

IS31CS5526A

UART to I2C Bridge Using Low-Power 1-T 8051 MCU

Preliminary Information
March 2020

GENERAL DESCRIPTION

The IS31CS5526A is a UART to I2C converter based on MCU with customer specific code. The MCU is an ultra-low-power 1T-8051 with 16KB e-Flash and 1KB SRAM running at 16MHz. There is an additional 128KHz clock for low-power operations.

IS31CS5526A also includes a buzzer/melody tone generator that covers four octaves with programmable duration for each tone. There are six timers/counters and six programmable I/O ports. On-chip POR (Power-On Reset) and LVD (Low Voltage Detect) reset along with multiple watchdog timers allow robust operation against harsh environment.

IS31CS5526A is available in SOP-8 package. It operates from 2.5V to 5.5V over the temperature range of -40°C to 85°C.

FEATURES for UART-to-I2C Bridge

- UART to I2C Conversion
 - 1 byte CRC
 - 9600bps fixed
- Buzzer Tone Generation
 - Cover 4 octaves
 - Programmable tone duration for each tone
 - Circular tone buffer: 10 buffer sets
 - Tone buffer feature enables continuous melody
- UART Command
 - LED display
 - Key read
 - Auto key/status read interval set
 - Buzzer Tone Set
- Trimmed Internal Oscillator
- Operating Temperature: -40°C ~ 85°C
- SOP-8 Package and RoHS Compliant

APPLICATIONS

- Home Appliance
- Industrial Application
- Mobile Devices

TYPICAL APPLICATION CIRCUIT

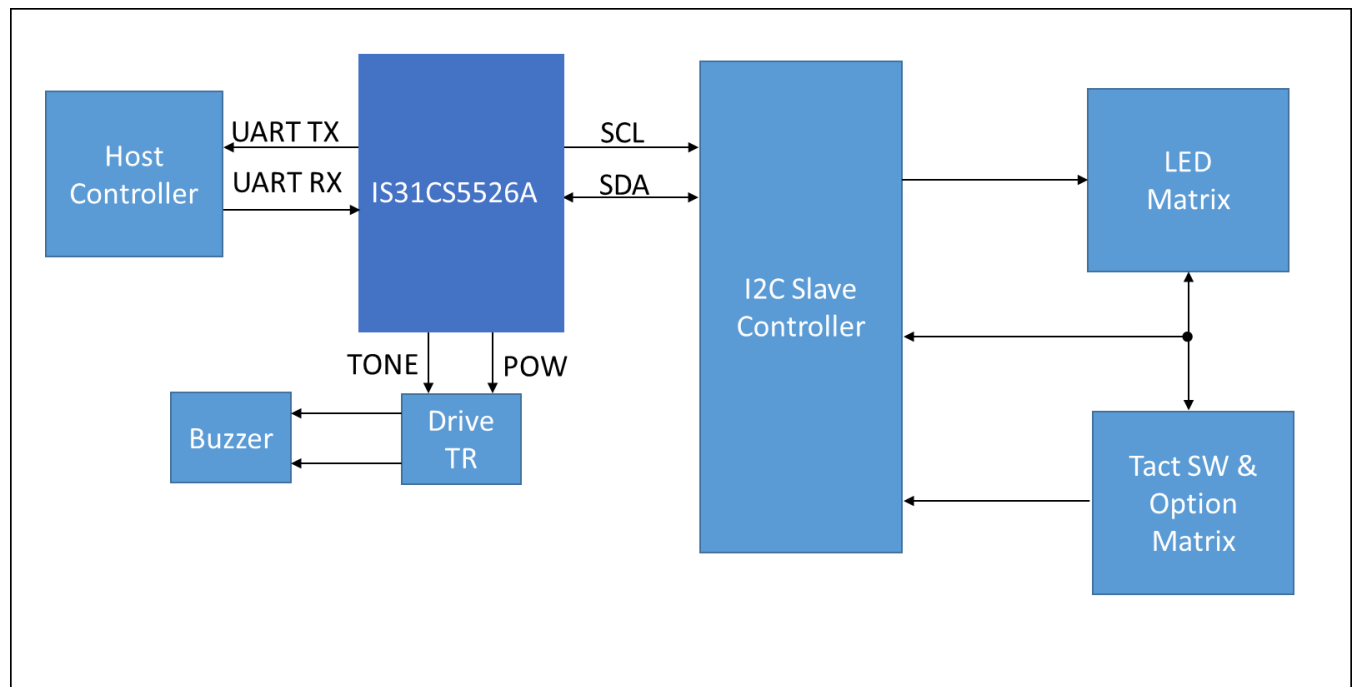
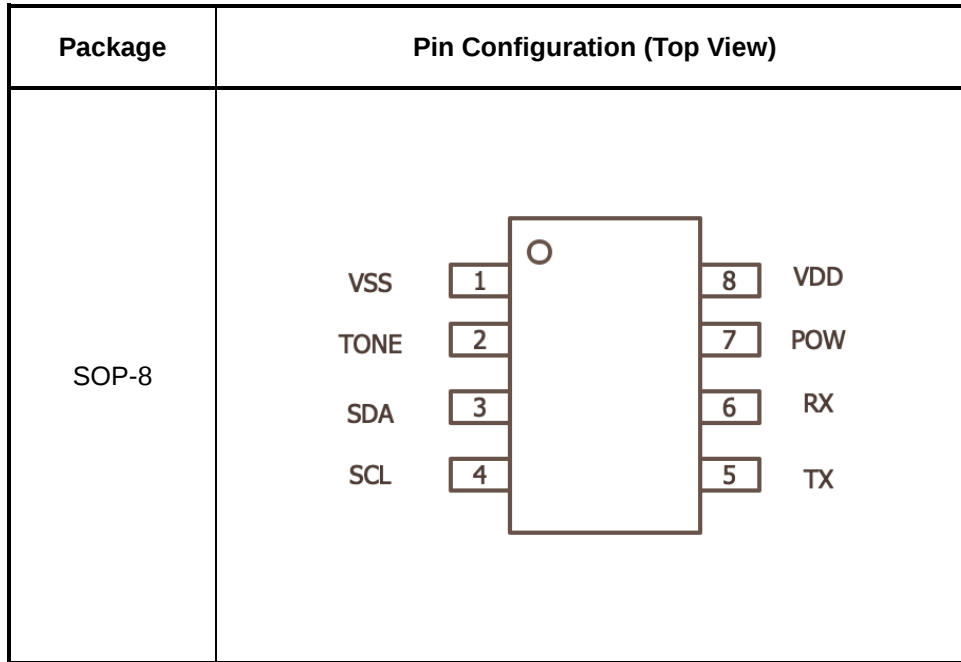


