# HCPL-354

AC Input Phototransistor Optocoupler
SMD Mini-Flat Type

## Data Sheet

### Description

The HCPL-354 contains a phototransistor, optically coupled to two light emitting diodes connected inverse parallel. It can operate directly by AC input current. It is packaged in a 4-pin mini-flat SMD package with a 2.0 mm profile. The small dimension of this product allows significant space saving. The package volume is 30% smaller than that of conventional DIP type. Input-output isolation voltage is 3750 $V_{rms}$. Response time, $t_r$, is typically 4 µs and minimum CTR is 20% at input current of ± 1 mA.

### Ordering Information

Specify Part Number followed by Option Number (if desired).

HCPL-354-XXXE
- E: Lead Free
- XXX: Option Number

000 = No Options
060 = IEC/EN/DIN EN 60747-5-2 Option
00A = Rank Mark A

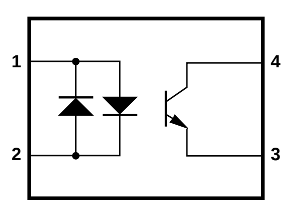
### Features

- **AC input response**
- **Current transfer ratio (CTR: min. 20% at $I_F$ = ± 1 mA, $V_{CE}$ = 5 V)**
- **Isolation voltage between input and output ($V_{iso}$ = 3,750 $V_{rms}$)**
- **Subminiature type (The volume is smaller than that of conventional DIP type by as far as 30%)**
- **Mini-flat package**
- **2.0 mm profile**
- **UL approved**
- **CSA approved**
- **IEC/EN/DIN EN 60747-5-2 approved**
- **Options available:**
  - **IEC/EN/DIN EN 60747-5-2 approvals (060)**

### Applications

- **Detecting or monitoring AC signals**
- **Programmable controllers**
- **AC/DC-input modules**
- **AC line/digital logic isolation**

