



Analog Integrations Corporation



October 2016

BACKGROUND

● History

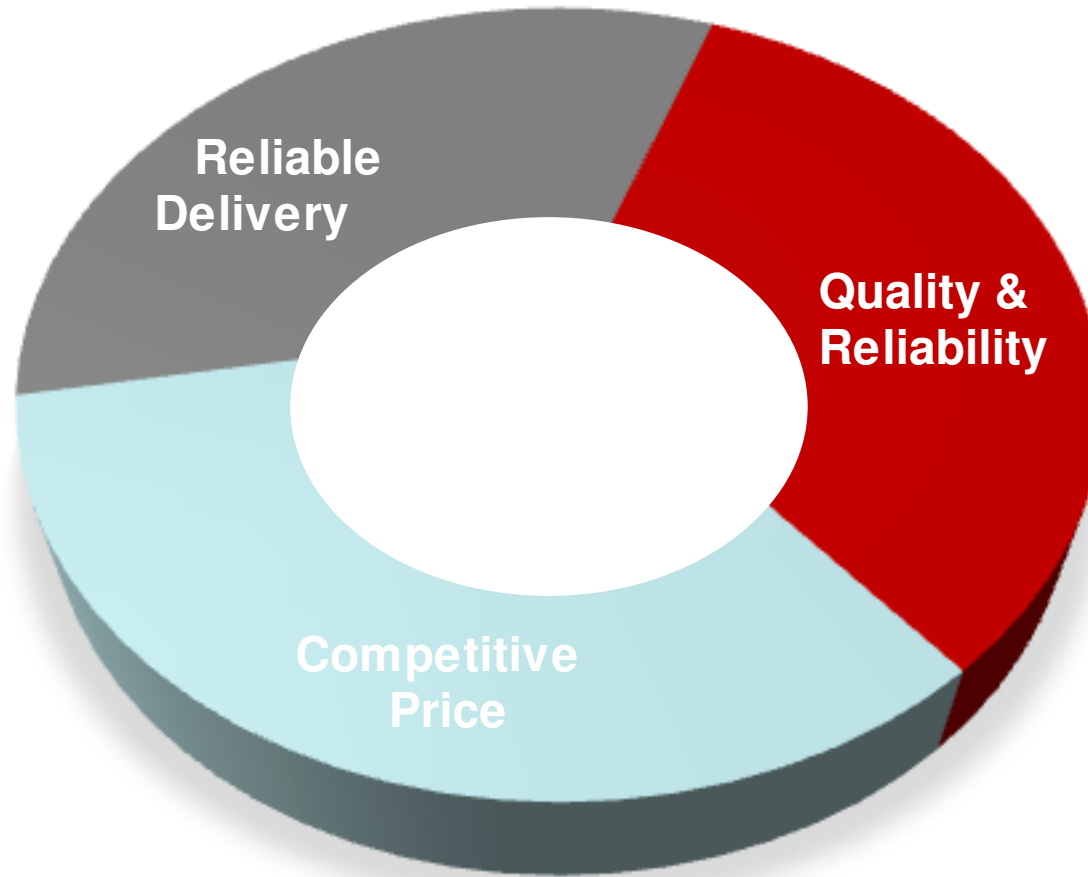
- Dedicated to Power Management IC Solutions
- Incorporated In January 1992
- Chairman & CEO : Albert Lee
- Employee : 89
- Paid-in Capital : \$ 9M
- IPO In January 2004



● Location

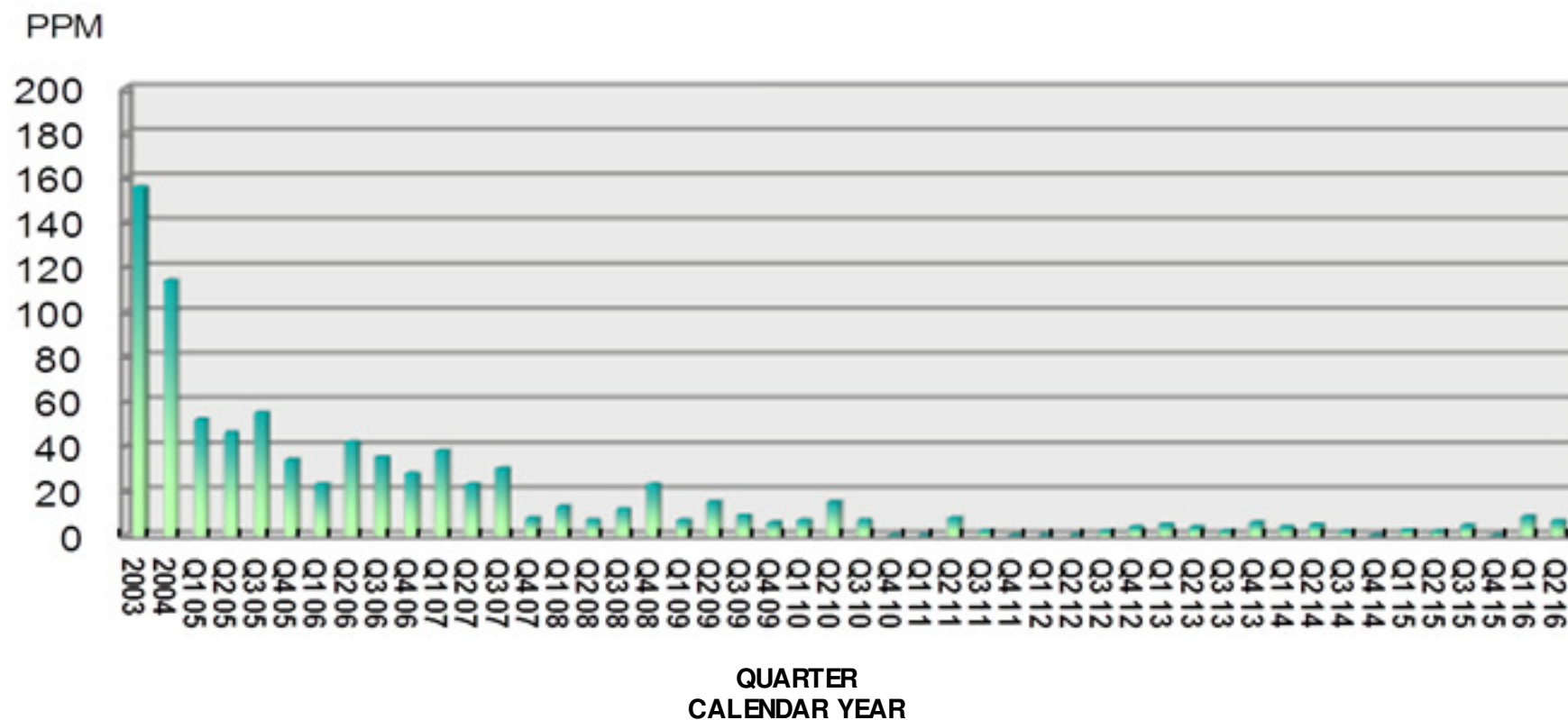
- Headquarters: Hsinchu Science Park, Taiwan
- Sales Office : Taipei, Tokyo, Shenzhen

