iC-BM FOUR-CHANNEL FOUR-QUADRANT ANALOG MULTIPLIER

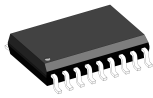
FEATURES

- MLT04 replacement
- Four independent channels
- Four-quadrant multiplication
- Voltage output: W = 0.4 × X × Y
- ±2.5 V analog input range
- 3.5 MHz bandwidth
- Low power dissipation

APPLICATIONS

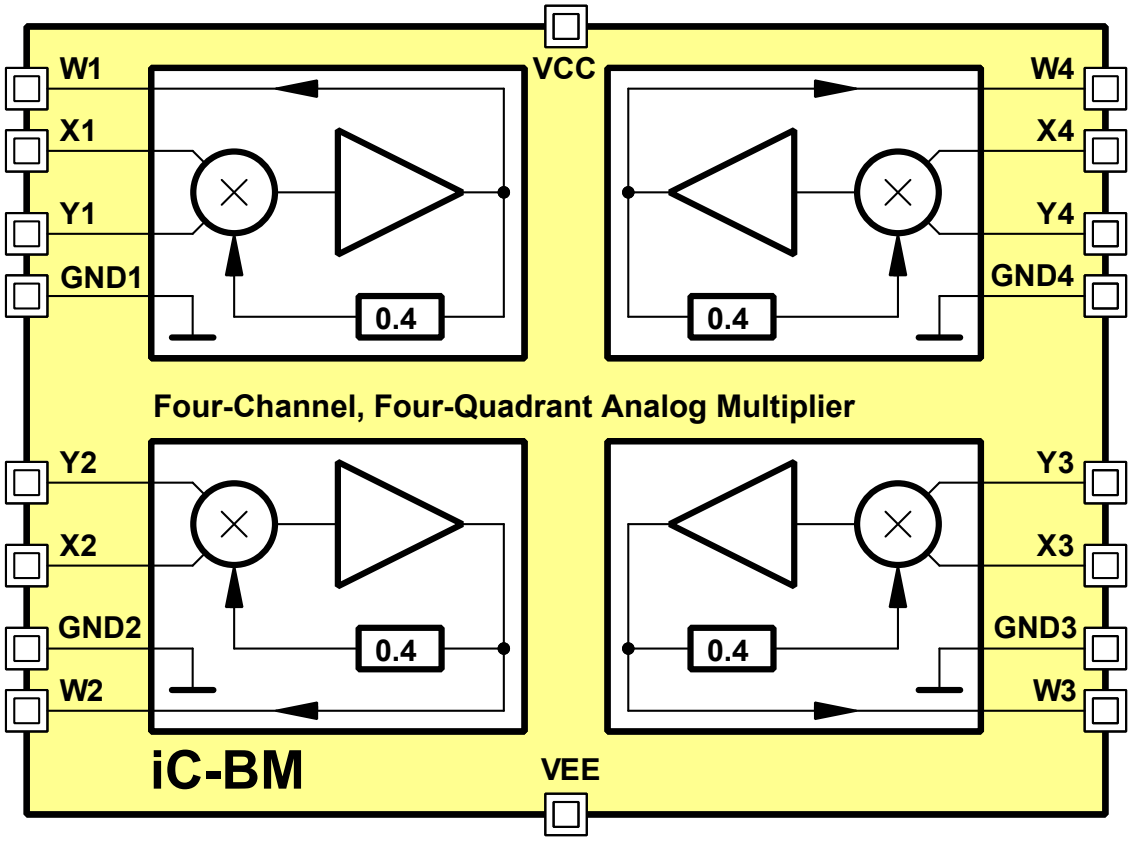
- Analog computation
- Squaring circuits
- Modulation and demodulation
- Voltage controlled amplifiers and filters

PACKAGES



SO18W
(RoHS compliant)

