K

- **K-Chargepump** **92%**
- **75%**
- **0.02%**
- **0.8W 1W 1.2W**
- TDD-Noise
- EMI
- PSRR -65dB 217Hz
- 2mm×2mm FC-16

AW8736 K

K-Chargepump 92% 75% 0.02%

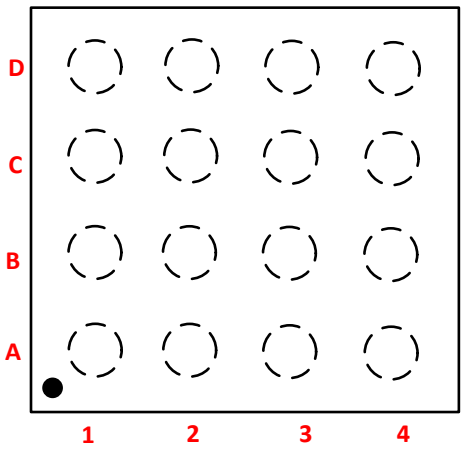
AW8736 K-Chargepump 3.3V-4.35V

AW8736 0.8W 1W 1.2W 0.7W

AW8736 TDD-Noise EMI TDD-Noise EMI

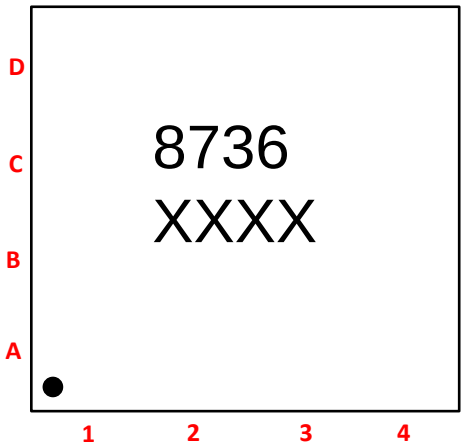
AW8736 AW8736 2mm × 2mm FC-16

AW8736FCR TOP VIEW



▲

AW8736FCR MARKING

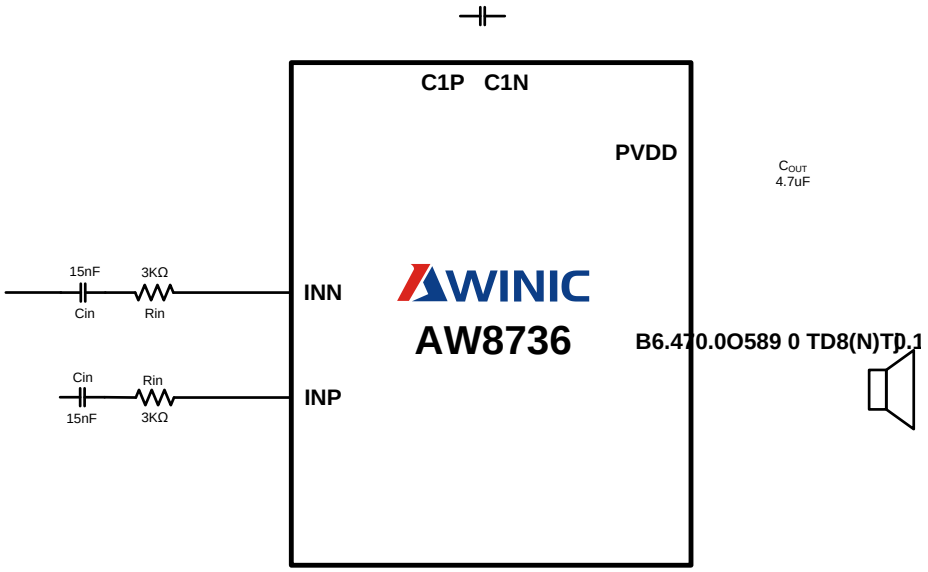


8736 – AW8736FCR
XXXX –

1 AW8736FCR

K

A1	INP	
A2	INN	
A3	VDD	
A4	SHDN	
B1	C2N	Flying C2
B2		
B3	VDD	
B4	VOP	
C1	C1N	Flying C1
C2	GND	
C3		
C4		
D1	C2P	Flying C2
D2	C1P	Flying C1
D3	PVDD	
D4	VON	

