## Description

The GM358 consists of two high gain, internally frequency compensated operational amplifiers which are designed to operated from a single power supply over a wide range of voltages. Operation from split power supplies is also available. The GM358 feature low power drain, a common mode input voltage range extending to GND/VEE. The GM358 is equivalent to one-half of the GM324.

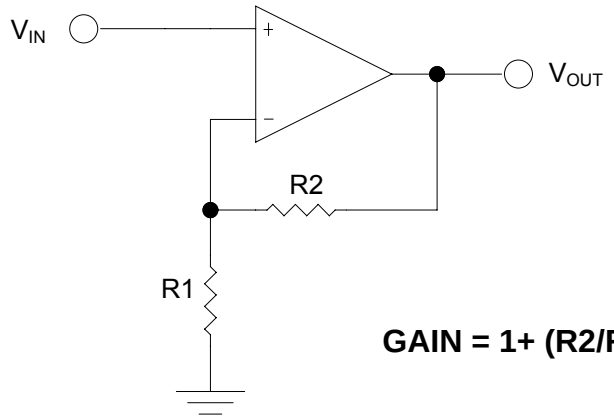
Application areas include transducer amplifiers, DC gain blocks and all the conventional op-amp circuits which now can be more easily implemented in single power supply systems. For example, the GM358 can be directly operated of the standard +5V power supply voltage which is used in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

The GM358 is available in SOP-8 and DIP-8 packages.

## Features

- **True Differential Input Stage**
- **Internally Frequency Compensated for Unity Gain**
- **Single Supple Operation: 3V to 40V**
- **Wide Bandwidth (unity Gain, temperature compensated): 1 MHz**
- **Short Circuit Protected Outputs**
- **Low Input Bias Current**
- **Common Mode Range Extends to Negative Supply**
- **Single and Split Supply Operation**

