National Semiconductor

PRELIMINARY

COP888CGMH/COP884CGMH and COP888EGMH microCMOS Microcontroller Emulator

General Description

The COP888CGMH and COP888EGMH hybrid emulators are members of the COPS™ microcontroller family. The device is a two chip system in a dual cavity package. Within the package is the COP888CG or COP888EG and a UV-erasable 8k EPROM with port recreation logic. Code executes out of EPROM. The device is offered in the following packages: COP888CG and COP888EG are in 44-pin LDCC, 40-pin DIP, and COP884CGMH in 28-pin DIP. All packages contain transparent windows which allow the EPROM to be erased and re-programmed.

The COP888CGMH/COP888EGMH are fully static, 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 device operates over a voltage range of 4.5V to 5.5V. High throughput is achieved with an efficient, regular instruction set operating at a maximum of 1 μs per instruction rate.

These devices are primarily intended as a prototyping design tool. The Electrical Performance Characteristics are not tested but are included for reference only.

Features

- Low cost 8-bit microcontroller
- Fully static CMOS, with low current drain
- Two power saving modes: HALT and IDLE
- 1 μs instruction cycle time
- 8192 bytes on-board EPROM
- 192 bytes on-board RAM for COP888CGMH; 256 bytes for COP888EGMH
- Single supply operation: 4.5V–5.5V
- Full duplex UART
- Two analog comparators
- MICROWIRE/PLUS serial I/O
- WATCHDOG 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
- Fourteen multi-source vectored interrupts servicing
  - — External Interrupt
  - — Idle Timer T0
  - — Two Timers each with 2 interrupts
  - — MICROWIRE/PLUS
  - — Multi-Input Wake Up
  - — Software Trap
  - — UART (2)
  - — Default VIS
- 8-bit Stack Pointer SP (stack in RAM)
- Two 8-bit Register Indirect Data Memory Pointers (B and X)
- Versatile instruction set with true bit manipulation
- Memory mapped I/O
- BCD arithmetic instructions
- Package: 44 LDCC with 39 I/O pins
  40 DIP with 35 I/O pins
  28 DIP with 23 I/O pins
- Software selectable I/O options
  - — TRI-STATE® Output
  - — Push-Pull Output
  - — Weak Pull Up Input
  - — High Impedance Input
- Schmitt trigger inputs on ports G and L
- Form fit and function emulation device for the COP888CG and COP888EG
- Real time emulation and full program debug offered by National's Development Systems

Ordering Information

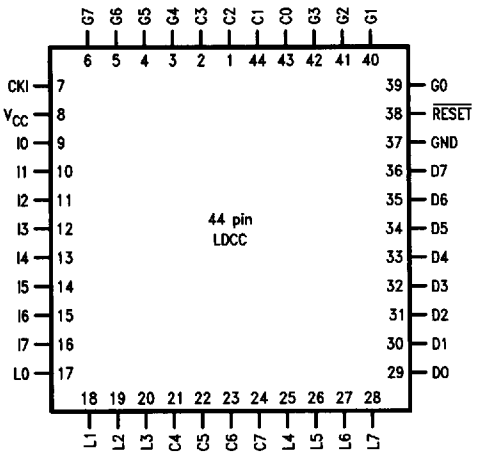
Hybrid Emulator	Package Type	Part Emulated with Crystal Oscillator Option
COP888CGMHD-X	40-Pin DIP	COP888CG-XXX/N
COP888CGMHEL-X	44-Pin LDCC	COP888CG-XXX/V
COP884CGMHD-X	28-Pin DIP	COP884CG-XXX/N

Hybrid Emulator	Package Type	Part Emulated with Crystal Oscillator Option
COP888EGMHD-X	40-Pin DIP	COP888EG-XXX/N
COP888CGMHEL-X	44-Pin LDCC	COP888EG-XXX/V

X indicates Crystal Option: for applications requiring R/C oscillator option check with your local sales representative.

