# HMC460LC5

v08.1217

## GaAs pHEMT MMIC LOW NOISE AMPLIFIER, DC - 20 GHz

### Typical Applications

The HMC460LC5 is ideal for:

- Telecom Infrastructure
- Microwave Radio & VSAT
- Military & Space
- Test Instrumentation

### Features

Noise Figure: 2.5 dB @ 10 GHz

Gain: 14 dB @ 10 GHz

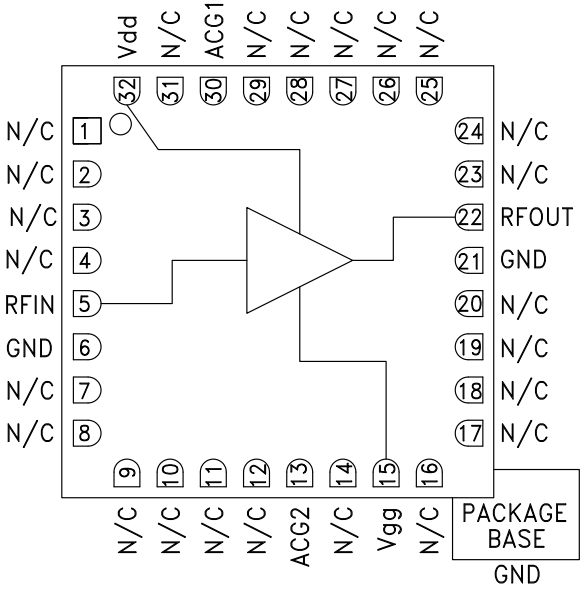
P1dB Output Power: +16.5 dBm @ 10 GHz

Supply Voltage: +8V @ 75 mA

50 Ohm Matched Input/Output

32 Lead Ceramic 5 x 5 mm SMT Package: 25 $mm^2$

### Functional Diagram




### General Description

The HMC460LC5 is a GaAs MMIC pHEMT Low Noise Distributed Amplifier in a leadless 5 x 5 mm ceramic surface mount package which operates from DC to 20 GHz. The amplifier provides 14 dB of gain, 2.5 dB noise figure and +16.5 dBm of output power at 1 dB gain compression while requiring only 75 mA from a Vdd = 8V supply. Gain flatness is excellent from DC to 20 GHz making the HMC460LC5 ideal for EW, ECM, Radar and test equipment applications. The wideband amplifier I/Os are internally matched to 50 Ohms.

### Electrical Specifications, $T_A$ = +25 °C, Vdd= 8V, Idd= 75 mA*

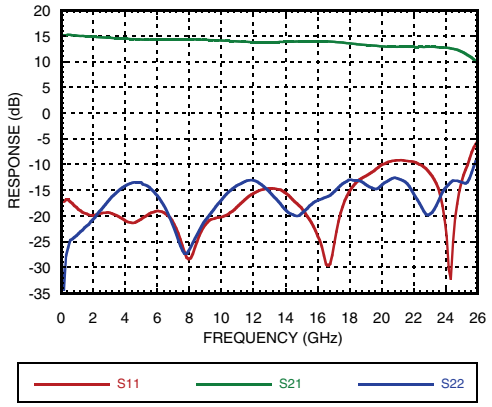
| Parameter | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency Range | | DC - 6.0 | | | 6.0 - 18.0 | | | 18.0 - 20.0 | | GHz |
| Gain | 11 | 14 | | 11 | 14 | | 10 | 13 | | dB |
| Gain Flatness | | ± 0.5 | | | ± 0.15 | | | ± 0.25 | | dB |
| Gain Variation Over Temperature | | 0.008 | | | 0.01 | | | 0.01 | | dB/ °C |
| Noise Figure | | 3.5 | 5.0 | | 2.5 | 4.0 | | 3.5 | 5 | dB |
| Input Return Loss | | 17 | | | 18 | | | 12 | | dB |
| Output Return Loss | | 17 | | | 15 | | | 15 | | dB |
| Output Power for 1 dB Compression (P1dB) | 14 | 17 | | 13 | 16 | | 12 | 15 | | dBm |
| Saturated Output Power (Psat) | | 18 | | | 18 | | | 17 | | dBm |
| Output Third Order Intercept (IP3) | | 29.5 | | | 29 | | | 28.5 | | dBm |
| Supply Current (Idd) (Vdd= 8V, Vgg= -0.9V Typ.) | | 75 | | | 75 | | | 75 | | mA |