BLOCK DIAGRAM



DESCRIPTION

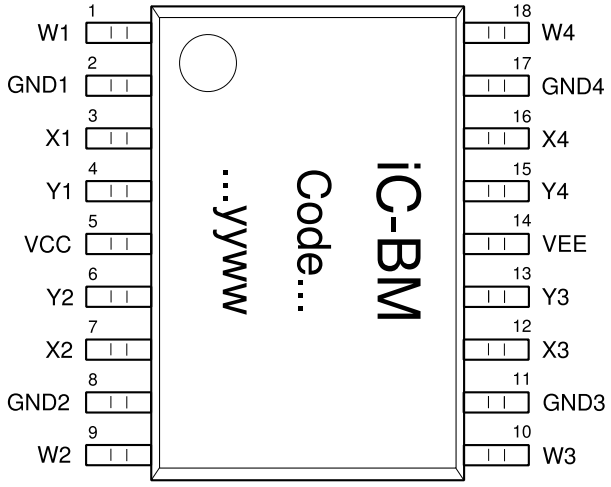
iC-BM features four analog multipliers. Each four-quadrant multiplier consists of a Gilbert cell multiplier with a 0.4 scale factor, a linearisation circuit and a unity gain output amplifier.

For higher precision all internal bias currents are derived from an internal band-gap reference.

All pins are ESD protected.

