



LowPowerSemi 微源半導體

无线充电现有解决方案及未来思考

电源管家，让设计更简单！

--戴兴科

<http://www.lowpowersemi.com>

关于无线充

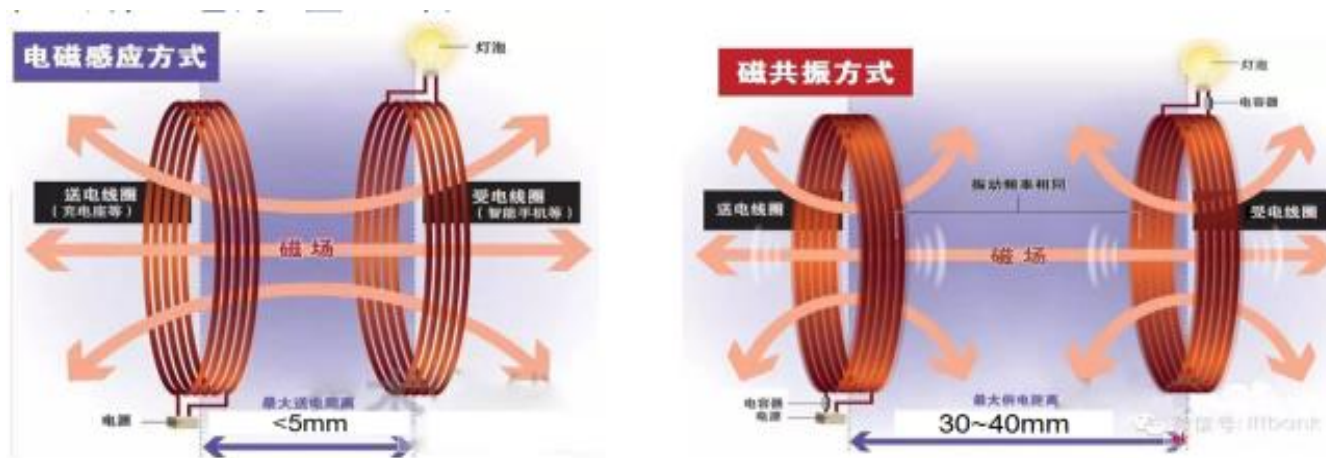
- 1.无线充技术已存在多年，Apple发布iphone x后得到爆发性成长
- 2.无线充应用的产品非常广，如IoT,手机，笔记本电脑,电动工具，汽车...
- 3.无线充应用的场景非常广，如家用消费，办公室，车用，公共场所，共享领域...
- 4.无线充应用的标准不统一，如WPC Qi,PMA,A4WP
- 5.无线充应用的需求大，如每人的手机充电需要3台以上不同应用场景



无线充的实现方式

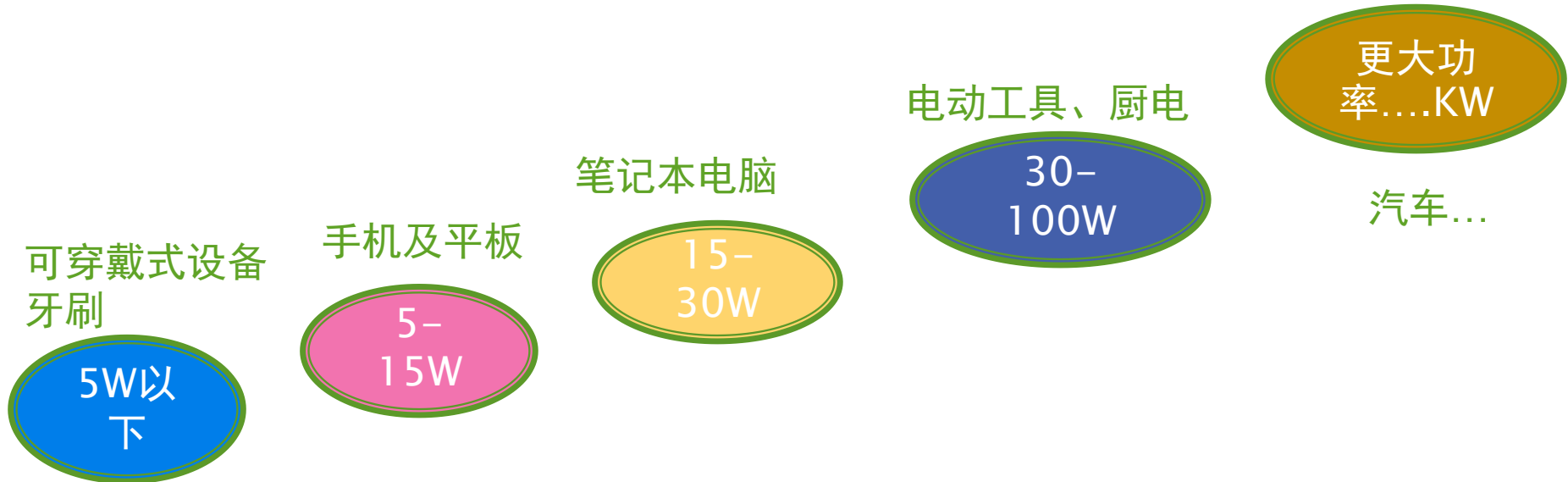
手机带来的电磁感应技术，定频调压技术对无线充提出更高的要求

- 无线充电是一种非传导形式的能量转换方式
- 电磁感应
 - 发射线圈产生磁场
 - 接收线圈接收磁场并产生电流
- 磁共振
 - 发射以及接收线圈同时工作在磁共振的环境下



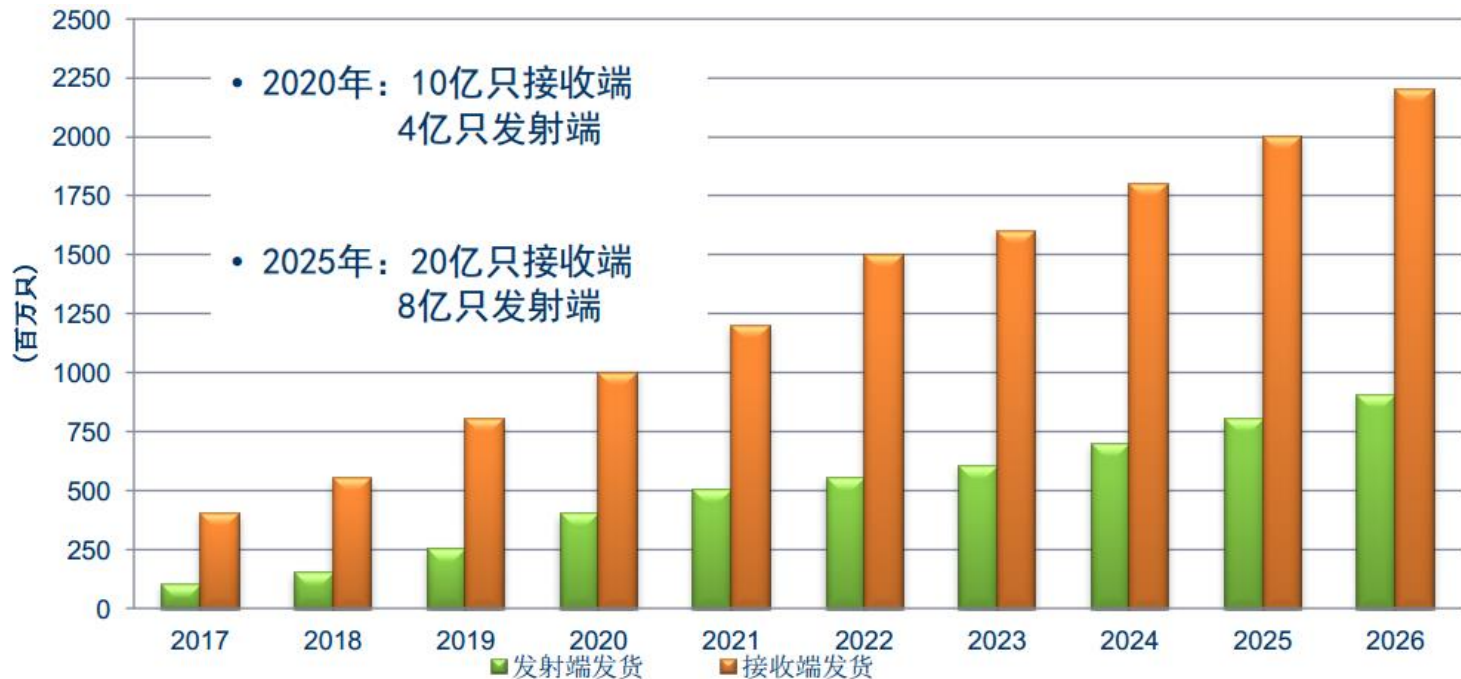
无线充的功率分布

随着华为，小米等手机无线充的标配，2018年的出货主要集中在5-10W间的手机应用市场，其中10W及7.5W的市场将成为主要出货量的产品，5W成为礼品市场的主力，且发热低的N+N结构将成为主流

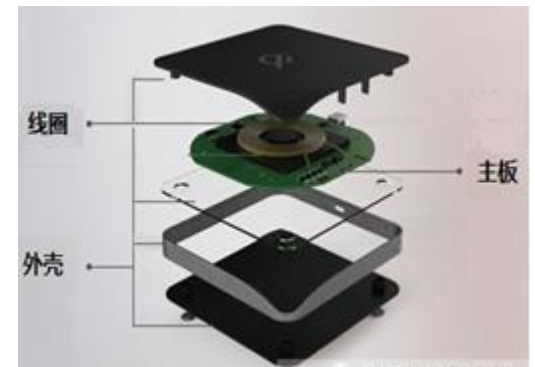
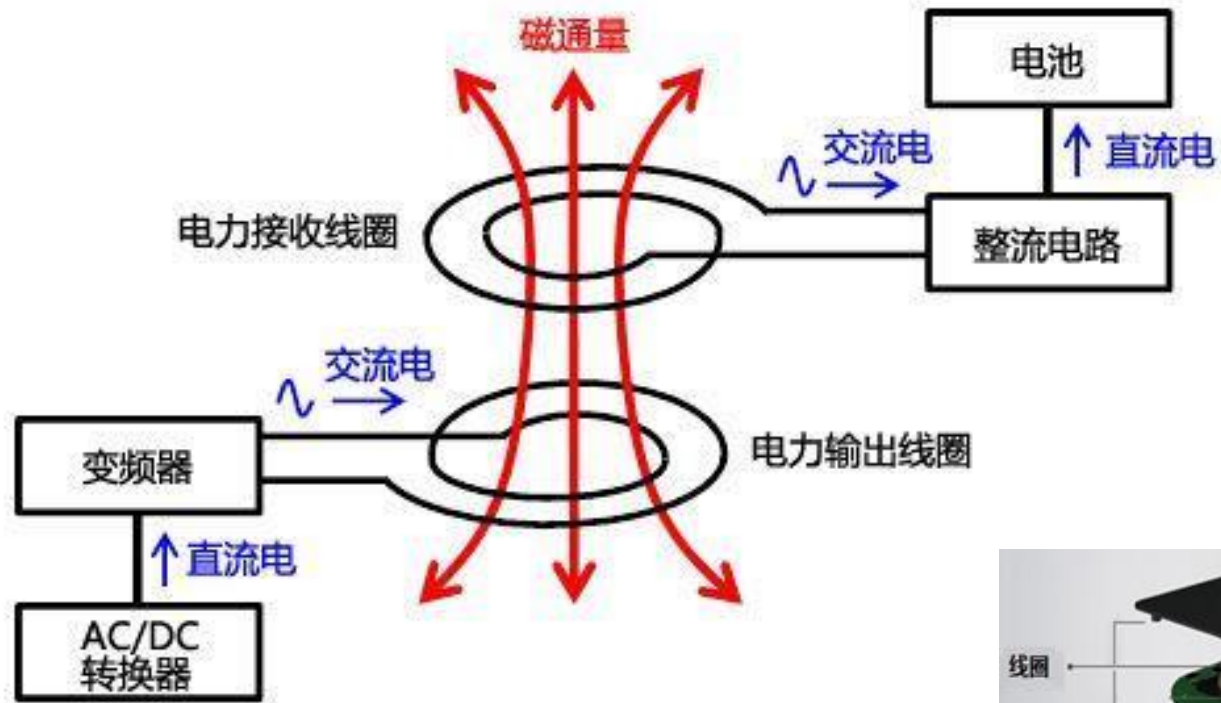


无线充的市场增长

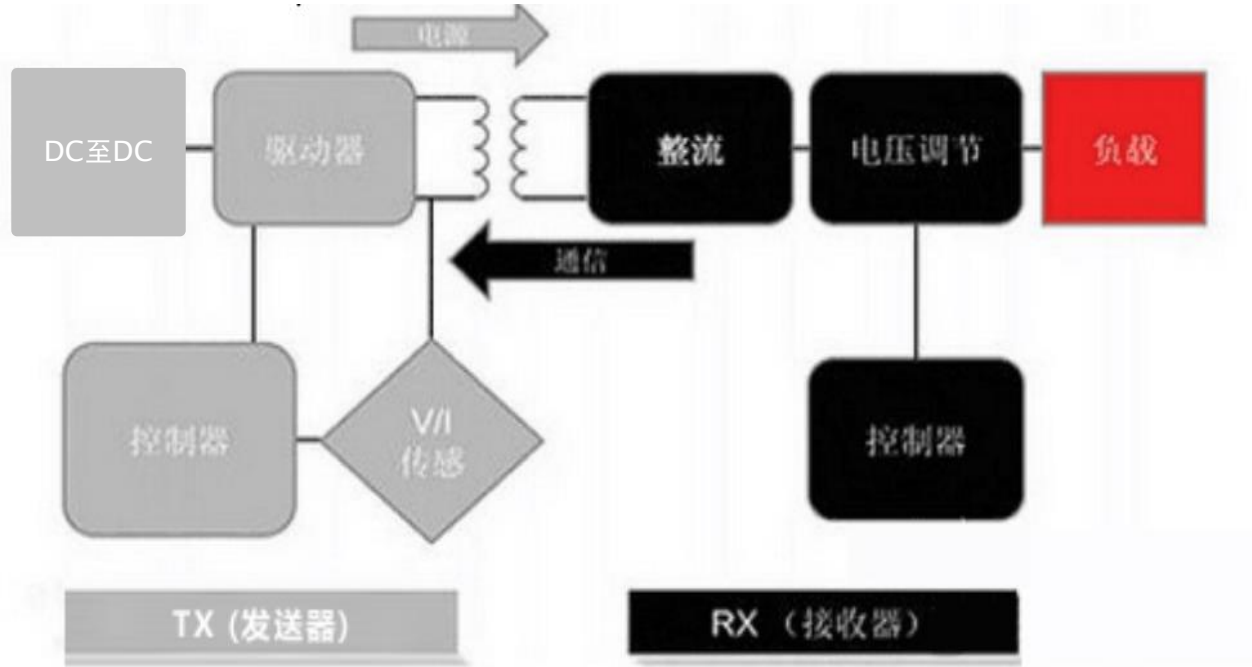
2018年的出货将达到5亿只以上，还有很多未认证的发射端，其中80%以上来自于手机手表带来的应用需求，采用Qi的标准



