

SANYO

No. 3851B

LA9210M**Analog Signal Processor
for CD Players****OVERVIEW**

The LA9210M is a bipolar analog signal processor and servocontroller IC for CD players. It is designed to be used with an LA7860/65 series digital signal processor and a minimum of external components to form a complete controller for a compact disc player.

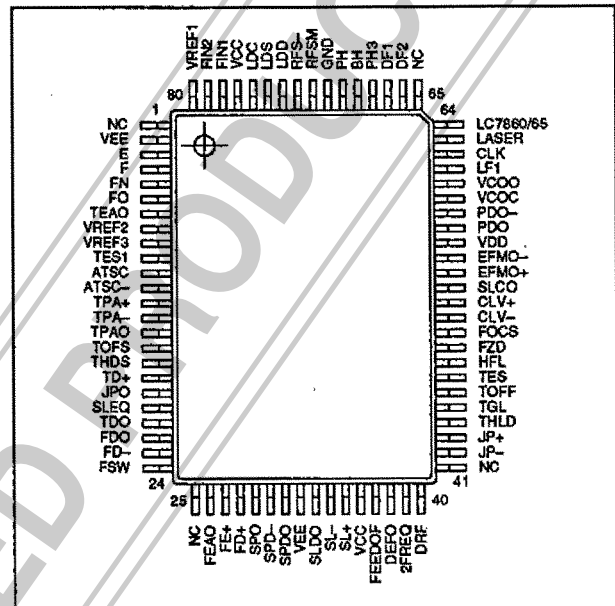
The LA9210M operates from either a single 5 V supply, single-ended 5 V and 7 V supplies or a dual ± 5 V supply and is available in 80-pin QIPs.

FUNCTIONS

- RF amplifier
- Slice level control
- Voltage-controlled oscillator (VCO)
- VCO control amplifier
- Automatic laser power control (APC)
- Focus error amplifier
- Tracking error amplifier
- Track jump amplifier
- Focus servo preamplifier
- Tracking servo preamplifier
- Spindle servo preamplifier
- Sled servo preamplifier
- RF detector
- HF level detector
- Defect detector
- Shock detector
- Focus switch
- Tracking servo gain switch
- Tracking error slice comparator

