



MILITARY DATA SHEET

MNCOPCG-XXX/V-MRP REV 0B0

Original Creation Date: 07/28/94
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SINGLE-CHIP microCMOS MICROCONTROLLER

General Description

The COP888 family of microcontrollers uses an 8-bit single chip core architecture fabricated with National Semiconductor's M2-CMOS(TM) process technology. The COP888CG is a member of this expandable 8-bit core processor family of microcontrollers. They are fully static parts, fabricated using double-metal silicon gate microCMOS technology. Features include an 8-bit memory mapped architecture, MICROWIRE/PLUS serial I/O, three 16-bit timer/counters supporting three modes (Processor Independent PWM generation, External Event counter, and Input Capture mode capabilities), full duplex UART, two comparators, and two power savings modes (HALT and IDLE), both with a multi-sourced wakeup/interrupt capability. This multi-sourced interrupt capability may also be used independent of the HALT or IDLE modes. Each I/O pin has software selectable configurations. The devices operate over a voltage range of 2.5V to 6V. High throughput is achieved with an efficient, regular instruction set operating at a maximum of 1uS per instruction rate.

Industry Part Number

COP888CG

NS Part Numbers

COPCG-XXX/V-MPC

Prime Die

COP8CG88

Processing

HERMETIC - MIL-STD-883, Method 5004
 PLASTIC - SOP-5-264

Quality Conformance Inspection

HERMETIC - MIL-STD-883, Method 5005
 PLASTIC - SOP-5-264

Subgrp	Description	Temp (°C)
1	Static tests at	+25
2	Static tests at	+85
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+85
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+85
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+85
11	Switching tests at	-55

Features

- Fully static CMOS, with low current drain
- Two power saving modes: HALT and IDLE
- 1µS instruction cycle time
- 4096 bytes on-board ROM (COP888CG)
- 192 bytes on-board RAM (COP888CG)
- Single supply operation: 2.5V-6V
- Full duplex UART
- Two analog comparators
- MICROWIRE/PLUS(TM) serial I/O
- WATCHDOG(TM) and Clock Monitor logic
- Idle Timer
- Multi-Input Wakeup (MIWU) with optional interrupts (8)
- Three 16-bit timers, each with two 16-bit registers supporting:
 - Processor Independent PWM mode
 - External Event counter mode
 - Input Capture mode
- 8-bit Stack Pointer SP (stack in RAM)
- Two 8-bit Register Indirect Data Memory Pointers (B and X)
- Fourteen multi-source vectored interrupts servicing
 - External Interrupt
 - Idle Timer T0
 - Three Timers (Each with 2 Interrupts)
 - MIRCOWIRE/PLUS
 - Multi-Input Wake Up
 - Software Trap
 - UART (2)
 - Default VIS
- Versatile instruction set
- True bit manipulation
- Memory mapped I/O
- BCD arithmetic instructions
- Package:
 - 44 PLCC with 39 I/O pins
- Software selectable I/O options
 - TRI-STATE(R) Output
 - Push-Pull Output
 - Weak Pull Up Input
 - High Impedance Input
- Schmitt trigger inputs on ports G and L
- Temperature range: -55 C to +85 C
- Form factor emulation devices
- Real time emulation and full program debug offered by National's Development Systems

(Absolute Maximum Ratings)

(Note 1)

Supply Voltage (Vcc)	7V
Voltage at Any Pin	-0.3V to Vcc + 0.3V
Total Current into Vcc Pin (Source)	100mA
Total Current out of GND Pin (Sink)	110mA
Storage Temperature Range	-65 C to +140 C

Note 1: Absolute maximum ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications are not ensured when operating the device at absolute maximum ratings.

Electrical Characteristics

DC PARAMETERS

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
	Operating Voltage				2.5	6	V	1, 2, 3
	Supply Current	CKI = 10MHz, Vcc = 6.0V, tC = 1uS	1			12.5	mA	1, 2, 3
		CKI = 4MHz, Vcc = 6.0V, tC = 2.5uS	1			5.5	mA	1, 2, 3
		CKI = 4MHz, Vcc = 4.0V, tC = 2.5uS	1			2.5	mA	1, 2, 3
		CKI = 1MHz, Vcc = 4.0V, tC = 10uS	1			1.4	mA	1, 2, 3
	HALT Current	CKI = 0MHz, Vcc = 6.0V	2			10	uA	1, 2, 3
		CKI = 0MHz, Vcc = 4.0V	2			6	uA	1, 2, 3
	Idle Current	CKI = 10MHz, Vcc = 6.0V, tC = 1uS				3.5	mA	1, 2, 3
		CKI = 4MHz, Vcc = 6.0V, tC = 2.5uS				2.5	mA	1, 2, 3
		CKI = 1MHz, Vcc = 4.0V, tC = 10uS				0.7	mA	1, 2, 3
Vih	Input Levels RESET	Logic High			0.8Vcc		V	1, 2, 3
Vil	Input Levels RESET	Logic Low				0.2Vcc	V	1, 2, 3
Vih	Input Levels CKI, All Other Inputs	Logic High			0.7Vcc		V	1, 2, 3
Vil	Input Levels CKI, All Other Inputs	Logic Low				0.2Vcc	V	1, 2, 3
	Hi-Z Input Leakage	Vcc = 6.0V, Vin = 0V			-2	2	uA	1, 2, 3
	Input Pullup Current	Vcc = 6.0V, Vin = 0V			40	250	uA	1, 2, 3
	Output Current D Outputs	Source, Vcc = 4.0V, Voh = 3.3V			.4		mA	1, 2, 3
		Source, Vcc = 2.5V, Voh = 1.8V			.2		mA	1, 2, 3
		Sink, Vcc = 4.0V, Vol = 1.0V			10		mA	1, 2, 3
		Sink, Vcc = 2.5V, Vol = 0.4V			2		mA	1, 2, 3