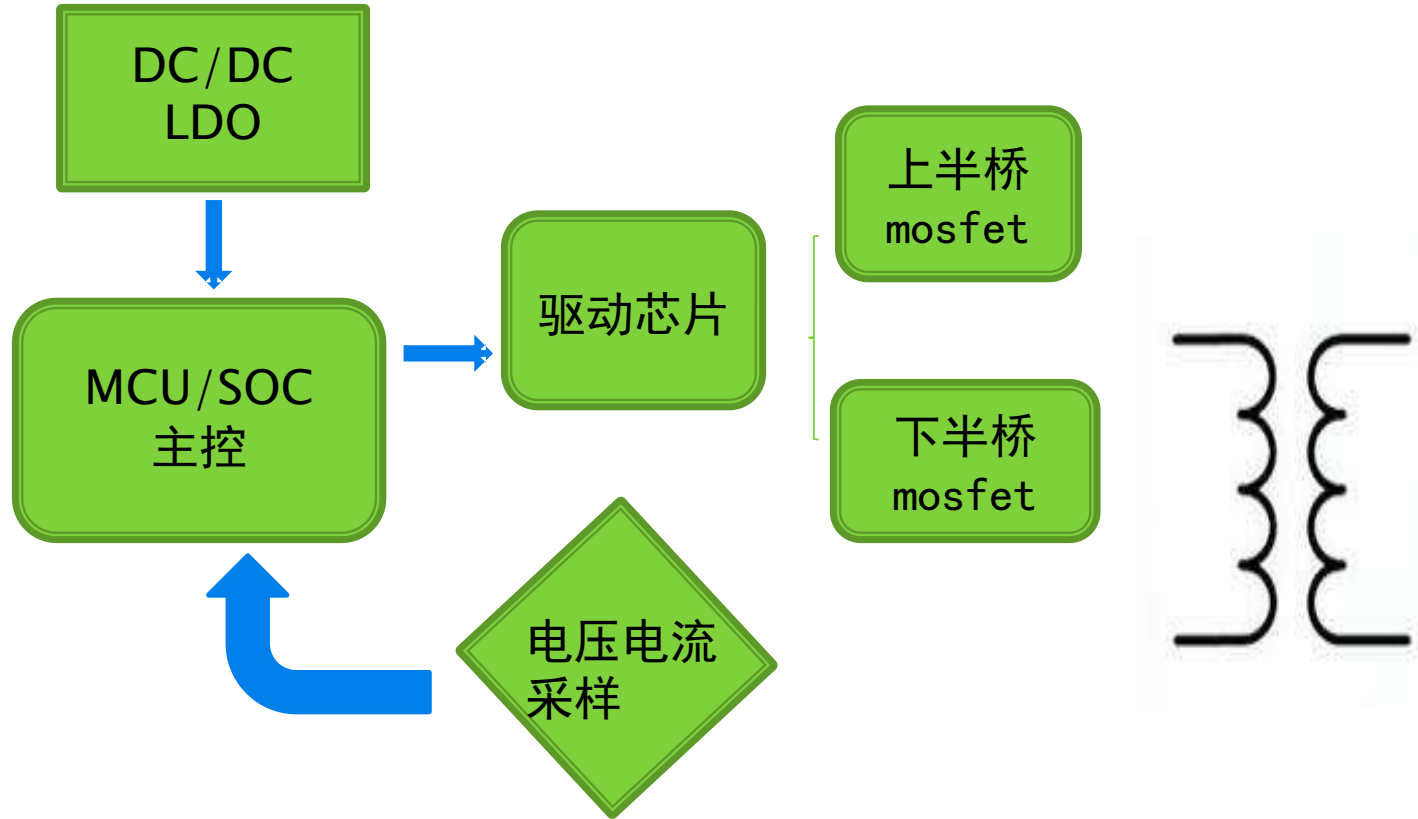
无线充原理结构



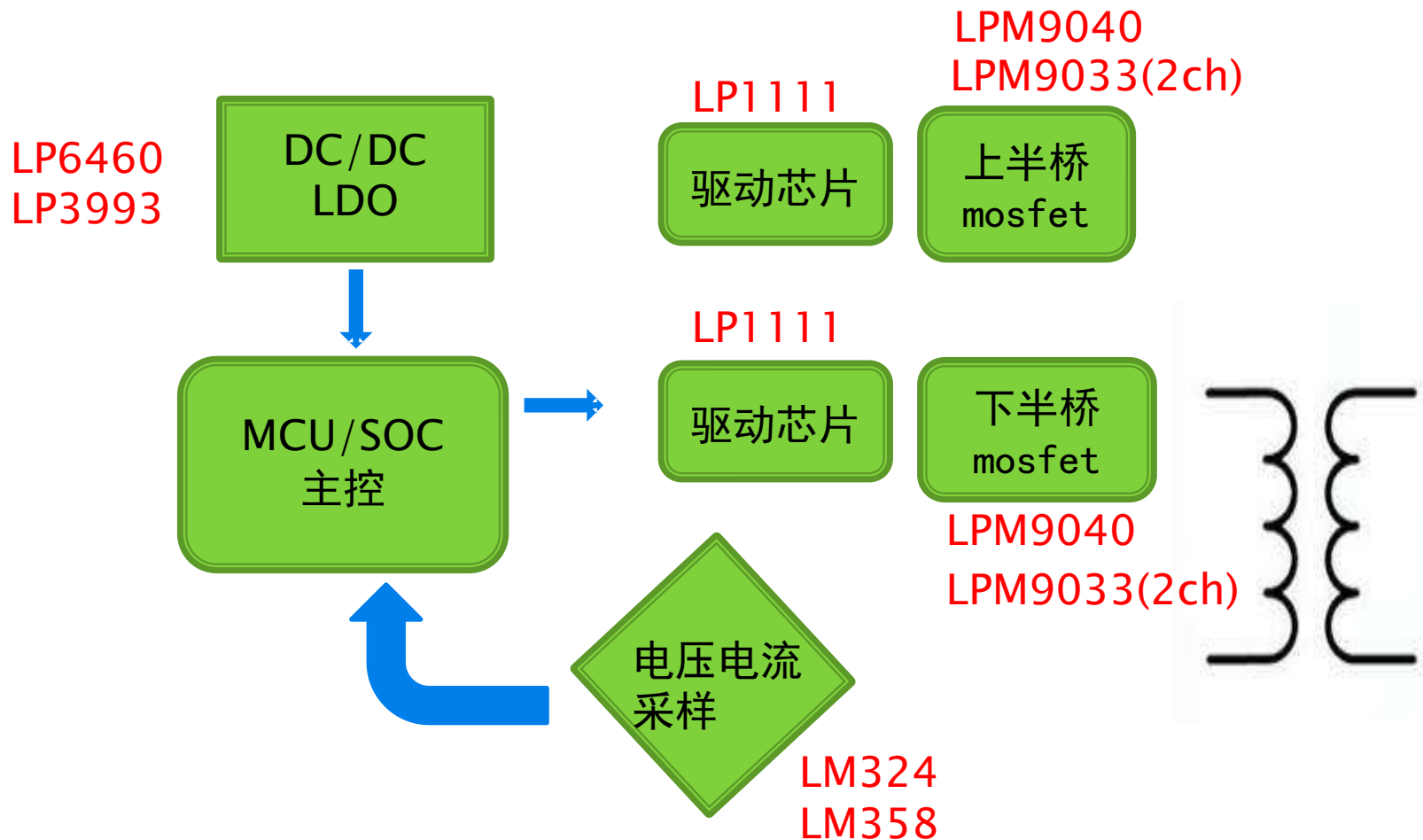
无线充电电路原理结构



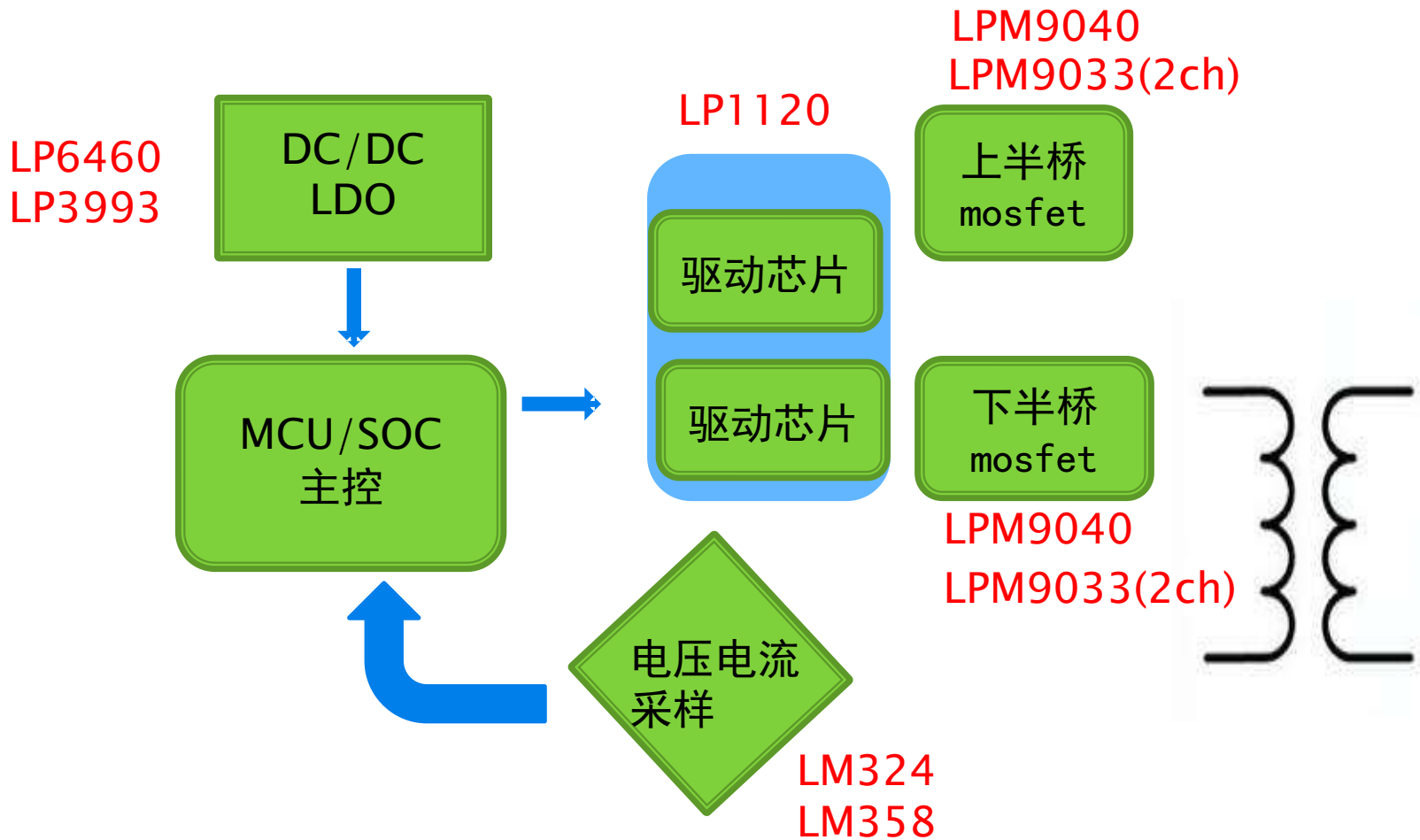
无线充电电路Tx原理结构



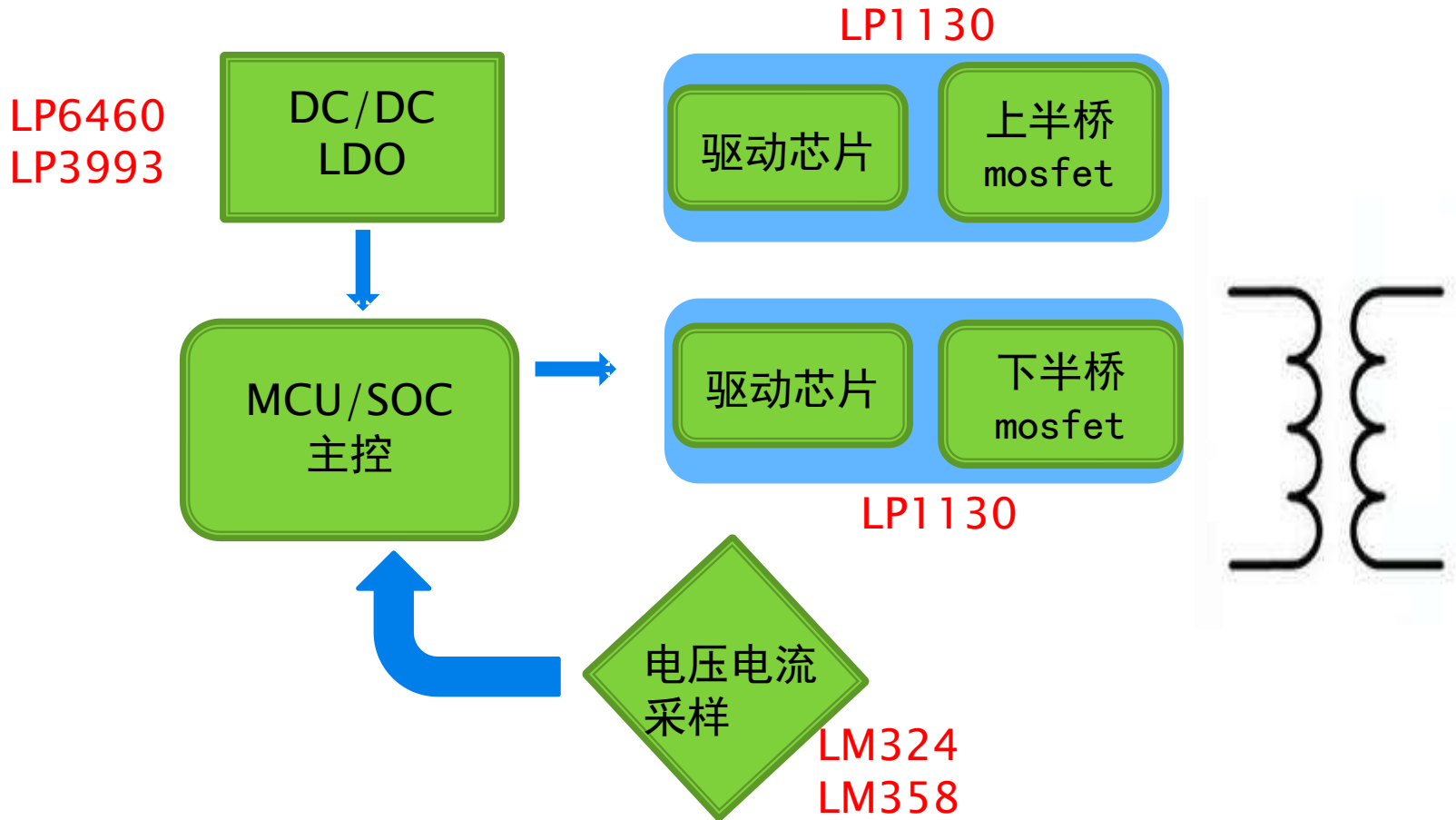
无线充电电路Tx原理结构1



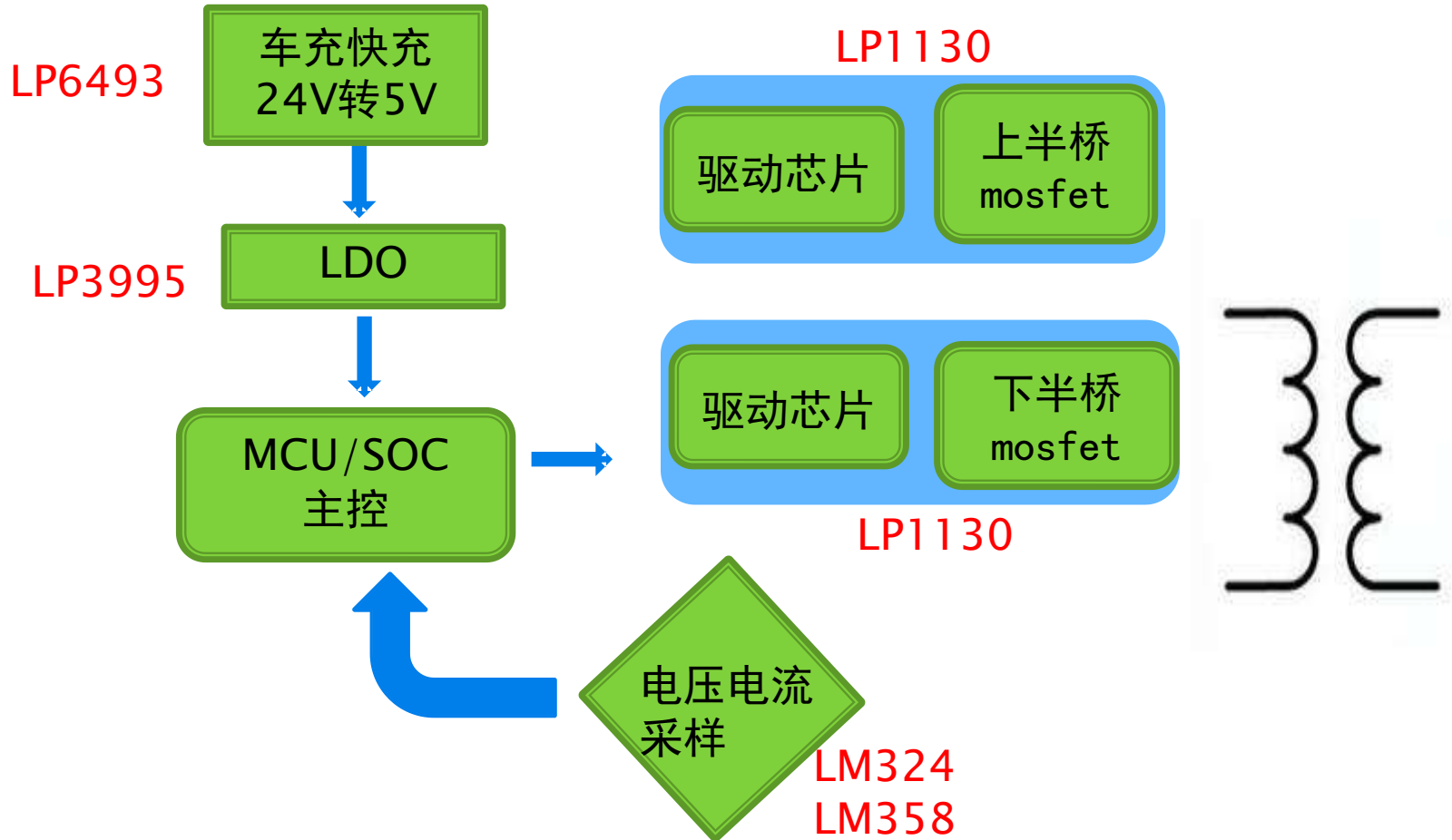
无线充电Tx原理结构2



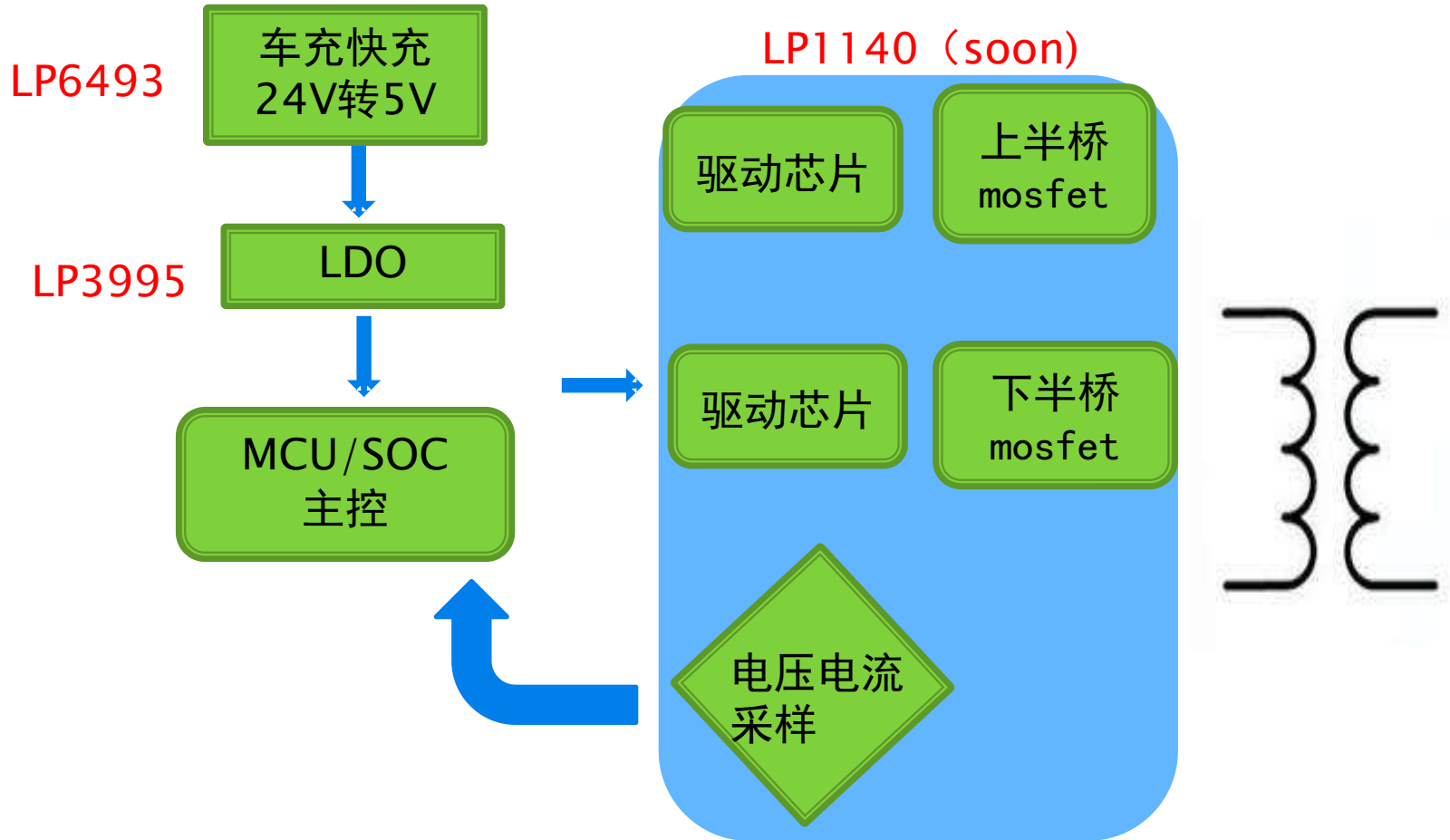
无线充电电路Tx原理结构3



车用无线充电Tx原理结构3



车用无线充电电路Tx原理结构3



Mosfet Gate驱动

LP1111

- 输入电压4.3V - 15V
- 自适应死区时间 mosfet随意选择
- 3.5A驱动电流
- 两种封装SOP8和TDFN8-2x2mm

LP1120

- 双通道mos Gate驱动
- 输入电压4.3V - 15V
- 自适应死区时间 mosfet随意选择
- 3.5A驱动电流
- 两种封装SOP16和TQFN16

半桥

LP1130

- 输入电压4.3V – 15V
- 自适应死区时间
- 内置2ch N mosfet（8毫欧内阻）
- 封装QFN16

LP1131

- 输入电压4.3V – 6.5V
- 自适应死区时间
- 内置2ch N mosfet（18毫欧内阻）
- Id 6A mosfet 电流
- 简易封装SOP8

主回路降压DC/DC

LP6483

- 3A大电流输出
- 输入电压4.3V – 30V
- 同步整流内置N mosfet
- 封装eSOP8

LP6460

- 2A大电流输出
- 输入电压4.3V – 16V
- 同步整流内置 N mosfet
- 封装SOT23-6

车充降压DC/DC

LP6493