Connection Diagrams

Plastic Chip Carrier

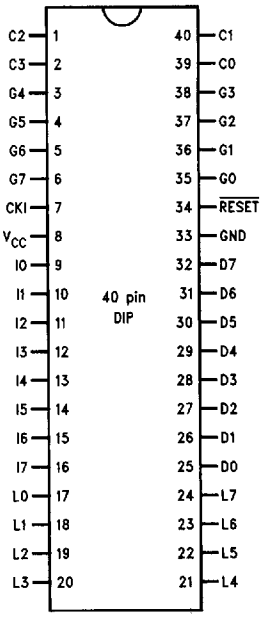


TL/DD/10425–2

Top View

Order Number
COP888CGMHEL-X or COP888EGMHEL-X
See NS Package EL44B

Dual-In-Line Package

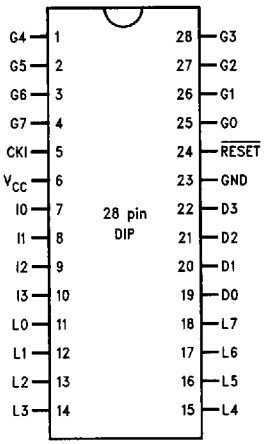


TL/DD/10425–3

Top View

Order Number
COP888CGMHD-X or COP888EGMHD-X
See NS Package D40J

Dual-In-Line Package



TL/DD/10425–4

Top View

Order Number COP884CGMHD
See NS Package D28G

FIGURE 1. COP888CGMHD/COP888EGMH Connection Diagrams

Connection Diagrams (Continued)

COP888CGMH/COP888EGMH Pinouts

Port	Type	Alternate Fun	Alternate Fun	28-Pin DIP	40-Pin DIP	44-Pin LDCC
L0	I/O	MIWU		11	17	17
L1	I/O	MIWU	CKX	12	18	18
L2	I/O	MIWU	TDX	13	19	19
L3	I/O	MIWU	RDX	14	20	20
L4	I/O	MIWU	T2A	15	21	25
L5	I/O	MIWU	T2B	16	22	26
L6	I/O	MIWU	T3A	17	23	27
L7	I/O	MIWU	T3B	18	24	28
G0	I/O	INT		25	35	39
G1	WDOUT			26	36	40
G2	I/O	T1B		27	37	41
G3	I/O	T1A		28	38	42
G4	I/O	SO		1	3	3
G5	I/O	SK		2	4	4
G6	I	SI		3	5	5
G7	I/CKO	HALT RESTART		4	6	6
I0	I			7	9	9
I1	I	COMP1IN−		8	10	10
I2	I	COMP1IN+		9	11	11
I3	I	COMP1OUT		10	12	12
I4	I	COMP2IN−			13	13
I5	I	COMP2IN+			14	14
I6	I	COMP2OUT			15	15
I7	I				16	16
D0	O			19	25	29
D1	O			20	26	30
D2	O			21	27	31
D3	O			22	28	32
D4	O				29	33
D5	O				30	34
D6	O				31	35
D7	O				32	36
C0	I/O				39	43
C1	I/O				40	44
C2	I/O				1	1
C3	I/O				2	2
C4	I/O					21
C5	I/O					22
C6	I/O					23
C7	I/O					24
V_{CC}				6	8	8
GND				23	33	37
CKI				5	7	7
$\overline{\text{RESET}}$				24	34	38

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	7V
Voltage at Any Pin	−0.3V to V_{CC} + 0.3V
Total Current into V_{CC} Pin (Source)	100 mA
Total Current out of GND Pin (Sink)	110 mA
Storage Temperature Range	−65°C to +140°C

Note: *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.*

The following AC and DC Electrical Characteristics are not tested but are for reference only.

