Octal line driver

NE5170

DESCRIPTION

The NE5170 is an octal line driver which is designed for digital communications with data rates up to 100kb/s. This device meets all the requirements of EIA standards RS-232C/RS-423A and CCITT recommendations V.10/X.26. Three programmable features:

(1) output slew rate, (2) output voltage level, and (3) three-state control (high-impedance) are provided so that output characteristics may be modified to meet the requirements of specific applications.
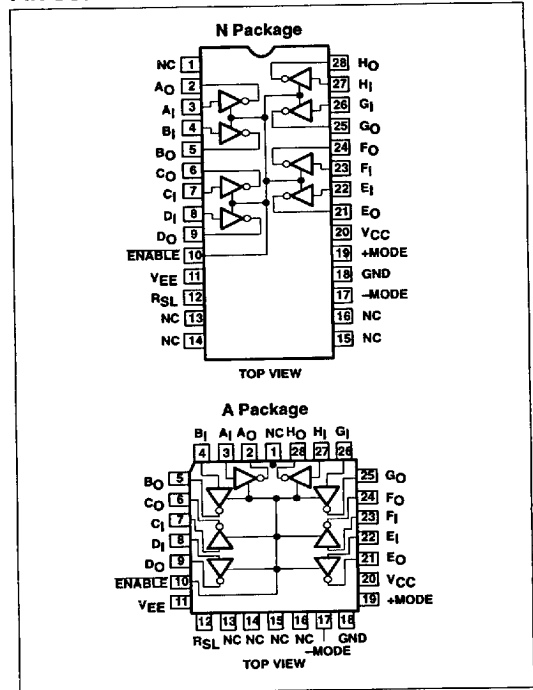
FEATURES

- Meets EIA RS-232C/423A and CCITT V.10/X.26
- Simple slew rate programming with a single external resistor
- 0.1 to 10V/μs slew rate range
- High/low programmable voltage output modes
- TTL compatible inputs

APPLICATIONS

- High-speed modems
- High-speed parallel communications
- Computer I/O ports
- Logic level translation

PIN CONFIGURATION

FUNCTION TABLE

ENABLE	Logic Input	OUTPUT VOLTAGE (V)		
		RS-423A[1]	RS-232C	
			Low Output Mode[1]	High Output Mode[2]
L	L	5 to 6V	5 to 6V	$\geq$ 9V
L	H	−5 to 6V	−5 to 6V	$\leq$ −9V
H	X	High-Z	High-Z	High-Z

NOTES:
1. V_{CC} = +10V and V_{EE} = −10V; R_L = 3kΩ
2. V_{CC} = +12V and V_{EE} = −12V; R_L = 3kΩ

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
28-Pin Plastic Dual In-Line (DIP) Package	0 to +70°C	NE5170N	0408B
28-Pin Plastic Lead Chip Carrier (PLCC) Package	0 to +70°C	NE5170A	0401F

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ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage and + MODE	15	V
V_{EE}	Supply voltage and − MODE	−15	V
I_{OUT}	Output current[1]	±150	mA
V_{IN}	Input voltage ($\overline{\text{Enable}}$, Data)	−1.5 to +7	V
V_{OUT}	Output voltage[2]	±15	V
	Minimum slew resistor[3]	1	kΩ
P_D	Power dissipation	1200	mW

NOTES:
1. Maximum current per driver. Do not exceed maximum power dissipation if more than one output is on.
2. High impedance mode.
3. Minimum value of the resistor used to set the slew rate.

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 10V ±10%; V_{EE} = −10V ±10%; ±MODES = 0V; R_{SL} = 2kΩ, 0°C ≤ T_A ≤ 70°C, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS		UNIT
			Min	Max	
V_{OH}	Output high voltage	V_{IN} = 0.8V, R_L = 3kΩ[2]	5	6	V
		R_L = 450Ω[2]	4.5	6	
		R_L = 3kΩ[3], C_L = 2500pF	V_{CC}−3		
V_{OL}	Output low voltage	V_{IN} = 2.0V, R_L = 3kΩ[2]	−6	−5	V
		R_L = 450Ω[2]	−6	−4.5	
		R_L = 3kΩ[3], C_L = 2500pF		V_{EE}+3	
V_{OU}	Output unbalance voltage	V_{CC} = |V_{EE}|, R_L = 450Ω[2]		0.4	V
I_{CEX}	Output leakage current	|V_O| = 6V, ENABLE = 2V or V_{CC} = V_{EE} = 0V	−100	100	µA
V_{IH}	Input high voltage		2.0		V
V_{IL}	Input low voltage			0.8	V
I_{IL}	Logic "0" input current	V_{IN} = 0.4V	−400	0	µA
I_{IH}	Logic "1" input current	V_{IN} = 2.4V	0	40	µA
I_{OS}	Output short circuit current[1]	V_O = 0V	−150	150	mA
V_{CL}	Input clamp voltage	I_{IN} = −15mA	−1.5		V
I_{CC}	Supply current	NO LOAD		35	mA
I_{EE}		NO LOAD	−45		mA

NOTES:
1. Maximum current per driver. Do not exceed maximum power dissipation if more than one output is on.
2. V_{OH}, V_{OL} at R_L = 450Ω will be ≥ 90% of V_{OH}, V_{OL} at R_L = ∞.
3. High Output Mode; +MODE pin = V_{CC}; −MODE pin = V_{EE}; 9V ≤ V_{CC} ≤ 13V; −9V ≥ V_{EE} ≥ −13V.

