

## DC Input, Half-Pitch Phototransistor Optocoupler

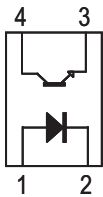
## Data Sheet

## Description

The ACPL-217 is a DC-input single-channel half-pitch phototransistor optocoupler that contains a light-emitting diode optically coupled to a phototransistor. It is packaged in a 4-pin SO package.

The input-output isolation voltage is rated at  $3750V_{RMS}$ . Response time,  $t_r$ , is  $2\mu s$  typically, while minimum CTR is 50% at input current of 5 mA.

## ACPL-217 Pin Layout



| Pin | Description |
|-----|-------------|
| 1   | Anode       |
| 2   | Cathode     |
| 3   | Emitter     |
| 4   | Collector   |

## Features

- Current transfer ratio (CTR: 50% (min) at  $I_F = 5\text{ mA}$ ,  $V_{CC} = 5V$ )
- High input-output isolation voltage ( $V_{ISO} = 3750V_{RMS}$ )
- Non-saturated Response time ( $t_r$ :  $2\mu s$  (typ) at  $V_{CC} = 10V$ ,  $I_C = 2\text{ mA}$ ,  $R_L = 100\Omega$ )
- SO package
- CMR  $10\text{ kV}/\mu s$  (typical)
- Safety and regulatory approvals
  - cUL
  - IEC/EN/DIN EN 60747-5-2
- Options available:
  - CTR Ranks 0, A, B, C, and D

## Applications

- I/O Interface for programmable controllers, computers.
- Sequence controllers.
- System appliances, measuring instruments.
- Signal transmission between circuits of different potentials and impedances.

## Ordering Information

ACPL-217-xxxx is UL Recognized with 3750V<sub>RMS</sub> for 1 minute per UL1577 and Canadian Component Acceptance Notice #5.

| Part Number | RoHS Compliant Option                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     | Package | Surface Mount | Tape & Reel | IC Orientation | IEC/EN/DIN EN 60747-5-2 | Quantity          |
|-------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------|---------------|-------------|----------------|-------------------------|-------------------|
|             | Rank 0<br>50% <<br>CTR <<br>600%<br>I <sub>F</sub> = 5 mA,<br>V <sub>CE</sub> = 5V | Rank A<br>80% <<br>CTR <<br>160%<br>I <sub>F</sub> = 5 mA,<br>V <sub>CE</sub> = 5V | Rank B<br>130% <<br>CTR <<br>260%<br>I <sub>F</sub> = 5 mA,<br>V <sub>CE</sub> = 5V | Rank C<br>200% <<br>CTR <<br>400%<br>I <sub>F</sub> = 5 mA,<br>V <sub>CE</sub> = 5V | Rank D<br>300% <<br>CTR <<br>600%<br>I <sub>F</sub> = 5 mA,<br>V <sub>CE</sub> = 5V |         |               |             |                |                         |                   |
| ACPL-217    | -500E                                                                              | -50AE                                                                              | -50BE                                                                               | -50CE                                                                               | -50DE                                                                               | SO-4    | X             | X           | 0°             |                         | 3000 pcs per reel |
|             | -560E                                                                              | -56AE                                                                              | -56BE                                                                               | -56CE                                                                               | -56DE                                                                               | SO-4    | X             | X           | 0°             | X                       | 3000 pcs per reel |
|             | -700E                                                                              | -70AE                                                                              | -70BE                                                                               | -70CE                                                                               | -70DE                                                                               | SO-4    | X             | X           | 180°           |                         | 3000 pcs per reel |
|             | -760E                                                                              | -76AE                                                                              | -76BE                                                                               | -76CE                                                                               | -76DE                                                                               | SO-4    | X             | X           | 180°           | X                       | 3000 pcs per reel |

To order, choose a part number from the part number column and combine with the desired option from the option column to form an order entry.

