

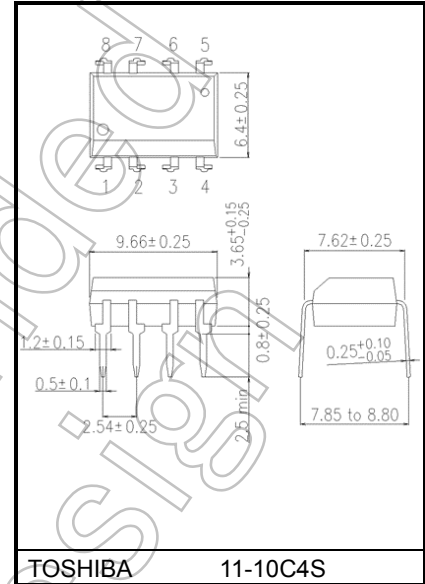
## TLP2530, TLP2531

Digital Logic Isolation  
Line Receiver  
Power Supply Control  
Switching Power Supply  
Industrial Inverter

Unit: mm

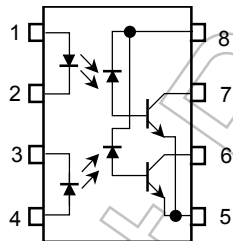
The TOSHIBA TLP2530 and TLP2531 dual photocouplers consist of a pair of infrared emitting diode and integrated photodetector. This unit is 8-lead DIP. Separate connection for the photodiode bias and output transistor collectors improve the speed up to a hundred times that of a conventional phototransistor coupler by reducing the base-collector capacitance.

- TTL compatible
- Switching speed:  $t_{pHL} = 0.2 \mu s$ ,  $t_{pLH} = 0.3 \mu s$  (typ.)  
(@ $R_L = 1.9 k\Omega$ )
- Guaranteed performance over temp:  $0^\circ C$  to  $70^\circ C$
- Isolation voltage: 2500 Vrms (min)
- UL-recognized: UL1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A  
File No.E67349

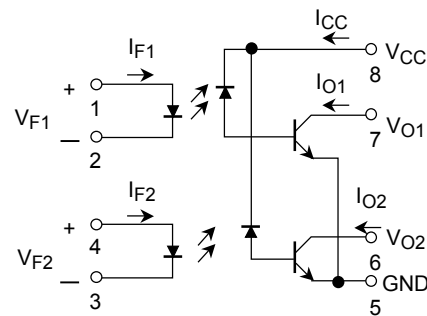


Weight: 0.54 g (typ.)

### Pin Configuration (top view)



### Schematic



Start of commercial production  
1986-03

## Absolute Maximum Ratings (Ta = 25°C)

| Characteristic                                     |                                                               | Symbol               | Rating     | Unit             |
|----------------------------------------------------|---------------------------------------------------------------|----------------------|------------|------------------|
| LED                                                | Forward current (each channel)                                | I <sub>F</sub>       | 25         | mA               |
|                                                    | Forward current derating (each channel) (Ta > 70 °C)          | ΔI <sub>F</sub> /Ta  | -0.8       | mA / °C          |
|                                                    | Pulse forward current (each channel) (Note 1)                 | I <sub>FP</sub>      | 50         | mA               |
|                                                    | Pulse forward current derating (each channel) (Ta > 70 °C)    | ΔI <sub>FP</sub> /Ta | -1.6       | mA / °C          |
|                                                    | Total pulse forward current (each channel) (Note 2)           | I <sub>FPT</sub>     | 1          | A                |
|                                                    | Reverse voltage (each channel)                                | V <sub>R</sub>       | 5          | V                |
|                                                    | Diode power dissipation (each channel)                        | P <sub>D</sub>       | 45         | mW               |
|                                                    | Diode power dissipation derating (each channel) (Ta > 70 °C)  | ΔP <sub>D</sub> /Ta  | -0.8       | mW / °C          |
| Detector                                           | Output current (each channel)                                 | I <sub>O</sub>       | 8          | mA               |
|                                                    | Peak output current (each channel)                            | I <sub>OP</sub>      | 16         | mA               |
|                                                    | Output voltage (each channel)                                 | V <sub>O</sub>       | -0.5 to 15 | V                |
|                                                    | Supply voltage                                                | V <sub>CC</sub>      | -0.5 to 15 | V                |
|                                                    | Output power dissipation (each channel)                       | P <sub>O</sub>       | 35         | mW               |
|                                                    | Output power dissipation derating (each channel) (Ta > 70 °C) | ΔP <sub>O</sub> /Ta  | -0.6       | mW / °C          |
| Operating temperature range                        |                                                               | T <sub>opr</sub>     | -55 to 100 | °C               |
| Storage temperature range                          |                                                               | T <sub>stg</sub>     | -55 to 125 | °C               |
| Lead solder temperature (10 s) (Note 3)            |                                                               | T <sub>sol</sub>     | 260        | °C               |
| Isolation voltage (AC, 60 s, R.H. ≤ 60 %) (Note 4) |                                                               | BV <sub>S</sub>      | 2500       | V <sub>rms</sub> |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: 50 % duty cycle, 1 ms pulse width.

