Ordering number : EN ———

CMOS IC

LC78641E

Compact Disk Player DSP

Preliminary

Overview

The LC78641E is a CMOS IC that integrates servo control for audio CDs, EFM signal processing, and audio signal processing on one chip, enabling the configuration of systems with a small number of peripheral components. The servo control block performs A/D conversion of FE, TE, and RFENV signals from the head amplifier (LA9235M), digitally performes focus, tracking, sled, and spindle servo processing required for the CD servo, and performs D/A conversion and output of control signals to each actuator.

The EFM signal processing block has EFM signal demodulation and sync detection/protection/interpolation, deinterleave, and error detection and correction functions.

The audio signal processing block has data interpolation/muting functions used according to the error correction status, an 8× over sampling digital filters, a 1-bit DAC, and LPF (operational amplifier). The status and characteristics of each function block can be set and its data can be read via the microcontroller interface.

Playback function
- Audio CD playback (normal speed, 2× speed)
- Jitter free playback (VCEC)

Servo control block
- Digital processing of tracking, focus, sled, and spindle servos
- Automatic adjustment functions: focus gain, focus offset, focus bias, tracking gain, tracking offset, tracking balance
- Quantity of light, scratch, shock, jitter detection
  Track jump through speed control

EFM processing block
- Error detection, correction (dual C1 puls dual C2 correction)
  Jitter margin ±4 frames
- EFM signal sync detection, protection, interpolation

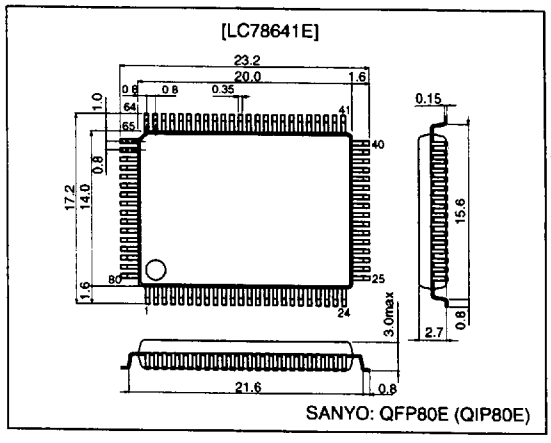
Audio processing block
- Interpolation (Quadruple interpolation)
- Digital attenuator
- Built-in deemphasis filter
- 1-bit DAC (third-order noise shaper method)
- Built-in audio output LPF
- Fade-out function
- Bilingual function
- Built-in 8× audio sampling digital filter

Supply voltage and package dimensions
- Package: 80-pin plastic package
- Supply voltage 3.3 V
  (5-V interface with microcontroller possible)

Package Dimensions

unit: mm

3174-QFP80E



Specifications

Absolute Maximum Ratings at Ta = 25°C, V_{SS} = 0 V

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{DD3max}		V_{SS} – 0.3 to V_{SS} + 4.6	V
	V_{DD5max}		V_{SS} – 0.3 to V_{SS} + 6.0	V
Input voltage	V_{IN3}		V_{SS} – 0.3 to V_{DD3} + 0.3	V
	V_{IN5}		V_{SS} – 0.3 to V_{DD5} + 0.3	V
Output voltage	V_{OUT3}		V_{SS} – 0.3 to V_{DD3} + 0.3	V
	V_{OUT5}		V_{SS} – 0.3 to V_{DD5} + 0.3	V
Allowable power dissipation	Pdmax		300	mW
Operating temperature	Topr		–20 to +75	°C
Storage temperature	Tstg		–40 to +125	°C