Example 1:

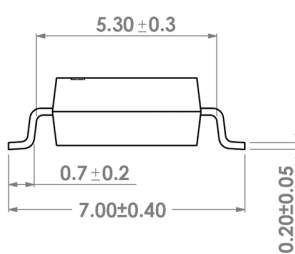
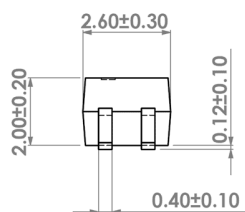
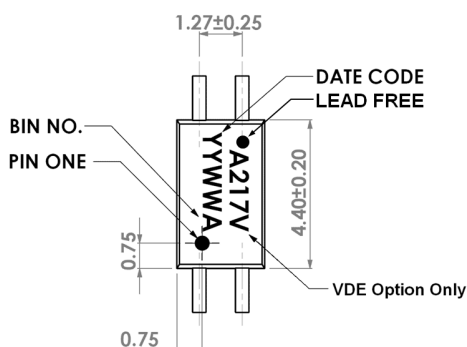
ACPL-217-560E to order product of SO-4 Surface Mount package in Tape & Reel packaging with IEC/EN/DIN EN 60767-5-2 Safety Approval, 50% < CTR < 600% and RoHS compliant.

Example 2:

ACPL-217-50BE to order product of SO-4 Surface Mount package in Tape & Reel packaging with 130% < CTR < 260% and RoHS compliant.

Option data sheets are available. Contact your Broadcom sales representative or authorized distributor for information.

## Package Outline Drawings



## Solder Reflow Temperature Profile

Recommended reflow condition as per JEDEC Standard, J-STD-020 (latest revision). Non-Halide Flux should be used.

## Absolute Maximum Ratings

| Parameter                                     | Symbol               | ACPL-217 | Unit      | Note  |
|-----------------------------------------------|----------------------|----------|-----------|-------|
| Storage Temperature                           | $T_S$                | -55~125  | °C        |       |
| Operating Temperature                         | $T_A$                | -55~110  | °C        |       |
| Average Forward Current                       | $I_{F(AVG)}$         | 50       | mA        |       |
| Pulse Forward Current                         | $I_{FSM}$            | 1        | A         |       |
| Reverse Voltage                               | $V_R$                | 6        | V         |       |
| LED Power Dissipation                         | $P_I$                | 65       | mW        |       |
| Collector Current                             | $I_C$                | 50       | mA        |       |
| Collector-Emitter Voltage                     | $V_{CEO}$            | 80       | V         |       |
| Emitter-Collector Voltage                     | $V_{ECO}$            | 7        | V         |       |
| Isolation Voltage (AC for 1 min, R.H. 40~60%) | $V_{ISO}$            | 3750     | $V_{RMS}$ | 1 min |
| Collector Power Dissipation                   | $P_C$                | 150      | mW        |       |
| Total Power Dissipation                       | $P_{TOT}$            | 200      | mW        |       |
| Lead Solder Temperature                       | 260°C for 10 seconds |          |           |       |

## Electrical Specifications (DC)

Over recommended ambient temperature at 25°C unless otherwise specified.

