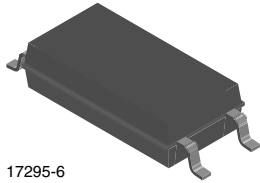
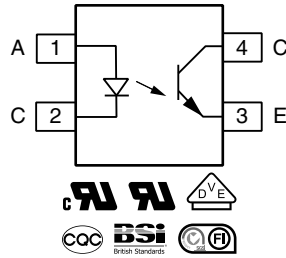


# Optocoupler, Phototransistor Output, Low Input Current, 4 Pin LSOP, Long Creepage Mini-Flat Package



17295-6



## FEATURES

- Low profile package
- High collector emitter voltage,  $V_{CE0} = 80\text{ V}$
- Isolation test voltage,  $5000\text{ V}_{RMS}$
- Isolation voltage  $V_{IORM} = 1050\text{ V}_{peak}$
- Low coupling capacitance
- High common mode transient immunity
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## DESCRIPTION

The VOL618A has a GaAs infrared emitting diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a 4 pin LSOP wide body package.

It features a high current transfer ratio, low coupling capacitance, and high isolation voltage.

The coupling device is designed for signal transmission between two electrically separated circuits.

## APPLICATIONS

- Telecom
- Industrial controls
- Battery powered equipment
- Office machines
- Programmable controllers

## AGENCY APPROVALS

(All parts are certified under base model VOL618A)

- UL1577, file no. E76222
- cUL CSA 22.2 bulletin 5A, double protection
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1
- BSI: EN 60065:2002, EN 60950-1:2006
- FIMKO EN60950-1
- CQC: GB8898-2011, GB4943.1-2011

| ORDERING INFORMATION   |                  |                  |                     |
|--|------------------|------------------|---------------------|
| <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 2px;">V</div> <div style="border: 1px solid black; padding: 2px;">O</div> <div style="border: 1px solid black; padding: 2px;">L</div> <div style="border: 1px solid black; padding: 2px;">6</div> <div style="border: 1px solid black; padding: 2px;">1</div> <div style="border: 1px solid black; padding: 2px;">8</div> <div style="border: 1px solid black; padding: 2px;">A</div> <div style="border: 1px solid black; padding: 2px;">-</div> <div style="border: 1px solid black; padding: 2px;">#</div> <div style="border: 1px solid black; padding: 2px;">X</div> <div style="border: 1px solid black; padding: 2px;">0</div> <div style="border: 1px solid black; padding: 2px;">0</div> <div style="border: 1px solid black; padding: 2px;">1</div> <div style="border: 1px solid black; padding: 2px;">T</div> </div> | CTR<br>BIN       | PACKAGE OPTION   | TAPE<br>AND<br>REEL |
|  |                  |                  |                     |
| AGENCY CERTIFIED/PACKAGE   | CTR (%)          |                  |                     |
|  | 1 mA             |                  |                     |
| <b>UL, cUL, BSI, FIMKO, CQC</b>  | <b>50 to 600</b> | <b>63 to 125</b> | <b>100 to 200</b>   |
| 4 pin LSOP, mini-flat, long creepage   | VOL618AT         | VOL618A-2T       | VOL618A-3T          |
| <b>UL, cUL, BSI, FIMKO, CQC, VDE (option 1)</b>  | <b>50 to 600</b> | <b>63 to 125</b> | <b>100 to 200</b>   |
| 4 pin LSOP, mini-flat, long creepage   | -                | VOL618A-2X001T   | VOL618A-3X001T      |



| ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |   |                   |             |      |
|---|---|-------------------|-------------|------|
| PARAMETER   | TEST CONDITION                                  | SYMBOL            | VALUE       | UNIT |
| <b>INPUT</b>  |   |                   |             |      |
| Reverse voltage   |   | V <sub>R</sub>    | 6           | V    |
| Power dissipation   |   | P <sub>diss</sub> | 100         | mW   |
| Forward current   |   | I <sub>F</sub>    | 60          | mA   |
| Forward surge current   | t <sub>p</sub> < 10 μs                          | I <sub>FSM</sub>  | 1.5         | A    |
| Junction temperature  |   | T <sub>J</sub>    | 125         | °C   |
| <b>OUTPUT</b>   |   |                   |             |      |
| Collector emitter voltage   |   | V <sub>CEO</sub>  | 80          | V    |
| Emitter collector voltage   |   | V <sub>ECO</sub>  | 7           | V    |
| Collector current   |   | I <sub>C</sub>    | 50          | mA   |
|   | t <sub>p</sub> /T = 0.5, t <sub>p</sub> < 10 ms | I <sub>C</sub>    | 100         | mA   |
| Power dissipation   |   | P <sub>diss</sub> | 150         | mW   |
| Junction temperature  |   | T <sub>J</sub>    | 125         | °C   |
| <b>COUPLER</b>  |   |                   |             |      |
| Total power dissipation   |   | P <sub>tot</sub>  | 250         | mW   |
| Storage temperature range   |   | T <sub>stg</sub>  | -55 to +125 | °C   |
| Ambient temperature range   |   | T <sub>amb</sub>  | -55 to +110 | °C   |
| Soldering temperature <sup>(1)</sup>  | ≤ 10 s  | T <sub>slid</sub> | 260         | °C   |

**Notes**

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.
- <sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices.

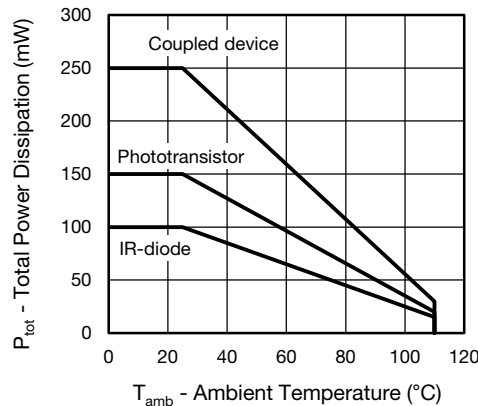


Fig. 1 - Total Power Dissipation vs. Ambient Temperature

| ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |   |           |                    |      |      |      |      |
|---|---|-----------|--------------------|------|------|------|------|
| PARAMETER   | TEST CONDITION                                  | PART      | SYMBOL             | MIN. | TYP. | MAX. | UNIT |
| <b>INPUT</b>  |   |           |                    |      |      |      |      |
| Forward voltage   | I <sub>F</sub> = 5 mA                           |           | V <sub>F</sub>     | -    | 1.16 | 1.5  | V    |
| Capacitance   | V <sub>R</sub> = 0 V, f = 1 MHz                 |           | C <sub>O</sub>     | -    | 45   | -    | pF   |
| Reverse current   | V <sub>R</sub> = 6 V                            |           | I <sub>R</sub>     | -    | -    | 100  | μA   |
| <b>OUTPUT</b>   |   |           |                    |      |      |      |      |
| Collector emitter leakage current   | V <sub>CE</sub> = 10 V, I <sub>F</sub> = 0 A    |           | I <sub>CEO</sub>   | -    | 10   | 200  | nA   |
| Collector emitter capacitance   | V <sub>CE</sub> = 5 V, f = 1 MHz                |           | C <sub>CE</sub>    | -    | 7    | -    | pF   |
| <b>COUPLER</b>  |   |           |                    |      |      |      |      |
| Collector emitter saturation voltage  | I <sub>C</sub> = 0.32 mA, I <sub>F</sub> = 1 mA | VOL618A-2 | V <sub>CEsat</sub> | -    | 0.25 | 0.4  | V    |
|   | I <sub>C</sub> = 0.5 mA, I <sub>F</sub> = 1 mA  | VOL618A-3 | V <sub>CEsat</sub> | -    | 0.25 | 0.4  | V    |
|   | I <sub>C</sub> = 0.8 mA, I <sub>F</sub> = 1 mA  | VOL618A-4 | V <sub>CEsat</sub> | -    | 0.25 | 0.4  | V    |
| Coupling capacitance  | f = 1 MHz                                       |           | C <sub>C</sub>     | -    | 0.25 | -    | pF   |

