



# Portable Solutions

*Comprehensive power management, protection and media solutions for today's variety of portable applications from ON Semiconductor.*

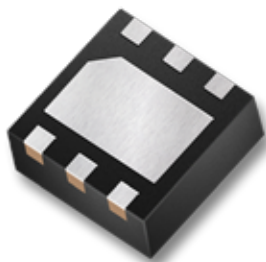
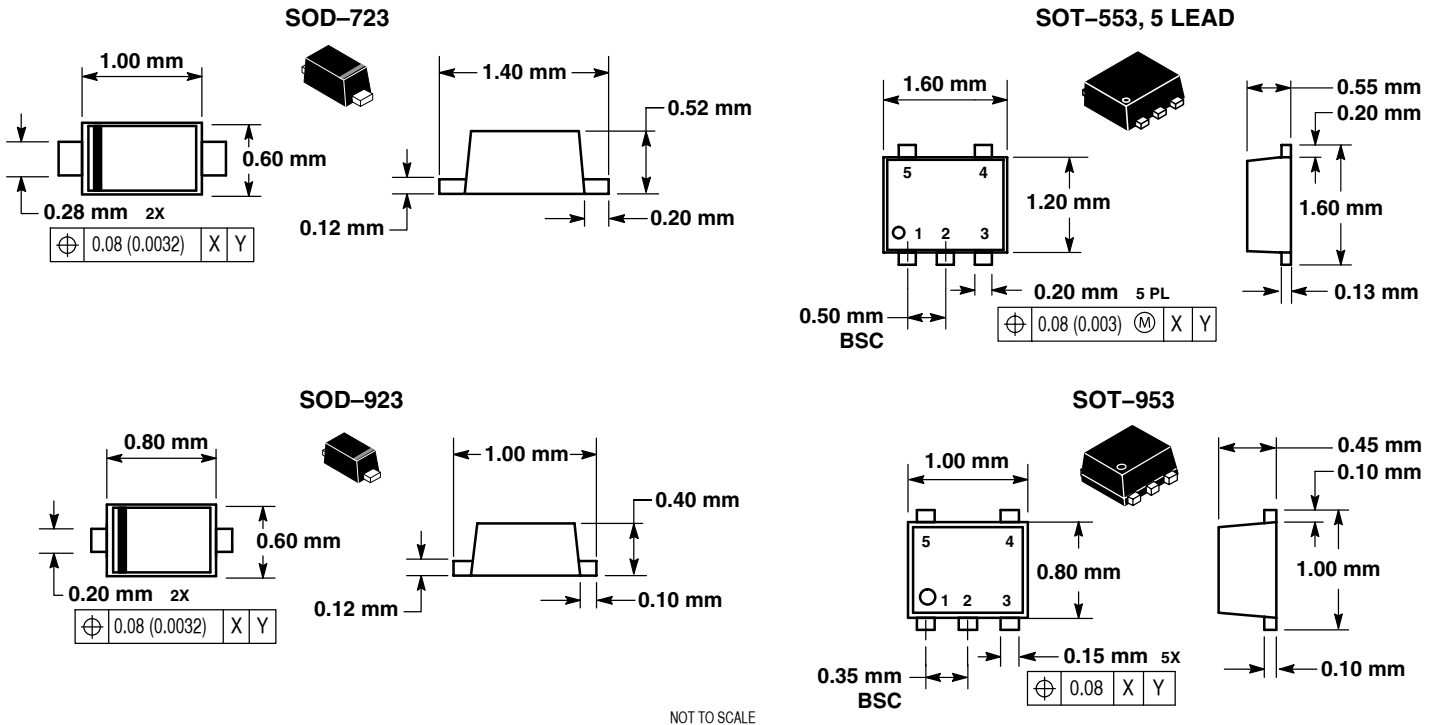


## Low Profile, Small Footprint Packaging

ON Semiconductor offers the latest in low-profile, small-outline packaging. We enable the design and production of ultra-thin end-user products for the consumer market, by manufacturing some of the lowest profile packaging available in the world, in vast volumes. Whether you are designing mobile phones, MP3 players, digital still cameras, PDAs, game players, or other portable appliances, our packaging technology allows the ON Semiconductor product portfolio to be used in designs with the most demanding space constraints.



All of our packages are available with Pb-free leads to ensure compliance with RoHS standards.



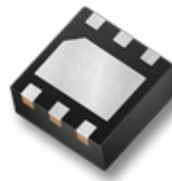
**DFN-6, 3x3**



**ChipFET™**



**SOT-23-5**



**WDFN-6, 2x2**



**SC-70**



**SOT-723**

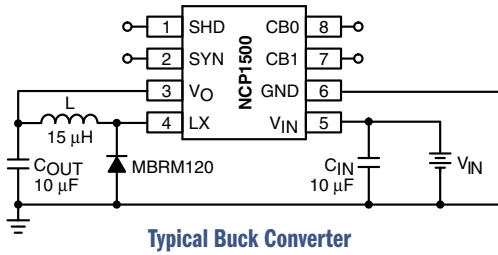
Realistic sizes are approximate.

## A Multitude of Solutions for Today's Portable Electronics

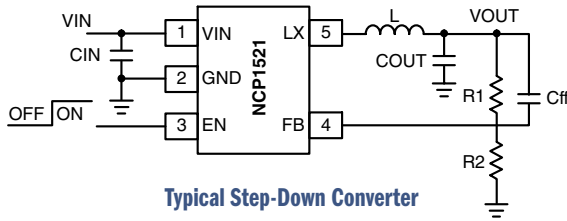




## High Efficiency DC-DC Converters



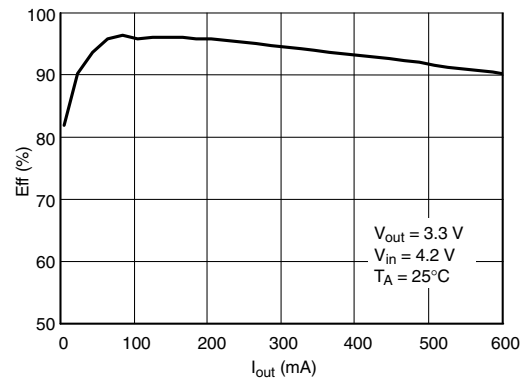
Typical Buck Converter



Typical Step-Down Converter

### Key Features

- PWM buck converter operates either as an LDO or in PFM mode when output current decreases (NCP1500/01/19/21/22/23/29), maximizing efficiency at both light and full loads
- High switching frequencies allow use of smaller output filters, capacitors, and inductors, while maintaining high efficiency



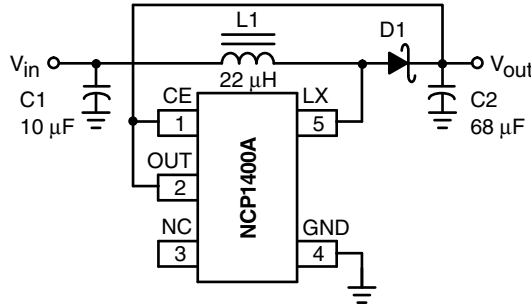
NCP1521 - Efficiency vs Output Current

### Buck Converters

Device	Package(s)	Topology	Frequency	Input Voltage	Output Voltage	Max Current	Typical Efficiency	Features
NCP1500	Micro8™	PWM/Linear	External Sync 270-630 kHz	2.7 - 5.4 V	1.0 - 1.8 V Selectable	300 mA	91%	Turns into LDO Mode when Sync is Absent
NCP1501	Micro8	PWM/Linear	External Sync 450-1000 kHz	2.5 - 5.2 V	1.0 - 1.8 V Selectable	300 mA	92%	Sync Rec, Turns into LDO Mode when Sync is Absent
NCP1510A	MicroBump-9	PWM/Pulse	1 MHz or External Sync 450-1000 kHz	2.7 - 5.2 V	1.0 - 1.8 V Selectable	300 mA	95%	Sync Rec, Turns into Pulse Mode to Save Power when Sync Pin is Low
NCP1519*	Thin SOT-23-5	PWM/PFM	1.7 Mhz	2.7 - 5.5 V	Adj 0.9 - 3.3 V by External Resistors, 1.2, 1.5, 1.8 V	400 mA	96%	Sync Rec, Ultra-Low 60 μA Iq at Light Loads
NCP1521	Thin SOT-23-5, Thin DFN-6	PWM/PFM	1.5 Mhz	2.7 - 5.5 V	Adjustable 0.9 - 3.3 V by External Resistors	600 mA	96%	Sync Rec, Ultra-Low 30 μA Iq at Light Loads
NCP1522	Thin SOT-23-5	PWM/PFM	3 MHz	2.7 - 5.5 V	Adjustable 0.9 - 3.3 V by External Resistors	600 mA	93%	Sync Rec, Ultra-Low 60 μA Iq at Light Loads
NCP1523*	MicroBump-8	PWM/PFM	3 MHz	2.7 - 5.5 V	Adjustable 0.9 - 3.3 V by External Resistors	600 mA	93%	Sync Rec, Ultra-Low 60 μA Iq at Light Loads
NCP1526	Thin DFN-10	Dual Output PWM + LDO	3 MHz	2.7 - 5.5 V	PWM 1.2 V; LDO 2.8 V Other Options Available	PWM 400 mA LDO 150 mA	95%	Sync Rec, Ultra-Thin DFN: 0.55 mm Thickness
NCP1529*	Thin SOT-23-5	PWM/PFM	1.7 Mhz	2.7 - 5.5 V	Adj 0.9 - 3.3 V by External Resistors, 1.2, 1.5, 1.8 V	1 A	96%	Sync Rec, Ultra-Low 60 μA Iq at Light Loads
NCP1530	Micro8	PWM/PFM	600 kHz or External Sync Up to 1200 kHz	2.7 - 5.5 V	2.5 - 5.0 V	600 mA	92%	Programmable Soft-Start
NCP1550	SOT-23-5	PWM/PFM	600 kHz	2.5 - 6.0 V	1.8 - 3.3 V	2000 mA (Ext Switch)	90%	Enable Pin