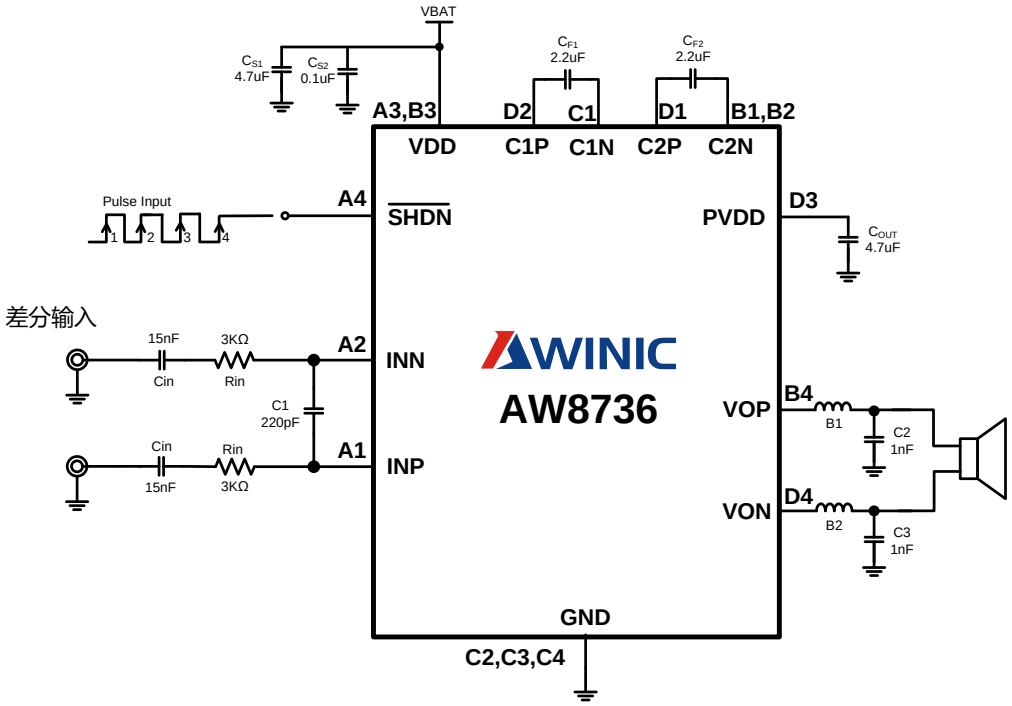


2 AW8736 (1)

1: INN INP

K

Cs X7R/X5R VDD 1uF



3 AW8736

K

(2)

V_{DD}	
INP INN	
JA	
T_{JMAX}	
T_{STG}	
10	
ESD 3	
HBM	±6KV
Latch-up	
JEDEC STANDARD NO.78B DECEMBER 2008	+IT 450mA -IT -450mA

2:

3: HBM 100pF MIL-STD-883G Method 3015.7

AW8736 Cin Rin 16.5K

320K/(Rin+16.5K)

1 Cin=15nF Rin=3K 16.3V/V

2 Cin=15nF Rin=10K 12V/V

		V/V		NCN W		NCN
				RL=8Ω	RL=4Ω	
1		16.3	12	1.2	2.25	
2		16.3	12	1	2	
3		16.3	12	0.8	1.6	
4		16.3	12	1.65W@THD=1%	2.15W@THD=1%	

K

T_A=25

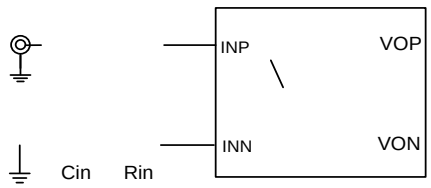
V_{DD}			3.0		5.0	V
V_{IH}	$\overline{SHDN}$		1.3		V_{DD}	V
V_{IL}	$\overline{SHDN}$		0		0.35	V
$\|V_{OS}\|$		V_{DD}=3.0V to 5.0V	-30	0	30	mV
I_{SD}		V_{DD}=3.6V $\overline{SHDN}$=0V			1	
T_{TG}	Thermal AGC			150		
T_{TGR}	Thermal AGC			130		
T_{SD}				160		
T_{SDR}				130		
T_{ON}				40		ms
K-Chargepump						
PVDD		V_{DD} =3.0V to 3.8V		1.5* VDD		V
		V_{DD} >3.8V		5.8		V
Vhys	OVP	V_{DD} >3.8V		50		mV
F_{CP}		V_{DD}=3.0V to 5.0V	0.8	1.06	1.33	MHz
CP		V_{DD}=4.2V I_{load}=200mA		92		%
T_{ST}		COUT=4.7uF	1	1.2	1.4	ms
I_L	PVDD			350		mA
K 1-4						
I_q		V_{DD}=3.6V		9.5		mA
		V_{DD}=4.2V Po=1.2W R_L		75		%
Fosc		V_{DD}=3.0V to 5.0V	600	800	1000	kHz
Av				16.3		V/V
Rini				16.5		
Pncn	1 NCN	V_{DD}=4.2V R_L		1.2		W
		V_{DD}=4.2V R_L=4		2.25		W
	2 NCN	V_{DD}=4.2V R_L		1		W
		V_{DD}=4.2V R_L=4		2		W
	3 NCN	V_{DD}=4.2V R_L		0.8		W
		V_{DD}=4.2V R_L=4		1.6		W
PSRR		V_{DD}=4.2V Vp-p_sin=200mV 217Hz	-53	-65		dB
		V_{DD}=4.2V Vp-p_sin=200mV 1kHz	-53	-65		dB
SNR		V_{DD}=4.2V Po=0.8W R_L		84.5		dB

K

		V_{DD}=4.2V Po=1.65W R_L		87.5		dB
Vn		VDD=4.2V f=20Hz to 20kHz input ac grounded	A-weighting	155		uVrms
THD+N	+	V_{DD}=4.2V,Po=1W,R_L ,f=1kHz,Mode1		0.02		%
		V_{DD}=4.2V,Po=1.2W,R_L ,f=1kHz,Mode4		0.02		%
P_O	4	THD+N=10% f=1kHz R_L V_{DD}=4.2V		2.0		W
		THD+N=1% f=1kHz R_L V_{DD}=4.2V		1.65		W
		THD+N=10% f=1kHz R_L V_{DD}=3.6V		1.5		W
		THD+N=1% f=1kHz R_L V_{DD}=3.6V		1.23		W
		THD+N=10% f=1kHz R_L=4 V_{DD}=4.2V		2.58		W
		THD+N=1% f=1kHz R_L=4 V_{DD}=4.2V		2.15		W
		THD+N=10% f=1kHz R_L=4 V_{DD}=3.6V		1.85		W
		THD+N=1% f=1kHz R_L=4 V_{DD}=3.6V		1.55		W
T_H	$\overline{SHDN}$	V_{DD}=3.0V to 5.0V	0.75	2	10	us
T_L	$\overline{SHDN}$	V_{DD}=3.0V to 5.0V	0.75	2	10	us
T_{LATCH}	$\overline{SHDN}$	V_{DD}=3.0V to 5.0V	150		500	us
T_{OFF}	$\overline{SHDN}$	V_{DD}=3.0V to 5.0V	150		500	us
NCN 4						
T_{AT}	(13.5dB)			40		ms
T_{RL}	13.5dB			1.2		s
A_{MAX}				-13.5		dB