DC Electrical Characteristics 0°C ≤ T_A ≤ +70°C unless otherwise specified

Parameter	Conditions	Min	Typ	Max	Units
Operating Voltage		4.5		5.5	V
Power Supply Ripple (Note 1)	Peak-to-Peak			0.1 V_{CC}	V
Supply Current (Note 2)					
CKI = 10 MHz	V_{CC} = 5.5V, t_c = 1 μs			25	mA
HALT Current (Note 3)	V_{CC} = 5.5V, CKI = 0 MHz		250		μA
IDLE Current					
CKI = 10 MHz	V_{CC} = 5.5V, t_c = 1 μs			15	mA
Input Levels					
$\overline{\text{RESET}}$					
Logic High		0.8 V_{CC}			V
Logic Low				0.2 V_{CC}	V
CKI (External and Crystal Osc. Modes)					
Logic High		0.7 V_{CC}			V
Logic Low				0.2 V_{CC}	V
All Other Inputs					
Logic High		0.7 V_{CC}			V
Logic Low				0.2 V_{CC}	V
Hi-Z Input Leakage	V_{CC} = 5.5V	−2		+2	μA
Input Pullup Current	V_{CC} = 5.5V	40		250	μA
G and L Port Input Hysteresis			0.05 V_{CC}		V
Output Current Levels					
D Outputs					
Source	V_{CC} = 4.5V, V_{OH} = 3.3V	0.4			mA
Sink	V_{CC} = 4.5V, V_{OL} = 1V	10			mA
All Others					
Source (Weak Pull-Up Mode)	V_{CC} = 4.5V, V_{OH} = 2.7V	10		100	μA
Source (Push-Pull Mode)	V_{CC} = 4.5V, V_{OH} = 3.3V	0.4			mA
Sink (Push-Pull Mode)	V_{CC} = 4.5V, V_{OL} = 0.4V	1.6			mA
TRI-STATE Leakage	V_{CC} = 4.5V	−2		+2	μA

Note 1: Rate of voltage change must be less then 0.5 V/ms.

Note 2: Supply current is measured after running 2000 cycles with a square wave CKI input, CKO open, inputs at rails and outputs open.

Note 3: The HALT mode will stop CKI from oscillating in the RC and the Crystal configurations. Test conditions: All inputs tied to V_{CC}, L and G ports in the TRI-STATE mode and tied to ground, all outputs low and tied to ground. The comparators and Clock Monitor are disabled.

DC Electrical Characteristics $0°C \le T_A \le +70°C$ unless otherwise specified (Continued)

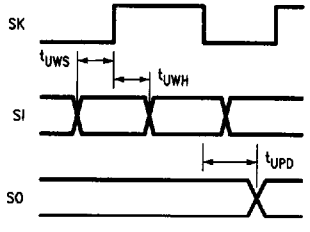
Parameter	Conditions	Min	Typ	Max	Units
Allowable Sink/Source Current per Pin					
D Outputs (Sink)				15	mA
All Others				3	mA
Maximum Input Current without Latchup (Note 4)	$T_A = 25°C$			±100	mA
RAM Retention Voltage, V_r	500 ns Rise and Fall Time (Min)	2			V
Input Capacitance				7	pF
Load Capacitance on D2				1000	pF

AC Electrical Characteristics $0°C \le T_A \le +70°C$ unless otherwise specified

Parameter	Conditions	Min	Typ	Max	Units
Instruction Cycle Time (t_c)					
Crystal, Resonator,		1		DC	μs
R/C Oscillator		3		DC	μs
CKI Clock Duty Cycle (Note 5)	f_r = Max	40		60	%
Rise Time (Note 5)	f_r = 10 MHz Ext Clock			5	ns
Fall Time (Note 5)	f_r = 10 MHz Ext Clock			5	ns
Inputs					
t_{SETUP}		200			ns
t_{HOLD}		60			ns
Output Propagation Delay	R_L = 2.2k, C_L = 100 pF				
t_{PD1}, t_{PD0}					
SO, SK				0.7	μs
All Others				1	μs
MICROWIRE™ Setup Time (t_{UWS})		20			ns
MICROWIRE Hold Time (t_{UWH})		56			ns
MICROWIRE Output Propagation Delay (t_{UPD})				220	ns
Input Pulse Width					
Interrupt Input High Time		1			t_c
Interrupt Input Low Time		1			t_c
Timer Input High Time		1			t_c
Timer Input Low Time		1			t_c
Reset Pulse Width		1			μs

Note 4: Except pin G7: −60 mA to +100 mA (sampled but not 100% tested).