Allowable Operating Range at Ta = 25°C, V_{SS} = 0 V

Parameter	Symbol	Pin Name	Ratings			Unit
			min	typ	max	
Supply voltage	V_{DD3}	V_{DD}, XV_{DD}, LV_{DD}, RV_{DD}, VV_{DD}, $ADAV_{DD}$	3.0	3.3	3.6	V
	V_{DD5}	V_{DD}5V	3.0		5.5	V
High-level input voltage	V_{IH3}(1)	HFL, FG, CONT1 to 5, TEST, EMPH, ASLRCK, ASDATA, ASDFIN, SBCK, DEFECT	0.7 V_{DD3}		V_{DD3}	V
	V_{IH3}(2)	EFMIN	0.6 V_{DD3}		V_{DD3}	V
	V_{IH5}(1)	CE, CL, DI, *RES	0.8 V_{DD5}		V_{DD5}	V
	V_{IH5}(2)	CONT6 to 7	0.7 V_{DD5}		V_{DD5}	V
Low-level input voltage	V_{IL3}(1)	HFL, FG, CONT1 to 5, TEST, EMPH, ASLRCK, ASDATA, ASDFIN, SBCK, DEFECT	0		0.2 V_{DD3}	V
	V_{IL3}(2)	EFMIN	0		0.4 V_{DD3}	V
	V_{IL5}(1)	CE, CL, DI, *RES	0		0.2 V_{DD5}	V
	V_{IL5}(2)	CONT6 to 7	0		0.3 V_{DD5}	V
Data/CE set up time	t_{SU}	CL, DI, CE	400			ns
Data/CE hold time	t_{HD}	CL, DI, CE	400			ns
High-level clock pulse width	t_{WH}	SBCK, CL	400			ns
Low-level clock pulse width	t_{WL}	SBCK, CL	400			ns
Data read access time	t_{RAC}	DO, PW	0		400	ns
Command transfer time	t_{CE}	CE	1000			ns
Subcode read cycle time	t_{SC}	SFSY		136		µs
Subcode read enable time	t_{SF}	SFSY	400			ns
Port input data setup time	t_{CSU}	CONT1 to CONT7, CL	400			ns
Port input data hold time	t_{CHD}	CONT1 to CONT7, CL	400			ns
Port output data delay time	t_{CDD}	CONT1 to CONT7, CE			1200	ns
Operating frequency range	f_{OP}	EFMIN			10	MHz
Xtal oscillation frequency	fX	X_{IN}, X_{OUT}		16.9344		MHz