**Note**

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

| <b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |   |           |        |      |      |      |      |
|--|---|-----------|--------|------|------|------|------|
| PARAMETER  | TEST CONDITION                              | PART      | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| $I_C/I_F$  | $I_F = 1\text{ mA}$ , $V_{CE} = 5\text{ V}$ | VOL618A   | CTR    | 50   | -    | 600  | %    |
|  |   | VOL618A-2 | CTR    | 63   | -    | 125  | %    |
|  |   | VOL618A-3 | CTR    | 100  | -    | 200  | %    |

| <b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |   |           |      |      |      |               |  |
|---|---|-----------|------|------|------|---------------|--|
| PARAMETER   | TEST CONDITION  | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |  |
| Turn on time  | $V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ | $t_{on}$  | -    | 6    | -    | $\mu\text{s}$ |  |
| Rise time   | $V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ | $t_r$     | -    | 3.5  | -    | $\mu\text{s}$ |  |
| Turn off time   | $V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ | $t_{off}$ | -    | 5.5  | -    | $\mu\text{s}$ |  |
| Fall time   | $V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ | $t_f$     | -    | 5    | -    | $\mu\text{s}$ |  |

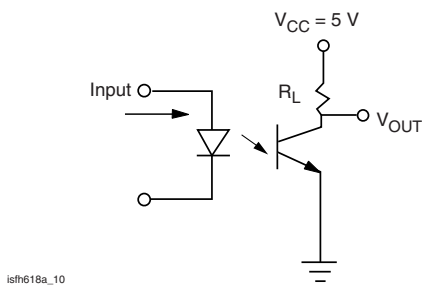


Fig. 2 - Test Circuit

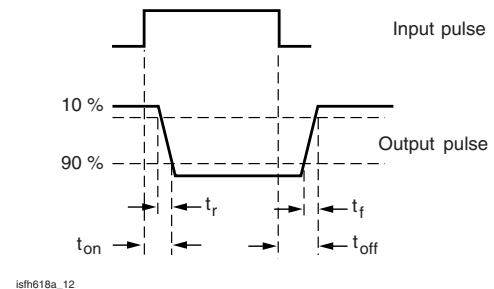


Fig. 3 - Test Circuit and Waveforms

| <b>SAFETY AND INSULATION RATINGS</b>                    |  |            |           |                    |  |
|---|--|------------|-----------|--------------------|--|
| PARAMETER   | TEST CONDITION   | SYMBOL     | VALUE     | UNIT               |  |
| Partial discharge test voltage - routine test           | 100 %, $t_{test} = 1\text{ s}$   | $V_{pd}$   | 2         | $\text{kV}_{peak}$ |  |
| Partial discharge test voltage - lot test (sample test) | $t_{Tr} = 60\text{ s}$ , $t_{test} = 10\text{ s}$ ,<br>(see figure 4)                              | $V_{IOTM}$ | 8         | $\text{kV}_{peak}$ |  |
|   |  | $V_{pd}$   | 1.68      | $\text{kV}_{peak}$ |  |
| Isolation test voltage between emitter and detector     | $t = 1\text{ min}$   | $V_{ISO}$  | 5000      | $\text{V}_{RMS}$   |  |
| Insulation voltage                                      |  | $V_{IORM}$ | 1050      | $\text{V}_{peak}$  |  |
| Insulation resistance                                   | $V_{IO} = 500\text{ V}_{DC}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$                              | $R_{IO}$   | $10^{12}$ | $\Omega$           |  |
|   | $V_{IO} = 500\text{ V}_{DC}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$                             | $R_{IO}$   | $10^{11}$ | $\Omega$           |  |
|   | $V_{IO} = 500\text{ V}_{DC}$ , $T_{amb} = 150\text{ }^{\circ}\text{C}$<br>(construction test only) | $R_{IO}$   | $10^9$    | $\Omega$           |  |
| Safety rating - maximum input current                   |  | $I_{si}$   | 130       | mA                 |  |
| Safety rating - maximum power dissipation               |  | $P_{SO}$   | 265       | mW                 |  |
| Rated impulse voltage                                   |  | $V_{IOTM}$ | 8         | kV                 |  |
| Safety rating - maximum ambient temperature             |  | $T_{si}$   | 150       | $^{\circ}\text{C}$ |  |
| Comparative tracking index                              |  | CTI        | 275       | mm                 |  |
| Clearance distance                                      |  |            | 8         | mm                 |  |
| Creepage distance                                       |  |            | 8         | mm                 |  |
| Insulation distance (internal)                          |  |            | 0.4       | mm                 |  |

