NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC667

10-BIT D/A CONVERTER

The μPC667 is high-speed and high-precision 10-bit D/A converter.
Clock rate of the μPC667 is 60 Msps. Conversion precision of the μPC667 is ±1.0 LSB.

FEATURES

- Resolution 10-bit
- Clock rate 60 Msps
- Technology Bi-CMOS
- Power supply +5 V
- D/A conversion method R-2R ladder resistance and segment summing system
- Analog output form Voltage output type
- Built-in reference voltage generating circuit

ORDERING INFORMATION

Part Number	Package
μPC667CT	30-pin plastic shrink DIP (400 mil)

The information in this document is subject to change without notice.

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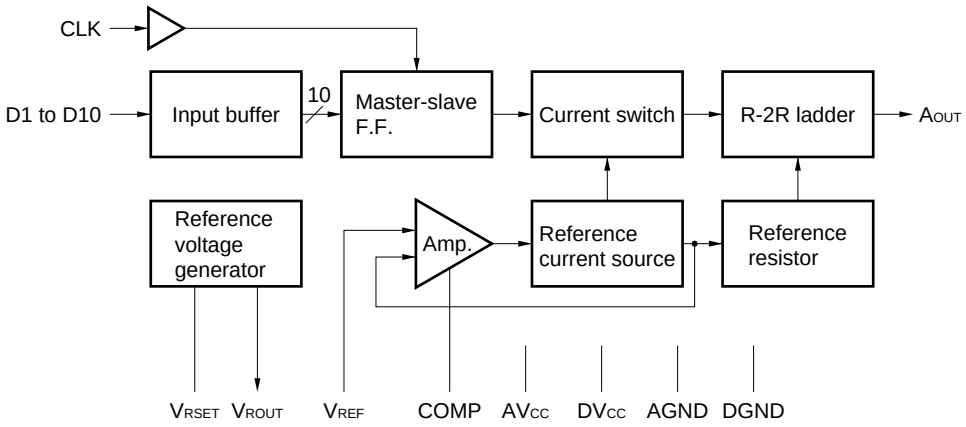
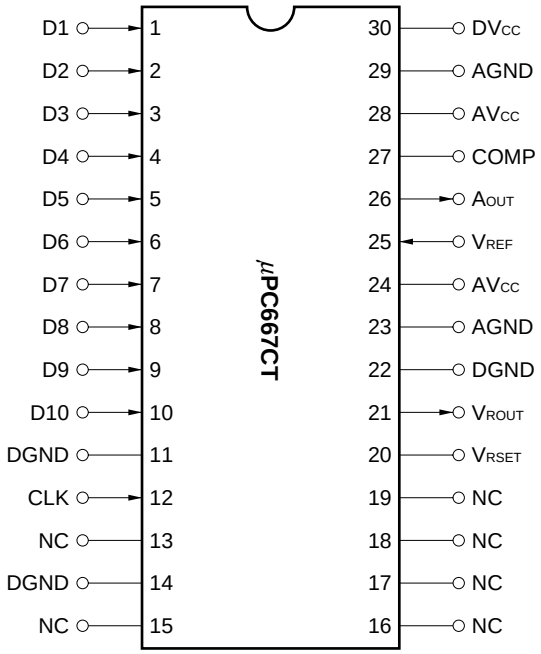
The mark ★ shows major revised points.

BLOCK DIAGRAM

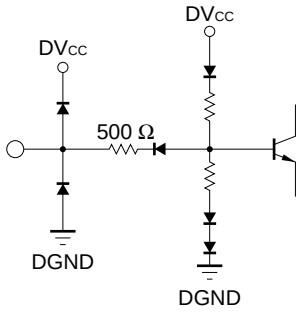
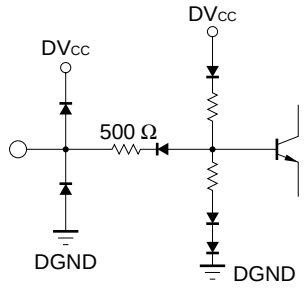
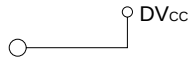
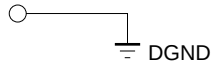
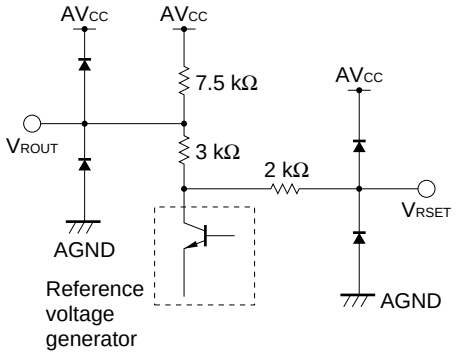