Electrical Characteristics at Ta = 25°C, V_{DD} = 3.3 V, V_{SS} = 0 V

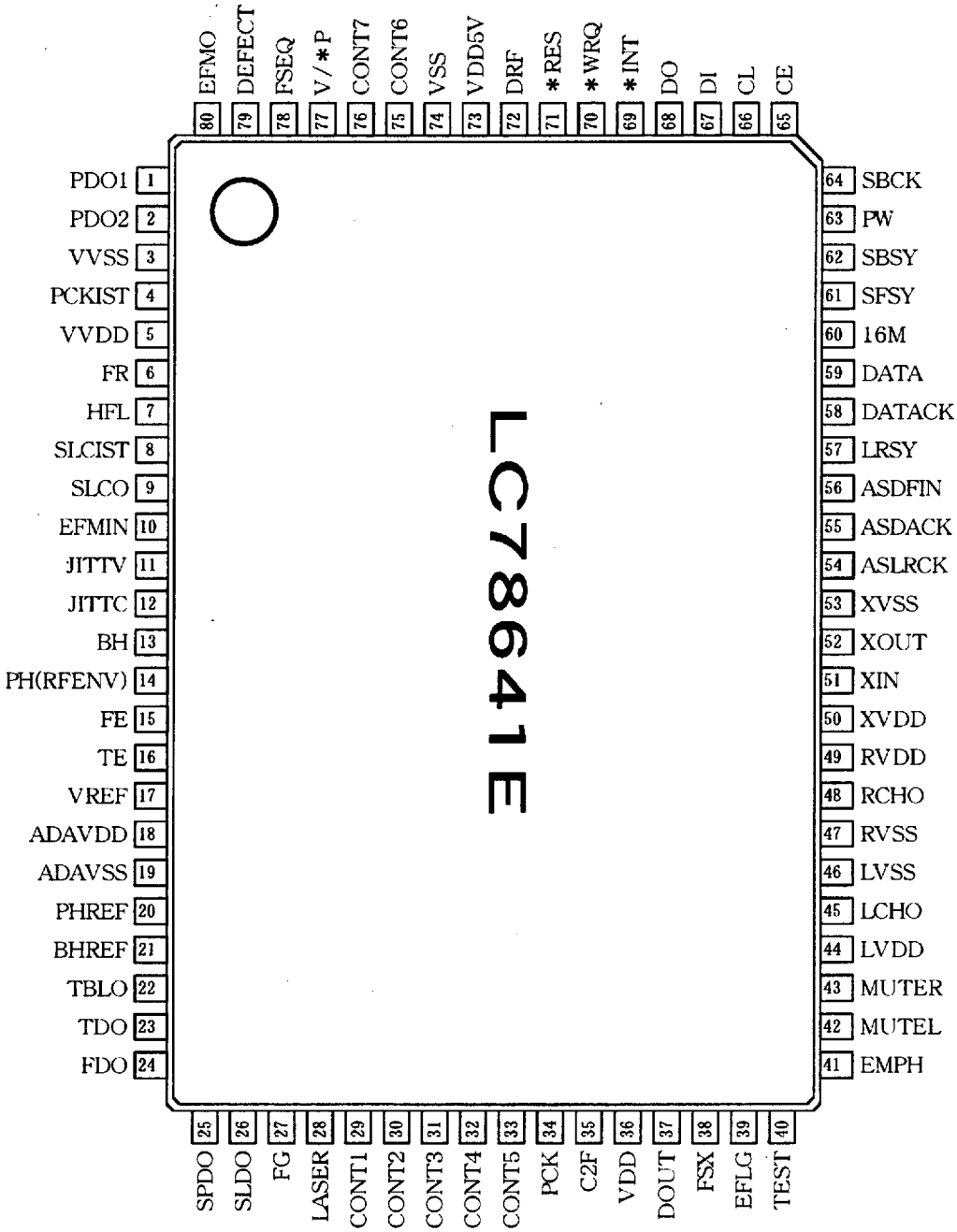
Parameter	Symbol	Pin Name	Conditions	Ratings			Unit
				min	typ	max	
Current drain	I_{DD}	V_{DD}, XV_{DD}, LV_{DD}, RV_{DD}, VV_{DD}, $ADAV_{DD}$, V_{DD5V}	Normal speed		30	45	mA
High-level input current	I_{IH3}	HFL, FG, CONT1 to 5, TEST, EMPH, ASLRCK, ASDATA, ASDFIN, SBCK, DEFECT	V_{IN} = 3.6 V			10	µA
	I_{IH5}	CE, CL, DI, *RES, CONT6 to 7	$V_{IN} = V_{DD5V}$ = 5.5 V			10	µA
Low-level input current	I_{IL3}	HFL, FG, CONT1 to 5, TEST, EMPH, ASLRCK, ASDATA, ASDFIN, SBCK, DEFECT	V_{IN} = 0 V	–10			µA
	I_{IL5}	CE, CL, DI, *RES, CONT6 to 7	V_{IN} = 0 V	–10			µA
High-level output current	V_{OH3}	LASER, CONT1 to 5, PCK, C2F, FSX, EFLG, EMPH, MUTEL, MUTER, LRSY, DATACK, DATA, 16M, SFSY, SBSY, PW, V/*P, FSEQ, EFMO, DEFECT, DOUT	I_{OH} = –4 mA	V_{DD3} – 0.8			V
	V_{OH5}	DO, *INT, *WRQ, DRF, CONT6 to 7	I_{OH} = –4 mA	V_{DD5} – 2.1			V
Low-level output current	V_{OL3}	LASER, CONT1 to 5, PCK, C2F, FSX, EFLG, EMPH, MUTEL, MUTER, LRSY, DATACK, DATA, 16M, SFSY, SBSY, PW, V/*P, FSEQ, EFMO, DEFECT, DOUT	I_{OL} = 4 mA			0.4	V
	V_{OL5}	DO, *INT, *WRQ, DRF, CONT6 to 7	I_{OL} = 4 mA			0.4	V
Charge pump output current	I_{PDOH}	PDO	R_{ISET} = 2.7 kΩ	36	45	54	µA
	I_{PDOL}	PDO	R_{ISET} = 2.7 kΩ	–54	–45	–36	µA

Analog Characteristics of 1-Bit DAC Block at Ta = 25°C, $V_{DD} = LV_{DD} = RV_{DD}$ = 3.3 V, $V_{SS} = LV_{SS} = RV_{SS}$ = 0 V

Parameter	Symbol	Pin Name	Conditions	Ratings			Unit
				min	typ	max	
Total harmonic distortion	THD+N	LCHO, RCHO	1 KHz: 0 dB data input, 20 KHz-LPF use (AD725 built in)	—	—	—	%
D range	DR	LCHO, RCHO	1 KHz: -60 dB data input, 20 KHz-LPF, A filter use (AD725D built in)	—	—	—	dB
Signal-to-noise ratio	S/N	LCHO, RCHO	1 KHz: 0 dB data input, 20 KHz-LPF, A filter use (AD725D built in)	—	—	—	dB
Crosstalk	CT	LCHO, RCHO	1 KHz: 0 dB data input, 20 KHz-LPF use (AD725D built in)	—	—	—	dB