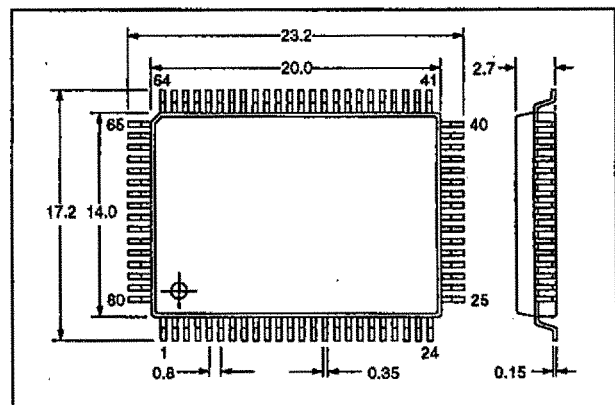
FEATURES

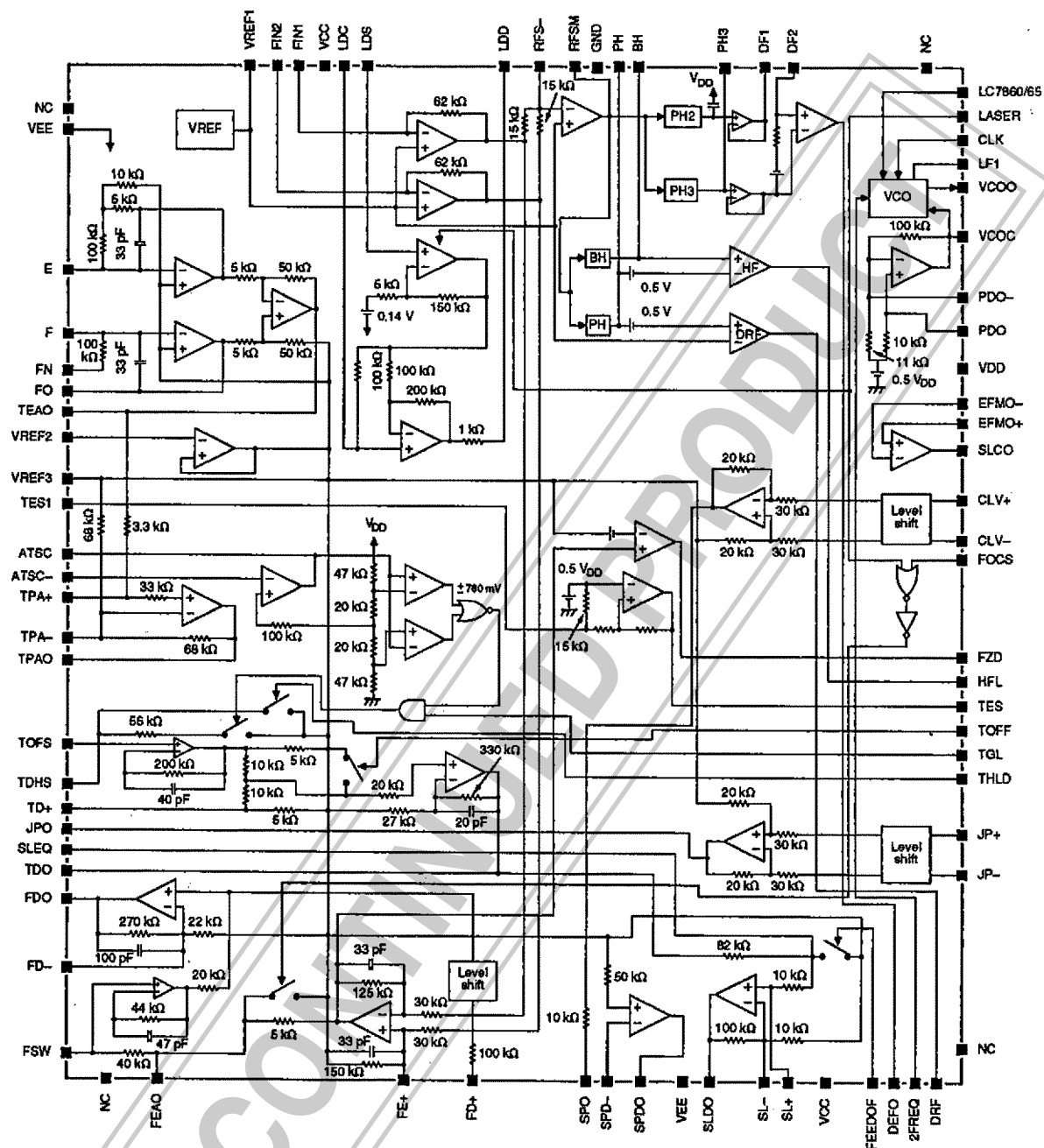
- Minimum of external components required
- Normal and double-speed VCO
- 5 V supply, single-ended 5 V and 7 V supplies or dual ± 5 V supply
- 80-pin QIP

PINOUT**PACKAGE DIMENSIONS**

Unit: mm

3174-QIP80E





SPECIFICATIONS

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Single-ended supply voltage. See note 1.	V_{CC}	10	V
	V_{DD}	7	
Dual supply voltage. See note 2.	$V_{CC} - V_{EE}$	13	V
	V_{DD}	7	
TDO, FDO, SFDO and SLDO input current	I_I	1	mA
TDO, FDO, SFDO and SLDO output current	I_O	1	mA
Power dissipation	P_D	480 ($T_a \leq 60\text{ }^{\circ}\text{C}$)	mW
Operating temperature range	T_{opr}	-25 to 75	$^{\circ}\text{C}$
Storage temperature range	T_{stg}	-40 to 150	$^{\circ}\text{C}$

Notes

1. VEE connected to ground, $V_{CC} \geq V_{DD}$
2. VREF1, VREF2 and VREF3 connected to ground, $V_{CC} \geq V_{DD}$

Recommended Operating Conditions

$T_a = 25\text{ }^{\circ}\text{C}$

Parameter	Symbol	Rating	Unit
Dual supply voltage	V_{CC}	5	V
	V_{DD}	5	
	V_{EE}	-5	
Single-ended supply voltage ranges. See note 1.	V_{CC}	4.2 to 8.0	V
	V_{DD}	4.2 to 6.0	
Dual supply voltage ranges. See note 2.	V_{CC}	4.2 to 6.0	V
	V_{DD}	4.2 to 6.0	
	V_{EE}	-6.0 to -4.2	

