KS58015 APPLICATION NOTE

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ANALOG

LSI DIVISION

CAUTIONS FOR DESIGNING OSCILLATION CIRCUITS

It is becoming more common to configure the oscillation circuit with a digital IC, and the simplest way is to use an inverter gate.
Fig. shows the configuration of a basic oscillation circuit with a C-MOS inverter.

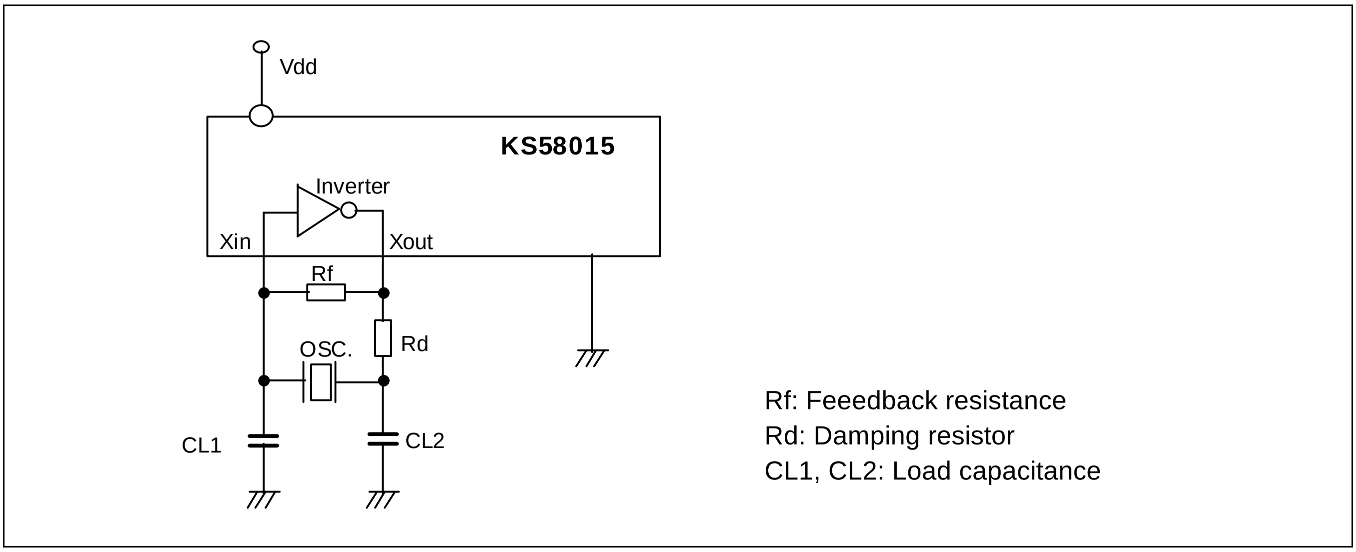
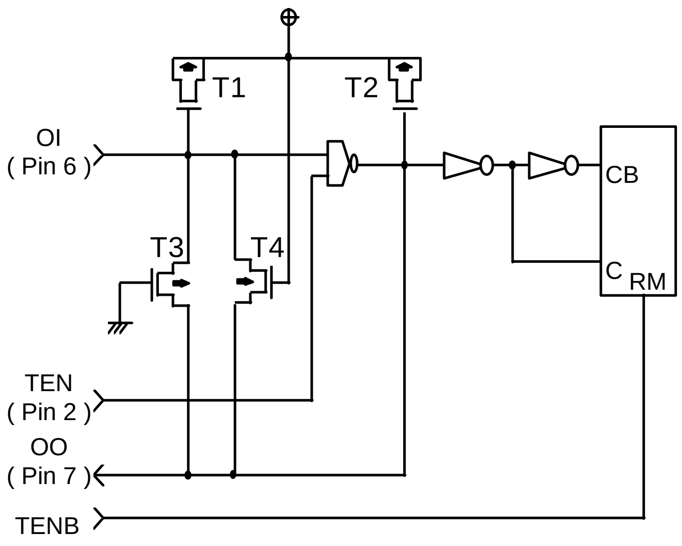