CORE COMPETENCY



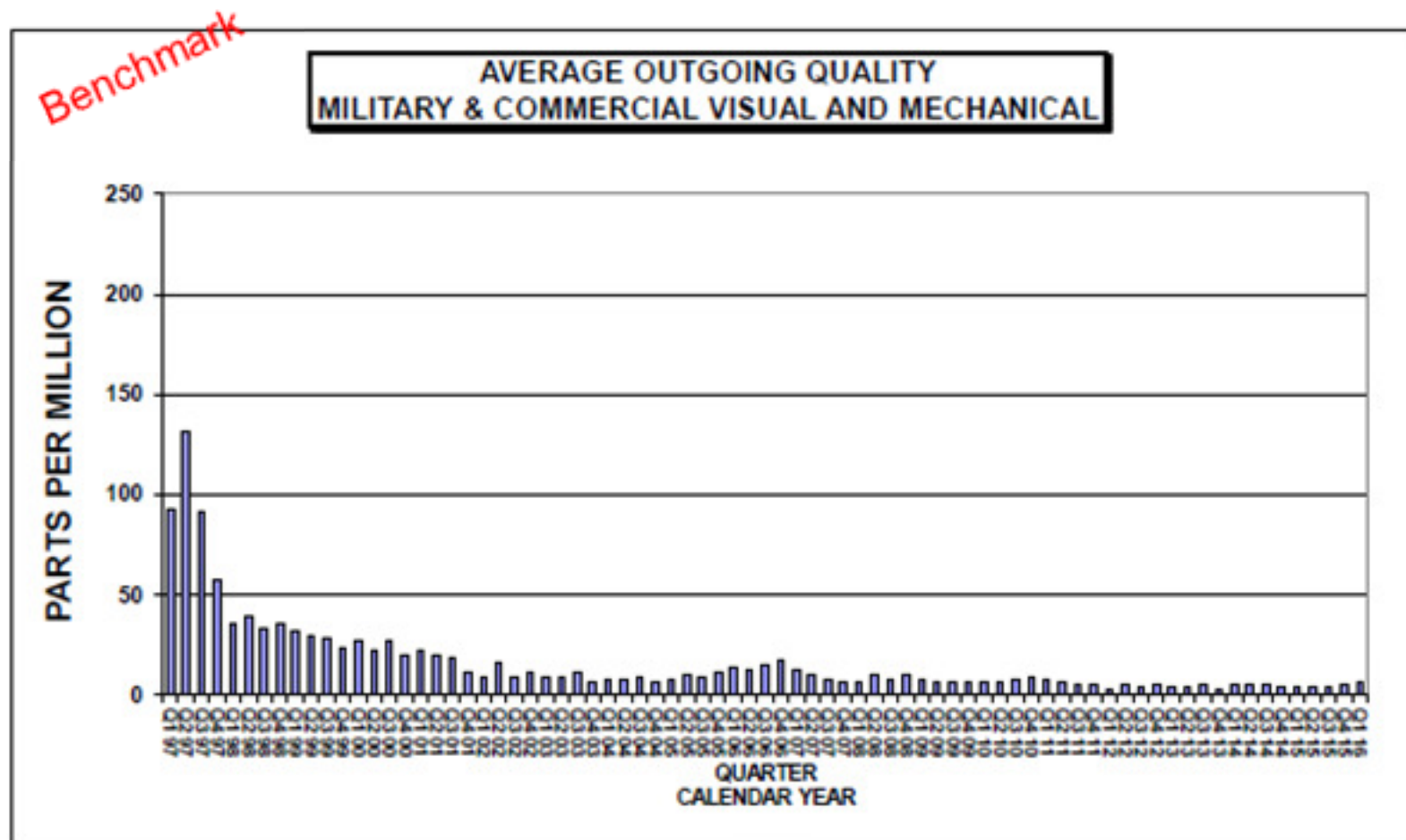
OUTGOING QUALITY

- Visual and mechanical



Q2 2016	
Total Sample Inspected	448,000
Total Reject Devices	3
AOQ PPM	6.70

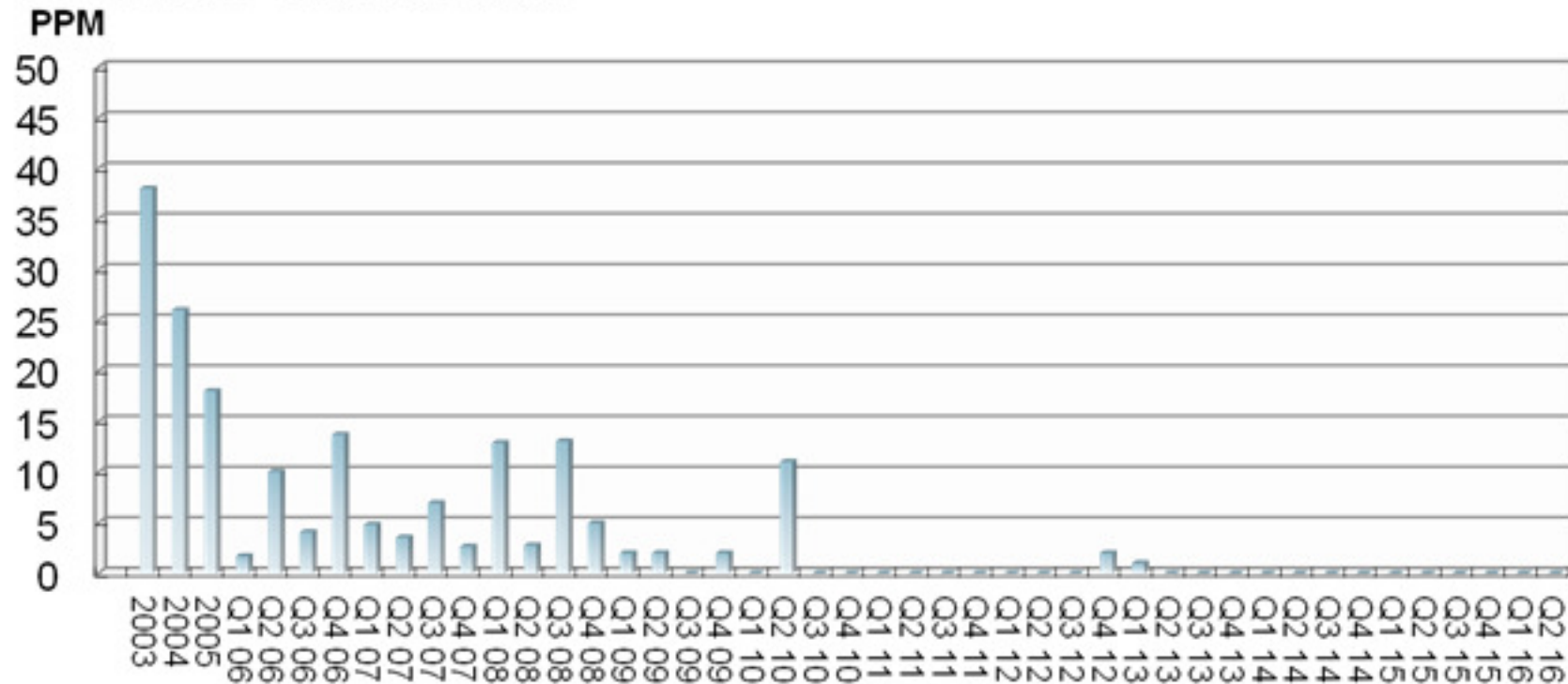
LTC OQC



Q1 2016	
Total Sample Inspected	10,111,377
Total Reject Devices	10
AOQ PPM	5.93

OUTGOING QUALITY

- Final Electrical

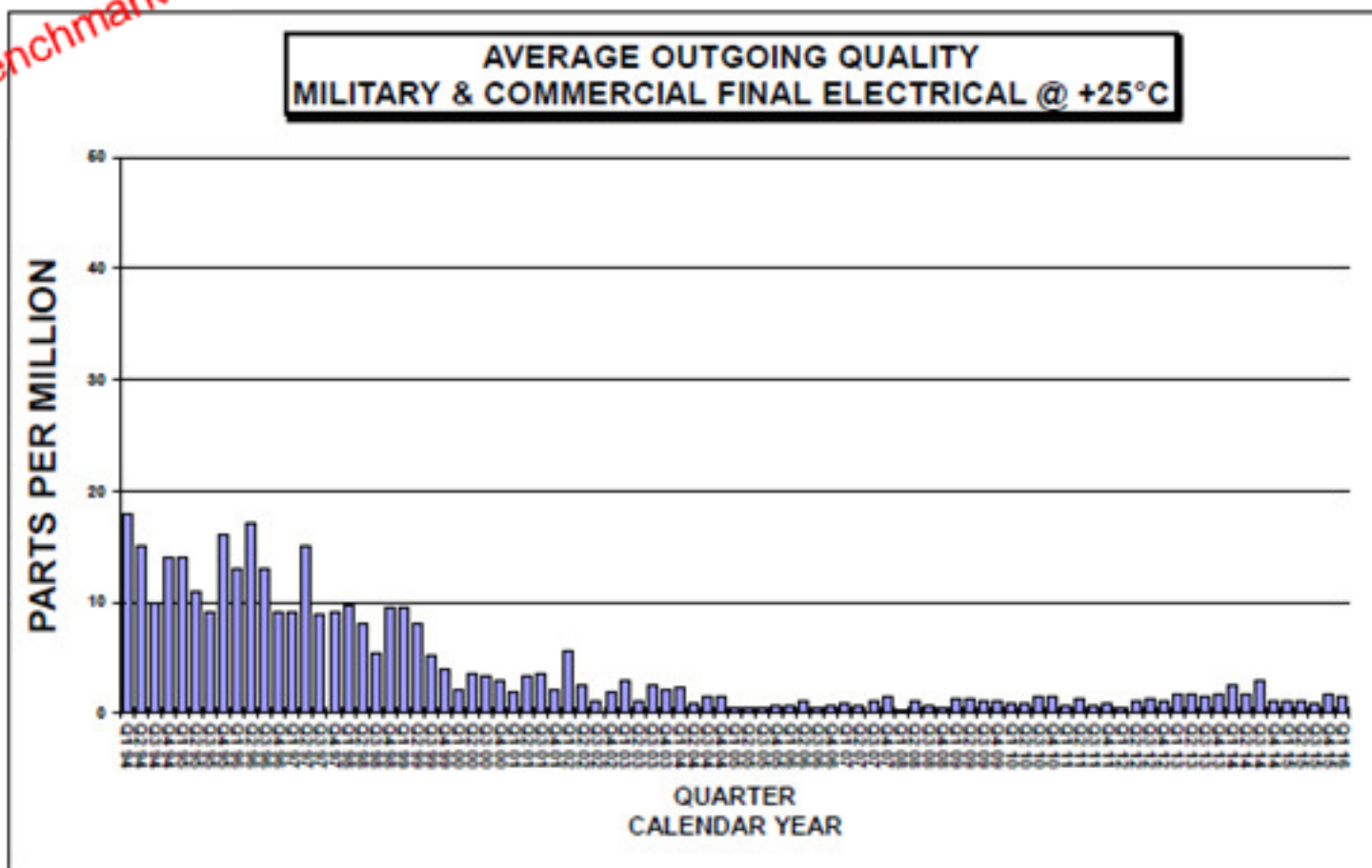


QUARTER
CALENDAR YEAR

Q2 2016	
Total Sample Tested	312,800
Total Reject Devices	0
AOQ PPM	0

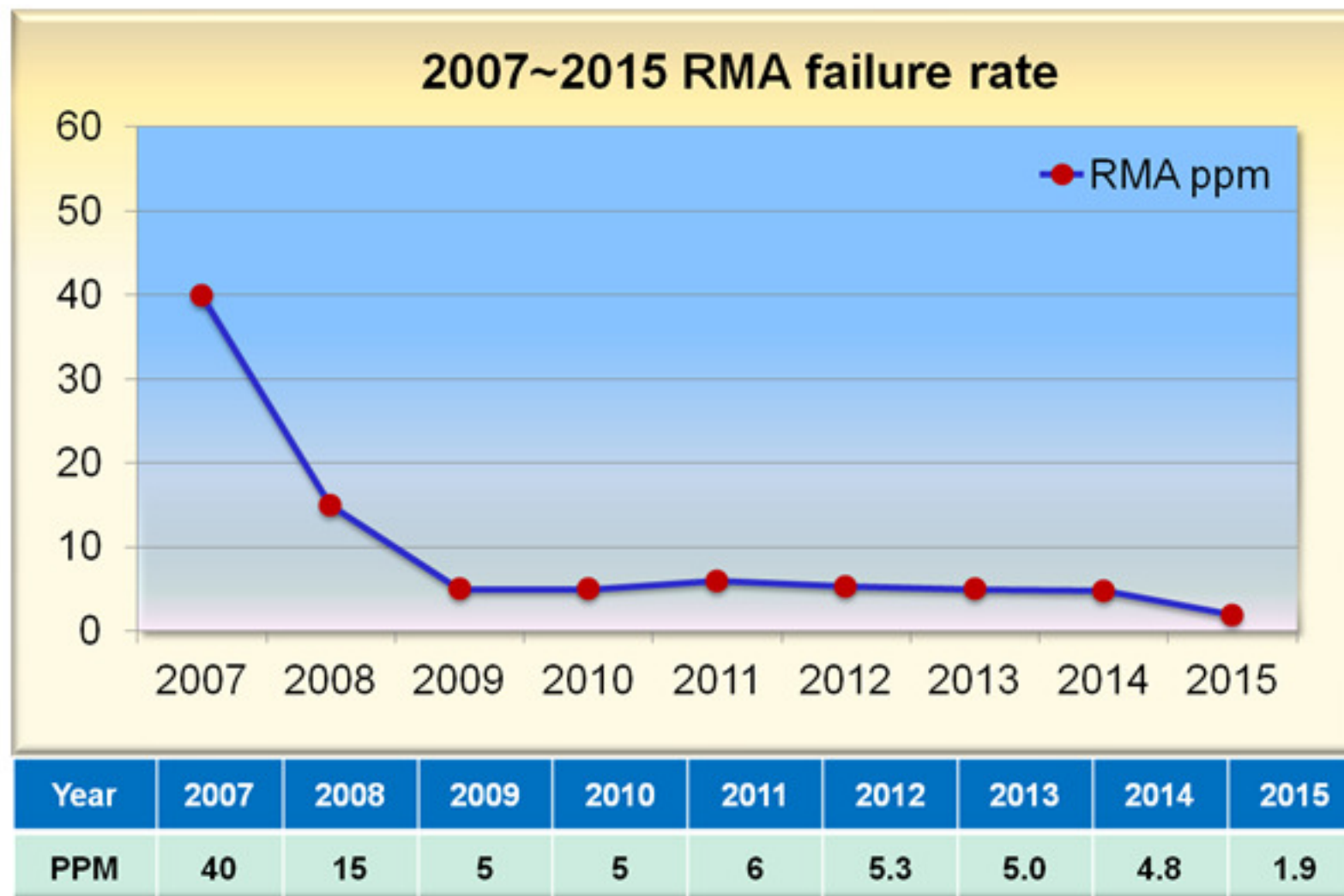
LTC OQC

Benchmark

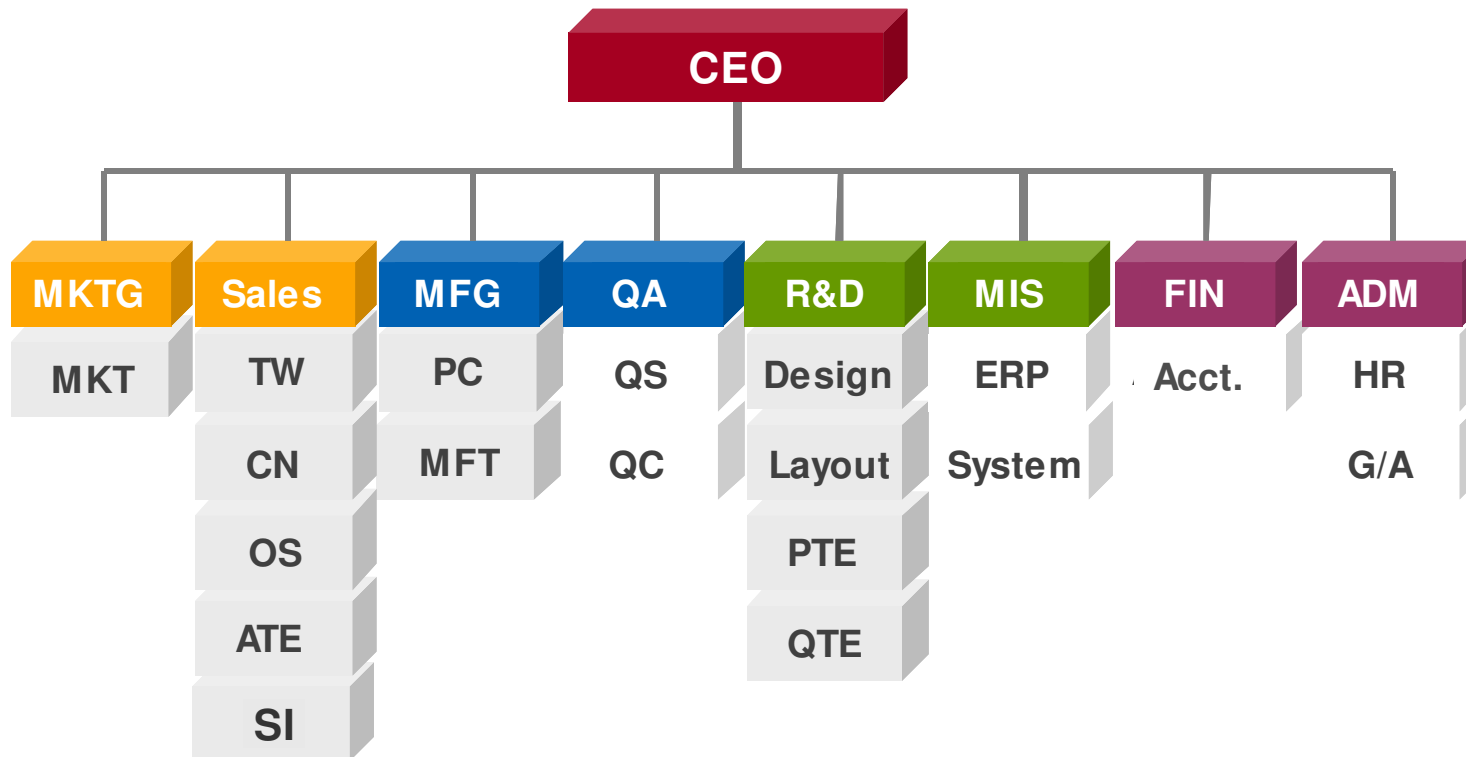


Q1 2016	
Total Sample Tested	5,824,516
Total Reject Devices	9
AOQ PPM (EIA-554)	1.55

