SCRAMBLER IC WITH COMPANDOR

FEATURES

- **Compandor**
- **Speech Scrambler/Descrambler**
- **Low Voltage Operation (1.8 V)**
- **IDC for Modulation Control**
- **Mute Function**

APPLICATIONS

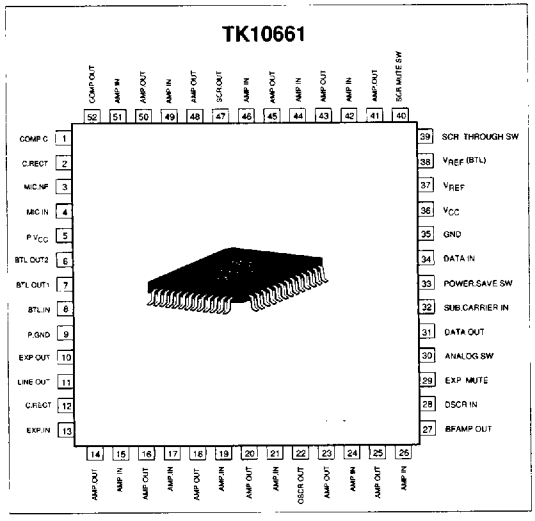
- **Cordless Telephone**
- **Secure Communications Devices**

DESCRIPTION

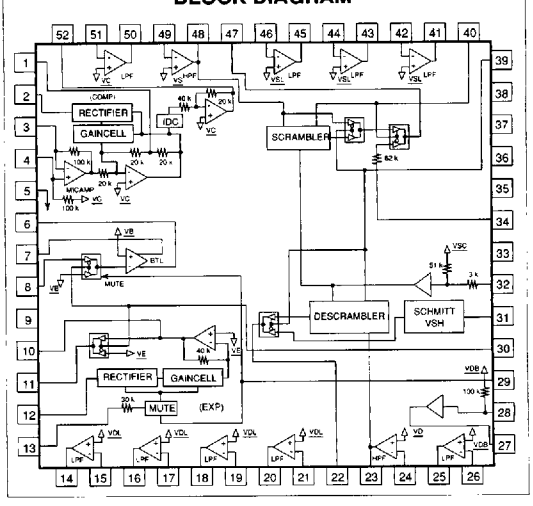
The TK10661 is a complete noise reduction and voice scrambler/descrambler system. The device is designed for use in cordless telephones and can operate down to 1.8 V. Current consumption is typically 10.3 mA at V_{CC} = 2.0 V. Scrambling is accomplished by inverting the audio spectrum using an externally-generated carrier frequency. The IC has internal analog switches to disable or enable companding and scrambling functions under CMOS or TTL control. The device includes an Instantaneous Deviation Control (IDC) circuit for modulation control. A mute function is also provided. A power save control pin puts the chip in a low power standby mode, consuming only 60 µA.

The TK10661 is available in a QPACK-52 surface mounted package.

TK10661



BLOCK DIAGRAM



ORDERING INFORMATION

TK10661 □ □ □□

- Tape/Reel Code
- Temp. Range
- Package Code

PACKAGE CODE	TEMP. RANGE	TAPE/REEL CODE
Q: Surface Mount	C : -10 to +70 °C	BX: Bulk/Bag TX: Paper Tape TR: Tape Right TL: Tape Left MG: Magazine

ABSOLUTE MAXIMUM RATINGS

Input Voltage V_{CCMAX} ..... 8 V
Power Dissipation (Note 1) ..... 650 mW
Operating Voltage Range ..... 1.8 to 5.5 V
Maximum Input Frequency ..... 80 kHz
Junction Temperature ..... 150 °C
Storage Temperature Range ..... -55 to +150 °C
Operating Temperature Range ..... -10 to +70 °C
Lead Soldering Temp. (10 sec.) ..... 300 °C