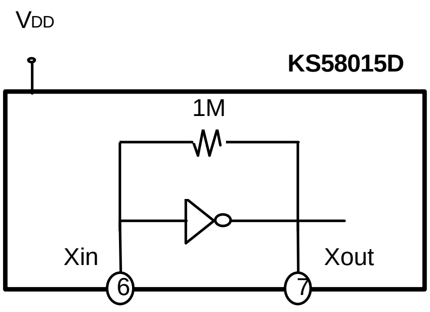
Figure 1. Fig. Oscillation circuit

Inverter works as an inverter amplifier of the oscillation circuit. The feedback resistance, Rf provides negative feedback around the inverter in order to put it in the linear region, so the oscillation will start, when power is applied.
If the value of Rf is too large, and if accidentally decreased, oscillation will stop due to the loss of loop gain. Also, if Rf is too great, noise from other circuits can be introduced into the oscillation circuit. Obviously, if Rf is too small, loop gain will be low. An Rf of 1MΩ is generally used with a ceramic resonator.
Damping resistor, Rd provides loose coupling between the inverter and the feedback circuit and decreases the loading on the inverter, thus saving energy. In addition, the damping resistor stablizes the phase of the feedback circuit and provides a means of reducing the gain in the high frequency area, thus preventing the possibility of spurious oscillation. Load capacitance CL1 and CL2 provide the phase lag of 180°. If CL1 and CL2 values are too low, the loop gain in the high frequency is increased, which in turn increases the probability of spurious oscillation.

2. INTERNAL OSCILLATION CIRCUIT AND PROPER RC PARAMETER IN KS58015



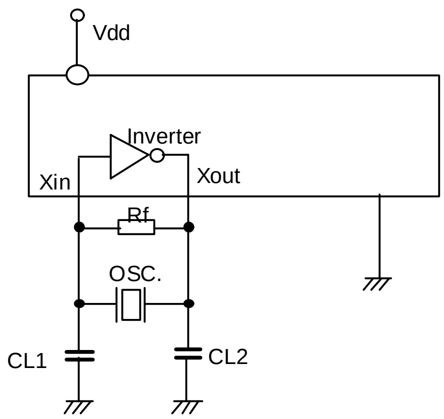
< KS58015D Oscillation Internal block >



< KS58015D Block diagram >

Figure 2.

Above internal circuit displays 1MΩ which consists of T3 and T4 with ro resistance and T1 and T2 is diode protecting surge volatage and static electricity.
So, according to feedback resistor(T3,T4) and oscillation input impedance tolerance, characteristics may be slightly changed.
Therefore, in order to protect the this problem, we recommend the below application circuit around oscillation block



No	Value	Function
Oscillation component	Rs < 150Ω L = 100mH Co = 5pF C1 = 0.02pF	The best impedance matching value
Rf	1MΩ	stablizes the internal feedback resistor
CL1	30pF	Stablizes the oscillation level.
CL2	30pF	

< Recommended external componets >

3. CRYSTAL - KS58015 INPUT IMPEDANCE COMPARISION TABLE

< Crystal/Resonator impedance comparision >

No	Crystal/Resonator	Test conditon	Impedance	O/X
1	CSA3.58MGUGAB (Resonator)	3MHz, 1.0V	800Ω	O
2	SUNNY (Crytal)	3MHz, 1.0V	15.32Ω	X
3	UNI (Crystal)	3MHz, 1.0V	15.32Ω	X

< KS58015 input impedance table >

No	Lot number	Test conditon	Impedance
1	601	3MHz, 1.0V	2.05Ω
2	605	3MHz, 1.0V	2.05Ω
3	135	3MHz, 1.0V	1.94Ω

Test equipment : HP4275A - Multi frequency LCR meter.

4. APPLICATION INFORMATION

A. General standard of DTMF sending level

General spec.	DC Current	DTMF sending level	
	20 ~ 120mA	– 8dBm (High freq.)	– 6dBm (Low freq.)