*Adjust Vgg between -2 to 0V to achieve Idd= 75 mA typical.*

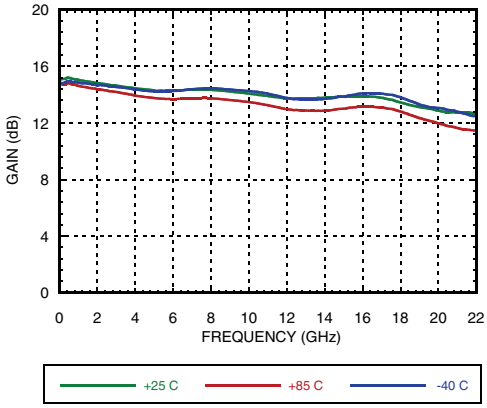


*For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106*
*Phone: 781-329-4700 • Order online at www.analog.com*
*Application Support: Phone: 1-800-ANALOG-D*

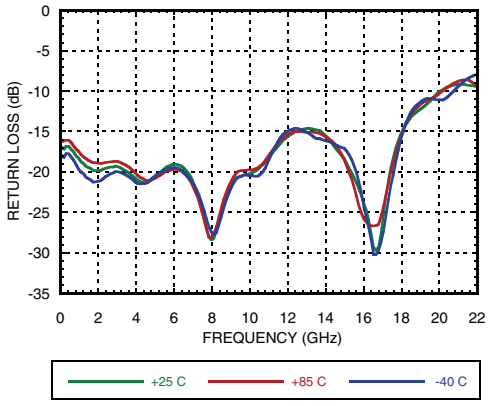
### Broadband Gain & Return Loss



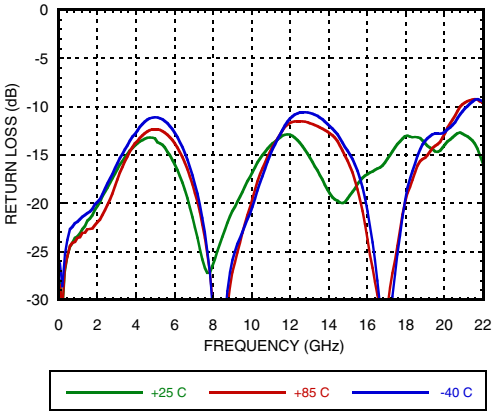

### Gain vs. Temperature



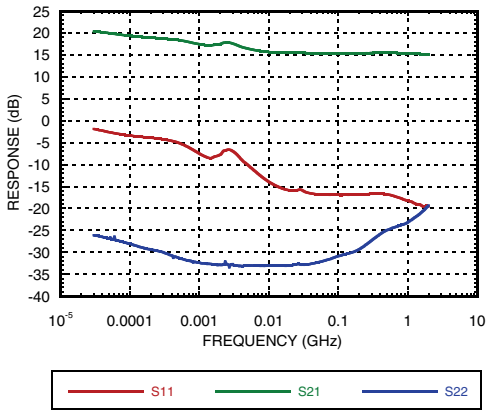

### Input Return Loss vs. Temperature



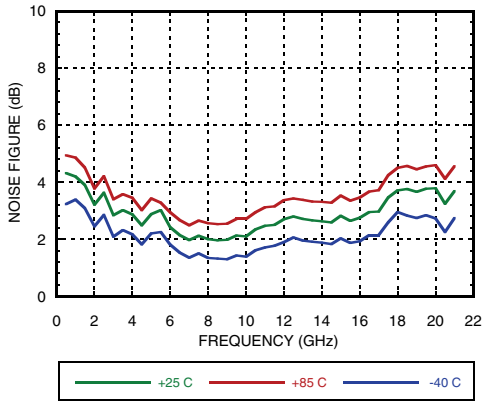

### Output Return Loss vs. Temperature



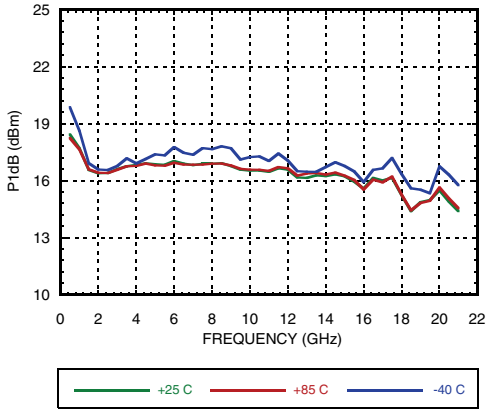

### Low Frequency Gain & Return Loss



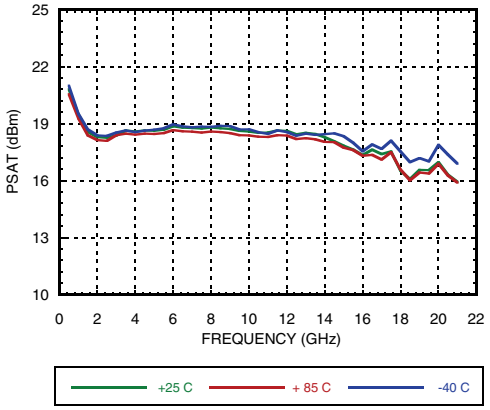

### Noise Figure vs. Temperature



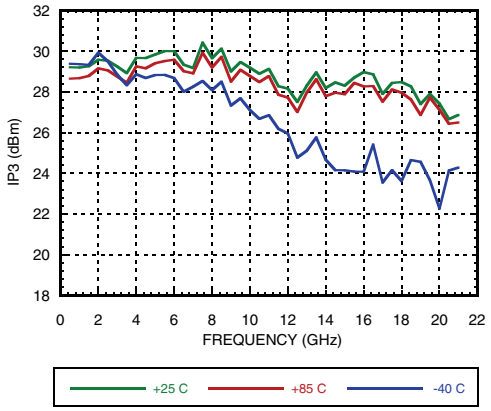