| Parameter                            | Symbol        | Min.               | Typ.               | Max. | Unit              | Test Conditions                                                                                                                                        | Note                      |
|--------------------------------------|---------------|--------------------|--------------------|------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Forward Voltage                      | $V_F$         | —                  | 1.2                | 1.4  | V                 | $I_F = 20 \text{ mA}$                                                                                                                                  | Figure 6                  |
| Reverse Current                      | $I_R$         | —                  | —                  | 10   | $\mu\text{A}$     | $V_R = 5 \text{ V}$                                                                                                                                    |                           |
| Terminal Capacitance                 | $C_t$         | —                  | 30                 | —    | pF                | $V = 0, f = 1 \text{ MHz}$                                                                                                                             |                           |
| Collector Dark Current               | $I_{CEO}$     | —                  | —                  | 100  | nA                | $V_{CE} = 48 \text{ V}, I_F = 0 \text{ mA}$                                                                                                            | Figure 12                 |
| Collector-Emitter Breakdown Voltage  | $BV_{CEO}$    | 80                 | —                  | —    | V                 | $I_C = 0.5 \text{ mA}, I_F = 0 \text{ mA}$                                                                                                             |                           |
| Emitter-Collector Breakdown Voltage  | $BV_{ECO}$    | 7                  | —                  | —    | V                 | $I_E = 100 \mu\text{A}, I_F = 0 \text{ mA}$                                                                                                            |                           |
| Current Transfer Ratio               | CTR           | 50                 | —                  | 600  | %                 | $I_F = 5 \text{ mA}, V_{CE} = 5 \text{ V}$                                                                                                             | $CTR = (I_C/I_F) * 100\%$ |
| Saturated CTR                        | CTR(sat)      | —                  | 100                | —    | %                 | $I_F = 1 \text{ mA}, V_{CE} = 0.4 \text{ V}$                                                                                                           |                           |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | —                  | —                  | 0.4  | V                 | $I_F = 8 \text{ mA}, I_C = 2.4 \text{ mA}$                                                                                                             | Figure 14                 |
| Isolation Resistance                 | $R_{ISO}$     | $5 \times 10^{10}$ | $1 \times 10^{11}$ | —    | $\Omega$          | DC500V, R.H. 40~60%                                                                                                                                    |                           |
| Floating Capacitance                 | $C_F$         | —                  | 0.6                | 1    | pF                | $V = 0, f = 1 \text{ MHz}$                                                                                                                             |                           |
| Cut-off Frequency (-3 dB)            | $F_C$         | —                  | 80                 | —    | kHz               | $V_{CC} = 5 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$                                                                                           | Figure 2, Figure 19       |
| Response Time (Rise)                 | $t_r$         | —                  | 2                  | —    | $\mu\text{s}$     | $V_{CC} = 10 \text{ V}, I_C = 2 \text{ mA}, R_L = 100 \Omega$                                                                                          | Figure 1                  |
| Response Time (Fall)                 | $t_f$         | —                  | 3                  | —    | $\mu\text{s}$     |                                                                                                                                                        |                           |
| Turn-on Time                         | $t_{on}$      | —                  | 3                  | —    | $\mu\text{s}$     |                                                                                                                                                        |                           |
| Turn-off Time                        | $t_{off}$     | —                  | 3                  | —    | $\mu\text{s}$     |                                                                                                                                                        |                           |
| Turn-ON Time                         | $t_{ON}$      | —                  | 2                  | —    | $\mu\text{s}$     | $V_{CC} = 5 \text{ V}, I_F = 16 \text{ mA}, R_L = 1.9 \text{ k}\Omega$                                                                                 | Figure 1, Figure 17       |
| Storage Time                         | $T_S$         | —                  | 25                 | —    | $\mu\text{s}$     |                                                                                                                                                        |                           |
| Turn-OFF Time                        | $t_{OFF}$     | —                  | 40                 | —    | $\mu\text{s}$     |                                                                                                                                                        |                           |
| Common Mode Rejection Voltage        | CMR           | —                  | 10                 | —    | kV/ $\mu\text{s}$ | $T_A = 25^\circ\text{C}, R_L = 470 \Omega,$<br>$V_{CM} = 1.5 \text{ kV(peak)}, I_F = 0 \text{ mA},$<br>$V_{CC} = 9 \text{ V}, V_{np} = 100 \text{ mV}$ | Figure 20                 |