- 3A大电流输出
- 输入电压4.3V – 36V
- 同步整流内置N mosfet
- 封装eSOP8
- 支持快充

LP6490A

- 2.4A大电流输出
- 输入电压4.3V – 36V
- 同步整流内置N mosfet
- 封装eSOP8
- 支持快充

LDO&协议

LDO-LP3995, LP3993

- 3-40V输入电压范围
- 静态电流4uA
- 200mA大电流输出
- 400mV低压差
- SOT89和SOT23封装

协议（诱骗）芯片-LP101

- 诱骗协议包含BC1.2/Apple/AFC/QC2.0/QC3.0/FCP
- 全Asic设计，电压稳定
- 兼容性强
- SOT23封装
- 全系列协议芯片：**LP100**(QC2.0), **LP102**(USB识别), **LP103**(QC3.0+AFC+FCP), **LP104**(PD+QC, soon)

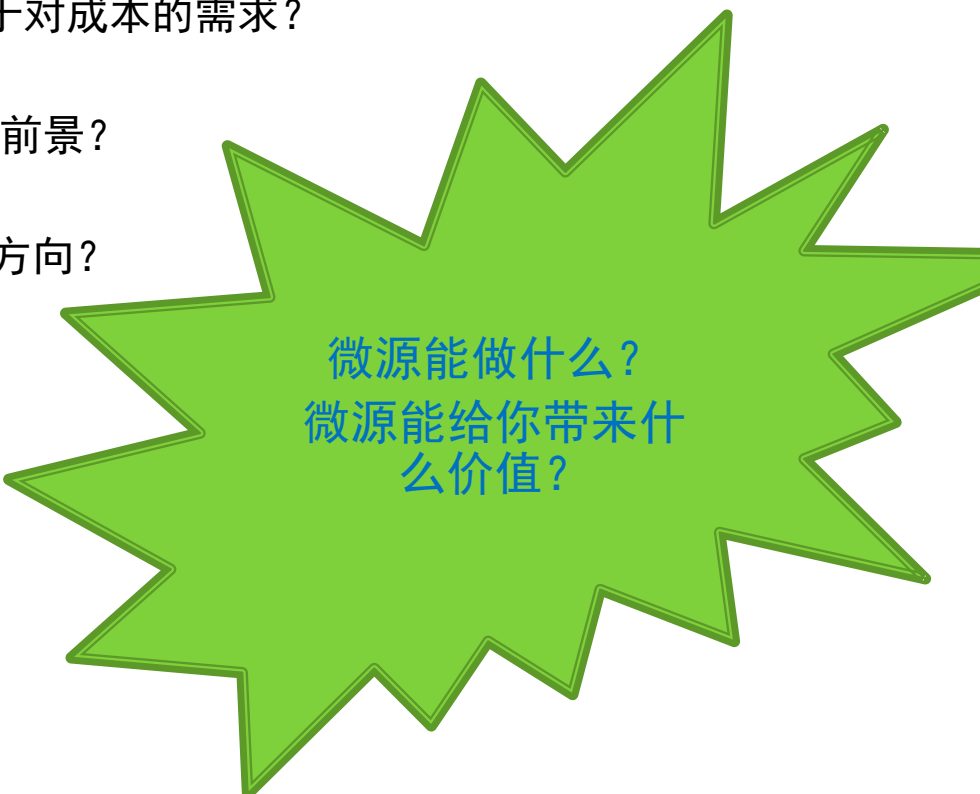
mosfet

型号	通道		封装	内阻(mΩ)	VDS(V)
LPM9040	1	N	TDFN-8	9	30
LPM9040A	1	N	SOP8	8	30V
LPM9033	2	N+N	TDFN-8	10	30
LPM9034	2	N+N	TDFN-8	18	30
LPM9042	2	N+N	DFN8 sop8	10	30
LPM9031	2	N+N	SOP8	18	30
LPM9926	2	N+N	SOP8	18	20
LPM4953	2	P+P	SOP8	45	20
LPM9029 D	2	N+P	SOP8	45	20
LPM3401	1	P	SOT23	45	30
LPM3400	1	N	SOT23	22	30

我们的思考

- 1.SOC内置驱动与分立方案的优劣势？
- 2.单芯片半桥全桥与分立方案的优劣势？
- 3.无线充对于体积的需求是否会大于对成本的需求？
- 4.SOC与简易MCU在无线充未来的前景？
- 5.无线充效率的提升与减小发热的方向？

