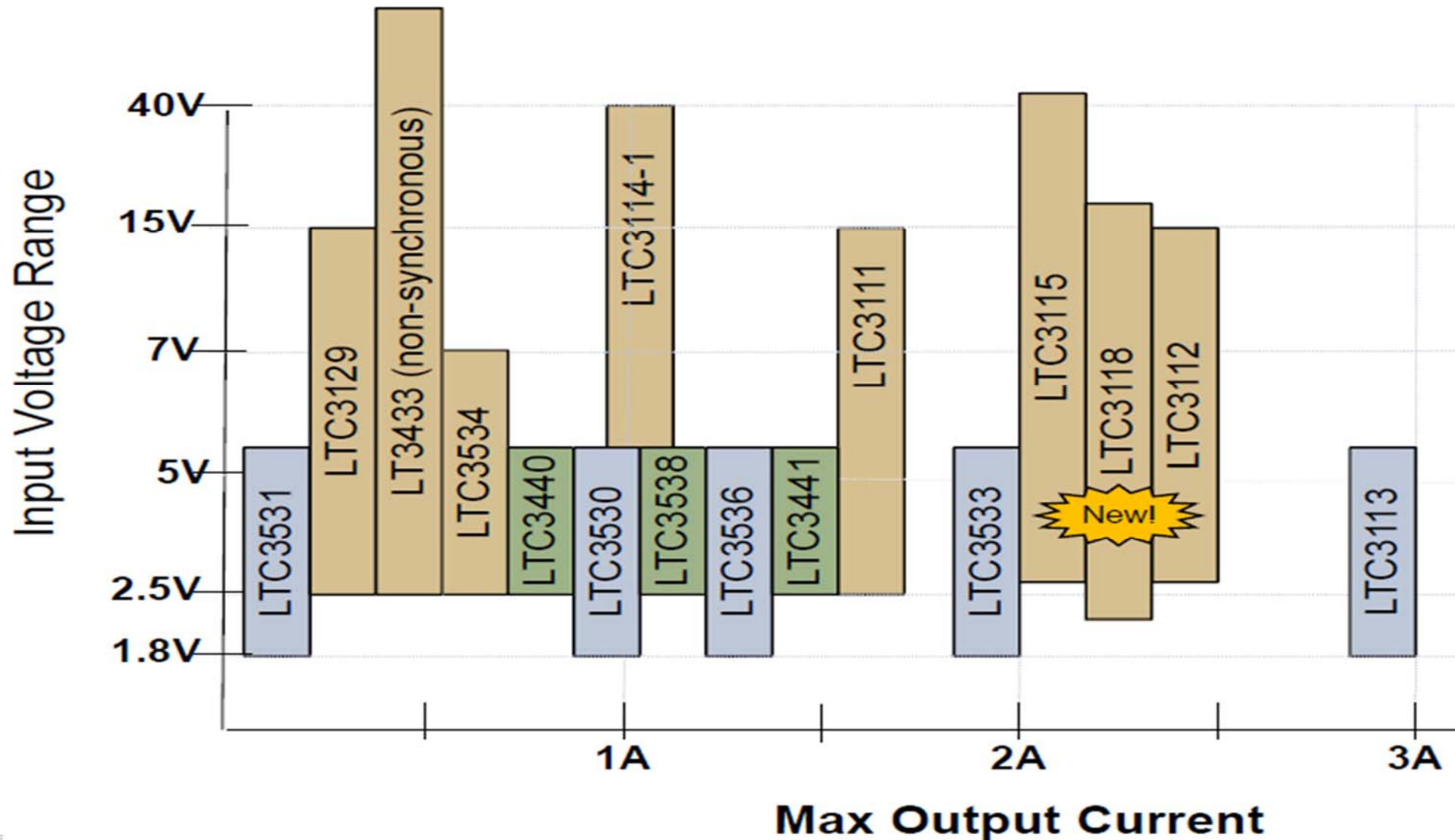
Why Buck boost required?



New DC/DC converter (Buck-Boost)

LTC Buck-Boost History (Internal switch)

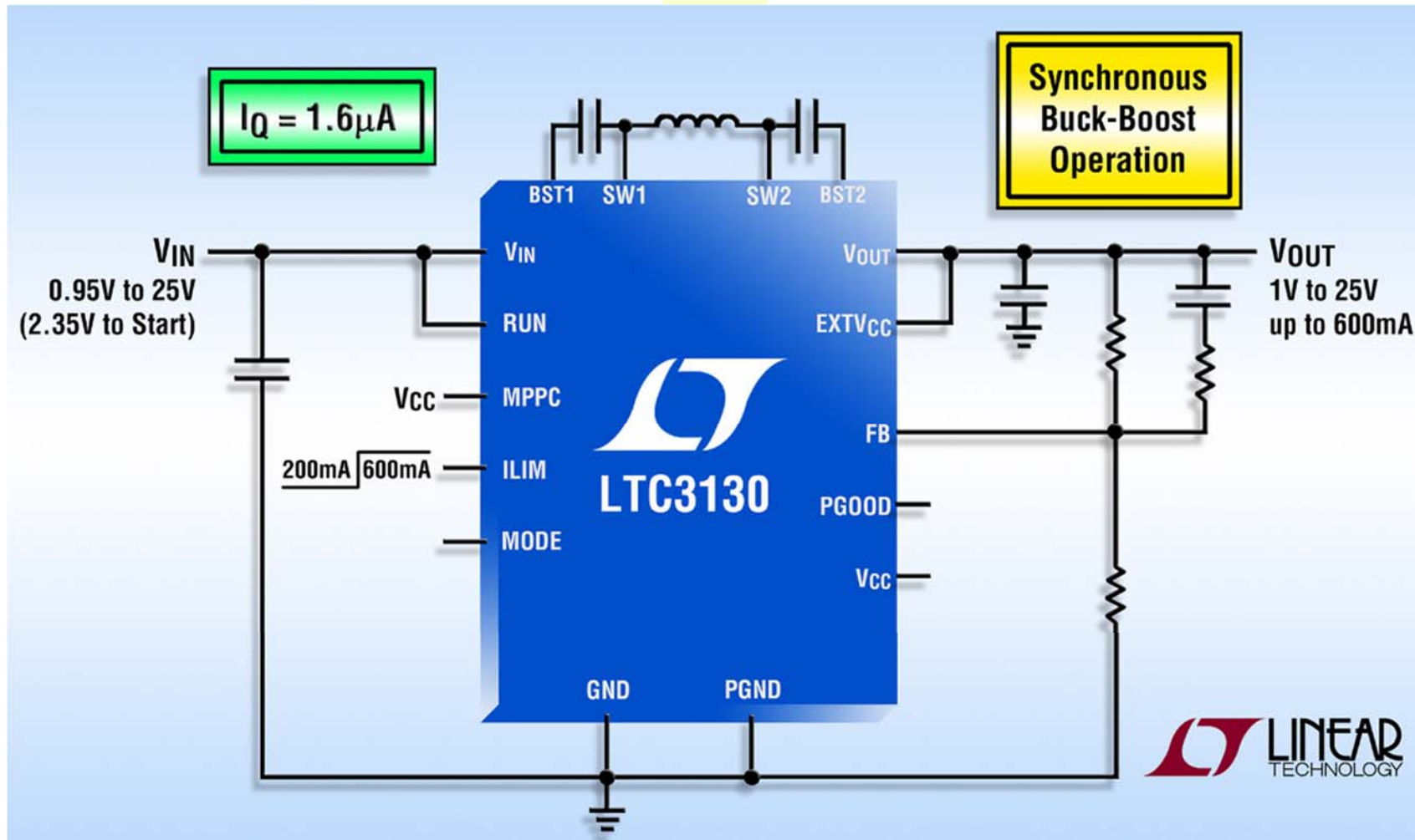
5.5V_{in} → 15V_{in} → 40V_{in}



New DC/DC converter (Buck-Boost)

LTC Buck-Boost History (Internal switch)

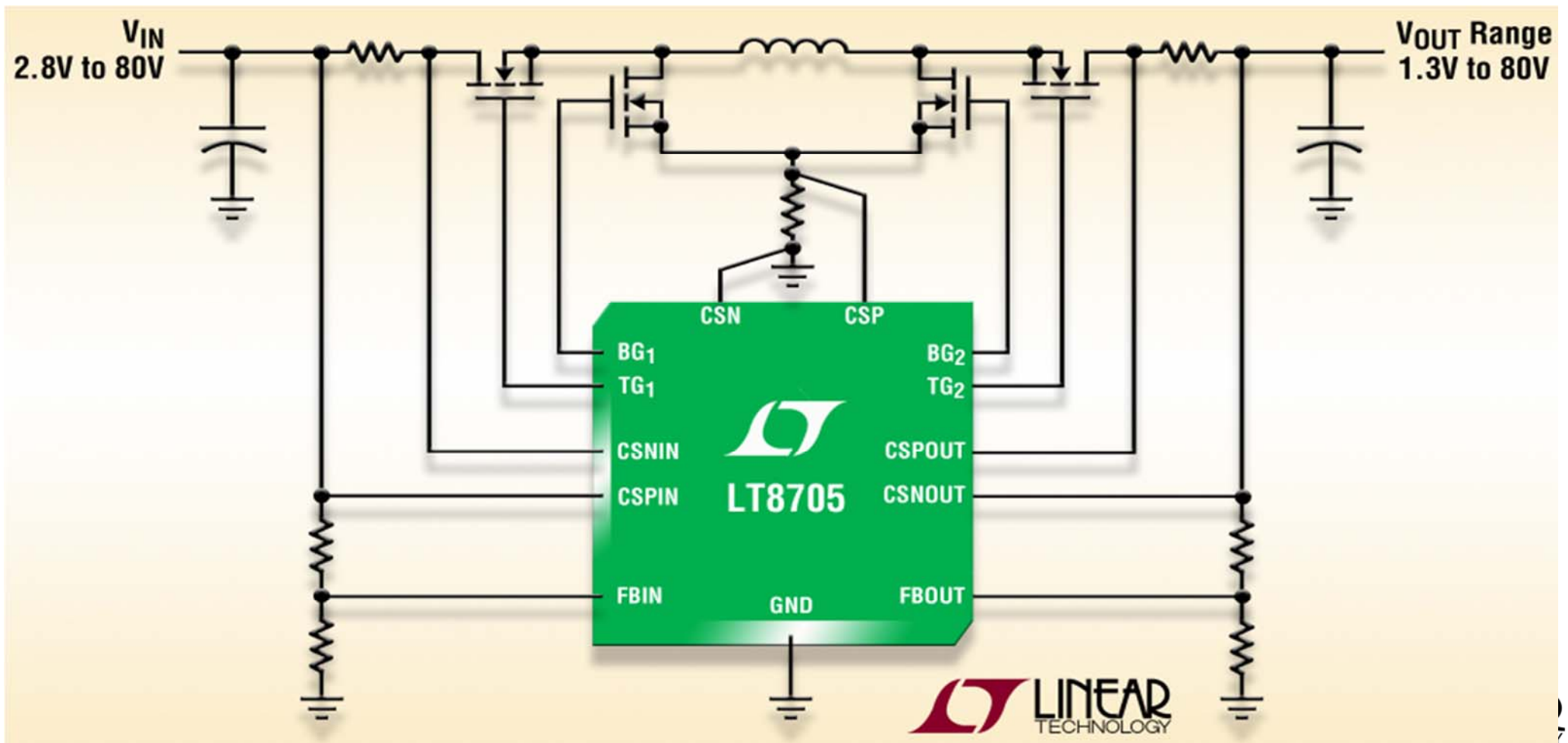
5.5V_{in} → 15V_{in} → 40V_{in} → **25V**



