Data Sheet

aMTP777

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FEATURES

- Standard CMOS process.
- Embedded 4K byte EPROM for MCU programming.
- Embedded 8-bit MCU.
- Connect external SPI flash to store voice data
- Combination of voice building blocks to extend playback duration.
- Table entries are available for voice block combinations.
- User selectable 10bit/8bit PCM or 4bit ADPCM data compress.
- Voice Group Trigger Options: Edge / Level; Hold / Un-hold; Retrigger / Non-retrigger.
- Programmable I/Os, Timer Interrupt and Watch Dog Timer.
- Built-in oscillator with fixed Rosc, software control sampling frequency
- 2.4V – 3.6V single power supply and < 5uA low stand-by current.
- PWM Vout1 and Vout2 drive speaker directly.
- D/A COUT with ramp-up ramp-down option to drive speaker through an external BJT.
- Volume control.
- Maximum 10-bit resolution.
- Internal Power-up reset circuit built-in; RSTB provides external controlled reset to the chip.

DESCRIPTION

Aplus' aMTP777 is a 4K-byte 8-bit MCU based Voice controller IC. It is fabricated with Standard CMOS process with embedded voice storage memory. Voice data is stored in an external multi-programmable SPI flash with 4-bit ADPCM compression at different sampling rate. 10-bit/8-bit PCM is also available as user selectable option to improve sound quality. There are upto nineteen programmable I/O pins. Key trigger and Parallel CPU trigger mode can be configured according to different application requirement. User selectable triggering and output signal options provide maximum flexibility to various applications. Built-in resistor controlled oscillator, 10-bit resolution current mode D/A output and PWM direct speaker driving minimize the number of external components. Volume control for both DAC and VOUT output is available.

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PIN CONFIGURATION
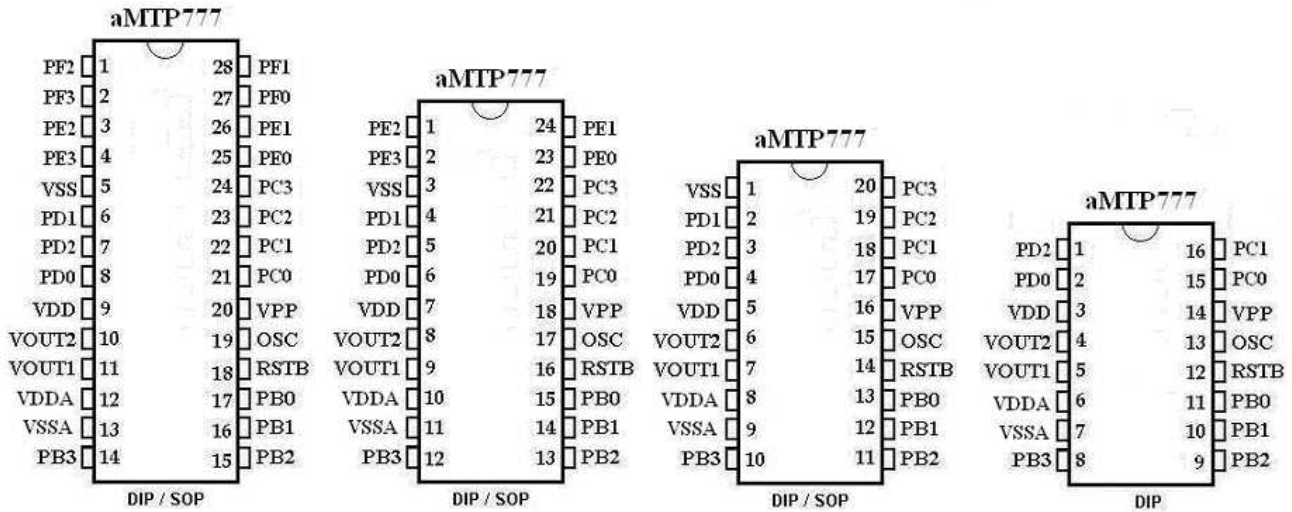
PIN DESCRIPTIONS