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AC ELECTRICAL CHARACTERISTICS

$V_{CC} = +10V$; $V_{EE} = -10V$; Mode = GND, $0°C \leq T_A \leq 70°C$

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS		UNIT
			Min	Max	
t_{PLZ}	Propagation delay output high to high impedance	$R_L = 450$, $C_L = 50pF$ or $R_L = 3k$, $C_L = 2500pF$		5	µs
t_{PLZ}	Propagation delay output low to high impedance	$R_L = 450$, $C_L = 50pF$ or $R_L = 3k$, $C_L = 2500pF$		5	µs
t_{PZH}	Propagation delay high impedance to high output	$R_{SL} = 200k$ $R_L = 450$, $C_L = 50pF$ or $R_L = 3k$, $C_L = 2500pF$		150	µs
t_{PZL}	Propagation delay high impedance to low output	$R_{SL} = 200k$ $R_L = 450$, $C_L = 50pF$ or $R_L = 3k$, $C_L = 2500pF$		150	µs
SR	Output slew rate	$R_{SL} = 2k$	8	12	V/µs
		$R_{SL} = 20k$	0.8	1.2	
		$R_{SL} = 200k$	0.06	0.14	

NOTE:
SR: Load condition. (A) For $R_{SL} < 4k\Omega$ use $R_L = 450\Omega$; $C_L = 50pF$; (B) for $R_{SL} > 4k\Omega$ use either $R_L = 450\Omega$, $C_L = 50pF$ or $R_L = 3k\Omega$, $C_L = 2500pF$.

AC PARAMETER TEST CIRCUIT AND WAVEFORMS

NOTES:
1. See AC electrical characteristics table for values of R_{SL}, R_L and C_L.
2. V_{IN} pulse. Frequency = 1kHz, duty cycle = 50%, $Z_{OUT} = 50\Omega$, $t_r = t_f \leq 10ns$.

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SLEW RATE PROGRAMMING

Slew rate for the NE5170 is set using a single external resistor connected between the R_{SL} pin and ground. Adjustment is made according to the formula:

$$R_{SL} \text{ (in k}\Omega) = \frac{20}{\text{Slew Rate}}$$

where the slew rate is in V/µs. The slew resistor can vary between 2 and 200kΩ which gives a slew rate range of 10 to 0.1V/µs. This adjustment of the slew rate allows tailoring output characteristics to recommendations for cable length and data rate found in EIA standard RS–423A. Approximations for cable length and data rate are given by:

Max. data rate (in kb/s) = 300/t

Cable length (in feet) = 100×t

where t is the rise time in microseconds. The absolute maximum data rate is 100kb/s and the absolute maximum cable length is 4000 feet.

OUTPUT MODE PROGRAMMING

The NE5170 has two programmable output modes which provide different output voltage levels. The low output mode meets the specifications of EIA standards RS–423A and RS–232C. The high output mode meets the specifications of RS–232C only, since higher output voltages result from programming this mode. The high output mode provides the greater output voltages where higher attenuation levels must be tolerated. Programming the high output mode is accomplished by connecting the +MODE pin to V_{CC} and the –MODE pin to V_{EE}. The low output mode results when both of these pins are connected to ground.
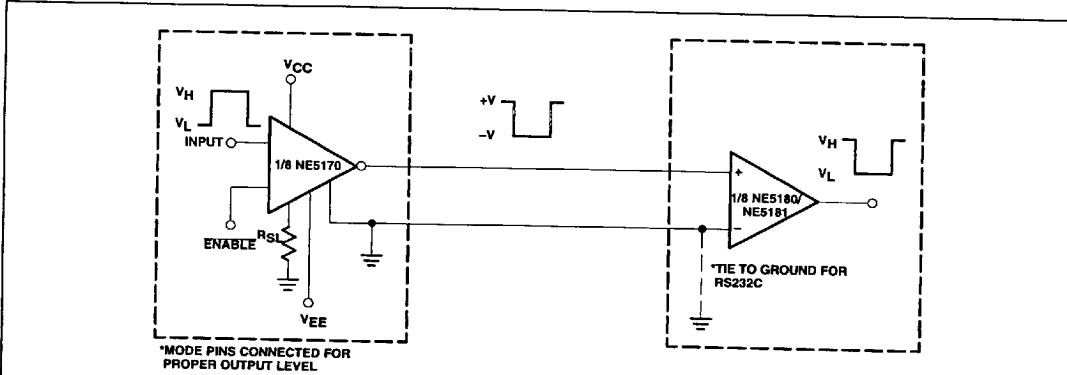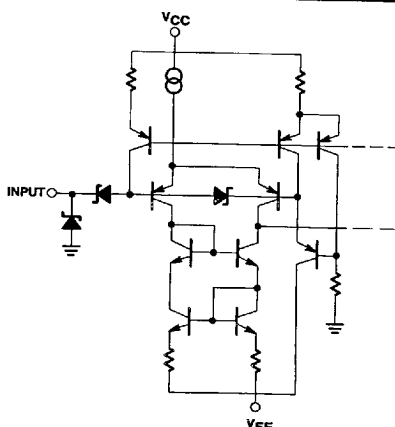
APPLICATION