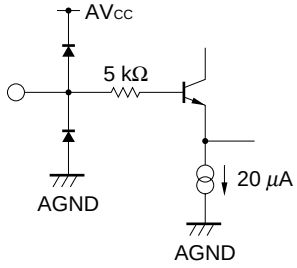
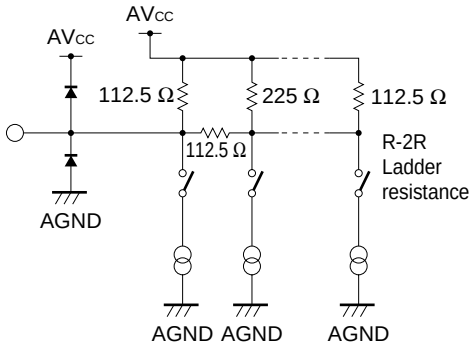
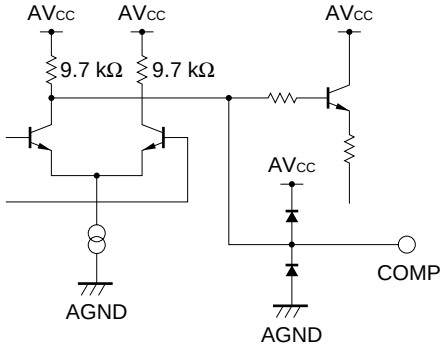
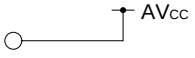
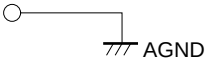
PIN CONFIGURATION (Top View)



AGND	:	Ground for Analog Circuit
A_{OUT}	:	Analog Output
AV_{CC}	:	Power Supply for Analog Circuit
CLK	:	Clock
COMP	:	Phase Compensation
D1 to D10	:	Digital Signal
DGND	:	Ground for Digital Circuit
DV_{CC}	:	Power Supply for Digital Circuit
NC	:	No Connection
V_{REF}	:	Reference Voltage
V_{ROUT}	:	Reference Voltage Output
V_{RSET}	:	Reference Voltage Adjustment

PIN FUNCTIONS

Pin Name	Pin No.	Input/ Output	Function	Equivalent Circuit
D1 to D10	1 to 10	Input	Digital signal D1 is MSB, D10 is LSB.	
CLK	12	Input	Clock The rising edge of signal input to this pin triggers analog output.	
DVCC	30	—	Power supply for digital circuit	
DGND	11, 14, 22	—	Ground for digital circuit	
VRSET	20	—	Reference voltage adjustment Voltage adjusting pin for the incorporated reference voltage generating circuit. The output voltage of VROUT pin varies according to the voltage applied to this pin. When no adjustment is necessary, connect approx. 0.1 μF capacitance between this pin and GND pin.	
VROUT	21	Output	Reference voltage output Voltage output pin of the incorporated reference voltage generating circuit. This pin has high output impedance, and must be connected with a high impedance element.	

Pin Name	Pin No.	Input/ Output	Function	Equivalent Circuit
V_{REF}	25	Input	Reference voltage The output full-scale range is set according to the voltage applied to this pin. Apply standard 4.0 V. When no adjustment is necessary, connect the output from V_{ROUT} pin directly to this pin.	
A_{OUT}	26	Output	Analog signal Analog signal output pin.	
COMP	27	—	Phase compensation Phase compensating capacitor connection pin for full-scale amplifier. Approx. 0.1 μF capacitor must be connected between this pin and AV_{CC} pin.	
AV_{CC}	24, 28	—	Power supply for analog circuit	
AGND	23, 29	—	Ground for analog circuit	
NC	13, 15 to 19	—	No Connection	

ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings (T_A = 25 °C)

Parameter	Symbol	Ratings	Unit
Supply voltage for digital circuit	DV_{CC}	–0.3 to +6.0	V
Input voltage	V_I	–0.3 to V_{CC} +0.3	V
Operating ambient temperature	T_A	–20 to +70	°C
Storage temperature	T_{stg}	–40 to +125	°C
Power dissipation	P_D	0.8 (T_A = +60 °C)	W
Supply voltage for analog circuit	AV_{CC}	DV_{CC} –0.3 to DV_{CC} +0.3	V