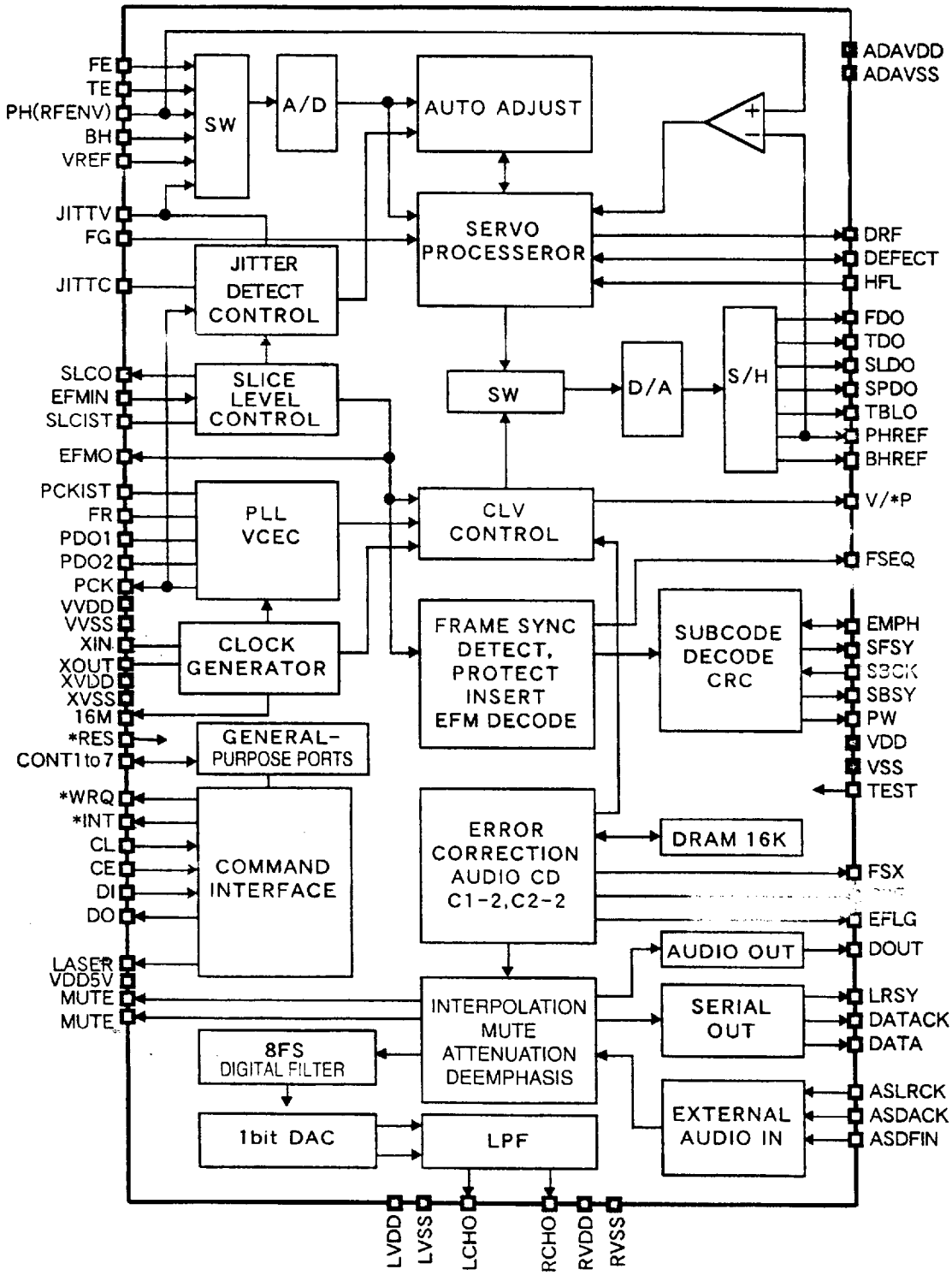
Note: * Measured in normal playback mode with Sanyo's 1-bit DAC block reference circuit.

Pin Assignment



Top view

Block Diagram



5