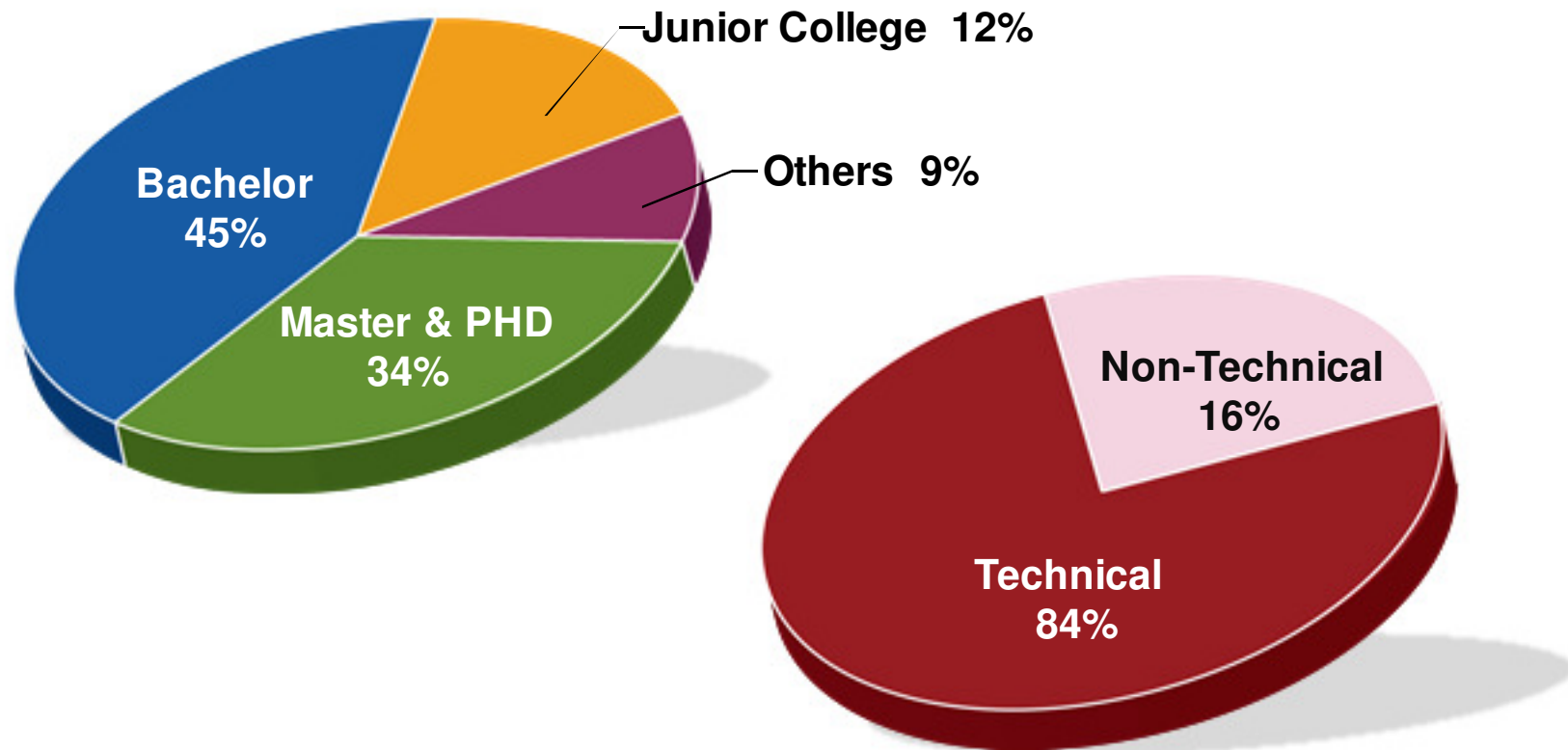
RMA FAILURE RATE



ORGANIZATION CHART

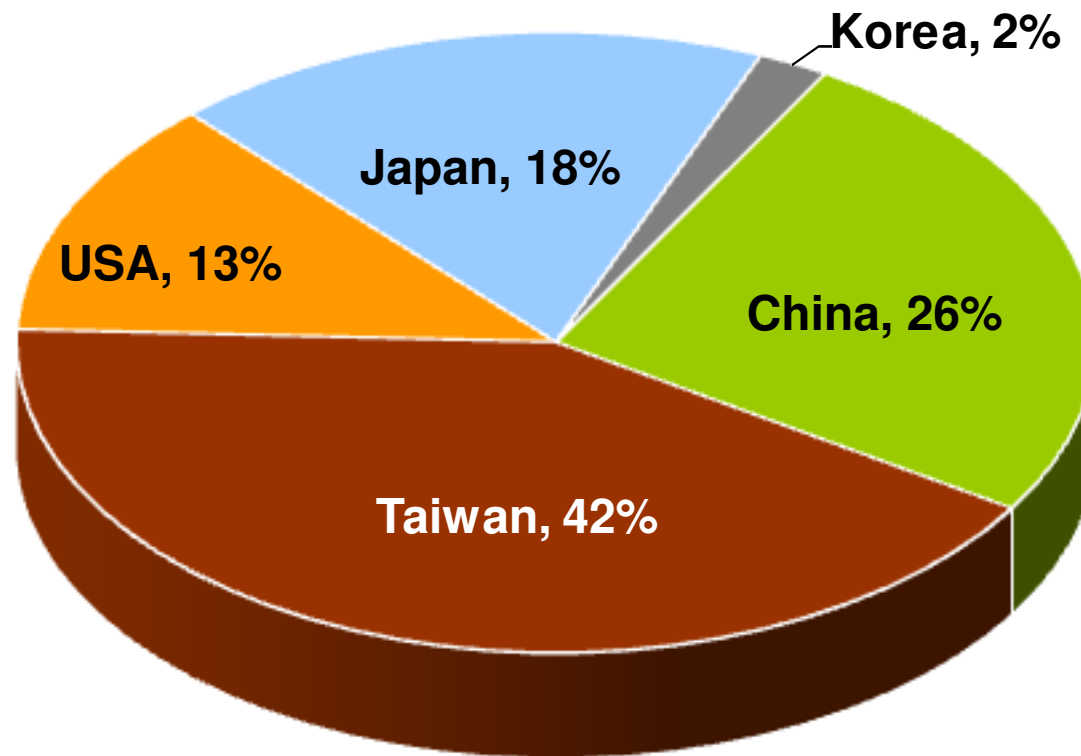


MANPOWER / HR



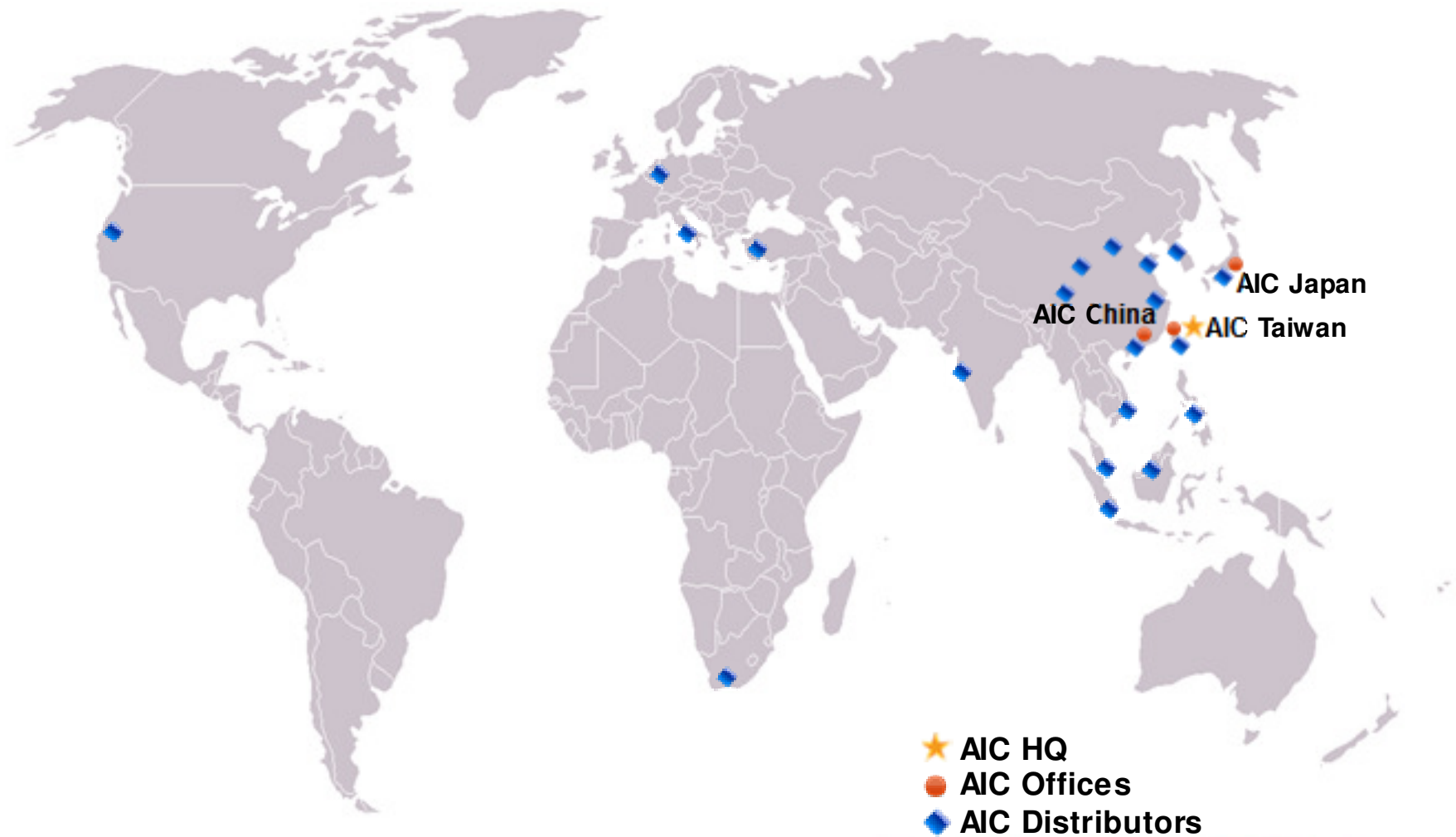
AIC employs 89 professionals with an average age of 41. More than 91% of the employees have a college or advanced degree.

GEOGRAPHIC COVERAGE



AIC has established a sound reputation as one of the leading analog IC companies in Japan market.

SALES CHANNEL



APPLICATION & CUSTOMER

LCD TV

Hisense 海信



CVTE
Dream-Future



TOSHIBA
Leading Innovation >>>

TPV
TPV TECHNOLOGY LIMITED

ORION
ELECTRIC CO., LTD.

SONY

APPLICATION & CUSTOMER

STB

HubTech

NEC

TOSHIBA

Leading Innovation >>>

homecast
Connecting Your Digital Dream

ARION
TECHNOLOGY



MITSUBISHI

Sunniwell
朝歌数码

GOOSAT

KONKA

APPLICATION & CUSTOMER

Networking



NEC

FUJITSU

ALPHA

MITSUBISHI

ZyXEL



T&W

Gemtek

D-Link

Kasda[®]
Networks with Innovation

PRODUCT APPLICATION & CUSTOMER

Portable

Canon

Panasonic

Nintendo®

FUJITSU

SONY



MITSUBISHI®

FOXCONN®

lenovo

5xLINK

Cal-Comp

APPLICATION & CUSTOMER

Lighting

億光電子
EVERLIGHT



OSVI
LED LIGHT

LITEON[®]



LUSTROUS
Green Technology of Lighting

PARTNER

- Foundry House



nuvoTon



- Assembly House



QUALITY POLICY



Customer #1



Do it right the first time



Improve quality continuously

CERTIFICATIONS

- ISO 9001:2008 certified
- ISO 14001:2004 certified



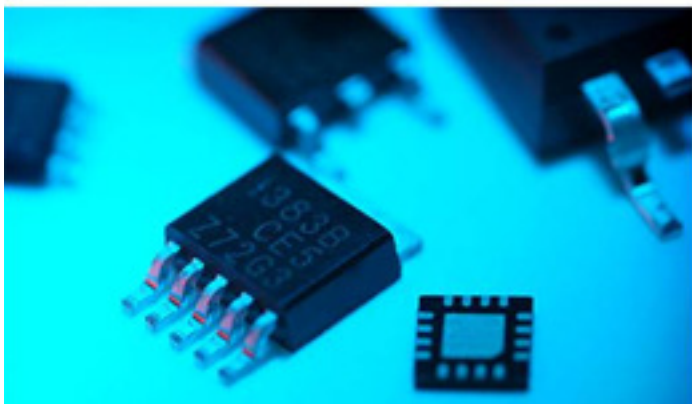
RECOGNITIONS

- Sony: Green Partner
- Canon: Green Activity
- RICOH: Approval for Production Audit
- Samsung: Eco-Partner
- LGE: Green Program





AIC Power Solutions Overview



PRODUCT PORTFOLIO



● Power Conversion

- Linear Voltage Regulator
- DC/DC Converter ★★★★★
- White-LED Driver
- LED Lighting Driver ★★★

● Power Manipulation

- Supervisory
- Battery Management
- Power Switch ★★
- High Current Driver



POWER CONVERSION



Linear Voltage Regulator	DC/DC Converter
• Low Dropout Linear Regulator • Ultra Low Dropout Linear Regulator • Negative Voltage Regulator • Voltage Reference • DDR Regulator • Fan Control Driver	• Step - Up • Inverting • Charge - Pump • Step - Down • Multiple Output
White-LED Driver	LED Lighting Solution
• Charge - Pump • Boost Converter • Buck Converter • Constant Current Switcher	• Off - Line Linear • Step – Down • AC/DC

