8-BIT μP-COMPATIBLE D/A CONVERTER—CURRENT OUTPUT SE/NE5118

DESCRIPTION

The NE5118 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 ultra-low 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 co-efficient.

The output has high voltage compliance increasing versatility.

FEATURES

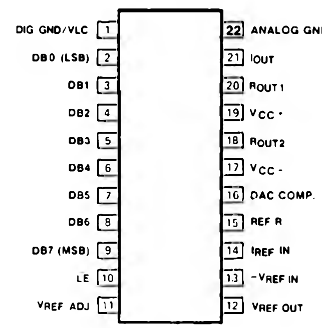
- 8-bit resolution
- Input latches
- Low-loading data inputs
- On-chip voltage reference
- Fast settling output current—200ns
- Accurate to ± 1/2 LSB (.19%)
- Monotonic to 8 bits
- Reference short-circuit protected
- Compatible with 8086, 6800 and many other μP's

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

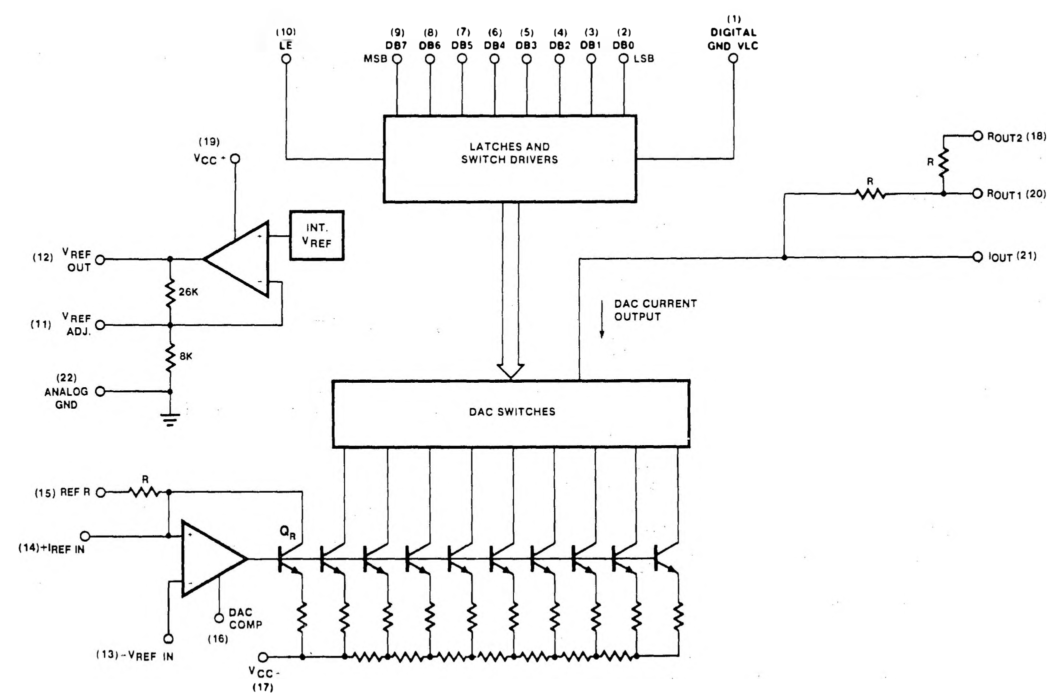
F,N PACKAGE



TOP VIEW

ORDER NUMBERS
NE5118F SE5118F
NE5118N

BLOCK DIAGRAM



All R values equal 5kΩ and are thermally matched.

