National Semiconductor

2900 Family/
Bipolar Microprocessor

IDM29803 16-Way Branch Controller

General Description

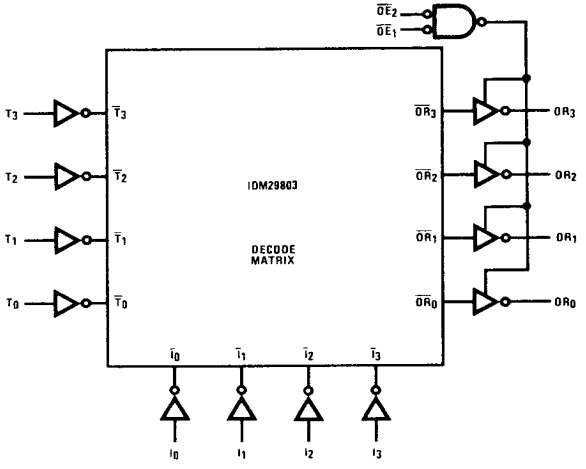
When used in conjunction with the IDM2909A address controller, the IDM29803 provides 16-way branch control. Four different inputs can be tested simultaneously by the 16 instructions of the IDM29803; thus, the four OR inputs of the IDM2909A can be driven by the four outputs of the IDM29803 and a branch can be made to any one of the 16 addresses.

If one test (T) input is being tested, the device will select one of two possible addresses; if two inputs are being tested, the device will select one of four possible addresses and, if three inputs are being tested, one of eight addresses will be selected. If all four inputs are tested, one of sixteen addresses is selected as the field used to drive the OR inputs of the IDM2909A. The "zero" instruction serves as a test inhibit function.

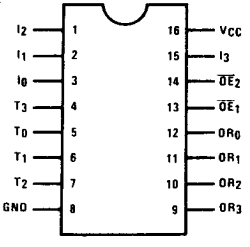
Features and Benefits

- 16 separate instructions — 2-, 4-, 8-, or 16-way branch in one microprogram execution cycle
- Four discrete test inputs
- Four discrete outputs for driving the four OR inputs of the IDM2909A address controller
- Provides a maximum branching capability in a microprogram control unit using the IDM2909A
- Uses low-power Schottky technology
- Meets all requirements of MIL-STD-883

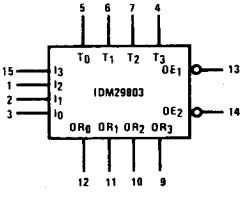
Logic Diagram



Connection Diagram



Logic Symbol



Absolute Maximum Ratings (Note 1)

Storage Temperature	−65°C to +125°C
Temperature (Ambient) Under Bias	−55°C to +125°C
Supply Voltage to Ground Potential	−0.5V to +7.0V
DC Voltage Applied to Outputs for High Output State	−0.5V to +V_{CC} max
DC Input Voltage	−0.5V to +5.5V
DC Output Current, into Outputs	30 mA
DC Input Current	−30 mA to +5.0 mA

Operating Range

P/N	Ambient Temperature	V_{CC}
Com'l IDM29803DC,NC	0°C to +70°C	4.75V to 5.25V
Mil IDM29803DM,DM/883	−55°C to +125°C	4.50V to 5.50V

DC Electrical Characteristics (Note 2)

