

FEATURES

- Up to 1.25Gbps operation
- Low noise
- Chatter-Free /LOS Generation
- PECL /LOS Output
- TTL /EN Input
- Differential PECL inputs for data
- /EN input is TTL with internal 27K pull-up
- Single power supply
- Designed for use with SY88902 and SY88904
- Available in a tiny 10-pin (3mm x3 mm) MSOP

APPLICATIONS

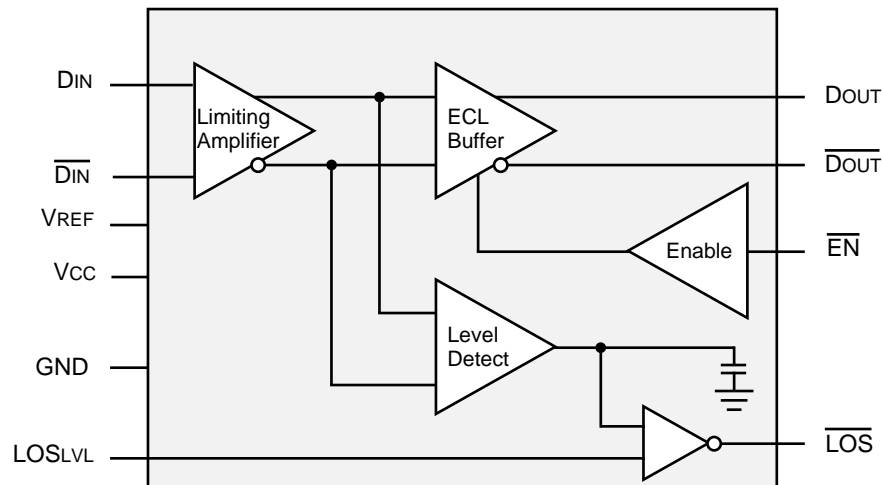
- 1.25Gbps Gigabit Ethernet
- 531Mbps and 1062Mbps Fibre Channel
- 622Mbps SONET
- Gigabit Interface Converter

DESCRIPTION

The SY88913 limiting post amplifier with its high gain and wide bandwidth is ideal for use as a post amplifier in fiber-optic receivers with data rates up to 1.25Gbps. Signals as small as 5mVp-p can be amplified to drive devices with PECL inputs. The SY88913 generates a chatter-free PECL Loss of Signal (/LOS).

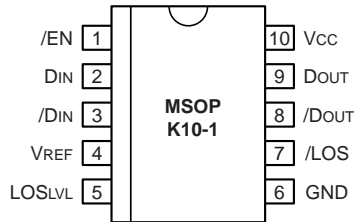
The SY88913 incorporates a programmable level detect function to identify when the input signal has been lost. This information can be fed back to the /EN input of the device to maintain stability under loss of signal conditions. Using LOSLVL pin the sensitivity of the level detect can be adjusted. The LOSLVL voltage can be set by connecting a resistor divider between VCC and VREF, Figure 2. Figure 3 shows the relationship between input level sensitivity and the voltage set on LOSLVL. Figure 4 shows the relationship between input level sensitivity and resistor divider ratio.

BLOCK DIAGRAM



PACKAGE/ORDERING INFORMATION

Ordering Information



10-Pin MSOP (K10-1)

| Part Number | Package Type | Operating Range | Package Marking | Lead Finish |
|----------------------------|--------------|-----------------|-------------------------------------|----------------|
| SY88913KC | K10-1 | Commercial | 913 | Sn-Pb |
| SY88913KCTR ⁽¹⁾ | K10-1 | Commercial | 913 | Sn-Pb |
| SY88913KG | K10-1 | Commercial | 913 with Pb-Free bar-line indicator | Pb-Free NiPdAu |
| SY88913KGTR ⁽¹⁾ | K10-1 | Commercial | 913 with Pb-Free bar-line indicator | Pb-Free NiPdAu |

Note:

- 1. Tape and Reel.