Pin Names	Description
VOUT1	PWM output to drive speaker directly
VOUT2_COUT	PWM output or COUT DAC output select by programmable option
VSS	Power Ground
VSSA	Analog Power Ground
OSC	Oscillator input
VDD	Positive Power Supply
VDDA	Analog Positive Power Supply
VPP	Positive Power for EPROM programming, NC during voice playback
PB0~PB3	Programmable I/O port B
PC0~PC3	Programmable I/O port C
PD0~PD2	Programmable I/O port D
PE0~PE3	Programmable I/O port E
PF0~PF3	Programmable Input port F
RSTB	Reset pin, Low active;

Note:
- PB, PC, PD, PE and PF ports are software programmable I/O pins that can be set to different configurations such as pure input, input with pull-up, input with pull-down and output. The programmable I/O pins set up will take effect immediately after chip RESET is applied.
- Pins for memory programming are: VDD, VDDA, VSS, VSSA, VPP, PB0, PB1, OSC, VOUT2 and RSTB.

BLOCK DIAGRAM
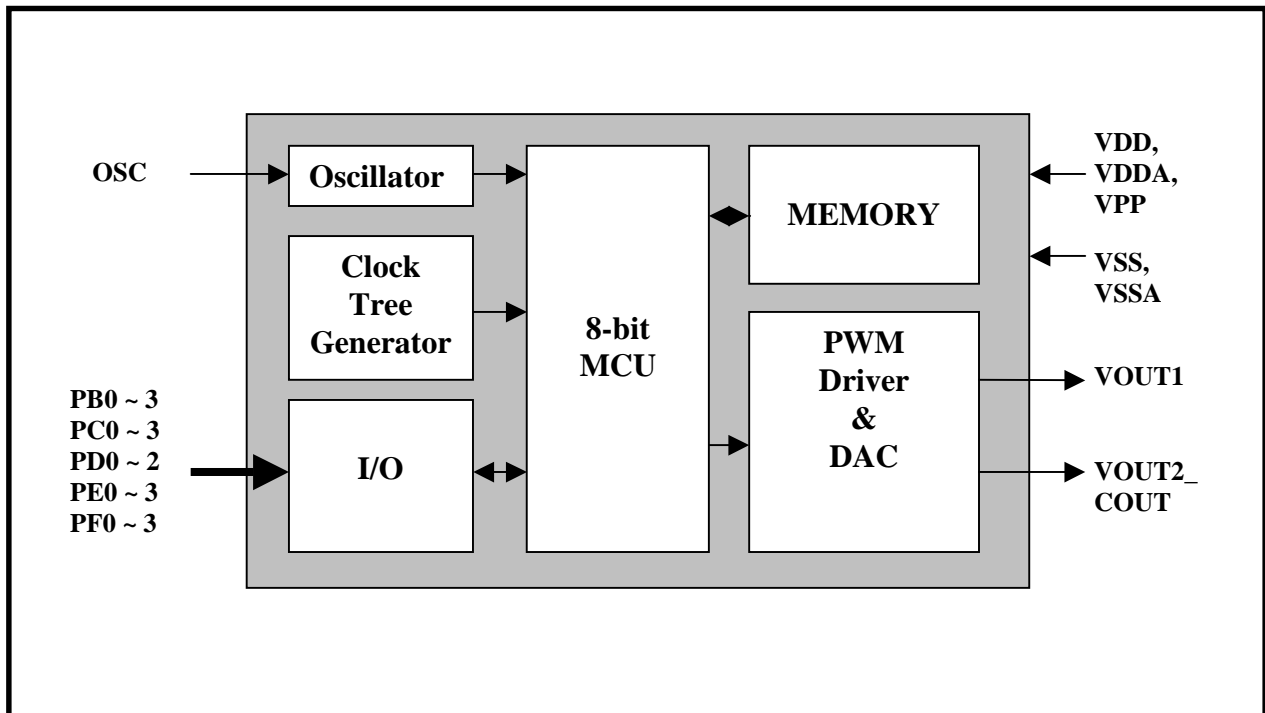
ABSOLUTE MAXIMUM RATINGS

Symbol	Rating	Unit
$V_{DD} - V_{SS}$	-0.5 ~ +4.0	V
V_{IN}	$V_{SS} - 0.3 < V_{IN} < V_{DD} + 0.3$	V
V_{OUT}	$V_{SS} < V_{OUT} < V_{DD}$	V
T (Operating):	0 ~ +85	℃
T (Junction)	-40 ~ +125	℃
T (Storage)	-55 ~ +125	℃