\* Planned 2H06

## High Efficiency DC-DC Converters



Typical Boost Converter

### Key Features

- High switching frequency allows use of small inductors and capacitors

Feature	NCP1410	Competitor
Output Voltage Range	1.5 ~ 5.5 V	2.0 ~ 5.5 V
Operation Startup Voltage	1.0 ~ 5.5 V	1.1 ~ 5.5 V
Max Switching Frequency	600 kHz	500 kHz
Inductor	15 to 22 μH	22 μH
Output Ripple Voltage	34 mA Typ	Not Specified
Efficiency	92% Typ	91% Typ
Operating Current @ I <sub>OUT</sub> = 0	9 μA Typ	16 μA Typ
Shutdown Current	0.05 μA Typ	0.1 μA Typ
Reference Voltage Accuracy	1.19 V ± 0.6%	1.3 V ± 2.0%

### Boost Converters

Device	Package(s)	Topology	Frequency	Input Voltage	Output Voltage	Max Current	Typ Efficiency	Features
NCP1400A	SOT-23-5	PWM	180 kHz	0.8 - 5.5 V	1.8 - 5.0 V	100 mA	88%	Enable Pin
NCP1402	SOT-23-5	PFM	180 kHz	0.8 - 5.5 V	1.8 - 5.0 V	200 mA	85%	Enable Pin
NCP1403	SOT-23-6	PFM	300 kHz	1.2 - 5.5 V	Up to 15 V	50 mA	82%	Enable Pin
NCP1406	SOT-23-5	PFM	1000 kHz	1.2 - 5.5 V	Up to 25 V	50 mA	85%	Enable Pin
NCP1410	Micro8™	PFM	600 kHz	1.0 - 5.5 V	1.5 - 5.5 V	250 mA	92%	Sync Rec, Low Battery Detection
NCP1421	Micro8	PFM	1200 kHz	1.0 - 5.0 V	1.5 - 5.0 V	600 mA	94%	True Cutoff, Ring-Killer, Low Battery Detection
NCP1422	DFN-10	PFM	1.2 MHz	1.0 - 5.0 V	1.0 - 5.0 V	800 mA	94%	Sync Rec, True Cutoff, Low Battery Detection
NCP1423	Micro10	PFM	600 kHz	0.8 - 3.3 V	1.8 - 3.3 V	400 mA	92%	Sync Rec, True Cutoff, Low Battery Detection, Low Startup Voltage (0.8 V)
NCP1450A	SOT-23-5	PWM	180 kHz	0.8 - 5.5 V	1.8 - 5.0 V	1000 mA (Ext Switch)	88%	Enable Pin

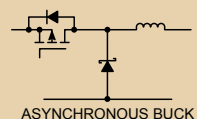
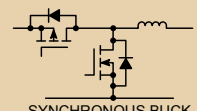
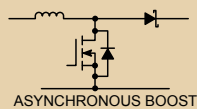
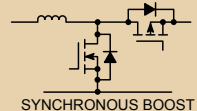
## Optimize Figure-of-Merit with MOSFETs for DC-DC Conversion

### Complete μCool™ Portfolio

- N-Channel & P-Channel
- Single, Dual, Complementary and FETKY®
- 8 V, 20 V, 30 V

### Key Performance Characteristics

- Low R<sub>ds(on)</sub> and Gate Charge Deliver Low Figure-of-Merit Ratio (<110 for Single N-Channel)
- Package Thermal Resistance of 38°C/W
- Package Footprints as Small as 4 mm<sup>2</sup>
- Low Profile <0.75 mm



### μCool™ MOSFETs

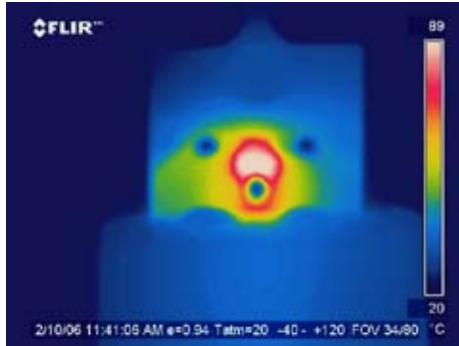
Device	V <sub>DS</sub>	Polarity	Configuration	R <sub>DS(ON)</sub> *	Package
NTJD4116N	30 V	N	Dual	<70 mΩ	WDFN, 2 x 2 mm
NTLJF4156N	30 V	N	FETKY	<70 mΩ	WDFN, 2 x 2 mm
NTLJF3117P	20 V	P	FETKY	<100 mΩ	WDFN, 2 x 2 mm
NTLJD3119C	20 V	N/P	Complementary	<70/100 mΩ	WDFN, 2 x 2 mm

### Other New MOSFETs

Device	V <sub>DS</sub>	Polarity	Configuration	R <sub>DS(ON)</sub> *	Package
NTHD3102C	20 V	N/P	Complementary	<45/85 mΩ	ChipFET™, 2 x 3 mm
NTGS3441P	20 V	P	Single	<110 mΩ	TSOP-6, 3 x 3 mm
NTGD3122C	20 V	N/P	Complementary	<80/145 mΩ	TSOP-6, 3 x 3 mm
NTGF3123F	20 V	P	FETKY	<80 mΩ	TSOP-6, 3 x 3 mm
NTJS4160N	30 V	N	Single	<85 mΩ	SC-88, 2 x 2 mm

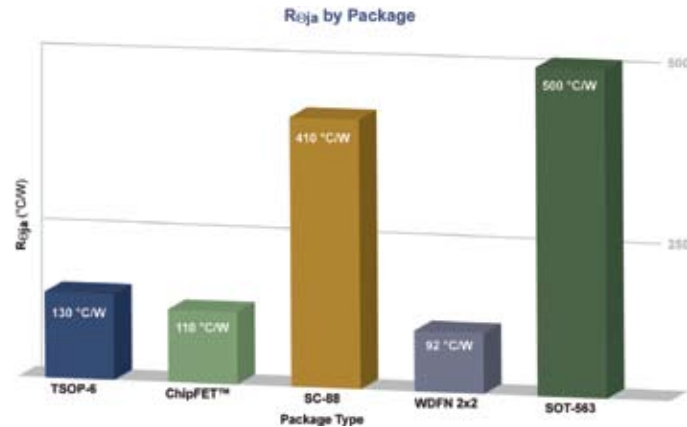
\* R<sub>DS(ON)</sub> 4.5 V<sub>GS</sub>

## Smaller, Thinner, Faster, Cooler & Safer Load Switch Elements



Thermal Image of  $\mu$ Cool™ NTLJS3113P (Power FET)

Minimum Pad,  $I_{(load)} = 4$  A, Steady State



Thermal Resistance Comparison of Different Packages

Test Conditions: FR4, 1-in-2, 1 oz Cu, Dual Die

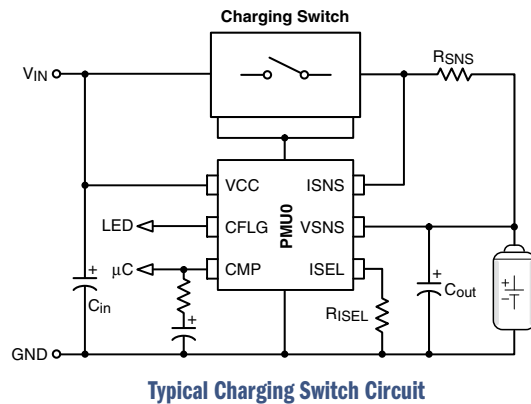
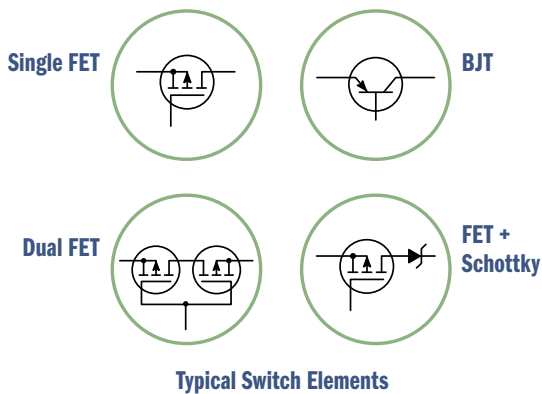
Power MOSFETs							
	Device	BVDSS	Polarity	Configuration	RDS(ON) 4.5 Vgs	Package	Dimensions
High Load Current >4 A	NTLTS3107P	20 V	P	Single	< 16 mΩ	Micro-8 LL	3.3 x 3.3 mm
	NTHS5404	20 V	N	Single	< 30 mΩ	ChipFET	3 x 2 mm
	NTLJS4159N	30 V	N	Single	< 35 mΩ	WDFN	2 x 2 mm
Low to Medium Load Current <4 A	NTLJD4114N	30 V	N	Dual	< 70 mΩ	WDFN	3.3 x 3.3 mm
	NTZD3151P	20 V	P	Single	< 150 mΩ	SOT-563	1.6 x 1.6 mm
	NTK3142P	20 V	P	Single	< 4 Ω	SOT-723	1.2 x 1.2 mm
Integrated Load Switches							
	Device	Description				Package	Dimensions
Integrated Load Switches	NTGD1100L	N-Channel Level Shift, 8 V P-Channel Switch < 80 mΩ				TSOP-6	3 x 3 mm
	NTJD1155L	N-Channel Level Shift, 8 V P-Channel Switch < 175 mΩ				SC-88	2 x 2 mm
	NTLJD2105L	N-Channel Level Shift, 8 V P-Channel Switch < 50 mΩ				WDFN	2 x 2 mm
Low V <sub>CE(sat)</sub> BJTs							
	Device	Description				Package	Dimensions
Low to Medium Load Current <4 A	NSS35200CF8T1G	35 V, 2 A DC, 7 A Peak				ChipFET	2 x 3 mm
	NSS40400CF8T1G	40 V, 4 A DC, 7 A Peak				ChipFET	2 x 3 mm
	NSS30201MR6T1G	30 V, NPN, 2 A DC, 3 A Peak				TSOP-6	2 x 3 mm
High Load Current >4 A	NSS40600CF8T1G	40 V, PNP, 6 A DC, 7 A Peak				ChipFET	2 x 3 mm
	NSS40601CF8T1G	40 V, NPN, 6 A DC, 7 A Peak				ChipFET	2 x 3 mm
	NSS12500UW3T2G	12 V, PNP, 5 A DC, 7 A Peak				WDFN-3	2 x 2 mm
Integrated Load Switches							
	Device	Description				Package	Dimensions
Integrated Load Switches	EMF5XV6T5	12 V, PNP with NPN BRT Driver				SOT-563	1.6 x 1.6 mm