PACKAGES

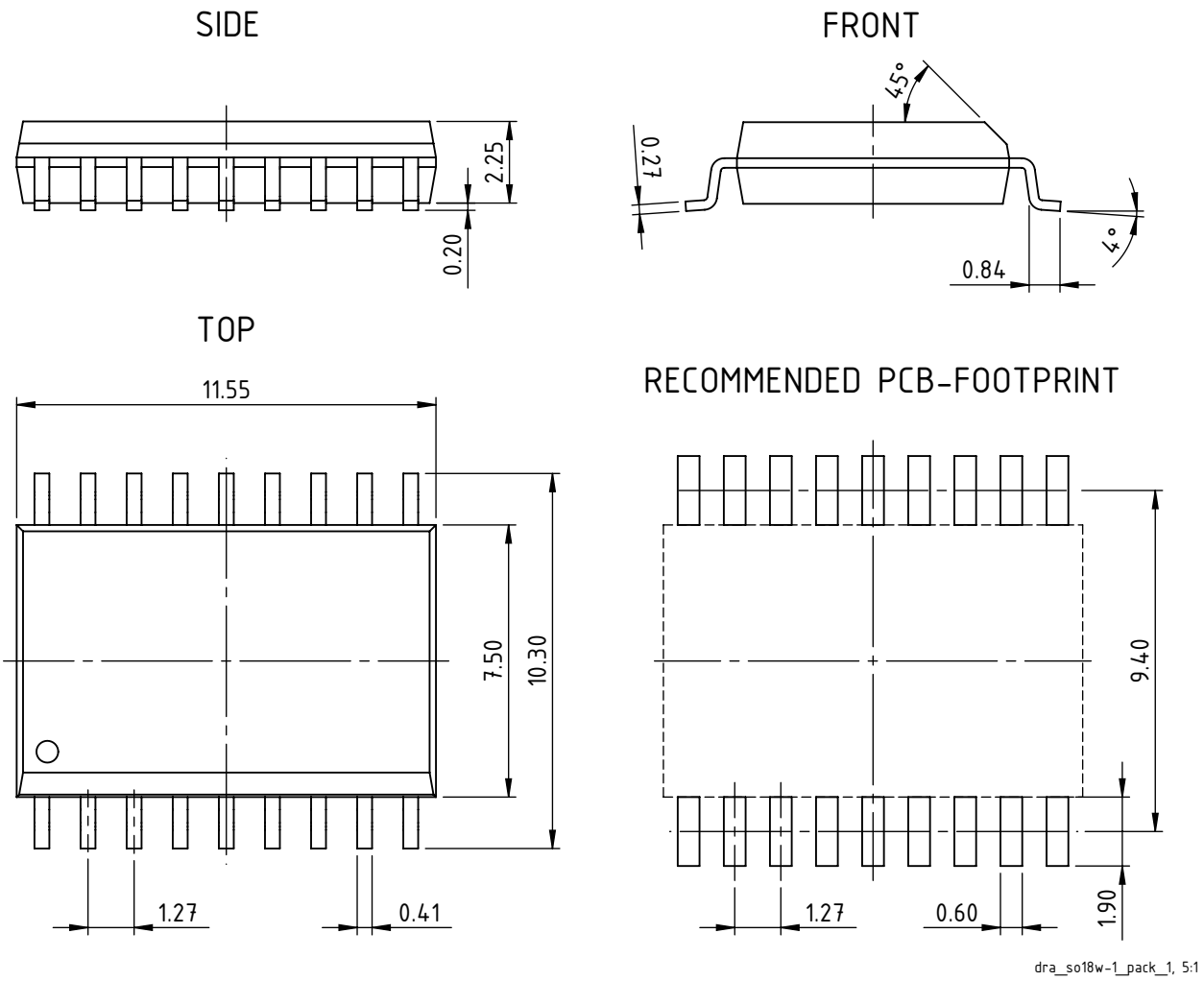
PIN CONFIGURATION SO18W



PIN FUNCTIONS

No.	Name	Function
1	W1	Channel 1: Analog multiplier output
2	GND1	Channel 1: Ground
3	X1	Channel 1: First input of multiplier
4	Y1	Channel 1: Second input of multiplier
5	VCC	Positive power supply +5 V
6	Y2	Channel 2: Second input of multiplier
7	X2	Channel 2: First input of multiplier
8	GND2	Channel 2: Ground
9	W2	Channel 2: Analog multiplier output
10	W3	Channel 3: Analog multiplier output
11	GND3	Channel 3: Ground
12	X3	Channel 3: First input of multiplier
13	Y3	Channel 3: Second input of multiplier
14	VEE	Negative power supply -5 V
15	Y4	Channel 4: Second input of multiplier
16	X4	Channel 4: First input of multiplier
17	GND4	Channel 4: Ground
18	W4	Channel 4: Analog multiplier output

PACKAGE DIMENSIONS SO18W



All dimensions given in mm.

ABSOLUTE MAXIMUM RATINGS

Beyond these values damage may occur; device operation is not guaranteed.

Item No.	Symbol	Parameter	Conditions	Min.	Max.	Unit
G001	VCC	Positive Power Supply			7	V
G002	VEE	Negative Power Supply		-7		V
G003	V()	Voltage at Pins $X_{1...4}$, $Y_{1...4}$ and $W_{1...4}$		-7	7	V
G004	Tj	Chip Temperature		-40	150	°C
G005	Ts	Storage Temperature		-40	150	°C

THERMAL DATA

Operating Conditions: VCC = 5 V ±0.25 V , VEE = -5 V ±0.25 V, Tj = -40...100 °C, R_L = 2 kΩ, if not other specified

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
T01	Ta	Operating Ambient Temperature Range		-40		85	°C
T02	Rthja	Thermal Resistance Chip/Ambient			68		K/W

All voltages are referenced to ground unless otherwise stated.
All currents flowing into the device pins are positive; all currents flowing out of the device pins are negative.

ELECTRICAL CHARACTERISTICS

Operating Conditions: VCC = 5 V ±0.25 V , VEE = -5 V ±0.25 V, Tj = -40...100 °C, R_L = 2 kΩ, if not other specified