### Functional Diagram

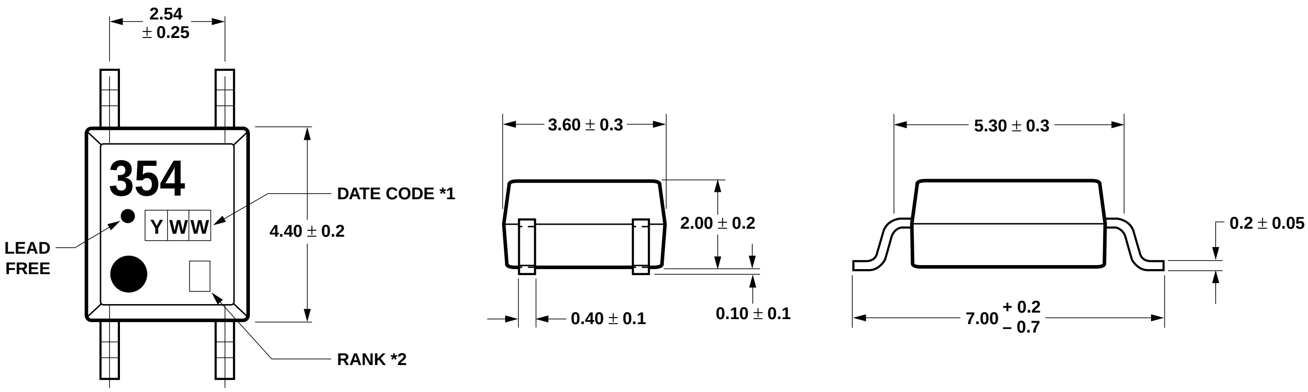



1. ANODE, CATHODE
2. CATHODE, ANODE
3. EMITTER
4. COLLECTOR

***CAUTION:*** *It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.*

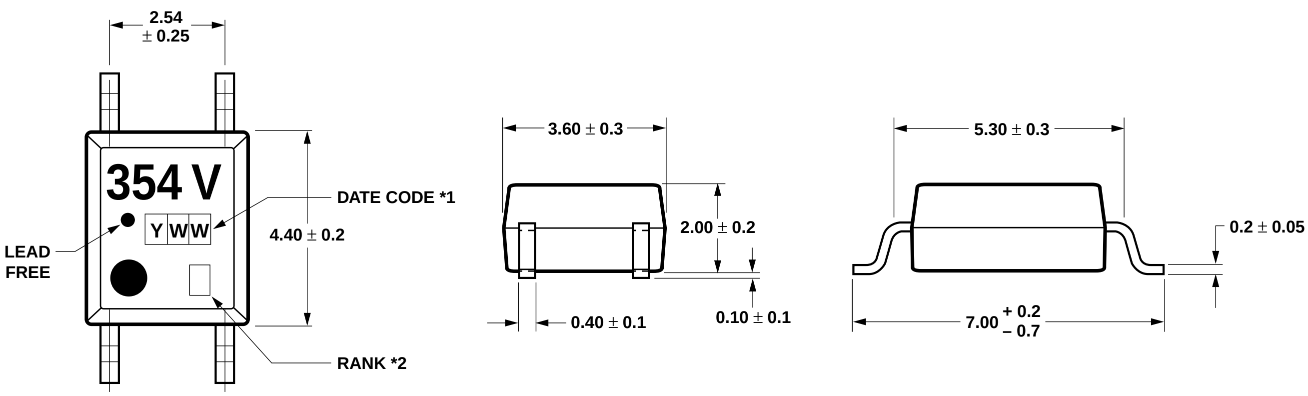
## Package Outline Drawing

### HCPL-354-000E




DIMENSIONS IN MILLIMETERS.

### HCPL-354-060E

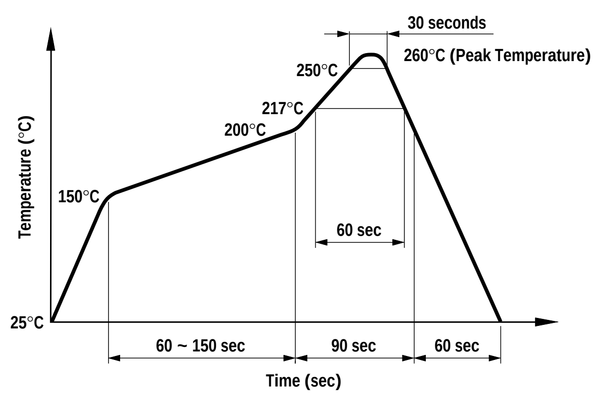



DIMENSIONS IN MILLIMETERS.

## Solder Reflow Temperature Profile

1) One-time soldering reflow is recommended within the condition of temperature and time profile shown at right.

2) When using another soldering method such as infrared ray lamp, the temperature may rise partially in the mold of the device. Keep the temperature on the package of the device within the condition of (1) above.



## Absolute Maximum Ratings

| Parameters | Symbol | Min. | Max. | Units |
|---|---|---|---|---|
| Storage Temperature | $T_S$ | –55 | 150 | ˚C |
| Ambient Operating Temperature | $T_A$ | –55 | 100 | ˚C |
| Lead Solder Temperature for 10s (1.6 mm below seating plane) | $T_{sol}$ | | 260 | ˚C |
| Average Forward Current | $I_F$ | | ±50 | mA |
| Input Power Dissipation | $P_I$ | | 70 | mW |
| Collector Current | $I_C$ | | 50 | mA |
| Collector-Emitter Voltage | $V_{CEO}$ | | 35 | V |
| Emitter-Collector Voltage | $V_{ECO}$ | | 6 | V |
| Collector Power Dissipation | $P_C$ | | 150 | mW |
| Total Power Dissipation | $P_{tot}$ | | 170 | mW |
| Isolation Voltage (AC for 1 minute, R.H. = 40 ~ 60%)[1] | $V_{iso}$ | | 3750 | $V_{rms}$ |

## Electrical Specifications ($T_A$ = 25˚C)

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Forward Voltage | $V_F$ | – | 1.2 | 1.4 | V | $I_F$ = ±20 mA |
| Terminal Capacitance | $C_t$ | – | 30 | 250 | pF | V = 0, f = 1 kHz |
| Collector Dark Current | $I_{CEO}$ | – | – | 100 | nA | $V_{CE}$ = 20 V, $I_F$ = 0 |
| Collector-Emitter Breakdown Voltage | $BV_{CEO}$ | 35 | – | – | V | $I_C$ = 0.1 mA, $I_F$ = 0 |
| Emitter-Collector Breakdown Voltage | $BV_{ECO}$ | 6 | – | – | V | $I_E$ = 10 µA, $I_F$ = 0 |
| Collector Current | $I_C$ | 0.2 | – | 4 | mA | $I_F$ = ±1 mA, |
| Current Transfer Ratio[2] | CTR | 20 | – | 400 | % | $V_{CE}$ = 5 V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | – | 0.1 | 0.2 | V | $I_F$ = ±20 mA, $I_C$ = 1 mA |
| Isolation Resistance | $R_{iso}$ | $5 \times 10^{10}$ | $1 \times 10^{11}$ | – | Ω | DC 500 V<br>40 ~ 60% R.H. |
| Floating Capacitance | $C_f$ | – | 0.6 | 1 | pF | V = 0, f = 1 MHz |
| Response Time (Rise) | $t_r$ | – | 4 | 18 | µs | $V_{CE}$ = 2 V, $I_C$ = 2 mA, |
| Response Time (Fall) | $t_f$ | – | 3 | 18 | µs | $R_L$ = 100 Ω |

| Rank Mark | CTR (%) | Conditions |
|---|---|---|
| A | 50 ~ 150 | $I_F$ = ±1 mA, |
| No Mark | 20 ~ 400 | $V_{CE}$ = 5 V,<br>$T_A$ = 25˚C |

