

# NE/SE5118/5119

## 8-Bit Microprocessor-Compatible D/A Converter — Current Output

### Linear Products

### Product Specification

#### DESCRIPTION

The NE/SE5118/19 is a high-speed 8-bit digital-to-analog converter subsystem on one monolithic chip. The data inputs have input latches, controlled by a latch enable pin. The data and latch enable inputs are ultralow loading for easy interfacing with all logic systems. The latches appear transparent when the  $\overline{LE}$  input is in the low state. When  $\overline{LE}$  goes high, the input data present at the moment of transition is latched and retained until  $\overline{LE}$  again goes low. This feature allows easy compatibility with most microprocessors.

The chip also comprises a stable voltage reference (5V nominal). The voltage reference may be externally trimmed with a potentiometer for easy adjustment of full-scale, while maintaining a low temperature coefficient.

The output has high voltage compliance, increasing versatility.

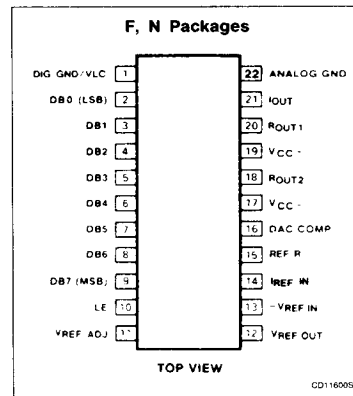
#### FEATURES

- 8-bit resolution
- Input latches
- Low-loading data inputs
- On-chip voltage reference
- Fast settling output current — 200ns
- Accurate to  $\pm \frac{1}{4}LSB$  (0.1%)
- Monotonic to 8 bits
- Reference short-circuit protected
- Compatible with 8086, 6800 and many other microprocessors

#### APPLICATIONS

- Precision 8-BIT D/A converters
- A/D converters
- Programmable power supplies
- Test equipment
- Measuring instruments
- Analog-digital multiplication
- CRT display drivers
- High-speed modems

#### PIN CONFIGURATION



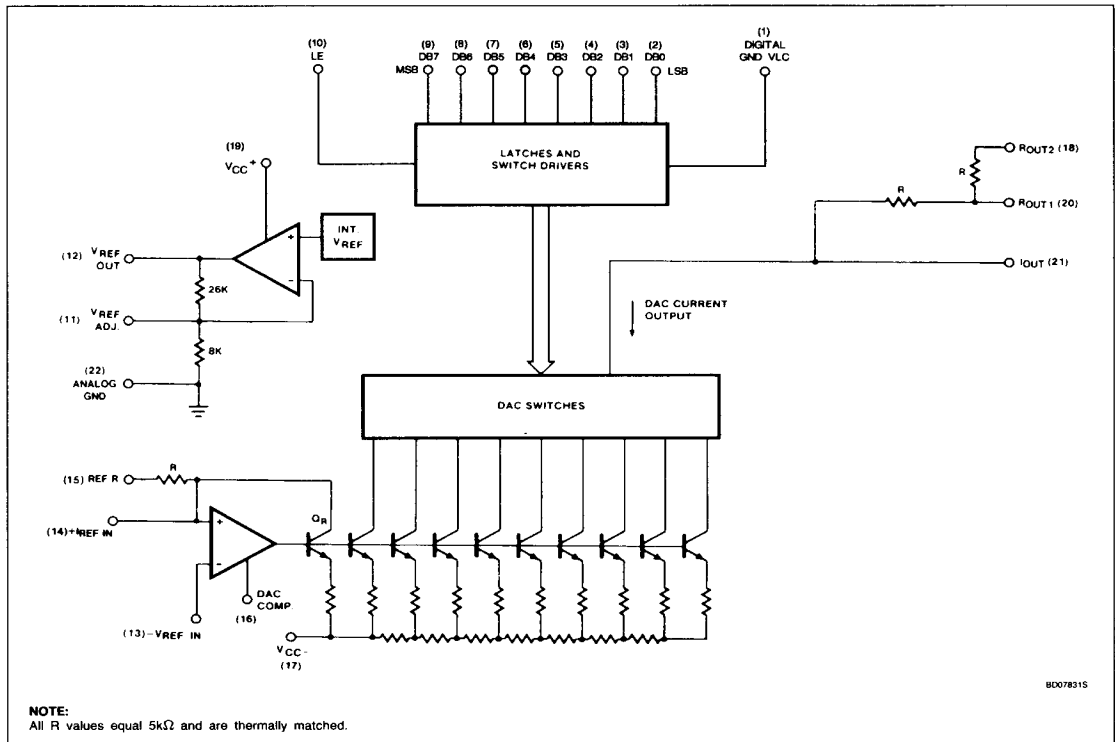
#### ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
22-Pin Plastic DIP	0 to +70°C	NE5119N
22-Pin Ceramic DIP	0 to +70°C	NE5119F
22-Pin Ceramic DIP	-55°C to +125°C	SE5119F