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
General							
101	V(VCC)	Positive Supply Voltage Range		4.75	5	5.25	V
102	V(VEE)	Negative Supply Voltage Range		-5.25	-5	-4.75	V
103	I(VCC)	Positive Supply Current	$W_{1...4}$ without load resistors		15	20	mA
104	I(VEE)	Negative Supply Current	$W_{1...4}$ without load resistors	-20	-15		mA
105	P_{DISS}	Power Dissipation	$P_{DISS} = 5\,V \times I_{CC} + 5\,V \times I_{EE}$		150	200	mW
Multiplier Performance							
201	$V(X_{1...4})os$	Offset Voltage $X_{1...4}$	$V(X_{1...4}) = 0\,V$, $V(Y_{1...4}) = ±2.5\,V$	-50		50	mV
202	$V(Y_{1...4})os$	Offset Voltage $Y_{1...4}$	$V(Y_{1...4}) = 0\,V$, $V(X_{1...4}) = ±2.5\,V$	-50		50	mV
203	$V(W_{1...4})os$	Output Offset Voltage $W_{1...4}$	$V(X_{1...4}) = 0\,V$, $V(Y_{1...4}) = 0\,V$	-50		50	mV
204	TCV()os	Output Offset Drift $W_{1...4}$	$V(X_{1...4}) = 0\,V$, $V(Y_{1...4}) = 0\,V$		50		µV/°C
205	K	Fix Scale Factor	$V(X_{1...4}) = ±2.5\,V$, $V(Y_{1...4}) = ±2.5\,V$	0.38	0.4	0.42	1/V
206	$TE(X_{1...4})$	Total Error $X_{1...4}$	$-2.5\,V \leq X \leq 2.5\,V$, Y = 2.5 V, measured as % of the ±2.5 V full scale	-5	±2	5	%
207	$TE(Y_{1...4})$	Total Error $Y_{1...4}$	$-2.5\,V \leq Y \leq 2.5\,V$, X = 2.5 V, measured as % of the ±2.5 V full scale	-5	±2	5	%
208	$TCE(X_{1...4})$	Total Error Drift $X_{1...4}$	$V(X_{1...4}) = -2.5\,V$, $V(Y_{1...4}) = 2.5\,V$		0.005		%/°C
209	$TCE(Y_{1...4})$	Total Error Drift $Y_{1...4}$	$V(Y_{1...4}) = -2.5\,V$, $V(X_{1...4}) = 2.5\,V$		0.005		%/°C
210	SE()	Total Square Error $X_{1...4}$, $Y_{1...4}$	$V(X_1) = V(Y_1)$, $V(X_2) = V(Y_2)$, $V(X_3) = V(Y_3)$ and $V(X_4) = V(Y_4)$		5		%
211	$LE(X_{1...4})$	Linearity Error $X_{1...4}$	$-2.5\,V \leq X \leq 2.5\,V$, Y = 2.5 V	-1	±0.2	1	%
212	$LE(Y_{1...4})$	Linearity Error $Y_{1...4}$	$-2.5\,V \leq Y \leq 2.5\,V$, X = 2.5 V	-1	±0.2	1	%
Dynamic Performance							
301	BW	Small Signal Bandwidth	$V(W_{1...4}) = 0.1\,V_{rms}$		3.5		MHz
302	SR	Slew Rate	$V(W_{1...4}) = ±2.5\,V$		30		V/µs
303	t_S	Settling Time	$V(W_{1...4}) = Δ2.5\,V$ and 1% error band		1		µs
304	FT_{AC}	AC Feedthrough	$V(X_{1...4}) = 0\,V$, $V(Y_{1...4}) = 1\,V_{rms}$ and f = 1 kHz		-65		dB
305	CT_{AC}	Crosstalk	$V(X_{1...4}) = V(Y_{1...4}) = 1\,V_{rms}$, f = 100 kHz, applied to adjecent channel		-90		dB
Outputs: $W_{1...4}$							
401	Isc()	Short Circuit Current			±30		mA
402	$THD(X_{1...4})$	Total Harmonic Distortion $X_{1...4}$	f = 1 kHz, $V(Y_{1...4}) = 2.5\,V$		0.1		%
403	$THD(Y_{1...4})$	Total Harmonic Distortion $Y_{1...4}$	f = 1 kHz, $V(X_{1...4}) = 2.5\,V$		0.02		%
404	PSSR()	Power Supply Sensitivity Ratio	$V(X_{1...4}) = V(Y_{1...4}) = 0\,V$, VCC = Δ5% or VEE = Δ5%			10	mV/V
405	EN_A	Audio Band Noise	BW = 10 Hz to 50 kHz		70		$µV_{rms}$
406	EN_W	Wide Band Noise	BW = 1.9 MHz		590		$µV_{rms}$
407	en	Spot Noise Voltage	Noise at f = 1 kHz		0.3		$µV/\sqrt{Hz}$
408	Vmax()	Voltage Swing	VCC = +5 V, VEE = -5 V	3.0	3.3		V
409	ROUT()	Open Loop Output Resistance	VCC = +5 V, VEE = -5 V, T = +25 °C		60		Ω
Inputs: $X_{1...4}$, $Y_{1...4}$							
501	VR()in	Analog Input Range	$V(GND_{1...4}) = 0\,V$	-2.5		2.5*	V
502	I()in	Input Current	$V(X_{1...4}) = V(Y_{1...4}) = 0\,V$		2.3	10	µA
503	R()in	Input Resistance			1		MΩ
504	C()in	Input Capacitance			3		pF

* For input voltages > 3 V the output is undefined.

ORDERING INFORMATION

Type	Package	Order Designation
iC-BM	SO18W	iC-BM SO18W

For technical support, information about prices and terms of delivery please contact:

iC-Haus GmbH
Am Kuemmerling 18
D-55294 Bodenheim
GERMANY

Tel.: +49 (61 35) 92 92-0
Fax: +49 (61 35) 92 92-192
Web: http://www.ichaus.com
E-Mail: sales@ichaus.com

Appointed local distributors: http://www.ichaus.com/sales_partners