### P1dB vs. Temperature



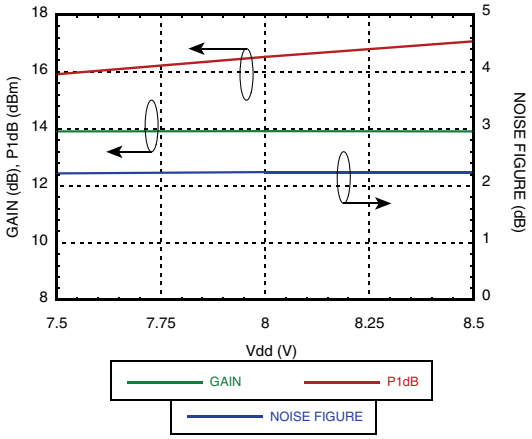

### Psat vs. Temperature



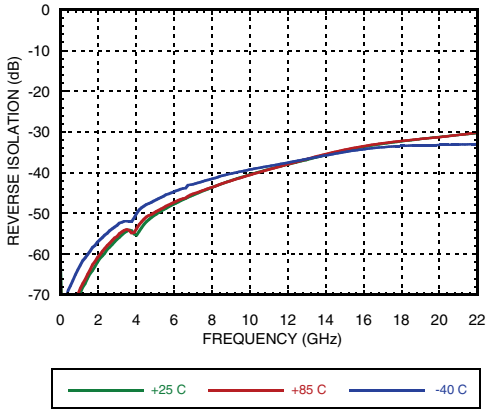

### Output IP3 vs. Temperature



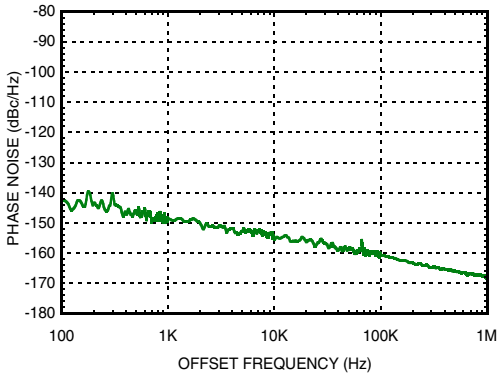

### Gain, Power & Noise Figure vs. Supply Voltage @ 10 GHz, Fixed Vgg




### Reverse Isolation vs. Temperature




### Additive Phase Noise Vs Offset Frequency, RF Frequency = 10 GHz, RF Input Power = 8 dBm (Psat)



# GaAs pHEMT MMIC LOW NOISE AMPLIFIER, DC - 20 GHz

## Absolute Maximum Ratings

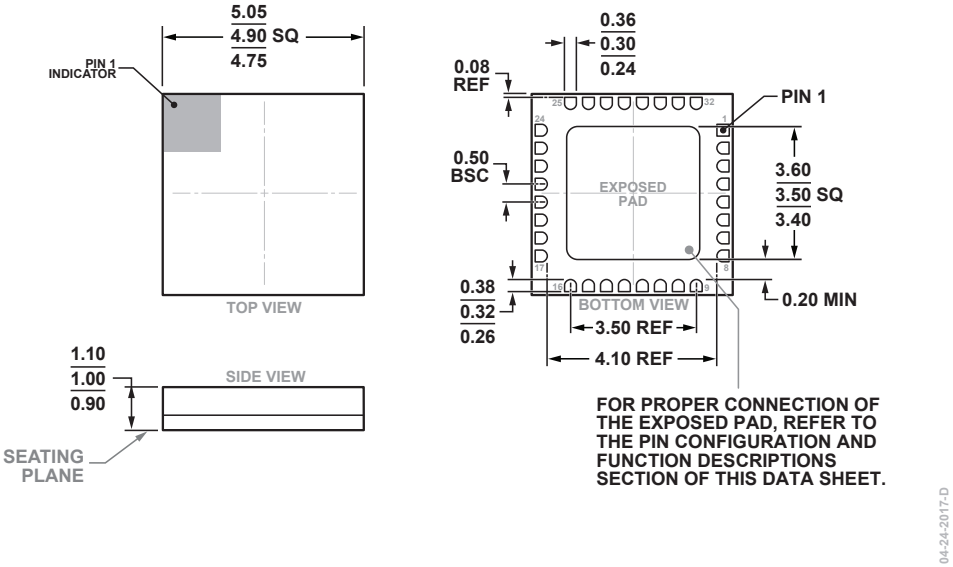
| | |
|---|---|
| Drain Bias Voltage (Vdd) | +9 Vdc |
| Gate Bias Voltage (Vgg) | -2 to 0 Vdc |
| Gate Bias Voltage (Igg) | 2.5 mA |
| RF Input Power (RFIN)(Vdd = +8 Vdc) | +18 dBm |
| Channel Temperature | 175 °C |
| Continuous Pdiss (T = 85 °C) (derate 23 mW/°C above 85 °C) | 2 W |
| Thermal Resistance (channel to package bottom) | 44.4 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -55 to +85 °C |
| ESD Sensitivity (HBM) | Class 1A |

## Typical Supply Current vs. Vdd

| Vdd (V) | Idd (mA) |
|---|---|
| +7.5 | 74 |
| +8.0 | 75 |
| +8.5 | 76 |

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

## Outline Drawing



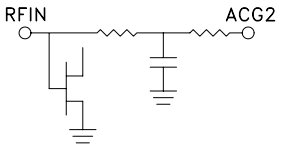
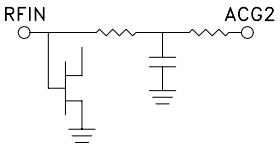
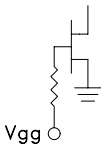
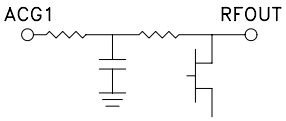
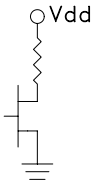

32-Terminal Ceramic Leadless Chip Carrier [LCC]
(E-32-1)
Dimensions shown in millimeters.