Figure 1 Typical Application Circuit

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PIN CONFIGURATION



PIN DESCRIPTION

No.	Pin	Description
1	VSS	Ground.
2	TONE	Buzzer tone control.
3	SDA	Configured as I2C master SDA I/O
4	SCL	Configured as I2C master SCL I/O.
5	TX	Configured as UART TX output
6	RX	Configured as UART RX input
7	POW	Buzzer power control
8	VDD	Power supply. Typical decoupling capacitors of 0.1μF and 10μF should be connected between VDD and GND.

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ORDERING INFORMATION
Industrial Range: -40°C to +85°C

Order Part No.	Package	QTY
IS31CS5526A-GRLS2-TR	SOP-8, Lead-free	2500/Reel

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ABSOLUTE MAXIMUM RATINGS

Supply voltage, V_{CC}	-2.2V ~ +5.5V
Voltage at any input pin	-0.3V ~ $V_{CC}+0.3V$
Maximum junction temperature, T_{JMAX}	+150°C
Storage temperature range, T_{STG}	-65°C ~ +150°C
Operating temperature range, $T_A=T_J$	-40°C ~ +85°C
Junction Package thermal resistance, junction to ambient (4 layer standard test PCB based on JESD 51-2A), $\theta_{JA}(SOP-8)$	127°C/W
ESD (HBM)	±2kV

Note 1: Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$, $V_{CC} = 2.2V \sim 5.5V$, unless otherwise noted.