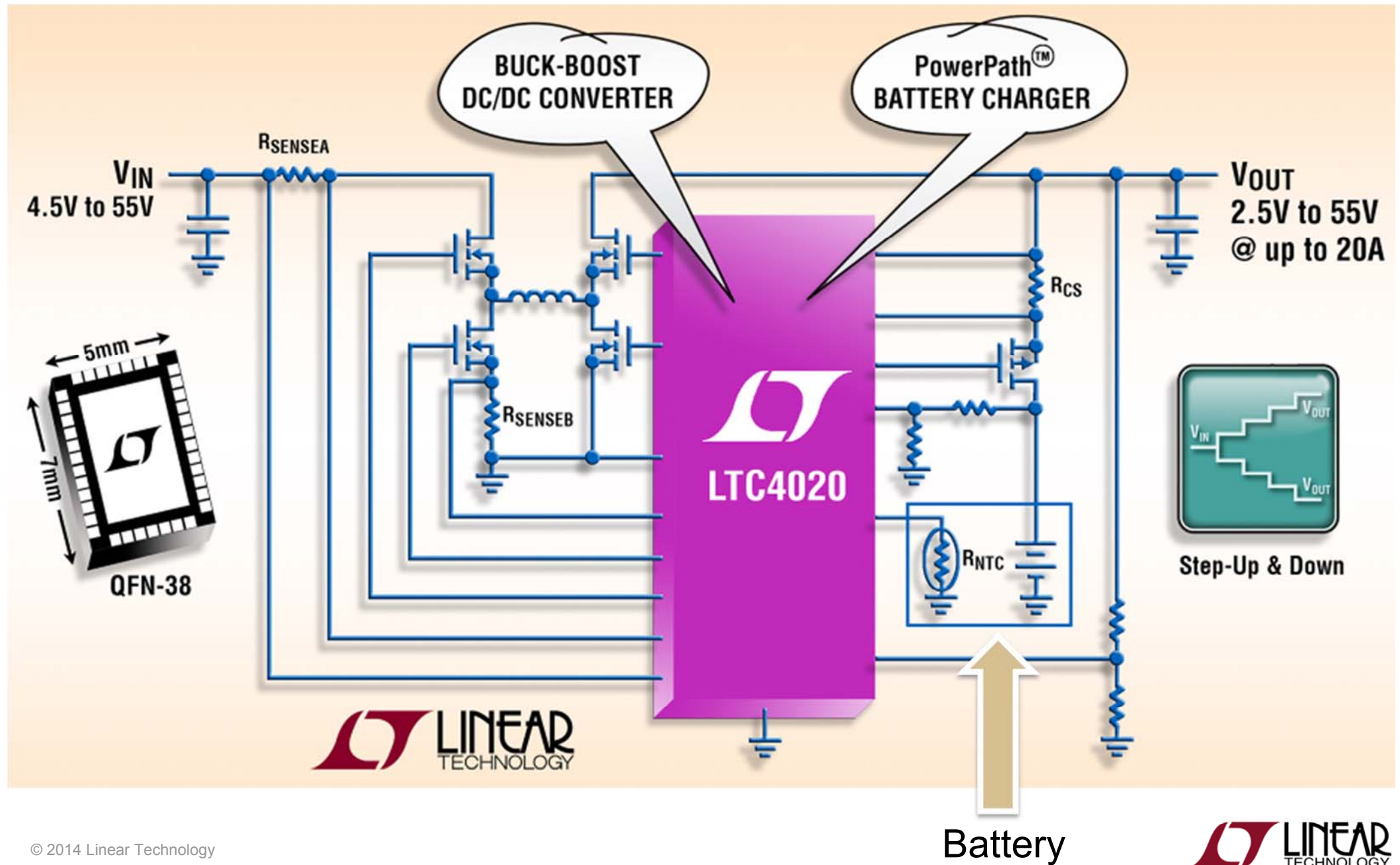
New DC/DC converter (Buck-Boost)

LTC Buck-Boost History (Controller)

	LTC3785	LTC3780	LTC3789	LT3790	LT8705
V _{IN} (V)	2.7 – 10	4 – 36	4 – 38	4.7 – 60	2.8 – 80

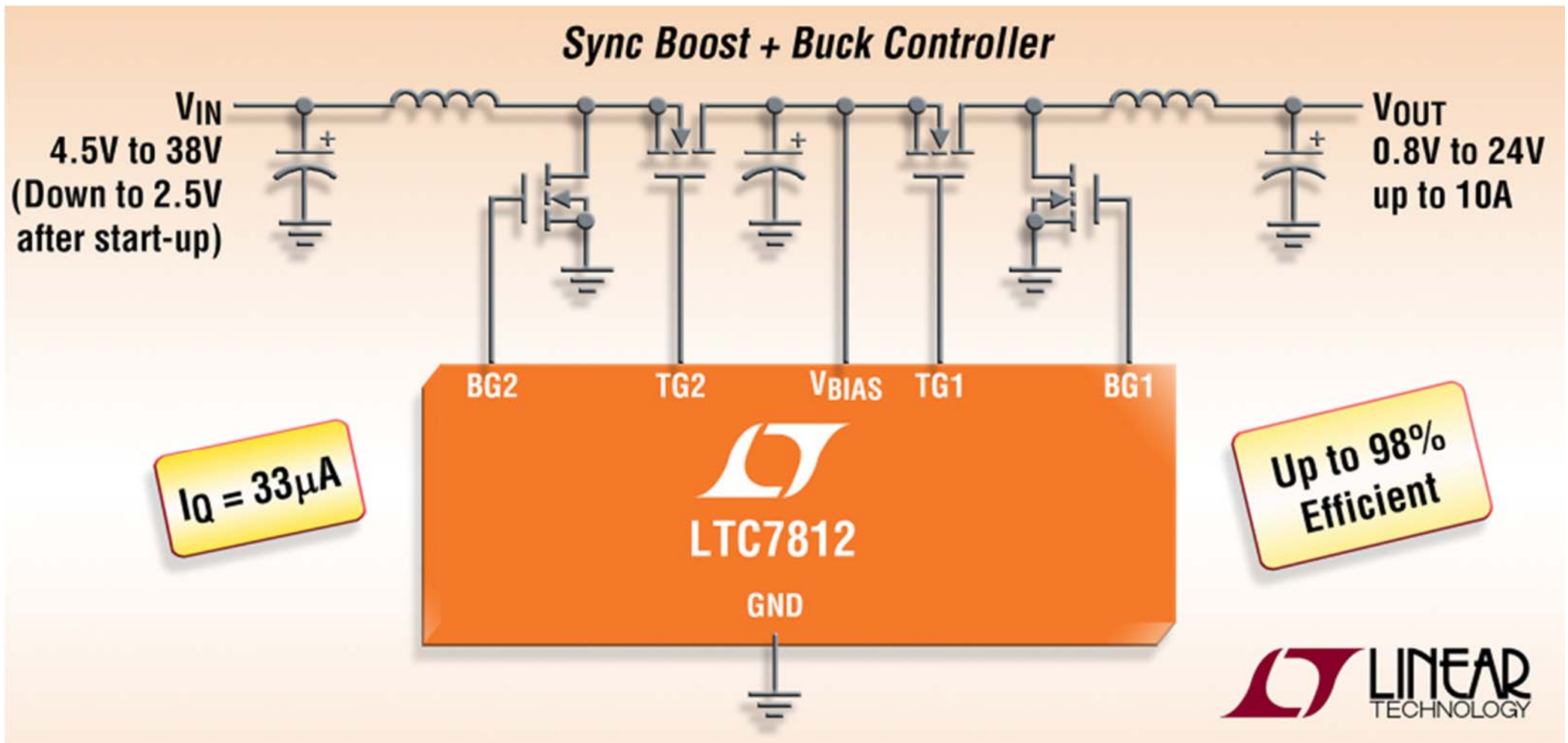


New DC/DC converter (Buck-Boost Charger)



New DC/DC converter (Pre-Boost plus Buck)

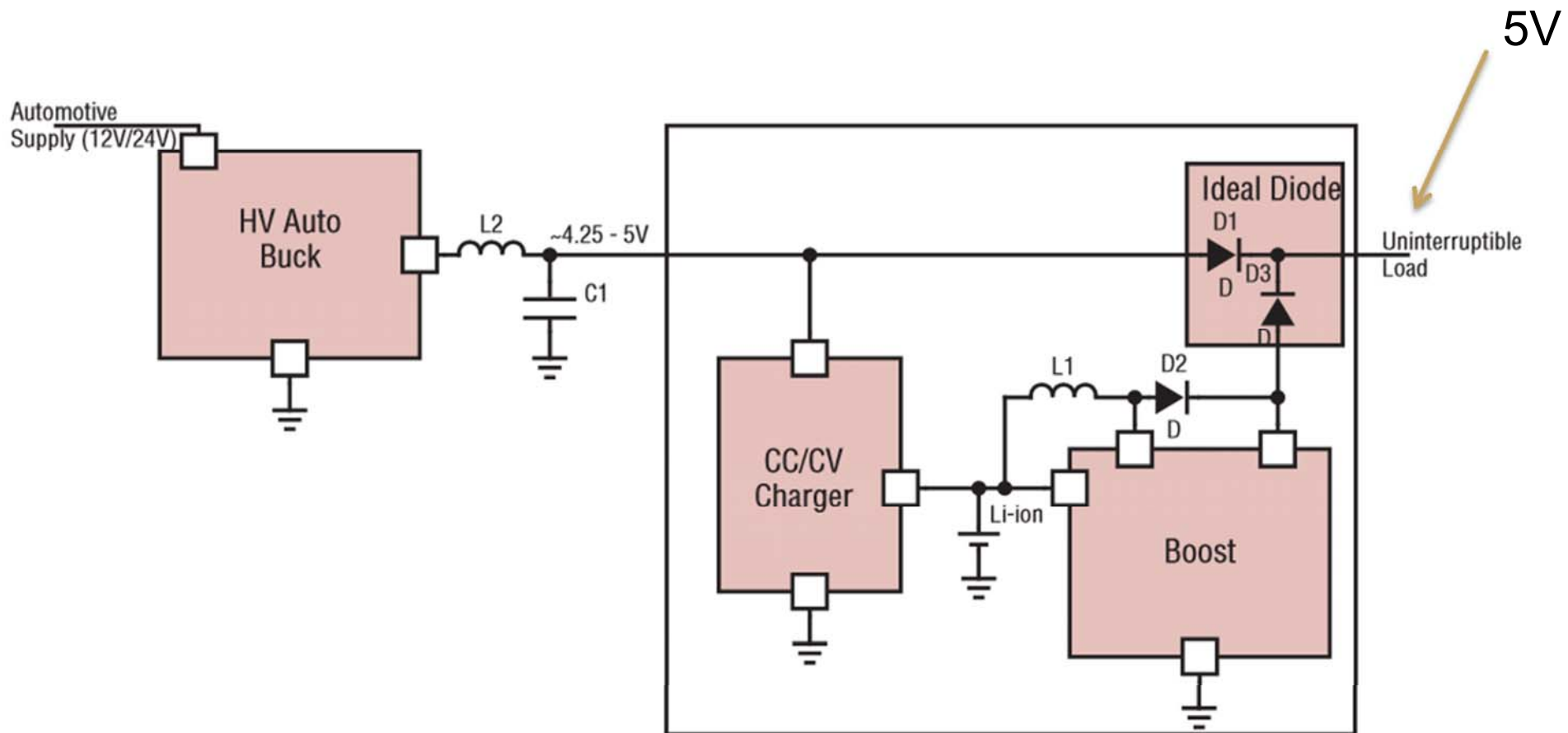
- Maintain output regulation (input Dips, Cold crank)
- Low input & output ripple
- **Low EMI**
- High power capable



