SLASO38 – D2234, JUNE 1976 — REVISED SEPTEMBER 1986

- **Functionally Interchangeable With Siliconix DG182, DG185, DG188, DG191 With Same Terminal Assignments**
- **Monolithic Construction**
- **Adjustable Reference Voltage**
- **JFET Inputs**
- **Uniform On–State Resistance for Minimum Signal Distortion**
- **±10-V Analog Voltage Range**
- **TTL, MOS, and CMOS Logic Control Compatibility**

description

The TL182, TL185, TL188, and TL191 are monolithic high-speed analog switches using Bi-MOS technology. They comprise JFET-input buffers, level translators, and output JFET switches. The TL182 switches are SPST; the TL185 switches are DPST. The TL188 is a pair of complementary SPST switches as is each half of the TL191.

A high level at a control input of the TL182 turns the associated switch off. A high level at a control input of the TL185 turns the associated switch on. For the TL188, a high level at the control input turns the associated switches S1 on and S2 off.

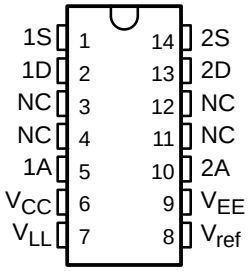
The threshold of the input buffer is determined by the voltage applied to the reference input (V_{ref}). The input threshold is related to the reference input by the equation $V_{th} = V_{ref} + 1.4$ V. Thus, for TTL compatibility, the V_{ref} input is connected to ground. The JFET input makes the device compatible with bipolar, MOD, and CMOS logic families. Threshold compatibility may, again, be determined by $V_{th} = V_{ref} + 1.4$ V.

The output switches are junction field-effect transistors featuring low on-state resistance and high off-state resistance. The monolithic structure ensures uniform matching.

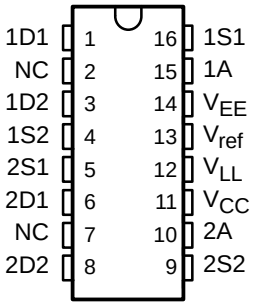
BI-MOS technology is a major breakthrough in linear integrated circuit processing. BI-MOS can have ion-implanted JFETs, p-channel MOS-FETs, plus the usual bipolar components all on the same chip. BI-MOS provides for monolithic circuit designs that previously have been available only as expensive hybrids.

C-suffix devices are characterized for operation from 0°C to 70°C, I-suffix devices are characterized for operation from –25°C to 85°C and M-suffix devices are characterized for operation over the full military temperature range of –55°C to 125°C.

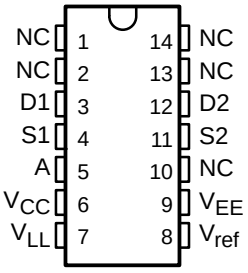
TL182 . . . N PACKAGE
(TOP VIEW)



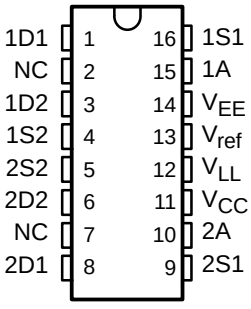
TL185 . . . N PACKAGE
(TOP VIEW)



TL188 . . . N PACKAGE
(TOP VIEW)



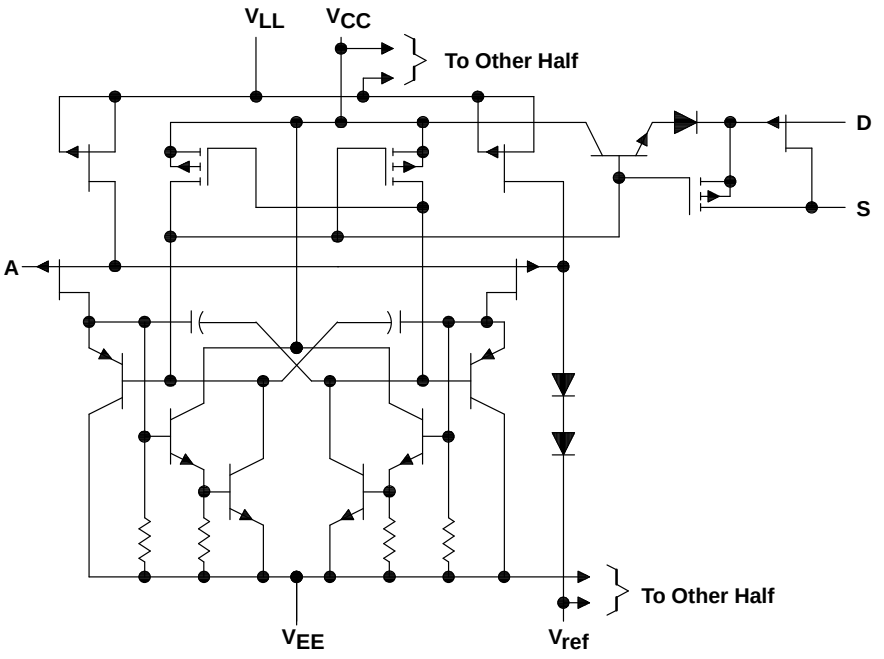
TL191 . . . N PACKAGE
(TOP VIEW)