**Note**

- According to DIN EN 60747-5-5 (VDE 0884), § 7.4.3.8.2, (see figure 4). This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

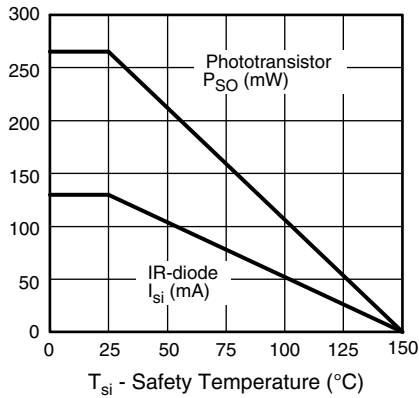


Fig. 4 - Derating Diagram

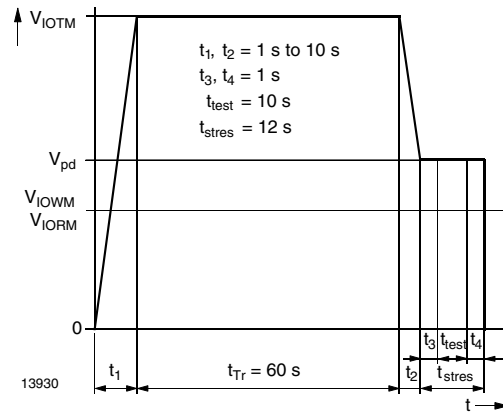


Fig. 5 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-5

**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

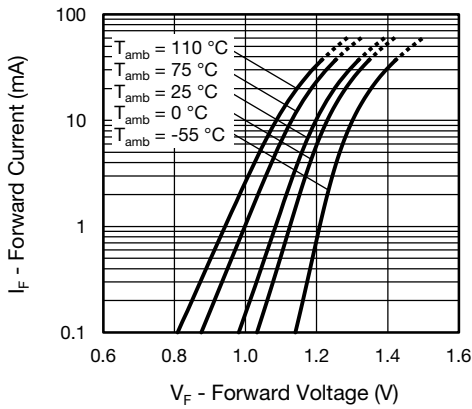


Fig. 6 - Forward Voltage vs. Forward Current

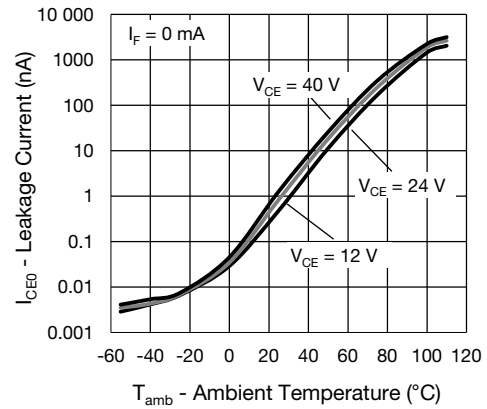


Fig. 8 - Collector Emitter Current vs. Ambient Temperature

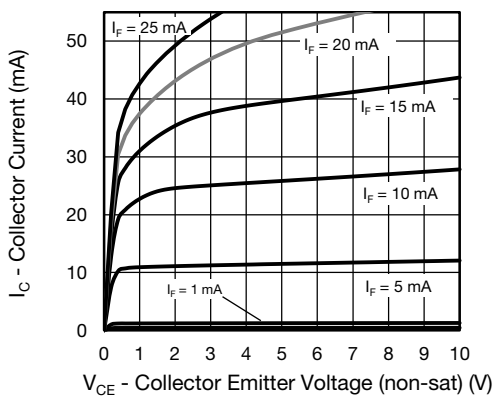


Fig. 7 - Collector Current vs. Collector Emitter Voltage (non-saturated)

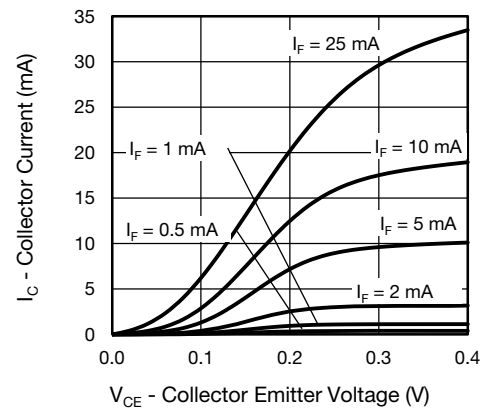


Fig. 9 - Collector Current vs. Collector Emitter Voltage (saturated)

