DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1686G/GV

GENERAL PURPOSE 5 V DOWN CONVERTER IC

DESCRIPTION

The μPC1686 is Silicon monolithic IC designed for TV/VCR tuner applications. This IC consists of double balanced mixer, local oscillator, IF amplifier, and voltage regulator.

The package is 8 pin SOP or SSOP suitable for high-density surface mount.

FEATURES

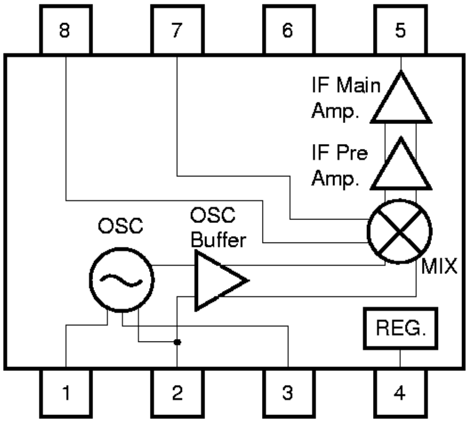
- VHF/CATV band operation
- Single-end push-pull IF amplifier suppresses fluctuation in output impedance.
- Good capability of VHF-varactor diode due to balanced amplifier oscillator
- Supply voltage: 5 V
- Packaged in 8 pin SOP or SSOP suitable for high-density mounting

ORDERING INFORMATION

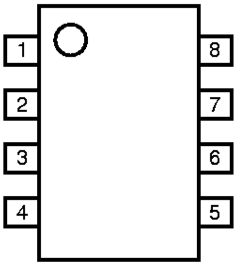
PART NUMBER	PACKAGE	SUPPLYING FORM
μPC1686G-E1	8 pin plastic SOP (225 mil)	Embossed tape 12 mm wide. 2.5k/REEL. Pin 1 indicates pull-out direction of tape.
μPC1686G-E2	8 pin plastic SOP (225 mil)	Embossed tape 12 mm wide. 2.5k/REEL. Pin 1 indicates roll-in direction of tape.
μPC1686GV-E1	8 pin plastic SSOP (175 mil)	Embossed tape 8 mm wide. 1k/REEL. Pin 1 indicates pull-out direction of tape.

For evaluation sample order, please contact your local NEC office. (Part number for sample order: μPC1686G, μPC1686GV)

INTERNAL BLOCK DIAGRAM



PIN CONFIGURATION (Top View)



1. OSC base (bypass)
2. OSC base (feedback)
3. OSC collector (coupling)
4. V_{CC}
5. IF output
6. GND
7. RF input 1 (bypass)
8. RF input 2

Caution: Electro-static sensitive devices.

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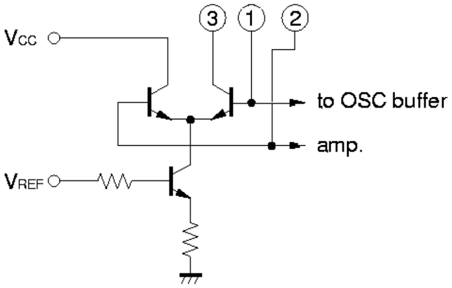
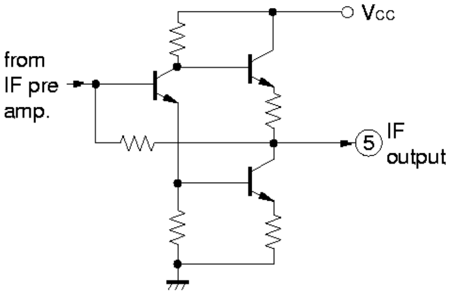
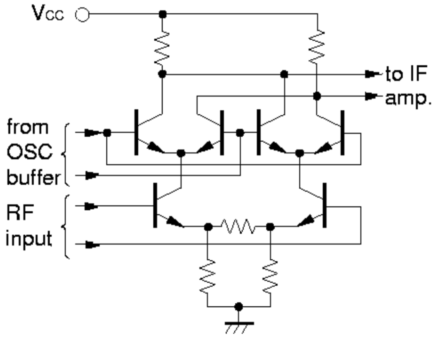
PIN EXPLANATION