B. System block diagram

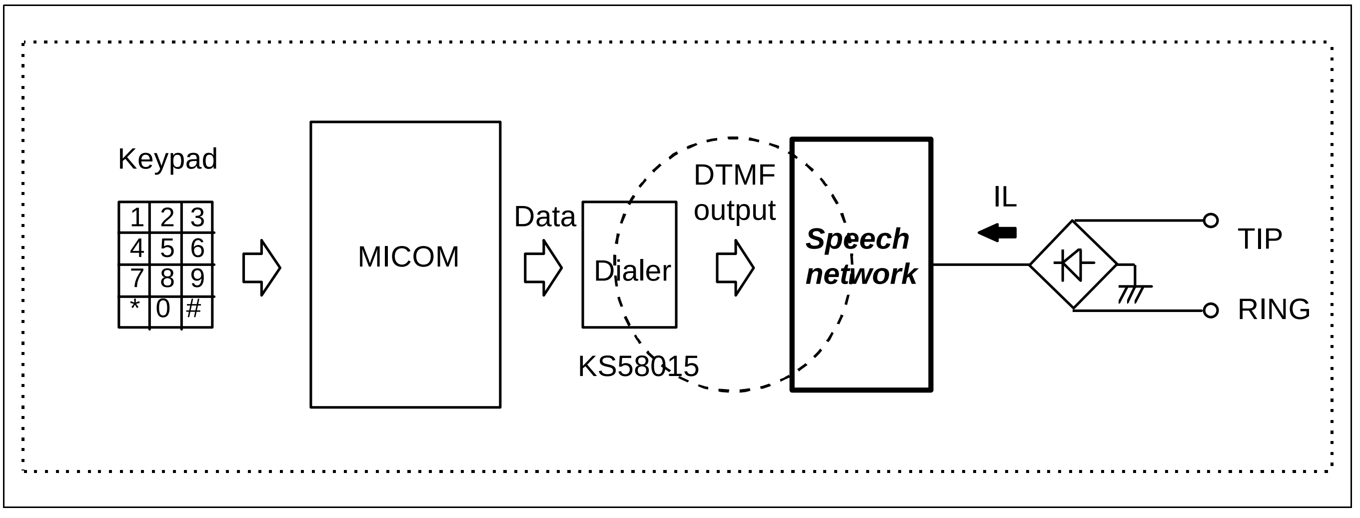


Figure 3.

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C. Application circuit with Speech network

- Application circuit using DTMF interfaced with general speech network IC

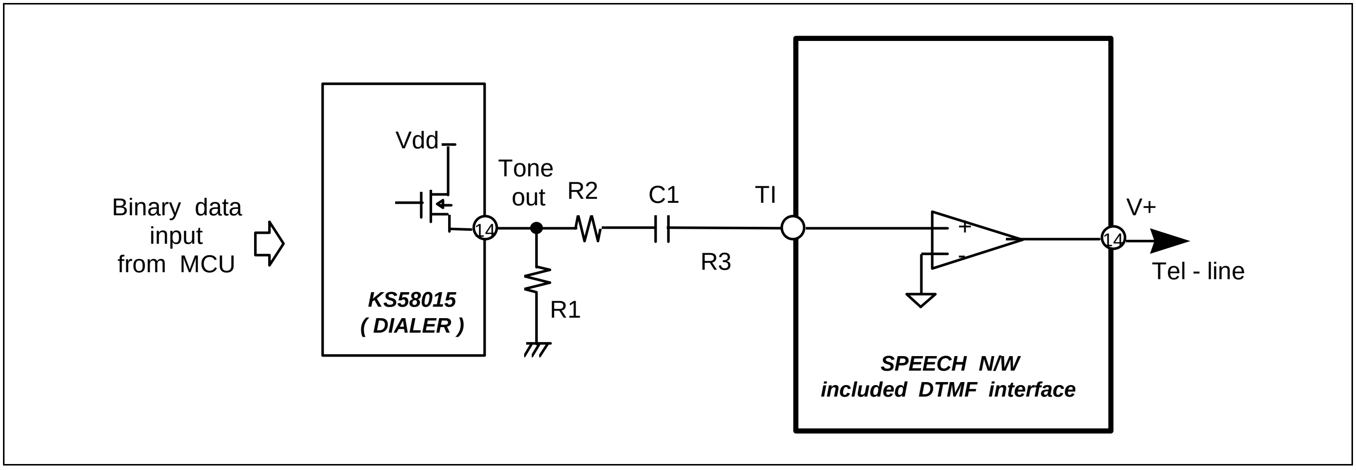

Figure 4.