PIN NAMES

GENERAL DESCRIPTION

| Pin | Type | Function |
|---------|--------------|---|
| DIN | Data Input | Data Input |
| /DIN | Data Input | Inverting Data Input |
| LOS LVL | Input | Loss of Signal Level Set |
| /EN | TTL Input | Output Enable (active Low) |
| /LOS | PECL Output | Loss of Signal Indicator (active Low) |
| GND | Ground | Ground |
| DOUT | PECL Output | Data Output |
| /DOUT | PECL Output | Inverting Data Output |
| VCC | Power Supply | Positive Power Supply |
| VREF | Output | Reference Voltage Output for LOS Level Set (see Fig. 2) |

General

The SY88913 is an integrated limiting amplifier intended for high-frequency fiber-optic applications. The circuit connects to typical transimpedance amplifiers found within a fiber-optics link. The linear signal output from a transimpedance amplifier can contain significant amounts of noise, and may vary in amplitude over time. The SY88913 limiting amplifier quantizes the signal and outputs a voltage-limited waveform.

The TTL /EN pin allows the user to disable the signal without removing the input signal.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

| Symbol | Rating | Value | Unit |
|---|--------------------------------|--|------|
| V _{CC} | Power Supply Voltage | 0 to +7.0 | V |
| D _{IN} , /D _{IN} | Input Voltage | 0 to V _{CC} | V |
| D _{OUT} , /D _{OUT} , /LOS | Output Voltage (with 50Ω load) | V _{CC} -2.5, V _{CC} +0.3 | V |
| T _A | Operating Temperature Range | -40 to +85 | °C |
| T _{store} | Storage Temperature Range | -55 to +125 | °C |

Note:

1. Permanent device damage may occur if absolute maximum ratings are exceeded. This is a stress rating only and functional operation is not implied at conditions other than those detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

V_{CC} = +5V ±10%, R_{LOAD} = 50Ω to V_{CC}-2V, T_A = -40°C to +85°C.

| Symbol | Parameter | T _A = -40°C | | T _A = 0°C | | T _A = +25°C | | | T _A = +85°C | | Unit |
|---------------------|-------------------------------------|------------------------|---|------------------------|---|------------------------|------------------------|---|------------------------|---|------|
| | | Min. | Max. | Min. | Max. | Min. | Typ. | Max. | Min. | Max. | |
| I _{CC} | Power Supply Current ⁽¹⁾ | — | 35 | — | 35 | — | 21 | 35 | — | 35 | mA |
| I _{IL} | /EN Input LOW Current | -0.3 ⁽⁵⁾ | — | -0.3 ⁽⁵⁾ | — | -0.3 ⁽⁵⁾ | — | — | -0.3 ⁽⁵⁾ | — | mA |
| I _{IH} | /EN Input HIGH Current | — | 20 ⁽²⁾ 100 ⁽³⁾ | — | 20 ⁽²⁾ 100 ⁽³⁾ | — | — | 20 ⁽²⁾ 100 ⁽³⁾ | — | 20 ⁽²⁾ 100 ⁽³⁾ | μA |
| V _{CMR} | Common Mode Range | GND +2.0 | V _{CC} -1.0 | GND +2.0 | V _{CC} -1.0 | GND +2.0 | — | V _{CC} -1.0 | GND +2.0 | V _{CC} -1.0 | V |
| V _{offset} | Differential Output Offset | — | ±100 | — | ±100 | — | — | ±100 | — | ±100 | mV |
| LOS _{LVL} | LOS _{LVL} Level | V _{REF} | V _{CC} | V _{REF} | V _{CC} | V _{REF} | — | V _{CC} | V _{REF} | V _{CC} | V |
| V _{OH} | DOUT and /DOUT HIGH Output | V _{CC} -1085 | V _{CC} -880 | V _{CC} -1025 | V _{CC} -880 | V _{CC} -1025 | V _{CC} -955 | V _{CC} -880 | V _{CC} -1025 | V _{CC} -880 | mV |
| V _{OL} | DOUT and /DOUT LOW Output | V _{CC} -1830 | V _{CC} -1555 | V _{CC} -1810 | V _{CC} -1620 | V _{CC} -1810 | V _{CC} -1705 | V _{CC} -1620 | V _{CC} -1810 | V _{CC} -1620 | mV |
| V _{REF} | Reference Supply ⁽⁴⁾ | V _{CC} -2.625 | V _{CC} -2.325 | V _{CC} -2.625 | V _{CC} -2.325 | V _{CC} -2.625 | V _{CC} -2.475 | V _{CC} -2.325 | V _{CC} -2.625 | V _{CC} -2.325 | V |
| V _{IH} | /EN Input HIGH Voltage | 2.0 | — | 2.0 | — | 2.0 | — | — | 2.0 | — | V |
| V _{IL} | /EN Input LOW Voltage | — | 0.8 | — | 0.8 | — | — | 0.8 | — | 0.8 | V |