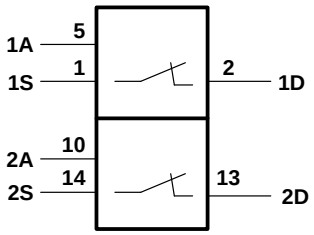
NC–No internal connection

TL182 twin SPST switch

schematic (each channel)



symbol

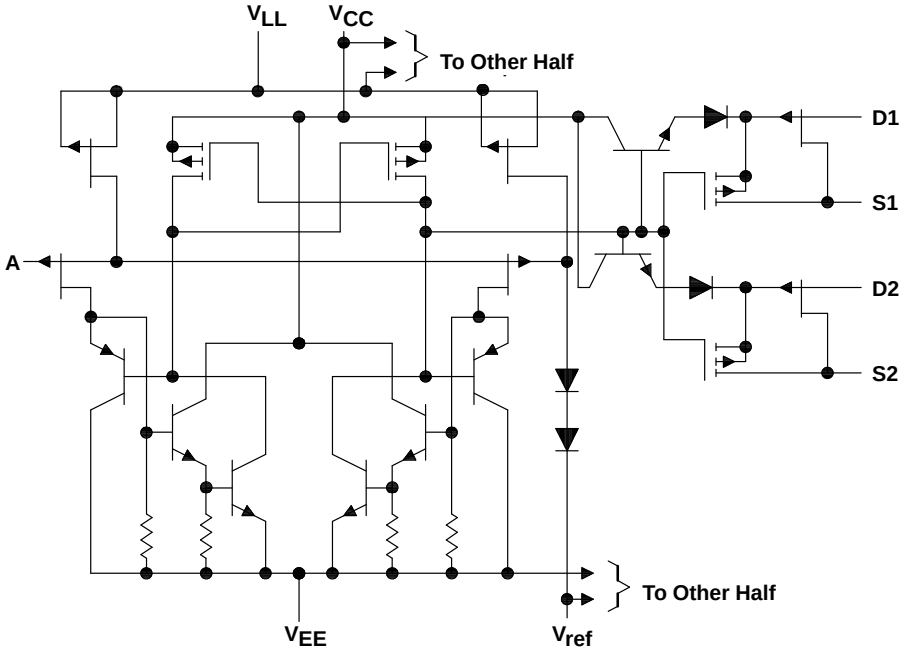


FUNCTION TABLE
(each half)

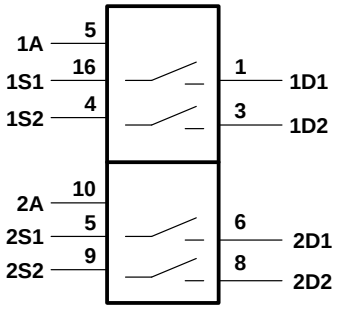
INPUT A	SWITCHES SW1 AND SW2
L	On (closed)
H	Off (open)

TL185 twin DPST switch

schematic (each channel)



symbol



FUNCTION TABLE
(each half)

INPUT A	SWITCHES SW1 AND SW2
L	Off (open)
H	On (closed)