## ORDERING GUIDE

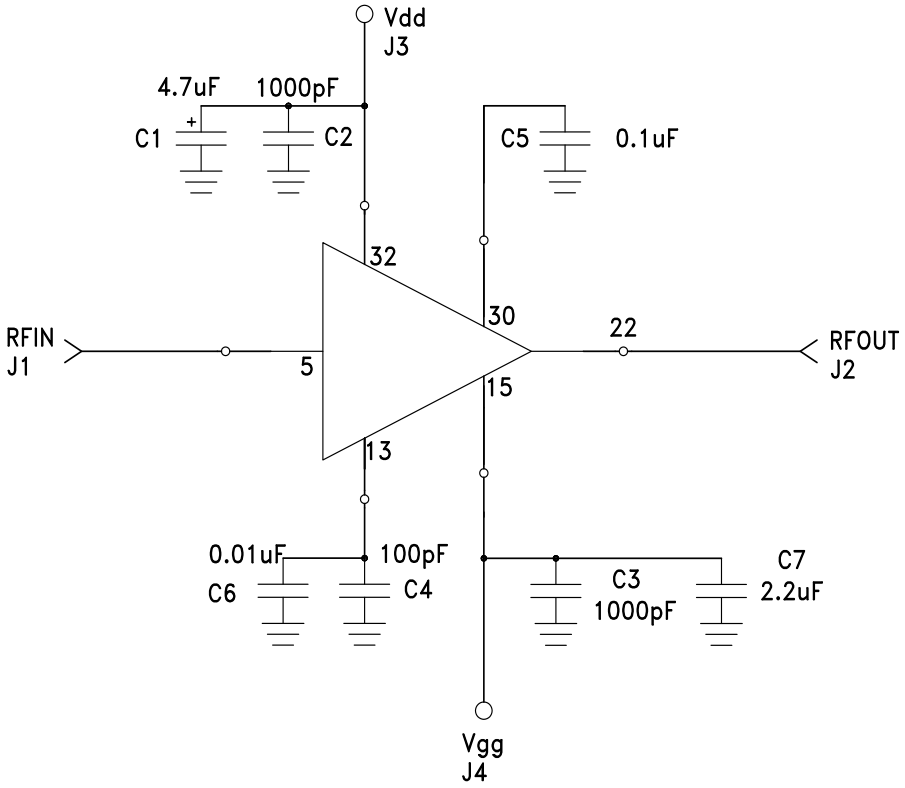
| Part Number | Package Material | Lead Finish | MSL Rating | Package Marking [2] |
|---|---|---|---|---|
| HMC460LC5 | Alumina, White | Gold over Nickel | MSL3 [1] | H460<br>XXXX |