PARAMETER		CONDITIONS	Com'l			Mil			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
I_F	Input Load Current, All Inputs	V_{CC} = Max, V_F = 0.45V		−80	−250		−80	−250	μA
I_R	Input Leakage Current, All Inputs	V_{CC} = Max, V_R = 2.7V			25			25	μA
I_{RB}	Input Leakage Current, All Inputs	V_{CC} = Max, V_{RB} = 5.5V			1.0			1.0	mA
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = 16 mA		0.35	0.45		0.35	0.5	V
V_{IL}	Low Level Input Voltage				0.80			0.80	V
V_{IH}	High Level Input Voltage		2.0			2.0			V
I_{CEX}	Output Leakage Current (Open-Collector Only)	V_{CC} = Max, V_{CEX} = 2.4V			50			50	μA
		V_{CC} = Max, V_{CEX} = 5.5V			100			100	μA
V_C	Input Clamp Voltage	V_{CC} = Min, I_{IN} = −18 mA		−0.8	−1.2		−0.8	−1.2	V
C_{IN}	Input Capacitance	V_{CC} = 5V, V_{IN} = 2V, T_A = 25°C, 1 MHz		4.0			4.0		pF
C_O	Output Capacitance	V_{CC} = 5V, V_O = 2V, T_A = 25°C, 1 MHz, Output "OFF"		6.0			6.0		pF
I_{CC}	Power Supply Current	V_{CC} = Max, All Inputs Grounded, All Outputs Open		80	130		80	130	mA
TRI-STATE PARAMETERS									
I_{SC}	Output Short Circuit Current	V_O = 0V, V_{CC} = Max, (Note 3)	−30	−60	−100	−30	−60	−100	mA
I_{HZ}	Output Leakage (TRI-STATE)	V_{CC} = Max, V_O = 0.45 to 2.4V, Chip Disabled			±50			±50	μA
V_{OH}	Output Voltage High	I_{OH} = −2 mA				2.4	3.2		V
		I_{OH} = −6.5 mA	2.4	3.2					V

AC Electrical Characteristics (With standard load)

PARAMETER		CONDITIONS	Com'l			Mil			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
t_{AA}	Address Access Time	*(Figure 1)*	10	35	50	10	35	60	ns
t_{EA}	Enable Access Time	*(Figure 2)*	5	15	25	5	15	30	ns
t_{ER}	Enable Recovery Time	*(Figure 2)*	5	15	25	5	15	30	ns

Note 1: Absolute maximum ratings are those values beyond which the device may be permanently damaged. They do not mean that the device may be operated at these values.

Note 2: These limits apply over the entire operating range unless stated otherwise. All typical values are for V_{CC} = 5V and T_A = 25°C.

Note 3: During I_{SC} measurement, only one output at a time should be grounded. Permanent damage may otherwise result.

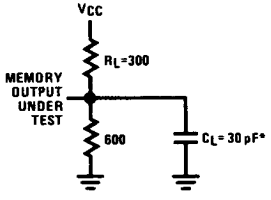
Switching Characteristics Over Operating Range

Symbol	Description	Test Conditions	Com'l Min	Com'l Max	Mil Min	Mil Max	Units
t_{PLH}	I_i to OR_i	C_L = 15 pF, R_L = 2.0 kΩ		50		60	ns
t_{PHL}							
t_{PLH}	T_i to OR_i			50		60	ns
t_{PHL}							
t_{ZH}	$\overline{OE}_i$ to OR_i			25		30	ns
t_{ZL}							
t_{HZ}	$\overline{OE}_i$ to OR_i			25		30	ns
t_{LZ}							

Definition of Functional Terms

I_0, I_1, I_2, I_3	The four instruction inputs to the device
T_0, T_1, T_2, T_3	The four test inputs for the device
OR_0, OR_1, OR_2, OR_3	The four outputs of the device that are connected to the four OR inputs of the IDM2909A
$\overline{OE}_1, \overline{OE}_2$	Output Enable. When either $\overline{OE}$ input is High, the OR_i outputs are in the high impedance state. When both the $\overline{OE}_1$ and $\overline{OE}_2$ inputs are Low, the OR outputs are enabled and the selected data will be present.

Standard Test Load



*C_L includes probe and jig capacitance

- Input waveforms are supplied by a pulse generator having the following characteristics: PRR = 1 MHz, Z_{OUT} = 50 Ω, $t_r \leq 2.5$ ns and $t_f \leq 2.5$ ns (between 1.0V and 2.0V).
- t_{AA} is measured with both enable inputs at a steady low level.
- t_{EA} and t_{ER} are measured from the 1.5V on inputs and outputs with all address inputs at a steady level and with the unused enable input at a steady low level.