For Simple circuit (1)

Design requirements

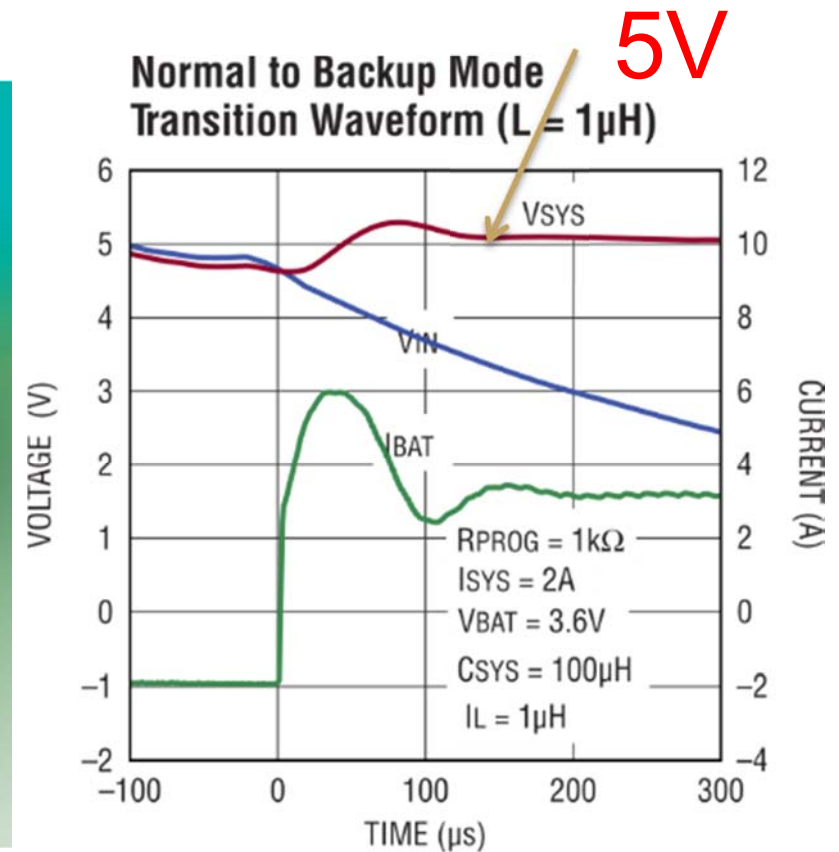
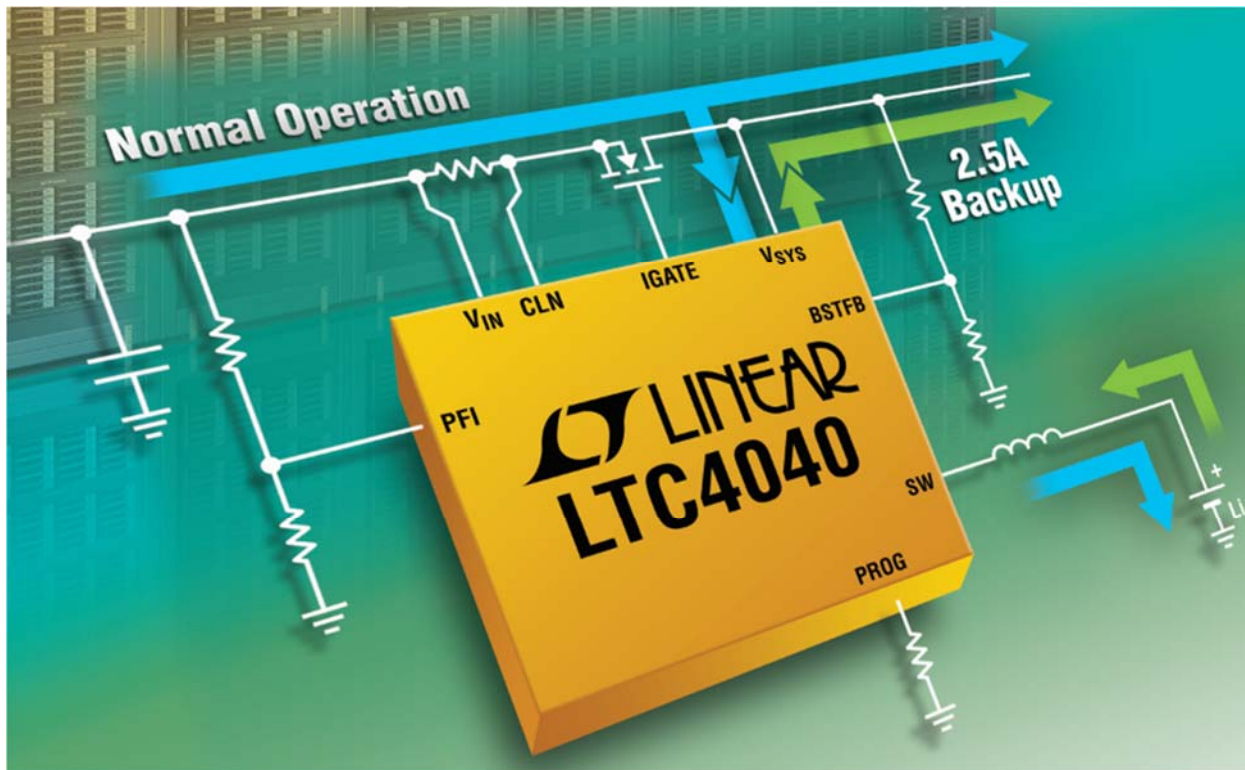
- Charging & supply system power
- 5V need to be maintained regardless input condition



For Simple circuit (1)

Design requirements

- Charging & supply system power
- 5V need to be maintained regardless input condition



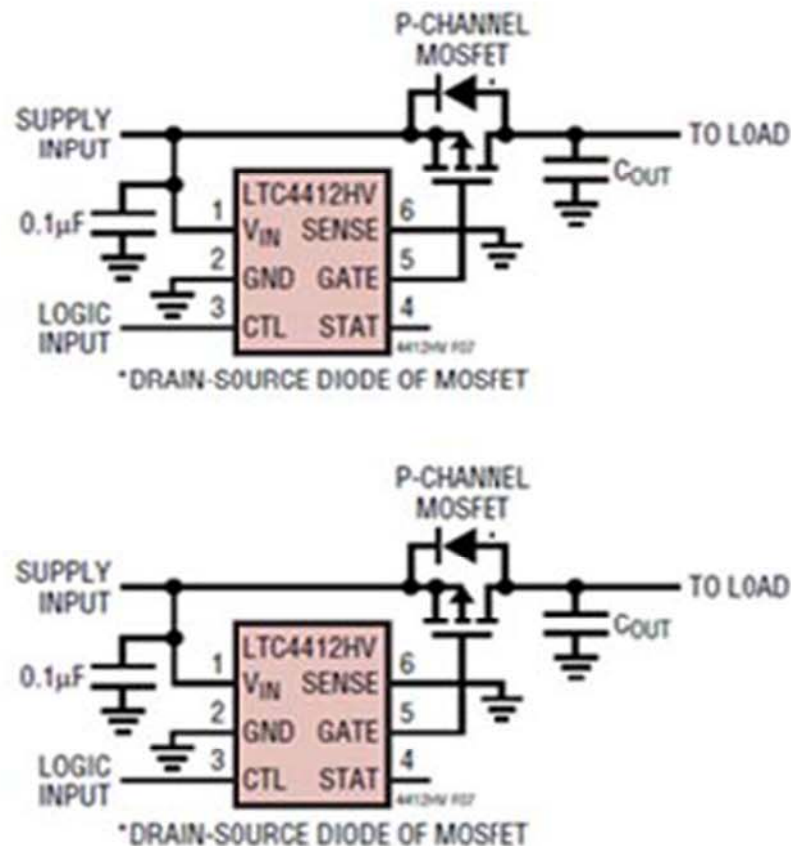
For Simple circuit (2)

Design requirements

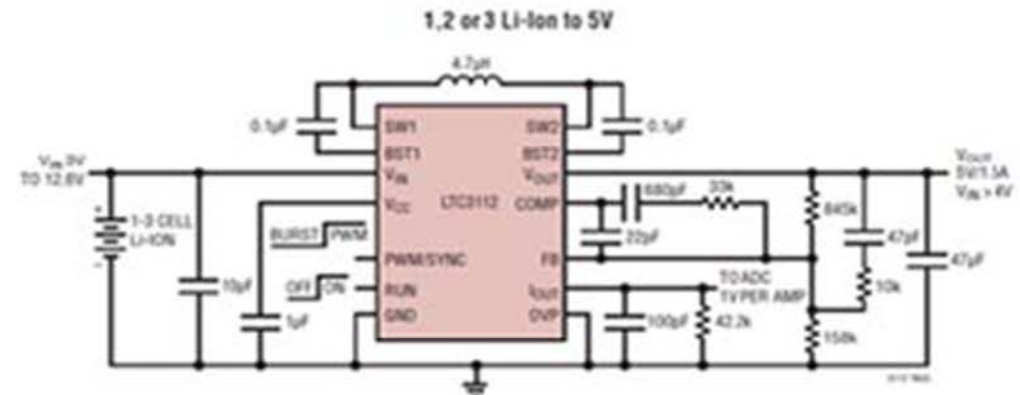
- Dual power source (5V adapter, Li-Ion battery), Need Diode OR circuit
- Buck or Boosted output

A single LTC3118 replaces this...