Notes

1. VEE connected to ground
2. VREF1, VREF2 and VREF3 connected to ground

Electrical Characteristics

Supply current

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Supply current	I_{CC}		9	18	27	mA
	I_{DD}		10	15	20	
	I_{EE}		-28	-19	-10	

RF amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
RF offset voltage	$V_{RF(off)}$	FIN1 and FIN2 open, measured at RFSM	-0.65	-0.3	0.05	V
FIN1 and FIN2 RF voltage gain	G_{VRF}	$R_g = 1\text{ M}\Omega$, $R_L = 33\text{ k}\Omega$, $f = 200\text{ kHz}$	-12.5	-11.0	-9.5	dB

Focus error amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{FE(off)}$	FIN1 and FIN2 open, measured at FEA0	-50	0	50	mV
FIN1 and FIN2 voltage gain	G_{VFE}	$R_g = 1\text{ M}\Omega$, $R_L = 33\text{ k}\Omega$, $f = 1\text{ kHz}$	-15.0	-11.5	-8.0	dB
FIN1 and FIN2 voltage gain differential	ΔG_{VFE}	$R_g = 1\text{ M}\Omega$, $R_L = 33\text{ k}\Omega$	-1.5	0	1.5	dB
Cutoff frequency	$f_{FE(\infty)}$	Measured at the half power point (-3 dB)	-	30	-	kHz

Focus drive amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{FD(off)}$	FEAO grounded, measured at FDO	-110	0	110	mV
Voltage gain	G_{VFD}	FEAO input	21.0	22.5	24.0	dB
LOW-level search voltage	V_{FSL}	$V_{FOCUS} = 5\text{ V}$, $V_{FD+} = 1.5\text{ V}$	-3.1	-2.0	-0.9	V
HIGH-level search voltage	V_{FSH}	$V_{FOCUS} = 5\text{ V}$, $V_{FD+} = 3.5\text{ V}$	0.9	2.0	3.1	V

Tracking error amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{TE(off)}$	5 k Ω resistor between FN and FO, 10 k Ω resistor between FN and ground, E and F open, measured at TEO	-200	0	200	mV
Voltage gain	G_{VTE}	5 k Ω resistor between FN and FO, 10 k Ω resistor between FN and ground, E and F open, $f = 1\text{ kHz}$	1.0	4.5	8.0	dB
Voltage gain differential	ΔG_{VTE}	5 k Ω resistor between FN and FO, 10 k Ω resistor between FN and ground	-1	0	1	dB
Cutoff frequency	$f_{TE(\infty)}$	Measured at the half-power point (-3 dB)	-	30	-	kHz

Tracking error preamplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{TP(off)}$	5 k Ω resistor between FN and FO, 10 k Ω resistor between FN and ground, measured at TPAO	-350	0	350	mV
Voltage gain	G_{VTP}	5 k Ω resistor between FN and FO, 10 k Ω resistor between FN and ground, TPA+ open, 1 M Ω resistor between E and F, $f = 1\text{ kHz}$	7.0	10.5	14.0	dB

Tracking detector amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{TD(off)}$	200 k Ω resistor between TOFS and ground, measured at TDO	-120	0	120	mV
Voltage gain	G_{VTD}	200 k Ω resistor between TOFS and ground, TOFS input, TD- open	16.5	18.0	19.5	dB

Peak hold circuit

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{PH(0)}$	$I_{FIN1} = I_{FIN2} = 7.3\text{ }\mu\text{A}$, measured between PH and RFSM	-0.2	-0.1	0.1	V