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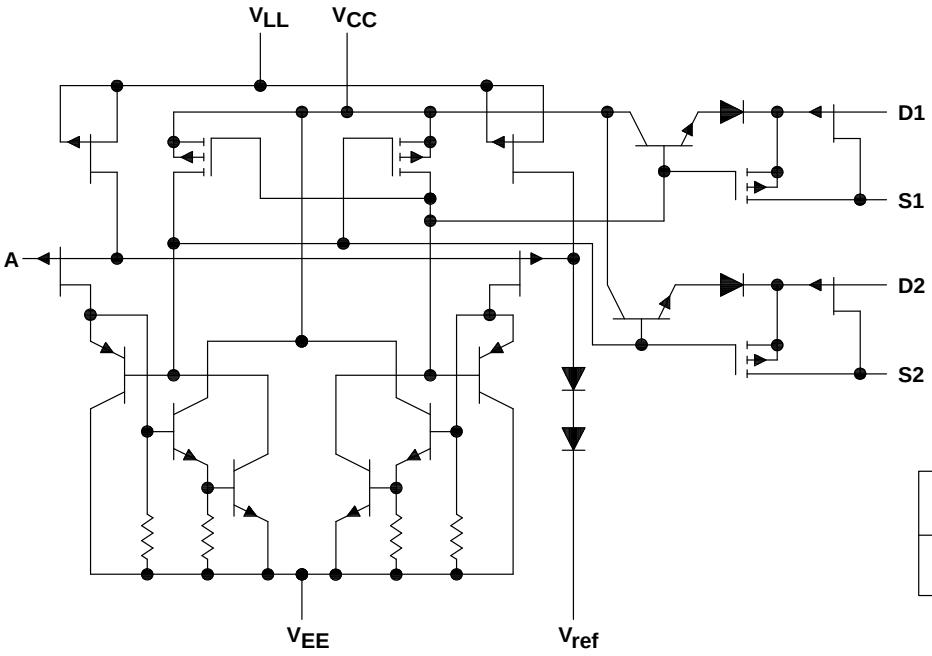
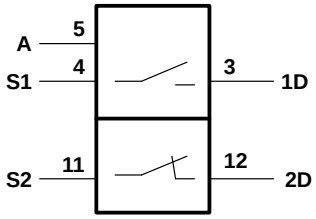
TL188 dual complementary SPST switch

schematic (each channel)



symbol

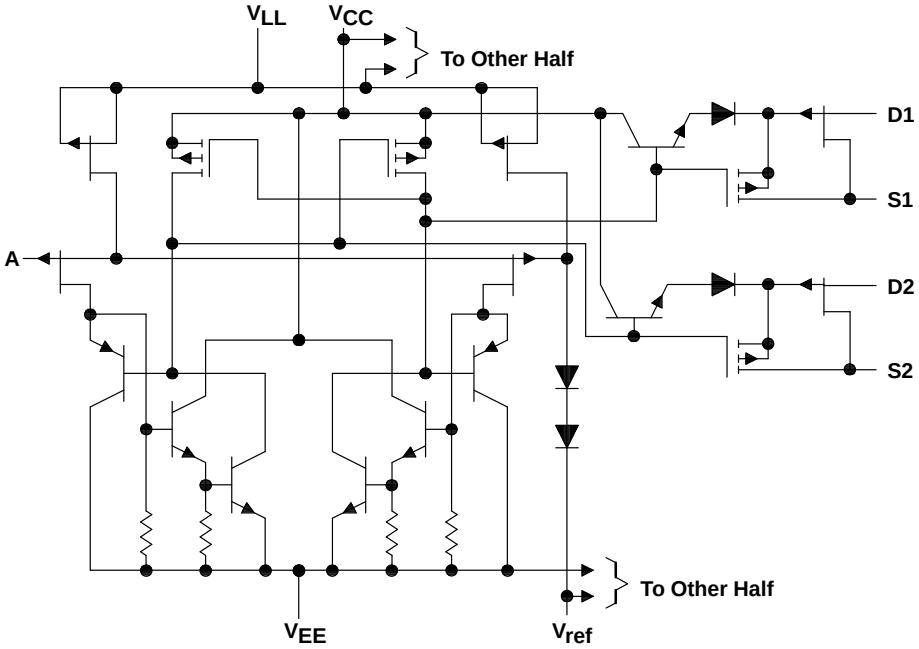


FUNCTION TABLE
(each half)

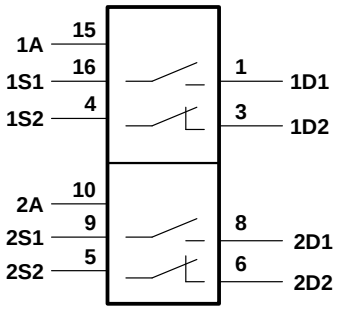
INPUT A	SWITCHES SW1	SW2
L	Off (open)	On (closed)
H	On (closed)	Off (open)