2X LTC4412
1X LTC3112
2X P-Channel MOSFET



+

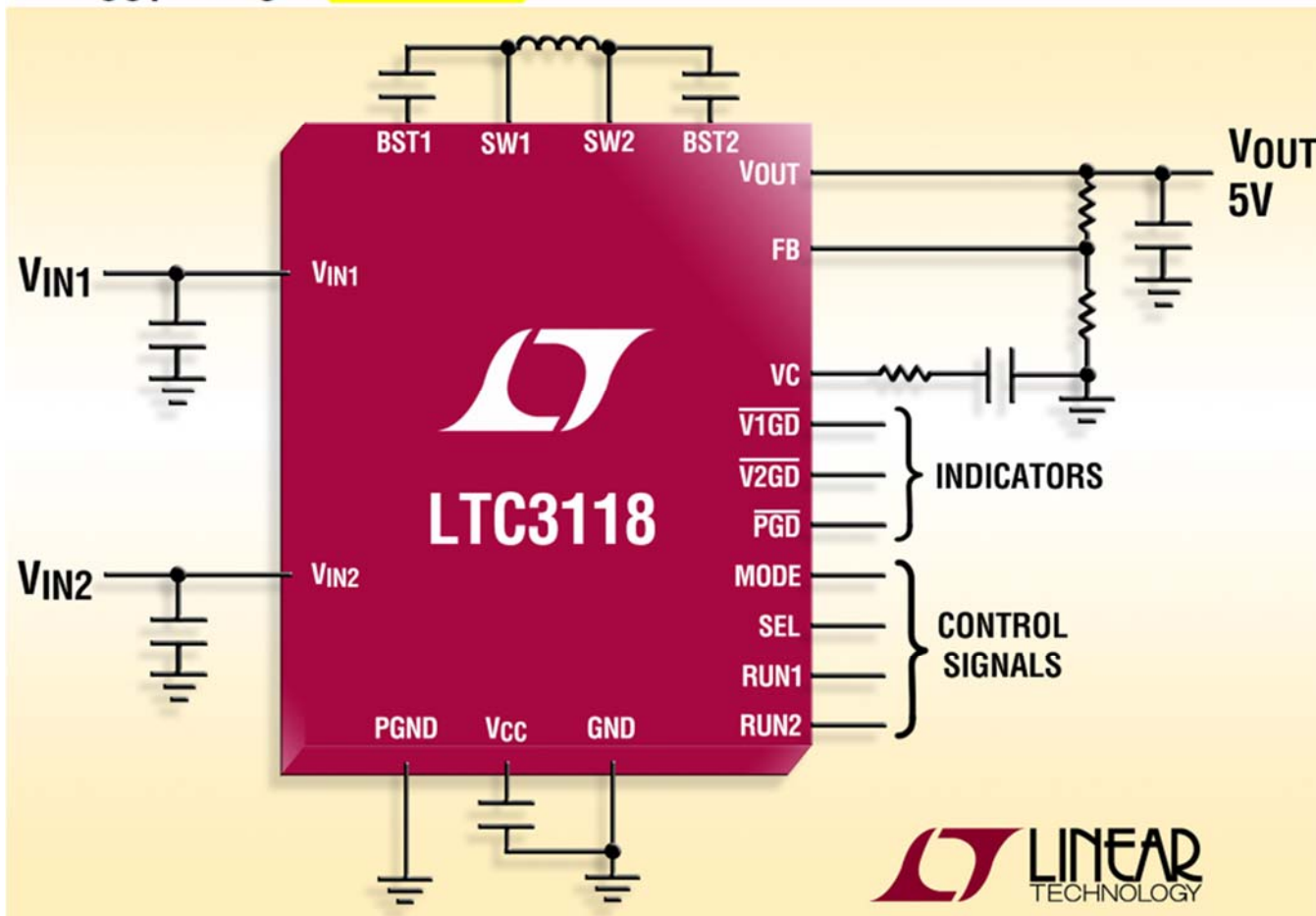


- No Reverse Blocking – need back to back Fets
- No Ideal Diode-OR mode
- 80uA Iq (total) vs. 30uA (LTC3118)

For Simple circuit (2)

FEATURES

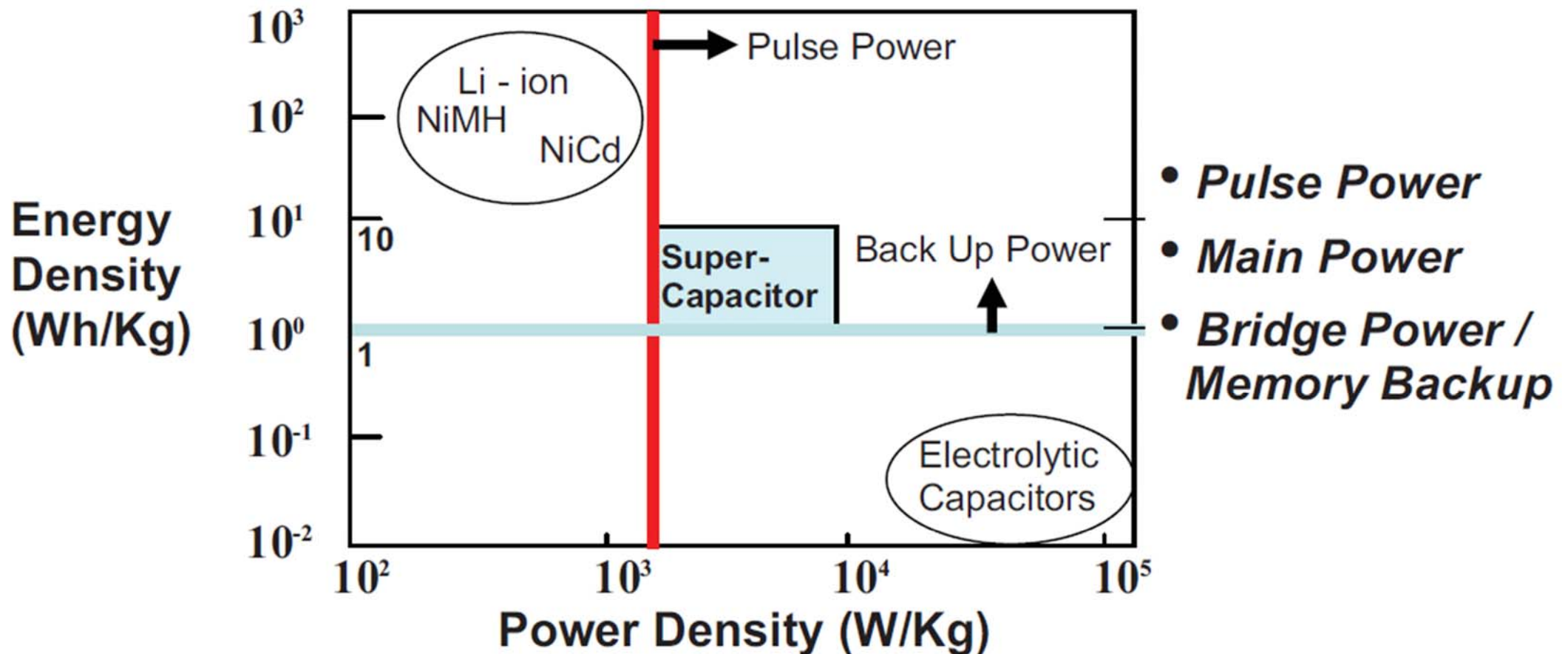
- Integrated High Efficiency Dual Input PowerPath™ Plus Buck-Boost DC/DC Converter
- Ideal Diode or Priority V_{IN} Select Modes
- V_{IN1} and V_{IN2} Range: 2.2V to 18V
- V_{OUT} Range: 2V to 18V



For Simple circuit (3)

Design requirements

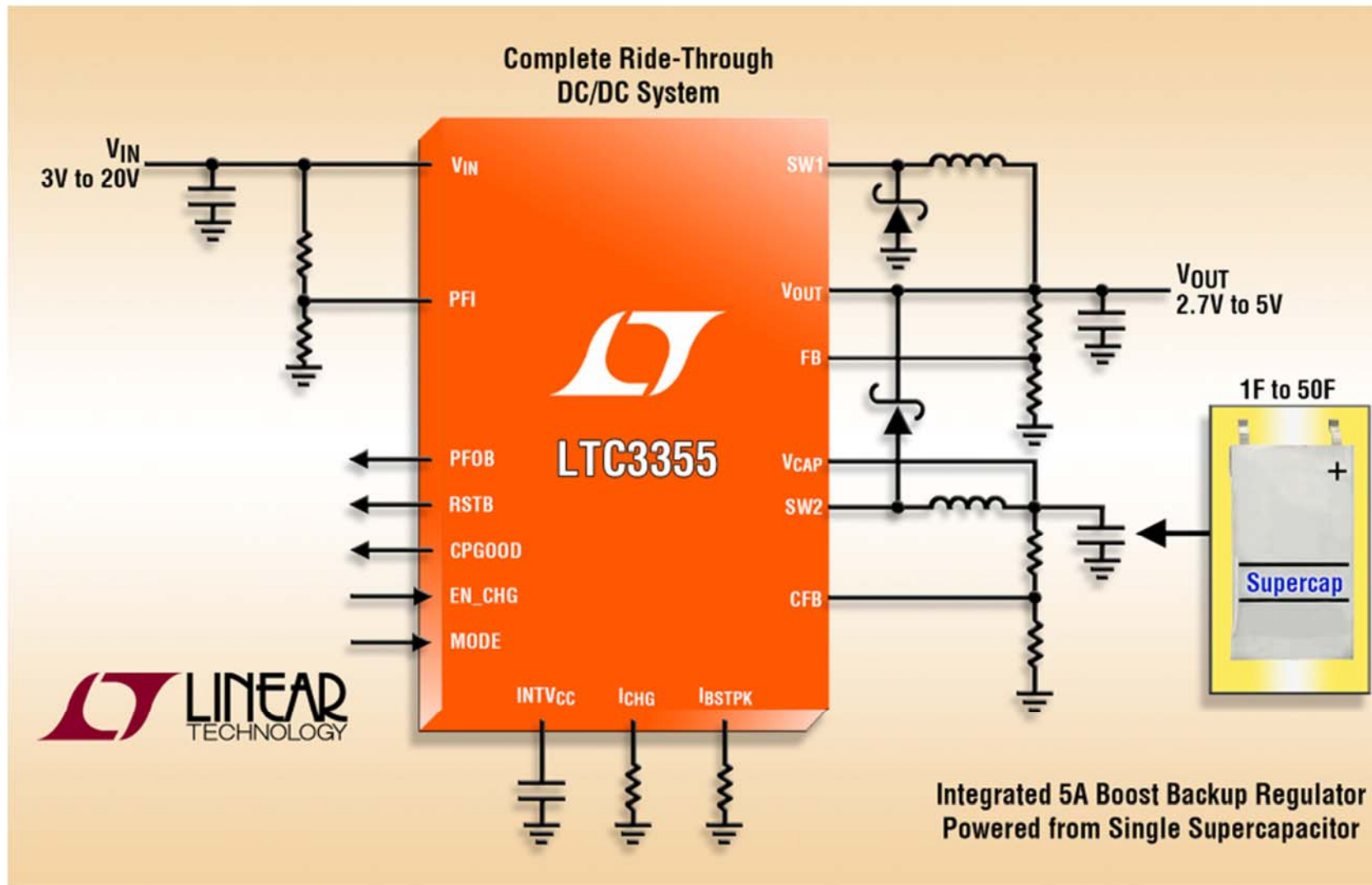
- Use Supercap
- Back up power



For Simple circuit (3)