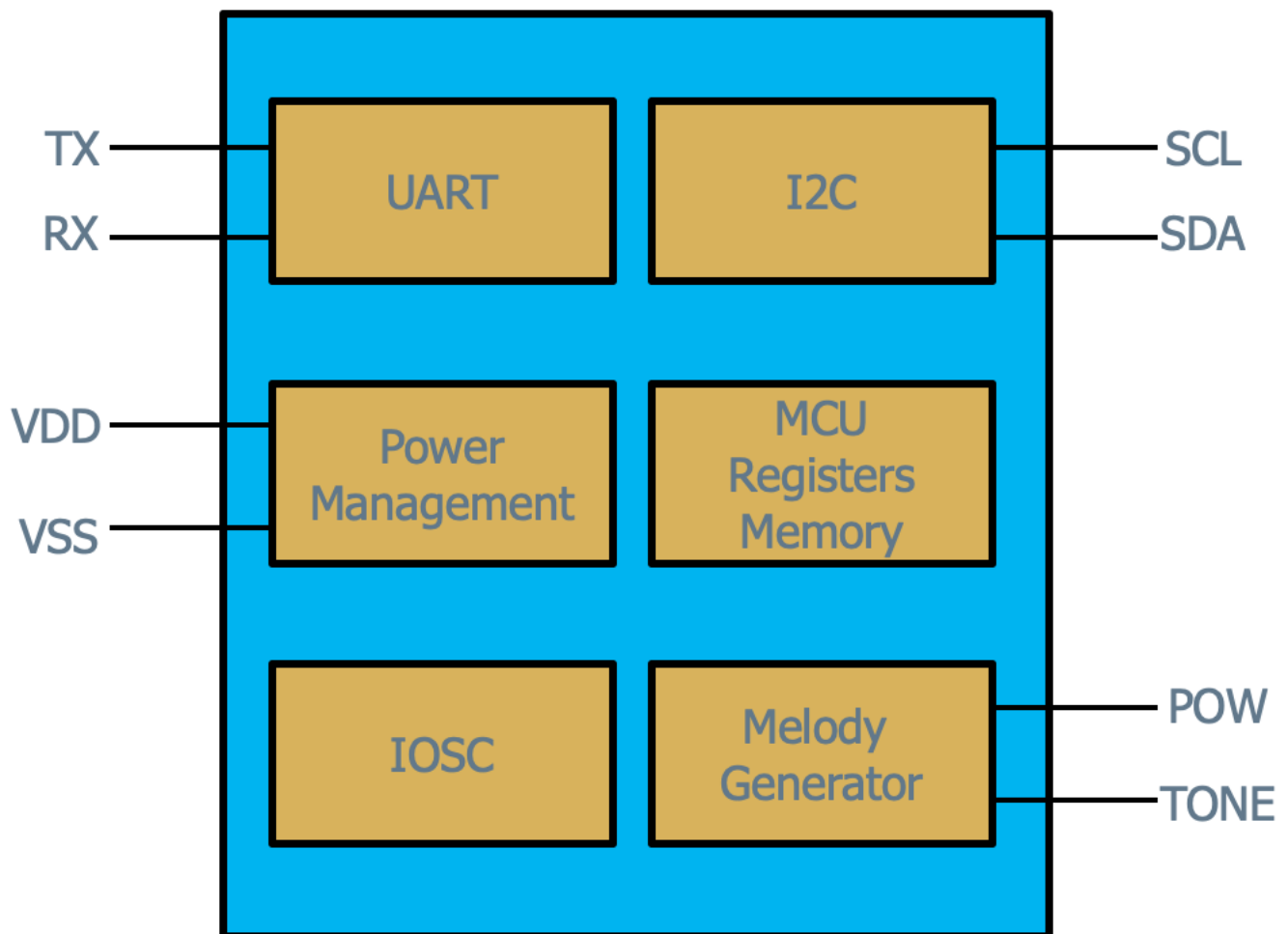
SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	NOTE
Power Supply Current						
IDD Normal	Total IDD through VDD at 16MHz	-	7	-	mA	
IDD versus Frequency	Total IDD Core Current versus Frequency	-	150	250	uA/MHz	
IDD, Stop	IDD, stop mode	-	150	-	μA	Main regulator on
IDD, Sleep	IDD, sleep mode, 25°C	-	1	3	μA	Main regulator off
	IDD, sleep mode, 85°C	-	2	6	μA	Main regulator off
	IDD, sleep mode, 125°C	-	10	25	μA	Main regulator off
GPIO DC Characteristics						
VOH,4.5V	Output High Voltage 1 mA	-	-0.2	-0.5	V	Reference to VDD
VOH,4.5V	Output High Voltage 2 mA	-	-0.3	-0.7	V	Reference to VDD
VOL,4.5V	Output Low Voltage 4 mA	-	0.2	0.4	V	Reference to VSS
VOL,4.5V	Output Low Voltage 8 mA	-	0.3	0.5	V	Reference to VSS
VOH,3.0V	Output High Voltage 1 mA	-	-0.3	-0.6	V	Reference to VDD
VOH,3.0V	Output High Voltage 2 mA	-	-0.4	-0.8	V	Reference to VDD
VOL,3.0V	Output Low Voltage 4 mA	-	0.2	0.4	V	Reference to VSS
VOL,3.0V	Output Low Voltage 8 mA	-	0.3	0.6	V	Reference to VSS
IIOT	Total IO Sink and Source Current	-80	-	80	mA	
VIH	Input High Voltage	$\frac{3}{4}V_D$	-	-	V	
VIL	Input Low Voltage	-	-	$\frac{1}{4}V_{DD}$	V	
VIHYS	Input Hysteresis	100	300	600	mV	
RPU	Equivalent Pull-Up resistance	-	25K	-	Ohm	
RPU,RSTN	RSTN Pull-Up resistance	-	5K	-	Ohm	
RPD	Equivalent Pull-Down Resistance	-	25K	-	Ohm	
REQAN1	Equivalent ANIO Switch Resistance, 3.3V	-	800	-	Ohm	ANIO1 Switch
	Equivalent ANIO Switch Resistance, 5V	-	500	-	Ohm	ANIO1 Switch
REQAN2	Equivalent ANIO Switch Resistance,	-	4K	-	Ohm	ANIO2 Switch