★ **Caution Exposure to Absolute Maximum Rating for extended periods may affect device reliability; exceeding the ratings could cause permanent damage. The parameters apply independently.**

Recommended Operating Conditions

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Supply voltage for digital circuit	DV_{CC}		4.75	5.0	5.25	V
Supply voltage for analog circuit	AV_{CC}		4.75	5.0	5.25	V
Reference voltage input pin voltage	V_{REF}		3.8	4.0	4.2	V
High-level voltage of digital input	V_{IH}		2.0			V
Low-level voltage of digital input	V_{IL}				0.8	V
Conversion clock frequency	f_{CLK}				60	MHz
Phase compensation capacitance	C_{COMP}			1.0		μF

DC Characteristics and AC Characteristics (T_A = –10 to +70 °C, DV_{CC} = AV_{CC} = +5 ±0.25 V)

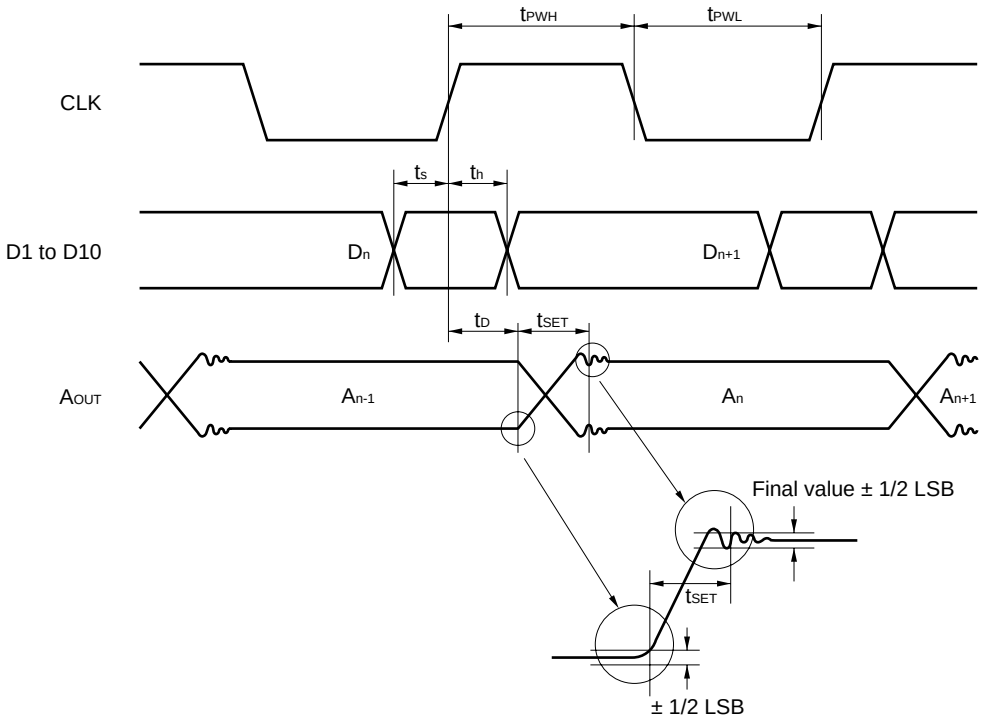
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Resolution	RSL			10		Bit
Integral linearity error	ILE	T_A = 0 to 60 °C, V_{REF} = 4.0 V	–1.0		+1.0	LSB
Differential linearity error	DLE	T_A = 0 to 60 °C, V_{REF} = 4.0 V	–1.0		+1.0	LSB
Supply current	I_{CC}			50	71	mA
Set-up time	t_s			3	7	ns
Hold time	t_h			1.5	7	ns
Settling time	t_{SET}	T_A = 25 °C, R_L = 375 Ω, V_{REF} = 4.0 V		13		ns
Output delay time	t_d	V_{REF} = 4.0 V		9	13	ns
Full-scale voltage output	V_{ofs}	V_{REF} = 4.0 V, R_L > 100 kΩ	4.95		5.0	V
Zero-scale voltage output	V_{ozs}	V_{REF} = 4.0 V, R_L > 100 kΩ	3.95	4	4.05	V
Output resistance	Z_{out}	V_{REF} = 4.0 V	70	85	100	Ω
Internal reference voltage output voltage	V_{ROUT}	AV_{CC} = 5.0 V	3.8	4.0	4.2	V

Cautions 1. As for the phase compensation capacitance, capacitor of 1 μF should be connected between the phase compensation capacitance pin (COMP) and the power supply pin for analog circuit (AV_{CC}).