Note 2: Pulse width ≤ 1 μs, 300 pps.

Note 3: 2 mm below seating plane.

Note 4: Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7 and 8 shorted together.

## Recommended Operating Conditions

| Characteristic                 | Symbol           | Min | Typ. | Max | Unit |
|--------------------------------|------------------|-----|------|-----|------|
| Supply voltage                 | V <sub>CC</sub>  | 0   | —    | 12  | V    |
| Forward current (each channel) | I <sub>F</sub>   | —   | 16   | 25  | mA   |
| Operating temperature          | T <sub>opr</sub> | -25 | —    | 85  | °C   |

Note: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

### Electrical Characteristics (Ta = 0°C to 70°C, unless otherwise noted)

| Characteristic                                            |         | Symbol                          | Test Condition                                                                                                  | Min                | Typ.             | Max | Unit  |
|-----------------------------------------------------------|---------|---------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------|------------------|-----|-------|
| Input forward voltage (each channel)                      |         | V <sub>F</sub>                  | I <sub>F</sub> = 16 mA, Ta = 25 °C                                                                              | —                  | 1.65             | 1.7 | V     |
| Temperature coefficient of forward voltage (each channel) |         | ΔV <sub>F</sub> / ΔTa           | I <sub>F</sub> = 16 mA                                                                                          | —                  | -2               | —   | mV/°C |
| Input reverse breakdown voltage (each channel)            |         | BV <sub>R</sub>                 | I <sub>R</sub> = 10 μA, Ta = 25 °C                                                                              | 5                  | —                | —   | V     |
| Input capacitance (each channel)                          |         | C <sub>T</sub>                  | f = 1 MHz, V <sub>F</sub> = 0 V                                                                                 | —                  | 45               | —   | pF    |
| Logic high output current (each channel)                  |         | I <sub>OH</sub>                 | I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 5.5 V<br>Ta = 25 °C                                   | —                  | 3                | 500 | nA    |
|                                                           |         |                                 | I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 15 V                                                  | —                  | —                | 50  | μA    |
| Logic low supply current                                  |         | I <sub>CCL</sub>                | I <sub>F1</sub> = I <sub>F2</sub> = 16 mA<br>V <sub>O1</sub> = V <sub>O2</sub> = Open<br>V <sub>CC</sub> = 15 V | —                  | 160              | —   | μA    |
| Logic high supply current                                 |         | I <sub>CCH</sub>                | I <sub>F1</sub> = I <sub>F2</sub> = 0 mA<br>V <sub>O1</sub> = V <sub>O2</sub> = Open<br>V <sub>CC</sub> = 15 V  | —                  | 0.05             | 4   | μA    |
| Current transfer ratio (each channel)                     | TLP2530 | I <sub>O</sub> / I <sub>F</sub> | I <sub>F</sub> = 16 mA, V <sub>O</sub> = 0.4 V<br>V <sub>CC</sub> = 4.5 V, Ta = 25 °C                           | 7                  | 30               | —   | %     |
|                                                           | TLP2531 |                                 |                                                                                                                 | 19                 | 30               | —   |       |
|                                                           | TLP2530 | I <sub>O</sub> / I <sub>F</sub> | I <sub>F</sub> = 16 mA, V <sub>O</sub> = 0.4 V<br>V <sub>CC</sub> = 4.5 V                                       | 5                  | —                | —   | %     |
|                                                           | TLP2531 |                                 |                                                                                                                 | 15                 | —                | —   |       |
| Logic low output voltage (each channel)                   | TLP2530 | V <sub>OL</sub>                 | I <sub>F</sub> = 16 mA, I <sub>O</sub> = 1.1 mA<br>V <sub>CC</sub> = 4.5 V                                      | —                  | 0.1              | 0.4 | V     |
|                                                           | TLP2531 |                                 | I <sub>F</sub> = 16 mA, I <sub>O</sub> = 2.4 mA<br>V <sub>CC</sub> = 4.5 V                                      | —                  | 0.1              | 0.4 | V     |
| Resistance (input-output)                                 |         | R <sub>S</sub>                  | V <sub>S</sub> = 500 V R.H. ≤ 60 % (Note 1)                                                                     | 5×10 <sup>10</sup> | 10 <sup>14</sup> | —   | Ω     |
| Capacitance (input-output)                                |         | C <sub>S</sub>                  | f = 1 MHz (Note 1)                                                                                              | —                  | 0.6              | —   | pF    |
| Resistance (input-input)                                  |         | R <sub>I-I</sub>                | V <sub>I-I</sub> = 500 V (Note 1)                                                                               | —                  | 10 <sup>11</sup> | —   | Ω     |
| Capacitance (input-input)                                 |         | C <sub>I-I</sub>                | f = 1 MHz (Note 1)                                                                                              | —                  | 0.25             | —   | pF    |

