KTMicro

Monolithic Digital Stereo FM Transmitter
Radio-Station-on-a-Chip™

KT0801A

▪ Features

Hardware and software compatible with KT0801
Additional features to KT0801
> **Increased transmission Power**
> **Support input clock and external crystal:**
> > **32.768KHz, 7.6MHz, 15.2MHz**
> **Input signal detection**
> **Bass control**

Professional Grade Performance:
> **SNR ≥ 60 dB**
> **Stereo Separation > 40 dB**
> **International compatible 76MHz ~ 108MHz**

Ultra-Low Power Consumption:
> **< 17 mA operation current**
> **< 3 µA standby current**

Small Form factor:
> **24-pin QFN**

Simple Interface:
> **Single power supply**
> **Industry standard 2-wire I^{2}C MCU interface compatible**

Advanced Digital Audio Signal Processing:
> **On-chip 20-bit ΔΣ Audio ADC**
> **On-chip DSP core**
> **On-chip 24dB PGA with optional 1dB step**
> **Automatic calibration against process and temperature**

On-Chip LDO (low-drop-out) regulator:
> **Accommodates 1.6V ~ 3.6V supply**

Programmable transmit level
Programmable pre-emphasis (50/75 µs)
Pb-free and RoHS Compliant

Applications

MP3 Player
Cellular Phone
PDA
Portable Personal Media player
Laptop Computer
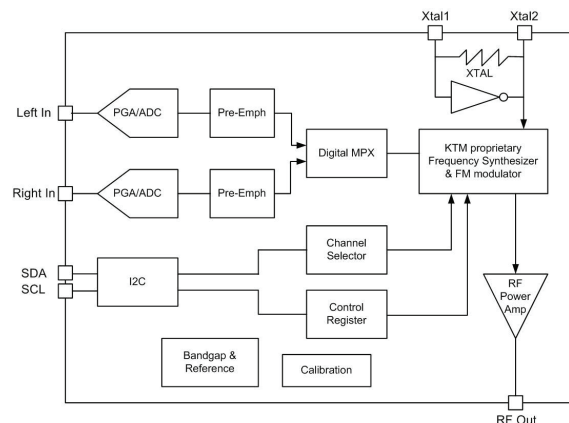**Wireless Speaker**

Rev. 1.0

Figure 1: KT0801A System Diagram

▪ General Description

KT0801A, our new generation of low cost Monolithic Digital FM Transmitter, is designed to process high-fidelity stereo audio signal and transmit modulated FM signal over a short range. It's based on the architecture of award-winning KT0801 and it's also an upgrade of KT0801. The additional features added to KT0801A are increased transmission power up to 113 dBuV, support of 32.768 KHz input clock and crystal, bass control and auto level detection.

The KT0801A features dual 20-bit ΔΣ audio ADCs, a high-fidelity digital stereo audio processor and a fully integrated radio frequency (RF) transmitter. An on-chip low-drop-out regulator (LDO) allows the chip to be integrated in a wide range of low-voltage battery-operated systems with power supply ranging from 1.6V to 3.6V.

The KT0801A is configured as an I^{2}C slave and programmed through the industry standard 2-wire MCU interface.
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Thanks to its high integration level, the KT0801A is mounted in a generic 24-pin QFN package. It only requires a single low-voltage supply. No external tuning is required that makes design-in effort minimum.

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▪ Operation Condition

Table 1: Operation Condition

Parameter	Symbol	Operating Condition	Min	Typ	Max	Units
IO/Regulator Supply	IOVDD	Relative to GND	1.6		3.6	V
Operating Temp	T_A	Ambient Temperature	-30	25	85	°C
Note: 1. When LDO enabled, no external voltage should be applied to this 1.8V supply.						

● Specifications and Features

Table 2: FM Transmitter Functional Parameters (Unless otherwise noted TA = -30~85 °C, IOVDD=1.6~3.6 V, F_{in} = 1 kHz)

Parameter	Symbol	Test/Operating Condition	Min	Nom	Max	Units
FM Frequency Range	F_{tx}	Pin 19	76		108	MHz
Current Consumption	I_{VDD}	Pin 1 with PA (power amp.) at default power mode	-	10	17	mA
Standby Current	I_{stand}	Pin 1	-	0.1	1	μA
Signal to Noise Ratio	SNR	V_{in} = 0.7 V_{p-p}, G_{in} = 0	60		-	dB
Total Harmonic Distortion	THD	V_{in} = 0.7 V_{p-p}, G_{in} = 0	0.3			%
Left/Right Channel Balance	BAL	V_{in} = 0.7 V_{p-p}, G_{in} = 0	-0.2	-	0.2	dB
Stereo Separation[0] (L<->R)	SEP	V_{in} = 0.7 V_{p-p}, G_{in} = 0	40		-	dB
Sub Carrier Rejection Ratio	SCR	V_{in} = 0.7 V_{p-p}, G_{in} = 0	-	-	-60	dB
Input Swing[1]	V_{in}	Single-ended input	-	0.35	1.4	V_{RMS}
PGA Range for Audio Input	G_{in}		-12	0	12	dB
PGA Gain Step for Audio Input	G_{step}		1		4	dB
Required Input Common-Mode Voltage when DC-coupled	V_{cm}	Pin 4, 6	0	0.8	1.8	V
Power Supply Rejection[2]	PSRR	IOVDD = 1.9 ~ 3.6 V	40	-	-	dB
Ground Bounce Rejection[2]	GSRR	IOVDD = 1.9 ~ 3.6 V	40	-	-	dB
Input Resistance (Audio Input)	R_{in}	Pin 4, 6	120	150	180	kΩ
Input Capacitance (Audio Input)	C_{in}	Pin 4, 6	0.5	0.8	1.2	pF
Audio Input Frequency Band	F_{in}	Pin 4, 6	20	-	15k	Hz
Transmit Level	V_{out}		96	108	113	dBμV
Channel Step	STEP		-	50		kHz
Pilot Deviation				7.5	15	kHz
Frequency Response		Mono,-3dB, ΔF=60kHz, 50/75μs pre-emphasis	30		15k	Hz
Pre-emphasis Time Constant	T_{pre}	SIG_PROC<1> = 1	-	50	-	μs
		SIG_PROC<0> = 0	-	75	-	μs
Crystal/External Clock	CLK	Dual-frequency setup	0.32768	7.6	15.2	MHz
2-wire I²C Clock	SCL	Pin 17	0	100	400	kHz
High Level Input Voltage	V_{IH}	Pin 3, 9, 10, 12, 13, 16, 17, 24	0.75 x IOVDD	-	IOVDD + 0.25	V
Low Level Input Voltage	V_{IL}	Pin 3, 9, 10, 12, 13, 16, 17, 24	- 0.25	-	0.25 x IOVDD	V

Notes:
0. Measured with MPX signal
1. Maximum is given on the condition of PGA gain = -12dB.
2. Fin = 20 ~ 15k Hz.

- **Package and Pin List**

A 24-pin QFN package is used. The chip IO pin-out is listed in Table 3.

Table 3: KT0801A Pin Definition

| Pin Index	Name	I/O Type	Function
1	IOVDD	Power	1.6~3.3V external logic IOVDD or Regulator high supply input.
2, 14, 18, 21，22	NC		Reserved. No connection is recommended. Though these pin definitions are different from in KT0801, KT0801A can function in a KT0801 system without any PCB change.
3	HF	Digital Input	Please refer to Table 5 on page 12.
4	INL	Analog Input	Left channel audio input.
5, 11, 15, 20,	GND	Ground	Ground.
6	INR	Analog Input	Right channel audio input.
7	NC1		Reserved. Do not connect.
8	NC2		Reserved. Do not connect.
9	SW1	Digital Input	Control bit. Chip enable, supply mode and clock source.
10	SW2	Digital Input	Control bit. Chip enable, supply mode and clock source.
12	RSTB	Digital Input	Reset (active low).
13	ADDR	Digital Input	Set the 4th I2C address bit (MSB being the 1st bit).
16	SDA	Digital I/O	Serial data I/O.
17	SCL	Digital I/O	Serial clock input.
19	PA_OUT	Analog Output	FM RF output.
23	XI	Analog I/O	Crystal input.
24	XO/RCLK	Analog I/O	Crystal input or external reference clock input.
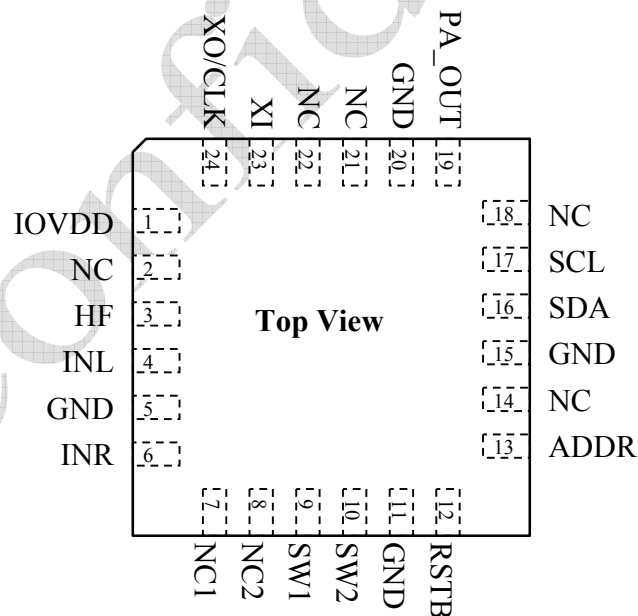
Figure 2: Pin-out

- ## I²C Compatible 2-Wire Serial Interface

General Descriptions

Please note that during the power-up, RSTB should be set to low first to reset the chip. The registers should not be accessed until 150 ms after RSTB returns to high.

The serial interface consists of a serial controller and registers. An internal address decoder transfers the content of the data into appropriate registers.

Both the write and read operations are supported according to the following protocol:

Write Operations:
BYTE WRITE:
The write operation is accomplished via a 3-byte sequence:
>   Serial address with write command
>   Register address
>   Register data

A write operation requires an 8-bit register address following the device address word and acknowledgment. Upon receipt of this address, the KT0801A will again respond with a "0" and then clock in the 8-bit register data. Following receipt of the 8-bit register data, the KT0801A will output a "0" and the addressing device, such as a microcontroller, must terminate the write sequence with a stop condition (see Figure 3).

Read Operations:
RANDOM READ:
The read operation is accomplished via a 4-byte sequence:
>   Serial address with write command
>   Register address
>   Serial address with read command
>   Register data

Once the device address and register address are clocked in and acknowledged by the KT0801A, the microcontroller must generate another start condition. The microcontroller now initiates a current address read by sending a device address with the read/write select bit high. The KT0801A acknowledges the device address and serially clocks out the register data. The microcontroller does not respond with a "0" but does generate a following stop condition (see Figure 3).

