



# Standard Linear Products

DC/DC switching regulators, low-voltage LDOs, mid-voltage LDOs and voltage references

**NXP**  
STANDARD  
LINEAR



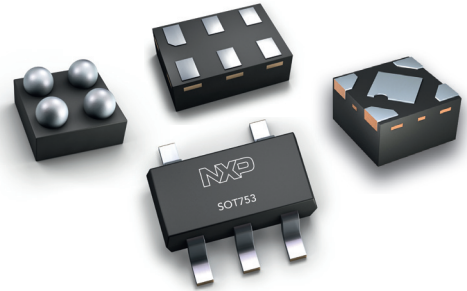
# The Standard Linear Portfolio

## Low-voltage

### NXP's standard linear portfolio for low-voltage applications

- ▶ Low-voltage LDOs
- ▶ High frequency DC/DC solutions

Optimized for applications with challenging space requirements, high battery lifetime demands, and a superior operating stability.

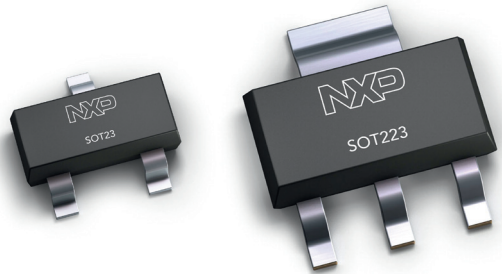


## Mid-voltage

### NXP's standard linear portfolio for mid-voltage applications

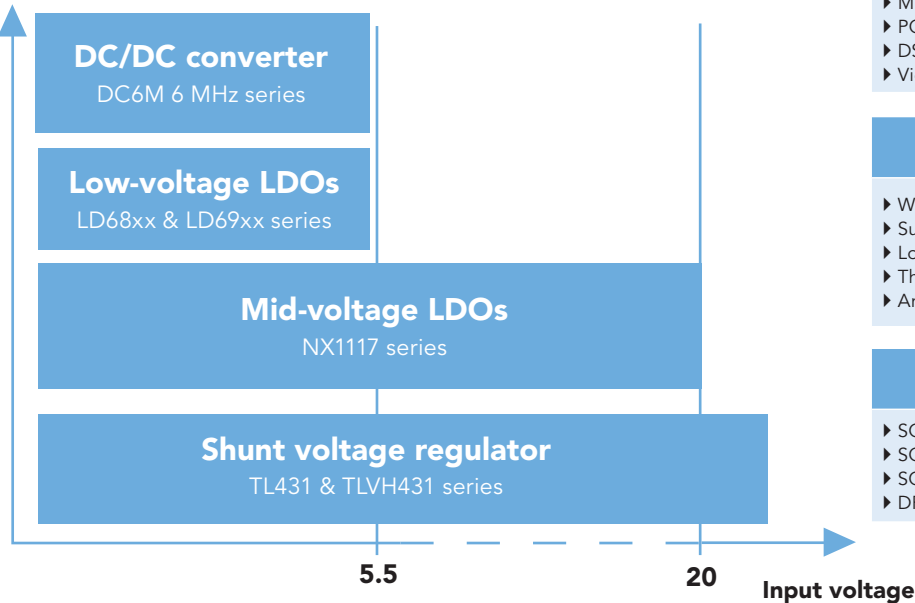
- ▶ Adjustable precision shunt regulators
- ▶ Mid-voltage LDOs with adjustable and fixed output voltages

To support your expectation for high product quality and supply reliability .



## Solutions for your demand

### Complexity



### Solutions for different markets

- |                 |              |                 |
|-----------------|--------------|-----------------|
| ▶ Mobile phones | ▶ Game pads  | ▶ LCD TV        |
| ▶ PC tablets    | ▶ Notebooks  | ▶ Set top box   |
| ▶ DSCs          | ▶ Netbooks   | ▶ Power adaptor |
| ▶ Video cameras | ▶ Ultrabooks | ▶ Shaver        |

### Solutions for different applications

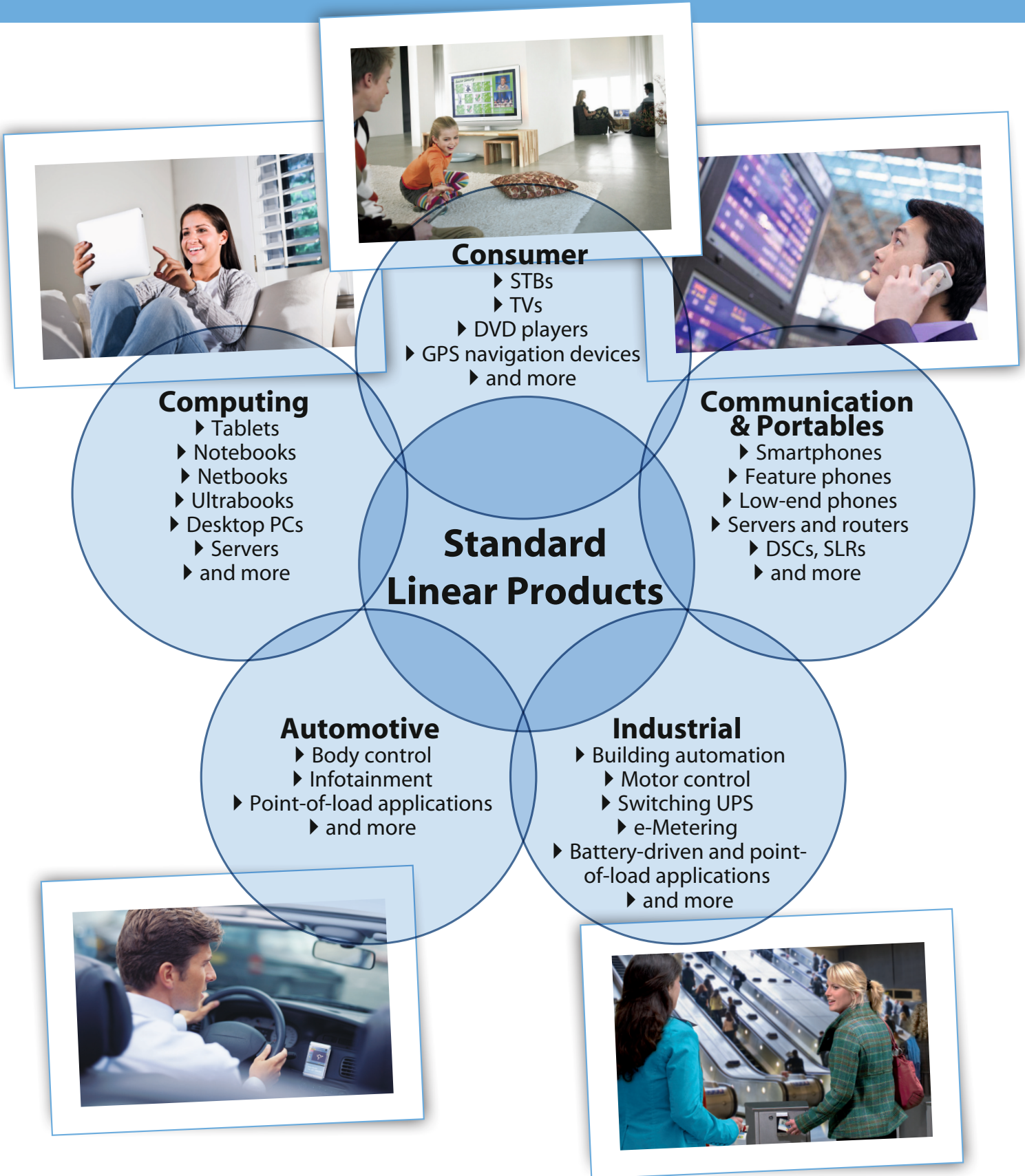
- ▶ Wide range of input & output voltages
- ▶ Supply currents from 150 – 1.000 mA
- ▶ Low quiescent and standby currents
- ▶ Thermal shutdown, overcurrent protection, fold-back
- ▶ And even more features...

### Solutions in different packages

- |             |                     |
|-------------|---------------------|
| ▶ SOT23     | ▶ DFN1010C-4        |
| ▶ SOT753    | ▶ WLCSP4            |
| ▶ SOT223    | ▶ WLCSP6            |
| ▶ DFN1410-6 | ▶ And more packages |

NXP, your one-stop-shop for high-quality products, supplies an attractive portfolio of **standard linear devices**.

# Solutions for every market



# Application block diagrams

## Product Examples

**LD6836CX4**  
300 mA LV LDO  
low-dropout  
WLCSP4



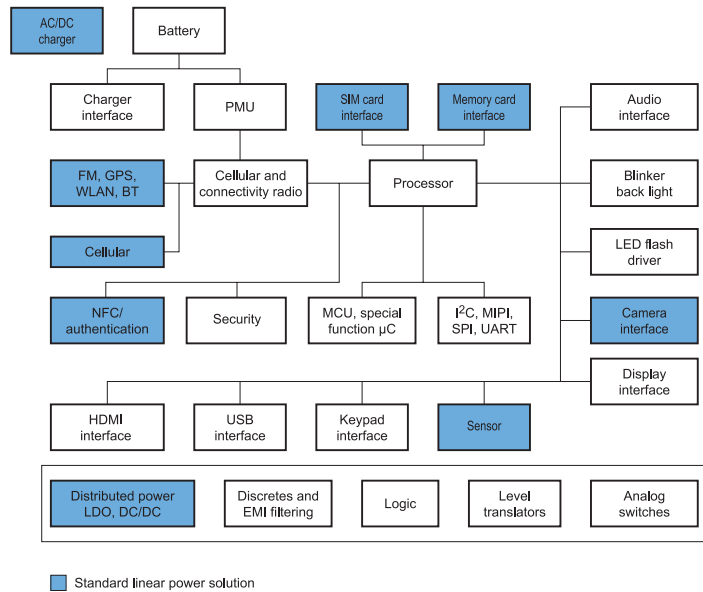
**LD6915LX**  
2x150 mA LV LDO  
Dual-channel  
DFN1212-6



**DC6M series**  
650 mA DC/DC  
6 MHz, step-down  
WLCSP6



## Mobile phone



## Product Examples

**LD6815TD**  
150 mA LV LDO  
High PSRR  
SOT753  
(SOT23-5)



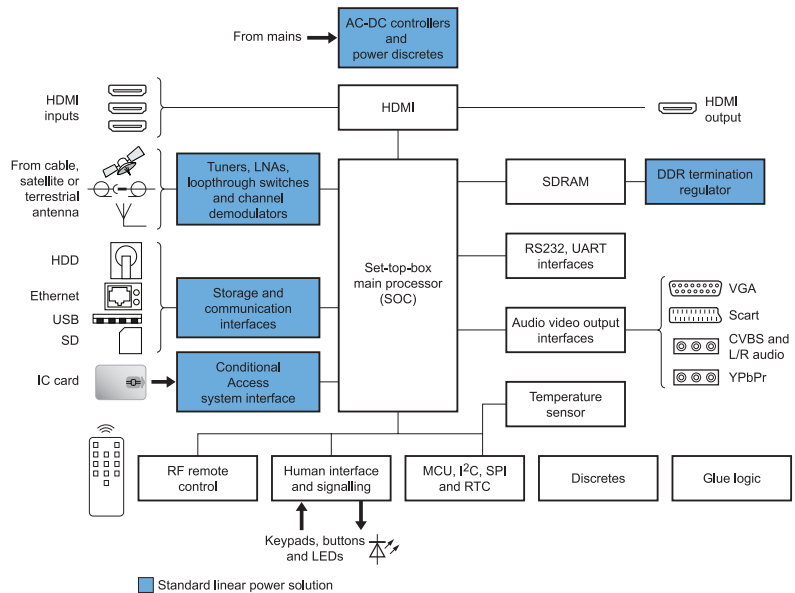
**NX1117 series**  
1 A MV LDO  
1% output  
tolerance  
SOT23



