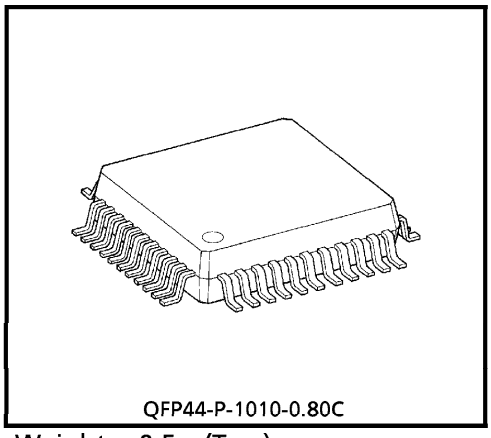
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA2031F

CD FOCUS TRACKING SERVO LSI

The TA2031F is a 3-beam type PUH compatible focus tracking servo LSI to be used in the CD player system. (Compatible with the Foucault's method focus error detection PUH with generally low focus error detecting sensitivity.)
In combination with a CMOS single chip processor TC9236AF, a CD player system can be composed very simply.



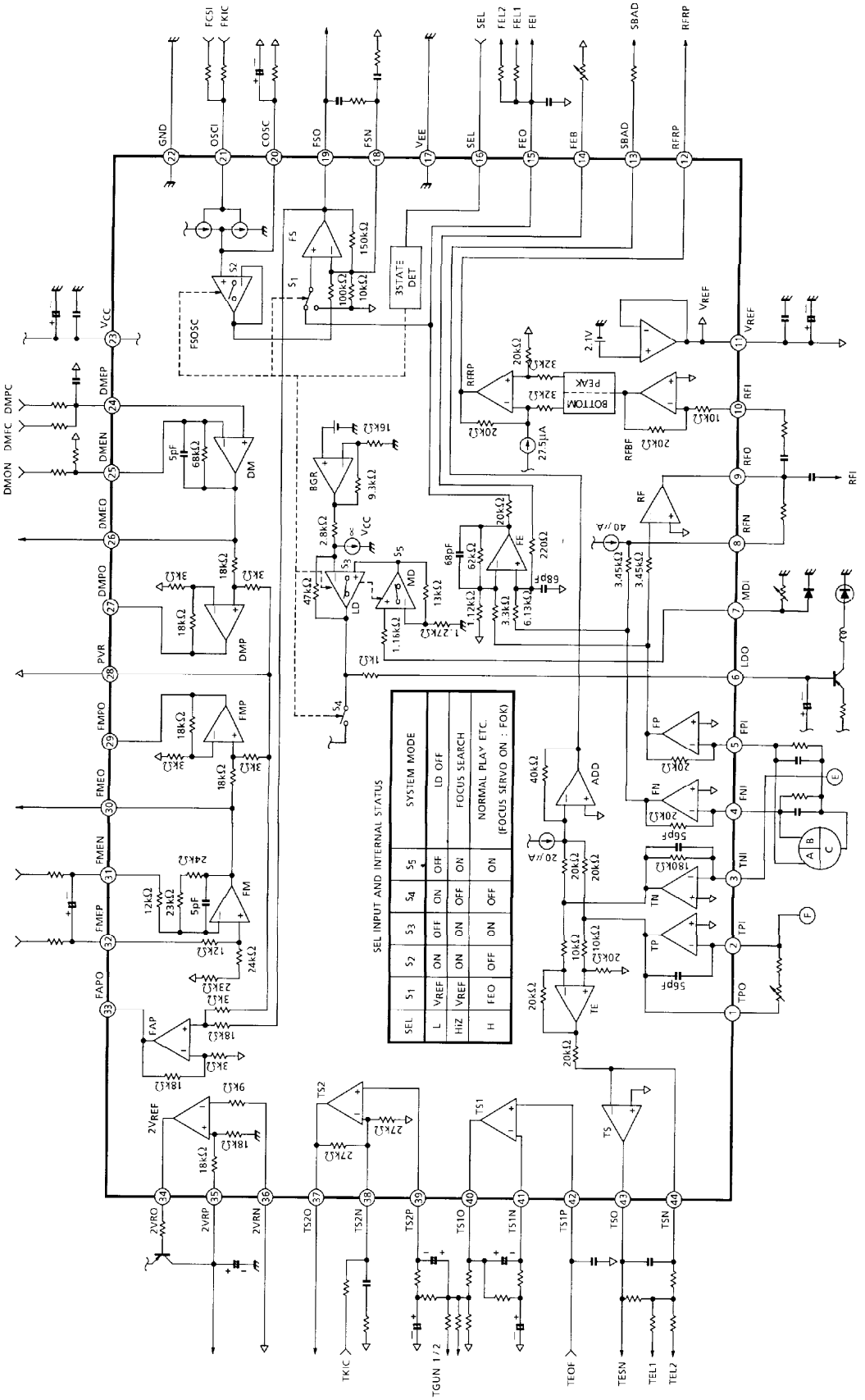
QFP44-P-1010-0.80C

Weight : 0.5g (Typ.)

FEATURES

- Built-in RF amp, focus error amp, and tracking error amp.
- Built-in focus tracking servo amp.
- Built-in phase compensation amp and LPF amp.
- Built-in ALPC amp.
- Connections between PUH and power driver IC for motor driver allow simplified structuring of CD player system.
  Directly connectable to BTL amp (TA8192F) or PWM driver (TA8460F).

BLOCK DIAGRAM



PIN FUNCTION

PIN No.	SYMBOL	I / O	FUNCTION DESCRIPTION	REMARKS
1	TPO	O	Sub-beam I-V amp (TP AMP) output terminal.	Connected to TPI through adjusting feedback resistor.
2	TPI	I	Sub-beam I-V amp (TP AMP) input terminal.	Connected to pin diode F.
3	TNI	I	Sub-beam I-V amp (TN AMP) input terminal.	Connected to pin diode E.
4	FNI	I	Main-beam I-V amp (FN AMP) input terminal.	Connected to pin diode B + C.
5	FPI	I	Main-beam I-V amp (FP AMP) input terminal.	Connected to pin diode A + C.
6	LDO	O	Laser diode amp (LD AMP) input terminal.	Connected to laser diode circuit.
