# M54587P/FP

8-UNIT 500mA DARLINGTON TRANSISTOR ARRAY WITH CLAMP DIODE

## DESCRIPTION

M54587P and M54587FP are eight-circuit collector-current-synchronized Darlington transistor arrays. The circuits are made of PNP and NPN transistors. Both the semiconductor integrated circuits perform high-current driving with extremely low input-current supply.

## FEATURES

- High breakdown voltage ($BV_{CEO} \geq 50V$)
- High-current driving ($I_{C(max)}$ = 500mA)
- "L" active level input
- With input diode
- With clamping diodes
- Wide operating temperature range (Ta = –20 to +75°C)

## APPLICATION

Interfaces between microcomputers and high-voltage, high-current drive systems, drives of relays and MOS-bipolar logic IC interfaces

## FUNCTION

The M54587 is produced by adding PNP transistors to M54585 inputs. Eight circuits having active L-level inputs are provided.

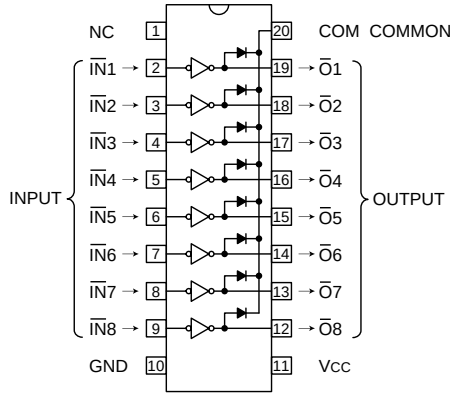
Resistance of 7kΩ and diode are provided in series between each input and PNP transistor base. The input diode is intended to prevent the flow of current from the input to the $V_{CC}$. Without this diode, the current flow from "H" input to the $V_{CC}$ and the "L" input circuits is activated, in such case where one of the inputs of the 8 circuits is "H" and the others are "L" to save power consumption. The diode is inserted to prevent such misoperation.

This device is most suitable for a driver using NMOS IC output especially for the driver of current sink.

Collector current is 500mA maximum. Collector-emitter supply voltage is 50V.

The M54587FP is enclosed in a molded small flat package, enabling space saving design.

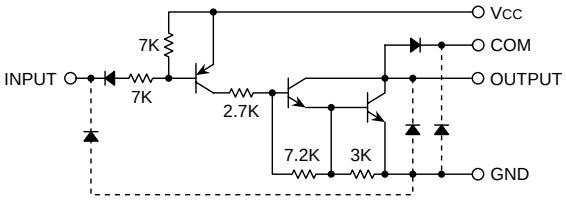
## PIN CONFIGURATION




Package type 20P4(P) 20P2N-A(FP)

NC : No connection

## CIRCUIT DIAGRAM (EACH CIRCUIT)




The eight circuits share the Vcc, COM and GND

The diode, indicated with the dotted line, is parasitic, and cannot be used.

Unit : Ω



MITSUBISHI ELECTRIC

**ABSOLUTE MAXIMUM RATINGS (Unless otherwise noted, Ta = –20 ~ +75°C)**

| Symbol | Parameter | Conditions | Ratings | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 10 | V |
| $V_{CEO}$ | Collector-emitter voltage | Output, H | –0.5 ~ +50 | V |
| $V_I$ | Input voltage | | –0.5 ~ $V_{CC}$ | V |
| $I_C$ | Collector current | Current per circuit output, L | 500 | mA |
| $I_F$ | Clamping diode forward current | | 500 | mA |
| $V_R$ | Clamping diode reverse voltage | | 50 | V |
| $P_d$ | Power dissipation | Ta = 25°C, when mounted on board | 1.79/1.1 | W |
| $T_{opr}$ | Operating temperature | | –20 ~ +75 | °C |
| $T_{stg}$ | Storage temperature | | –55 ~ +125 | °C |

**RECOMMENDED OPERATING CONDITIONS (Unless otherwise noted, Ta = –20 ~ +75°C)**

| Symbol | Parameter | | Limits | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| $V_{CC}$ | Supply voltage | | 4 | 5 | 8 | V |
| $I_C$ | Collector current Per channel | $V_{CC}$ = 5V, Duty Cycle P : no more than 6% FP : no more than 5% | 0 | — | 400 | mA |
| | | $V_{CC}$ = 5V, Duty Cycle P : no more than 34% FP : no more than 15% | 0 | — | 200 | |
| $V_{IH}$ | "H" input voltage | | $V_{CC}$–0.7 | — | $V_{CC}$ | V |
| $V_{IL}$ | "L" input voltage | | 0 | — | $V_{CC}$–3.6 | V |