VOICE DURATION (@ 6KHz sampling rate)

SPI Flash Size	4-bit ADPCM	8-bit PCM	10-bit PCM
16M bit	682 sec	341 sec	272 sec
32M bit	1364 sec	682 sec	545 sec
64M bit	2728 sec	1364 sec	1091 sec
128M bit	5456 sec	2728 sec	2182 sec

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DC CHARACTERISTICS (T_A = 0 to 70℃, V_{DD} = 3.0V, V_{SS} = 0V)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
V_{DD}	Operating Voltage	2.2	3.0	3.6	V	
I_{SB}	Standby current	—	1	5	μA	I/O properly terminated
I_{OP}	Operating current	—	7	—	mA	I/O properly terminated
V_{IH}	"H" Input Voltage	2.5	3.0	3.5	V	V_{DD}=3.0V
V_{IL}	"L" Input Voltage	-0.3	0	0.5	V	V_{DD}=3.0V
I_{VOUTL_N}	V_{OUT} low O/P Current (Normal Volume)	—	130	—	mA	Vout=1.0V
I_{VOUTL_H}	V_{OUT} low O/P Current (High Volume)	—	200	—	mA	Vout=1.0V
I_{VOUTH_N}	V_{OUT} high O/P Current (Normal Volume)	—	-130	—	mA	Vout=2.0V
I_{VOUTH_H}	V_{OUT} high O/P Current (High Volume)	—	-200	—	mA	Vout=2.0V
I_{CO}	C_{OUT} O/P Current	—	-2	—	mA	Data = 80h
I_{OH}	O/P High Current	—	-10	—	mA	V_{OH}=2.5V
I_{OL}	O/P Low Current	—	17	—	mA	V_{OL}=0.3V
RN_{VOUT}	VOUT pull-down resistance	—	100K	—	Ω	VOUT pin set to internal pull-down
RN_{PIO}	Programmable IO pin pull-down resistance	—	1M	—	Ω	PBx, PCx, PDx set to internal pull-down
RU_{PIO}	Programmable IO pin pull-up resistance	3.3K	4.7K	—	Ω	PBx, PCx, PDx set to internal pull-up
ΔFs/Fs	Frequency stability	-3	—	+3	%	V_{DD} = 3V +/- 0.4V
ΔFc/Fc	Chip to chip Frequency Variation	-5	—	+5	%	Also apply to lot to lot variation

