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	NO	VERSION	APPROVED
	1	V 1.4	2007-08-01

Data Sheet

MTI04CS/MTI04CQ

MULTI-CHANNEL PROGRAMMABLE GAIN TRANSIMPEDANCE AMPLIFIER

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MAZeT GmbH Sales Göschwitzer Straße 32 07745 JENA / GERMANY Phone: +49 3641 2809-0 Fax: +49 3641 2809-12 E-Mail: sales@MAZeT.de Url: http://www.MAZeT.de	Approvals	Date	MAZeT GmbH	
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1. GENERAL DESCRIPTION

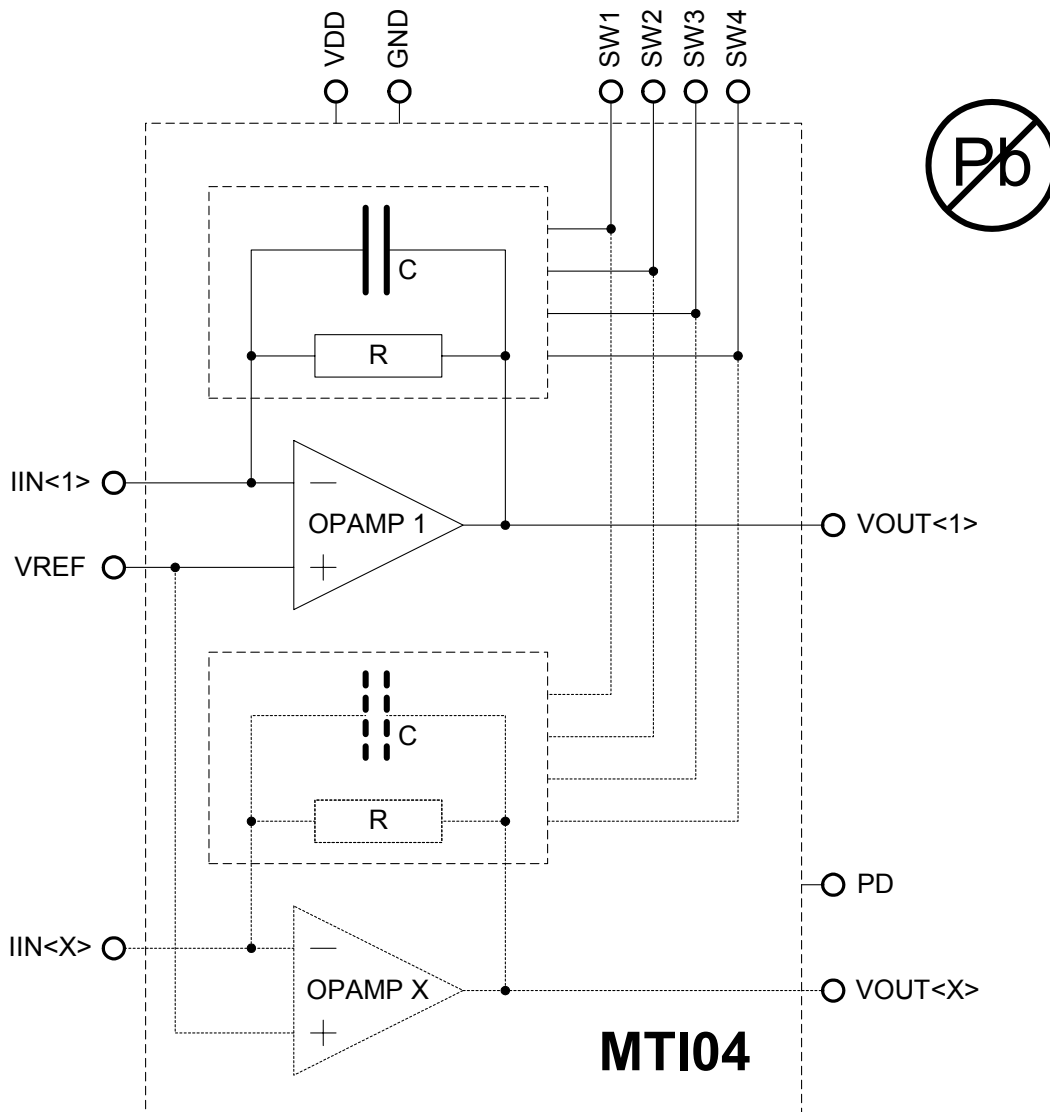
The MTI-devices are a family of integrated circuits of **programmable gain transimpedance amplifiers** with **4 channels** per IC (more custom specific, on request).

The MTI-devices are mainly used for **signal conditioning of sensors with current outputs**. They are especially suitable for connection of photodiodes of **array and row sensors**.