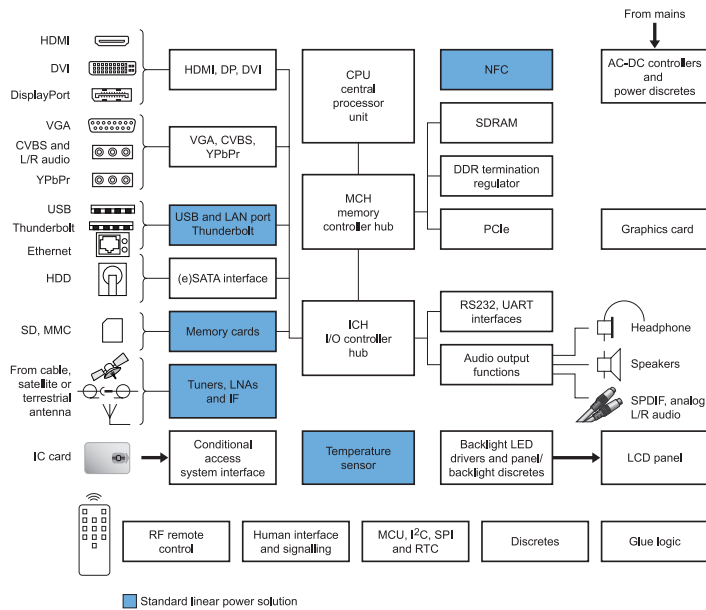
**TL431 series**  
 $V_{REF} = 2.495 V$   
0.5% tolerance  
SOT23



## Set Top Box

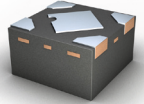


## Computing



## Product Examples

**LD6805K**  
150 mA LV LDO  
high PSRR  
DFN1010C-4



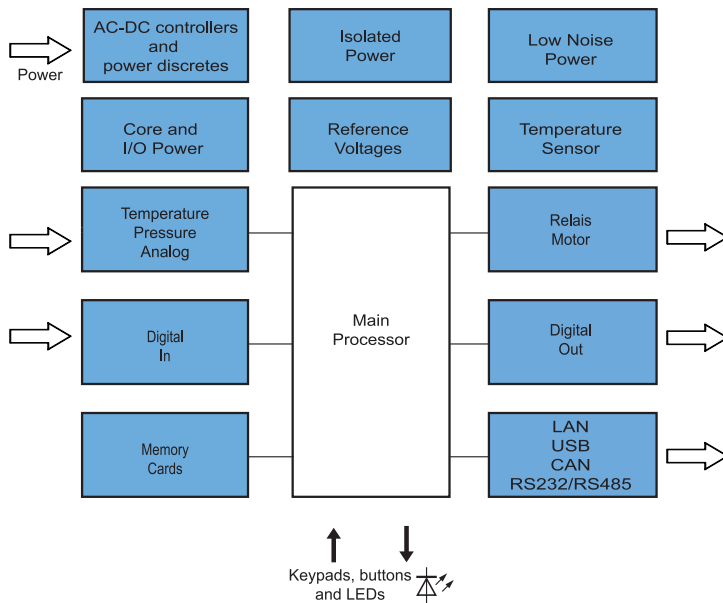
**TL431 series**  
 $V_{REF} = 2.495V$   
0.5% tolerance  
SOT23



**LD6806F**  
200 mA LV LDO  
low-voltage  
DFN1410-6



## Industry



## Product Examples

**NX1117 series**  
1 A MV LDO  
1% tolerance  
SOT223



**LD6836TD**  
300 mA LV LDO  
low-dropout  
SOT753



**DC6M Series**  
650 mA DC/DC  
6 MHz, step-down  
WLCSP6



# Application boards

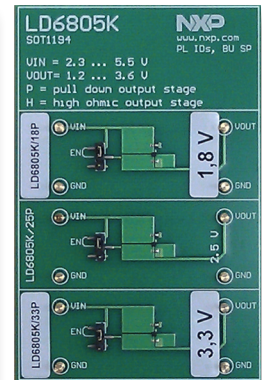
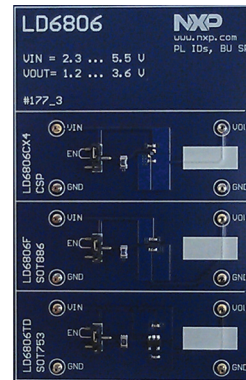
## Single-channel LDOs

### Features

- ▶ Three package types available: CSP, leadless DFN, leaded
- ▶ Three different output voltages on the board
- ▶ Application-level design includes capacitors
- ▶ EN jumper for EN-Pin
- ▶ Layout available
- ▶ Supply voltage range: 2.3 to 5.5 V

### Products & packages

- ▶ LD6806TD SOT753 (SOT23-5)
- ▶ LD6806F DFN1410-6 (SOT886)
- ▶ LD6806CX4 WLCSP-4
- ▶ LD6805K DFN1010C-4 (SOT1194)



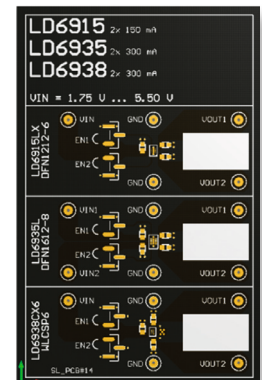
## Dual-channel LDOs

### Features

- ▶ Small leadless DFN & CSP packages
- ▶ Three different output voltages on the board
- ▶ EN jumper for EN-Pin
- ▶ With auto-discharge (pull-down) or high-ohmic when disabled
- ▶ Layout available
- ▶ Supply voltage range: 1.75 to 5.5 V

### Products & packages

- ▶ LD6915LX DFN1212-6 (SOT1229)
- ▶ LD6935L DFN1612-8 (SOT1225)
- ▶ LD6938CX6 WLCSP6



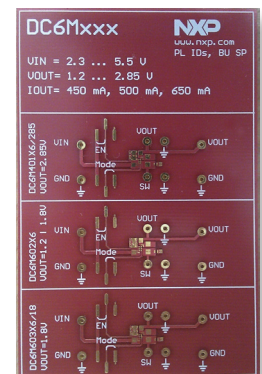
## 6 MHz DC/DC Step-Down Converter

### Features

- ▶ Three different mode versions: (1) operation mode select (2) output voltage select (3) XSHUTDOWN/Power Good
- ▶ Three different output voltages
- ▶ Two different output currents
- ▶ Board includes choke & capacitors
- ▶ EN jumper and Mode jumper
- ▶ Supply voltage range: 2.3 to 5.5 V

### Products & packages

- ▶ DC6M603X6 (XSHUTDOWN) 650 mA output current
- ▶ DC6M602X6 (Voltage select) 650 mA output current
- ▶ DC6M401X6 (Mode Select) 425 mA output current
- ▶ Package: WLCSP-6 1.36 x 0.96 x 0.47 mm



# High performance in ultra small packages

## Ultra small wafer-level chipscale package

Low-voltage LDO	LD68x6 series with ultra small WLCSP package and ultra low-dropout performance	
	<p><b>4-ball WLCSP package</b></p>  <p>0.47mm 0.76 mm 0.76 mm</p>	<ul style="list-style-type: none"> <li>▶ Ultra-small package</li> <li>▶ Ultra-low-dropout performance</li> <li>▶ 150, 200, and 300 mA output current available</li> <li>▶ Very good noise performance</li> <li>▶ Very low quiescent current</li> <li>▶ Thermal shutdown and overcurrent protection</li> <li>▶ 0.4 mm pitch and high power dissipation</li> </ul>

## Package options

CSP	WLCSP-4	WLCSP-6	
			
DFN	DFN1010C-4	DFN1410-6	DFN1612-8
			
		DFN1212-6	
			
Leaded	SOT23	SOT753 (SOT23-5)	
			
	SOT223		
			

3

4


5

6

8

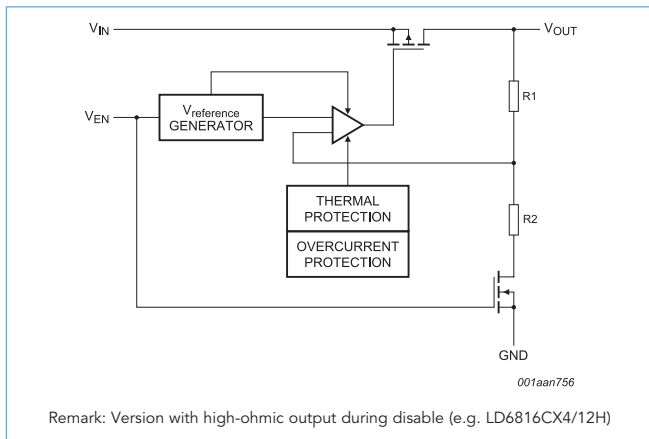
Pins

# LD6816 ultra low-dropout voltage regulators – 150 mA

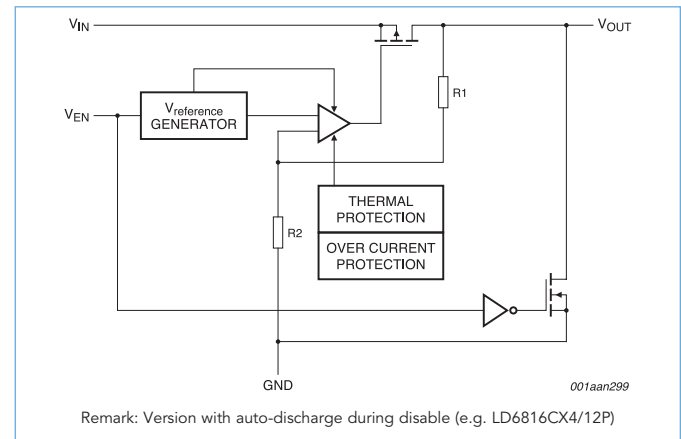
Package							WLCSP4	
								
Size (mm)							0.76 × 0.76 × 0.47	
P <sub>tot</sub> @°C (mW)							770	
V <sub>IN</sub> (V)	I <sub>OUT</sub> typ (mA)	Quiescent current (μA)	V <sub>do</sub> drop @ 150 mA typ (mV)	Output noise typ (μVrms)	PSRR @ 1 kHz dB	Output voltage V*	LD6816CX4/xxH high-ohmic output stage	LD6816CX4/xxP pull-down output stage
2.3 - 5.5	150	70	45	30	55	1.2	LD6816CX4/12H	LD6816CX4/12P
						1.3	LD6816CX4/13H	LD6816CX4/13P
						1.4	LD6816CX4/14H	LD6816CX4/14P
						1.5	LD6816CX4/15H	LD6816CX4/15P
						1.6	LD6816CX4/16H	LD6816CX4/16P
						1.8	LD6816CX4/18H	LD6816CX4/18P
						2.0	LD6816CX4/20H	LD6816CX4/20P
						2.1	LD6816CX4/21H	LD6816CX4/21P
						2.2	LD6816CX4/22H	LD6816CX4/22P
						2.3	LD6816CX4/23H	LD6816CX4/23P
						2.5	LD6816CX4/25H	LD6816CX4/25P
						2.7	LD6816CX4/27H	LD6816CX4/27P
						2.8	LD6816CX4/28H	LD6816CX4/28P
						2.9	LD6816CX4/29H	LD6816CX4/29P
						3.0	LD6816CX4/30H	LD6816CX4/30P
3.3	LD6816CX4/33H	LD6816CX4/33P						
3.6	LD6816CX4/36H	LD6816CX4/36P						