TYPICAL APPLICATIONS

Note:
1. PB0 to PB2 are set to input; PB3 is set to output
2. C1 and C2 must be connected directly on the VDD, VDDA and VSS, VSSA pins of the chip
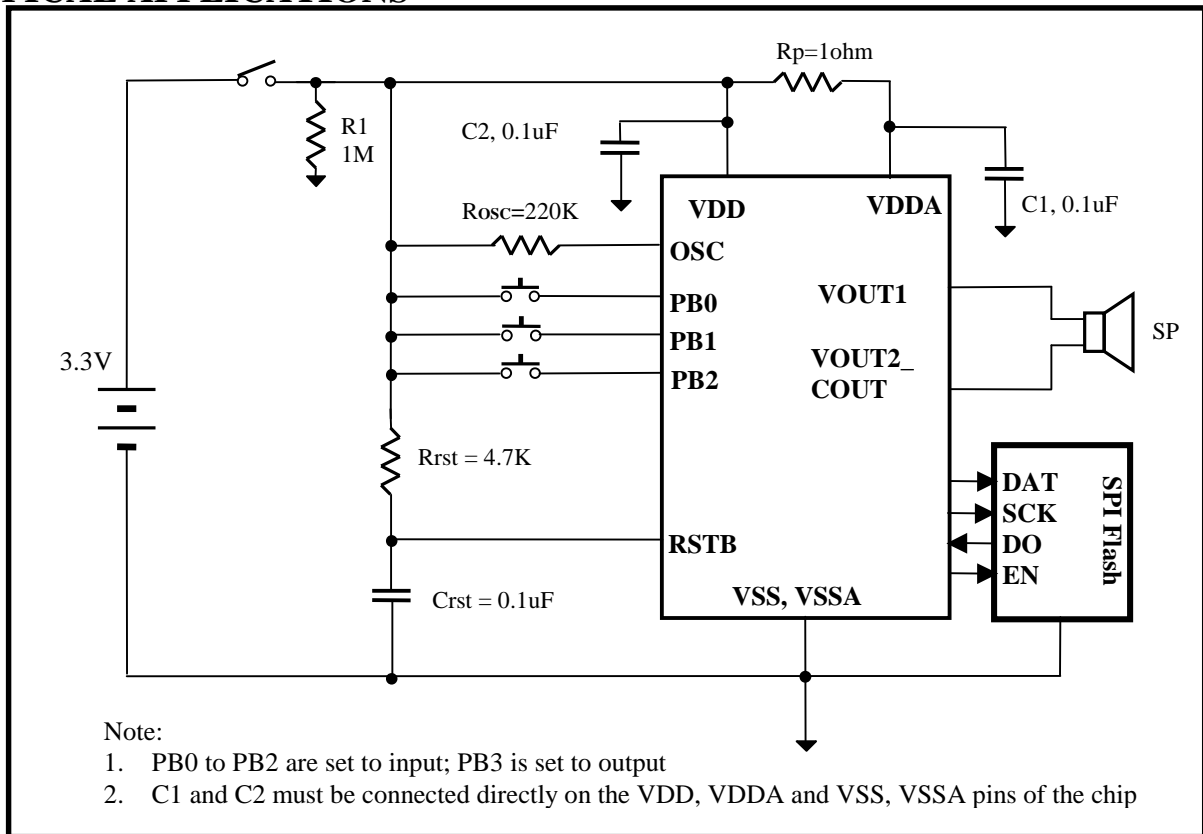
Using 3.3V Battery Direct Drive Speaker

Note :
PB0 to PB2 are set to input
C1 and C2 must be connected directly on the VDD/VDDA and VSS/VSSA pins