## Smaller, Thinner, Faster, Cooler & Safer Charging Switch Elements

Charging Switches			
Device Type	Package		
	WDFN 2x2 mm	SOT-23/TSOP-6	ChipFET
FET Single	NTLJS3113P	NTGS3443P	NTHS4101P, NTHS5441
Low $V_{CE(sat)}$ BJT	NSS12500UW3T1G	NSS30100LT1G	NSS35200CF8T1G
FET + Schottky	NTLJF3117P	NTGF3123P	NTHD3101F, NTHD4P02F
FET Dual	NTLJD3115P	NTGD4161P	NTHD4102P, NTHD4401P

### Key Features

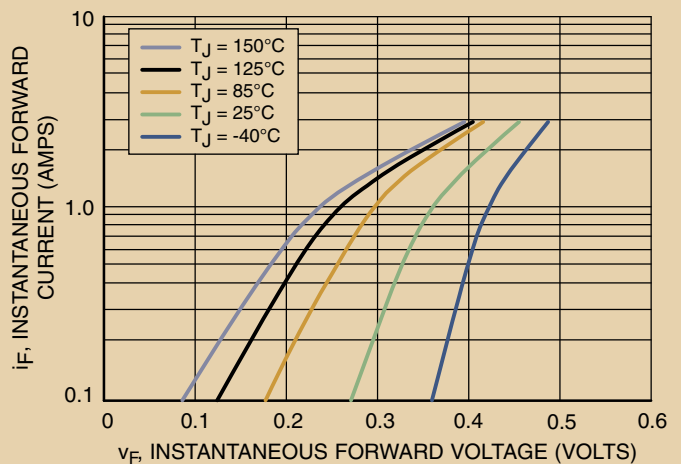
- Thermal Performance >1.5 W
- Package Footprints as Small as 4 mm<sup>2</sup>
- Low Profile <0.8 mm



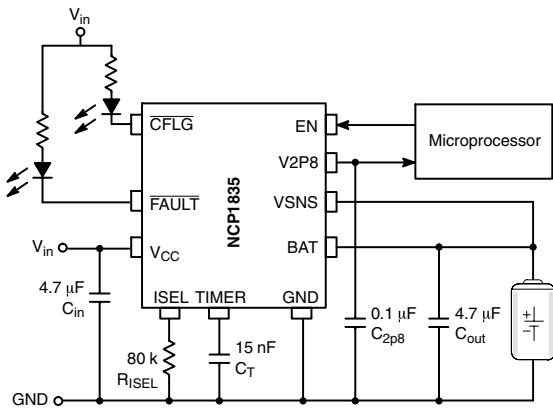
## Rectifiers Manage Big Power in Small Packages

### Schottky Rectifiers

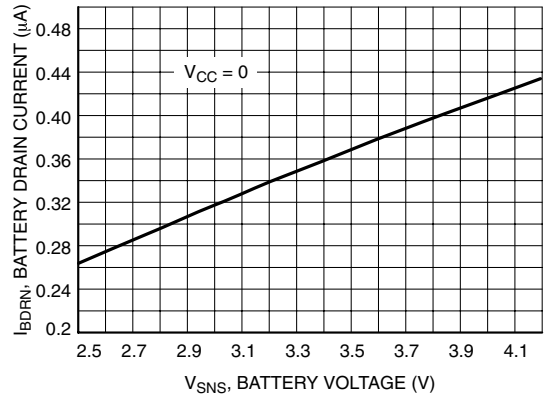
Device	$V_{RRM}$	$V_f$	Current	Package
MBRM110E	10 V	0.46 V	1 A	POWERMITE®
MBRM120E	20 V	0.46 V	1 A	POWERMITE
MBRM130L	30 V	0.33 V	1 A	POWERMITE
MBRM140	40 V	0.52 V	1 A	POWERMITE
MBR0520L	20 V	0.33 V	0.5 A	SOD-123
MBR0530	30 V	0.43 V	0.5 A	SOD-123
MBR0540	40 V	0.46 V	0.5 A	SOD-123
MBR130	30 V	0.47 V	1 A	SOD-123



## Low Standby Current Battery Management for Extended Battery Life



Typical Application Circuit

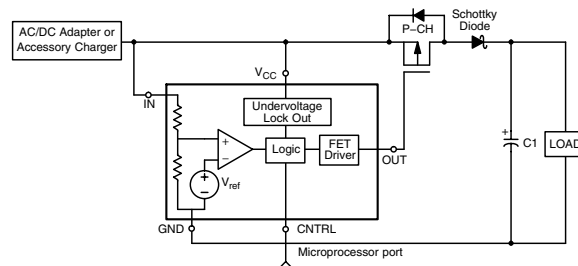


Battery Drain Current versus Battery Voltage

### Battery Management Circuits

Device	Description	Package	Key Features
NCP1835	Up to 1 A Single-Cell Lithium-ion/Polymer Integrated CCCV Battery Charger	DFN-10	No External MOSFET
NCP1835B	Up to 300 mA Single-Cell Lithium-ion/Polymer Integrated CCCV Battery Charger	DFN-10	No External MOSFET
NCP1800	Single-Cell Lithium-ion CCCV Battery Charger	Micro8™	Industry Leading Standby Current 0.5 μA, Adjustable Charge Current Limit
MC33340/2	Nickel Chemistry Battery Cradle Charger	SOIC-8	Peak Voltage Detection

## Integrated Overvoltage Protection for Battery and Charging Circuits



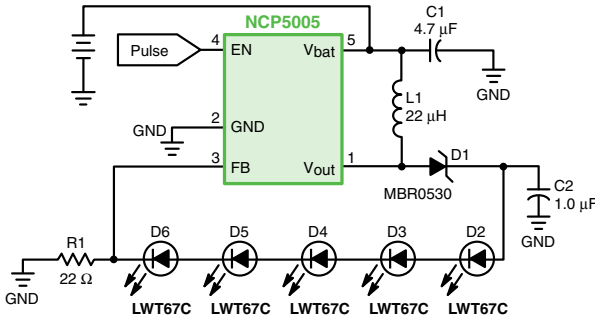
Typical OVP Device Diagram

### Battery Protection Circuits

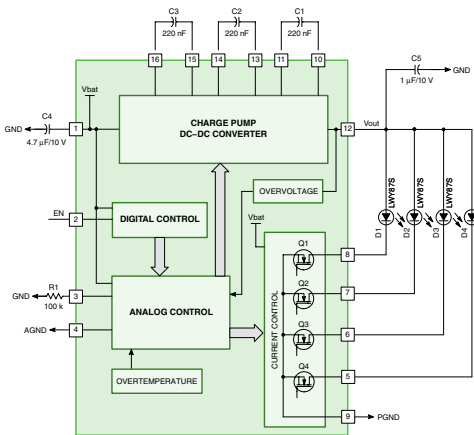
Device	Overvoltage Protection			MOSFET		Package			Ambient Operating Temperature (°C)
	UVLO (V)	OVP (V)	Logic Override	Vds (V)	Rdson max (mW) @ 4.5 V	Type	Area (mm)	Height (mm)	
NUS2045	2.8	6.85	Yes	20	71	DFN	3.3 x 3.3	0.85	-40 to +85
NUS3045	2.8	6.85	Yes	30	66	DFN	3.3 x 3.3	0.85	-40 to +85
NUS3046		5.5	Yes	30	66	DFN	3.3 x 3.3	0.85	-40 to +85
NUS1204		4.7	No	12	75	TDFN	2.0 x 2.0	0.85	-40 to +85
NUS3055	2.8	6.85	Yes	30	66	TLLGA	2.5 x 3.0	0.55	-40 to +85
NUS3035		4.45	Yes	30	66	TLLGA	2.5 x 3.0	0.55	-40 to +85
NCP345	2.6	6.85	Yes	NA	NA	SOT-23-5	3.0 x 2.75	1.00	-40 to +85
NCP346		4.4, 5.5	Yes	NA	NA	SOT-23-5	3.0 x 2.75	1.00	-40 to +85