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SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	NOTE
	3.3V					
	Equivalent ANIO Switch Resistance, 5V	-	2.5K	-	Ohm	ANIO2 Switch
VDDC Characteristics						
VDDCN	Normal Core Voltage 1.5V (Calibrated)	1.4	1.5	1.6	V	Normal Mode
VDDCS	Sleep Core Voltage 1.5V	-	1.42	-	V	Sleep Mode
Low Supply (VDD) Voltage Detection						
VDET	Detection Range	2.0	-	4.8	V	
VDETHYS	Detection Hysteresis	-	100	-	mV	

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FUNCTIONAL BLOCK DIAGRAM



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COMMANDS

Display Command Set

Command	One byte of data								Remark
1xh	0	0	0	1	0	0	0	DON	Display Setting 0b: OFF(Default) 1b: ON
2xh	0	0	1	0	0	DISPMOD			Display Mode 000b: 4 x 14 seg (Default) 001b: 5 x 14 seg 010b: 6 x 14 seg 011b: 7 x 14 seg 100b: 8 x 14 seg 101b ~ 111b: Inhibit
3xh	0	0	1	1	0	DIMMOD			Dimming Mode: Pulse Width 000b: 1/16(Default) 001b: 2/16 010b: 3/16 011b: 5/16 100b: 7/16 101b: 12/16 110b: 14/16 111b: 31/32
5xh	0	1	0	1	0	ADDRSET			Display RAM Writing Address ADDRSET: 000b ~ 111b After 5xh, 2 bytes of display data follows

Buzzer Tone Command Set

Command	One byte of data								Remark
Bxh	1	0	1	1	0	0	0	BS	Buzzer Start or Stop 0b: Buzzer stop and clear 1b: Buzzer start (only support BS = 0b)
Cxh ~ Fxh	1	1	OCTAVE		TONE				Octave 00b: A4 ~ G#5 01b: A5 ~ G#6 10b: A6 ~ G#7 11b: A7 ~ G#8 Tone(Musical Scale) 0000b: A, 0001b: A# 0010b: B 0011b: C, 0100b: C# 0101b: D, 0110b: D# 0111b: E

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					1000b: F, 1001b: F# 1010b: G, 1011b: G# 1100b ~ 1111b: Inhibit After this command, 3 byte of Time Data follows
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Key/Status Read Command Set

Command	One byte of data								Remark
42h	0	1	0	0	0	0	1	0	Key/Status Read
48h ~ 4Fh	0	1	0	0	1	INTV			Auto Key/Status Read Interval INTV(Interval) 0: No Auto Read 1: 20m sec 2: 30m sec 3: 40m sec 4: 50m sec 5: 60m sec 6: 70m sec 7: 80m sec

COMMAND Format

Rx frame format (command set from Host controller to I2C Slave Controller)

Header	Command Set	data	CRC
B3h		0 ~ 4 bytes	

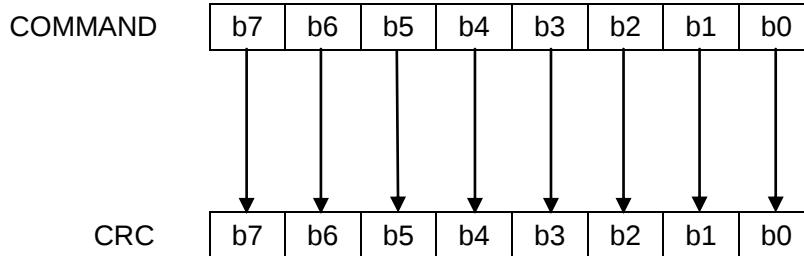
Tx frame format (key/status read)