7	MDI	I	Monitor photo diode amp (MD AMP) input terminal.	Connected to monitor photo diode.
8	RFN	I	RF amp (RF AMP) negative phase input terminal.	Connected to RFO through feedback resistor.
9	RFO	O	RF amp (RF AMP) output terminal.	—
10	RFI	I	RF ripple signal generating circuit input terminal.	Connected to RFO through CR.
11	V_{REF}	O	Reference voltage output terminal. (+2.1V)	—
12	RFRP	O	RF ripple signal output terminal.	—
13	SBAD	O	Defects detection signal output terminal.	—
14	FEB	I	Focus error balance adjusting input terminal.	Adjusting semi-fixed resistor is connected.
15	FEO	O	Focus error amp (FE AMP) output terminal.	Gain adjusting resistor is connected.
16	SEL	I	Analog switch control signal input terminal.	—
17	V_{EE}	—	Power source terminal. (GND)	—
18	FSN	I	Focus output amp (FS AMP) nagative phase input terminal.	Connected to FSO through feedback CR.
19	FSO	O	Focus output amp (FS AMP) output terminal.	—
20	COSC	O	Focus search signal generating capacitor connecting terminal.	CR is connected.
21	OSCI	I	Focus search signal generating built-in current source control input terminal.	—
22	GND	—	Ground terminal	—
23	V_{CC}	—	Power source terminal. (+5V)	—
24	DMEP	I	Disc motor amp (DM AMP) positive phase input terminal.	—
25	DMEN	I	Disc motor amp (DM AMP) negative phase input terminal.	—
26	DMEO	O	Disc motor amp (DM AMP) output terminal.	—
27	DMPO	O	Disc motor driving amp (DMP AMP) output terminal.	—