The possibility to **adjust the transimpedance in 8 stages** is a special feature. The adjustment is made by programming three pins and is valid for all channels together.

The device packages (naked chip on request) are ROHS conform and optimized for **COB-mounting and SMD**.

2. BLOCK DIAGRAM



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3. DESCRIPTION OF INTERFACE

3.1 Pinning

signal name	typ.	a/d ^a	function
VDD	input	a/d	power supply
GND	input	a/d	power supply
VREF	input	a	reference voltage
SW1	input	d	input 1 for adjustment of transimpedance of MTI-amplifier (pull down)
SW2	input	d	input 2 for adjustment of transimpedance of MTI-amplifier (pull down)
SW3	input	d	input 3 for adjustment of transimpedance of MTI-amplifier (pull down)
SW4	input	d	switchable frequency range dependend on input capacitance of the photo-sensor (pull down)
PD	input	d	power down modus (pull down)
IIN<X>	input	a	analog current input of amplifier X
VOOUT<X>	output	a	analog voltage output of amplifier X

a.) analog or digital

3.2 Adjustment of Transimpedance

settings of digital inputs			transimpedance R
SW1	SW2	SW3	
VDD	VDD	VDD	20M Ω – stage 1
GND	VDD	VDD	10M Ω – stage 2
GND	VDD	GND	5M Ω – stage 3
VDD	GND	VDD	2M Ω – stage 4
GND	GND	VDD	1M Ω – stage 5
VDD	GND	GND	500k Ω – stage 6
VDD	VDD	GND	100k Ω – stage 7
GND	GND	GND	25k Ω^b – stage 8

b.) default by pull down

3.3 Switchable Frequency Range

settings of digital input	allowed capacitance of photo-sensor
SW4	
VDD	< 5pF
GND	< 80pF ^c

c.) default by pull down

3.4 Power Down Modus

settings of digital input	bias current of the IC
PD	
VDD	< 8 μ A
GND	typical ^d

d.) default by pull down

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4. DESCRIPTION OF FUNCTION

The MTI-devices are programmable gain transimpedance amplifiers with different numbers of channels (MTI04 – 4 channels). There is one transimpedance amplifier per channel between a current input IIN<X> and a voltage output VOUT<X>. Its transimpedance is selectable in 8 stages. This adjustment can be effected by setting of digital inputs SW1, SW3 and SW4 and is valid for all channels simultaneously (headline 3.2).

Also simultaneously valid for all channels is a compensation of the input capacitance of photo-sensors for two possible frequency ranges (switchable by SW4, headline 3.3). The pins SW1, SW2, SW3 and SW4 are pull down inputs.

The second input of all transimpedance amplifiers is used for a *common* supply by a reference voltage necessarily fed in through the pin VREF.

All channels are compensated for an external input capacitance of the photo-sensor of smaller than 80pF (SW4 = GND).

The power supply for the MTI-devices is typical 3V to 5V between VDD and GND.

The power down modus is adjusted by PD = VDD and switches off the functionality.

5. ELECTRICAL CHARACTERISTICS

5.1 Maximum Conditions

Violations of absolute maximum conditions are not allowed under any circumstances, otherwise the IC can be destroyed.

All voltages are referenced to GND = 0V.

parameter	name	min.	max.	unit
power supply	VDD	0.3	7.0	V
input and output voltages	⇒ IC-pinning	0.3	VDD+0.3	V
power dissipation	P _{OP}		0.025	W
operating temperature	T _{OP}	-40	125	°C
storage temperature	T _{STG}	55	155	°C

5.2 Operating Conditions

All voltages are referenced to GND = 0V.

parameter	name	min.	typ.	max.	unit	condition
supply voltage	VDD	2.7	3 to 5	5.5	V	
bias current MTI04	I(VDD)		2.5	4.0	mA	27°C, VDD=5.5V
bias current MTI04	I(VDD)			8	μA	PD=VDD
operating temperature	T _{OP}	-40	27	125	°C	
input high level	V _{IH}	0.7*VDD		VDD+0.3	V	
input low level	V _{IL}	-0.3		0.8	V	
reference voltage	VREF	0.4		VDD-0.4	V	

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AC/DC-Characteristics

Unless otherwise specified the data in this table is valid for $T_{OP} = 27^{\circ}\text{C}$ and $V_{DD} = 5\text{V}$.
All voltages are referenced to $\text{GND} = 0\text{V}$.

parameter	name	min.	typ.	max.	unit	condition
input current	I(IIN<X>)		0.025		μA	stage 1
			0.05		μA	stage 2
			0.1		μA	stage 3
			0.25		μA	stage 4
			0.5		μA	stage 5
			1		μA	stage 6
			5		μA	stage 7
			20		μA	stage 8
feedback resistor	R	14000	20000	26700	$\text{k}\Omega$	stage 1
		7000	10000	13350	$\text{k}\Omega$	stage 2
		3500	5000	6700	$\text{k}\Omega$	stage 3
		1400	2000	2670	$\text{k}\Omega$	stage 4
		700	1000	1335	$\text{k}\Omega$	stage 5
		350	500	670	$\text{k}\Omega$	stage 6
		70	100	133	$\text{k}\Omega$	stage 7
		17	25	34	$\text{k}\Omega$	stage 8
signal frequency at input SW4 = GND ($C_{\text{PHOTO-SENSOR}} < 80\text{pF}$)	$f_{3\text{dB}}$	4	6	16	kHz	stage 1, T_{OP} (5.2)
		7	11	28	kHz	stage 2, T_{OP} (5.2)
		11	16	42	kHz	stage 3, T_{OP} (5.2)
		18	26	66	kHz	stage 4, T_{OP} (5.2)
		25	35	95	kHz	stage 5, T_{OP} (5.2)
		35	50	130	kHz	stage 6, T_{OP} (5.2)
		80	120	280	kHz	stage 7, T_{OP} (5.2)
		160	300	580	kHz	stage 8, T_{OP} (5.2)
signal frequency at input SW4 = VDD ($C_{\text{PHOTO-SENSOR}} < 5\text{pF}$)	$f_{3\text{dB}}$	4	6	16	kHz	stage 1, T_{OP} (5.2)
		7	11	28	kHz	stage 2, T_{OP} (5.2)
		14	21	45	kHz	stage 3, T_{OP} (5.2)
		35	54	130	kHz	stage 4, T_{OP} (5.2)
		70	110	260	kHz	stage 5, T_{OP} (5.2)
		100	160	360	kHz	stage 6, T_{OP} (5.2)
		260	380	780	kHz	stage 7, T_{OP} (5.2)
		500	800	1700	kHz	stage 8, T_{OP} (5.2)
temperature coefficient of the feedback resistor	TC_R		-3300		ppm/K	
offset voltage	V_{OFF}^1	-10		10	mV	T_{OP} (5.2)
capacitive load at VOUT<X>	C_{LOAD}			50	pF	$I_{\text{LOAD}} < 0.5\text{mA}$ per output
pull down current SW1, SW2, SW3, SW4, PD	I_{PDPAD}			200	μA	digital inputs
input capacitance of external connected photo-sensors	$C_{\text{PHOTO-SENSOR}}$			80	pF	per input SW4 = GND
input capacitance of external connected photo-sensors	$C_{\text{PHOTO-SENSOR}}$			5	pF	per input SW4 = VDD
tolerance of the feedback resistors between the four channels	TOL_R^2	1		10	%	DC input current; for all stages

¹ $V_{\text{OFF}} = \text{VOUT}<X> - V_{\text{REF}}$; results from input offset voltage and input leakage current