Figure 1 Switching Time Test Circuit

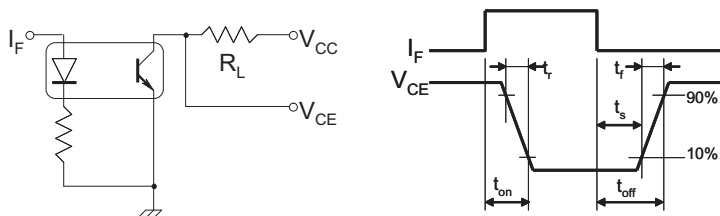
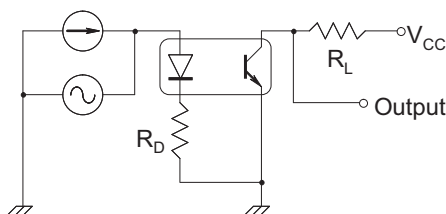
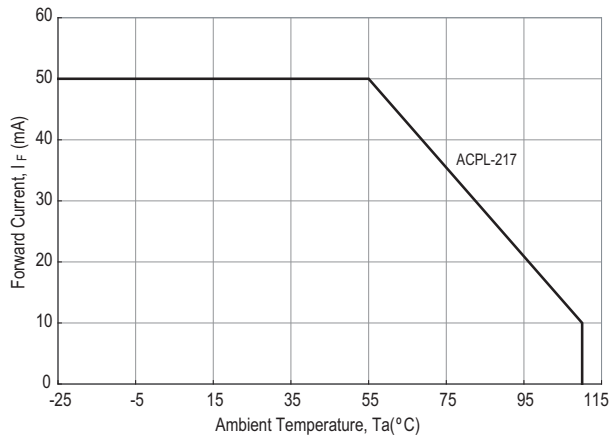
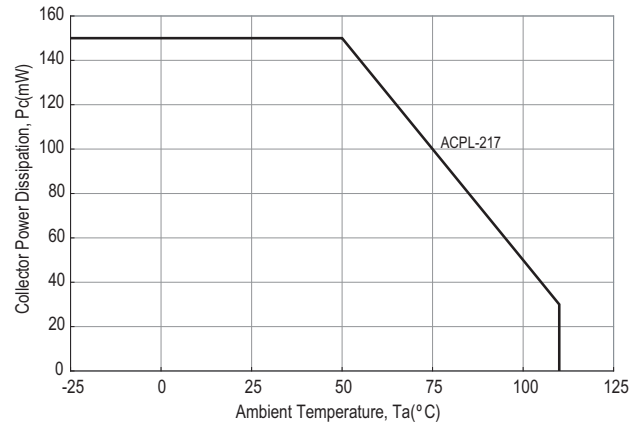
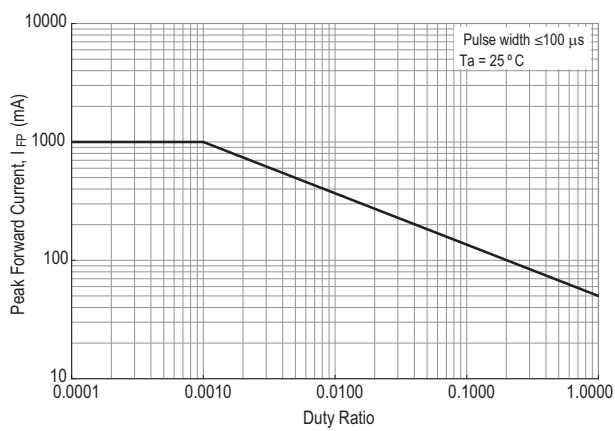
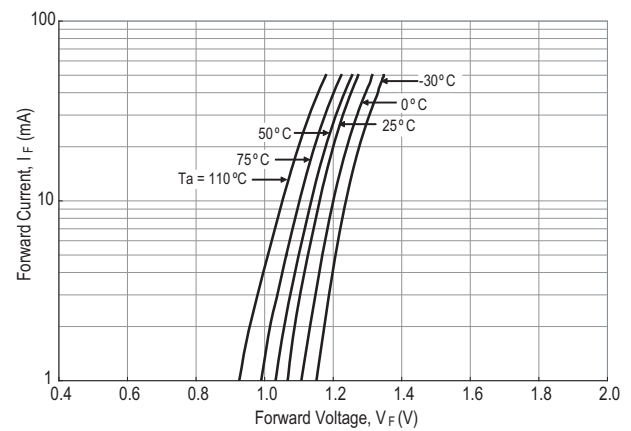
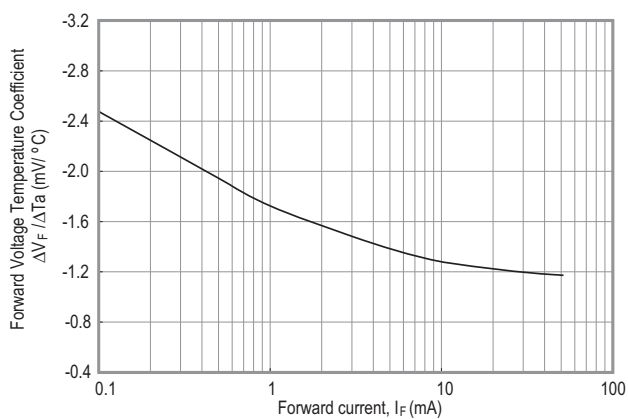
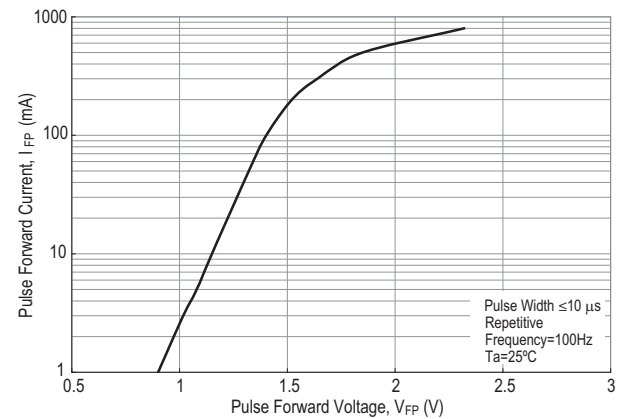
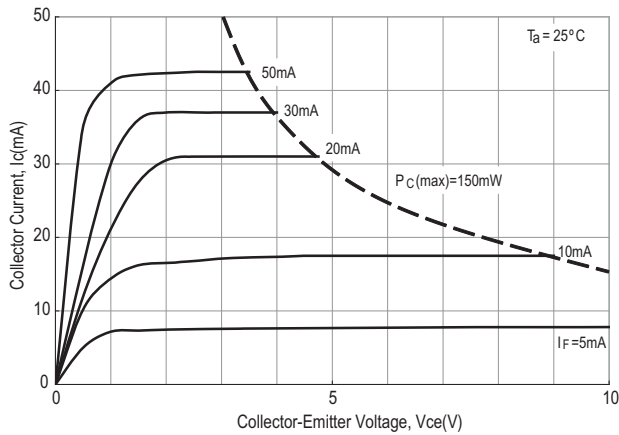
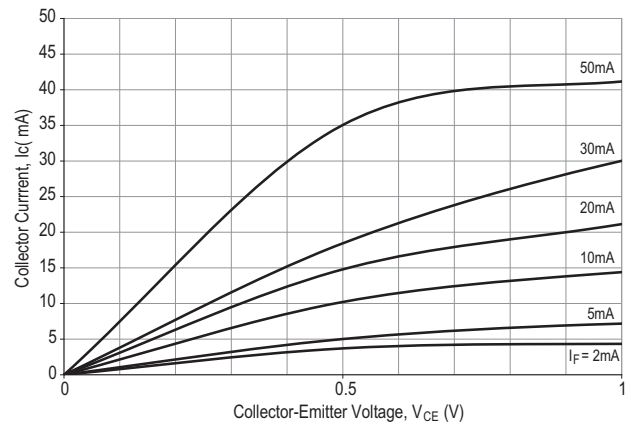
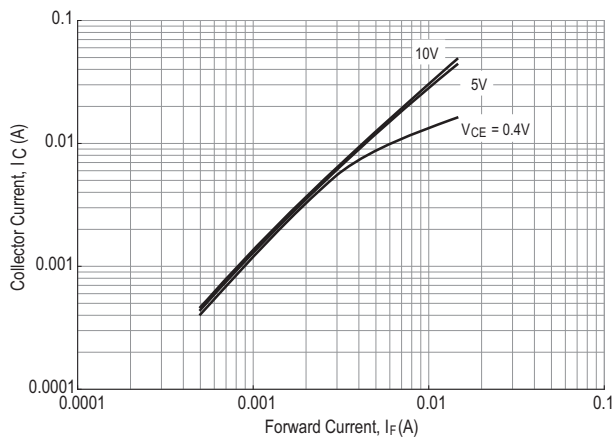