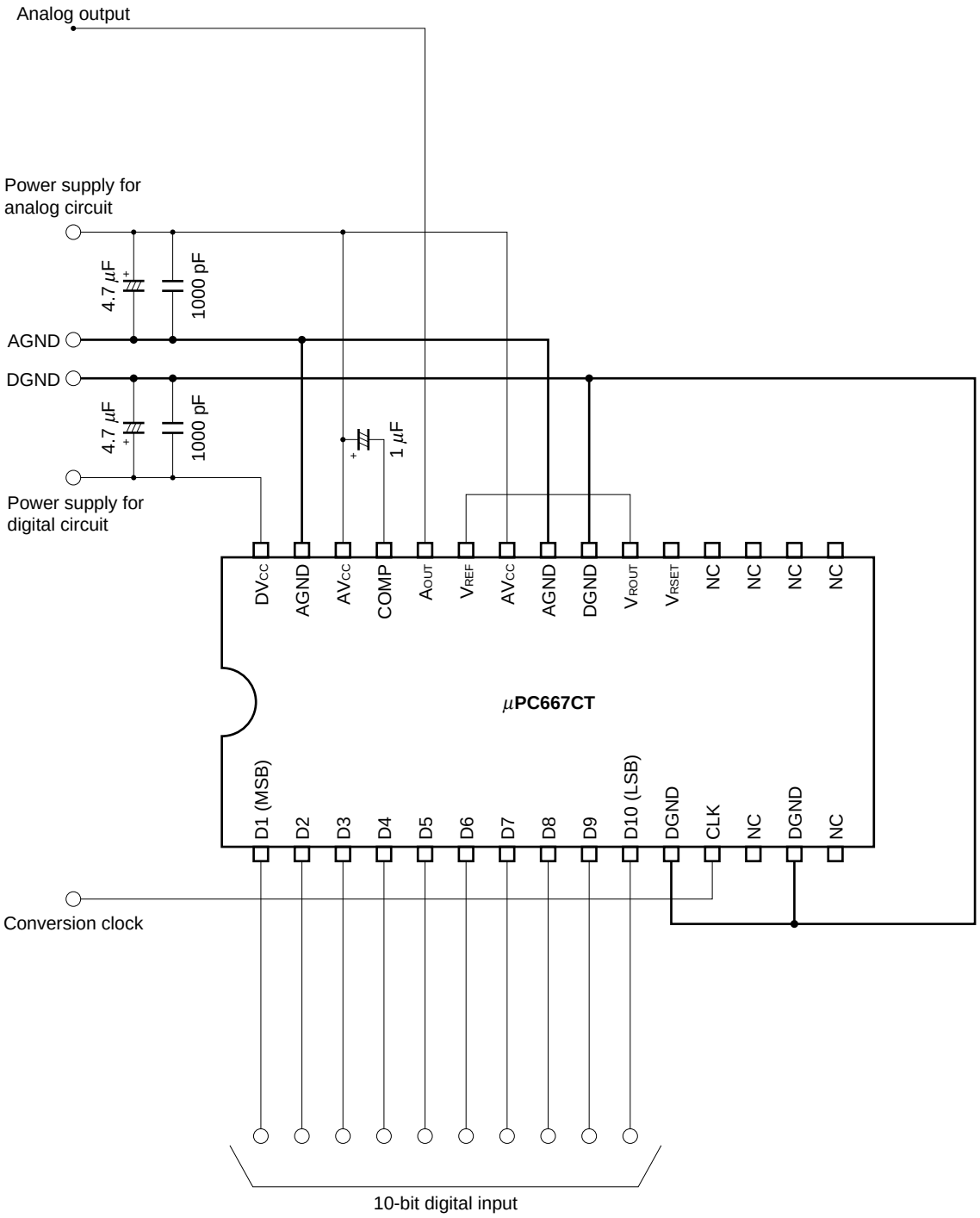
2. The internal reference voltage output pin (V_{ROUT}) and the reference voltage input pin (V_{REF}) should be shorted.

3. The power supply and GND lines for analog circuit (AV_{CC} and AGND) and those for digital circuit (DV_{CC} and DGND) should be located as separately as possible.