Note: All typicals at Ta = 25 °C.

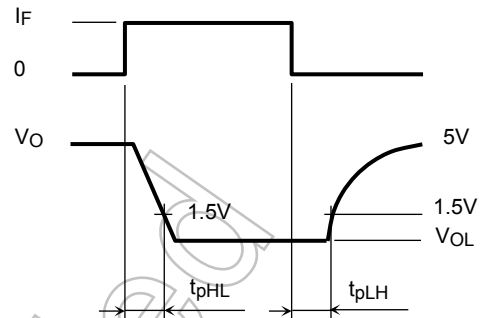
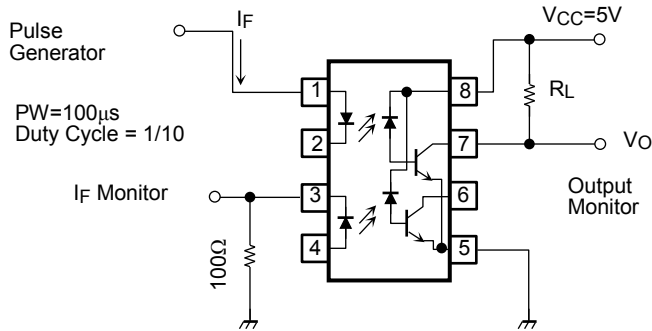
Note 1: Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7 and 8 shorted together.

Switching Characteristics (unless otherwise specified,  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$ ,  $I_F = 16\text{mA}$ )