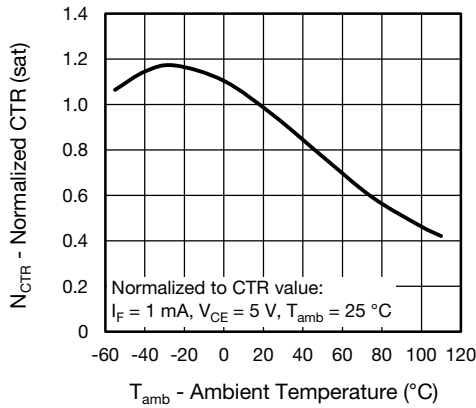


Fig. 10 - Normalized Current Transfer Ratio vs. Ambient Temperature (saturated)

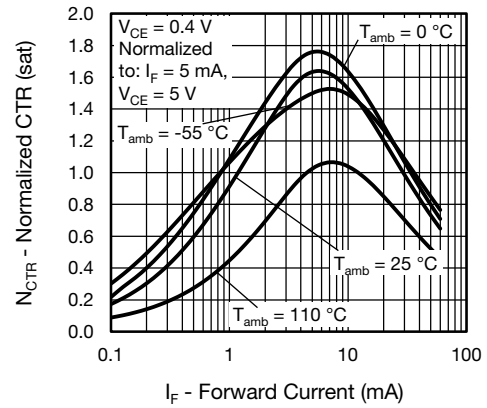


Fig. 13 - Current Transfer Ratio vs. Forward Current (non-saturated) Normalized to 1 mA at 25 °C

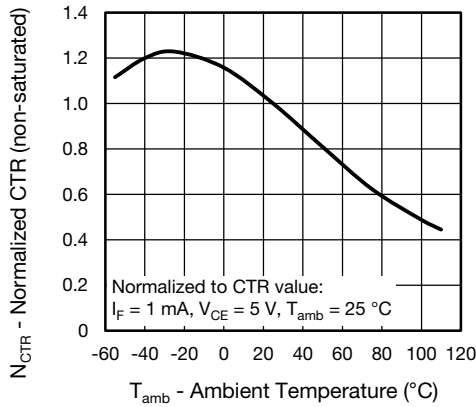


Fig. 11 - Normalized Current Transfer Ratio vs. Ambient Temperature (non-saturated)

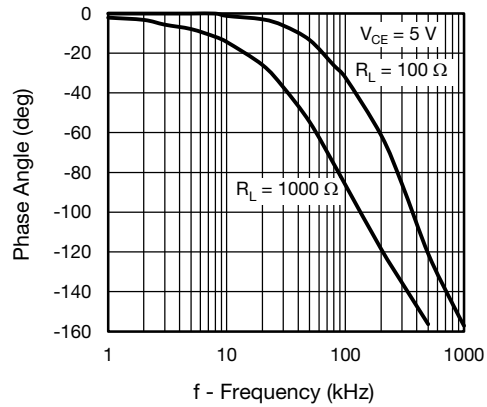


Fig. 14 -  $f_{CTR}$  vs. Phase Angle

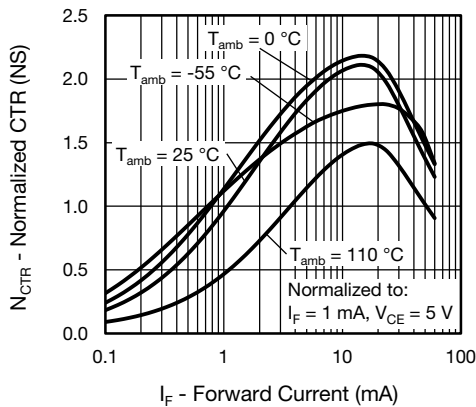


Fig. 12 - Current Transfer Ratio vs. Forward Current (saturated) Normalized to 1 mA at 25 °C