**Notes:**

1. Isolation voltage shall be measured using the following method:
   (a) Short between anode and cathode on the primary side and between collector and emitter on the secondary side.
   (b) The isolation voltage tester with zero-cross circuit shall be used.
   (c) The waveform of applied voltage shall be a sine wave.

2. $CTR = \frac{I_C}{I_F} \times 100\%$

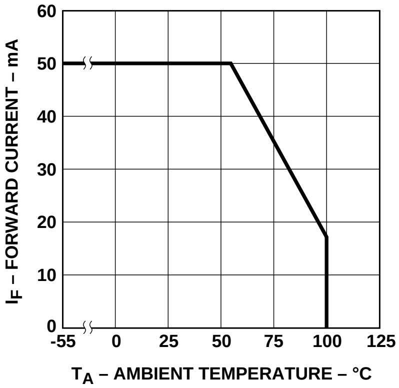



Figure 1. Forward current vs. ambient temperature.

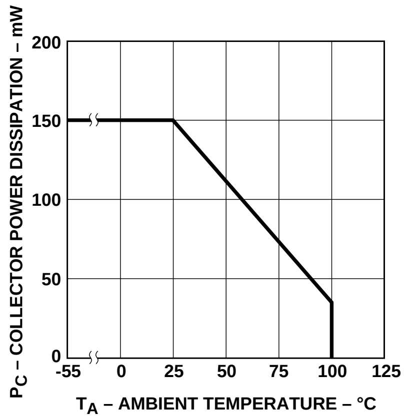



Figure 2. Collector power dissipation vs. ambient temperature.

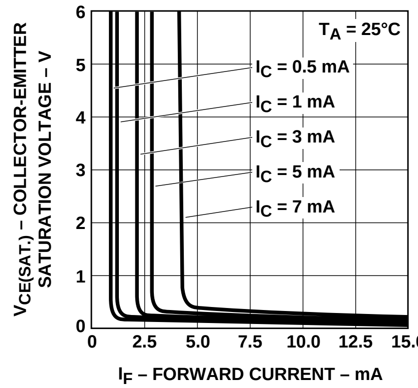



Figure 3. Collector-emitter saturation voltage vs. forward current.

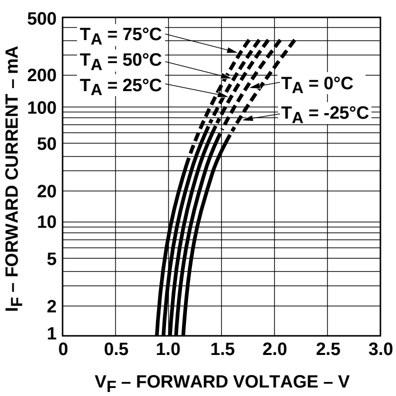



Figure 4. Forward current vs. forward voltage.

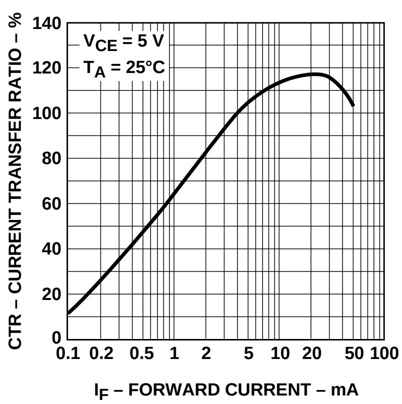



Figure 5. Current transfer ratio vs. forward current.

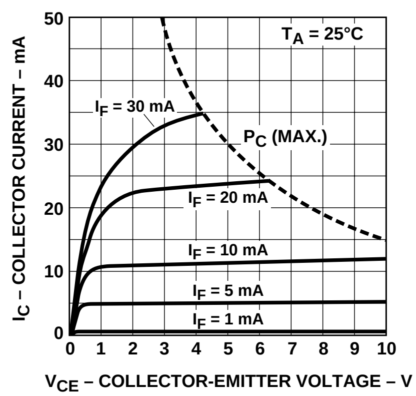



Figure 6. Collector current vs. collector-emitter voltage.