RF detector

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
LOW-level threshold voltage	$V_{DRFL(TO)}$	The voltage on PH at which DRF goes LOW	-	-	0.5	V
		The voltage between PH and VREF1 at which DRF goes LOW. REF1, REF2 and REF3 open	-	-	0.28	
HIGH-level threshold voltage	$V_{DRFH(TO)}$	The voltage on PH at which DRF goes HIGH	1.15	-	-	V
		The voltage between PH and VREF1 at which DRF goes HIGH. REF1, REF2 and REF3 open	0.72	-	-	
LOW-level output voltage	$V_{DRF(OL)}$		-	0	0.6	V
HIGH-level output voltage	$V_{DRF(OH)}$		4.0	4.1	4.6	V

Focus zero-crossing detector

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
LOW-level threshold voltage	$V_{FZDL(TO)}$	1 M Ω FIN2 input resistor, the voltage on FEAO at which FZD goes LOW	-	-	-0.85	V
HIGH-level threshold voltage	$V_{FZDH(TO)}$	1 M Ω FIN2 input resistor, the voltage on FEAO at which FZD goes HIGH	-0.35	-	-	V
LOW-level output voltage	$V_{FZD(OL)}$		-	0	0.6	V
HIGH-level output voltage	$V_{FZD(OH)}$		4.0	4.1	4.6	V

Bottom hold circuit

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{BH(OH)}$	$I_{FIN1} = I_{FIN2} = 7.3\text{ }\mu\text{A}$, measured between BH and RFSM	-0.2	-0.1	0.1	V

High-frequency level comparator

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
LOW-level threshold voltage	$V_{HFL(TO)}$	$V_{PH} = 0\text{ V}$, the voltage on BH at which HFL goes LOW	-	-	-0.7	V
HIGH-level threshold voltage	$V_{HFL(TO)}$	$V_{PH} = 0\text{ V}$, the voltage on BH at which HFL goes HIGH	-0.3	-	-	V
LOW-level output voltage	$V_{HF(OL)}$		-	0	0.6	V
HIGH-level output voltage	$V_{HF(OH)}$		4.0	4.1	4.6	V

Tracking error slice comparator

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
LOW-level threshold voltage	$V_{TESL(TO)}$	100 k Ω TES1 input resistor, the voltage on TES1 at which TES goes LOW	1.0	1.7	2.5	V
HIGH-level threshold voltage	$V_{TESH(TO)}$	100 k Ω TES1 input resistor, the voltage on TES1 at which TES goes HIGH	2.5	3.5	4.0	V
LOW-level output voltage	$V_{TES(OL)}$		0	0.2	1.0	V
HIGH-level output voltage	$V_{TES(OH)}$		4.0	4.1	4.6	V

Jump pulse amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{JP(OH)}$	Measured at JPO	-20	0	20	mV
LOW-level output voltage	$V_{JP(OL)}$	$JP- = 5\text{ V}$	-3.55	-3.20	-2.85	V
HIGH-level output voltage	$V_{JP(OH)}$	$JP+ = 5\text{ V}$	2.85	3.20	3.55	V

Servo pulse amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{SP(off)}$	Measured at SPO	-20	0	20	mV
LOW-level output voltage	$V_{SP(OL)}$	$V_{CLV-} = 5\text{ V}$	-3.55	-3.20	-2.85	V
HIGH-level output voltage	$V_{SP(OH)}$	$V_{CLV+} = 5\text{ V}$	2.85	3.20	3.55	V

Spindle drive amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{SPD(off)}$	51 k Ω resistor between SPD- and SPDO, measured at SPDO	-110	0	110	mV
Voltage gain	G_{VSPD}	51 k Ω resistor between SPD- and SPDO, 51 k Ω SPD- input resistor	-1.5	0	1.5	dB

Sled amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{SLD(off)}$	SLEQ grounded, measured at SLDO	-60	0	60	mV
Output voltage with gain	$V_{SLD(O)}$	SLEQ grounded, $I_{SL+} = 10\text{ }\mu\text{A}$	1.2	1.9	2.6	V

VCO control amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Quiescent output voltage	$V_{VCOQ(O)}$	Measured at VCOQ	2.3	2.5	2.7	V
Output voltage with gain	$V_{VCOQ(O)}$	$I_{PDO} = 10\text{ }\mu\text{A}$	3.15	3.50	3.85	V