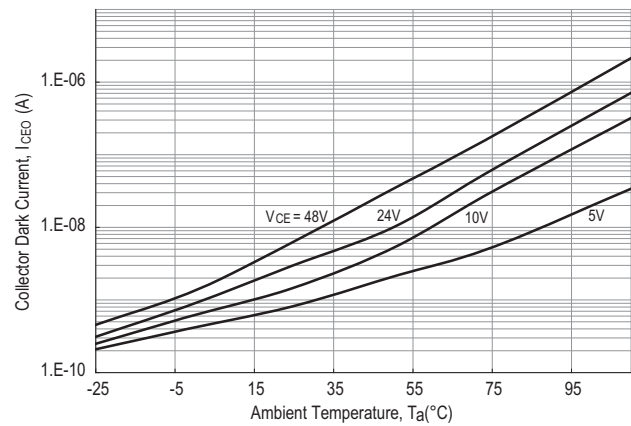
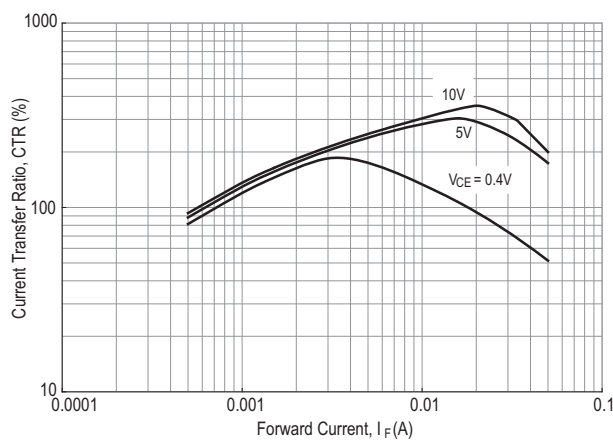
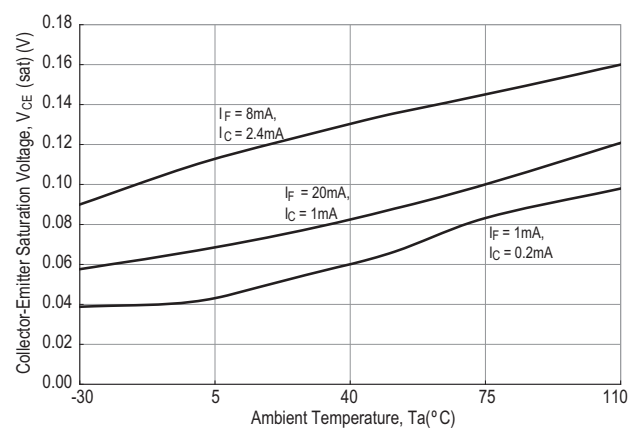
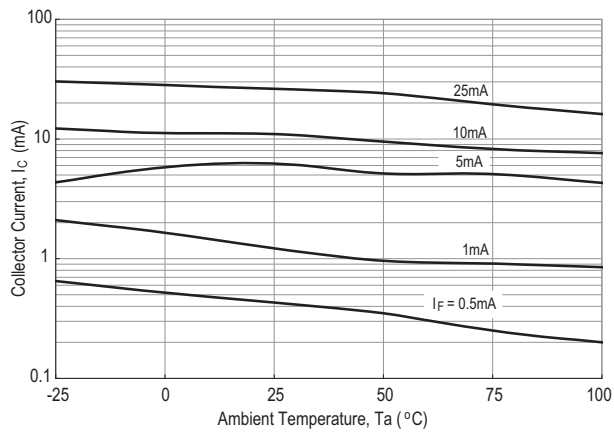
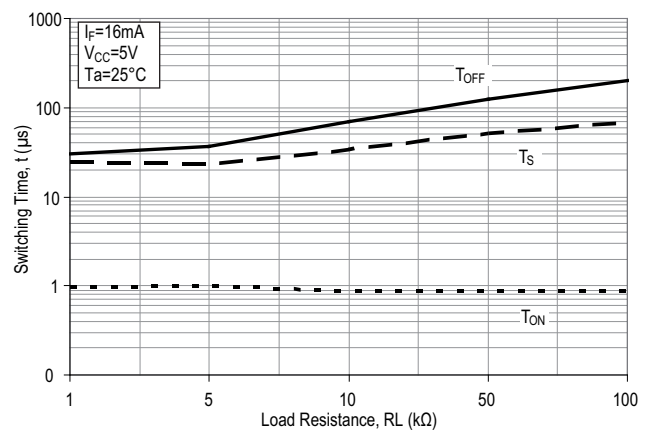
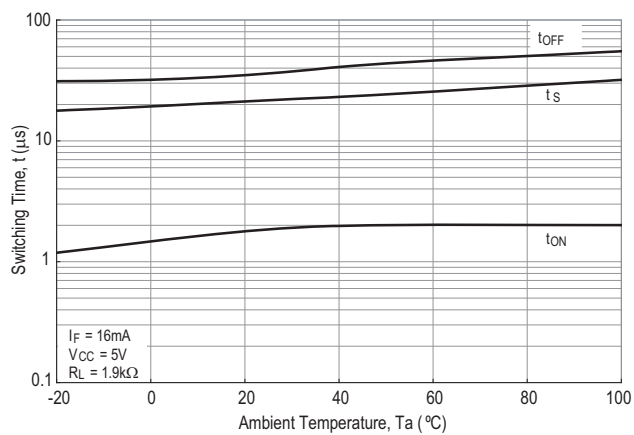
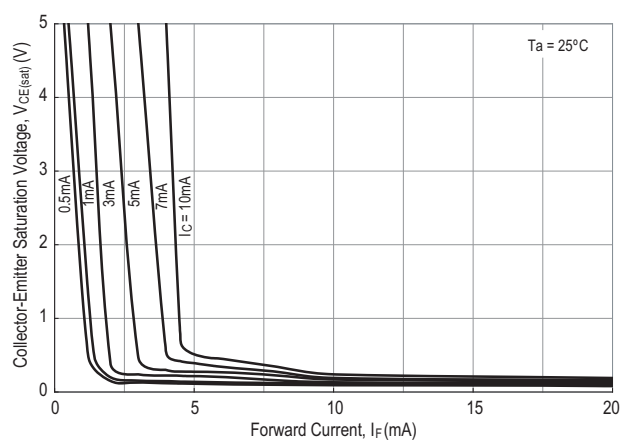
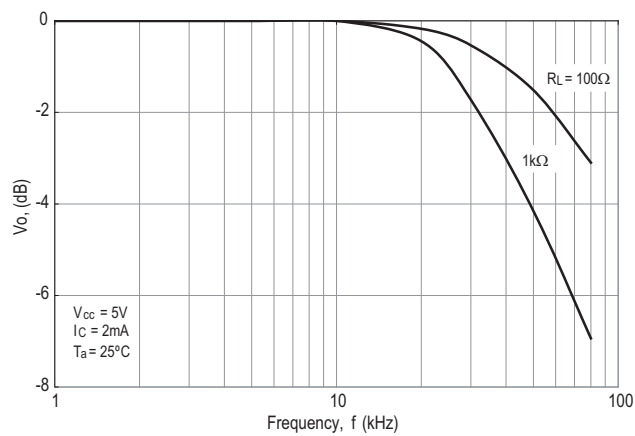
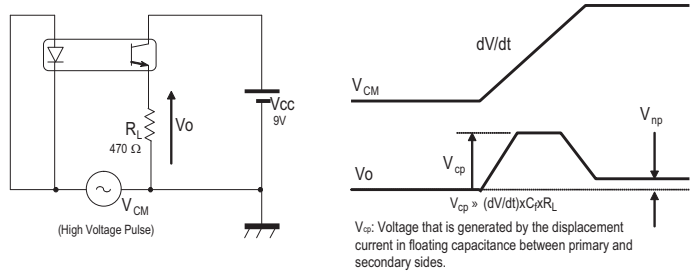


Figure 2 Frequency Response Test Circuit



**Figure 3 Forward Current vs. Ambient Temperature****Figure 4 Collector Power Dissipation vs. Ambient Temperature****Figure 5 Pulse Forward Current vs. Duty Cycle Ratio****Figure 6 Forward Current vs. Forward Voltage****Figure 7 Forward Voltage Temperature Coefficient vs. Forward Current****Figure 8 Pulse Forward Current vs. Pulse Forward Voltage**

**Figure 9 Collector Current vs. Collector-Emitter Voltage****Figure 10 Collector Current vs. Small Collector-Emitter Voltage****Figure 11 Collector Current vs. Forward Current****Figure 12 Collector Dark Current vs. Ambient Temperature****Figure 13 Current Transfer Ratio vs. Forward Current****Figure 14 Collector-Emitter Saturation Voltage vs. Ambient Temperature**

**Figure 15 Collector Current vs. Ambient Temperature****Figure 16 Switching Time vs. Load Resistance****Figure 17 Switching Time vs. Ambient Temperature****Figure 18 Collector-Emitter Saturation Voltage vs. Forward Current****Figure 19 Frequency Response****Figure 20 CMR Test Circuit**

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