4: 13.5dB 13.5dB

AW8736 4



4 AW8736

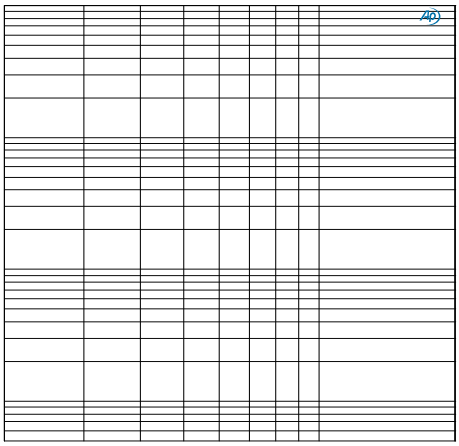
K

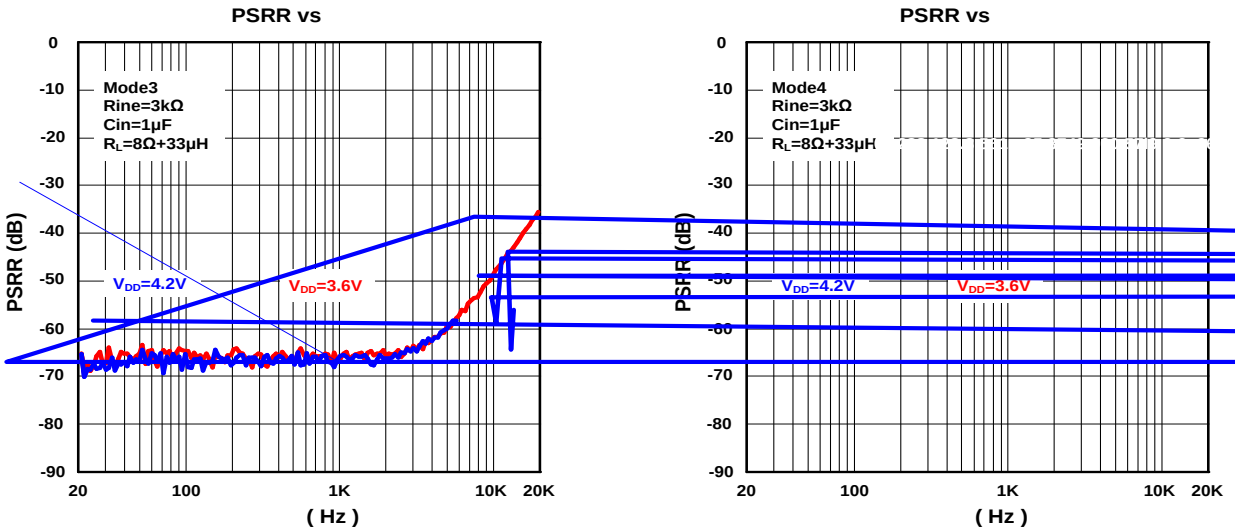
1

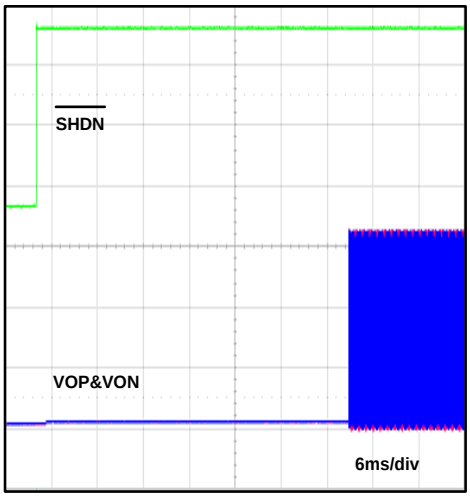
500	10nF	32kHz
1k	4.7nF	

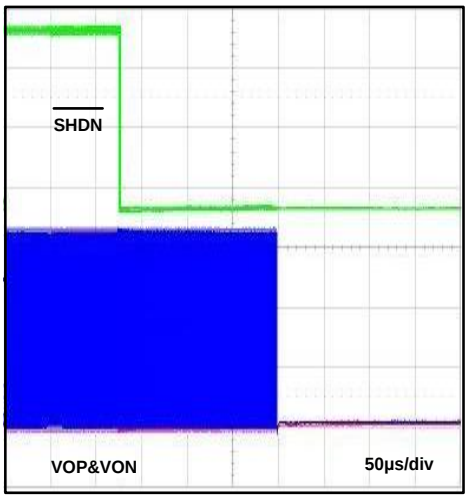
K

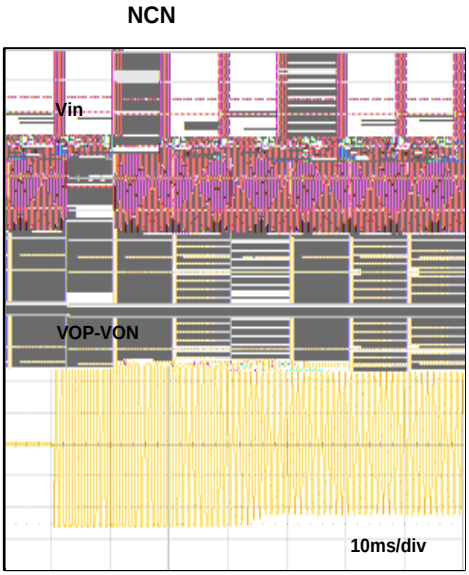
K

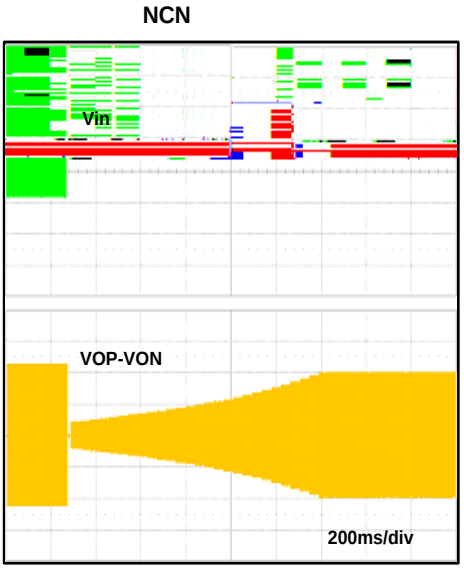


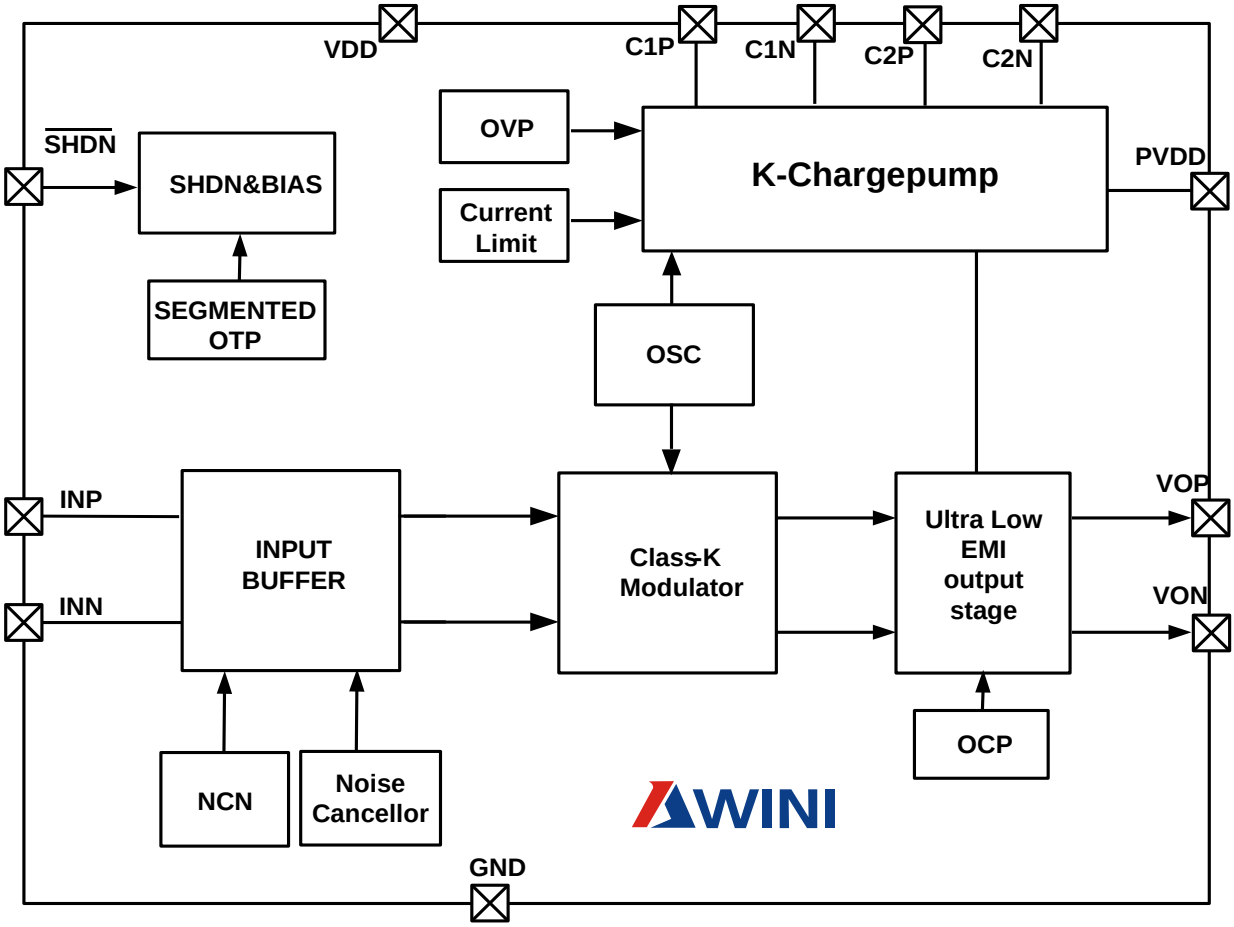

PSRR vs
Mode3
Rine=3kΩ
Cin=1μF
RL=8Ω+33μH
VDD=4.2V
VDD=3.6V
PSRR (dB)
(Hz)
PSRR vs
Mode4
Rine=3kΩ
Cin=1μF
RL=8Ω+33μH
VDD=4.2V
VDD=3.6V
PSRR (dB)
(Hz)


SHDN
VOP&VON
6ms/div


SHDN
VOP&VON
50μs/div


NCN
Vin
VOP-VON
10ms/div


NCN
Vin
VOP-VON
200ms/div


VDD
C1P
C1N
C2P
C2N
SHDN
SHDN&BIAS
SEGMENTED OTP
OVP
Current Limit
K-Chargepump
PVDD
OSC
INP
INN
INPUT BUFFER
Class-K Modulator
Ultra Low EMI output stage
VOP
VON
OCP
NCN
Noise Cancellor
GND

6 AW8736

K

AW8736 K
K-Chargepump (OVP)
92% 75% 0.02%

AW8736 K-Chargepump
3.3V-4.35V AW8736 0.8W 1W
1.2W 0.7W
AW8736 TDD-Noise EMI TDD-Noise EMI