**ELECTRICAL CHARACTERISTICS (Unless otherwise noted, Ta = –40 ~ +85°C)**

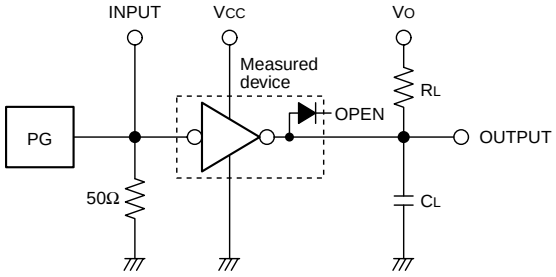
| Symbol | Parameter | Test conditions | | Limits | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | min | typ* | max | |
| $V_{(BR)CEO}$ | Collector-emitter breakdown voltage | $I_{CEO}$ = 100μA | | 50 | — | — | V |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_I$ = $V_{CC}$–3.6V | $I_C$ = 400mA | — | 1.2 | 2.4 | V |
| | | | $I_C$ = 200mA | — | 0.95 | 1.6 | |
| $I_I$ | Input current | $V_I$ = $V_{CC}$–3.6V | | — | –290 | –600 | μA |
| $V_F$ | Clamping diode forward volltage | $I_F$ = 400mA | | — | 1.4 | 2.4 | V |
| $I_R$ | Clamping diode reverse current | $V_R$ = 50V | | — | 0.1 | 100 | μA |
| $I_{CC}$ | Supply current (AN only Input) | $V_{CC}$ = 5V, $V_I$ = $V_{CC}$–3.5V | | — | 1.9 | 3 | mA |
| $h_{FE}$ | DC amplification factor | $V_{CC}$ = 5V, $V_{CE}$ = 4V, $I_C$ = 350mA, Ta = 25°C | | 2000 | 3500 | — | — |

✻ : The typical values are those measured under ambient temperature (Ta) of 25°C. There is no guarantee that these values are obtained under any conditions.

**SWITCHING CHARACTERISTICS (Unless otherwise noted, Ta = 25°C)**

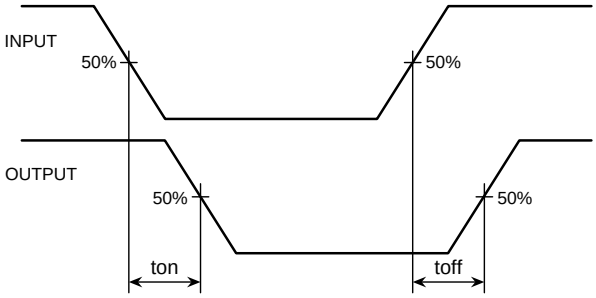
| Symbol | Parameter | Test conditions | Limits | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| $t_{on}$ | Turn-on time | $C_L$ = 15pF (note 1) | — | 120 | — | ns |
| $t_{off}$ | Turn-off time | | — | 2400 | — | ns |

## NOTE 1 TEST CIRCUIT



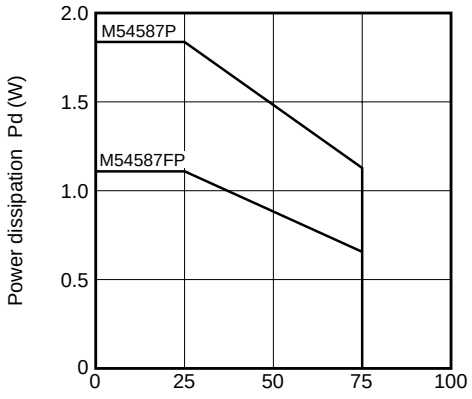

(1)Pulse generator (PG) characteristics : PRR=1kHz,
tw = 10µs, tr = 6ns, tf = 6ns, Zo = 50Ω
VI = 0.4 ~ 4V
(2)Input-output conditions : RL = 30Ω, Vo = 10V, Vcc = 4V
(3)Electrostatic capacity CL includes floating capacitance at connections and input capacitance at probes