[1] Max peak reflow temperature of 260 °C
[2] 4-Digit lot number XXXX

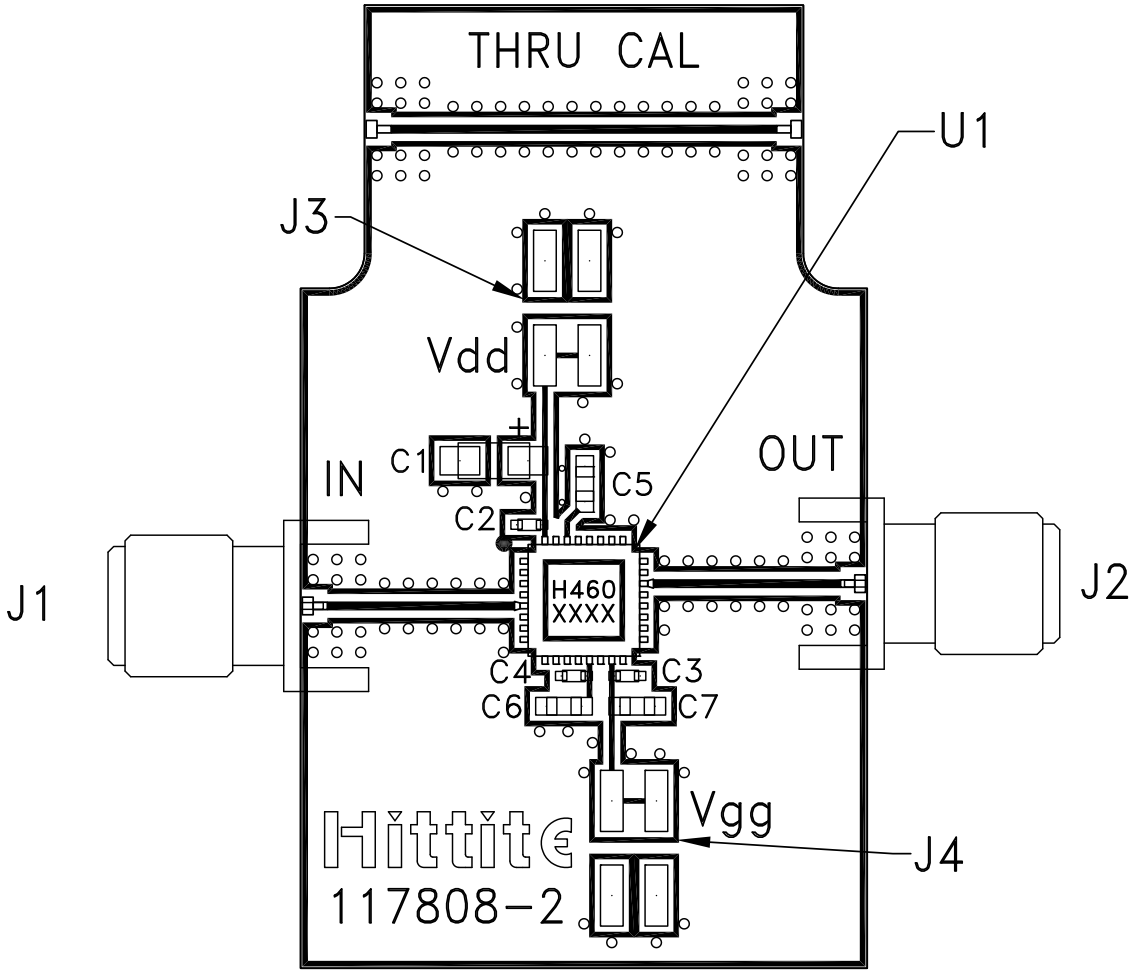
## Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1 - 4, 7 - 12, 14, 16 - 20, 23 - 29, 31 | N/C | No connection. These pins may be connected to RF ground. Performance will not be affected. | |
| 5 | RFIN | This pin is DC coupled and matched to 50 Ohms. |  |
| 6, 21 | GND | Package bottom must be connected to RF/DC ground. |  |
| 13 | ACG2 | Low frequency termination. Attach bypass capacitor per application circuit herein. |  |
| 15 | Vgg | Gate control for amplifier. Please follow “MMIC Amplifier Biasing Procedure” application note |  |
| 22 | RFOUT | This pin is DC coupled and matched to 50 Ohms. |  |
| 30 | ACG1 | Low frequency termination. Attach bypass capacitor per application circuit herein. |  |
| 32 | Vdd | Power supply voltage for the amplifier. External bypass capacitors are required |  |

### Application Circuit



### Evaluation PCB




### List of Materials for Evaluation PCB 117810 [1]

| Item | Description |
|---|---|
| J1 - J2 | PCB Mount SMA Connector |
| J3 - J4 | 2 mm Molex Header |
| C4 | 100 pF Capacitor, 0402 Pkg. |
| C2, C3 | 1000 pF Capacitor, 0402 Pkg. |
| C1 | 4.7 µF Capacitor, Tantalum |
| C5 | 0.1 uF Capacitor, 0603 Pkg. |
| C6 | 0.01 uF Capacitor, 0603 Pkg. |
| C7 | 2.2 uF Capacitor, 0603 Pkg. |
| U1 | HMC460LC5 |
| PCB [2] | 117808 Evaluation PCB |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and package bottom should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Analog Devices upon request.

# Mouser Electronics

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HMC460LC5TR HMC460LC5 117810-HMC460LC5 HMC460LC5TR-R5