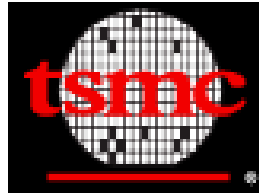
**高性价比的系统级解决方案！
电源管家，让设计更简单！**



微源能做什么？
微源能给你带来什么价值？

我们的供应链

晶圆



台积电

封装



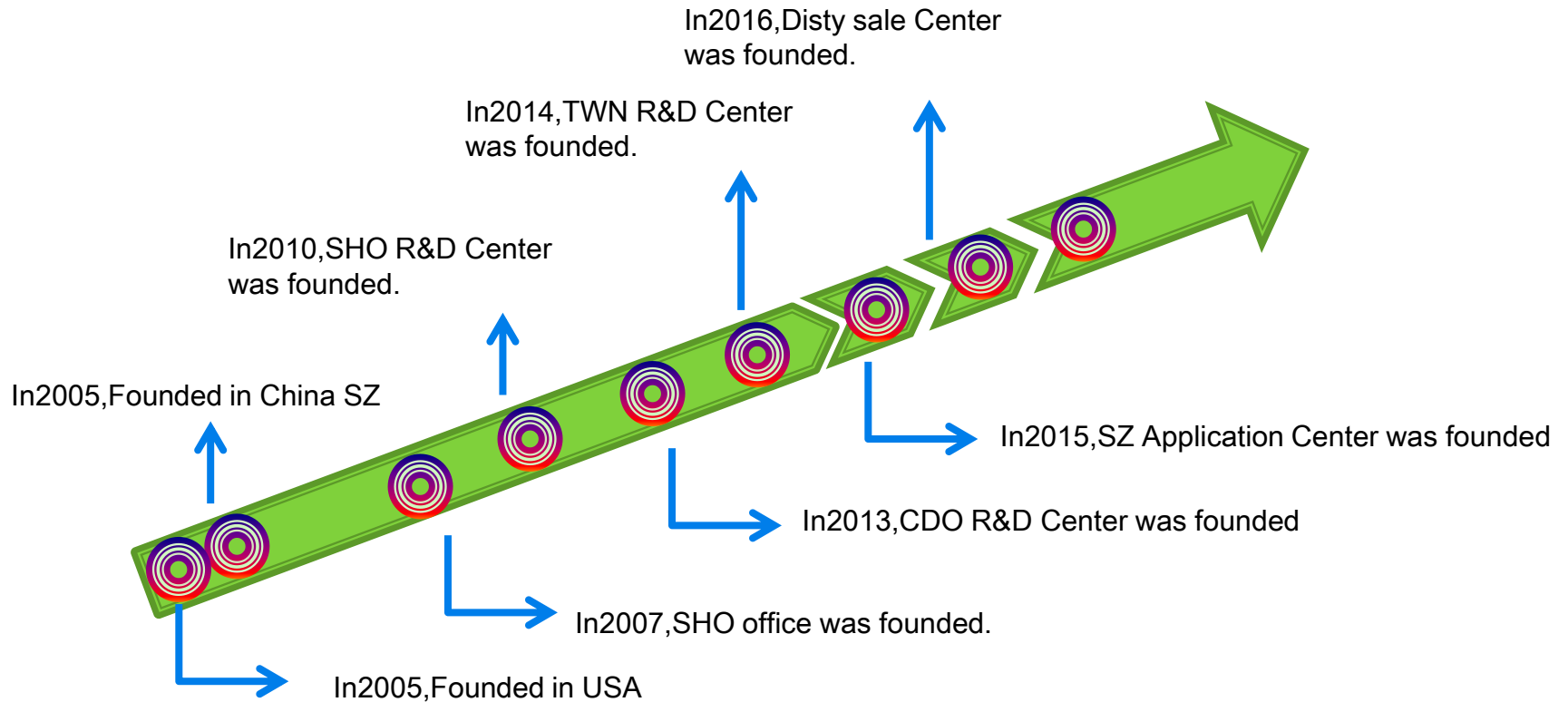
长电科技



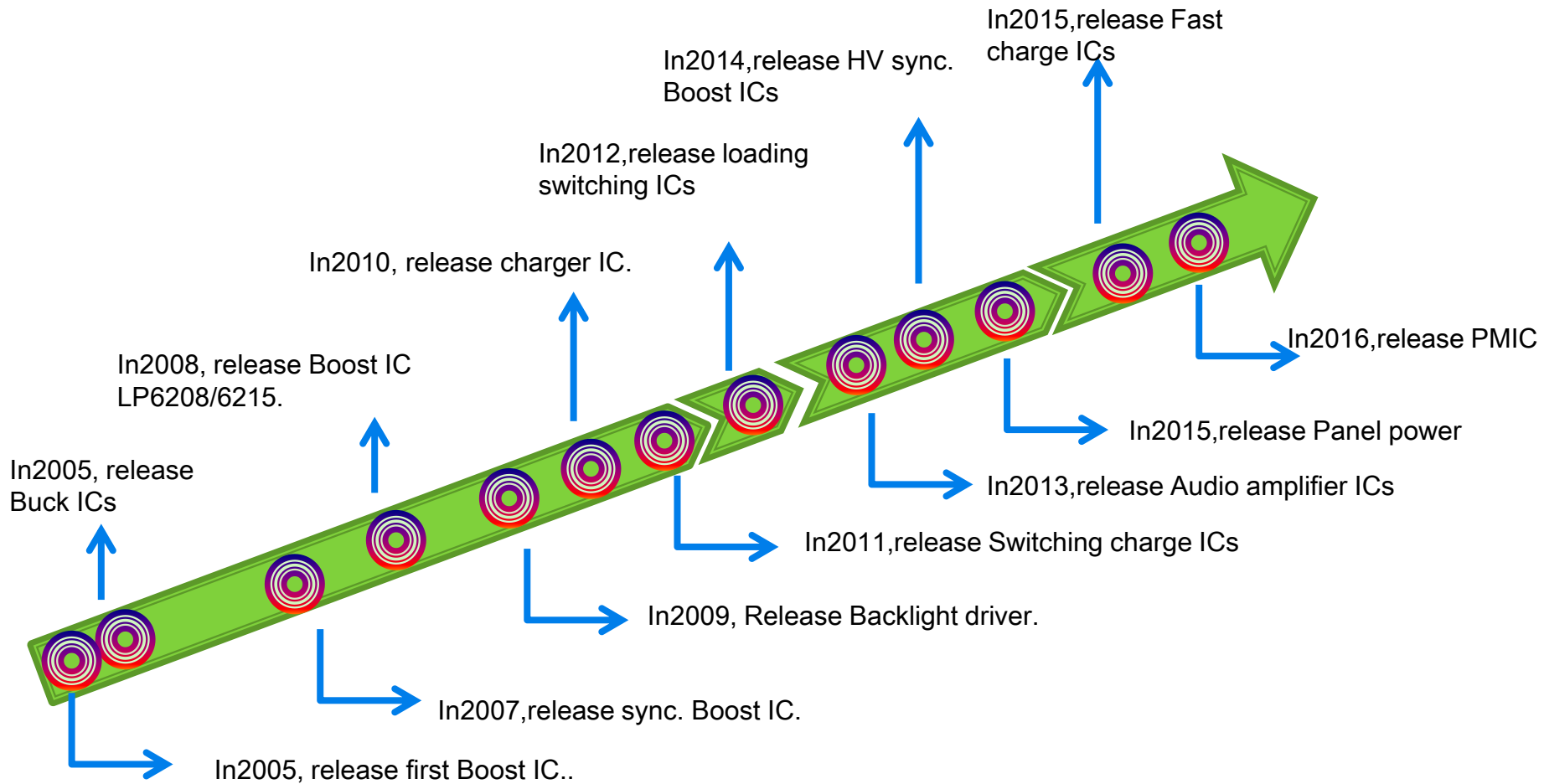
Our Office



Milestone

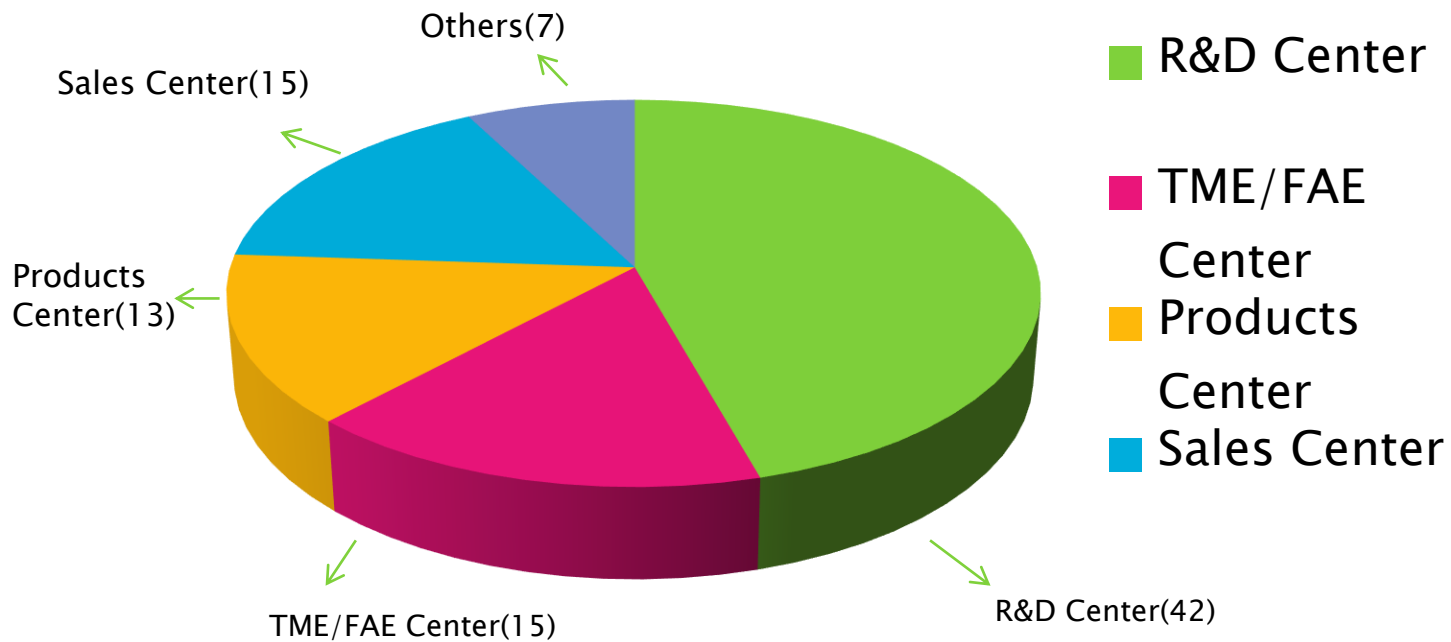


Products schedule



Functions of LPS Team

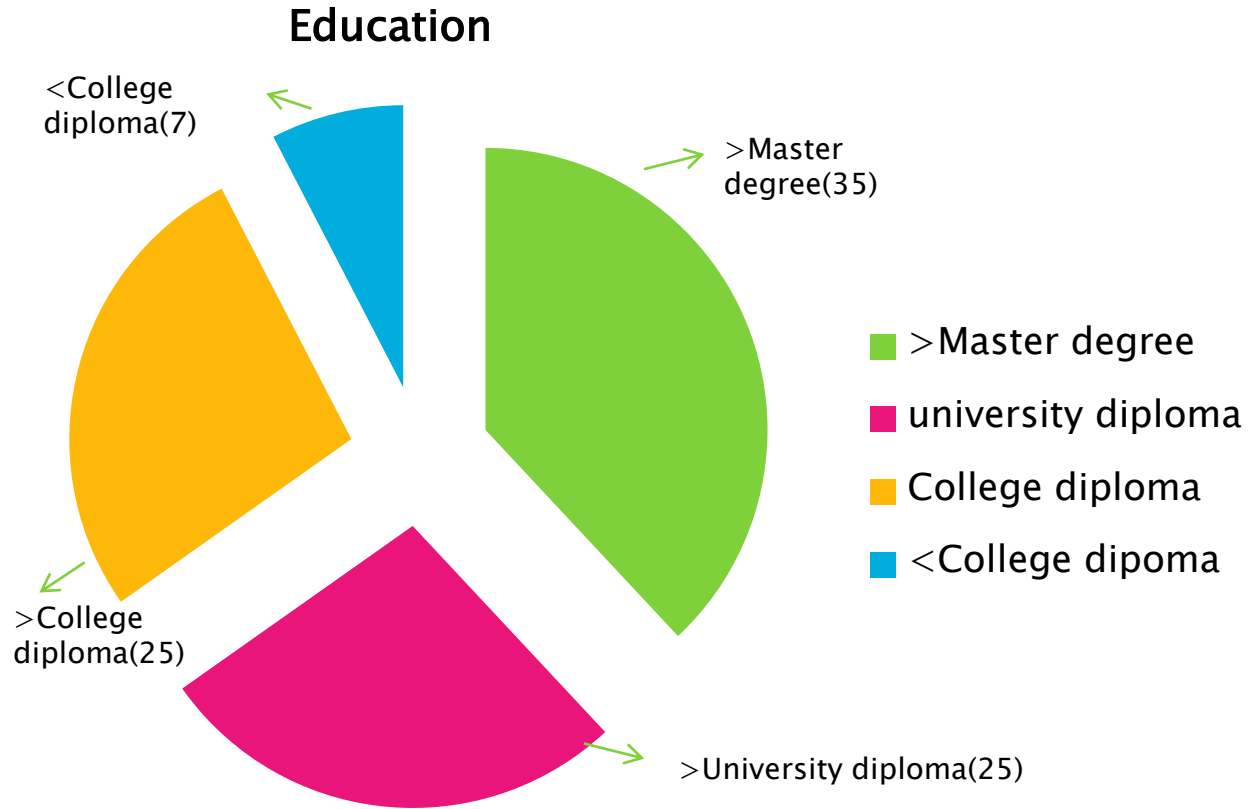
Lowpower Human Resource



* Employees in LPS: 92

* Until May/2017

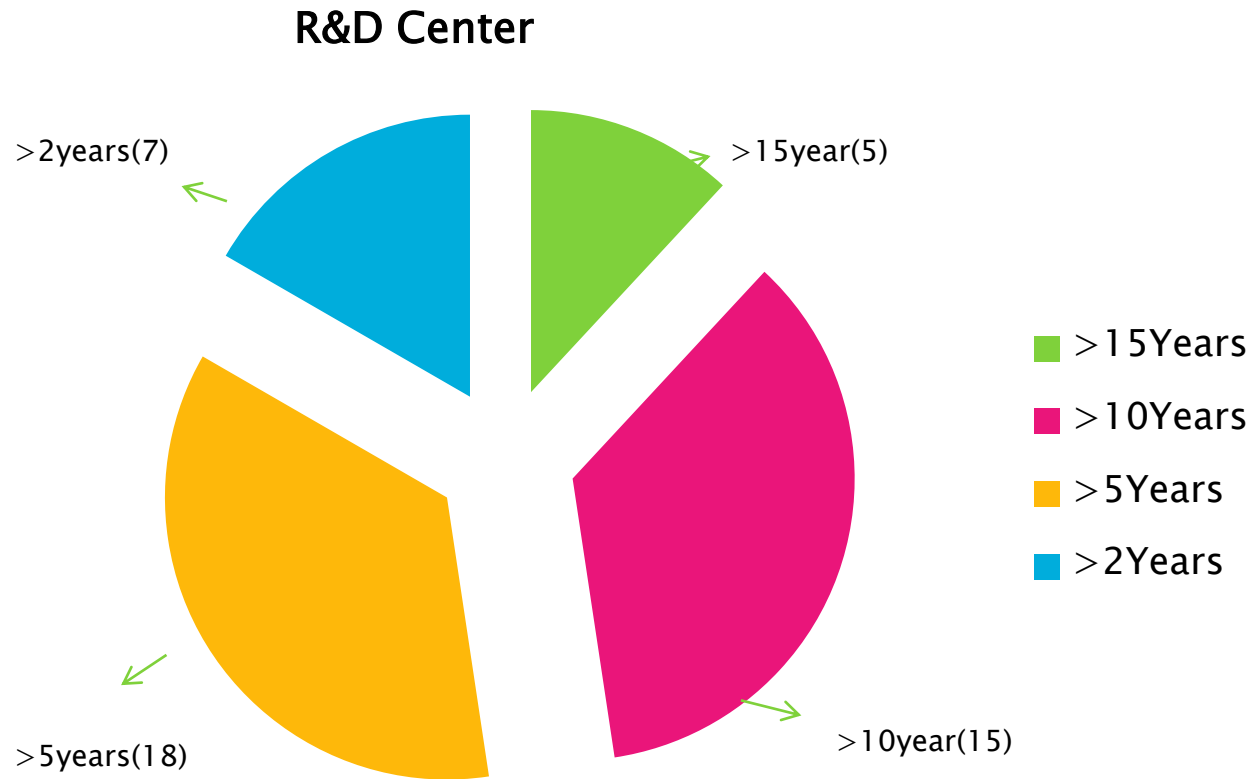
Experience of R&D Team



* Employees in LPS: 92

* Until May/2016

Experience of R&D Team



* Employees in R&D: 42

* Until May/2016

LPS Products&Market

3 Panel(3F)

Handheld panel
Work panel
Home products

5 system

System Power
Panel Power
Fast charge
Audio Amplifier
Mosfet

8 Products Line

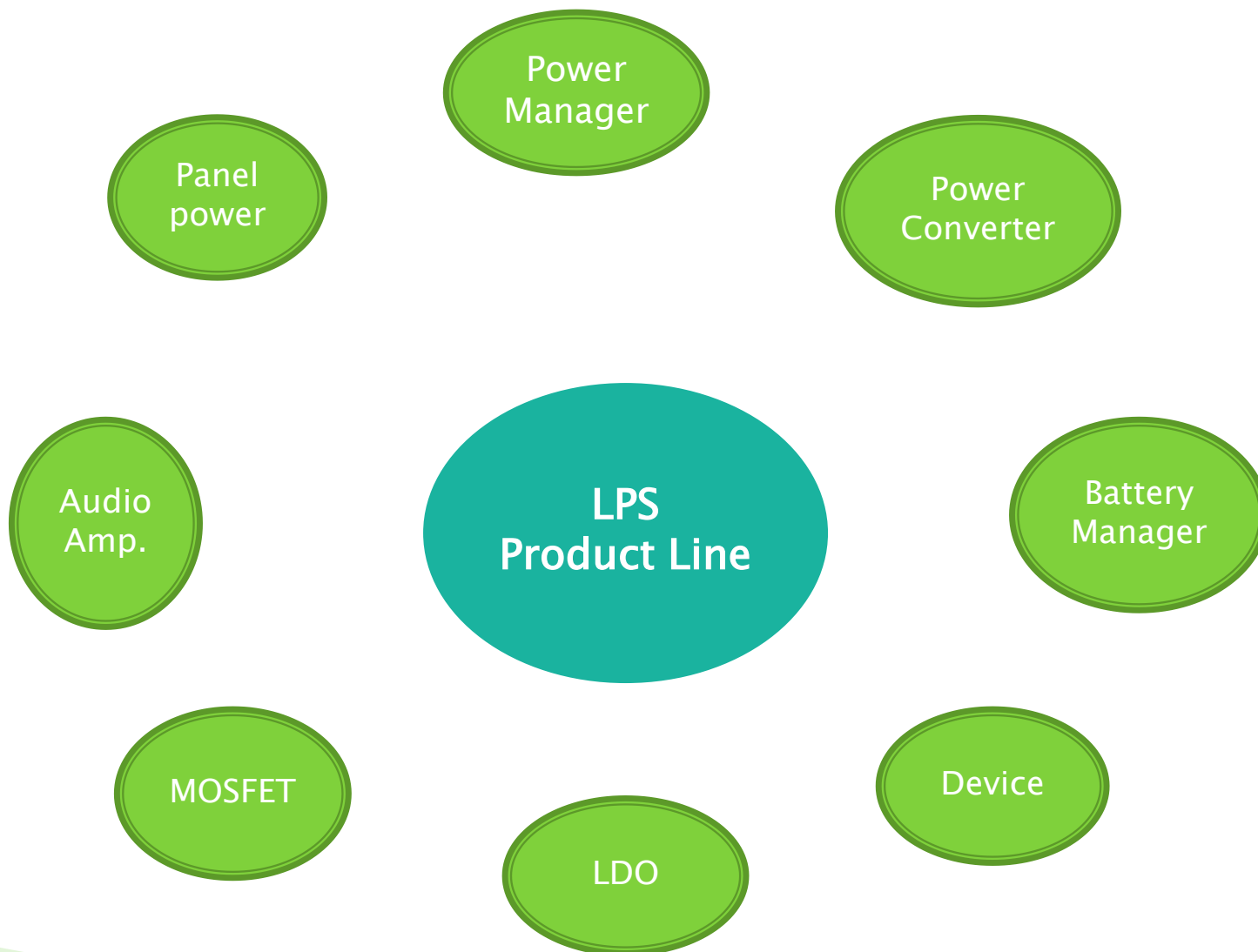
Power Converter
Power Management
Charge
LDO
Interface Device
Audio Amplifier
Panel Power
Mosfet

10 Field

MID/Sport DV
OTT/STB/Networks
Car charge/Camera
TV
Mobile phone
Panel
Audio Speaker
Power Bank
Safety Products
IoT

