8×8 bit parallel multipliers

LMU557/LMU558

general information

The LMU557 and LMU558 are 8-bit parallel multipliers with high speed and low power operation. They are pin for pin equivalents with 54S557 and 54S558 type multipliers. Full military ambient temperature range operation is attained by the use of advanced CMOS technology.

Both the LMU557 and LMU558 produce the 16-bit product of two 8-bit signed or unsigned numbers in a single unclocked operation. Assertion of control inputs TCA and TCB indicate that the corresponding input value is in two's complement notation.

Provision is made for proper rounding for any combination of signed or unsigned inputs. The R_U input to the LMU558 causes the product to be rounded to 8 bits of precision for unsigned or mixed mode multiplication. For multiplication of two signed operands, the R_S input is used for rounding, and the most significant bit of the product is discarded. (It will be identical to the sign bit for all except the $(-2^8)*(-2^8)$ case, which will cause overflow if the result MSB is not considered.)

The LMU557 internally produces the R_U and R_S controls from a single round input, denoted R. With R asserted, R_S rounding occurs if either TCA or TCB is asserted, while R_U rounding is implemented for TCA and TCB not asserted. This implementation frees a pin for control of the transparent output register in the LMU557 via the G input.

Both the LMU557 and LMU558 offer three-state output buffers controlled by the $\overline{OE}$ input. The LMU557 has a 16-bit transparent latch between the multiplier array and the output drivers for flexibility in implementing pipelined systems. In addition both polarities of the result MSB (R_{15}) are available as separate output pins to allow simple expansion to longer word lengths in signed multiplication.

features

- 8 by 8 parallel multiplier
- Pin for pin replacement for AM25S557/8, SN54S557/8
- Double precision product
- High-speed, low-power CMOS technology
- Fully combinatorial, no clocks required
- Unsigned, two's complement, or mixed operands
- Transparent output latch on LMU557
- Signed or unsigned product rounding
- TTL compatible inputs and outputs
- 85mW typical power dissipation

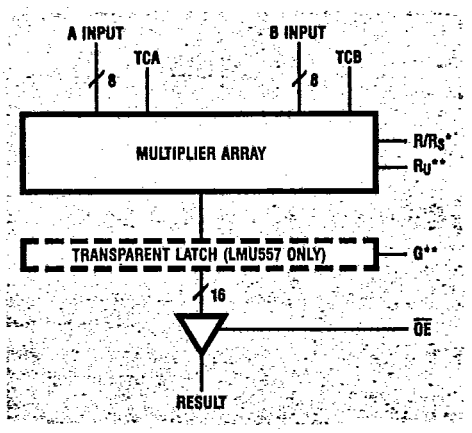
PIN CONFIGURATION

A INPUTS	OUTPUTS
A_7 – MSB A input A_6 – A_5 A_4 A_3 A_2 A_1 A_0	$\overline{R_{15}}$ – inverted result MSB R_{15} – result MSB R_{14} R_{13} R_{12} R_{11} R_{10} R_9 R_8
B INPUTS	**OUTPUTS**
B_7 – MSB B input B_6 B_5 B_4 B_3 B_2 B_1 B_0	R_7 R_6 R_5 R_4 R_3 R_2 R_1 R_0

PIN DESCRIPTION

PIN	FUNCTION	FUNCTION	PIN
1	A_0	TCA	40
2	A_1	R_0	39
3	A_2	R_1	38
4	A_3	R_2	37
5	A_4	R_3	36
6	A_5	R_4	35
7	A_6	R_5	34
8	A_7	R_6	33
9	RS/R	R_7	32
10	VCC	R_8	31
11	$\overline{RU/G}$	GND	30
12	B_0	R_9	29
13	B_1	R_{10}	28
14	B_2	R_{11}	27
15	B_3	R_{12}	26
16	B_4	R_{13}	25
17	B_5	R_{14}	24
18	B_6	R_{15}	23
19	B_7	$\overline{R_{15}}$	22
20	TCB	$\overline{OE}$	21

functional diagram



PIN 9 IS R FOR LMU557 AND Rs FOR LMU558
***PIN 11 IS G FOR LMU557 AND Ru FOR LMU558*

absolute maximum ratings

Supply Voltage	−0.5 to 7.0V
Input Voltage	0 to 5.5V
Output Voltage	0 to Vcc
Operating Temperature (Ambient)	−55°C to 125°C
Storage Temperature	−65°C to 150°C

recommended operating conditions

PARAMETER		min	typ	max	unit
Vcc	Supply Voltage Commercial	4.75	5.0	5.25	V
Vcc	Supply Voltage Military	4.50	5.0	5.5	V
IOL	Low Level Output Current			8.0	mA
IOH	High Level Output Current			−2.0	mA
TAMB	Operating Temperature Commercial (Ambient)	0	25	70	°C
TAMB	Operating Temperature Military (Ambient)	−55	25	125	°C