Note 5: Parameter sampled (not 100% tested).



TL/DD/10425–5

FIGURE 2. MICROWIRE/PLUS Timing

Comparators AC and DC Characteristics V_{CC} = 5V, T_A = 25°C

Parameter	Conditions	Min	Typ	Max	Units
Input Offset Voltage	$0.4V \le V_{IN} \le V_{CC} - 1.5V$		±10	±25	mV
Input Common Mode Voltage Range		0.4		$V_{CC} - 1.5$	V
Low Level Output Current	V_{OL} = 0.4V	1.6			mA
High Level Output Current	V_{OH} = 4.6V	1.6			mA
DC Supply Current per Comparator (When Enabled)				250	μA
Response Time	TBD mV Step, TBD mV Overdrive, 100 pF Load		1		μs

Pin Descriptions

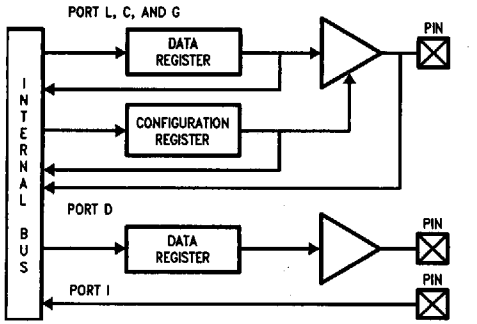
V_{CC} and GND are the power supply pins.

CKI is the clock input. This can come from an R/C generated oscillator, or a crystal oscillator (in conjunction with CKO). See Oscillator Description section.

$\overline{\text{RESET}}$ is the master reset input. See Reset Description section.

The COP888CGMH/COP888EGMH contains three bidirectional 8-bit I/O ports (C, G and L), where each individual bit may be independently configured as an input, output or TRI-STATE under program control. Three data memory address locations are allocated for each of these I/O ports. Each I/O port has two associated 8-bit memory mapped registers, the CONFIGURATION register and the output DATA register. A memory mapped address is also reserved for the input pins of each I/O port. *Figure 3* shows the I/O port configurations. The DATA and CONFIGURATION registers allow for each port bit to be individually configured under software control as shown below:

CONFIGURATION Register	DATA Register	Port Set-Up
0	0	Hi-Z Input (TRI-STATE Output)
0	1	Input with Weak Pull-Up
1	0	Push-Pull Zero Output
1	1	Push-Pull One Output



TL/DD/10425–6

FIGURE 3. I/O Port Configurations

Port L is an 8-bit I/O port. All L-pins have Schmitt triggers on the inputs.

The Port L supports Multi-Input Wake Up on all eight pins. L1 is used for the UART external clock. L2 and L3 are used for the UART transmit and receive. L4 and L5 are used for the timer input functions T2A and T2B. L6 and L7 are used for the timer input functions T3A and T3B.

The Port L has the following alternate features:

- L0 MIWU
- L1 MIWU or CKX
- L2 MIWU or TDX
- L3 MIWU or RDX
- L4 MIWU or T2A
- L5 MIWU or T2B
- L6 MIWU or T3A
- L7 MIWU or T3B

Port G is an 8-bit port with 5 I/O pins (G0, G2–G5), an input pin (G6), and two dedicated output pins (G1 and G7). Pins G0 and G2–G6 all have Schmitt Triggers on their inputs. Pin G1 serves as the dedicated WDOUT WATCHDOG output, while pin G7 is either input or output depending on the oscillator mask option selected. With the crystal oscillator option selected, G7 serves as the dedicated output pin for the CKO clock output. With the single-pin R/C oscillator mask option selected, G7 serves as a general purpose input pin but is also used to bring the device out of HALT mode with a low to high transition. There are two registers associated with the G Port, a data register and a configuration register. Therefore, each of the 5 I/O bits (G0, G2–G5) can be individually configured under software control.