\* Other output voltages are available on request

## Functional diagram: High-ohmic output



## Functional diagram: Auto-discharge (pull-down)



## Key features

- ▶ Ultra low-dropout voltage (45 mV @ 150 mA)
- ▶ Very low output noise (30 μVrms)
- ▶ Thermal shutdown protection and current limiter

## Key benefits

- ▶ Very small WLCSP package
- ▶ Very low standby and supply current for battery-powered solutions
- ▶ No additional noise bypass capacitor needed

## Key applications

- ▶ Mobile phones, PC tablets, DSCs (digital still cameras), video cameras, game pads, notebooks, netbooks, ultrabooks

### LDOs in ultra-small WLCSP package

State-of-the-art wafer-level chip scale technology


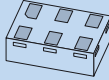
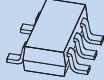
Dimensions of only 0.76 × 0.76 × 0.47 mm

High power dissipation of 770 mW





# LD6806 ultra low-dropout voltage regulators – 200 mA

Package							WLCSP4	DFN1410-6 (SOT886)	SOT753			
												
Size (mm)							0.76 x 0.76 x 0.47		1.45 x 1.0 x 0.5		2.9 x 1.5 x 1.0	
P <sub>tot</sub> @°C (mW)							770		450		800	
V <sub>IN</sub> (V)	I <sub>OUT</sub> typ (mA)	Quiescent current (µA)	V <sub>do</sub> drop @ 200 mA typ (mV)	Output noise typ (µVrms)	PSRR @ 1 kHz dB	Output voltage V*	LD6806CX4/xxH high-ohmic output stage	LD6806CX4/xxP pull-down output stage	LD6806F/xxH high-ohmic output stage	LD6806F/xxP pull-down output stage	LD6806TD/xxH high-ohmic output stage	LD6806TD/xxP pull-down output stage
2.3 - 5.5	200	70	60	30	55	1.2	LD6806CX4/20H	LD6806CX4/20P	LD6806F/20H	LD6806F/20P	LD6806TD/20H	LD6806TD/20P
						1.3	LD6806CX4/21H	LD6806CX4/21P	LD6806F/21H	LD6806F/21P	LD6806TD/21H	LD6806TD/21P
						1.4	LD6806CX4/14H	LD6806CX4/14P	LD6806F/14H	LD6806F/14P	LD6806TD/14H	LD6806TD/14P
						1.5	LD6806CX4/15H	LD6806CX4/15P	LD6806F/15H	LD6806F/15P	LD6806TD/15H	LD6806TD/15P
						1.6	LD6806CX4/16H	LD6806CX4/16P	LD6806F/16H	LD6806F/16P	LD6806TD/16H	LD6806TD/16P
						1.8	LD6806CX4/18H	LD6806CX4/18P	LD6806F/18H	LD6806F/18P	LD6806TD/18H	LD6806TD/18P
						2.0	LD6806CX4/20H	LD6806CX4/20P	LD6806F/20H	LD6806F/20P	LD6806TD/20H	LD6806TD/20P
						2.1	LD6806CX4/21H	LD6806CX4/21P	LD6806F/21H	LD6806F/21P	LD6806TD/21H	LD6806TD/21P
						2.2	LD6806CX4/22H	LD6806CX4/22P	LD6806F/22H	LD6806F/22P	LD6806TD/22H	LD6806TD/22P
						2.3	LD6806CX4/23H	LD6806CX4/23P	LD6806F/23H	LD6806F/23P	LD6806TD/23H	LD6806TD/23P
						2.5	LD6806CX4/25H	LD6806CX4/25P	LD6806F/25H	LD6806F/25P	LD6806TD/25H	LD6806TD/25P
						2.7	LD6806CX4/27H	LD6806CX4/27P	LD6806F/27H	LD6806F/27P	LD6806TD/27H	LD6806TD/27P
						2.8	LD6806CX4/28H	LD6806CX4/28P	LD6806F/28H	LD6806F/28P	LD6806TD/28H	LD6806TD/28P
						2.9	LD6806CX4/29H	LD6806CX4/29P	LD6806F/29H	LD6806F/29P	LD6806TD/29H	LD6806TD/29P
						3.0	LD6806CX4/30H	LD6806CX4/30P	LD6806F/30H	LD6806F/30P	LD6806TD/30H	LD6806TD/30P
						3.3	LD6806CX4/33H	LD6806CX4/33P	LD6806F/33H	LD6806F/33P	LD6806TD/33H	LD6806TD/33P
3.6	LD6806CX4/36H	LD6806CX4/36P	LD6806F/36H	LD6806F/36P	LD6806TD/36H	LD6806TD/36P						

\* Other output voltages are available on request

## Key features

- ▶ Ultra low-dropout voltage (60 mV @ 200 mA)
- ▶ Very low output noise (30 µVrms)
- ▶ Thermal shutdown protection and current limiter

## Key benefits

- ▶ Very small WLCSP package
- ▶ Very low standby and supply current for battery-powered solutions
- ▶ No additional noise bypass capacitor needed

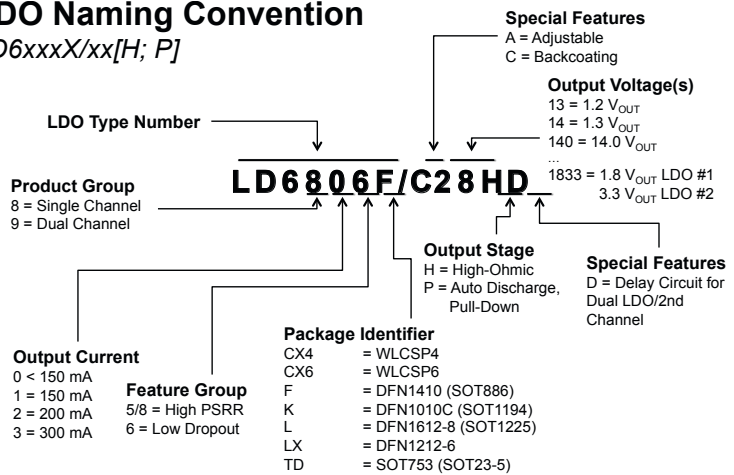
## Key applications

- ▶ Mobile phones, PC tablets, DSCs (digital still cameras), video cameras, game pads, notebooks, netbooks, ultrabooks

## Part numbering for LDOs

### LDO Naming Convention

LD6xxxX/xx[H; P]



## In the spotlight

### LDOs in very small DFN package


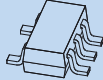
State-of-the-art dual-flat no-leads (DFN) package technology

Dimensions of only 1.45 x 1.0 x 0.5 mm

High power dissipation of 450 mW

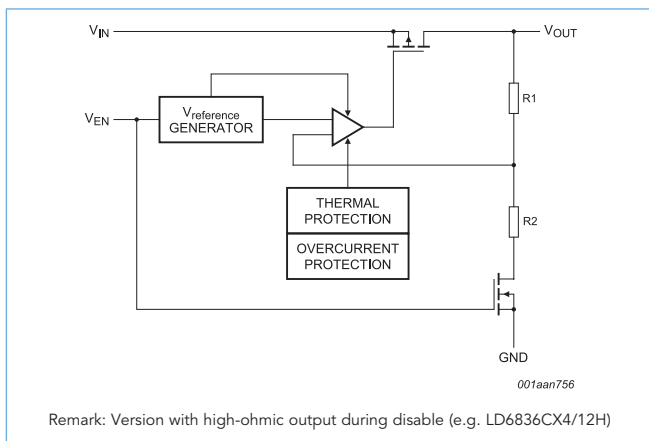


# LD6836 ultra low-dropout voltage regulators – 300 mA

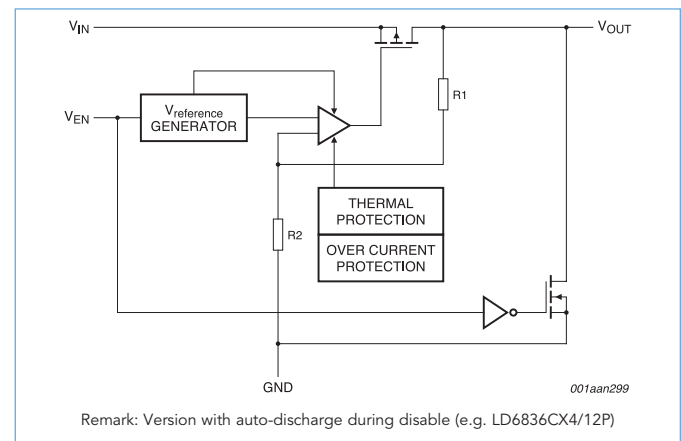
Package							WLCSP4		SOT753	
										
Size (mm)							0.76 × 0.76 × 0.47		2.9 × 1.5 × 1.0	
P <sub>tot</sub> @ °C (mW)							770		800	
V <sub>IN</sub> (V)	I <sub>OUT</sub> typ (mA)	Quiescent current (μA)	V <sub>do</sub> drop @ 300 mA typ (mV)	Output noise typ (μVrms)	PSRR @ 1 kHz dB	Output voltage v*	LD6836CX4/xxH High ohmic output stage	LD6836CX4/xxP Pull down output stage	LD6836TD/xxH High ohmic output stage	LD6836TD/xxP Pull down output stage
2.3 - 5.5	300	70	90	30	55	1.2	LD6836CX4/12H	LD6836CX4/12P	LD6836TD/12H	LD6836TD/12P
						1.3	LD6836CX4/13H	LD6836CX4/13P	LD6836TD/13H	LD6836TD/13P
						1.4	LD6836CX4/14H	LD6836CX4/14P	LD6836TD/14H	LD6836TD/14P
						1.5	LD6836CX4/15H	LD6836CX4/15P	LD6836TD/15H	LD6836TD/15P
						1.6	LD6836CX4/16H	LD6836CX4/16P	LD6836TD/16H	LD6836TD/16P
						1.8	LD6836CX4/18H	LD6836CX4/18P	LD6836TD/18H	LD6836TD/18P
						2.0	LD6836CX4/20H	LD6836CX4/20P	LD6836TD/20H	LD6836TD/20P
						2.1	LD6836CX4/21H	LD6836CX4/21P	LD6836TD/21H	LD6836TD/21P
						2.2	LD6836CX4/22H	LD6836CX4/22P	LD6836TD/22H	LD6836TD/22P
						2.3	LD6836CX4/23H	LD6836CX4/23P	LD6836TD/23H	LD6836TD/23P
						2.5	LD6836CX4/25H	LD6836CX4/25P	LD6836TD/25H	LD6836TD/25P
						2.7	LD6836CX4/27H	LD6836CX4/27P	LD6836TD/27H	LD6836TD/27P
						2.8	LD6836CX4/28H	LD6836CX4/28P	LD6836TD/28H	LD6836TD/28P
						2.9	LD6836CX4/29H	LD6836CX4/29P	LD6836TD/29H	LD6836TD/29P
						3.0	LD6836CX4/30H	LD6836CX4/30P	LD6836TD/30H	LD6836TD/30P
3.3	LD6836CX4/33H	LD6836CX4/33P	LD6836TD/33H	LD6836TD/33P						
3.6	LD6836CX4/36H	LD6836CX4/36P	LD6836TD/36H	LD6836TD/36P						

\* Other output voltages are available on request

## Functional diagram: High-ohmic output



## Functional diagram: Auto-discharge (pull-down)



## Key features

- ▶ Ultra low-dropout voltage (90 mV @ 300 mA)
- ▶ Very low output noise (30 μVrms)
- ▶ Thermal shutdown protection and current limiter

## Key benefits

- ▶ Very small WLCSP package
- ▶ Very low standby and supply current for battery-powered solutions
- ▶ No additional noise bypass capacitor needed

## Key applications

- ▶ Mobile phones, PC tablets, DSCs (digital still cameras), video cameras, game pads, notebooks, netbooks, ultrabooks

In the spotlight

### SOT753 general purpose package

General purpose package SOT753 (SOT23-5 footprint)