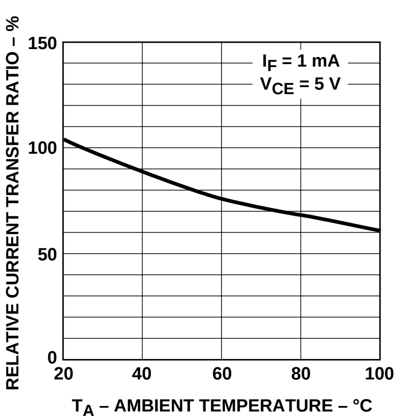



Figure 7. Relative current transfer ratio vs. ambient temperature.

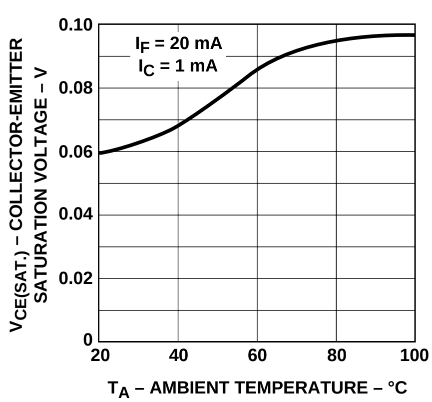



Figure 8. Collector-emitter saturation voltage vs. ambient temperature.

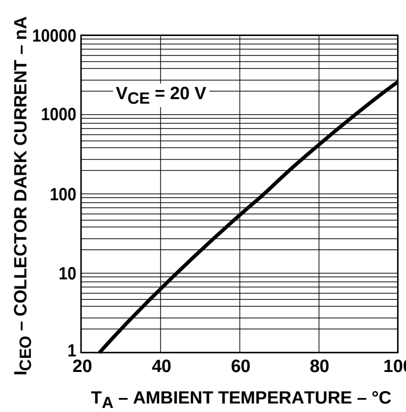
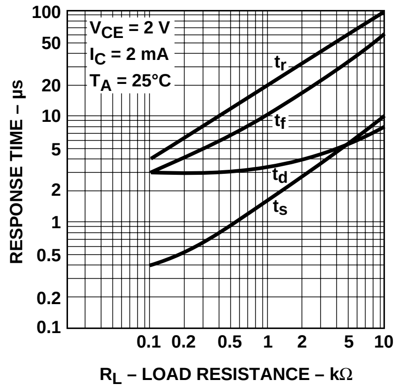



Figure 9. Collector dark current vs. ambient temperature.



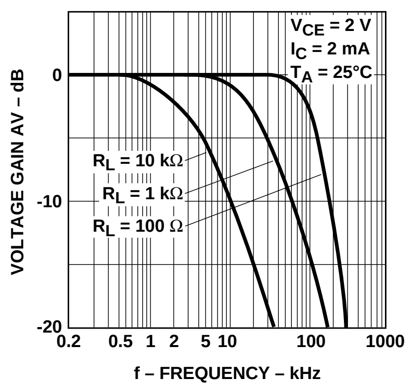
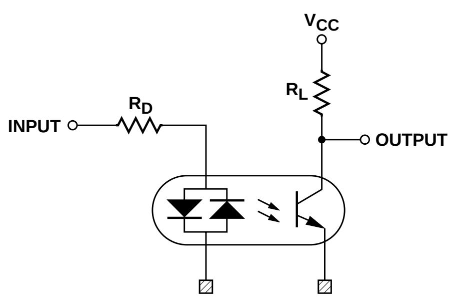




Figure 10. Response time vs. load resistance.

Figure 11. Frequency response.



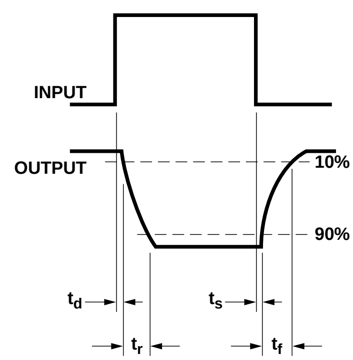




Figure 12. Test circuit for response time.

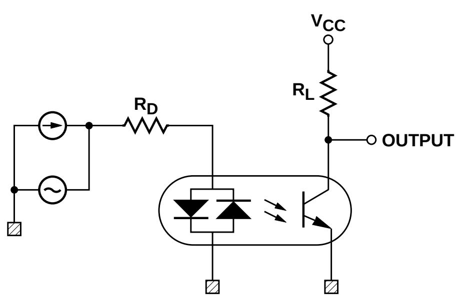



Figure 13. Test circuit for frequency response.

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