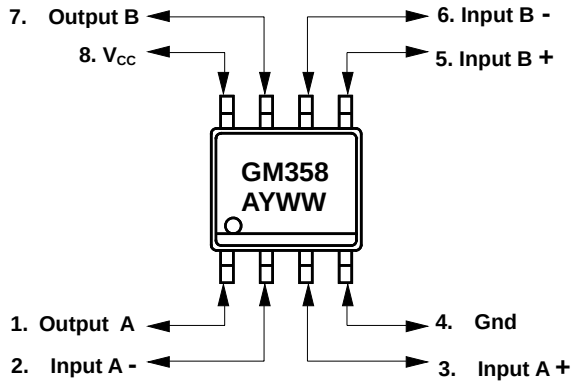
## Typical Application Circuits



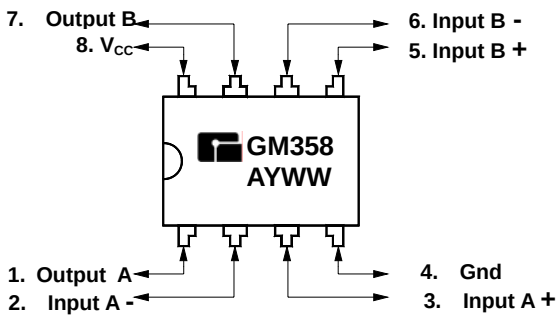

**GAIN = 1+ (R2/R1)**

## Marking Information and Pin Configurations (Top View) – Pb Free

**SO8**



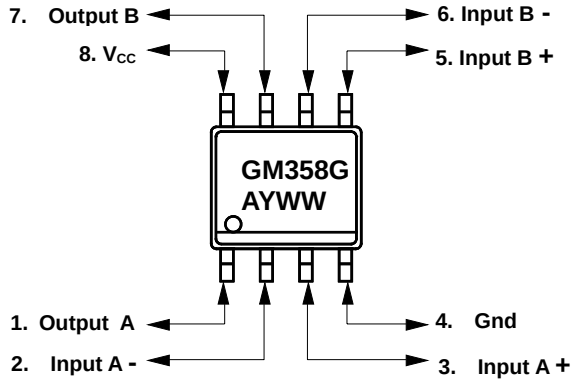

**DIP8**



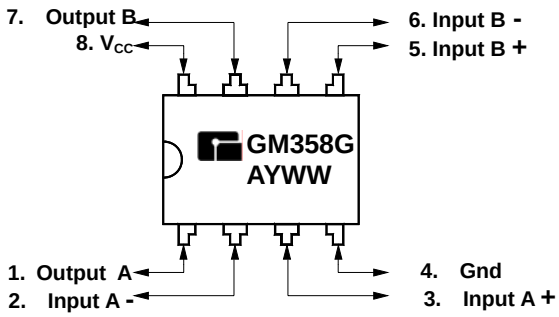

A: Assembly / Test site code
Y: Year
WW: Week

## Marking Information and Pin Configurations (Top View) – Green

**SO8**




**DIP8**




G: Green Product
A: Assembly / Test site code
Y: Year
WW: Week

## Ordering Information – Pb Free Product

| Ordering Number | Package | Shipping |
|---|---|---|
| GM358D8T | DIP-8 | 60 Units / Tube |
| GM358S8T | SOP-8 | 100 Units / Tube |
| GM358S8R | SOP-8 | 2,500 Units / Tape & Reel |

## Ordering Information – Green Product

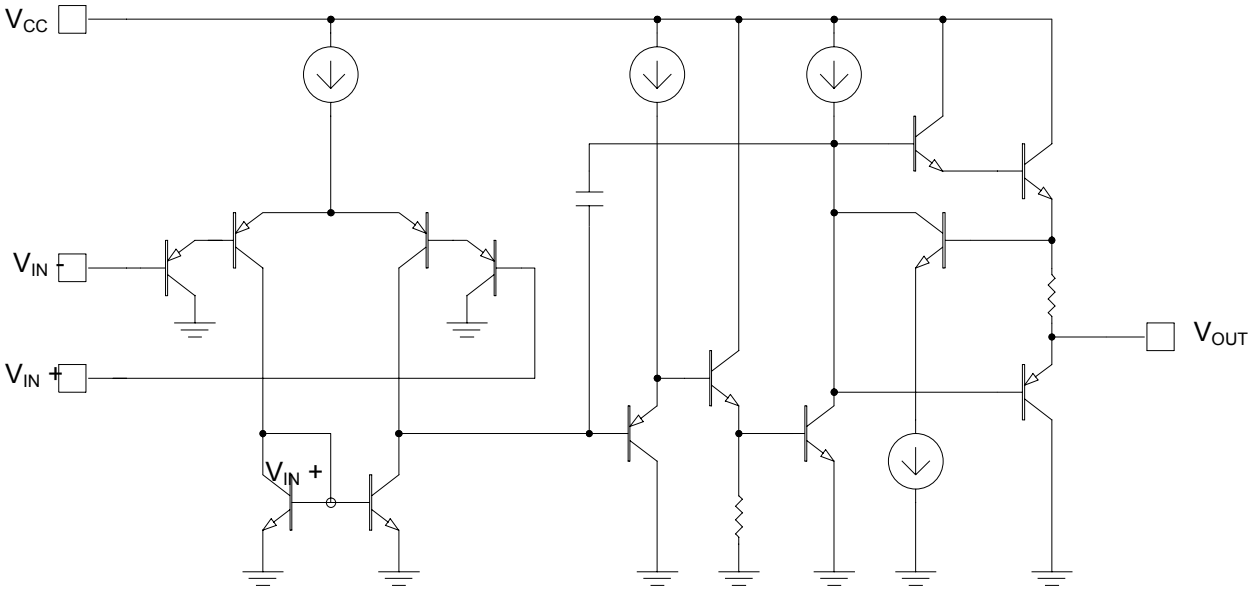
| Ordering Number | Package | Shipping |
|---|---|---|
| GM358D8TG | DIP-8 | 60 Units / Tube |
| GM358S8TG | SOP-8 | 100 Units / Tube |
| GM358S8RG | SOP-8 | 2,500 Units / Tape & Reel |

## Absolute Maximum Ratings

| PARAMETER | Symbol | RATINGS | UNITS |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 32 | V |
| | $V_{CC}$, $V_{EE}$ | ±16 | |
| Input Differential Voltage Range (Note 1) | $V_{IDR}$ | 32 | V |
| Input Common Mode Voltage Range (Note 2) | $V_{ICR}$ | =0.3 to 32 | V |
| Output Short Circuit Duration | $t_{SC}$ | Continuous | - |
| Junction Temperature | $T_J$ | 150 | °C |
| Operating Ambient Temperature Range | $T_A$ | 0 to 70 | °C |
| Storage Temperature | | - 65 to 150 | °C |
| Lead Temperature (soldering 10 sec.) | | 260 | °C |
| ESD Tolerance – Human Body Mode | | 2,000 | V |