Output driving of HT LDO:
HT7133 (30mA, 3.3V)
HT7536 (100mA, 3.6V)
HT7335 (250mA, 3.5V)
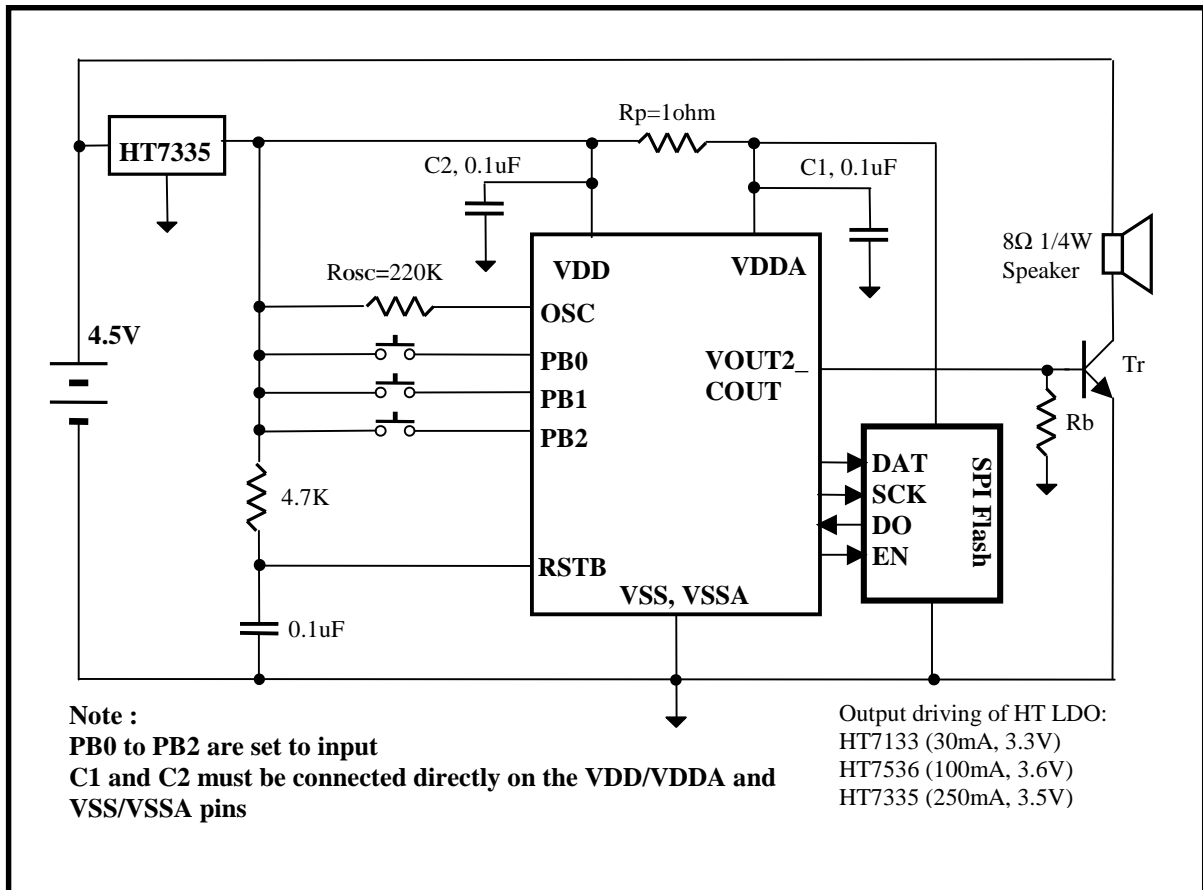
Using 4.5V Battery with COUT speaker drive
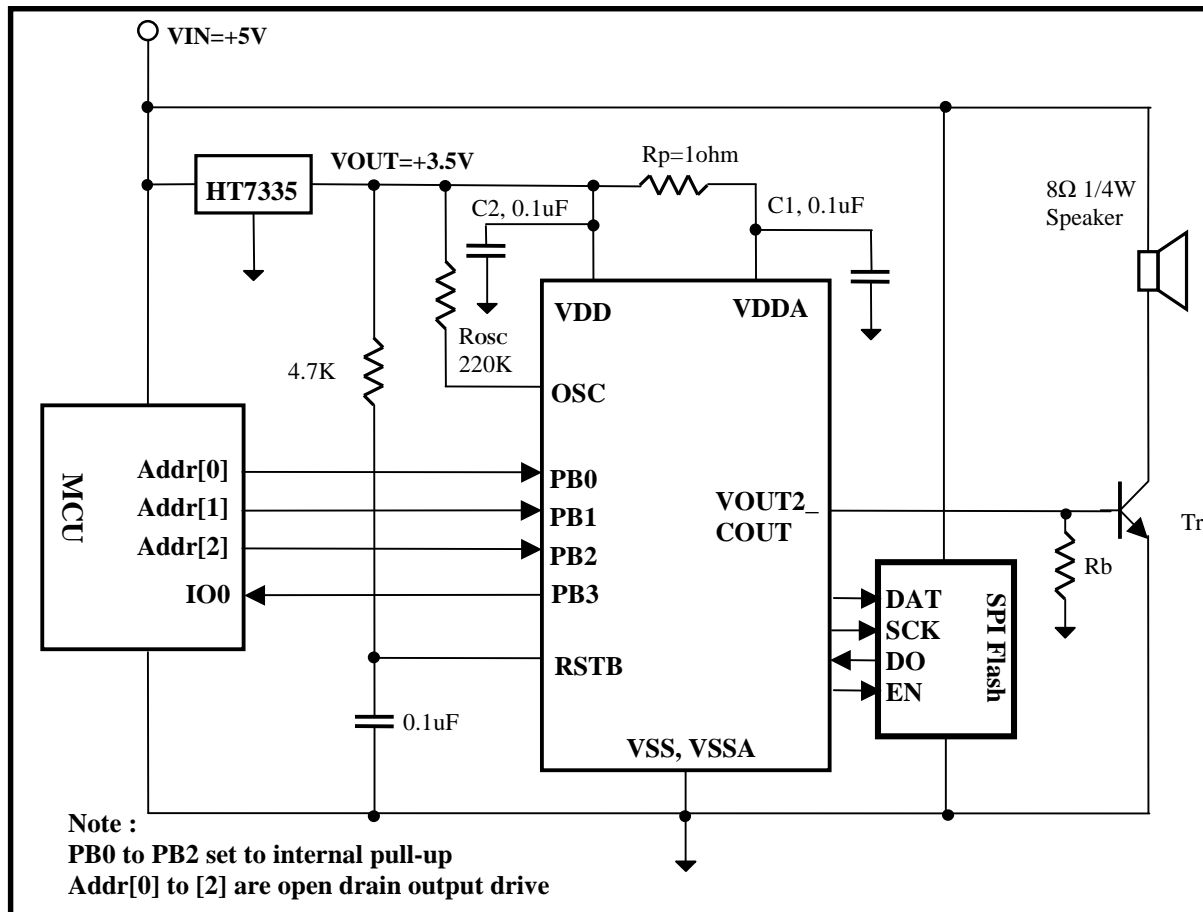
5V CPU Control with COUT