Slice level comparator amplifier

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Output voltage	$V_{SLC(O)}$	10 k Ω resistor between SLCO and EFMO-, 10 k Ω resistor between EFMO+ and 2.5 V reference	2.4	2.5	2.6	V

Focus switch

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{FSW(O)}$	$V_{FOCS} = 5\text{ V}$, measured at FEAO	-20	0	20	mV
Focus switch OFF threshold voltage	$V_{FSW1(TO)}$	The voltage on FOCS at which the focus switch turns OFF	-	-	1.0	V
Focus switch ON threshold voltage	$V_{FSW2(TO)}$	The voltage on FOCS at which the focus switch turns ON	4.0	-	-	V

Tracking OFF switch

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{TFS(O)}$	$V_{TOFF} = 5\text{ V}$, 200 k Ω TOFS input resistance, $V_{TOFS} = 0.126\text{ V}$	-20	80	160	mV
Tracking OFF switch OFF threshold voltage	$V_{TFS1(TO)}$	The voltage on TOFF at which the tracking OFF switch turns OFF	-	-	1.0	V
Tracking OFF switch ON threshold voltage	$V_{TFS2(TO)}$	The voltage on TOFF at which the tracking OFF switch turns ON	4.0	-	-	V

Tracking hold switch

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{THS(O)}$	56 k Ω resistor between THDS and 5 V reference, $V_{THLD} = 5\text{ V}$, measured at THDS	-60	0	60	mV
Tracking hold switch OFF threshold voltage	$V_{THS1(TO)}$	The voltage on THLD at which the tracking hold switch turns OFF	-	-	1.0	V
Tracking hold switch ON threshold voltage	$V_{THS2(TO)}$	The voltage on THLD at which the tracking hold switch turns ON	4.0	-	-	V

Tracking servo gain switch

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Tracking gain LOW-level switch OFF threshold voltage	$V_{TGS1(TO)}$	The voltage on TGL at which the tracking gain LOW-level switch turns OFF	–	–	1.0	V
Tracking gain LOW-level switch ON threshold voltage	$V_{TGS2(TO)}$	The voltage on TGL at which the tracking gain LOW-level switch turns ON	4.0	–	–	V

Sled amplifier OFF switch

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Sled OFF switch OFF threshold voltage	$V_{SFS1(TO)}$	The voltage on FEEDOF at which the sled OFF switch turns OFF	–	–	0.5	V
Sled OFF switch ON threshold voltage	$V_{SFS2(TO)}$	The voltage on FEEDOF at which the sled OFF switch turns ON	2.0	–	–	V

Automatic laser power control circuit

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Start voltage P	$V_{APCP(S)}$	LDC open, $V_{LDD} = -3\text{ V}$, measured on LDS	–4.95	–4.91	–4.87	V
End voltage P	$V_{APCP(E)}$	LDC open, $V_{LDD} = 3\text{ V}$, measured on LDS	–4.85	–4.81	–4.77	V
Start voltage N	$V_{APCN(S)}$	LDC grounded, $V_{LDD} = 3\text{ V}$, measured on LDS	–4.93	–4.89	–4.85	V
End voltage N	$V_{APCN(E)}$	LDC grounded, $V_{LDD} = -3\text{ V}$, measured on LDS	–4.87	–4.83	–4.79	V
OFF voltage P	$V_{APCP(OFF)}$	LDC open, $V_{LASER} = 5\text{ V}$	4.0	4.6	5.0	V
OFF voltage N	$V_{APCN(OFF)}$	LDC grounded, $V_{LASER} = 5\text{ V}$	–5.0	–4.3	–4.0	V
Automatic power control OFF threshold voltage	V_{APC1}	The voltage on LASER at which the focus switch turns OFF and the automatic power control circuit turns ON	–	–	1.0	V
Automatic power control ON threshold voltage	V_{APC2}	The voltage on LASER at which the focus switch turns ON and the automatic power control circuit turns OFF	4.5	–	–	V

Defect detector circuit

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Offset voltage	$V_{DF(0)}$	$I_{FIN1} = I_{FIN2} = 7.3\text{ }\mu\text{A}$, 10 k Ω resistor between FEFO and ground	0.2	0.4	0.6	V
LOW-level output voltage	$V_{DF(OL)}$		—	0	0.2	V
HIGH-level output voltage	$V_{DF(OH)}$		4.0	4.8	5.0	V