Figure 1

8-BIT μP-COMPATIBLE D/A CONVERTER—CURRENT OUTPUT SE/NE5118

ABSOLUTE MAXIMUM RATINGS

	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 R_{REF} input	12	V
$V_{REF}ADJ$	Voltage at V_{REF} 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_{REFIN}	Reference input current (Pin 14)	3	mA
P_D	Power dissipation*		
	-N package	800	mW
	-F package	1000	mW
T_A	Operating temperature range		
	SE5118	−55 to +125	°C
	NE5118	0 to +70	°C
T_{STG}	Storage temperature range	−65 to +150	°C
T_{SOLD}	Lead soldering temperature (10 seconds)	300	°C

*NOTES

For N package, derate at 120°C/W above 35°C

For F package, derate at 75° C/W above 75°C

DC ELECTRICAL CHARACTERISTICS

$V_{CC}+ = +15V$, $V_{CC}- = -15V$, SE5118, $-55°C \leq T_A \leq 125°C$, NE5118, $0°C \leq T_A \leq 70°C$ unless otherwise specified. Typical values are specified at 25°C

	PARAMETER	TEST CONDITIONS	SE5118 Min	SE5118 Typ	SE5118 Max	NE5118 Min	NE5118 Typ	NE5118 Max	UNIT
	Resolution		8	8	8	8	8	8	Bits
	Monotonicity		8	8	8	8	8	8	Bits
	Relative accuracy				±0.19			±0.19	%FS
$V_{CC}+$	Positive supply voltage		11.4	15		11.4	15		V
$V_{CC}-$	Negative supply voltage		−11.4	−15		−11.4	−15		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, $2V<V_{IN}<18V$		0.1	10		0.1	10	μA
$I_{IN(0)}$	Logic "0" input current	Pin 1 = 0V, $-5V<V_{IN}<0.8V$		−2.0	−10		−2.0	−10	μA
I_{FS}	Full scale output current	Unipolar operation $V_{REF\ IN} = 5.000V$, $T_A = 25°C$	1.90	1.992	2.10	1.90	1.992	2.10	mA
I_{ZS}	Zero scale current		-6	1	+6	-6	1	+6	μA
V_{REF}	Reference voltage	$I_{REF} = 1mA$, $T_A = 25°C$	4.9	5.0	5.25	4.9	5.0	5.25	V
$PSR+_{(out)}$	Output power supply rejection (+)	$V- = -15V$, $13.5V \leq V+ \leq 16.5V$, external $V_{REF\ IN} = 5.000V$		.001	.01		.001	.01	%FS/%VS
$PSR-_{(out)}$	Output power supply rejection (−)	$V+ = 15V$, $-13.5V \leq V- \leq -16.5V$, external $V_{REF\ IN} = 5.000V$		.001	.01.		.001	.01	%FS/%VS
TC_{FS}	Full scale temperature coefficient	$V_{REFIN} = 5.000V$[1]		20			20		ppm/°C
TC_{ZS}	Zero scale temperature coefficient	$I_{REFIN} = 1.00mA$[2]		5			5		ppm/°C

NOTES

1. This is for voltage out only. See Unipolar Voltage Output schematic.
2. This is for current output mode.

DC ELECTRICAL CHARACTERISTICS (Cont'd) $V_{CC}+ = +15V$, $V_{CC}- = -15V$, SE5118, $-55°C \leq T_A \leq 125°C$, NE5118, $0°C \leq T_A \leq 70°C$ unless otherwise specified. Typical values are specified at 25°C

PARAMETER		TEST CONDITIONS	SE5118			NE5118			UNIT
			Min	Typ	Max	Min	Typ	Max	
I_{REF}	Reference output current	Note 1			3			3	mA
I_{REFSC}	Reference short circuit current	$T_A = 25°C$, $V_{REF\ OUT} = 0V$		15	30		15	30	mA
$PSR+_{(REF)}$	Reference power supply rejection (+)	$V- = -15V$, $13.5V \leq V+ \leq 16.5V$, $I_{REF} = 1.0mA$		.003	.01		.003	.01	%VR/ %VS
$PSR-_{(REF)}$	Reference power supply rejection (−)	$V+ = 15V$, $-13.5V \leq V- \leq 16.5V$, $I_{REF} = 1.0mA$		.003	.01		.003	.01	%VR/ %VS
TC_{REF}	Reference voltage temperature coefficient	$I_{REF} = 1.0mA$		60			60		ppm/°C
Z_{IN}	DAC $R_{REF}IN$ input impedance			5.0			5.0		kΩ
$I_{CC}+$	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_D	Power dissipation	$I_{REF} = 1.0mA$, $V_{CC} = \pm 15V$		255	435		255	435	mW