RANDOM REGISTER WRITE PROCEDURE
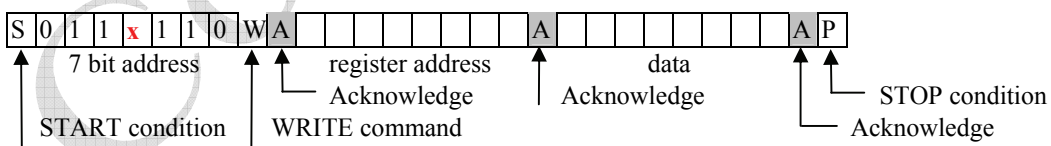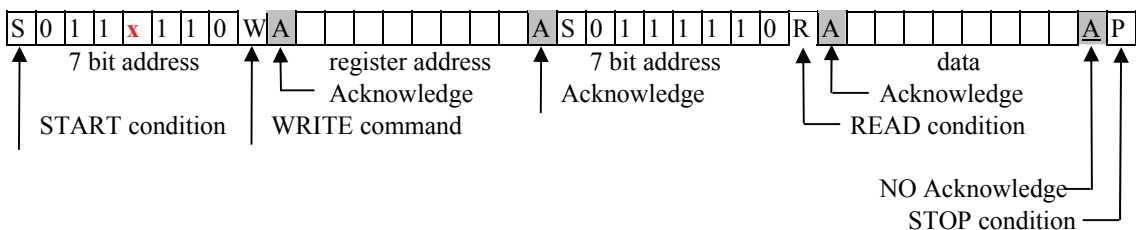

RANDOM REGISTER READ PROCEDURE

Figure 3: Serial Interface Protocol

CURRENT ADDRESS READ: The internal data register address counter maintains the last address accessed during the last read or write operation, incremented by one. This address stays valid between operations as long as the chip power is maintained.

Once the device address with the read/write select bit set to "1" is clocked in and acknowledged by the KT0801A, the current address data word is serially clocked out. The microcontroller does not respond with an input "0" but does generate a following stop condition (see Figure 4).

CURRENT REGISTER READ PROCEDURE
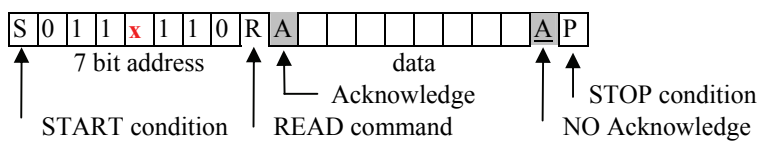
Figure 4: Serial Interface Protocol

Note: The x is the optional 4th MSB bit address code that is set by the ADDR pin (pin 13) and is provided to allow a dual-transmitter-single-controller configuration that will enable multi-channel surround sound applications. ADDR (pin 13) must be externally tied to ground or IOVDD for low or high setup, respectively. The serial controller supports slave mode only. Any register can be addressed randomly.

The address of the slave in the first 7 bits and the 8th bit tells whether the master is receiving data from the slave or transmitting data to the slave. When ADDR is set to "0" (i.e. tied to ground), the I^2C write address is 0x6C and the read address is 0x6D. When ADDR is set to "1" (i.e. tied to power), the I^2C write address is 0x7C and the read address is 0x7D.

Slave Mode Protocol

With reference to the clocking scheme shown in Figure 5, the serial interface operates in the following manner:
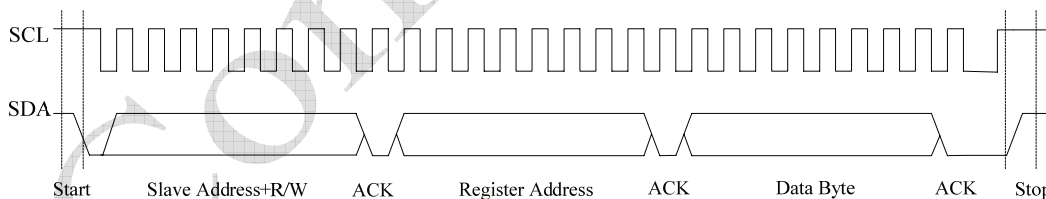
Figure 5: Serial Interface Slave Mode Protocol

CLOCK and DATA TRANSITIONS: The SDA pin is normally pulled high with an external device. Data on the SDA pin may change only during SCL low time periods (see Figure 6). Data changes during SCL high periods will indicate a start or stop condition as defined below.

START CONDITION: A high-to-low transition of SDA with SCL high is a start condition which must precede any other command (see Figure 7).

STOP CONDITION: A low-to-high transition of SDA with SCL high is a stop condition. After a read sequence, the stop command will place the KT0801A in a standby power mode (see Figure 7).