Pin Descriptions (Continued)

Since G6 is an input only pin and G7 is the dedicated CKO clock output pin (crystal clock option) or general purpose input (R/C clock option), the associated bits in the data and configuration registers for G6 and G7 are used for special purpose functions as outlined below. Reading the G6 and G7 data bits will return zeros.

Note that the chip will be placed in the HALT mode by writing a "1" to bit 7 of the Port G Data Register. Similarly the chip will be placed in the IDLE mode by writing a "1" to bit 6 of the Port G Data Register.

Writing a "1" to bit 6 of the Port G Configuration Register enables the MICROWIRE/PLUS to operate with the alternate phase of the SK clock. The G7 configuration bit, if set high, enables the clock start up delay after HALT when the R/C clock configuration is used.

	Config Reg.	Data Reg.
G7	CLKDLY	HALT
G6	Alternate SK	IDLE

Port G has the following alternate features:

- G0 INTR (External Interrupt Input)
- G2 T1B (Timer T1 Capture Input)
- G3 T1A (Timer T1 I/O)
- G4 SO (MICROWIRE Serial Data Output)
- G5 SK (MICROWIRE Serial Clock)
- G6 SI (MICROWIRE Serial Data Input)

Port G has the following dedicated functions:

- G1 WDOUT (WATCHDOG and/or Clock Monitor dedicated output)
- G7 CKO (Oscillator dedicated output or general purpose input)

Port I is an 8-bit port. Port I1–I3 are used for Comparator 1. Port I4–I6 are used for Comparator 2.

The Port I has the following alternate features.

- I1 COMP1 − IN (Comparator 1 Negative Input)
- I2 COMP1 + IN (Comparator 1 Positive Input)
- I3 COMP1OUT (Comparator 1 Output)
- I4 COMP2 − IN (Comparator 2 Negative Input)
- I5 COMP2 + IN (Comparator 2 Positive Input)
- I6 COMP2OUT (Comparator 2 Output)

Port D is an 8-bit output port that is preset high when $\overline{\text{RESET}}$ goes low. The user can tie two or more D port outputs together in order to get a higher drive.

Port C is an 8-bit I/O port.

Oscillator Circuits

The chip can be driven by a clock input on the CKI input pin which can be between DC and 10 MHz. The CKO output clock is on pin G7 (crystal configuration). The CKI input frequency is divided down by 10 to produce the instruction cycle clock ($1/t_C$).

Figure 4 shows the Crystal and R/C diagrams.

CRYSTAL OSCILLATOR

CKI and CKO can be connected to make a closed loop crystal (or resonator) controlled oscillator.

Table I shows the component values required for various standard crystal values.

R/C OSCILLATOR (SPECIAL ORDER FROM FACTORY)

By selecting CKI as a single pin oscillator input, a single pin R/C oscillator circuit can be connected to it. CKO is available as a general purpose input, and/or HALT restart input.

Table II shows the variation in the oscillator frequencies as functions of the component (R and C) values.