# 8-Bit Microprocessor-Compatible D/A Converter — Current Output

NE/SE5118/5119

## BLOCK DIAGRAM



# 8-Bit Microprocessor-Compatible D/A Converter — Current Output

NE/SE5118/5119

## ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNIT
$V_{CC+}$	Positive supply voltage	18	V
$V_{CC-}$	Negative supply voltage	-18	V
$V_{IN}$	Logic input voltage	0 to 18	V
$V_{REF IN}$	Voltage at $V_{REF IN}$ input	12	V
$V_{REF ADJ}$	Voltage at $V_{REF ADJ}$ adjust	0 to $V_{REF}$	V
$V_{SUM}$	Voltage at sum node	12	V
$I_{REFSC}$	Short-circuit current to ground at $V_{REF OUT}$	Continuous	
$I_{REF IN}$	Reference input current (Pin 14)	3	mA
$P_D$	Maximum power dissipation $T_A = 25^\circ\text{C}$ (still-air) <sup>1</sup> F package N package	1740 2190	mW mW
$T_A$	Operating ambient temperature range SE5119 NE5119	-55 to +125 0 to +70	$^\circ\text{C}$ $^\circ\text{C}$
$T_{STG}$	Storage temperature range	-65 to +150	$^\circ\text{C}$
$T_{SOLD}$	Lead soldering temperature (10sec max)	300	$^\circ\text{C}$

### NOTE:

1. Derate above  $25^\circ\text{C}$ , at the following rates:  
F package at 13.9mW/ $^\circ\text{C}$ .  
N package at 17.5mW/ $^\circ\text{C}$ .

**DC ELECTRICAL CHARACTERISTICS**  $V_{CC+} = +15\text{V}$ ,  $V_{CC-} = -15\text{V}$ , SE5119,  $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ , NE5119.  
 $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ , unless otherwise specified. Typical values are specified at  $25^\circ\text{C}$ .

SYMBOL	PARAMETER	TEST CONDITIONS	NE/SE5118			NE/SE5119			UNIT
			Min	Typ	Max	Min	Typ	Max	
	Resolution		8	8	8	8	8	8	Bits
	Monotonicity		8	8	8	8	8	8	Bits
	Relative accuracy				$\pm 0.1$			$\pm 0.1$	%FS
$V_{CC+}$	Positive supply voltage		11.4	15	16.5	11.4	15	16.5	V
$V_{CC-}$	Negative supply voltage		-11.4	-15	-16.5	-11.4	-15	-16.5	V
$V_{IN(1)}$	Logic "1" input voltage	Pin 1 = 0V	2.0			2.0			V
$V_{IN(0)}$	Logic "0" input voltage	Pin 1 = 0V			0.8			0.8	V
$I_{IN(1)}$	Logic "1" input current	Pin 1 = 0V, $2\text{V} < V_{IN} < 18\text{V}$		0.1	10		0.1	10	$\mu\text{A}$
$I_{IN(0)}$	Logic "0" input current	Pin 1 = 0V, $-5\text{V} < V_{IN} < 0.8\text{V}$		-2.0	-10		-2.0	-10	$\mu\text{A}$
$I_{FS}$	Full-scale output current	Unipolar operation $V_{REF IN} = 5.000\text{V}$ , $T_A = 25^\circ\text{C}$	1.90	1.992	2.10	1.90	1.992	2.10	mA
$I_{ZS}$	Zero-scale current			1			1		$\mu\text{A}$
$V_{REF}$	Reference voltage	$I_{REF} = 1\text{mA}$ , $T_A = 25^\circ\text{C}$	4.9	5.0	5.25	4.9	5.0	5.25	V
$PSR^+(\text{OUT})$	Output power supply rejection (+)	$V_- = -15\text{V}$ , $13.5\text{V} \leq V_+ \leq 16.5\text{V}$ external $V_{REF IN} = 5.000\text{V}$		0.001	0.01		0.001	0.01	%FS/ %VS