ACKNOWLEDGE: All addresses and data words are serially transmitted to and from the KT0801A in 8-

bit words. The KT0801A sends a "0" to acknowledge that it has received each word. This happens during the ninth clock cycle (see Figure 8).
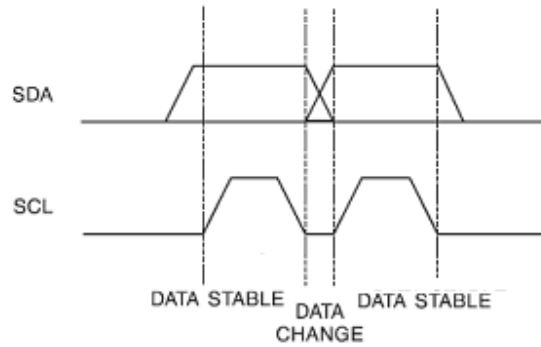
Data Validity

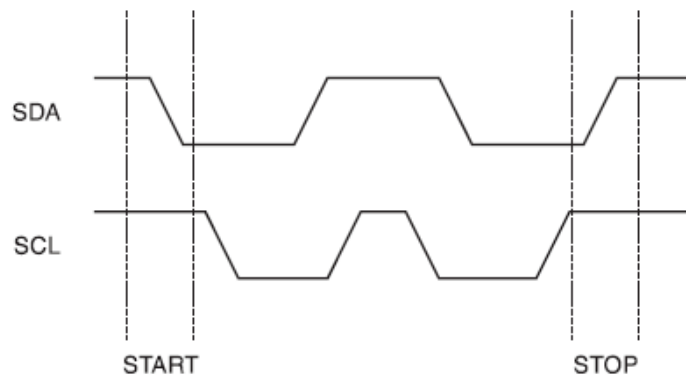**Figure 6: Clock and Data Transitions**

Start and Stop Definition

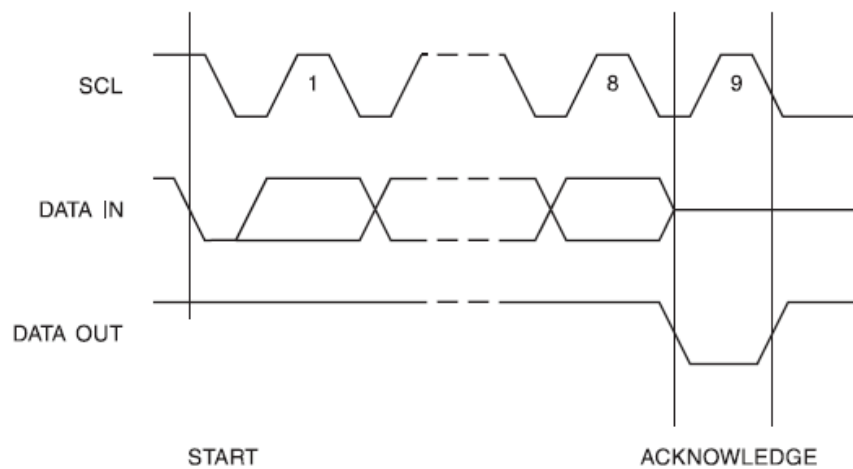**Figure 7: Start and Stop Definition**

Output Acknowledge

Figure 8: Acknowledge

▪ Register Bank

The register bank stores channel frequency codes, calibration parameters, operation status, mode and power controls, which can be accessed by the internal digital controller, state machines and external micro controllers through the serial interface.

All registers are 8 bits wide. Control logics are active high unless specifically noted.

Register	7	6	5	4	3	2	1	0
0x00	CHSEL[8:1]							
0x01	RFGAIN[1:0]		PGA[2:0]			CHSEL[11:9]		
0x02	CHSEL[0]	RFGAIN[3]	-	-	MUTE	PLTADJ	-	PHTCNST
0x04		MONO	PGA_LSB[1:0]		-		BASS[1:0]	
0x0B	-	-	PDPA	-	-	-	-	-
0x0E	-	-	-	-	-	-	PA_BIAS	-
0x0F	-	-	-	PW_OK	-	SLNCID	-	-
0x10	-	-	-	LMTLVL[1:0]		-	-	PGAMOD
0x12	SLNCDIS	SLNCTHL[2:0]			SLNCTHH[2:0]			SW_MOD
0x13	RFGAIN[2]	-	-	-	-	PA_CTRL	-	-
0x14	SLNCTIME[2:0]			SLNCCNTHIGH[2:0]			-	-
0x16	-			-	-	SLNCCNTLOW[2:0]		

Note 1: ONLY read/write the defined registers. Don't read/write ANY undefined address.

Note 2: Shaded registers are used in KT0801.

Register 0x00 (Address: 0x00, Default value: 0x81)

Bit	7	6	5	4	3	2	1	0
KT0801A	CHSEL[8:1]							
KT0801	*CHSEL[7:0]*							

As the minimum frequency step is changed from 100KHz in KT0801 to 50KHz in KT0801A. The 12 bits (Reg0x1[2:0]; Reg0x0[7:0]; Reg0x2[7]) are required to select the FM transmission channel instead of 11 bits in KT0801. If a 100 KHz step is wanted to be compatible with KT0801, set Reg0x2[7] to 0 and thus no software change is needed from KT0801 to KT0801A to set the same FM frequency.