Figure 1. RS-232C/RS-423A Data Transmission
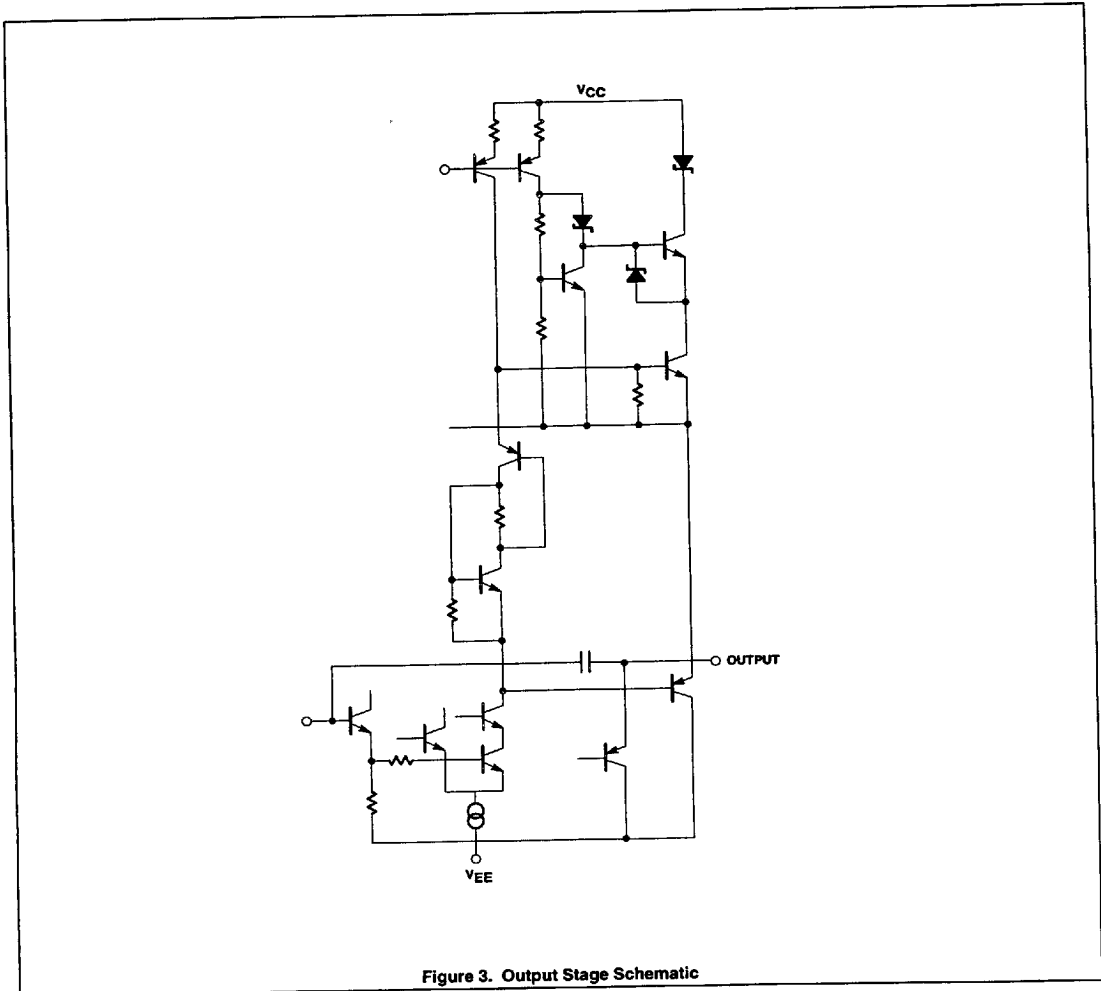

Figure 2. Input Stage Schematic

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Figure 3. Output Stage Schematic

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Figure 4. Typical I_{CC} and I_{EE} vs Supply Voltages

Figure 7. Typical −MODE Current vs −MODE Voltage

Figure 10. Typical Output Low Voltage vs Temperature

Figure 5. Typical Input Current vs Input Voltage

Figure 8. Typical Output Low Voltage vs Load Current

Figure 11. Typical Output High Voltage vs Temperature

Figure 6. Typical +MODE Current vs +MODE Voltage

Figure 9. Typical Output High Voltage vs Load Current

Figure 12. Typical Slew Rate vs R_{SL}

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