Notes:

1. No output load.
2. V_{IN} = 2.7V.
3. V_{IN} = V_{CC}.
4. I_{REF} must be limited to be within -0.8mA (source) and 0.5mA (sink).
5. V_{IN} = 0.5V.

AC ELECTRICAL CHARACTERISTICS

$V_{CC} = +5V \pm 10\%$, $R_{LOAD} = 50\Omega$ to $V_{CC} - 2V$, $T_A = -40^\circ C$ to $+85^\circ C$.

| Symbol | Parameter | $T_A = -40^\circ C$ | | $T_A = 0^\circ C$ | | $T_A = +25^\circ C$ | | | $T_A = +85^\circ C$ | | Unit | Conditions |
|------------|---|---------------------|------|-------------------|------|---------------------|--|------|---------------------|------|------------------|--|
| | | Min. | Max. | Min. | Max. | Min. | Typ. | Max. | Min. | Max. | | |
| PSRR | Power Supply ⁽¹⁾ Rejection Ratio | — | — | — | — | — | 35 | — | — | — | dB | Input referred, 55MHz |
| VID | Input Voltage Range | 5 | 1800 | 5 | 1800 | 5 | — | 1800 | 5 | 1800 | mV _{PP} | |
| t_r, t_f | Output Rise/Fall Time | — | 350 | — | 350 | — | 200 <small>tr_{in}, t_{fin}</small> | 350 | — | 350 | ps | $V_{ID} > 100mV_{PP}$ $V_{ID} < 100mV_{PP}$ |
| VOD | Differential Output Voltage Swing ⁽²⁾ | — | — | — | — | — | 600 200 | — | — | — | mV mV | $V_{ID} = 15mV_{PP}$ $V_{ID} = 5mV_{PP}$ |
| t_{OFFL} | /LOS Release Time ⁽³⁾ Minimum Input | — | 0.5 | — | 0.5 | — | 0.1 | 0.5 | — | 0.5 | μs | |
| t_{OFFH} | /LOS Release Time ⁽⁴⁾ Maximum Input | — | 0.5 | — | 0.5 | — | 0.1 | 0.5 | — | 0.5 | μs | |
| t_{ONL} | /LOS Assert Time ⁽³⁾ | — | 0.5 | — | 0.5 | — | 0.2 | 0.5 | — | 0.5 | μs | |
| VSR | /LOS Sensitivity Range | 5 | 50 | 5 | 50 | 5 | — | 50 | 5 | 50 | mV _{PP} | |
| HYS | /LOS Hysteresis | 2 | 8 | 2 | 8 | 2 | 4.6 | 8 | 2 | 8 | dB | |

Notes:

1. Input referred noise = RMS output noise/low frequency gain.
2. Input is 622MHz square wave.
3. Input is a 200MHz square wave, $t_r < 300ps$, $8mV_{PP}$.
4. Input is a 200MHz square wave, $t_r < 300ps$, $1.8V_{PP}$.

APPLICATION NOTE

Output Termination

The SY88913 outputs must be terminated with a 50Ω load to VCC – 2V (or Thevenin equivalent).

Layout and PCB Design

Since the SY88913 is a high-frequency component, performance can largely be determined by board layout and design. A common problem with high-gain amplifiers is feedback from the large swing outputs to the input via the power supply.