R1: Tone output Pull down resistor.
As KS58015 Tone output pin consistors of N-channel open source circuits, you must apply pull down resistor.

R2: DTMF level control resistor

C1: DC coupling resistor.
C1 acts as low pass filter associated with internal resister of speech network.

- Recommended application circuit using SEC KA2425A (MC34014)

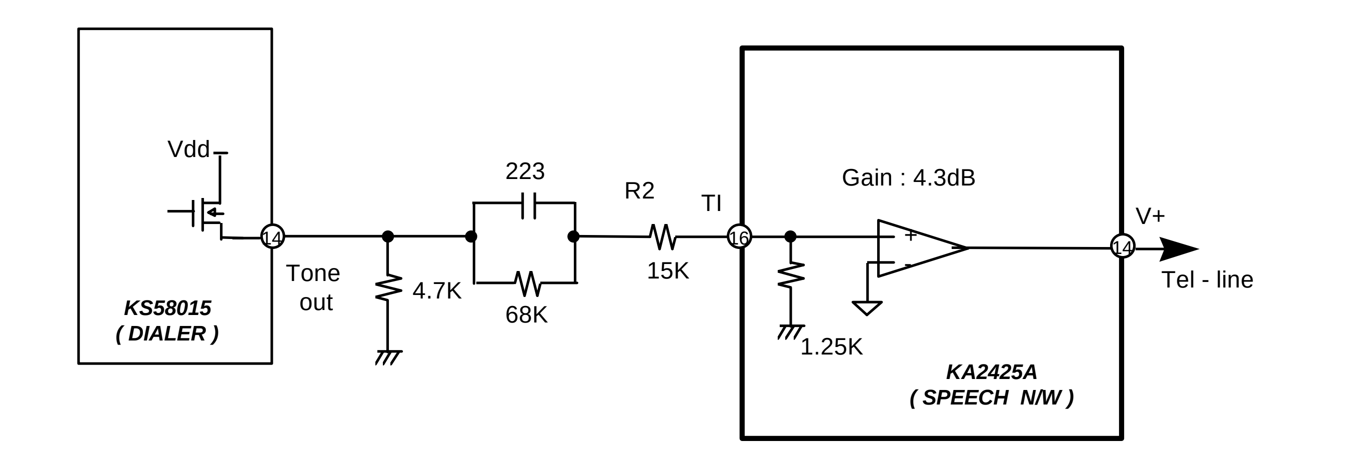

Figure 5.

CHARACTERISTIC INFORMATION

A. Data diagram

Items	Symbol	Test condition	Min.	Typ.	Max.	Real value	Unit
Osc. start up time	tsu(O)	90% amplitude Vdd=3.0V	–	4	–	≤ 1.3	ms
Data set up time	tsu(D)	Vdd=3.0V	200	–	–	≤ 20	ns
Data hold time	tH(D)	Vdd=3.0V	200	–	–	≤ 20	ns
Data duration	tW(D)	Vdd=3.0V	600	–	–	≤ 20	ns