Register 0x01 (Address: 0x01, Default value: 0xC3)

Bit	7	6	5	4	3	2	1	0
KT0801A	RFGAIN[1:0]		PGA[2:0]			CHSEL[11:9]		
KT0801	*RFGAIN[1:0]*		*PGA[2:0]*			*CHSEL[10:8]*		

Bits	Type	Default	Label	Description
7:6	RW	11	RFGAIN[1:0]	Transmission Range Adjustment with RFGAIN[3] in Reg 0x02[6] and RFGAIN[2] in Reg 0x13[7] (See Table 4 below)
5:3	RW	000	PGA[2:0]	PGA Gain Control (see PGA_LSB description, Reg 0x04) 111: 12dB 110: 8dB 101: 4dB 100: 0dB 000: 0dB 001: -4dB 010: -8dB 011: -12dB

Bits	Type	Default	Label	Description
2:0	RW	011	CHSEL[11:9]	FM Channel Selection[11:9]

Table 4: Transmission power setting

RFGAIN<3:0>	RFOUT
0000	95.5 dBuV
0001	96.5 dBuV
0010	97.5 dBuV
0011	98.2 dBuV
0100	98.9 dBuV
0101	100 dBuV
0110	101.5 dBuV
0111	102.8 dBuV
1000	105.1 dBuV (107.2dBuV PA_BIAS=1)
1001	105.6 dBuV (108dBuV, PA_BIAS=1)
1010	106.2 dBuV (108.7dBuV, PA_BIAS=1)
1011	106.5 dBuV (109.5dBuV, PA_BIAS=1)
1100	107 dBuV (110.3dBuV, PA_BIAS=1)
1101	107.4 dBuV (111dBuV, PA_BIAS=1)
1110	107.7 dBuV (111.7dBuV, PA_BIAS=1)
1111 **(default setting)**	**108 dBuV** (112.5dBuV, PA_BIAS=1)

Register 0x02 (Address: 0x02, Default: 0x40)

Bit	7	6	5	4	3	2	1	0
KT0801A	CHSEL[0]	RFGAIN[3]	-	-	MUTE	PLTADJ	-	PHTCNST
KT0801	-	-	-	-	*MUTE*	*PLTADJ*	-	*PHTCNST*

Bits	Type	Default	Label	Description
7	RW	0	CHSEL[0]	LSB o CHSEL, additional to KT0801
6	RW	1	RFGAIN[3]	MSB of RFGAIN
5:4	RW	00	Reserved	
3	RW	0	MUTE	Software Mute 1: MUTE Enabled 0: MUTE Disabled
2	RW	0	PLTADJ	Pilot Tone Amplitude Adjustment 1: Amplitude high 0: Amplitude low
1	RW	0	NA	Reserved
0	RW	0	PHTCNST	Pre-emphasis Time-Constant Set 1: 50 μs (Europe, Australia) 0: 75 μs (USA, Japan)

Register 0x04 (Address: 0x04, Default: 0x04) - *New*

Bit	7	6	5	4	3	2	1	0
KT0801A	-	MONO	PGA_LSB[1:0]		FDEV[1:0]		BASS[1:0]	
KT0801	-	-	-		-		-	

Bits	Type	Default	Label	Description
7	RW	0	Reserved	

Bits	Type	Default	Label	Description		
6	RW	0	MONO	Force MONO		
5:4	RW	00	PGA_LSB[1:0]	**PGA<2:0>**	**PGA_LSB<1:0>**	**PGA Gain**
				111	**11**	**12dB**
				111	10	11
				111	01	10
				111	00	9
				110	**11**	**8**
				110	10	7
				110	01	6
				110	00	5
				101	**11**	**4**
				101	10	3
				101	01	2
				101	00	1
				100	**11**	**0**
				100	10	0
				100	01	0
				100	00	0
				000	**00**	**0**
				000	01	-1
				000	10	-2
				000	11	-3
				001	**00**	**-4**
				001	01	-5
				001	10	-6
				001	11	-7
				010	**00**	**-8**
				010	01	-9
				010	10	-10
				010	11	-11
				011	**00**	**-12**
				011	01	-13
				011	10	-14
				011	11	-15
3:2	RW	01	NC			
1:0	RW	00	BASS[1:0]	Bass boost control 00 = Disable 01 = Low 10 = Med 11 = High		

Register 0x0B (Address: 0x0B, Default: 0x00) - *New*

Bit	7	6	5	4	3	2	1	0
KT0801A	-	-	PDPA	-	-	-	-	-
KT0801	-	-	-	-	-	-	-	-

Bits	Type	Default	Label	Description
7	RW	0	Reserved	
6	RW	0	Reserved	
5	RW	0	PDPA	Power Amplifier Power Down
4	RW	0	Reserved	
3	RW	0	Reserved	

Bits	Type	Default	Label	Description
1	RW	0	Reserved	
0	RW	0	Reserved	

Register 0x0E (Address: 0x0E, Default: 0x02) – *New*

Bit	7	6	5	4	3	2	1	0
KT0801A	-	-	-	-	-	-	PA_BIAS	-
KT0801	-	-	-	-	-	-	-	-

Bits	Type	Default	Label	Description
7:2	RW	0x00	Reserved	
1	RW	1	PA_BIAS	PA bias current enhancement.
0	RW	0	Reserved	

Register 0x0F (Address: 0x0F, Read only) – *New*

Bit	7	6	5	4	3	2	1	0
KT0801A	-	-	-	PW_OK	-	SLNCID	-	-
KT0801	-	-	-	-	-	-	-	-

Bits	Type	Default	Label	Description
7	R	NA	Reserved	
6	R	NA	Reserved	
5	R	NA	Reserved	
4	R	NA	PW_OK	Power OK indicator
3	R	NA	Reserved	
2	R	NA	SLNCID	1 when Silence is detected
1	R	NA	Reserved	
0	R	NA	Reserved	

Register 0x10 (Address: 0x10, Default: 0x08) – *New*

Bit	7	6	5	4	3	2	1	0
KT0801A	-	-	-	LMTLVL[1:0]		-	-	PGAMOD
KT0801	-	-	-	-	-	-	-	-

Bits	Type	Default	Label	Description
7:5	RW	000	Reserved	
4:3	RW	01	LMTLVL[1:0]	Internal audio limiter level control 00 = lowest level 01 = low level 10 = high level 11 = hjghest level
2:1	RW	00	Reserved	
0	RW	0	PGAMOD	PGA mode selection 0 = 4dB step (compatible with KT0801) 1 = 1dB step with PGA_LSB[1:0] used