Header	Buzzer Status	Key data	CRC
9Ch	STS	4 bytes	

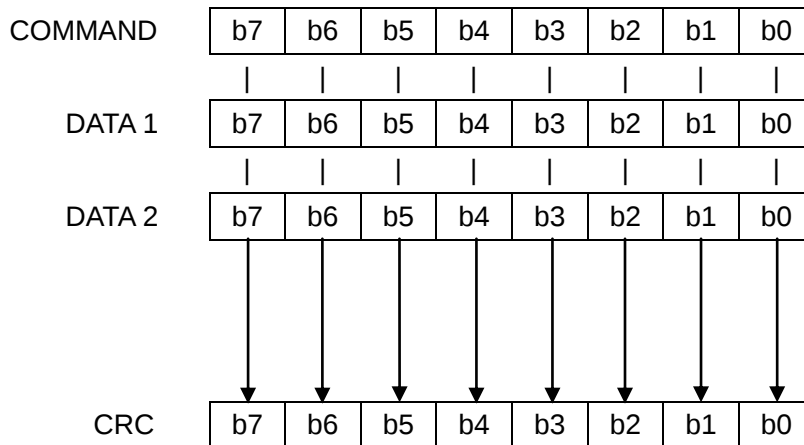
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CRC calculation

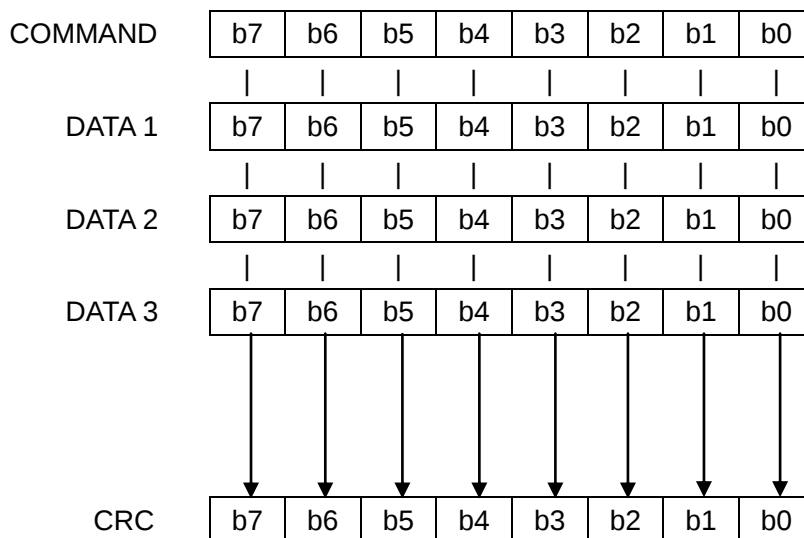
1. I2C Slave Controller compatible parity byte excluding the header
 2. The same even parity scheme is applied for Rx and Tx frame
- (i) Buzzer Stop/Start command (Bxh) and Key/Status read command (4xh) and Display command (1xh ~ 3xh)



- (ii) Display memory setting (5xh)

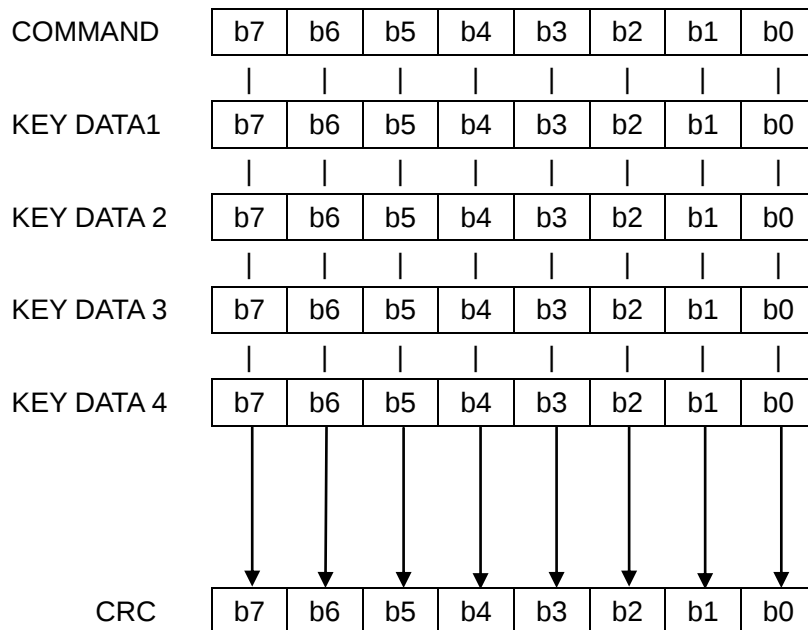


- (iii) Buzzer tone command (Cxh ~ Fxh)



