MITSUBISHI HYBRID ICs

M57950L

HYBRID IC FOR DRIVING TRANSISTOR MODULES

DESCRIPTION
M57950L is a Hybrid Integrated Circuit designed for driving Transistor Modules QM30DY, QM50DY, etc., in an Inverter application. This device operates as an isolation amplifier for Transistor Modules due to the electrical isolation between the input and output, and features a small outline of 10-pin SIP.

FEATURES
- Electrical isolation between input and output with integrated opto-coupler. $V_{iso}=2500$Vrms
- Large load and sink current driving capability
  - $I_{OL}=-1$A (MAX)
  - $I_{OLP}=-3$A (MAX)
- Applicable with TTL input
- Small outline, 10-pin SIP package

APPLICATION
To drive Transistor Modules for Inverter applications

OUTLINE DRAWING
Dimensions in mm

BLOCK DIAGRAM

CIRCUIT DIAGRAM
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**ABSOLUTE MAXIMUM RATINGs (Ta=–20 ~ +70°C, unless otherwise noted)**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC</td>
<td>Supply voltage</td>
<td>DC</td>
<td>14</td>
<td>V</td>
</tr>
<tr>
<td>VEE</td>
<td>Supply voltage</td>
<td>DC</td>
<td>–5</td>
<td>V</td>
</tr>
<tr>
<td>VI</td>
<td>Input voltage</td>
<td>Between terminals ① and ②</td>
<td>–1 ~ 7</td>
<td>V</td>
</tr>
<tr>
<td>IOH</td>
<td>Output current</td>
<td>Pulse width 10µs, Freq. 2kHz, peak value</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>IOLP</td>
<td>Isolation voltage</td>
<td>Sinewave voltage 60Hz/min, Ta=25°C</td>
<td>2500</td>
<td>Vrms</td>
</tr>
<tr>
<td>Tj</td>
<td>Junction temperature</td>
<td></td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Topg</td>
<td>Operating temperature</td>
<td></td>
<td>–20 ~ +70</td>
<td>°C</td>
</tr>
<tr>
<td>Tstg</td>
<td>Storage temperature</td>
<td></td>
<td>–25 ~ +100</td>
<td>°C</td>
</tr>
</tbody>
</table>

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**ELECTRICAL CHARACTERISTICS (Ta=25°C, VCC=8V, unless otherwise noted)**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test conditions</th>
<th>Limits</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIH</td>
<td>“H” input current</td>
<td>V=5V</td>
<td>–</td>
<td>10</td>
</tr>
<tr>
<td>IOH</td>
<td>“H” output current</td>
<td>Rext=9Ω, V=1.6V</td>
<td>–0.8</td>
<td>–</td>
</tr>
<tr>
<td>IOLP</td>
<td>“L” output peak current</td>
<td>Cext=10µF, R=2Ω</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>Pd</td>
<td>Internal power dissipation</td>
<td>IOH=–0.9A, IOLP=2A, f=2kHz, D.F.=50%</td>
<td>–</td>
<td>0.33</td>
</tr>
<tr>
<td>tPLH</td>
<td>“L-H” propagation delay time</td>
<td>V=0→4V, Ta=100°C</td>
<td>–</td>
<td>5</td>
</tr>
<tr>
<td>tr</td>
<td>“L-H” rise time</td>
<td>V=0→4V, Ta=100°C</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>tPHL</td>
<td>“H-L” propagation delay time</td>
<td>V=5→0V, Ta=100°C</td>
<td>–</td>
<td>8</td>
</tr>
<tr>
<td>tF</td>
<td>“H-L” fall time</td>
<td>V=5→0V, Ta=100°C</td>
<td>–</td>
<td>3</td>
</tr>
</tbody>
</table>
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**PERFORMANCE CURVES**

1. **ALLOWABLE POWER DISSIPATION VS. AMBIENT TEMPERATURE (MAXIMUM RATING)**
   - **Graph showing Allowable Power Dissipation ($P_D$) vs. Ambient Temperature ($T_a$) in °C.**
   - Key: $P_D$ vs. $T_a$ is plotted with a descending trend.

2. **INTERNAL POWER DISSIPATION VS. “H” DUTY FACTOR (TYPICAL)**
   - **Graph showing Internal Power Dissipation ($P_I$) vs. “H” Duty Factor ($D.F.$) in mW.**
   - Key: $P_I$ vs. $D.F.$ is plotted with a descending trend.

3. **“H” OUTPUT CURRENT VS. “H” LIMITING RESISTOR (TYPICAL)**
   - **Graph showing “H” Output Current ($I_{OH}$) vs. “H” Limiting Resistor ($R_{ext}$) in mA.**
   - Key: $I_{OH}$ vs. $R_{ext}$ is plotted with a descending trend.