Register 0x12 (Address: 0x12, Default: 0x80) - *New*

Bit	7	6	5	4	3	2	1	0
KT0801A	SLNCDIS	SLNCTHL[2:0]			SLNCTHH[2:0]			SW_MOD
KT0801	-	-	-	-	-	-	-	-

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Bits	Type	Default	Label	Description
7	RW	1	SLNCDIS	Silence detection disable 0 : enable 1 : disable
6:4	RW	000	SLNCTHL	Silence detection low threshold 000 : 0.25mv 001 : 0.5mv 010 : 1mv 011 : 2mv 100 : 4mv 101 : 8mv 110 : 16mv 111 : 32mv
3:1	RW	000	SLNCTHH	Silence detection high threshold 000 : 0.5mv 001 : 1mv 010 : 2mv 011 : 4mv 100 : 8mv 101 : 16mv 110 : 32mv 111 : 64mv
0	RW	0	SW_MOD	Switching channel mode selection. 0 = mute when changing channel 1 = pa off when changing channel

Register 0x13 (Address: 0x13, Default: 0x80)

Bit	7	6	5	4	3	2	1	0
KT0801A	RFGAIN[2]	-			-	PA_CTRL	-	-
KT0801	*PA_HI_PW*	-	-	-	-	-	-	-

Bits	Type	Default	Label	Description
7	RW	1	RFGAIN[2]	PA (Power amplifier) power (combined with Reg 0x01[7:6] and Reg 0x02[6])to set up transmission range)
6:3	RW	0000	Reserved	
2	RW	0	PA_CTRL	Power amplifier structure selection 0 = PA powered by internal power supply, KT0801 compatible 1 = PA powered by external power supply via external inductor **Note: When external inductor is used, this bit must be set to 1 immediately after the Power OK indicator is set to 1. Otherwise, the device may be damaged!**
1:0	RW	00	Reserved	

Register 0x14 (Address: 0x14, default 0x00) - *New*

Bit	7	6	5	4	3	2	1	0
KT0801A		SLNCTIME<2:0>			SLNCCNTHIGH<2:0>		-	-
KT0801	-	-	-	-	-	-	-	-

Bits	Type	Default	Label	Description

Bits	Type	Default	Label	Description
7:5	RW	000	SLNCTIME<2:0>	Silence detection low level and high level duration time 000 : 50ms 001 : 100ms 010 : 200ms 011 : 400ms 100 : 1s 101 : 2s 110 : 4s 111 : 8s
4:2	RW	000	SLNCCNTHIGH<2:0>	Silence detection high level counter threshold 000 : 15 001 : 31 010 : 63 011 : 127 100 : 255 101 : 511 110 : 1023 111 : 2047
1：0	RW	00	Reserved	

Register 0x16 (Address 0x16, default: 0x00) - *New*

Bit	7	6	5	4	3	2	1	0
KT0801A	-			-	-		SLNCCNTLOW[2:0]	
KT0801	-	-	-	-	-	-	-	-

Bits	Type	Default	Label	Description
7:3	RW	0x0	Reserved	
2:0	RW	000	SLNCCNTLOW[2:0]	Silence low counter 000 : 1 001 : 2 010 : 4 011 : 8 100 : 16 101 : 32 110 : 64 111 : 128

Chip Enable and Mode Control

There are 2 external Pins SW1 and SW2 (Pin 9 and 10) which enable chip and define the supply voltage level and clock source of the chip. The definition is shown below.

Table 5: Pin SW vs. Chip Supply and Clock Source

SW[1:2]	HF	Chip Mode
00	x	Disabled
11	0	XTAL/External reference 7.6MHz
11	1	XTAL/External referenc 15.2MHz
10	1	XTAL/External reference 32768Hz

Mute

The FM transmitter can be muted by setting Register MUTE to "1" through I2C programming.

Silence Detection

Bit name	Register location	Description
SLNCDIS	Reg 0x12[7]	Setting to 0 to enable the silence detection
SLNCTIME[2:0]	Reg 0x14[7:5]	silence detection time window
SLNCTHL[2:0]	Reg 0x12[6:4]	Low threshold voltage of input signal for silence detection
SLNCTHH[2:0]	Reg 0x12[3:1]	High threshold voltage of input signal for silence detection
SLNCCNTTHL[2:0]	Reg 0x14[4:2]	# of time when the input signal amplitude is lower than SLNCTHL
SLNCCNTTHH[2:0]	Reg 0x16[2:1]	# of time when the input signal amplitude is higher than SLNCTHH
SLNCID	Reg 0x0F[2]	(Read only) Set to 1 when silence is detected.

The silence detection scheme is enabled by setting SLNCDIS to 0.

During the time defined by SLNTIME[2:0], the chip will be muted when the number of time when the input amplitude is higher than the voltage defined by SLNCTHL[2:0] is lower than SLNCCNTTHL[2:0]. The SLNCID bit is set to 1.

When the input signal amplitude is higher than the voltage defined by SLNCTHH[2:0] and the number of time when that happens is more than SLNCCNTTHH[2:0], the chip exits from the mute status and the SLNCID is cleared to 0.