AW8736 AW8736 2mm×2mm
FC-16 -40 85

NCN

AW8736 NCN 3.3V~4.35V NCN
AW8736
AW8736 4 NCN
1.2W 1W 0.8W

NCN(Non-Crack-Noise)

NCN

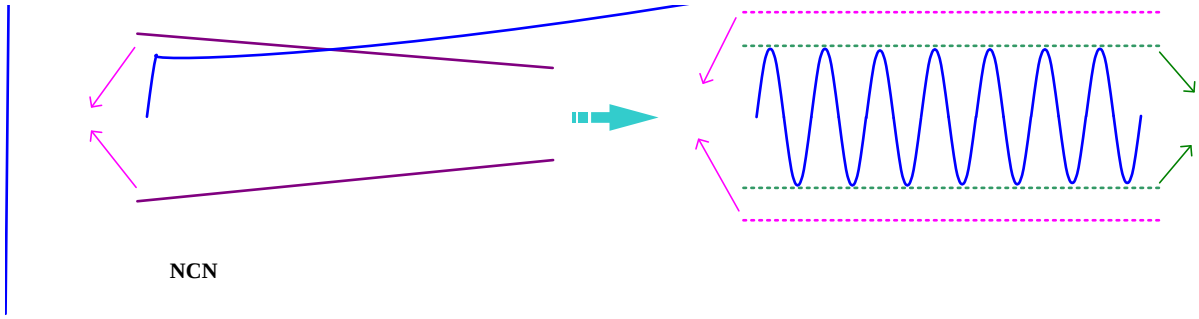
NCN 7

7 NCN

AW8736 NCN

NCN 8

AW8736



8 NCN

attack time

NCN -13.5dB

AW8736

40ms

release time

NCN

AW8736

1.2s

K-Chargepump

AW8736 K-chargepump

1.1MHz,

AW8736 K-chargepump PVDD VDD 1.5

100% K-chargepump

$$\eta = \frac{P_{OUT}}{P_{IN}} * 100\%$$

M K-chargepump I_{IN} I_{OUT} M

$$\eta = \frac{P_{OUT}}{P_{IN}} * 100\% = \frac{V_{OUT} * I_{OUT}}{V_{IN} * M * I_{OUT}} * 100\% = \frac{V_{OUT}}{M * V_{IN}} * 100\%$$