Lowpower Semi Family

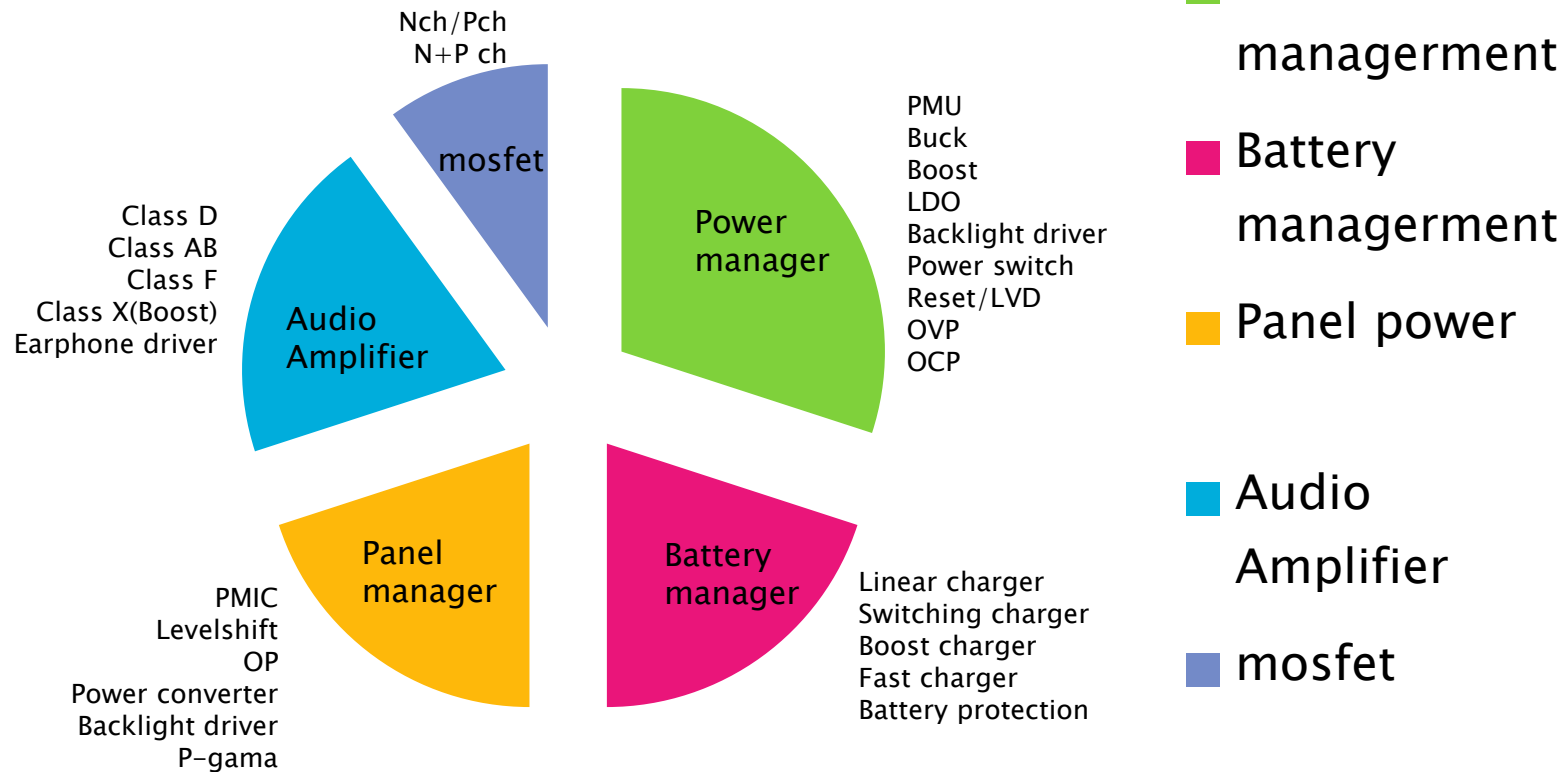
LPS Products



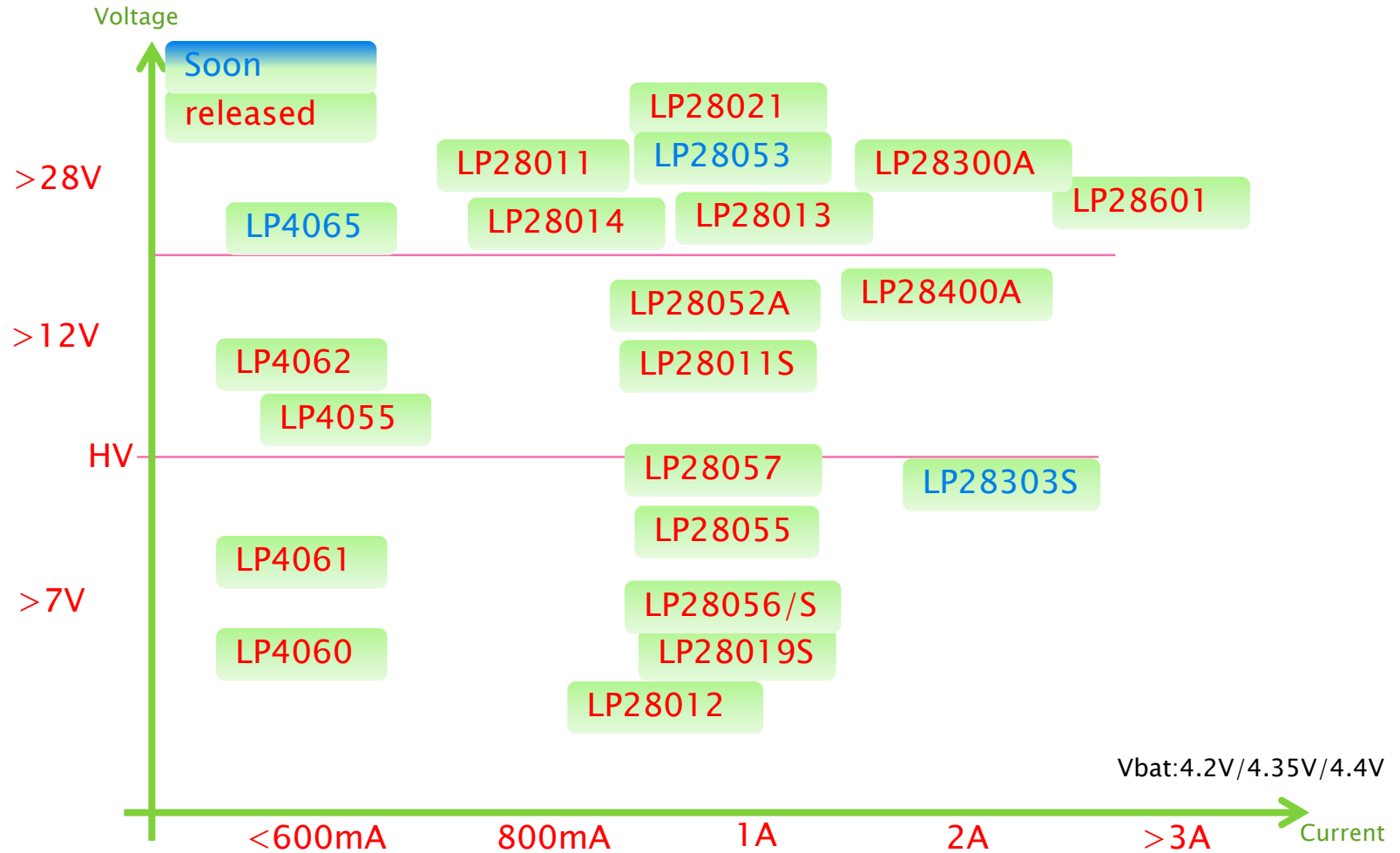
Application Market



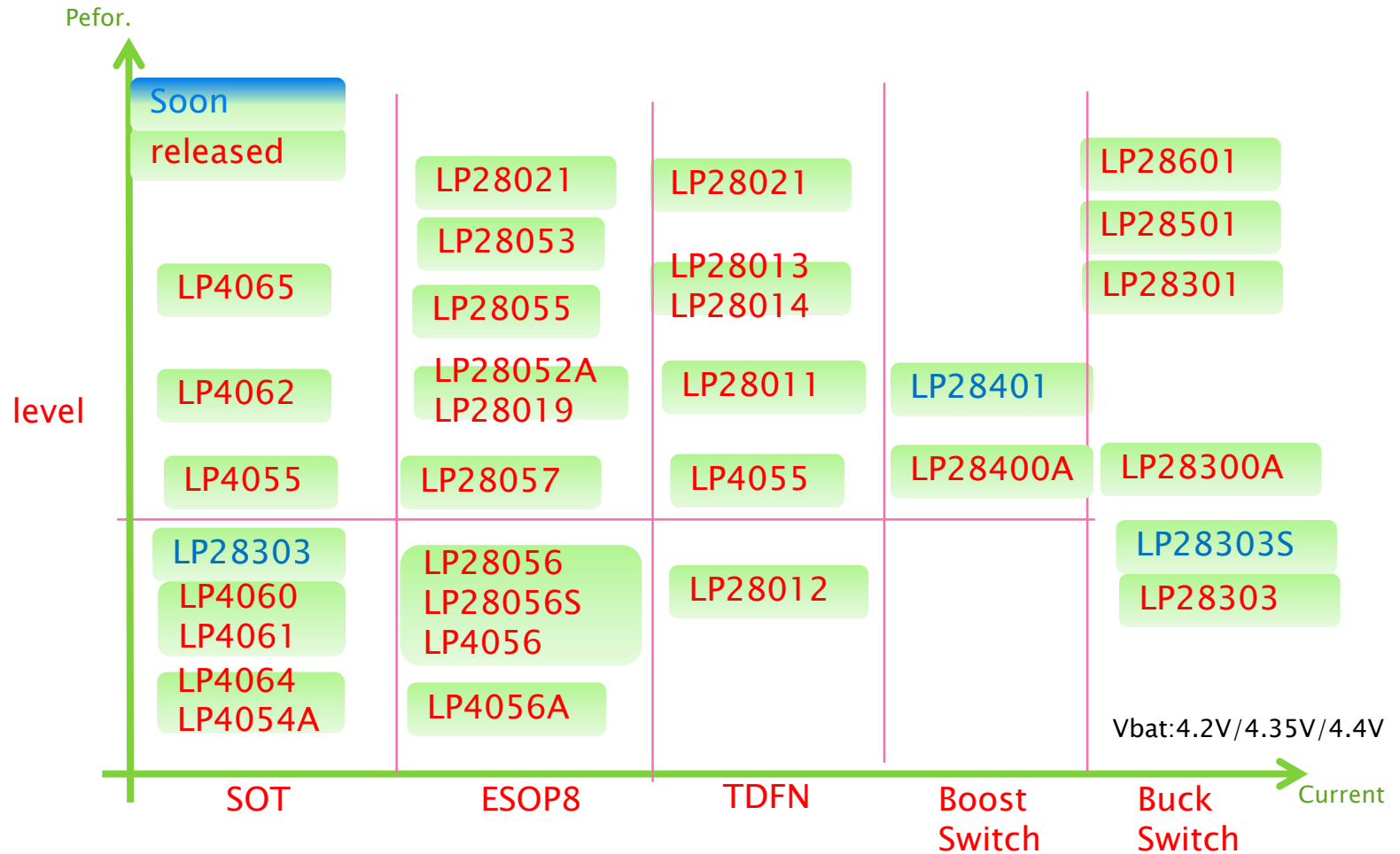
LPS Products



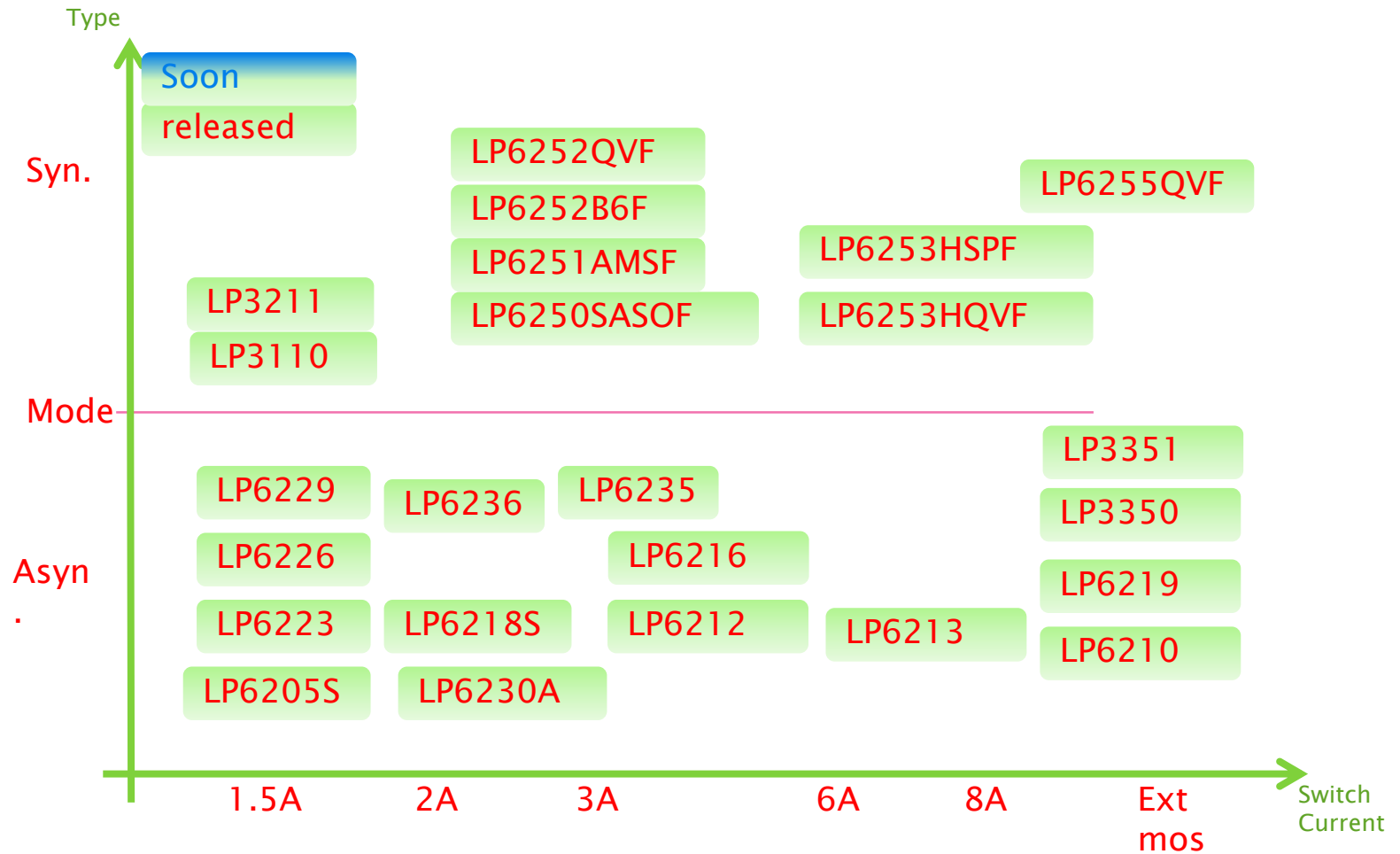
Battery Charge ICs



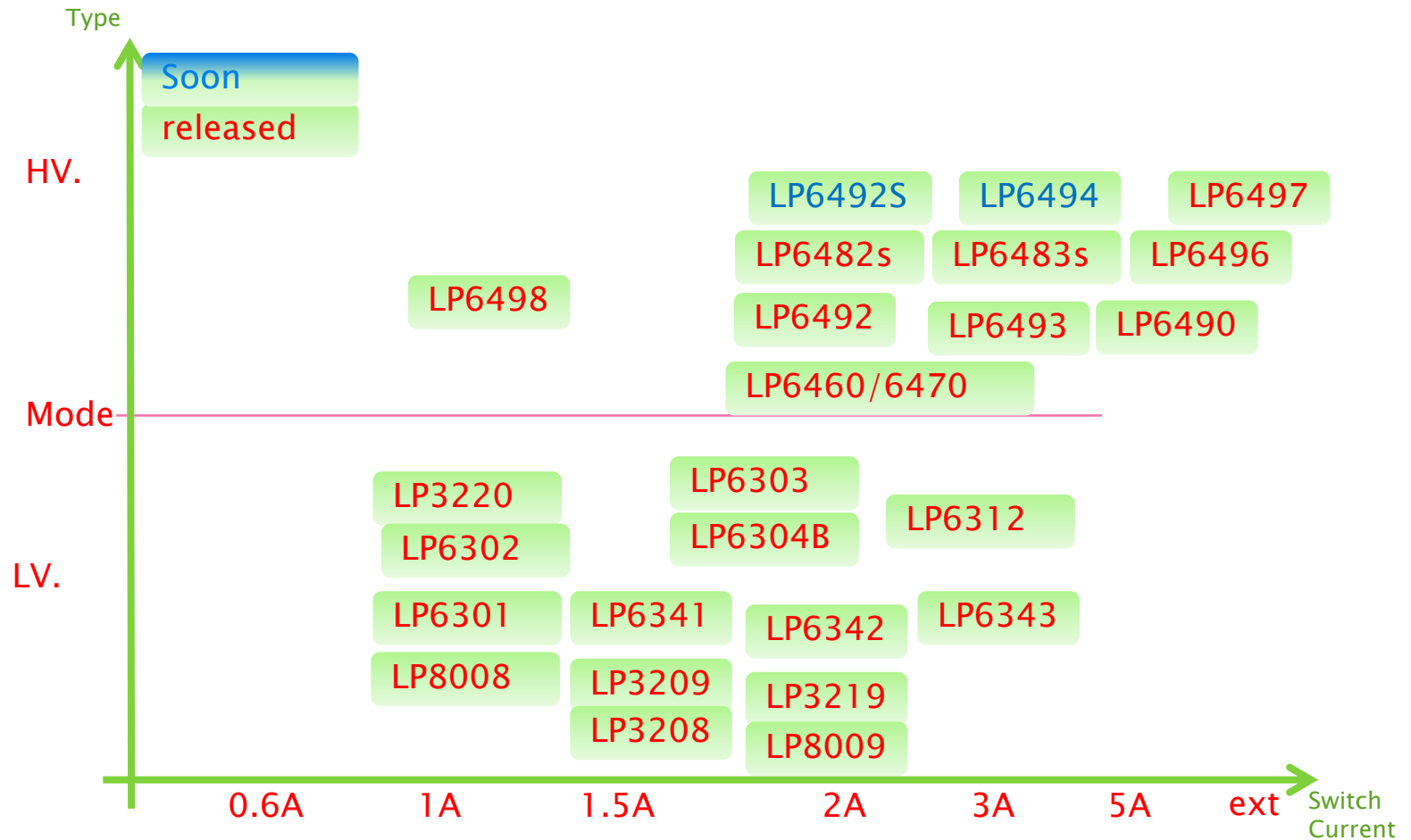
Battery Charge ICs



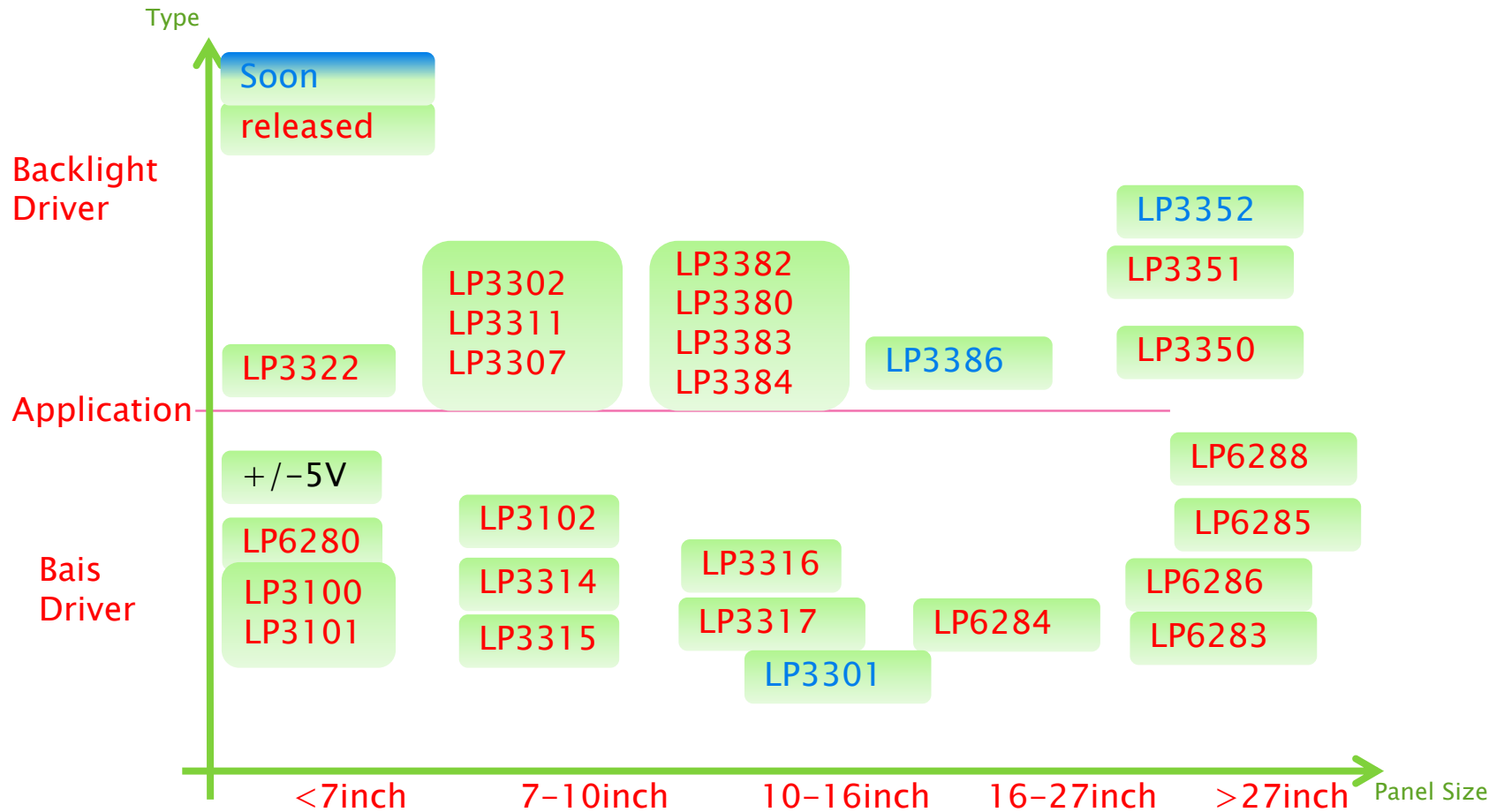
Boost Converter ICs



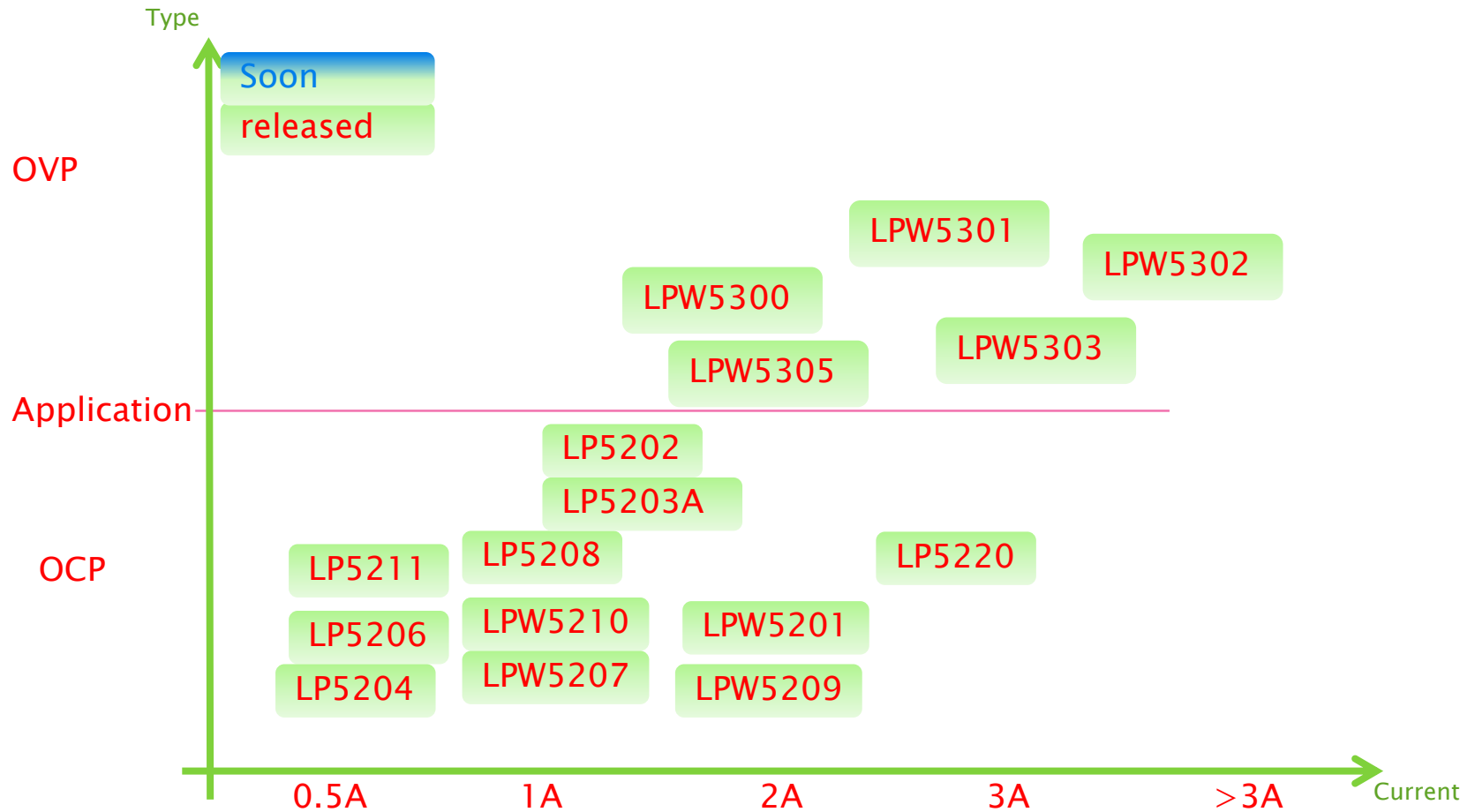
Buck Converter ICs



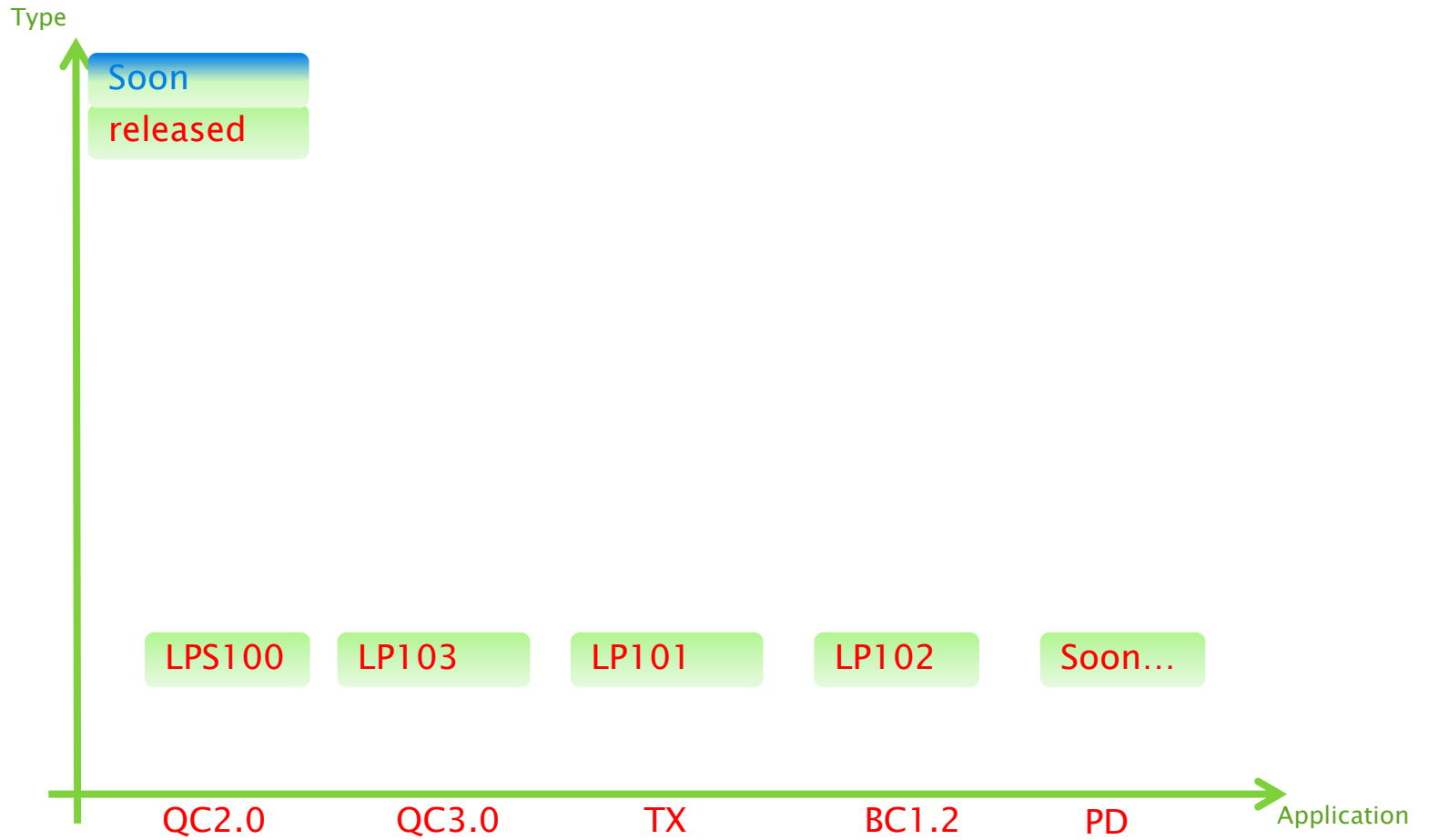
Backlight Driver ICs