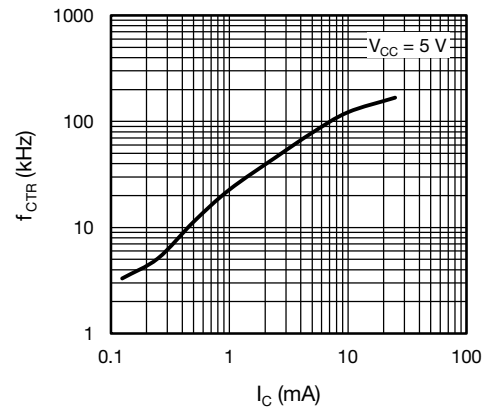


Fig. 15 - Frequency (-3 dB) vs. Collector Current

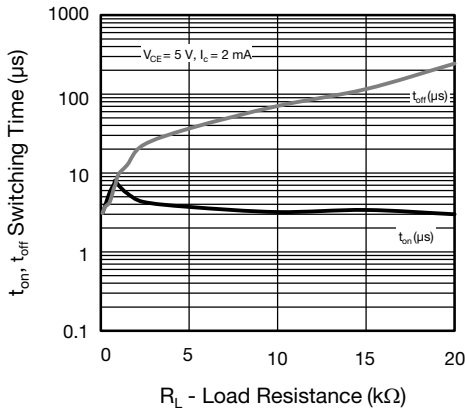


Fig. 16 - Switching Time vs. Load Resistance

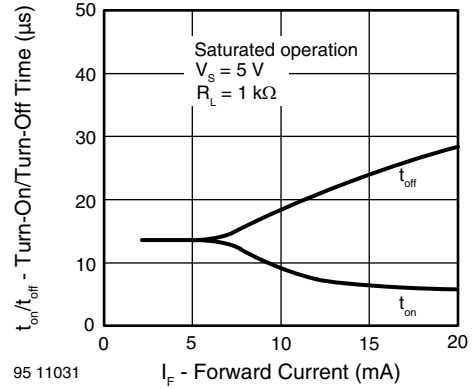


Fig. 18 - Turn-On/Turn-Off Time vs. Forward Current

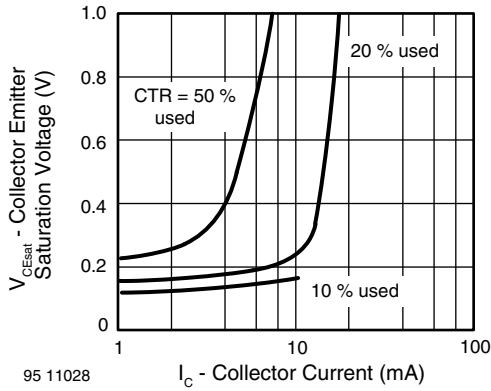


Fig. 17 - Collector Emitter Saturation Voltage vs. Collector Current

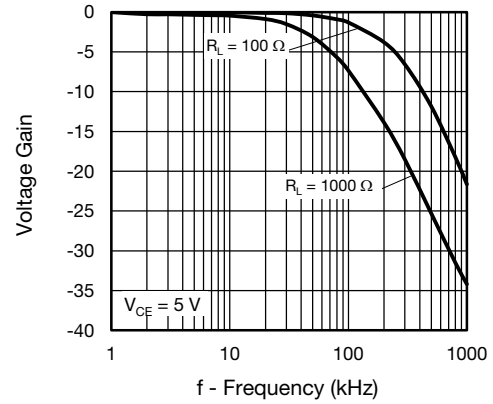
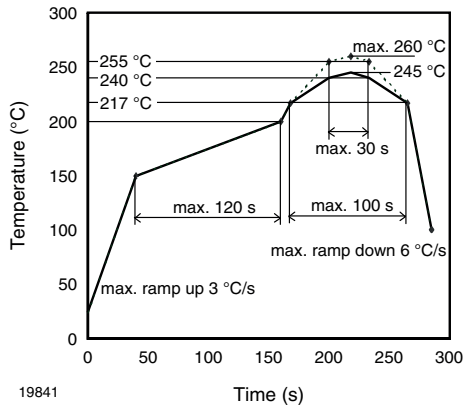


Fig. 19 - Voltage Gain vs. Cut-off Frequency



**SOLDER PROFILE**



19841

Fig. 22 - Lead (Pb)-free Reflow Solder Profile according to J-STD-020

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{amb} < 30\text{ °C}$ ,  $RH < 85\%$

Moisture sensitivity level 1, according to J-STD-020





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