ELECTRICAL CHARACTERISTICS

Test conditions: V_{CC} = 2.0 V (36 Pin), V_{CCP} = 2.4 V (5 Pin), T_A = 25 °C, f = 1.0 kHz, Sub = 3.5 kHz, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
I_{CC}	Supply Current 1	36 Pin, 33 Pin = GND		10.3	16.0	mA
I_{CCP}	Supply Current 2	5 Pin, 33 Pin = GND		0.6	3.0	mA
I_{CCS}	Standby Supply Current 1	36 Pin, 33 Pin = Open		1.9	3.0	mA
I_{CCPS}	Standby Supply Current 2	5 Pin, 33 Pin = Open		60	150	µA
Compressor		4 Pin = 52 Pin				
V_{ORC}	Output Reference Voltage	V_{IN} = 50 mV, V_{IN} = 0dB	110	135	165	mV
ΔG_{C1}	Gain Error 1	V_{IN} = -20 dB	-1.0	0	+1.0	dB
ΔG_{C2}	Gain Error 2	V_{IN} = -40 dB	-1.5	0	+1.5	dB
THD_C	Total Harmonic Distortion	V_{IN} = 50 mV		0.2	1.0	%
V_{NOC}	Output Noise Voltage	Rg = 600 Ω (Note 2)		0.8	3.0	mV
V_L	Limiting Voltage	V_{IN} = 316 mV	0.45	0.55	0.65	Vp-p
BPF 1, 2		51 Pin - 48 Pin, 26 - 23 Pin				
V_{IN}	Maximum Input Voltage	THD = 3%	550	630		mV
V_{GBP}	Voltage Gain	V_{IN} = 100 mV	-2.5	0	+2.5	dB
THD_{BP}	Total Harmonic Distortion	V_{IN} = 100 mV		0.04	1.0	%
Scrambler		48 Pin - 47 Pin, 26 - 23 Pin				
V_{IMS}	Maximum Input Voltage	THD = 5 %, f = 2.5 kHz (Note 3)	250	350		mV
V_{GS}	Voltage Gain	V_{IN} = 100 mV, f = 2.5 kHz (Note 3)	-2.5	+0.5	-3.5	dB
ΔG_{ST}	Through On/Off Difference	V_{IN} = 100 mV, f = 2.5 kHz (Note 3)	-3.0	0	+3.0	dB

Note 1: Power dissipation must be derated at the rate of 4.7 mW/°C for operation at T_A = 25 °C and above.
Note 2: Measured by using the noise evaluation filter based on P. 53 of CCITT.
Note 3: Extended 3 kHz LPF is used.

ELECTRICAL CHARACTERISTICS (CONT.)

Test conditions: V_{CC} = 2.0 V (36 Pin), V_{CCP} = 2.4 V (5 Pin), T_A = 25 °C, f = 1.0 kHz, Sub = 3.5 kHz, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
V_{GSD}	Data Voltage Gain	V_{IN} = 100 mV, 40 Pin = GND	-3.0	0	+3.0	dB
Leaks	Carrier Leak	After Offset Adjustment (47 k - 49 k)		0.3	1.3	mV
LPF (6th Order)		46 Pin - 41 Pin				
V_{IMLP6}	Maximum Input Voltage	THD = 3%	330	400		mV
V_{GLP6}	Voltage Gain	V_{IN} = 100 mV	1.1	3.8	6.5	dB
THD_{LP6}	Total Harmonic Distortion	V_{IN} = 100 mV		0.2	1.0	%
Buffer Amplifier		28 Pin - 27 Pin				
V_{IMBF}	Maximum Input Voltage	THD = 3%	250	300		mV
V_{GBF}	Voltage Gain	V_{IN} = 100 mV	-2.5	0	+2.5	dB
THD_{BF}	Total Harmonic Distortion			0.02	1.0	%
Descrambler						
V_{INDS}	Maximum Input Voltage	THD = 5%, f = 2.5 k (Note 3)	300	420		mV
V_{GDS}	Voltage Gain	V_{IN} = -100 mV, f = 2.5 kHz, (Note 3)	-4.8	-1.8	+2.2	dB
ΔG_{VDS}	Through On/Off Difference	V_{IN} = -100 mV, f = 2.5 kHz, (Note 3)	-3.0	0	+3.0	dB
Leak	Carrier Leak	After Offset Adjustment, (47 k - 49 k)		0.2	1.3	mV
Schmitt		28 Pin - 31 Pin				
V_{INST}	Input Sensitivity	Duty = 50 ± 5%	40	100		mV
V_{OSH}	Output Level (High)	V_{IN} = 100 mV	1.6	2.0		V
V_{OSL}	Output Level (Low)	V_{IN} = 100 mV		50	300	mV

Note 2: Measured by using the noise evaluation filter based on P. 53 of CCITT.
Note 3: Extended 3 kHz LPF is used.