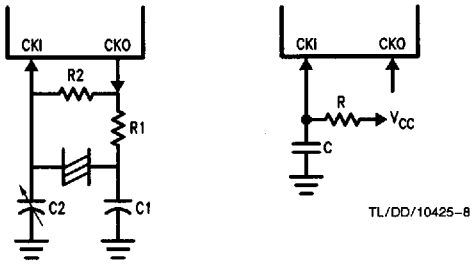


FIGURE 4. Crystal and R/C Oscillator Diagrams

TABLE I. Crystal Oscillator Configuration, $T_A = 25°C$, $V_{CC} = 5V$

R1 (kΩ)	R2 (MΩ)	C1 (pF)	C2 (pF)	CKI Freq (MHz)
0	1	30	30–36	10
0	1	30	30–36	4
0	1	200	100–150	0.455

TABLE II. RC Oscillator Configuration, $T_A = 25°C$, $V_{CC} = 5V$

R (kΩ)	C (pF)	CKI Freq (MHz)	Instr. Cycle (μs)
3.3	82	2.8 to 2.2	3.6 to 4.5
5.6	100	1.5 to 1.1	6.7 to 9
6.8	100	1.1 to 0.8	9 to 12.5

Programming the COP888CGMH/ COP888EGMH

Programming the COP888CGMH/COP888EGMH hybrid emulators is accomplished through the duplicator board which is a stand alone programmer capable of supporting different package types. It works in conjunction with a preprogrammed EPROM (either via the development system or a standard programmer) holding the application program. The duplicator board essentially copies the information in the EPROM into the hybrid emulator.

The last byte of program memory (EPROM location 01FFF Hex) must contain the value specified in the following table.

Programming the COP888CGMH/ COP888EGMH (Continued)

TABLE III

Package	HALT Mode	Contents of Last Byte (Address 01FFF)
28	Enabled	6F
28	Disabled	EF
40/44	Enabled	7F
40/44	Disabled	FF

ERASING THE PROGRAM MEMORY

Erasure of the program memory is achieved by removing the device from its socket and exposing the transparent window to an ultra-violet light source.

The erasure characteristics of the device are such that erasure begins to occur when exposed to light with wavelengths shorter than approximately 4000 Angstroms (Å). It should be noted that sunlight and certain types of fluorescent lamps have wavelengths in the 3000Å to 4000Å range.

After programming, opaque labels should be placed over the window of the device to prevent temporary functional failure due to the generation of photo currents, erasure, and excessive HALT current. Note that the device will also draw more current than normal (especially in HALT mode) when the window of the device is not covered with an opaque label.

The recommended erasure procedure for the device is exposure to short wave ultraviolet light which has a wavelength of 2537Å. The intergrated dose (UV intensity × exposure time) for erasure should be a minimum of 15 W-sec/ cm^2.

The device should be placed within one inch of the lamp tubes during erasure. Some lamps have a filter on their tubes which should be removed before erasure. The following table shows the minimum erasure time for various light intensities.

TABLE IV. Minimum COP888CGMH/COP888EGMH Erasure Time

Light Intensity (Micro-Watts/cm^2)	Erasure Time (Minutes)
15,000	20
10,000	25
5,000	50

An erasure system should be calibrated periodically. The distance from lamp to device should be maintained at one inch. The erasure time increases as the square of the distance. Lamps lose intensity as they age. When a lamp has aged, the system should be checked to make certain that adequate UV dosages are being applied for full erasure.

Development Support

IN-CIRCUIT EMULATOR

The MetaLink iceMASTER™-COP8 Model 400 In-Circuit Emulator for the COP8 family of microcontrollers features high-performance operation, ease of use, and an extremely flexible user-interface for maximum productivity. Interchangeable probe cards, which connect to the standard common base, support the various configurations and packages of the COP8 family.

The iceMASTER provides real time, full speed emulation up to 10 MHz, 32k Bytes of emulation memory and 4k frames of trace buffer memory. The user may define as many as 32k trace and break triggers which can be enabled, disabled, set or cleared. They can be simple triggers based on code or address ranges or complex triggers based on code address, direct address, opcode value, opcode class or immediate operand. Complex breakpoints can be ANDed and ORed together. Trace information consists of address bus values, opcodes and user selectable probe clips status (external event lines). The trace buffer can be viewed as raw hex or as disassembled instructions. The probe clip bit values can be displayed in binary, hex or digital waveform formats.

During single-step operation the dynamically annotated code feature displays the contents of all accessed (read & write) memory locations and registers, as well as flow-of-control direction change markers next to each instruction executed.

The iceMASTER'S performance analyzer offers a resolution of better than 6 μs. The user can easily monitor the time spent executing specific portions of code and find "hot spots" or "dead code". Up to 15 independent memory areas based on code address or label ranges can be defined. Analysis results can be viewed in bargraph format or as actual frequency count.

Emulator memory operations for program memory include single line assembler, disassembler, view, change and write to file. Data memory operations include fill, move, compare, dump to file, examine and modify. The contents of any memory space can be directly viewed and modified from the corresponding window.

The iceMASTER comes with an easy to use windowed interface. Each window can be sized, highlighted, color-controlled, added, or removed completely. Commands can be accessed via pull-down menus and/or redefinable hot keys. A context sensitive hypertext/hyperlinked on-line help system explains clearly the options the user has from within any window.

The iceMASTER connects easily to a PC via the standard COMM port and its 115.2k Baud serial link keeps typical program download time to under 3 seconds.

The following tables list the emulator and probe cards ordering information.

Emulator Ordering Information

Part Number	Description
IM-COP8/400	Metalink base unit in-circuit emulator for all COP8 devices, symbolic debugger software and RS 232 serial interface cable
MHW-PS3	Power Supply 110V/60 Hz
MHW-PS4	Power Supply 220V/50 Hz

Development Support

Probe Card Ordering Information

Part Number	Package	Voltage Range	Emulates
MHW-884CG28D5PC	28 DIP	4.5–5.5V	COP884CG
MHW-884CG28DWPC	28 DIP	2.5–6.0V	COP884CG
MHW-888CG40D5PC/ MHW-888EG40D5PC	40 DIP	4.5–5.5V	COP888CG/ COP888EG
MHW-888CG40DWPC/ MHW-888EG40DWPC	40 DIP	2.5–6.0V	COP888CG/ COP888EG
MHW-888CG44D5PC/ MHW-888EG44D5PC	44 PLCC	4.5–5.5V	COP888CG/ COP888EG
MHW-888CG44DWPC/ MHW-888EG44DWPC	44 PLCC	2.5–6.0V	COP888CG/ COP888EG

MACRO CROSS ASSEMBLER

National Semiconductor offers a COP8 macro cross assembler. It runs on industry standard compatible PCs and supports all of the full-symbolic debugging features of the MetaLink iceMASTER emulators.

Assembler Ordering Information

Part Number	Description	Manual
MOLE-COP8-IBM	COP8 Macro Cross Assembler for IBM PC/XT, AT or Compatible	424410527-001

SINGLE CHIP EMULATOR DEVICE

The COP8 family is fully supported by single chip form, fit and function emulators. For more detailed information refer to the emulation device specific data sheets and the form, fit, function emulator selection table below.

PROGRAMMING SUPPORT

Programming of the single chip emulator devices is supported by different sources. National Semiconductor offers a duplicator board which allows the transfer of program code from a standard programmed EPROM to the single chip emulator and vice versa. Data I/O supports COP8 emulator device programming with its uniSite 48 and System 2900 programmers. Further information on Data I/O programmers can be obtained from any Data I/O sales office or the following USA numbers:

Telephone: (206) 881-6444 Fax: (206) 882-1043

Single Chip Emulator Selection Table

Device Number	Clock Option	Package	Description	Emulates
COP888CGMHEL-X/ COP888EGMHEL-X	X=1 : Crystal X=3 : R/C	44 LDCC	Multi-Chip Module (MCM), UV Erasable	COP888CG/ COP888EG
COP888CGMHD-X/ COP888EGMHD-X	X=1 : Crystal X=3 : R/C	40 DIP	MCM, UV Erasable	COP888CG/ COP888EG
COP884CGMHD-X	X=1 : Crystal X=3 : R/C	28 DIP	MCM, UV Erasable	COP884CG
COP884CGMHEA-X	X=1 : Crystal X=3 : R/C	28 LCC	MCM (Same Footprint as 28SO), UV Erasable	COP884CG