Design requirements

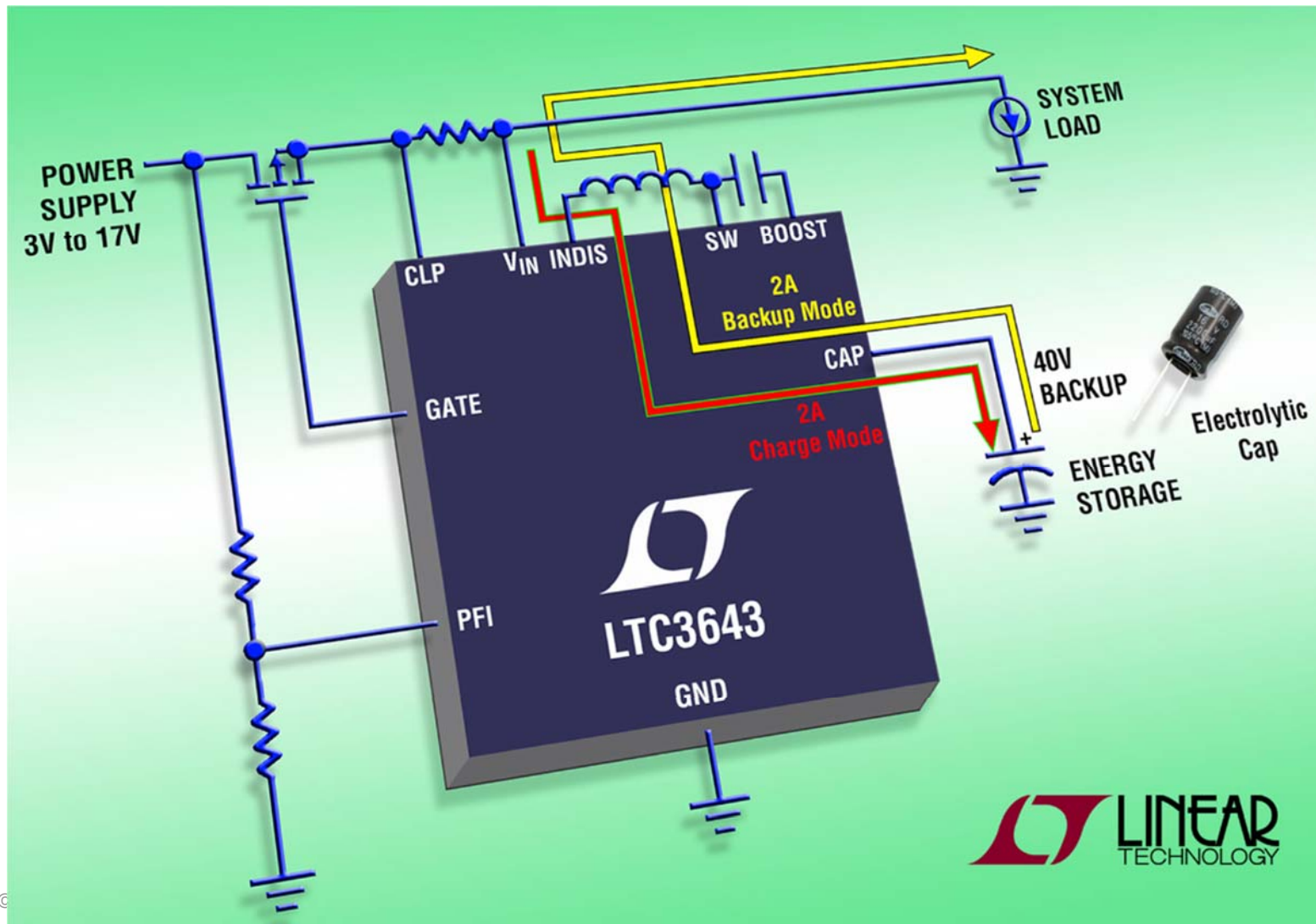
- Use Supercap
- Back up power



For Simple circuit (4)

Design requirements

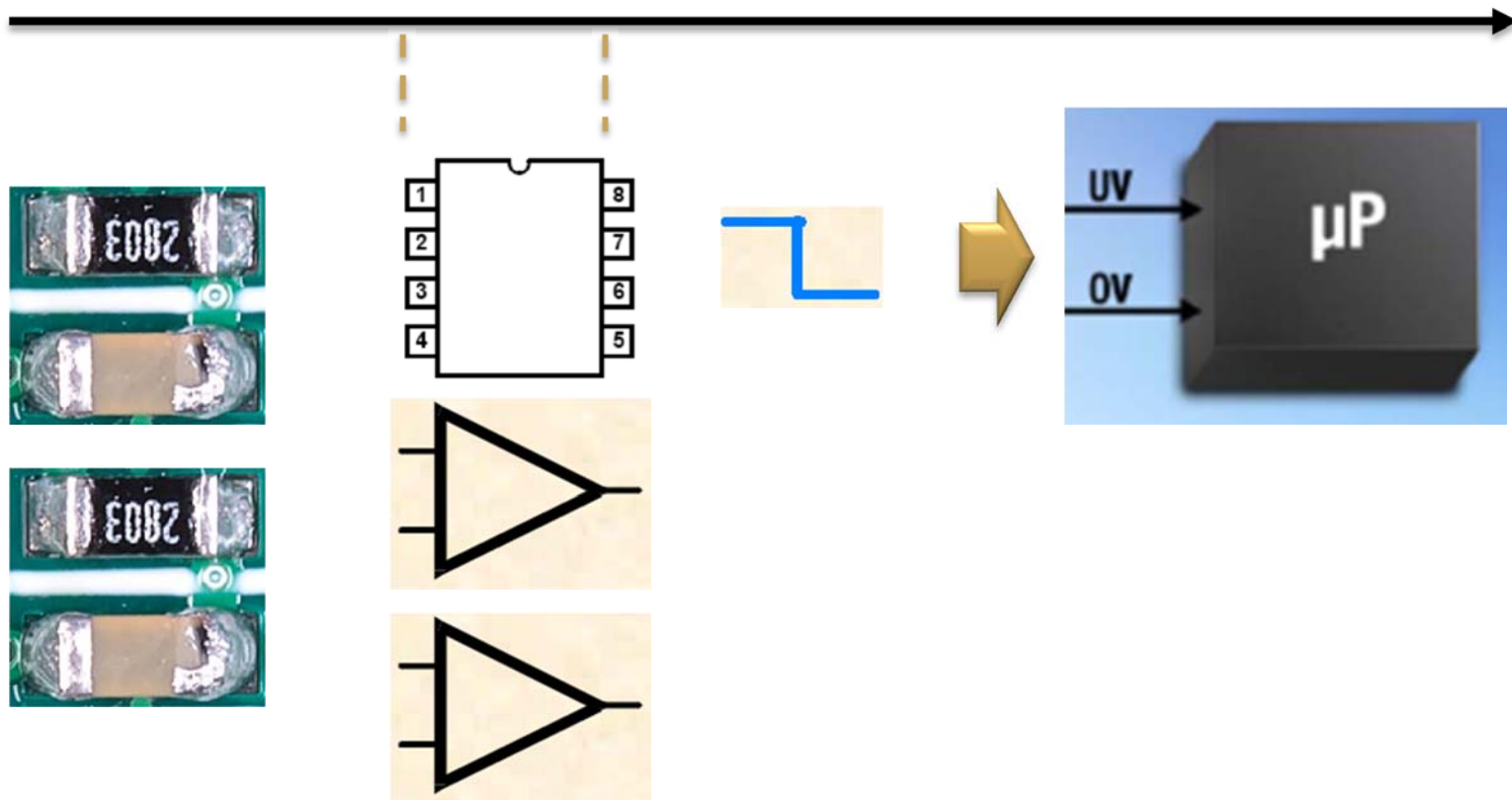
- Use Supercap
- Back up power



For Simple circuit (4)

Monitoring power supply (48V or higher battery voltage)
-OV, UV need to be reported to μ P