Electrical Characteristics

DC PARAMETERS (Continued)

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
	Output Current All Others	Source (Weak Pull-Up) Vcc=4.0V, Voh=2.7V			10	110	uA	1, 2, 3
		Source (Weak Pull-Up) Vcc=2.5V, Voh=1.8V			2.5	33	uA	1, 2, 3
		Source (Push-Pull Mode) Vcc = 4.0V, Voh = 3.3V			.4		mA	1, 2, 3
		Source (Push-Pull Mode) Vcc = 2.5V, Voh = 1.8V			.2		mA	1, 2, 3
		Sink (Push-Pull Mode) Vcc=4.0V, Vol=0.4V			1.6		mA	1, 2, 3
		Sink (Push-Pull Mode) Vcc=2.5V, Vol=0.4V			.7		mA	1, 2, 3
	Tri-State Leakage	Vcc = 6V			-2	2	uA	1, 2, 3
Vr	RAM Retention Voltage	500nS Rise and Fall Time (min)			2		V	1, 2, 3

Electrical Characteristics

AC PARAMETERS

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tC	Instruction Cycle Time Crystal/Resonator	4V <= Vcc =< 6V			1	DC	uS	9, 10, 11
		2.5 = Vcc =< 4V			2.5	DC	uS	9, 10, 11
tC	Instruction Cycle Time R/C Oscillator Mode	4V <= Vcc =< 6V			3	DC	uS	9, 10, 11
		2.5 <= Vcc =< 4V			7.5	DC	uS	9, 10, 11
tPD1, tPD0	Output Propagation Delay	SO, SK, RL = 2.2K, CL = 100pF, 4V <= Vcc =< 6V	3			.7	uS	9, 10, 11
		SO, SK, RL = 2.2K, CL = 100pF, 2.5V <= Vcc =< 4V	3			1.75	uS	9, 10, 11
		All Others, RL = 2.2K, CL = 100pF, 4V <= Vcc =< 6V	3			1	uS	9, 10, 11
		All Others, RL = 2.2K, CL = 100pF, 2.5V <= Vcc =< 4V	3			2.5	uS	9, 10, 11
	Input Pulse Width Interrupt Input High Time		4		1		tC	9, 10, 11
	Input Pulse Width Interrupt Input Low Time		4		1		tC	9, 10, 11
	Input Pulse Width Timer Input High Time		4		1		tC	9, 10, 11
	Input Pulse Width Timer Input Low Time		4		1		tC	9, 10, 11
	RESET Pulse Width				1		uS	9, 10, 11
	Input Offset Voltage	.4V <= Vin =< Vcc -1.5V				±25	mV	9, 10, 11
	Input Common Mode Voltage Range				.4	Vcc -1.5	V	9, 10, 11
	Low Level Output Current	Vol = 0.4V			1.6		mA	9, 10, 11
	High Level Output Current	Voh = 4.6V			1.6		mA	9, 10, 11

Note 1: Supply current measured after running 2000 cycles with a square wave CKI input, CKO open, inputs at rails and outputs open.

Note 2: The HALT mode will stop CKI from oscillating in the RC and the Crystal configurations. Measurement of IDD HALT is done with device neither sourcing or sinking current; with L, C, and G0-G5 programmed as low outputs and not driving a load; all inputs tied to Vcc; clock monitor and comparators disabled. Parameter refers to HALT mode entered via setting bit 7 of the G Port data register. Part will pull up CKI during HALT in crystal clock mode.

(Continued)

- Note 3: The output propagation delay is referenced to the end of the instruction cycle where the output change occurs.
- Note 4: t_C = Instruction Cycle Time.

Burn-in/QCI Electrical End-Point Tests

OP#	Operation description	Sub-Groups
01	MRP, B4 - Must be performed within 48 hours of moisture	1,9
02	MRP, C1 - Must be performed within 96 hours of burn-in	1,9
03	MRP, C1	2,3,10,11
04	MRP, C2 - Must be performed within 48 hours of moisture	1,9
05	MRP, D2	1,9
06	MRP, D3	1,2,9,10
07	MRP, D4 - Test between precondition and Temp. Cycle	1,9
08	MRP, D4	1,2,9,10

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
V44ARK	PLASTIC CHIP CARRIER,SQ,.050LD PITCH,44LD(P/P DWG)

See attached graphics following this page.