AC ELECTRICAL CHARACTERISTICS $V_{CC} = \pm 15V$, $T_A = 25°C$

PARAMETER		TO	FROM	TEST CONDITIONS	SE/NE5118			UNIT
					Min	Typ	Max	
T_{SLH}	Settling time	± ½ LSB	Input	All bits Low-to-high		200		ns
T_{SHL}	Settling time	± ½ LSB	Input	All bits High-to-low		200		ns
t_{PLH}	Propagation delay	Output	Input	All bits switched Low-to-high		60		ns
t_{PHL}	Propagation delay	Output	Input	All bits switched High-to-low		60		ns
t_{PLSB}	Propagation delay	Output	Input	1 LSB change		60		ns
t_{PLH}	Propagation delay	Output	$\overline{LE}$	Low-to-high transition		60		ns
t_{PHL}	Propagation delay	Output	$\overline{LE}$	High-to-low transition		60		ns
t_s	Set-up time	$\overline{LE}$	Input		100			ns
t_h	Hold time	Input	$\overline{LE}$		50			ns
t_{pw}	Latch enable pulse width				150			ns

NOTES

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

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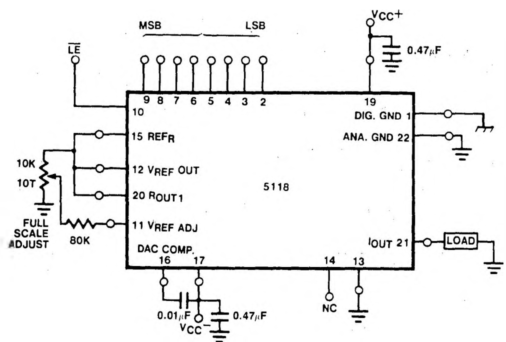
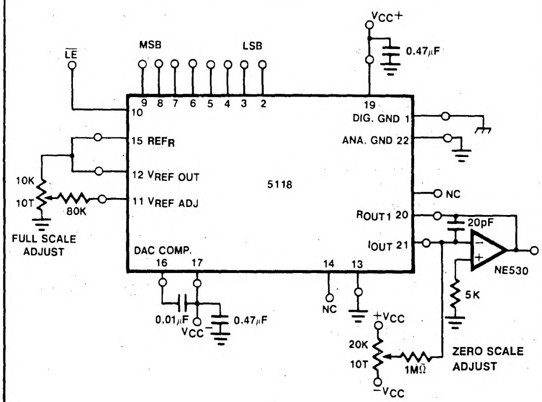
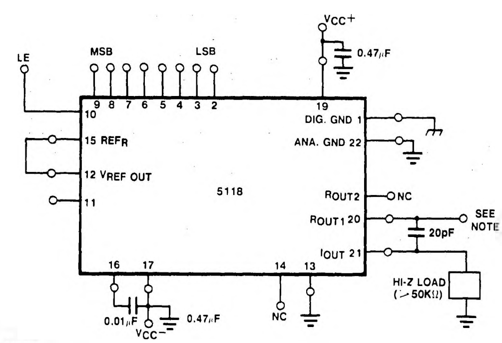
BIPOLAR OUTPUT OPERATION (−1mA TO +1mA)



UNIPOLAR VOLTAGE OUTPUT (0 →+10V)



FAST VOLTAGE OUTPUT



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

BASIC UNIPOLAR CURRENT OUTPUT (0 →−2mA)