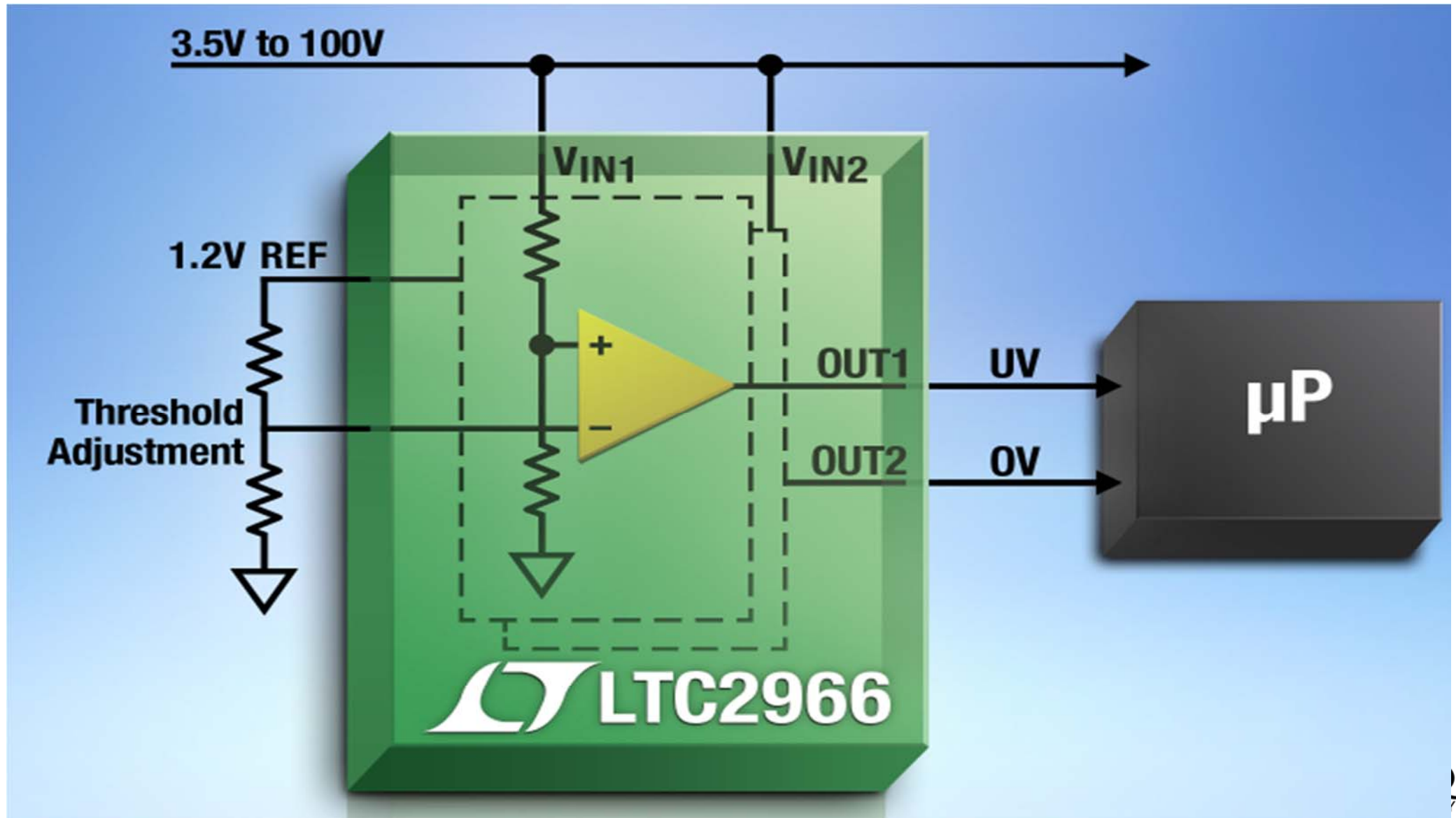
48V
Power rail



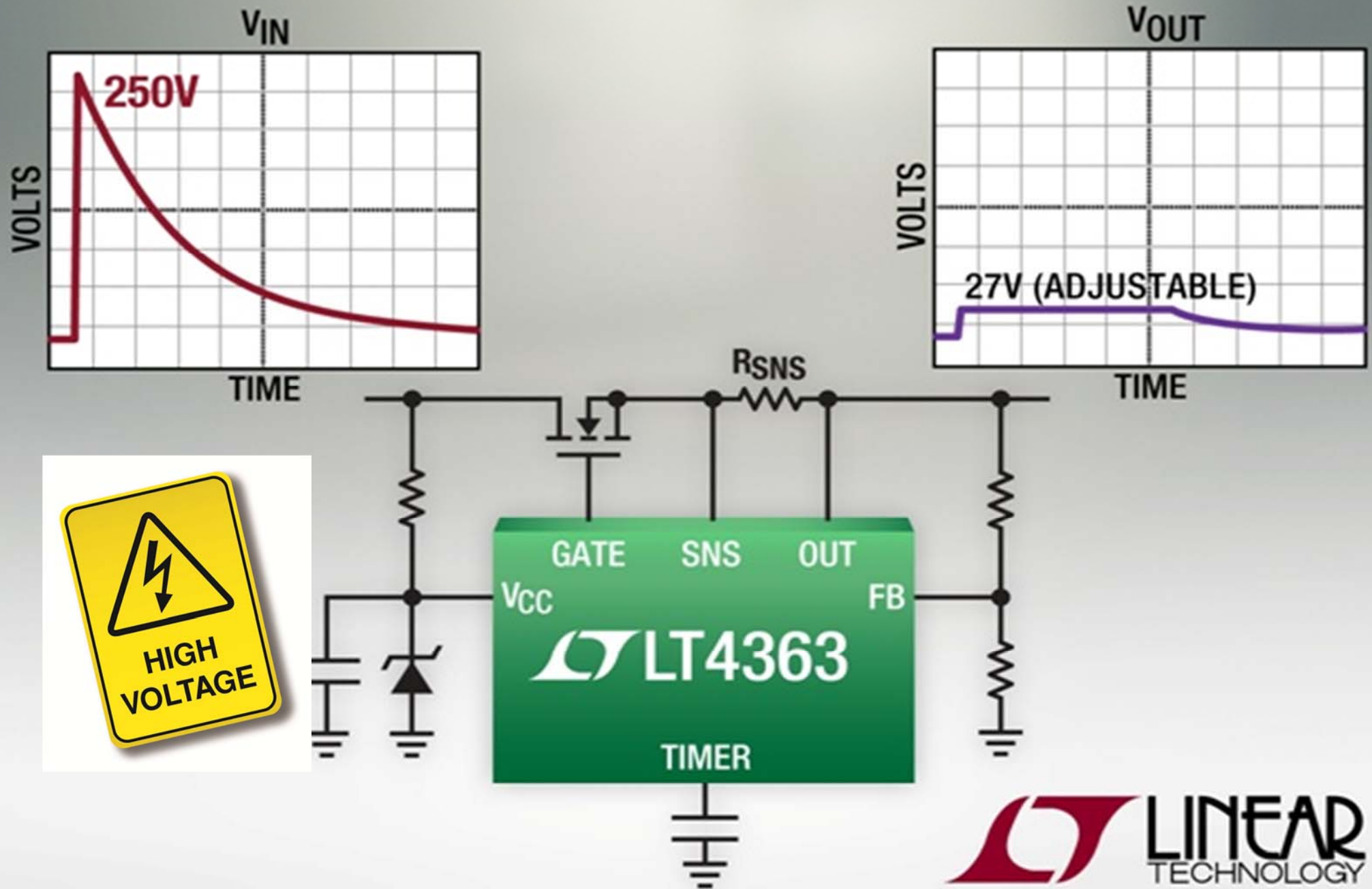
For Simple circuit (4)

Design requirements

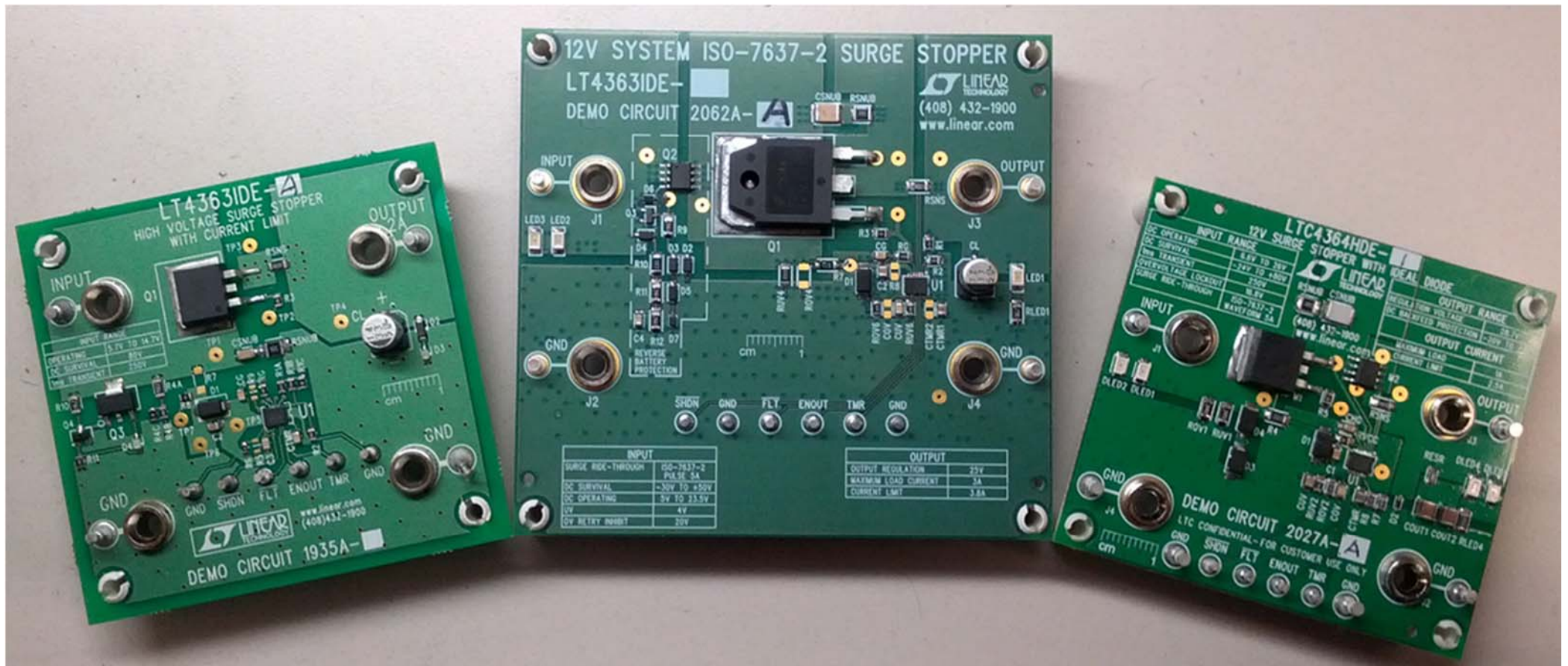
-OV / UV reporting to μP



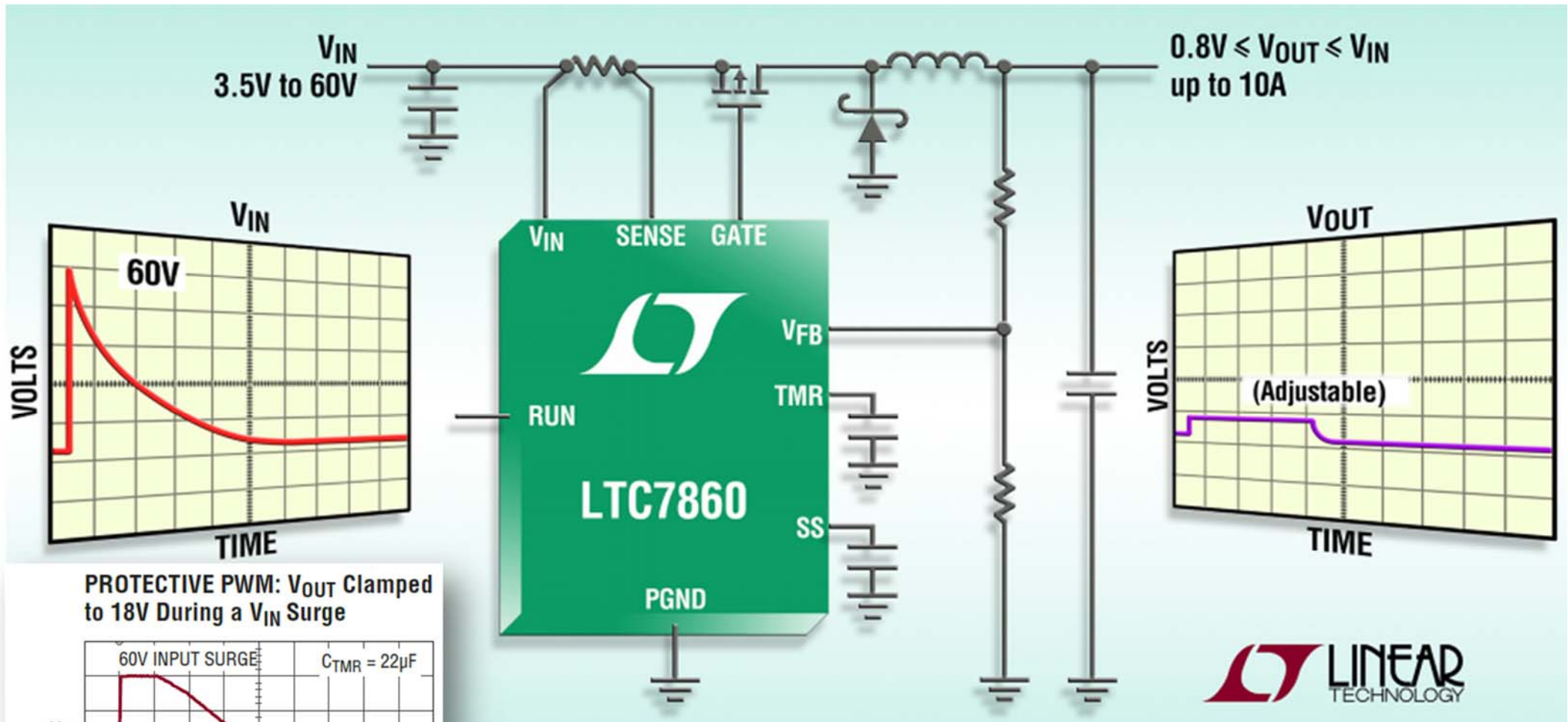
Protection (Surge stopper)