Switching Time Waveforms

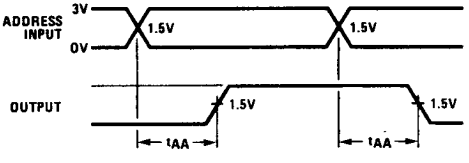


Figure 1. Address Access Time

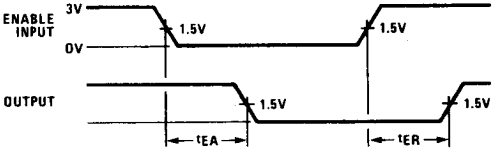


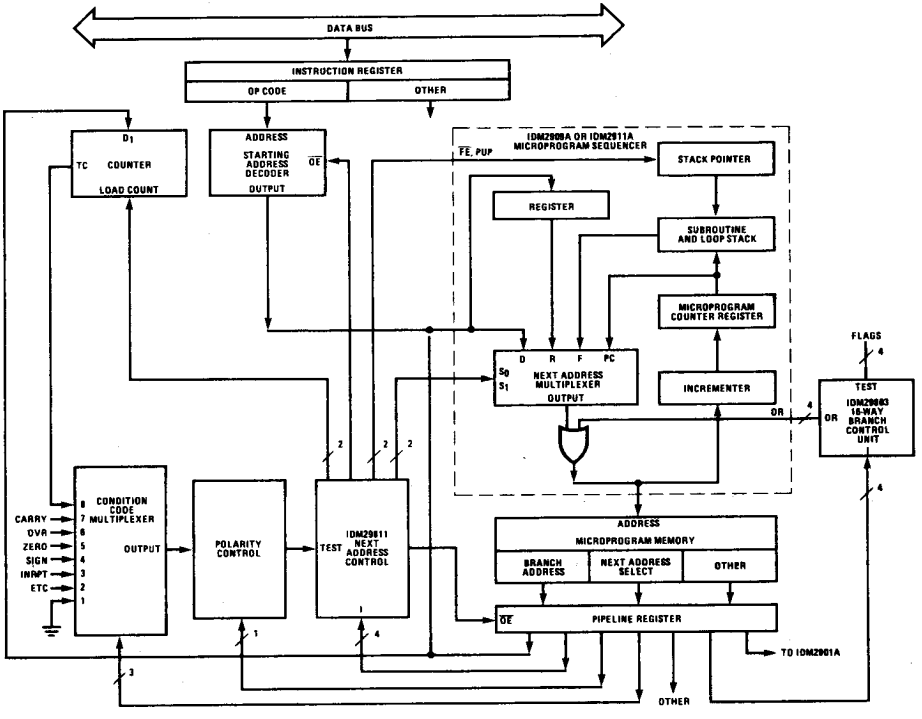
Figure 2. Enable Access Time and Recovery Time

Guaranteed Loading Rules Over Operating Range (In Unit Loads)

A Low-Power Schottky TTL Unit Load is defined as 20 μA measured at 2.7 V High and -0.36 mA measured at 0.4 V Low.

Pin Nos.	Input/ Output	Input Load	Output High	Output Low
1	I_2	0.5	–	–
2	I_1	0.5	–	–
3	I_0	0.5	–	–
4	T_3	0.5	–	–
5	T_0	0.5	–	–
6	T_1	0.5	–	–
7	T_2	0.5	–	–
8	GND	–	–	–
9	OR_3	–	100	44
10	OR_2	–	100	44
11	OR_1	–	100	44
12	OR_0	–	100	44
13	OE_1	0.5	–	–
14	OE_2	0.5	–	–
15	I_3	0.5	–	–
16	V_{CC}	–	–	–

Applications Example



Note: The least significant microprogram sequencer is an IDM2909A and the more significant sequencers are IDM2911A's.

A Typical Computer Control Unit Using the IDM2909A, IDM2911A, IDM29803 and IDM29811.