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(iv) Key / Status Read (Tx frame)



The bit of CRC is 1 if the number of “1” is odd; otherwise it is 0

Key / Status Tx Frame

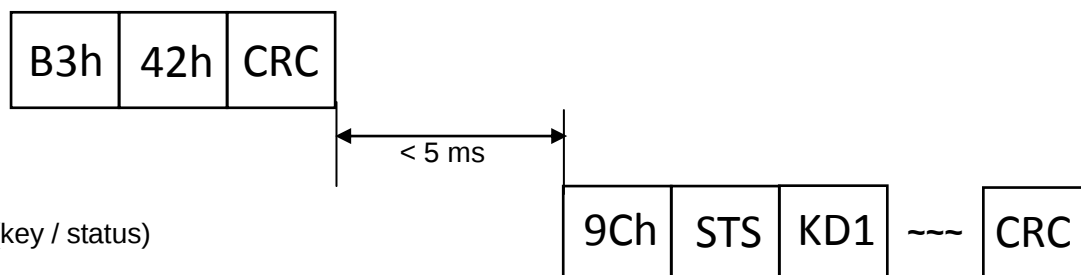
Header (9Ch)	STS	KD1	KD2	KD3	KD4	CRC
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STS (Buzzer Status) : Remaining Buzzer Buffer Size (buffer size: 0 ~ 10).

KD (Key Data) KD1 / KD2 / KD3 / KD4: The Key Data bytes from I2C Slave Controller (Transparent from I2C Slave)

Key / Status Read

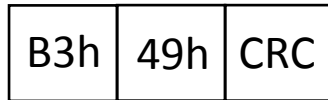
Rx (command)



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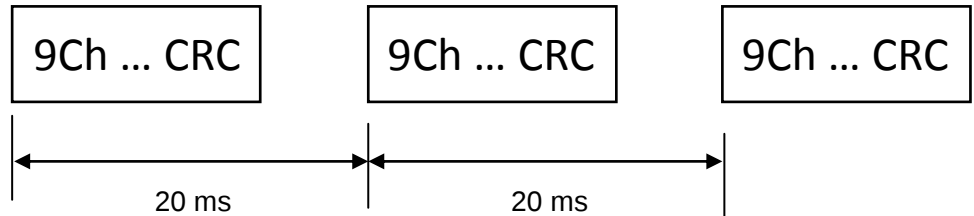
Auto Key / Status Read

Rx (command)



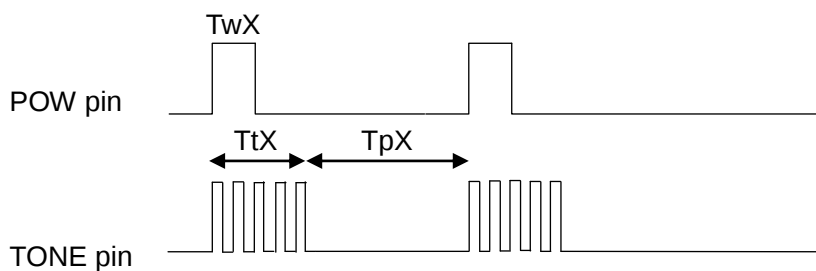
49h: 20 ms auto interval set

Tx (Key / Status)



Buzzer Tone Setting

1st byte	2nd byte	3rd byte	forth byte	fifth byte	sixth byte
B3h	Cmd + Oct + Tone	TwX	TtX	TpX	CRC



(i) Cmd + Oct + Tone: Octave and tone definition

b0 ~ b3: Tone
b4 ~ b5: Octave

(ii) TwX: Time span and POW time definition

b0 ~ b6: POW time (0 ~ 127)
b7: Time span (0 : 2ms, 1: 4ms)

(iii) TtX: Tone generation time definition

b0 ~ b7: Tone time (0 ~ 255)
Use the same Time span defined by TwX.

(iv) TpX: Tone pause time definition

b0 ~ b7: Pause time (0 ~ 254)