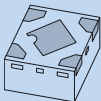
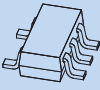
Dimensions of only 2.9 × 1.5 × 1.0 mm

Very high power dissipation of 800 mW



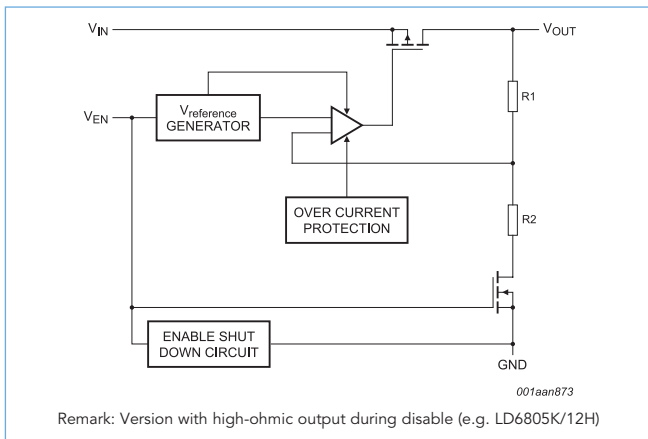
# LD6805 and LD6815 high-PSRR low-dropout voltage regulators – 150 mA

types in **bold** represent new products

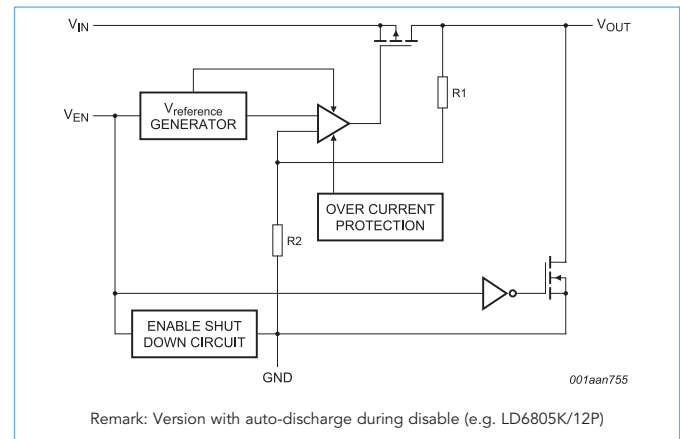
Package							DFN1010C-4 (SOT1194)		SOT753	
										
Size (mm)							1.0 x 1.0 x 0.55		2.9 x 1.5 x 1.0	
P <sub>tot</sub> @ °C (mW)							400		800	
V <sub>IN</sub> (V)	I <sub>OUT</sub> typ (mA)	Quiescent current (μA)	V <sub>do</sub> drop @ 150 mA typ (mV)	Output noise typ (μVrms)	PSRR @ 1 kHz dB	Output voltage V*	LD6805K/xxH high-ohmic output stage	LD6805K/xxP pull-down output stage	LD6815TD/xxH high-ohmic output stage	LD6815TD/xxP pull-down output stage
2.3 - 5.5	150	35	250	40	75	1.2	LD6805K/12H	LD6805K/12P	LD6815TD/12H	LD6815TD/12P
						1.3	LD6805K/13H	LD6805K/13P		
						1.4	LD6805K/14H	LD6805K/14P	-	-
						1.5	LD6805K/15H	LD6805K/15P	LD6815TD/15H	LD6815TD/15P
						1.6	LD6805K/16H	LD6805K/16P	-	-
						1.8	LD6805K/18H	LD6805K/18P	LD6815TD/18H	LD6815TD/18P
						1.85	LD6805K/185H	-	-	-
						2.0	LD6805K/20H	LD6805K/20P	-	-
						2.1	LD6805K/21H	LD6805K/21P	LD6815TD/21H	LD6815TD/21P
						2.2	LD6805K/22H	LD6805K/22P	-	-
						2.3	LD6805K/23H	LD6805K/23P	-	-
						2.5	LD6805K/25H	LD6805K/25P	LD6815TD/25H	LD6815TD/25P
						2.8	LD6805K/28H	LD6805K/28P	LD6815TD/28H	LD6815TD/28P
						2.9	LD6805K/29H	LD6805K/29P	LD6815TD/29H	LD6815TD/29P
						3.0	LD6805K/30H	LD6805K/30P	LD6815TD/30H	LD6815TD/30P
						3.1	LD6805K/31H	LD6805K/31P	-	-
3.3	LD6805K/33H	LD6805K/33P	LD6815TD/33H	LD6815TD/33P						
3.6	LD6805K/36H	LD6805K/36P	LD6815TD/36H	LD6815TD/36P						

\* Other output voltages are available on request

## Functional diagram: High-ohmic output



## Functional diagram: Auto-discharge (pull-down)



### Key features

- ▶ High power supply ripple rejection (PSRR)
- ▶ Very low quiescent current and low noise (40 μVrms)
- ▶ Small package size

### Key benefits

- ▶ Very small package for mobile applications
- ▶ Very low standby and supply current for battery-powered solutions
- ▶ No additional noise bypass capacitor needed

### Key applications

- ▶ Mobile phones, PC tablets, DSCs (digital still cameras), video cameras, game pads, notebooks, netbooks, ultrabooks

### In the spotlight

#### High-PSRR LDO in very small DFN package


State-of-the-art dual-flat no-leads (DFN) package technology

Dimensions of only 1.0 x 1.0 x 0.55 mm

High power dissipation of 400 mW



# LD6835 high-PSRR low-dropout voltage regulators – 300 mA

Package							DFN1010C-4 (SOT1194)	
								
Size (mm)							1.0 x 1.0 x 0.55 mm	
P <sub>tot</sub> @ °C (mW)							400	
V <sub>IN</sub> (V)	I <sub>OUT</sub> typ (mA)	Quiescent current (μA)	V <sub>do</sub> drop @ 300 mA typ (mV)	Output noise typ (μVrms)	PSRR @ 1 kHz dB	Output voltage V*	LD6835K/xxH high-ohmic output stage	LD6835K/xxP pull-down output stage
1.75 - 5.5	300	30	240	50	75	1.2	LD6835K/12H	LD6835K/12P
						1.4	LD6835K/14H	LD6835K/14P
						1.5	LD6835K/15H	LD6835K/15P
						1.8	LD6835K/18H	LD6835K/18P
						2.5	LD6835K/25H	LD6835K/25P
						2.6	LD6835K/26H	LD6835K/26P
						2.8	LD6835K/28H	LD6835K/28P
						2.85	-	LD6835K/285P
						2.9	LD6835K/29H	LD6835K/29P
						3.0	LD6835K/30H	LD6835K/30P
						3.1	LD6835K/31H	LD6835K/31P
						3.3	LD6835K/33H	LD6835K/33P
						3.6	LD6835K/36H	LD6835K/36P

\* Other output voltages are available on request

## Key features

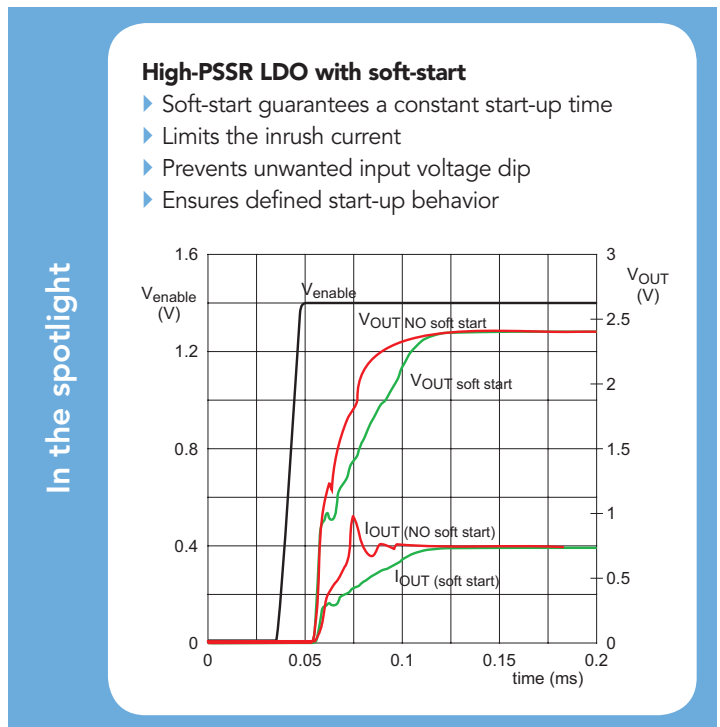
- ▶ High power supply ripple rejection (PSRR)
- ▶ Very low quiescent current (30 μA) and low noise (50 μVrms)
- ▶ Small package size

## Key benefits

- ▶ Very small package for mobile application
- ▶ Very low standby and supply current for battery-powered solutions
- ▶ No additional noise bypass capacitor needed

## Key applications

- ▶ Mobile phones, tablet PCs, DSCs (digital still cameras), video cameras, game pads, notebooks, netbooks, ultrabooks

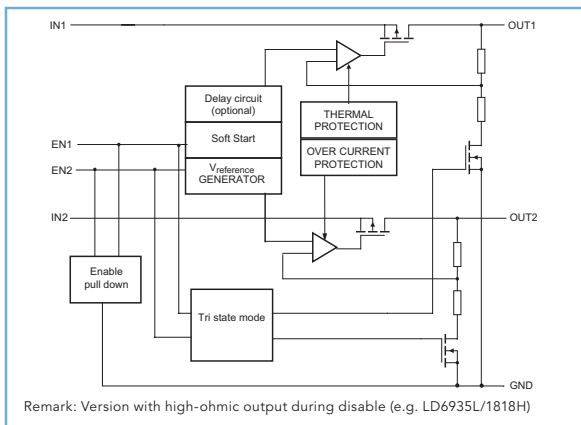


# LD6915, LD6935 and LD6938 dual high-PSRR low-dropout voltage regulators - 150 mA and 300 mA

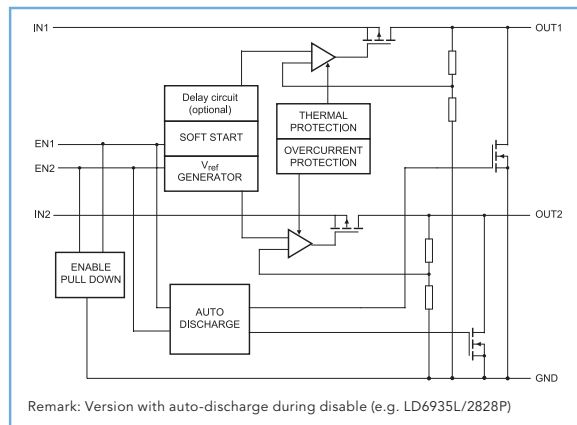
Package		DFN1212-6 (SOT1229)				DFN1612-8 (SOT1225)		WLCSP6		
Size (mm)		1.2 x 1.2 x 0.4 mm				1.6 x 1.2 x 0.4 mm		1.2 x 0.8 x 0.47 mm		
P <sub>tot</sub> @°C (mW)		400				600		800		
V <sub>IN</sub> (V)	Quiescent current (µA)	Output noise typ (µVrms)	PSRR @ 1kHz (dB)	I <sub>OUT</sub> typ (mA)	V <sub>DO</sub> drop @ 300 mA typ (mV)	Output voltage (V)*				
1.75 - 5.5	30	50	75	2 x 150 (LD6915)	120 (LD6915)	1.2/1.2	-	-	-	LD6938CX6/1212P
						1.2/1.5	-	-	-	LD6938CX6/1215P
						1.2/1.8	-	-	-	LD6938CX6/1218P
						1.5/2.8	-	-	-	-
						1.8/1.5	-	LD6915LX/1815P	-	-
						1.8/1.8	-	LD6915LX/1818P	-	-
						1.8/1.25	-	-	-	-
						1.8/2.8	-	LD6915LX/1828P	-	-
						1.8/3.3	-	-	-	-
						2.8/1.8	-	LD6915LX/2818P	LD6915LX/2818PD	-
						2.8/2.8	-	-	-	-
						2.85/1.8	-	-	-	-
						2.85/3.0	-	-	-	-
						3.0/1.8	-	LD6915LX/3018P	-	-
						3.0/2.8	LD6915LX/3028H	LD6915LX/3028P	-	-
						3.0/3.0	-	-	-	-
						3.1/1.7	-	-	-	-
						3.1/3.1	-	-	-	-
						3.3/1.25	-	-	-	-
						3.3/1.8	-	LD6915LX/3318P	-	-
						3.3/2.8	LD6915LX/3328H	LD6915LX/3328P	LD6915LX/3328HD	-
						3.3/2.85	-	-	-	LD6938CX6/33285H
						3.3/3.0	-	-	-	LD6938CX6/3330P
						3.3/3.3	-	LD6915LX/3333P	-	-
						3.6/1.2	-	LD6915LX/3612P	-	-
										LD6938CX6/3612H

\* Other output voltages are available on request \*\* optionally available with delay circuit

## Functional diagram: High-ohmic output



## Functional diagram: Auto-discharge (pull-down)



## Key features

- ▶ High power supply ripple rejection (PSRR)
- ▶ Very low quiescent current (30 µA)
- ▶ Soft-start, thermal shutdown, foldback, current limiter, optional with delay circuit

## Key benefits

- ▶ Very low standby and supply current for battery-powered solutions
- ▶ Small packages for board space reduction
- ▶ No additional noise bypass capacitor needed

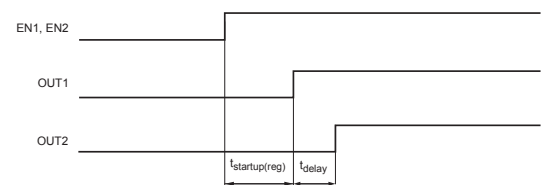
## Key applications

- ▶ Mobile phones, tablet PCs, DSCs (digital still cameras), video cameras, game pads, notebooks, netbooks, ultrabooks

## Delay Circuit


- ▶ The delay circuit prevents an unwanted input voltage dip when both outputs are enabled at the same time by delaying the second LDO

In the spotlight

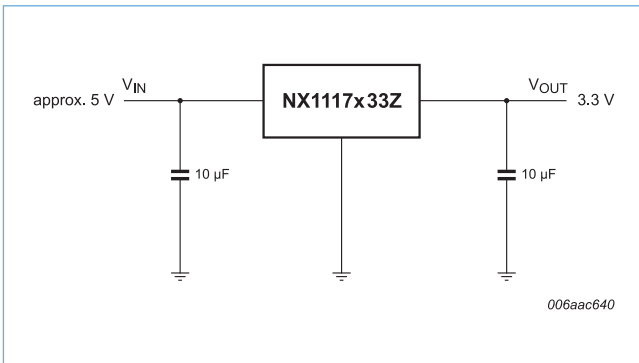


# NX1117 low-dropout adjustable and fixed linear voltage regulator

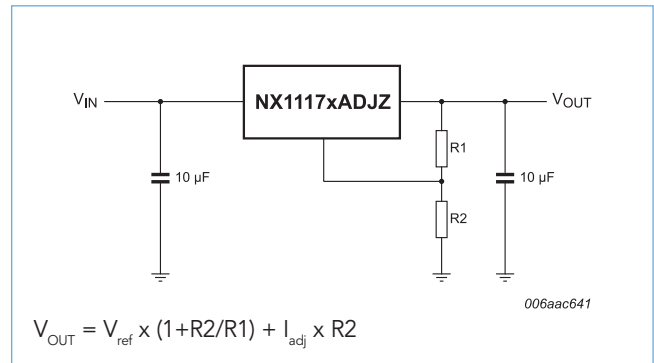
types in **bold** represent new products

Package				SOT223 (SC-73)		
						
Size (mm)				6.5 x 3.5 x 1.65		
P <sub>tot</sub> (mW)				1700		
						AEC-Q100 qualified
V <sub>max</sub> (V)	I <sub>max</sub> (A)	V <sub>out</sub> drop (V) @ 800 mA	V <sub>out</sub> (V)	V <sub>out</sub> tolerance		V <sub>out</sub> tolerance
				1%	1.25%	1%
20	1	1.1	1.25 adjustable	NX1117CADJZ	NX1117CEADJZ	<b>NX1117IADJZ</b>
			1.2	NX1117C12Z	NX1117CE12Z	<b>NX1117I12Z</b>
			1.5	NX1117C15Z	NX1117CE15Z	<b>NX1117I15Z</b>
			1.8	NX1117C18Z	NX1117CE18Z	<b>NX1117I18Z</b>
			1.9	NX1117C19Z	NX1117CE19Z	<b>NX1117I19Z</b>
			2.0	NX1117C20Z	NX1117CE20Z	<b>NX1117I20Z</b>
			2.5	NX1117C25Z	NX1117CE25Z	<b>NX1117I25Z</b>
			2.85	NX1117C285Z	NX1117CE285Z	<b>NX1117I285Z</b>
			3.3	NX1117C33Z	NX1117CE33Z	<b>NX1117I33Z</b>
			5.0	NX1117C50Z	NX1117CE50Z	<b>NX1117I50Z</b>
		12.0	-	-	<b>NX1117I120Z</b>	

## NX1117x33Z: Typical application for fixed output voltage versions



## NX1117xADJZ: Typical application for adjustable output voltage versions



## Key applications

- ▶ Post regulation for SMPS
- ▶ Automotive, industrial, and consumer equipment point of load
- ▶ Battery charger
- ▶ Hard-drive controllers
- ▶ Core voltage supply: FPGA, PLD, DSP, CPU
- ▶ LCD TV
- ▶ Set-top box
- ▶ DVD player
- ▶ Automotive multimedia

## In the spotlight

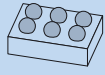
### NX1117i low-dropout linear voltage regulator

- Adjustable or fixed output voltage options with 1% accuracy in SOT223
- Wide input voltage range up to 20 V
- Maximum output current of 1 A
- Output current limiting and thermal shutdown
- Temperature range from -40 to 125 °C
- AEC-Q100 qualified (grade 1)



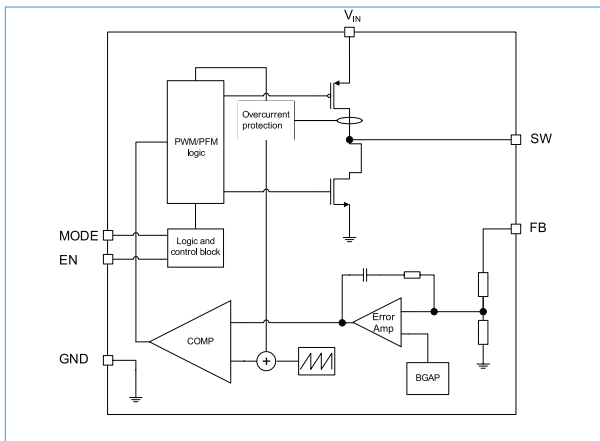
# DC6M401, DC6M402 small size 6 MHz DC/DC buck converter – 425 mA

types in **bold** represent new products

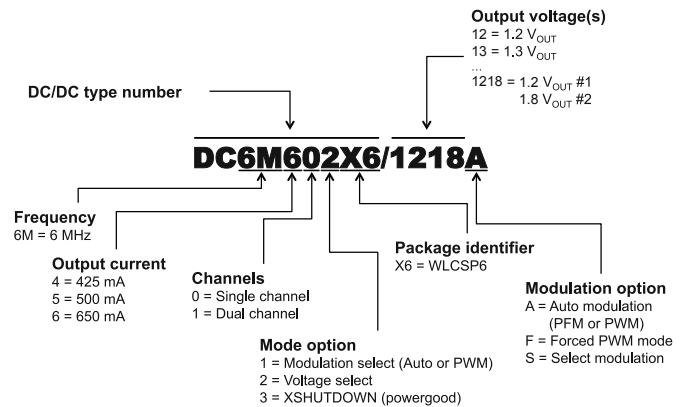
Package							WLCSP6	
								
Size (mm)							1.36 x 0.96 x 0.47	
P <sub>tot</sub> @ °C							800	
V <sub>IN</sub> (V)	I <sub>OUT</sub> (mA)	Operation frequency (MHz)	Quiescent current typ (µA)	Output voltage ripple typ (mV)	Efficiency up to (%)	Output voltage V*	DC6M401/xxxS Modulation select	DC6M402/xxxxxA Voltage select auto modulation
2.3 - 5.5	425	6	0.2	7	95	1.8	<b>DC6M401X6/18S</b>	-
						2.85	<b>DC6M401X6/285S</b>	-
						1.8 / 2.85	-	<b>DC6M402X6/18285A</b>

\* Other output voltages are available on request

## Functional diagram



## Part numbering for DC/DC converter



## Key features

- ▶ True 6 MHz operation frequency
- ▶ Very high efficiency of up to 95%
- ▶ Inrush current limiter (soft start)
- ▶ Protection through thermal shutdown and current limiter
- ▶ Ultra-low output ripple of 7 mV (typ)

## Key benefits

- ▶ Very small WLCSP package for board space reduction
- ▶ Only very small inductor or PCB R-coil needed (470 nH)
- ▶ Optimized for SD card and SIM card applications

## Key applications

- ▶ Mobile phones, PC tablets, DSCs (digital still cameras), video cameras, game pads, notebooks, netbooks, ultrabooks
- ▶ Battery operated applications requiring a lower-than-battery-voltage supply with high currents and high-efficiency down conversion

## In the spotlight

### 6 MHz DC/DC buck converter in WLCSP package

High frequency (6 MHz) allows usage of small 470 nH inductor

3 mode types available (PWM/PFM, voltage select, XSHUTDOWN)

Very high efficiency of up to 95%

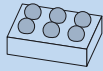
425 mA, 500 mA and 650 mA output currents available

Very small package → Wafer-level chip scale package



## DC6M501, DC6M502, DC6M503 small size 6 MHz DC/DC buck converter – 500 mA

types in **bold** represent new products

Package							WLCSP6			
										
Size (mm)							1.36 x 0.96 x 0.47			
P <sub>tot</sub> @ °C							800			
V <sub>IN</sub> (V)	I <sub>OUT</sub> (mA)	Operation frequency (MHz)	Quiescent current typ (µA)	Output voltage ripple typ (mV)	Efficiency up to (%)	Output voltage V*	DC6M501/xxxS Modulation select	DC6M502/xxxxxA Voltage select auto modulation	DC6M502/xxxxxF Voltage select forced PWM	DC6M503/xxxA XSHUTDOWN Auto modulation
2.3 - 5.5	500	6	0.2	7	95	1,2	<b>DC6M501X6/125</b>	-	-	<b>DC6M503X6/12A</b>
						1,5	<b>DC6M501X6/155</b>	-	-	<b>DC6M503X6/15A</b>
						1,8	<b>DC6M501X6/185</b>	-	-	<b>DC6M503X6/18A</b>
						1.2 / 1.5	-	<b>DC6M502X6/1215A</b>	<b>DC6M502X6/1215F</b>	-
						1.2 / 1.8	-	<b>DC6M502X6/1218A</b>	<b>DC6M502X6/1218F</b>	-
						1.5 / 1.8	-	<b>DC6M502X6/1518A</b>	<b>DC6M502X6/1518F</b>	-

\* Other output voltages are available on request

### Key features

- ▶ True 6 MHz operation frequency
- ▶ Ultra-low output ripple of 7 mV (typ)
- ▶ Very high efficiency of up to 95%
- ▶ Inrush current limiter (soft start)
- ▶ Protection through thermal shutdown and current limiter

### Key benefits

- ▶ Very small WLCSP package for board space reduction

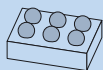
- ▶ Only very small inductor or PCB R-coil needed (470 nH)
- ▶ Supports SMIA standard (XSHUTDOWN/powergood)

### Key applications

- ▶ Mobile phones, tablet PCs, DSCs (digital still cameras), video cameras, game pads, notebooks, netbooks, ultrabooks
- ▶ Battery operated applications requiring a lower-than-battery-voltage supply with high currents and high-efficiency down conversion

## DC6M601, DC6M602, DC6M603 small size 6 MHz DC/DC buck converter – 650 mA

types in **bold** represent new products

Package							WLCSP6			
										
Size (mm)							1.36 x 0.96 x 0.47			
P <sub>tot</sub> @ °C							800			
V <sub>IN</sub> (V)	I <sub>OUT</sub> (mA)	Operation frequency (MHz)	Quiescent current typ (µA)	Output voltage ripple typ (mV)	Efficiency up to (%)	Output voltage V*	DC6M601/xxS Modulation select	DC6M602/xxxxxA Voltage select auto modulation	DC6M602/xxxxxF Voltage select forced PWM	DC6M603/xxxA XSHUTDOWN Auto modulation
2.3 - 5.5	650	6	0.2	7	95	1,2	<b>DC6M601X6/125</b>	-	-	<b>DC6M603X6/12A</b>
						1,5	<b>DC6M601X6/155</b>	-	-	<b>DC6M603X6/15A</b>
						1,8	<b>DC6M601X6/185</b>	-	-	<b>DC6M603X6/18A</b>
						2,85	<b>DC6M601X6/285S</b>	-	-	-
						1.2 / 1.5	-	<b>DC6M602X6/1215A</b>	<b>DC6M602X6/1215F</b>	-
						1.2 / 1.8	-	<b>DC6M602X6/1218A</b>	<b>DC6M602X6/1218F</b>	-
1.5 / 1.8	-	<b>DC6M602X6/1518A</b>	<b>DC6M602X6/1518F</b>	-						

\* Other output voltages are available on request

### Key features

- ▶ True 6 MHz operation frequency
- ▶ Very high efficiency of up to 95%
- ▶ Inrush current limiter (soft start)
- ▶ Protection through thermal shutdown and current limiter
- ▶ Ultra-low output ripple of 7 mV (typ)

### Key benefits

- ▶ Very small WLCSP package for board space reduction


- ▶ Only a very small inductor or PCB R-coil is needed (470 nH)
- ▶ Supports SMIA standard (XSHUTDOWN/powergood)

### Key applications

- ▶ Mobile phones, tablet PCs, DSCs (digital still cameras), video cameras, game pads, notebooks, netbooks, ultrabooks
- ▶ Battery operated applications requiring a lower-than-battery-voltage supply with high currents and high-efficiency down conversion


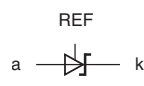

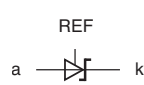


# TL431 adjustable shunt voltage regulator with $V_{ref} = 2.495\text{ V}$

				SOT23		
Package						
Size (mm)				2.9 x 1.3 x 1.0		
P <sub>tot</sub> (mW)				580		
Pinning configuration				Normal pinning*	Mirrored pinning*	
V <sub>KA</sub> (V)	I <sub>K</sub> (mA)	V <sub>ref</sub>	T <sub>amb</sub> (°C)			
36	100	2.495	2%	0 to 70	TL431CDBZR <sup>1)</sup>	
				-40 to 85	TL431IDBZR <sup>1)</sup>	
				-40 to 125	TL431QDBZR <sup>1)</sup>	
					TL431FDT <sup>2)</sup>	TL431MFDT <sup>2)</sup>
					TL431SDT <sup>3)</sup>	TL431MSDT <sup>3)</sup>
					TL431ACDBZR <sup>1)</sup>	
			1%	-40 to 85	TL431AIDBZR <sup>1)</sup>	
				-40 to 125	TL431AQDBZR <sup>1)</sup>	
					TL431AFDT <sup>2)</sup>	TL431AMFDT <sup>2)</sup>
					TL431ASDT <sup>3)</sup>	TL431AMSDT <sup>3)</sup>
					TL431BCDBZR <sup>1)</sup>	
				0.5%	0 to 70	TL431BCDBZR <sup>1)</sup>
-40 to 85	TL431BIDBZR <sup>1)</sup>					
-40 to 125	TL431BQDBZR <sup>1)</sup>					
	TL431BFDT <sup>2)</sup>	TL431BMFDT <sup>2)</sup>				
	TL431BSDT <sup>3)</sup>	TL431BMSDT <sup>3)</sup>				

<sup>1)</sup> Offers enhanced stability area and very low load capacity requirement  
<sup>2)</sup> Offers higher ElectroMagnetic Interference (EMI) ruggedness, e.g. for Switch Mode Power Supply  
<sup>3)</sup> Is designed for standard requirements and linear applications

## \* Normal pinning vs. mirrored pinning for TL431

	Pin	Symbol	Description	Simplified outline	Graphic symbol
Normal pinning	1	k	cathode		
	2	REF	reference		
	3	a	anode		
Mirrored pinning	1	REF	reference		
	2	k	cathode		
	3	a	anode		

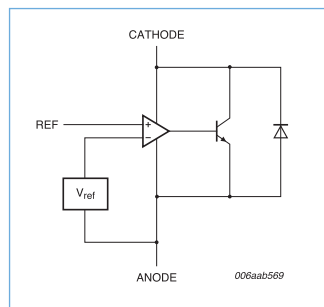
### Key benefits

- ▶ Simple solution to achieve a stabilized voltage
- ▶ Any output voltage from 2.5 to 36 V can be set by just two external resistors
- ▶ Full temperature range from -40 to 125 °C
- ▶ Low temperature drift: typically 6 mV (between 0 and 70 °C)
- ▶ Low output noise
- ▶ High quality level according AEC-Q100

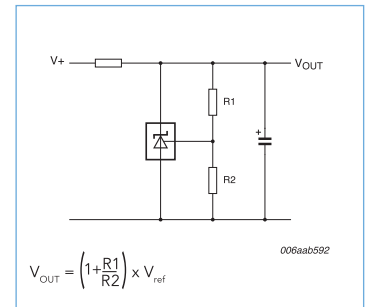
### Key applications

- ▶ Shunt voltage regulator
- ▶ Precision current limiter
- ▶ Precision constant current sink
- ▶ Isolated feedback loop for Switch Mode Power Supply (SMPS)

### Functional diagram




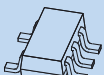
### Shunt voltage regulator












Any voltage in the given range can be set by only 2 external resistors

# TLVH431 adjustable shunt voltage regulator with $V_{ref} = 1.24V$

types in **bold** represent new products

Package				SOT23		SOT753	
							
Size (mm)				2.9 x 1.3 x 1.0		2.9 x 1.5 x 1.0	
P <sub>tot</sub> (mW)				480		450	
Pinning configuration				Normal pinning*		Mirrored pinning*	
V <sub>KA</sub> (V)	I <sub>K</sub> (mA)	V <sub>ref</sub>	T <sub>amb</sub> (°C)				
20	80	1.24	1.5%	0 to 70	<b>TLVH431CDBZR</b>		
				-40 to 85	<b>TLVH431IDBZR</b>		
				-40 to 125	<b>TLVH431QDBZR</b>	<b>TLVH431MQDBZR</b>	<b>TLVH431QDBVR</b>
			1%	0 to 70	<b>TLVH431ACDBZR</b>		
				-40 to 85	<b>TLVH431AIDBZR</b>		
				-40 to 125	<b>TLVH431AQDBZR</b>	<b>TLVH431AMQDBZR</b>	<b>TLVH431AQDBVR</b>
0.75%	-40 to 125	<b>TLVH431DQDBZR</b>	<b>TLVH431DMQDBZR</b>	<b>TLVH431DQDBVR</b>			

## \*Normal pinning vs. mirrored pinning for TLVH431

	Pin	Symbol	Description	Simplified outline	Grafic symbol
 <b>SOT23</b> Normal pinning	1	REF	reference		REF a —  — k
	2	k	cathode		
	3	a	anode		
 <b>SOT23</b> Mirrored pinning	1	k	cathode		REF a —  — k
	2	REF	reference		
	3	a	anode		
 <b>SOT753</b> Pinning	1	NC	no internal connection		REF a —  — k
	2	NC	no internal connection		
	3	k	cathode		
	4	REF	reference		
	5	a	anode		

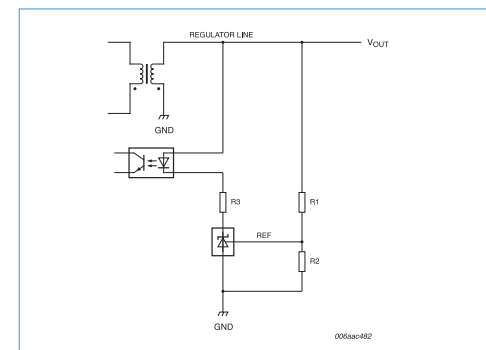
## Key benefits

- ▶ Enabling regulated voltage down to 1.24 V
- ▶ Any higher output voltage up to 18 V can be set by just two external resistors
- ▶ Supports feedback loop application for 3.3 V SMPS
- ▶ Lowest I<sub>k</sub>(min) value of 55 μA (typical) for improved energy efficiency
- ▶ Full temperature range from -40 to 125 °C
- ▶ Very low temperature drift: typically 4 mV (between -40 and 125 °C)
- ▶ Low output noise
- ▶ High quality level according AEC-Q100

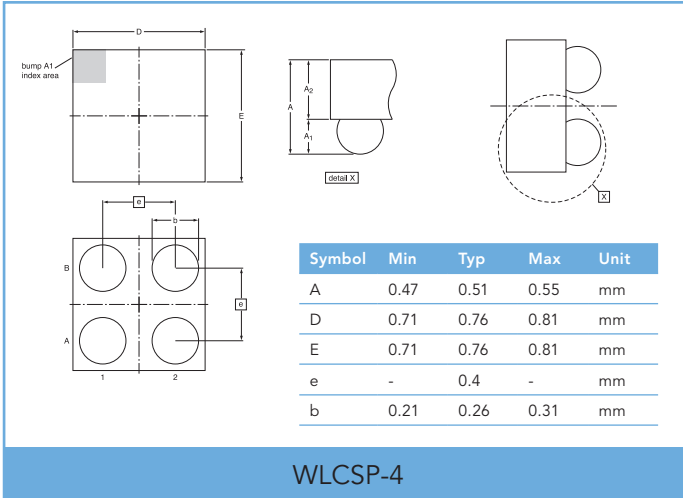
## Key applications

- ▶ Shunt voltage regulator
- ▶ Precision current limiter
- ▶ Precision constant current sink
- ▶ Isolated feedback loop for Switch Mode Power Supply (SMPS)

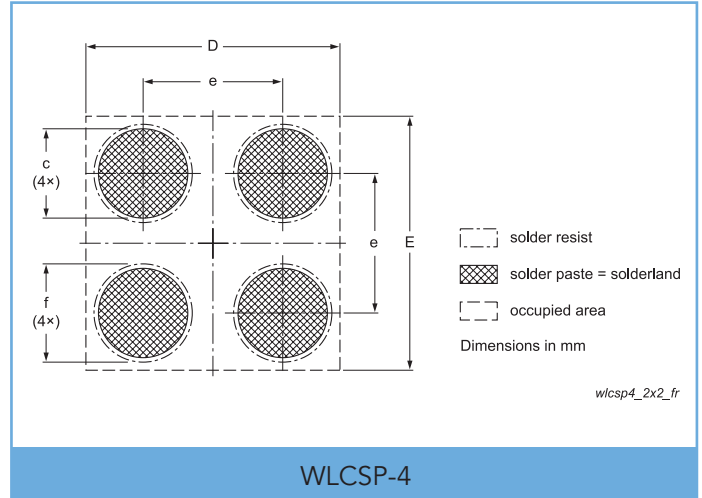
## Feedback loop application



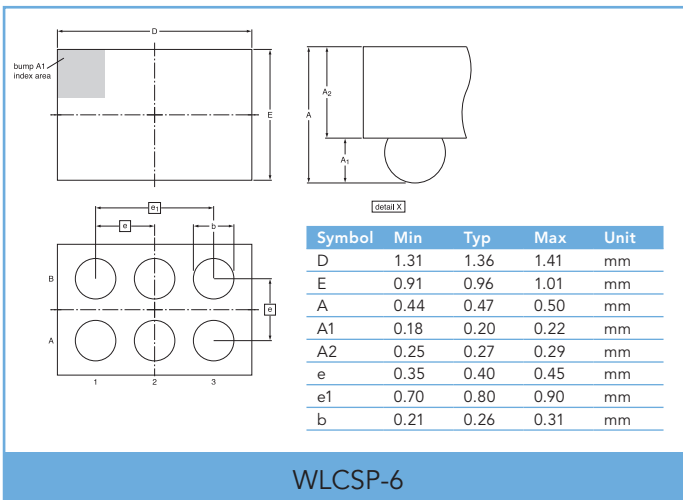
# Package dimensions and footprints



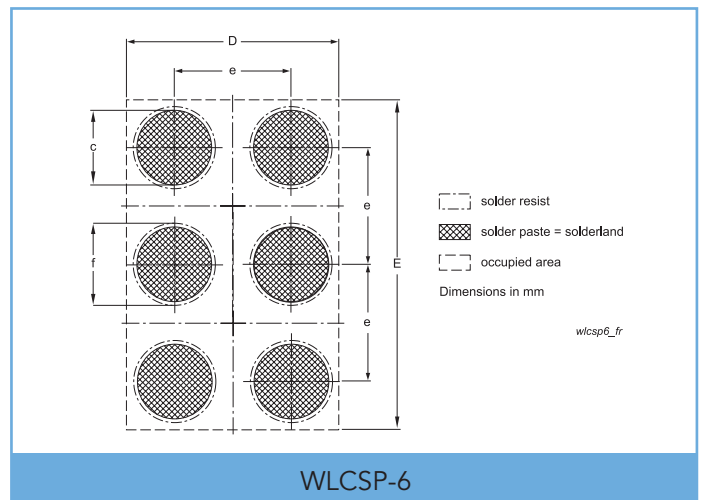
WLCSP-4



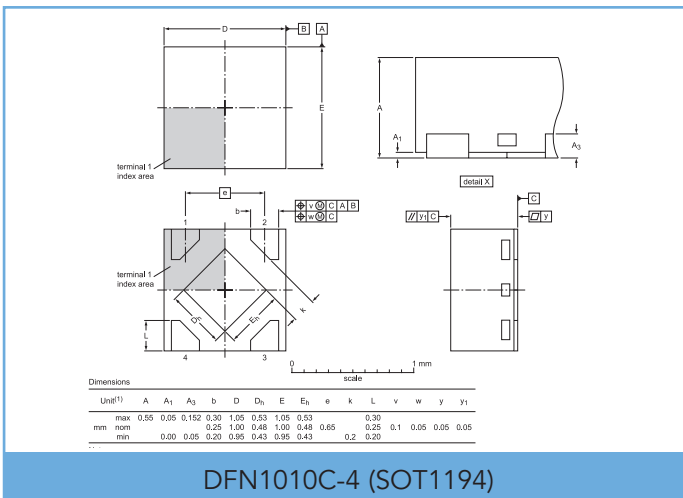
WLCSP-4



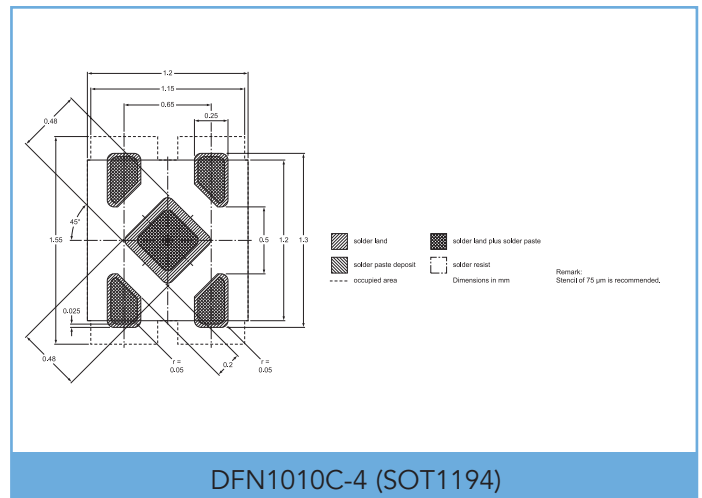
WLCSP-6



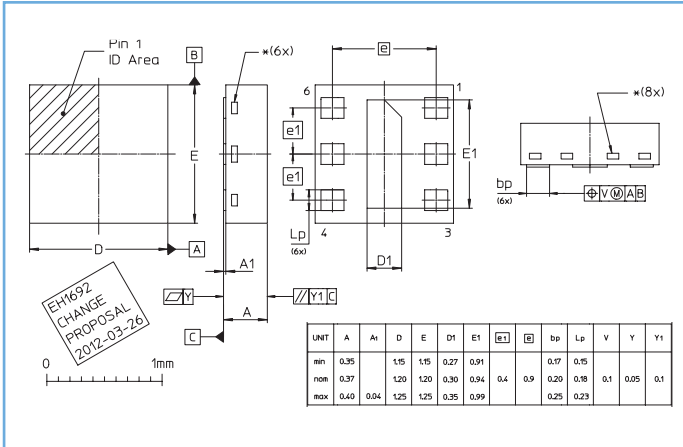
WLCSP-6



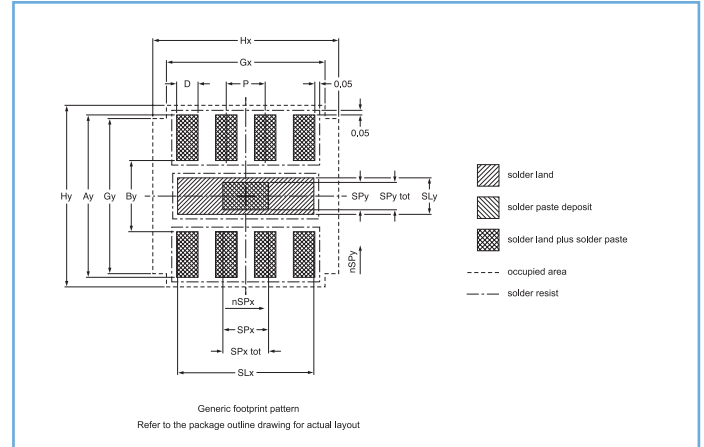
DFN1010C-4 (SOT1194)



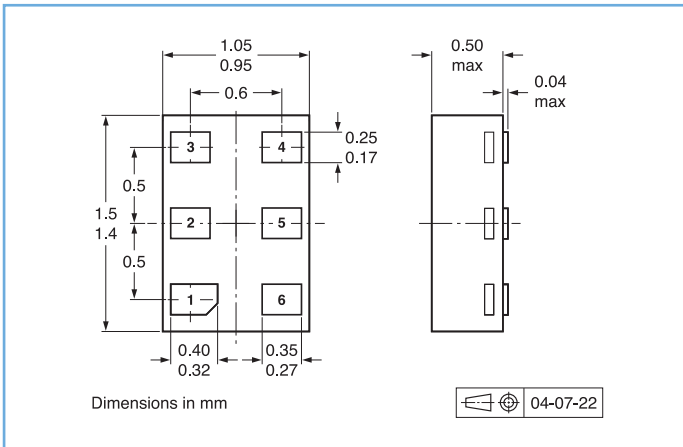
# Package dimensions and footprints



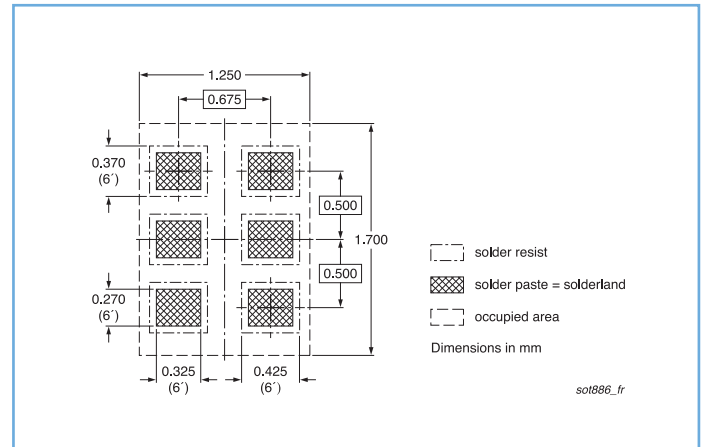
DFN1212-6 (SOT1229)



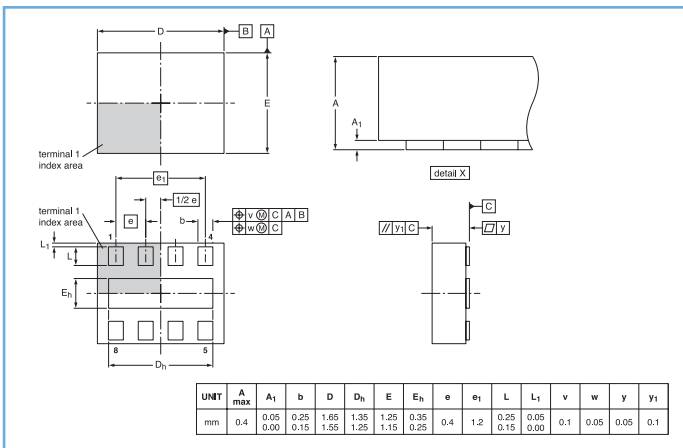
DFN1212-6 (SOT1229)



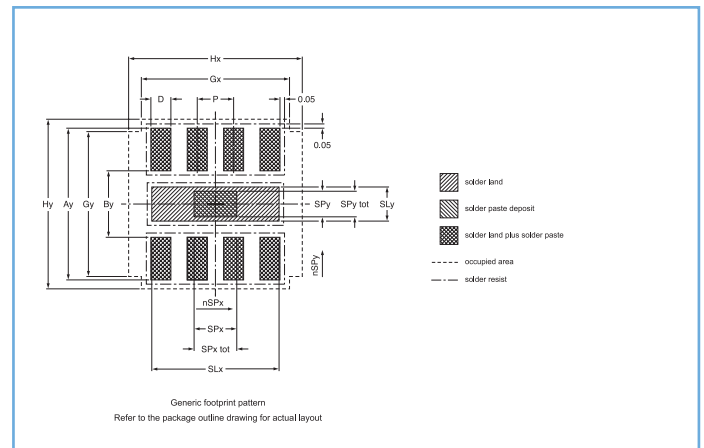
DFN1410-6 (SOT886)



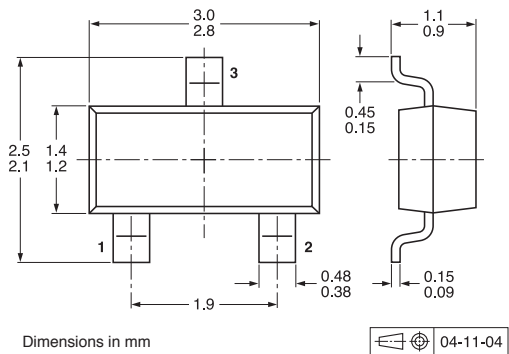
DFN1410-6 (SOT886)



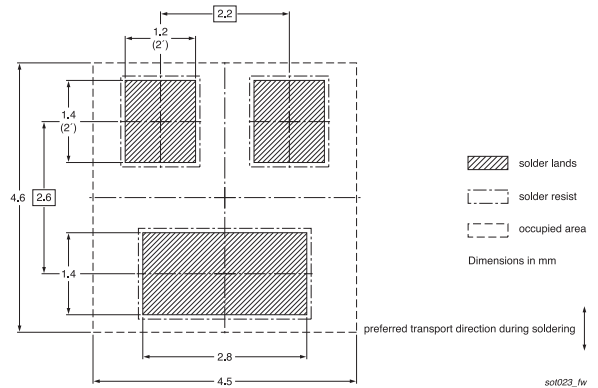
DFN1612-8 (SOT1225)



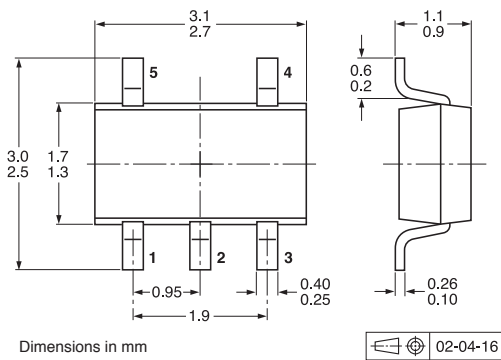
DFN1612-8 (SOT1225)



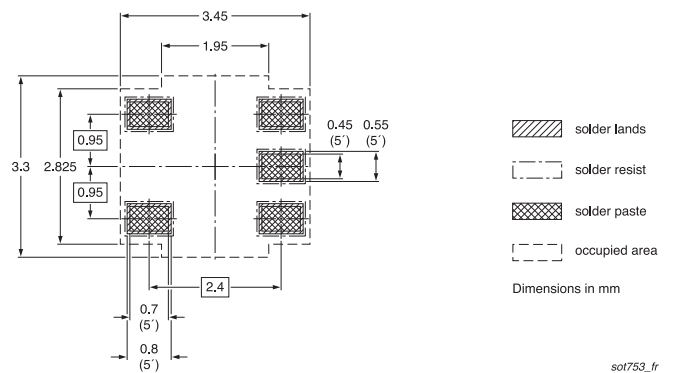
SOT23



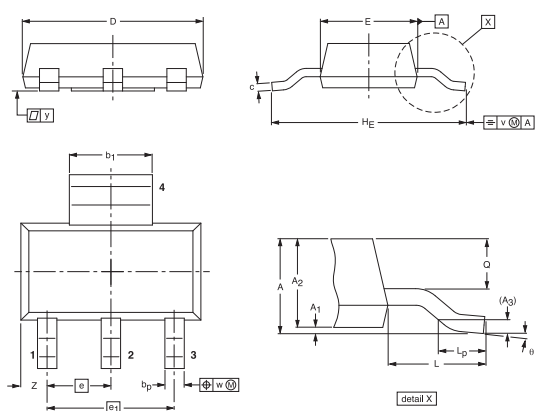
SOT23



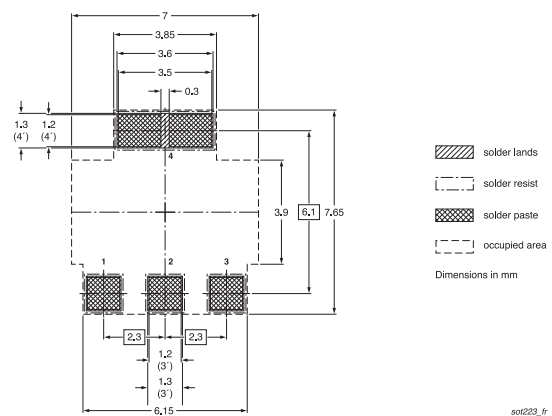
SOT753 (SOT23-5)



SOT753 (SOT23-5)



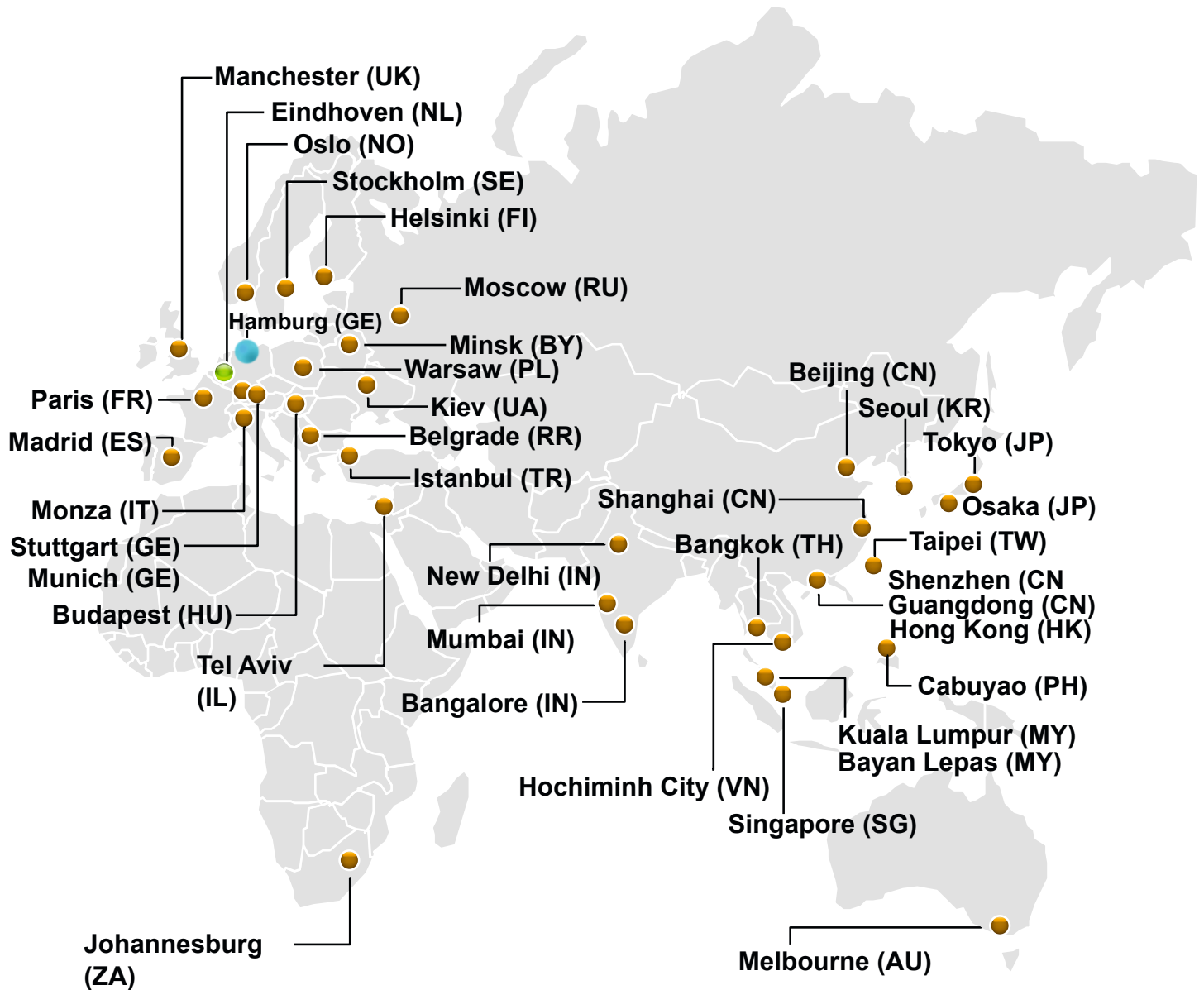
SOT223



SOT223

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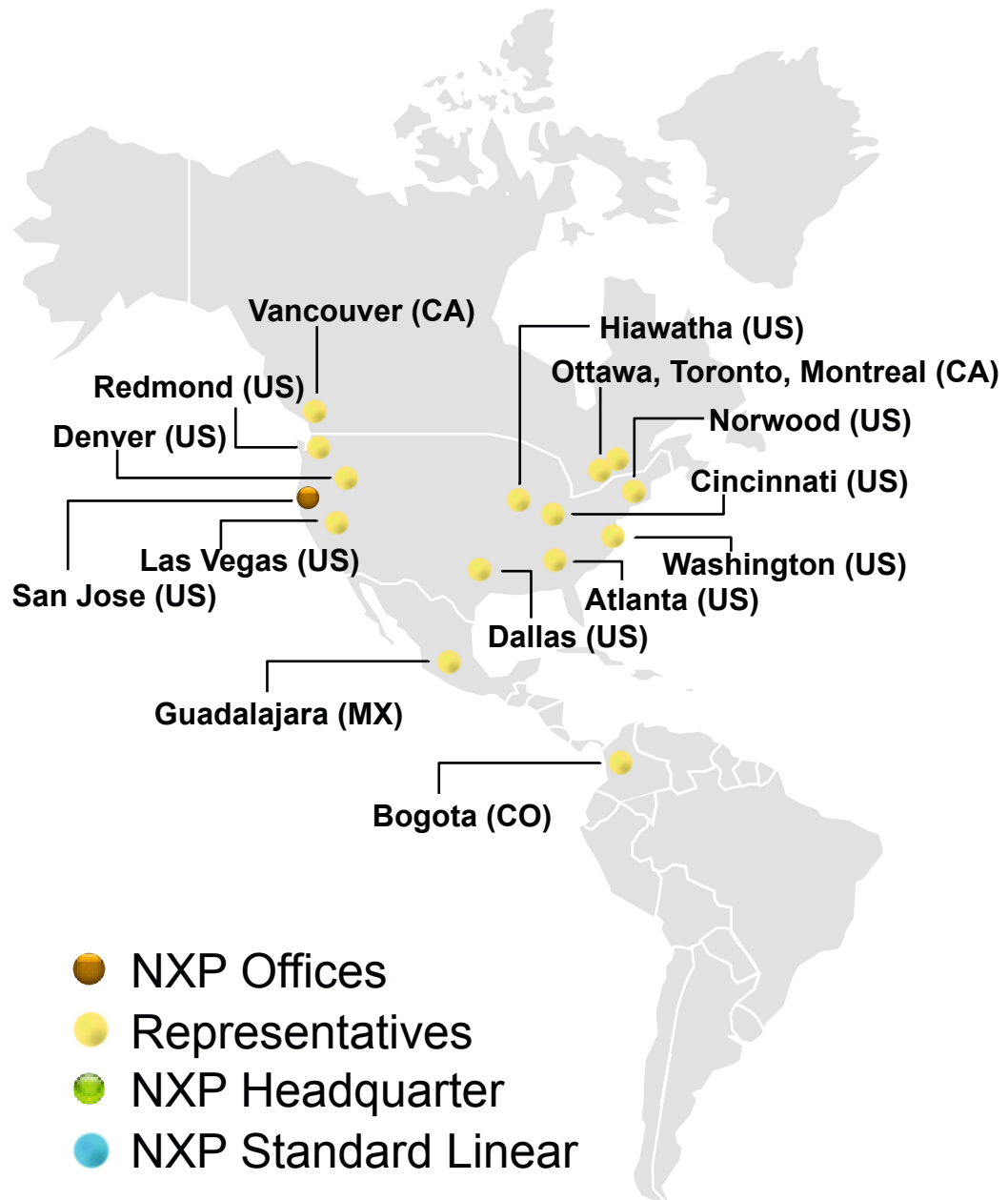


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