Note 1: Split Power Supplies
Note 2: For Supply less 40V, the absolute maximum input range is equal to the supply voltage

## Block Diagram



## Electrical Characteristics ($V_{CC}$ = 5V, at specified free-air temperature, unless otherwise specified)

| Parameter | Symbol | Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Input offset Voltage | $V_{IO}$ | $V_{CC}$ = 5V to Max<br>$V_{IC}$ = $V_{ICR}$ min<br>$V_O$ = 1.4V | $T_A$ = 25°C | | 3 | 7 | mV |
| | | | Full Range | | | 9 | |
| Average Temperature Coefficient of Input offset Voltage | $\alpha V_{IO}$ | | Full Range | | 7 | | µV/°C |
| Input Offest Current | $I_{IO}$ | | $T_A$ = 25°C | | 2 | 50 | nA |
| | | | Full Range | | | 150 | |
| Average Temperature Coefficient of Input offset Current | $\alpha I_O$ | | Full Range | | 10 | | pA/°C |
| Input Bias Current | $I_{IB}$ | $V_O$ =1.4V | $T_A$ = 25°C | | -20 | -250 | nA |
| | | | Full Range | | | -500 | |
| Common-Mode Input Voltage Range | $V_{ICR}$ | $V_{CC}$ = 5V to Max | $T_A$ = 25°C | 0 to $V_{CC}$-1.5V | | | V |
| | | | Full Range | 0 to $V_{CC}$-2.0V | | | |
| High-Level output Voltage | $V_{OH}$ | $R_L$ = 2K | $T_A$ = 25°C | $V_{CC}$-1.5V | - | - | V |
| | | $V_{CC}$ = MAX, $R_L$ = 2K | Full Range | 26 | | | |
| | | $V_{CC}$ = MAX, $R_L$ = 10K | Full Range | 27 | 28 | | |
| High-Level output Voltage | $V_{OL}$ | $R_L$ = 10K | Full Range | | 5 | 20 | mV |
| Large-Signal Differential Voltage Amplification | $A_{VD}$ | $V_{CC}$ = 15V,<br>$V_O$ = 1V to 11V<br>$R_L \geq$ 2K | $T_A$ = 25°C | 25 | 100 | | V/mV |
| | | | Full Range | 15 | | | |
| Common Mode Rejection Ratio | CMRR | $V_{CC}$ = 5V to Max<br>$V_{IC}$ = $V_{ICR}$ min | $T_A$ = 25°C | 65 | 80 | | dB |
| Supply Voltage Rejection Ratio | $K_{SVR}$ | $V_{CC}$ = 5V to Max | $T_A$ = 25°C | 65 | 100 | | dB |
| Crosstalk Attenuation | $V_{O1}/V_{O2}$ | f = 1KHz to 20KHz | $T_A$ = 25°C | | 120 | | dB |
| Output Current | $I_O$ | $V_{CC}$ = 15V, $V_{ID}$ = 1V,<br>$V_O$ = 0V | $T_A$ = 25°C | -20 | -30 | | mA |
| | | | Full Range | -10 | | | |
| | | $V_{CC}$ = 15V, $V_{ID}$ = -1V,<br>$V_O$ = 15V | $T_A$ = 25°C | 10 | 20 | | |
| | | | Full Range | 5 | | | |
| | | $V_{ID}$ = -1V, $V_O$ = 200mV | Full Range | 12 | 30 | | µA |
| Short-Circuit output Current | $I_{OS}$ | $V_{CC}$ at 5V, Gnd at -5V,<br>$V_O$ = 0V | $T_A$ = 25°C | | ±40 | ±60 | mA |
| Supply Current (two amplifiers) | $I_{CC}$ | $V_O$ = 2.5V, No Load | Full Range | | 0.7 | 1.2 | mA |
| | | $V_{CC}$ = Max,<br>$V_O$ = 0.5$V_{CC}$, No Load | Full Range | | 1 | 2 | |

* All characteristics are measured under open loop conditions with zero common-mode input voltage unless otherwise specified. "MAX" $V_{CC}$ for testing purposes is 30V.