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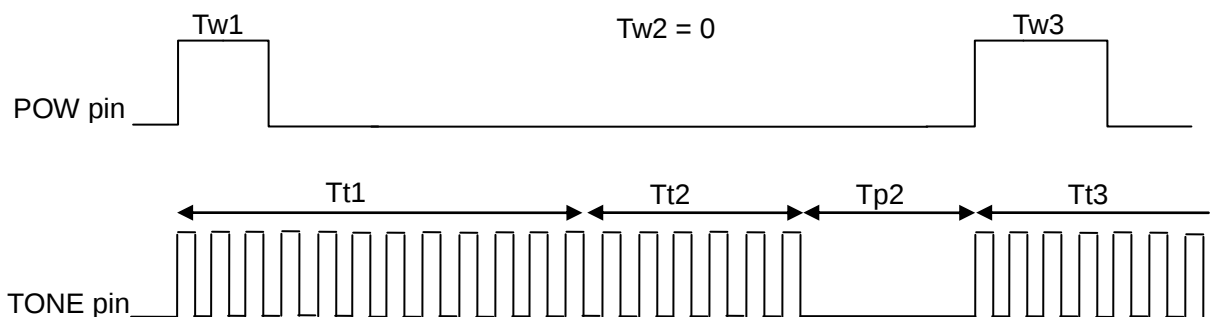
Use the same Time span defined by TwX.

The real time duration for TwX / TtX / TpX = Time span * TwX / TtX / TpX

Buzzer Operating Mode

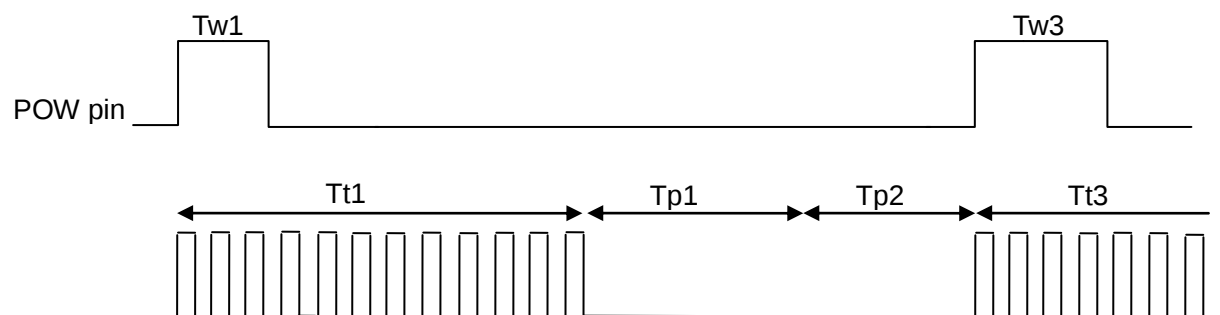
(i) Buzzer Time Extension – TONE

1st Command						2nd Command					
B3h	Oct + Tone	Tw1	Tt1	00h	CRC	B3h	Same Cmd	00h	Tt2	Tp2	CRC



(ii) Buzzer Time Extension – Pause

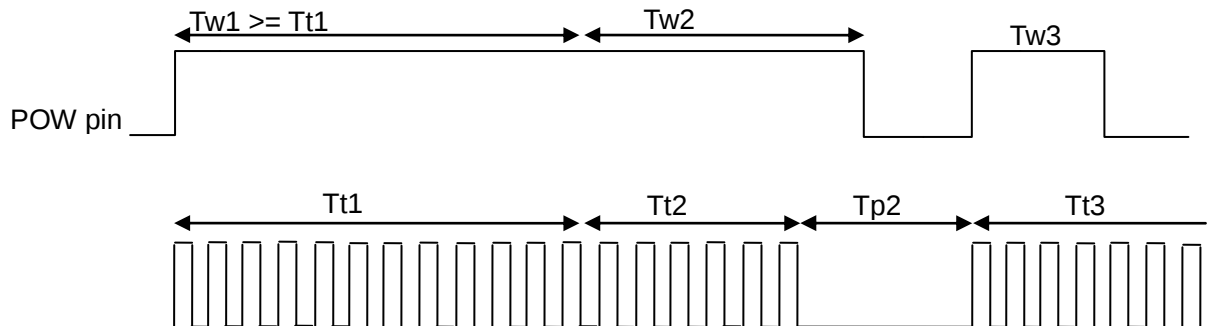
1st Command						2nd Command					
B3h	Oct + Tone	Tw1	Tt1	Tp1	CRC	B3h	Same Cmd	00h	00h	Tp2	CRC



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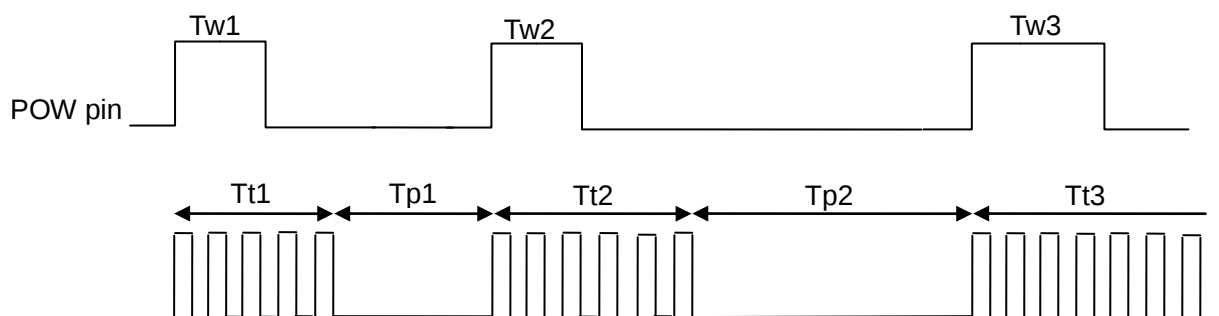
(iii) Buzzer Time Extension – POW

1st Command						2nd Command					
B3h	Oct + Tone	Tw1	Tt1	00h	CRC	B3h	Same Cmd	Tw2	Tt2	Tp2	CRC



(iv) Tone Append Feature

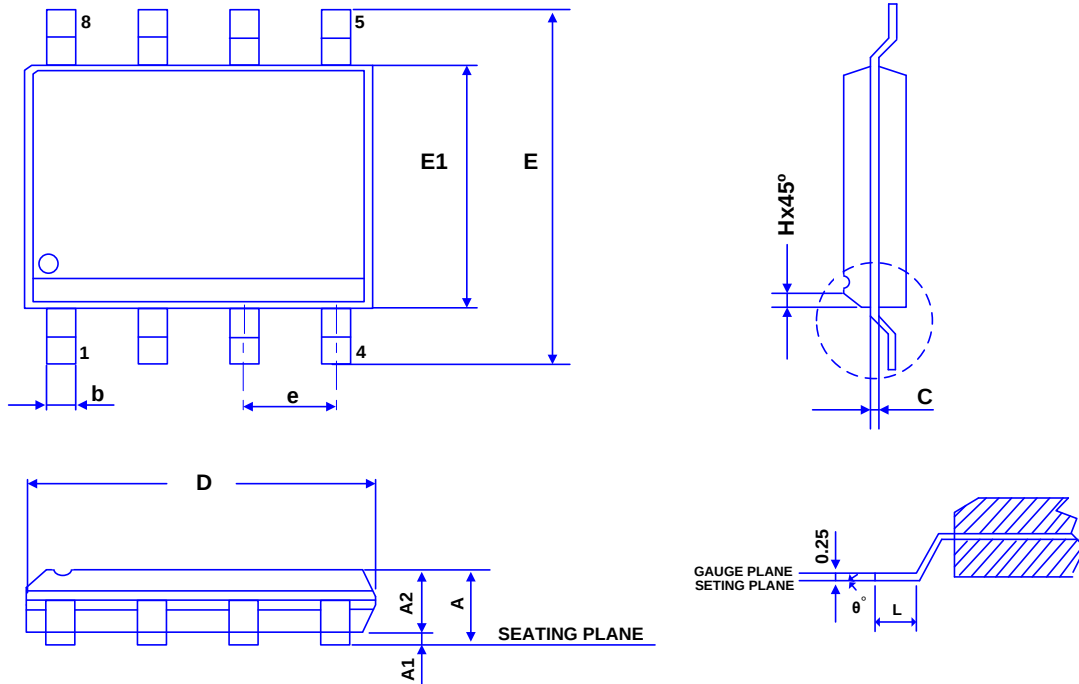
B3h	Oct + Tone	Tw1	Tt1	Tp1	CRC	~	B3h	Oct + Tone	Tw2	Tt2	Tp2	CRC
						~						



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PACKAGE INFORMATION

SOP-8



SYMBOLS	DIMENSIONS IN MILLIMETERS	
	MIN.	MAX.
A	-	1.75
A1	0.1	0.25
A2	1.25	-
b	0.31	0.51
c	0.10	0.25
D	4.90 BSC	
E	6.00 BSC	
E1	3.90 BSC	
e	1.27 BSC	
L	0.40	1.27
h	0.25	0.50
θ°	0	8

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REVISION HISTORY

Revision	Detail Information	Date
A	Formal product release version datasheet.	2022.3.30
0A	Initial release.	2019.12.14
0B	Modified the package from TSSOP-8 to SOP-8 Added ordering information	2019.12.16
0C	Added “Absolute Maximum Ratings” table, “Electrical Characteristics” table, and package information	2019.12.24
0D	Fixed typos	2019.12.25
0E	Added commands and command format	2020.02.05
0F	Modified the ordering information	2020.03.11