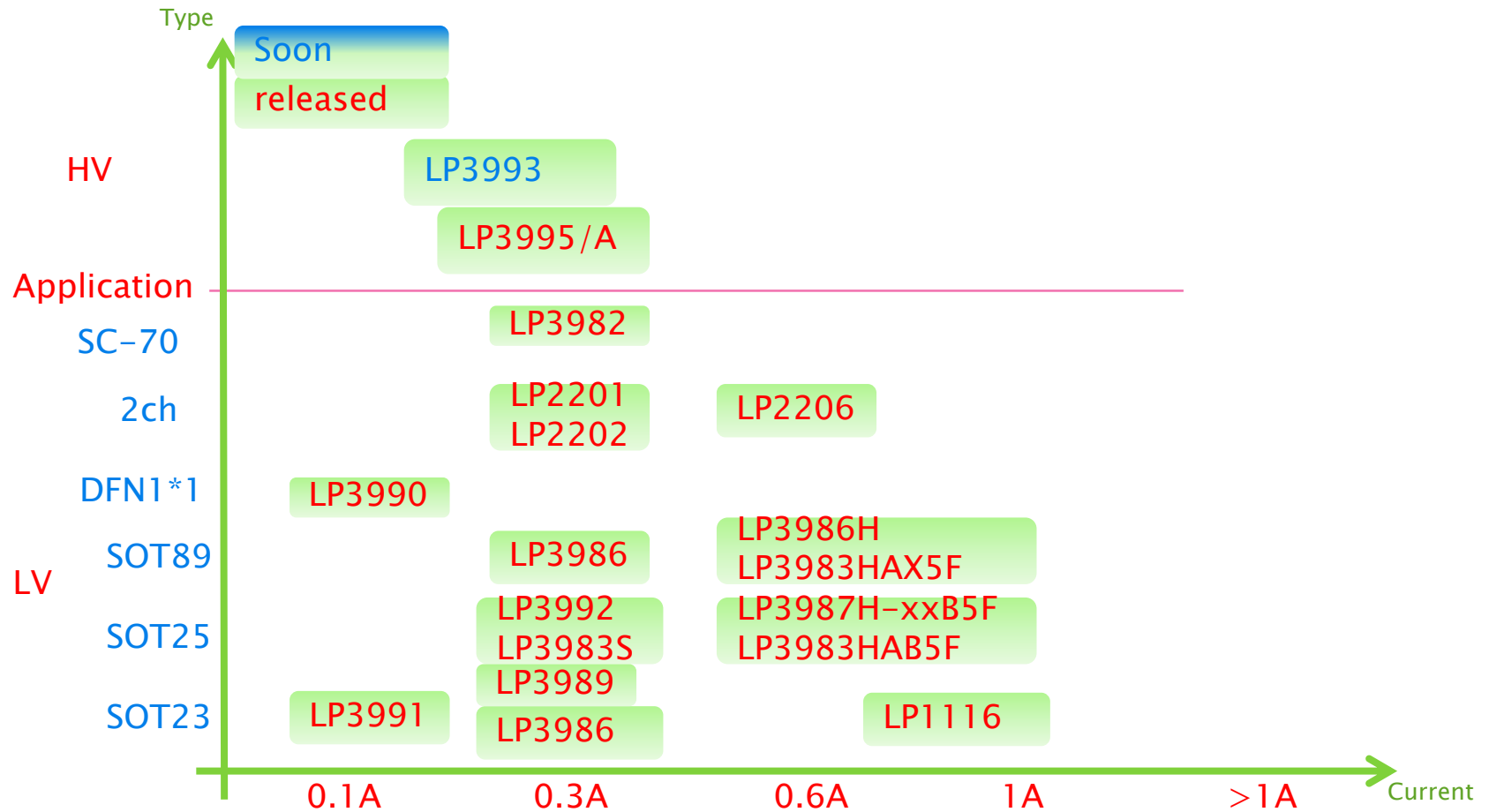
OVP/OCP ICs



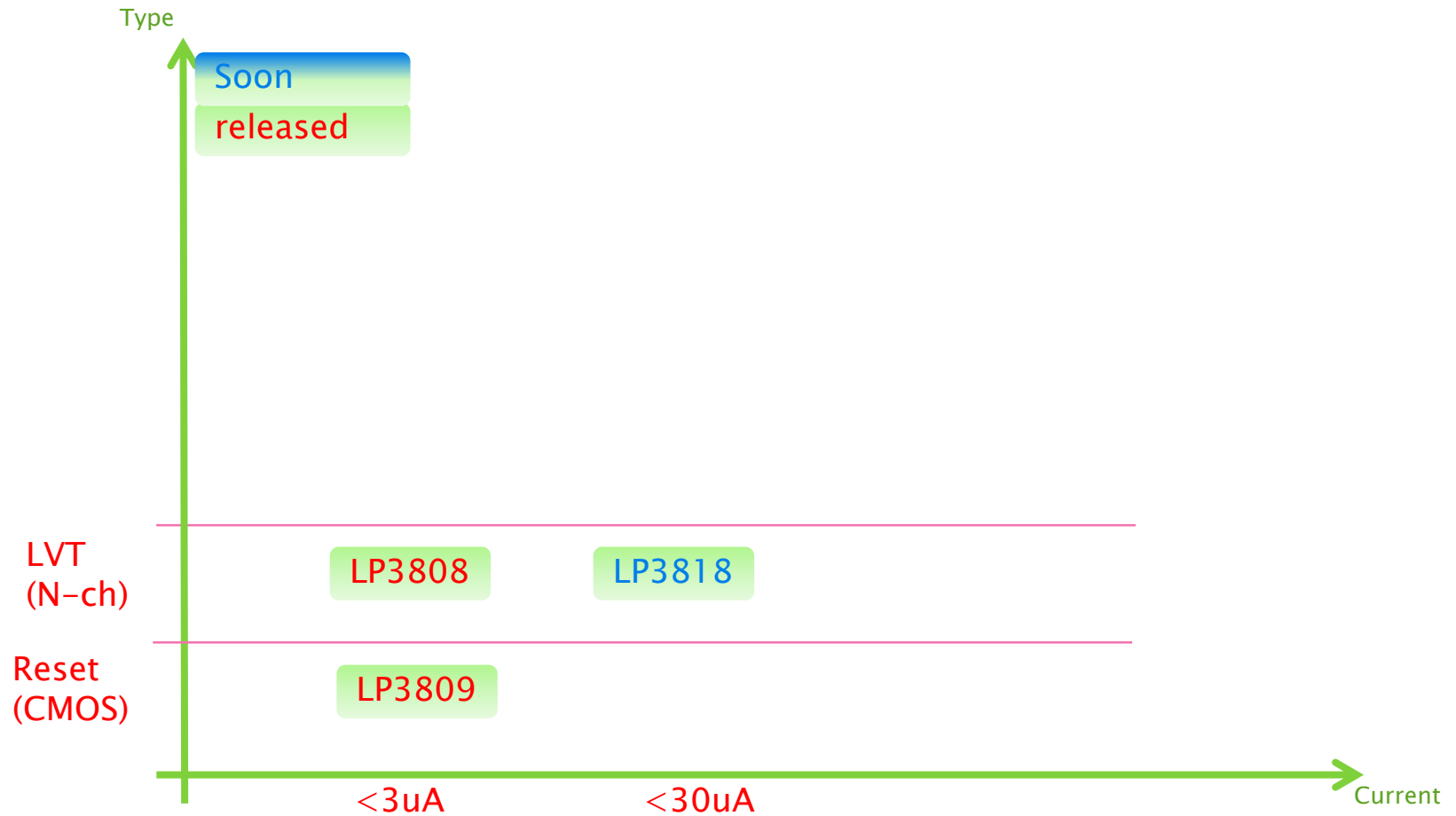
协议 ICs



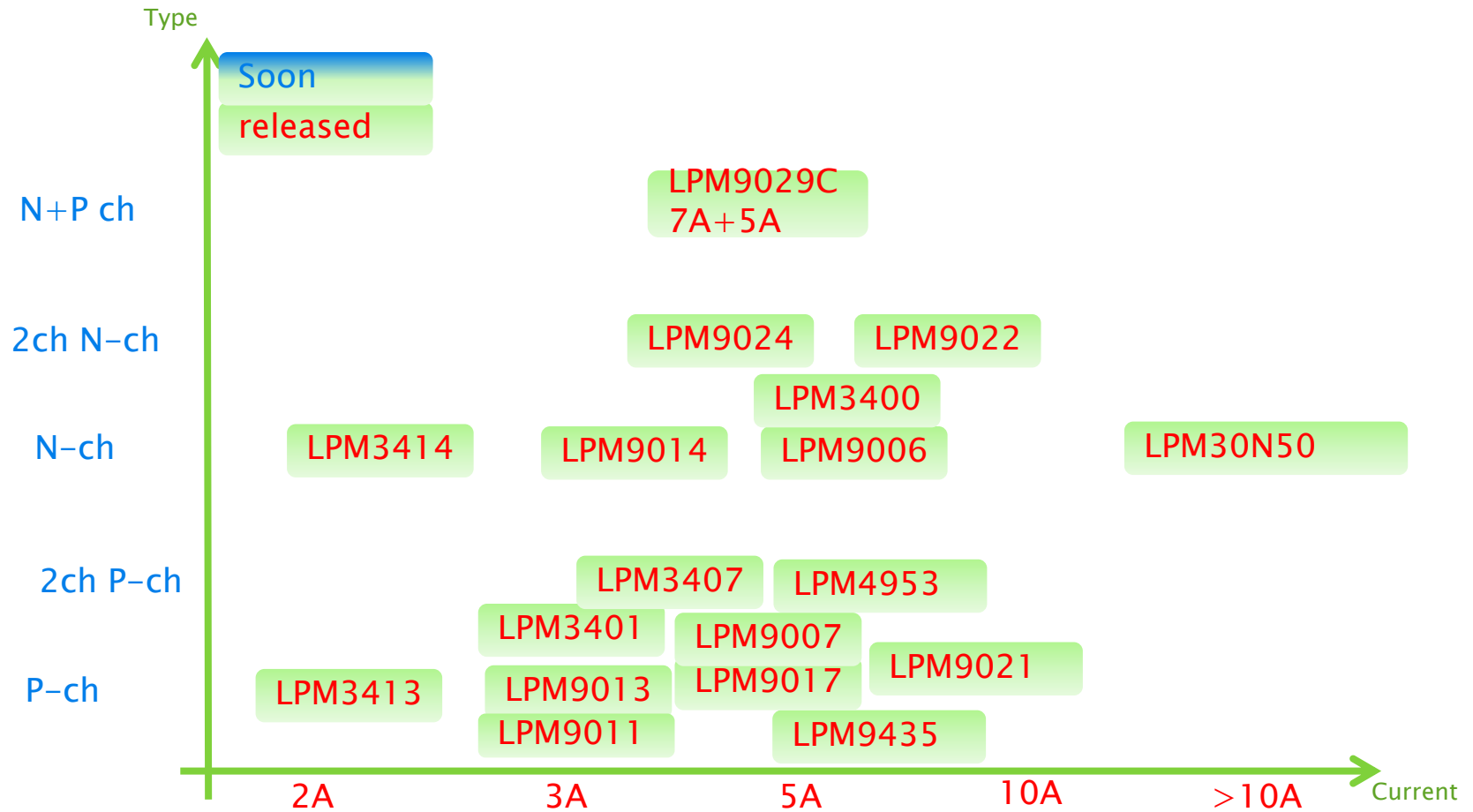
LDO ICs



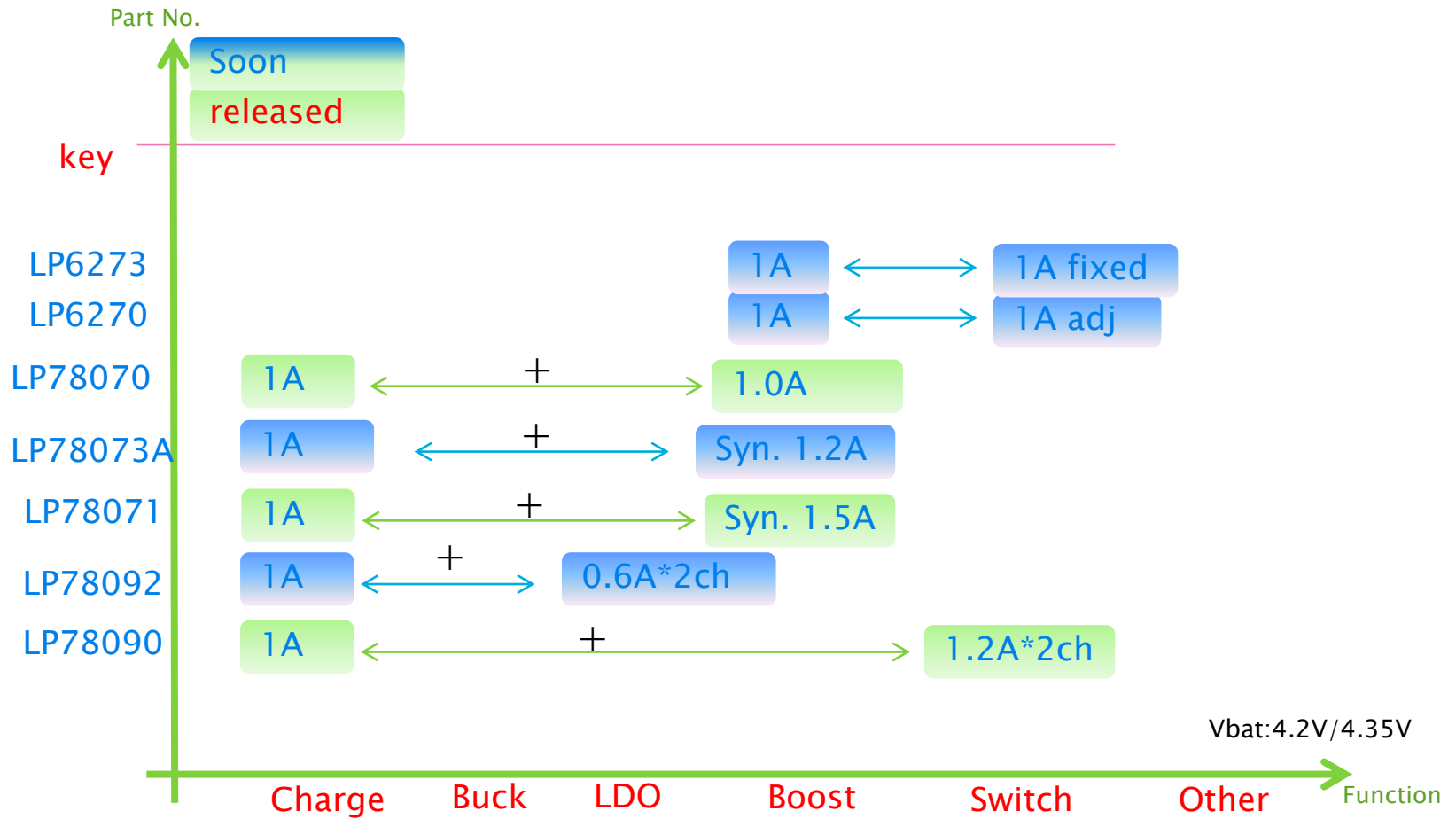
Reset/Voltage detector ICs



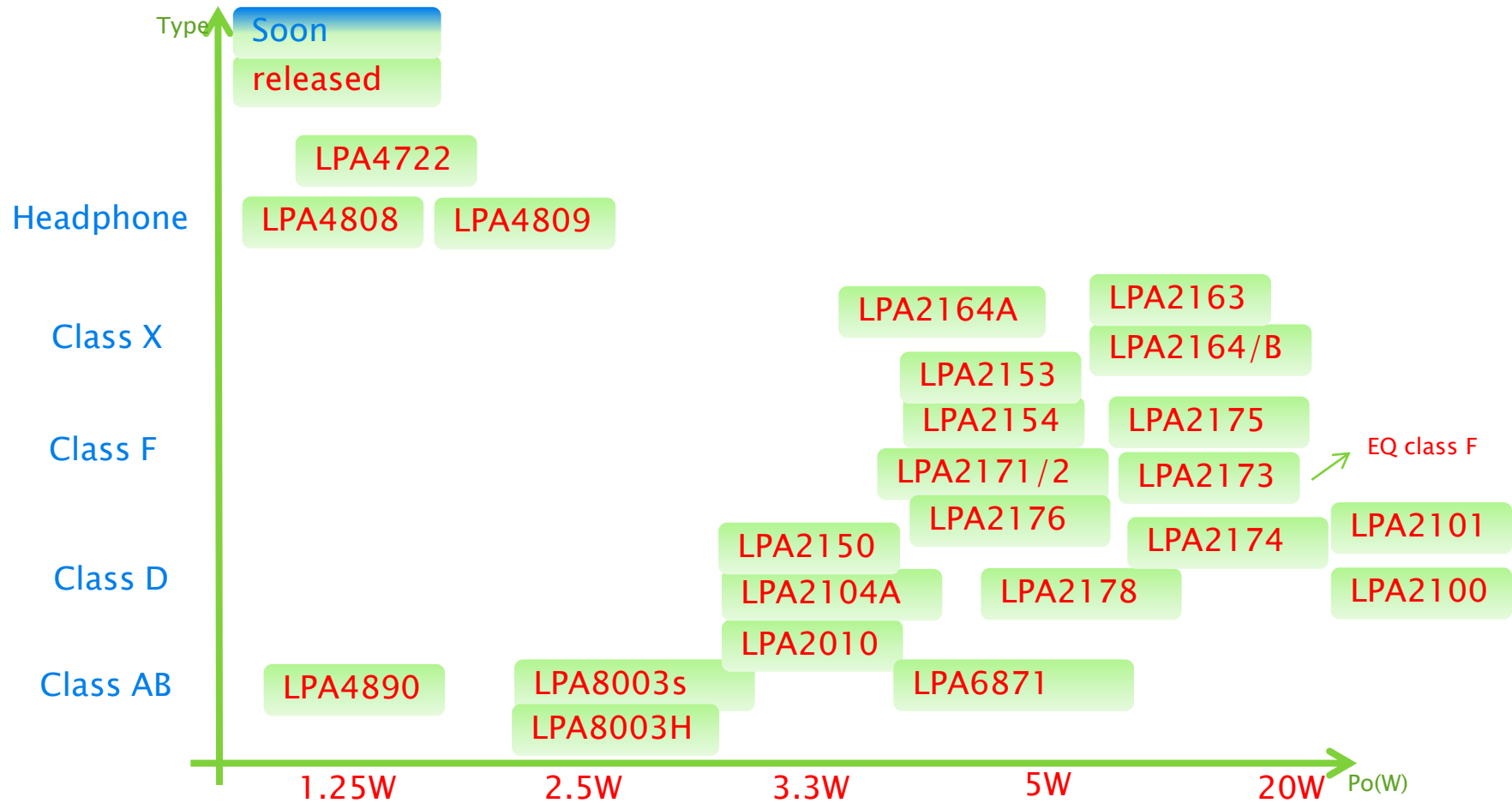
Power Mosfet



PMIC/Multichannel ICs



Audio Ampfilier ICs



Product list-1

Function	Series	Part No.		
Charger	Linear charger	LP40xx	LP280xx	
	Switch charger	LP283XX	LP282XX	
	Fast Charger	LP28301	LP28501	LP28601
Boost	Syn.	LP625x	LP628X	
	Asyn.	LP62xx	LP33XX	LP31xx
Buck	High Voltage	LP646X	LP648X	LP649X
	Low Voltage	LP634X	LP630X	LP32XX
LDO	High Vin Voltage	LP3993	LP3995	
	Low Vin Voltage	LP399x	LP398x	
Switch		LP520X	LP521X	LP522X

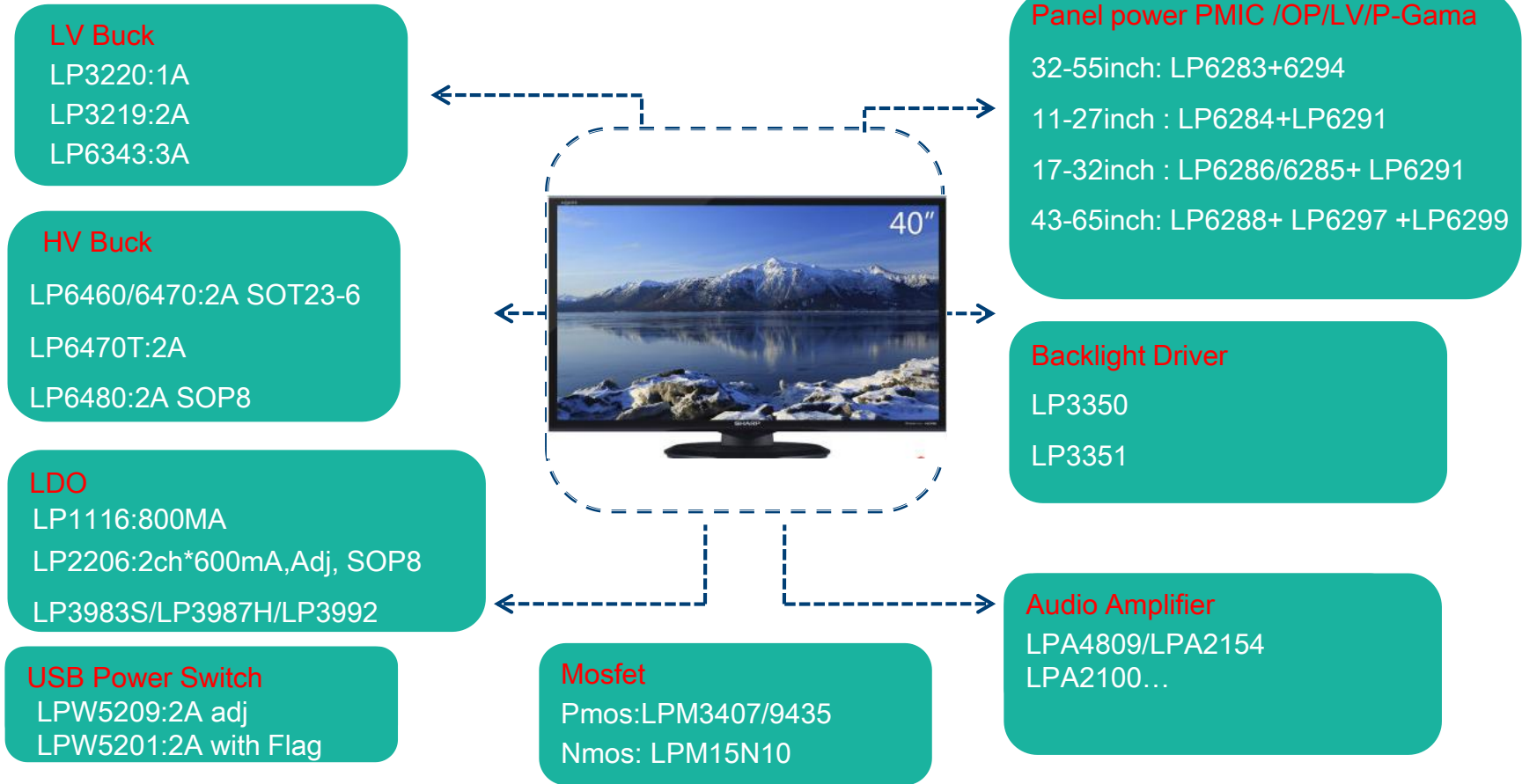
Product list-2

Function	Series	Part No.		
Audio Amp.	Class AB	LPA4890	LPA8003s	
	Class D	LPA2100	LP2104	LPA8302
	Class F	LPA217X	LPA215X	
	Class X	LPA216x	LP2164A	LPA2102
	earphone	LPA4809	LPA4808	
Reset	LVD	LP3808		
	Reset	LP3809	LP3803	LP3811
OVP/OCP		LP530X	LPW52xx	
mosfet	N-ch	LPM34xx	LPM90XX	
	P-ch	LPM34XX	LPM90XX	