## Typical Performance Characteristics

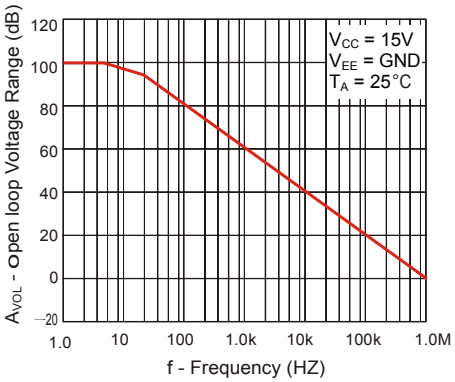



**Figure 1. Large-Signal Open Loop Voltage Gain**

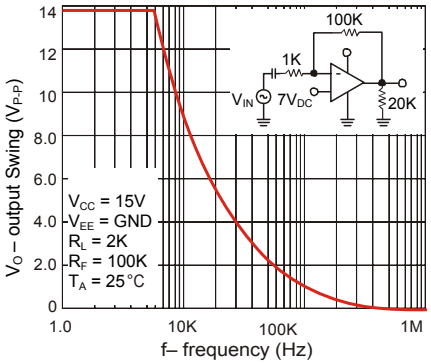



**Figure 2. Large - Signal Frequency Response**

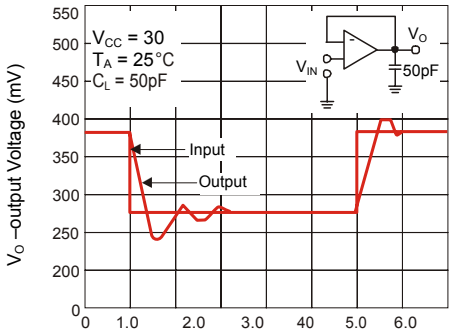



**Figure 3. Small Signal Voltage Follower Pulse Response (Noninverting)**

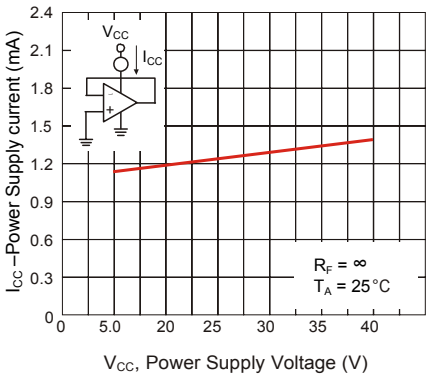



**Figure 4. Power Supply Current versus Power Supply Voltage**

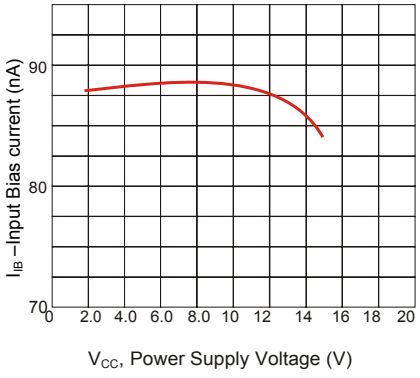



**Figure 5. Input Bias Current versus Supply Voltage**

## Application Information

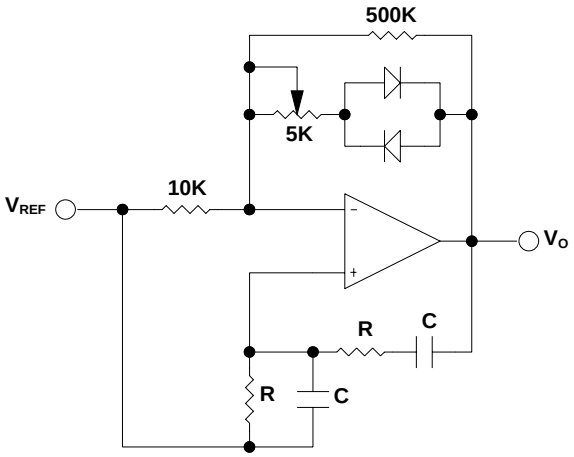