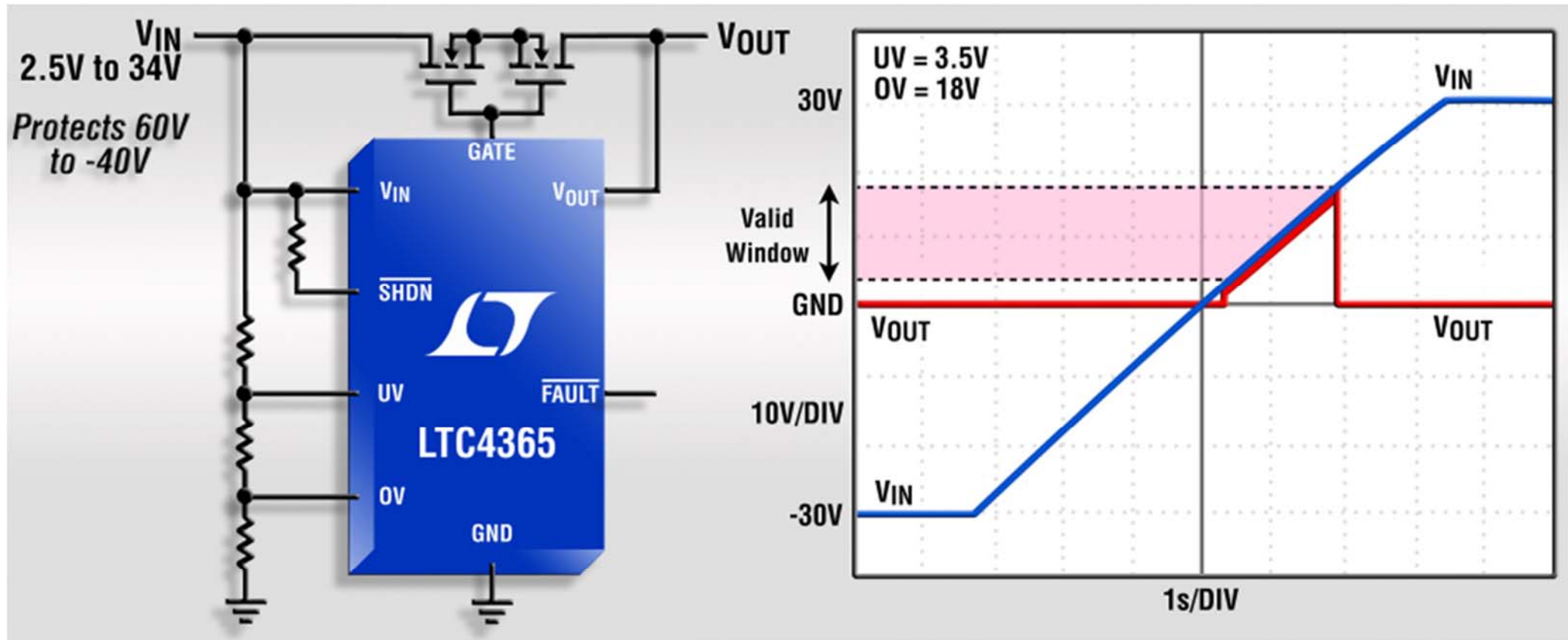
Protection (Surge stopper)



Protection (Switching Surge stopper)



Protection (Window passer)

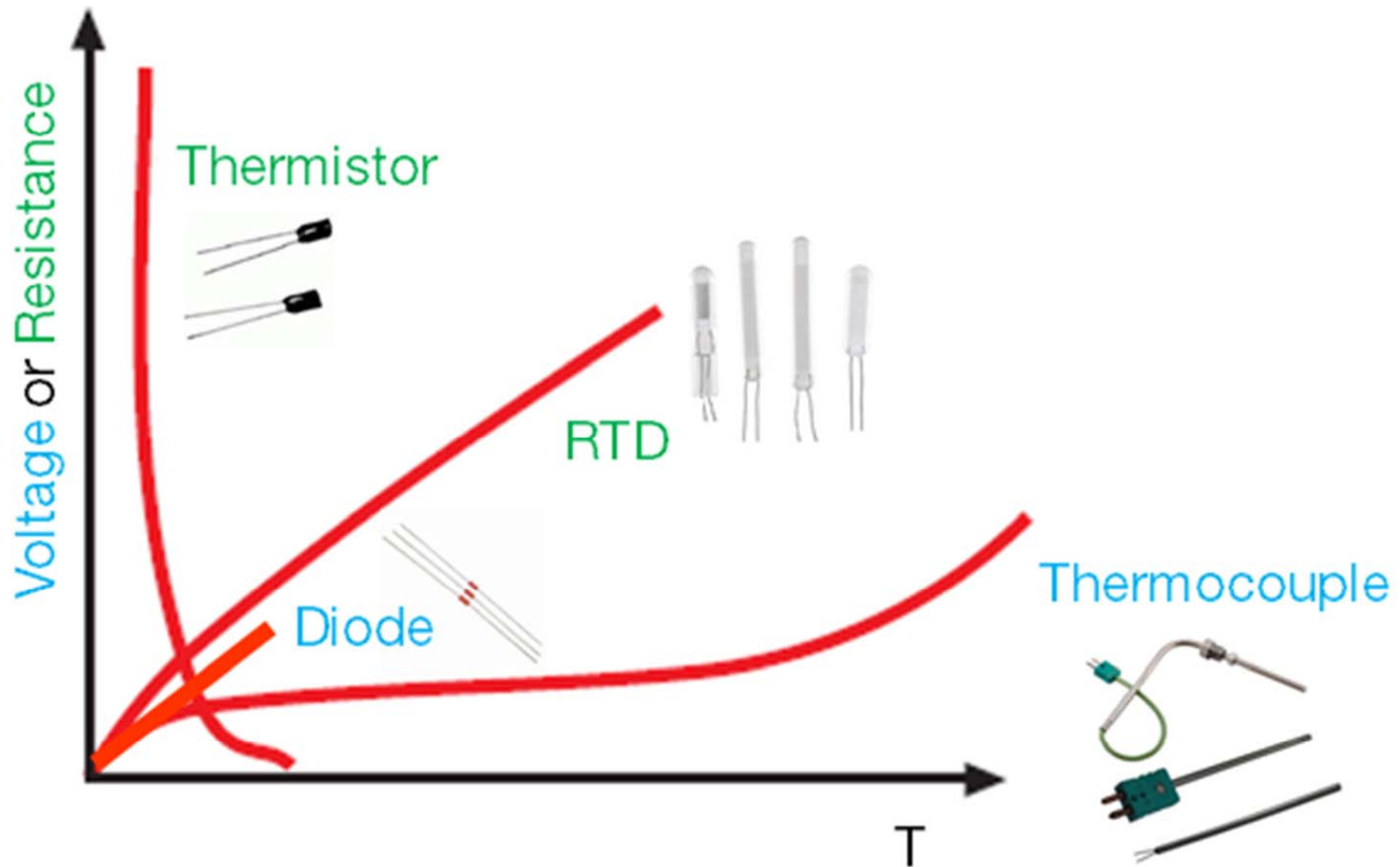


FEATURES

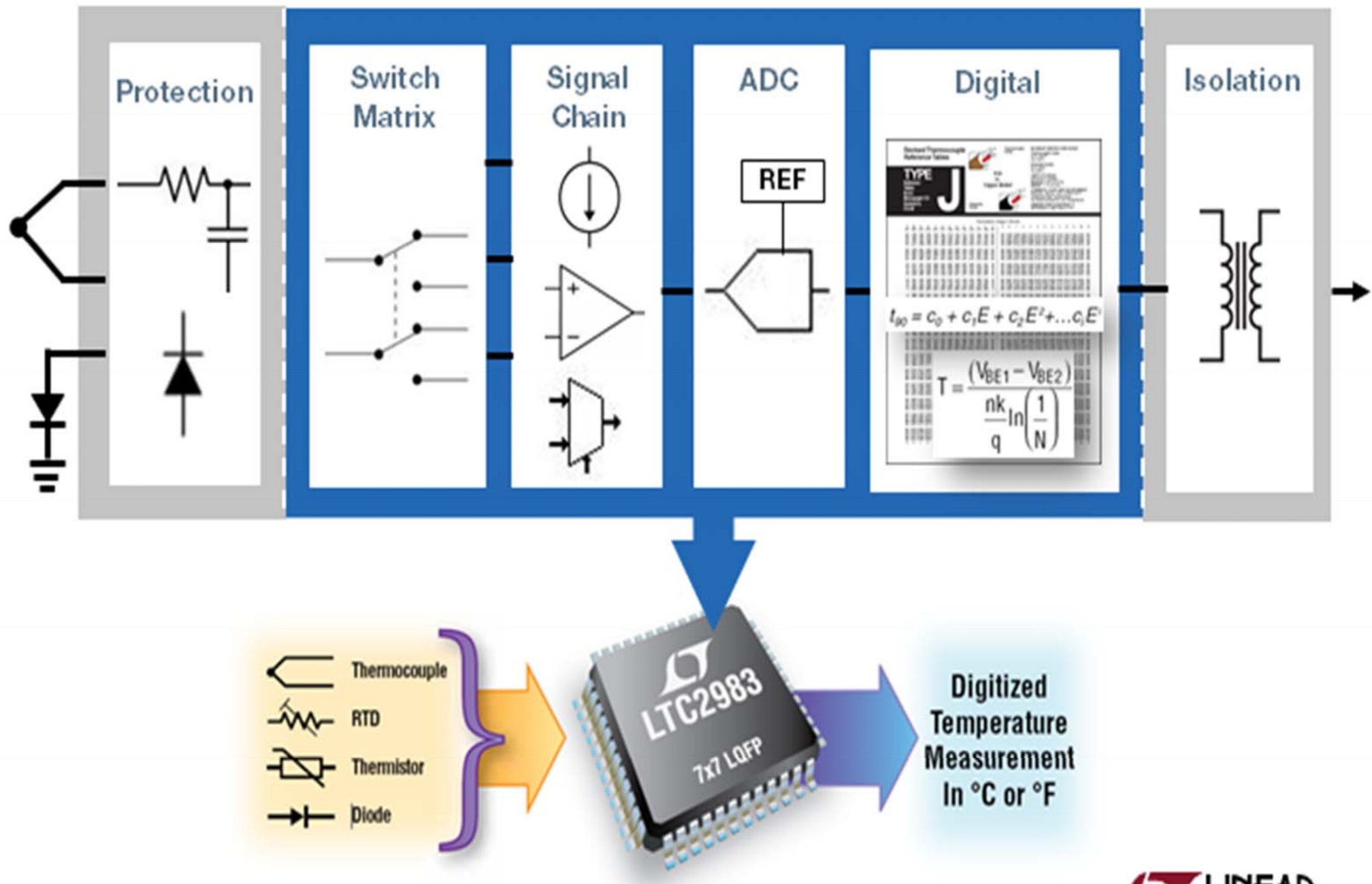
- Wide Operating Voltage Range: 2.5V to 34V
- Overvoltage Protection to 60V
- Reverse Supply Protection to -40V
- LTC4365: Blocks 50Hz and 60Hz AC Power
- LTC4365-1: Fast (1ms) Recovery from Fault
- No Input Capacitor or TVS Required for Most

LTC4367 (High Voltage)