Shock detector circuit

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Quiescent voltage	$V_{SH(OFF)}$	Measured on ATSC	2.3	2.5	2.7	V
Detector LOW-level threshold voltage	$V_{SHCL(TO)}$	ATSC— current (between 0 and $-15\text{ }\mu\text{A}$) at which $V_{THDS} = 4\text{ V}$	-9.0	-7.5	-6.0	μA
Detector HIGH-level threshold voltage	$V_{SHCH(TO)}$	ATSC— current (between 0 and $-15\text{ }\mu\text{A}$) at which $V_{THDS} = 4\text{ V}$	6.0	7.5	9.0	μA

Voltage-controlled oscillator

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Free-running frequency	f_{VCO}	LC7860/65 grounded, $f_{CLK} = 4.3224\text{ MHz}$, $V_{2FREQ} = 0\text{ V}$, 160 k Ω resistor between LF1 and 5 V	8.14	8.64	9.14	MHz
		$V_{LC7860/65} = 5\text{ V}$, $f_{CLK} = 2.1609\text{ MHz}$, $V_{2FREQ} = 0\text{ V}$, 160 k Ω resistor between LF1 and 5 V	8.14	8.64	9.14	
Maximum adjustment frequency	Δf_{VCO}	$V_{PDO} = 2\text{ V}$, $V_{LC7860/65} = 5\text{ V}$, $f_{CLK} = 2.1609\text{ MHz}$, $V_{2FREQ} = 0\text{ V}$, 160 k Ω resistor between LF1 and 5 V	0.60	0.95	—	MHz
Minimum adjustment frequency	Δf_{VCO2}	$V_{PDO} = 3\text{ V}$, $V_{LC7860/65} = 5\text{ V}$, $f_{CLK} = 2.1609\text{ MHz}$, $V_{2FREQ} = 0\text{ V}$, 160 k Ω resistor between LF1 and 5 V	—	-0.95	-0.60	MHz