Duplicator Board Ordering Information

Part Number	Description	Devices Supported
COP8-PRGM-28D	Duplicator Board for 28 DIP Multi-Chip Module (MCM) and for use with Scrambler Boards	COP884CGMHD
COP8-SCRM-DIP	MCM Scrambler Board for 40 DIP Socket	COP888CGMHD/COP888EGMHD
COP8-SCRM-PCC	MCM Scrambler Board for 44 PLCC/LDCC	COP888CGMHEL/COP888EGMHEL
COP8-SCRM-SBX	MCM Scrambler Board for 28 LCC Socket	COP884CGMHEA
COP8-PRGM-DIP	Duplicator Board with COP8-SCRM-DIP Scrambler Board	COP884CGMHD, COP888CGMHD/ COP888EGMHD
COP8-PRGM-PCC	Duplicator Board with COP8-SCRM-PCC Scrambler Board	COP888CGMEL/COP888EGMHD, COP884CGMHD

Development Support (Continued)

DIAL-A-HELPER

Dial-A-Helper is a service provided by the Microcontroller Applications group. The Dial-A-Helper is an Electronic Bulletin Board Information system and additionally, provides the capability of remotely accessing the MOLE development system at a customer site.

INFORMATION SYSTEM

The Dial-A-Helper system provides access to an automated information storage and retrieval system that may be accessed over standard dial-up telephone lines 24 hours a day. The system capabilities include a MESSAGE SECTION (electronic mail) for communications to and from the Microcontroller Applications Group and a FILE SECTION which consists of several file areas where valuable application software and utilities could be found. The minimum requirement for accessing the Dial-A-Helper is a Hayes compatible modem.

If the user has a PC with a communications package then files from the FILE SECTION can be down loaded to disk for later use.

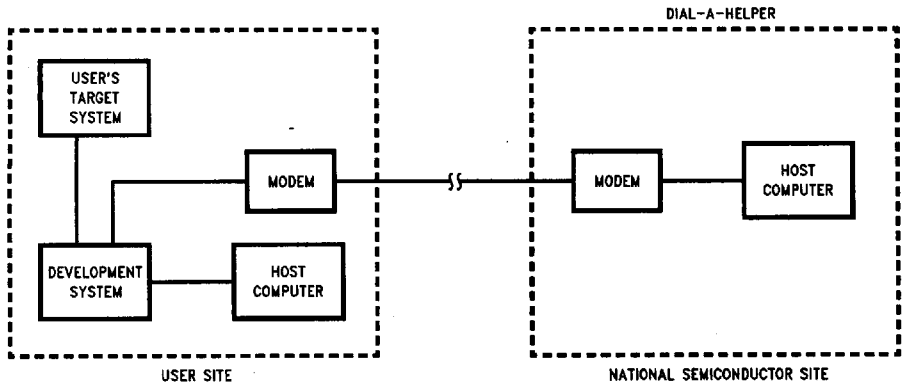
ORDER P/N: MOLE-DIAL-A-HLP

Information System Package contains:
- Dial-A-Helper Users Manual
- Public Domain Communications Software

FACTORY APPLICATIONS SUPPORT

Dial-A-Helper also provides immediate factor applications support. If a user is having difficulty in operating the development system, he can leave messages on our electronic bulletin board, which we will respond to, or under extraordinary circumstances he can arrange for us to actually take control of his system via modem for debugging purposes.

Voice: (408) 721-5582
Modem: (408) 739-1162
Baud: 300 or 1200 Baud
Set-up: Length: 8-Bit
Parity: None
Stop Bit: 1
Operation: 24 Hrs., 7 Days



TL/DD/10425-11