Product list-3

Function	Series	Part No.		
PMIC	Charge+Boost	LP7807X		
	Charge+Buck	LP7808X		
	Charge+LDO	LP7809X		
	Buck+Boost	LP7806x		
	Buck+LDO	LP7805X		
	Panel	Power	LP6280	LP6283/4
Levelshift		LP629x		
Boost		LP31XX		
OP		LP627x		

LPS for TV



1st solution: LP3219+6460+6283+3350+9017+5210+3983S

LPS for MID

Buck Converter

LP3220/3219: 1A/2A
 LP6312: 2*2A
 LP6304B: 4*2A

Fast charger

LP28601 : 3.5A with OTG
 LP28021: 1A Charger

OVP/OCP

LP5301: 36V/2.5A
 LPM5303: 36V/2.5A

Panel /backlight driver

LP3382/0/LP3307(backlight)
 LP3316/7(Bias)
 LP3102/6280(+/-5.6V)...



Audio amplifier

LPA8302
 LPA4890

Mosfet

LPM9021: 6A TDFN2*2
 LPM9022: 2*5A TDFN2*3mm
 LPM3401/LPM3400/3413/4

LDO

LP3990H: 500mA DFN1*1mm
 LP3987H: 500mA SOT25
 LP3983S: 300mA adj SOT25
 LP3992: 300mA SOT25

OTG Boost

LP6252: 1A Syn.
 LP6253HQVF: 2A Syn.
 LP6226+LPW5210...

1st solution: LP28601 + 6304 + 6252 + 3382 + 5203A + 8302

LPS for VR/AR

Buck Converter

LP3220/3219: 1A/2A
 LP6312: 2*2A
 LP6304: 4*2A

Fast charger

LP28601 : 3.5A with OTG
 LP28021: 1A Charger

OVP/OCP

LP5301: 36V/3A
 LPM5303: 36V/2.5A

Panel /backlight driver

LP3382/0/LP3307(backlight)
 LP3316/7(bias)
 LP3102...



Audio amplifier

LPA8302
 LPA4890

Mosfet

LPM9021: 6A TDFN2*2
 LPM9022: 2*5A TDFN2*3mm
 LPM3401/LPM3400/3413/4

LDO

LP3990H: 500mA DFN1*1mm
 LP3987H: 500mA SOT25
 LP3983S: 300mA adj SOT25
 LP3992: 300mA SOT25

OTG Boost

LP6252: 1A Syn.
 LP6253HQVF: 2A Syn.
 LP6226+LPW5210...

1st solution: LP28601+6304+6252+3382+5203A+8302+3990

LPS for Car DVR

LV Vcore GPU/IO/DDR

LP6303:3A Buck
LP3219:2A Buck
LP3220:1A Buck

HV Syn Buck

LP6490:3.5A/40V
LP6483/2S:3A/2A/36V

OVP/OCP

LP5303 :2.5A
LP5300/1: 1.5A/2.5A

Charge

LP28501 : 3.5A ,16V HV
LP4060/4055 : 0.6A
LP28021 : 36V/1A

Panel Backlight driver

Backlight: LP3382
+/-5V Bias: LP3102
Vbias: LP3316/LP6236QVF



Audio amplifier

Class AB: LPA4890:1.2W
Class D: LPA2100 25W
Class F: LPA2153 2*5W

MOSfet

Pmos: LPM3401/3413/9435/4953/9021
Nmos: LPM3400/3414/9006
N+Pmos: 9029C

LDO

1ch: LP3992, 3983S, 3987H
LP1116, 3990
2ch: LP2201/2203/2206

OTG

LP62523H: 2.5A
LP6252: 1.2A
LP6236: 1A

1st solution: LP28021+6303+6252+3307+5203A+4890

LPS for Sport DV

Buck

LP6312: 2*2A Buck
 LP6304: 4*2A Buck
 LP6301: 1*1.5A Buck
 LP3219/3220: 2A/1A

PMIC:Charge+LDO

LP78090 : 1A charge+2Ch
 600 mA LDO

OVP/OCP

LP5303 :2.5A
 LP5301: 1.5A

Charge

LP28501 : 3.5A /16V HV
 LP4060/4055 : 0.6A
 LP28021 : 1A , Battery Reverse
 protection

Panel B.L.

Backlight: LP3382/3307
 +/-5V Bias: LP3102/6280
 Vbias: LP3317/LP6236QVF



Audio amplifier

LPA4890: 2.5W Class AB
 LPA8302: 3W Class D

Mosfet

Pmos:LPM3401/3413/9435/4953/9021
 Nmos: LPM3402/3414/9006
 N+Pmos: 9029C

LDO

1ch:LP3981,3983S,3987H,3992,
 LP1116,3990
 2ch:LP2201/2203/2206

OTG

LP62523H: 2.5A
 LP6252: 1.2A
 LP6236: 1A

1st solution:LP5301+78090+6303+6252+3307+5203A

LPS for STB/OTT

LV Buck

LP6304:4*2A Buck
 LP6303:3*2A Buck
 LP6312:2*2A
 LP3219/3209/3220:2A/1.5A/1A

HV Buck

LP6470:2A syn.
 LP6460:2A Syn.
 LP6480/1:2A/3A

OVP/OCP

LP5303 :2.5A
 LP5302: 1.5A+ ext mos

Reset

LP3809-2.63V/2.93V:260mS

USB Power Switch

LPW5206/5208/5210
 LPW5220:2*1.5A
 LPW5203:power switch



LDO电源芯片

LP1116:800mA,SOT223
 LP3995: Iq 3uA/36V,SOT89/23
 LP3983S: Adj output 300mA,SOT25
 LP3987H:500mA SOT25
 LP3992/LP3981:300mA SOT25
 LP3986:300mA SOT23/SOT89

MOSfet

Pmos:LPM3401/3413/9435/4953/9021
 Nmos: LPM3402/3414/9006
 N+Pmos: 9029C

OTG Boost

LP62523H: 2.5A syn
 LP6252: 1.2A syn
 LP6236: 1A

Audio Line-out

LPA4809/LPA2010AMSF

1st solution:LP5301+6304+5210+3983S+3809+5203A

LPS for Mobile phone

+/-5V Bias :

LP6280: 150mA driver
 LP3100:50mA
 LP3101: 50mA

Backlight driver

LP3322:10pcs series
 LP3380: 2*6pcs

Fast charge

LP28601:3.5A HV SW
 LPS100:QC2.0 device



Flash LED driver

LP3367 1A
 LP3368 双路1+1A
 LP3110 300mA

Single LDO

LP3990:DFN1*1mm
 LP3992:SOT23-5
 LP3982:SC-70
 LP3983S:SOT25 Adj
2ch LDO
 LP2201/2202 SOT23-6
 LP2204/2206 TDFN2*2mm

Buck

LP6301:1A Syn. Buck

1st solution:LP6280+28601+3322+3367+9017+3990

LPS for SMOK

Charge (Battery Reverse Protection)

LP28021: 36V/1A, BRP, ESOP8/TDFN10
 LP28053/28057: 30V/12V/1A, BRP, ESOP8
 LP4055: 12V/600mA, BRP, TDFN2*2-6, SOT25
 LP4060/4061: 600mA, BRP, SOT25/SOT26
 LP28013/28014: 30V/1A, BRP, TDFN-10

Fast charge

LP28300: 1/2/3cell 2.0A 20V, DFN10/esop8
 LP28303: 7V/3A, 1cell, TDFN10/esop8
 LP28400A: 2/3/4cell 2A from 5V

OVP

LP5301QVF: 36V/2.5A, TDFN6 2*2

Sync. Boost converter

LP6253 : 5V/2A
 LP6255 : 20V/2A Control,
 LP6216: 12V/400mA (Gatedriver)
 LP3301: 12V/400mA (OLED)
 LP6257: 12V/400mA syn. (Soon)

Voltage monitor

Battery Detector: LP3808

Mosfet Gate Driver

LP1110: 40V/3.5A driver, TDFN10 3*3
 LP1111: 40V/3.5A, Driver, TDFN-8 2*2
 LP1120: 40V/3A, 2ch Driver, TDFN16 3*3
 LP1130: half-bridge, 40V/10mR

N-ch Mosfet

LPM9040: 1ch 40V/10mΩ, TDFN3*3
 LPM9042: 2ch 40V/12mΩ, TDFN3*3
 LPM9033: 2ch 30V/8mΩ, TDFN3*3
 LPM9034: 1ch 30V/7mΩ, TDFN5*6

P-ch Mosfet

LPM9035: 1ch 30V/15mΩ, TDFN3*3
 LPM9023: 1ch 20V/30mΩ, TDFN2*2
 LPM3401: 2ch 30V/50mΩ, SOT23

LDO

LP3995A: 36V/2uA low Iq 200mA
 LP3990: TDFN1*1mm 300mA



1st solution: LP28300+3995A+6216

LPS for Audio Speaker

Power Out	Vin(V)	Laod(Ω)	Audio	Charger	Boost	mosfet
3W	3.7V	4 Ω /10%	LPA4871 LPA2104	LP4060A	-	LPM3413
3W*2		4 Ω	LPA2150	LP4055 LP28057	6236	LPM3413
4W	3.7	4 Ω	LPA2164A	LP4055	-	LPM3413
5W	3.7	4 Ω	LPA2176/5/1 LPA2173/4	LP28057	6212	LPM3401
5W*2	3.7	4 Ω	LPA2153 LPA2173*2	LP28057 LP28021SPF	6213	LPM3401
6W*2	3.7	3 Ω	LPA2173*2	LP28057	6213	LPM3401
8W*2	3.7	4 Ω	LPA2101*2	LP28021SPF	6255	LPM3401
8W*2	7.4	4 Ω	LPA2101*2	LP28400ASPF	-	LPM3401
10W*2	7.4	4 Ω	LPA2100*2	LP28400ASPF	LP6255	LPM3401
15W*2	7.4	4 Ω	LPA2100*2	LP28400ASPF	LP6255	LPM3401
15W	12(3cell)	4 Ω	LPA2100	LP28401(3cell)	LP6255	LPM30N50
20W	7.4	4 Ω	LPA2100	LP28400ASPF	LP6255	LPM30N50

LPS for Audio Speaker

Battery Charge

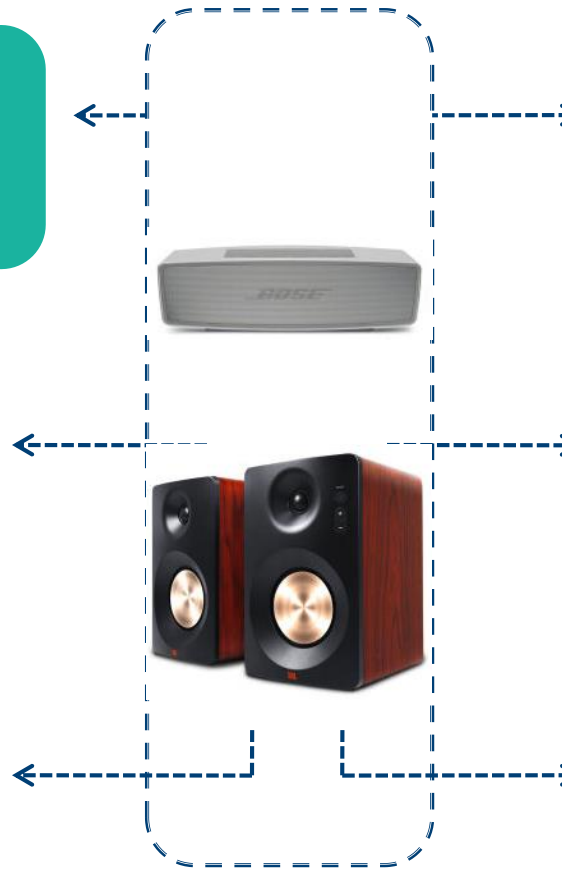
LP4060: 500mA sot25
 LP28057: 1A, reverse protection
 LP4055: 500mA, reverse protection

Fast charge

LP28501: 3.5A HV SW
 LP28300: 2A HV SW
 LP28400A : 2cell from 5-12V

MOS管

LPM3401/3400/3413/3414
 LPM9021-12V 5.6A
 LPM30N50: 30V 50A



Boost Converter

LP6212: 6V/2A output
 LP6213: 12V/2A output

Sync boost Converter

LP6253: 2A/5V output
 LP6255 : 2*6W ~ 20W
 LP78073A: 1A charger+1.2A Boost

Audio Amplifier

Class D: 25W LPA2100(EQ,NCN)
 8W: 2106
 2*3W: 2150
 Class F: 5W 2172/2173/2174/2175/2176/2178
 Class X(with boost): 2163/2164/2164A
 Class AB: 8003/4890/4809...

LPS for IoT

Battery Charge

LP4055 : 0.5A,Reverse Protection
 LP28014: 32V/1A Charger,TDFN-8

OVP/OCP:

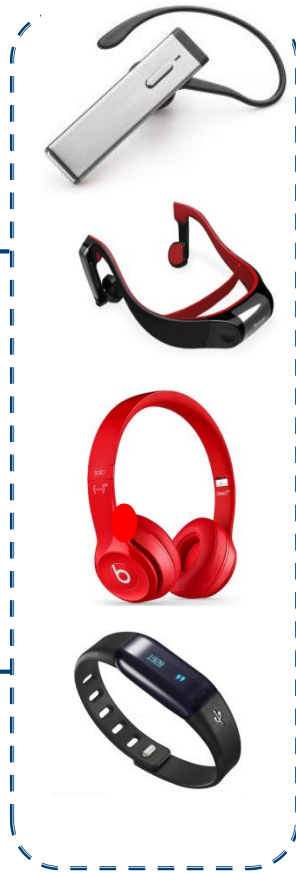
LP5301: 36V/1.5A,TDFN-8,2*2mm
 LPM5305: 30V/2.5A,TDNF-8,2*2mm

Boost Converter

LP6236QVF: 12V/300mA(OLED)
 LP6208C: 3.3V/500mA(0.9V Boost)
 LP6210:3.3V/200mA(0.9V boost)

Earphone amplifier

LPA4809:105mW/16R,MSOP8



MOSfet

LPM3401/3400/3413/3414
 LPM9021 : TDFN62*2mm12V 5.6A
 LPM9022 : 2ch Nmos,2*3mm

Single LDO

LP3990:DFN1*1mm
 LP3992:SOT23-5
 LP3982:SC-70
 LP3983S:SOT25 Adj

2ch LDO:

LP2201/2202 SOT23-6
 LP2204/2206 TDFN2*2

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Our goal is to become of one of the major analog IC supplier in the world.

- **C**ontinuously improve product performance
- **R**educe product costs
- **M**ore localized technical support
- **S**hort lead-time

Our Partner





Thank you Very much!

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