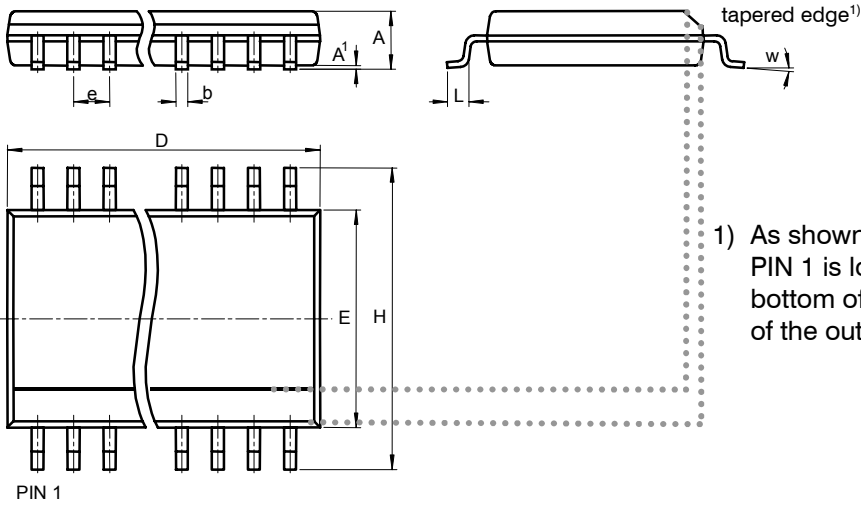
² up to max. 1% available on request

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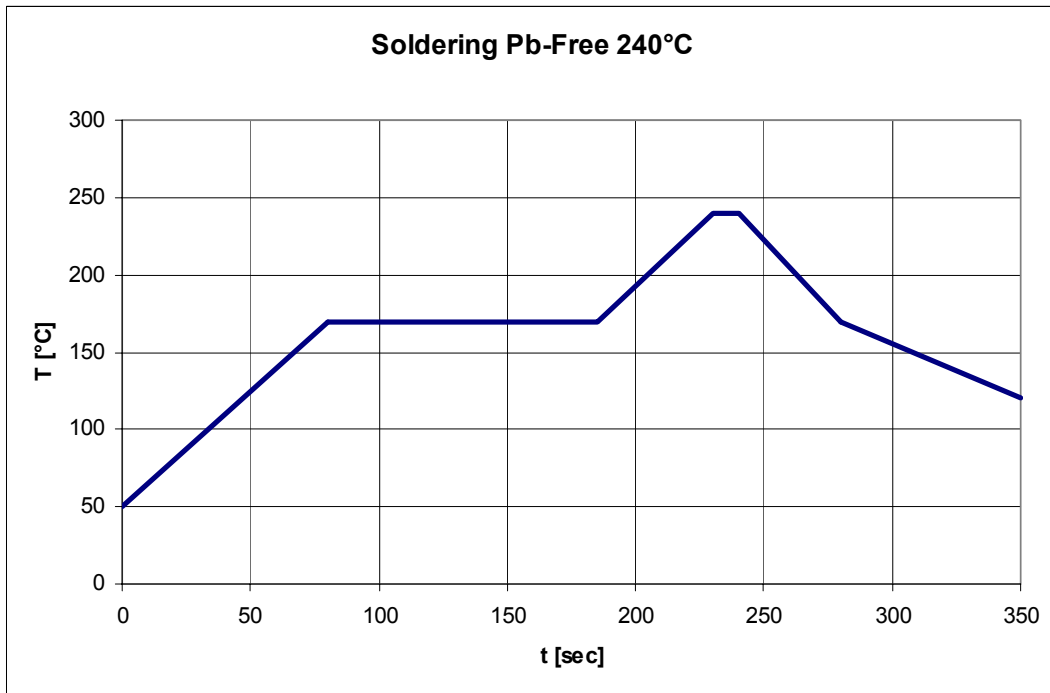
6. PACKAGES

6.1 Shape And Dimensions



dimensions – mm

TYP	PACKAGE	D	E	H	A	A1	e	b	L	w
MTI04CS	SOP16	9.90	3.80	6.00	1.75	0.15	1.27	0.41	0.72	4°
MTI04CQ	QSOP16	4.90	3.80	6.00	1.75	0.15	0.635	0.38	0.72	4°



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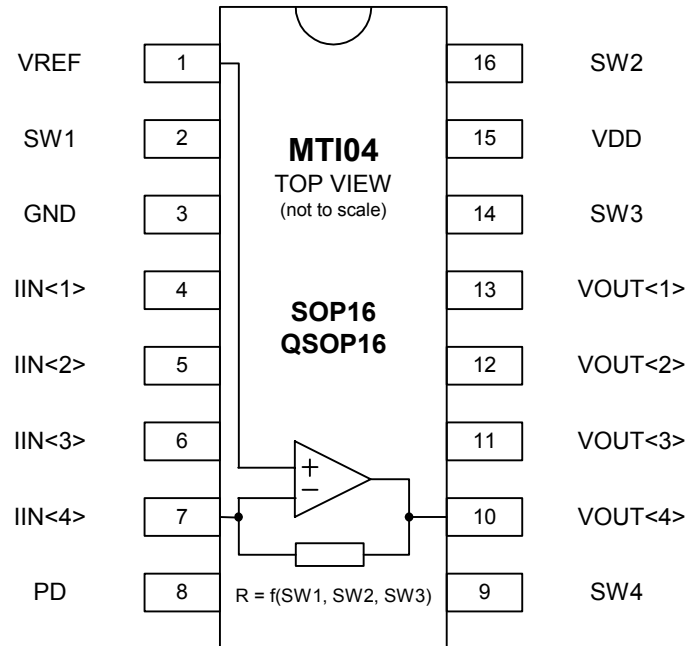
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6.2 Pin-Configuration



7. ORDERING INFORMATION

NAME OF PRODUCT	PACKAGE	NUMBER OF CHANNELS
MTI04CS	SOP16	4
MTI04CQ	QSOP16	4



8. CONTACT

For further information, please feel free to contact:

MAZeT GmbH**Sales office:**

Göschwitzer Straße 32

07745 JENA

GERMANY

Phone: +49 3641 2809-0

Fax: +49 3641 2809-12

E-Mail: sales@MAZeT.deUrl: <http://www.MAZeT.de>

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9. APPLICATIONS

Connection of MAZeT Color Sensor