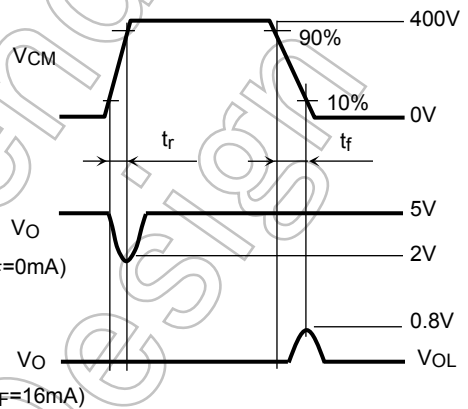
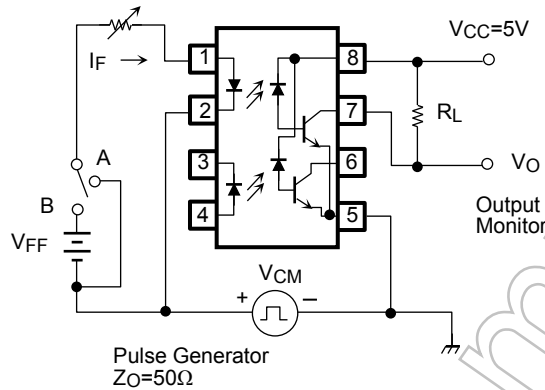
| Characteristic                                                                       |         | Symbol    | Test Circuit | Test Condition                                                                     | Min | Typ.  | Max | Unit                     |
|--------------------------------------------------------------------------------------|---------|-----------|--------------|------------------------------------------------------------------------------------|-----|-------|-----|--------------------------|
| Propagation delay time to logic low at output (each channel)                         | TLP2530 | $t_{pHL}$ | 1            | $R_L = 4.1\text{ k}\Omega$                                                         | —   | 0.3   | 1.5 | $\mu\text{s}$            |
|                                                                                      | TLP2531 |           |              | $R_L = 1.9\text{ k}\Omega$                                                         | —   | 0.2   | 0.8 |                          |
| Propagation delay time to logic high at output (each channel)                        | TLP2530 | $t_{pLH}$ | 1            | $R_L = 4.1\text{ k}\Omega$                                                         | —   | 0.5   | 1.5 | $\mu\text{s}$            |
|                                                                                      | TLP2531 |           |              | $R_L = 1.9\text{ k}\Omega$                                                         | —   | 0.3   | 0.8 |                          |
| Common mode transient immunity at logic high level output (each channel)<br>(Note 1) | TLP2530 | $CM_H$    | 2            | $V_{CM} = 400\text{ V}_{p-p}$<br>$R_L = 4.1\text{ k}\Omega$ , $I_F = 0\text{ mA}$  | —   | 1500  | —   | $\text{V} / \mu\text{s}$ |
|                                                                                      | TLP2531 |           |              | $V_{CM} = 400\text{ V}_{p-p}$<br>$R_L = 1.9\text{ k}\Omega$ , $I_F = 0\text{ mA}$  | —   | 1500  | —   |                          |
| Common mode transient immunity at logic low level output (each channel)<br>(Note 1)  | TLP2530 | $CM_L$    | 2            | $V_{CM} = 400\text{ V}_{p-p}$<br>$R_L = 4.1\text{ k}\Omega$ , $I_F = 16\text{ mA}$ | —   | -1500 | —   | $\text{V} / \mu\text{s}$ |
|                                                                                      | TLP2531 |           |              | $V_{CM} = 400\text{ V}_{p-p}$<br>$R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ | —   | -1500 | —   |                          |
| Bandwidth (each channel)                                                             |         | BW        | 3            | $R_L = 100\text{ }\Omega$                                                          | —   | 2     | —   | MHz                      |

Note 1: Common mode transient immunity in logic high level is the maximum tolerable (positive)  $dV_{CM} / dt$  on the leading edge of the common mode pulse,  $V_{CM}$ , to assure that the output will remain in a logic high state (i.e.,  $V_O > 2.0\text{ V}$ ).  
Common mode transient immunity in logic low level is the maximum tolerable (negative)  $dV_{CM} / dt$  on the trailing edge of the common mode pulse signal,  $V_{CM}$ , to assure that the output will remain in logic low state (i.e.,  $V_O < 0.8\text{ V}$ ).