# 8-Bit Microprocessor-Compatible D/A Converter — Current Output

NE/SE5118/5119

**DC ELECTRICAL CHARACTERISTICS (Continued)**  $V_{CC+} = +15V$ ,  $V_{CC-} = -15V$ , SE5119,  $-55^{\circ}C \leq T_A \leq 125^{\circ}C$ , NE5119,  $0^{\circ}C \leq T_A \leq 70^{\circ}C$ , unless otherwise specified. Typical values are specified at  $25^{\circ}C$ .

SYMBOL	PARAMETER	TEST CONDITIONS	NE/SE5118			NE/SE5119			UNIT
			Min	Typ	Max	Min	Typ	Max	
RSR <sub>(OUT)</sub>	Output power supply rejection (–)	$V+ = 15V$ , $-13.5V \leq V- \leq -16.5V$ external $V_{REF IN} = 5.000V$		0.001	0.01		0.001	0.01	%FS/ %VS
TC <sub>FS</sub>	Full-scale temperature coefficient	$V_{REF IN} = 5.000V$ (Pin 15)		20			20		ppm/ $^{\circ}C$
TC <sub>ZS</sub>	Zero-scale temperature coefficient	$I_{REF IN} = 1.00mA$ (Pin 14)		5			5		ppm/ $^{\circ}C$
$I_{REF}$	Reference output current	$T_A = 25^{\circ}C$			3			3	mA
$I_{REFSC}$	Reference short circuit current <sup>1</sup>	$V_{REF OUT} = 0V$		15	30		15	30	mA
PSR <sub>+(REF)</sub>	Reference power supply rejection (+)	$V- = -15V$ , $13.5V \leq V+ \leq 16.5V$ , $I_{REF} = 1.0mA$		0.003	0.01		0.003	0.01	%VR/ %VS
PSR <sub>-(REF)</sub>	Reference power supply rejection (–)	$V+ = 15V$ , $-13.5V \leq V- \leq -16.5V$ , $I_{REF} = 1.0mA$		0.003	0.01		0.003	0.01	%VR/ %VS
TC <sub>REF</sub>	Reference voltage temperature coefficient	$I_{REF} = 1.0mA$		60			60		ppm/ $^{\circ}C$
Z <sub>IN</sub>	DAC R <sub>REF IN</sub> input impedance			5.0			5.0		k $\Omega$
$I_{CC+}$	Positive supply current	$V_{CC+} = 15V$		7	14		7	14	mA
$I_{CC-}$	Negative supply current	$V_{CC-} = -15V$		–10	–15		–10	–15	mA
P <sub>D</sub>	Power dissipation	$I_{REF} = 1.0mA$ , $V_{CC} = \pm 15V$		255	435		255	435	mW

**NOTE:**

1. For reference currents  $> 3mA$ , use of an external buffer is required.

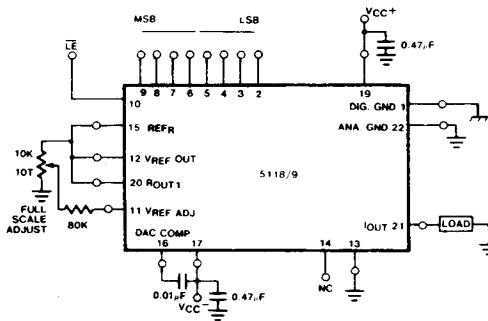
**AC ELECTRICAL CHARACTERISTICS**  $V_{CC} = \pm 15V$ ,  $T_A = 25^{\circ}C$ , unless otherwise specified.