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8 x 8 bit parallel multipliers

electrical characteristics

PARAMETER		TEST CONDITIONS	min	typ	max	unit
V_{IL}	Low Level Input Voltage.				0.8	V
V_{IH}	High Level Input Voltage		2.0			V
V_{OL}	Low Level Output Voltage	V_{CC} = min, I_{OL} = 8mA			0.5	V
V_{OH}	High Level Output Voltage	V_{CC} = min, I_{OH} = −2.0mA	3.5			V
I_{IL}	Low Level Input Current	V_{CC} = max, V_{IL} = 0.4V			20	μA
I_{IH}	High Level Input Current	V_{CC} = max, V_{IH} = 2.4V			20	μA
I_{CC}	Supply Current	Military Commercial		17[1] 17	35[2] 30[3]	mA
I_{CC}	Quiescent				0.5	mA

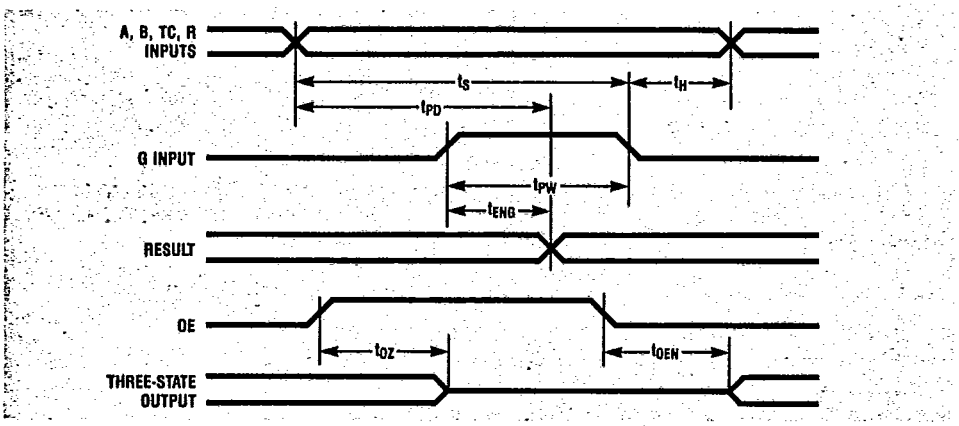
1) 5MHz clock rate: TTL input levels; V_{CC} = 5V; T_A = 25°C; all possible input patterns.
2) 5MHz clock: V_{IH} = 2.0; V_{IL} = 0.8; V_{CC} = 5.5V; T_A = −55°C; all outputs toggling every clock.
3) As above, T_A = 0°C; V_{CC} = 5.25V.

switching characteristics

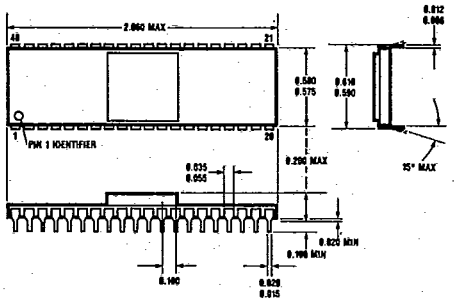
PARAMETER		0°–70°C V_{CC} = 4.75V min*	typ	max*	−55°–125°C V_{CC} = 4.5V min*	typ	max*	unit
t_{PD}	A, B, TC, R Inputs to $R_8 - R_{15}$, $\overline{R_{15}}$			60			70	ns
t_{PD}	A, B, TC, R Inputs to $R_0 - R_7$			55			60	ns
t_S	A, B, TC Inputs to G Set-up Time	45			55			ns
t_H	A, B, TC Inputs to G Hold Time	0			0			ns
t_{ENG}	G Enable to Result			30			35	ns
t_{PW}	G Pulse Width	15			20			ns
t_{OZ}	Output Disable Time			20			25	ns
t_{OEN}	Output Enable Time			25			30	ns

AC TEST CONDITIONS:
Input levels: 0 to 3V Output timing reference levels: 1.5V Output load: 1.0KΩ to 5V, 820Ω to GND, 60pF to GND

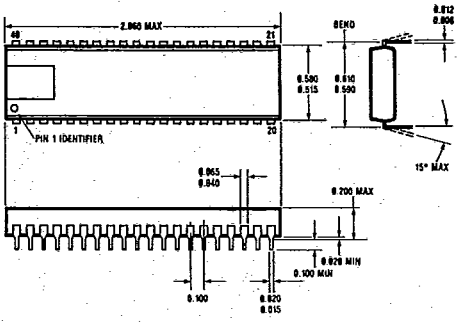
timing diagram



packages



40-PIN MOLDED
DUAL-IN-LINE PACKAGE
Dimensions shown in inches and (mm).



40-PIN HERMETICALLY SEALED
DUAL-IN-LINE PACKAGE
Dimensions shown in inches and (mm).

ordering information

ORDERING CODE	SPEED (NS)	PACKAGE TYPE	OPERATING RANGE
LMU557/558 PC	60	P3	COMMERCIAL
DC		D3	
PCR		P3	
DCR		D3	
LMU557/558 DM	70	D3	MILITARY
DMB		D3	

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