# Optimize Efficiency and Space with Inductive and Charge Pump LED Drivers



**Inductive Solution – NCP5005**



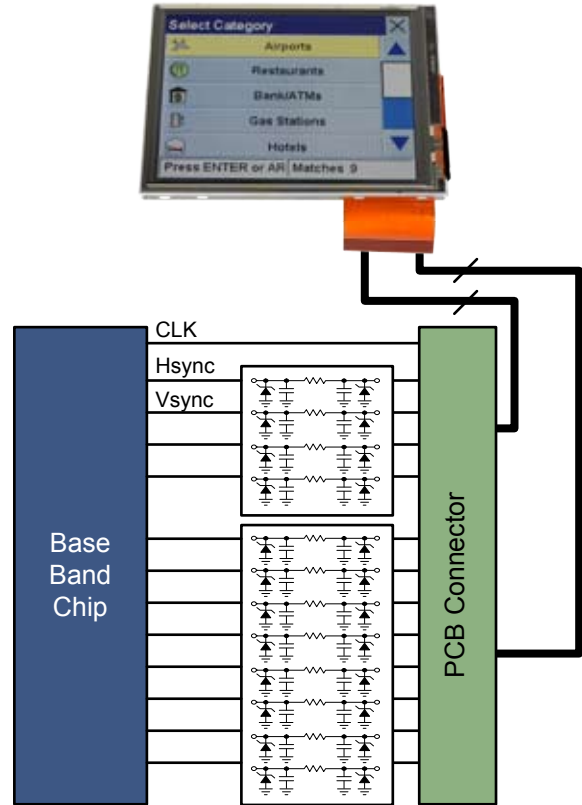
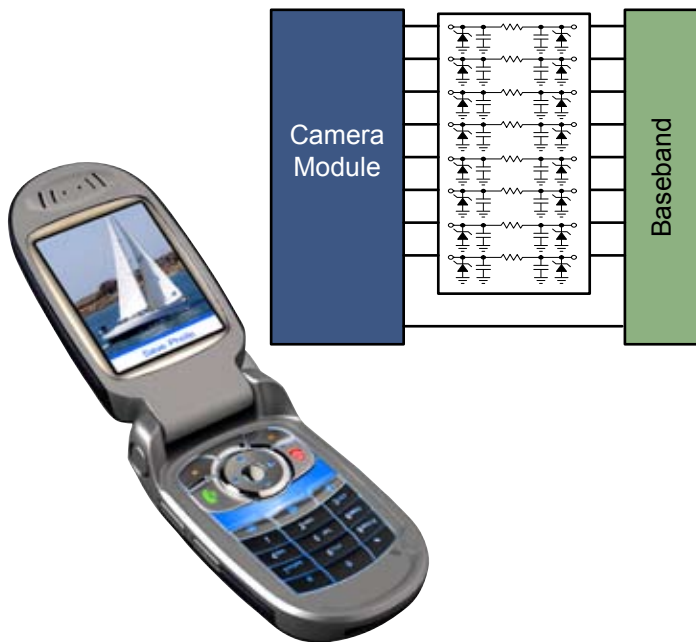
**Charge Pump Solution – NCP5604A**



Application	LED Type	Number of LEDs/ Connection	Topology	Product	Key Feature
Display Backlighting	Standard, 10-25 mA	2 LEDs/Parallel	Linear	<b>NUD4301</b> : Adjustable (1-30 mA) constant current driver; DFN-8 (2 x 2 mm)	Linear or PWM dimming
		2 - 5 LEDs/Series	Inductive	<b>NCP5006/5007</b> : Up to 92% efficiency PFM boost, 21 V/ 1 W output; thin SOT-23-5 (3 x 3 mm)	Simple, open LED output clamp
		3 - 5 LEDs/Series	Inductive	<b>NCP5005</b> : Enhanced version of NCP5006 - high EMI immunity	Enhanced EMI immunity, best for RF sensitive application
		2 - 5 LEDs/Series	Inductive	<b>NCP5010</b> : 1 MHz PWM boost, 22 V/0.5 W output, integrated rectifier & true-cutoff; uBump-8 (1.7 x 1.7 mm)	Highly integrated driver
		2 LEDs/Parallel	Charge Pump	<b>NCP5602</b> : 90% peak efficiency, 2 outputs (25 mA each), 2% current matching; I2C; LLGA-12 (2 x 2 mm)	ICON mode; I2C dimming control
		2 LEDs/Parallel	Charge Pump	<b>NCP5612</b> : 2 outputs (25 mA each), I2C; LLGA-12 (2 x 2 mm)	ICON mode; S-Wire link dimming control
		2 - 6 LEDs/Series	Inductive	<b>NCP1406</b> : Up to 90% efficiency, PFM (up to 1 MHz), 25 V/0.5 W output; thin SOT-23-5 (3 x 3 mm)	Can operate from 1 or 2 alkaline or Ni-based cells
		3 or 4 LEDs/Parallel	Charge Pump	<b>NCP5604A/B</b> : Consistent 90% efficiency, 3 or 4 outputs (25 mA each), 0.5% current matching; TQFN-16 (3 x 3 x 0.8 mm)	NCP5604A: Drives 4 LEDs NCP5064B: Drives 3 LEDs
Flash (Torch)	Low current - up to 50 mA for 1 cell/100 mA for 2 cell	Single LED	Inductive	<b>NCP1400ASN50</b> : Fixed frequency PWM micropower boost converter; thin SOT-23-5 (3 x 3 mm)	Can operate from 1 or 2 alkaline or Ni-based cells
	Medium current/Multi-die WLED, 100-350 mA	Single (or multiple in parallel)	Charge Pump	<b>NCP5603</b> : 200 mA cont/350 mA pulsed, voltage regulated output, 4.5 V or 5 V, 75% eff; DFN-10 (3 x 3 mm)	High-current single output charge pump
	Medium current up to 50 mA for 2 cell and 100 mA for 3 cell	2 - 6 LEDs/Series	Inductive	<b>NCP1406</b> : Up to 90% efficiency, PFM (up to 1 MHz), 25 V/0.5 W output; thin SOT-23-5 (3 x 3 mm)	Simple, low cost
	High current WLED, up to 600 mA	Single (or multiple in parallel)	Inductive	<b>NCP1421</b> : PFM boost (up to 1.2 MHz), sync rec, output up to 5 V, 600 mA cont, 94% eff, true-cutoff, 50 nA shutdown current; Micro8 (3 x 5 mm)	Synchronous rectification
	High current WLED, up to 800 mA	Single (or multiple in parallel)	Inductive	<b>NCP1422</b> : PFM boost (up to 1.2 MHz), sync rec, output up to 5 V, 800 mA cont, 94% eff, true-cutoff, 50 nA shutdown current; DFN-10 (3 x 3 mm)	Synchronous rectification
	High current WLED, up to 1 A	2 - 5 LEDs/Series	Inductive	<b>NCP5050</b> : 23 V/4.5 W output, PWM, 1.7 MHz; DFN-10	Integrated switch for 2 adjustable output current levels
Single Driver for Backlight & Flash	LED (10 - 25 mA), Flash LED (100 - 400 mA)	4 LEDs + Flash LED	Charge Pump	<b>NCP5608</b> : Consistent 90% efficiency, 8 outputs (4 @ 25 mA each + 4 @ 100 mA each), 0.5% current matching; TQFN-24 (4 x 4 mm)	One chip lighting solution
OLED Driver Supply	-	-	Inductive	<b>NCP1406</b> : Up to 90% efficiency, PFM (up to 1 MHz), 25 V/0.5 W output; thin SOT-23-5 (3 x 3 mm)	Can operate from 1 or 2 alkaline or Ni-based cells

**BOLD** denotes new or pending device.

## EMI Filtering with ESD Protection for LCD and Camera Interfaces



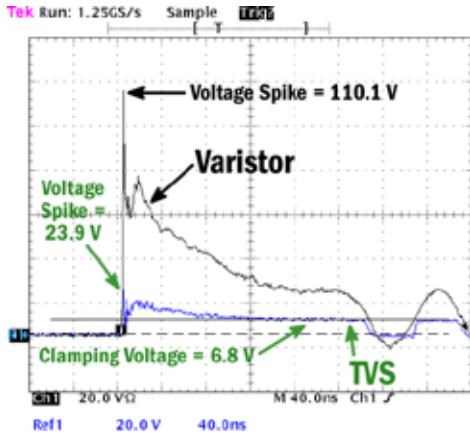
### Key Features

- Excellent low-pass filter characteristics from 800 MHz to 5 GHz
- Low profile package for slim portable electronics
- 0.4 mm pin pitch provides improved layout options

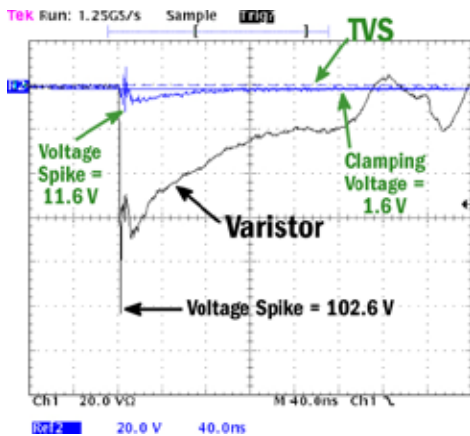
EMI Filtering Devices					
Device	# Lines	Package	Capacitance (pF) @ 2.5 V/Diode	Attenuation @ 900 mHz to 5.0 Ghz	Comments
NUF4402MN	4	DFN 8	12	> -28 dB	Low parasitic inductance package design
NUF4403MN	4	DFN 8	17	> -35 dB	
NUF4210MN	4	DFN 8	8.5	> -19 dB	
NUF4001MU	4	uDFN 8*	12	> -30 dB	
NUF6401MN	6	DFN 12	17	> -35dB	Low parasitic inductance package design
NUF6406MN	6	DFN 12	13	> -28dB	
NUF6402MN	4 + 4	DFN 12	17	> -35dB	
NUF6001MU	6	uDFN 12*	17	> -35dB	
NUF8401MN	8	DFN 16	13	> -28 dB	-
NUF8402MN	8	DFN 16	17	> -35 dB	
NUF8410MN	8	DFN 16	8.5	> -19 dB	
NUF8001MU	8	uDFN 16*	13	> -28 dB	
NZF220D	2	SC-88	6	> -20 dB	-
NUF2030XV6	2	SOT-563	16	> -20 dB	
NUF2042XV6	2	SOT-563	21	> -20 dB	
NUF2220XV6	2	SOT-563	7	> -18 dB	
NUF2230XV6	2	SOT-563	16	> -23 dB	
NZF220T	1	SC-70	7	> -20 dB	