## TIMING DIAGRAM

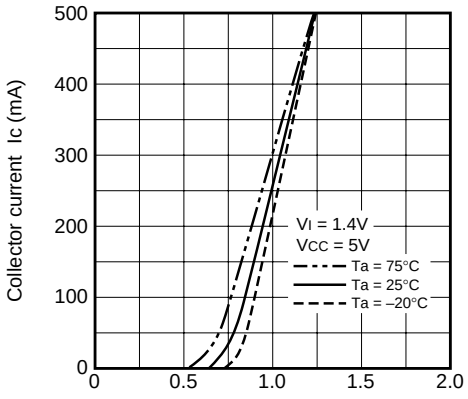



## TYPICAL CHARACTERISTICS

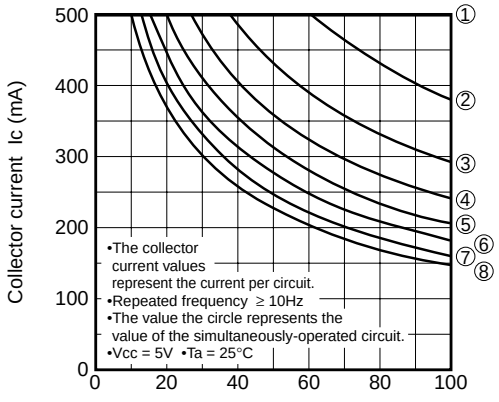
Thermal Derating Factor Characteristics



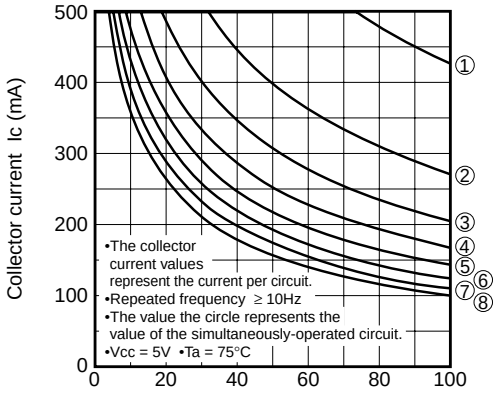

Output Saturation Voltage
Collector Current Characteristics



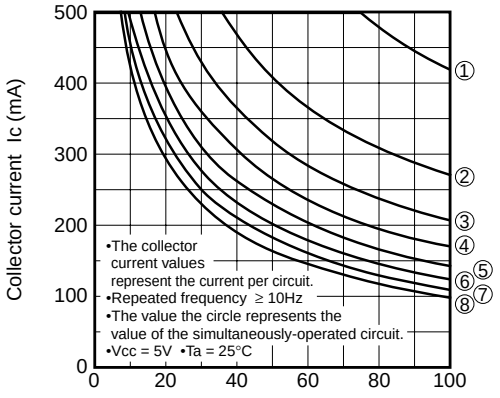

Duty Cycle-Collector Characteristics
(M54587P)




Duty Cycle-Collector Characteristics
(M54587P)

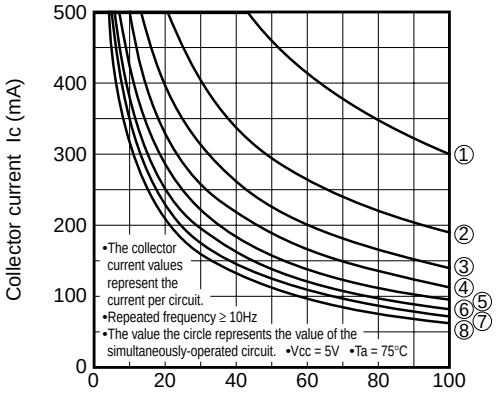


Duty Cycle-Collector Characteristics
(M54587FP)



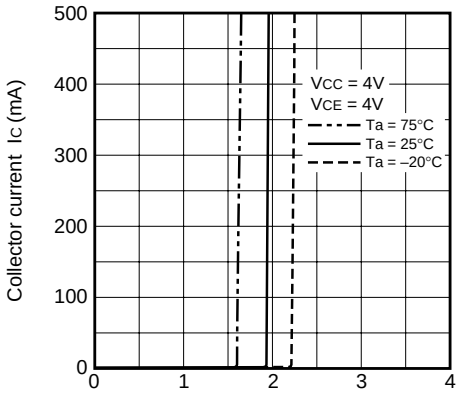

Duty cycle (%)

Duty Cycle-Collector Characteristics
(M54587FP)



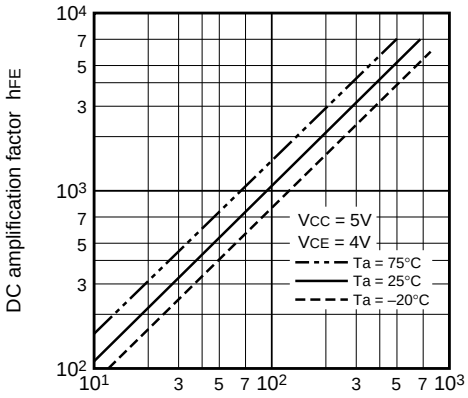

Duty cycle (%)

Output Current Characteristics



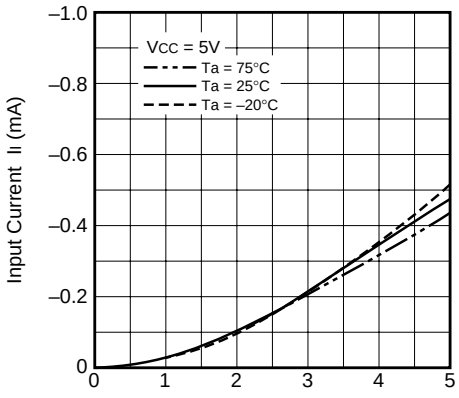

Input voltage Vcc-VI (V)

DC Amplification Factor
Collector Current Characteristics



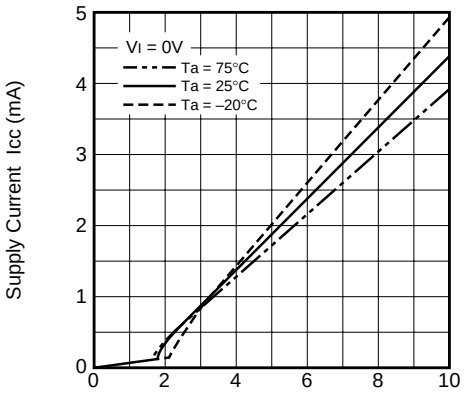

Collector current IC (mA)

Input Characteristics




IInput voltage Vcc-VI (V)

Driver Supply Characteristics




Supply voltage Vcc (V)

Clamping Diode Characteristics