PIN No.	SYMBOL	I / O	FUNCTION DESCRIPTION	REMARKS
28	PVR	I	Driving amp reference voltage input terminal.	Connected to V_{REF}.
29	FMPO	O	Feed motor driving amp (FMP AMP) output terminal.	—
30	FMEO	O	Feed motor amp (FM AMP) output terminal.	—
31	FMEN	I	Feed motor amp (FM AMP) negative phase input terminal.	—
32	FMEP	I	Feed motor amp (FM AMP) positive phase input terminal.	—
33	FAPO	O	Focus actuator driving amp (FAP AMP) output terminal.	—
34	2VRO	O	$2V_{REF}$ amp ($2V_{REF}$ AMP) output terminal.	Connected to 2VRP through external output Tr.
35	2VRP	I	$2V_{REF}$ amp ($2V_{REF}$ AMP) positive phase input terminal.	—
36	2VRN	I	$2V_{REF}$ amp ($2V_{REF}$ AMP) negative phase input terminal.	—
37	TS2O	O	Tracking servo amp 2 (TS2 AMP) output terminal.	—
38	TS2N	I	Tracking servo amp 2 (TS2 AMP) negative phase input terminal.	—
39	TS2P	I	Tracking servo amp 2 (TS2 AMP) positive phase input terminal.	—
40	TS1O	O	Tracking servo amp 1 (TS1 AMP) output terminal.	—
41	TS1N	I	Tracking servo amp 1 (TS1 AMP) negative phase input terminal.	Connected to TS1O through feedback CR.
42	TS1P	I	Tracking servo amp 1 (TS1 AMP) positive phase input terminal.	—
43	TSO	O	Tracking output amp (TS AMP) output terminal.	—
44	TSN	I	Tracking output amp (TS AMP) negative phase input terminal.	Connected to TSO through feedback CR.

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage	V_{CC}-V_{EE}	0.3~12.0	V
Power Dissipation	P_D *	780	mW
Operating Temperature	T_{opr}	−25~75	°C
Storage Temperature	T_{stg}	−55~150	°C

* Derated above 25°C in the proportion of 6.2mW / °C.

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{CC} = 5V, V_{EE} = GND, Ta = 25°C)