Temperature Sensors



Temperature Monitoring Blocks



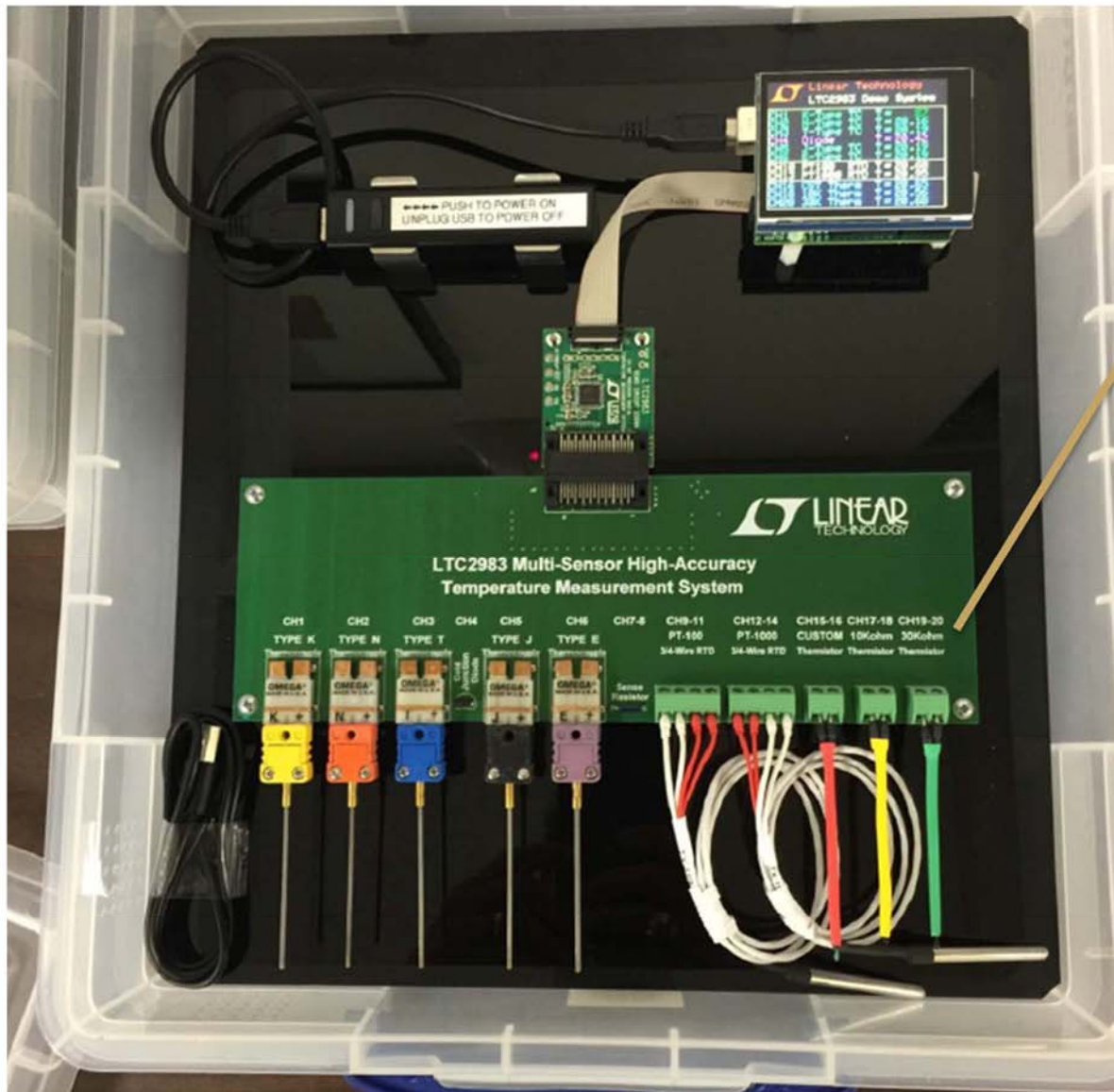
Temperature Monitoring Blocks



Other useful parts

Temperature Monitoring Blocks

CH1	CH2	CH3	CH4	CH5	CH6	CH7-8	CH9-11	CH12-14	CH15-16	CH17-18	CH19-20
TYPE K	TYPE N	TYPE T		TYPE J	TYPE E		PT-100	PT-1000	CUSTOM	10Kohm	30Kohm
Thermocouple	Thermocouple	Thermocouple		Thermocouple	Thermocouple		3/4-Wire RTD	3/4-Wire RTD	Thermistor	Thermistor	Thermistor



W/EEPROM
Less Channel
Version coming

Demo Circuit 1115A
LTC6101CCS5

IN

4V-60V

R1

DALE
R02F

OUT

7Amax

R2

U1

R3

Linear Tech. Corp.
www.linear.com

MON

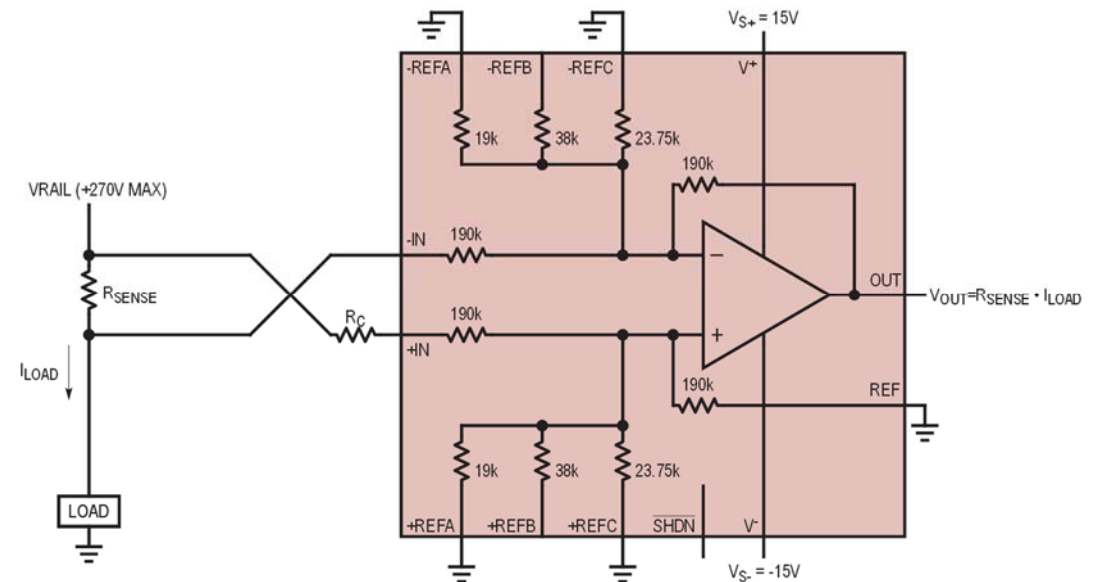
GND



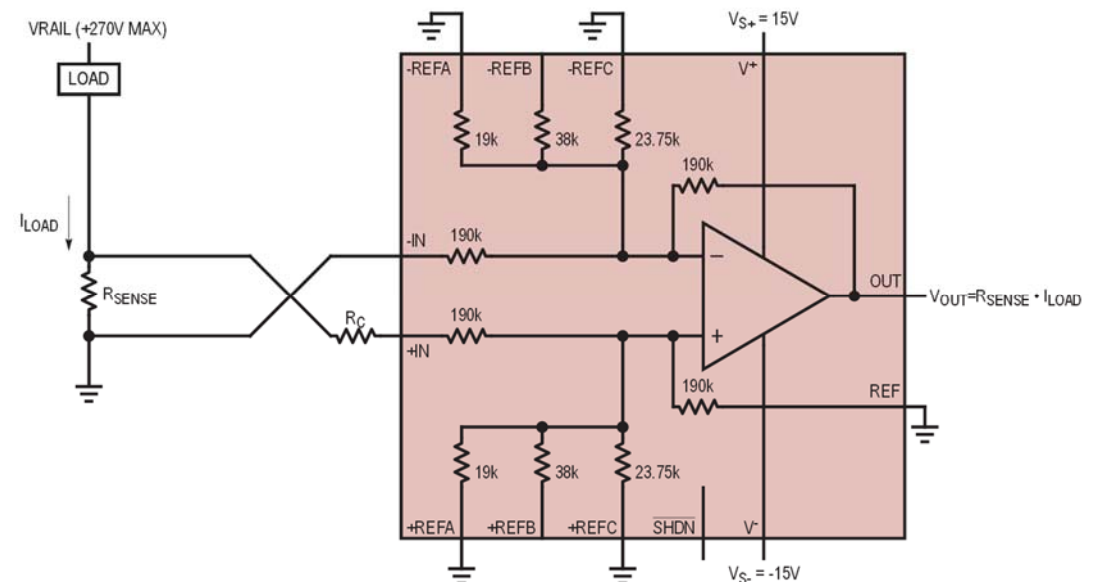
Current Monitoring

➤ High Side

- Applicable to+/-270V
- Bi-directional
- Negative power rail



➤ Low Side



Other useful parts

PoE (High power, PoDL, bt?, up to 90W)
More Power = More Features + New Applications



Heated, PTZ
Cameras



Brighter
Lighting



Point to Point
Dish Antennas



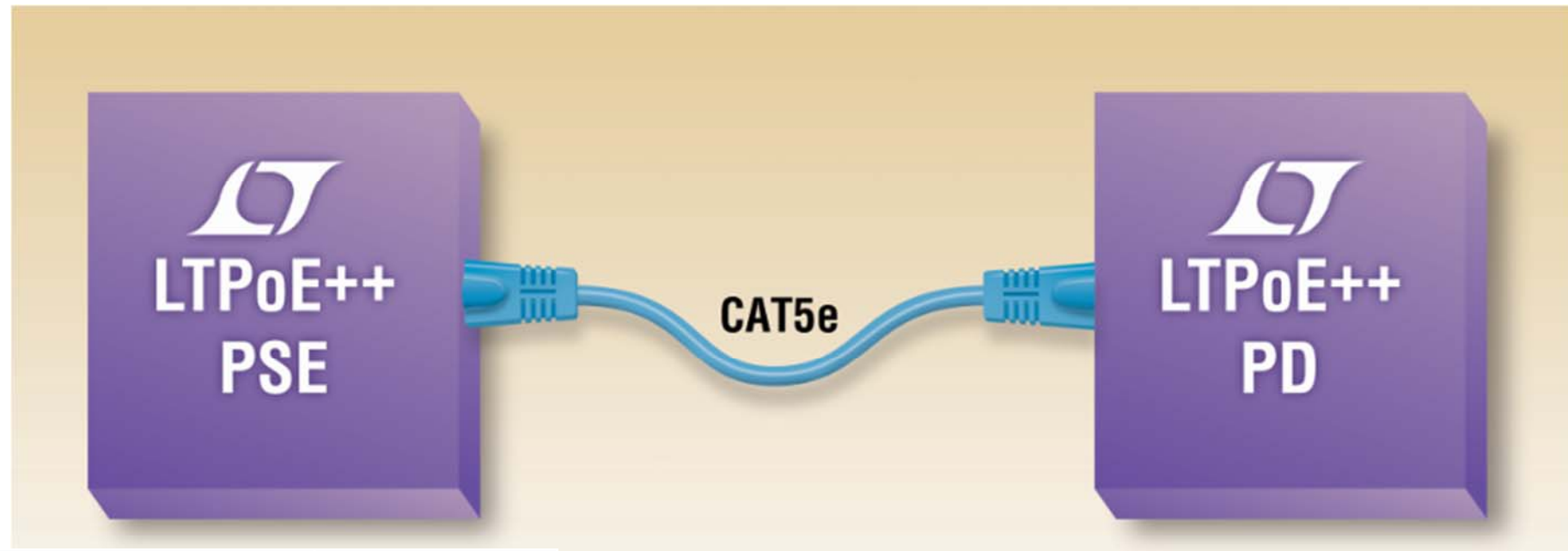
Longer Range
Access Points &
Picocells



Larger,
Touchscreen
Panels

Other useful parts

PoE (High power, up to 90W)



Part Number	Description
LTC4274A	1-Port PSE
LTC4266A	4-Port PSE
LTC4290A/LTC4271	8-Port PSE
LTC4270A/LTC4271	12-Port PSE

PD Input Power

90W
70W
52.7W
38.7W
25.5W
13W

Part Number	Description
LT4275	1-Port PD
LT4276	1-Port PD with DC/DC
LT4321	PD Ideal Diode Bridge

감사합니다!

한국지사 02-792-1617