\* Low profile package with 0.4 mm pin pitch

## Transient Voltage Protection Devices for I/O



IEC61000-4-2 Contact Positive Pulse



IEC61000-4-2 Contact Negative Pulse

### Speaker/Microphone

ESD5B Series

### Keypad/Volume Key

ESD9X Series     $\mu$ ESDxxS Series  
 ESD5Z Series    NUP45V6 Series  
 NZQA Series    NUP5120 Series

### USB Connector

NUP2202 Series  
 NUP4202 Series

### Battery Contacts

ESD5Z Series

### Bottom Connector

NZL Series     $\mu$ ESDxxD Series  
 NZQA Series    NUP5120 Series  
 NUP45V6 Series    NUP8010 Series

### Charger Line

ESD5Z Series



### TVS Protection Devices

Device	Description	Package	Dimensions (mm) L x W x H	Surge Rating 8 x 20 $\mu$ s	ESD Rating IEC61000-4-2 Contact
ESD9X Series	TVS and ESD Protection Diode	SOD-923	1.0 x 0.6 x 0.4	Up to 140 W	30 kV
$\mu$ ESDxxS Series	TVS and ESD Protection Diode	SOD-723	1.4 x 0.6 x 0.5	Up to 128 W	30 kV
$\mu$ ESDxxD Series	Dual TVS and ESD Protection Diode	SOT-723	1.2 x 1.2 x 0.5	—	22 kV
ESD5B Series	Bi-directional TVS and ESD Protection Diode	SOD-523	1.6 x 0.8 x 0.6	—	30 kV
ESD5Z Series	TVS and ESD Protection Diode	SOD-523	1.6 x 0.8 x 0.6	Up to 240 W	30 kV
NZL Series	Dual TVS and ESD Protection Diode	SC-89	1.6 x 1.6 x 0.7	—	22 kV
SM05 Series	Dual ESD Protection Diode	SOT-23	2.9 x 2.4 x 1.0	Up to 300 W	15 kV
NZQA Series	Quad TVS Array	SOT-553	1.6 x 1.6 x 0.55	Up to 100 W	9 kV
NUP45V6 Series	Quad TVS Array	SOT-953	1.0 x 1.0 x 0.45	—	8 kV
NUP5120 Series	Penta TVS Array	SOT-563	1.6 x 1.6 x 0.55	Up to 90 W	8 kV
NUP2202/4202 Series	Single and Dual Port USB 2.0	SC-88	2.0 x 2.1 x 1.0	Up to 500 W	20 kV
NUP8010 Series	Eight Line TVS Array	DFN-8	1.6 x 1.6 x 1.0	Up to 20 W	8 kV

## Audio Filters – LC Network EMI Filters with ESD Protection

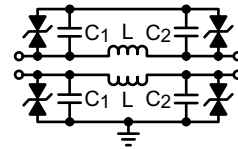
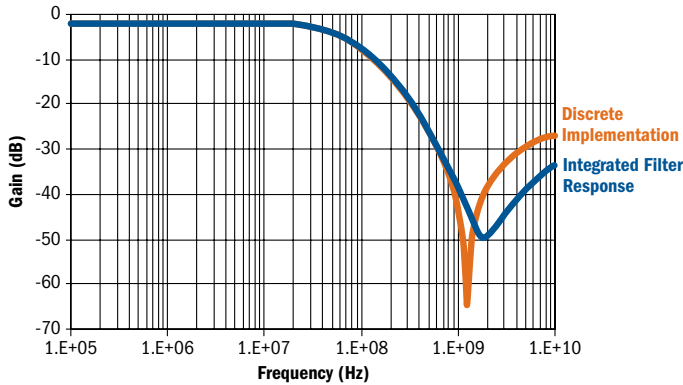


Figure 1

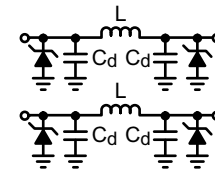


Figure 2

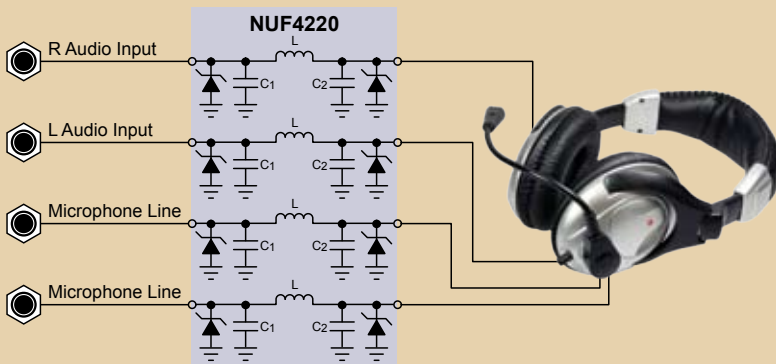
### Key Features

- ESD protection exceeds 15 kV (IEC61000-4-2)
- Integrated Inductors ranges 2.7 - 5.0 nH
- Low Series Resistance of 0.28 - 4.0 Ohms
- Excellent S21 curves characteristics
- Steady state current of greater than 500 mA/line
- Peak Current 1.2 A

### EMI Audio Filters

Device	Lines	Resistance ( $\Omega$ )	Inductance (nH)	Package	Circuit Diagram
NUF2441FCT1G	2	0.27	3	Flip-Chip	Figure 1
NUF2450MUT1G	2	1.5	2.5	uDFN (1.2 x 1.8 mm)	Figure 2
NUF2070MNT1G	2	2.5	4.5	DFN (2.0 x 2.0 mm)	Figure 1
NUF2114MNT1G	2	10	–	DFN (2.0 x 2.0 mm)	–
NUF2116MNT1G	2	68	–	DFN (2.0 x 2.0 mm)	–
NUF4220MNT1G	4	1.2	5	DFN (2.0 x 2.0 mm)	Below

## EMI Filter and ESD Protection for Stereo Headset Jacks Shrinks by 50% for MP3/Cellphone Applications

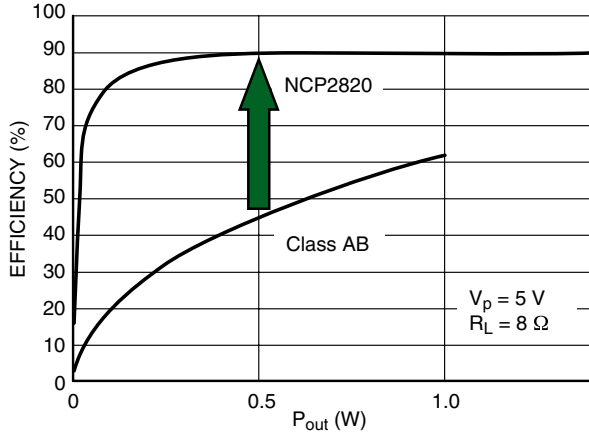


NUF4220 Stereo Headset Filter Solution

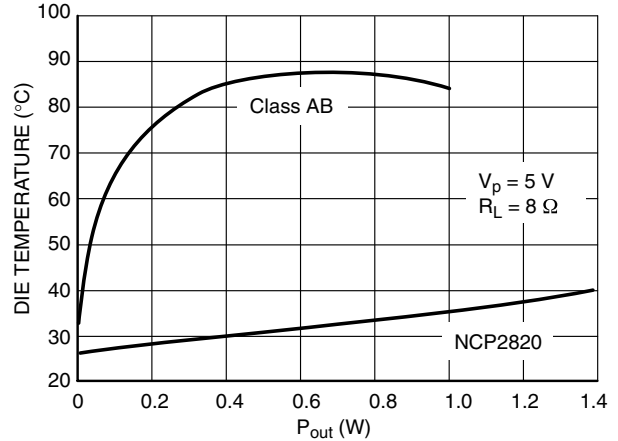
### Key Performance Characteristics

- > 35 dB of RF Attenuation from 900-3000 MHz
- Compliant with IEC61000-4-2 (Level 4) - 15 kV Air and Contact
- Extremely low loss signal path in Audio Band
- 2 x 2 mm DFN Package
- Flow through pinout for easy PCB layout

## NCP2820 Filter-Free Class D Audio Amp Improves System Efficiency and Eliminates PCB Hot Spots in Audio Subsystems



**Extend Battery Life over with 2X Efficiency Improvement at 0.5 W Output Power**



**Keep Cool Across All Power Ranges**

### Key Performance Characteristics

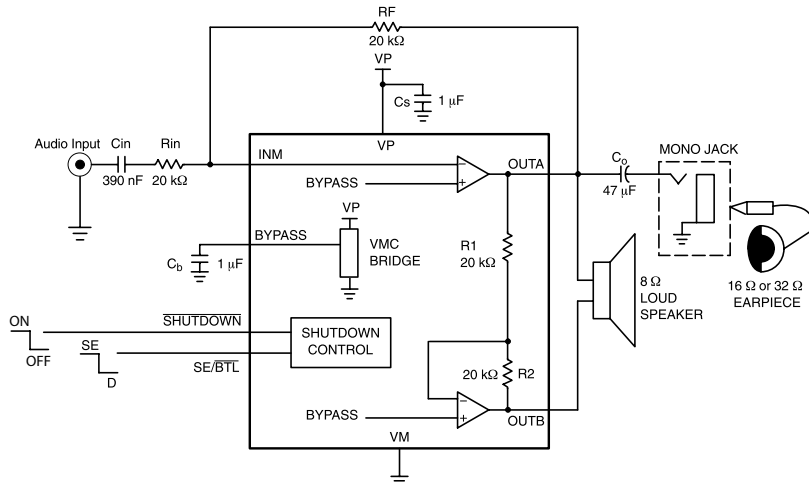
- Wide Supply Range of 2.2 – 5.5 V
  - Superior >65 dB PSRR allows direct connection to the Battery
  - 1 W to 8 W (BTL) Bridge Tied Load or 2.65 W to 4 W BTL @ 5 V
- Thermal overload protection circuitry
- “Pop and click” noise protection circuit

### Low Voltage Audio Amplifier Selector Guide

Audio Output/ Application	Class	Topology/ Features	Output Power	PSRR @ 217 Hz	Efficiency	THD+N	Turn-On Time (Typ)	Iq (Typ)	Shut-Down Current (Typ)	Package(s)	Device
Mono Speaker – Basic Telephone Operation & Polyphonic Ringtones	AB	BTL	1 W+	-73 dB	63%	0.02%	285 ms	1.5 mA	10 nA	Micro8™ Microbump-9	<b>NCP2890</b>
	AB	BTL	1 W+	-73 dB	63%	0.02%	100 ms	1.5 mA	10 nA	Microbump-9	<b>NCP2892A</b>
	AB	Differential	1 W+	-80 dB	64%	0.006%	140 ms	1.9 mA	20 nA	Microbump-9 DFN-10	<b>NCP4894</b>
Stereo Headphones – MP3 Players, Bluetooth Headsets	AB	Virtual Ground No Output Cap	135 mW/Ch	-82 dB	63%	0.003%	285 ms	1.54 mA	10 nA	Micro10	<b>NCP2809</b>
	AB	Differential	150 mW/Ch	-80 dB	64%	0.006%	140 ms	1.9 mA	20 nA	Microbump-9 DFN-10	<b>NCP4894</b>
Mono Speaker/Earpiece – Low Cost Integrated Solution	AB	Single End/ Differential	1 W to Speaker; 250 mW to Earpiece	-70 dB	64%	SE 0.003%, BTL 0.01%	140 ms	1.7 mA	20 nA	Microbump-9	<b>NCP4896</b>
Mono Speaker – Handsfree Speaker Phone	D	Filterless, Gain Select by Resistors	2.65 W	-65 dB	90%	0.05%	9 ms	2.2 mA	300 nA	Microbump-9 DFN-8	<b>NCP2820</b>
	D	Filterless, Integrated Ext Selectable Gain 6 or 12dB	2.65 W	-65 dB	90%	0.05%	9 ms	2.5 mA	500 nA	Microbump-9	<b>NCP2821</b>
Stereo Speakers – Offer Stereo Sound Quality to Play Video/Music-on-Demand, MP3	D	Filterless, Gain Selection by Resistor	2 W+ per Channel	-65 dB	90%	0.05%	9 ms	4.4 mA	600 nA	Microbump-9	<b>2x NCP2820 or NCP2821</b>



## Complete Audio Amplifier Solution for Driving Speakerphone and Earpiece in a 2.1 mm<sup>2</sup> Chipscale Package



**NCP4896 Class AB Audio Amplifier**



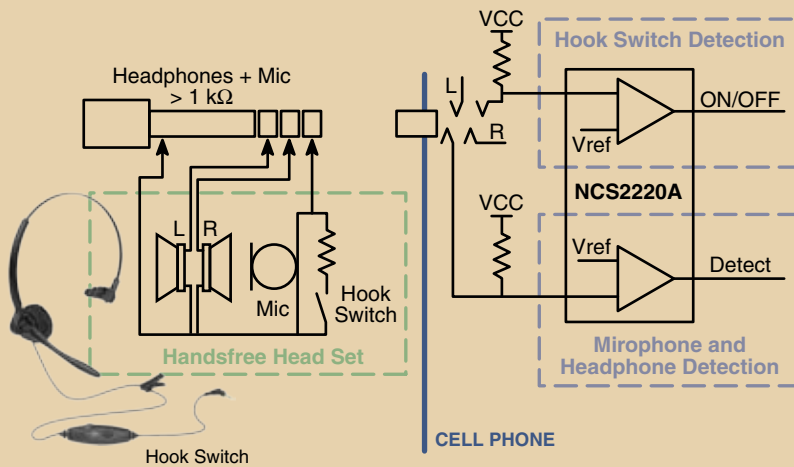
### Key Performance Characteristics

- Wide Supply Range of 2.2 – 5.5 V
- Superior >70 dB PSRR allows direct connection to the battery
- THD+N:
  - 0.003%-0.01% (40 mW Pout)
  - 0.02% (400 mW)
- 1 W to 8 W (BTL) Bridge Tied Load @ 5 V
- 90 mW to 32 W single ended load @ 5 V
- Thermal overload protection circuitry
- "Pop and click" noise protection circuit



**NCP4896 Demo Board Available**

## Low Voltage, Low Power Comparators



**Typical Detection Circuit**

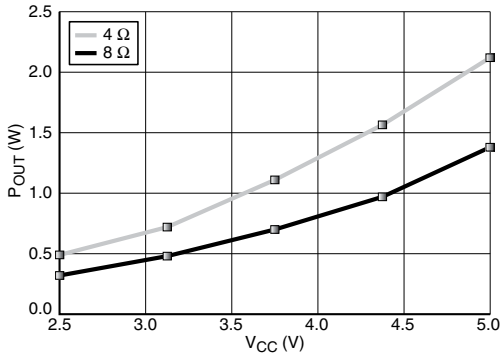
### Key Performance Characteristics

- Higher Detection Accuracy/Reliability
- Additional ESD Protection
- OK with DC and Audio Signals
- Internal Hysteresis
- Ultra Small Packaging

### Comparators

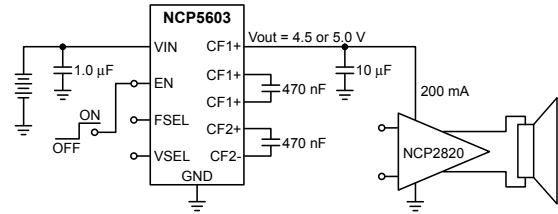
Device	VRRM	Package(s)
NCS2200 Series	Single Low Voltage Comparator	SC-70, SOT-23, QFN 2 x 2.2, uDFN 1.2 x 1.0
NCS2200A	Dual Low Voltage Comparator	uDFN 1.6 x 1.6

## Biased Audio for the Highest Output Power from a Single-Cell Lithium-Ion Battery



NCP2820 Output Power versus Supply for THD+N < 1%

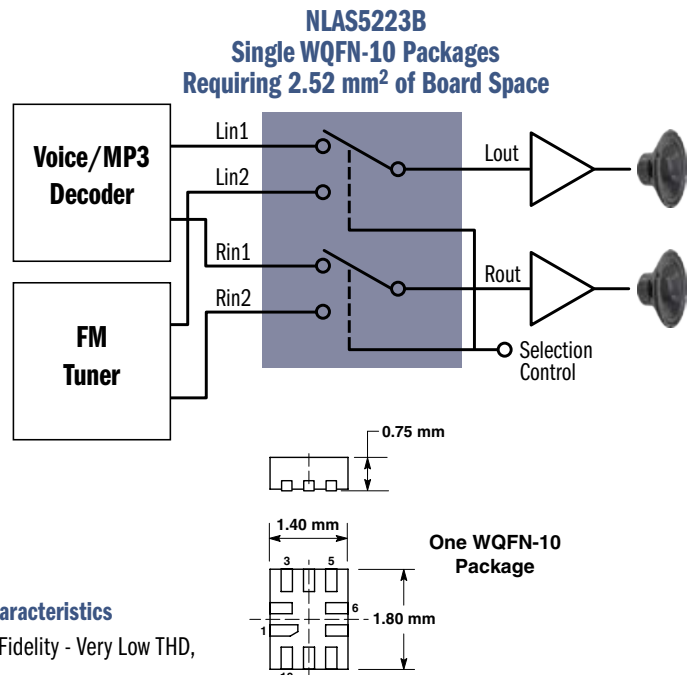
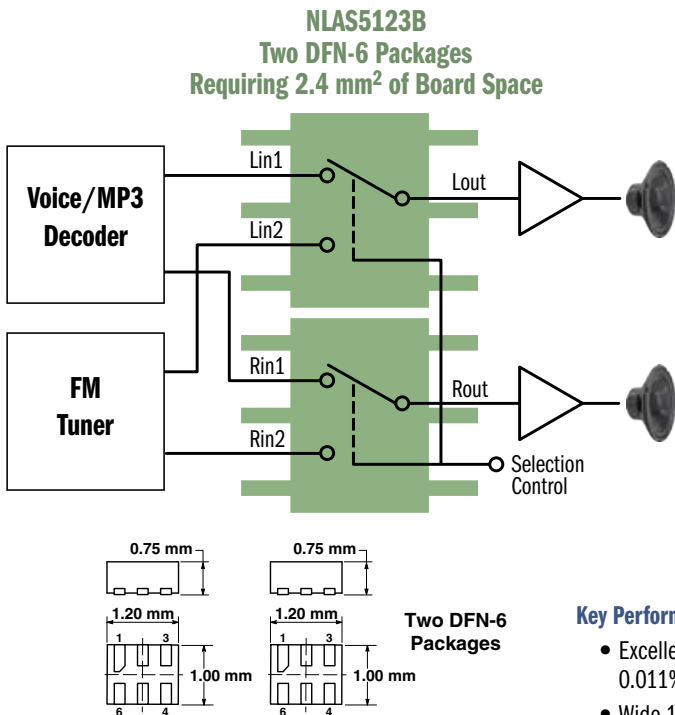
To maximize the power output of a linear audio amplifier in portable applications, it is necessary to bias the amp at a fixed voltage instead of operating directly from the battery.



### DC-DC Converters

Device	Architecture	Current Capability (V <sub>out</sub> = 5 V, V <sub>in</sub> = 3.6 V)	Efficiency @ Current Load (V <sub>out</sub> = 5 V, V <sub>in</sub> = 3.6 V)	Package
NCP5603	Charge Pump	160 mA	75%	DFN-10, 3 x 3 mm
NCP1421	Inductive	500 mA	87%	Micro10, 3 x 5 mm
NCP1422	Inductive	700 mA	88%	DFN-10, 3 x 3 mm

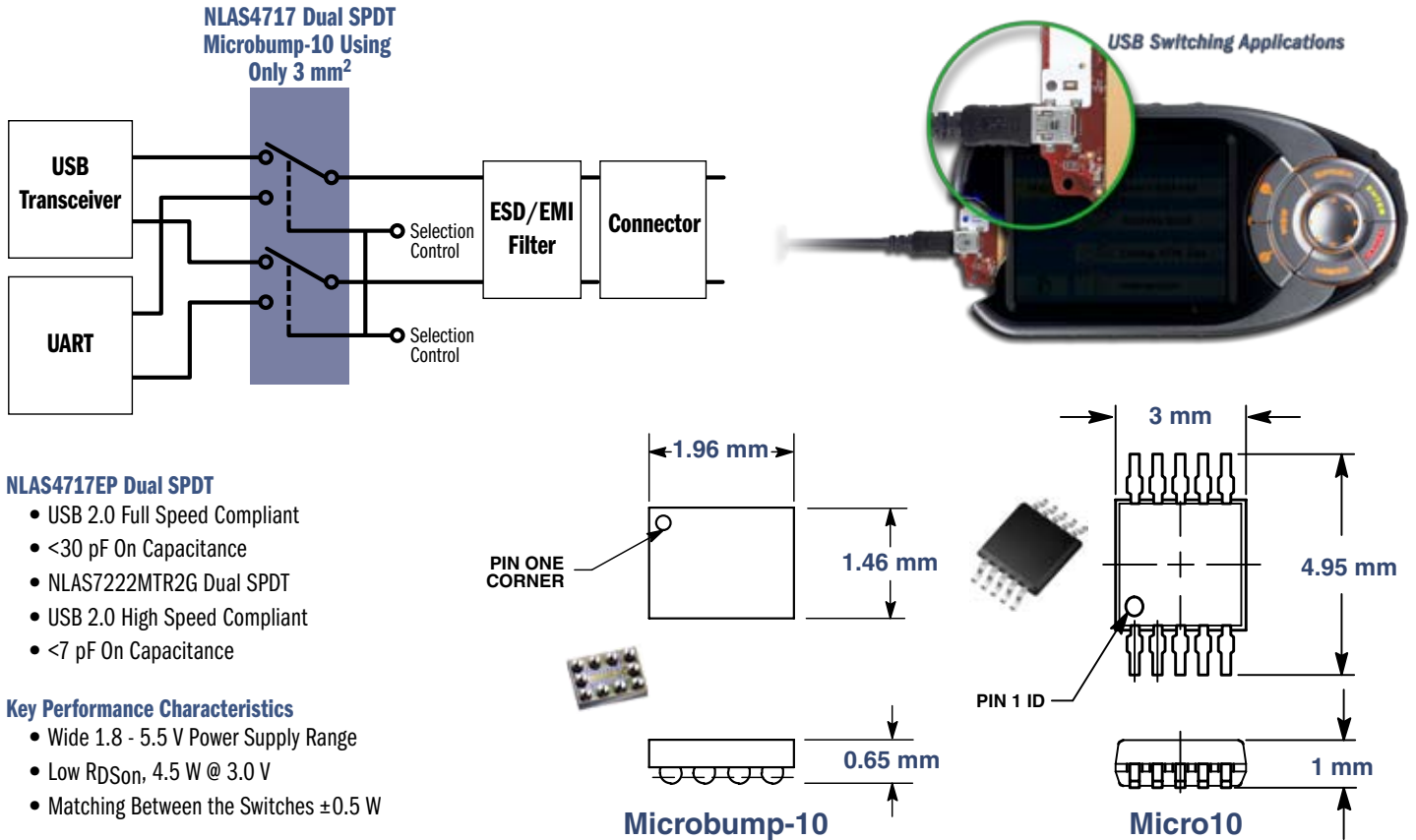
## Stereo Switching with SPDT Audio Switches



### Key Performance Characteristics

- Excellent Audio Fidelity - Very Low THD, 0.011% Typical
- Wide 1.65 to 5.5 V Power Supply Range
- Extended Temperature Capable
- Low R<sub>DS(on)</sub>, Tight Channel Matching

## Low Capacitance Analog Switches for Data Switching



## Ensure Low Drain Current with Voltage Supervisory Devices

Voltage Detection	NCP300/301 NCP302/303 NCP304/305	Under Voltage Sensing			
Reset Generator	MAX809/810 NCP803	Under Voltage Sensing	Reset Time-Out Counter		
μP Supervisor	MAX708	Under Voltage Sensing	Reset Time-Out Counter	Power Fail Comparator	Manual Reset

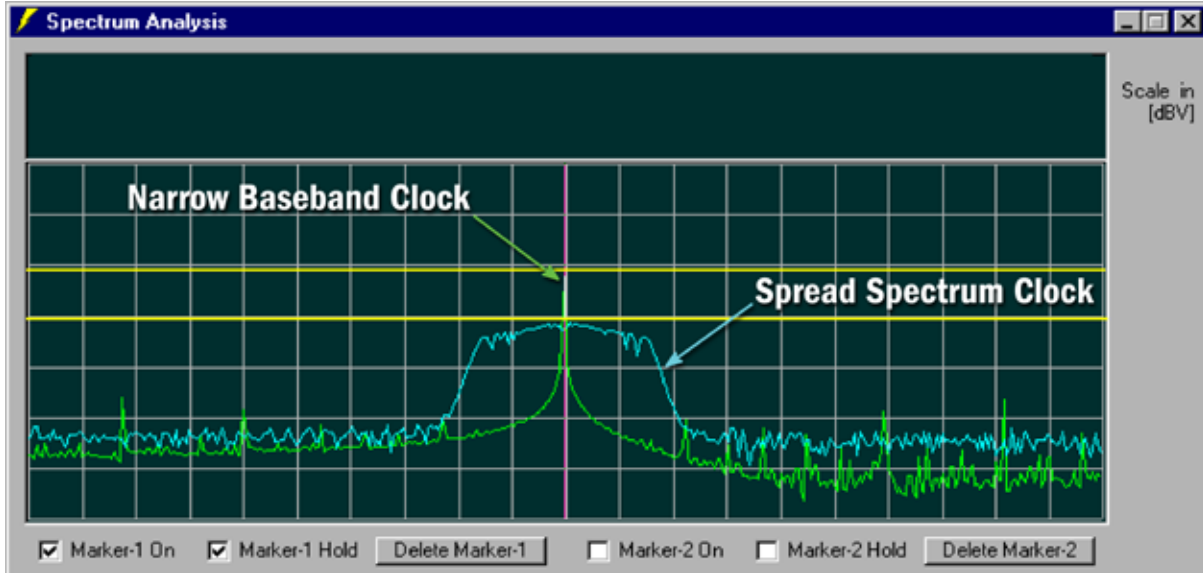
### Key Performance Characteristics

- Lowest quiescent current for extended battery life
- Complete range of products
- Large number of voltage thresholds
- Wide operating voltage range up to 10 V

### Supervisory Devices

Device	Function	Pertinent Features	Package
NCP300	Volt Detector	Complementary Output, No External Delay	SOT-23-5
NCP301	Volt Detector	Open Drain Output, No External Delay	SOT-23-5
NCP302	Volt Detector	Complementary Output, Programmable External Delay	SOT-23-5
NCP303	Volt Detector	Open Drain Output, Programmable External Delay	SOT-23-5
NCP304	Volt Detector	Complementary Output, No External Delay	SC-82AB
NCP305	Volt Detector	Open Drain Output, No External Delay	SC-82AB
MAX809	Reset Generator	140 mS, Minimum Output Reset-Low Delay	SOT-23
MAX810	Reset Generator	140 mS, Minimum Output Reset-High Delay	SOT-23
MAX803	Reset Generator	140 mS, Minimum Output Drain Output Reset-Low Delay	SOT-23
MAX708	μP Reset Mo	200 mS Push-Pull Output Reset Delay, Std Threshold	SO-8, Micro8™

## Achieve Lower EMI with Spread-Spectrum Clock Synthesizers



### EMI Clock Synthesizers

Device	f <sub>in</sub> (MHz)	Accepts Crystal Input	Accepts Reference Input	Power Down	Spread Spectrum Enable/Disable	Modulation Rate Equation	Output Frequency Deviation	Reference Output
NB2669A	6 - 13	N	Y	Y	N	f <sub>in</sub> ÷ 256	±1%	N
NB2760A	6 - 13	Y	Y	Y	N	f <sub>in</sub> ÷ 256	±0.75%	N
NB2762A	6 - 13	Y	Y	Y	N	f <sub>in</sub> ÷ 256	-1.25%	N
NB2769A	6 - 13	Y	Y	Y	N	f <sub>in</sub> ÷ 256	±1%	N
NB2869A	6 - 13	Y	Y	N	N	f <sub>in</sub> ÷ 256	±1%	Y
NB2969A	6 - 13	Y	Y	N	N	f <sub>in</sub> ÷ 256	±1%	Y, ÷ 2
NB2579A	13 - 30	Y	Y	N	Y	f <sub>in</sub> ÷ 640	±1%	N
NB2779A	13 - 30	Y	Y	Y	N	f <sub>in</sub> ÷ 640	±1%	N
NB2870A	13 - 30	Y	Y	N	N	f <sub>in</sub> ÷ 640	±0.75%	Y
NB2872A	15 - 30	Y	Y	N	N	f <sub>in</sub> ÷ 640	-1.25%	Y
NB2879A	15 - 30	Y	Y	N	N	f <sub>in</sub> ÷ 640	±1%	Y
NB2780A	30 - 50	Y	Y	Y	N	f <sub>in</sub> ÷ 1280	±0.75%	N

#### Key Performance Characteristics

- Replace ferrite beads and chokes
- Reduce peak EMI by 6 - 26 dBm
- Power Down mode reduces current draw to 4 µA



## LDO Voltage Regulators

### Single Output Low-Dropout Linear Regulators (LDOs)

Device	I <sub>out</sub>	Dropout* (typ)	I <sub>q</sub> ** (typ)	PSRR****	Absolute Max Input Voltage	Package(s) - pins	V <sub>out</sub>	Features
NCP512	80 mA	160 mV	40 µA	60 dB	6 V	SC-70-5	1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.1, 3.3, 5 V	Enable
NCP553	80 mA	650 mV	2.8 µA	25 dB	12 V	SC82AB-4	1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.3, 5 V	Ultra Low I <sub>q</sub> , No Cap
LM2931A/C/AC	100 mA	160 mV	400 µA (@10mA)	90 dB	40 V	SO-8, TO-92-3, TO-220-3/5, DPAK-3, D2PAK-3/5	Adj, 5 V	High PSRR
LP2950C/AC	100 mA	350 mV	75 µA	–	30 V	DPAK-3, TO-92-3	3, 3.3, 5 V	Tight Line & Load Reg.
LP2951C/AC	100 mA	350 mV	75 µA	–	30 V	SO-8, Micro8, DIP-8	Adj, 3, 3.3, 5 V	Enable, Error Output
<b>NCP612</b>	100 mA	200 mV	40 µA	60 dB	6 V	SC-70-5	1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.1, 3.3, 5 V	Enable
<b>NCP662</b>	100 mA	230 mV	2.5 µA	25 dB	6 V	SC82AB-4	1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.3, 5 V	Enable, Ultra Low I <sub>q</sub>
<b>NCP663</b>	100 mA	230 mV	2.5 µA	25 dB	6 V	SC82AB-4	1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.3, 5 V	Ultra Low I <sub>q</sub>
<b>NCP580</b>	120 mA	180 mV	90 µA	80 dB	6.5 V	SC82AB-4	1.5, 1.8, 2.5, 2.8, 3, 3.3 V	Enable, Ultra Low Noise
MC78PC	150 mA	200 mV (@100 mA)	35 µA	70 dB	9 V	SOT-23-5	1.8, 2.5, 2.8, 3, 3.3, 5 V	Enable, Ultra Low Noise
NCP500	150 mA	150 mV	175 µA	62 dB	6 V	SOT-23-5, (2x2.2) DFN-6	1.8, 1.85, 2.5, 2.6, 2.7, 2.8, 3, 3.3, 5 V	Enable, Fast Transient
NCP511	150 mA	90 mV (@100 mA)	40 µA	60 dB	6 V	SOT-23-5	1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.3, 5 V	Enable
NCP551	150 mA	720 mV	4.0 µA	25 dB	12 V	SOT-23-5	1.5, 1.8, 2.5, 2.7, 2.8, 3, 3.3, 5 V	Enable, Ultra Low I <sub>q</sub>
<b>NCP623</b>	150 mA	180 mV	170 µA	90 dB	12 V	Micro8, (3x3) DFN-6	3.3, 4, 5 V	Enable, Ultra Low Noise
<b>NCP582</b>	150 mA	220 mV	75 µA	70 dB	6.5 V	SOT-563-6, SC82AB-4	1.5, 1.8, 2.5, 2.8, 2.9, 3, 3.3 V	Enable, Ultra Low Noise
<b>NCP583</b>	150 mA	250 mV	1.0 µA	45 dB	6.5 V	SOT-563-6, SC82AB-4	1.5, 1.8, 2.5, 2.8, 2.9, 3, 3.3 V	Enable, Ultra Low I <sub>q</sub>
<b>NCP600****</b>	150 mA	100 mV	175 µA	62 dB	6 V	SOT-23-5	Adj	Enable, Fast Turn-ON
<b>NCP584</b>	200 mA	200 mV	3.5 µA	75 dB	6.5 V	SOT-23-5	0.9, 1.2, <b>1.5</b> , 1.8, <b>2.6</b> , <b>3.1</b> V	Enable, Tri-Mode
MC33275	300 mA	260 mV	125 µA	75 dB	13 V	SO-8, DPAK-3, SOT-223-3, (4x4) <b>DFN-8</b>	2.5, 3, 3.3, 5 V	Tight Line & Load Reg.
<b>NCP585</b>	300 mA	310 mV	3.5 µA	75 dB	6.5 V	SOT-23-5, HSON-6	0.9, 1.2, 1.8 V	Enable, Tri-Mode
<b>NCP3334****</b>	500 mA	340 mV (max)	190 µA	–	16 V	SO-8	Adj	Enable, High Accuracy
<b>NCP3335A</b>	500 mA	340 mV (max)	190 µA	75 dB	16 V	Micro8, (3x3) DFN-10	Adj, 2.5, 2.85, 3.3, 5 V	Enable, High Accuracy

\* Voltage dropout was measured at full load for V<sub>out</sub> = 3.3 V where applicable unless noted.

\*\* I<sub>q</sub> was measured at 0 or 0.1 mA load unless noted

\*\*\* Release to Market in Q2-2006

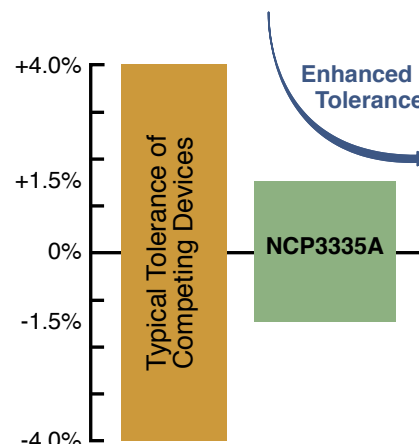
\*\*\*\* PSRR was measured at f = 120 Hz for V<sub>out</sub> = 3.3 when applicable.

**Bold** Denotes NEW Products, Packages, and/or Voltage Options

Contact an ON Sales Representative for other voltage options or for automotive grade regulators.

#### Key Performance Characteristics

- Maintains accuracy over full temperature and load current operating conditions



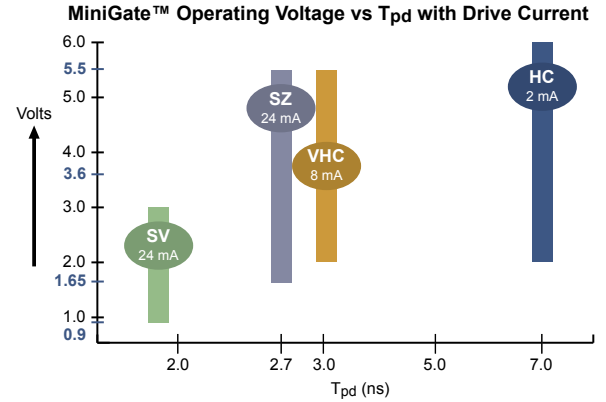


## MiniGate™ Logic

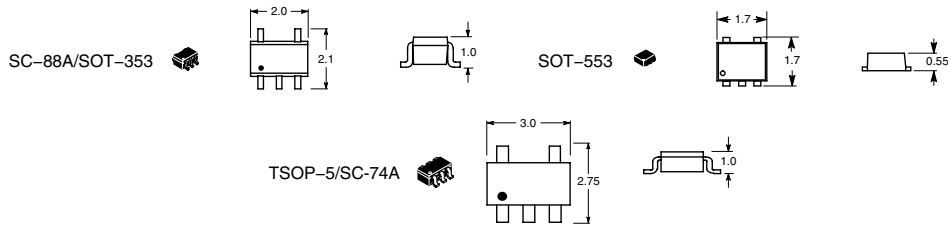
### Logic MiniGates

Function	Designator	NL17SV**XV5T2 SOT-553 Package	NL17SZ**DFT2G SOT-353 Package	NL17SZ**XV5T2 SOT-553 Package
2-Input NAND Gate	00	✓	✓	✓
2-Input NOR Gate	02	✓	✓	✓
Input Inverter	04	✓	✓	✓
Unbuffered Input Inverter	U04		✓	✓
Inverter, Open Drain	06		✓	✓
Non-Inverting Buffer, Open Drain	07		✓	✓
2-Input AND Gate	08	✓	✓	✓
Schmitt Inverter	14		✓	✓
Non-Inverting Buffer	16	✓	✓	✓
Schmitt Buffer	17		✓	✓
2-Input OR Gate	32	✓	✓	✓
2-Input XOR Gate	86		✓	
3-State, Non-Inverting Buffer, Active Low	125		✓	✓
3-State, Non-Inverting Buffer, Active High	126		✓	✓

Most devices also offered in Duals (NL27WZxx Series) or Triples (NL37WZxx Series)



### MiniGate™ Package Size Comparison - 5 Leads



## SIM/SAM Card Interface ICs

### Key Features of NCN4555/7

- Single & Dual SIM interface (Subscriber Identity Module)
- Sequencer on NCN4557
- 1.8 V - 5.5 V Digital Input Voltage
- Fully compatible with ISO7816-3, GSM11.11/11.12/11.18, IMT-2000 / 3G TS 31.101
- Supports 1.8 V / 3 V Cards
- Linear DC-DC Converter (LDO) able to supply current in excess of 50 mA at 1.8 V & 3 V (Vbat ranging from 2.7 V to 5.5 V)
- Very low stand-by and operating power consumption
- >5 MHz clock frequency
- >7 kV HBM ESD protection on SIM pins
- Low profile 3 mm x 3 mm QFN-16 package



### SIM Interface Device Comparison

Product Features	NCN4555	NCN4557
Analog Interfaces	1 card	2 cards
Card Types (V)	1.8/3	1.8/3
Max Clock Frequency (MHz)	>5	>5
Power Supply (Type)	Built-In LDO-Type DC-DC	Built-In LDO-Type DC-DC
Power Supply (V)	2.7 - 5.5	2.7 - 5.5
Activation/Deactivation	No	Yes
Packaging	Low Profile QFN-16	Low Profile QFN-16
Temperature Range (°C)	-25 to +85	-25 to +85
Wireless Protocol	GSM 11.1x/3G TS 31.101	GSM 11.1x/3G TS 31.101
ESD Protection (kV)	8	8

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