TL191 twin dual complementary SPST switch

schematic (each channel)



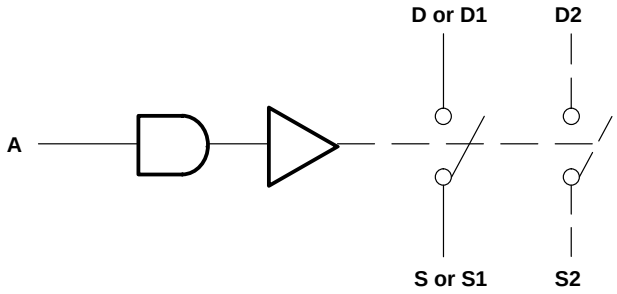
symbol



FUNCTION TABLE
(each half)

INPUT A	SWITCHES SW1	SW2
L	Off (open)	On (closed)
H	On (closed)	Off (open)

functional block diagram



See the preceding two pages for operation of the switches.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Positive supply to negative supply voltage, $V_{CC} - V_{EE}$	36 V
Positive supply voltage to either drain, $V_{CC} - V_D$	33 V
Drain to negative supply voltage, $V_D - V_{EE}$	33 V
Drain to source voltage, $V_D - V_S$	±22 V
Logic supply to negative supply voltage, $V_{LL} - V_{EE}$	36 V
Logic supply to logic input voltage, $V_{LL} - V_I$	33 V
Logic supply to reference voltage, $V_{LL} - V_{ref}$	33 V
Logic input to reference voltage, $V_I - V_{ref}$	33 V
Reference to negative supply voltage, $V_{ref} - V_{EE}$	27 V
Reference to logic input voltage, $V_{ref} - V_I$	2 V
Current (any terminal)	30 mA
Operating free-air temperature range: TL182C, TL185C, TL188C, TL191C	0°C to 70°C
TL182I, TL185I, TL188I, TL191I	–25°C to 85°C
TL182M, TL185M, TL188M, TL191M	–55°C to 125°C
Storage temperature range	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

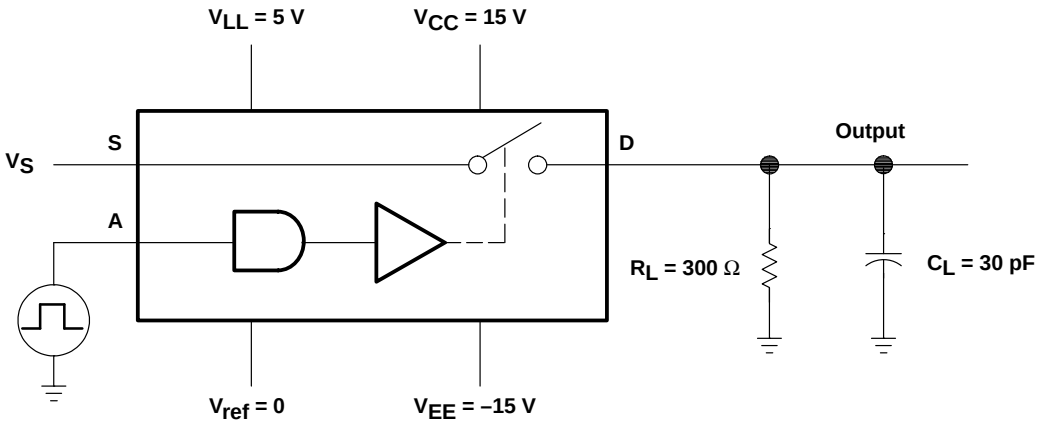
electrical characteristics, V_{CC} = 15 V, V_{EE} = 15 V, V_{LL} = 5 V, V_{ref} = 0 V