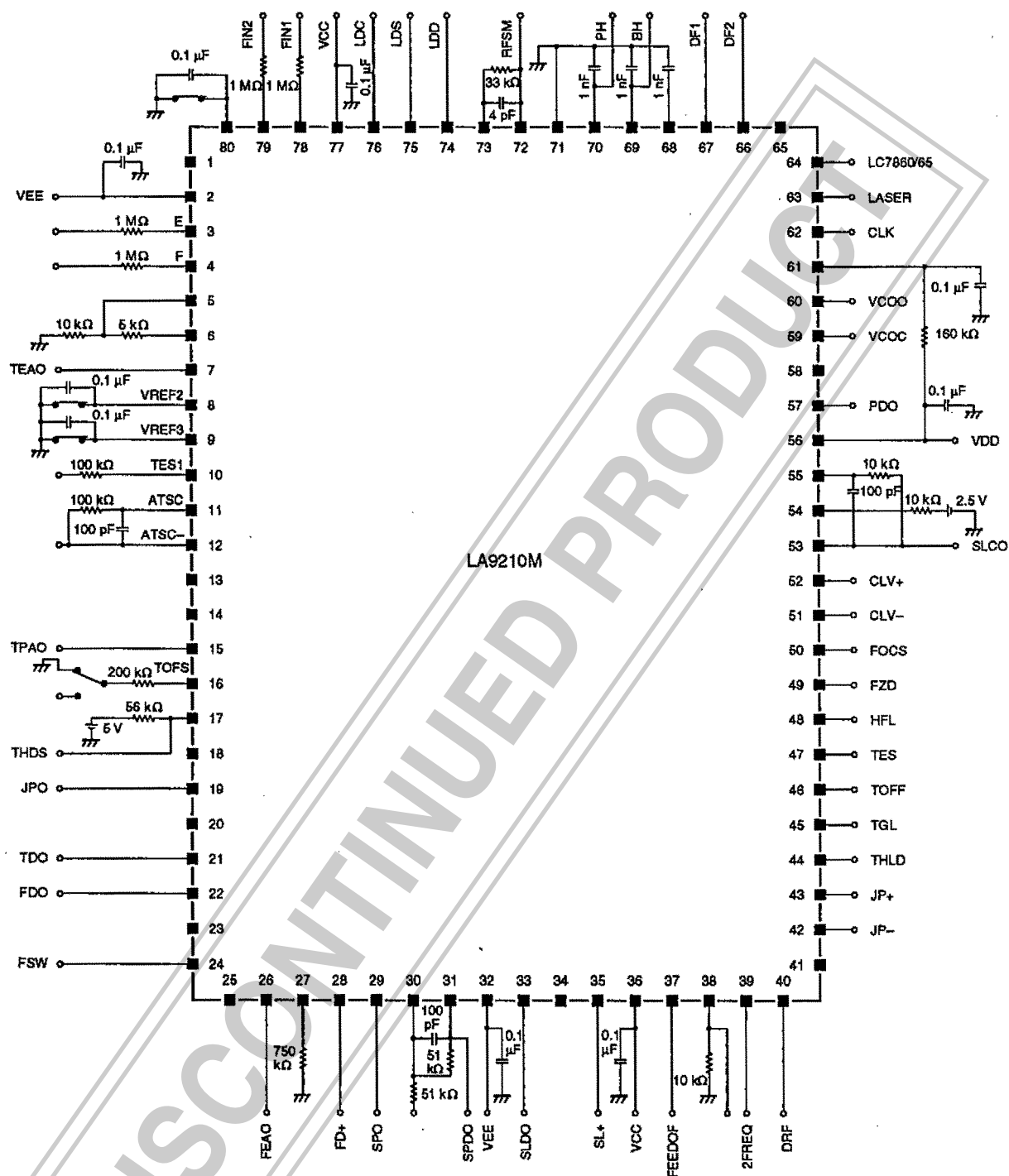
Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Output voltage	$V_{CO1(O)}$	$V_{LC7880/65} = 5\text{ V}$, $I_{CLK} = 2.1609\text{ MHz}$, $V_{2FREQ} = 5\text{ V}$, 160 k Ω resistor between LF1 and 5 V	0.5	2.0	4.0	V_{pp}
	$V_{CO2(O)}$	$V_{LC7880/65} = 5\text{ V}$, $I_{CLK} = 2.1609\text{ MHz}$, $V_{2FREQ} = 0\text{ V}$, 160 k Ω resistor between LF1 and 5 V	0.5	2.0	4.0	V_{pp}

Reference voltage

$V_{CC} = 5\text{ V}$, $V_{DD} = 5\text{ V}$, $V_{EE} = -5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$, $V_{REF1} = V_{REF2} = V_{REF3} = 0\text{ V}$ unless otherwise noted

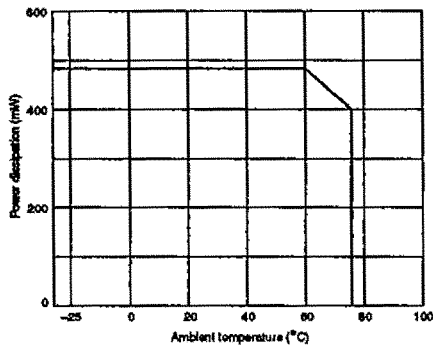
Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
VREF1 reference voltage	V_{REF1}	Measured at VREF1 with VREF1 open	-3.55	-3.30	-3.05	V
VREF3 reference voltage	V_{REF3}	Measured at VREF3 with VREF2 and VREF3 open	-0.15	0	0.15	V

Measurement Circuit



Typical Performance Characteristics

Power dissipation vs. ambient temperature



- No products described or contained herein are intended for use in surgical implants, life-support systems, aerospace equipment, nuclear power control systems, vehicles, disaster/crime-prevention equipment and the like, the failure of which may directly or indirectly cause injury, death or property loss.
- Anyone purchasing any products described or contained herein for an above-mentioned use shall:
 - ① Accept full responsibility and indemnify and defend SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors and all their officers and employees, jointly and severally, against any and all claims and litigation and all damages, cost and expenses associated with such use;
 - ② Not impose any responsibility for any fault or negligence which may be cited in any such claim or litigation on SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors or any of their officers and employees jointly or severally.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.