### Test Circuit 1: Switching Time, $t_{pHL}$ , $t_{pLH}$

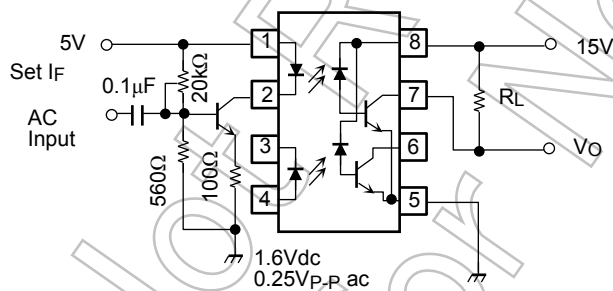


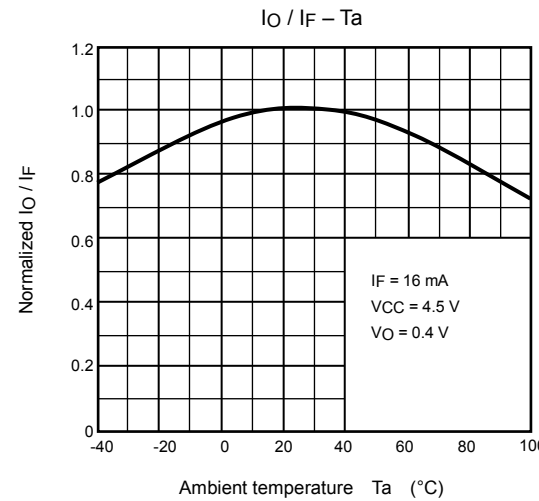
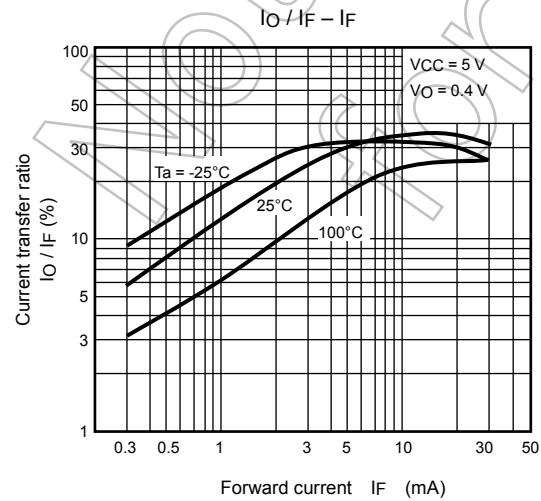
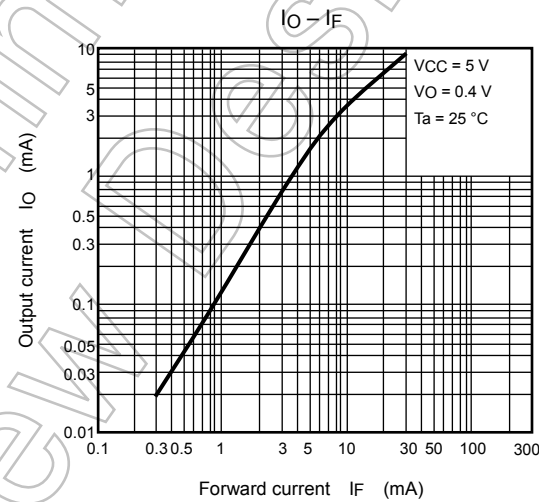
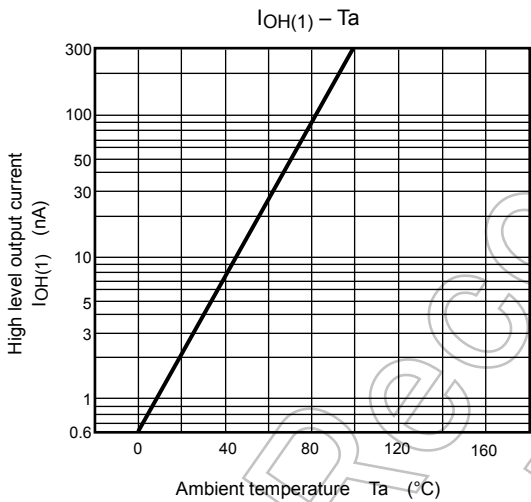
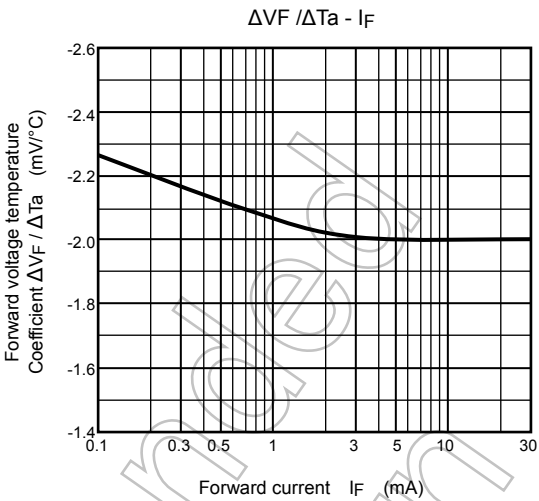
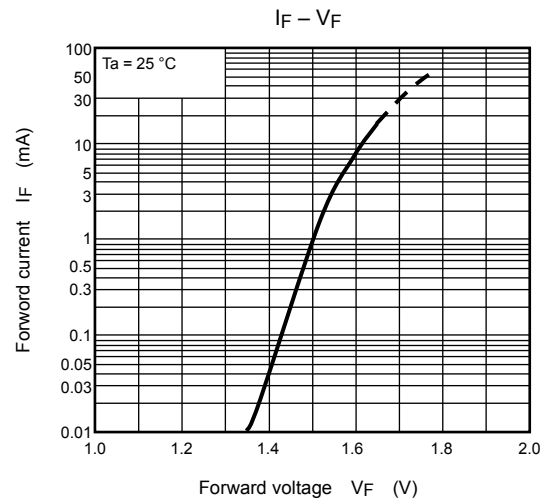
### Test Circuit 2: Common mode transient Immunity and Typical Waveform