POWER MANIPULATION



Supervisory	Battery Management
• Microprocessor Reset Circuits • Reset Circuits with Manual Reset Input	• NiMH/NiCd Charger • Li-Ion Charger • Li-ion Protection
Power Switch	Others
• Universal Power Switch • USB Power Switch	• High Current Driver • Universal DC/DC Converter • Universal AC/DC Converter

Buck Converters

AIC28xx/23xx/22xx Series

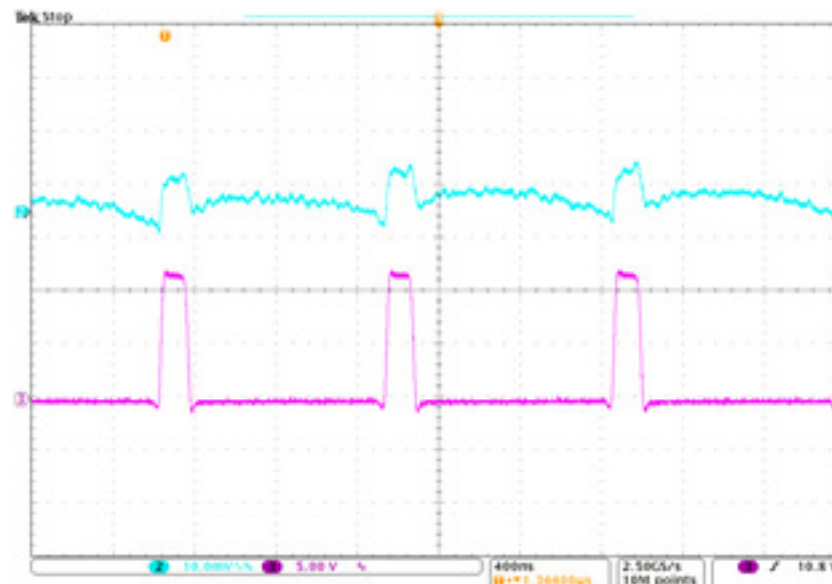
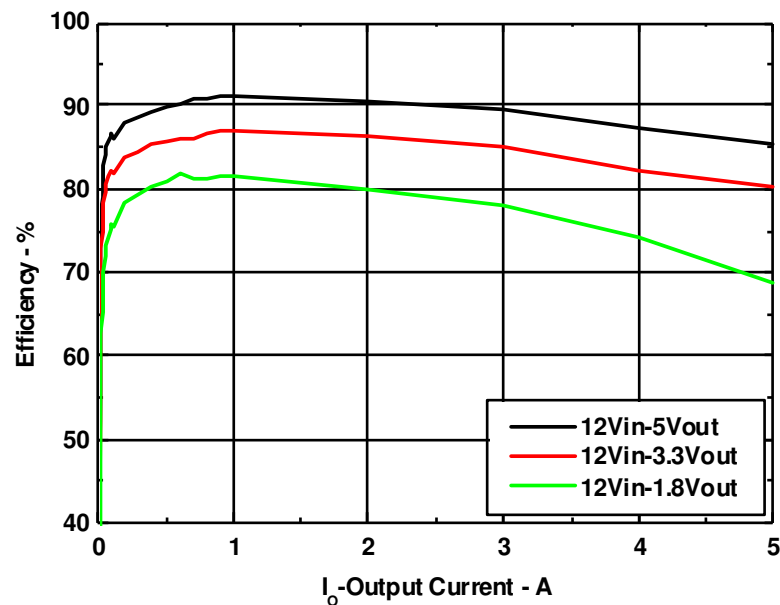
Output Current		≤1.5A	≤2A	≤3A	≤5A
HV Buck	Vin up to 36V			AIC2893 AOT	
	Vin up to 23V		AIC2822 AIC2857F AIC2862	AIC2823 AIC2858F AIC2863	
	Vin up to 16V		AIC2832 AIC2842 AIC2852 AIC2880	AIC2833(FC) AIC2843(FC) AIC2873 AOT	AIC2868(8A) AIC2865 AIC2864(4A)
LV Buck	Vin up to 6V	AIC2259 AOT AIC2304 AIC2354 AIC2355 AIC2359(Dual) AIC2140/43 AIC2235	AOT AIC2262(FC) AIC2321/22 AIC2361/62 Ultra Low Iq 0.35uA Low Iq 1uA	AOT AIC2323 AIC2363 AIC2369	AIC2324(4A) AIC2364(4A) AIC2367(5A)



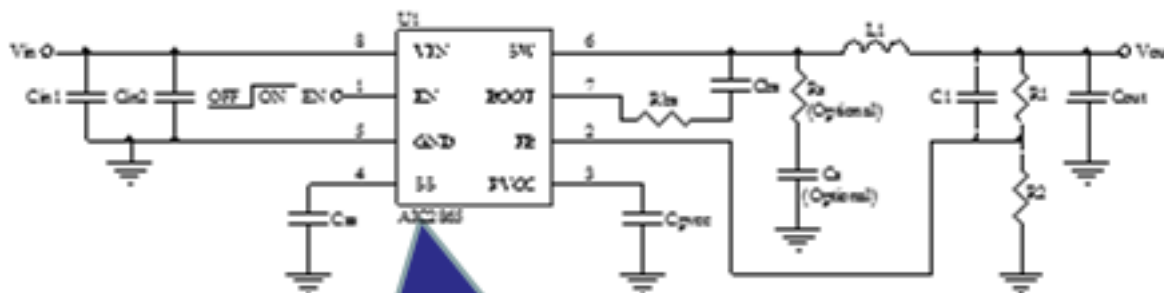
Mass Production!!

AIC2865

5A 16V 700kHz COT Synchronous Step-Down Converter

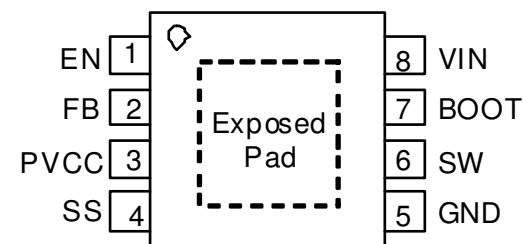


Application Circuit



TPS54528 Compatible

Package



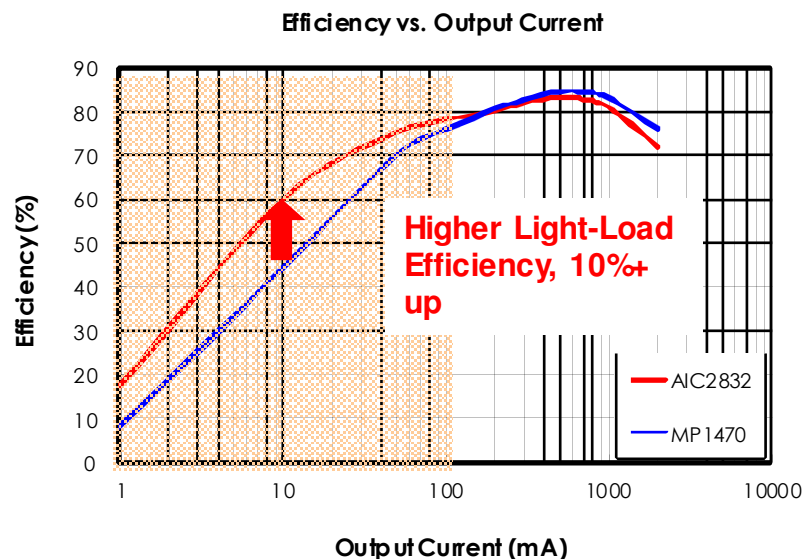
SOP-8 exposed pad



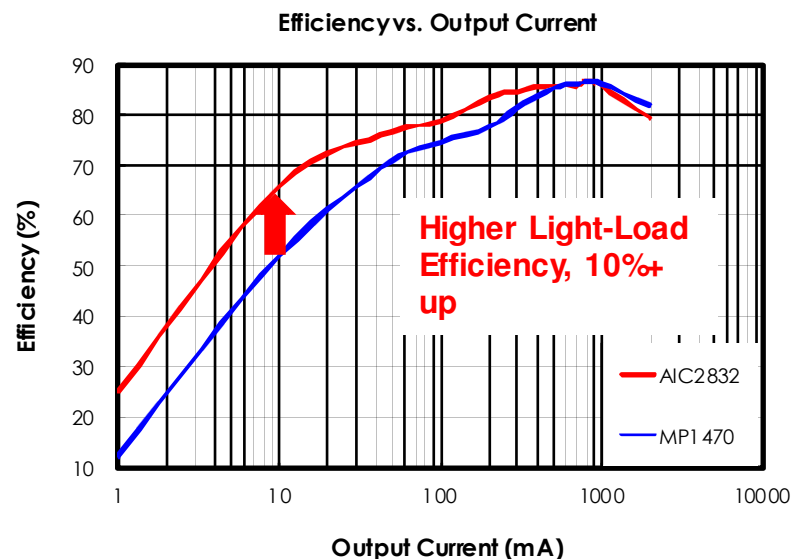
Mass Production!!