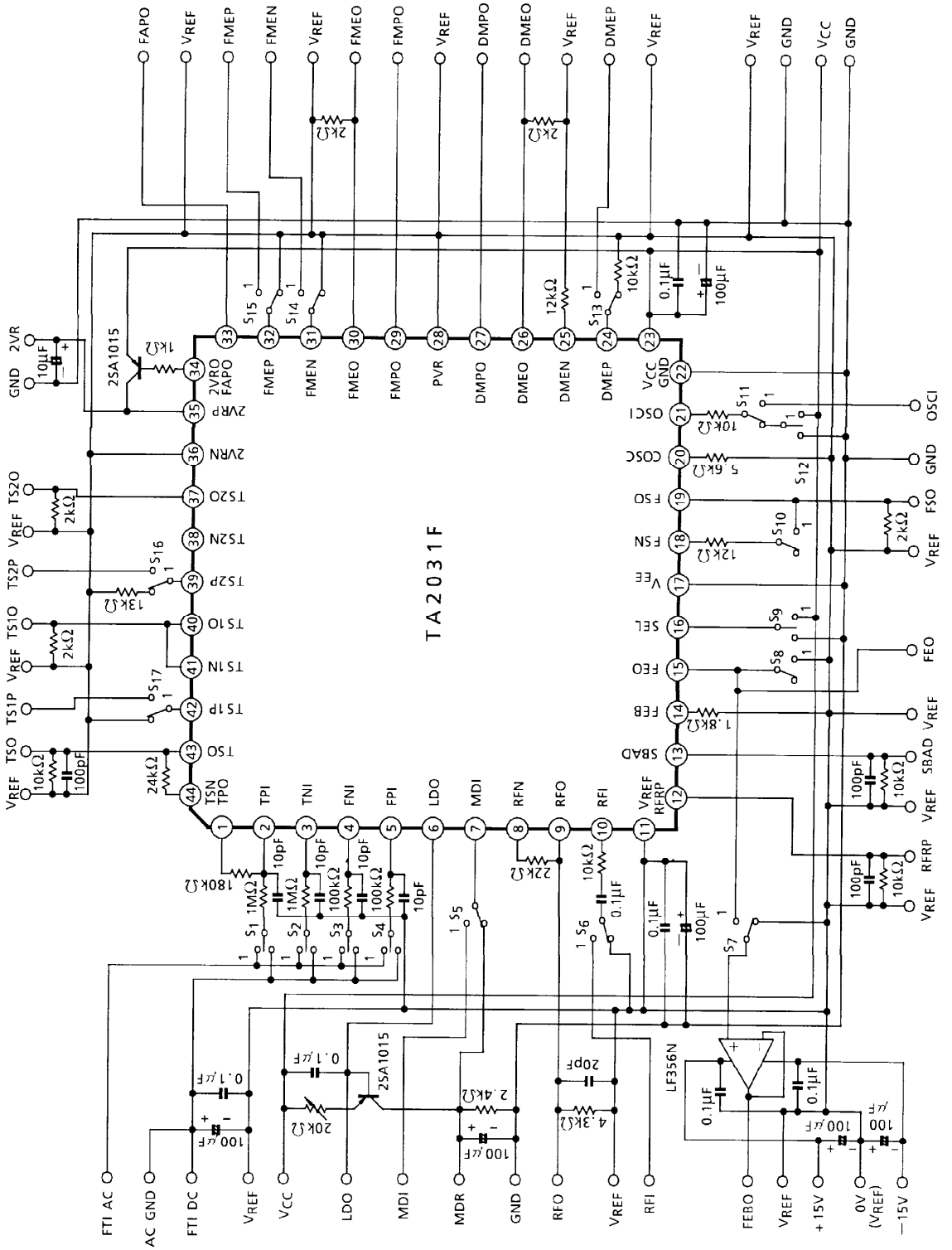
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Source	Power Supply Voltage	V_{CC}	—	Ta = −25~75°C	4.5	5.0	5.5	V
	Power Supply Current	I_{CC}	1	—	14.0	24.0	32.0	mA
Reference Power Supply V_{REF}	Reference Voltage	V_{REF}	1	—	1.95	2.10	2.25	V
	Reference Voltage Temperature Characteristic	$\Delta V / \Delta T$	1	—	−3.0	−2.0	−1.0	mV / °C
	Output Current	I_{OH}	1	—	5.0	—	—	mA
	Input Current	I_{OL}	1	—	5.0	—	—	mA
FI ↓ RFO	Permissive Input Current	I_{IM}	1	Per each ch	30	—	—	μA
	Transfer Resistance	R_T	1	f = 100kHz	115	127	140	kΩ
	Frequency Characteristic	f_c	2	−3dB point	3.0	—	—	MHz
	Output Signal Slew Rate	SR	2	C_{RFO} = 20pF	10	20	—	V / μs
	Total Harmonic Distortion	THD	1	f = 100kHz V_{REO} = 1.27V_{p-p}	—	−40	−30	dB
	Operation Reference Voltage	V_{OPR}	1	V_{REF} reference	−1.13	−0.88	−0.72	V
	Upper Limit Output Voltage	V_{OH}	1	V_{REF} reference	1.4	—	—	V
	Lower Limit Output Voltage	V_{OL}	1	V_{REF} reference	—	—	−1.4	V
	Permissive Load Resistance	R_{LM}	—	—	10	—	—	kΩ
RFI ↓ RFRP	Input Operating Voltage	V_I	1	—	0.8	—	1.6	V_{p-p}
	Voltage Gain	G_V	1	f = 1kHz	0.55	0.62	0.69	V / V
	Peak Hold Frequency Characteristic	f_{CPD}	1	—	60	120	240	kHz
	Bottom Hold Frequency Characteristic	f_{CBD}	1	—	60	120	240	kHz
	Operation Reference Voltage 1	V_{OPR}	1	V_{REF} reference	−0.61	−0.55	−0.49	V
	Operation Reference Voltage 2	V_{OPR}	1	V_{REF} reference, 700kHz, 1V_{p-p} input	−120	0	120	mV
	Permissive Load Resistance	R_{LM}	—	—	10	—	—	kΩ

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
FI ↓ FEO	Transfer Resistance	R_T	1	f = 1kHz, FPI→FEO	293	376	458	kΩ
	Gain Balance	GB	1	f = 1kHz	− 1.5	—	1.5	dB
	Frequency Characteristic	f_C	1	− 3dB point	20	30	60	kHz
	Total Harmonic Distortion	THD	1	f = 1kHz $V_{FEO} = 1.7V_{p-p}$	—	—	− 40	dB
	Output Offset Voltage	V_{OS}	1	V_{REF} reference	− 300	—	300	mV
	Offset Voltage Drift	$\Delta V / \Delta T$	1	—	− 1.2	—	1.2	mV / °C
	Upper Limit Output Voltage	V_{OH}	1	V_{REF} reference	1.5	—	—	V
	Lower Limit Output Voltage	V_{OL}	1	V_{REF} reference	—	—	− 1.5	V
TI ↓ TSO	Permissive Input Current	I_{IM}	1	Per each ch	5.0	—	—	μA
	Transfer Resistance	R_T	1	f = 1kHz	354	432	554	kΩ
	Gain Balance	GB	1	f = 1kHz	− 2.0	—	2.0	dB
	Frequency Characteristic	f_C	1	− 3dB point	10	16	30	kHz
	Total Harmonic Distortion	THD	1	f = 1kHz $V_{TSO} = 0.8V_{p-p}$	—	—	− 40	dB
	Output Offset Voltage	V_{OS}	1	V_{REF} reference	− 50	—	50	mV
	Offset Voltage Drift	$\Delta V / \Delta T$	1	—	− 200	—	200	μV / °C
	Upper Limit Output Voltage	V_{OH}	1	V_{REF} reference	1.5	—	—	V
	Lower Limit Output Voltage	V_{OL}	1	V_{REF} reference	—	—	− 1.5	V
	Permissive Load Resistance	R_{LM}	—	—	10	—	—	kΩ
TI ↓ SBAD	Permissive Input Current	I_{IM}	1	Total in both ch	7.0	—	—	μA
	Transfer Resistance	R_T	1	f = 1kHz	280	360	440	kΩ
	Frequency Characteristic	f_C	1	− 3dB point	10	16	30	kHz
	Total Harmonic Distortion	THD	1	f = 1kHz $V_{SBAD} = 1.6V_{p-p}$	—	—	− 40	dB
	Operation Reference Voltage	V_{OPR}	1	V_{REF} reference	− 0.88	− 0.80	− 0.72	V
	Upper Limit Output Voltage	V_{OH}	1	V_{REF} reference	1.5	—	—	V
	Lower Limit Output Voltage	V_{OL}	1	V_{REF} reference	—	—	− 1.5	V
	Permissive Load Resistance	R_{LM}	—	—	10	—	—	kΩ
OSCI ↓ FSO	Output Amplitude	V_O	—	$f_{OSCI} = 0.5Hz$ (CMOS level)	610	700	780	mV_{p-p}
	Output Offset Voltage	V_{OS}	—	OSCI : HiZ	− 35	—	35	mV
	Output Switch Isolation	V_{ISO}	—	$f_{OSCI} = 0.5Hz$ SEL : "H" level	—	—	25	mV_{p-p}

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
FEO ↓ FSO	Voltage Gain 1	G_{V1}	—	f = 10kHz $V_{FSO} = 1V_{p-p}$	14.5	16.0	17.5	V / V
	Voltage Gain 2	G_{V2}	—	R_{NF} (FSO-FSN) : 12kΩ	1.79	2.11	2.43	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	0.5	V
	Output Offset Voltage	V_{OS}	—	—	− 32	—	32	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{FSO} = 1V_{p-p}$	—	—	− 40	dB
FEO ↓ FAPO	Voltage Gain	G_V	—	f = 10kHz $V_{FAPO} = 1V_{p-p}$	14.0	16.0	18.0	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	1.0	V
	Output Offset Voltage	V_{OS}	—	—	− 40	—	40	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{FAPO} = 1V_{p-p}$	—	—	− 40	dB
TS1P ↓ TS1O	Voltage Gain	G_V	—	f = 10kHz $V_{TS1O} = 1V_{p-p}$	0.95	1.00	1.05	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	1.0	V
	Output Offset Voltage	V_{OS}	—	—	− 5.0	—	5.0	mV
	Input Bias Current	I_I	—	—	− 100	—	100	nA
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{TS1O} = 1V_{p-p}$	—	—	− 40	dB
TS2P ↓ TS2O	Voltage Gain	G_V	—	f = 10kHz $V_{TS2O} = 1V_{p-p}$	1.9	2.0	2.1	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	0.5	V
	Output Offset Voltage	V_{OS}	—	—	− 10	—	10	mV
	Input Bias Current	I_I	—	—	− 100	—	100	nA
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{TS2O} = 1V_{p-p}$	—	—	− 40	dB
DMEP ↓ DMEO	Voltage Gain	G_V	—	f = 10kHz $V_{DMEO} = 1V_{p-p}$	5.7	6.7	7.7	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	0.5	V
	Output Offset Voltage	V_{OS}	—	—	− 15	—	15	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{DMEO} = 1V_{p-p}$	—	—	− 40	dB

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
DMEP ↓ DMPO	Voltage Gain	G_V	—	f = 10kHz $V_{DMPO} = 1V_{p-p}$	5.4	6.7	8.0	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	1.2	V
	Output Offset Voltage	V_{OS}	—	—	− 30	—	30	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{DMPO} = 1V_{p-p}$	—	—	− 40	dB
FMEP ↓ FMEO	Voltage Gain	G_V	—	f = 10kHz $V_{FMEO} = 1V_{p-p}$ $V_{FMEN} = V_{REF}$	3.6	3.9	4.3	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	0.5	V
	Output Offset Voltage	V_{OS}	—	—	− 15	—	15	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{FMEO} = 1V_{p-p}$	—	—	− 40	dB
FMEP ↓ FMPO	Voltage Gain	G_V	—	f = 10kHz $V_{FMPO} = 1V_{p-p}$ $V_{FMEN} = V_{REF}$	3.4	3.9	4.6	V / V
	Upper Limit Output Voltage	V_{OH}	—	GND reference	3.6	—	—	V
	Lower Limit Output Voltage	V_{OL}	—	GND reference	—	—	1.0	V
	Output Offset Voltage	V_{OS}	—	—	− 20	—	20	mV
	Total Harmonic Distortion	THD	—	f = 10kHz $V_{FMPO} = 1V_{p-p}$	—	—	− 40	dB
2VRN ↓ 2VR	DC Voltage Gain	G_{VDC}	—	$V_{2VR} = V_{REF}$	1.90	2.00	2.10	V / V
MDI ↓ LDO	Reference Operating Voltage	V_{MDI}	—	V_{MDI} at which V_{LDO} becomes 3.5V.	170	178	192	mV
	Voltage Gain	G_V	—	f = 10kHz $V_{LDO} = 0.5V_{p-p}$	170	200	230	V / V
	Input Bias Current	I_I	—	—	− 200	—	200	nA
	Ripple Removing Ratio (with V_{CC})	RR	—	Input converted value	—	—	− 56	dB
	Frequency Characteristic	f_c	—	− 3dB point	20	—	—	kHz
	LD Off Voltage (with V_{CC})	$V_{LD\ OFF}$	—	SEL = L	− 0.7	—	—	V

TEST CIRCUIT 1



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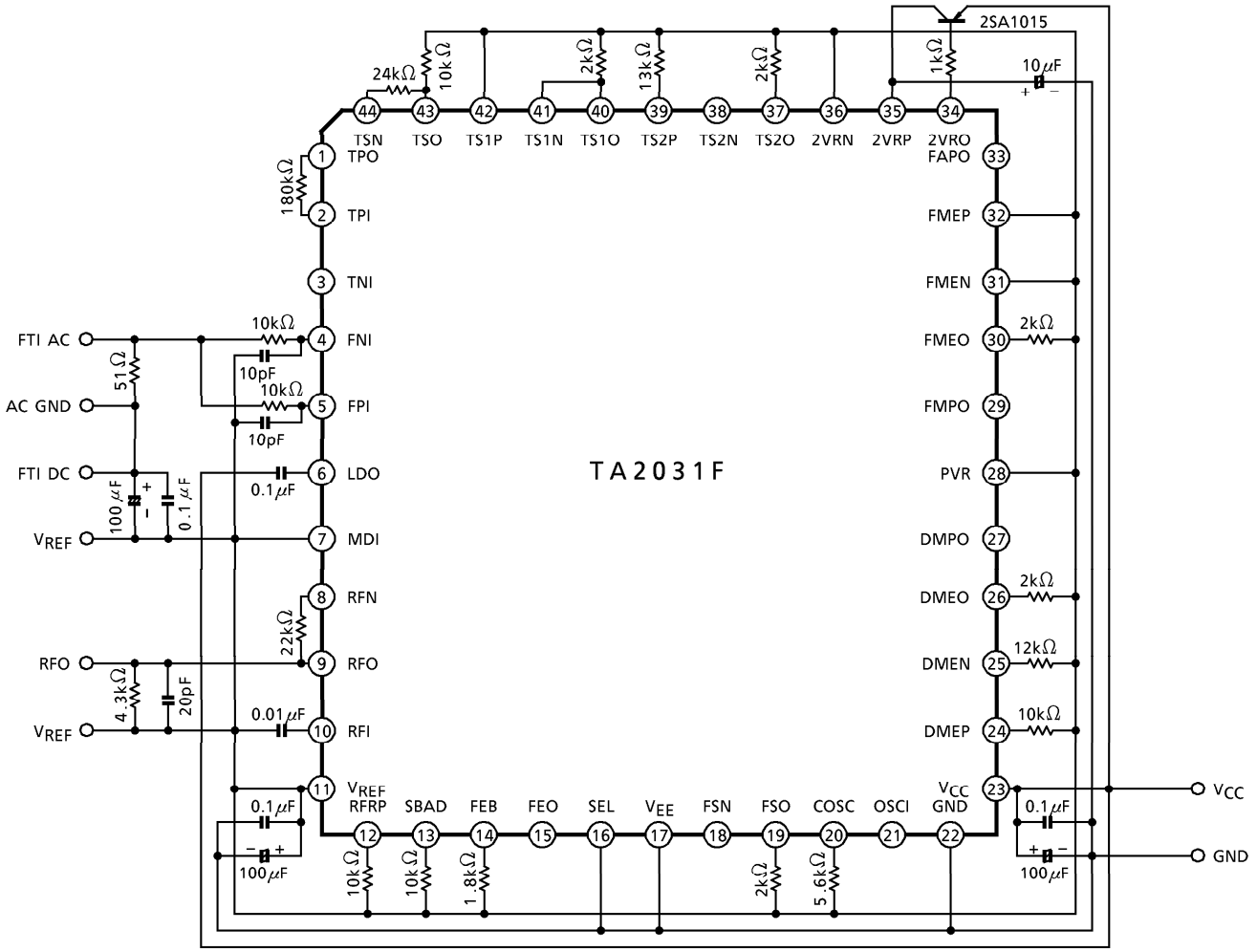
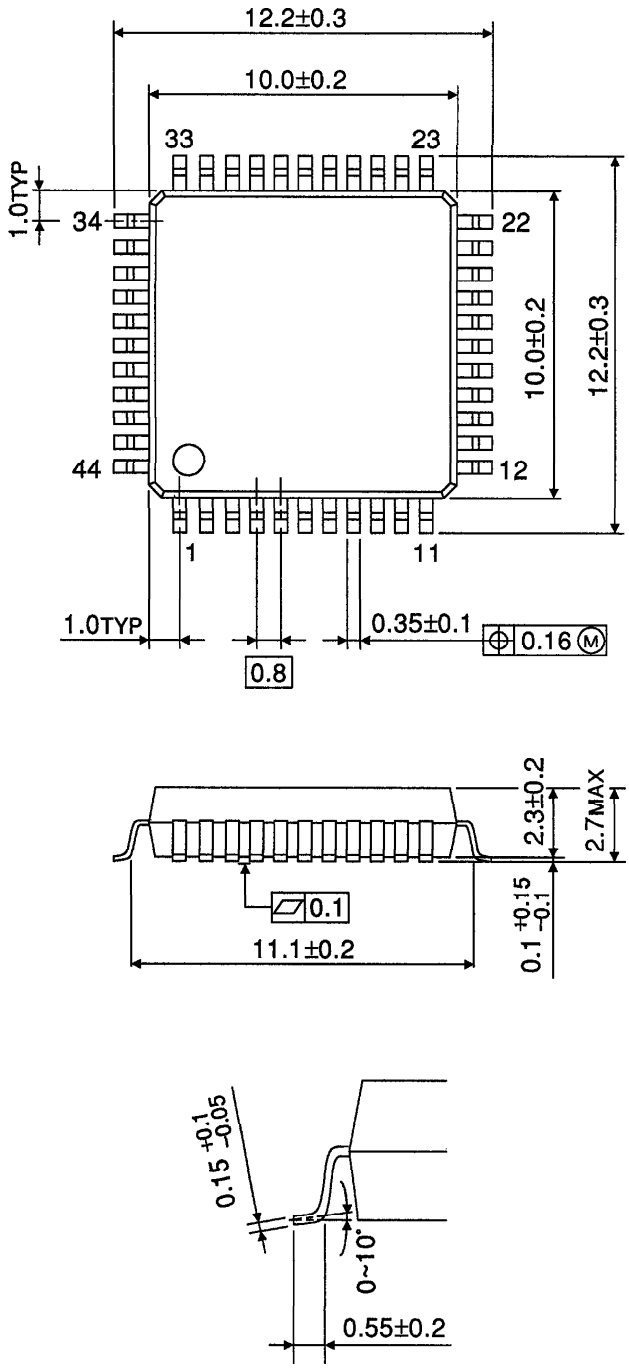
TEST CIRCUIT 2



PACKAGE DIMENSIONS

QFP44-P-1010-0.80C Unit : mm



Weight : 0.5g (Typ.)