ELECTRICAL CHARACTERISTICS (CONT.)

V_{CC} = 2.0 V (36 Pin), V_{CCP} = 2.4 V (5 Pin), T_A = 25 °C, f = 1.0 kHz, Sub = 3.5 kHz, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
LPF (8th Order)		21 Pin - 14 Pin				
V_{IMLP8}	Maximum Input Voltage	THD = 3%	600	700		mV
V_{GLP8}	Voltage Gain	V_{IN} = 316 mV	-14	-11	-8	dB
THD	Total Harmonic Distortion			0.4	1.0	%
Expander		13 Pin - 10 Pin, 11 Pin				
V_{ORE}	Output Reference Voltage	V_{IN} = 50 mV, V_{IN} = 0 dB	100	165	260	mV
ΔG_{E1}	Gain Error 1	V_{IN} = -10 dB	-1.0	0	+1.0	dB
ΔG_{E2}	Gain Error 2	V_{IN} = -20 dB	-1.5	0	+1.5	dB
THD_E	Total Harmonic Distortion	V_{IN} = 50 mV		0.3	1.0	%
V_{NOE}	Output Noise Voltage	Rg = 600 Ω (Note 3)		5	50	µV
A_{TT}	Mute Attenuation	V_{IN} = 50 mV (Note 3)	75	87		dB
ΔG_{EL}	Expander Line Gain Error	V_{IN} = 50 mV	-2	0	+2	dB
BTL Amplifier						
V_{OMB}	Maximum Output Voltage	THD = 10%, R1 = 2k	1.2	1.6		V
V_{NOB}	Output Noise Voltage	Rg = 600 Ω		4.0	100	µV
THD	Total Harmonic Distortion	V_{IN} = -100 mV		0.6	2.0	%
A_{TT}	Mute Attenuation	V_{IN} = -100 mV	65	80		dB
SW Threshold Voltage						
V_{P29}	Exp. BTL/Mute	20 Pin		1.35		V
V_{P29HI}	Exp. BTL Out		V_{P29}		V_{CC}	V
V_{P29LO}	Mute		0		0.6	V
V_{P30}	Line/BTL Out	30 Pin		1.35		V
V_{P30HI}	Line Out		V_{P30}		V_{CC}	V
V_{P30LO}	BTL Out		0		0.6	V
V_{P33}	Power Save	33 Pin		1.35		V
V_{P33HI}	Save		V_{P33}		V_{CC}	V
V_{P33LO}	Power		0		0.6	V

Note 2: Measured by using the noise evaluation filter based on P. 53 of CCITT.
Note 3: External 3 kHz LPF is used.

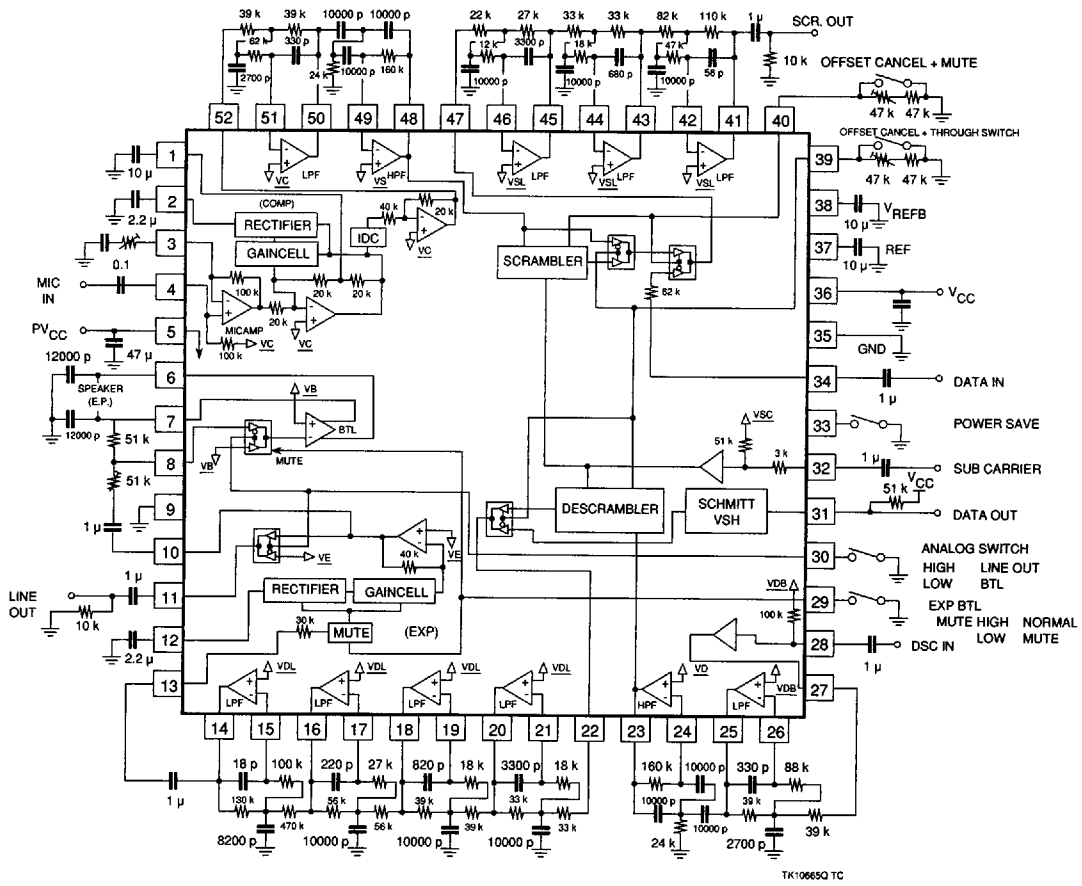
ELECTRICAL CHARACTERISTICS (CONT.)