AIC2832

2A 16V 490kHz PWM/PSM Synchronous Step-Down Converter

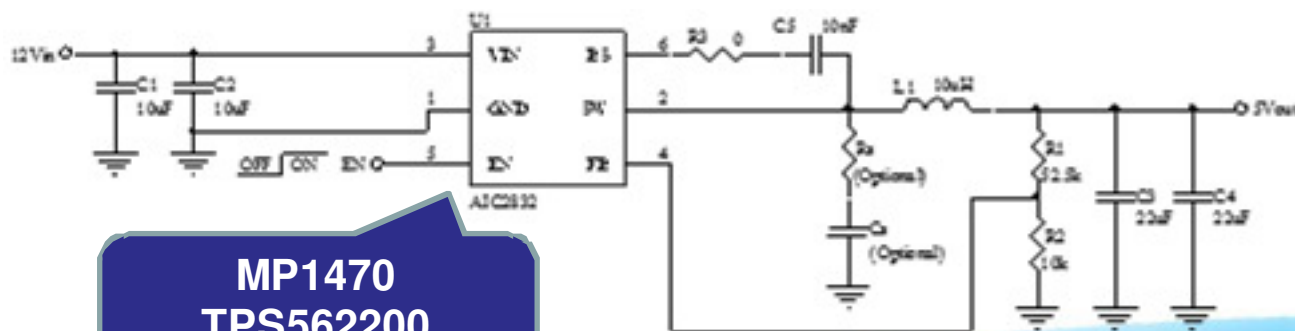


1.05V_{OUT} Efficiency at V_{IN}=12V



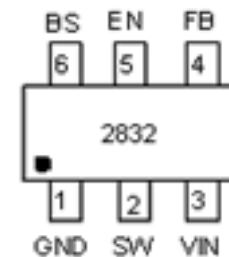
1.8V_{OUT} Efficiency at V_{IN}=12V

Application Circuit



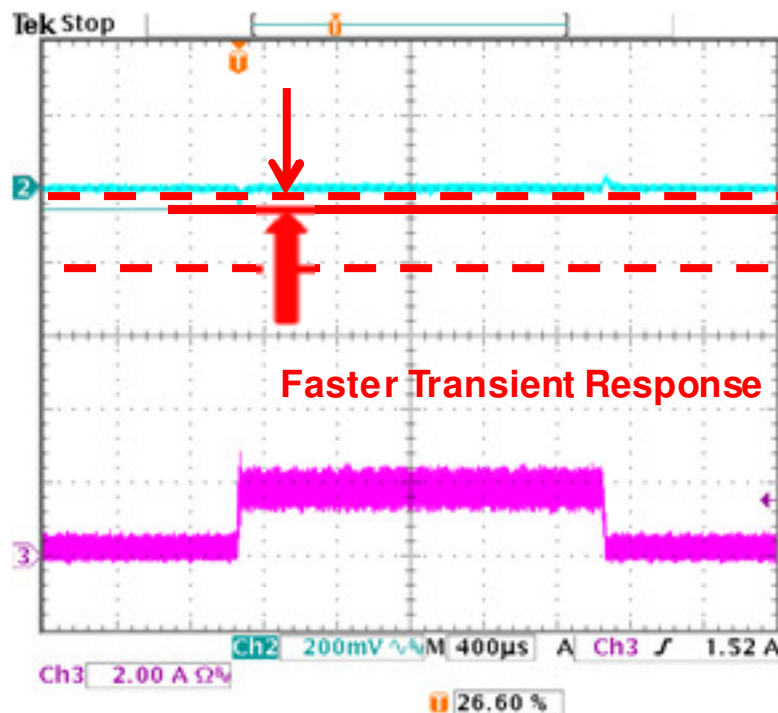
**MP1470
TPS562200
Compatible**

Package

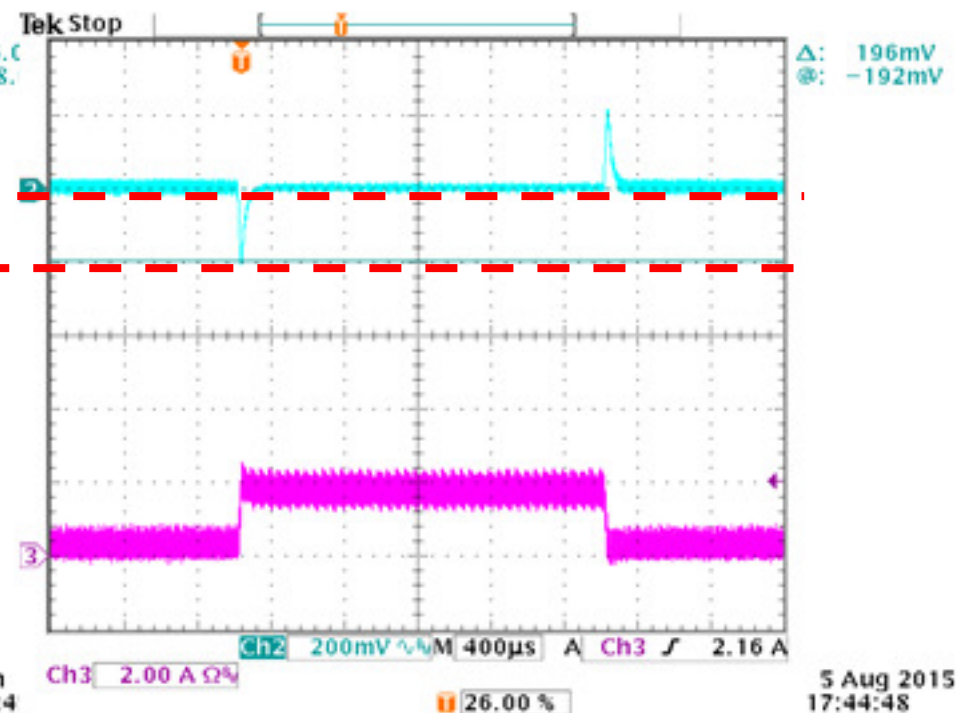


SOT-23-6

2A 16V 490kHz PWM/PSM Synchronous Step-Down Converter

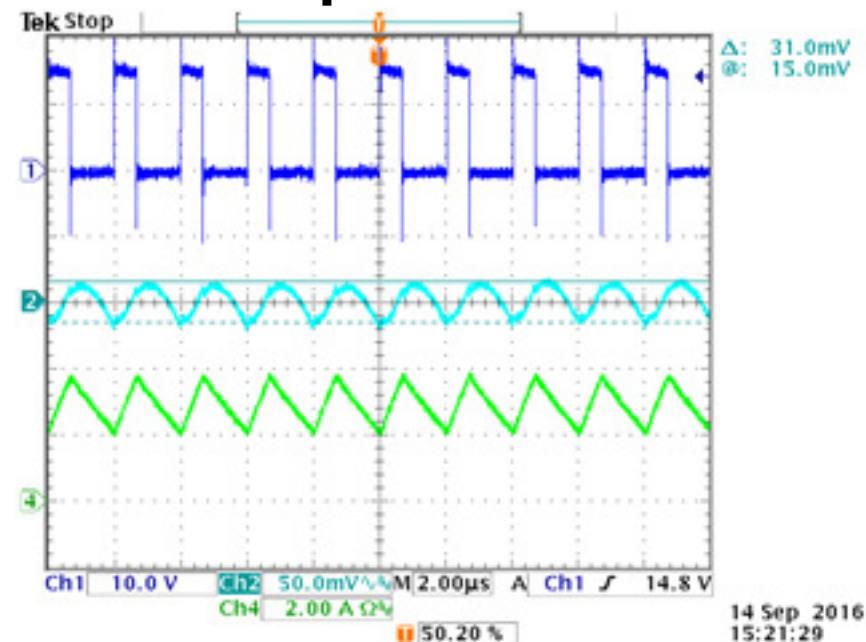
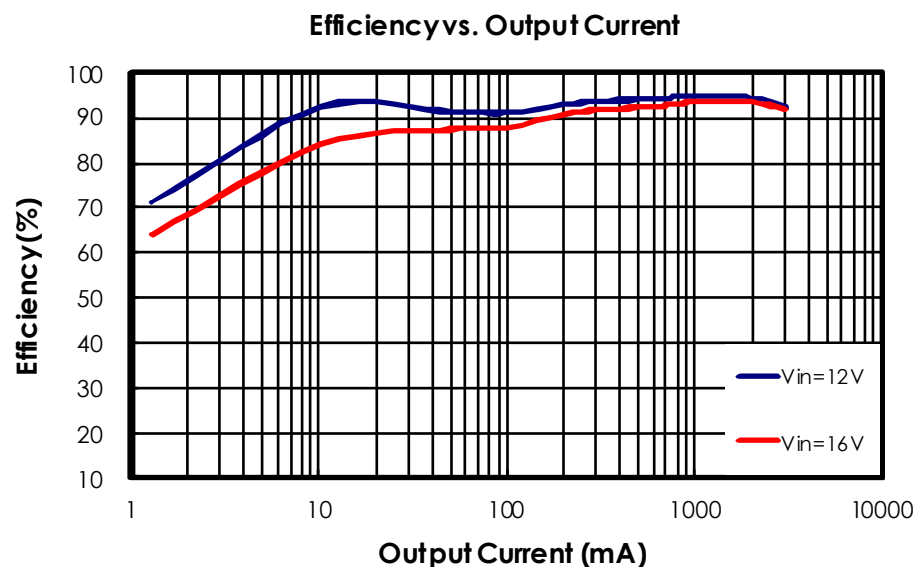


AIC2832 $V_{IN}=12V$, $V_{OUT}=1.05V$, $I_O=0.2 \sim 1.8A$,
drop=59mV
 CH2: Output Voltage, CH3: Inductor Current



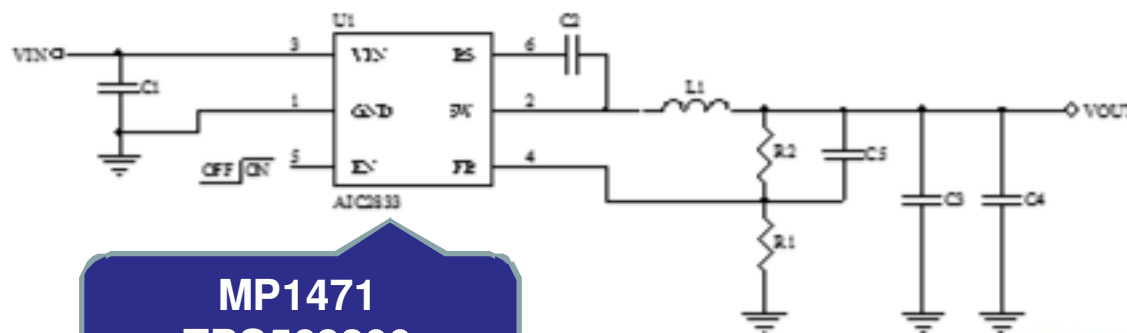
MP1470 $V_{IN}=12V$, $V_{OUT}=1.05V$, $I_O=0.2 \sim 1.8A$,
drop=196mV
 CH2: Output Voltage, CH3: Inductor Current

3A 16V 490kHz PWM/PSM Synchronous Step-Down Converter



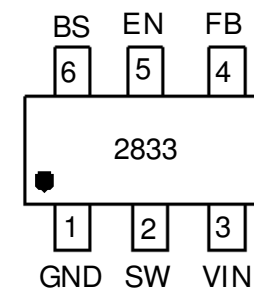
$V_{OUT}=5V$, $I_{OUT}=3A$ Ripple at $V_{IN}=12V$

Application Circuit



MP1471
TPS563200
Compatible

Package



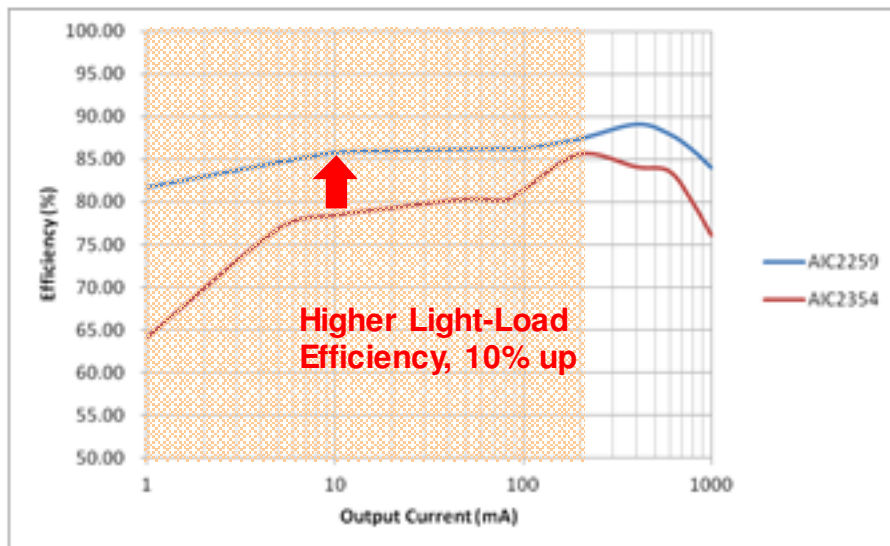
SOT-23-6



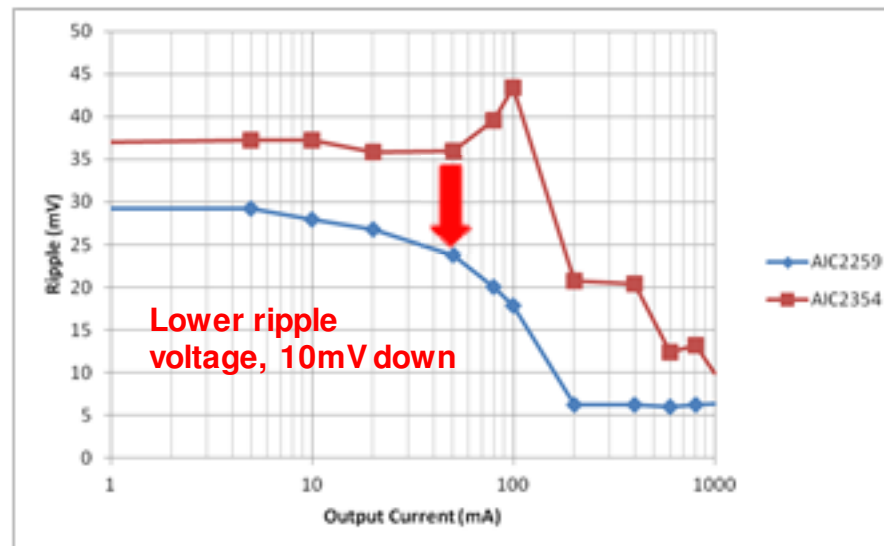
Sampling Now!!