4. **“L” OUTPUT PEAK CURRENT VS. REVERSE SUPPLY VOLTAGE (TYPICAL)**
   - **Graph showing “L” Output Peak Current ($I_{OLP}$) vs. Reverse Supply Voltage ($V_{EE}$) in A.**
   - Key: $I_{OLP}$ vs. $V_{EE}$ is plotted with a descending trend.

5. **ALLOWABLE POWER DISSIPATION VS. AMBIENT TEMPERATURE (MAXIMUM RATING)**
   - **Graph showing Allowable Power Dissipation ($P_D$) vs. Ambient Temperature ($T_a$) in °C.**
   - Key: $P_D$ vs. $T_a$ is plotted with a descending trend.

6. **“H” DUTY FACTOR D. F. (%)**
   - **Graph showing “H” Duty Factor (%) vs. Allowable Power Dissipation in mW.**
   - Key: Duty Factor (%) vs. Allowable Power Dissipation is plotted with a descending trend.

7. **“H” LIMITING RESISTOR ($R_{ext}$) vs. “L” OUTPUT PEAK CURRENT ($I_{OLP}$) in A.**
   - **Graph showing “H” Limiting Resistor ($R_{ext}$) vs. “L” Output Peak Current ($I_{OLP}$) in A.**
   - Key: $R_{ext}$ vs. $I_{OLP}$ is plotted with a descending trend.

8. **“L” OUTPUT PEAK CURRENT VS. REVERSE SUPPLY VOLTAGE (TYPICAL)**
   - **Graph showing “L” Output Peak Current ($I_{OLP}$) vs. Reverse Supply Voltage ($V_{EE}$) in V.**
   - Key: $I_{OLP}$ vs. $V_{EE}$ is plotted with a descending trend.

9. **REVERSE SUPPLY VOLTAGE VS. “L” OUTPUT VOLTAGE (TYPICAL)**
   - **Graph showing Reverse Supply Voltage ($V_{EE}$) vs. “L” Output Voltage ($V_{OL}$) in V.**
   - Key: $V_{EE}$ vs. $V_{OL}$ is plotted with a descending trend.

10. **PROPAGATION DELAY TIME VS. AMBIENT TEMPERATURE (TYPICAL)**
    - **Graph showing Propagation Delay Time ($t_{PLH}$ and $t_{PHL}$) vs. Ambient Temperature ($T_a$) in °C.**
    - Key: $t_{PLH}$ and $t_{PHL}$ vs. $T_a$ are plotted with an ascending trend.

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*Feb. 1999*
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PROPAGATION DELAY TIME VS. “H” INPUT VOLTAGE (TYPICAL)

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>VCC=10V, VEE=–3V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rext=9Ω, R2=1Ω</td>
<td>T=100°C</td>
</tr>
</tbody>
</table>

POWER DISSIPATION OF Rext VS. “H” DUTY FACTOR (TYPICAL)

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>VCC=10V, VEE=–4V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rext=9Ω, R2=1Ω</td>
<td>T=100°C</td>
</tr>
</tbody>
</table>

OUTPUT CHARACTERISTIC OF FULL WAVE RECTIFYING CIRCUIT WITH CENTER-TAPPED TRANSFORMER (FOR REFERENCE)

<table>
<thead>
<tr>
<th>RIPPLE AMPLITUDE</th>
<th>Vo</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

T: 8V, 1A×2 CENTER-TAPPED TRANSFORMER
C1: 4700μF, C2: 470μF
EXPLANATION OF FUNCTION
(cf. Fig. 2, 3, 4, and 5)

(1) With low input level (V_in = 0 ~ 1V)
   Tr1 ...... OFF, Tr2 ...... ON
   The base terminal of transistor module is reverse biased with re-
   spect to its emitter by reverse power supply VEE.

(2) With high input level (V_in = 4 ~ 5V)
   Tr1 ...... ON, Tr2 ...... OFF
   The base terminal of transistor module is forward biased and
driven by the current IOH through the resistor Rext.

(3) With low input level (V_in = 0 ~ 1V)
   Tr1 ...... OFF, Tr2 ...... ON
   The base terminal of transistor module is reverse biased as
   stated in (1) after flowing reverse recovery pulse current IOLP. The
   steady reverse base current is limited by the internal base-emitter
   resistor Raic of the transistor module.

M57950L Typical application circuit

M57950L Typical operating waveform

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Note: IOH and IOLP correspond to base forward current IB1
and base reverse current IB2 of the transistor module
to be driven respectively.