Test conditions: V_{CC} = 2.0 V (36 Pin), V_{CCP} = 2.4 V (5 Pin), T_A = 25 °C, f = 1.0 kHz, Sub = 3.5 kHz, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
V_{P39}	Offset/Through	39 Pin		1.15		V
V_{P39HI}	Offset		0.9		V_{P39}	V
V_{P39LO}	Through		0		0.6	V
V_{P40}	Offset/Mute.Data	40 Pin		1.15		V
V_{P40HI}	Offset		0.9		V_{P40}	V
V_{P40LO}	SCR Mute.Data		0		0.6	V
V_{SUB}	Subcarrier Input Level	Square Wave, 32 Pin	0.2	0.4	1.0	Vp-p

Note 2: Measured by using the noise evaluation filter based on P. 53 of CCITT.
Note 3: External 3 kHz LPF is used.

TEST CIRCUIT



FUNCTION OF EACH SWITCH

PIN 29: EXP, BTL MUTE SWITCH

PIN 29	10 (EXPOUT)	11 (LINEOUT)	6/7 (BTLOUT 1/2)
OPEN	EXPOUT	LINEOUT/MUTE*	BTLOUT/MUTE**
GND	MUTE	MUTE	MUTE

* When Pin 30 is connected to GND.
** When Pin 30 is open.

PIN 30: LINE/BTL SWITCH

PIN 30	11 (LINEOUT)	6/7 (BTLOUT 1/2)
OPEN	LINEOUT	MUTE*
GND	MUTE	BTLOUT*

* Pins 11 and 6/7 will be MUTED when Pin 29 is connected to GND, regardless of conditions at Pin 30.

FUNCTION OF EACH SWITCH (CONT.)

PIN 33: POWER SAVE SWITCH

PIN 33	CIRCUIT OPERATION
OPEN	PARTIAL*
GND	ALL

* Operates only the following circuits:
  DSCR IN Buffer Amp
  DSCR LPF Amp
  DSCR HPF Amp
  Data Schmitt Trigger

PIN 40: SCR OFFSET ADJUSTMENT/MUTE (DATA.OUT) SWITCH

PIN 40	47 (SCR.OUT)*
OPEN	SCR.OUT
GND	DATA.OUT

* When Pin 40 is open, Pin 34 is MUTED. When Pin 40 is connected to GND, Pin 34 INPUT is connected to Pin 47 OUT through an analog switch.

PIN 39: DSCR OFFSET ADJUSTMENT/ SCR, DSCR THROUGH SWITCH

PIN 39	22 (DSCR.OUT)	47 (SCR.OUT)*
OPEN	DSCR.OUT	SCR.OUT
GND	THROUGH.OUT	THROUGH.OUT

* When Pin 40 is connected to GND, Pin 47 OUT is connected to Pin 34 IN through an analog switch, regardless of conditions at Pin 39.

NOTES