Reset

The global reset is issued after the RSTB pin set to "0" or automatic on-chip power-on reset. After a global reset, all registers are reset to the default value.

▪ Typical Application Circuits

The KT0801A can be integrated in a wide range of systems by requiring only a single power supply. Though there are a few power and ground pins in KT0801 defined as NC in KT0801A, KT0801A can be a direct drop-in replacement of KT0801 if a customer chose not to take advantage of the additional features from KT0801A.

Figure 9 shows a configuration with zero external components. Figure 10 shows a setup with an external inductor (FB)to boost the transmission power.
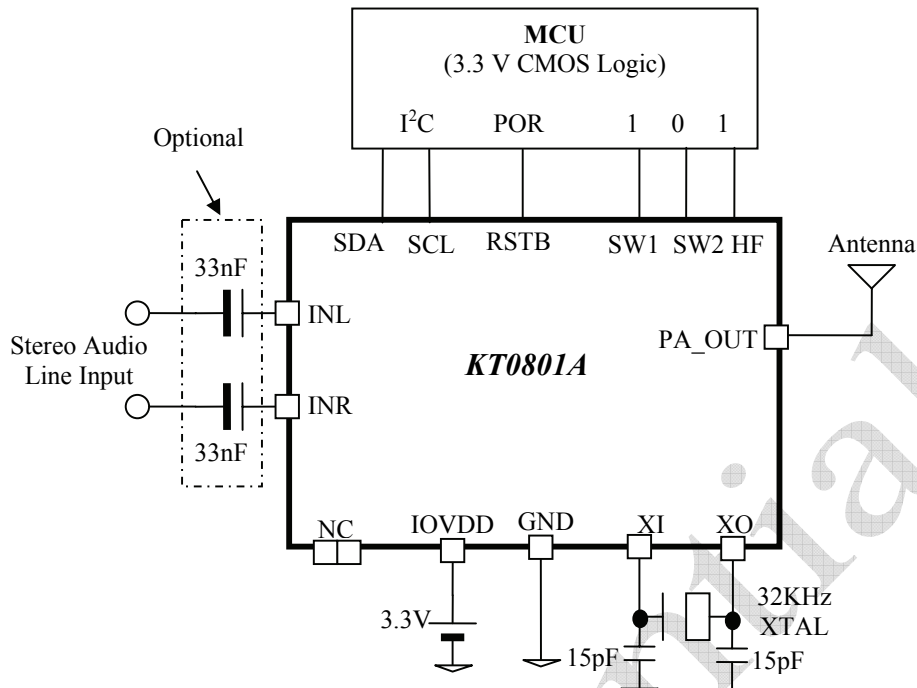
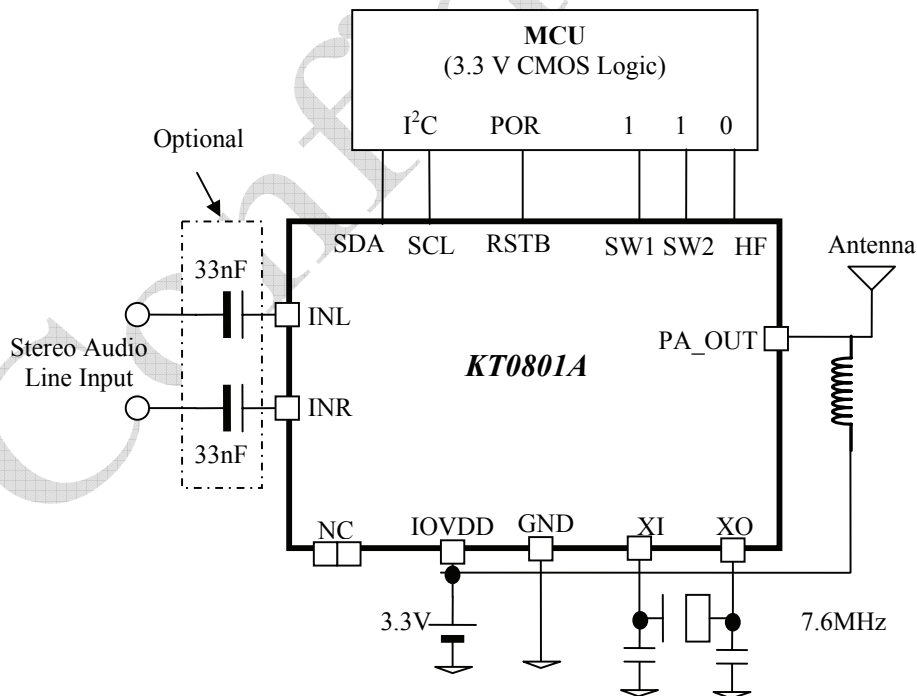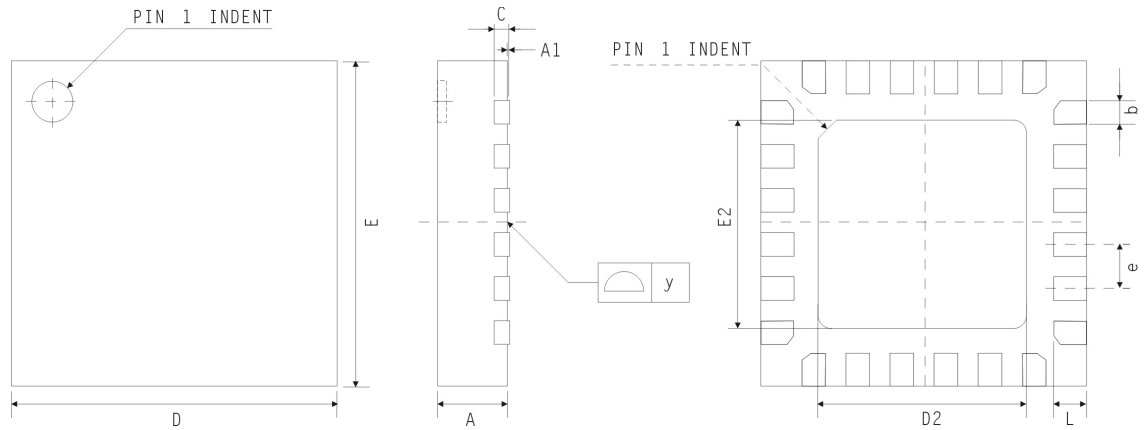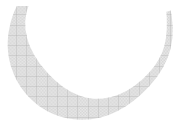**Figure 9: Typical application configuration with a 3.3V supply**