AIC2259

1A, 1.5MHz **AOT** Synchronous Step-Down DC/DC Converter

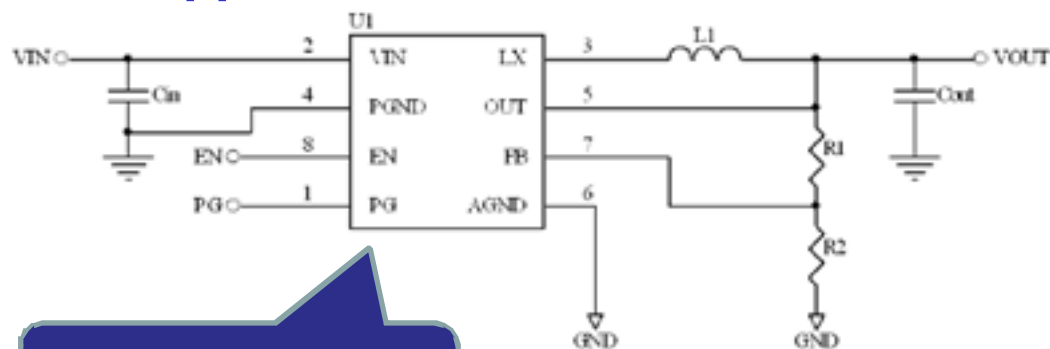


$V_{OUT}=1.0V$ Efficiency at $V_{IN}=5V$



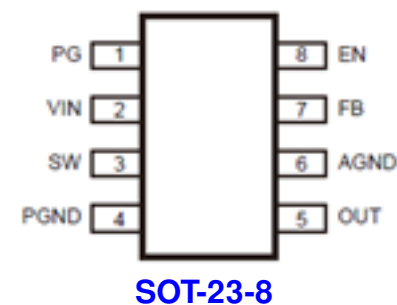
$V_{OUT}=1.0V$ Ripple at $V_{IN}=5V$

Application Circuit



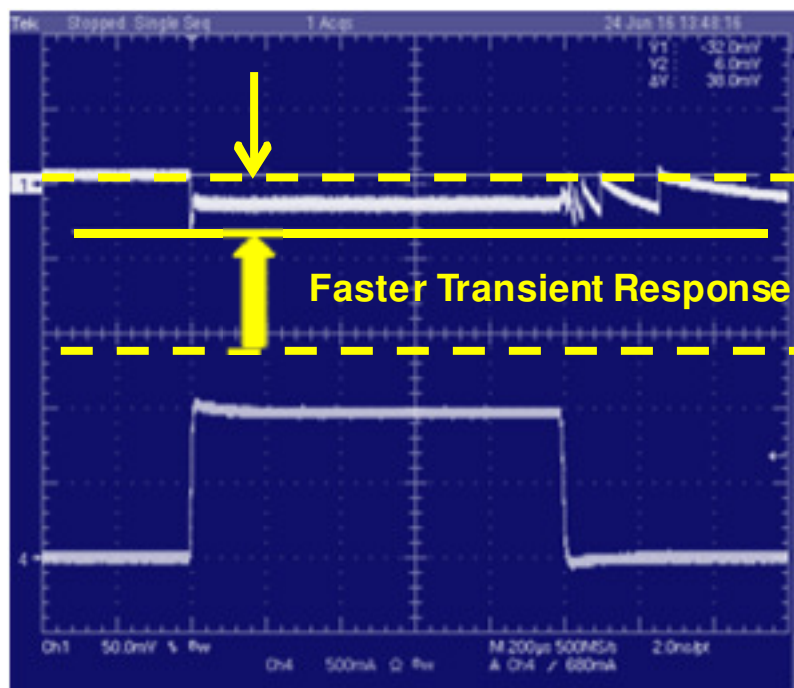
**MP2159
Compatible**

Package

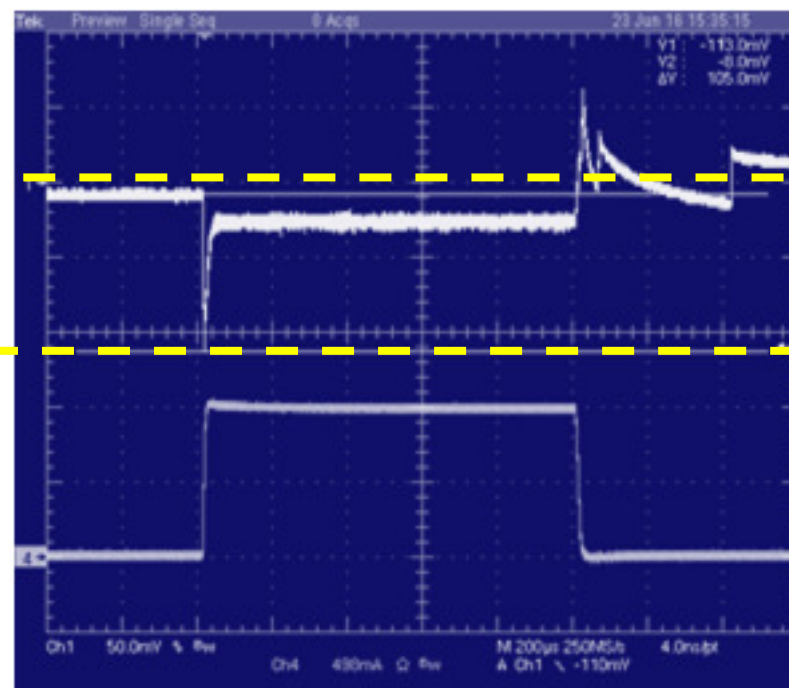


SOT-23-8

1A, 1.5MHz **AOT** Synchronous Step-Down DC/DC Converter

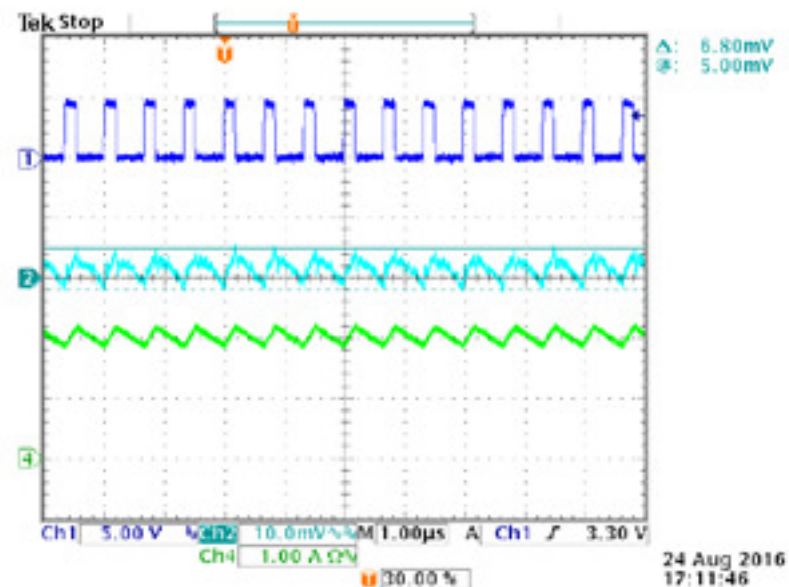
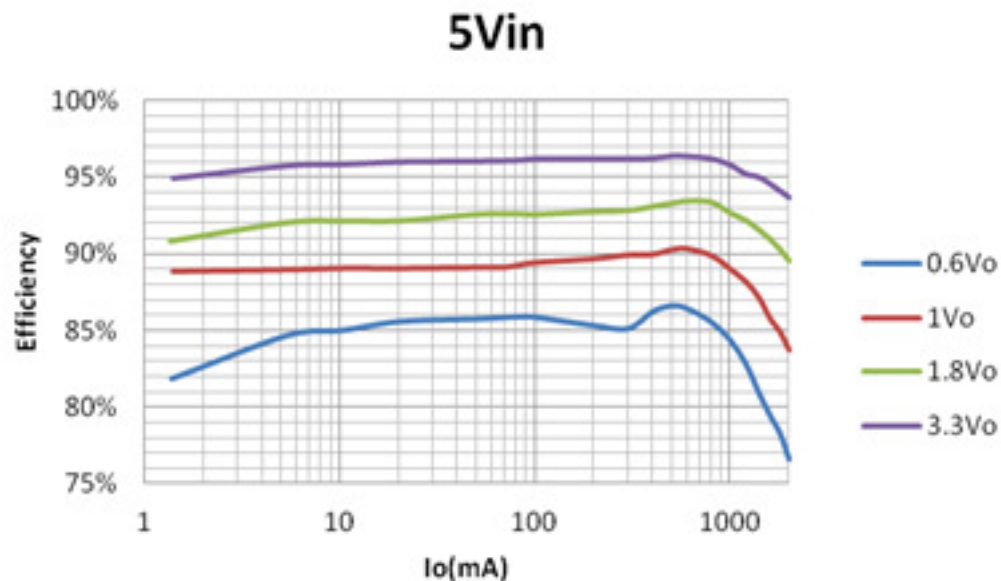


AIC2259 $V_{IN}=5V$, $V_{OUT}=1.0V$, $I_O=0 \sim 1A$,
drop=38mV
(CH1: Output Voltage, CH4: Output Current)



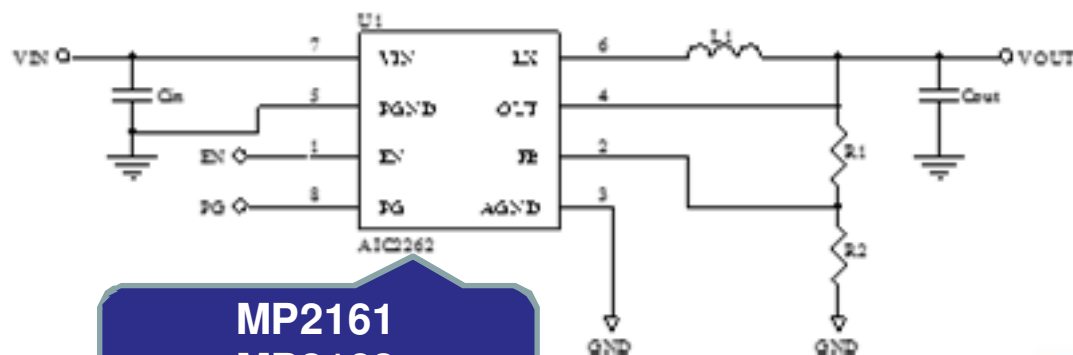
AIC2354 $V_{IN}=5V$, $V_{OUT}=1.0V$, $I_O=0 \sim 1A$,
drop=105mV
(CH1: Output Voltage, CH4: Output Current)

2A 1.5MHz AOT Synchronous Step-Down Converter



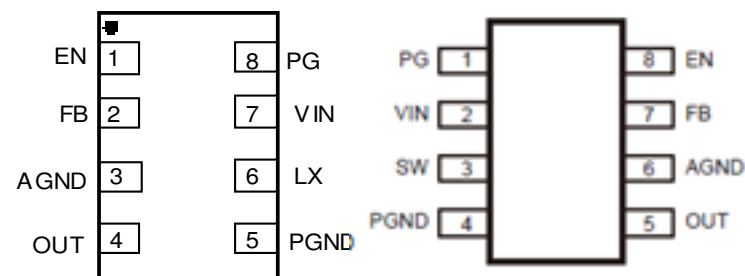
$V_{OUT}=1.2V$, $I_{OUT}=2A$ Ripple at $V_{IN}=5V$

Application Circuit



MP2161
MP2162
Compatible

Package



8-pin DFN 2mm x 1.5mm

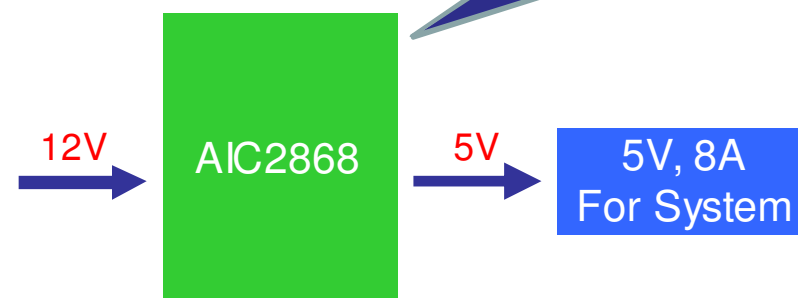
SOT-23-8

8A 16V 700kHz Synchronous Step-Down Converter

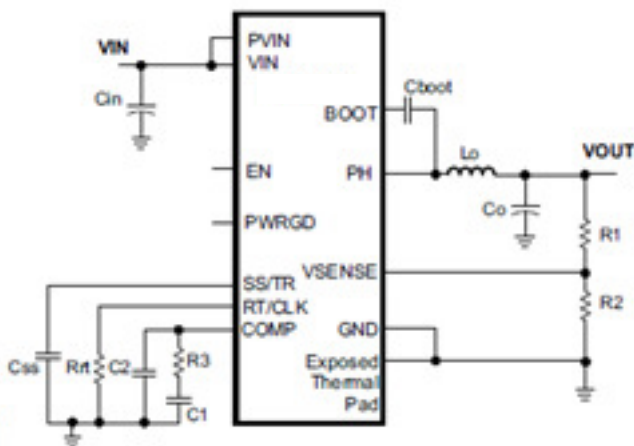
- 8A Continuous Output Current
- Wide 4.5V to 16V Operating Input Range
- Output Adjustable from 0.8V to 6V
- Up to 91% efficiency
- Low $R_{ds(on)}$ Internal Switch
- Adaptive On Time Control
- Fast Transient Response
- Pseudo 700kHz Switching Frequency
- Programmable Soft Start
- Thermal Shutdown
- Cycle by Cycle Over Current Protection
- Short Circuit Protection
- Thermal Shutdown
- Available in a 3.5mmX3.5mm, VQFN-14 package

VIN = 4.5V~16V

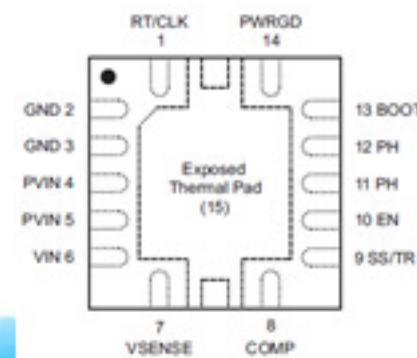
TPS54821
Compatible



Application Circuit



Package



14-pin VQFN 3.5mm x 3.5mm

3A 17V Synchronous Step-Down Converter with AOT Control

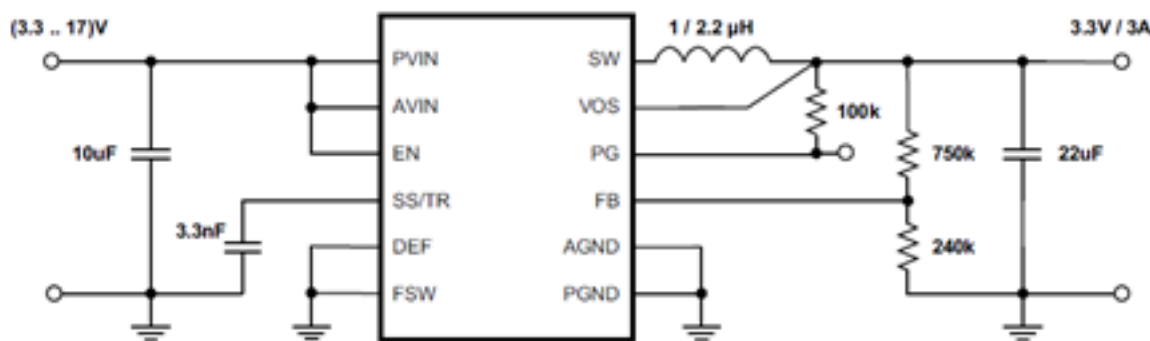
- AOT Topology
- Input Voltage Range: 3 V to 17 V
- Up to 3A Output Current
- Adjustable Output Voltage From 0.9 V to 5 V
- Pin-Selectable Output Voltage (Nominal, + 5%)
- Programmable Soft Start and Tracking
- Seamless Power Save Mode Transition
- Quiescent Current of 19 μ A (Typical)
- Selectable Operating Frequency
- Power Good Output
- 100% Duty Cycle Mode
- Short-Circuit Protection
- Over-Voltage Protection with Latch
- Over Temperature Protection
- Available in a 3-mm $\times$ 3-mm, VQFN-16 Package