Note for COUT speaker drive:

1. C1 and C2 must be connected as close to the VDD/VDDA and VSS/VSSA pins as possible.
2. Rb is base resistor from 120 Ohm to 390 Ohm depends on value of VDD and transistor gain.
3. Tr is an NPN transistor with beta larger than 150, e.g. 8050D.
4. Rosc = 220K Ohm with Vdd=3.0V can support sampling rate up to 14KHz.

Bonding Diagrams
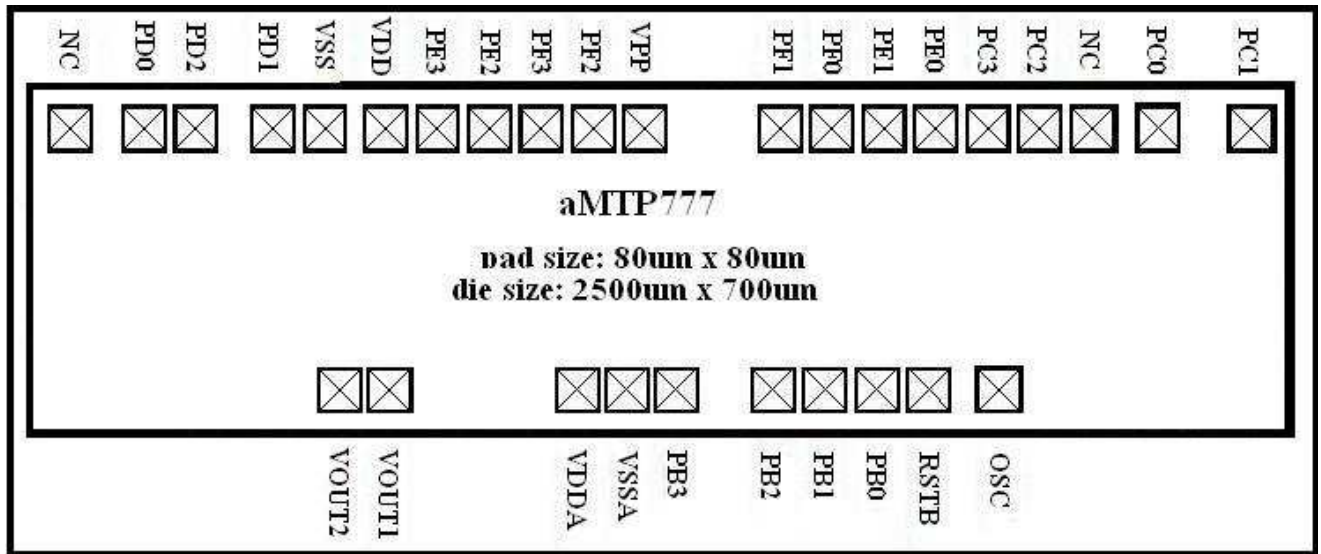
Note: Substrate must be connected to VSS