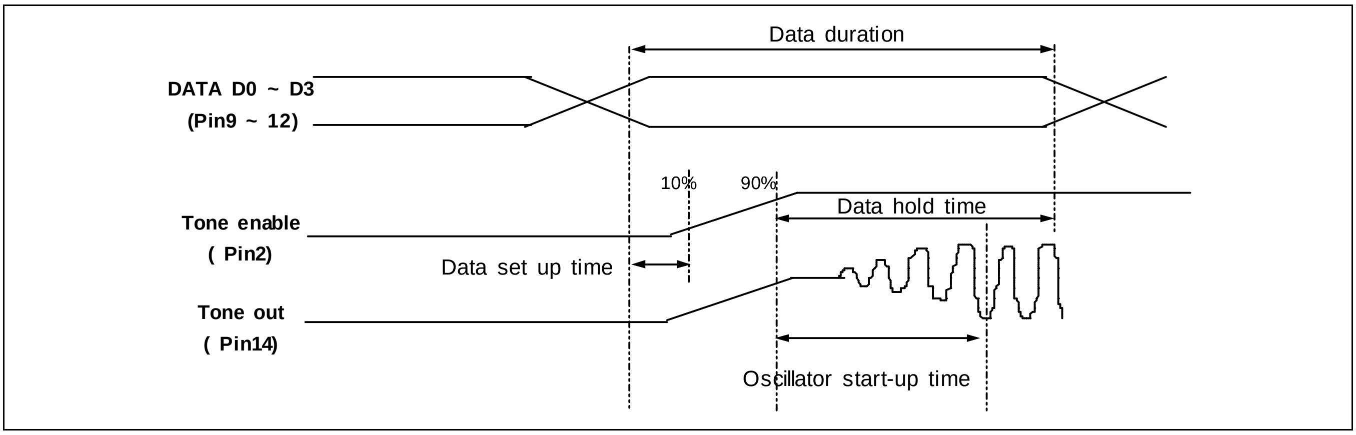

Figure 6.

Test condition: Vdd = 3.0V, Vss = 0V,
3.579545 MHz crystal used

B. Load resistor - Sink current characteristic

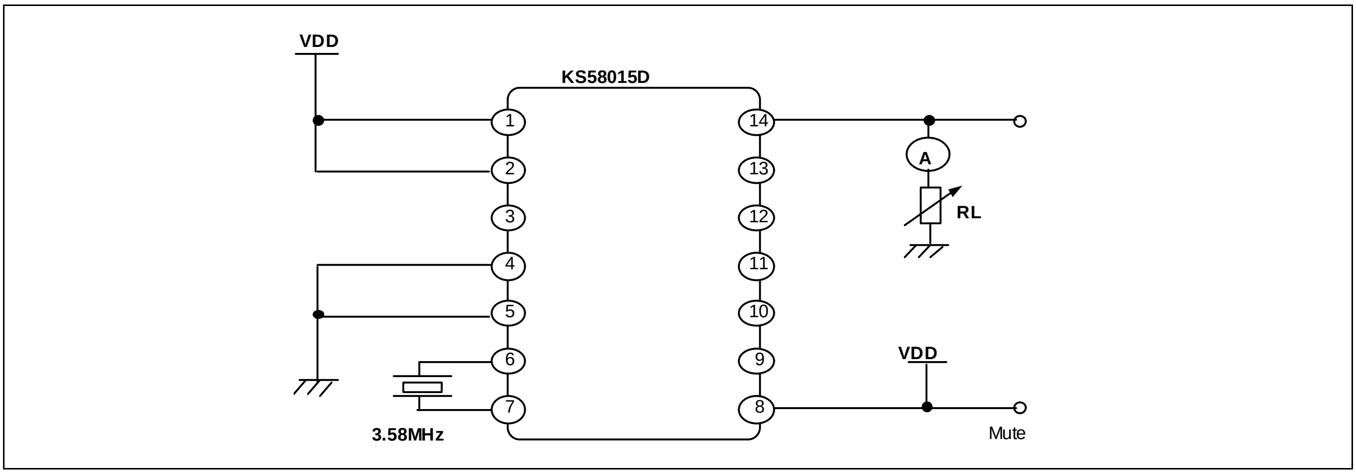

Figure 7.

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< Comparison table on RL - Output sink current

RL	Output sink current (uA)	Output voltage level (mVrms)
1K	3400	267
2K	1590	270
3K	1030	271
5K	667	271
8K	414	271
10K	330	271
15K	226	271
20K	166	271
25K	135	271
30K	111	271
40K	85	271
50K	67	271
60K	56	271
70K	47	270
80K	42	270
90K	37	270
100K	34	270