★ **Timing Chart**

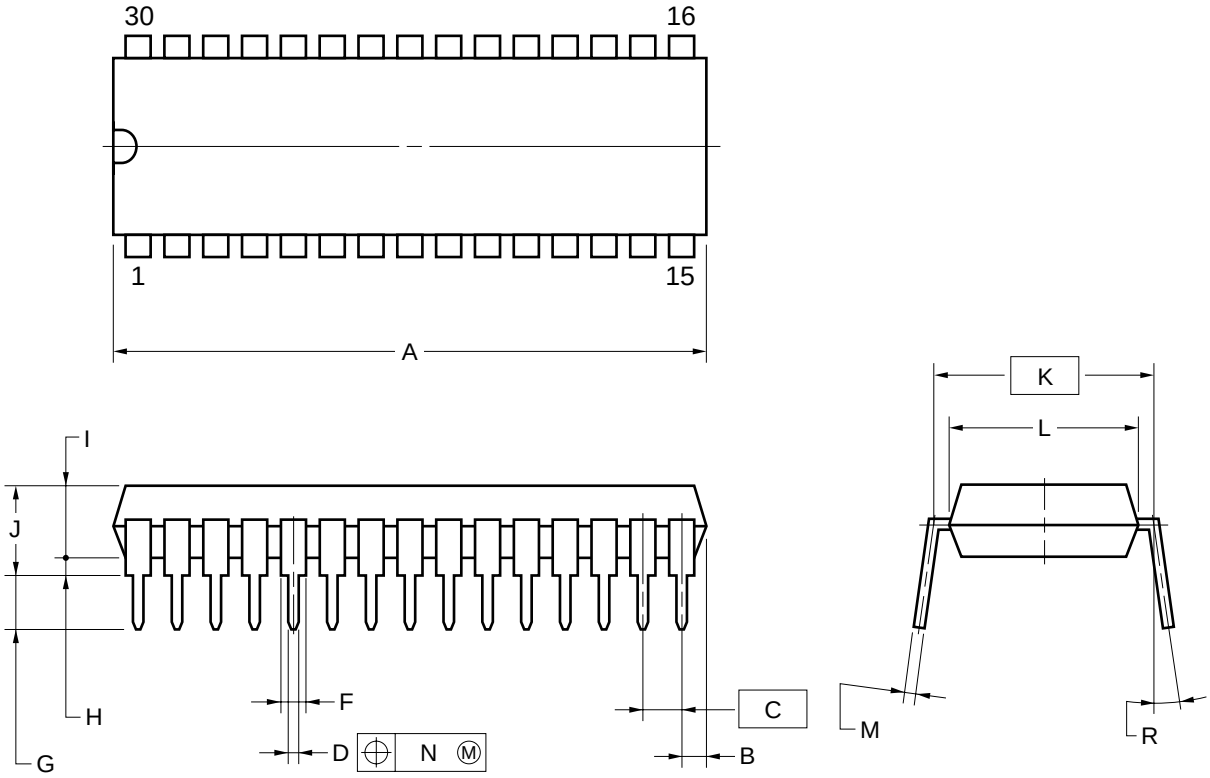


APPLICATION CIRCUIT EXAMPLE



PACKAGE DRAWING

30PIN PLASTIC SHRINK DIP (400 mil)



NOTES

1) Each lead centerline is located within 0.17 mm (0.007 inch) of its true position (T.P.) at maximum material condition.

2) Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS	INCHES
A	28.46 MAX.	1.121 MAX.
B	1.78 MAX.	0.070 MAX.
C	1.778 (T.P.)	0.070 (T.P.)
D	0.50 ± 0.10	$0.020^{+0.004}_{-0.005}$
F	0.85 MIN.	0.033 MIN.
G	3.2 ± 0.3	0.126 ± 0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
K	10.16 (T.P.)	0.400 (T.P.)
L	8.6	0.339
M	$0.25^{+0.10}_{-0.05}$	$0.010^{+0.004}_{-0.003}$
N	0.17	0.007
R	0~15°	0~15°

S30C-70-400B-1

RECOMMENDED SOLDERING CONDITIONS

When soldering this product, it is highly recommended to observe the conditions as shown below. If other soldering processes are used, or if the soldering is performed under different conditions, please make sure to consult with our sales offices.

For more details, refer to our document **"SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (IEI-1207)**.

Through-hole device

μPC667CT: 30-pin plastic Shrink DIP (400 mil)

Process	Conditions
Wave soldering (only to leads)	Solder temperature: 260 °C or below, Flow time: 10 seconds or less.
Partial heating method	Terminal temperature: 300 °C or below, Heat time: 3 seconds or less (Per each lead).

★

Caution For through-hole devices, the wave soldering process must be applied only to leads, and make sure that the package body does not get jet soldered.

[MEMO]

The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

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