The SY88913 ground pin should be connected to the circuit board ground. Use multiple PCB vias close to the part to connect to ground. Avoid long, inductive runs which can degrade performance.

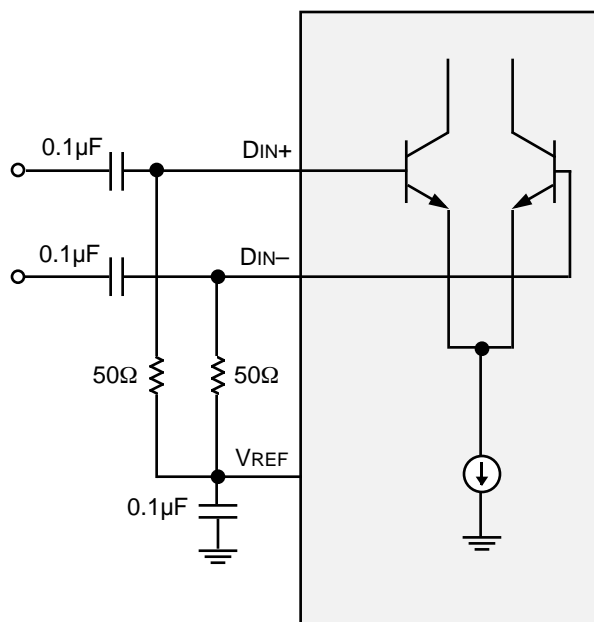
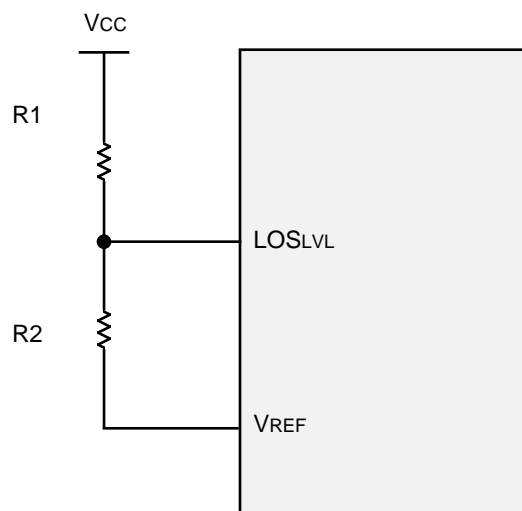


Figure 1. Differential Input Configuration



Notes:
 Resistor Divider = $R2 / (R1 + R2)$
 $R1 + R2 \geq 5k\Omega$

Figure 2. LOSLVL Circuit

PERFORMANCE CURVE

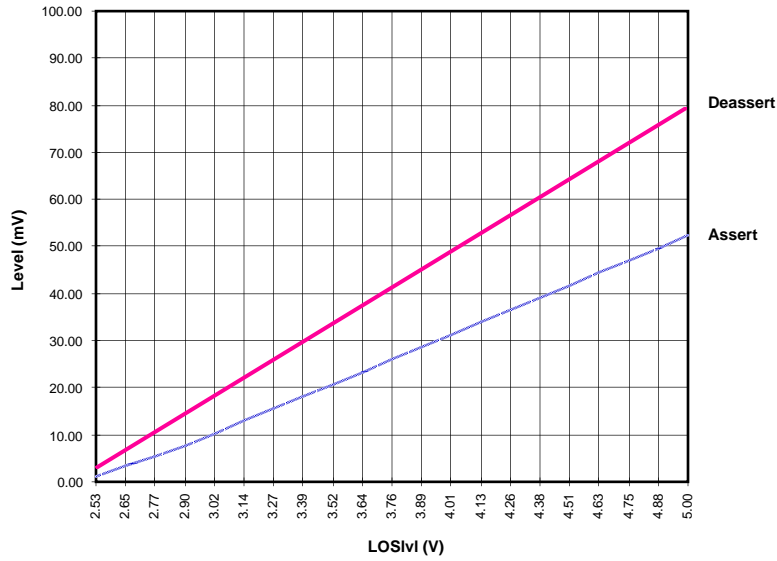


Figure 3. LOS Assert and Deassert Levels vs Resistor Divider

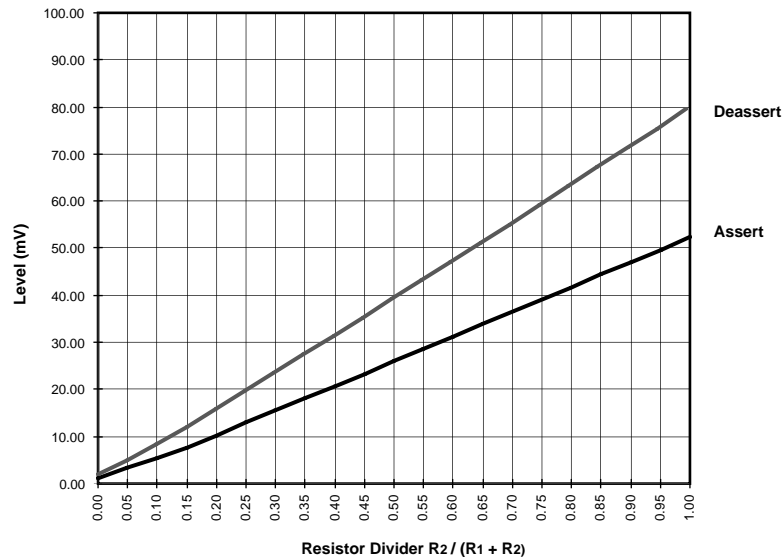
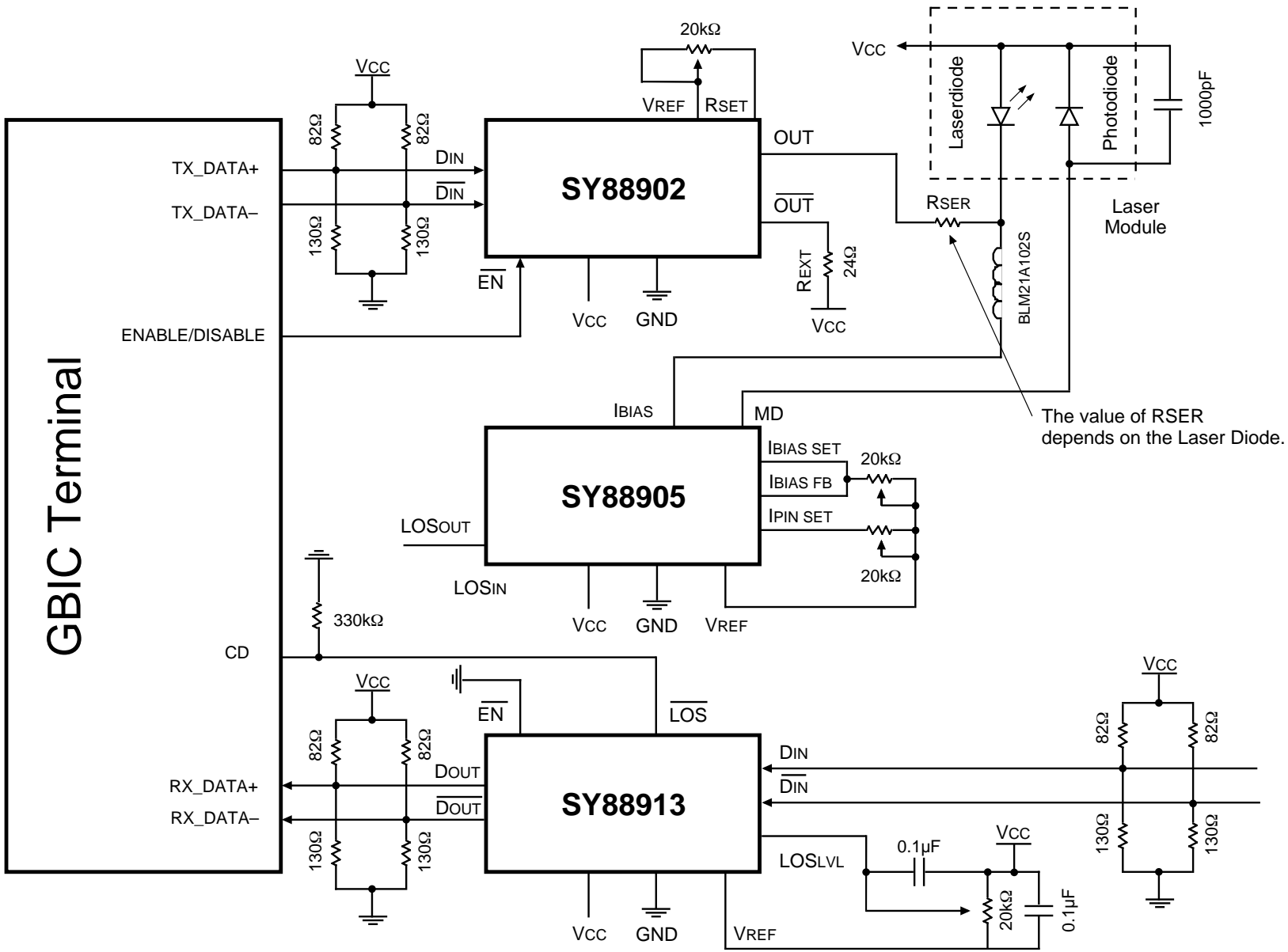
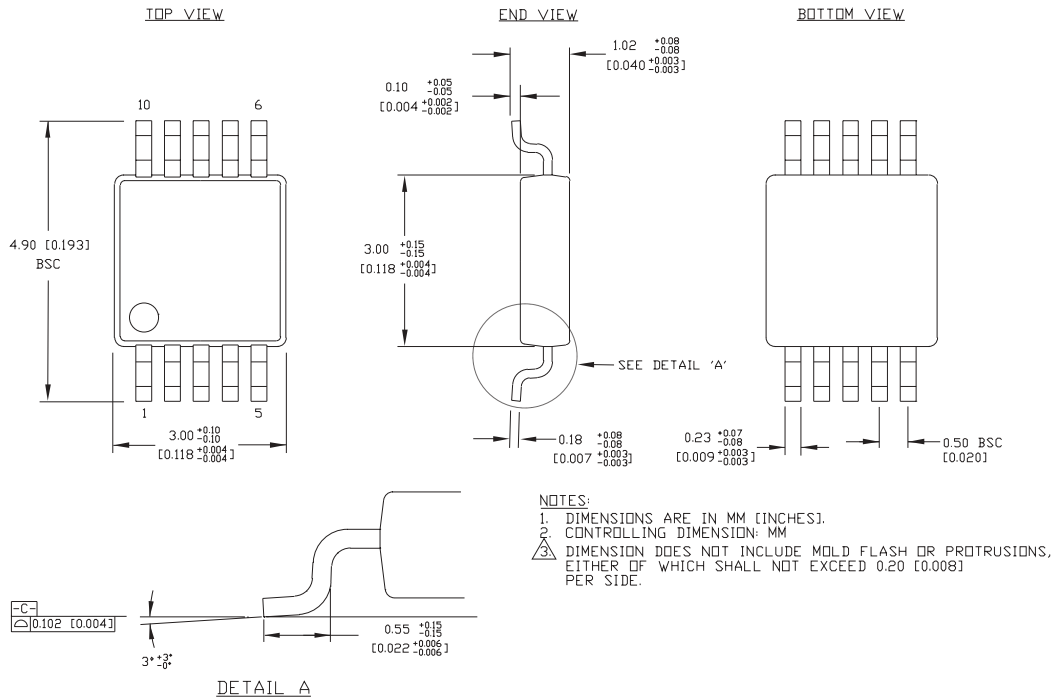


Figure 4. Resistor Divider $R_2 / (R_1 + R_2)$

APPLICATION EXAMPLE FOR 3-CHIP SET SOLUTION



10 LEAD MSOP (K10-1)



Rev. 00

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