Fig.1 Wien Bridge Oscillator

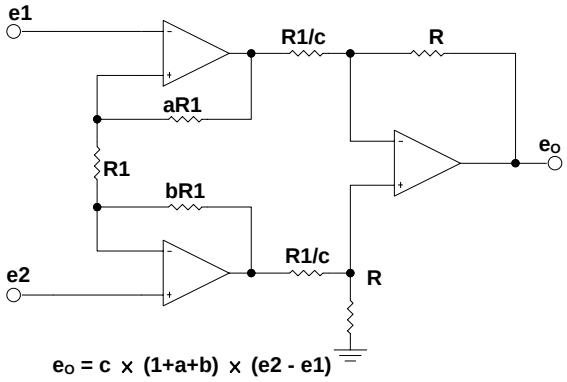



Fig. 2 High Impedance Differential Amplifier

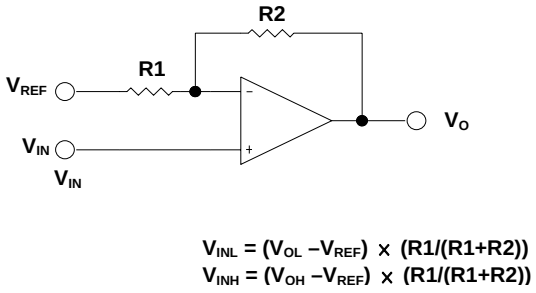



Fig. 3 Comparator with Hysteresis

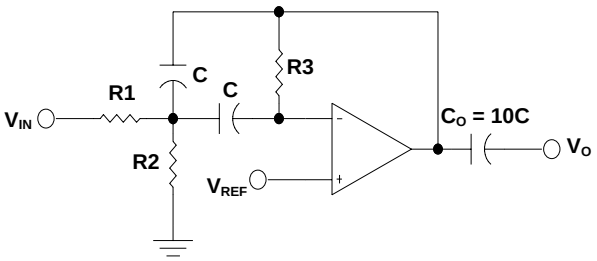



Fig. 4 Multiple Feedback Bandpass Filter

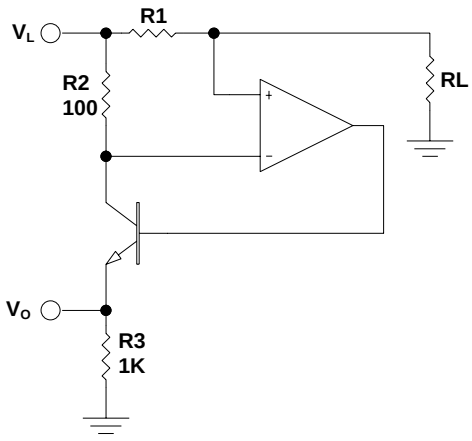



Fig. 5 Current Monitor

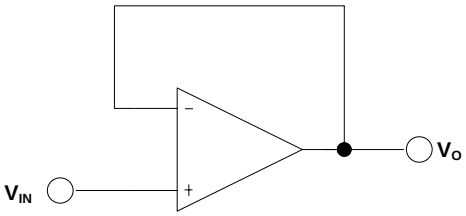
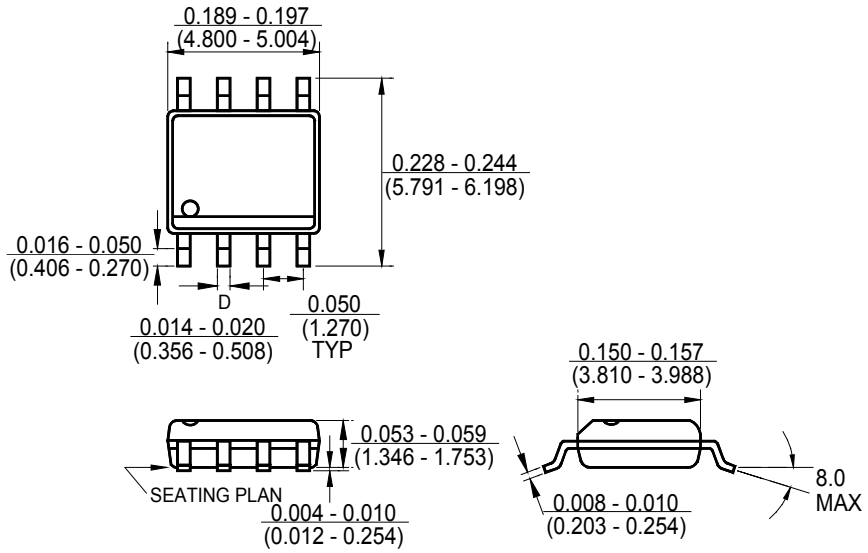
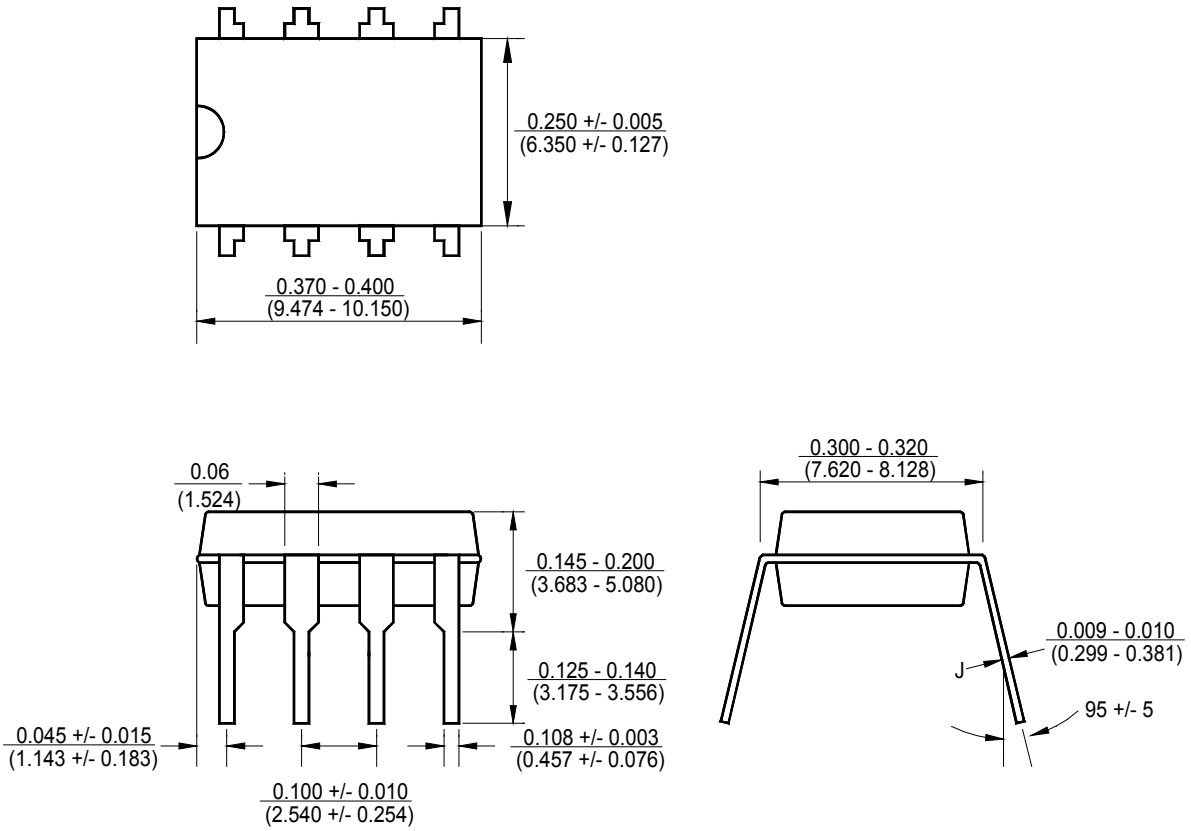



Fig. 6 Voltage Follower

## Package Outline Dimensions – SO 8




## Package Outline Dimensions – DIP 8



## Ordering Number

| GM | 358 | S8 | R | G |
|---|---|---|---|---|
| APM Gamma Micro | Circuit Type | Package Type<br>S8: SO 8<br>D8: DIP 8 | Shipping Type<br>R: Taping & Reel<br>T: Tube | Blank :Pb-free<br>G :Green |

Note:

**Pb-free products:**

- RoHS compliant and compatible with the current require-ments of IPC/JEDEC J-STD-020.
- Suitable for use in Pb-free soldering processes with 100% matte tin (Sn) plating.

**Green products:**

- Lead-free (RoHS compliant)
- Halogen free(Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight)