



## High Power Monolithic OPERATIONAL AMPLIFIER

### FEATURES

- POWER SUPPLIES TO  $\pm 40\text{V}$
- OUTPUT CURRENT TO 10A PEAK
- PROGRAMMABLE CURRENT LIMIT
- INDUSTRY-STANDARD PIN OUT
- FET INPUT
- TO-3 AND LOW-COST POWER PLASTIC PACKAGES

### APPLICATIONS

- MOTOR DRIVER
- SERVO AMPLIFIER
- SYNCHRO EXCITATION
- AUDIO AMPLIFIER
- PROGRAMMABLE POWER SUPPLY

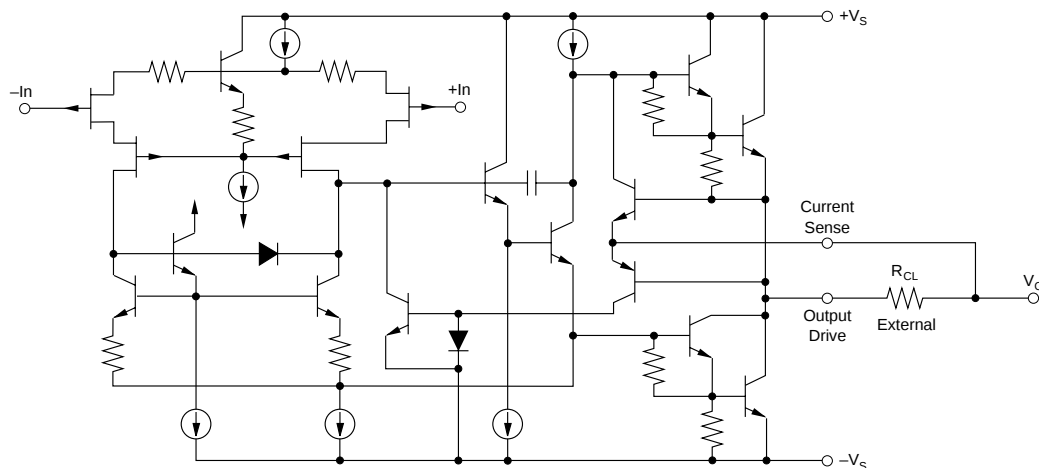
### DESCRIPTION

The OPA541 is a power operational amplifier capable of operation from power supplies up to  $\pm 40\text{V}$  and delivering continuous output currents up to 5A. Internal current limit circuitry can be user-programmed with a single external resistor, protecting the amplifier and load from fault conditions. The OPA541 is fabricated using a proprietary bipolar/FET process.

Pinout is compatible with popular hybrid power amplifiers such as the OPA511, OPA512 and the 3573. The OPA541 uses a single current-limit resistor to set both the positive and

negative current limits. Applications currently using hybrid power amplifiers requiring two current-limit resistors need not be modified.

The OPA541 is available in an 11-pin power plastic package and an industry-standard 8-pin TO-3 hermetic package. The power plastic package has a copper-lead frame to maximize heat transfer. The TO-3 package is isolated from all circuitry, allowing it to be mounted directly to a heat sink without special insulators.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

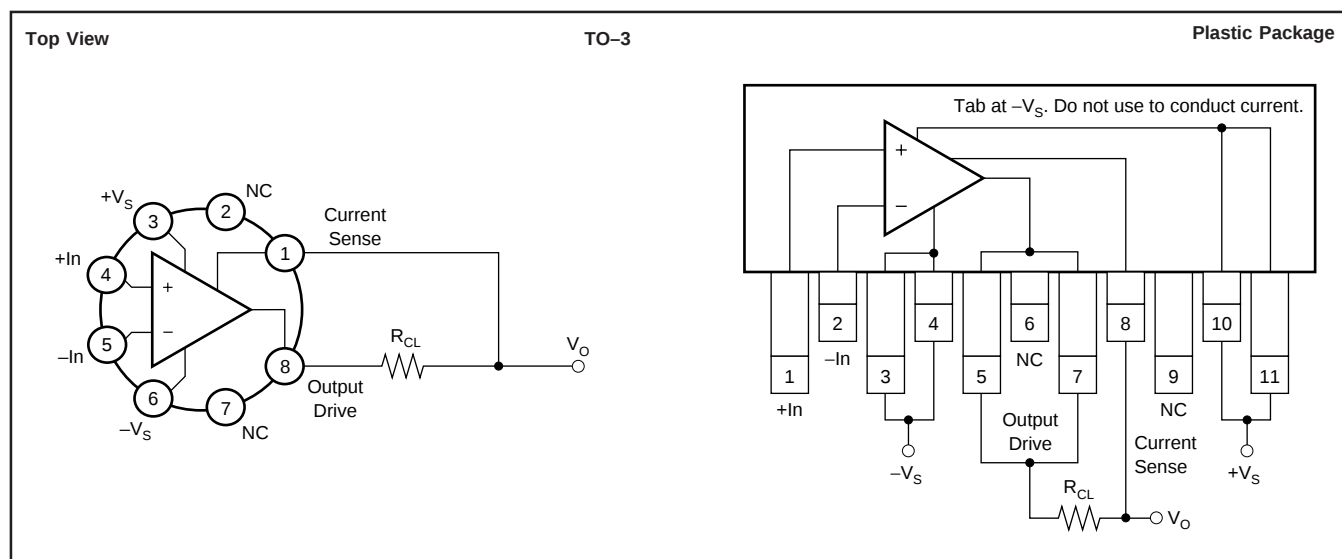
|                                                  |                 |
|--------------------------------------------------|-----------------|
| Supply Voltage, $+V_S$ to $-V_S$ .....           | 80V             |
| Output Current .....                             | see SOA         |
| Power Dissipation, Internal <sup>(2)</sup> ..... | 125W            |
| Input Voltage: Differential .....                | $\pm V_S$       |
| Common-mode .....                                | $\pm V_S$       |
| Temperature: Pin solder, 10s .....               | +300°C          |
| Junction <sup>(2)</sup> .....                    | +150°C          |
| Temperature Range:                               |                 |
| AM, BM SM                                        |                 |
| Storage .....                                    | -65°C to +150°C |
| Operating (case) .....                           | -55°C to +125°C |
| AP                                               |                 |
| Storage .....                                    | -40°C to +85°C  |
| Operating (case) .....                           | -25°C to +85°C  |

NOTE: (1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. (2) Long term operation at the maximum junction temperature will result in reduced product life. Derate internal power dissipation to achieve high MTTF.

## PACKAGE/ORDERING INFORMATION

For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com).

## CONNECTION DIAGRAMS



## ELECTROSTATIC DISCHARGE SENSITIVITY

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

# ELECTRICAL CHARACTERISTICS

At  $T_C = +25^\circ\text{C}$  and  $V_S = \pm 35\text{VDC}$ , unless otherwise noted.

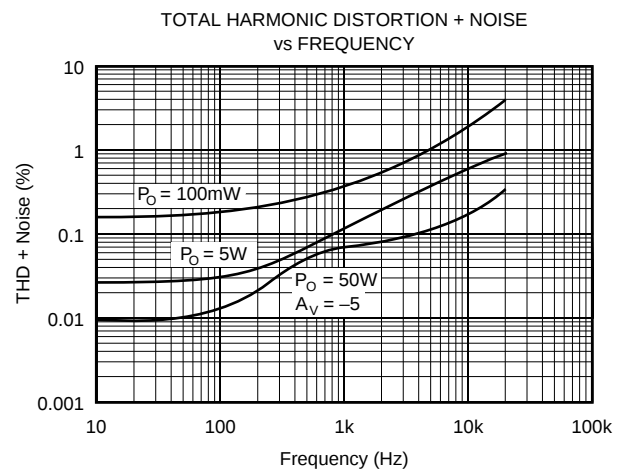
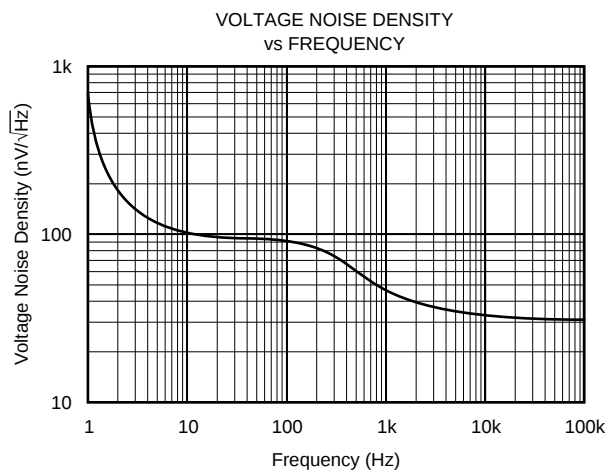
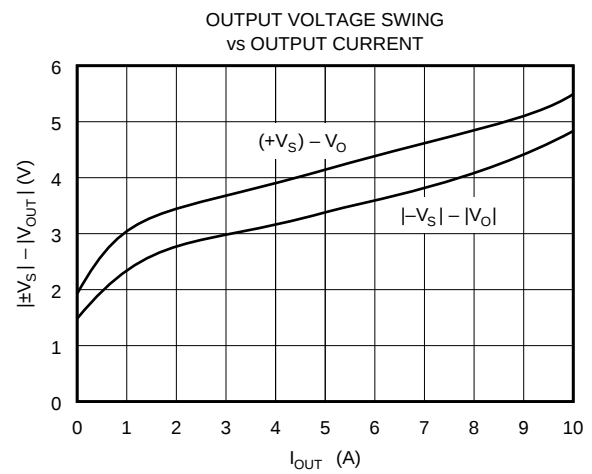
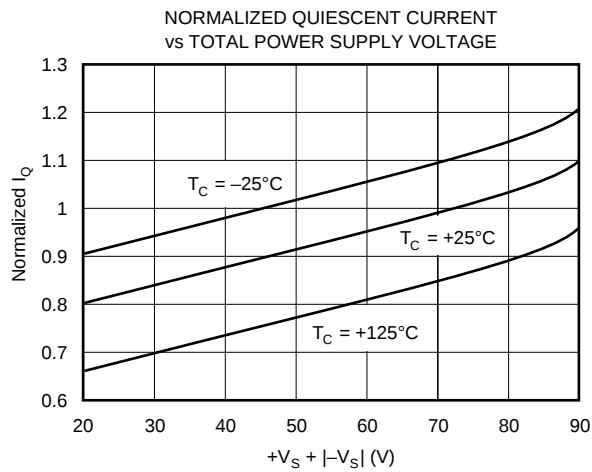
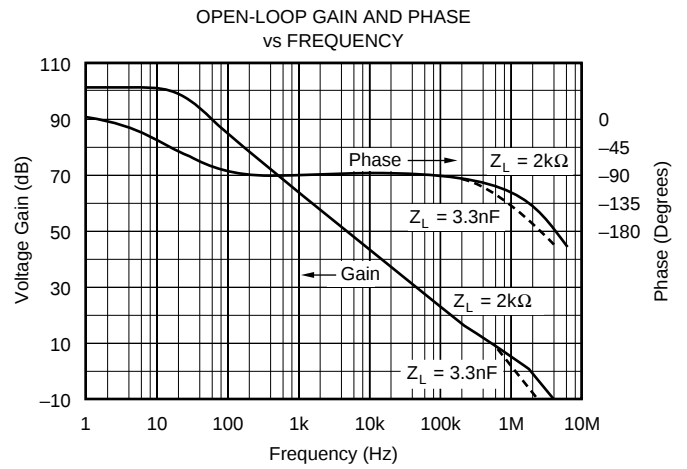
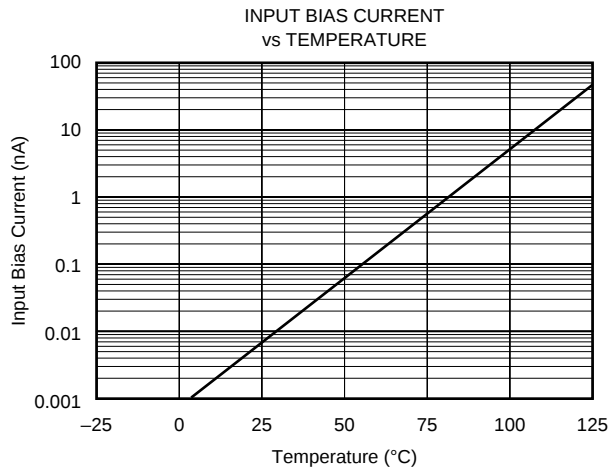
| PARAMETER                                                                                                                                                        | CONDITIONS                                                                                                                                                                          | OPA541AM/AP                                                       |                                                                      |                                              | OPA541BM/SM |                            |                          | UNITS                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------|-------------|----------------------------|--------------------------|--------------------------------------------------------------------------------------|
|                                                                                                                                                                  |                                                                                                                                                                                     | MIN                                                               | TYP                                                                  | MAX                                          | MIN         | TYP                        | MAX                      |                                                                                      |
| <b>INPUT OFFSET VOLTAGE</b><br>$V_{OS}$<br>vs Temperature<br>vs Supply Voltage<br>vs Power                                                                       | Specified Temperature Range<br>$V_S = \pm 10\text{V}$ to $\pm V_{MAX}$                                                                                                              |                                                                   | $\pm 2$<br>$\pm 20$<br>$\pm 2.5$<br>$\pm 20$                         | $\pm 10$<br>$\pm 40$<br>$\pm 10$<br>$\pm 60$ |             | $\pm 0.1$<br>$\pm 15$<br>* | $\pm 1$<br>$\pm 30$<br>* | mV<br>$\mu\text{V}/^\circ\text{C}$<br>$\mu\text{V/V}$<br>$\mu\text{V/W}$             |
| <b>INPUT BIAS CURRENT</b><br>$I_B$                                                                                                                               |                                                                                                                                                                                     |                                                                   | 4                                                                    | 50                                           |             | *                          | *                        | pA                                                                                   |
| <b>INPUT OFFSET CURRENT</b><br>$I_{OS}$                                                                                                                          | Specified Temperature Range                                                                                                                                                         |                                                                   | $\pm 1$                                                              | $\pm 30$<br>5                                |             | *                          | *                        | pA<br>nA                                                                             |
| <b>INPUT CHARACTERISTICS</b><br>Common-Mode Voltage Range<br>Common-Mode Rejection<br>Input Capacitance<br>Input Impedance, DC                                   | Specified Temperature Range<br>$V_{CM} = ( V_S  - 6\text{V})$                                                                                                                       | $\pm( V_S  - 6)$<br>95                                            | $\pm( V_S  - 3)$<br>113<br>5<br>1                                    |                                              | *           | *                          | *                        | V<br>dB<br>pF<br>$T\Omega$                                                           |
| <b>GAIN CHARACTERISTICS</b><br>Open Loop Gain at 10Hz<br>Gain-Bandwidth Product                                                                                  | $R_L = 6\Omega$                                                                                                                                                                     | 90                                                                | 97<br>1.6                                                            |                                              | *           | *                          | *                        | dB<br>MHz                                                                            |
| <b>OUTPUT</b><br>Voltage Swing<br><br>Current, Peak                                                                                                              | $I_O = 5\text{A}$ , Continuous<br>$I_O = 2\text{A}$<br>$I_O = 0.5\text{A}$                                                                                                          | $\pm( V_S  - 5.5)$<br>$\pm( V_S  - 4.5)$<br>$\pm( V_S  - 4)$<br>9 | $\pm( V_S  - 4.5)$<br>$\pm( V_S  - 3.6)$<br>$\pm( V_S  - 3.2)$<br>10 |                                              | *           | *                          | *                        | V<br>V<br>V<br>A                                                                     |
| <b>AC PERFORMANCE</b><br>Slew Rate<br>Power Bandwidth<br>Settling Time to 0.1%<br>Capacitive Load<br><br>Phase Margin                                            | $R_L = 8\Omega$ , $V_O = 20\text{Vrms}$<br>2V Step<br>Specified Temperature Range, $G = 1$<br>Specified Temperature Range, $G > 10$<br>Specified Temperature Range, $R_L = 8\Omega$ | 6<br>45<br>3.3                                                    | 10<br>55<br>2<br>40                                                  | <br><br><br>SOA <sup>(1)</sup>               | *           | *                          | *                        | V/ $\mu\text{s}$<br>kHz<br>$\mu\text{s}$<br>nF<br>Degrees                            |
| <b>POWER SUPPLY</b><br>Power Supply Voltage, $\pm V_S$<br>Current, Quiescent                                                                                     | Specified Temperature Range                                                                                                                                                         | $\pm 10$                                                          | $\pm 30$<br>20                                                       | $\pm 35$<br>25                               | *           | $\pm 35$<br>*              | $\pm 40$<br>*            | V<br>mA                                                                              |
| <b>THERMAL RESISTANCE</b><br>$\theta_{JC}$ (Junction-to-Case) <sup>(2)</sup><br>$\theta_{JC}^{(2)}$<br>$\theta_{JA}$ (Junction-to-Ambient)<br>OPA541AP (Plastic) | AC Output $f > 60\text{Hz}$<br>DC Output<br>No Heat Sink                                                                                                                            |                                                                   | 2.5<br>3<br>40<br>40                                                 |                                              |             |                            |                          | $^\circ\text{C/W}$<br>$^\circ\text{C/W}$<br>$^\circ\text{C/W}$<br>$^\circ\text{C/W}$ |
| <b>TEMPERATURE RANGE</b><br>$T_{CASE}$                                                                                                                           | AM, BM, AP<br>SM                                                                                                                                                                    | -25                                                               |                                                                      | +85                                          | *           |                            | *                        | $^\circ\text{C}$<br>$^\circ\text{C}$                                                 |

\* Specification same as OPA541AM/AP.

NOTE: (1) SOA is the Safe Operating Area shown in Figure 1. (2) Plastic package may require insulator which typically adds  $1^\circ\text{C/W}$ .

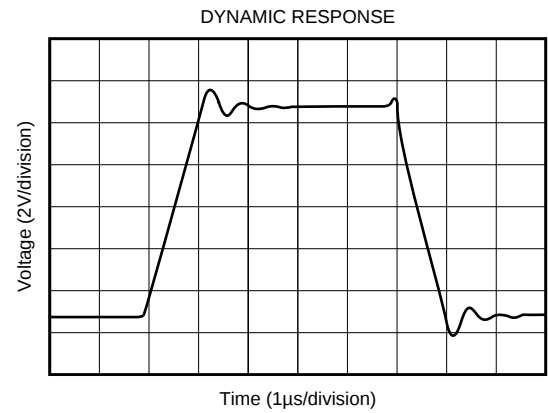
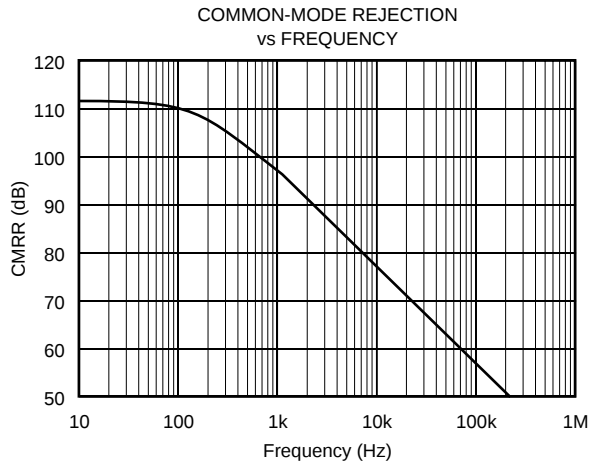
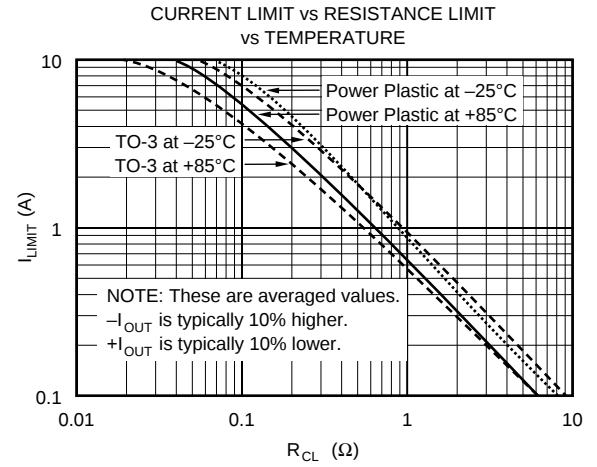
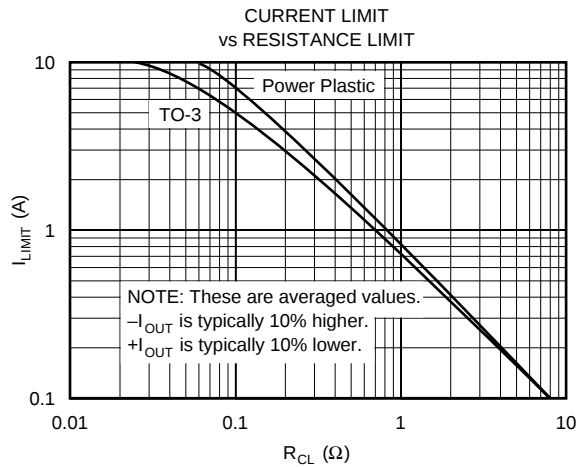
# TYPICAL CHARACTERISTICS

At  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 35\text{VDC}$ , unless otherwise noted.



# TYPICAL CHARACTERISTICS (Cont)

At  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 35\text{VDC}$ , unless otherwise noted.



# INSTALLATION INSTRUCTIONS

## POWER SUPPLIES

The OPA541 is specified for operation from power supplies up to  $\pm 40\text{V}$ . It can also be operated from unbalanced power supplies or a single power supply, as long as the total power supply voltage does not exceed  $80\text{V}$ . The power supplies should be bypassed with low series impedance capacitors such as ceramic or tantalum. These should be located as near as practical to the amplifier's power supply pins. Good power amplifier circuit layout is, in general, like good high frequency layout. Consider the path of large power supply and output currents. Avoid routing these connections near low-level input circuitry to avoid waveform distortion and oscillations.

## CURRENT LIMIT

Internal current limit circuitry is controlled by a single external resistor,  $R_{CL}$ . Output load current flows through this external resistor. The current limit is activated when the voltage across this resistor is approximately a base-emitter turn-on voltage. The value of the current limit resistor is approximately:

$$\begin{aligned} \text{(AM, BM, SM)} \quad R_{CL} &= \frac{0.809}{|I_{LIM}|} - 0.057 \\ \text{(AP)} \quad R_{CL} &= \frac{0.813}{|I_{LIM}|} - 0.02 \end{aligned}$$

Because of the internal structure of the OPA541, the actual current limit depends on whether current is positive or negative. The above  $R_{CL}$  gives an average value. For a given  $R_{CL}$ ,  $+I_{OUT}$  will actually be limited at about 10% below the expected level, while  $-I_{OUT}$  will be limited about 10% above the expected level.

The current limit value decreases with increasing temperature due to the temperature coefficient of a base-emitter junction voltage. Similarly, the current limit value increases at low temperatures. Current limit versus resistor value and temperature effects are shown in the Typical Performance Curves. Approximate values for  $R_{CL}$  at other temperatures may be calculated by adjusting  $R_{CL}$  as follows:

$$\Delta R_{CL} = \frac{-2\text{mV}}{|I_{LIM}|} \times (T - 25)$$

The adjustable current limit can be set to provide protection from short circuits. The safe short-circuit current depends on power supply voltage. See the discussion on Safe Operating Area to determine the proper current limit value.

Since the full load current flows through  $R_{CL}$ , it must be selected for sufficient power dissipation. For a  $5\text{A}$  current limit on the TO-3 package, the formula yields an  $R_{CL}$  of  $0.105\Omega$  ( $0.143\Omega$  on the power plastic package due to different internal resistances). A continuous  $5\text{A}$  through  $0.105\Omega$  would require an  $R_{CL}$  that can dissipate  $2.625\text{W}$ .

Sinusoidal outputs create dissipation according to rms load current. For the same  $R_{CL}$ , AC peaks would still be limited to  $5\text{A}$ , but rms current would be  $3.5\text{A}$ , and a current limiting resistor with a lower power rating could be used. Some applications (such as voice amplification) are assured of signals with much lower duty cycles, allowing a current resistor with a low power rating. Wire-wound resistors may be used for  $R_{CL}$ . Some wire-wound resistors, however, have excessive inductance and may cause loop-stability problems. Be sure to evaluate circuit performance with the resistor type planned for production to assure proper circuit operation.

## HEAT SINKING

Power amplifiers are rated by case temperature, not ambient temperature as with signal op amps. Sufficient heat sinking must be provided to keep the case temperature within rated limits for the maximum ambient temperature and power dissipation. The thermal resistance of the heat sink required may be calculated by:

$$\theta_{HS} = \frac{T_{CASE} - T_{AMBIENT}}{P_D (\text{max})}$$

Commercially available heat sinks often specify their thermal resistance. These ratings are often suspect, however, since they depend greatly on the mounting environment and air flow conditions. Actual thermal performance should be verified by measurement of case temperature under the required load and environmental conditions.

No insulating hardware is required when using the TO-3 package. Since mica and other similar insulators typically add approximately  $0.7^\circ\text{C/W}$  thermal resistance, their elimination significantly improves thermal performance. See Application Bulletin SBOA021, available for download at [www.ti.com](http://www.ti.com), for further details on heat sinking. On the power plastic package, the metal tab may have a high or low impedance connection to  $-V_S$ . The case should be allowed to float and will likely assume the potential of  $-V_S$ . Current should **NOT** be conducted through the case.

## SAFE OPERATING AREA

The safe operating area (SOA) plot provides comprehensive information on the power handling abilities of the OPA541. It shows the allowable output current as a function of the voltage across the conducting output transistor (see Figure 1). This voltage is equal to the power supply voltage minus the output voltage. For example, as the amplifier output swings near the positive power supply voltage, the voltage



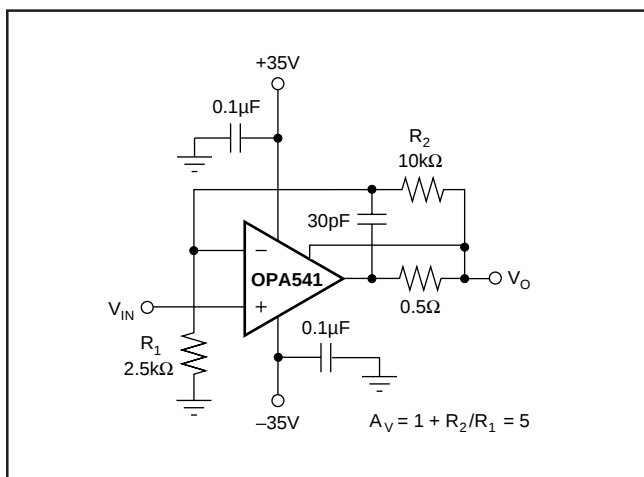


FIGURE 5. Paralleled Operation, Extended SOA.

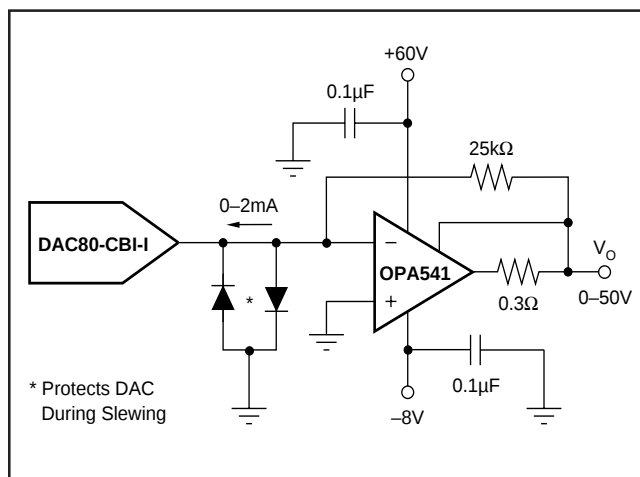


FIGURE 6. Programmable Voltage Source.

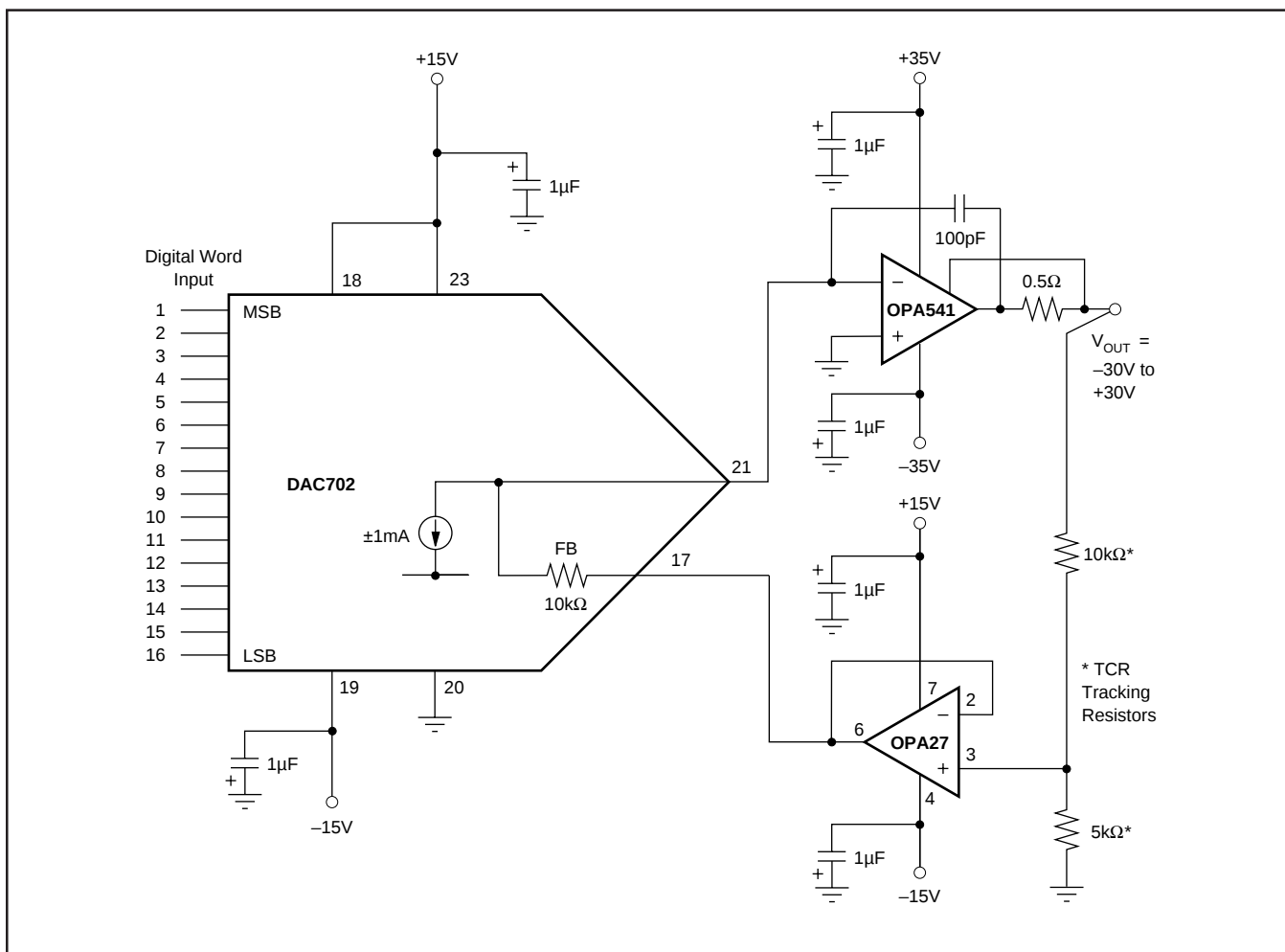


FIGURE 7. 16-Bit Programmable Voltage Source.

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Top-Side Markings<br>(4) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|--------------------------|-------------------------|
| OPA541-W         | ACTIVE        | WAFERSALE    | YS                 | 0    |                | TBD                        | Call TI          | Call TI              |              |                          | <a href="#">Samples</a> |
| OPA541AM         | NRND          | TO-3         | LMF                | 8    | 1              | Pb-Free (RoHS<br>Exempt)   | NI               | N / A for Pkg Type   |              | OPA541AM                 |                         |
| OPA541AM-BI      | NRND          | ZZ (BB)      | ZZ030              | 8    |                | TBD                        | Call TI          | Call TI              |              |                          |                         |
| OPA541AP         | ACTIVE        | TO-220       | KV                 | 11   | 25             | Green (RoHS<br>& no Sb/Br) | CU SN            | N / A for Pkg Type   | -25 to 85    | OPA541AP                 | <a href="#">Samples</a> |
| OPA541APG3       | ACTIVE        | TO-220       | KV                 | 11   | 25             | Green (RoHS<br>& no Sb/Br) | CU SN            | N / A for Pkg Type   | -25 to 85    | OPA541AP                 | <a href="#">Samples</a> |
| OPA541BM         | NRND          | TO-3         | LMF                | 8    | 18             | Pb-Free (RoHS<br>Exempt)   | NI               | N / A for Pkg Type   |              | OPA541BM                 |                         |
| OPA541SM         | NRND          | TO-3         | LMF                | 8    | 18             | Pb-Free (RoHS<br>Exempt)   | NI               | N / A for Pkg Type   |              | OPA541<br>OPA541SM       |                         |
| OPA541SM-BI      | OBSOLETE      | TO-3         | LMF                | 8    |                | TBD                        | Call TI          | Call TI              |              |                          |                         |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

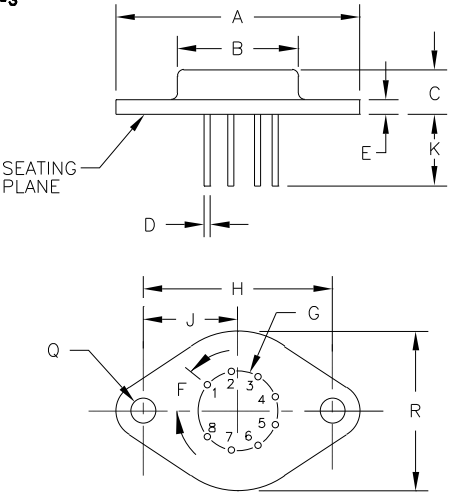
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "--" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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Package Number 030 - 8-Pin Metal TO-3

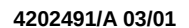


| DIM | INCHES |       | MILLIMETERS |       | NOTE |
|-----|--------|-------|-------------|-------|------|
|     | MIN.   | MAX.  | MIN.        | MAX.  |      |
| A   | 1.510  | 1.550 | 38.35       | 39.37 |      |
| B   | .745   | .770  | 18.92       | 19.56 |      |
| C   | .260   | .300  | 6.60        | 7.62  |      |
| D   | .038   | .042  | 0.97        | 1.07  |      |
| E   | .080   | .105  | 2.03        | 2.67  |      |
| F   | 40°    | BASIC | 40°         | BASIC |      |
| G   | .500   | BASIC | 12.70       | BASIC |      |
| H   | 1.182  | 1.192 | 30.02       | 30.28 |      |
| J   | .591   | .596  | 15.01       | 15.14 |      |
| K   | .400   | .500  | 10.16       | 12.70 |      |
| Q   | .151   | .161  | 3.84        | 4.09  |      |
| R   | .980   | 1.020 | 24.89       | 25.91 |      |

- NOTES:
- LEADS IN TRUE POSITION WITHIN .010" (.25mm) © MMC AT SEATING PLANE.
  - PIN NUMBERS SHOWN FOR REFERENCE ONLY. NUMBERS MAY NOT BE MARKED ON PACKAGE.

|                       |         |
|-----------------------|---------|
| PACKAGE NUMBER: ZZ030 | REV.: C |
| JEDEC NUMBER: UNKNOWN |         |

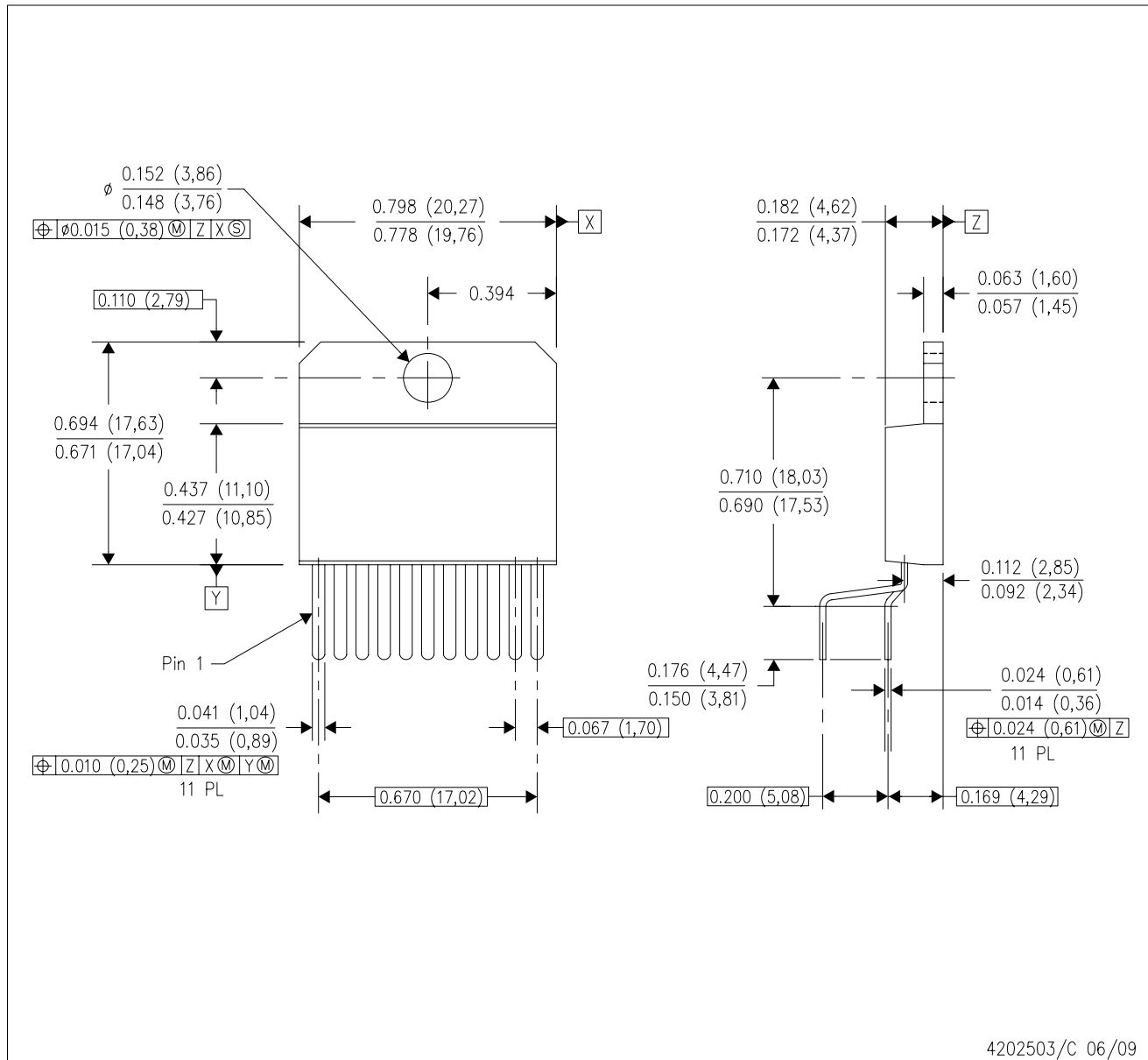
## METAL CYLINDRICAL PACKAGE



- 

KV (R-PZFM-T11)

PLASTIC FLANGE-MOUNT



4202503/C 06/09

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In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

|                              |                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------|
| Audio                        | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                               |
| Amplifiers                   | <a href="http://amplifier.ti.com">amplifier.ti.com</a>                               |
| Data Converters              | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>                       |
| DLP® Products                | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
| DSP                          | <a href="http://dsp.ti.com">dsp.ti.com</a>                                           |
| Clocks and Timers            | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>                             |
| Interface                    | <a href="http://interface.ti.com">interface.ti.com</a>                               |
| Logic                        | <a href="http://logic.ti.com">logic.ti.com</a>                                       |
| Power Mgmt                   | <a href="http://power.ti.com">power.ti.com</a>                                       |
| Microcontrollers             | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a>                   |
| RFID                         | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Applications Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
| Wireless Connectivity        | <a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a> |

### Applications

|                               |                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------|
| Automotive and Transportation | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>                         |
| Communications and Telecom    | <a href="http://www.ti.com/communications">www.ti.com/communications</a>                 |
| Computers and Peripherals     | <a href="http://www.ti.com/computers">www.ti.com/computers</a>                           |
| Consumer Electronics          | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
| Energy and Lighting           | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
| Industrial                    | <a href="http://www.ti.com/industrial">www.ti.com/industrial</a>                         |
| Medical                       | <a href="http://www.ti.com/medical">www.ti.com/medical</a>                               |
| Security                      | <a href="http://www.ti.com/security">www.ti.com/security</a>                             |
| Space, Avionics and Defense   | <a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a> |
| Video and Imaging             | <a href="http://www.ti.com/video">www.ti.com/video</a>                                   |

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)

Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)

[www.lifeelectronics.ru](http://www.lifeelectronics.ru)