Pin No.	Symbol	Function and Explanation	Equivalent Circuit
1	OSC base (bypass)	Internal oscillator consists in balance amplifier. 2 pin and 3 pin should be externally equiped with tank resonater circuit in order to oscillate with feedback loop.	
2	OSC base (feedback)	1 pin should be grounded through approximate 10 pF coupling capacitor.	
3	OSC collector (coupling)	3 pin is defined as open collector. This pin should be coupled through resistor or chock coil in order to adjust Q and be supplied voltage. In case of abnormal oscillation, adjust its Q lower to stabilize the operation.	
4	V_{CC}	Supply voltage pin for the IC.	
5	IF output	IF output pin. IF amplifier is designed as single-end push-pull amplifier. This pin is assigned for the emitter follower output with 50 Ω constant resistive impedance in wide band.	
6	GND	GND pin for the IC.	
7	RF input 1 (bypass)	7 pin and 8 pin are inputs for mixer designed as double balanced type. Either pin can be assigned for input and another for ground.	
8	RF input 2		

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Condition
Supply voltage	V_{CC}	6.0	V	T_A = 25 °C
Power dissipation	P_D	250	mW	T_A = 85 °C[Note 1]
Operating temperature range	T_A	–40 to +85	°C	
Storage temperature range	T_{stg}	–65 to +150	°C	

Note 1. Mounted on 50 × 50 × 1.6 mm double copper clad epoxy glass board.

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	UNIT
Supply voltage	V_{CC}	4.5	5.0	5.5	V
Operating temperature	T_A	–40	+25	+85	°C

ELECTRICAL CHARACTERISTICS (V_{CC} = 5 V, T_A = 25 °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Circuit current 1	$I_{CC}1$	no input signal[Note 2]	25	38	48	mA
Conversion gain 1	CG1	f_{RF} = 55 MHz, f_{IF} = 44 MHz, P_{RF} = –40 dBm, P_{OSC} = –5 dBm[Note 2]	15	19	22	dB
Conversion gain 2	CG2	f_{RF} = 200 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm, P_{OSC} = –5 dBm[Note 2]	15.5	19.5	22.5	dB
Conversion gain 3	CG3	f_{RF} = 440 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm, P_{OSC} = –5 dBm[Note 2]	16	20	23	dB
Noise figure 1	NF1	f_{RF} = 55 MHz, f_{IF} = 44 MHz, P_{OSC} = –5 dBm[Note 2]	—	11	14	dB
Noise figure 2	NF2	f_{RF} = 200 MHz, f_{IF} = 50 MHz P_{OSC} = –5 dBm[Note 2]	—	11	14	dB
Noise figure 3	NF3	f_{RF} = 440 MHz, f_{IF} = 50 MHz, P_{OSC} = –5 dBm[Note 2]	—	12	15	dB
Maximum output power 1	$P_{O(SAT)}1$	f_{RF} = 55 MHz, f_{IF} = 44 MHz, P_{RF} = 0 dBm, P_{OSC} = –5 dBm[Note]	—	+10	—	dBm
Maximum output power 2	$P_{O(SAT)}2$	f_{RF} = 200 MHz, f_{IF} = 50 MHz, P_{RF} = 0 dBm, P_{OSC} = –5 dBm[Note 2]	—	+10	—	dBm
Maximum output power 3	$P_{O(SAT)}3$	f_{RF} = 440 MHz, f_{IF} = 50 MHz, P_{RF} = 0 dBm, P_{OSC} = –5 dBm[Note 2]	—	+10	—	dBm
Circuit current 2 (UIF)	$I_{CC}2$	no input signal[Note 3]	—	38	—	mA
Power gain (UIF)	G_{PS}	f_{IF} = 50 MHz, P_{in} = –40 dBm[Note 3]	—	23	—	dB
Noise figure 4 (UIF)	NF4	f_{IF} = 50 MHz[Note 3]	—	10.5	—	dB

Notes 2. on test circuit 1

3. on test circuit 3

STANDARD CHARACTERISTICS (FOR REFERENCE) (V_{CC} = 5 V, T_A = 25 °C unless otherwise specified)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Oscillation frequency stability	f_{stb}	V_{CC} = ±10 %, f_{OSC} = 100 to 490 MHz Note 4	–	±100	–	kHz
Oscillation frequency drift	f_{drift}	f_{OSC} = 100 to 490 MHz, 30 min Note 4	–	100	–	kHz
Oscillation start voltage	V_{OSC}	f_{OSC} = 100 to 490 MHz Note 4	–	3.0	–	V
Voltage standing wave ratio	VSWR	f_{IF} = 30 to 60 MHz Note 2	–	–	1.5	
1 % cross-modulation distortion 1	CM1	f_{RF} = 55 MHz, f_{IF} = 44 MHz Note 2, 5	–	94	–	dBμ
1 % cross-modulation distortion 2	CM2	f_{RF} = 200 MHz, f_{IF} = 50 MHz Note 2, 5	–	94	–	dBμ
1 % cross-modulation distortion 3	CM3	f_{RF} = 440 MHz, f_{IF} = 50 MHz Note 2, 5	–	94	–	dBμ
1 % cross-modulation distortion 4	CM4	**Note 3, 6**	–	94	–	dBμ

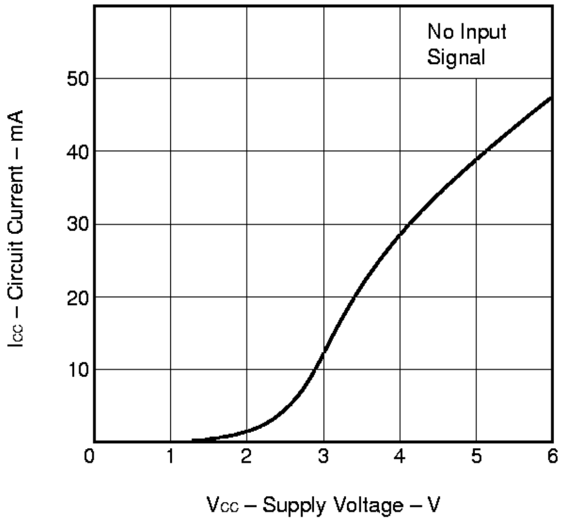
Notes 4. on test circuit 2

5. f_{undes} = f_{RF} ±12 MHz, P_{in} = –31 dBm, P_{OSC} = –5 dBm
AM: 100 kHz, 30 % Mod., S/I Ratio = 46 dBc, output 75 Ω open

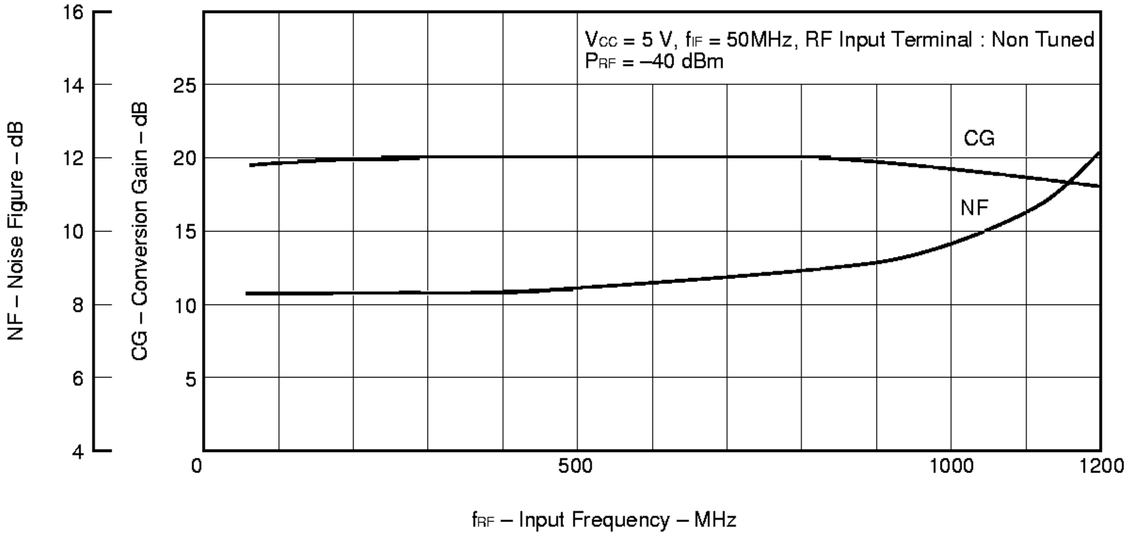
6. f_{IF} = 50 MHz, f_{undes} = 62 MHz, P_{in} = –31 dBm
AM: 100 kHz, 30 % Mod., S/I Ratio = 46 dBc, output 75 Ω open

TYPICAL CHARACTERISTICS (T_A = 25 °C)

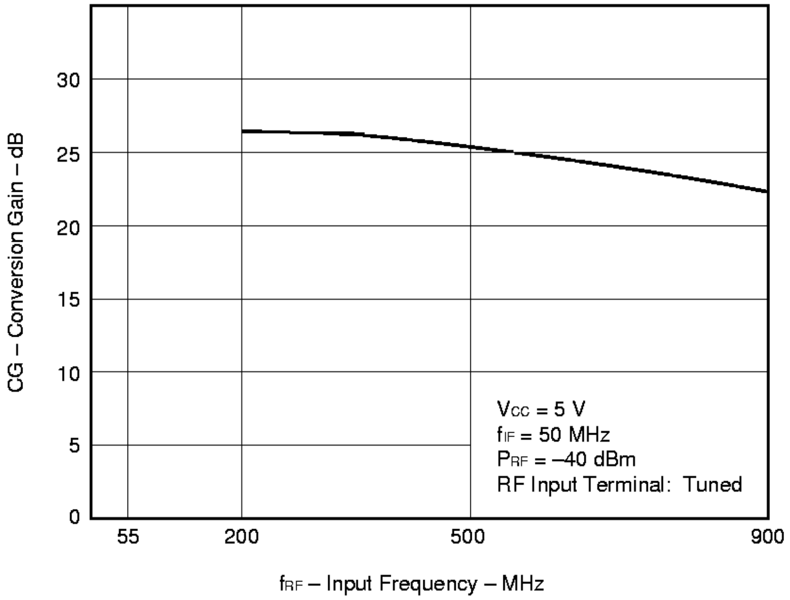
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



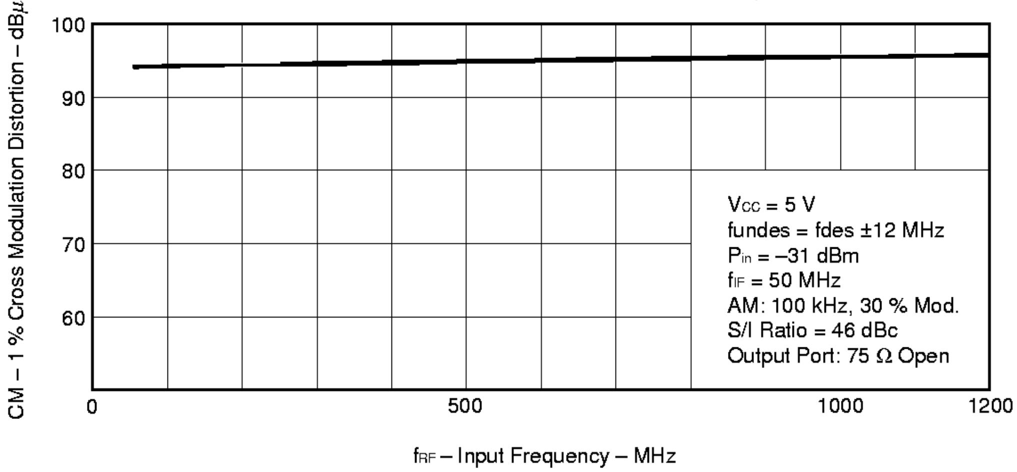
CONVERSION GAIN AND NOISE FIGURE vs. FREQUENCY



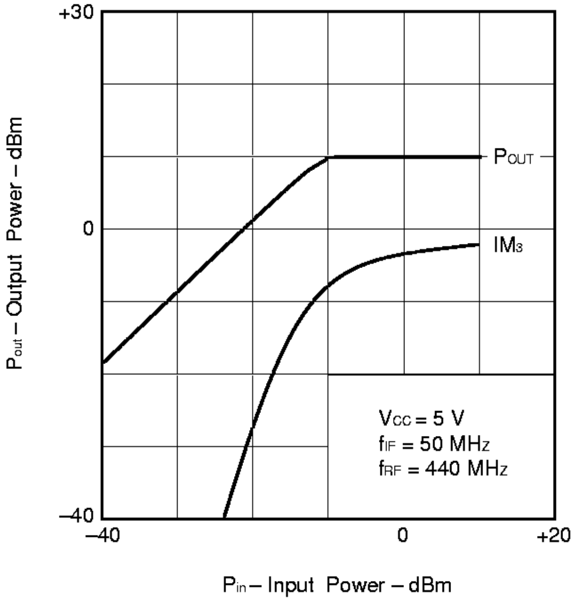
CONVERSION GAIN vs. FREQUENCY



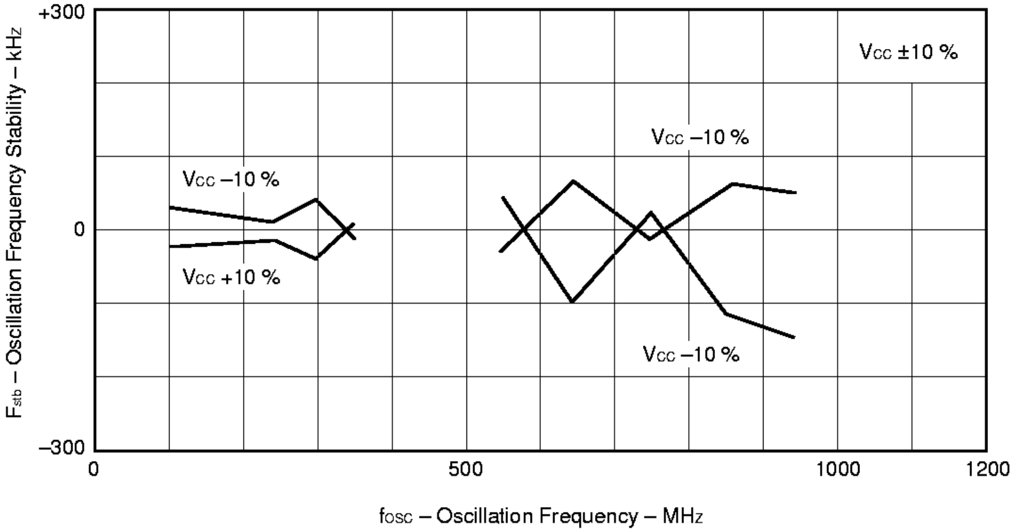
1 % CROSS MODULATION DISTORTION vs. FREQUENCY



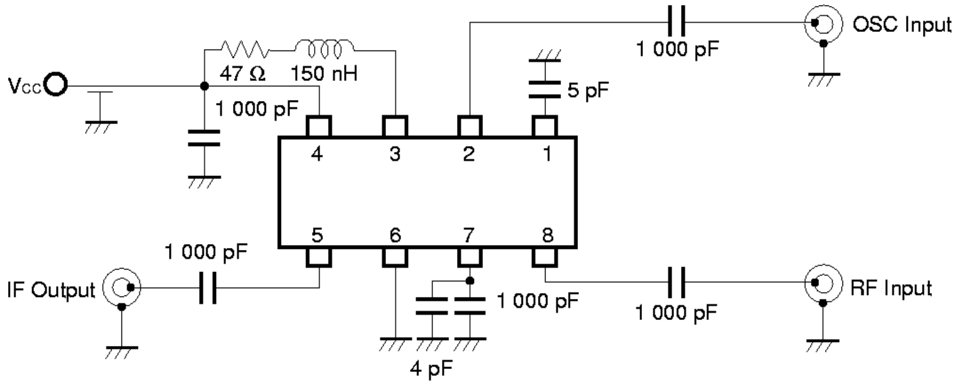
OUTPUT POWER vs. INPUT POWER



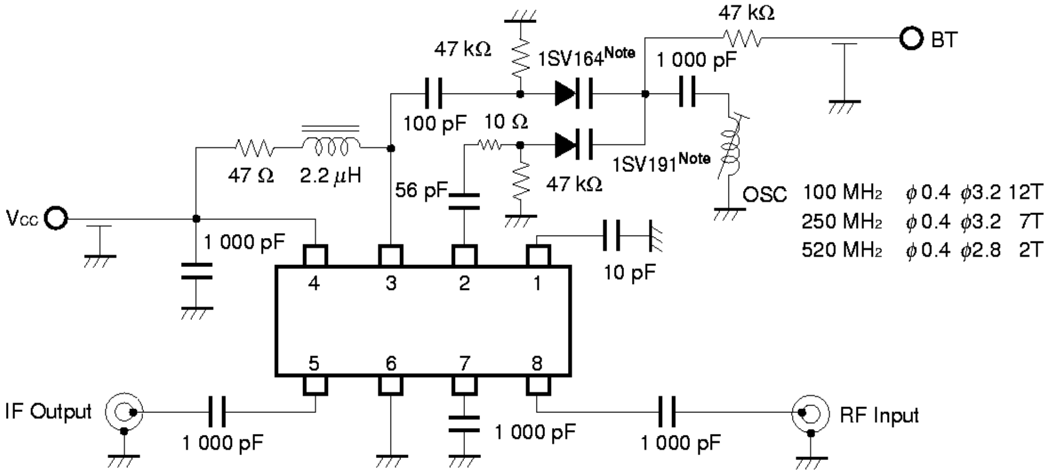
OSC-FREQUENCY STABILITY vs. FREQUENCY



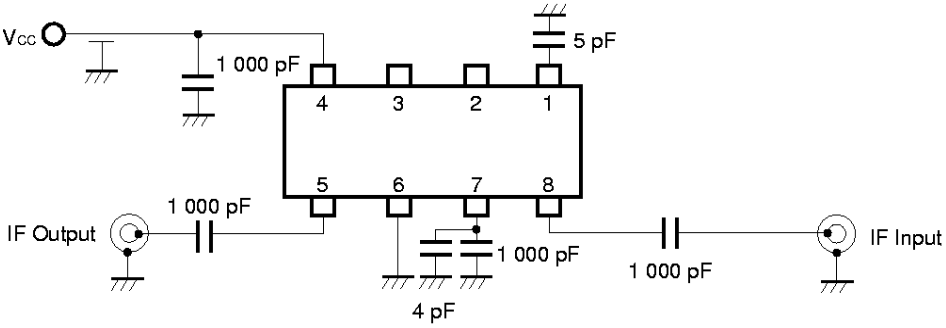
TEST CIRCUIT 1



TEST CIRCUIT 2

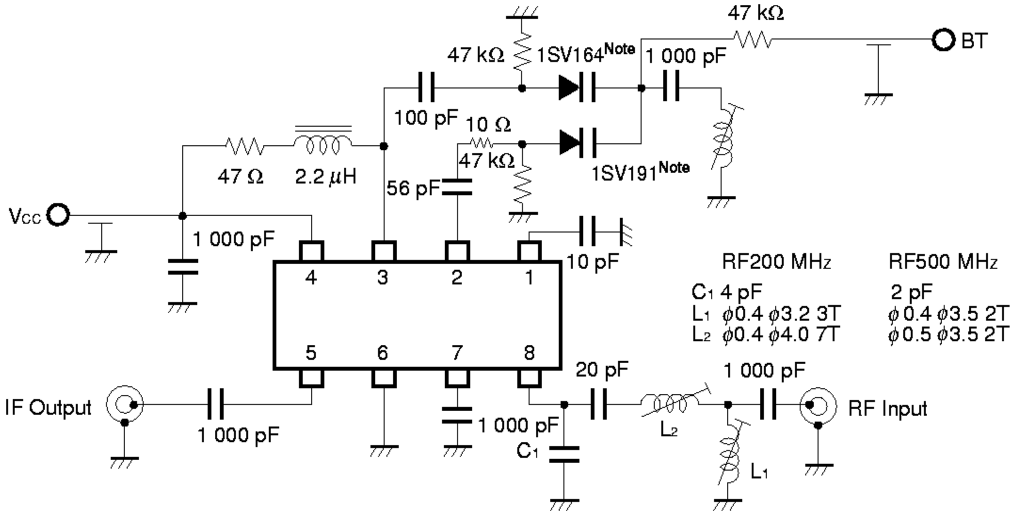


TEST CIRCUIT 3



Note Our varactor diodes are discontinued. For varactor diode, contact other supplier.

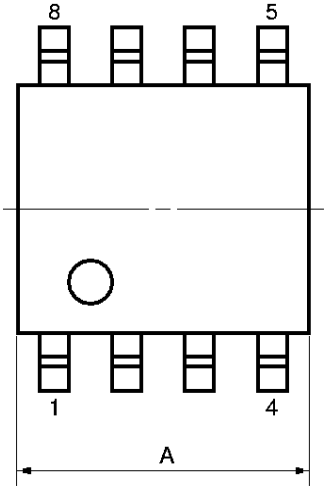
TYPICAL APPLICATION CIRCUIT



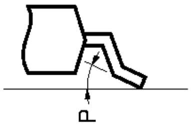
Note Our varactor diodes are discontinued. For varactor diode, contact other supplier.

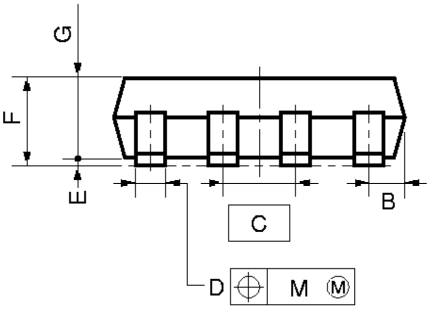
PACKAGE DIMENSIONS

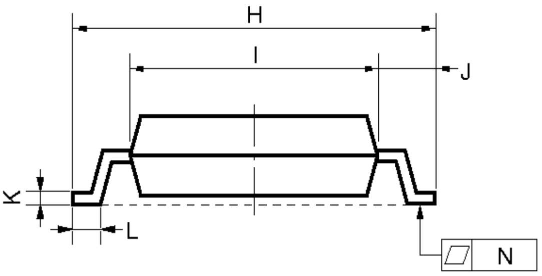
8 PIN PLASTIC SOP (225 mil)



detail of lead end







NOTE

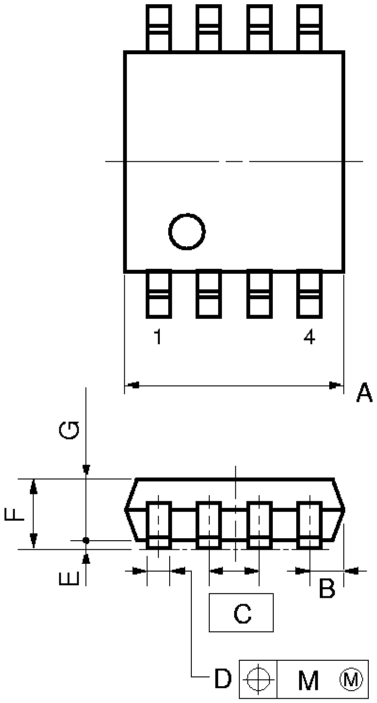
Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

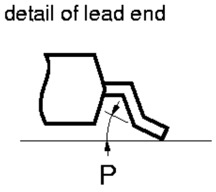
ITEM	MILLIMETERS	INCHES
A	5.37 MAX.	0.212 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	$0.40^{+0.10}_{-0.05}$	$0.016^{+0.004}_{-0.003}$
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071 MAX.
G	1.49	0.059
H	6.5±0.3	0.256±0.012
I	4.4	0.173
J	1.1	0.043
K	$0.15^{+0.10}_{-0.05}$	$0.006^{+0.004}_{-0.002}$
L	0.6±0.2	$0.024^{+0.008}_{-0.009}$
M	0.12	0.005
N	0.10	0.004
P	$3°^{+7°}_{-3°}$	$3°^{+7°}_{-3°}$

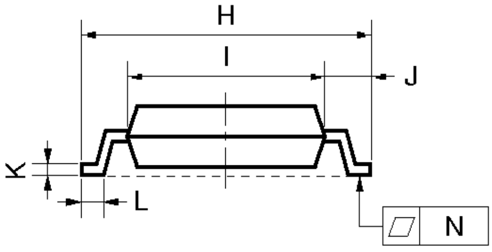
S8GM-50-225B-4

PACKAGE DIMENSIONS

8 PIN PLASTIC SSOP (175 mil)







NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	3.00 MAX.	0.118 MAX.
B	0.575 MAX.	0.023 MAX.
C	0.65 (T.P.)	0.026 (T.P.)
D	$0.3^{+0.10}_{-0.05}$	$0.012^{+0.004}_{-0.002}$
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071 MAX.
G	1.5±0.1	0.060±0.004
H	4.94±0.2	0.195±0.008
I	3.2±0.1	0.126±0.004
J	0.87±0.2	0.034±0.008
K	$0.15^{+0.10}_{-0.05}$	$0.006^{+0.004}_{-0.002}$
L	0.5±0.2	$0.020^{+0.008}_{-0.009}$
M	0.10	0.004
N	0.15	0.006
P	$3^\circ{}^{+7^\circ}_{-3^\circ}$	$3^\circ{}^{+7^\circ}_{-3^\circ}$

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales officers in case other soldering process is used or in case soldering is done under different conditions.

For details of recommended soldering conditions for surface mounting, refer to information document **SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E).**

μPC1686

Soldering Process	Soldering Conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 235 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 3, Exposure limit[Note]: None	IR35-00-3
VPS	Peak package's surface temperature: 215 °C or below, Reflow time: 40 seconds or below (200 °C or higher), Number of reflow process: 3, Exposure limit[Note]: None	VP15-00-3
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or below Number of flow process: 1, Exposure limit[Note]: None	WS60-00-1
Partial heating method	Terminal temperature: 300 °C or below, Flow time: 3 seconds or below, Exposure limit[Note]: None	

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Caution Do not apply more than single process at once, except for "Partial heating method".

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
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Anti-radioactive design is not implemented in this product.

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