PARAMETER		TEST CONDITIONS			TL1_M		TL1_I		TL1_C		UNIT
					MIN	MAX	MIN	MAX	MIN	MAX	
V_{IH}	High-level control input voltage			T_A = MIN to MAX	V_{ref} +2		V_{ref} +2		V_{ref} +2		V
V_{IL}	Low-level control input voltage			T_A = MIN to MAX		V_{ref} +0.8		V_{ref} +0.8		V_{ref} +0.8	V
I_{IH}	High-level control input current	V_I = 5 V		T_A = 25°C		10		10		20	µA
				T_A = MAX		20		20		20	
I_{IL}	Low-level control input current	V_I = 0		T_A = MIN to MAX		–250		–250		–250	µA
$I_{D(off)}$	Off-state drain current	V_D = 10 V, V_S = –10 V,		T_A = 25°C				5		5	nA
		V_{IH} = 2 V, V_{IL} = 0.8 V		T_A = MAX		100		100		100	
$I_{S(off)}$	Off-state source current	V_D = –10 V, V_S = 10 V,		T_A = 25°C				5		5	nA
		V_{IH} = 2 V, V_{IL} = 0.8 V		T_A = MAX		100		100		100	
$I_{D(on)}$ + $I_{S(on)}$	On-state channel leakage current	V_D = –10 V, V_S = –10 V,		T_A = 25°C				–10		–10	nA
		V_{IH} = 2 V, V_{IL} = 0.8 V		T_A = MAX		–200		–200		–200	
$r_{DS(on)}$	Drain-to-source on-state resistance	V_D = –10 V, I_S = 1 mA, V_{IH} = 2 V, V_{IL} = 0.8 V	TL182, TL188	T_A = MIN to 25°C		75		100		100	Ω
				T_A = MAX		100		150		150	
			TL185, TL191	T_A = MIN to 25°C		125		150		150	
				T_A = MAX		250		300		300	
I_{CC}	Supply current from V_{CC}	Both control inputs at 0 V		T_A = 25°C		1.5		1.5		1.5	mA
I_{EE}	Supply current from V_{EE}					–5		–5		–5	
I_{LL}	Supply current from V_{LL}					4.5		4.5		4.5	
I_{ref}	Reference current					–2		–2		–2	
I_{CC}	Supply current from V_{CC}	Both control inputs at 0 V		T_A = 25°C		1.5		1.5		1.5	mA
I_{EE}	Supply current from V_{EE}					–5		–5		–5	
I_{LL}	Supply current from V_{LL}					4.5		4.5		4.5	
I_{ref}	Reference current					–2		–2		–2	

switching characteristics, V_{CC} = 10 V, V_{EE} = 20 V, V_{LL} = 5 V, V_{ref} = 0 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	TL1_M	TL1_I	TL1_C	UNIT
			TYP	TYP	TYP	
t_{on}	Turn-on time	R_L = 300 W, CL = 30 pF, See Figure 1	175	175	175	ns
t_{off}	Turn-off time		350	350	350	

PARAMETER MEASUREMENT INFORMATION

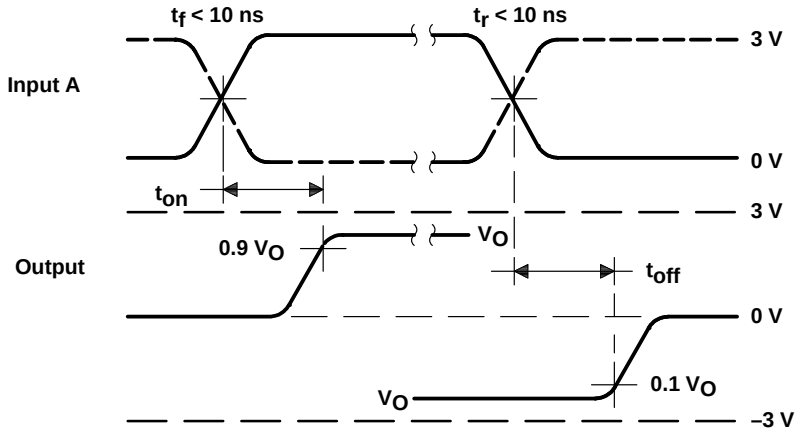


C_L = includes probe and jig capacitance

V_S = 3 V for t_{on} and −3 V for t_{off}

$$V_O = V_S \frac{R_L}{R_L + r_{DS(on)}}$$

TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. The solid waveform applies for TL185 and SW1 of TL185 and TL191; the dashed waveform applies for TL182 and SW2 of TL185 and TL191.

B. V_O is the steady-state output with the switch on. Feed through via the gate capacitance may result in spikes (not shown) at the leading and trailing edges of the output waveform.

Figure 1

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