Function Table

Function	I_3	I_2	I_1	I_0	T_3	T_2	T_1	T_0	OR_3	OR_2	OR_1	OR_0
No Test	L	L	L	L	X	X	X	X	L	L	L	L
Test T_0	L	L	L	H	X	X	X	L	L	L	L	L
					X	X	X	H	L	L	L	H
Test T_1	L	L	H	L	X	X	L	X	L	L	L	L
					X	X	H	X	L	L	L	H
Test T_0 & T_1	L	L	H	H	X	X	L	L	L	L	L	L
					X	X	L	H	L	L	L	H
					X	X	H	L	L	L	H	L
					X	X	H	H	L	L	H	H
Test T_2	L	H	L	L	X	L	X	X	L	L	L	L
					X	H	X	X	L	L	L	H
Test T_0 & T_2	L	H	L	H	X	L	X	L	L	L	L	L
					X	L	X	H	L	L	L	H
					X	H	X	L	L	L	H	L
					X	H	X	H	L	L	H	H
Test T_1 & T_2	L	H	H	L	X	L	L	X	L	L	L	L
					X	L	H	X	L	L	L	H
					X	H	L	X	L	L	H	L
					X	H	H	X	L	L	H	H
Test T_0, T_1, & T_2	L	H	H	H	X	L	L	L	L	L	L	L
					X	L	L	H	L	L	L	H
					X	L	H	L	L	L	H	L
					X	L	H	H	L	L	H	H
					X	H	L	L	L	H	L	L
					X	H	L	H	L	H	L	H
					X	H	H	L	L	H	L	L
					X	H	H	H	L	H	H	H
Test T_3	H	L	L	L	L	X	X	X	L	L	L	L
					H	X	X	X	L	L	L	H
Test T_0 & T_3	H	L	L	H	L	X	X	L	L	L	L	L
					L	X	X	H	L	L	L	H
					H	X	X	L	L	L	H	L
					H	X	X	H	L	L	H	H
Test T_1 & T_3	H	L	H	L	L	X	L	X	L	L	L	L
					L	X	H	X	L	L	L	H
					H	X	L	X	L	L	H	L
					H	X	H	X	L	L	H	H
Test T_0, T_1, & T_3	H	L	H	H	L	X	L	L	L	L	L	L
					L	X	L	H	L	L	L	H
					L	X	H	L	L	L	H	L
					L	X	H	H	L	L	H	H
					H	X	L	L	L	H	L	L
					H	X	L	H	L	H	L	H
					H	X	H	L	L	H	H	L
					H	X	H	H	L	H	H	H
Test T_2 & T_3	H	H	L	L	L	L	X	X	L	L	L	L
					L	H	X	X	L	L	L	H
					H	L	X	X	L	L	H	L
					H	H	X	X	L	L	H	H
Test T_0, T_2, & T_3	H	H	L	H	L	L	X	L	L	L	L	L
					L	L	X	H	L	L	L	H
					L	H	X	L	L	L	H	L
					L	H	X	H	L	L	H	H
					H	L	X	L	L	H	L	L
					H	L	X	H	L	H	L	H
					H	H	X	L	L	H	H	L
					H	H	X	H	L	H	H	H
Test T_1, T_2, & T_3	H	H	H	L	L	L	L	X	L	L	L	L
					L	L	H	X	L	L	L	H
					L	H	L	X	L	L	H	L
					L	H	H	X	L	L	H	H
					H	L	L	X	L	H	L	L
					H	L	H	X	L	H	L	H
					H	H	L	X	L	H	H	L
					H	H	H	X	L	H	H	H
Test T_0, T_1, T_2, & T_3	H	H	H	H	L	L	L	L	L	L	L	L
					L	L	L	H	L	L	L	H
					L	L	H	L	L	L	H	L
					L	L	H	H	L	L	H	H
					L	H	L	L	L	H	L	L
					L	H	L	H	L	H	L	H
					L	H	H	L	L	H	H	L
					L	H	H	H	L	H	H	H
					H	L	L	L	H	L	L	L
					H	L	L	H	H	L	L	H
					H	L	H	L	H	L	H	L
					H	L	H	H	H	L	H	H
					H	H	L	L	H	H	L	L
					H	H	L	H	H	H	L	H
					H	H	H	L	H	H	H	L
					H	H	H	H	H	H	H	H

Ordering Information

Package Type	Package Number	Temperature Range	Order Number
Molded DIP	N16A	0°C to +70°C	IDM29803NC
Hermetic DIP	J16A (D16C)	0°C to +70°C	IDM29803JC
Hermetic DIP	J16A (D16C)	−55°C to +125°C	IDM29803JM
Hermetic DIP	J16A (D16C)	−55°C to +70°C	IDM29803JM/883