SYMBOL	PARAMETER	TO	FROM	TEST CONDITIONS	NE/SE5118/19			UNIT
					Min	Typ	Max	
t <sub>SLH</sub>	Settling time	$\pm 1/2$ LSB	Input	All bits Low-to-High		200		ns
t <sub>SHL</sub>	Settling time	$\pm 1/2$ LSB	Input	All bits High-to-Low		200		ns
t <sub>PLH</sub>	Propagation delay	Output	Input	All bits switched Low-to-High		60		ns
t <sub>PHL</sub>	Propagation delay	Output	Input	All bits switched High-to-Low		60		ns
t <sub>PLSB</sub>	Propagation delay	Output	Input	1 LSB change		60		ns
t <sub>PLH</sub>	Propagation delay	Output	$\overline{LE}$	Low-to-High transition		60		ns
t <sub>PHL</sub>	Propagation delay	Output	$\overline{LE}$	High-to-Low transition		60		ns
t <sub>S</sub>	Setup time	$\overline{LE}$	Input		100			ns
t <sub>H</sub>	Hold time	Input	$\overline{LE}$		50			ns
t <sub>PW</sub>	Latch enable pulse width				150			ns

# 8-Bit Microprocessor-Compatible D/A Converter — Current Output

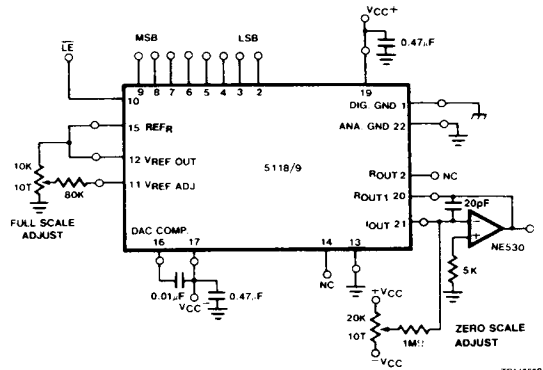
NE/SE5118/5119

## TYPICAL APPLICATIONS



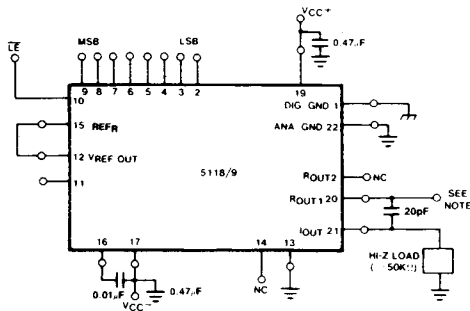
TC146405

Bipolar Output Operation (-1mA to +1mA)

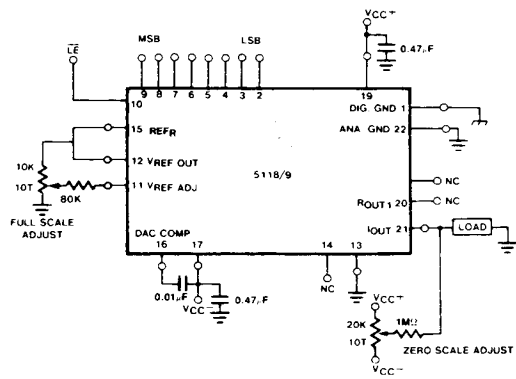


TC146505

Unipolar Voltage Output (0 to +10V)



TC147005



TC146705

### NOTE:

DATA INPUT CODE	VOLTAGE OUTPUT (PIN 21)	
0 0 0 0 0 0 0 0	+10V	0V
1 1 1 1 1 1 1 1	0V	-10V
	Pin 20 tied to +10V	Pin 20 tied to 0V

Fast Voltage Output

Basic Unipolar Current Output (0 to -2mA)