M (1.5),V_{OUT} V_{IN} I_{OUT}

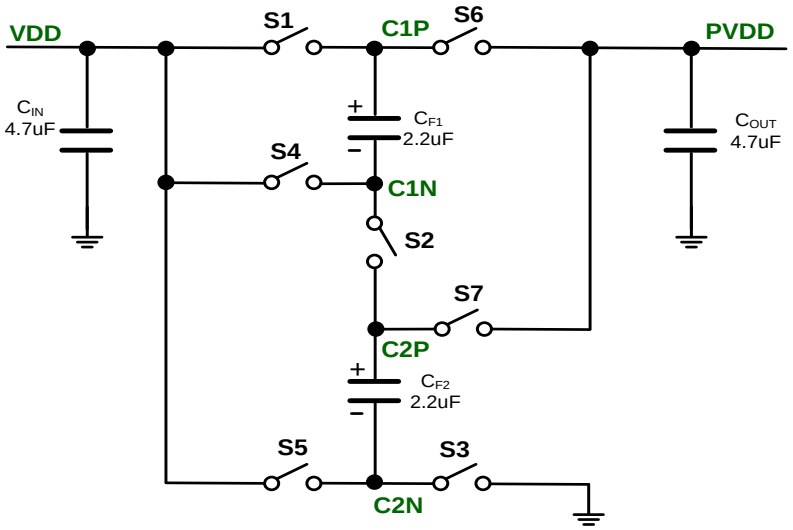
K-chargepump 1.5 100%

IC 92% K-chargepump

9 AW8736 7 7

PVDD VDD 1.5

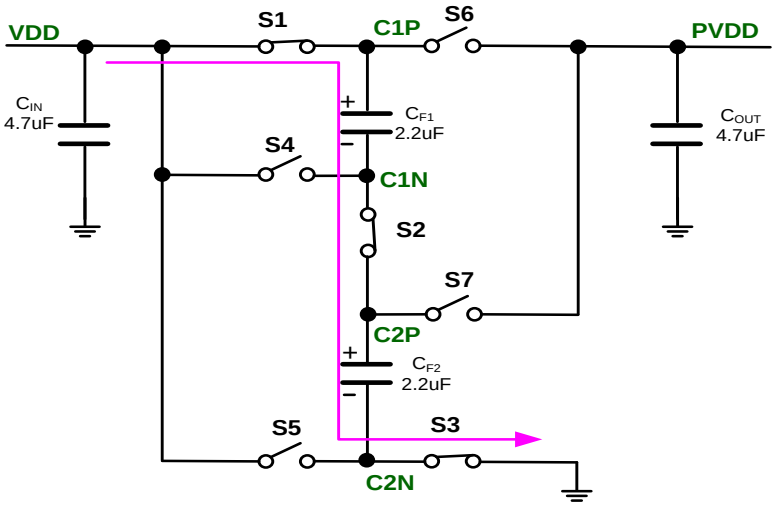
K



9

10 S1 S2 S3 VDD Flying

C_{F1} C_{F2}

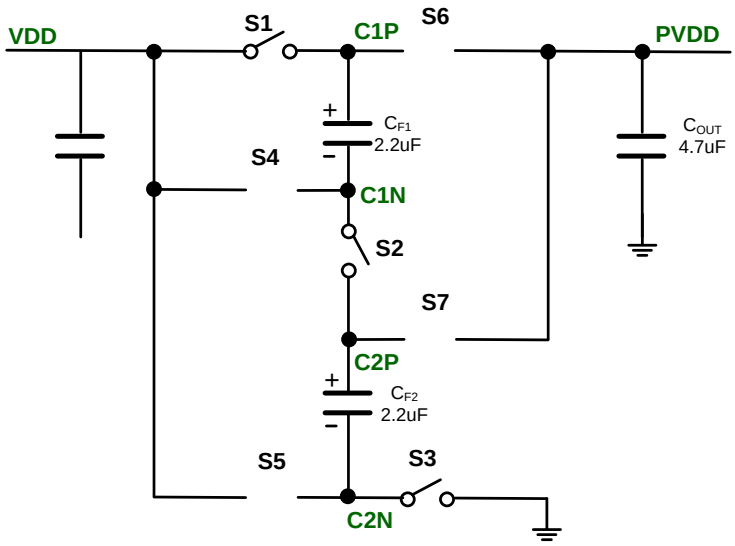


10 Φ1 Flying

11 S1 S2 S3 S4 S5 S6 S7

Flying C_{F1} C_{F2} VDD PVDD

K



11 Φ2 Flying C_{OUT}

K-chargepump

350mA 1.2ms

K-chargepump

1.5A

(OVP)

K-chargepump PVDD VDD 1.5

K

K-chargepump VDD 3.8V

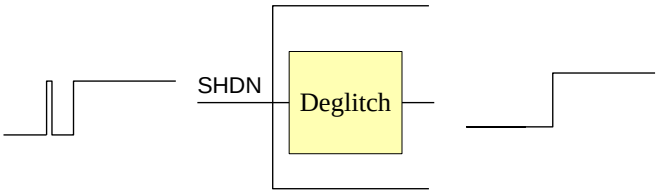
PVDD VDD PVDD 5.8V 50mV

GPIO

GPIO

Deglitch 12

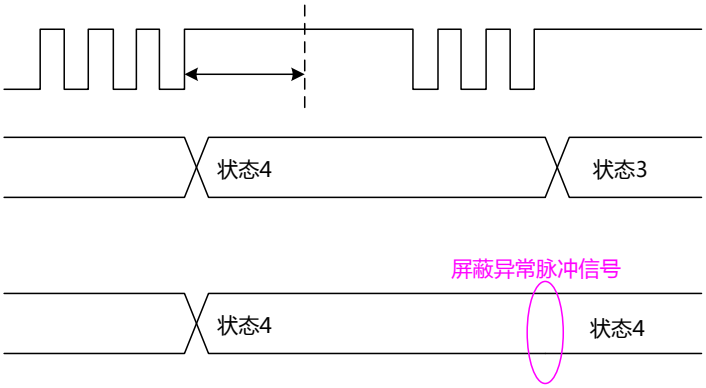
K



12 Deglitch

BB AW8736

13



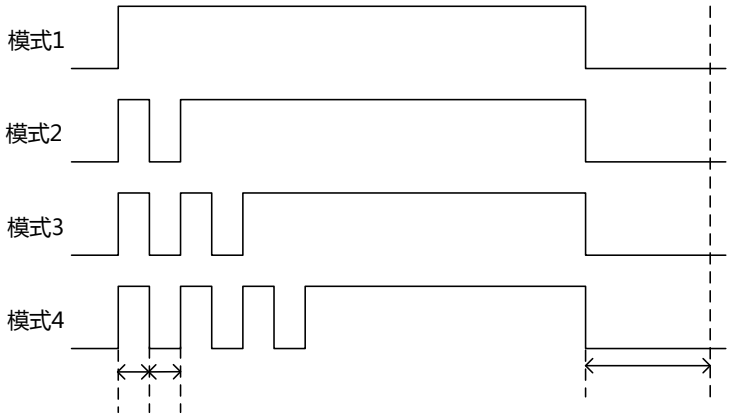
13

AW8736 SHDN 14

SHDN AW8736 1 SHDN

AW8736 AW8736 4 4

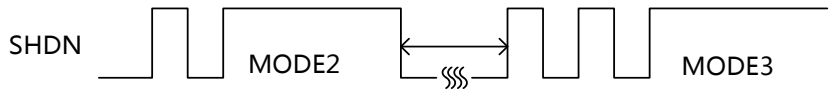
K



14

SHDN 1ms T_{OFF}

15



15

RNS(RF TDD Noise Suppression)

TDD Noise

GSM TDMA Time Division Multiple Access( )

TDMA 8 4.615ms

0.577ms

GSM RF 4.615ms 217Hz

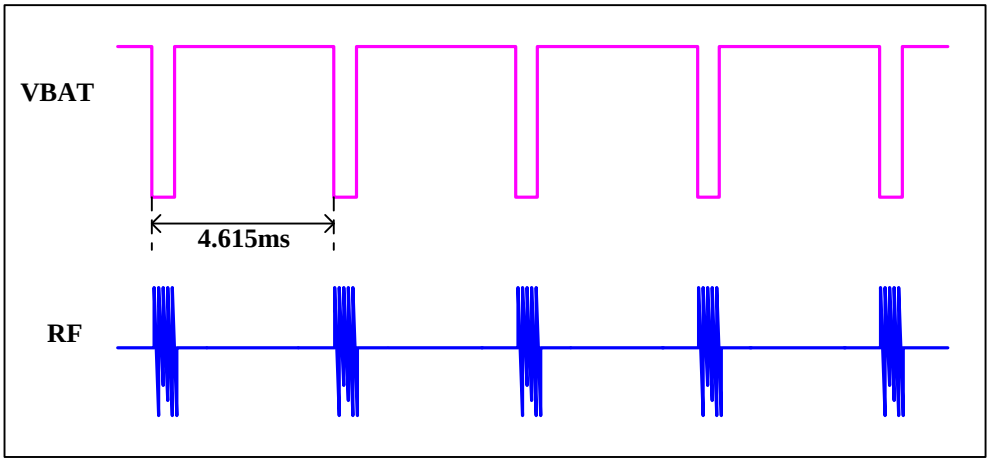
Burst Burst 217Hz 900MHz

1800MHz RF 217Hz 217Hz

217Hz

TDD Noise 217Hz 217Hz

K



16 GSM RF

RNS TDD Noise

RF 217Hz

217Hz

PSRR

$$PSRR = 20\log(\frac{vout_{ac}}{vdd_{ac}})$$

PSRR

-60dB -60dB 1000 500mVp 0.5mV

PSRR -60dB -80dB TDD Noise

Rin Cin

PSRR 24 1% PSRR -46dB 10% PSRR -28dB TDD Noise

K

PSRR AW8736

10% PSRR

RF

RF

PCB RF

RF

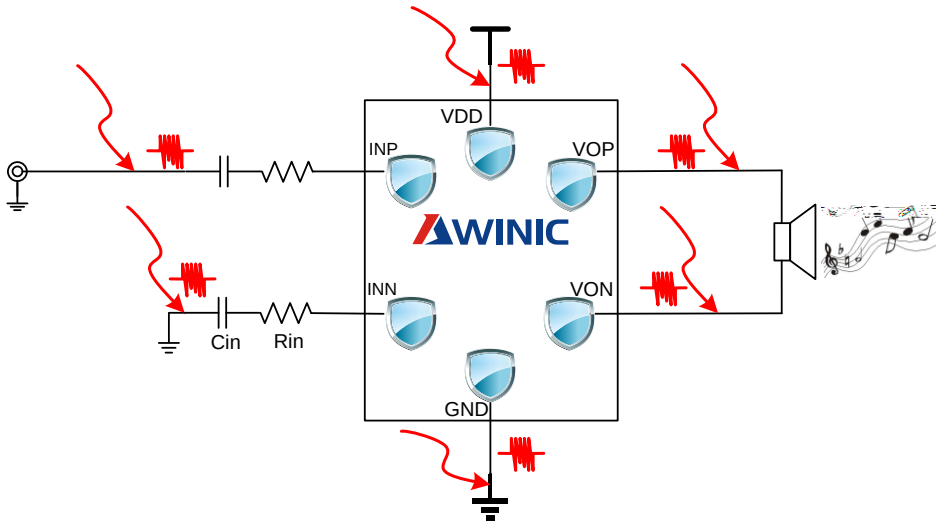
RF PCB RF

RF TDD Noise AW8736

RF RF

RF RF TDD

Noise



17 RF

D

D

LC

LC PCB THD+N

K

AW8736 D LC

VOP VON

VOP VON

EEE

AW8736 EEE

EMI FCC CLASS B

Pop-Click

Pop-Click AW8736 Pop-Click

Thermal AGC/

AW8736 Thermal AGC

AW8736 Thermal AGC 150

130

160

130 AW8736

AW8736 AW8736

K

$$f_L(-3dB) = \frac{1}{2*\pi*(R_{ini}//R_{ine})*2*C_d}(Hz) = \frac{1}{2*\pi*2.54k\Omega*2*0.47nF}(Hz) = 66.7kHz$$

C_S

ESR K6 VDD A3 B3 ESR
equivalent-series-resistance X7R X5R 4.7uF V_{DD}
V_{DD}
33pF~0.1uF
A3 B3

Flying C_F

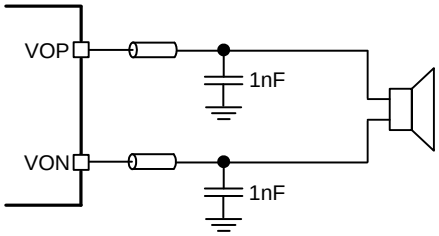
Flying Flying
Flying
Flying 2.2uF ESR X7R
X5R 10V

C_{OUT}

ESR
4.7uF ESR X7R X5R 10V

AW8736 K EEE FCC CLASS
B EMI

K



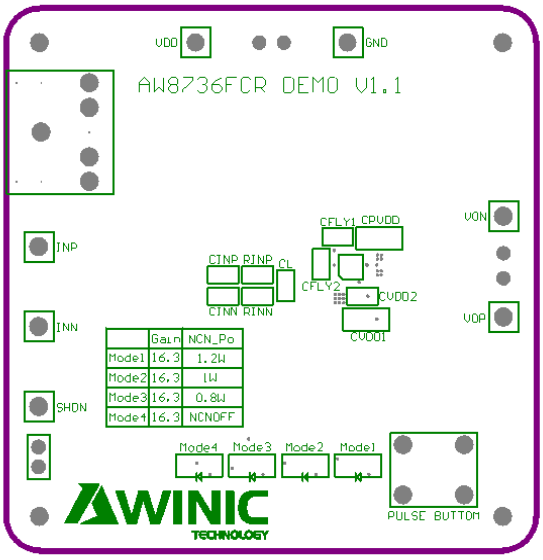
18

Sunlord	UPZ1608U221-2R2TF	0603	Imax=2.2A;Z@100MHz=220 ;DCR=0.05 8Ω

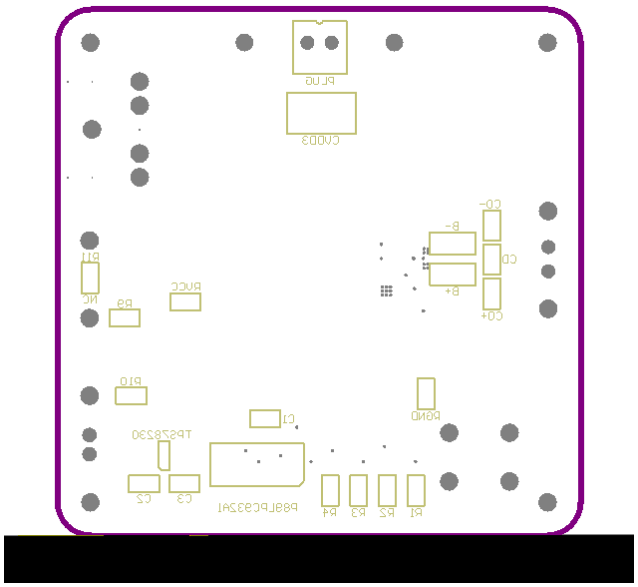
K

1nF

PCB

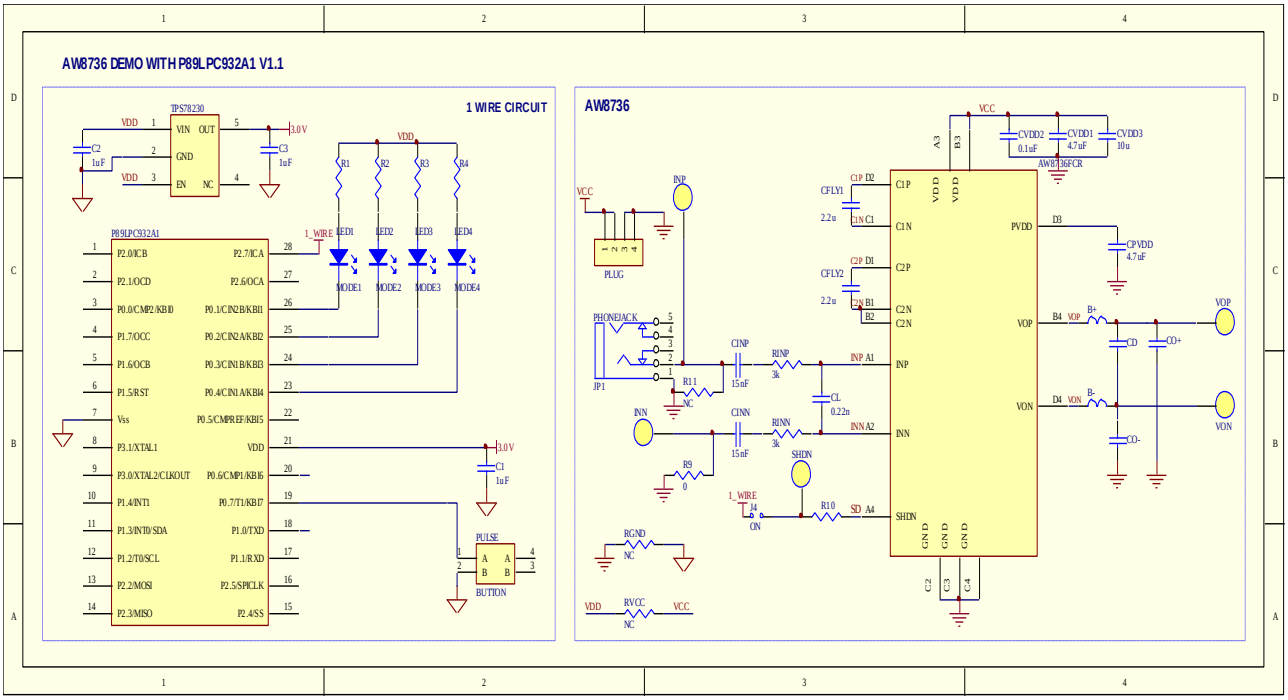


Top Layer



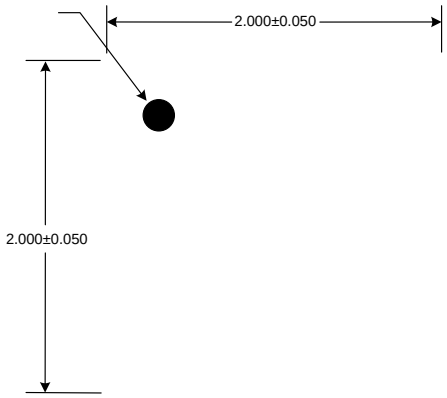
Bottom Layer

Demo

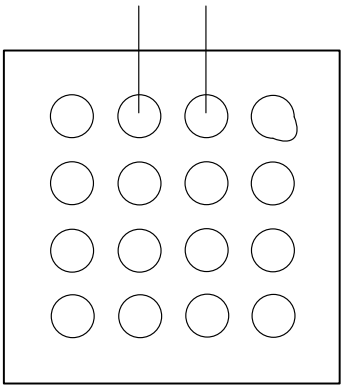

AW8736 DEMO WITH P89LPC932A1 V1.1
1 WIRE CIRCUIT
AW8736
TPS78230
P89LPC932A1
PLUG
PHONEJACK
JP1
PULSE
BUTTON
AW8736FCR

K

TOP VIEW



BOTTOM VIEW



SIDE VIEW

K

V0.9	AW8736FCR		2012-10-31
V1.0	AW8736FCR		2012-11-30
V1.1	SNR		2013-01-05
V1.2	12 4ohm		2013-02-22
V1.3			2013-03-29
V1.4	1 ‘ CH ’ 10V X5R X7R 2 3 4 3.3V~4.35V 5 12 ‘ ’ 6 NCN No-Crack-Noise Non-Crack-Noise 7 13 ‘ ’ 8 K-ChargePump “PVDD VDD 1.5 2 ”		2013-04-19
V1.5	AW8736		2013-05-21