VIN = 5V ~ 15V

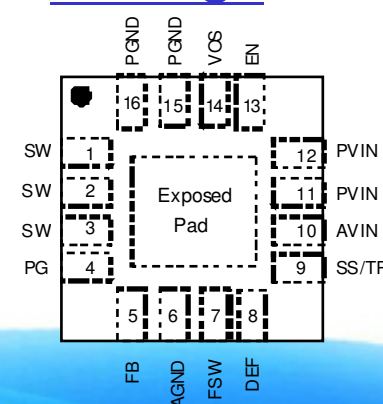


Capable for 100% Duty Cycle Operation

Application Circuit



Package

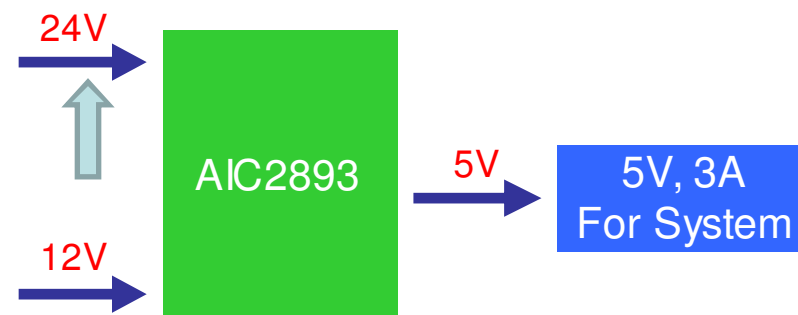


16-pin VQFN 3mm $\times$ 3mm

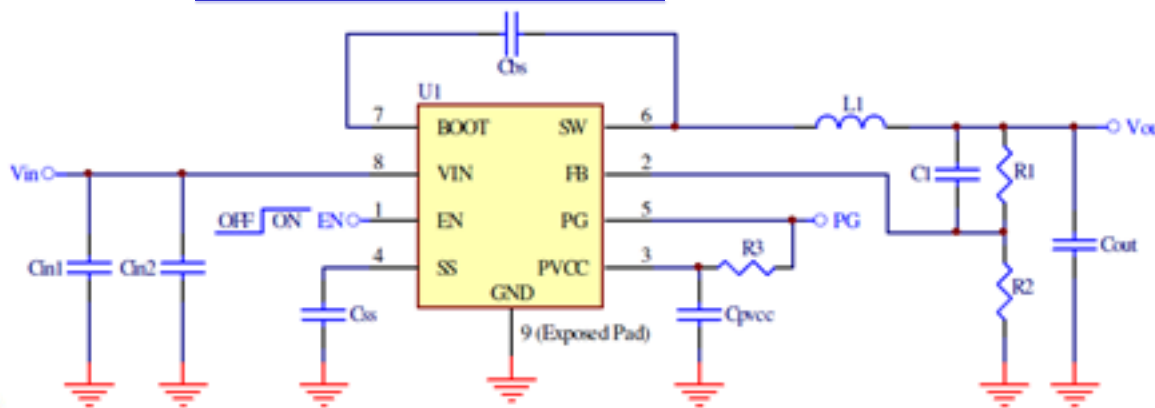
3A 36V 650kHz Synchronous Step-Down Converter

- 3A Continuous Output Current
- Wide 4.5V to 36V Operating Input Range
- Output Adjustable from 0.8V to 6V
- Up to 91% efficiency
- Low $R_{ds(on)}$ Internal Switch
- Adaptive On Time Control
- Fast Transient Response
- 650kHz Switching Frequency
- Programmable Soft Start
- Thermal Shutdown
- Cycle by Cycle Over Current Protection
- Short Circuit Protection
- Thermal Shutdown
- Available in SOP-8 exposed pad (Heat Sink) package

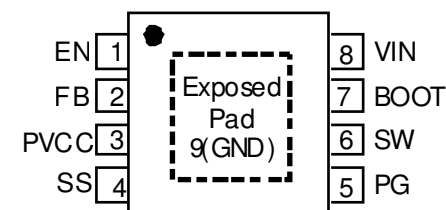
VIN = 4.5V ~ 36V



Application Circuit



Package

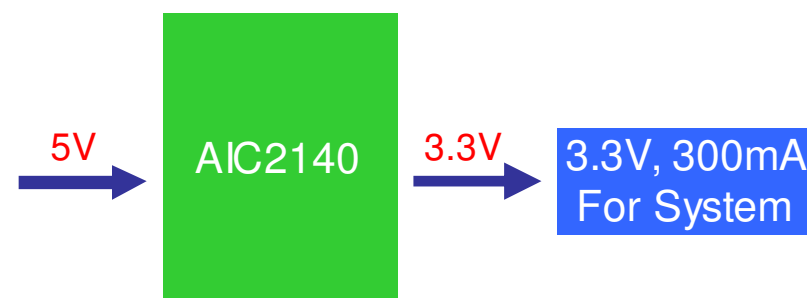


SOP-8 exposed pad

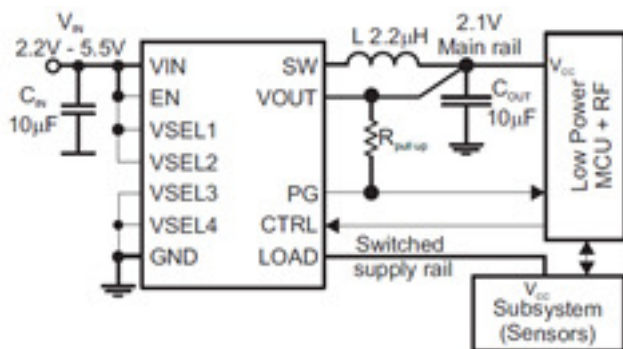
300mA Ultra Low Iq Step-Down Converter with AOT Control

- Typ. 360nA Quiescent Current
- Adaptive On Time Control
- 2.2V to 5.5V Input Range
- Up to 90% Efficiency at 10 μ A Output Current
- 16 Selectable Output Voltages in 100mV Steps between 1.8V to 3.3V
- Up to 300mA Output Current
- Automatic Transition to No Ripple 100% Mode
- Low Output Ripple Voltage
- Slew Rate Controlled Load Switch
- Discharge Function on VOUT / LOAD
- Power Good Output
- Up to 2 MHz Switching Frequency
- Optimized for Operation with a Tiny 2.2 μ H Inductor and 10 μ F C_{OUT}
- Small 2.4 x 2.4 mm² DFN-12 Package

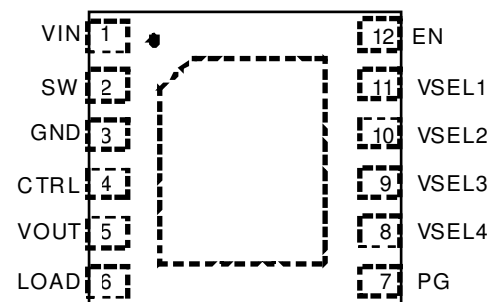
VIN = 4.5V~16V



Application Circuit



Package



12-pin DFN 2.4mm x 2.4mm

Boost Converters

AIC16xx/34xx/36xx Series

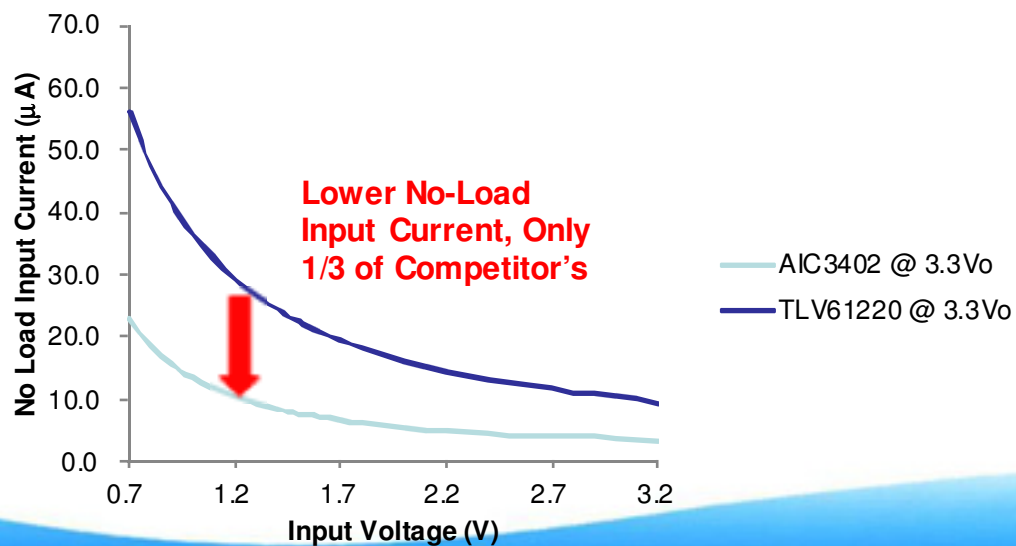
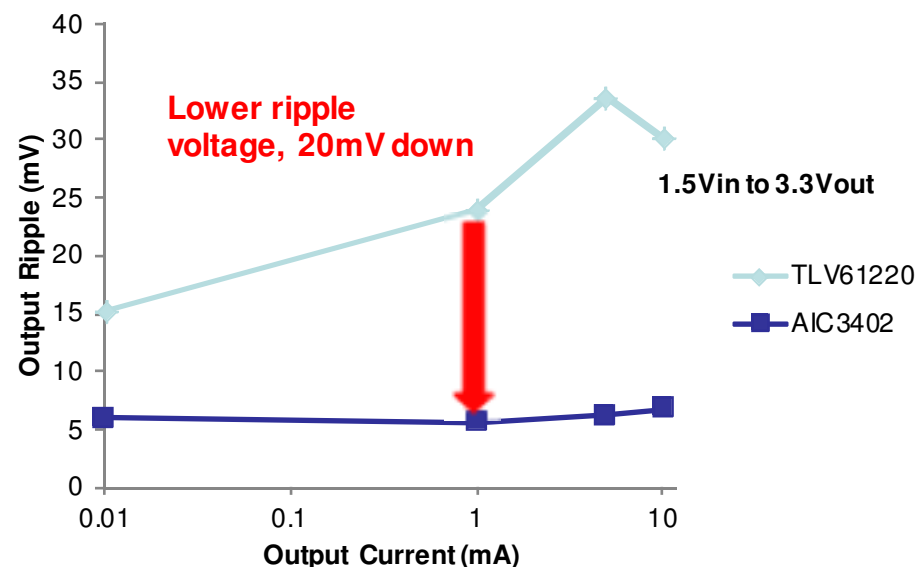
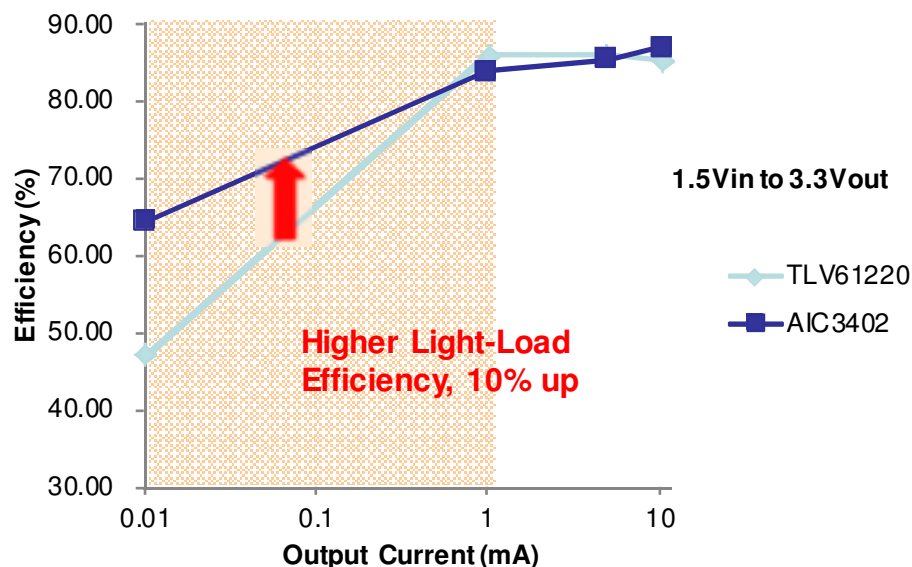
Switch Current Limit		≤1A	≤2A	≤3A	≤5A
Boost	Vout up to 40V		AIC3646**		
	Vout up to 30V	AIC1634* AIC1647 AIC1896*			
	Vout up to 22V	AIC3643			
	Vout up to 5.5V	AIC1642 AIC3402 AIC3411/12 AIC3413 AIC3634*** AIC3643***	AIC3415	AIC3417	AIC3418 AIC3420(6.5A)
Buck-Boost	Vin up to 5.5V	AIC2341 AIC2340		AIC2343	