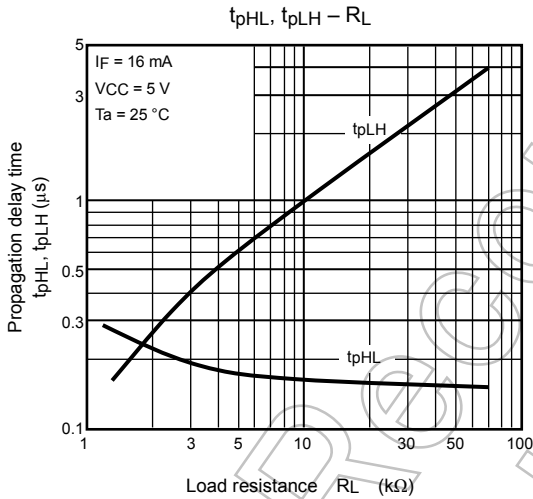
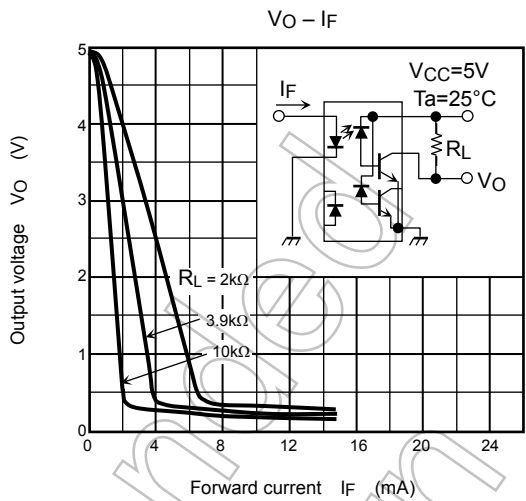
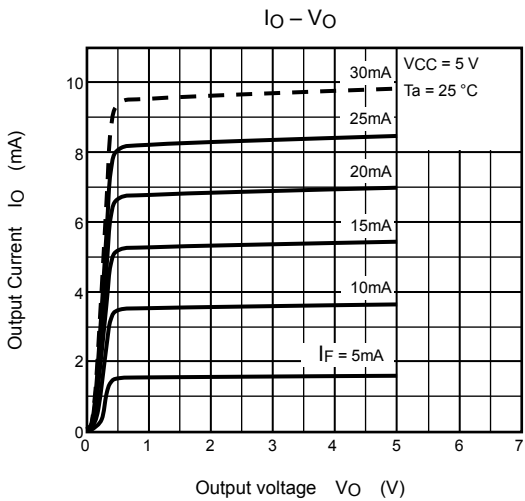
$$CM_H = \frac{320(V)}{t_r(\mu s)}, CM_L = \frac{320(V)}{t_f(\mu s)}$$

### Test Circuit 3: Frequency Response





NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



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