Figure 10: Application that requires higher transmission power (>5dBm)

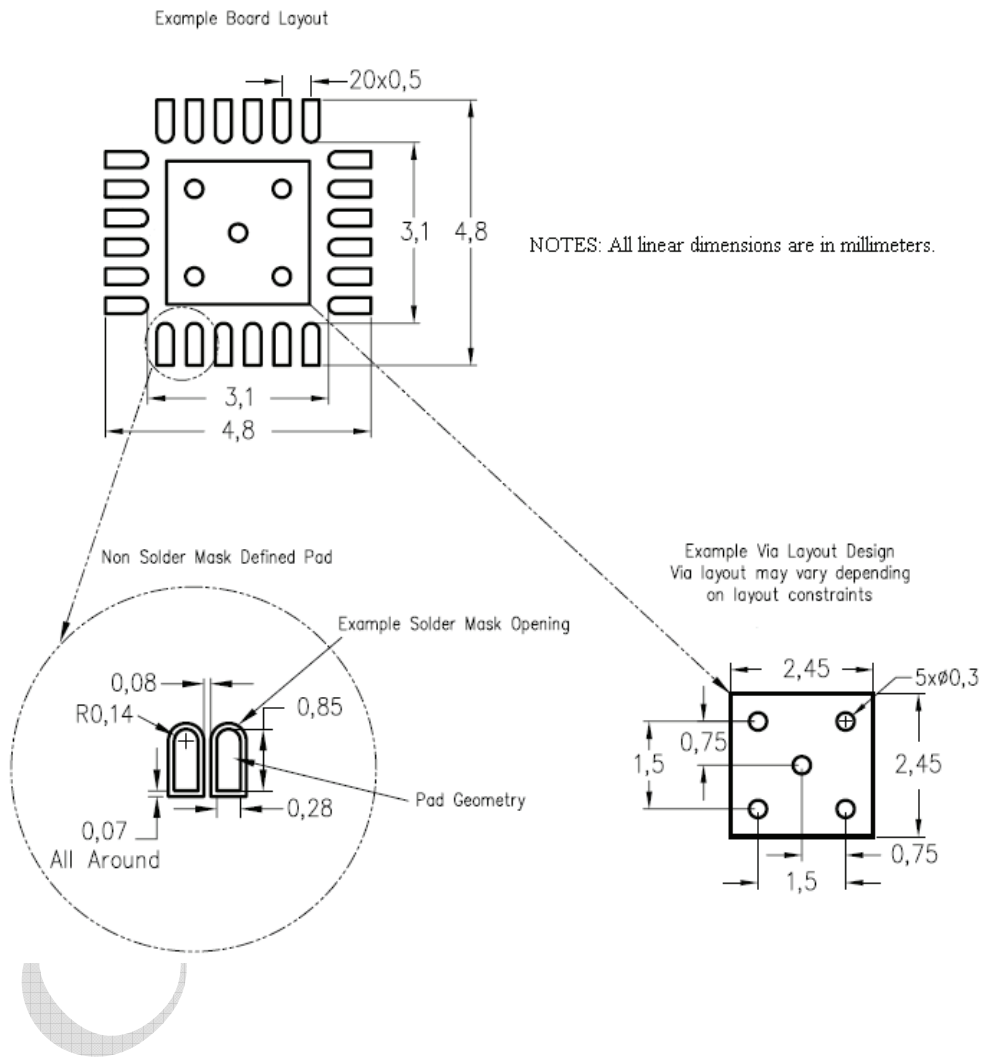▪ **Package Outline**

Symbols	(MILLIMETERS)		
	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0.00	0.02	0.05
b	0.20	0.25	0.30
C	0.19	0.20	0.25
D	3.95	4.00	4.05
D2	2.65	2.70	2.75
E	3.95	4.00	4.05
E2	2.65	2.70	2.75
e	-	0.5	-
L	0.30	0.40	0.50
y	0.00	-	0.076

- **Recommended PCB Land Pattern**

Example Board Layout

20x0,5

3,1　4,8

3,1

4,8

NOTES: All linear dimensions are in millimeters.

Non Solder Mask Defined Pad

Example Solder Mask Opening

0,08

R0,14

0,85

0,28

0,07

Pad Geometry

All Around

Example Via Layout Design
Via layout may vary depending
on layout constraints

2,45

5xØ0,3

0,75

1,5

2,45

0,75

1,5

■ Revision History

V1.0   Official Release

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