* Vin up to 10V
** Vin up to 28V

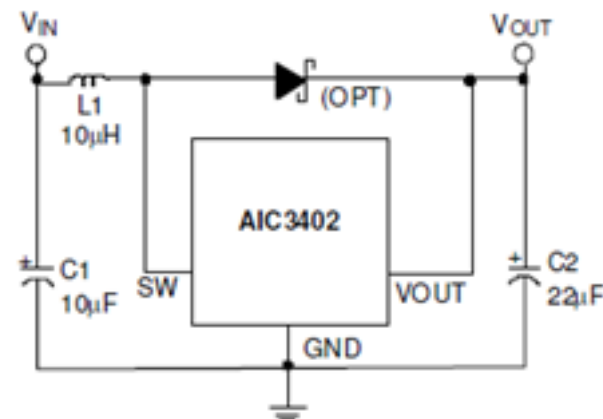
*** Vin up to 22V

Low Iq 3uA

Synchronous Step-Up DC/DC Converter



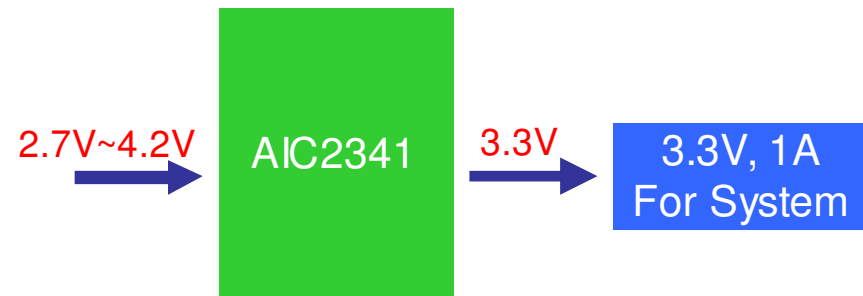
Application Circuit



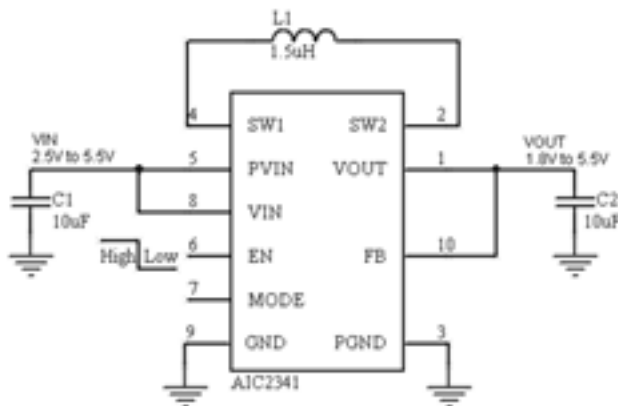
1A 2.5MHz Synchronous Buck-Boost DC/DC Converter

- Regulated Output with Input Voltage Above, Below, or Equal to The Output
- 1A Output Current at 3.3V in Step-Down Mode
- Up to 800mA Output Current at 3.3V in Boost Mode
- Single Inductor
- 2.5V to 5.5V Input Voltage Range
- Fixed and Adjustable Output Voltage Options from 1.8V to 5.5V
- Up to 95% Efficiency
- Stable with Low ESR Ceramic Capacitors
- No Schottky Diode Required
- Output Disconnect in Shutdown
- <1uA Shutdown Current
- <65uA Quiescent Current
- Power Saving Mode for Improved Light-Efficiency Operation
- Forced Fixed Frequency Operation Mode
- Load Disconnect During Shutdown
- Undervoltage Lockout Protection

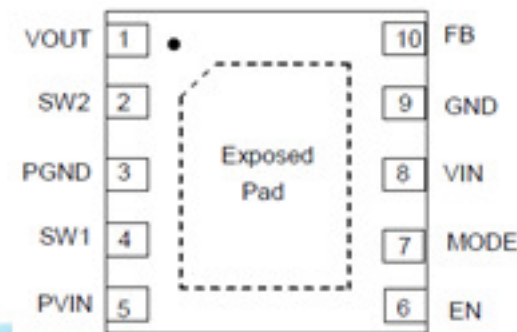
VIN = 2.5V~5.5V



Application Circuit



Package



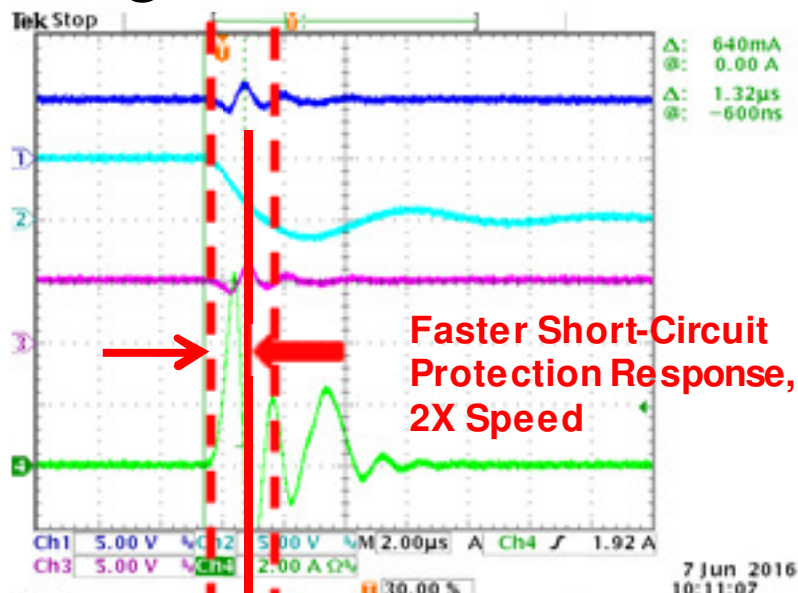
10-pin DFN 3mm x 3mm

Power Switch

AIC61xx Series

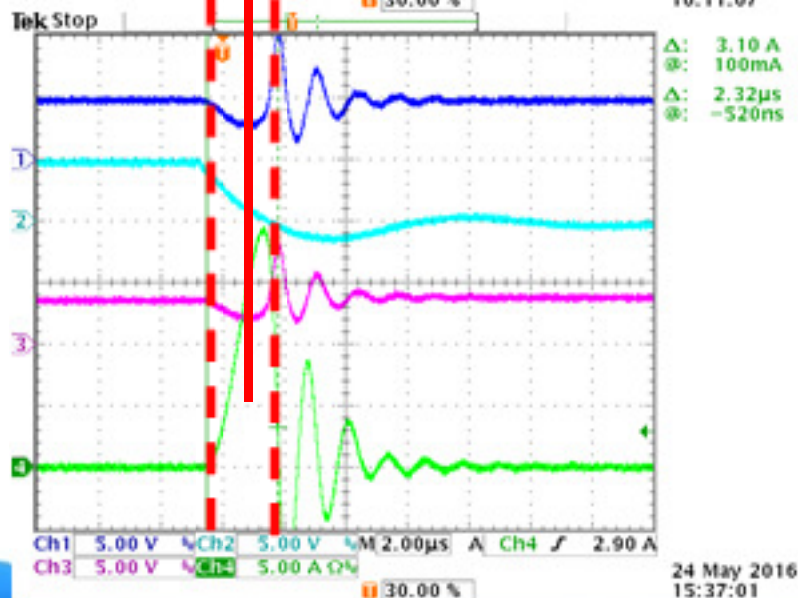
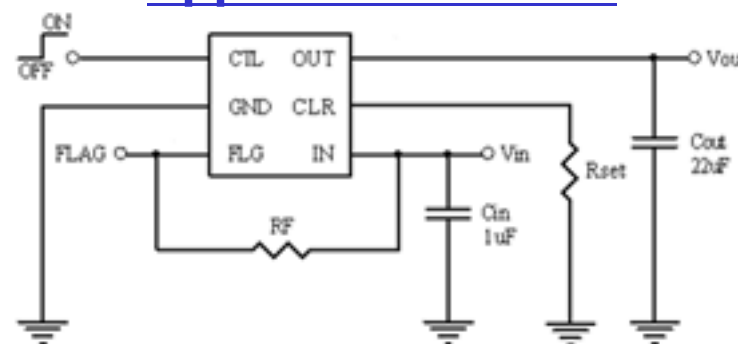
Current Limit		Single Channel	Dual Channel
USB Power Switch	≤1A	AIC6161 AIC6151	AIC6186
	≤2A	AIC6162(1.4A) AIC6163 AIC6170 AIC6152	AIC6176(1.25A) AIC6178 AIC6188(1.55A)
	≤3A	AIC6156 AIC6164(3.2A)	Fast SCP 1.3uS, ±7~15% Curr. Accuracy
Regulatory USB Power Switch	≤1A	AIC6166 AIC6168	
Bare-Bone Power Switch	≤1A	AIC6191	AIC6196
	≤2A	AIC6193	AIC6198

Single Channel USB Switch with Adjustable Current Limit



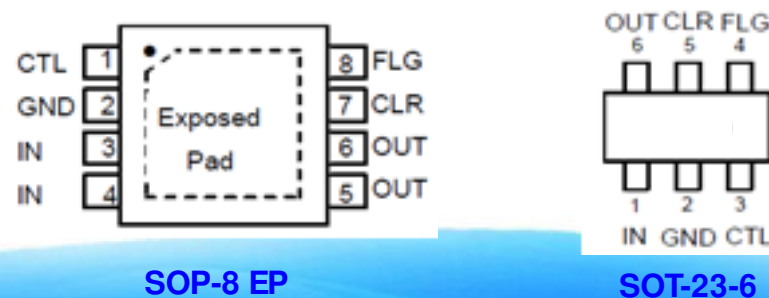
AIC6156 $V_{IN}=5V$, $I_{CL}=0.5A$, **Res. Time=1.32μs**
(CH1: Input Voltage, CH2: Output Voltage, CH3: FLG, CH4: Input Current)

Application Circuit



TPS2554 $V_{IN}=5V$, $I_{CL}=0.5A$, **Res. Time=2.32μs**
(CH1: Input Voltage, CH2: Output Voltage, CH3: FLG, CH4: Input Current)

Package



SOP-8 EP

SOT-23-6



USB Power Switch at 3A

	AIC	TI	Rohm	On-Semi
Part Number	AIC6156	TPS2554 TPS2555	BD82024 BD82025	NCP383
Short Circuit Response Time(uS)	1.3	1.5	5	2
Continuous Load Current (A)	0.5~3 (Adj.)	0.5~2.5 (Adj.)	2.5 (Adj.)	0.5~2.1 (Adj.)
MOS R-DS-ON (mohm)	60	73	90	45
Supply current (μA)	85	90	95	99
Input Voltage Range (V)	3.5~5.5	4.5~5.5	2.8~5.5	2.7~5.5
Current Limit Threshold (mA)	3060/ 3600/ 4140 1700/ 2000/ 2300 425/ 500/ 575	2550/ 2840 / 3100 2150/ 2430/ 2650 420/ 480/ 530 185/ 230/ 265	2100/2500/3300	2580/2800/3010 900/1000/1100 500/600/700
Current Limit Accuracy (%)	±15	±12	±15	±8
High Side Switch	NMOS	NMOS	NMOS	NMOS
Flag Delay Time (mS)	9	8.5	12	7
Output discharge	Yes	Yes	Yes	No
Package	SOP-8/SOT23-6	VSON	SOP8	UDFN10



USB Power Switch at 2A

	AIC	TI	Rohm	On-Semi
Part Number	AIC6152	TPS2553	BD2222G BD2242G BD2243G	NCP380 NCV380
Short Circuit Response Time(uS)	1.3	2	5	2
Continuous Load Current (A)	0.5~2 (Adj.)	0.75~1.7 (Adj.)	0.2~1.7 (Adj.)	0.5~2.1 (Adj.)
MOS R-DS-ON (mohm)	60	85	89	70
Supply current (μA)	85	100	120	90
Input Voltage Range (V)	3.5~5.5	2.5~6.5	2.8~5.5	2.5~5.5
Current Limit Threshold (mA)	1700/ 2000/ 2300 425/ 500/ 575	1610/ 1700 / 1800 1215/ 1295/ 1375 490/ 520/ 550 100/ 130/ 150	1566/1696/1826 911/1028/1145 112/212/313	2100/2250/2500 1000/1150/1300 500/580/650
Current Limit Accuracy (%)	±15	±6	±8	±12
High Side Switch	NMOS	NMOS	NMOS	PMOS
Flag Delay Time (mS)	9	8	7	8
Output discharge	Yes	No	BD2242/43	No
Package	SOT23-6	SOT23-6	SSOP6	TSOP-6

Highlights

- **Focused Products**

- AIC2865 – 5A HVB in SOP8-EP, HLL η , pin-compatible with TPS54528
- AIC2832 – 2A HVB in SOT23-6, HLL η , pin-compatible with MP1470/TPS562200
- AIC2833 – 3A HVB in SOT23-6, HLL η , pin-compatible with MP1471/TPS563200
- AIC2259 – 1A LVB in SOT23-8, HLL η , AOT, pin-comp. with MP2159
- AIC2262 – 2A LVB in SOT23-8/DFN, HLL η , AOT, pin-comp. with MP2161
- AIC6156/52/51 – 3A/2A/1A UPS in SOP8-EP and SOT23-6, 1.3 μ S Fast SCP, $\pm 7 \sim 15\%$ current accuracy

- **Advanced Technology**

- AOT (Adaptive On-Time Control) –
 - **Higher** light-load eff., **Smaller** ripple V., **Faster** transient
- Low I_q – Power-saving, extending battery life, 30 μ A -> 3 μ A -> 0.3 μ A (Q1 '17)
- Fast Short-Circuit Response Time – 1.3 μ S

Mastering the POWER

